(No Model.)

6 Sheets—Sheet 1.

D. H. CHURCH.

GRINDING MACHINE.

No. 517,643. Patented Apr. 3, 1894.

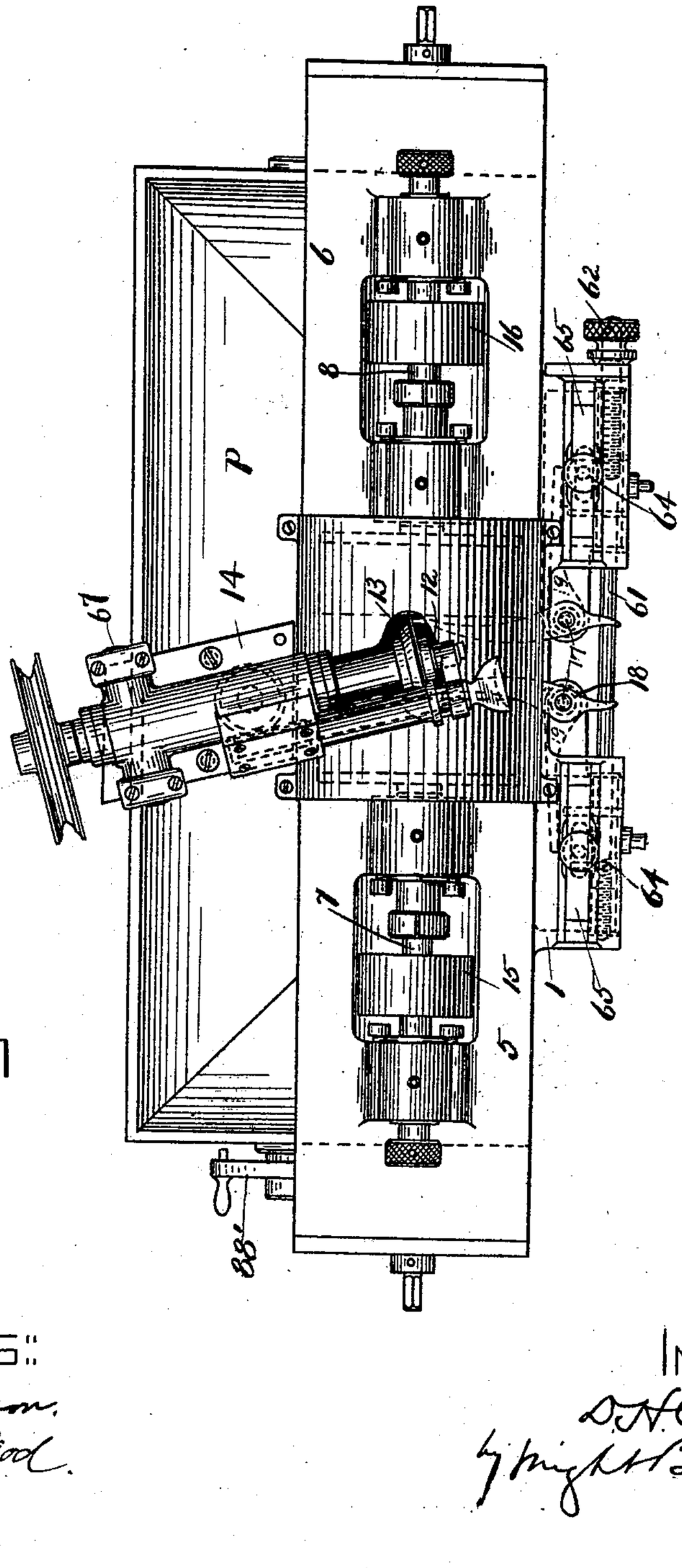

Fig. 1.

WITNESSES:
A. D. Harrison.
W. F. McLeod.

INVENTOR:
D. H. Church
by Wright Brown Quinby & Otis
Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 6 Sheets—Sheet 2.

D. H. CHURCH.

GRINDING MACHINE.

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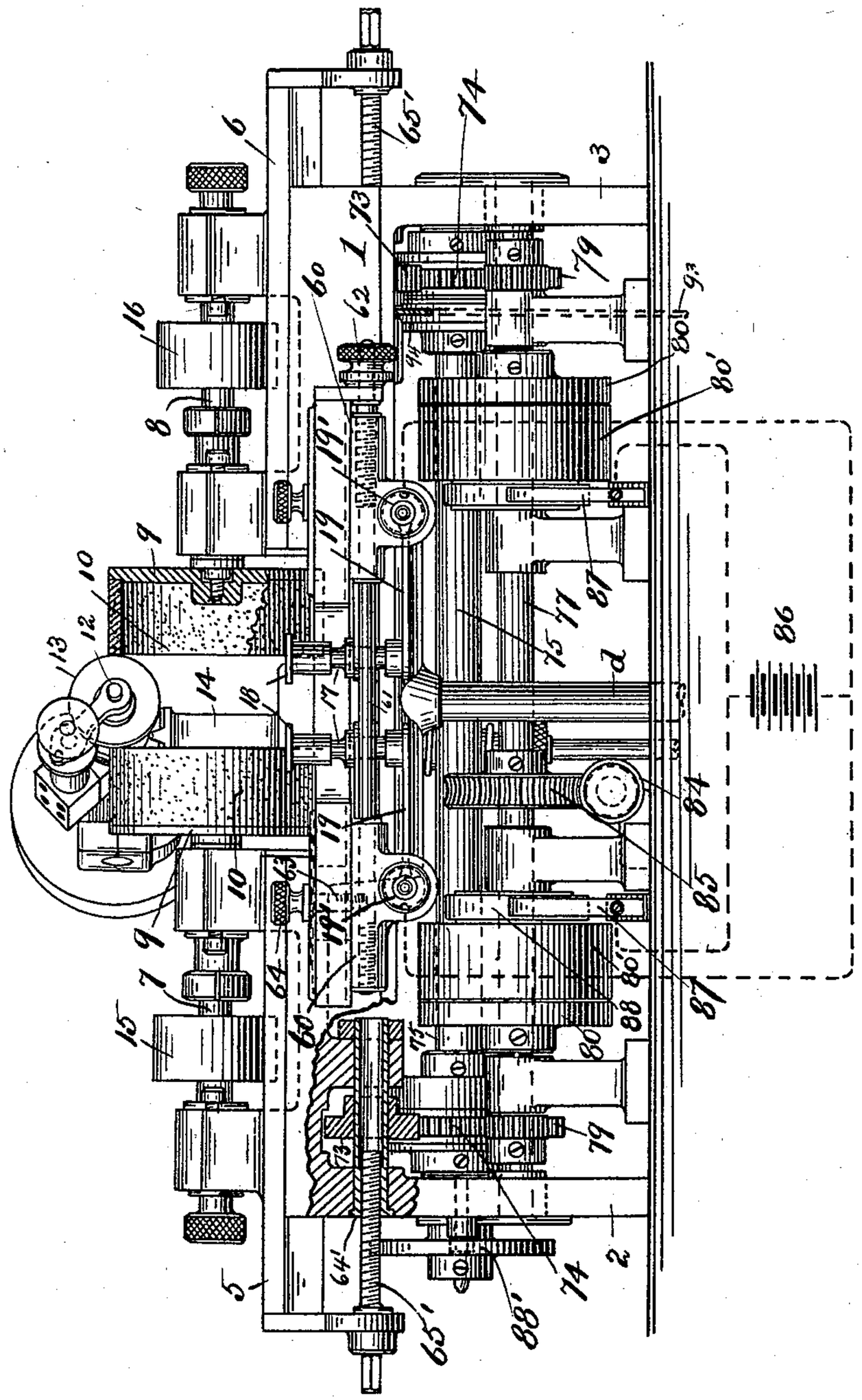

