July 20, 1948. J. A. ELMES ET AL 2,445,391

GRINDING MACHINE

Filed Sept. 4, 1946 3 Sheets-Sheet 1

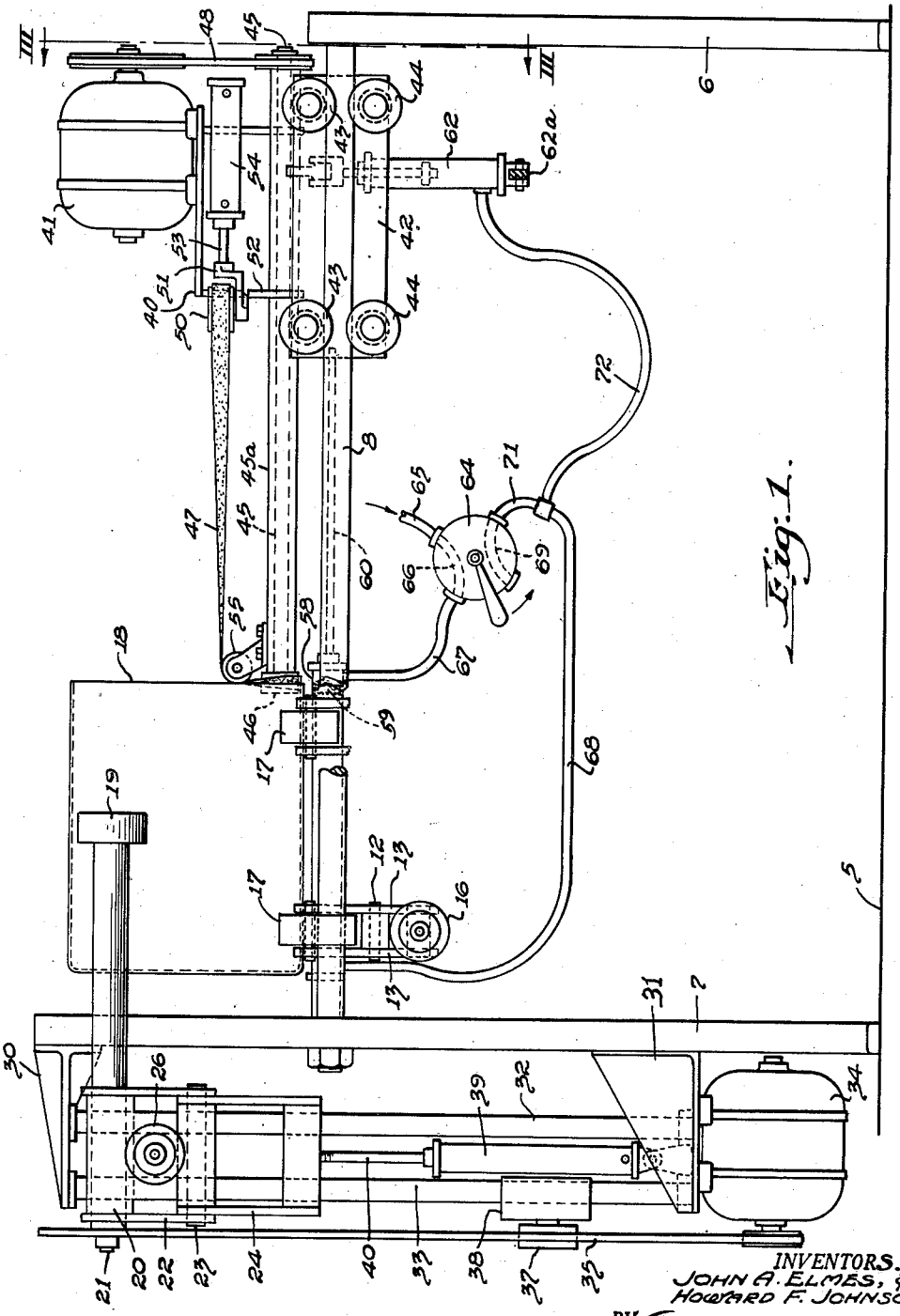


Fig. 1.

