



(51) International Patent Classification:
D06F 37/24 (2006.01)

(21) International Application Number:
PCT/US2018/023054

(22) International Filing Date:
19 March 2018 (19.03.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/476,251 24 March 2017 (24.03.2017) US

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(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP,
KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

(54) Title: MANUALLY OPERATED LAUNDRY TREATING APPLIANCE

(57) Abstract: A manually operated clothes washer (10, 110, 310) includes a tub (12, 112, 212, 312) having a bottom (14) and a peripheral wall (16, 116, 216) extending upwardly from the bottom (14), a damper (20, 120) located within the tub (12, 112, 212, 312), and an impeller (22, 122) or an agitator (322) having at least one vane (24, 124, 324) and rotatably mounted to the damper (20, 120). The clothes washer (10, 110, 310) also includes a drive system (148, 348) having a manually-operated input (26, 126, 226, 326).

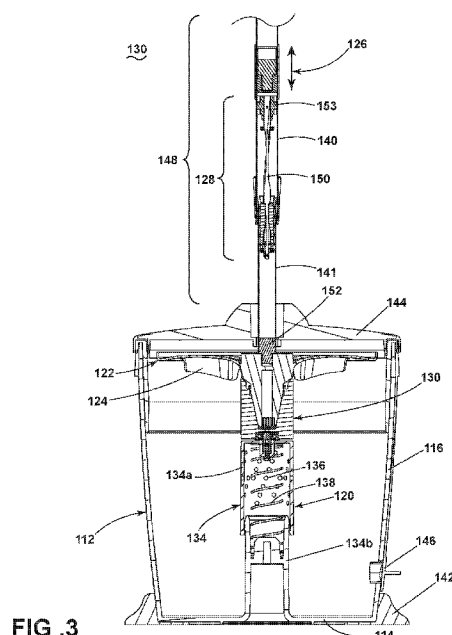


FIG. 3

Published:

— *with international search report (Art. 21(3))*

MANUALLY OPERATED LAUNDRY TREATING APPLIANCE**CROSS-REFERENCE TO RELATED APPLICATION**

[0001] This application claims the benefit of U.S. Provisional Application No. 62/476,251, filed March 24, 2017.

BACKGROUND

[0002] While automatic washing machines are prevalent in the contemporary household, they are not without their disadvantages. As of today, automatic clothes washing machines are both expensive and consume significant space in the household, so that in frequent cases no space can be found in modern homes where they can be located when working, and even more when idle. In addition, they require dedicated electrical outlets as well as their own plumbing lines to function. Also, depending upon the particular machine used, they can be energy intensive as well. In environments or cultures where electrical resources are not cost effective or readily available, or where one prefers not to be dependent on such resources, there is a need for an efficient and effective way to wash clothes independently of the constraints found in a modern home. This can be achieved by a manually operated clothes washer.

[0003] While manually operated clothes washers have existed for a long time, many are bulky and heavy, making them difficult to transport or store. They also use antiquated mechanisms for the manual operation, which often did not take into consideration ease of use and strain prevention that is associated with contemporary ergonomic and efficient designs.

BRIEF SUMMARY

[0004] In one aspect, the disclosure relates to a manually operated clothes washer that includes a tub having a bottom and a peripheral wall extending upwardly from the bottom to define an open top, a damper located within the tub, an impeller having at least one vane and rotatably mounted to the damper such that the at least one vane confronts the bottom and a drive system having a manually-operated, reciprocating input and a reciprocating to rotational motion converter operably coupling the reciprocating input to the impeller, wherein reciprocating movement of the reciprocating input rotates the impeller.

[0005] In another aspect, the disclosure relates to a manually operated clothes washer that includes a tub having a bottom and a peripheral wall extending upwardly from the bottom to

define an open top, a damper having a collapsible housing with a predetermined cracking threshold, which, when exceeded, the collapsible housing collapses, an impeller having at least one vane and rotatably mounted to the damper such that the at least one vane confronts the bottom, a manually reciprocating handle having at least first and second telescoping elements, with the second element mounted to the impeller, and a reciprocating to rotational motion converter operably coupling the first and second telescoping elements, wherein reciprocating movement of the first and second telescoping elements results in rotation of the impeller.