Fig. 2.

WITNESSES:
A. D. Harrison.
W. F. McLeod

INVENTOR:
D. H. Church
by Wright Brown Quinby & Otty
Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

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D. H. CHURCH.

GRINDING MACHINE.

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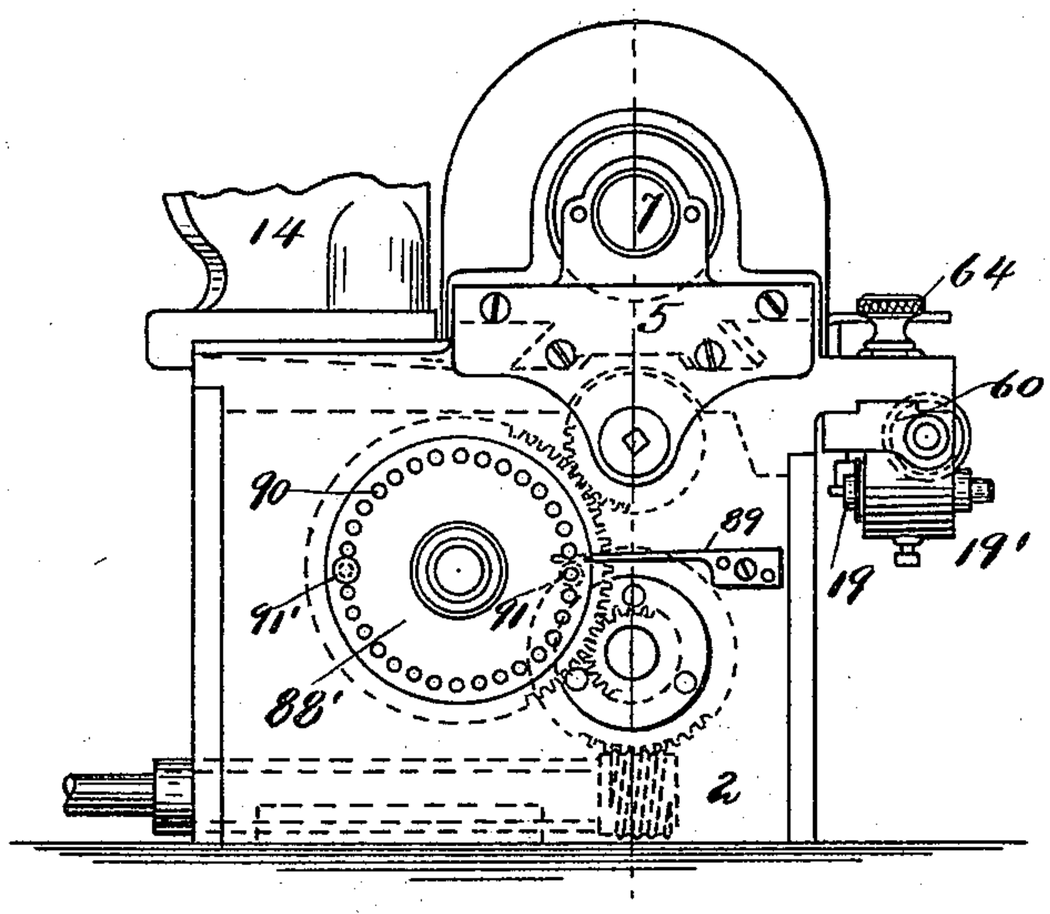

Fig. 3.

