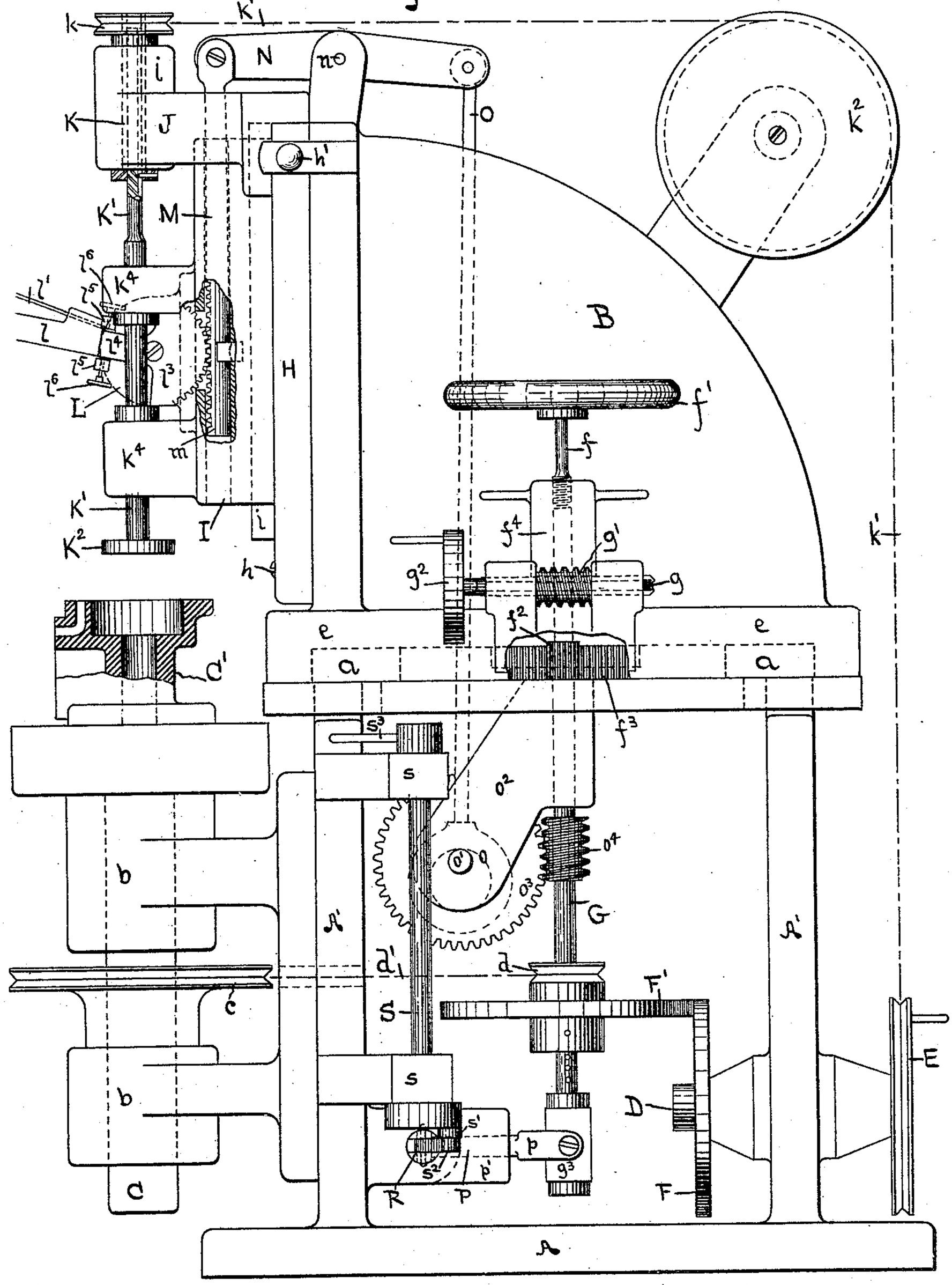
(No Model.) 3 Sheets—Sheet 1.

C. H. NORTON.

GRINDING MACHINE.

No. 429,698. Fig. 1. Patented June 10, 1890.



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(No Model.) 3 Sheets—Sheet 2.

