Feb. 23, 1932. S. EINSTEIN ET AL 1,846,956

GRINDING MACHINERY

Filed July 22, 1926 3 Sheets-Sheet 1

Fig. 1.

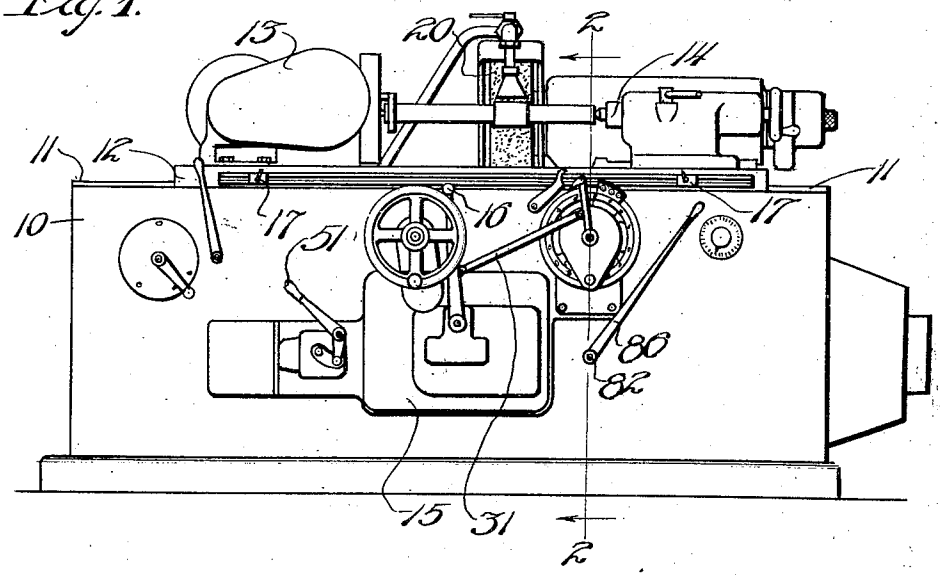


Fig. 2.