[0006] In yet another aspect, the disclosure relates to a manually operated agitator assembly for a clothes washer comprising a damper, an impeller having at least one vane and rotatably mounted to the damper such that the at least one vane confronts the damper and a drive system having a manually-operated, reciprocating input and a reciprocating to rotational motion converter operably coupling the reciprocating input to the impeller, wherein reciprocating movement of the reciprocating input rotates the impeller.

[0007] In still another aspect, the disclosure relates to a manually operated clothes washer comprising a tub having a bottom and a peripheral wall extending upwardly from the bottom to define an open top, a damper located within the tub, an agitator having at least one vane and rotatably mounted to the damper such that the at least one vane confronts the bottom, and a drive system having a manually-operated, reciprocating input and a reciprocating to rotational motion converter operably coupling the reciprocating input to the agitator, wherein reciprocating movement of the manually-operated, reciprocating input rotates the agitator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] In the drawings:

[0009] Figure 1 is a schematic view of a manually operated laundry treating appliance according to an embodiment of the inventive concepts.

[0010] Figure 2 is a front view of a first specific implementation of the laundry treating appliance according to Figure 1.

[0011] Figure 3 is a cross-sectional view of the laundry treating appliance of Figure 2 in an extended state taken along line III-III and including a drive system.

[0012] Figure 4 is an enlarged view of the drive system of Figure 3.

[0013] Figure 5 is an enlarged view of a bush and a seat from a one-way clutch assembly 160.

[0014] Figure 6 is a cross-sectional view of the laundry treating appliance of Figure 2 in a compressed state taken along line III-III' and including a drive system.

[0015] Figure 7 is an isometric view of the laundry treating appliance according to a second embodiment of the inventive concept.

[0016] Figure 8 is a partially exploded perspective view of the laundry treating appliance according to a third embodiment of the inventive concept.

[0017] Figure 9 is an exploded perspective view of a portion of the laundry treating appliance of Figure 8 including a drive system.

[0018] Figure 10A is a perspective view of the drive system of Figure 9 in a first configuration.

[0019] Figure 10B is a perspective view of the drive system of Figure 9 in a second configuration.

DETAILED DESCRIPTION

[0020] Below is described a manually operated laundry washing machine which, while providing comparable efficacy in cleaning laundry as compared to a conventional automatic clothes washer currently available on the market, does not suffer the drawbacks of large size, lack of portability, and being expensive. It also utilizes a mechanical energy input mechanism that is efficient and ergonomic for the user. Various implementations of inventive concept(s) relative to the manually operated laundry washing machine are shown and disclosed in the following description and corresponding drawings.

[0021] Figure 1 is a schematic view of one implementation of the manually operated laundry treating appliance. The laundry treating appliance may be any manually operated appliance such as a clothes washer which can be used to clean or otherwise treat items placed therein. The laundry treating appliance is schematically illustrated as a washing machine 10 having a tub 12 comprising a bottom 14 and a peripheral wall 16 extending upwardly from the bottom to define an open top 18. The tub 12 can be specifically designed or can be a simple container, such as a bucket.

[0022] An impeller 22 having a plurality of vanes 24 may be disposed on an inner surface of the tub 12 with the vanes oriented such that they are intended to agitate the laundry below them. The impeller is rotatably mounted to a shaft 30, which is supported in the tub 12 by a damper 20. A manually operable drive system 48 comprising a reciprocating input 26 and a

motion converter 28 are provided to take a reciprocating input and convert it to rotational motion to rotate the impeller 22 in a rotational direction 32 about the shaft 30.

[0023] The impeller 22, damper 20, and drive system can all be an integral unit that can be stored separately from the tub 12. When washing laundry, the integral unit can be placed in the tub 12. The integral unit can be sub-divided into other integral units, such as the reciprocating input 26 and motion converter 28 as a first unit, and the impeller 22, a shaft 30 and damper 20 as a second unit. In this configuration, the second unit can be left in the tub 12 while the first unit is stored separately.