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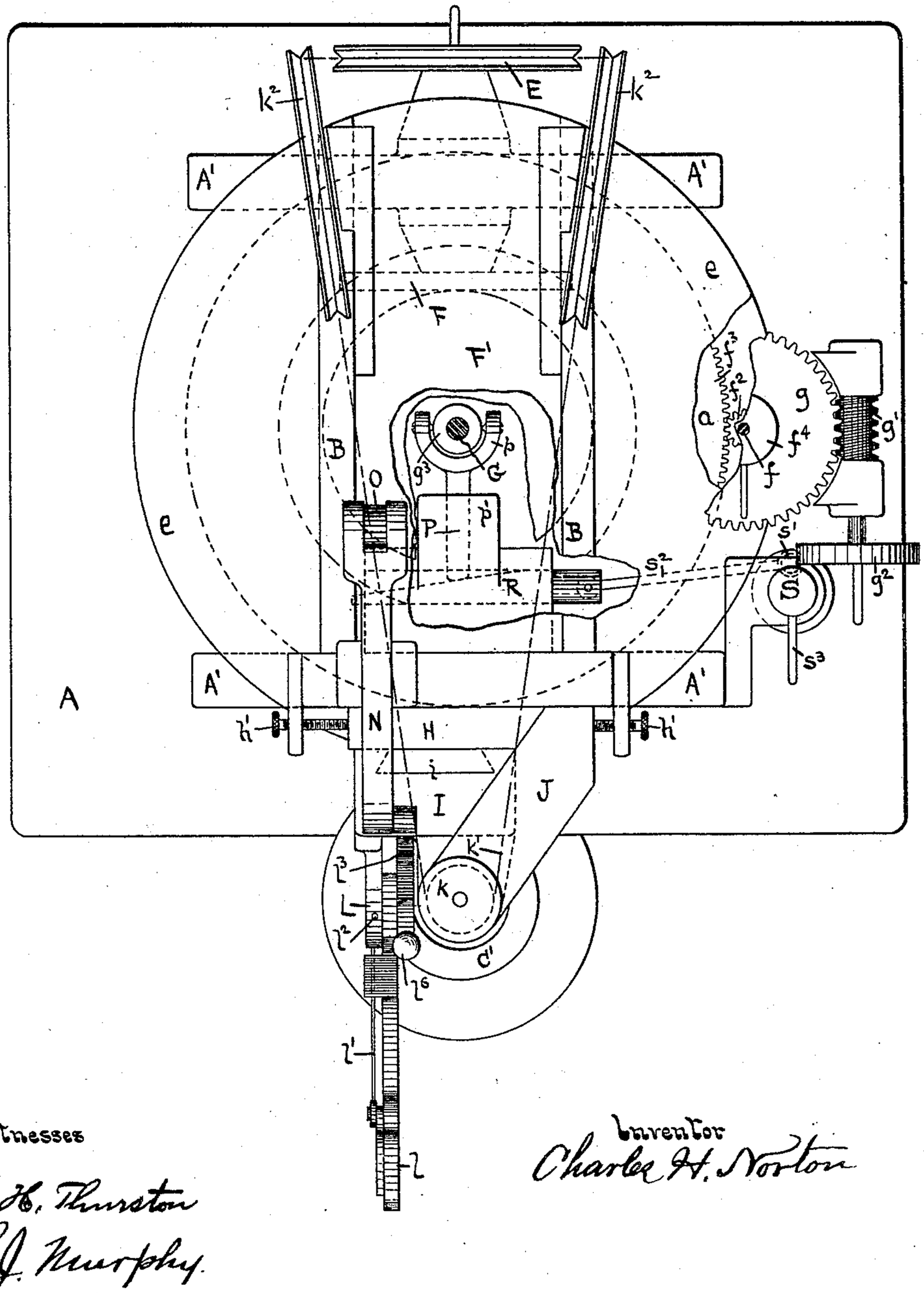
Fig. 2.



