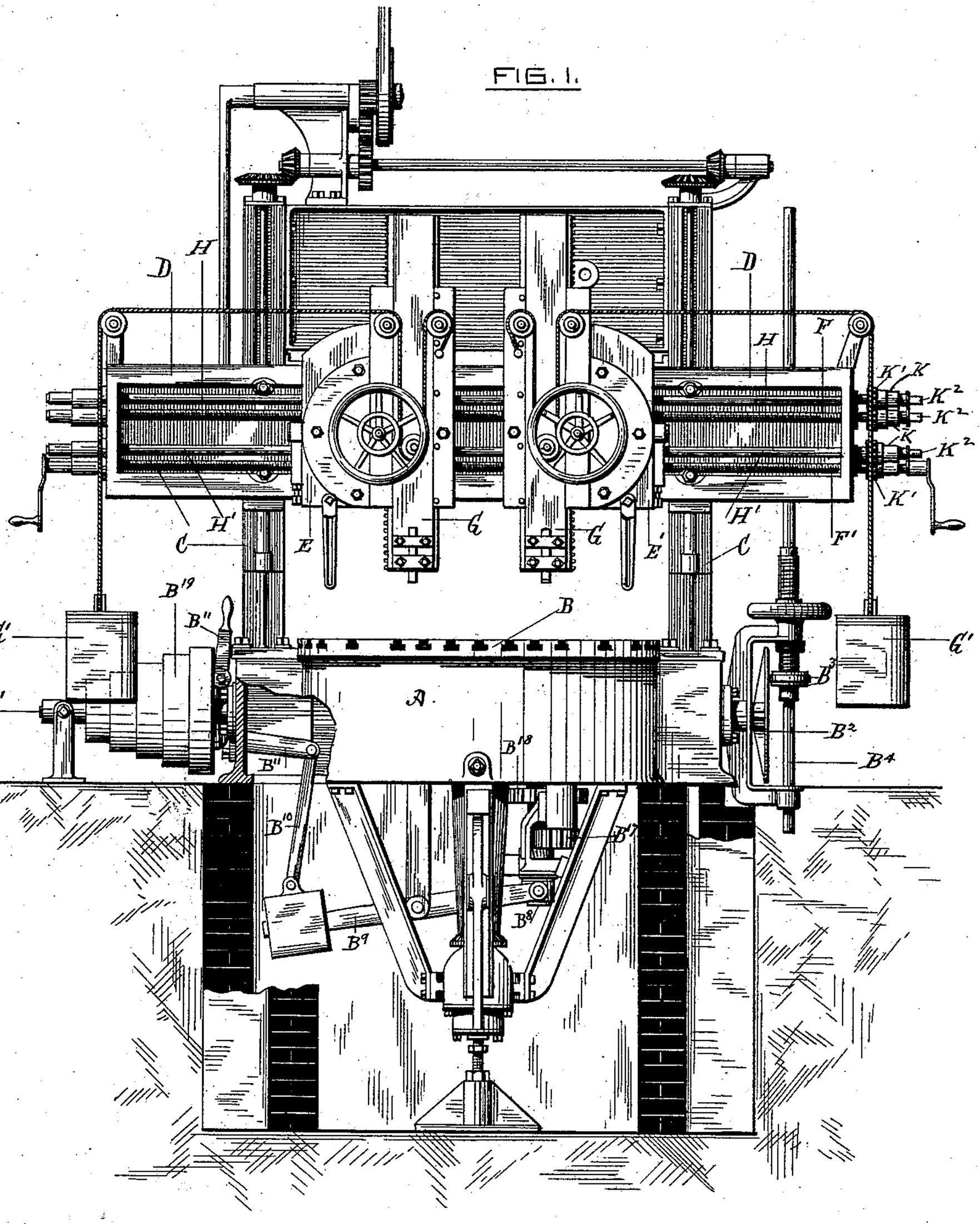
(No Model.) 3 Sheets—Sheet 1.

A. C. STEBBINS.

BORING MILL.

No. 392,170. Patented Oct. 30, 1888.

FIG. 1.



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(No Model.) 3 Sheets—Sheet 2.