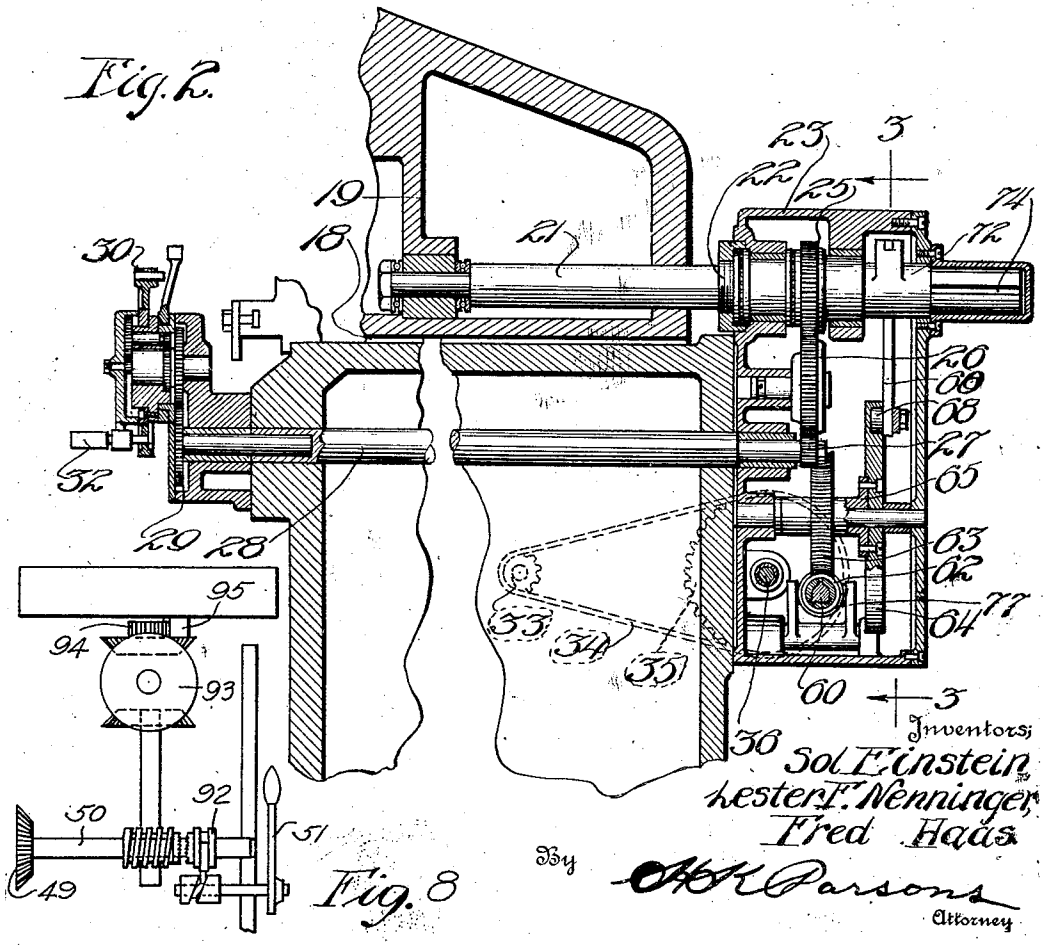


Fig. 8

Inventors;
Sol Einstein,
Lester F. Nenninger,
Fred Haas
By
H. K. Parsons
Attorney

Feb. 23, 1932. S. EINSTEIN ET AL 1,846,956

GRINDING MACHINERY

Filed July 22, 1926 3 Sheets-Sheet 2

Fig. 3.

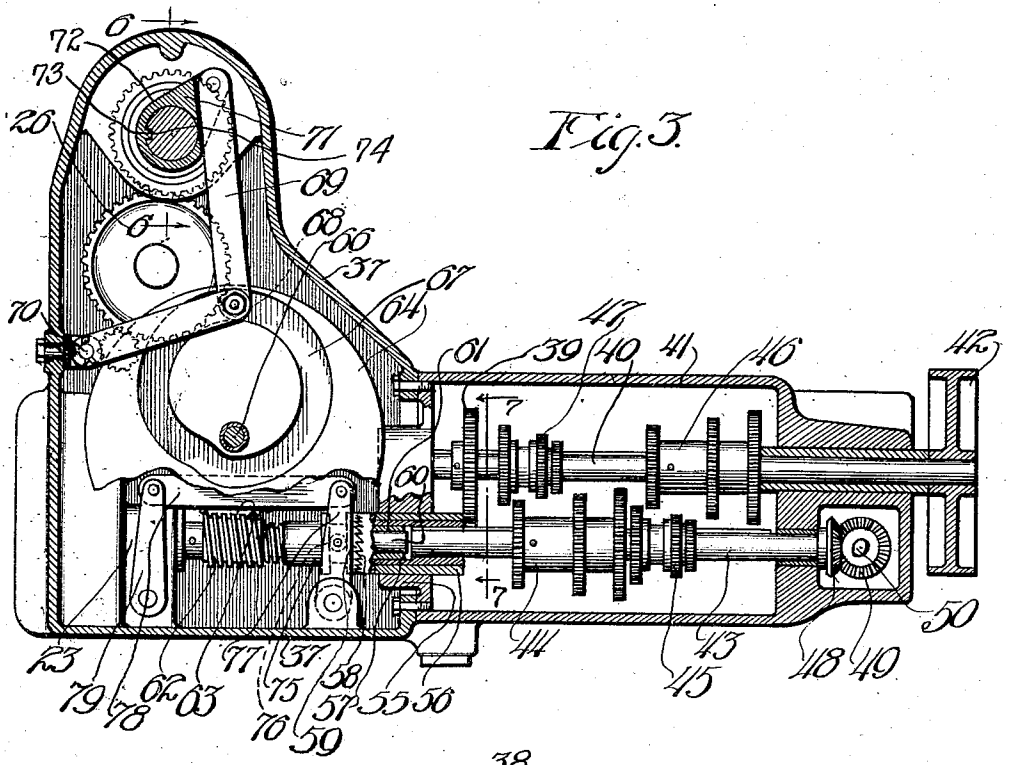


Fig. 5.