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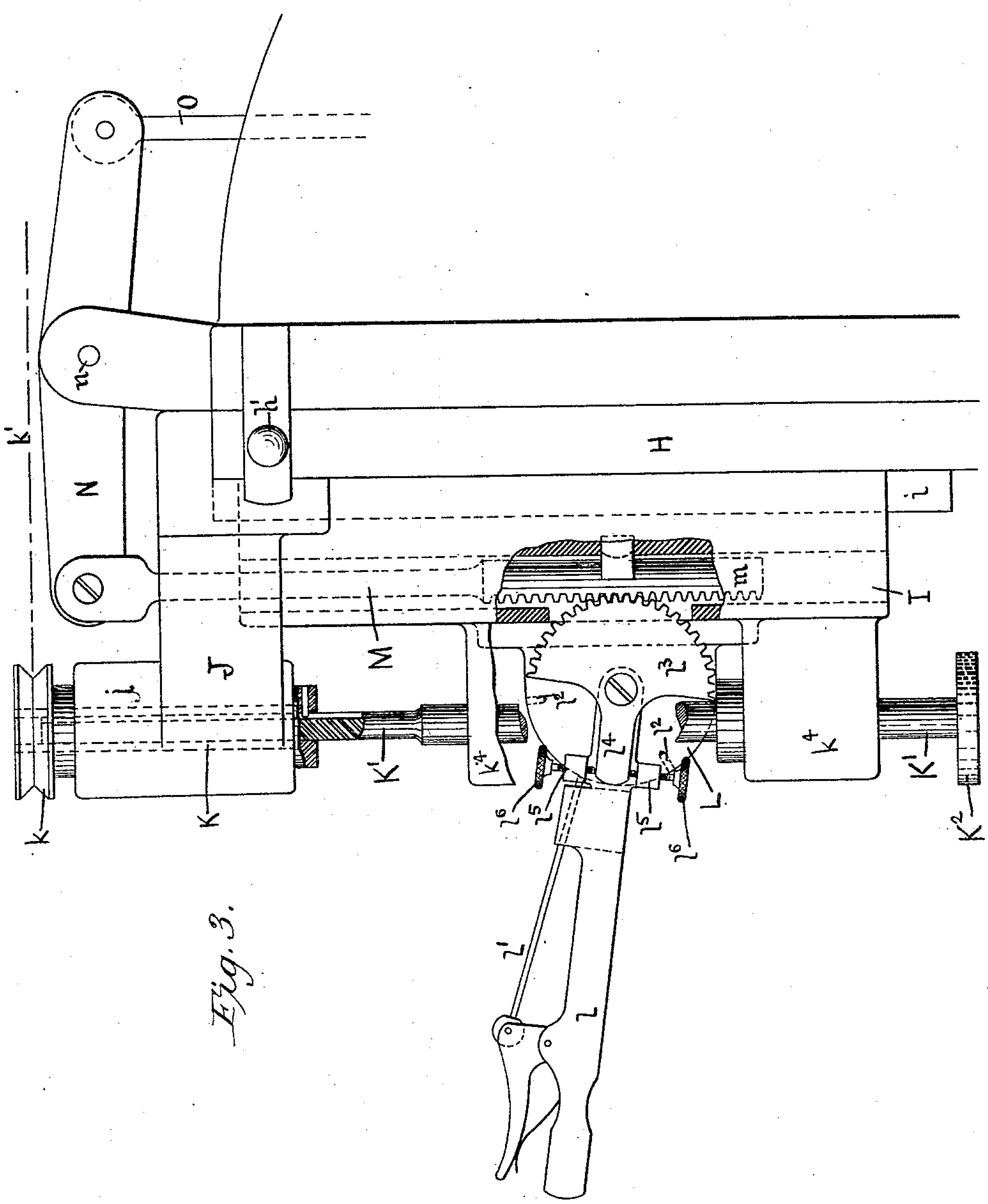

Fig. 3.

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GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 429,698, dated June 10, 1890.

Application filed December 12, 1889. Serial No. 333,511. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. NORTON, of the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Grinding-Machines; and I do hereby declare the following specification, taken in connection with the accompanying drawings, forming a part of the same, to be a full, clear, and exact description thereof.

The machine hereinafter described is particularly adapted for the grinding of the interior surfaces of cylinders. The characteristics which make it especially valuable for this purpose are certain combinations of devices and arrangements of parts so that the very nice work of surfacing by grinding the interior of a cylinder can be performed with great rapidity and accuracy, and with great convenience in performing the work. These results are accomplished by so combining the grinding-wheel and its driving-spindle and the carriage which carries the same with the mechanism which causes the carriage to reciprocate for causing the grinding-wheel to traverse the length of the cylinder that such grinding-wheel and its shaft can be disconnected from the influence of the feed mechanism and be quickly withdrawn by hand from the cylinder to be ground. Furthermore, the mechanism which gives rotation to the cylinder to be ground and the feed mechanism which reciprocates the carriage which carries the grinding-wheel can be stopped instantly at pleasure at any desired point without stopping the revolution of the grinding-spindle. Again, the devices for connecting and disconnecting the source of motion from the mechanism which rotates the cylinder to be ground and operates the traversing carriage carrying the grinding-wheel are peculiar and effective.

