(No Model.) 3 Sheets—Sheet 1.

C. H. NORTON.

GRINDING MACHINE.

No. 453,022. Patented May 26, 1891.

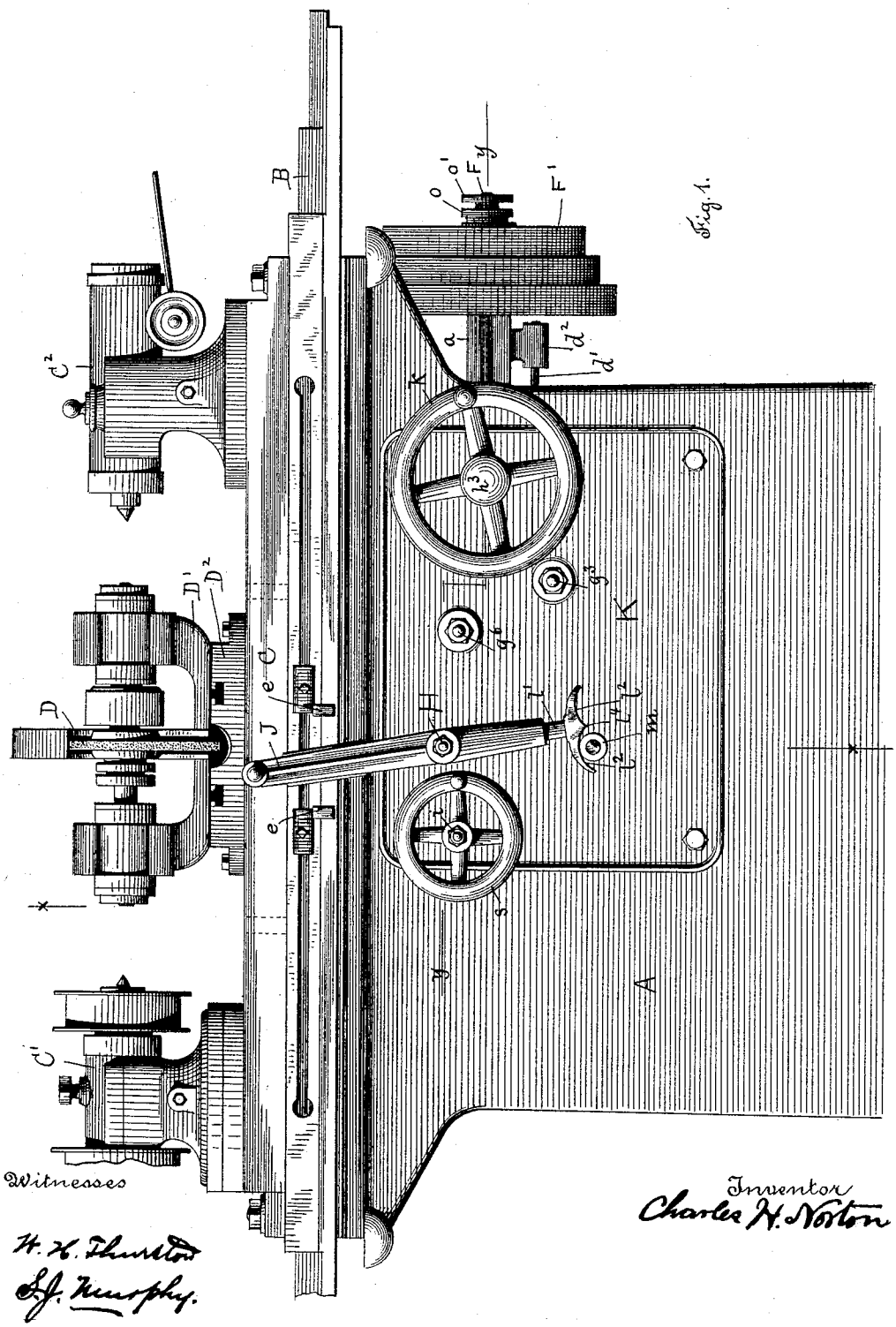

Fig. 1.

(No Model.)

3 Sheets—Sheet 2.

C. H. NORTON.

GRINDING MACHINE.

No. 453,022. Patented May 26, 1891.