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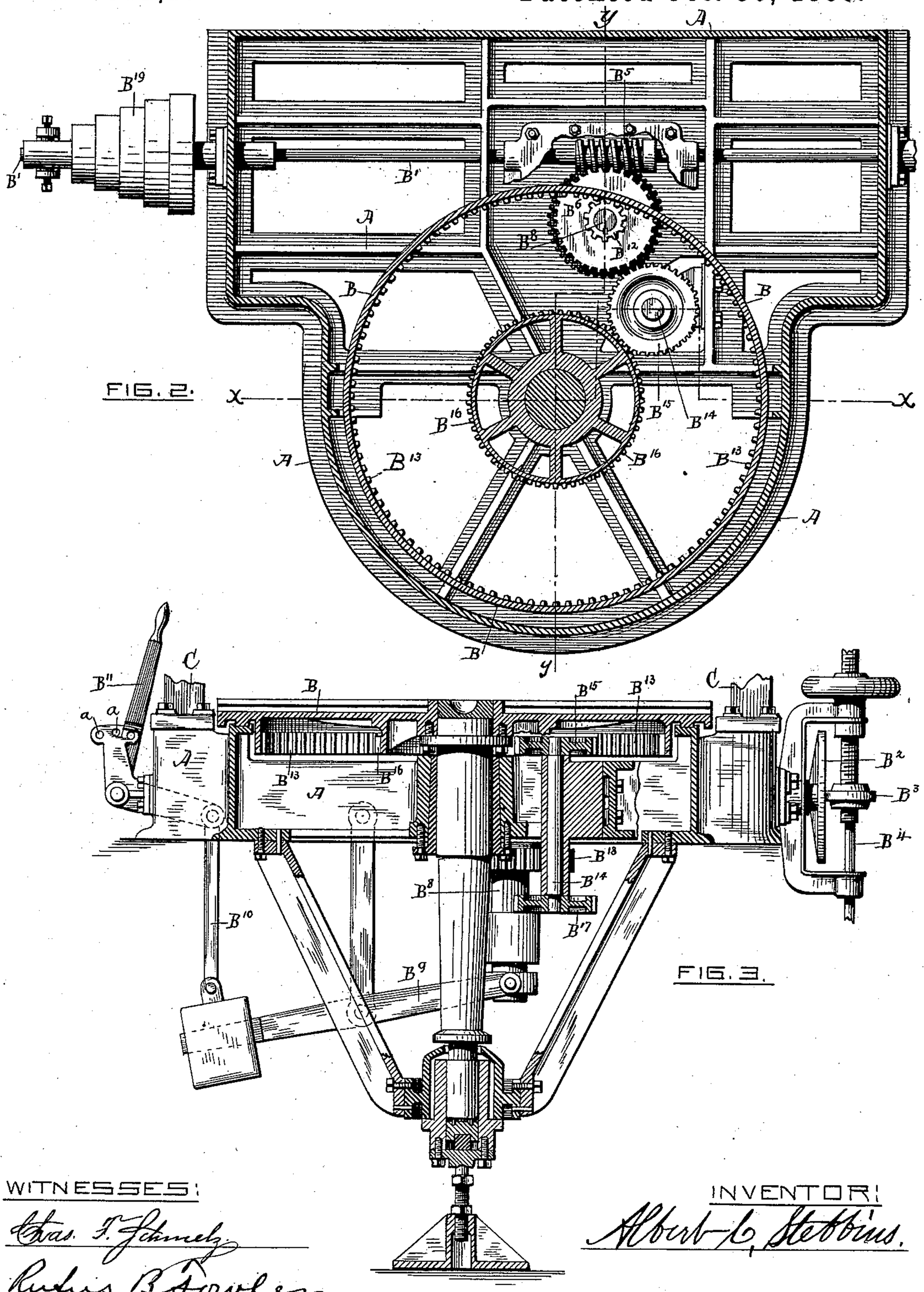

FIG. 2.

FIG. 3.

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FIG. 4.