In the accompanying drawings, Figure 1 represents a side elevation of my improved grinding-machine, partly in section. Fig. 2 is a plan view of the same with some of the parts broken away. Fig. 3 is a side view, partly in section, of a portion of the machine, showing the connection between the grinding-wheel and its shaft and the mechanism by which it is operated.

The machine is provided with a suitable base A, having uprights or standards A′ A′, upon which the several parts of the machine are mounted. To the upper end of these uprights an annular head *a* is secured, upon which the upper frame-work B, which carries the grinding mechanism, is mounted so as to be capable of being revolved thereon. Secured to one of the uprights A′ are two bearings *b b* for supporting the work-carrying shaft C, which is provided with a pulley *c*, and to the upper end of which the cylinder to be ground (represented at C′) is secured, so as to be revolved therewith. Mounted in the opposite standard A′ is a shaft D, carrying at one end the main driving-pulley E of the machine, to which power may be applied in any suitable way, and at the other end a friction disk or pulley F, designed to be engaged with and to communicate motion to a corresponding friction disk or pulley F′, arranged at right angles thereto.

The friction-disk F′ is mounted upon a vertical shaft G, located in the center of the machine. Secured to this shaft G is a pulley *d*, from which a belt *d′* extends to the pulley *c* to give motion to the work-carrying shaft C.

The upper frame-work B is provided with a circular base *e*, which is mounted upon and fits over the annular head *a*, as shown in Fig. 1. Mounted in the circular base *e* is a vertical shaft *f*, provided at its upper end with a hand-wheel *f′* and at its lower end with a pinion f^2, which engages with a circular interior rack f^3, secured to the annular head *a*, whereby by turning the hand-wheel *f′* the circular base *e*, together with the frame-work B and all the mechanism mounted thereon, may be revolved, for the purpose hereinafter described.

To secure a nice and accurate adjustment of the upper frame-work and the grinding mechanism carried thereby with relation to the stationary lower part of the machine and the work-carrying shaft supported thereon, a worm-wheel *g*, Fig. 2, is loosely mounted on the shaft *f*, which worm-wheel meshes with a worm-shaft *g′*, mounted in suitable bearings secured to the circular base *e*, said worm-shaft being provided with a suitable hand-wheel g^2 for giving rotation thereto. Upon the shaft

f is a friction-nut f^4, by means of which the worm-wheel g may be connected so as to revolve with or be disconnected from the shaft f. By connecting the worm-wheel g to the shaft f and revolving the worm-shaft g' it will be seen that a fine movement may be given to the upper frame-work and the mechanism carried thereon and an accurate adjustment thereof be effected.

To the front of the frame B is attached a support or slide H, arranged to swing upon a pivot h at its lower end, as shown in Fig. 1, the extent of movement of which is governed by the adjusting-screws h' h', and by which screws the position of the slide H may be accurately adjusted to secure the necessary alignment of the grinding-spindle with the work-carrying shaft. The slide H is provided with ways i, upon which slides the reciprocating carriage I. Secured to the slide H is a bracket J, carrying a bearing or support j for the hollow vertical shaft K. (Shown in dotted lines, Figs. 1 and 3.) This shaft K carries a pulley k at its upper end, to which motion is imparted by means of a belt k', which connects the pulley k with the main driving-pulley E, the belt passing over guide-pulleys k^2 k^2, as shown in the drawings.

K′ is the grinding-spindle, which is mounted in suitable bearings k^4 k^4 on the reciprocating carriage I, and carries at its lower end the grinding-wheel K^2. The upper end of this grinding-spindle is reduced in diameter, for the purpose hereinafter explained, and is connected with the hollow shaft K by a groove-and-spline connection, as shown in Figs. 1 and 3, whereby it may be made to revolve therewith, but may have a longitudinal motion with relation thereto.

The means for giving the necessary reciprocating movement to the carriage I are as follows: Secured to the reciprocating carriage is a sector L. Pivoted to this sector is a suitable lever l, provided with a latch l' for holding it in position, something like the reversing-lever of a locomotive, the sector L being provided with suitable sockets l^2 for receiving the end of the latch l'. Also pivoted to the sector L by the same pivot-pin is a segmental gear l^3, adapted to be connected to and operated by the lever l. For the purpose of effecting this connection between the lever and the segmental gear the latter is provided with a projecting extension l^4, the end of which extension lies between two lugs l^5 l^5, secured to the lever l, and so arranged that there is a certain amount of play or lost motion between the projection of the segmental gear and the lugs on the lever, all as shown in Fig. 3. Each of the lugs l^5 l^5 is provided with a set-screw or adjusting-screw l^6, which are screwed up to clamp the projecting extension of the segmental gear, and which may also be employed to accurately adjust the vertical position of the grinding-wheel. By this arrangement the reciprocating carriage and the grinding-spindle mounted thereon may be raised and lowered by hand independent of the feed mechanism next to be described.