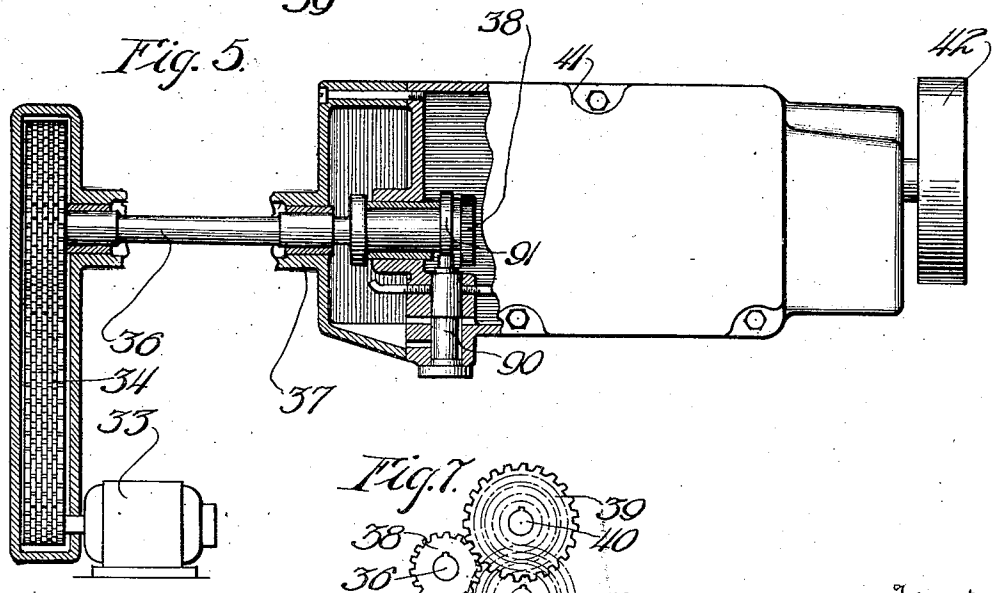


Fig. 7.

Inventors;
Sol Einstein,
Lester F. Menninger,
Fred Haas.

