R. K. LE BLOND & W. F. GROENE.

MILLING MACHINE.

APPLICATION FILED JUNE 6, 1908.

956,643.

Patented May 3, 1910.

4 SHEETS—SHEET 1.

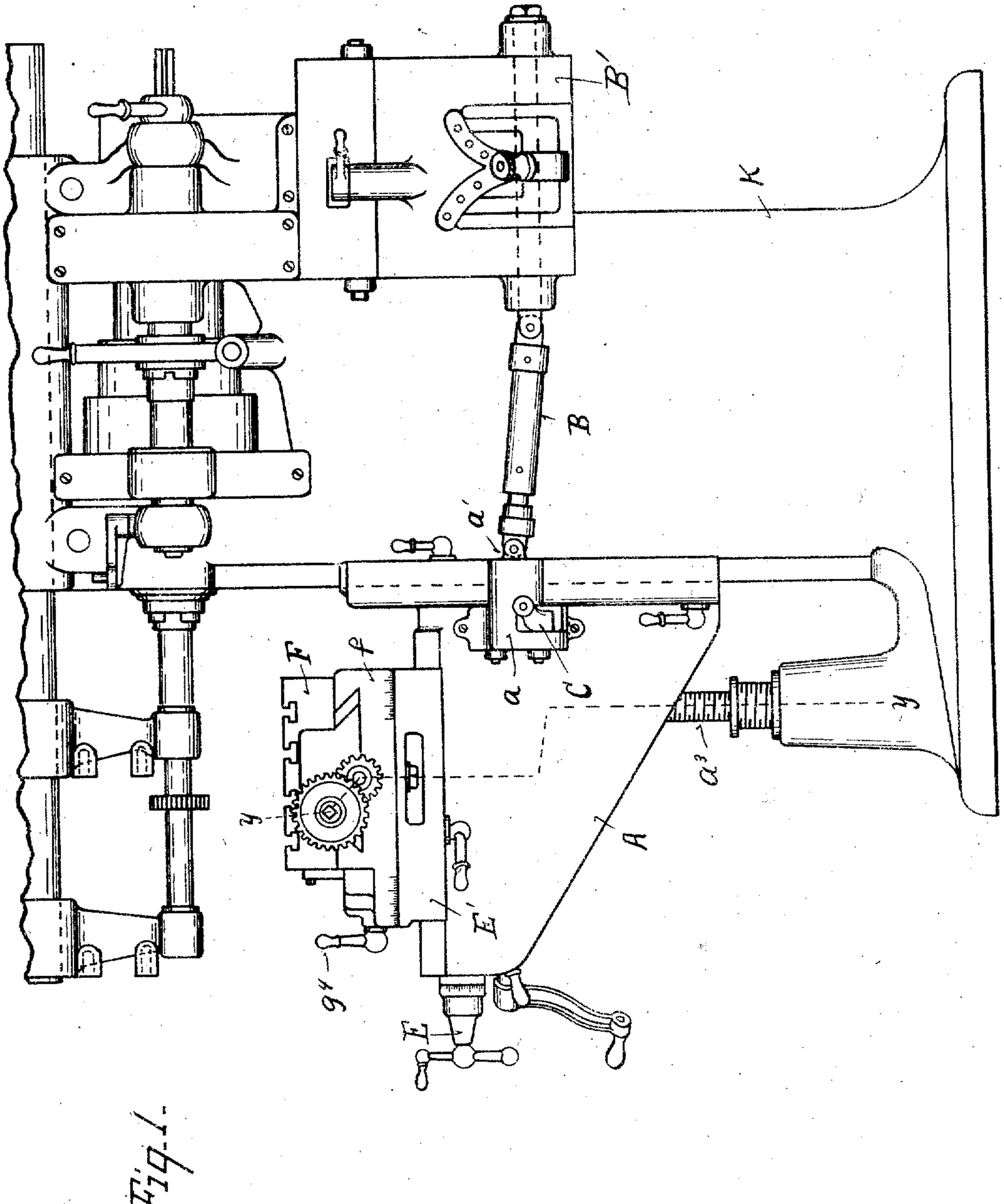

Fig. 1.

