Aug. 7, 1945. J. W. ALSDORF 2,381,418

ART OF GRINDING ANNULAR SURFACES

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Fig. 1

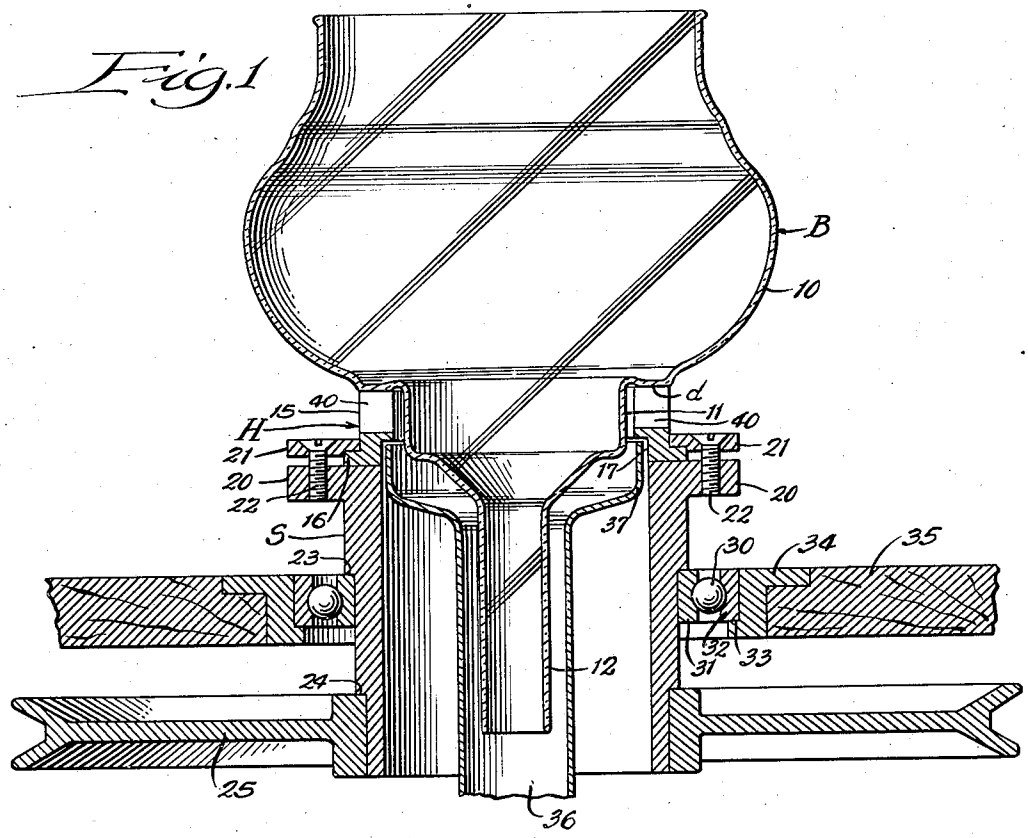
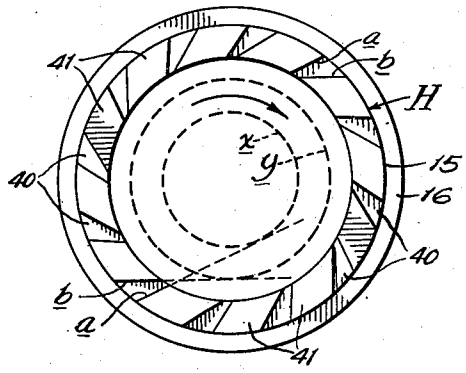


Fig. 2



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ART OF GRINDING ANNULAR SURFACES

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6 Claims. (Cl. 51—209)

This invention which relates generally to the grinding of annular surfaces is concerned both with an apparatus and a method therefor. In particular the herein disclosed apparatus and method has special utility in the lapping of a previously ground annular sealing surface upon the upper bowl of a vacuum coffee brewer which is commonly produced from boro silicate glass. Problems encountered in the lapping of such objects include (1) the high degree of precision that is required, (2) the extremely hard nature of the work that is to be treated, and (3) the tendency of the lapping surface, through use, to become untrue whereby the treated work is imperfectly lapped.

With the aim of coping successfully with these and other difficulties, I have devised a simple and inexpensive apparatus for carrying out this invention, a suggestive embodiment being illustrated in the drawing in the manner following:

Figure 1 is a central vertical section through the lapping apparatus, and Fig. 2 is a top plan view of the lapping head per se.