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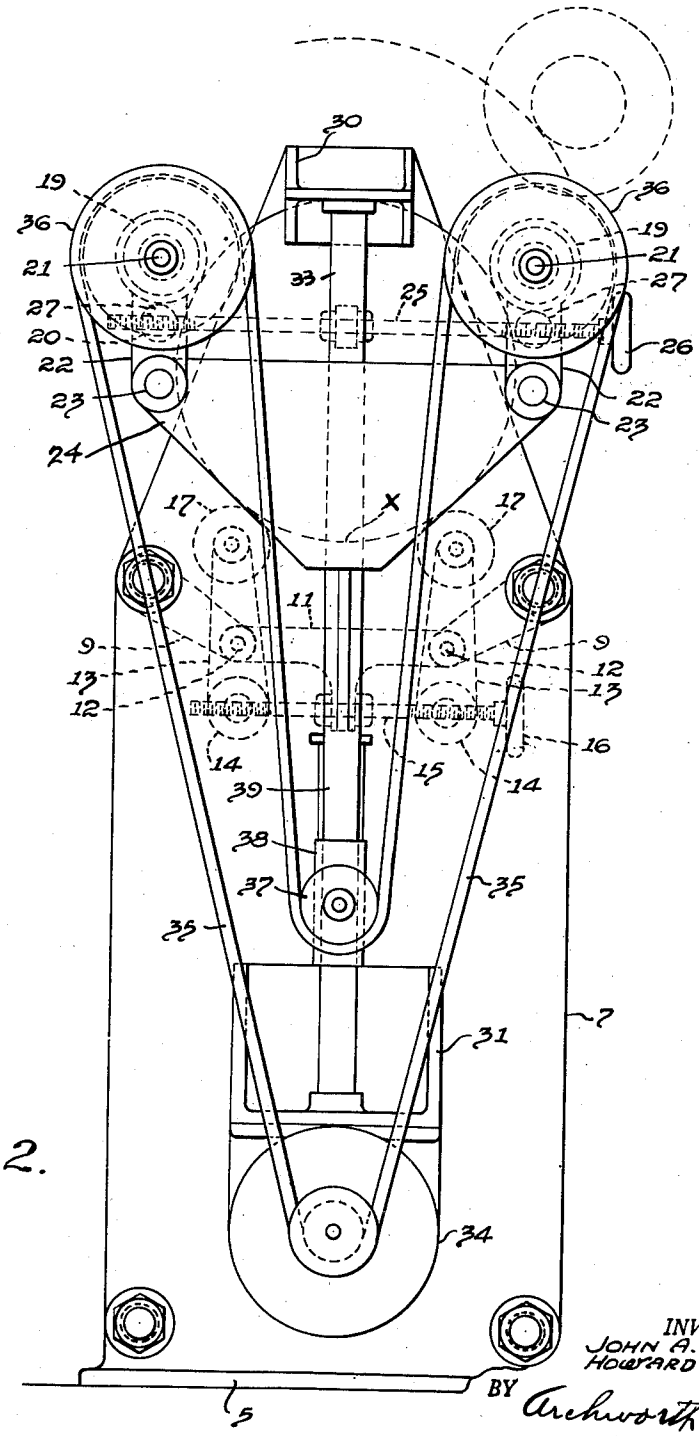


Fig. 2.

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Filed Sept. 4, 1946 3 Sheets-Sheet 3

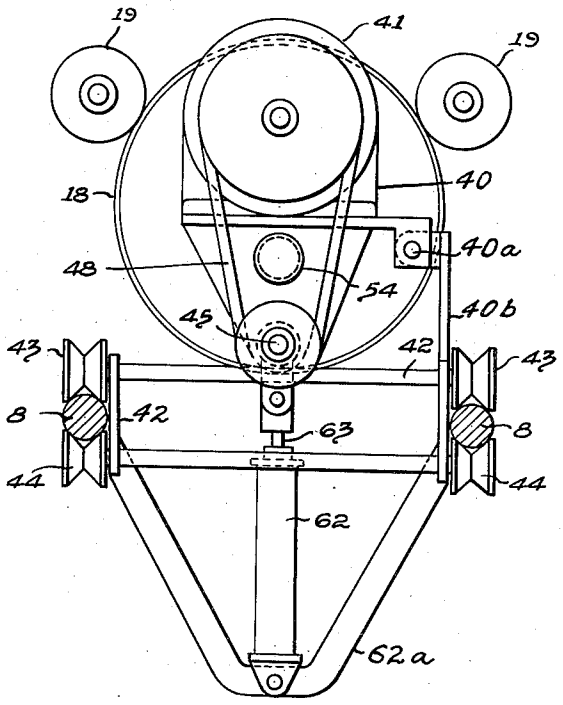


Fig. 3.

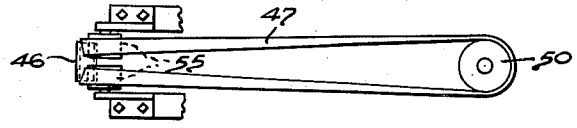


Fig. 4.