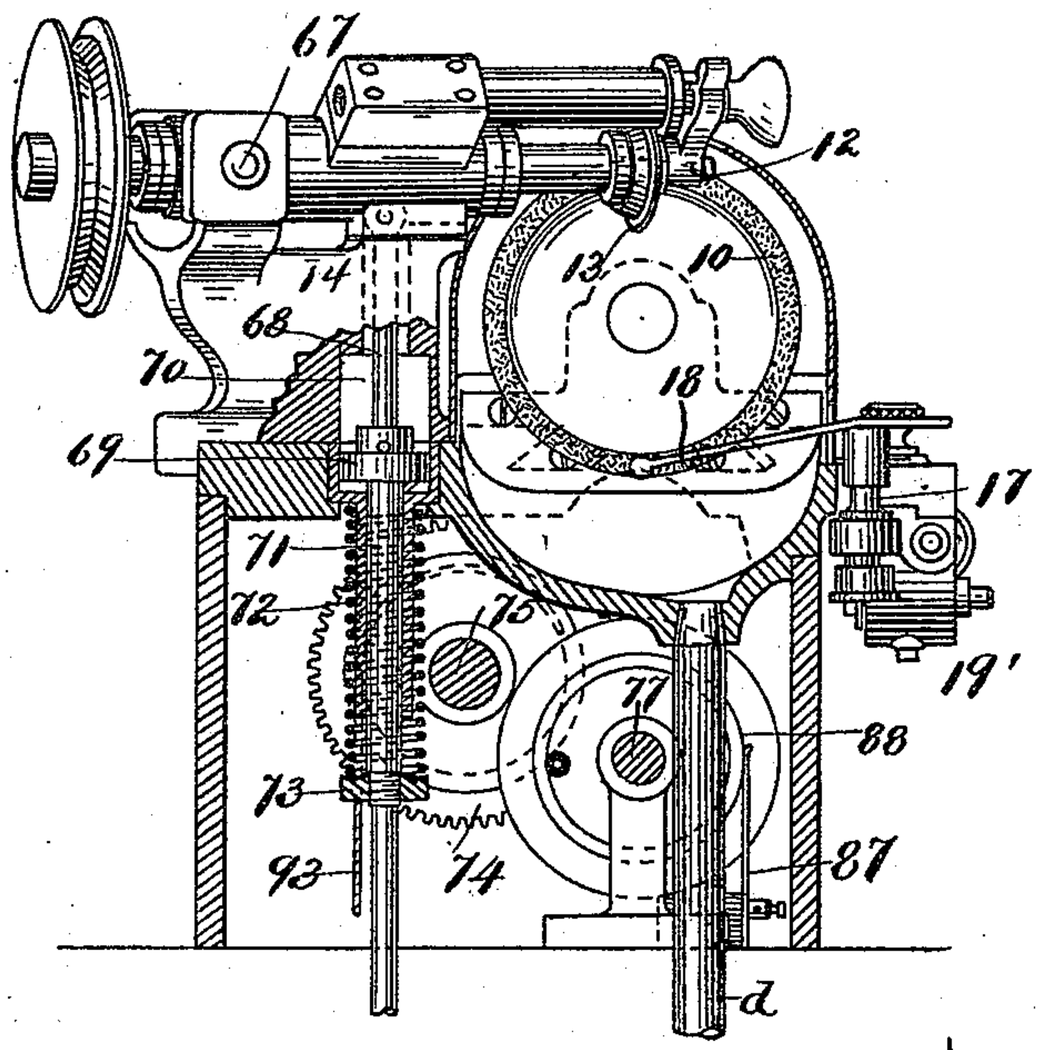

Fig. 4.

WITNESSES:
A. D. Harrison.
W. F. McLeod.

INVENTOR:
D. H. Church
by Wright Brown Quinby & Atty's.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

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D. H. CHURCH.

GRINDING MACHINE.

No. 517,643. Patented Apr. 3, 1894.

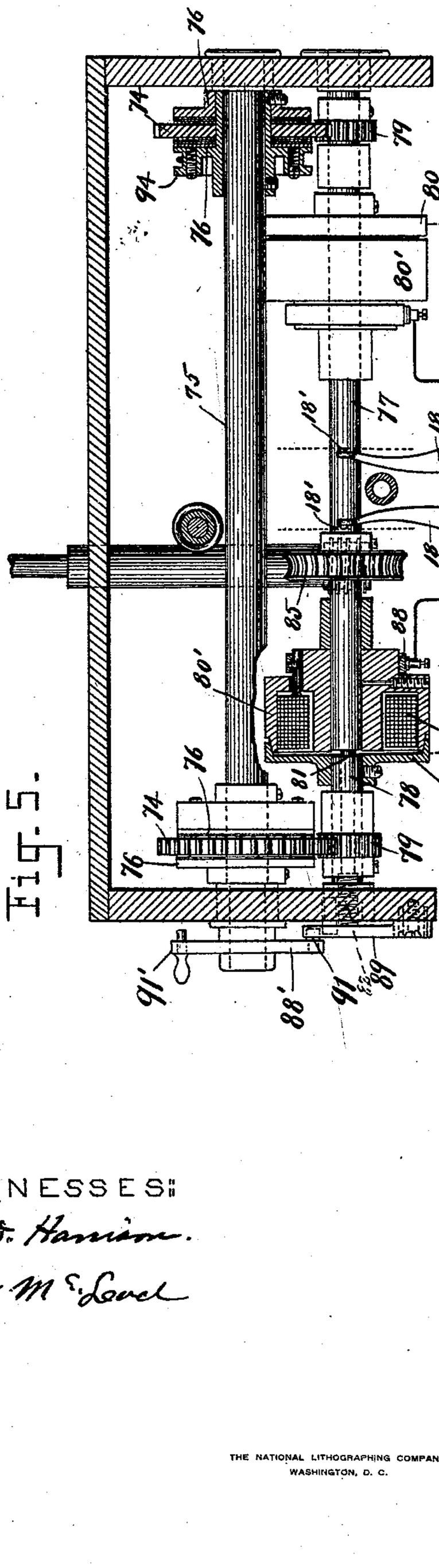

Fig. 5.