A typical article or object with which the present lapping apparatus may be advantageously used is an upper bowl B for a vacuum coffee brewer. Such a bowl, illustrated in Fig. 1, is of funnel shape, being formed with walls **10** approaching toward the bottom where its under side is provided with a slightly depending annular surface *d* to the inside of which is a depending well with walls **11** merging with and joining to a hollow stem **12**. For lapping of the annular surface *d* the article is rested upon the working face at the top end of a lapping head H which may take the form of a ring **15** having an external base flange **16** and an internal under recess **17**.

The lapping head, as shown, is mounted upon the flanged upper end **20** of a sleeve S with the aid of a clamping ring **21** which is fitted around the head to rest upon its flange **16**, there being fastening means, such as screws **22**, extended through the clamping ring for threaded engagement within holes that are provided in the sleeve flange. The sleeve exterior is stepped down to provide spaced stop shoulders **23** and **24**, the latter relatively close to its lower end whereon is carried a pulley **25** engageable with the shoulder **24**, the pulley being adapted to receive power transmitted by a belt (not shown) leading from any convenient source. A mounting wherein the sleeve may freely rotate is also provided, this desirably taking the form of balls **30** confined in a raceway comprising inner and outer rings **31** and **32**, the former disposed closely around the sleeve and against the upper stop shoulder **23**, and the latter resting within a seat **33** provided interiorly of a facing ring **34** which is fitted into a circular opening within the bed **35** of the machine. By mechanism such as has been described, I provide for rotation of the lapping ring about a fixed vertical axis while furnishing support for the article or object which is to be operated upon. Since it is customary to supply a small quantity of fine abrasive material, usually with water as a vehicle therefor, to the lapping surface which operates upon the article, some small particles, as drying proceeds, will be dislodged, and to educt these away I have shown a drain tube **36** fixedly positioned within the rotating sleeve in surrounding relation to the article stem **12**, the upper end of this tube being enlarged at **37** to occupy space within the recess **17** to the inside of the lapping head H. In this way any abrasive material which works its way to the inside of the lapping head will drain down into the tube to be conducted away to a desired point.

The mechanism thus far described, while simple and effective for the purposes of my invention, and therefore advantageous in many respects, is endowed with special utility by reason of certain improved features of construction incorporated into the top end or working face of the lapping head. These features consist of a succession of deep recesses or slots **40**, each extending crosswise of the lapping ring working face between its inner and outer surfaces, the slots being shown as spaced apart substantially 30°. The slots are each bordered by converging walls *a* and *b* with an intervening narrow gap of about one-sixteenth inch at the inner open end, these walls being angled at 30° or thereabouts so as to be tangent to inner and outer circles *x* and *y* concentric with the ring axis. Between adjacent slots the working face comprises a succession of spaced raised surfaces **41**, all of the same area and shape (approaching that of a parallelogram), and all accurately finished off to be in one and the same plane transversely of the axis of the head.

In operation the lapping head is caused to rotate at a suitable speed which may be about 225 R. P. M. The object or article to be treated has desirably been preliminarily ground upon its annular surface *d*. After such conditioning it is ready to be lapped when placed, held down, and perhaps manipulated, upon the working face of the rotating lapping head, as indicated in Fig. 1. It is easy and simple to handle the object manually in this operation, and to apply thereto such downward pressure as experience may demonstrate to be best for quick and satisfactory results. The object is held stationary while the lapping head continues to rotate for producing, with the aid of a plastic abrasive paste that may be applied with a brush, an annular sealing surface which is very accurate and true. While it is not difficult to prepare the lapping head end accurately and precisely, as required for this op-

eration, this condition is generally short-lived, and uneven wear is the result. Any appreciable deviation or departure from the original accurate and true finish of the lapping surfaces **41** will transmit a corresponding imperfection to the finished annular surface *d* of the object, and consequently will fail to meet the requirements of this invention. But the special construction of the lapping head working face by which crosswise slots having walls *a* so disposed as to prevent the flowable abrasive material from working outwardly through the progressively narrowing spaces, has proven effective to prolong the working life of the lapping surfaces almost indefinitely. The wear, such as it is, is practically uniform, and it is possible to lap many thousands of objects all uniformly so as to produce commercially perfect sealing surfaces.

