No. 609,221. Patented Aug. 16, 1898.

R. H. WHITE.

BALL GRINDING MACHINE.

(Application filed Feb. 4, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

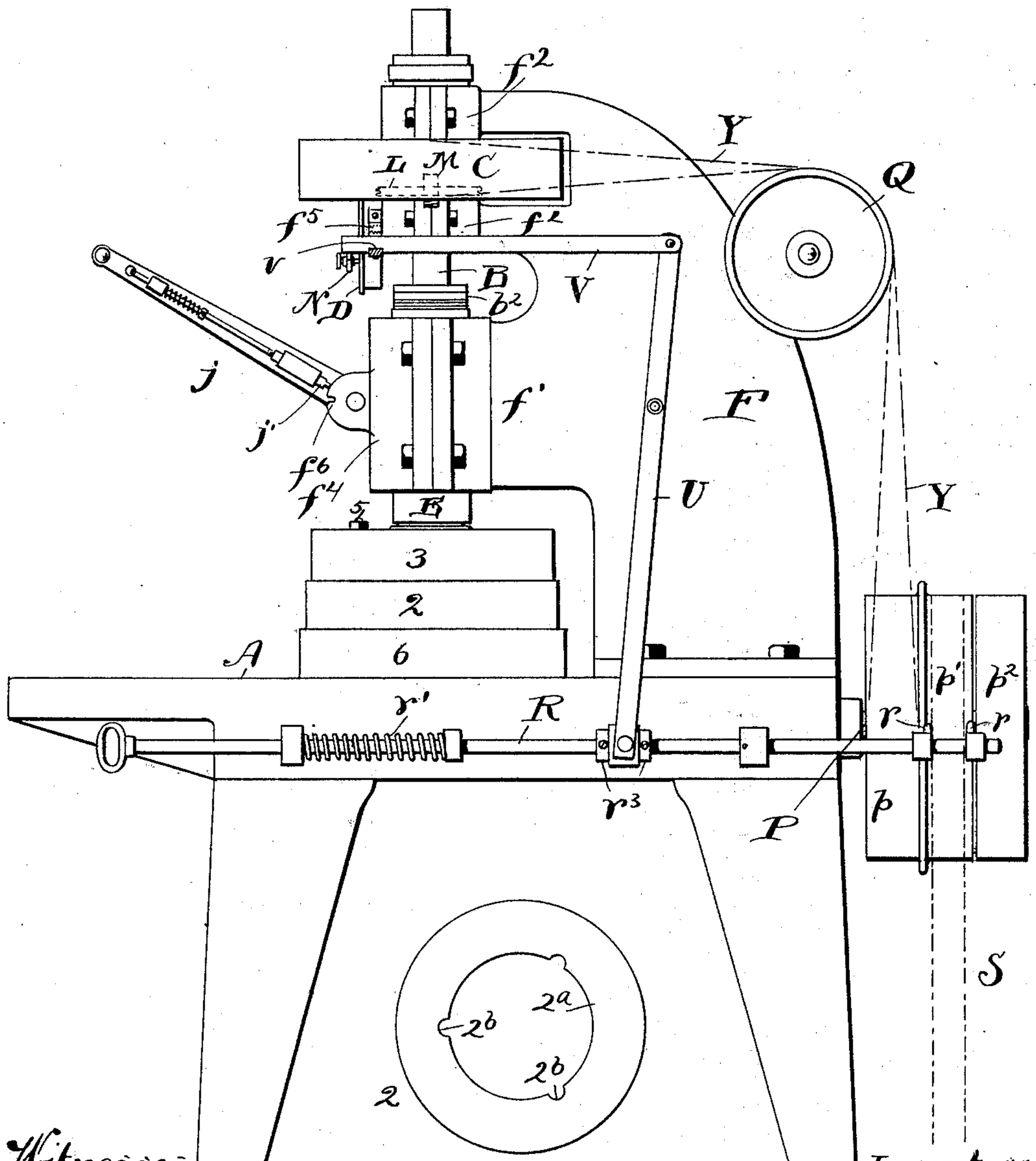

Fig. 7.

