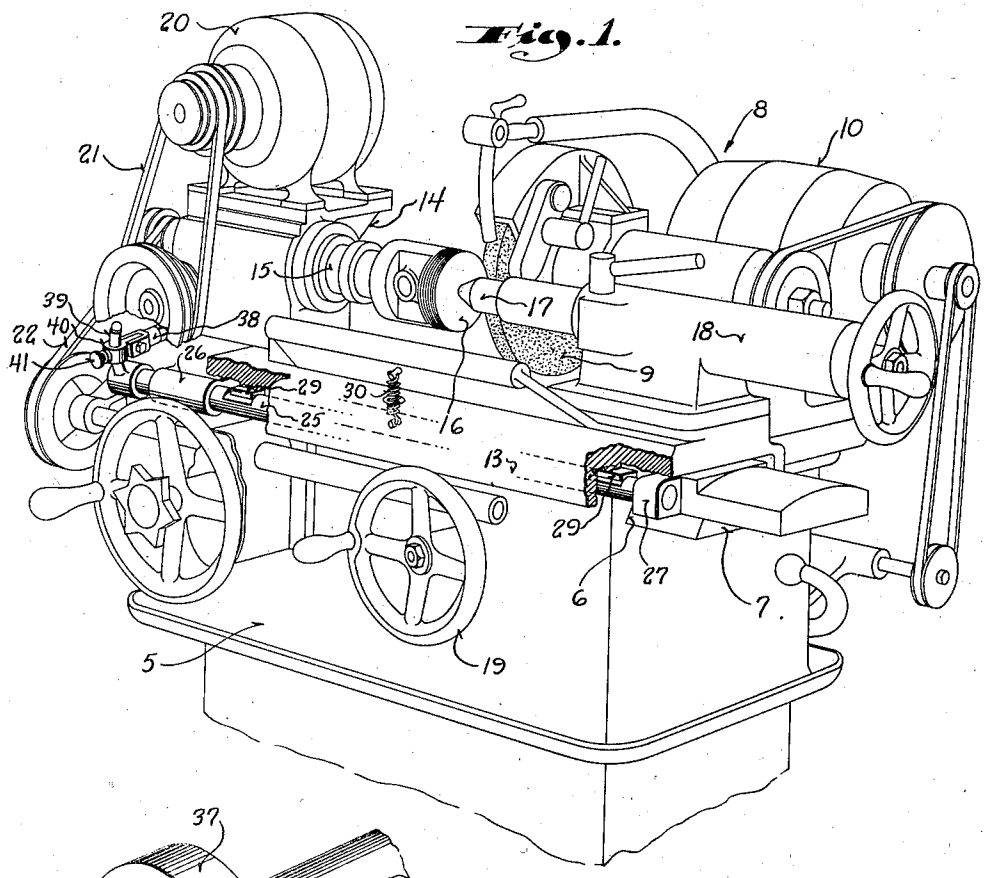
May 10, 1938. E. H. ODOM 2,116,686

GRINDING MACHINE

Filed April 15, 1936 2 Sheets-Sheet 1

Fig. 1.



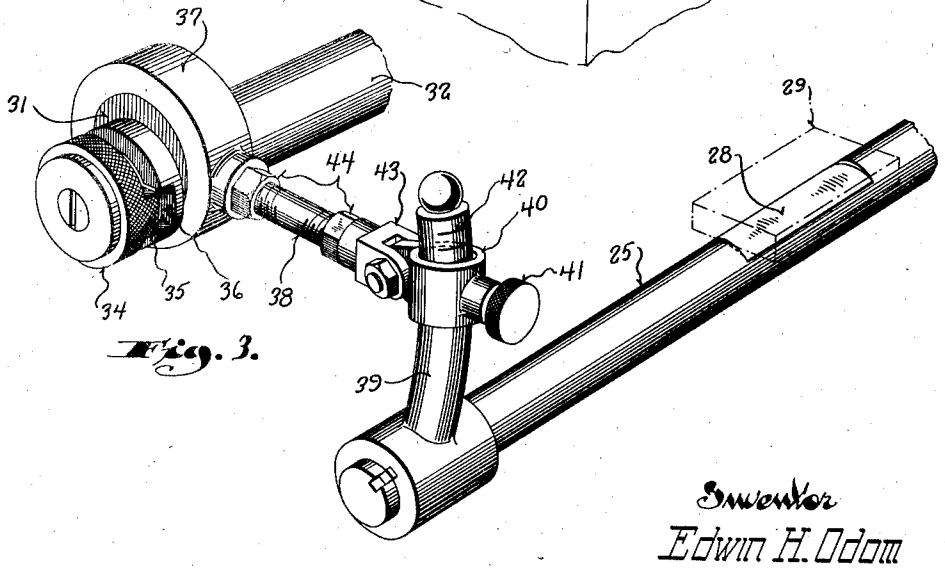


Fig. 3.

