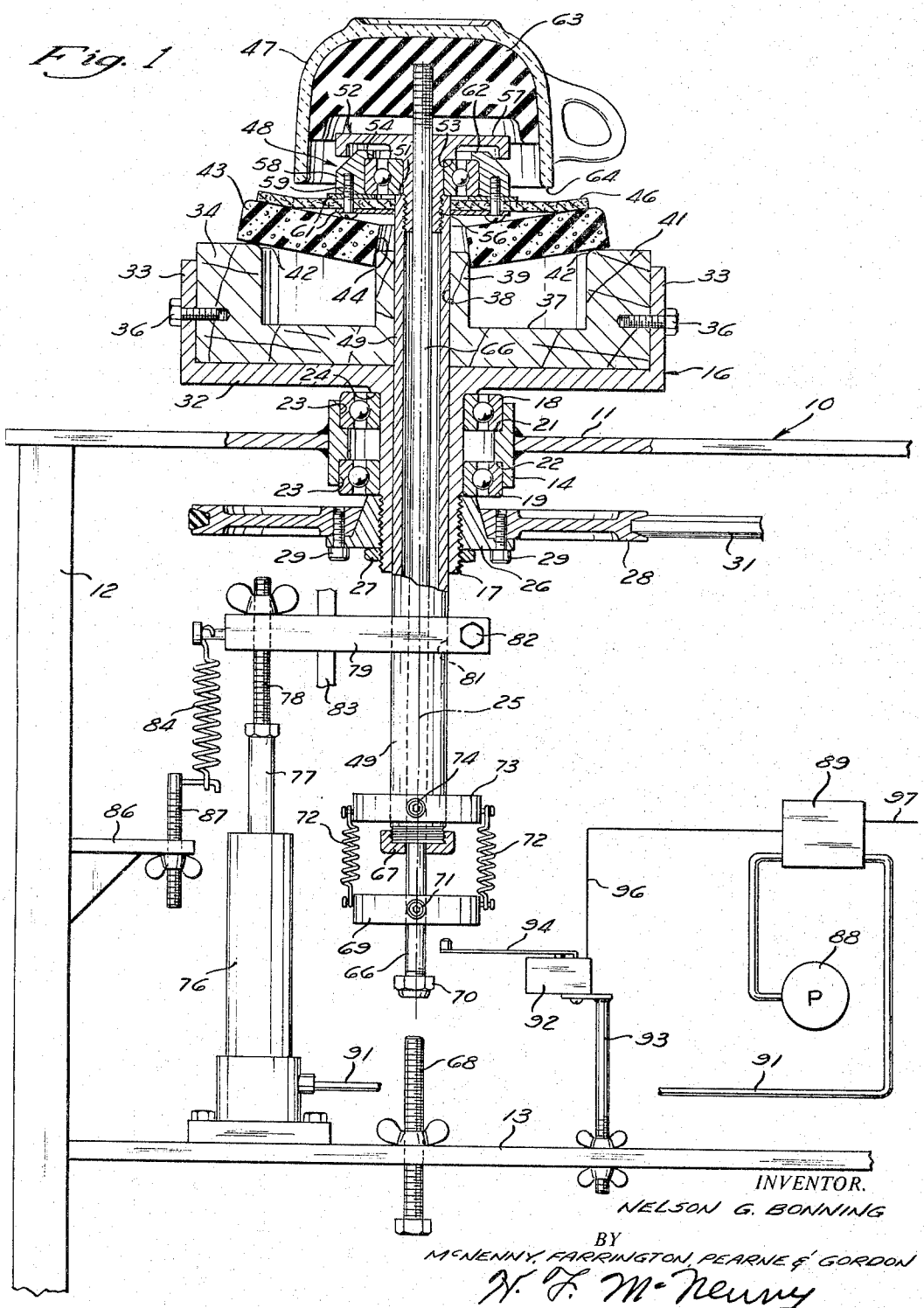
Dec. 5, 1967 N. G. BONNING 3,355,840

CUP TOPPING MACHINE

Filed Jan. 13, 1965 2 Sheets-Sheet 1

Fig. 1



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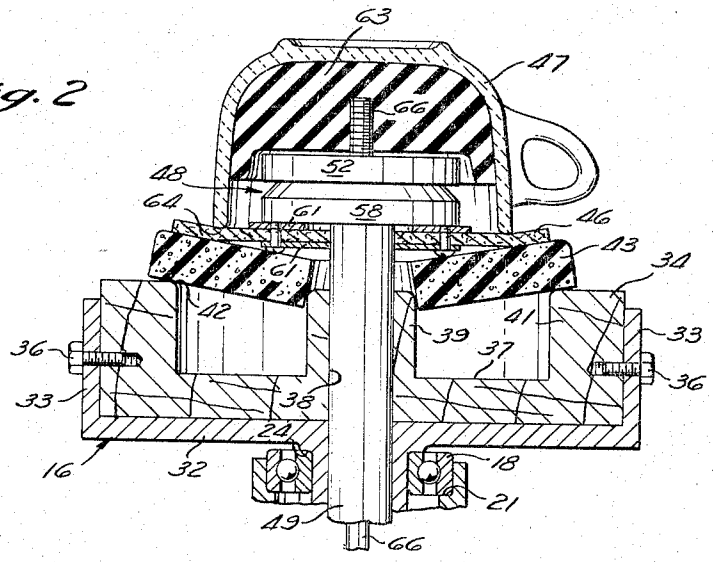
Filed Jan. 13, 1965 2 Sheets-Sheet 2

Fig. 2



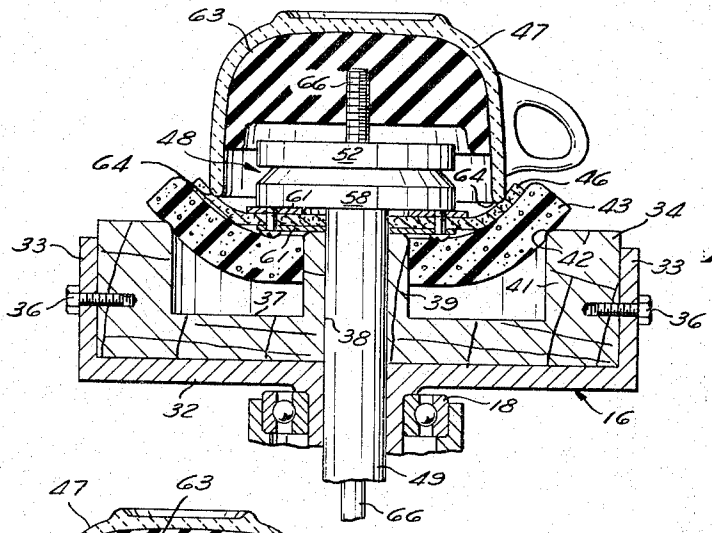


Fig. 3

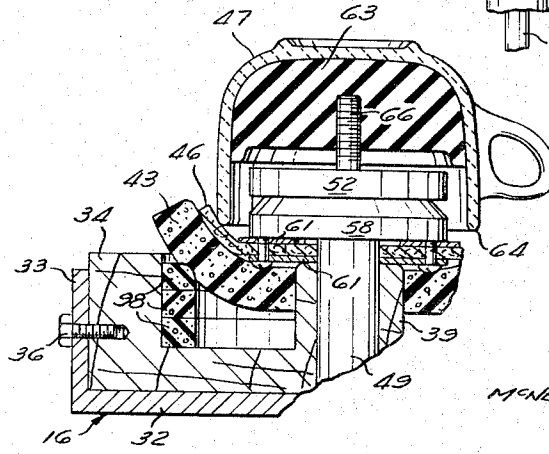


Fig. 4

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CUP TOPPING MACHINE

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ABSTRACT OF THE DISCLOSURE

A topping machine providing a chum to support a piece of hollowware with its rim in engagement with a rotating abrasive disc. Power means operate to progressively deform the abrasive disc while it contacts the rim from a first position in which the disc is substantially normal to the rim to a second position in which the disc extends generally axially around the rim. The progressive deformation causes the disc to progressively round off the rim. Springs urge the chum away from the disc with a force which is substantially constant while the topping operation progresses.