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

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(No Model.) 3 Sheets—Sheet 2.

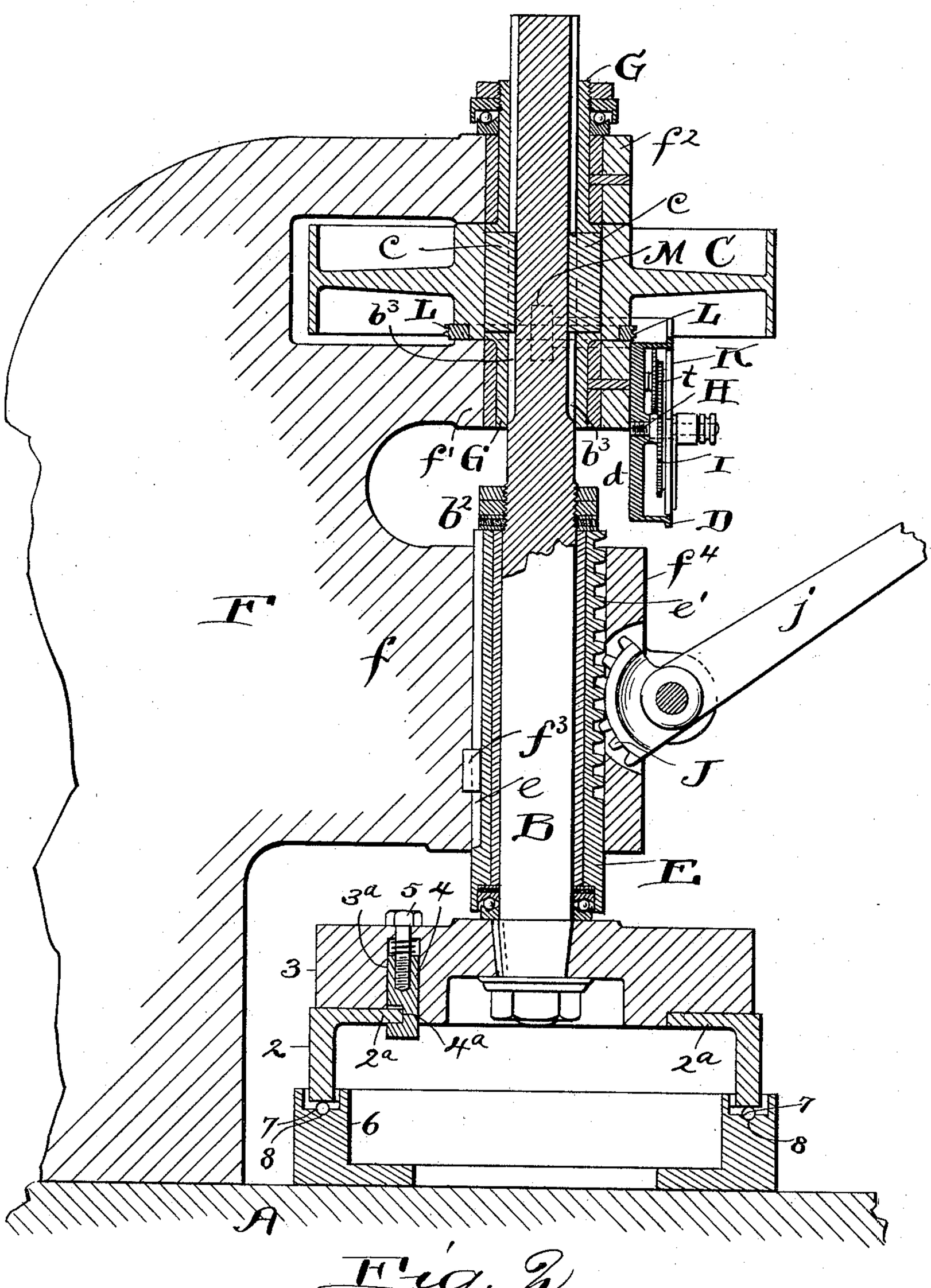

Fig. 2.