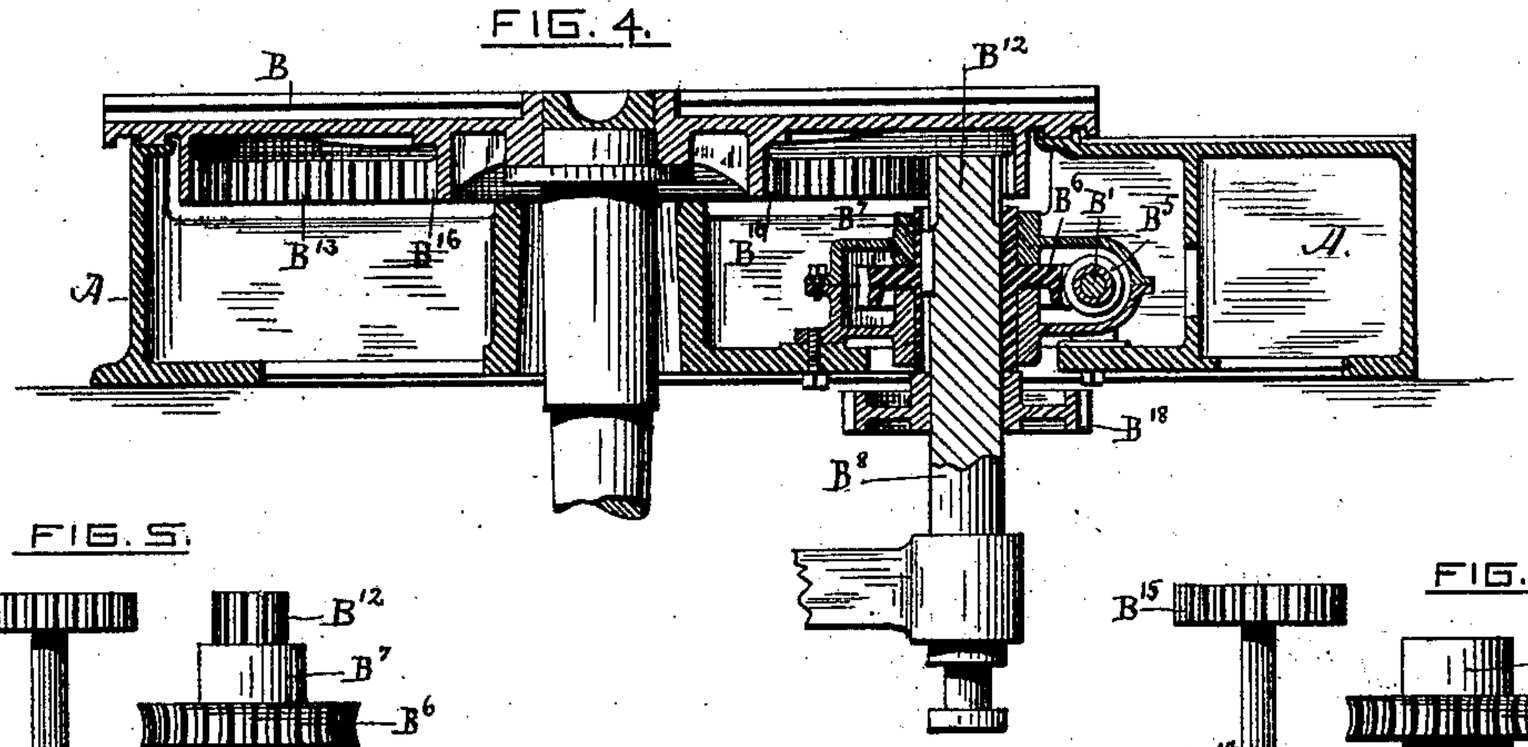


FIG. 5.

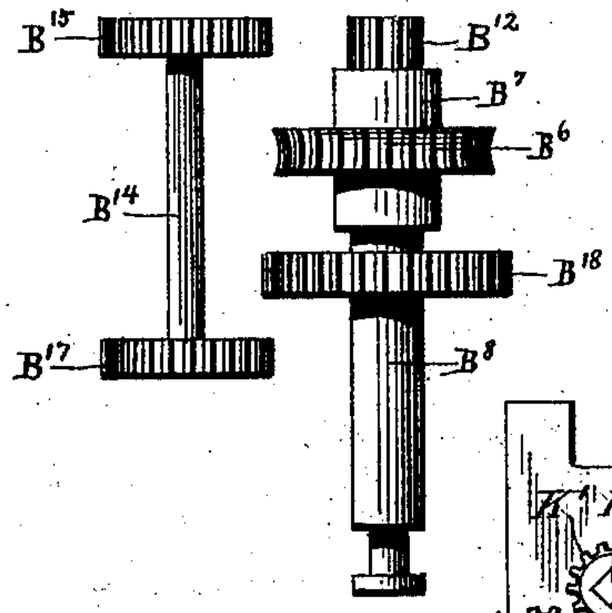


FIG. 6.

