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1,656,820

W. F. FRASER

GRINDING MACHINE

Original Filed May 4, 1923

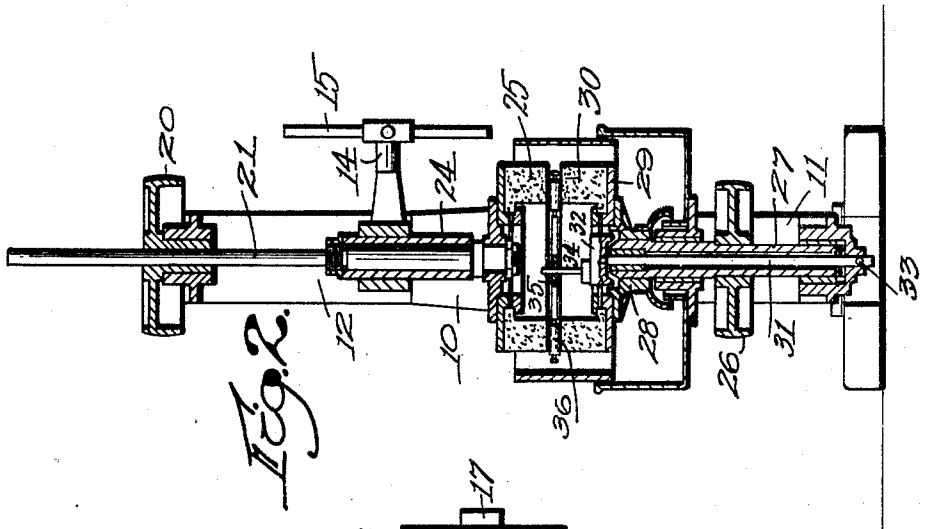


Fig. 2.

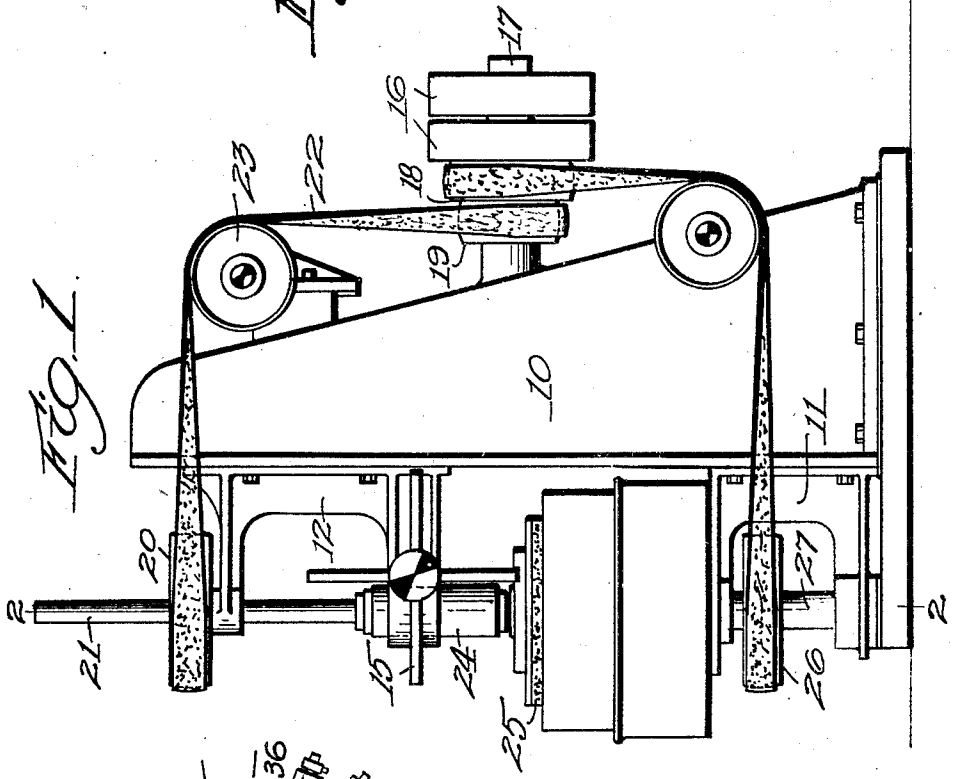


Fig. 1.

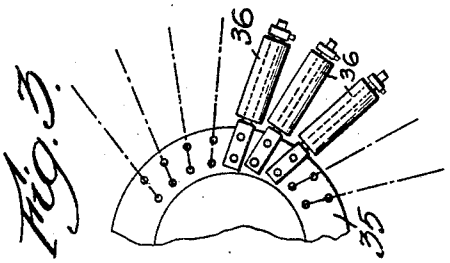


Fig. 3.

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UNITED STATES PATENT OFFICE.

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GRINDING MACHINE.

Application filed May 4, 1923, Serial No. 636,706. Renewed November 15, 1926.

This invention relates to a machine for grinding cylindrical work such as piston pins, rollers and the like between a pair of plane-surfaced grinding wheels.