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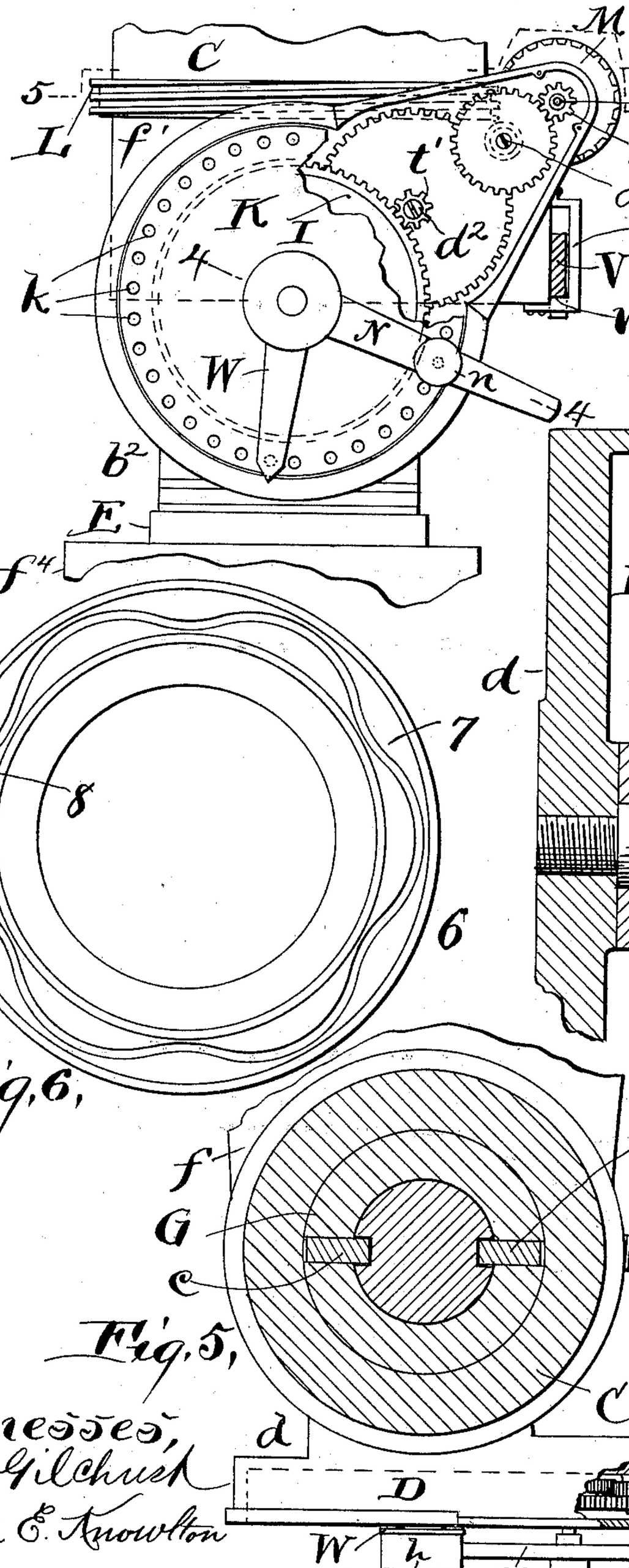