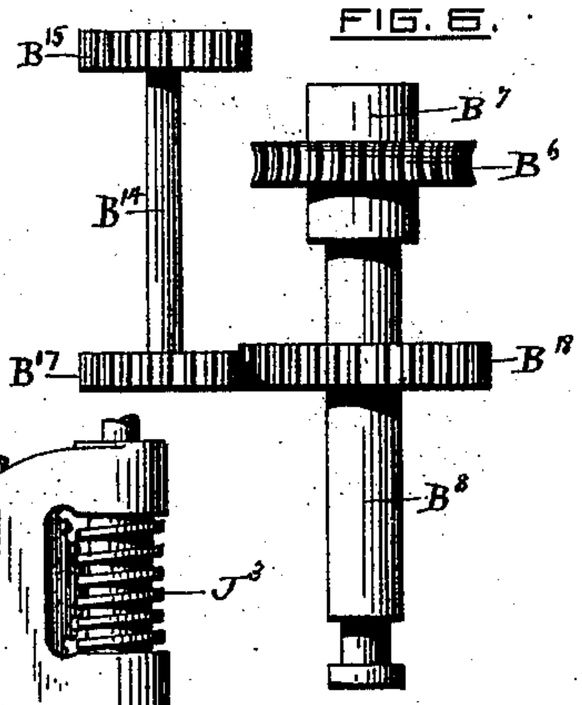


FIG. 7.

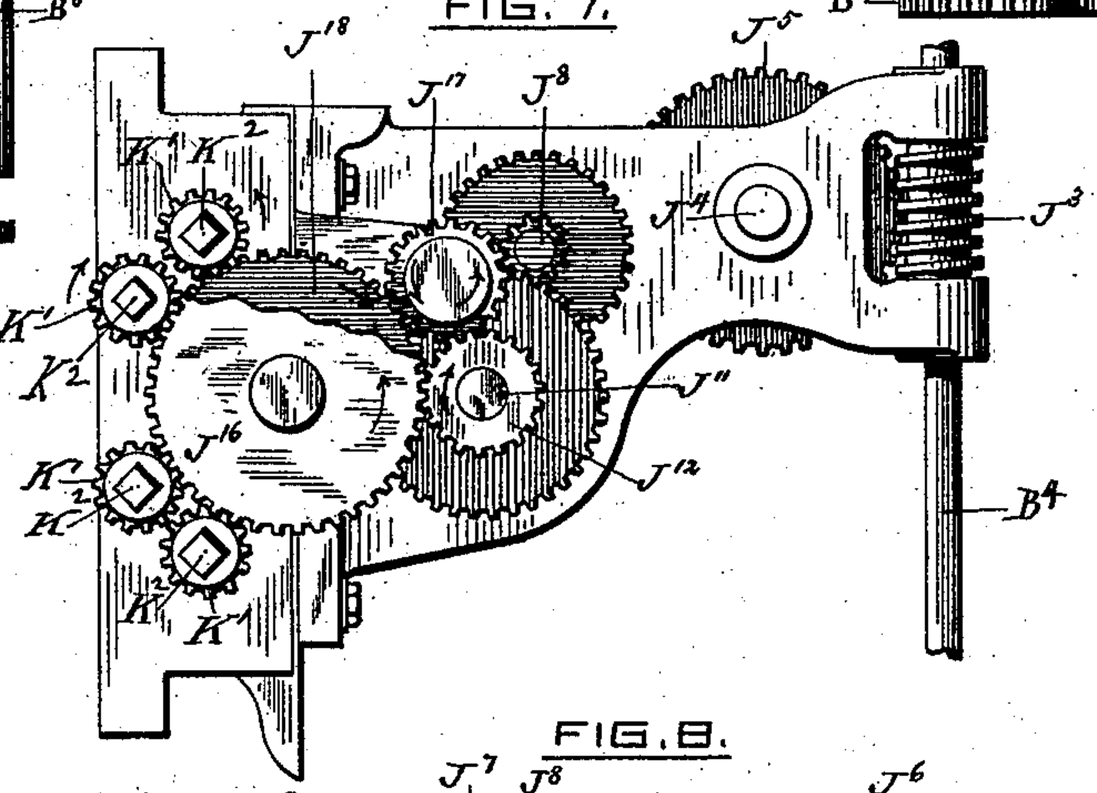


FIG. 8.