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Filed April 15, 1936 2 Sheets-Sheet 2

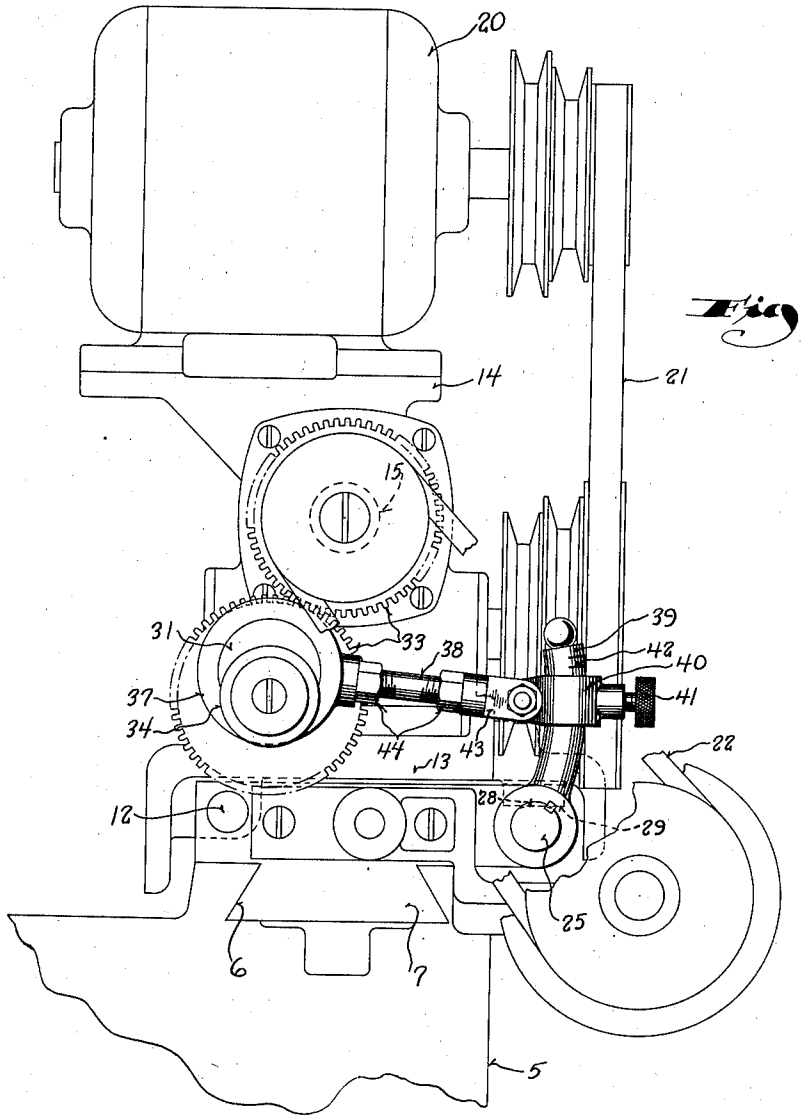


Fig. 2.

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UNITED STATES PATENT OFFICE

2,116,686

GRINDING MACHINE

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Application April 15, 1936, Serial No. 74,499

9 Claims. (Cl. 51—97)

This invention relates to improvements in grinders and refers particularly to machines for grinding pistons.

As is well known, pistons are now generally cam ground, that is, they are not exactly round but slightly elliptical. Grinding the pistons in this manner requires motion together and apart between the grinding wheel and the piston. In the grinders heretofore in use, this necessary relative motion was generally produced by a cam follower or roller riding on a cam corresponding to the shape of the piston to be ground and revolving in unison therewith.

Obviously, this past arrangement did not permit ready adjustment of the degree of cam grinding for the only way in which adjustment could be effected was by removal and substitution of the pattern cam. The objections to this procedure are apparent. Not only did it require considerable time to make an adjustment, but it generally necessitated removal of the work so that no adjustment could be made with the piston in place.