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UNITED STATES PATENT OFFICE

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GRINDING MACHINE

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Application September 4, 1946, Serial No. 694,800

8 Claims. (Cl. 51—142)

1

Our invention relates to surfacing apparatus that is particularly suitable for use in grinding and polishing the inner wall surfaces of hollow articles such as metal cups, cooking utensils and the like.

It has heretofore been common practice to grind the inner wall surfaces of hollow articles by abrasive wheels, but difficulty has been experienced not only in grinding the surfaces uniformly, but there is often uneven grinding by reason of chunks of abrasive material breaking off the grinding wheel and getting caught between the wheel and the work, thus causing deep score marks. Discoloration of the metal may occur when the grinding wheel becomes too greatly heated by the friction.

Our invention has for its object the provision of a grinding apparatus that can be operated in a manner to effect better uniformity or evenness of finish, and by which grinding operations can be conducted with greater rapidity than by the use of abrasive wheels, and without overheating.

Briefly stated, our invention involves the use of an abrasive belt, with supporting and driving apparatus therefor, so arranged that belts of considerable length can be used even in vessels of smaller diameter, thus not only avoiding overheating of the belt by the grinding friction, but also making it unnecessary to change belts as frequently as would be the case with the use of short belts. Again, any grains which become loosened from the belt will be small and will not adversely affect the grinding operation to a noticeable degree.

In the accompanying drawings, Figure 1 is a side view of the machine with certain of the parts broken away or in section; Fig. 2 is a view of the left-hand end of Fig. 1; Fig. 3 is a view taken on the line III—III of Fig. 1, and Fig. 4 is a plan view of a portion of the apparatus of Fig. 1.

The apparatus comprises a base 5 to which are secured upright frame members 6 and 7 at the front and rear ends thereof respectively. A pair of bars 8 that serve as track rails as well as frame members are secured at their ends to the uprights 6—7. Two pairs of bracket arms 9 are pivotally supported on each of the rails, the lower ends of these arms being connected to cross heads 11 by pivot pins 12 upon which roller-carrying arms 13 are pivotally mounted intermediate their ends. The lower ends of the arms 13 have nuts 14 mounted therein for swiveling movement and having threaded engagement with an adjusting screw 15 that has a hand wheel 16.

2

The screw 15 is rotatably supported on a depending leg of the cross head 11 and has its end portions reversely threaded with respect to one another, so that upon turning of the screw, the arms 13 will be rocked toward and from one another about their pivots 12.

The arms 13 at their upper ends carry rollers 17 that serve to support a vessel 18 that is to be ground on its inner peripheral surface. It will be seen that turning of the screw 15 will provide for adjustment of the work-supporting rolls 17 to utensils of various diameters.

The work piece 18 is held in its seat on the rollers 17 and rotated, by a pair of driving rolls 19 that are mounted on shafts 21 which are journaled in bearings 20 that are carried by arms 22 that are pivotally mounted at 23 on a cross head 24. An adjusting screw 25 having a hand wheel 26 and being reversely threaded near its respective ends has threaded engagement with swivel nuts 27 that are carried by the arms 22, so that the screw can be turned to move the upper ends of the arms 22 and the shafts 21 toward and away from one another, to thereby vary the spacing between the friction rolls 19 and thus adapt them to work pieces of various diameters.

Brackets 30 and 31 are secured to the upper and lower ends respectively of the upright 7. Guide posts 32 and 33 are secured at their ends to these brackets. An electric motor 34 is carried by the bracket 31 and through a belt 35, and pulleys 36 which drives the shafts 21. The belt is maintained under tension by a weighted pulley 37 whose weighted element 38 is loosely and slidably supported on the post 33.

The bracket or cross head 24 is slidably supported on the posts 32—33 and is moved vertically thereon by a piston contained within a cylinder 39 that has a piston rod 40 that is connected to the cross head 24, so that when fluid pressure is admitted to the lower end of the cylinder 39, the cross head 24, together with the roll shafts 21, will be raised and the rollers 19 thereby lifted out of contact with the work piece 18. If desired, fluid pressure can be admitted to the upper end of the cylinder 39 to produce a downward pull on the cross head 24 and to thereby hold the rollers 19 more tightly in engagement with the utensil 18. However, the weight of the cross head and the shafts, together with their associated elements, may be sufficient to provide adequate frictional driving force of the rollers 19 and the peripheral surface of the vessel. The cross head 24 will, of course, be raised to lift the rollers 19 clear of the utensil 18 when the

utensil is to be removed and another one substituted therefor. The driving tension of the belt 35 will be maintained at various vertical positions of the cross head 24 by the weight of the pulley 37.

