

Aug. 1, 1961

B. G. CATLIN ET AL.

2,994,330

ULTRASONIC BRUSH AND COMB CLEANER

2 Sheets-Sheet 1

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Fig. 2

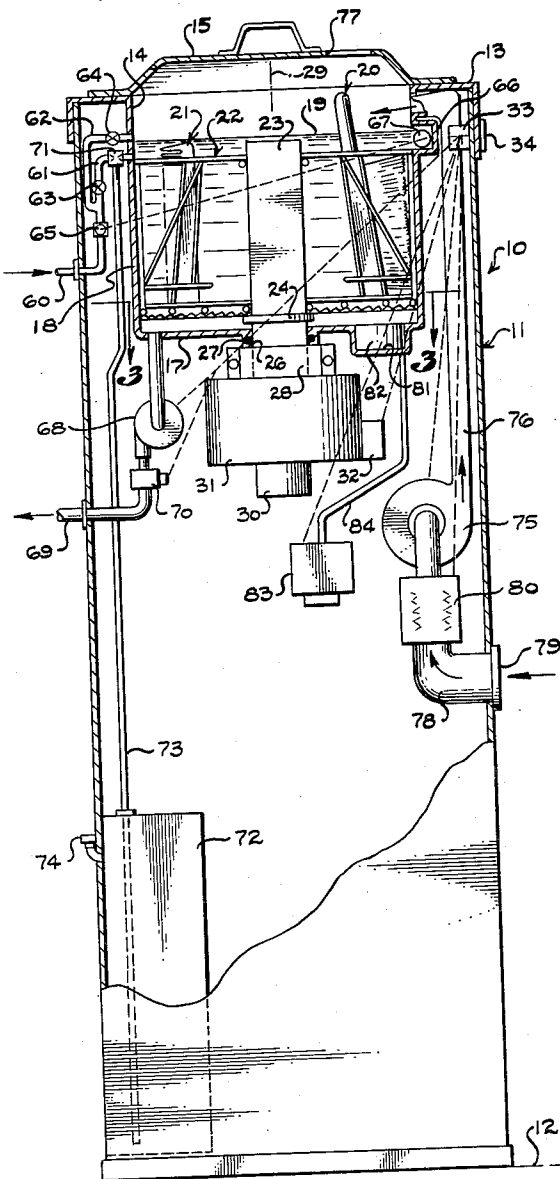


Fig. 1

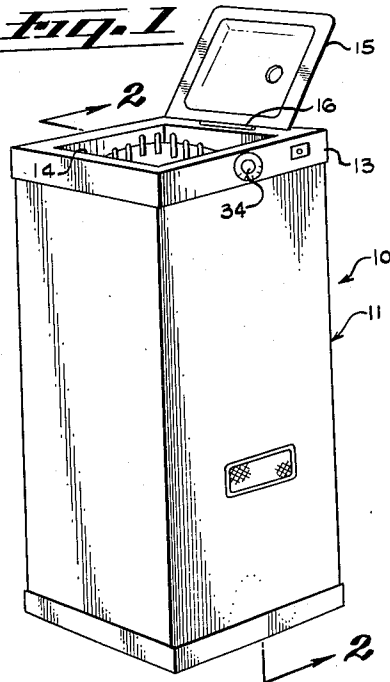
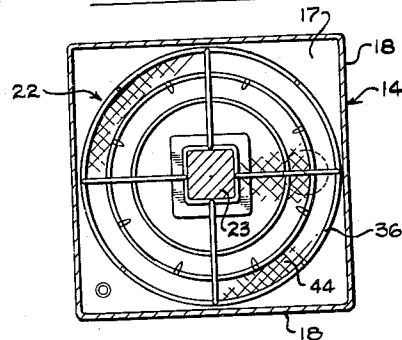