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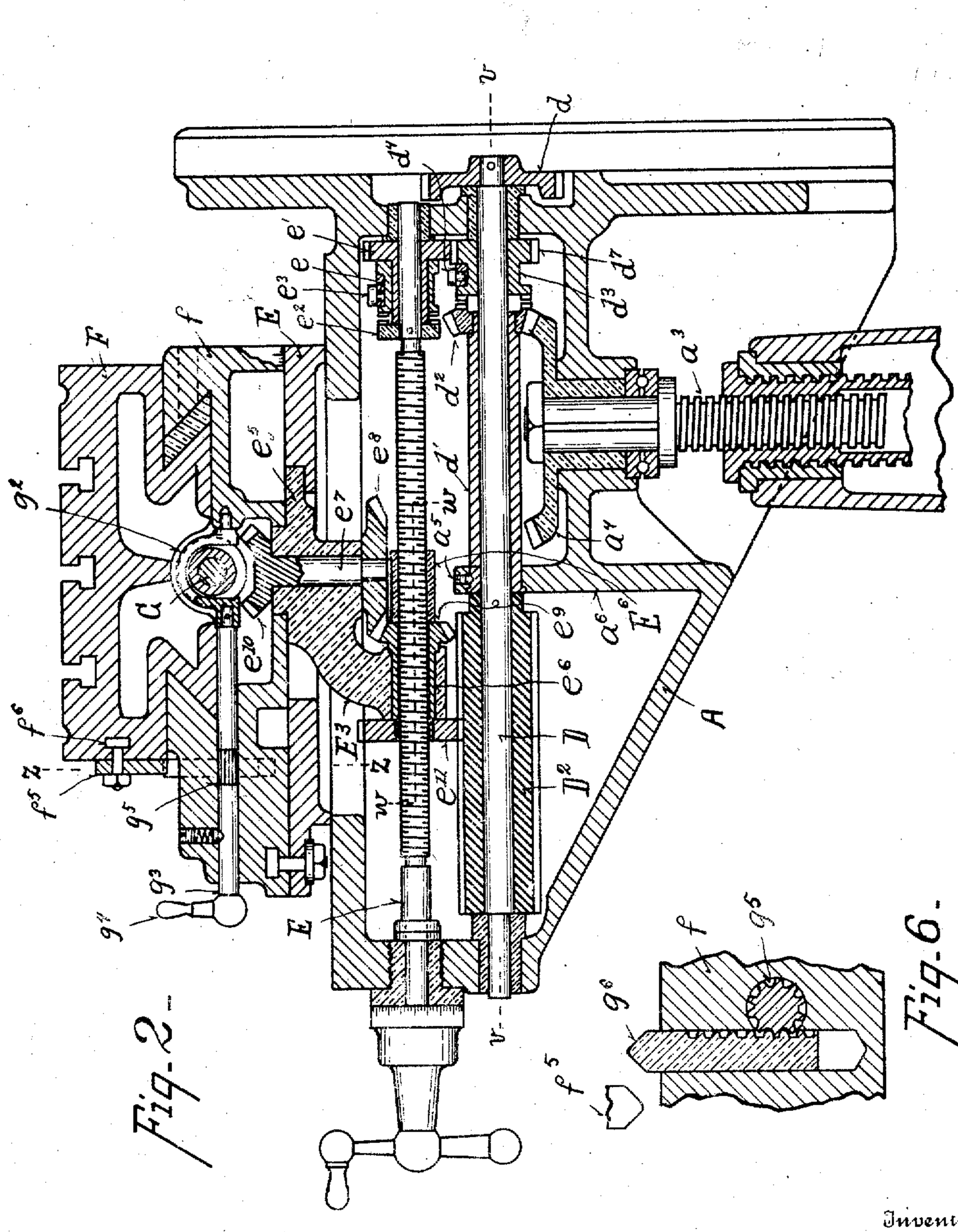

Fig. 2.