This invention relates generally to machines for the production of hollowware and more particularly to a topping machine for smoothly finishing the rim of a piece of hollowware, such as a ceramic cup or the like.

Many types of hollowware formed of ceramic material and other types of materials are formed by molding. When the piece of hollowware is removed from the mold a sharp and rough surface is usually present along the exterior surface of the rim of the piece. This rough and irregular surface results from the joint between the separable mold members used to form the piece.

Various methods have been utilized in the past to eliminate this rough and sharp edge so that the rim surface smoothly blends into the adjacent surfaces. One commonly used method of rounding and smoothing the rim has been to place the piece of hollowware upright on a rotating rubber chum and touching the rim with a carboloy tool ground to shape the rim. With such a method considerable operator skill is required if the operation is to be carried out rapidly since the tool must be precisely positioned to form the smooth surface without damaging the rim. Experience has established that skilled operators can top approximately eighty-five dozen cups per hour by this prior method of operation.

With a topping machine incorporating this invention essentially no skill is required and uniformly high quality articles are produced. In practice it has been found that unskilled labor using a machine according to this invention can top in excess of ninety-five dozen cups per hour and that the quality of the surface of the rim produced is uniformly as high or better than the surfaces produced by other high production topping procedures and apparatus.

It is an important object of this invention to provide a novel and improved topping machine for hollowware which eliminates the necessity of operator skill while producing uniformly good quality rim surfaces at high production rates.

It is another object of this invention to provide a novel and improved topping machine for ceramic hollowware which includes a member having an abrasive surface and power means to produce relative movement between the rim of the piece of hollowware and the abrasive surface while automatically shaping the surface to smoothly blend and round the rim of the hollowware.

It is still another object of this invention to provide a novel and improved topping machine for hollowware including a chum for positioning the hollowware in the machine and power operated means automatically operable to abrasively smooth and round the rim of the piece of hollowware.

It is still another object of this invention to provide a novel and improved topping machine for hollowware including a deformable element formed with an abrasive surface which is rotated by power against the rim of the piece of hollowware while being progressively deformed to smoothly round such rim.

It is still another object of this invention to provide a novel and improved topping machine for hollowware including a deformable abrasive member engageable with the rim of a piece of hollowware positioned in the machine and automatic power operated means to produce relative movement between the piece of hollowware and abrasive surface while deforming the abrasive surface up around the edge of the hollowware to form a smoothly blended rim.

It is still another object of this invention to provide a novel and improved topping machine for ceramic hollowware including a chum to support a piece of hollowware, a disc of abrasive material containing substantial openings to prevent clogging, a chuck to support the disc for rotation, a deformable rubber-like backing member and means to deform the backing member and abrasive disc from a first position in which the surface of the disc is generally along a plane to a second position in which the surface of the disc is deformed to a generally cup shape so that the rim of the piece of hollowware will be rounded and smooth.

Further objects and advantages will appear from the following description and drawings wherein:

FIGURE 1 is a side elevation partially in longitudinal section illustrating the structural detail of one preferred embodiment of cup topping machine incorporating this invention with the elements in the position they assume immediately after the cup is positioned in the machine and prior to the cup topping operation;

FIGURE 2 is a fragmentary view illustrating the position of the elements at the moment the topping operation commences;

FIGURE 3 is a fragmentary view illustrating the position of the elements at the completion of the topping operation; and,

FIGURE 4 is a fragmentary view illustrating the cup topping machine modified for smaller diameter cups.