By

O. K. Parsons
Attorney

Feb. 23, 1932. S. EINSTEIN ET AL 1,846,956

GRINDING MACHINERY

Filed July 22, 1926 3 Sheets-Sheet 3

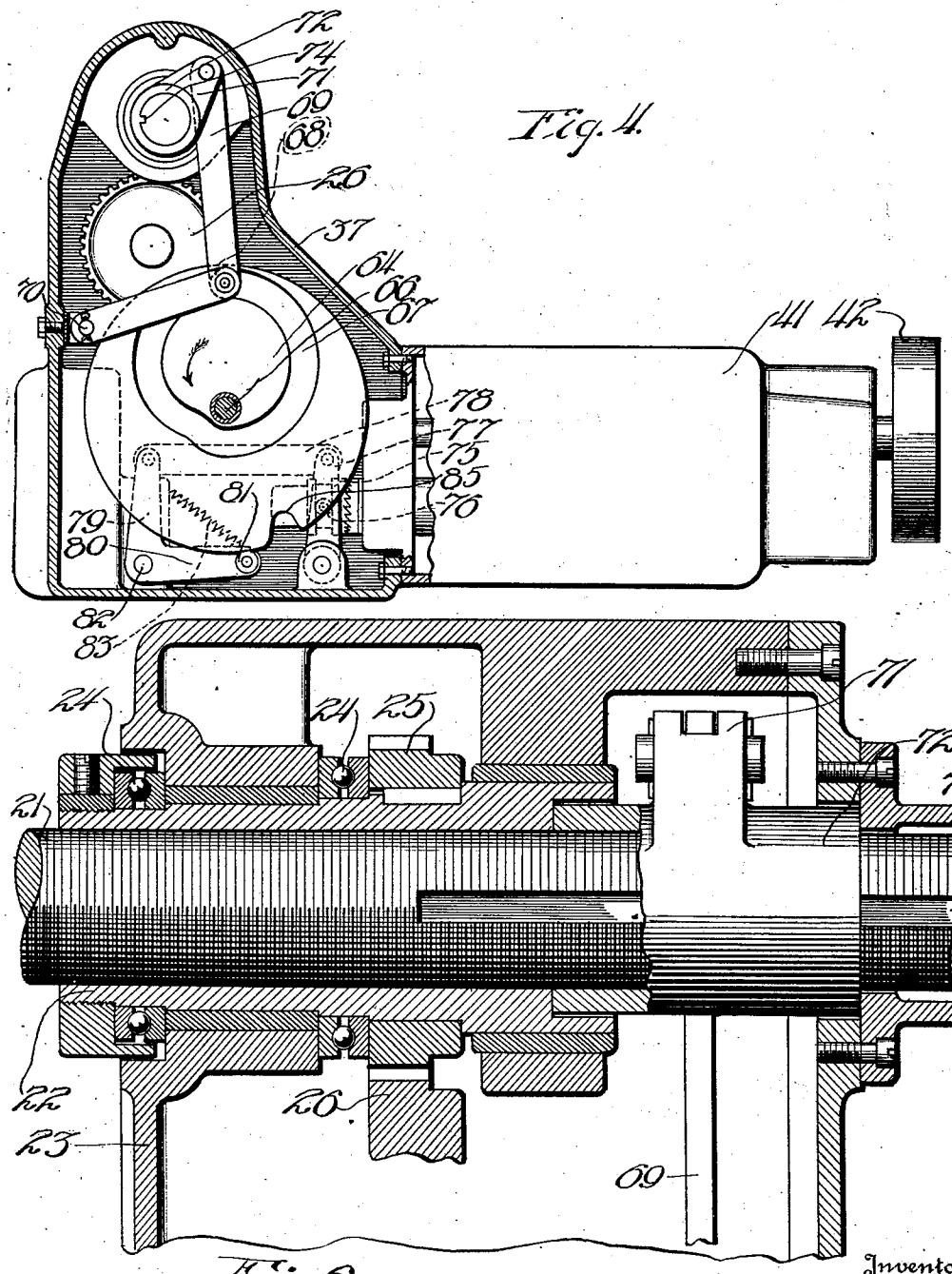


Fig. 4.

Fig. 6.

Inventors;
Sol Einstein,
Chester F. Henninger,
Fred Haas.

By
A. K. Parsons
Attorney

Patented Feb. 23, 1932 1,846,956

UNITED STATES PATENT OFFICE

SOL EINSTEIN, LESTER F. NENNINGER, AND FRED HAAS, OF CINCINNATI, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO CINCINNATI GRINDERS INCORPORATED, OF CINCINNATI, OHIO, A CORPORATION OF OHIO

GRINDING MACHINERY

Application filed July 22, 1926. Serial No. 124,249.

This invention relates to improvements in grinding machinery and has particular reference to what is commonly known as a center grinder.

Center grinders or machines which are intended to grind work held between centers are ordinarily divided into two classes, one in which there is a relative in and out movement imparted to the work and the grinding wheel in a feeding direction without axial movement and the other in which either the work or grinding wheel has an axial shifting movement as for operation upon surfaces greater in axial extent than the width of the grinding wheel.

One of the objects of the present invention is the provision of an improved grinding machine which may be selectively employed for either type of grinding operation.