Fig. 3



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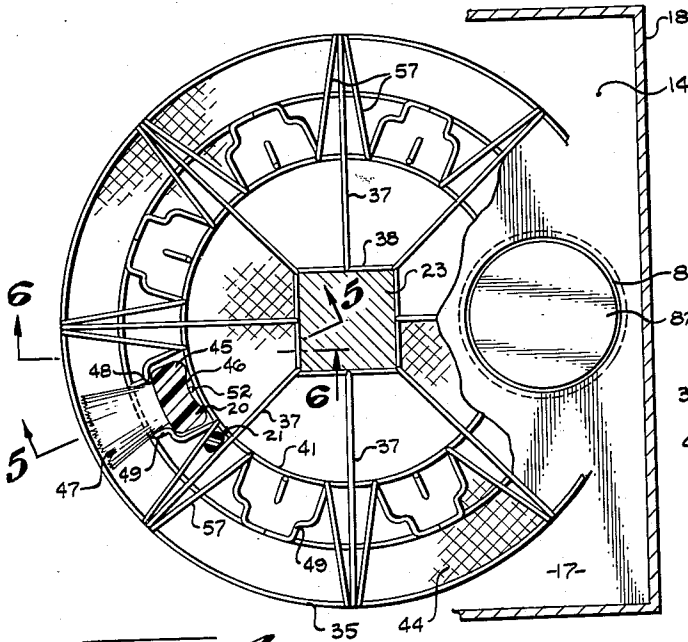


Fig. 4

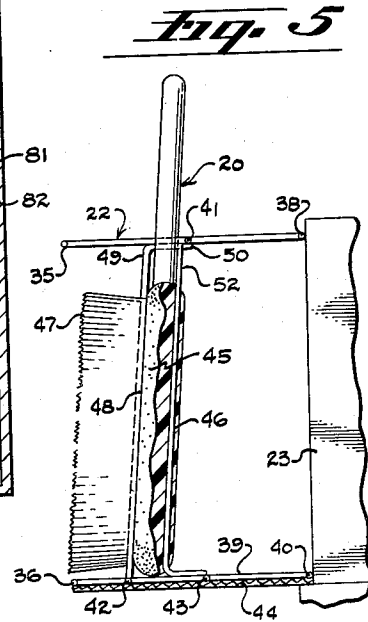


Fig. 5

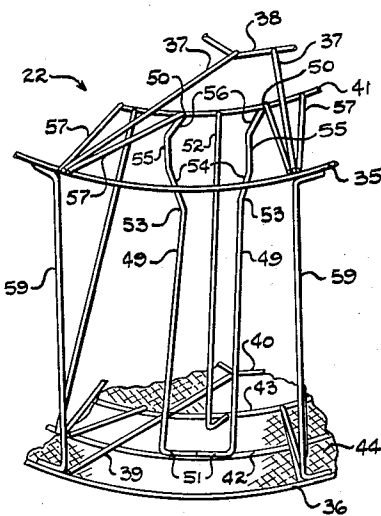


Fig. 6

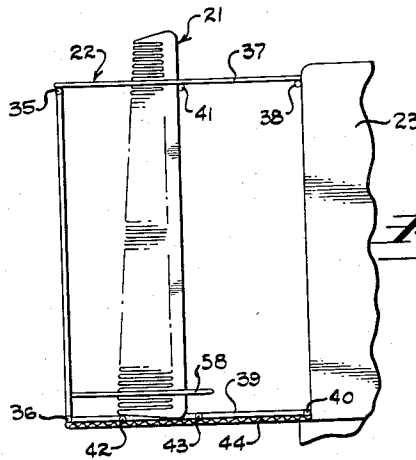


Fig. 7

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ULTRASONIC BRUSH AND COMB CLEANER

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2 Claims. (Cl. 134—58)

This invention has to do with apparatus for cleaning hairbrushes and combs, and relates especially to a device which is adapted for use in a beauty parlor or barber shop for relatively rapidly and thoroughly cleaning a number of brushes and/or combs at the same time. In certain respects, the present apparatus may be considered an improvement on the brush and comb cleaning device disclosed and claimed in our copending application Serial Number 772,947, filed on November 10, 1958, on "Brush and Comb Cleaner."

The apparatus shown in the above mentioned prior application acts to clean brushes and/or combs by mechanically agitating them within a body of cleaning liquid, typically water containing a suitable detergent. The general object of the present invention is to provide means for effectively enhancing the cleaning action attained by this prior apparatus, in a manner allowing for completion of a cleaning operation in a substantially reduced time, while at the same time attaining substantially increased thoroughness in the cleaning action.