Fig. 3,

Fig. 6,

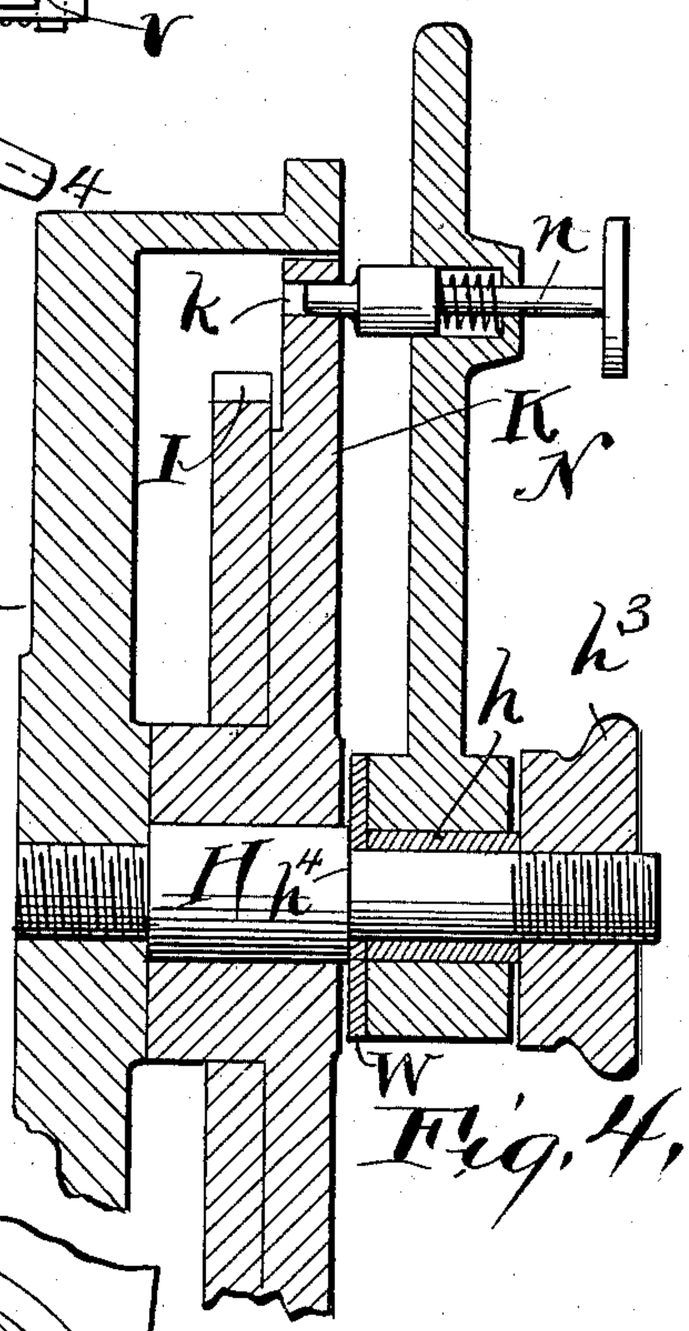

Fig. 4,

Fig. 5,

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

UNITED STATES PATENT OFFICE.

ROLLIN H. WHITE, OF CLEVELAND, OHIO.

BALL-GRINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 609,221, dated August 16, 1898.

Application filed February 4, 1898. Serial No. 669,094. (No model.)

To all whom it may concern:

Be it known that I, ROLLIN H. WHITE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Ball-Grinding Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

In the use of ball-grinding machines as heretofore constructed the operator, by one or more trials with the machine under the then existing conditions, finds that in operating upon a certain lot of balls said balls will be ground to the proper size in a certain period of time. Having ascertained this, the operator when he begins the grinding operation notes the time and should stop the machine when the predetermined period has expired. He usually, however, has charge of a number of grinding-machines, wherefore he is not only liable to forget the time at which any one of the machines should be stopped, but is also liable to be busy with loading or unloading another machine when the time arrives. When the machine is permitted to operate longer than the ascertained time, the balls will be ground too small for their intended use and perhaps too small for any use. It will be understood that one lot of balls require more grinding to bring them to the proper size than will another lot; also, that the speed of the machine is an important element to be noted and must be constant if the operator is to judge when the balls are finished by noting the time during which they are being ground. The real thing to be effected to produce uniform results with a given lot of balls is to subject each load of the machine taken from the same lot of balls to the grinding action produced by the same number of revolutions of the grinder.

One object of my invention is to make the proper operation of the machine independent of the watchfulness of the operator and the varying speed of the machine by providing means whereby the machine will be either automatically stopped or, which is less desirable, some signal will be given to the operator to indicate that the machine should be stopped when the balls have been sufficiently ground. Another object is to provide means whereby the machine may be adjusted from time to time, so that the balls will be ground more or less, according to circumstances, and another object is to improve generally the particular machine which is described in my pending application, Serial No. 640,614, filed June 14, 1897.