Fig. 6.

Witnesses

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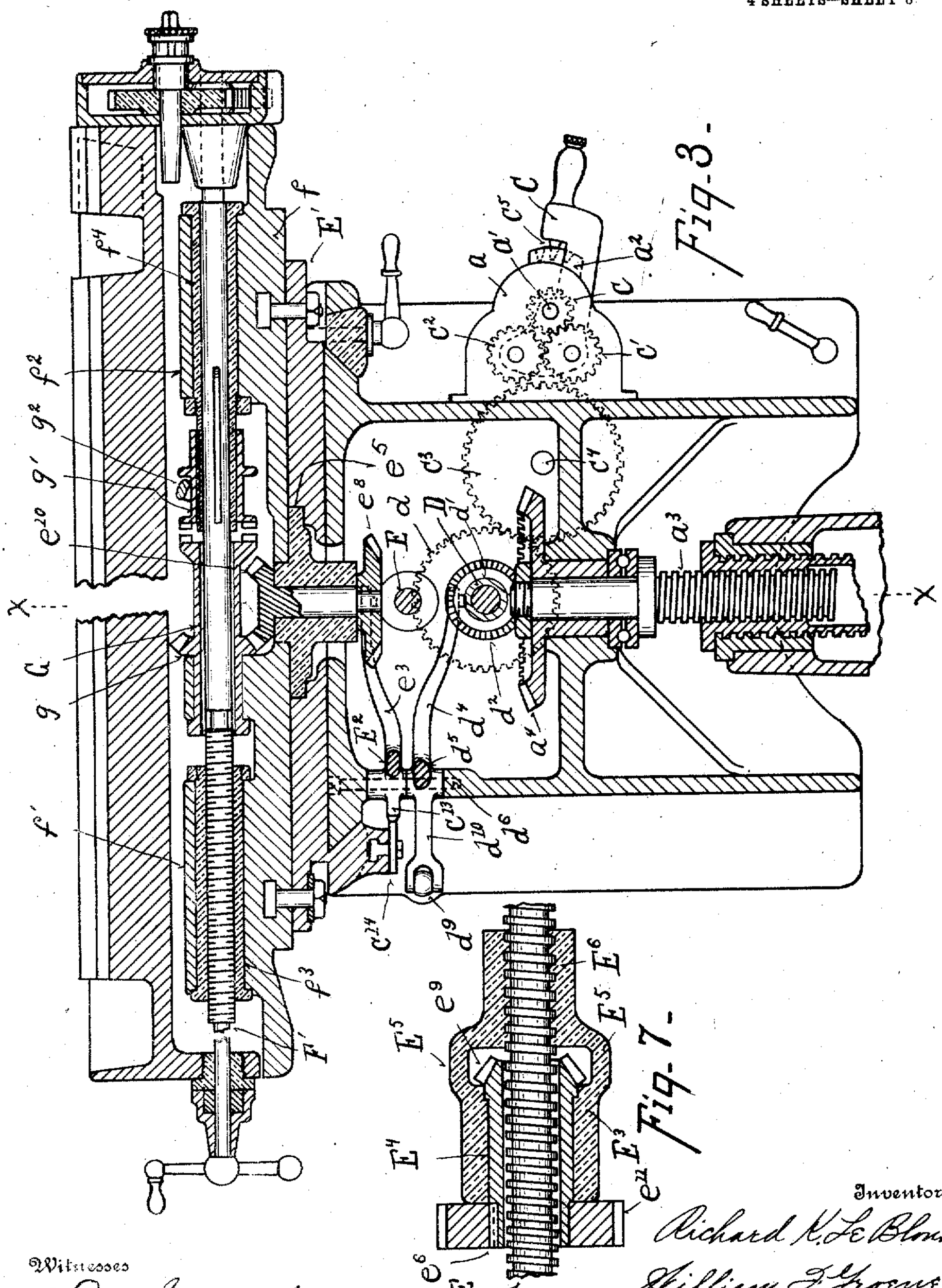

Fig. 3.