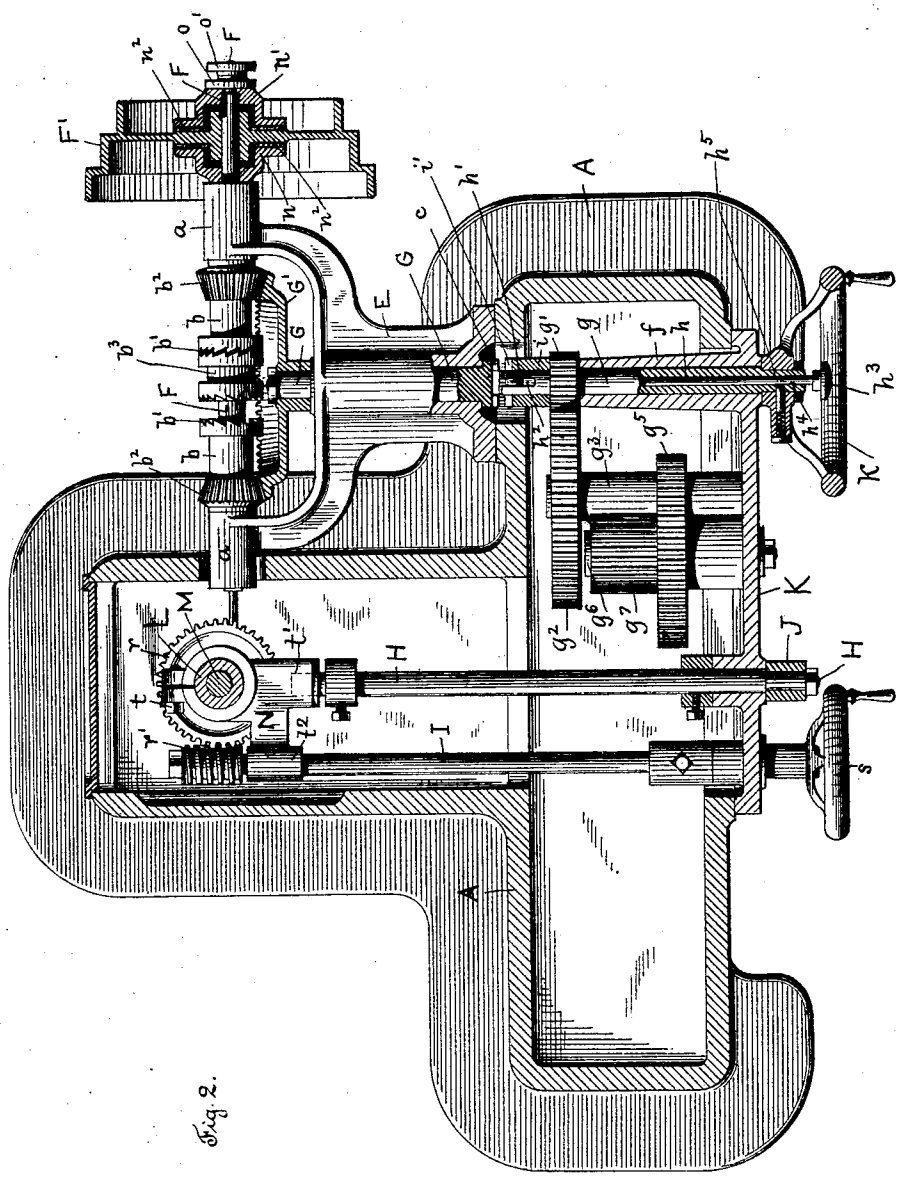

Fig. 2.

Witnesses

H. K. Thurston

S. J. Murphy.

Inventor

Charles H. Norton

(No Model.) 3 Sheets—Sheet 3.

C. H. NORTON.

GRINDING MACHINE.

No. 453,022. Patented May 26, 1891.