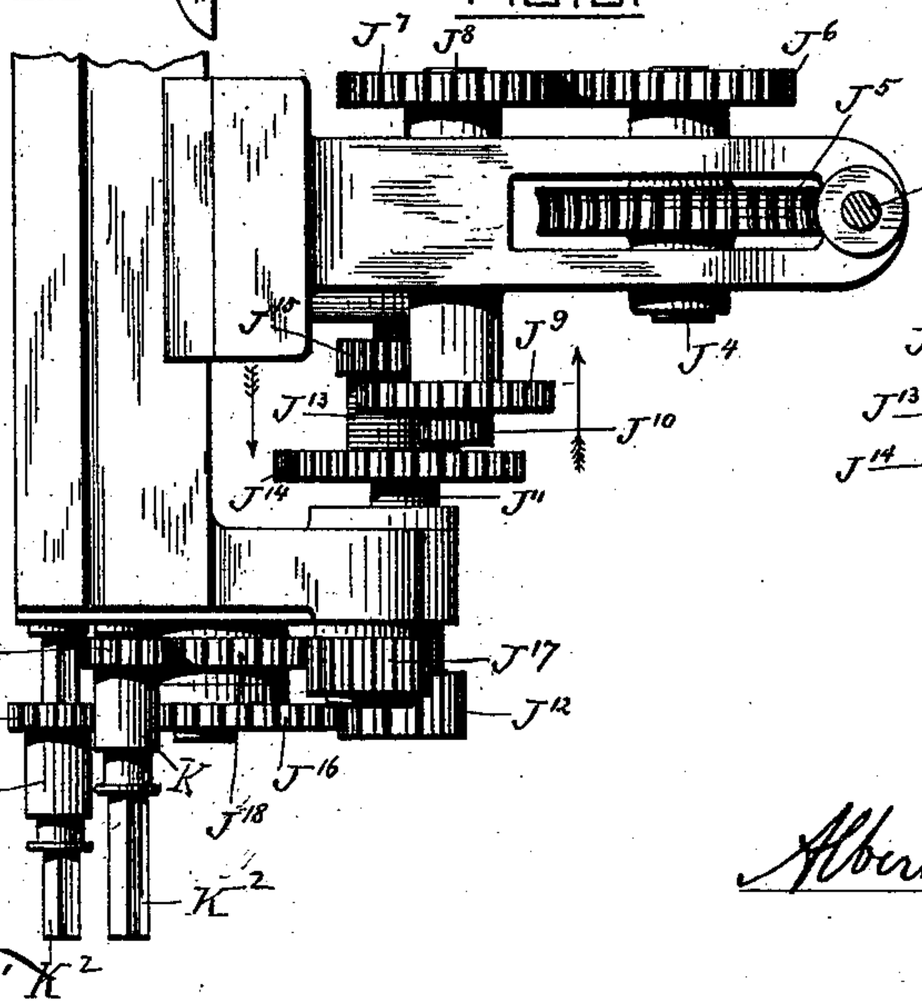


FIG. 9.

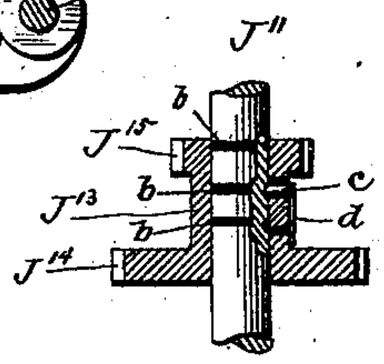
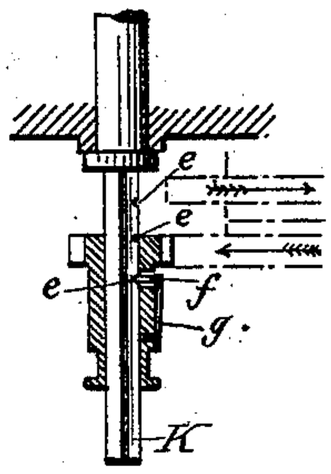


FIG. 10



WITNESSES:
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UNITED STATES PATENT OFFICE.

ALBERT C. STEBBINS, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE POND MACHINE TOOL COMPANY, OF SAME PLACE.

BORING-MILL.

SPECIFICATION forming part of Letters Patent No. 392,170, dated October 30, 1888.

Application filed March 23, 1887. Serial No. 232,109. (No model.)

To all whom it may concern:

Be it known that I, ALBERT C. STEBBINS, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Boring-Mills, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a front view of a boring-mill embodying my invention. Fig. 2 is a horizontal sectional view showing a portion of the mechanism for rotating the table. Fig. 3 shows a portion of the mechanism for rotating the table, partly in section, on line X X, Fig. 2. Fig. 4 represents a portion of the mechanism for rotating the table, partly in section, on line Y Y, Fig. 2. Figs. 5 and 6 show a detached portion of the mechanism for rotating the table, but in different positions. Figs. 7 and 8 are respectively an elevation and end view of the mechanism for feeding the cutting-tools. Fig. 9 is a sectional view of the sliding gears by which a change in the speed of the cutting-tool is effected, and Fig. 10 represents a sectional view of one of the sliding gears on the feed-rods and screws.