Fig. 7.

Witnesses

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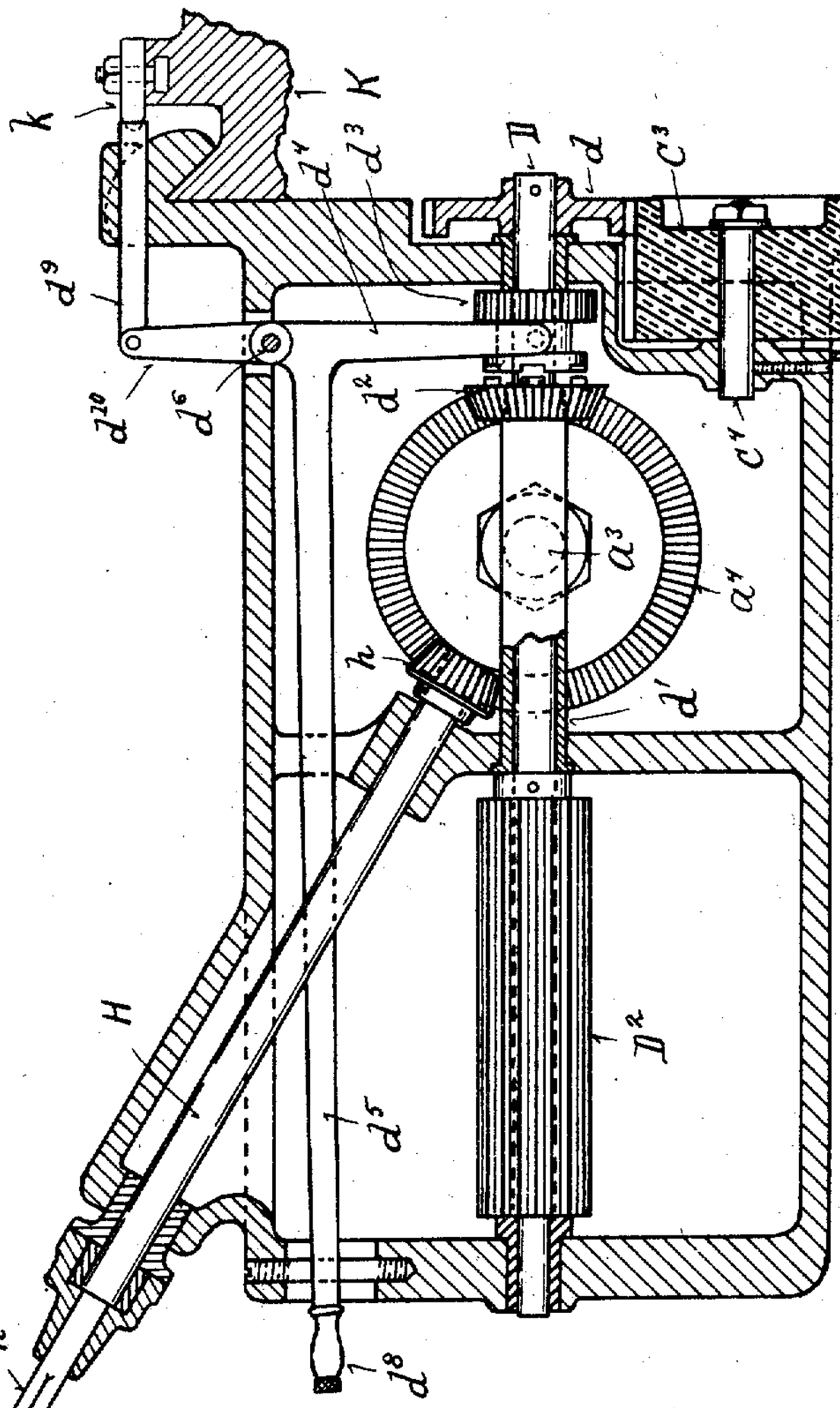

Fig. 4.