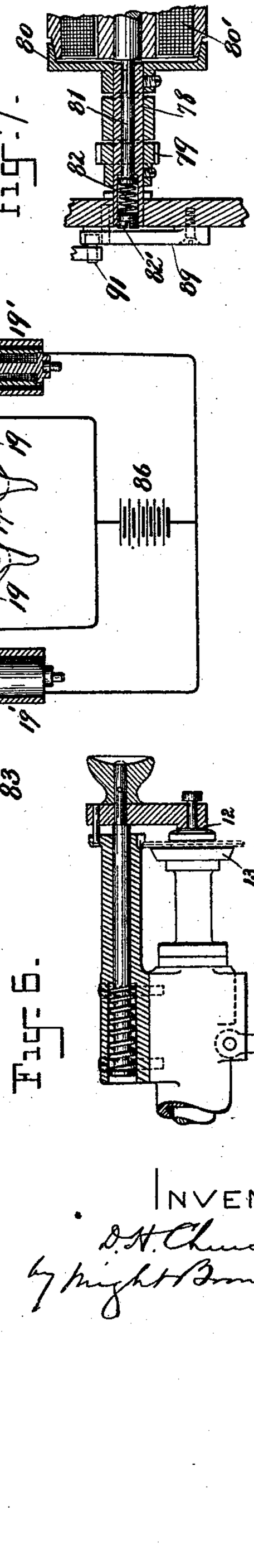

Fig. 7.

Fig. 6.

WITNESSES:
A. D. Harrison.
N. F. McLeod

INVENTOR:
D. H. Church
by Wright Brown Quinby & Atty's.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

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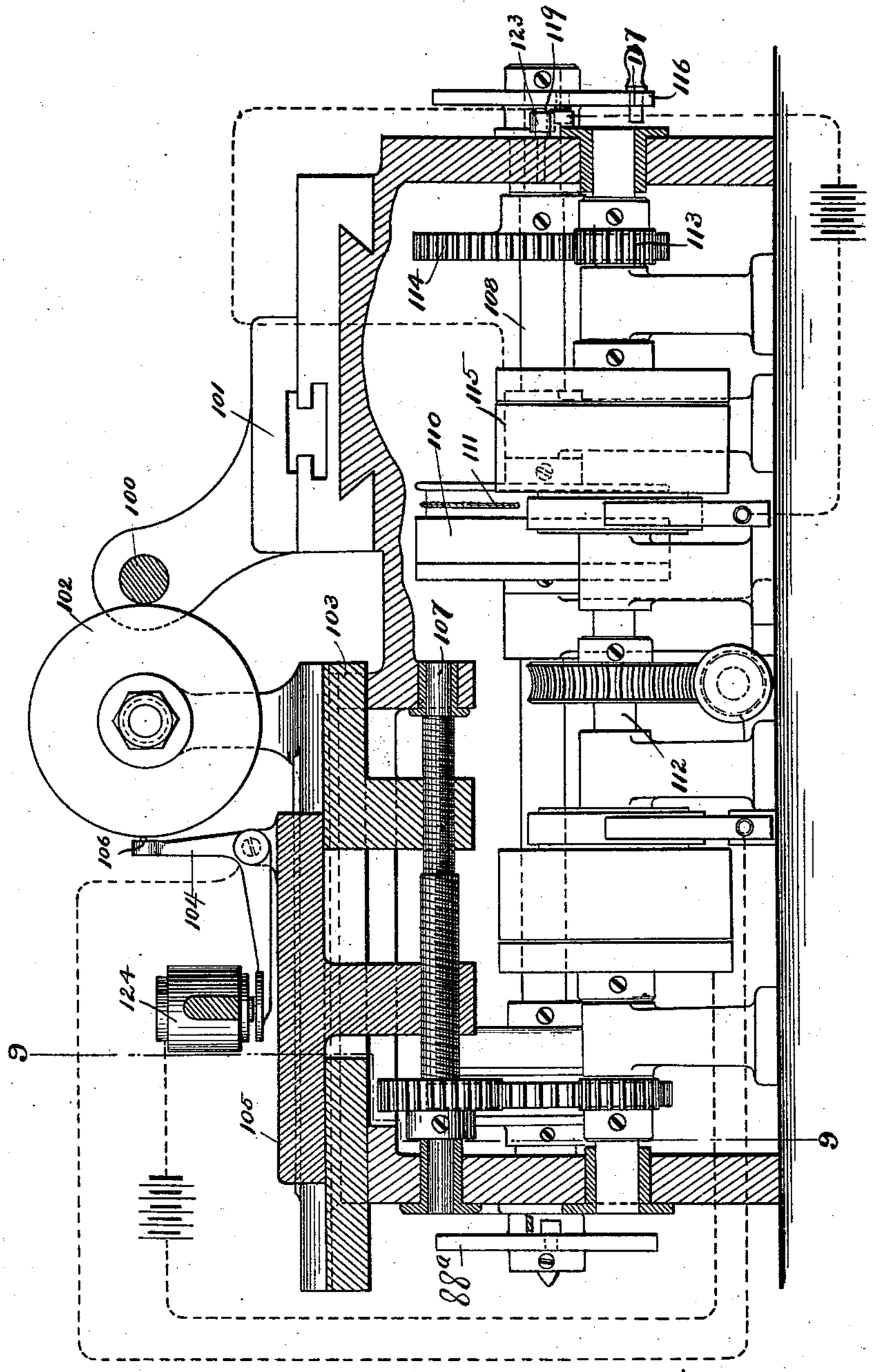
D. H. CHURCH.

GRINDING MACHINE.

No. 517,643. Patented Apr. 3, 1894.

Fig. 8.



WITNESSES:
A. D. Harrison.
W. J. McLeod.

INVENTOR:
D. H. Church
by Wright Brown Crosby
Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 6 Sheets—Sheet 6.

D. H. CHURCH.

GRINDING MACHINE.

No. 517,643 Patented Apr. 3, 1894.

Fig. 9.