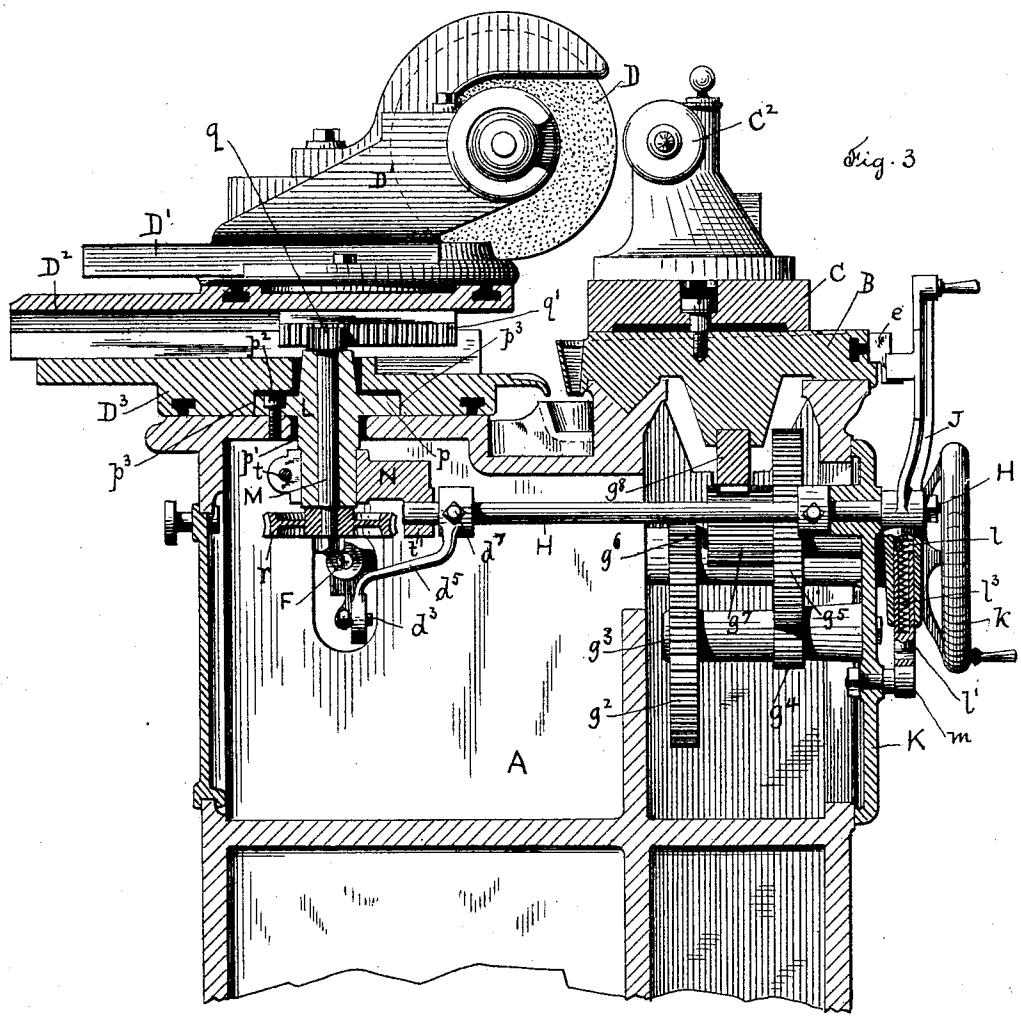

Fig. 3.

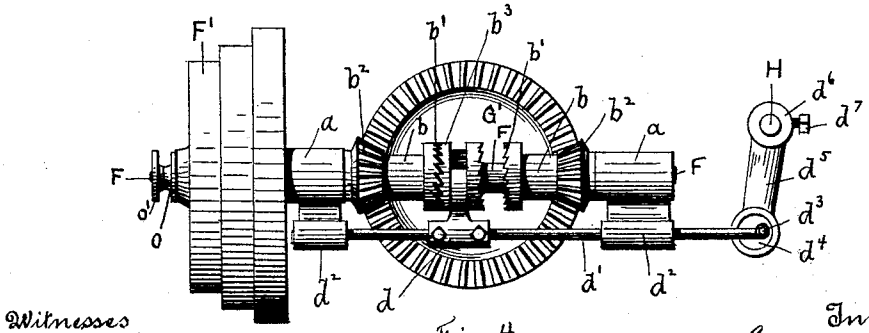

Fig. 4.

Witnesses

H. H. Thurston

S. J. Murphy.

Inventor

Charles H. Norton

UNITED STATES PATENT OFFICE.

CHARLES H. NORTON, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO THE BROWN & SHARPE MANUFACTURING COMPANY, OF SAME PLACE.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 453,022, dated May 26, 1891.

Application filed September 1, 1890. Serial No. 363,648. (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 object of the present improvements is to simplify the construction of the machine and to lessen the cost of construction; and to that end the invention consists in certain combinations and arrangements of parts hereinafter described, whereby the cost of construction will be materially reduced, and at the same time the employment and use of interchangeable parts will be made possible or greatly facilitated.

Referring to the drawings, Figure 1 represents a front elevation of a grinding-machine embodying my improvements. Fig. 2 is a horizontal section on the line *y y* of Fig. 1. Fig. 3 is a vertical section on the line *x x* of Fig. 1, and Fig. 4 is a detail showing the clutch-shaft with its clutches.

The general construction of the machine shown in the drawings is similar to that of grinding-machines heretofore constructed and requires no detailed description.

The machine is provided with the usual base A, upon which the different parts of the machine are mounted.

B represents the platen or reciprocating table, and C the pivoted table which carries the head and foot stocks C′ C^2.

D is the grinding-wheel, which is mounted upon the pivoted bed D′, which is pivoted to the reciprocating bed D^2, which latter is in turn mounted upon the pivoted base D^3, as heretofore.