Similar letters refer to similar parts in the several views.

The construction and arrangement of the operating parts of my improved boring-mill are similar to those now in general use, and consist of a bed, A, upon which is rotated a face-plate, B. To the bed A are attached the two uprights C C, provided with vertical ways for the cross-head D, upon which are placed the saddles E E′, capable of a sliding motion along the cross-head D by means of the rotating screws F F′.

The saddles E E′ carry the tool-holders G, counterbalanced by the weights G′, arranged so their action is in the line of the axes of the tool-holders. A vertical feed is given to the tool-holders by the splined rotating rods H H′, having connecting mechanism acting upon racks on the tool-holders in a manner common in machines of this class.

The face-plate is supported by an upright spindle upon a central step, and is rotated by the cone-pulley shaft B′ through mechanism which embodies the first part of my present invention, and which is fully described hereinafter. The feed of the cutting-tools is accomplished by a disk, B^2, on the shaft B′, and a friction-wheel, B^3, and shaft B^4, through mechanism which embodies the second part of my invention, as hereinafter set forth.

Upon the shaft B′, which is driven through the cone-pulley B^4, I place a worm, B^5, engaging a worm-gear, B^6, on the vertical sleeve B^7, Fig. 4. B^8 is a vertical shaft, having a spline-connection with the sleeve B^7, and capable of sliding vertically through the sleeve by means of the lever B^9, link B^{10}, and bell-crank lever B^{11}. At the upper end of the shaft B^8, I attach a pinion, B^{12}, which engages the internal gear, B^{13}, on the lower side of the face-plate B, thereby imparting a slow rotary motion to the face-plate.

Journaled in the frame-work of the machine is a vertical shaft, B^{14}, having at its upper end a gear, B^{15}, which engages an external gear on the lower side of the face-plate B, and at the lower end of the vertical shaft B^{14} is placed a gear, B^{17}, which is engaged by the gear B^{18}, attached to the sliding shaft B^8, when the shaft B^8 is at its lowest position and the pinion B^{12} is withdrawn from the internal gear, B^{13}, into the sleeve B^7. The rotary motion imparted by the worm B^5 is then conveyed through the sliding shaft B^8 and gears B^{17} and B^{18} to the external gear, B^{16}, giving a quicker rotary motion to the face-plate B.

In Fig. 5 the sliding shaft B^8 is shown in its highest position, with the pinion B^{12} raised above the sleeve B^7 and in position to engage the internal gear, B^{13}, and the gear B^{18} raised above and out of engagement with gear B^{17} on the shaft B^{14}.

In Fig. 6 the sliding shaft B^8 is shown in its lowest position, with the pinion B^{12} withdrawn into the sleeve B^7 and the gear B^{18} lowered so as to engage the gear B^{17} on the shaft B^{14}. The shaft B^8 may also be held in a position intermediate between the highest and lowest positions, as shown in Figs. 5 and 6, with both the pinion B^{12} and gear B^{18} disengaged from the internal gear, B^{13}, and the spur-gear B^{17}. A latching device of any common and well-known form of construction is attached to the bell-

crank lever B^{11}, (not shown in the drawings,) and by its engagement of the holes *a* the sliding shaft B^8 is securely maintained in its highest, lowest, or intermediate positions, enabling the operator to disconnect the face plate and give it a rotary motion on its central supporting-step entirely independent of any connection with the driving mechanism, and also to vary the speed of the face-plate relatively to the speed of the shaft B', which is also capable of a variation in its speed by means of its cone-pulley B^4.

I secure an automatic and independent feeding motion of the two tool-holders G by providing each tool-holder with a rotating screw and splined rod, the screw F and rod H imparting a horizontal and vertical feeding motion to one of the tool-holders and the screw F' and rod H' to the other tool-holder. The screws F F' and rods H H' are rotated by means of the friction-disk B^2 on the shaft B', brush-wheel B^3, and vertical shaft B^4, having a worm, J^3, which imparts a feeding motion to the tool-holders G through connecting mechanism peculiar to my improved boring-mill, and by which I am enabled to change the direction of the feed of either of the tool-holders at will, and also to vary the speed of the tool-holders to correspond with the change in the speed of the face-plate caused by the change of the driving mechanism from the internal gear, B^{13}, to the external gear, B^{16}, and vice versa.