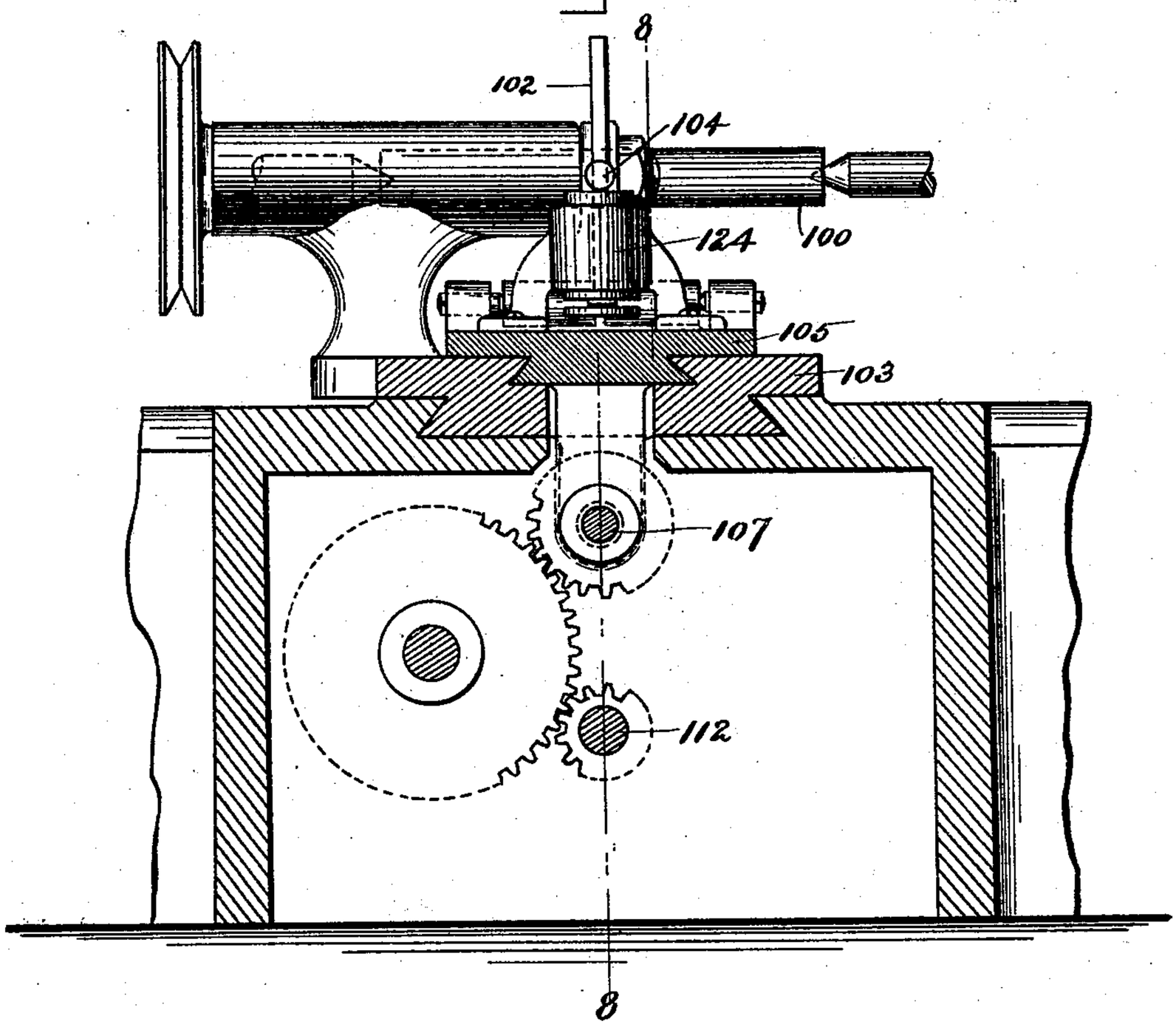


Fig. 10.

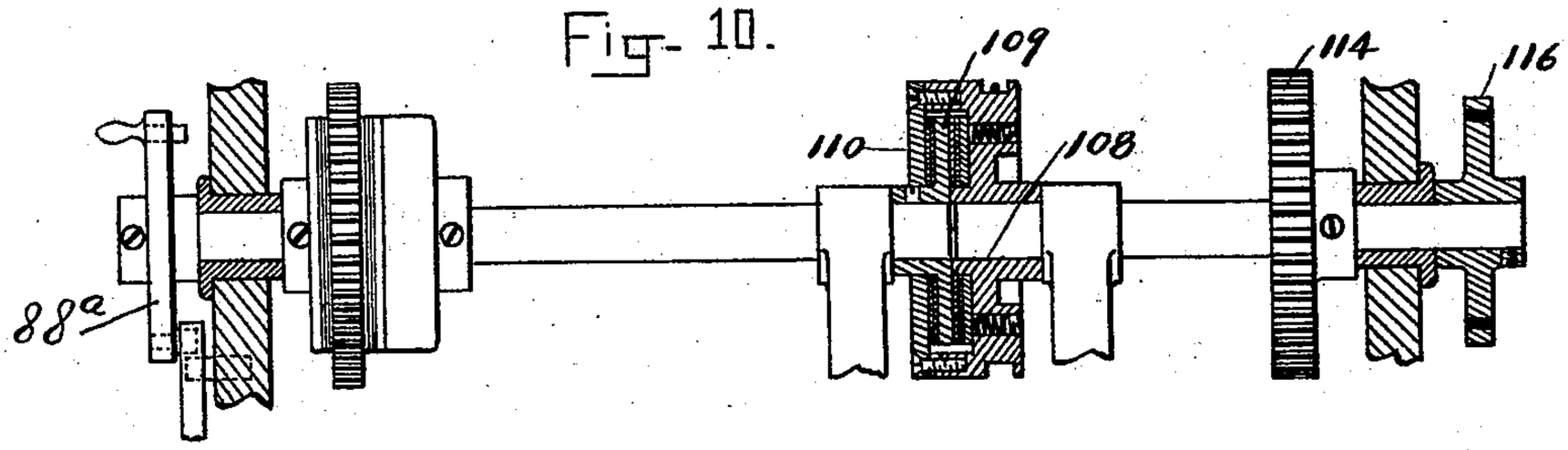
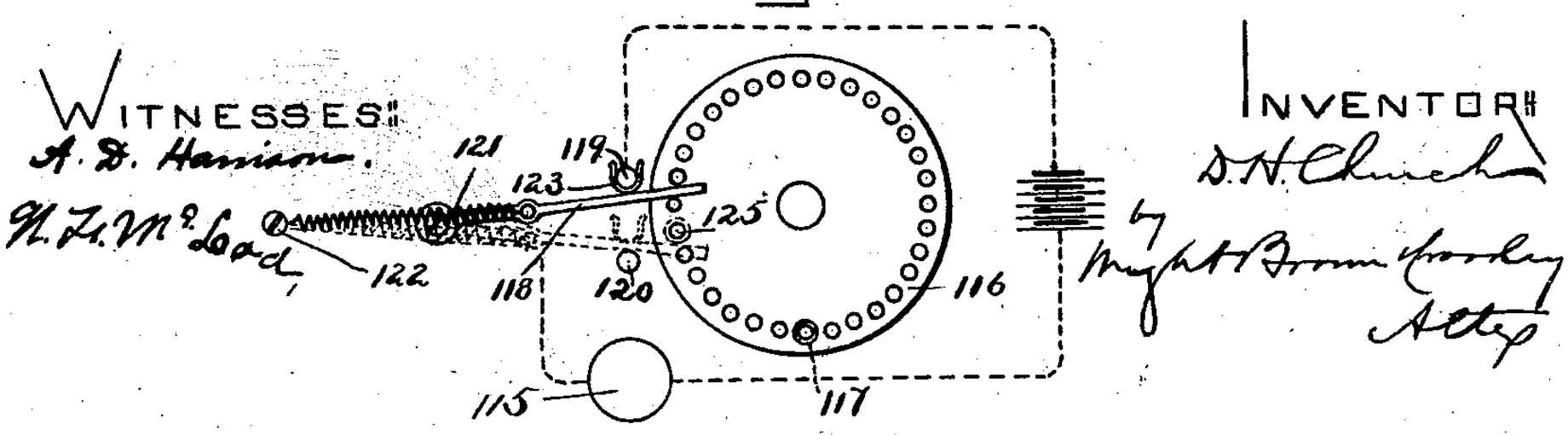


