March 26, 1940. D. A. WALLACE 2,195,066

SURFACE FINISHING APPARATUS

Original Filed April 11, 1939 4 Sheets-Sheet 1

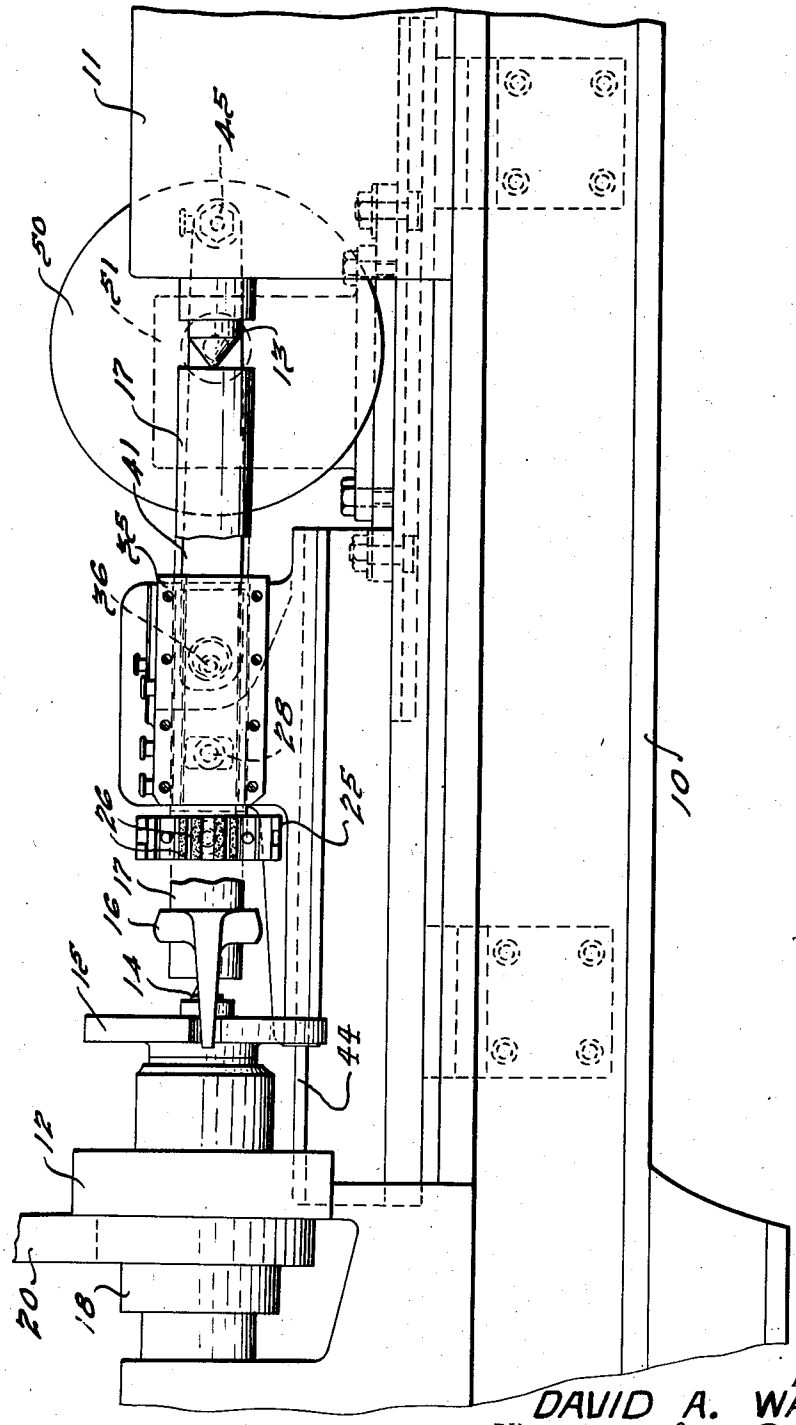


FIG. 1.