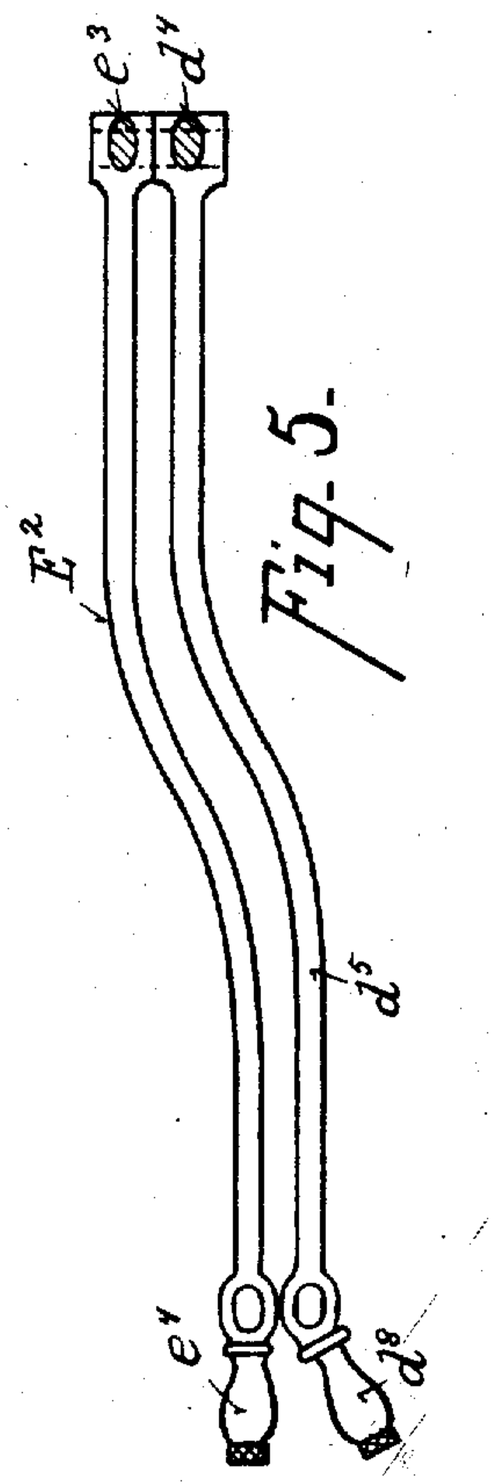

Fig. 5.

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UNITED STATES PATENT OFFICE.

RICHARD K. LE BLOND AND WILLIAM F. GROENE, OF CINCINNATI, OHIO, ASSIGNORS TO THE R. K. LE BLOND MACHINE TOOL COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

MILLING-MACHINE.

956,643. Specification of Letters Patent. Patented May 3, 1910.

Application filed June 6, 1908. Serial No. 437,084.

To all whom it may concern:

Be it known that we, RICHARD K. LE BLOND and WILLIAM F. GROENE, citizens of the United States of America, and residents of Cincinnati, county of Hamilton, State of Ohio, have invented certain new and useful Improvements in Milling-Machines, of which the following is a specification.

The object of our invention is to simplify the feeds of the slides of milling machines, and the means of regulating said feeds.

Referring to the accompanying drawings, in which like parts are indicated by similar reference letters wherever they occur throughout the various views: Figure 1 is a side elevation of a milling machine embodying our invention, showing the overhanging arm partly broken away. Fig. 2 is a sectional view taken upon line *x*—*x* of Fig. 3. Fig. 3 is a sectional view taken upon irregular line *y*—*y* of Fig. 1, the table and the feed screw for the table in Fig. 3 being shown broken away and the ends being brought together to economize space. Fig. 4 is a horizontal sectional view taken upon line *v*—*v* of Fig. 2. Fig. 5 is a detail view of the lever arms, the lower one of which regulates the feed of the knee, and the upper one of which regulates the feed of the saddle. Fig. 6 is a detail view of the automatic means of stopping the feed of table, the view being taken upon line *z*—*z* of Fig. 2, upon a somewhat enlarged scale. Fig. 7 is a detail horizontal sectional view upon line *w*—*w* of Fig. 2.