With these and other objections to past and existing piston grinders in mind, this invention contemplates as one of its objects the provision of a greatly improved means of producing the necessary relative motion between the work and the grinding wheel which is so arranged that adjustment thereof can be instantly effected without requiring removal of the work or in anywise dismantling the machine.

Another object of this invention is to provide a grinder of the character described wherein the desired relative motion between the work and the grinder toward and from each other is produced by oscillating a rock shaft through an adjustable range of angular motion.

Another object of this invention is to provide a piston grinder having means for causing the same to grind either a true circle or an ellipse which means may be instantly rendered operative or inoperative merely by actuating a clutch.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a perspective view of a piston grinder embodying this invention, parts thereof being broken away and in section to illustrate structural details;

Figure 2 is an end view of the upper portion of the grinder; and

Figure 3 is a perspective view of part of the mechanism for producing relative motion between the work and the grinder wheel.

Referring now particularly to the accompanying drawings in which like numerals indicate like parts throughout the several views, the numeral 5 designates the bed or base of the machine, the top of which has guideways 6 in which a carriage 7 is slidably mounted. Mounted on the back of the bed or base 5 is a grinder unit, indicated generally by the numeral 8, and comprising a grinder wheel 9 and a motor 10 to drive the same.

Being mounted directly on the base or bed 5, the grinder unit is stationary, whereas the carriage 7 is arranged to slide across the bed or base on a line parallel to the axis of the grinder.

Hingedly mounted to the rear of the carriage, as at 12, is a table 13. The axis of the hinge 12 is parallel to the grinder wheel axis so that the table 13 in swinging on its hinged connection with the carriage moves upwardly and rearwardly toward the grinding wheel, and being carried by the carriage, the table 13 moves longitudinally with the carriage to carry the work past the wheel, as will be hereinafter more fully described.

Mounted on one end of the table 13 is a fixed head 14 in which a work arbor 15 is journalled. The work arbor projects from the head 14 to engage the skirt of a piston 16, the head of which is held by a center 17 adjustably mounted in a tail stock 18 fixed to the opposite end of the table 13. The piston 16 is thus held in position to be engaged with the grinding wheel and to be moved back and forth across the face of the wheel. The proper disposition of the wheel with respect to the piston is effected by suitable adjusting mechanism (not shown) operated by a hand wheel 19.

The arbor 15 is driven by a motor 20 conveniently mounted on the head 14 and drivingly connected with the arbor 15 through a belt drive 21 and suitable gears (not shown) contained within the head 14. To feed the piston back and forth suitable feed mechanism (not

shown) is provided which is driven from the rear of the tool arbor through a belt drive 22.

The mechanism thus far described is substantially conventional construction. The manner in which the table 13 and consequently the piston is rocked back and forth with respect to the grinding wheel to effect the desired cam grinding to which this invention is particularly directed will now be described.

The forward portion of the table 13 rests on a rock shaft 25. The rock shaft has its opposite ends journalled in bearings 26 and 27 mounted on the carriage, and at points near these bearings, the shaft has arcuate cam surfaces 28 with which hardened blocks or wear plates 29 fixed to the underside of the table 13 engage. The cam surfaces 28 are eccentric to the axis of the rock shaft so that as the shaft is oscillated, the forward end of the table 13 is raised and lowered thereby moving the piston toward and from the periphery of the grinding wheel. Obviously, by determining the angular range of motion of the rock shaft, the extent of the back and forth motion of the piston with respect to the grinding wheel is determined.

Although the weight of the table 13 and the mechanism which it carries is ordinarily sufficient to maintain proper engagement between the blocks 29 and the cam surfaces 28, it is desirable to provide a spring 30 to positively maintain this engagement. The spring 30 has one end fastened to the table and its opposite end fastened to the carriage and may be located at any desired convenient point. In the present instance, the spring is shown as passing through an opening in the table to have its lower end attached to the carriage.

Oscillatory motion is imparted to the rock shaft 25 from an eccentric 31 mounted on a shaft 32 carried by the head 14. The shaft 32 is driven from the arbor 15 by meshing gears 33, but the eccentric 31 is free on the shaft except when a clutch collar 34 slidably splined to the shaft 32 is in its operative position engaging its teeth 35 in recesses 36 formed in a hub on the eccentric. In Figure 3, the clutch collar 34 is shown disengaged so that rotation of the shaft 32 will not impart movement to the eccentric. When the clutch collar is disengaged, the rock shaft 25 is left in its normal central position to permit true circular grinding.