INVENTOR
DAVID A. WALLACE
BY Harness, Lind, Dates & Davis.
ATTORNEYS.

March 26, 1940. D. A. WALLACE 2,195,066

SURFACE FINISHING APPARATUS

Original Filed April 11, 1939 4 Sheets-Sheet 2

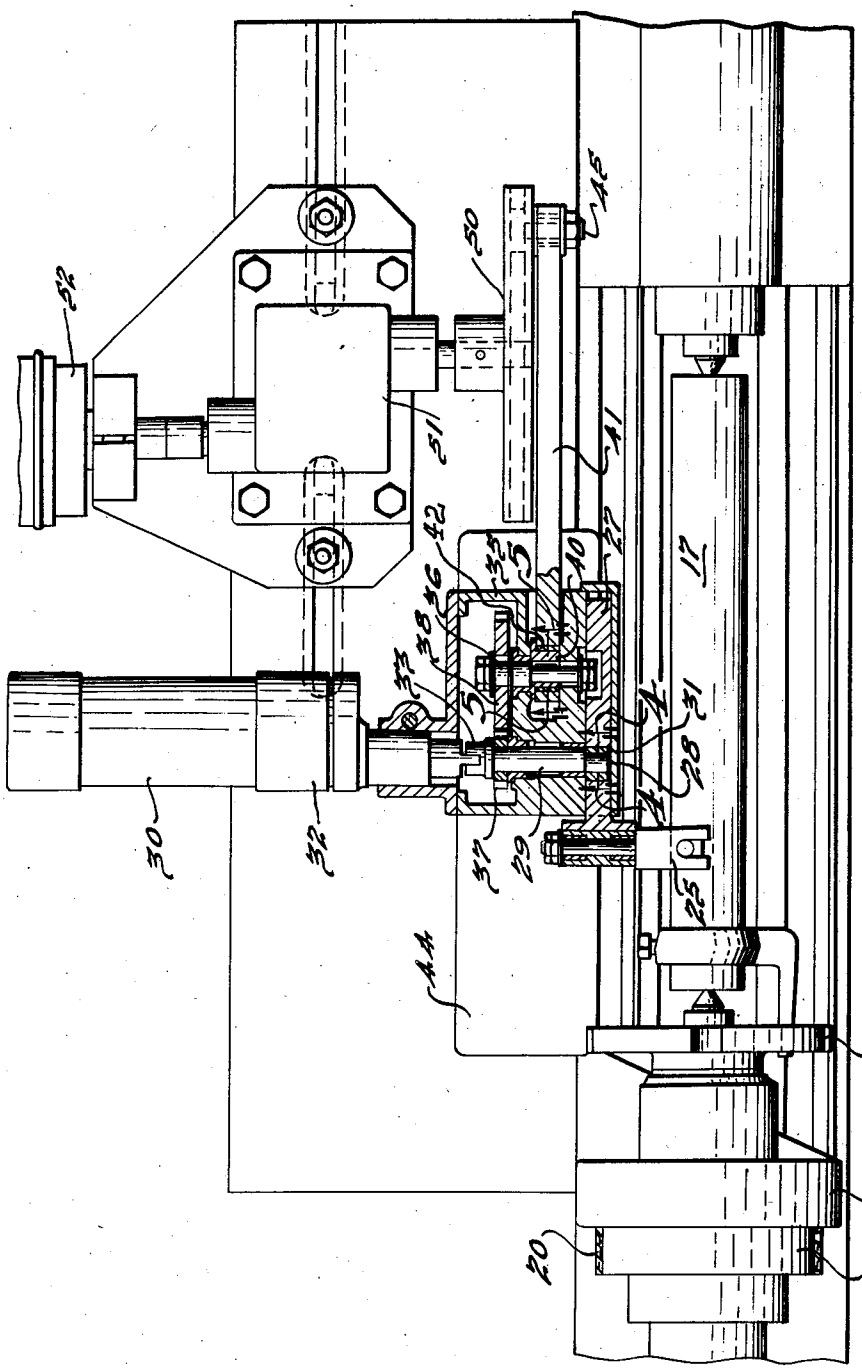


Fig. 2.