Referring to the parts: Journaled in a box, *a*, which is secured to the knee, A, is a short power transmission shaft, *a'*, to the end of which is secured the power feed spindle, B, which receives its power from feed box, B'. Fixed upon the shaft, *a'*, is a pinion, *c*, and journaled thereon is a reversing lever, C, which at its inner end has two stud shafts, upon which are journaled pinions, *c'*. c^2. Pinion, *c'*, meshes with pinion, *c*, and with pinion, c^2. The pinions, *c'* and c^2 are situated so that when the lever, C, is in a central position, such as shown in Fig. 3, they stand adjacent to but out of gear with a gear wheel, c^3, which is journaled upon a stud shaft, c^4, which is mounted in the knee, as illustrated in Fig. 4, and that when the lever, C, is brought to its uppermost position, the pinion, c^2, will mesh with gear wheel, c^3, and that when the lever, C, is brought to its lowermost position, the pinion, *c'*, meshes with gear, c^3. Thus when the lever, C, stands in its central position, the gear, c^3, is stationary, and when the lever, C, is in its uppermost position, gear, c^3, has rotation transmitted to it in one direction and when lever, C, is in its lowermost position, gear, c^3, has rotation transmitted to it in the opposite direction. Lever, C, may be locked in its intermediate, or in its upper, or lowermost position, by means of a lock-pin, c^5, taking into the recesses in a lug, a^2, formed upon the knee.

Journaled in the knee, A, is a longitudinal driving spindle, D, vertically above the elevating screw, a^3, of the knee. Spindle, D, is termed the "driving spindle" of the knee herein for the reason that the elevating screw of the knee, the cross feed screw of the saddle and the feed screw of the table derive their rotations directly from it. Spindle, D, has a gear wheel, *d*, which meshes into the elongated gear wheel, c^3. Mounted loosely upon spindle, D, is a sleeve, *d'*, which carries a bevel pinion, d^2, which meshes with a bevel gear, a^4, which is secured to the upper end of the elevating screw, a^3. The sleeve, *d'*, is held against rotation by means of a set screw, a^5, in the transverse wall, a^6, of the knee, but pinion, d^2, is mounted rotatably upon the reduced inner end of the sleeve, *d'*.

Feathered upon the spindle, D, adjacent to the bevel pinion, d^2, is a clutch, d^3, which is engaged by the arm, d^4, of the feed-regulating lever, d^5, which is mounted upon a vertical pivot, d^6, in the wall of the knee, as illustrated in Fig. 4. By throwing the lever, d^5, clutch, d^3, may be brought into engagement with bevel pinion, d^2, to convey rotation to the elevating screw, a^3. It is seen that the lever, d^5, being mounted upon the vertical pivot, d^6, has movement simply in a horizontal plane so that the weight of the lever itself will not cause it to be jarred by the vibration of the machine out of the position to which it has been placed. Clutch, d^3, may be automatically shifted out of engagement with the bevel gear, d^2, by means of a plunger, d^9, which is secured to the end, d^{10}, of the arm, d^8. Arm, d^9, projects through a perforation in the knee to be engaged by a dog, *k*, to be adjusted upon the column, K, to the point at which it is desired to automatically stop the movement of