The invention consists in the combination, with a ball-grinding machine, of mechanism having the functions of that which is hereinafter described, and also in the construction and combination of parts hereinafter described, and pointed out definitely in the claims.

In the drawings, Figure 1 is a side elevation of a ball-grinding machine containing my invention. Fig. 2 is a sectional side elevation of the same. Fig. 3 is a front elevation of that part of the machine which includes the mechanism for releasing the belt-shifter. Fig. 4 is a sectional view on line 4 4 of Fig. 3. Fig. 5 is a plan view of the mechanism shown in Fig. 3. Fig. 6 is a plan view of the block which supports the balls during the grinding operation, and Fig. 7 is a plan view of the grinder.

Referring to the parts by letters and figures, A represents the substantially horizontal bed of the machine, and F a standard extending above the bed and having several horizontal bracket-arms $f f' f^2$. In the lower bracket-arm f is a vertically-movable sleeve E, which forms one bearing for the rotatable grinder-shaft B. This sleeve may be moved up and down in the bracket-arm, but is prevented from rotation by a fixed feather f^3, which enters a longitudinal groove e in the sleeve. On the front side of the sleeve a vertical rack e' is formed. A gear-segment J is pivoted to the bracket-arm f or, rather, to a cap-plate f^4, which is secured to said bracket-arm and with it forms the bearing for said sleeve. This gear-segment meshes with the rack e' on the sleeve. A lever-arm j is rigid with the gear-segment and furnishes the means for turning it on its pivot to raise or lower said sleeve E.

Secured to the rotatable grinder-shaft just above the sleeve E is an adjustable collar b^2, with which the upper end of the sleeve E engages, whereby the upward movement of the sleeve causes the upward movement of the shaft.

C represents a pulley which embraces the

shaft B and which lies between the two bracket-arms f' f^2, whereby said pulley is prevented from moving up or down. A sleeve G, which passes through and is rigidly fastened to the pulley, is mounted in the two bracket-arms f' f^2. Feathers c, carried by the sleeve, enter grooves b^3 in the shaft, whereby the simultaneous rotation of the shaft and pulley is insured, although the shaft is free to move vertically within the pulley or, more specifically, within the sleeve G, which is a part of the pulley.

Secured to or formed with one of the bracket-arms f' is the back plate d of a case D, which incloses a train of gears, which will be presently explained. A stud H is screwed into or otherwise fastened to the plate d. Upon it is loosely mounted a disk K and a gear I, which parts are fast to each other.

Secured to the hub of the pulley C or formed upon said hub is a worm L, which engages with and turns a worm-wheel M. This worm-wheel is fast to a shaft m, mounted in a hollow stud d', which is rigid with the plate d, and on the opposite end of this shaft a pinion m' is fast. Motion is transmitted from this pinion m' through a train of gears t and pinions t' (which are mounted on studs d^2, secured to the plate d) to the gear I.

The various gears and pinions last referred to are of such relative size and the pitch of the worm L is such that very many revolutions of the pulley are necessary to cause one revolution of the gear I, and consequently of the disk K. In the machine which is illustrated in the drawings the disk K revolves once for each five thousand revolutions (about) of the pulley; but this of course may be varied as desired.

Loosely mounted upon a bushing h, which surrounds a reduced part of the stud H, is an indicating-arm N. In the outer end of this arm is a spring-pin n, which is adapted to enter any one of a plurality of holes k which are formed in the disk K concentric with its axis of rotation, whereby said arm is compelled to move with the said disk K, and it is the angular advance of this arm which determines when the machine should stop.