INVENTOR
DAVID A. WALLACE
BY Hanes, Lind, Patel & Hanes.
ATTORNEYS.

March 26, 1940. D. A. WALLACE 2,195,066

SURFACE FINISHING APPARATUS

Original Filed April 11, 1939 4 Sheets-Sheet 3

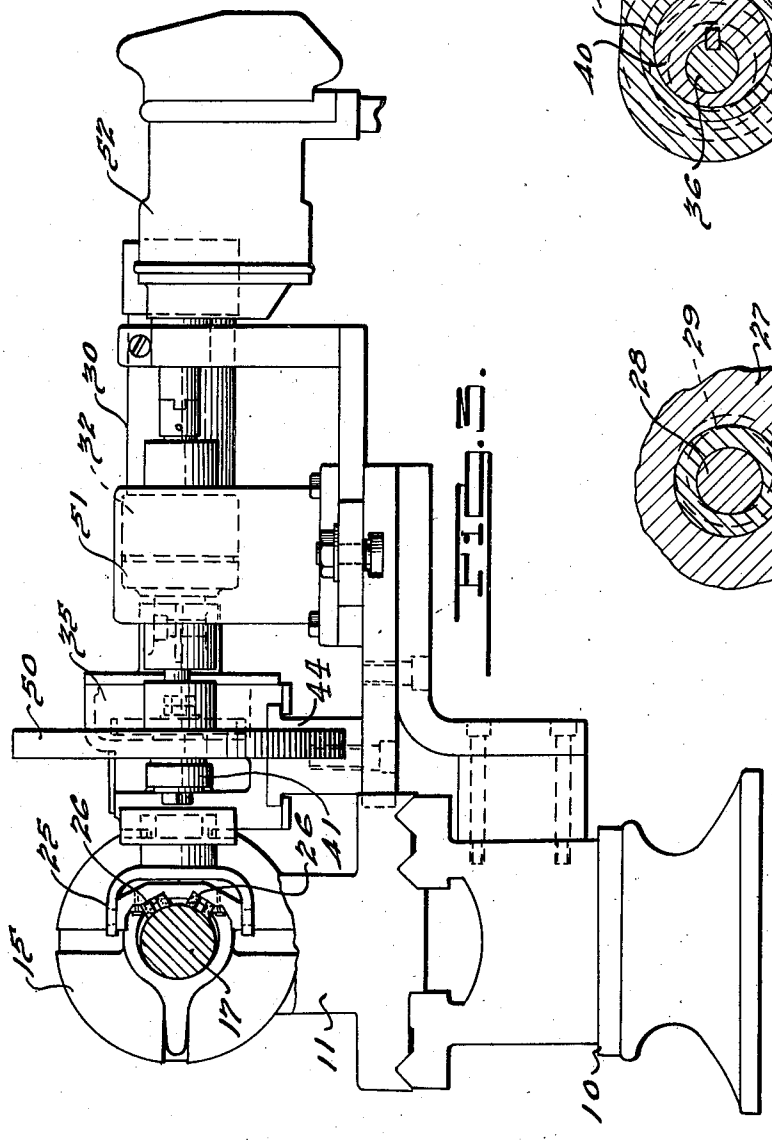


Fig. 3.

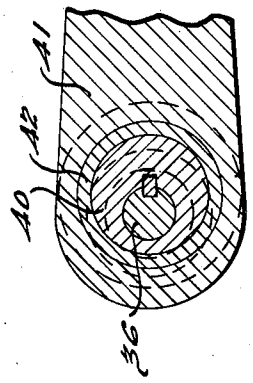


Fig. 5.

Fig. 4.

INVENTOR
DAVID A. WALLACE
BY Harness, Dind, Pate & Kain.
ATTORNEYS.