At the rear end of the machine, a motor 41 is mounted on a rocking frame 40 that is pivotally supported at 40a on a bracket 40b which is secured to a carriage 42 that travels on the track rails 8 and is provided with upper and lower wheels 43 and 44 respectively. A shaft 45 is journaled in a tube 45a that is mounted in the frame 40, and at its front end the shaft carries a driving pulley 46, for an abrasive belt 47. The shaft 45 is driven from the motor 41 by a belt 48.

A guide pulley 50 for the sanding belt 47 is carried by a bearing arm 51 that has a depending leg 52 which extends into a slot in the carriage 42 so as to maintain the axis of the pulley vertical. The bracket 51 is connected to a piston rod 53 extending from a cylinder 54 that is mounted on the frame 40. Fluid pressure is admitted to the ends of the cylinder 54 to control the tension of the abrasive belt 47.

The abrasive belt 47 passes around a pair of guide pulleys 55 whose axis extends at right angles to both the axis of the pulley 50 and the axis of the pulley 46. This necessitates a twist of the belt to planes which are perpendicular to each other. This arrangement permits the use of a relatively long abrasive belt for grinding the interiors of work pieces of even small diameters, such as small metal cups.

With the parts in the position shown in Fig. 1, ready for a grinding operation on the work piece 18, the motor 34 will be set in motion to rotate the rolls 19 and the work piece, whereupon pressure will be admitted to the rear end of a cylinder 58 that has a piston 59 and a piston rod 60, the rod 60 being connected to the carriage 42. As the carriage, together with the motor 41 and the belt-tensioning cylinder 54 moves forward, the driving pulley 46 and the abrasive belt will be moved longitudinally of the utensil 18 to grind or polish the same during its rotation by the rolls 19. When the pulley 46 has reached the bottom wall of the work piece 18, fluid pressure will be admitted to the lower end of a cylinder 62 that is supported by a bracket 62a, from the carriage 42, and has a piston and a piston rod 63 which will swing the rocking frame 40 a slight distance about its pivot 40a. This vertical movement need be only a small fraction of an inch, so that the abrasive belt will not have engagement with the work piece 18 during withdrawal movement of the carriage.

Control of the movements of the carriage is effected by a suitable valve device such as that shown at 64. As here shown, fluid pressure is supplied from a suitable source through a pressure line 65. The valve has a port 66 which is brought into registry with the line 65 for effecting movement of the carriage toward the work piece, this port in that position of the valve serving to direct the fluid flow through a pipe 67 that leads into the rear end of the cylinder 58. At this time, exhaust from the front end of the cylinder will be through a pipe 68 and a port 69 in the valve. At this time, there will be no pressure in the cylinder 62.

To effect movement of the grinding belt out of the work piece, the valve 64 will be turned to a position at which the port 69 will bring the pressure line 65 into communication with a pipe 71, the pipe 68 and a flexible pipe 72, the pipe 72 being flexible because the cylinder 62 is carried by the carriage 42 and the cylinder 58 is maintained stationary on the frame work 5—6—7. At this time, pressure will, therefore, be supplied into the lower end of the cylinder 62 to tilt the frame 40 slightly and lift the belt 47 clear of the work piece, and the pressure thereby admitted through the pipe 68 will move the piston 59 and the carriage backwardly so as to withdraw the sanding belt from the work piece.

The apparatus is readily adaptable to utensils of various diameters because of the adjustability of the supporting rollers 17. These rollers will be adjusted by the screws 15 to such point that any utensil supported thereon will have its bottom-most point (at X) in Fig. 2 in a definitely-spaced relation to the axis of the shaft 45. Therefore, the sanding belt can be held against the work with the same degree of pressure for all diameters of work pieces, or adjustments of the supporting rollers can be made to vary the grinding pressure.

We claim as our invention:

1. Apparatus for grinding interior surfaces of open-end hollow articles, comprising a sanding belt, a supporting member movable axially into an article, a pulley mounted on the forward end of the supporting member, on an axis that is parallel to the axis of the article, a sanding belt extending around the pulley and looped throughout a greater distance than the length of the article, means on the supporting member for guiding the belt through a path that extends around the pulley and thence parallel to the axis thereof and to a point exteriorly of the article when the supporting member is at its foremost position in the article, and means for driving the belt.

2. Apparatus for grinding interior surfaces of open-end hollow articles, comprising an abrasive belt, a pulley for the belt, mounted on the inner end of a shaft that extends parallel to the axis of an article to be ground, a second pulley for the belt, mounted on an axis that is transverse to the shaft and located adjacent to the outer end of the shaft, a guide member between the two pulleys in position to direct the belt in two relatively right angular paths, as it travels around the pulleys, a movable support for the pulleys and said member, means for shifting the support axially of the article to move the first-named pulley along the inner surface thereof, and means for driving one of the pulleys during said movement.