The first feature of invention consists in constructing and arranging certain of the operating parts of the machine in two groups and so that each of said groups may be separately and independently assembled and attached to a support therefor, the two supports with such groups of parts attached thereto secured in place upon the base of the machine, and an operative connection then made between the two groups, whereby they will operate together. The mechanism thus arranged in groups consists, first, in the reversing mechanism proper, including the clutch-shaft and clutches, by means of which the direction of movement of the platen is to be automatically reversed, and, second, the train of gearing with its operating-shaft, by means of which the motion in one direction or the other is to be transmitted to the platen to move it back and forth. Heretofore it has been customary in the construction of machines of this character not only to mount each of the parts composing these groups separately, but also to accurately fit them in place one by one upon the base of the machine. This necessarily involves a large expenditure of time and labor and consequent expense, and also makes impracticable the use of interchangeable parts. By the improvement hereinafter described it is not necessary that each of the parts be separately fitted in place in the machine; but each group of parts may be assembled and fitted together upon a suitable support therefor in any convenient place away from the machine, and when necessary tested by itself, and then the supports carrying the parts mounted thereon simply bolted to the base of the machine, the provision for operatively connecting the two groups together being such that these supports do not require to be accurately fitted upon the base of the machine, allowance being made for any inaccuracy in the distance between the two supports. Referring to Fig. 2, in which this feature of the invention is most clearly exhibited, E is a bracket adapted to be secured to the base of the machine. This bracket E is constructed to furnish bearings *a a* for the clutch-shaft F, to which shaft the cone-pulley F′ is secured in the manner hereinafter described. Loosely mounted upon the clutch-shaft F are two sleeves *b b*, each of said sleeves being provided at one end with a clutch-face *b*′ and at the other end with a bevel-gear b^2. Mounted upon the clutch-shaft F, between the sleeves *b b*, is a double clutch member b^3, which is connected to the shaft F by a groove-and-spline connection, so as to be revolved thereby, but so as to be capable of being slid thereon. Mounted in a suitable

bearing in the bracket E is another shaft G, arranged at right angles to the clutch-shaft F. This shaft G carries at one end a bevel-gear G′, arranged between and adapted to engage the bevel-gears b^2 b^3, and at its other end is provided with a clutch-face c, as shown in the drawings. The double clutch member b^3 is embraced by a fork d, fitting in a slot made to receive it, as shown in Fig. 4. This fork d is adjustably secured to a sliding rod d', mounted in suitable supports d^2 d^2, depending from the clutch-shaft bearings a a on the bracket E. The sliding rod d' is provided at one end with a transverse pin d^3, which enters a hole d^4 in the end of a bent lever d^5, as shown in Figs. 3 and 4. The hole d^4 in the bent lever is made considerably larger than the diameter of the pin d^3 to provide for a certain amount of lost motion between the two. The bent lever d^5 is provided with a hub d^6, by means of which it is secured to the rock-shaft H, being clamped in position by means of the clamp-bolt d^7. The rock-shaft H, which extends crosswise of the machine, may be supported in the base of the machine in any convenient manner; but it is preferred to mount this rock-shaft, as well as the worm-shaft I, Fig. 2, hereinafter to be referred to, in the manner hereinafter described. The rock-shaft H is provided at its forward end with the reversing-lever J, secured thereto, and arranged between and adapted to be actuated by the adjustable dogs e e, secured to the front edge of the platen B, in the usual manner, as shown in Fig. 1.

The operation of the reversing mechanism above described is similar to that of corresponding mechanism in former machines and will be readily understood. When the platen B is traveling in one direction, the double clutch member b^3 being in engagement with one of the clutch-faces b', the lever J will be hit by one of the dogs e, which will result in a rocking of the shaft H and the bent lever d^5, secured thereto, thereby causing a sliding of the rod d', so as to disengage the double clutch member b^3 from that one of the clutch-faces b' b' with which it had previously been in engagement and engage it with the other of said clutch-faces, and thus effect a reversal in the direction of revolution of the shaft G by the system of bevel-gearing.

As will be seen, that portion of the train of mechanism above described which consists of the clutch-shaft, with its clutch members, bevel-gears, and cone-pulley, and the shaft G, with its bevel-gear, together with the sliding rod and its fork, may all be assembled together and fitted in place in the bracket E and tested, if necessary, away from the machine, and the group of mechanism so mounted may then be secured in proper position by simply bolting the bracket E to the base A of the machine.

The train of gearing by means of which movement is imparted to the platen B to traverse it back and forth, and which constitutes the second group of mechanism above referred to, is shown at Figs. 2 and 3. This train of gearing is mounted upon a removable plate K, adapted to be bolted to the front of the base A, as shown in Fig. 1. The plate K is provided with a rearwardly-projecting hollow boss f, Fig. 2, cast integral with said plate K, and in such position thereon as to be in alignment with the shaft G when the bracket E and the plate K are both secured in place upon the machine. In the boss f is mounted a hollow shaft g, which is provided at its rear end with a pinion g', rigidly secured thereto. This pinion g' meshes with a gear-wheel g^2 upon a shaft g^3, mounted to revolve upon a stud projecting from the plate K. The shaft g^3 carries a pinion g^4, which in turn meshes with another gear-wheel g^5 upon the shaft g^6, also mounted upon a stud projecting from the plate K. The shaft g^6 carries the pinion g^7, which engages with the rack g^8 upon the platen.