March 26, 1940. D. A. WALLACE 2,195,066

SURFACE FINISHING APPARATUS

Original Filed April 11, 1939 4 Sheets-Sheet 4

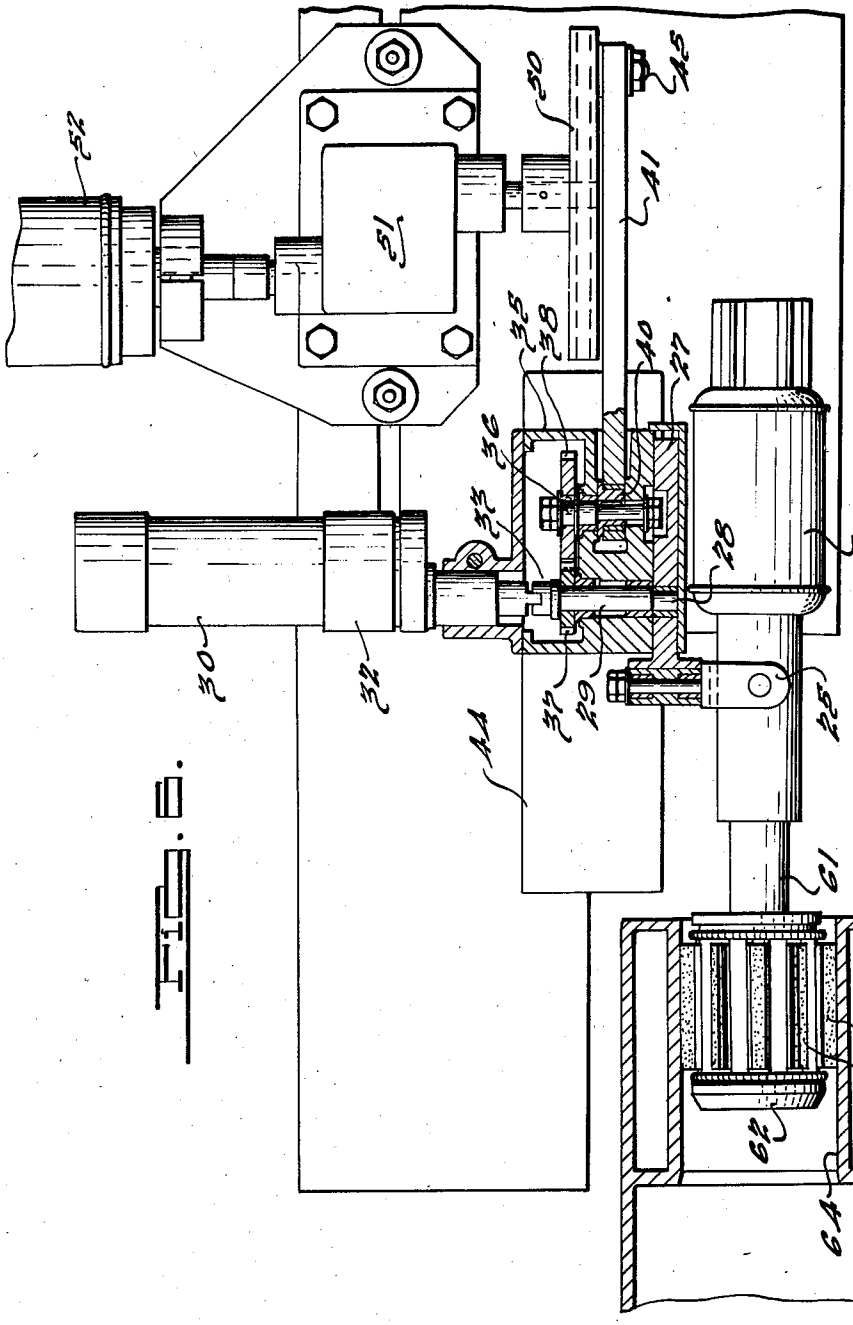


Fig. 5.