A further object of the present invention is the provision of a machine of this character in which the drive mechanism may be selectively coupled for infeed of the parts or for longitudinal movement or traverse as may be preferred.

An additional object of the present invention is the provision of a center grinding machine which shall have a complete automatic cyclic control of the relative feed of the grinding wheel and work during the grinding operation, together with an automatic separation of the parts in a positive manner on the completion of the grinding.

Another object of the invention is the provision of an improved combined manual and automatic control mechanism by which joint and simultaneous manual and automatic adjustment of the parts may be effected as desired.

Other objects and advantages of the present invention should be readily apparent by reference to the following specification taken in connection with the accompanying drawings and it will be understood that we may make any modifications in the specific structural details hereinafter described or illustrated within the scope of the appended claims without departing from or exceeding the spirit of the invention.

Figure 1 represents a front view of a grinder, embodying the invention.

Figure 2 is a fragmentary vertical sectional view as on the line 2—2 of Figure 1.

Figure 3 is a section through the automatic control mechanism taken on line 3—3 of Figure 2, parts being broken away.

Figure 4 is a semi-sectional rear view with the broken away parts of Figure 3 shown in elevation.

Figure 5 is a view partly in section illustrating the drive mechanism.

Figure 6 is an enlarged detailed view of the control screw and adjusting device therefor.

Figure 7 is a section on line 7—7 of Figure 3.

Figure 8 is a fragmentary sectional view of the power table drive mechanism.

In the drawings in which similar characters of reference are employed throughout to denote corresponding parts, the numeral 10 designates the bed of a grinder having the ways 11 for the grinding machine table 12. This table 12 is longitudinally movable on the bed in the customary manner and carries the driven headstock mechanism 13 and the tailstock 14. The drive and reverser mechanism for the table as an entirety is within the control box 15 on the front of the bed, from which extends the dog actuable reverser lever 16 for cooperation with dogs 17 on the table. These parts may be of any well known conventional grinding machine construction and are not therefore believed to require more specific description as in themselves forming no part of the essential novel features of the present invention.

The bed is further formed with the transverse ways 18 for the carriage 19 which supports the grinding wheel 20. This carriage has swivelled thereto the adjusting screw 21 which extends rearwardly therefrom and has threaded thereon the sleeve nut 22. This sleeve nut 22 is held against longitudinal movement relative the supplemental frame 23 as by the antifriction bearings 24 and has keyed thereon a gear 25, meshing with idler 26 which in turn is coupled by pinion 27 with the adjusting shaft 28 which extends to the front of the machine. This shaft is coupled

through a suitable gear train 29 with the ratchet wheel 30. Pawl connections with reverse lever 16 serve to impart a step by step advancing movement to ratchet 30 and thus a gradual feeding in of carriage 19 as the table 12 is reciprocated, this action being automatically effected through interengagement of dogs 17 and reverse lever 16. In addition a handle 32 is provided by which shaft 28 and nut 22 may be manually rotated.

To cause reciprocation of the table and thus incidentally the automatic infeed of the grinding wheel just referred to, use is made of a drive motor 33 coupled by silent chain 34 with gear 35 on shaft 36. This shaft is journaled in a bracket 37 bolted to the rear of the machine and bears a drive pinion 38. This pinion is in permanent driving mesh with gear 39 of sliding gear transmission shaft 40, supported by the supplemental frame member 41. Shaft 40 bears pulley 42 adapted to be coupled with the coolant pump which is thus continuously driven at a constant rate of speed. Journaled in the frame 41 is a second transmission shaft 43 bearing a fixed gear transmission unit 44 and a sliding unit 45 which is splined thereon. Unit 45 is adapted for coaction with fixed unit 46 on shaft 40, while unit 44 is adapted for cooperation with the splined sliding unit 47 of shaft 40, said gear changes being effected through dial lever 96 and suitable associated control mechanism of the type shown for example in United States Letters Patent 1,490,894. It will thus be seen that shaft 43 may be selectively driven from shaft 40 as illustrated at six different speeds. Shaft 43 is further provided with a bevel gear 48 meshing with a second bevel gear 49 on shaft 50 which extends toward the front of the machine for actuation of the table drive mechanism. A clutch lever 51 controls the operative association of shaft 50 with the table drive mechanism whereby said mechanism is rendered operative to reciprocate the table or is disconnected as when the table is to remain stationary for what is known as plunge-cut grinding.