Encircling the eccentric is an eccentric strap 37 which is connected through a link or rod 38 with a lever 39 fixed to the rock shaft 25. The connection between the rod or link 38 and the lever 39 which is curved to be concentric to the axis of the shaft 32 is adjustable so as to enable adjustment of the angular distance the rock shaft 25 is oscillated.

This adjustable connection is conveniently formed by a collar 40 slidably mounted on the lever 39 and pivotally connected to the adjacent end of the link or rod 38. A set screw 41 threaded in the collar and bearing against the lever 39 holds the collar in any adjusted position and to facilitate adjustment, the lever 39 is provided with graduations 42 representing differences of a thousandth of an inch between the major and minor diameters of the cam ground piston.

As will be readily apparent when the collar 40 is secured to the outermost end of the lever 39, the least degree of rocking motion will be imparted to the rock shaft 25, and as the collar is adjusted toward the shaft, the range of motion will be correspondingly increased.

The length of the link or rod 38 is adjustable by having its opposite ends provided with right and left threads and threaded into the eccentric strap and the yoke 43 by which the link or rod is connected to the collar 40. Lock nuts 44 serve to hold the rod in its adjusted position.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art to which this invention appertains, that this invention provides a substantial improvement over past piston grinding machines, and especially over past means for effecting cam grinding. It is to be particularly noted that the extent of the cam grinding is readily adjustable between fixed limits without in anywise dismantling the machine and without necessitating removal of the work. The adjustment therefor can be effective immediately and with great accuracy.

What I claim as my invention is:

1. In a grinder for grinding cylindrical work slightly elliptical including a grinding wheel and a work carrier for revolving the work on an axis parallel to that of the grinding wheel, means for producing movement together and apart between the work and the grinding wheel in synchronism with the revolution of the work so as to produce the desired elliptical shape comprising supporting members for the grinding wheel and the work carrier, means hingedly connecting said supporting members on an axis so related to that of the grinding wheel and the work carrier that hinge motion between the supporting members effects radial movement together and apart between the work and the grinding wheel, an oscillatory cam interposed between the supporting members at a distance from their hinged connection and coacting with the hinged connection to support one of said supporting members from the other whereby oscillation of said cam produces the required hinge motion between the supporting members to effect the desired movement together and apart between the work and the grinding wheel, continuously rotating power means, and an eccentric driving connection between the power means and the cam for oscillating the cam in synchronism with the revolution of the work.

2. In a grinder for grinding cylindrical work slightly elliptical including a grinding wheel and a work carrier for revolving the work on an axis parallel to that of the grinding wheel, means for producing movement together and apart between the work and the grinding wheel in synchronism with the revolution of the work so as to produce the desired elliptical shape comprising supporting members for the grinding wheel and the work carrier, means hingedly connecting said supporting members on an axis so related to that of the grinding wheel and the work carrier that hinge motion between the supporting members effects radial movement together and apart between the work and the grinding wheel, an oscillatory cam interposed between the supporting members at a distance from their hinged connection whereby oscillation of said cam produces the required hinge motion between the supporting members to effect the desired movement together and apart between the work and the grinding wheel, continuously rotating power means, an eccentric driving connection between the power means and the cam for oscillating the cam in synchronism with the revolution of the work, and means for adjusting said eccentric driving connection to adjust the range of angular motion imparted to the oscillatory cam.

3. In a grinder for grinding cylindrical work slightly elliptical including a grinding wheel and a work carrier for revolving the work on an axis parallel to that of the grinding wheel, means for producing movement together and apart between the work and the grinding wheel in synchronism with the revolution of the work so as to produce the desired elliptical shape comprising supporting members for the grinding wheel and the work carrier, means hingedly connecting said supporting members on an axis so related to that of the grinding wheel and the work carrier that hinge motion between the supporting members effects movement together and apart between the work and the grinding wheel, an oscillatory cam interposed between the supporting members at a distance from their hinged connection whereby oscillation of said cam produces the required hinge motion between the supporting members to effect the desired movement together and apart between the work and the grinding wheel, an eccentric revolving in unison with the work, and a connection between the eccentric and the oscillatory cam for oscillating the cam in synchronism with the revolution of the work.