INVENTOR
DAVID A. WALLACE.
BY Harness, Lind, Paley & Harris.
ATTORNEYS.

Patented Mar. 26, 1940 2,195,066

UNITED STATES PATENT OFFICE

2,195,066

SURFACE FINISHING APPARATUS

David A. Wallace, Detroit, Mich., assignor to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

Application April 11, 1939, Serial No. 267,266
Renewed January 3, 1940

10 Claims. (Cl. 51—67)

The present invention relates to the art of finishing surfaces, and comprises means for compounding a plurality of simultaneous movements whereby no increment of the work surface is successively twice traversed by the same particle of an abrading element moving at the rate of speed or in the same direction. The object of the invention is to cause a surface finishing tool to finish the entire surface of the work without permitting any single increment of surface to be twice traversed by the same increment of a working member travelling in the same direction at the same speed. A feature of the present invention is that the foregoing object is achieved by simple, economically purchased and assembled means.

A further object of the present invention is to provide means whereby a single prime mover produces simultaneous, reciprocating movements of different amplitudes and frequencies whereby a rapid stroke of the working tool is compounded with a slow stroke of the working tool so that the tool is continuously reciprocated relative to the work surface in relatively long, slow strokes, each of which comprises a plurality of relatively short, rapid strokes.

Having set forth the principal objects of the present invention, the same should be more clearly understood by reference to the following specification and accompanying drawings wherein like numerals refer to like parts throughout.

In the drawings, Fig. 1 is a front elevation of a machine embodying the present invention, showing the same in operation upon a cylindrical surface;

Fig. 2 is a top plan view of the machine shown in Fig. 1, with parts being shown in section;

Fig. 3 is an end elevation of the machine set forth in Figs. 1 and 2;

Fig. 4 is an enlarged section taken along line 4—4 of Fig. 2;

Fig. 5 is an enlarged section taken along line 5—5 of Fig. 2; and,

Fig. 6 is a top plan view, partially in section, of a modification of the present invention.

Referring to Figs. 1 to 5, inclusive, the machine comprises a bed 10 upon which is mounted a head stock 11 and a tail stock 12, the head stock being provided with work engaging means, such as the center point 13, and the tail stock being provided with work engaging means, such as the center point 14 and the driver 15 engaging clamp 16 secured to the work piece 17 whereby the cylindrical work may be rotated. It is to be appreciated that the work surface may be of various shapes and may be moved relative to the tool holder in various manners, the present showing being sufficient to illustrate the fact that the present invention preferably comprises means to move the surface of the work independently of the motion of the tool holder; or as will appear with respect to the modification shown in Fig. 6, it is desirable that the relative positions of the tool and the surface of the work be uniformly altered so as to successively present increments of work surface to the tool. In the present modification the cylindrical member 17 is rotated by means of the speed adjusting pulleys 18 attached to driver 15 and rotated by belt 20.

The surface finishing tool preferably comprises a tool holder 25 in which is replaceably mounted a plurality of abrading elements 26 which may be formed of artificial or natural material commonly used for surface finishing purposes. The tool holder is mounted on a sliding member such as a yoke 27 which is driven by an eccentric crank 28 on a driven shaft 29 connected to the shaft of a motor 30. An anti-friction roller 31 surrounds the crank pin 28 and engages the walls of the slot of yoke 27. The motor 30 may be provided with any suitable type of reduction gear mechanism 32 whereby various speeds of rotation of the crank 28 may be achieved by replacement of the motor by a motor having other gear ratios, a torque and groove connection 33 between the motor and shaft 29 being provided for the purpose of permitting such replacement.