Fig. 11.



WITNESSES:
A. D. Harrison.
H. F. McLeod,

INVENTOR:
D. H. Church
by Wright Brown Quinby & Otis
Attys

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

DUANE H. CHURCH, OF NEWTON, MASSACHUSETTS.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 517,643, dated April 3, 1894.

Application filed June 23, 1893. Serial No. 478,613. (No model.)

To all whom it may concern:

Be it known that I, DUANE H. CHURCH, of Newton, in the county of Middlesex and State of Massachusetts, have inverted certain new and useful Improvements in Grinding-Machines, of which the following is a specification.

This invention relates to grinding machines, and is an improvement on the machine shown and described in Letters Patent of the United States No. 494,058, granted to me March 21, 1893.

The object of the present invention is to provide means whereby the grinder may be held up to its work a predetermined time after the feed-mechanism has been rendered inoperative.

In order that the invention may be fully understood, I will proceed to describe it with reference to the accompanying drawings, of which—

Figure 1 represents a plan of a machine constructed according to my invention, and designed for grinding disks such as watch dials. Fig. 2 is a front elevation, partly in section. Fig. 3 is an end elevation. Fig. 4 is a vertical cross-section, taken through the middle of the machine, but showing the dial-holder in elevation. Fig. 5 shows a horizontal section. Fig. 6 shows a detail sectional view of the dial-holder. Fig. 7 shows a sectional detail of parts appearing at the left of Fig. 5. Fig. 8 shows a sectional view of a machine embodying the invention and designed for grinding elongated bodies. Fig. 9 shows a section on line 9—9 of Fig. 8. Fig. 10 shows a sectional view of parts appearing in Fig. 8. Fig. 11 shows an end view, as seen from the right of Fig. 8.

The same numerals and letters of reference indicate the same parts in all the figures.

Referring first to Figs. 1 to 7, the frame of the machine consists of a bed 1, supported by legs 2, 3. Mounted on the bed 1 are slides 5, 6, constructed to carry and support shafts 7 8, provided at their inner ends with holders 9 for carrying the substance desired to form the grinding-surface. In a machine of the character shown in Figs. 1 to 7, it is desired to use emery laps 10 for this purpose, which serve at the same time as housings to confine any dust or particles removed during the grinding operation. Beneath the grinders is a pan *p*, from which extends a duct *d*, for receiving and carrying off water which is supplied during the grinding operation.

Mounted on the bed 1 is a standard 14, which supports and carries the dial holding and operating devices 12 13, which are or may be of any suitable construction. When used for grinding watch-dials, it is preferred that the holding devices 12 13 be obliquely disposed in relation to the shafts 7 8 to an extent corresponding to the desired bevel to be given to the periphery of the dials.

The dial-holder is pivoted at 67, so that it may be raised and lowered in removing and replacing the dials, and provision is made for cushioning the up and down stroke, as follows: The holder is connected by a vertical rod 68 with a piston 69 in an air-cylinder 70. A plunger-rod 71, connected with said piston, extends out of the bottom of the cylinder, and connects with a treadle or other suitable power-applying agent. A spring 72 bears at one end against a shoulder 73 on the plunger-rod, and at the other end against the cylinder 70, whereby it cushions the upward stroke of the plunger-rod. The return or downward movement of the piston is cushioned by the air in the cylinder.

Shafts 7, 8, together with holders 9 and laps 10, are driven from any desired source by pulleys 15 16 respectively.

Mounted in carriages 60, on the underside of the bed 1, are two vertical shafts 17, provided with arms 18 19 at their upper and lower extremities respectively. The arms 18 extend inward (between the grinding-surfaces 10) and are provided on their extremities with diamond stops 18′, and said arms 18 are placed to bring the stops 18′ at a distance apart corresponding with the desired diameter of the dial to be ground. Thus the stops act as a calipers for measuring each dial, for the grinding of the dial continues until the faces 10 come in contact with the stops 18′, at which point the grinding ceases, as hereinafter explained. The arms 19 are normally in electrical contact with electro-magnets 19′, and are separated from the latter to break the connection by the contact of the stops 18′ with the grinding-surfaces 10.