As will be seen, by reason of the fact that the train of gearing above described is mounted upon the removable plate K, the parts thereof may be likewise assembled together and fitted in place upon said plate away from the machine, and the plate K, with the train of gearing mounted thereon, be then simply bolted in place upon the base A of the machine. As shown in Fig. 3, the base A is cut away at the front, so as to form an opening through which the parts composing the train of gearing may be inserted, said opening being covered by the plate K when the latter is in place.

The means for making an operative connection between the two groups of mechanism above described when said groups have been secured in place upon the base of the machine—that is, for operatively connecting the reversing mechanism proper with the train of gearing which imparts movement to the platen, so that said gearing will be operated by said reversing mechanism—is as follows: In the hollow shaft g is fitted a sliding rod or plunger h, provided at its rear end with a cross-pin h', the ends of which cross-pin work in a slot h^2, formed in the rear end of the hollow shaft g, as shown in Fig. 2. The forward end of the rod h may be provided with a suitable handle h^3, by which it may be manipulated. Surrounding the rear end of the hollow shaft g is a loose sleeve i, provided at its end with a clutch-face i', adapted to engage the clutch-face c on the end of the shaft G. This clutch-sleeve i is connected to the sliding rod h by means of the cross-pin h', so that said clutch-sleeve may be moved into and out of engagement with the clutch-face c by simply pushing or pulling the rod h in the proper direction. The forward end of the hollow shaft g is provided with a hand-wheel k for turning said shaft, and thus giving movement to the train of gearing and to the platen by hand when the clutch-sleeve i is withdrawn from engagement. A nick or

indentation h^4 is formed in the side of the rod h, which is adapted to be engaged by a spring-actuated pin h^5, mounted in the hub of the hand-wheel k, forming a sort of spring-latch, to assist in maintaining the engagement of the clutch-faces, but the resistance of which will be readily overcome by pulling upon the handle of the rod h. As will be understood, after the bracket E, with the reversing mechanism mounted therein, and the removable plate K, with the train of gearing, and the connecting clutch-sleeve, with its operating-rod mounted thereon, have been secured in place upon the base of the machine, all that is necessary is to simply push in the sliding rod h, so as to engage the clutch-sleeve i with the clutch-face c of the shaft G, whereby an operative connection will be formed between the reversing mechanism and the train of gearing, and so that the direction of revolution of the latter to move the platen back and forth will be automatically effected. By simply pulling out the rod h, so as to disengage the clutch-sleeve i, the platen may be moved in either direction by hand by means of the hand-wheel k.

By the organization and arrangement of the two groups of mechanism above described the several parts composing the same do not require to be separately fitted in place upon the base of the machine; but instead each group may be assembled and mounted upon its support, and then these supports (the bracket E and the plate K) simply bolted to the base. Inasmuch as there may be within certain limits more or less movement given to the clutch-sleeve i to engage or disengage the clutch-face on the shaft G, very accurate or nice fitting of the bracket or of the removable plate to the base of the machine becomes unnecessary, for the reason that if there be any inaccuracy in the distance between the two groups the movement of the clutch is sufficient to make proper connection, notwithstanding.

The next feature of invention relates to the construction and arrangement of the spring-plunger by means of which the reversing-clutch is disengaged and engaged with its clutch members. As is well known to persons familiar with this class of machinery, in which the platen has a comparatively slow movement, and thus does not acquire any substantial momentum of its own, if no provision other than the movement of the platen itself were made for disengaging and engaging the shifting double clutch, the machine would be liable to come to a standstill, for the reason that after said clutch had been disengaged from one of the clutch members by the movement of the platen there would be nothing to cause the engagement of the clutch with the other clutch member, the platen not having sufficient momentum, for the purpose with the result that the entire machine would stop. To guard against this a certain amount of lost motion has heretofore been provided between the reversing-lever and the shifting clutch, and so that the lever may be moved by one or the other of the dogs on the platen to a certain extent without disengaging the shifting clutch, the disengagement and re-engagement of the clutch being effected by a spring-actuated plunger or other similar device. Heretofore the acting faces of this plunger have been made wedge shape with straight sides. With this construction there was not always sufficient power developed to effect the disengagement of the clutch, at which time the greatest amount of power is required, while the re-engagement of the clutch would be accompanied by a positive and forcible blow or shock of the parts, metal to metal, due to the momentum of the lever, which is very objectionable in machines of this kind, in which accurate work is required. It is very desirable that the disengagement of the clutch shall be quickly and certainly effected, and to insure this result provision has heretofore been made for causing the spring-plunger to effect the hitting or tapping of a blow to secure prompt and certain disengagement, and this was made necessary by reason of the formation of the spring-plunger with straight acting faces. This hitting or tapping necessarily increased the metallic shock or jar of the parts, to overcome which is the object of the present feature of invention. To that end the invention consists in constructing the acting faces of the spring-plunger in the arcs of circles, whereby the greatest amount of power will be secured at the initial movement of the plunger and at the time when it is most needed to disengage the clutch, thus avoiding the necessity for striking a blow, and the power then gradually lessened, and finally the momentum of the lever overcome and practically cushioned. As shown in Fig. 3, the reversing-lever J is recessed out at its lower end, as at l. Into this recess is fitted a plunger l', one end of which is provided with the acting faces l^2 l^2, and the other end is recessed out to receive the spring l^3, one end of which spring bears against the bottom of the recess l in the lever and the other end bears against the bottom of the recess in the plunger, as shown. Each of the acting faces l^2 l^2 is formed in the arc of a circle, as shown in Fig. 1.