A topping machine incorporating this invention is illustrated in the drawings in the operations of topping a ceramic cup. It should be understood, however, that this invention is applicable to the topping of other forms of ceramic ware and also the topping of articles formed of materials other than ceramic materials, such as for example certain types of plastic and the like. The cup illustrated is sufficiently dry to have a reasonable degree of strength but is topped before either firing or glazing. The cup is formed by molding or any other suitable process and requires topping to produce a smooth, rounded rim surface.

The illustrated topping machine is mounted on a base **10** provided with a table-like upper surface **11**. Legs **12** rest on the floor and support both the upper surface **11** and a lower surface **13**. A bearing sleeve **14** projects through the upper surface **11** and is welded in place to provide a rigid support.

A rotating chuck **16** is provided with a tubular extension **17** extending through the bearing sleeve **14** and supported for rotation therein on spaced anti-friction bearings **18** and **19**. The bearing sleeve **14** is provided with opposed shoulders **21** and **22** which axially support the bearings **18** and **19** respectively. Radial support is provided by a close fit between the respective bearings and cylindrical surfaces **23** terminating at the shoulders **21** and **22**. The inner race of the bearing **18** is seated

against a shoulder 24 formed on the rotating chuck 16 adjacent to the end of the tubular extension 17. A ring 26 is threaded onto the lower end of the extension 17 and engages the inner race of the bearing 19 urging it upwardly toward the shoulder 24. This causes the respective outer races to tightly engage the shoulders 21 and 22 and axially locates the rotating chuck 16 on the base 10 for rotation about a central axis 25. A jam nut 27 is tightened against the ring 26 when the ring is properly adjusted to prevent relative rotation between a ring 26 and tubular extension 17. A pulley 28 is mounted on the ring 26 by bolts 29 and is connected by a V-belt 31 to an electric motor which rotates the chuck 16. The electric motor has not been shown in order to simplify the illustration, however, it is supported on the base 10 in a conventional manner.

The rotating chuck 16 is formed with a circular base 32 and an upstanding cylindrical flange 33. A wooden chuck 34 is sized to fit within the flange 33 against the base 32 and is locked in position by bolts 36 extending through threaded apertures in the flange 33. The wooden chuck is formed with an annular recess 37 and a central aperture 38. The recess and aperture cooperate to form a guide stem 39 and an upwardly extending cylindrical flange 41 having a rounded corner 42 which forms an annular support surface. A foam rubber disc 43 having a diameter sufficiently large so that it extends radially beyond the corner 42 and a central opening 44 proportioned to closely fit the guide stem 39 acts as a backup for a disc of abrasive 46. The engagement between the guide stem 39 and the central opening 44 radially locates the rubber disc 43 and cooperates with the engagement between the corner 42 and rubber disc to cause the disc to rotate with the chuck 16.

The abrasive disc 46 is formed of a material which is normally flat but is deformable to a generally cup shape and which is capable of abrasively smoothing the rim of a ceramic cup 47 in the leather hard state. The abrasive disc is formed of a material that will not become clogged in use and will not wear rapidly. One material which has been found in practice to operate very satisfactorily is a material formed of a mass of loose deformable fibers supporting spaced abrasive particles. One such material is more completely described in the United States Patent to Hoover et al., No. 2,958,593, dated Nov. 1, 1960.

The abrasive material 46 is mounted on an axially movable actuating assembly 48. This assembly includes a hollow shaft 49 extending up through the tubular extension 17 to an end surface 51. A lock nut 52 is formed with a threaded stem 56 which is threaded into the upper end of the shaft 49. A shoulder 53 on the lock nut 52 engages the inner race of a bearing 54 and firmly presses it against the end surface 51 of the shaft to axially support the bearing 54 on the shaft. A cylindrical surface on the stem 56 closely fits the inner surface of the inner race to radially locate the bearing. A radial skirt 57 on the lock nut 52 covers the bearing 54 and limits entry of dirt or other foreign matter.