3. Apparatus for grinding the interior surfaces of open-end hollow articles, comprising a support for an article, a carriage movable axially of the article, a shaft on the carriage on an axis parallel to the axis of the article, a pulley on the forward end of the shaft, a second pulley on the carriage adjacent to the rear end thereof and having its axis at right angles to said shaft and spaced above the shaft, a sanding belt extending around the pulleys, a guide device for the belt, located on the carriage, in a plane intermediate the shaft and the second-named pulley, and means for driving the shaft.

4. Apparatus for grinding the interior surfaces of open-end hollow articles, comprising a support for an article, a carriage movable axially of the article, a shaft on the carriage on an axis parallel to the axis of the article, a pulley on the forward end of the shaft, a second pulley on the carriage adjacent to the rear end thereof and having its axis at right angles to said shaft and spaced above the shaft, a sanding belt extend-

ing around the pulleys, a guide device for the belt, located on the carriage, in a plane intermediate the shaft and the second-named pulley, means for driving the shaft, means for rotating the article on its support, means for reciprocating the carriage axially of the article, to move the first-named pulley into and out of the article, and means for lifting the shaft to move the sanding belt out of engagement with the article, preliminary to backward movement of the carriage.

5. Apparatus for grinding the interior surfaces of open-end hollow articles, comprising a support for an article, a carriage movable axially of the article, a shaft on the carriage on an axis parallel to the axis of the article, a pulley on the forward end of the shaft, a second pulley on the carriage adjacent to the rear end thereof and having its axis at right angles to said shaft and spaced above the shaft, a sanding belt extending around the pulleys, a guide device for the belt, located on the carriage, in a plane intermediate the shaft and the second-named pulley, means for driving the shaft, means for rotating the article on its support, means for reciprocating the carriage axially of the article, to move the first-named pulley into and out of the article, and means for lifting the shaft to move the sanding belt out of engagement with the article, preliminary to backward movement of the carriage, the support for the article comprising rollers which are tangentially adjustable on the lower peripheral surface of the article.

6. Apparatus for grinding the interior surfaces of open-end hollow articles, comprising a support for an article, a carriage movable axially of the article, a shaft on the carriage on an axis parallel to the axis of the article, a pulley on the forward end of the shaft, a second pulley on the carriage adjacent to the rear end thereof and having its axis at right angles to said shaft and spaced above the shaft, a sanding belt extending around the pulleys, a guide device for the belt, located on the carriage, in a plane intermediate the shaft and the second-named pulley, means for driving the shaft, means for rotating the article on its support, means for reciprocating the carriage axially of the article, to move the first-named pulley into and out of the article, and means for lifting the shaft to move the sanding belt out of engagement with the article, preliminary to backward movement of the carriage, the support for the article comprising rollers which are tangentially adjustable on lower peripheral surfaces of the article, and the article-rotating means comprising driven rollers that frictionally engage upper peripheral areas of the article.

7. Apparatus for grinding interior surfaces of open-end hollow articles, comprising end frame members, a pair of rails connecting the end members, a pair of arms pivotally connected to the rails adjacent to the forward ends thereof, rollers carried by the arms in position to serve as a supporting seat, for an article, means for adjusting said arms about their pivots, frictional driving rolls above the said rollers, in position to engage upper peripheral areas of an article, a carriage on the rails, adjacent to their rear ends and movable thereon toward and from an article that is positioned between the rollers and the rolls, a shaft projecting forwardly from the carriage and carrying a pulley on its forward end for entry into the article, a second pulley on the carriage, a sanding belt extending around the pulley, and means on the carriage for driving one of the pulleys.

8. Apparatus for grinding interior surfaces of open-end hollow articles, comprising end frame members, a pair of rails connecting the end members, a pair of arms pivotally connected to the rails adjacent to the forward ends thereof, rollers carried by the arms in position to serve as a supporting seat, for an article, means for adjusting said arms about their pivots, frictional driving rolls above the said rollers, in position to engage upper peripheral areas of an article, a carriage on the rails, adjacent to their rear ends and movable thereon toward and from an article that is positioned between the rollers and the rolls, a rocking frame on the carriage, a shaft projecting forwardly from the frame and carrying a pulley on its forward end for entry into the article, a second pulley on the frame, a sanding belt extending around the pulleys, means on the frame for driving one of the pulleys, means for reciprocating the carriage on the rails, and means for lifting the frame preliminary to backward movement thereof, to move the belt out of engagement with the article preliminary to backward movement of the carriage.

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