4. In a grinder for grinding cylindrical work slightly elliptical including a grinding wheel and a work carrier for revolving the work on an axis parallel to that of the grinding wheel, means for producing movement together and apart between the work and the grinding wheel in synchronism with the revolution of the work so as to produce the desired elliptical shape comprising supporting members for the grinding wheel and the work carrier, means hingedly connecting said supporting members on an axis so related to that of the grinding wheel and the work carrier that hinge motion between the supporting members effects movement together and apart between the work and the grinding wheel, an oscillatory cam interposed between the supporting members at a distance from their hinged connection whereby oscillation of said cam produces the required hinge motion between the supporting members to effect the desired movement together and apart between the work and the grinding wheel, an eccentric revolving in unison with the work, a connecting rod reciprocated by the eccentric, and an adjustable connection between the connecting rod and the oscillatory cam, said connection being adjustable radially with respect to the oscillation axis of the cam to enable adjustment of the angular range of motion imparted to the oscillatory cam.

5. In a piston grinding machine, a grinding wheel revolving on a fixed axis, means for holding and revolving a piston on an axis parallel to that of the grinding wheel, and means for moving the piston holding and revolving means toward and from the grinding wheel in synchronism with the revolution of the piston to effect cam grinding, comprising a support on which the means for holding and revolving the piston is mounted, said support being movable relatively to the grinding wheel to enable the piston to be moved toward and from the grinding wheel, an oscillatory cam cooperating with the support and operable upon oscillation thereof to effect such motion of the support, and means for oscillating the cam in synchronism with the revolution of the piston, said last named means comprising an eccentric revolving in unison with the piston, a connecting rod reciprocable by the eccentric, and an eccentric connection between the rod and the cam.

6. In a piston grinding machine, a grinding wheel revolving on a fixed axis, means for holding and revolving a piston on an axis parallel to that of the grinding wheel, and means for moving the piston holding and revolving means toward and from the grinding wheel in synchronism with the revolution of the piston to effect cam grinding, comprising a support on which the means for holding and revolving the piston is mounted, said support being movable relatively to the grinding wheel to enable the piston to be moved toward and from the grinding wheel, an oscillatory cam cooperating with the support and operable upon oscillation thereof to effect such motion of the support, and means for oscillating the cam in synchronism with the revolution of the piston, said last named means comprising an eccentric revolving in unison with the piston, a connecting rod reciprocable by the eccentric, and an eccentric connection between the rod and the cam, said last named connection being adjustable radially with respect to the oscillation axis of the cam to permit adjustment of the angular range of motion of the cam.

7. In a piston grinding machine, a grinding wheel revolving on a fixed axis, means for holding and revolving a piston on an axis parallel to that of the grinding wheel, and means for moving the piston holding and revolving means toward and from the grinding wheel in synchronism with the revolution of the piston to effect cam grinding, comprising a support on which the means for holding and revolving the piston is mounted, said support being movable relatively to the grinding wheel to enable the piston to be moved toward and from the grinding wheel, an oscillatory cam cooperating with the support and operable upon oscillation thereof to effect such motion of the support, and means for oscillating the cam in synchronism with the revolution of the piston, said last named means including a power driven eccentric revolving in unison with the piston, and clutch means for rendering said eccentric inoperative so as to enable truly circular grinding.

8. In a grinder, a grinding wheel, a revoluble work carrier adapted to hold work in operative relationship to the wheel and to revolve the work, means for mounting the grinding wheel and work carrier for radial movement together and apart to effect cam grinding of the work, comprising hingedly connected supporting members, one of which carries the grinding wheel and the other the work carrier, an oscillatory cam interposed between said supporting members at a distance from their hinged connection in such a manner that oscillation of the cam causes hinge motion between the supporting members which hinge motion effects radial movement together and apart between the work and the grinding wheel, and means to oscillate the cam comprising an eccentric revolving in unison with the work, and a connection between the eccentric and the cam.

9. In a grinder, a grinding wheel, a revoluble work carrier adapted to hold work in operative relationship to the wheel and to revolve the work, means for mounting the grinding wheel and work carrier for radial movement together and apart to effect cam grinding of the work, comprising hingedly connected supporting members, one of which carries the grinding wheel and the other the work carrier, an oscillatory cam interposed

between said supporting members at a distance from their hinged connection in such a manner that oscillation of the cam causes hinge motion between the supporting members which hinge motion effects radial movement together and apart between the work and the grinding wheel, means for oscillating the cam comprising an eccentric revolving in unison with the work, and an adjustable connection between the eccentric and the cam including an arm fixed with respect to the cam and disposed substantially radially to the axis of the cam, a connecting rod driven by the eccentric, and means for attaching the connecting rod to said arm at different locations along the length of the arm.

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