Yoke 27 is guided for longitudinal reciprocation in a support 35 in which is mounted a shaft 36 parallel to the shaft 29. A gear train comprising gear 37 fixed to shaft 29 and meshing with a larger gear 38 fixed to shaft 36 rotates the shaft 36. An eccentric 40 is fixed to shaft 36 and pivotally supports the end of a crank rod 41, the connection preferably comprising an anti-friction bearing member 42. If the guide member 35 were fixed to a solid support, it could be seen that crank rod 41 would be reciprocated once for every several reciprocations of yoke 27. The guiding member 35, however, is guided for movement longitudinally of the work along a tongued bed 44, and the opposite end of crank rod 41 is fixed to a relatively fixed pivot member 45 so that, at the same time that the eccentric 28 causes the abrading elements to move longitudinally of the work in a series of rapid movements, the eccentric 40 causes the abrading elements 25 to move longitudinally of the work in a series of slower movements. The amplitude of each reciprocation may be the same provided that the eccentricity of

crank pin 28 and crank pin 40 is the same, or may be different if the eccentricity is different.

In order to present successive longitudinal increments of work surface to the working elements, in addition to successive circumferential increments of work surface, the relatively fixed pivot 45 is adjustably secured to a feeding wheel 50 which is driven through reduction gear assembly 51 connected to a source of motive power 52.

In the form of the invention set forth in Figs. 1 to 5, it should now be apparent that the abrading elements rapidly reciprocate over a small surface area in movements combining the effect of eccentrics 38 and 40, and at the same time the feeding wheel 50 and pulley 18 cause the working elements to move relative to the working surface along a spiral path of relatively short pitch. The combination of lateral and longitudinal feeding movements, thus produced, could be produced by such other means as may be necessary for other types of surfaces such as plane surfaces.

Fig. 6 shows the present invention adapted to the finishing of cylindrical bores, in this case the tool holder 25 supporting a motor 60 driving a shaft 61, upon which is mounted a cylindrical honing tool 62 having a plurality of circumferentially spaced abrading elements 63 engaging the surface of a cylindrical bore 64 to be finished. As previously described with respect to the modification of Figs. 1 to 5, the surface of the work is continuously abraded by the elements 63 moving longitudinally thereof in short, reciprocating steps, the movement of which represents the compound effect of the eccentrics 28 and 40, while the abrading tool as a whole is continuously presented to the surface 64 along a spiral path of relatively short pitch due to the compound effect of the feeding motors 60 and 52.

Having described several modifications of the present invention it should be apparent to those skilled in the art that the same permits of various modifications in arrangement and detail. All such modifications, as come within the scope of the following claims, are to be considered as part of my invention.

I claim:

1. A surface finishing machine comprising a surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member attached to said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said member whereby to reciprocate said member relative to said support, an eccentric mechanism mounted on said support and driven by said motor, and a relatively fixed element against which said eccentric mechanism thrusts whereby rotation of said eccentric mechanism by said motor causes reciprocation of said support, the simultaneous reciprocations of said member and said support producing compound reciprocations of said surface finishing tool.

2. A surface finishing machine comprising a surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member attached to said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said member whereby to reciprocate said member relative to said support, an eccentric mechanism mounted on said support and driven by said motor, a crank rod extending from said eccentric mechanism, and a relatively fixed pivot to which the opposite end of said crank rod is pivotally attached whereby rotation of said eccentric mechanism by said motor causes reciprocation of said support, the simultaneous reciprocations of said member and said support producing compound reciprocations of said surface finishing tool.

3. A surface finishing machine comprising a surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member attached to said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said member whereby to reciprocate said member relative to said support, a speed reducing mechanism mounted on said support and driven by said motor, an eccentric mounted on said support and rotated by said speed reducing mechanism, a crank rod extending from said eccentric mechanism, and a relatively fixed pivot to which the opposite end of said crank rod is pivotally attached whereby rotation of said eccentric mechanism by said motor causes reciprocation of said support, the simultaneous reciprocations of said member and said support producing compound reciprocations of said surface finishing tool.