In the event that it is desired to use the machine for plunge-cut grinding, which is to say grinding in which the width of the grinding wheel face is sufficient so that relative reciprocation of the parts is unnecessary and a direct feeding motion may be employed, this action is also effected through shaft 43. The frame 41 has a bushed boss as at 55, while within the bushing 56 is a rotatably supported sleeve 57 interiorly interlocking with the splines on shaft 43 and at its distant end having the clutch face 58 for cooperation with clutch 59 slidably supported by shaft 60. A bushing 61 within sleeve 57 forms a bearing for one end of shaft 60, while the opposite end is journaled in the frame member 23. This shaft bears a worm 62 meshing with the worm gear 63 on hub 65 rotatably supported by axle 66. This hub has secured thereto disk 64 provided with the cam path 67 receiving roller 68 of toggle mechanism 69. One end of the toggle is pivoted to a stud 70 carried by frame 23, while the other end of the toggle is pivoted to an arm 71 of sleeve 72 which has a spline 73 riding in keyway 74 of adjusting screw 21. It will thus be seen that when rotation is imparted to disk 64, cam path 67 will cause an up and down movement of toggle 69, thus rotating sleeve 72 and with it shaft 74. This rotative action of the shaft with nut 22 held stationary will cause a predetermined in and out movement of carriage 19 with respect to the work table. Attention is invited to the fact that the cam as shown in Figure 4 rotates in a counter-clockwise direction. It is shown at substantially the inception of a cycle of movement or with the carriage controlled thereby in retracted position. As the cam rotates, arm 71 will be drawn downward, rotating the control screw to move the carriage inward at a slow rate during substantially a half a revolution, at the end of which period the cam has a substantially concentric portion, causing a dwell in the grinding wheel for sparking out or final finishing to size. At the end of this dwell will be found a sharp rise on the cam causing a quick return movement of the carriage, withdrawing the grinding wheel from engagement with the work piece.

Referring particularly to the control clutch having the cyclic movement, the clutch member 59 is shown as formed with the spool portion 75 engaged by shifter yoke 76 having an upstanding arm 77 connected by link 78 with one arm 79 of a bell crank having a second angular arm 80 provided with a contact roller 81. This bell crank is supported for rocking movement by shaft 82 which extends to the front of the machine, and its roller 81 is urged by a spring 83 against the periphery of control disk 64. As the disk rotates, notch 85 in its edge will allow roller 81 to snap inward under the influence of spring 83. This inward movement by rocking of the bell crank and pull on link 78 swings the shifter yoke to disengage clutch members 58 and 59, thus stopping rotation of the cam disk 64.

When it is desired to start up the machine again, shaft 82 is rocked by handle 86 on the front of the machine to lift roller 81 out of notch 85 and throw the clutch members into engagement. Rotation of disk 64 then brings its periphery into engagement with roller 81 holding the clutch locked in engaging position until a new cycle has been performed.

It will of course be understood that control levers 51 and 86 are selectively actuated, either member 51 being shifted to render its clutch inoperative to prevent reciprocation of the table or lever 86 left in position so that

roller 81 interlocks with notch 85, so that there is no automatic infeed and return stroke of the carriage in the event that the table is being reciprocated and grinding on long work pieces performed.

In order that several parts of the gear mechanism may be properly lubricated, use is made of a plunger pump 90 shown in Figure 5, actuated by a cam 91 on shaft 36.