Before describing the particular form of belt-shipping mechanism which is shown in the drawings and which the arm N causes to operate to stop the machine it will be well to say that, as shown, the pulley C, and consequently the shaft B, is rotated by means of the belt Y passing over an idler-pulley Q and around a pulley p, loosely mounted on a fixed shaft P. Upon this same shaft are two pulleys p' p^2. The former is fast to pulley P and the other is not. The pulley p is driven when the driving-belt S is on the fast pulley p' and comes to rest when the belt is shipped to the loose pulley p^2. The belt-shipper consists of forks r engaging with the belt S and carried by the sliding bar R, which bar is accessible from the front of the machine. A spring r' exerts its force to move said bar in the direction to ship the belt to the loose pulley p^2. This bar may also be operated by means of a lever U, pivoted to the standard F, the lower end of which engages with a collar r^3, secured to the bar R. A sliding bar V is pivoted to the upper end of this lever and is provided with a notch v, which may engage with a plate f^5, attached to the standard F, and it is with this sliding bar V that the arm N engages when it has been turned far enough.

In operating the machine the operator determines by experiment the angular advance which has been made by the arm N while the grinder has rotated times enough to grind the balls, which angular advance is measured by the holes k in disk K. The arm N is then set back far enough from the bar V and secured to the disk K by the insertion of the pin in the proper hole k. The machine is then set in operation by shipping the belt onto the fast pulley p', the shipping mechanism being held in position to keep the belt on said pulley by the engagement of the plate f^5 in the notch v in the bar V. When by the revolution of the grinder-shaft transmitted through the described mechanism to disk K the arm N has been moved far enough, it strikes and lifts the bar V, whereupon the spring r' operates the belt-shipper, the belt being moved to the loose pulley, and the machine stops. The lever j is then drawn down, with the result of lifting the sleeve E and with it the grinder-shaft and grinder. A latch j', carried by the lever j, which engages in a notch in the ear f^6, holds the grinder up while the balls are being removed and a new lot placed in position to be ground. The arm N is again adjusted, the grinder is lowered, and the described operation repeated.

As a convenience for indicating that hole k in the disk with which the pin n shall be caused to engage to "set" it a pointer W is placed upon the stud H and is clamped in proper position relative to the bar V by the nut h^3, which causes the said pointer to be clamped to the stud between the sleeve h and a shoulder h^4 on said stud. When the machine comes to a stop, the arm N is moved backward and its pin is placed in the first hole k to the right of the pointer. This pointer at the time the machine stops indicates the angular advance measured in holes which the arm N has made during the grinding operation. If the balls have been ground too much or too little, the pointer can be readjusted to indicate the proper hole for the arm N to engage with to properly grind the balls in the next operation.

The grinder shown consists of a short cylinder 2, which is secured to the under side of a disk 3, which is secured to the lower end of the shaft B. This grinder has an inwardly-turned annular flange 2^a on its upper edge, and in the inner edge of this flange are three, more or less, notches 2^b. In vertical sockets 3^a in the lower side of the disk 3 are the notched clamping-bars 4, which are drawn up

by the bolts 5. In attaching the grinder to the disk the notches 2^b pass the lower ends of said clamping-bars 4, and the grinder is then turned, carrying the flange into the notches 4^a in the clamping-bars. This construction affords easy means for attaching and detaching the grinder. The balls Q to be ground are supported on a block 6, which rests and is movable upon the bed. In the top of this block is a circular recess or groove 7, adapted to contain a mixture of oil and emery or like substance and of such diameter that the lower edge of the grinder may enter it. In the bottom of this recess is an endless sinuous groove 8, which receives and guides the balls during the grinding operation. The distance of the groove from the axis of rotation is continuously changing, and consequently the balls are rolled in different directions, which causes all parts of their surfaces to be presented to the action of the grinder, whereby they are made spherical.

The mechanism to be operated by the arm N when it has been moved far enough may be varied as desired by the substitution of other means for causing the machine to stop or for giving an alarm to indicate that it hould be stopped.

Having described my invention, I claim—

1. In a ball-grinding machine, the combination of a grinder rotatable upon a vertical axis, a rotatable indicating-arm adapted by its position to indicate when the grinder has rotated the proper number of times, and mechanism for driving said grinder and indicating-arm simultaneously but at different speeds, the movement of the indicating-arm being the slower, substantially as specified.

2. In a ball-grinding machine, the combination of a rotatable grinder, its operating mechanism, a disk rotatable simultaneously with the grinder but at a slow speed comparatively, and an arm N, and means for adjustably connecting said arm and disk, substantially as specified.