These effects are attained by the employment simultaneously of two different types of cleaning action, with the apparatus for attaining these two types of cleaning action being interrelated in a unique manner such that the effectiveness of one of the two types of cleaning action is enhanced by and dependent upon the brush and comb movement which is associated with the other type of cleaning action. More particularly, the present apparatus combines mechanical agitation of the type utilized in the prior application with ultrasonic agitation of the liquid, brushes, and combs. The first type of agitation is effected by rotatively moving a carrier to which the brushes and combs are attached, with the rotary movement preferably being oscillatory, so that the carrier, brushes and combs move first in one rotary direction, then in the reverse rotary direction, etc. The ultrasonic cleaning action is attained by means of a unit which produces ultrasonic waves in the liquid at a localized area along the path of movement of the brushes and combs. The rotary movement of the carrier is then such as to successively advance the different brushes and combs past this localized zone of ultrasonic agitation, so that each of the brushes and combs is subjected directly to the high frequency agitation.

In this way, we assure subjection of all of the brushes to the ultrasonic agitation in the zone of highest intensity of the ultrasonic waves, and do so without the necessity for providing an ultrasonic unit which is large enough to set up high intensity ultrasonic waves throughout the entire cleaning chamber. This method of subjecting all of the brushes and combs to high intensity waves without using a large ultrasonic vibrator is of very great practical importance, since the materials which are employed for producing high frequency waves of this type are very expensive when purchased in large sizes, and would render the use of ultrasonic agitation impractical without the novelty of the present invention.

The above and other features and objects of the present invention will be better understood from the following detailed description of the typical embodiment illustrated in the accompanying drawings in which:

FIG. 1 is a perspective view showing a brush and comb cleaning unit constructed in accordance with the invention;

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FIG. 2 is an enlarged vertical section through the device of FIG. 1;

FIG. 3 is a horizontal section taken on line 3—3 of FIG. 2;

FIG. 4 is an enlarged plan view of the brush and comb carrier structure of the apparatus;

FIG. 5 is a vertical section taken on line 5—5 of FIG. 4;

FIG. 6 is a vertical section taken on line 6—6 of FIG. 4; and

FIG. 7 is a fragmentary perspective view of the brush and comb carrier unit.

Referring first to FIGS. 1 and 2, I have shown at 10 a brush and comb cleaning unit constructed in accordance with the invention, and which may typically include an outer housing or cabinet 11 adapted to rest on a floor surface 12. At its upper end, cabinet 11 has a top section 13, typically formed of sheet metal, and shaped to form a washing chamber 14 extending downwardly into the top of the cabinet, and closeable at its upper side by a cover or top door 15 which is hinged to part 13 at 16 for swinging movement between the open position of FIG. 1 and the closed position of FIG. 2. Chamber 14 has a bottom wall 17 and four upstanding side walls 18 giving to the chamber the preferably square horizontal cross-sectional configuration shown in FIG. 3. The bottom wall 17 of chamber 14 may extend directly horizontally except at the location of a typically cylindrical downward depression or recess 81 formed therein for receiving the ultrasonic vibrator unit 82. The bottom wall 17 and sidewalls 18 are imperforate and fluidtight except at the locations of certain later to be described fluid connections and other fittings, so that chamber 14 can contain a body of water 19 up to the level indicated in FIG. 2, during the washing and rinsing operations. The brushes 20 and combs 21 are contained within a carrier unit 22, which is removably insertible into chamber 14. Several of these carriers 22 may be provided for use with a single one of the washing units 10, so that each operator in a beauty shop or the like may have an individual one of the carriers 22 for holding his particular brushes and combs.

During a cleaning operation, the carrier 22 and its contained brushes and combs are rotatively driven by a vertically extending actuator post 23, which projects upwardly within chamber 14 at the center thereof. Post 23 is desirably of square or other non-circular horizontal section (see FIG. 3), for keying the carrier 22 rotatively to the post in a positive driving relation. Near bottom wall 17 of chamber 14, post 23 has an enlarged diameter flange 24 on which carrier 22 is supported when in its operative position. Beneath flange 24, post 23 has an externally cylindrical portion, which passes through a bottom aperture 26 in bottom wall 17 of the chamber, being sealed in fluid tight relation thereto by suitable means represented typically as a seal ring at 27. The post 23 is journaled by a bearing represented at 28 for rotation about vertical axis 29, the bearing 28 being mounted in fixed position relative to outer cabinet 11.