The principal object of the invention is to improve the grinding machines of this general character which have been designed heretofore and simplify the same, and more specifically to provide an arrangement in which the work itself will not be positively driven but both grinding wheels will be; to provide for rotating the grinding wheels in opposite directions so as to increase the effective speed of the machine without unduly speeding up the wheels themselves; to provide for supporting the work in such a manner that the grinding action will be caused both by the motion of the work out and in along the grinding surfaces and by a relative sliding motion; to provide an even grinding action on the work; and to provide an even wear on the grinding surfaces.

Further objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which

Fig. 1 is a side view of a grinding machine constructed in accordance with this invention;

Fig. 2 is a central sectional view through the grinding elements on the line 2—2 of Fig. 1; and

Fig. 3 is a plan of the work holding cage.

The invention is shown as applied to the type of grinding machine comprising a frame 10 having a horizontal support 11 near the bottom thereof and provided with a vertical head 12 adjustable on vertical ways near the top. This head is adapted to be raised and lowered by hand and fixed by bolts. It supports a shaft 14 thereon having radiating hand grips 15 by which it may be turned and provided with the necessary gearing, not shown, for raising and lowering the quill 24 which carries the spindle 21 with it.

The machine is driven from a tight and loose pulley 16 on a shaft 17, the tight pulley driving therefrom two pulleys 18 and 19 respectively. The pulley 19 drives a pulley 20 on the vertical spindle 21 by means of a belt 22 passing over an idler 23 which turns the belt through a quarter turn. This spindle 21 is carried by the slide 12 through a sleeve 24, below which is mounted the upper grinding wheel or stone 25. At the bottom of the spindle is hung a spider 40 positively driven by the spindle but hung loosely so as to be free to be moved up and down slightly independent of the spindle. The grinding wheel is fixed to the spider and rests on the work freely.

The pulley 18 in a similar way drives a pulley 26 on a vertical hollow shaft 27 carried in stationary bearings on the table 11 at the bottom of the machine. To the upper end of this shaft is fixed a head 28 to which is secured a plate 29 having on it the lower grinding wheel 30. These two grinding wheels 25 and 30 are both of annular construction having flat annular grinding surfaces located exactly opposite each other. They are arranged concentrically and rotate on concentric axes, in opposite directions and at different speeds.

Mounted in fixed position on the base of the machine and centrally in alignment with the shafts 21 and 27 is a fixed rod 31 extending up through the hollow shaft 27. At the top this rod has a head 32. The rod is fixed in position by a pin 33 at the bottom so that it cannot rotate. On the head 32 is mounted a vertical eccentric pin 34. In setting up the device the pin 34 can be located as desired on the head 32 to secure the desired amount of eccentricity by changing the position of the pin 34. It is positively fixed at a distance from the axes of the shafts 21 and 27. On this eccentric pin 34 is freely rotatable a suitable cage or holder 35 which carries a number of pins, rollers or the like 36 to be ground. These pins or rollers constitute the work and they are arranged at a small angle to the radial lines.

In the operation of the device the cage is placed in position on the eccentric pin between the two stones or grinding wheels and left free to rotate about that pin as a center but obviously it will rotate eccentrically with respect to the two concentric grinding wheels. The grinding wheels may be used with powdered grinding or polishing mate-

rials if desired and the full pressure due to the weight of the wheel 25 is exerted on the work.

The rotation of the shaft 17 results in rotating the two shafts 21 and 27 in opposite directions preferably at different speeds. Although the two stones thereof are rotated concentrically, their acting surfaces are always at any point moving in opposite directions. The result of this rotation is first to rotate the parts being operated upon and second, because of one grinding wheel moving at a faster speed than the other, it causes a slow rotating movement of the entire holder or cage, said cage being entirely free to rotate about the eccentrically mounted stationary pin 34.

The grinding action is due to the fact that the pins or rollers do not have their axial line corresponding with a radial line of the cage but are set at an angle thereto so that in rotating there is a corresponding sliding action between the rolls and the grinding elements, due to their angular position in the cage. This is the principal grinding action obtained. However, to obtain extremely accurate work, it is necessary that other actions be obtained in order to insure not only even distribution of grinding action on all portions of the work but likewise an even amount of wear on all portions of the grinding elements. The pins or rolls at different periods of the grinding operation should contact with the grinding element at different distances from the center. This is accomplished by the rotation of the eccentrically mounted work carrier which in one revolution will bring the rolls that were furthest from the center of the grinding element to the position of closest approach to the center, thus distributing the work of grinding that particular roll over the entire grinding surface of the grinding elements and at the same time any given portion of the grinding element operates on different portions of the work. The result is an entire freedom from lines or local irregularities which would be produced if these secondary movements were not present. This would be the case if the work holder was mounted concentrically with the grinding elements. The result is that the grinding operation is accomplished very rapidly and thoroughly and also uniformly.

Also, it will be apparent that the accuracy of the diameters of the finished work and their parallelism is not dependent initially upon the accuracy of the machine or extreme accuracy in the approach of the grinding elements one to the other. The upper grinding element rests upon the work solely by its own weight and that of the spindle and if desired additional weight may be placed thereon, but the movement is not what would ordinarily be called a positive one, being actuated solely by gravity. This stone is not fed toward the work at all but the grinding operation is continued until the work is reduced to the proper diameter.