A mounting ring 58 for the abrasive disc 46 closely fits the outer race of the bearing 54 and is threaded to receive mounting bolts 59 which perform the dual function of securing the mounting ring 58 to the outer race and clamping the abrasive disc 46 between two plates 61 which engage opposite sides of the abrasive disc 46. The upper plate 61 cooperates with a shoulder 62 to lock the mounting ring 58 to the outer race of the bearing 54.

With this structure the central portion of the abrasive disc 46 is radially and axially located with respect to the chuck assembly 48 but is free to rotate relative thereto under the influence of its engagement with the rubber disc 43. When the elements are in the position illustrated in FIGURE 1 the abrasive disc 46 extends generally radially with respect to the central axis. However, when the actuating assembly 48 is pulled downwardly with respect to the wooden chuck 34 to the position illustrated in FIGURE 3 both the rubber disc 43 and the abrasive disc 46 are deformed to a generally cup shape symmetrical about the central axis 25 of the machine so that portions of the abrasive disc 46 extend more nearly parallel to the central axis of the machine.

During the topping operation the cup 47 is supported on a rubber chum 63 proportioned to closely fit the inner surface of the cup 47 leaving its rim 64 exposed. The rubber chum 63 is threaded onto the upper end of a rod 66 which extends down through the lock nut 52 and is laterally supported thereby. The lower end of the rod 66 extends through a bearing nut 67 threaded onto the lower end of the shaft 49 and is provided with a stop nut 76 engageable with an adjustable stop 68 mounted on the lower surface 13.

A ring 69 is axially fixed on the rod 66 by a set screw 71 and is connected by tension spring 72 to a spring support ring 73 secured to the shaft 49 by a set screw 74. The springs 72 produce a resilient force urging the rod 66 and in turn the chum 63 upwardly with respect to the shaft 49 and the value of this force is adjustable by adjusting the position of the spring support ring 73 along the shaft 49. Therefore, the chum 63 is normally in an upper position, as illustrated in FIGURE 1, but is movable against the action of the springs 72 downwardly to the positions of either FIGURE 2 or FIGURE 3. The maximum downmovement occurs when the stop nut 67 engages the adjustable stop 68 and is the position illustrated in FIGURE 3.

In order to provide axial movement of the shaft 49 an air cylinder 76 is mounted on the lower surface 13 and is provided with a piston 77 engageable with an adjustable stop 78 threaded into an actuating arm 79. The arm 79 is formed with a bore 81 through which the shaft 49 extends. A clamping bolt 82 is tightened to lock the arm on the shaft 49. Opposed vertically extending stops 83 (only one of which is illustrated) are mounted on the base 10 and positioned to engage the arm 79 and prevent rotation of the shaft 49 with the rotating chuck 16. A spring 84 connected between the end of the arm 79 and a support 86 urges the shaft 49 in a downward direction with a force which is determined by the adjustment of a screw 87 threaded into the support 86.

When air pressure is supplied to the cylinder 76 the piston 77 extends raising the shaft 49 to the position illustrated in FIGURES 1 and 2. However, when the cylinder 76 is exhausted to atmosphere the spring 74 produces sufficient force to lower the shaft 49 until the lower plate 61 engages the upper end of the guide stem 39, as illustrated in FIGURE 3.

The cylinder 76 is connected to a source of air pressure, such as a pump 88 through a normally open solenoid valve 89 and a pressure line 91. When the valve 89 is not energized the pump 88 is connected through the line 91 and the cylinder 76 is pressurized causing the piston 71 to extend to the position illustrated in FIGURE 1. When the valve 89 is energized it connects the pressure line 91 to atmosphere, exhausting the cylinder 76 and allowing the piston 77 to retract under the influence of the force of the spring 84. The rate of retraction of the piston 77 can be controlled by an orifice type flow restriction (not shown) mounted either in the connection between the pressure line 91 and the cylinder 76 or in the exhaust of the solenoid valve 89. Generally, however, the friction in the line 91 and adjustment of the spring 84 is used to obtain the desired rate of movement.