In practice, the abrasive paste in a plastic state fills in the spaces of substantial depth between the lapping surfaces **41**, and in time the mass of this material tends to set or become non-flowable while still remaining very moist. Each new application of fresh paste on top establishes communication with the reservoir of water contained in the mass therebelow so that, in the ensuing lapping operation, there will be an upward feed of moisture tending to maintain a wet condition at the surface. The condition of wetness, characterized also by the presence of innumerable abrasive particles, contained in the vehicle for the plastic paste, spreads over the lapping surfaces **41** whereby to enhance their lapping effectiveness. Since it is important to retard drying and disintegration of the paste, and to maintain a thin spread of the paste in a wet condition over the lapping surfaces **41**, I find it advantageous to use deep slots in each of which a substantial mass of the paste material may accumulate in the form of a wet cake. So that this material, while in a plastic flowable condition, may not work its way outwardly in response to centrifugal forces, the walls *a* of the slots **40** are so angled that their ends furthest removed from the axis of the lapping head are disposed forwardly of their opposite ends in relation to the direction of rotation as indicated by the arrow in Fig. 2; in other words, the outer ends of these walls *a* lead the opposite or trailing ends. The result of this is to hold the paste material stationary within the slots while still permitting the mass to occupy the entire space between the inside and outside peripheries of the lapping ring.

I claim:

1. In the lapping of an annular surface upon an object, the steps of rotating against such surface a plurality of circularly arranged coplanar lapping surfaces disposed between and defined in part by inner and outer concentric circles spaced from each other by open ended slots bounded by diverging walls the trailing one of which, in relation to the direction of rotation of the annular lapping surfaces, is tangent to a circle interiorly of the other to control the position of masses of non-flowable wet abrasive material disposed within the slots, and of adding from time to time, fresh wet abrasive material in a plastic state to the previously placed masses thereof to maintain in cooperation therewith a wet abradant surface substantially coplanular with the plural lapping surfaces.

2. In the lapping of an annular surface upon an object, the steps of producing relative rotation between such surface and a plurality of circularly arranged lapping surfaces between which are masses of wet abrasive material in non-flowable condition exposed at opposite ends and upon the top, and of applying from time to time over the wet masses of abrasive material other fresh wet abrasive material in a plastic state in moisture-transmitting contact therewith and in amounts sufficient to maintain a wet abradant surface substantially level with the coplanar lapping surfaces.

3. For lapping an annular surface upon an object, an apparatus which comprises a rotatable lapping head having an annular working face provided with a plurality of coplanar lapping surfaces equally spaced and defined in part by the inner and outer circular surfaces of the head, each lapping surface being separated from the adjacent like surface by a slot having opposite ends open upon the circular surfaces of the head and the opposite walls of the slot being tangent to circles of unequal diameter both less than the inside diameter of the head.

4. For lapping an annular surface upon an object, an apparatus which includes a lapping head having an annular working face comprising a plurality of coplanar lapping surfaces with intervening recesses open at opposite ends, a mass of wet abrasive material in non-flowable state in each recess forming in itself a water reservoir between adjacent lapping surfaces and affording a moisture-transmitting base exposed at opposite ends and upon its top for fresh amounts of wet abrasive material applied thereover in a plastic state from time to time, and means for producing relative rotation between the lapping head and the object.

5. For lapping an annular surface upon an object, an apparatus which includes a rotatable lapping head having an annular working face comprising a plurality of coplanar lapping surfaces with intervening slots having opposite ends open upon the circular surfaces of the head with the trailing wall, in relation to the direction of head rotation, disposed with its outer end leading, a mass of wet abrasive material in non-flowable state in each slot forming in itself a water reservoir between adjacent lapping surfaces and affording a moisture-transmitting base exposed at opposite ends and upon its top for fresh amounts of wet abrasive material applied thereover in a plastic state from time to time, and means for producing relative rotation between the lapping head and the object.

6. For lapping an annular surface upon an object, an apparatus which includes a sleeve flanged at its upper end and rotatable unidirectionally about a vertical axis, a circular lapping head carried by the sleeve, coaxial therewith, for rotation therewith, the lapping head at its end remote from the sleeve being formed with an annular working face comprising a plurality of coplanar lapping surfaces with intervening slots each open upon the inner circular surface of the head, one wall of each slot being so angled as to present its outer end forwardly of the other in relation to the direction of rotation of the sleeve whereby to substantially prevent loose material in the slots from moving outwardly therefrom, there being a recess interiorly of the head opposite the base flange thereof, and a drain tube fixedly mounted within the sleeve and extending at its upper end into the recess interior of the head to receive loose material dislodged inwardly from the working face thereof.

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