[0024] During operation, the tub 12 manually receives a supply of treating chemistry. Non-limiting examples of treating chemistries that may be dispensed by the dispensing system during a cycle of operation include one or more of the following: water, enzymes, fragrances, stiffness/sizing agents, wrinkle releasers/reducers, softeners, antistatic or electrostatic agents, stain repellants, water repellants, energy reduction/extraction aids, antibacterial agents, medicinal agents, vitamins, moisturizers, shrinkage inhibitors, and color fidelity agents, and combinations thereof.

[0025] After or before the treating chemistry, laundry is placed within the tub 12. After the placement of the treating chemistry and laundry in the tub 12, the user then manually reciprocates the reciprocating input 26. The linear reciprocation from the reciprocating input 26 is converted into rotational motion by the motion converter 28, which rotationally drives the impeller 22 in rotational direction 32.

[0026] The reciprocating input 26 can be configured to provide an input force to the motion converter 28 in one or both of the reciprocating directions. The damper 20 resists and dampens the force from the reciprocating input 26 and can optionally permit the impeller 22 to reciprocate up/down in a direction 33 in the tub 12 in addition to rotating.

[0027] Figure 2 is a front view of a first specific implementation of the clothes washer of Figure 1. Because of the similarity of the specific implementation of Figure 2 to Figure 1, like parts in Figure 2 will be denoted with like numbers increased by 100 for ease of comparison to Figure 1.

[0028] According to the first implementation of Figure 2, a tub 112 rests on a base 142. The tub 112 has a peripheral wall 116. An opening defined by the peripheral wall at the top (not shown in Figure 2) is closed by a lid 144. A drive system 148 having a reciprocating input 126 is in the form of a telescoping handle having a first telescoping element 140 and a

second telescoping element 141, which is received within the first telescoping element 140 and passes through the lid 144.

[0029] Referring to Figure 3, the details of the impeller 122 and drive system 148, which includes the reciprocating input 126 and motion converter 128, are illustrated in greater detail. The impeller 122 comprises a plurality of vanes 124 and rests on a shaft 130 which in turn rests on a damper 120 and is coupled to the second telescoping element 141 on an opposite side than the damper 120.

[0030] The damper 120 comprises a collapsible/expandable housing 134 having upper and lower portions 134a and 134b, which are telescopically connected. At least the upper portion 134a has a plurality of perforations such as fluid openings 136 through which liquid can pass as the housing 134 is collapsed/expanded. Within the upper portion 134a, a biasing device, which is illustrated as a spring 138, is provided.

[0031] A static friction (not shown) between the upper portion 134a and the lower portion 134b provides the housing 134 with a cracking force threshold, which, when exceeded by the reciprocating input 126, overcomes the static friction. In addition, once the static friction is overcome, the housing offers a second resistance in the form of a spring force as the housing 138 moves from the expanded state toward the collapsed state. Thus the biasing device, including but not limited to the spring 138, further resists the axial force from the reciprocating input 126. In this manner, if the axial force applied to the impeller 122 from the reciprocating input 126, is less than the cracking force threshold, it is used solely for rotational movement of the impeller. If the axial force exceeds the cracking force threshold, but is less than the force required to both overcome the cracking force threshold and achieve maximum compression of the spring 138, then the impeller 122 will both rotate and be driven down for part of the duration of the downward motion of the reciprocating input, and will only rotate for the remainder of the downward motion of the reciprocating input 126. If the axial force meets or exceeds the sum of both the cracking force threshold and the force required to achieve maximum compression of the spring, then the impeller 122 will both rotate and be driven down for the entire duration of the downward motion of the reciprocating input 126.

[0032] The washing machine 110 may also include a drain system 146 for draining liquid from the tub 112. Additionally, the liquid supply and drain system may differ such as by inclusion of other valves, conduits, treating chemistry dispensers and the like, to control the

flow of liquid through the washing machine 110 and for the introduction of more than one type of treating chemistry.

[0033] Referring to Figure 4, further details of the drive system 148, including a motion converter 128, are shown in greater detail. The motion converter 128 is illustrated as a power screw 150, which is located within the interior of the telescoping elements 140, 141. The upper end of the power screw 150 is fixed within the interior of the first telescoping element 140 via a fastener 153. The motion converter 128 further comprises a one-way clutch 160, which is located within the second telescoping element 141.