The mechanism for imparting a feeding motion to the tool-holders is illustrated in Figs. 7 and 8, which show, respectively, an elevation and top view. The operating parts are journaled in a frame-work projecting from and attached to the rear of the cross-head D, and the worm J^3, which is carried by the frame-work, has a spline-connection with the shaft J^2, in order to allow a vertical adjustment of the cross-head.

J^4 is a shaft carrying a worm-wheel, J^5, driven by the worm J^3, and a spur-gear, J^6, engaging a like spur-gear, J^7, on the shaft J^8, which has a gear-wheel, J^9, and a pinion, J^{10}. Journaled below the shaft J^8 is a shaft, J^{11}, having a broad-faced pinion, J^{12}, and carrying a sliding sleeve, J^{13}, to which are attached a gear, J^{14}, adapted to engage the pinion J^{10}, and a pinion, J^{15}, adapted to engage the gear J^9, the former engagement imparting a slow motion to the shaft J^{11} and the latter engagement imparting a quicker motion to the shaft J^{11}, the two speeds bearing the same ratio to each other as the speeds imparted to the face-plate B by means of the internal gear, B^{13}, and the external gear, B^{16}, and their connected mechanism. The broad-faced pinion J^{12} engages by one half its face with the large spur-gear J^{16}, and by the other half its face with an intermediate broad-faced pinion, J^{17}, turning on a stud in the frame, and through which a rotary motion is imparted to the large spur-gear J^{18}, and in a contrary direction to the gear J^{16}. The gears J^{16} and J^{18} are held on a common stud, around which the screws F F' and rods H H' are journaled concentrically.

The projecting ends of the screws F F' and rods H H' are squared to receive the sliding sleeves K, each of which carries a pinion, K', which is brought into engagement with one of the spur-gears J^{16} or J^{18}, as desired, causing the rods or screws to be rotated in either direction; or the pinions K' may be brought midway between the gears J^{16} and J^{18}, and thereby entirely disconnected from the driving-power. Likewise the sleeves J^{13} may be brought into the position shown in Fig. 8, in which the pinion J^{10} and gear J^9 are midway the gear J^{13} and pinion J^{15}, thereby disconnecting the shafts J^8 and J^{11}. The shaft J^{11} has the three grooves *b*, into which a pin, *c*, is pressed by the spring *d*, and the squared section of the screws F F' and rods H H' have the notches *e*, into which a pin, *f*, is pressed by a spring, *g*, in a well-known manner, and by which the sleeve J^{13} and the sleeves K are retained in place.

When the face-plate is disconnected from the driving-power, by lowering the shaft B^5 into its intermediate position, so its pinion B^{12} and gear B^{18} are disengaged from the internal gear on the face-plate and the spur-gear B^{17} on the shaft B^{14}, the sleeve J^{13} is placed in the position shown in Fig. 8, in which the driving-power is disconnected from the feeding mechanism. When the face-plate is driven by the pinion B^{12} and internal gear B^{13}, imparting a slow motion to the face-plate, the feeding mechanism is driven by sliding the sleeve J^{13} in the direction of the arrow 1, Fig. 8, bringing the pinion J^{10} in mesh with the gear J^{14}, and when the face-plate B is driven by means of the external gear, B^{16}, and its connected mechanism, imparting a quicker motion to the face-plate, the feeding mechanism is driven by sliding the sleeve J^{13} in the direction of the arrow 2, bringing the gear J^9 in mesh with the pinion J^{15}, the two speeds of the feeding mechanism corresponding to the two speeds of the face-plate.

The sleeves K allow the rods H H' and the screws F F' to be disconnected at will from the driving-power, which is accomplished in a similar manner in machines of this class; but they also permit the direction of the motion to be changed, as desired, by engaging them with one or the other of the oppositely-rotating gear-wheels J^{16} and J^{18}, and by the use in connection with each of the tool-holders G of a rod and screw, each independent of the other, I am able to impart a feeding motion to each independently of the other, and in either direction, horizontally or vertically.

In the accompanying drawings and description I have set forth in detail only those portions of the machine which embody the features of my present invention.

The general construction and arrangement of the other operating parts are similar in my machine to those in common use and are familiar to those conversant with this class of machinery. The friction-disk and brush-wheel

adjustable radially on the friction-disk have long been in use as a part of the mechanism for imparting a feeding motion to the tool-holders of boring-mills, and it has been customary to accomplish the horizontal and vertical feed of the tool-holders by means of screws and splined rods journaled on the cross-head and suitably connected with the tool-holders for their vertical adjustment and feeding motion and with the saddles to accomplish the horizontal feeding motion of the tool-holders. An internal gear on the under side of the face-plate has also been employed, by which the face-plate has been driven through a vertical shaft; but it has been usual to either drive the face-plate by means of bevel-gears, which are liable to impart a lifting motion to face-plate; or, when an internal gear and vertical shaft are used, it has been customary to drive said vertical shaft by means of a bevel-gear, the decrease in the speed of the face-plate being wholly accomplished in the gearing between the face-plate and the cone-pulley shaft.