3. In a ball-grinding machine, the combination of a rotatable grinder, and mechanism for transmitting motion from the source of power to said grinder, a rotatable arm, and mechanism whereby it is turned simultaneously with the grinder but at a much slower speed, and means whereby this arm will disconnect some part of the power-transmitting mechanism when the grinder has made the desired number of revolutions, substantially as specified.

4. In a ball-grinding machine, the combination of a rotatable grinder, a belt-shipper, and a device adapted to cause the operation of the latter, with mechanism for simultaneously operating said grinder and belt-shipper-operating device, substantially as specified.

5. In a ball-grinding machine, in combination, a rotating grinder, its operating mechanism, an arm N and mechanism operating the same simultaneously with the grinder but at a slower speed, a spring-actuated belt-shipper, and a latching device which holds said belt-shipper in proper position to cause the belt to drive the machine, said latching device being in the path of said arm whereby it is released by said arm, substantially as specified.

6. In a ball-grinding machine, in combination, an endwise-movable rotating grinder-shaft, a sleeve (as the hub of the driving-pulley) which turns with the shaft but has no endwise movement, a worm on said sleeve, driving mechanism for said shaft, and a device operated by said worm for disconnecting some part of the driving mechanism, substantially as specified.

7. In a ball-grinding machine, an endwise-movable rotating grinder-shaft, its driving-pulley which has no endwise movement, a disk, mechanism operated by the driving-pulley for turning said disk, an arm mounted on the same axis with said disk, and means for adjustably connecting said disk and arm, substantially as specified.

8. In a ball-grinding machine, in combination, an endwise-movable grinder-shaft, a sleeve which turns with the shaft but has no endwise movement, a worm on said sleeve, a pivoted disk, mechanism driven by said worm for turning the disk, an arm mounted on the same axis with said disk, and means for adjustably connecting said disk and arm, substantially as specified.

9. In a ball-grinding machine, in combination, an endwise-movable grinder-shaft, a sleeve which turns with the shaft but has no endwise movement, a worm on said sleeve, a pivoted disk, mechanism driven by said worm for turning the disk, an arm mounted on the same axis with said disk, and means for adjustably connecting said disk and arm, and belt-shifting mechanism adapted to be set in operation by said arm, substantially as specified.

10. In a ball-grinding machine, in combination, a grinder-shaft, a worm which rotates simultaneously therewith, a rotating disk having a series of holes, mechanism intermediate of said worm and disk whereby the latter is driven, an arm pivoted upon the same axis as the disk, a pin carried thereby and adapted to engage with any of the holes in said disk, and a device adapted to be moved by said arm, substantially as specified.

11. In a ball-grinding machine, in combination, a rotatable grinder, a worm which rotates simultaneously therewith, a rotating disk having a series of holes, mechanism intermediate of said worm and disk whereby the latter is driven, an arm pivoted upon the same axis as the disk, a pin carried thereby and adapted to engage with any of the holes in said disk, an adjustable pointer, and means for fixing the pointer in different positions relative to said disk, and a device adapted to be moved by said arm, substantially as specified.

12. In a ball-grinding machine, in combination, a rotary grinder-shaft, a rotary disk, mechanism whereby both are rotated at different speeds, an arm mounted upon the axis of the disk, and means for adjustably connecting said arm and disk, spring-actuated belt-shifting mechanism, a sliding bar connected with said belt-shifting mechanism, said bar having a notch in its lower edge, a fixed plate with which said notch engages, a part of said bar being in the path of said arm, substantially as specified.

13. In a ball-grinding machine, in combination, of a substantially horizontal bed, a block movable upon the bed having a recess in its top surface adapted to contain a mixture of oil and emery or like substance, said block having at the bottom of said recess a sinuous endless ball-groove, and a rotary cylindrical grinder adapted to engage with balls in said sinuous groove, substantially as specified.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

ROLLIN H. WHITE.

Witnesses:
E. L. THURSTON,
PHILIP E. KNOWLTON.