[0034] The one-way clutch 160 further comprises a coaxially arranged bushing 162 and bearing 164, with the bushing 162 movably residing within the bearing 164, while the bearing is fixed to the second telescoping element 141. The bushing 162 has a restrictive opening 166 through which the power screw 150 passes. The restrictive opening 166 is shaped relative to the threads of the power screw 150, such that axial movement of the power screw 150 through the restrictive opening 166 rotates the bushing 162.

[0035] Referring to Figure 5, the bearing 164 has an angular notch 168 at its bottom and the bushing 162 has a corresponding angular notch 170 at its bottom, allowing the bushing to directionally couple with the bearing in one rotational direction, but not the other. Thus, as the power screw 150 rotates the bushing in one direction, the angular notches 168 and 170 engage and the axial movement of the power screw 150 through the bushing 162 rotates the bearing 164, which results in a corresponding rotation of the second telescoping element 141 as it is fixed to the bearing 164.

[0036] With the prior structural description in mind, the operation of the washing machine 110 will be described, with the assumption the washing machine 110 is starting in the expanded state as shown in Figure 3. As a user pushes down on the first telescoping element 140, the first telescoping element 140 slides over the second telescoping element 141, which drives the power screw 150 through the restrictive opening 166 of bushing 162. Pushing the first telescoping element 140 downwards causes the power screw 150 and the bushing 162 to be pushed downwards until the angular notches 168 and 170 of the bushing 162 and bearing 164 engage, assuming they are not already engaged. After engagement of the angular notches, further axial movement of the power screw 150 through the restrictive opening 166 of the bushing 162, results in the threads of the power screw 150 rotating the bushing 162, with the rotation being transferred through the engaged angular notches 168 and

170 to the bearing 164, which then transfers the rotation to the second telescoping element 141, which then rotates the impeller 122. As described above, the force applied in excess of the force required for rotation of the power screw 150 and thus the impeller 122 is used to compress the laundry. It is also worth noting that depending on the extent of the drag force exerted by the laundry on the impeller 122, there may be limited or no rotation of the laundry by the impeller 122. Both the rotation of the impeller 122 and the compression of the damper 120 while the tub 112 is loaded with laundry and treating chemistry contribute toward mechanical cleaning action on the laundry.

[0037] While moving upward during the reciprocation, the upward motion of the first telescoping element 140 results in the upward motion of the power screw 150, thereby resulting in the rotation of the bush 162 in a direction opposite to the direction of rotation achieved during the downward motion of the first telescoping element 140. Due to the angular nature of the notches in the bushing-bearing assembly, decoupling of the bushing-bearing assembly results, thereby causing no rotation of the second telescoping element 141 or impeller 122 during the upward motion of the first telescoping element 140. Thus, during the entirety of the reciprocating motion, the impeller 122 rotates only in a single direction.

[0038] If the downward force applied to the first telescoping element 140 is below the cracking force threshold, the damper 120 stays in the expanded state as shown in Figure 3, and the reciprocating movement of the reciprocating input 126 is entirely converted into rotational motion of the impeller 122, resulting in the agitation of the laundry by the vanes 124. If the downward force applied to the first telescoping element 140 is above the cracking force threshold, the damper 120 collapses and moves to the collapsed state as shown in Figure 6, which results in the impeller 122 moving downward into the tub 112. In greater detail, as the damper collapses, the collapsible housing 134 collapses, thereby compressing the spring 138. The reactive spring force compensates for some of the downward force of the reciprocating input 126, thereby resulting in the downward force of the reciprocating input 126 being partially converted into rotation of the impeller 122, and partially being converted into downward motion of the impeller 122 which results in the compression of the laundry in the tub 112.

[0039] In addition, as the impeller 122 is coupled to the damper 120 via the shaft 130, when the axial force from the reciprocating input is in the upward direction, the spring 138 assists the user in the upward motion by using the stored spring energy to return the housing

134 from the collapsed state to the expanded state. This results in further ease in operation for the user.