To operate the solenoid valve 89 a microswitch 92 is mounted by a screw 93 on the lower surface 13 and is provided with an operating arm 94 engageable by the ring 69. The arm 94 is formed of spring metal to permit overtravel. The microswitch 92 is of the normally open type connected through a pair of electrical conductors 96 to the solenoid valve 89 and in turn to a supply line 97 connected to a suitable source of electrical power.

In a topping operation a cup 47 is placed on the chum 63, as illustrated in FIGURE 1, the operator then presses downward on the cup causing the chum 63 and the rod 66 to move downwardly. This causes the ring 69 to close the switch 92 when the cup reaches the position of FIGURE 2. At this time the rim 64 of the cup 47 engages the abrasive disc 46 which is rotating with the rotating chuck 16. Since the microswitch closes at this instant the axially movable chuck assembly 48 is still in the upper position and the abrasive disc 46 engages the rim 64 of the cup substantially perpendicular to the central axis of the cup, as illustrated in FIGURE 2. However, the operation of the switch 92 causes the cylinder 76 to be exhausted and the actuation assembly 48 commences to move downward to the position of FIGURE 3. During such movement the operator maintains downward pressure on the cup 47 so the rim 64 of the cup remains in engagement with the abrasive disc 46 while the disc is being deformed to the cup shape, illustrated in FIGURE 3. All of this occurs while the disc 46 rotates relative to the rim of the cup 47 so the outer surface of the rim 64 is rounded and smoothed completing the topping operation.

Because the spring support rings 73 move downward during the downward movement of the shaft 49 the upward force produced by the spring 72 during this operation of topping actually reduces slightly. Therefore, the operator does not have to increase the pressure during the topping operation but merely maintains the pressure necessary to cause downward movement of the ring 69 and closing of the switch 92. In effect, the machine operator merely presses down on the cup with a uniform force during the entire topping operation, so operator skill is eliminated. As soon as the stop nut 67 engages the adjustable stop 68 the operator realizes that the topping operation is completed since the cup does not continue to move downward. The operator is therefore informed automatically that the topping operation is completed and he merely releases the downward pressure and the springs 72 raise the cup back to the position of FIGURE 1. This permits the switch 92 to close and the cylinder 76 is again pressurized to raise the axially movable chuck 48 back to the position of FIGURE 1 ready for the next cycle of operation. The operator then removes the cup which has been topped and places the subsequent cup on the chum and repeats the cycle of operation.

When it is desired to top cups having a smaller diameter a series of foam rubber rings 98 may be placed within the wooden chuck 34, as illustrated in FIGURE 4. These rings are provided with sufficient height to produce sufficient curving of both the rubber disc 43 and the abrasive disc 46 is produce proper topping even though the cup 47 of FIGURE 4 has a smaller diameter. The use of the removable rings 98 provides machine flexibility without requiring a series of different wooden chucks 34 for different size cups 47.

Because the topping operation is performed by an abrasive disc which is shaped automatically to produce a smooth curved rim on the cup and because the cup is accurately positioned without requiring operator skill the cost of topping is substantially lessened in two ways—first non-skilled labor can be used to operate the machine and second, higher operating rates are possible.

Although a preferred embodiment of this invention is illustrated, it is to be understood that various modifications and rearrangements of parts may be resorted to without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. A topping machine for hollowware having a circular rim lying along a plane comprising a chum adapted to support the hollowware with the rim thereof exposed, an abrasive disc having a surface generally normal to the axis of said rim, means connected to said disc operable to progressively deform said disc while said dissc engages said rim to a shape having portions of said surface extending more nearly aligned with the axis of said rim, and means connected to produce relative rotation between said disc and said rim, the progressive deformation of said disc causing said disc to progressively shape said rim.