M is a connecting-rod provided at its lower end with a rack m, which meshes with the segmental gear l^3, Figs. 1 and 3, and connected at its other end to one end of a lever-beam N, pivoted at n to the upper part of the frame-work B. To the opposite end of this lever-beam one end of an eccentric-rod O is connected. The other end of this eccentric-rod carries an eccentric o, mounted upon the eccentric shaft o', which in turn is mounted in suitable bearings in a bracket o^2, depending from the circular base e of the frame-work B. This eccentric-shaft o' carries at its other end a worm-wheel o^3, which meshes with a worm o^4, upon the central shaft G. This central shaft G has a loose fit in the bearing which supports its upper end, so that it may be capable of swinging to a limited extent, after the manner of a pendulum. The lower end of the shaft G is supported in a bearing g^3, which is pivotally connected to a horizontal slide P, the latter being provided with a forked end p to embrace the bearing g^3, as clearly shown in Fig. 2, the connection being such that the necessary movement of the lower end of the shaft may be permitted. The slide P is arranged to travel horizontally in a suitable support p', secured to one of the uprights A′. Arranged to travel back and forth in the support p', but in a direction at right angles to the line of movement of the slide P, is a wedge R, located so as to bear against the end of the slide P, as indicated in dotted lines, Fig. 2, whereby by the movement of the said wedge in the proper direction the slide P and the lower end of the shaft G, connected therewith, may be forced outward, and so as to force the frictional disk F′ upon the shaft G into operative contact with the frictional disk F, and thereby communicate power from the driving-shaft D to the shaft G to revolve the latter. For the purpose of operating the wedge R a rock-shaft S is mounted in suitable bearings s s, secured to one of the uprights A′. This rock-shaft is provided at its lower end with a crank-and-pitman connection s' s^2, connecting said rock-shaft with the wedge R, whereby a rocking of the shaft S will operate the wedge. The other end of the rock-shaft is provided with a suitable handle s^3 for operating it.

The operation of the machine is as follows, it being understood that the grinding-spindle with its grinding-wheel may be kept in continuous revolution by means of the belt k', even when the reciprocation of the carriage which carries the grinding-spindle and the revolution of the work-carrying shaft is stopped. It will now be supposed that the friction-disk F′ is out of contact with the disk F, and thus the reciprocating carriage I and the work-carrying shaft are at a standstill. It will also be supposed that the reciprocating carriage I, carrying the grinding-spindle K′, has been raised by hand by means

of the lever *l* to the position shown in Fig. 1, and the grinding-wheel thus elevated so as to permit the convenient attachment to the work-carrying shaft of the work to be ground. The cylinder whose interior surface is to be operated upon is then attached to the work-carrying shaft. By means of the hand-lever *l* the reciprocating carriage and the grinding-wheel are then lowered, so that the grinding-wheel will enter the cylinder to be ground, the segmental gear l^3 traveling down the rack *m* on the connecting-rod M, which is for the time being stationary. The proper alignment of the grinding-spindle and its grinding-wheel with the work-carrying shaft and the axis of the cylinder is effected by means of the adjusting-screws *h' h'*, and the proper position of the grinding-wheel laterally with relation to the interior surface of the cylinder is secured by revolving the upper framework, which carries the grinding mechanism, by turning the hand-wheel *f'*, or if a very accurate adjustment is desired, by revolving the worm *g'*, the worm-wheel *g* having been properly connected with the shaft *f*. If the vertical position of the grinding-wheel requires to be very accurately adjusted, this may be done by means of the adjusting-screws l^6 l^6. When the necessary adjustments have been made and the grinding is ready to be commenced, a proper movement of the rock-shaft S by means of its handle will, by means of the wedge R acting on the slide P, force the friction-disk F' into contact with the disk F, and thus cause the revolution of the shaft G, which in turn, by means of the belt *d'*, will give revolution to the work-carrying shaft and the cylinder to be ground. The revolution of the shaft G will also, by means of the worm o^4 and the connecting mechanism, give a reciprocating motion to the carriage I, the segmental gear l^2 being held stationary by means of the latch *l'* entering one of the sockets l^2 in the sector L, so that the rack *m* on the connecting-rod M will for the time being form a positive connection with the segmental gear, and thus cause the carriage I to partake of the movements of said connecting-rod.