m is a roller mounted upon a stud fixed to the plate K, with which roller the acting faces of the plunger co-operate.

The operation of the spring-actuated plunger to disengage and re-engage the shifting clutch will be readily understood. By properly regulating the amount of lost motion between the pin d^3 and the bent lever d^5 the parts may be so arranged that the movement of the platen B will, by means of one of the dogs e e, move the lever J up to and slightly past the vertical and until the point l^4 of the plunger at the junction of the two acting faces l^2 l^2 has passed the highest point on the roller m without disengaging the clutch b^3, and thus without stopping the machine. Thereupon

the plunger l' will be thrown forward by the force of the spring l^3, and thus by the action of one of the curved faces l^2 on its engaging roller m the necessary further movement will be given to the lever J to disengage the clutch b^3 from that one of the clutch-faces b' with which it happens to be in engagement and engage it with the other.

It will be observed that by the construction of the acting faces of the spring-plunger in the arcs of circles the greatest amount of power will be imparted to the reversing-lever and the connecting mechanism at the time when it is most needed to disengage the clutch, and that thereafter the power will be gradually lessened as the coacting roller rides along the curved acting face of the plunger until it reaches the bottom of the curve, and the momentum of the lever will then be checked and practically cushioned by the roller riding up the opposite end of the arc, with the result that any metallic shock or jar of the parts will be effectually prevented. After the lever has thus been cushioned and its momentum arrested it will fall back somewhat and into the position shown in Fig. 1, with the roller occupying the bottom of the arc or curve, thus leaving the pin d^3 out of contact with the bent lever d^5, as shown in Fig. 4. By making the notches between the engaging teeth on the clutch members sufficiently deep it will be possible also to avoid any bottoming of said teeth in the notches and the consequent slamming of the clutch into engagement, which would be likely to occur if the momentum of the lever were not checked and the lever cushioned, as described. Furthermore, as the power derived from the spring-actuated plunger is rapidly diminishing at the time that the engagement of the clutch takes place, the clutch will be engaged gently but positively.

The next feature of invention relates to means for overcoming or preventing the shock or jar resulting from the engagement of the teeth upon two positively-engaging clutch members. In the case of a friction-clutch the engagement is made gradually and without shock or jar; but in the case of a positively-engaging clutch there will necessarily be a considerable shock when the teeth of one member are brought into engagement with the teeth of the other member, especially if one of the members be revolving at the time, unless some means be employed for preventing it. To overcome this shock or jar in the engagement of a positive clutch is the object of the present feature of invention; and to that end the invention consists in such a connection between the clutch-shaft and the pulley which gives motion to said shaft that while said shaft will be driven by said pulley during the operation of the machine there will be a certain amount of slip or give between the pulley and the shaft at the time of the engagement of the clutch members, whereby the revolution of the shaft and the clutch secured thereto will be interrupted momentarily and until the engagement is made, and all shock or jar thereby avoided. This feature of invention is illustrated at Fig. 2. The cone-pulley F', instead of being secured rigidly to the clutch-shaft F, is mounted loosely on said shaft. Secured to the shaft F are two flanged collars $n\,n'$, one located upon each side of the hub of the cone-pulley, as shown. One of these flanged collars n is to be rigidly secured to the shaft F, while the other n' is to be connected thereto by a groove-and-spline connection, so as to revolve with the shaft, but so as to be capable of being adjusted lengthwise thereof. Between the opposing faces of these flanged collars $n\,n'$ and the web of the cone-pulley are arranged two friction-washers $n^2\,n^2$, of leather or other suitable material. Upon the end of the shaft F is a clamp-nut o and a check-nut o' for adjusting the position of the collar n', whereby said collar may be forced up, so as to grip the leather washers between the collars $n\,n'$ and the web of the cone-pulley, and held in said adjusted position, and thereby connect the pulley F' to the shaft, so as to impart rotation thereto to operate the platen. By a proper adjustment of the nut o, however, the amount of friction between the parts may be so regulated that upon the engagement of the double clutch member b^3 with one of the clutch-faces b' the obstruction to the revolution of the shaft caused by such engagement will serve to overcome the friction between the leather washers and the web of the pulley, and so as to allow the revolution of the pulley to continue without imparting rotation to the shaft and the clutch member secured thereto, and thus the shock which would otherwise be incident to such engagement will be obviated. After the engagement has been effected and the consequent obstruction to the revolution of the shaft removed the shaft will again be revolved to operate the platen by means of the frictional contact between the pulley and the leather washers, which will be sufficient for the purpose. The give or slip of the parts thus provided for entirely prevents the objectionable shock or jar above referred to, thereby enabling a positive clutch to be employed with all the advantages of both a positive clutch and a friction-clutch and without the disadvantages of either.