Post 23 is rotatively driven about axis 29 by means of an electric motor 30, through a two condition transmission 31 which is controlled by a control solenoid represented at 32. In one of its two conditions, the transmission or gear assembly 31 acts to rotatively oscillate post 23 about axis 29, that is, to first turn post 23 in one rotary direction through a predetermined angle, and to then return the post in the opposite circular direction through the same angle, following which the post is again driven in the first mentioned circular direction, etc. This rotary oscillating movement acts to correspondingly oscillate the brushes 20 and combs 21 within the washing liquid 19, to thereby effect a mechanical cleaning action on the brushes and combs. In the second condition of transmission 31, this apparatus acts to spin post 23 and

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the carrier 22 continuously in one circular direction about axis 29, and at a rate much faster than the rate of movement during the relatively slow rotary oscillating movement, to centrifugally throw the water off of the brushes and combs. This rate of spinning movement should preferably be in excess of 200 r.p.m. Solenoid 32, or any other convenient type of electrical control apparatus, functions to switch the transmission 31 between its two operating conditions under the control of a timer 33 having a control knob 34 at the outside of cabinet 11.

As best seen in FIGS. 3 through 7, the brush and comb carrier device 22 may take the form of a circular wire cage, which is adapted to receive the brushes and combs within individual guideways formed by the cage, and which holds the brushes and combs in essentially fixed positions relative to the cage 22 and post 23. In the illustrated preferred form of cage, this carrier 22 includes two outer vertically spaced top and bottom circular wires 35 and 36, which are centered about axis 29 and are parallel to one another. The upper of these wires 35 is rigidly connected by a series of circularly spaced horizontal radially extending wires 37 to an inner hub wire 38 which forms a horizontal square (see FIG. 4) adapted to be received about and closely fit the outer square surface of post 23. Similarly, the lower circular wire 36 is connected by horizontal radially extending wires 39 to a second square shaped wire 40, lying in the same horizontal plane as circular wire 36, and shaped in correspondence with and vertically aligned with top square wire 38 to coact therewith in effectively keying carrier 22 to the square upper portion of post 23 in positive rotary driving relation. Radially between the two outer and inner wires 35 and 38 at the top of carrier 22, the radially extending connector wires 37 carry an intermediate circular wire 41 centered about axis 29. Similarly, the lower radially extending wires 39 may carry a pair of such circular wires 42 and 43 centered about axis 29. Extending along the underside of wires 36, 39, 40, 42 and 43, carrier 22 has a horizontal apertured screen 44, typically formed of wire screening, and forming the bottom of the cage. The screen 44 and all of the wires above mentioned, as well as the additional wires which will be described subsequently, are welded or brazed together at the points of contact of the various elements, to form the desired rigid cage structure.

The cage 22 which is illustrated in the drawings is especially designed for holding the type of brush which is represented at 20 in the figures, and which is of the type conventionally utilized in beauty parlors. Specifically, this type of brush has a bristle carrying head 45 which contains a longitudinally extending recess or shallow groove 46 extending along the back side of head 45 (at the side opposite bristles 47). This head 45 also projects laterally beyond the bristles to form shoulders 48 at the sides of the bristles which are utilized for holding the brush in place. Between each pair of the radially extending connector wires 37 at the top of the cage, there is provided one guideway structure for receiving and holding one of the brushes 20. This guideway structure includes two generally parallel and generally vertical wires 49, which are attached at their upper ends 50 to wire 41, and which are secured at their lower ends 51 to bottom wire 42. Spaced radially inwardly of the major portions of these wires 49, the guideway structure includes a third wire 52, which is secured at its upper end to wire 41 and at its lower end to wire 43. As will be understood clearly from FIGS. 4 and 5, the head 45 of a brush 20 is insertible downwardly within the guideway formed by wires 49 and 52, with bristles 47 projecting radially outwardly between the two wires 49, and with wire 52 bearing against head 45 within recess 46. Along the major portion of their vertical extent, specifically up to the points indicated at 53 in FIG. 7, the two wires 49 extend substantially directly parallel, and these portions of wires 49 are slidably engaged by shoulders 48 on the brush