When the grinding of the work has been completed, the carriage I, carrying the grinding-spindle, is raised by means of the lever *l*, the segmental gear l^3 traveling on the rack *m* on the connecting-rod M, so as to raise the grinding-wheel clear of the work which has been ground, and the rock-shaft S is rocked by means of its handle, so as to withdraw the wedge R, and thus allow the shaft G to swing back, so as to remove the friction-disk F' from contact with the disk F, whereby the revolution of the shaft G is stopped, and thus the reciprocating carriage I and the work-carrying shaft C brought to a standstill, and that without stopping the revolution of the grinding-spindle, which may be continuously revolved by means of the belt *k'*. The cylinder C' or other work is then removed and another attached to the work-carrying-shaft in its place, when the operation above described is repeated.

It will be seen that with the construction and organization of devices above described the reciprocating carriage which carries the grinding-spindle and grinding-wheel may be automatically caused to travel back and forth, so as to give the necessary feed to the grinding-wheel during the operation of grinding, and that its connection with the feed mechanism, which is necessarily of slow motion, is such that said carriage may be quickly raised or lowered by hand, and thus raise or lower the grinding-wheel with reference to the work to be ground independent of the feed mechanism. It will also be seen that the reciprocation of the grinding-wheel carriage, as well as the revolution of the work-carrying shaft, may be stopped at pleasure without stopping or interfering with the continuous revolution of the grinding-spindle.

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

1. The combination, with a grinding-wheel and its spindle mounted upon a reciprocating carriage, of feed mechanism, substantially as described, for giving a reciprocatory movement to said carriage, and means, substantially as described, for disconnecting said grinding-wheel and spindle from the influence of said feed mechanism, and for raising or lowering said grinding-wheel and spindle by hand independent of the feed mechanism, substantially as described.

2. The combination, with a grinding-wheel and its spindle mounted upon a reciprocating carriage, of a connecting-rod for connecting said reciprocating carriage with the feed mechanism from which the reciprocatory movement is derived, said connecting-rod being provided with a rack, and a lever provided with a segmental gear, which latter meshes with the rack upon the connecting-rod, whereby by locking the lever in position the reciprocating movement of the connecting-rod will be transmitted to the carriage and the grinding-wheel and spindle mounted thereon, and by unlocking the lever the carriage, the grinding-wheel, and spindle may be raised or lowered by means of said lever and the segmental gear traveling upon the rack of the connecting-rod, substantially as described.

3. The combination of a grinding-wheel and its spindle mounted upon a reciprocating carriage, a work-carrying shaft, feed mechanism, substantially as described, for giving a reciprocatory movement to said grinding-wheel carriage, means, substantially as described, for giving rotation to the grinding-wheel spindle and to the work-carrying shaft, respectively, and means, substantially as described, for stopping the reciprocating feed of the grinding-wheel carriage and the revolution of the work-carrying shaft without stopping the revolution of the grinding-wheel and its spindle, substantially as described.

4. The combination of a grinding-wheel and its spindle mounted upon a reciprocating carriage, a work-carrying shaft, feed mechanism, substantially as described, for giving a reciprocatory movement to said grinding-wheel carriage, means, substantially as described, for giving rotation to the grinding-wheel spindle and the work-carrying shaft, respectively, the reciprocation of the grinding-wheel carriage and the rotation of the work-carrying shaft being derived from the same central vertical shaft, which shaft is adapted to be rotatively connected with and disconnected from the shaft from which the revolution of the grinding-wheel spindle is derived, whereby the reciprocation of said carriage and the rotation of the work-carrying shaft may be stopped at pleasure at any desired point without stopping the revolution of the grinding-wheel and spindle, substantially as described.

5. The combination, with the central vertical shaft G, supported so as to be capable of a slight swinging movement, as described, and provided with a worm to give motion to the feed mechanism for reciprocating the grinding-wheel carriage, a pulley-and-belt connection for giving rotation to the work-carrying shaft, and a friction-disk through which its own motion is derived, of the slide P, pivoted to the lower end of said central shaft, the wedge R, which bears against the end of the slide P, and means for operating said wedge to force outward the slide P and the lower end of said central shaft, and thus force the frictional disk upon said central shaft into operative contact with a corresponding disk upon the driving-shaft, or to withdraw said wedge, and thereby destroy said operative contact, substantially as described.

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