The carriages 60 are connected together by

a rod 61, having right and left hand screw-threads engaging the carriages respectively, whereby, when the said rod is turned in one direction, the carriages will be moved toward each other; and, when the said rod is turned in the opposite direction, the carriages are moved away from each other. Thus, by turning a knob 62 on the end of said rod, the arms 18 may be adjusted for dials of different diameters. Each of the carriages is provided with a screw 63, which projects through a slot in the bed 1, and has a head 64, whose under side is pressed by a flat spring 65 in a groove in the bed. By this means, accidental displacement of the carriages after adjustment is prevented. The electro-magnets 19′ are carried by the carriages 60, and hence the relation between them and the arm 19 is not disturbed by adjustment of the carriages.

The slides 5, 6 have a longitudinally reciprocating motion, moving simultaneously toward and away from each other. The movement of the slides is effected through the instrumentality of sleeves 64′, mounted to turn in bearings in the bed 1, and engaging screws 65′ on the slides. Gears 73 are fixedly mounted on the sleeves 64′, and they mesh with gears 74 mounted on a counter-shaft 75. These latter gears 74 have a frictional connection with the said counter-shaft, whereby they may, under certain conditions, turn independently thereof. Each of the said gears is held between disks 76, keyed to the shaft, and faced with a material such as leather, so as to create friction between them and the gear. One of these disks is spring-pressed against the gear, as shown in Fig. 5.

Motion is transmitted from the driving-shaft 77 to each of the gears 74, through the following-described mechanism: A hollow shaft 78 is supported in stationary bearings, and carries a gear 79, meshing with the gear 74, and one member 80 of a friction cone-clutch, the other member 80′ of which is mounted on the driving-shaft. The shaft 78 is permitted a slight endwise movement to lock and release the clutch. A rod 81 occupies the bore of the shaft 78, and is pressed against the end of the driving-shaft by a spring 82, bearing at one end against the rod and at the other end against a screw 82′ fastened in the end of the shaft 78, whereby said spring tends to separate the members of the clutch. The member 80′ of the clutch contains an electro-magnet 83, and the member 80 constitutes an armature to be acted upon by said magnet and drawn into frictional engagement with the member 80′.

The main-shaft 77 is continuously driven through any suitable means, such as worm 84 and gear 85.

The machine may be wired in any suitable manner so that an electrical circuit may be established through the magnets 83, and the gage devices may constitute switches by which to cut said magnets in and out. In the present instance, a source of electricity, as a battery, is indicated at 86, and connected with the magnets 19′ and 83 respectively. The magnets 83 being rotary parts, the connection is a sliding one, consisting of an electrode 87, contacting with an annular surface 88 of the magnet-casing. The circuit is completed by connecting the arms 19 of the gage devices with the magnets 83. As here shown, this connection is indicated as being with the clutch parts or armatures 80.

The extent of normal movement of the grinders, according to the diameter of dial desired, is regulated by means of a disk 88′, mounted fixedly on the end of the counter-shaft 75, and a stop-arm 89, fastened at one end to a fixed part of the machine and arranged to give or yield in one direction only. The disk 88′ is provided with an annular series of perforations 90 and stop-pins 91 and 91′ may be removably inserted in said perforations so as to project from the inner side of the disk and encounter the stop-arm 89. A weight (not shown) is suspended by a flexible connection 93 from a grooved pulley 94 on the shaft 75, and tends to rotate said shaft in a direction which will cause the pin 91 to bear against the under side of the stop-arm 89, as shown in Fig. 3. The pin 91′ is set to permit a rotation of the counter-shaft to the extent necessary for a normal movement of the grinders to grind a dial to the desired diameter, the rotation of said shaft being stopped by the pin 91′ encountering the upper side of the stop-arm 89. The impact of the pin 91 against the stop-arm, upon the return of the shaft by the weight on the cord 93, is cushioned by reason of the yielding property of the said stop-arm.

The operation of the machine is as follows, assuming that, *imprimis*, the grinding-surfaces 10 10 are fresh and not worn. The machine having been adjusted to the desired diametrical size of dial, the dial to be operated upon is placed in the holders 12 13, the slides 5 6 being separated, and the electrical circuit is established by bringing the arms 19 into contact with the magnets 19′, and the attractive power of the latter will hold the gage devices (comprising the arms 18 and 19) positively in this adjustment, and prevent accidental displacement. The magnets 83 now being excited, lock the clutches, so that the shafts 78 will turn with the driving-shaft 77. The machine being set in motion, the dial-holder revolves the dial at the desired speed, and the main-shaft 77, through the gears 79, 74 and 73, revolves the sleeves 64, and thereby moves the grinders toward each other, by the engagement of said sleeves with the screws 65. The grinding-surfaces 10 grind down the periphery of the dial until said surfaces encounter the stops 18′. When this occurs, the dial will have been reduced to the proper diameter, and the grinding ceases by reason of the arms 18 being moved toward each other, thereby moving the arms 19 away from the magnets 19′ and breaking the cir-

cuit, thus rendering the magnets 83 inactive, and permitting the springs 82 to disconnect the clutch-parts, so that the shafts 78 are no longer rotated by the driving-shaft 77. Simultaneously with this action, the stop-pin 91′ encounters the arm 89, and stops the counter-shaft 75 which has been rotating with the other parts. Then the weight runs the grinders back away from each other to their normal position, ready to act on another dial. The grinding of the first dial removes a portion of the grinding-surface 10, and hence, in grinding the next dial, in order to bring it to the same diameter as the first one, the grinders must move toward each other to an extent as much greater than in the first instance as the amount of grinding-surface worn away during the grinding of the first dial. When the grinders arrive at the point where they were stopped in grinding the first dial, the stop-pin 91′ encounters the arm 89, as before, and stops the rotation of the counter-shaft 75. But, by reason of the reduction in the grinding-surfaces 10, they will not have encountered the stop 18′ when this takes place, hence the electrical circuit remains unbroken, and the clutches are still locked by the influence of the magnets 83, and the rotation of the shafts 78 continues, and the grinders are moved farther toward each other, the frictional connection of the gears 74 with the counter-shaft permitting said gears to continue to turn, while said shaft is held stationary, said gears slipping between the disks 76. The movement of the grinders upon the dial continues until the grinding-surfaces encounter the stops 18′, when said grinders are stopped and run back, as before. The second dial is now complete, and is of an exact size with the previously-ground one. The operation may be continued until the emery laps 10 are completely worn away, and the disks ground will all be of a uniform diameter.