the knee. Mounted in the knee parallel to the spindle, D, is a cross-feed screw, E, of the saddle, E′. Mounted rotatably upon the screw, E, is a clutch member, *e*, which has a pinion, *e′*, to mesh with a pinion, d^7, of the clutch, d^3. Adjacent to the clutch member, *e*, a clutch member, e^2, is secured to the screw, E. Clutch member, *e*, is engaged by the arm, e^3, of regulating lever, E^2, which is journaled in the walls of the knee upon vertical pivot, d^6, and projects to the front of the knee, and has a handle, e^4, adjacent to the handle, d^8. Lever, E^2, has likewise movement simply in a horizontal plane, so that the vibration of the machine will not cause it to be moved of its own weight. Lever, E^2, has an automatic switch consisting of an arm, e^{13}, which projects into the path of a lug, e^{14}, adjustable in a T-groove upon the underside of saddle, E′, as shown in Fig. 3. Saddle, E′, has a central block, e^5, which projects through the longitudinal way in the knee, and has a downwardly projecting arm or bracket, E^3, which has an enlarged central bore, E^4, through which the feed screw, E, of the saddle passes free of contact. Bracket, E^3, is connected by arms, E^5, with a block-nut, E^6, which has an internally screw-threaded bore, the screw-threads of which engage the threads of the cross-feed screw, E. Journaled to rotate within the enlarged bore, E^4, of the bracket, is a sleeve, e^6, through which the feed-screw, E, passes without contact. (See Fig. 7).

We will now describe the means of conveying motion to the table, F, from driving spindle, D, of the knee. The swivel base, *f*, of the table, is centrally journaled upon the reduced upper end of the block, e^5, of the saddle, as shown in Fig. 2. Block, e^5, has a central vertical shaft, e^7, at the lower end of which is a bevel pinion, e^8, which meshes with a bevel pinion, e^9, upon the end of the sleeve, e^6. At the upper end of the shaft, e^7, is a bevel pinion, e^{10}. Sleeve, e^6, carries a pinion, e^{11}, which meshes with an elongated pinion, D^2, which is secured upon the shaft, D. Swivel base, *f*, has journal lugs, *f′*, f^2, shown in Fig. 3, in which are seated bushings, f^3, f^4. The internal screw-threads of bushing, f^3, are engaged by the threads of the feed-screw, F, of the table. The feed-screw, F′, vertically above the block, e^5, is devoid of screw-threading and has mounted loosely upon it a sleeve, G, which has a bevel gear, *g*, to mesh with the bevel pinion, e^{10}. Bushing, f^4, is mounted rotatably in bearings, f^2, and projects to a point adjacent to the sleeve, G, at which point clutch, *g′*, is mounted upon the sleeve, f^4, the sleeve and the clutch being splined upon the feed screw, F′. Clutch, *g′*, is engaged by the yoke, g^2, of a trip lever, g^3, which has upon its end a handle, g^4. Lever, g^3, is journaled in the swivel base, *f*, and has formed in it gear teeth, g^5, which are engaged by the teeth of a rack, g^6, the upper bevel end of which stands in the path of lugs, f^5, which may be adjusted in a T-way, f^6, upon the side of the table.

Journaled in the knee is a shaft, H, which has upon its inner end a bevel gear, *h*, to engage the bevel gear, a^4, upon the elevating screw and which at its outer end, *h′*, is left square for engagement with a crank for rotating the elevating screw by hand.

The operation is as follows: When either the pinion, *c′*, or c^2, is brought into engagement with the gear wheel, c^3, by the shifting of the reversing lever, C, rotation is conveyed to the spindle, D, the direction of the rotation being dependent upon which of the pinions, *c′*, or c^2, is brought into gear with the gear, c^3. If it be desired to elevate the knee, arm, d^5, is thrown to bring the clutch, d^3, into mesh with bevel pinion, d^2. In this position of the clutch, d^3, rotation will be conveyed to the elevating screw, a^3, by means of the bevel pinions, d^2, and a^4. To reciprocate the saddle while leaving the knee stationary, the lever, d^5, is put in position to hold the clutch, d^3, out of engagement with the bevel pinion, d^2, and the lever, E^2, is thrown to bring the clutch member, *e*, into engagement with the clutch member, e^2, which will then convey rotation from the shaft, D, to the cross-feed screw, E, and then the block, e^5, will be fed along the screw, E, and reciprocate the saddle, E′. If it be desired to reciprocate the table while having both the saddle and the knee stationary, levers, d^5 and E^2, are placed in a position such as to hold the clutch, d^3, out of engagement with the bevel, d^2, and the clutch member, *e*, out of engagement with clutch member, e^2, and handle, g^4, is thrown so as to turn the shaft, g^3, and cause the yoke, g^2, to throw the clutch, *g′*, into engagement with the sleeve, G. Rotation of the shaft, D, will then be conveyed by the pinion, D^2, through the pinions, e^{11}, e^8, e^{10}, G, and clutch member, *g′*, to the feed screw, F′, of the table. The reverse motion of any of these parts, viz. the knee, the saddle, or the table, is obtained simply by the shifting of the reverse lever.