4. A surface finishing machine comprising a surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member attached to said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said member whereby to reciprocate said member relative to said support, a gear train mounted on said support and driven by said motor, an eccentric mounted on said support and rotated by said gear train, a crank rod extending from said eccentric mechanism, and a relatively fixed pivot to which the opposite end of said crank rod is pivotally attached whereby rotation of said eccentric mechanism by said motor causes reciprocation of said support, the simultaneous reciprocations of said member and said support producing compound reciprocations of said surface finishing tool.

5. A surface finishing machine comprising a surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member attached to said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said member whereby to reciprocate said member relative to said support, an eccentric mechanism mounted on said support and driven by said motor, and a relatively fixed element against which said eccentric mechanism thrusts whereby rotation of said eccentric mechanism by said motor causes reciprocation of said support; in combination with feeding means as-

sociated with said surface finishing tool and operating simultaneously therewith to present successive increments of a surface to be finished to said tool; the simultaneous reciprocations of said member and said support producing compound reciprocations of said surface finishing tool and the movement of said feeding means causing simultaneous, relative movement of said surface and said tool whereby the successive compound reciprocations of said tool traverse successive increments of said surface.

6. A surface finishing machine comprising a surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member attached to said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said member whereby to reciprocate said member relative to said support, an eccentric mechanism mounted on said support and driven by said motor, a pivot element against which said eccentric mechanism thrusts whereby rotation of said eccentric mechanism by said motor causes reciprocation of said support, and means to move said pivot element in the direction of movement of said support and said member, the simultaneous reciprocations of said support and said member producing compound reciprocations of said surface finishing tool and the movement of said pivot element causing presentation of successive increments of work surface to said tool.

7. A surface finishing machine comprising a surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member attached to said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said member whereby to reciprocate said member relative to said support, an eccentric mechanism mounted on said support and driven by said motor, a pivot element against which said eccentric mechanism thrusts whereby rotation of said eccentric mechanism by said motor causes reciprocation of said support, and means to reciprocate said pivot element in the direction of movement of said support and said member, the simultaneous reciprocations of said support and said member producing compound reciprocations of said surface finishing tool and the reciprocations of said pivot element causing presentation of successive increments of work surface to said tool, first in one direction and then in the opposite direction.

8. A surface finishing machine comprising a surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member attached to said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said member whereby to reciprocate said member relative to said support, an eccentric mechanism mounted on said support and driven by said motor, a pivot element against which said eccentric mechanism thrusts whereby rotation of said eccentric mechanism by said motor causes reciprocation of said support, the simultaneous reciprocations of said member and said support producing compound reciprocations of said surface finishing tool, and means to present successive increments of work surface to said surface finishing tool.

9. A surface finishing machine comprising a surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member attached to said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said member whereby to reciprocate said member relative to said support, an eccentric mechanism mounted on said support and driven by said motor, a pivot element against which said eccentric mechanism thrusts whereby rotation of said eccentric mechanism by said motor causes reciprocation of said support, the simultaneous reciprocations of said member and said support producing compound reciprocations of said surface finishing tool, and means to present successive increments of work surface to said surface finishing tool, said means to present successive increments of work surface to said tool comprising means to provide simultaneous longitudinal and rotative relative movement of the work surface and said tool.

10. A surface finishing machine for finishing the surface of a cylindrical bore comprising a rotatable surface finishing tool, operating means for said surface finishing tool including a support guided for rectilinear movement, a member supporting said tool, said member being slidably mounted on said support and guided for rectilinear movement with respect thereto in substantially the direction of movement thereof, a motor mounted on said support, eccentric means connecting said motor and said support, an eccentric mechanism mounted on said support and driven by said motor, an element against which said eccentric mechanism thrusts whereby the rotation of said eccentric mechanism by said motor causes reciprocation of said support simultaneously with the reciprocation of said member, means to move said surface finishing tool in the direction of its axis of rotation, and means simultaneously to rotate said surface finishing tool, the simultaneous axial and rotative movements of said tool causing said tool to operate on successive increments of the surface of the bore.

DAVID A. WALLACE.