In operation, therefore, with conditions of action remaining the same it will be found that a given reduction in diameter will be obtained in a given time and therefore the time element is relied upon rather than any movement of one grinding element toward the other. As an example, if the operator finds that two minutes of operation on a given work reduces the diameter four ten thousandths of an inch and upon measuring or inspecting the work he finds that it is one ten thousandths bigger than desired, he would place the work in the machine and let it operate for one half minute and the work would be of correct size. It can thus be seen that this machine can be used to commercially produce work much closer in its finished dimensions than is obtainable in what is commonly known as a grinding machine and yet at a much more rapid rate than has been obtainable from what has been commonly known as a lapping machine. Upon the completion of the work or the desire to inspect the progress of the same, turning the hand wheel 15 raises the upper grinding wheel and allows inspection or removal of the work and its cage or holder and replacing by another.

Although I have illustrated and described only a single form of the invention, I am aware of the fact that modifications can be made therein by any person skilled in the art without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to all the details of construction herein shown and described but what I do claim is:—

1. In a machine of the character described, the combination of a hollow rotating shaft, supported in fixed bearings and projecting upwardly, an annular grinding wheel fixedly carried on top of said shaft and rotating concentrically therewith, a rod located in fixed position and extending up through said shaft and having a head on the top above the upper end of said shaft, a pin eccentrically mounted in stationary position on said head with respect to said shaft, a circular cage for supporting cylindrical articles to be ground in a position with their axes in a plane, said pin being adapted to center the cage in position for said cage to project over the top of said stone, and a grinding stone or wheel adapted to rest and operate on said work.

2. In a machine of the character described, the combination of a stationary frame, a table extending therefrom, a rotating hollow shaft supported in fixed bearings on said table and projecting up therefrom, an an-

nular grinding wheel fixedly carried on top of said shaft and rotating concentrically therewith, a rod located in fixed position on said table and extending up through said hollow shaft and having a head on the top above the upper end of said shaft, a stationary centering pin eccentrically mounted on said head with respect to said shaft and adapted to carry rotatably a circular cage for supporting articles to be ground, in position for said cage to project over the top of said stone, a vertically movable shaft above the first named shaft and concentric therewith, a grinding stone or wheel carried at the bottom of the upper shaft and adapted to operate on said work, and means for rotating said shafts in opposite directions and at different speeds.

3. In a machine of the character described, the combination with a rotary grinding element and a second rotary grinding element supported concentrically above the first, of means for rotating them independently upon substantially the same axis, means for holding the work on the surface of the lower grinding element comprising a circular cage in which the work is located, and means for centering said cage on an axis eccentric with respect to the axis of rotation of said grinding elements, said cage being free to be rotated on said axis by the rotation of the grinding element, said cage being arranged to hold each piece of work at an angle to the radii of the cage, the upper grinding element being supported to be rotated positively but to rest with its weight on the work, whereby the extent of the grinding action will depend on the time during which it is subjected to it and will be independent of any feeding action.

4. In a machine of the character described, the combination of a rotating shaft, an annular grinding wheel fixedly carried by said shaft and rotating concentrically therewith, a rod located in fixed position and having a head on the top above the upper end of said shaft, a pin eccentrically mounted in stationary position on said head with respect to said shaft, a cage for supporting cylindrical articles to be ground in a position with their axes in a plane, said pin being adapted to center the cage in position for said cage to project over the top of said stone, and a grinding stone or wheel adapted to rest and operate on the cylindrical articles.

5. In a machine of the character described, the combination with a rotary grinding stone having an annular top plane operating surface for supporting the work thereon, of a similar grinding stone over it and the other side up resting at all times freely by gravity alone on the work, a rotary spindle over said stone, and means for loosely connecting the upper stone with said spindle to positively rotate it therewith without taking any of its weight off the work, whereby the extent of the operation on the work will be measured by the duration of time alone.

6. In a machine of the character described, the combination of a hollow shaft, supported in fixed bearings and projecting upwardly, an annular grinding wheel fixedly carried on top of said shaft and arranged concentrically therewith, a rod located in fixed position and extending up through said shaft and having a head on the top above the upper end of said shaft, a pin eccentrically mounted on said head with respect to said shaft, a circular cage for supporting articles to be ground, said pin being adapted to center the cage in position for said cage to project over the top of said stone, a shaft above the first named shaft and concentric therewith, and a grinding stone or wheel carried at the bottom of the upper shaft and adapted to rest and operate on said work.

7. In a grinding machine, the combination with two annular horizontal grinding wheels having opposed concentric flat grinding surfaces, means for rotating each of said wheels independently of the other on a vertical axis, and a cage eccentrically mounted with respect to said axis having means for holding the work between said stones, said cage being free to turn on its eccentric axis, the upper stone resting solely by gravity on the work which is supported on the lower grinding stone.

In testimony whereof I have hereunto affixed my signature.

WARREN F. FRASER.