What we claim is:

1. In a milling machine the combination of a knee, a saddle upon the knee, a table upon the saddle, a horizontal driving spindle mounted in the knee, an elevating screw for the knee, gear wheels coupling the driving spindle and the elevating screw, a feed screw for the saddle mounted in the knee, gear wheels coupling the spindle and said feed screw, a bracket carried by the saddle and engaging the feed screw to effect the feed of the saddle, a pinion upon the driving spindle, a gear wheel mounted upon the bracket and intermeshing with the pinion

upon the driving spindle, a feed screw in the table, and means for coupling the feed screw of the table and the gear wheel carried by the bracket.

2. In a milling machine the combination of a knee, a saddle, a vertical feed for the knee, a cross feed for the saddle, a driving spindle mounted in the knee, a sliding clutch splined upon the driving spindle, and a sliding clutch splined upon the cross feed and engaging the clutch upon the driving spindle, the sliding clutch upon the spindle being adapted to couple the said spindle to the vertical feed, and the sliding clutch upon the cross feed screw being adapted to couple the cross feed screw to the driving spindle and means for moving the clutches to effect the aforesaid coupling of the driving spindle to the vertical and to the cross feeds.

3. In a milling machine the combination of a saddle, a table mounted upon the saddle, a feed screw for the table, a bracket carried by the saddle, a block nut secured to the bracket, a pinion adapted to convey rotation to the feed screw of the table, said pinion being carried by the bracket and having an enlarged bore, and a cross feed screw for the saddle, passing with clearance through the bore of the pinion and engaging the block nut.

4. In a milling machine the combination of a knee, a saddle mounted upon the knee, means for feeding the saddle upon the knee, a table mounted upon the saddle, a driving spindle mounted in the knee, means of coupling the driving spindle of the knee with the feed box, an elongated pinion secured upon the driving spindle of the knee, a feed screw for the table, a bracket upon the saddle and intermediate gears mounted upon the bracket and coupling the feed screw of the table and the elongated pinion upon the driving spindle.

5. In a milling machine the combination of a knee, a saddle mounted to reciprocate transversely upon the knee, a base swiveled upon the saddle, a table mounted to reciprocate upon the swivel base, a feed screw mounted in the swivel base and engaging the table, a central vertical shaft mounted in the saddle, means for coupling said shaft and the table feed screw, a cross feed screw for the saddle and a driving spindle both mounted in the knee vertically beneath said vertical shaft, and gear wheels coupling the vertical shaft and the driving spindle and adapted to move adjacent to but out of engagement with the cross feed screw.

6. In a milling machine the combination of a knee, a saddle and a table, a feed screw for the saddle mounted in the knee, a bracket projecting down from the saddle and engaging the feed screw to effect the feed of the saddle, a driving spindle mounted in the knee directly beneath the feed screw, a pinion upon the spindle, a second pinion mounted on the bracket passing the feed screw with clearance and engaging the pinion on the driving spindle, a feed screw for the table, and gear wheels carried by the bracket and adapted to connect the second pinion and the feed screw of the table.

7. In a milling machine the combination of a knee, a saddle upon the knee, a swivel base upon the saddle, a table upon the swivel base, a feed screw for the table, a vertical shaft adapted to engage the feed screw of the table, a cross feed screw adapted to reciprocate the saddle and a driving spindle, both the cross feed screw and the driving spindle being mounted centrally in the knee, and gear wheels mounted upon the saddle coupling the driving spindle, and the vertical shaft and passing the cross-feed screw with clearance.

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