2. A topping machine for hollowware having a circular rim comprising a chum to support the hollowware with the rim thereof exposed, an abrasive disc having a surface generally normal to the axis of said rim, power means connected to said disc operable to progressively deform said disc while said disc engages said rim to a shape symmetrical about said axis having portions of said surface extending more nearly aligned with the axis of said rim and means connected to produce relative rotation between said disc and said rim, the progressive deformation of said disc causing said disc to progressively shape said rim.

3. A topping machine for ceramic hollowware having a circular rim comprising a chum to support the hollowware with the rim thereof exposed, an abrasive disc element having a surface adapted to engage and smooth said rim, said disc being formed of a mass of loose deformable fibers supporting space dabrasive particles, power means connected to said element operable to progressively deform said element while it engages said rim between two positions so that the element progressively rounds the surface of said rim, and means connected to produce relative movement between said element and said rim.

4. A topping machine for hollowware having a rim-comprising a chum for supporting piece of hollowware, a deformable member having an abrasive surface, and power means operable while said surface engages to produce relative movement between said abrasive surface and the rim of a piece of hollowware on said chum while progressively deforming said member causing said surface to extend around said rim thereby progressively shaping said rim and producing a smooth rounded surface on said rim.

5. A topping machine for hollowware having a rim comprising a deformable member having an abrasive surface, a chum for supporting a piece of hollowware movable toward and away from said abrasive surface, and power means operable in response to chum movement to produce relative movement between said abrasive surface and the rim of a piece of hollowware on said chum while progressively deforming said member causing said surface to progressively extend around said rim thereby producing a smooth rounded surface on said rim.

6. A topping machine for hollowware having a rim comprising a deformable member having an abrasive surface, a chum for supporting a piece of hollowware movable toward and away from said abrasive surface, and power means operable in response to chum movement to produce relative movement between said abrasive surface and the rim of a piece of hollowware on said chum while progressively deforming said member causing said surface to progressively extend around said rim thereby producing a smooth rounded surface on said rim, said deformable member being formed of a loose mass of fibers supporting spaced abrasive particles.

7. A topping machine for hollowware having a rim symmetrical about an axis comprising a chum adapted to support a piece of hollowware with the rim thereof exposed, a disc having an abrasive surface, support means for said disc positioning said surface with a portion thereof symmetrical about the axis of a piece of hollowware on said chum, power means operable to produce relative rotation between said disc and said piece of hollowware about said axis while said portion of said surface is in contact with the rim of said piece of hollowware, and means operable to progressively deform said portion of said surface between first and second positions while said portion engages said rim of said piece of hollowware, said portion of said surface extending generally normal to said axis when in one of said positions and extending

more nearly parallel to said axis when in the other of said positions.

8. A topping machine for hollowware having a planar rim symmetrical about an axis comprising a disc having an abrasive surface, a chum adapted to support a piece of hollowware with the rim thereof exposed and movable toward and away from said surface, support means for said disc positioning said surface with a portion thereof symmetrical about a piece of hollowware on said chum, power means operable to produce relative rotation between said disc and said piece of hollowware about said axis while said portion of said surface is in contact with the rim of said piece of hollowware, and power means operable in response to chum movement to progressively deform said portion of said surface between first and second positions while said portion engages said rim of said piece of hollowware, said portion of said surface extending generally normal to said axis when in one of said positions and extending more nearly parallel to said axis when in the other of said positions.

9. A topping machine comprising a chuck journaled for rotation about an axis, a chum, a deformable backing member rotatable with said chuck and axially supported along a circular zone spaced from and co-axial with said axis, a deformable disc of abrasive supported for rotation with said backing member, and means carried by said chuck operable to axially move portions of said disc and backing member relative to said circular zone progressively deforming said disc while maintaining portions of said disc symmetrical with respect to said axis.