The machine could be so arranged that the diamond stops 18′ would rest upon the periphery of the disk being ground, and break contact when the desired size was attained, thus stopping the electrical feed and the forward motion of the grinding-lap.

I do not confine myself to the exact means shown and described for taking up the wear of the grinding-surfaces, as any suitable mechanical means could be substituted for those shown.

The invention is not limited to the conjoint use of the two grinding mechanisms here shown, and one of said mechanisms may be omitted without departing from the spirit of the invention.

The mechanism whereby the compensating feed movement and its automatic arrest may be effected may be variously modified, and I do not confine myself to the particular organization and details of mechanism here shown.

Figs. 8, 9, 10 and 11 illustrate a construction by which the invention may be embodied in a machine for grinding elongated bodies. The work, as 100, is carried on a carriage 101, mounted in a suitable manner so as to be capable of traveling back and forth across the grinding-lap 102. This grinding-lap is in the form of a disk, which is mounted on a slide 103. The stop-arm 104 is carried on an auxiliary slide 105, and has a diamond point 106 for contact with the periphery of the emery-lap 102. The slide 105 is mounted to move over the slide 103, and the two slides are driven by one screw-shaft 107, having screw-threads of different pitch engaging the slides respectively, whereby the slide 105 will move twice as fast as the slide 103. The screw-shaft is driven through its primary movement, and through its movement which compensates for the wearing away of the emery-lap, by mechanism of similar construction and arrangement to that already described with reference to the other figures.

In view of the fact that an elongated body is under treatment, and to be reduced to a uniform size throughout its length, the grinding-lap must be held up against the work for a certain length of time after the piece has been reduced to the desired diameter at one end. This may be accomplished by the construction here shown, in which a divided counter-shaft 108 has its ends frictionally connected by means of suitably-constructed heads 109 and 110. The head 110 comprises a drum, on which a cord or like flexible device 111 is adapted to be wound, said cord having a weight attached to its end, and arranged to turn back the feeding parts after one piece has been ground. The driving-shaft 112 is connected with the right-hand member of the divided counter-shaft, by gears 113 114, an electric friction-clutch 115 of a construction similar to that before described being inserted in the driving-shaft. A perforated disk 116 is fastened on the end of the divided counter-shaft, and receives a stop-pin 117, to throw the feed parts out of gear with the driving-shaft at a predetermined time.

A stop-arm 118 is pivoted to the end of the machine-frame, and extends behind the disk 116 and into the path of the pin 117, and may move to a limited extent on its pivot between stop-pins 119 and 120, so as to be utilized as a switch to cut out the clutch 115. A spring 121 is connected at one end with the arm 118, at a point in front of the pivot thereof, and said spring is connected at its opposite end with a stationary support 122. It will be seen that said spring will act to hold the pivoted arm against one or the other of the fixed stops 119 or 120, and, as soon as the arm is moved over the center, said spring quickly carries it against the fixed stop. The upper stop 119 is the terminal of an electric circuit, which includes the clutch 115. The other terminal of said circuit is the arm 118. Said arm carries a spring clip 123, for engagement with the stop 119. When the grinding operation begins, the arm 118 is in electrical engagement with the

stop 119, and the circuit is closed and the clutch locked. The pin 117 is set to permit a continued movement of the right-hand member of the shaft 108 after the left-hand member has been stopped by the pin in the disk 88ª coming against the stop-arm, as in the form of machine first described, the continued movement being sufficient to allow for the length of the work under treatment. It will now be seen that, after the primary feed and the wear-compensating feed have been effected, the emery-lap is still held up against the work, as the cord 111 is still being wound upon the head 110 as the latter is driven from the shaft 112 through the gears 113 and 114, and the frictional contact of the heads 109 and 110 prevents the left-hand member of the counter-shaft from turning back. This continues until the pin 117 encounters the arm 118 and moves it over the center, whereupon the spring 121 throws the arm against the fixed stop 120, and the circuit is broken by the disconnection of the clip 123 and terminal 119. As soon as the circuit is broken, the clutch 115 is released, and the weight on the cord 111 turns back the feed-parts, the two members of the counter-shaft turning together,—by reason of the frictional engagement of the heads 109 and 110,—until the left-hand member is stopped in the manner described with reference to the first form of machine. The right-hand member continues to be turned back by the weight, until a pin 125 in the disk 116 encounters the stop-arm 118, the head 110 slipping on the head 109. Said pin 125 moves the arm 118 over the center, and the spring 121 draws it against the stop 119, and the circuit is again closed.

It is evident that other constructions might be employed to accomplish the compensation for length of the work, and hence the invention is not limited to the particular construction shown.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

A grinding machine comprising in its construction a movable grinder, feed mechanism for advancing the same upon the work, means controlled by the grinding surface for rendering said feed mechanism inoperative, a retracting agent which constantly tends to withdraw the grinder, and means for restraining said retracting agent a predetermined time after the feed-mechanism has been rendered inoperative.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 17th day of June, A. D. 1893.

DUANE H. CHURCH.

Witnesses:
C. F. BROWN,
ARTHUR W. CROSSLEY.