Another feature of invention relates to the method of constructing the pivot for the pivoted wheel-arbor base and the manner of mounting the pinion-shaft by which the position of the reciprocating bed of the wheel-arbor is adjusted. Heretofore the pivot has been formed as a part of the wheel-arbor base, cast integral therewith, and fitting in a bearing made to receive it in the base of the machine, and the bearing for the pinion-shaft was formed in the wheel-arbor base itself. This construction required the accurate boring of the heavy and cumbrous base of the machine to form the pivot-bearing and the

accurate boring of the wheel-arbor base to form the long bearing for the pinion-shaft. Owing to the size and weight of these parts, and particularly of the base of the machine, these were difficult and tedious as well as expensive operations. The object of the present feature of invention is to obviate to a large extent the necessity of accurately boring these large and heavy parts; and it consists, primarily, in the employment of an independent flanged sleeve, in which is formed the bearing for the pinion-shaft, and the flange of which constitutes the pivot for the wheel-arbor base, the bearing for said pivot being formed in the wheel-arbor base instead of the main base of the machine. This flanged sleeve may also serve to furnish a support, with the aid of a suitable bracket, for both the reversing rock-shaft and the worm-shaft for giving movement to the reciprocating bed upon which the wheel-arbor is mounted to adjust the position of the grinding-wheel.

Referring to Fig. 3 of the drawings, in which this feature of invention is most clearly exhibited, L is the flanged sleeve provided with the annular flange p, which flange is to be accurately turned to form the pivot for the wheel-arbor base D^3. The top of the main base A is cast with a hole p' made sufficiently large to receive the sleeve L freely therein. This hole p' in the main base does not, as will be seen, require to be accurately located or to be bored to a fit. The lower end of the sleeve L is inserted through the hole p', the flange resting upon the upper surface of the base A, to which it is secured by screws p^2. The wheel-arbor base D^3 is bored out, as at p^3, to receive and fit the flange p, and thus form the bearing for the pivot. A hole is bored centrally through the flanged sleeve L to receive and form a bearing for the pinion-shaft M, which carries at its upper end the pinion q, which meshes with the rack q' on the reciprocating bed D^2. To the lower end of the pinion shaft M is secured the worm-wheel r, which is engaged and operated by the worm r' upon the inner end of the worm-shaft I, as shown in Fig. 2. The forward end of the worm-shaft I is provided with the hand-wheel s for operating it.

By the employment of an independent flanged sleeve, as described, to form the pivot and to furnish the long bearing required for the pinion-shaft it will be seen that the necessity for accurately boring the large and heavy base of the machine is entirely obviated and that the accurate boring of a long bearing in the comparatively large wheel-arbor base is also avoided. Said wheel-arbor base by the construction and arrangement of parts described requires to be bored only to form the shallow hole to receive and furnish a bearing for the flange on the sleeve, while the long bearing for the pinion-shaft is bored in the independent flanged sleeve, which is a comparatively small and light piece of metal and easily handled and held for the accurate boring required. Furthermore, by the construction described the parts can be very readily assembled and easily adjusted to secure the necessary alignment.

As hereinbefore stated, both the worm-shaft I and the rock-shaft H may be supported in the base of the machine in any convenient way; but it is preferred to mount them in the following manner, which is made possible by the use of the flanged sleeve L: Clamped to the lower end of the sleeve L is a bracket N, as shown in Figs. 2 and 3. This bracket is provided with a split hub to embrace the sleeve L and is clamped in place by a clamp-screw t, as shown. The bracket N is provided with two bearings t' t^2, in one of which t' one end of the shaft H is mounted and in the other t^2 one end of the worm-shaft I is supported. The forward ends of these two shafts are mounted in suitable supports in the removable front plate K, as shown in Fig. 2. By this arrangement of the shafts H and I and the method of supporting them said shafts may be also mounted in place in the removable plate K before it is secured to the base of the machine, the rear ends of said shafts being properly mounted in the bearings in the bracket N, which bracket, upon being inserted through the hole in the front of the base of the machine, may, when the plate K is bolted in position, be in turn clamped in place upon the end of the flanged sleeve L.