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as the brush slides downwardly. These portions of wires 49 are also substantially directly parallel to the inner wire 52, so that as the brush is slid downwardly within the guideway formed by wires 49 and 52, the head of the brush is effectively confined against lateral movement in any direction relative to carrier 22. Upwardly beyond point 53, wires 49 may flare relatively apart at 54, and then extend upwardly in parallel relation at 55, and then radially inwardly at 56 to their points of connection to wire 41. Thus, the upper ends of wires 49 are spaced an increased distance apart, to facilitate insertion of a brush downwardly into the guideway, with flaring portions 54 being engageable with the bristles of the brush to cam it into centered position in the guideway as the brush is inserted downwardly. The upper handle portion of the brush may of course project upwardly above the carrier structure, as seen in FIG. 5.

At the opposite sides of each brush guideway, there are formed a pair of comb receiving guideways, which are formed in part by the radial wires 37. More specifically, at the upper end of cage 22, there are provided additional wires 57, which extend between wires 35 and 41, and which flare slightly as they extend between these two wires, to form two tapered passages at the opposite sides of each wire 37 (see FIG. 4) into which two correspondingly tapered combs 21 are insertible downwardly. A similar V-shaped passage or guideway is formed at a location near the bottom of the cage and in vertical alignment with the V-shaped guideway formed by wires 37 and 57, this lower guideway being formed by a pair of wires 58 which are connected at their outer ends to vertical wires 59 which interconnect circular wires 35 and 36. These wires 58 flare as they extend radially inwardly, and are spaced above the bottom of the cage a distance sufficient to assure engagement of wires 58 with an inserted comb at a location above the bottom of the cage. As seen in FIG. 6, the upper circular wire 41 limits the radially inward movement of the comb, to confine the comb within the desired area in the cage. With reference to FIG. 4, it will be apparent from this figure that the carrier will hold two combs for each brush.

The previously mentioned ultrasonic agitator 82 may be either a piezoelectric or magnetostrictive transducer adapted to be energized by a high frequency alternating current, and to produce vibrations in the liquid 19 at a frequency corresponding to that of the energizing current. The preferred frequencies are within a range between about 50 kilocycles and 1 megacycle. A suitable material which may be used for this transducer is barium titanate. Transducer 82 may typically be of the short cylindrical configuration illustrated in FIGS. 2 and 4, and be nested within the previously mentioned correspondingly cylindrical recess 81 formed in bottom wall 17 of the cleaning chamber. Preferably, the upper surface of transducer 82 is planar and lies in the same horizontal plane as the main portion of bottom wall 17.

Transducer 82 is energized by a conventional power supply unit 83 which may be mounted in any manner within housing 11, with the high frequency alternating current from unit 83 being fed to transducer 82 through a line 84.

As is clearly brought out in FIGS. 2 and 4, the transducer 82 is preferably located directly beneath brush and comb carrier 22, and at a location directly beneath the path of rotary oscillating movement of the brushes 20 and comb 21 which are mounted in the carrier. Transducer 82 produces high intensity high frequency vibrations in the portion of the liquid which is located directly above transducer 82, so that when any one of the brushes or combs is positioned at that location, the ultrasonic vibrations function to greatly enhance the cleaning action attained. As the carrier 22 is oscillated rotatively about vertical axis 29, the various brushes and combs are successively moved through this zone of high intensity ultrasonic agitation, directly above transducer 82, so that all

of the brushes and combs have the advantage of this ultrasonic agitation. In order to assure movement of all of the combs and brushes to this location, the drive unit 31 is designed to oscillate carrier 22 through 360 degrees about axis 29, that is, through a complete turn, so that the cleaning action on each brush and comb will be the same as on all of the others. As in the case of the other operating units of the apparatus, the energization of ultrasonic transducer 82 is under the control of timer 33.