In the operation of the machine power is applied as from the motor or other prime mover 33 through shaft 36 to shaft 40 and thence through the speed determining transmission gears to shaft 43. Shaft 43 may therefore be considered the main source of power for actuation of both the reciprocating table 12 and the grinding wheel carriage 19. Power for reciprocation of the table is supplied from shaft 43 through shaft 50 and clutch 92 to reverser bevel gear system 93 and thence through pinion 94 and rack 95 to the table as indicated in Figure 8.

It will thus be seen that power actuation of the table is entirely selectively controlled by shift lever 51 and clutch 92.

In addition the variable rate power imparted to shaft 43 may be coupled through clutch 59 with worm 62. This worm drives cam disk 64 and through the action of cam track 67 on toggle mechanism 68 rocks or oscillates the non-translatable sleeve 72 slidably keyed on screw 21. Oscillation of the screw on account of its threaded engagement in non-translatable nut 22 produces a limited in and out movement of the grinding wheel and a consequent predetermined removal of stock from the work and subsequent disengagement of the work.

Nut 22 is also coupled through gear 25 and other associated gearing with shaft 28 manually actuable from the front of the machine. Inasmuch as the power actuation effects the screw only for definite back and forth shiftings of the grinding wheel carriage while the manual actuating mechanism operates upon the other member both of these may be simultaneously operated to vary the position of the grinding carriage for reciprocations of the same amplitude as determined by the oscillation of the sleeve and screw through cam 67. Through employment of clutches 59 and 92 it is therefore possible to selectively couple the grinding wheel carriage for positive in and out feeding movement of prescribed amplitude or the table with the table feed mechanism for reciprocation of the table past the grinding wheel.

From the foregoing description it will be seen there has been provided an improved machine for center grinding of cylindrical articles in which the work carriage itself may be reciprocated to axially shift the work past the surface of the grinding wheel and the feed of the wheel manually effected or automatically effected during the reciprocation of the table or which may be automatically employed for direct infeed grinding. It will further be noted that when so selectively employed there is provided a cam control mechanism operable from the same source of power as the table reciprocating and intermittent feed mechanism and which will serve to automatically accomplish a complete cycle of movement of the grinding wheel, comprising a slow infeed, a dwell for sparking out purposes and a positive accelerated return movement of the grinding wheel. It will also be noted that the mechanism is such that the position of the grinding wheel may be manually adjusted to increase either its inward or outward movement irrespective of whether the intermittent or automatic feed devices are being operated.

We claim:—

1. A grinding machine including a bed, a table reciprocable on the bed, a grinding wheel carriage movable in a direction at right angles to the direction of movement of the table, a power shaft, means for imparting a single in and out movement to the grinding wheel carriage toward the table, means for shifting the table, and control devices for selectively coupling the carriage actuating or table actuating means with the power shaft.

2. A grinding machine including a bed, a table reciprocable on the bed, a grinding wheel carriage movable in a direction at right angles to the direction of movement of the table, a power shaft, means for imparting a single in and out movement to the grinding wheel carriage toward the table, means for shifting the table, control devices for selectively coupling the carriage actuating or table actuating means with the power shaft and means for varying the effective rate of speed transmitted from the power shaft to either of the shifting means.

3. A cylindrical grinding machine including a bed, work supports carried thereby, a grinding wheel carriage slidably mounted on the bed, a feed screw rotatably but non-translatably secured to the carriage, a rotatable non-translatable nut engaged on the screw for imparting an in and out movement to the screw and carriage upon rotation of the nut, manual means for rotating the nut to adjust the position of the carriage, and cam controlled means for rotating the screw within the nut to impart a supplemental movement to the carriage.