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

1. In a machine having a reciprocating platen adapted to be automatically traversed in opposite directions, the combination of two groups of mechanisms, one group consisting of the reversing mechanism proper and the other group consisting of the train of gearing for transmitting movement to the platen in reverse directions, and separate and independent supports for said groups, whereby each group may be independently assembled and mounted upon its individual support away from the machine, and the two supports, with the mechanisms mounted thereon, then secured in place upon the base of the machine, substantially as described.

2. The combination of two groups of mechanisms, one group consisting of the reversing mechanism proper and the other group consisting of the train of gearing for transmitting movement to the platen in reverse directions, separate and independent supports for said groups, and means, substantially as described, for making an operative connection between said groups after their supports have been secured in place upon the base of the machine, whereby the train of gearing will be operated in the proper direction by the reversing mechanism, substantially as described.

3. The combination, with a bracket provided with suitable bearings, of a clutch-shaft carrying a double clutch member splined to

said shaft and two sleeves loosely mounted thereon, each of said sleeves being provided at one end with a bevel-gear and at the other end with a clutch-face, and a second shaft arranged at right angles to said clutch-shaft and provided at one end with a bevel-gear and at the other end with a clutch-face, substantially as described.

4. The combination of a bracket supporting a clutch-shaft and a bevel-gear shaft arranged at right angles to said clutch-shaft, said bevel-gear shaft being provided at its end with a clutch-face, a removable front plate supporting a train of gearing and provided with a hollow boss, a hollow pinion-shaft mounted in said hollow boss, a clutch-sleeve mounted upon said pinion-shaft and connected thereto by a pin-and-slot connection, said clutch-sleeve being arranged to engage with the clutch on the end of said bevel-gear shaft, and a sliding rod arranged to slide within said hollow pinion-shaft and connected to said clutch-sleeve to move the latter into and out of engagement with the clutch on the bevel-gear shaft, substantially as described.

5. The combination, with a shifting clutch, of a forked arm engaging said clutch, a sliding rod for operating said forked arm and provided at its end with a projecting pin, a bent lever provided with a hole to receive said projecting pin, said hole being of larger diameter than the diameter of said pin to provide for lost motion, and means for operating said bent lever to shift said clutch, substantially as described.

6. A spring-plunger for actuating a reversing-lever and mechanism connected therewith to operate a shifting clutch, the acting faces of said plunger being formed in the arcs of circles, substantially as described.

7. The combination of a spring-plunger for actuating a reversing-lever, the acting faces of said plunger being formed in the arcs of circles, and a roller or stud adapted to engage with the acting faces of said plunger to operate the lever, substantially as described.

8. The combination of a reversing-lever provided with a recess, a plunger fitting in said recess in the reversing-lever, and a spring arranged within the recess in said lever, one end of said spring bearing against the bottom of the recess in the lever and the other end against the plunger to actuate the latter, substantially as described.

9. The combination, with a clutch-shaft carrying positive clutch members, of a driving-pulley mounted on said clutch-shaft and connected thereto by a frictional connection, whereby said pulley will impart motion to said clutch-shaft when said clutch members are in engagement, but will slip or give under the greater strain caused by the act of engaging said clutch members, substantially as described.

10. The combination, with a clutch-shaft carrying positive clutch members, of a driving-pulley mounted on said shaft, a pair of flanged collars arranged upon said shaft, one upon each side of the web of said pulley, one of said flanged collars being rigidly secured to said shaft and the other connected to said shaft by a groove-and-spline connection, frictional washers interposed between said flanged collars and the web of said pulley, and an adjusting-nut or clamp-nut for tightening and holding the parts in operative connection, substantially as described.

11. The combination, with the wheel-arbor base of a grinding-machine, of an independent flanged sleeve adapted to be secured to the main base of the machine, the flange on said sleeve constituting the pivot for the wheel-arbor base and the main body of said sleeve furnishing a bearing for the pinion-shaft which operates the reciprocating bed of the grinding-wheel, substantially as described.

12. The combination, with the wheel-arbor base of a grinding-machine, of an independent flanged sleeve adapted to be secured to the base of the machine, the flange of said sleeve constituting the pivot for the wheel-arbor base and the main body of said sleeve furnishing a bearing for the pinion-shaft which operates the reciprocating bed of the grinding-wheel, and a bracket secured to the lower end of said sleeve to furnish a support for the rear end of the worm-shaft, by means of which said pinion-shaft is operated, substantially as described.

CHARLES H. NORTON.

Witnesses:
W. H. THURSTON,
S. J. MURPHY.