The washing and rinsing water is fed into chamber 14 through an inlet line 60 (see FIG. 2), which is connected to any suitable source of warm or hot water under pressure. This line 60 divides into two branches 61 and 62, the first of which conducts water into chamber 14 for the washing cycle, while the second branch 62 conducts water into the chamber for rinsing. Two solenoid valves 63 and 64 control the flow of water through the two branches 61 and 62 respectively, and are themselves controlled by timer 33. An additional solenoid valve 65 may be connected into line 60, and be controlled by a float operated electric switch 66, for closing off the flow of water into chamber 14 when the water reaches the filled level represented in FIG. 2, as sensed by the float 67 which actuates switch 66. Connected into wash water branch line 61 there is provided an aspirator 71 which acts to draw liquid detergent from a supply tank 72 through a line 73, and to mix the detergent into the wash water in a predetermined proportion sufficient to thoroughly wash the brushes and combs. The detergent may be filled into tank 72 through any suitable fill fitting, as represented at 74.

After the washing operation, and after the rinsing operation, the water is withdrawn from chamber 14 by a motor operated pump 68, which connects into the bottom of chamber 14, and which pumps the water to a waste line represented at 69. A solenoid valve 70 may be connected into line 69 for positively closing off the flow of water therethrough when desired, with this solenoid valve and pump 68 both being controlled by timer 33.

During drying of the brushes and combs, heated air is blown through chamber 14 by means of an electrically operated blower 75, whose discharge line 76 may connect into an upper portion of chamber 14 above the maximum water level represented in FIG. 2. This air may be directed downwardly by the portion of conduit 76 which connects into chamber 14, so that the heated air will be assured of contacting and drying the brushes and combs before the air is allowed to leave the chamber through a suitable outlet, which is typically represented as an outlet opening 77 formed in cover 15 of the apparatus. The air flowing to blower 75 may pass through a conduit 78 which communicates with the atmosphere through a screened opening 79 in the wall of cabinet 11. The air is heated by an electric heater unit 80, with this heater 80 and blower 75 both being controlled by timer 33.

Timer 33 may be an essentially conventional timer such as is used on clothes washing machines, dishwashing machines, and the like. This timer is adapted, when manually set to a predetermined starting position, to commence a predetermined timed cycle of operation, during which the various parts of the apparatus are sequentially energized to operate through a predetermined washing, rinsing and drying cycle. For maximum simplicity in the present disclosure, it may be assumed that timer 33 operates continuously and at a constant or uniform rate during the entire cycle of operations, with the only other automatic control being that afforded by float controlled switch 66 which acts to stop the filling of chamber 14 when a predetermined level is reached. During the intervals for such filling of chamber 14, the timer may be designed to leave fill valve 63 or 64 in an open condition for a period of time which is more than sufficient for filling the chamber regardless of the particular water pressure which may be encountered, to thus assure adequate time for complete filling up to the level of float valve shutoff.

To now describe a cycle of operation of the illustrated apparatus, assume that an operator has positioned a number of brushes and combs in carrier 22, and has then inserted that carrier and the brushes and combs downwardly into chamber 14 to the position represented in FIG. 2. The operator then closes cover 15 of the device, and turns timer control knob 34 to the starting position, to start the cycle of operations for which the device is designed. During that cycle, the timer acts first to open valve 63, to feed warm or hot wash water into chamber 14. During this time, valve 64 is of course closed and float switch 66 maintains valve 65 opened. The timer leaves valve 63 in this open condition long enough to be sure of completely filling chamber 14 to the FIG. 2 level. When the water (and contained detergent fed into the water through aspirator 71) reaches the level shown in FIG. 2, float actuated control switch 66 functions to close solenoid valve 65 to prevent the admission of any further water and detergent into chamber 14.

After chamber 14 has thus been filled, timer 33 energizes transducer 82, and at the same time actuates motor 30 and control solenoid 32 to commence rotary oscillation of post 23 and the attached carrier 22 together with its contained brushes and combs. The resulting combination of ultrasonic agitation and rotary oscillation brings the brushes and combs into very intimate contact with the detergent solution, to thoroughly clean all dirt and other impurities from the brushes and combs. As has been previously discussed, the three-hundred and sixty degree range of rotary oscillatory movement of the carrier and its contained brushes and combs results in sequential movement of all of the individual brushes and combs through the zone of ultrasonic agitation (the zone above agitator 82), so that all of the brushes and combs receive the advantage of subjection to the high frequency vibrations.