10. A topping machine comprising a chum movable along an axis, a rotatable chuck journaled for rotation about said axis, a foam rubber backing member rotatable with said chuck and axially supported along a circular zone spaced from and co-axial with said axis, a deformable disc of abrasive supported for rotation with said backing member, power means operable to axially move portions of said disc and backing member relative to said zone progressively deforming said disc while maintaining portions of said disc symmetrical with respect to said axis, and control means for said power means operated by axial movement of said chum.

11. A topping machine comprising a chum movable along an axis, a rotatable chuck journaled for rotation about said axis, a foam rubber backing member rotatable with said chuck and axially supported along a circular zone spaced from and co-axial with said axis, a deformable disc of abrasive supported for rotation with said backing member, power means operable to axially move portions of said disc and backing member relative to said zone progressively deforming said disc while maintaining portions of said disc symmetrical with respect to said axis, and control means for said power means operated by axial movement of said chum, said chuck having a central portion radially locating said backing member and limiting the extent of movement in one direction produced by said power means.

12. A topping machine comprising a chum movable along an axis, a chuck rotatable about said axis, an abrasive disc mounted for rotation with said chuck and axially supported along a support zone, a power driven assembly connected to a portion of said disc spaced from said support zone and axially movable to move said portion axially relative to said support zone, and resilient means operable to urge said chum in a direction away from said disc with a force which remains substantially constant during the operation of said power driven assembly.

13. A topping machine comprising a chum movable along an axis, a chuck rotatable about said axis, an abrasive disc mounted for rotation with said chuck and axially supported along a circular zone radially spaced from said axis, a power driven assembly connected to a central portion of said disc inwardly spaced from said zone and axially movable to move said central portion axially relative to said zone, resilient means connected between said assembly and chum operable to urge said chum in a direction away from said disc with a force which remains substantially constant during the operation of said power driven assembly, and control means operating said power driven assembly in response to axial movement of said chum.

14. A topping machine comprising a base, a chuck rotatable on said base about an axis, said chuck including an annular surface spaced from said axis co-axial therewith and a cylindrical surface inwardly spaced from said annular surface and co-axial therewith, a backing disc of elastomer material formed with a central opening guided along said cylindrical surface and a portion engaging said annular surface, a deformable disc of abrasive engaging the surface of said backing disc remote from said chuck, actuating means operatively connected to said abrasive disc inwardly from said annular surface operable to move axially the central portion of said discs relative to said annular surface, and a chum adapted to support a piece of hollowware co-axial with said axis and movable along said axis.

15. A topping machine comprising a base, a chuck rotatable on said base about an axis, said chuck including an annular surface spaced from said axis co-axial therewith and a cylindrical surface inwardly spaced from said annular surface and co-axial therewith, a backing disc of elastomer material formed with a central opening guided along said cylindrical surface and a portion engaging said annular surface, a deformable disc of abrasive engaging the surface of said backing disc remote from said chuck, actuating means operatively connected to said abrasive disc inwardly from said annular surface operable to move axially the central portion of said discs relative to said annular surface, a chum adapted to support a piece of hollowware co-axial with said axis and movable along said axis, control means for said actuating means operable in response to axial movement of said chum, springs operatively conected between said chum and actuating means urging said chum away from said discs, and a stop limiting movement of said chum in a direction toward said discs.

16. A topping machine comprising a base, a chuck rotatable on said base about an axis, said chuck including an annular surface spaced from said axis co-axial therewith and a cylindrical surface inwardly spaced from said annular surface, a backing disc of rubber-like material formed with an opening guided along said cylindrical surface and a portion engaging said annular surface, a deformable abrasive disc engaging the surface of said backing disc remote from said chuck, said abrasive disc being formed of an open mass of fibers supporting spaced hard particles, actuating means connected operatively to said abrasive disc inwardly from said annular surface operable to axially move the central portion of said discs relative to said annular surface, a chum adapted to support a piece of hollowware co-axial with said axis and movable along said axis, control means for said actuating means operable in response to axial movement of said chum, springs operatively connected between said chum and actuating means urging said chum away from said discs, and a stop limiting movement of said chum in a direction toward said discs.

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