I employ a worm on the cone-pulley shaft to impart a rotary motion to the mechanism directly employed in rotating the face-plate, and I thereby secure a rapid motion of the cone-pulley shaft and friction-disk with a comparatively slow motion of the face-plate without the intervention of a train of gearing for the express purpose of reducing the speed of the face-plate or of employing gears with a great difference in size. Means are employed, as is usual in boring-mills, in order to raise the face-plate from its bearing upon the annular way on the bed and support it by means of the central spindle when disconnected from the driving mechanism, so as to reduce the friction and permit the face-plate to be readily rotated for the purpose of centering and adjusting the work.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a boring-mill, the combination, with a face-plate having an annular gear attached thereto, of a driving-shaft parallel with the axis of said face-plate, a gear on said shaft engaging said annular gear, said shaft being capable of a sliding motion, whereby its gear is disconnected from said annular gear, substantially as described.

2. The combination, with the face-plate of a boring-mill, having an external and internal annular gear attached thereto, of a fixed shaft having its axis parallel with the axis of the face-plate, a gear-wheel on said fixed shaft engaging the external annular gear of the face-plate, a gear-wheel on said fixed shaft, through which rotary motion is imparted to the fixed shaft, a shaft with its axis parallel with said fixed shaft and capable of sliding vertically, a pinion on said sliding shaft engaging the internal annular gear on said face-plate, and a gear-wheel on said sliding shaft, which by the sliding movement of said sliding shaft is made to engage the gear-wheel on said fixed shaft, substantially as described.

3. The combination, with a face-plate having an annular gear attached thereto, of a shaft with its axis parallel with the axis of the face-plate, a gear on said shaft engaging said annular gear on the face-plate, a pivoted lever with one end so applied to said shaft that the vibration of the lever will raise and lower said shaft, and connected means whereby said pivoted lever is operated by the attendant, substantially as described.

4. The combination, with the face-plate of a boring-mill, having the annular gears B^{13} and B^{16}, of the shaft B^{14}, with gears B^{15} and B^{17}, rotating shaft B^{8}, with pinion B^{12} and gear B^{18}, pivoted lever B^{9}, link B^{10}, and bell-crank lever B^{11}, substantially as described.

5. The combination, with the face-plate of a boring-mill, having an annular gear attached thereto, of a shaft with its axis parallel with the axis of the face-plate, a gear on said shaft engaging said annular gear, and a worm-gear on said shaft engaged by a worm on the driving-shaft, and a driving-shaft having an actuating-worm, substantially as described.

6. In a boring-mill, the combination, with the splined rod and screw, whereby a feeding motion is imparted to the tool-holders, and pinions having a sliding motion thereon, of a pair of rotating gears having coincident axes and rotating in opposite directions, said sliding pinions on said feeding rod and screw being arranged concentrically around said rotating gears, substantially as described.

7. In the feeding mechanism of a boring-mill, a pair of rotating gears turning about a common axis, but in opposite directions, one or more splined rods or screws journaled in the cross-head, by which a feeding motion is imparted to the tool-holders, and pinions having a sliding motion on said splined rods or screws, whereby they are connected with or disconnected from either of said rotating gears, all combined and operating substantially as described.

8. The combination of screws F F′, rods H H′, sliding pinions K′, and oppositely-running gear-wheels J^{16} and J^{18}, substantially as described.

9. The combination of screws F F′, rods H H′, pinions K′, gear-wheels J^{16} and J^{18}, pinions J^{12}, and intermediate pinion, J^{17}, said pinion J^{12} being rotated through intermediate gearing by an actuating-worm, J^{3}, on the vertical rotating shaft J^{2}, substantially as described.

10. The combination of rotating worm J^{3}, shaft J^{8}, driven by said worm through intermediate gearing, gear J^{9}, and pinion J^{10}, sleeve J^{13}, carrying a gear, J^{14}, and pinion J^{15}, and capable of sliding on the shaft J^{11}, shaft J^{11}, pinion J^{12}, screws F F′, splined rods H H′, and pinions K′, driven by said pinion J^{12} through intermediate gearing, substantially as described.

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H. M. FOWLER.