Timer 33 continues this washing operation for a predetermined period of time, say for example six minutes, following which timer 33 de-energizes transducer 82, motor 30 and solenoid 32, and energizes pump 68 and opens valve 70 to commence the discharge of washing water from chamber 14 through line 69. Both of the valves 63 and 64 are of course closed at this time. The emptying operation continues for a period of time which is long enough to assure complete removal of all of the liquid from chamber 14. After this emptying operation is completed, timer 33 opens valve 64 to admit warm or hot rinse water from line 60 into chamber 14 (valve 65 having been opened by float control 66 upon lowering of the water level in chamber 14). The rinse water continues to enter until it actuates float control switch 66 when the FIG. 2 level is reached, at which time the float control again closes valve 65. Subsequently, timer 33 closes valve 64 and again energizes transducer 82, motor 30 and solenoid 32, so that the ultrasonic agitation and rotary oscillation can function to assure removal of all of the detergent and the like from the brushes and combs. After a predetermined period of time has expired, say about three minutes, the timer stops the rotary oscillation and ultrasonic agitation, and energizes pump 68 and solenoid valve 70 to remove the water from chamber 14. It will of course be understood that pump 68 is inoperative, and valve 70 is closed, except during those periods when the water is actually being removed from chamber 14. The pump 68 and solenoid 70 act to completely close discharge line 69 during those periods when water is being filled into chamber 14, and during those periods when the combs and brushes are being agitated by post 23 and transducer 82.

After the rinse water has been completely removed from chamber 14, timer 33 actuates solenoid 32 to convert transmission 31 to a high speed spin condition, in which motor 30 acts to rotatively spin post 23 and carrier 22 with its contained brushes and combs rapidly and continuously in one circular direction, to centrifugally throw

water from the brushes and combs. Pump 68 may be left in operation during this period, and solenoid valve 70 may be left open, to continue to pump water from chamber 14. Also, simultaneously with the commencement of the spinning operation, timer 33 energizes blower 75 and heater 80 to blow heated air into chamber 14 through conduit 76, to thus speed up the drying operation. This spinning and heating operation is continued for a period sufficient to assure complete drying of the combs and brushes, say about three minutes, and with the air being sufficiently above the ambient temperature to perform the drying in a minimum period of time, the air temperature typically being between about 180 degrees and 212 degrees Fahrenheit. After the drying operation is completed, timer 33 stops the entire apparatus, and de-energizes all electrical components thereof, following which cover 15 can be swung to its FIG. 1 open position, and carrier 22 can be removed from chamber 14 with the cleaned brushes and combs. Another operator may then insert his particular carrier 22 and contained brushes into the apparatus, and again place the apparatus into operation to perform another washing, rinsing and drying cycle.

We claim:

1. Brush washing apparatus comprising means forming a washing chamber having a top opening and adapted to contain a body of water, means for filling water into said chamber, means for discharging the water from said chamber, a rotary post projecting upwardly within said chamber, a brush carrier detachably received about said post and removable upwardly therefrom and rotatively keyed to the post to turn therewith, said carrier including means for holding a plurality of brushes in essentially fixed positions relative to the carrier and post and at locations spaced about the post and such as to contact

water in the chamber, a unit for producing ultrasonic vibrations in the water at a predetermined localized zone in the chamber and through which said brushes move when the carrier turns, power operated drive means operable in one condition to rotatively oscillate said post and carrier through 360 degrees so that each brush carried by the carrier moves through said zone and operable in another condition to continuously rotatively spin said post and carrier, and cycle control means operable to automatically actuate said water filling and discharging means and said drive means and said ultrasonic unit to first fill the chamber with water, then produce said vibrations at said zone and rotatively oscillate the carrier and brushes through said zone, then discharge the water and refill with rinse water, then oscillate the carrier and brushes to rinse the latter, and then discharge the rinse water from the chamber and spin the post, carrier and brushes to centrifugally remove water from the latter.

2. Brush washing apparatus as recited in claim 1, in which said apparatus includes an air heater, and a blower for producing a flow of air from the heater through said chamber and past the brushes therein, said control means being operable to automatically cause said flow of heated air to pass through the chamber during said spinning operation.

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