4. A grinding machine of the type described, including a bed or support and a grinding wheel carriage slidably mounted thereon, a nut and screw device coupled with the carriage for imparting in and out movement thereto, and control means for said in and out movement, including a power actuated cam member, toggle connections between the cam and the screw and nut mechanism for producing an in and out movement of the car-

riage, a clutch in the power transmission line, means for initially engaging said clutch to rotate the cam, coacting means on the cam and clutch mechanism for holding the clutch in operative position, and means for shifting the clutch into inoperative position at a predetermined point in the movement of the cam.

5. A grinding machine of the character described, including a bed, a table supported for reciprocation on the bed, work holding members carried by the table, a grinding wheel carriage disposed in opposition to the table and movable in a direction toward and from the table, a screw coupled with the carriage for controlling the movement thereof, a driven shaft, connections between the driven shaft and table for reciprocating the latter, cooperating connections between the table and screw for actuating the latter to move the carriage inward as the table reciprocates and additional selectively engageable connections between the driven shaft and carriage for imparting cyclic in and out movement to the carriage, independent of the reciprocation of the table.

6. A cylindrical grinding machine including a bed, a table reciprocably mounted on the bed, a grinding wheel carriage mounted for movement toward and from the table, means on the front of the machine actuable by reciprocation of the table for imparting an inward feeding movement to the grinding wheel carriage, and means on the rear of the bed for imparting a cyclic in and out stroke to the grinding wheel carriage.

7. A cylindrical grinding machine including a bed, a table reciprocably mounted on the bed, a grinding wheel carriage mounted for movement toward and from the table, means on the front of the machine actuable by reciprocation of the table for imparting an inward feeding movement to the grinding wheel carriage, means on the rear of the bed for imparting a cyclic in and out stroke to the grinding wheel, power driven mechanism for actuating said means, and a control device for limiting said actuation to a single stroke.

8. A cylindrical grinding machine including a bed, a table reciprocably mounted on the bed, a grinding wheel carriage mounted for movement toward and from the table, means on the front of the machine actuable by reciprocation of the table for imparting an inward feeding movement to the grinding wheel carriage, means on the rear of the bed for imparting a cyclic in and out stroke to the grinding wheel carriage, power driven mechanism for actuating said means, a control device for limiting said actuation to a single stroke and manually operable means at the front of the machine for initiating said power stroke of the carriage.

9. In a cylindrical grinder the combination with a bed and a grinding wheel carriage mounted for reciprocation on the bed, of screw mechanism for adjusting the position of the carriage on the bed and additional power mechanism for imparting an in and out movement to the carriage, said mechanism including a sleeve splined on the screw, a toggle mechanism connected with the sleeve and having a cam follower, a rotatable disk having an eccentric cam path receiving the follower, and having a notch in the edge thereof, power means for rotating the disk, a control clutch for coupling the power means with the disk, and clutch shifting members, including a follower peripherally engaging the disk and a spring for shifting the clutch into inoperative position upon engagement of the follower in the notch of the disk.

10. In a grinding machine the combination with a bed or support of a grinding wheel carriage reciprocably mounted thereon, and means for imparting movement to said carriage including a feed screw coupled therewith, a nut engaged on the screw and held by the support against axial movement, means for rotating the nut to cause a feeding movement of the carriage in a direction determined by the direction of rotation of the nut, and additional means for imparting an independent rotary movement to the screw to supplement the action of the nut in adjusting the carriage.

11. A grinding machine of the character described including a bed or support, a grinding wheel carriage slidably mounted thereon, and means for controlling the position of the grinding wheel carriage including inter-engaged screw and nut members, one of said members being coupled to the grinding wheel carriage against axial movement relative thereto and the other of said members being coupled to the support and held against axial movement relative the support, means for rotating one of said members for imparting oscillations of predetermined amplitude to the grinding wheel carriage, additional means for rotating the other of said members to change the zone of movement of the carriage oscillation of a given amplitude, and power means for actuating one of said rotatable carriage shifting members.

In testimony whereof we affix our signatures.

SOL EINSTEIN.
LESTER F. NENNINGER.
FRED HAAS.