[0040] It should be noted that while embodiments described above provide for an initial downward movement of the impeller before rotation begins for the downward stroke by the user, it is contemplated that the one way clutch, screw, and damper could be revised or other structures used in their place to provide for any combination of rotation (clockwise or counterclockwise) and movement (downward/upward) of the impeller during either the up/down stroke by the user. While any combination of impeller rotation start/stop and impeller downward/upward movement is possible, the likely practical combinations are: the impeller simultaneously rotates and moves down during the entire downward stroke, the impeller rotates for only a first part of the stroke (up or down) and then moves downward for the remainder of the stroke or the impeller rotates the entire duration of the stroke without any movement (upward or downward).

[0041] Figure 7 illustrates a laundry treating appliance according to a second embodiment in accordance with the present disclosure. Parts similar to the first embodiment are marked with serial numbers increased by 100. In the second embodiment, the washing machine 210 includes a tub 212 with a peripheral wall 216 and resting on a base 242. An opening defined by the peripheral wall 216 at the top (not shown) is closed by a lid 244. The washing machine 210 can also include a drain system 246 for draining liquid from the tub 212. Reciprocating input is achieved via a hinged handle 290 attached to an outer first telescoping element 240 coupled to a second telescoping element 241, thereby achieving the convenience for the user of the appliance to operate the appliance more comfortably while being seated.

[0042] Figure 8 illustrates the laundry treating appliance according to a third embodiment, where parts similar to the second embodiment (Figure 7) are marked with numbers further increased by 100. A washing machine 310 can include a tub 312 resting on a base 342, an agitator 322 having a plurality of vanes 324 positioned within the tub 312, and a lid 344 removably mounted to the tub 312. A door 380, optionally comprising a transparent material, can be hingedly mounted to the lid 344 via a hinge or set of hinges 381 such that clothing or other articles to be washed can be loaded/unloaded into the washing machine 310 through the hinged door 380. In addition, a first pair of handles 382 can be provided on the lid 344 and a second pair of handles 384 can be provided on the tub 312 such that when assembled, the first pair of handles 382 can mate with the second pair of handles 384 and

prevent relative motion between the tub 312 and lid 344. The washing machine 310 can further include a drive system 348 comprising a shaft 330 and hinged handle 390. When assembled, the shaft 330 can extend vertically into the center of the agitator 322 and attach to the underside of the lid 344.

[0043] The details of the drive system 348 are best seen with reference to Figure 9, which illustrates the parts of the drive system 348 exploded from each other. The handle 390 can be attached to the lid 344 through a pivot rod 391 (or other suitable hinge mechanism) and also through an extension spring 393, and a connector 392 can also be included with the handle 390. A bottom enclosure 385 can surround the shaft 330 and attach to the underside of the lid 344 to enclose components of the drive system 348 (Figure 8) from the wash environment within the tub 312 (Figure 8). The drive system 348 (Figure 8) can further comprise a mechanical linkage such as a ball joint linkage mechanism 370 including a first member 371, second member 372, first ball joint 373, and second ball joint 374. The connector 392 can be attached to the linkage mechanism 370 such that oscillating input 326 of the handle 390 can be translated through the linkage mechanism 370 to cause rotational motion 332 of the shaft 330 in order to drive the agitator 322 (Figure 8).

[0044] The linkage mechanism 370 is shown in further detail from the underside of the lid 344 and handle 390, illustrated in Figure 10A with the hinged handle 390 in a “down” position and in Figure 10B with the hinged handle 390 in an “up” position. When assembled, the extension spring 393 can be in an extended condition when the handle 390 is in a “down” position (Figure 10A), and in a relaxed condition when the handle 390 is in an “up” position (Figure 10B), such that the spring 393 can bias the handle 390 toward an “up” position. In addition, the first ball joint 373 can be attached to the handle 390 via the connector 392, and is illustrated in a non-limiting example as sliding through the connector 392 and secured with fasteners 375 as appropriate. The first member 371 can be attached to the first ball joint 373 and the second ball joint 374, and the second member 372 can be attached to the second ball joint 374 and the shaft 330, illustrated in a non-limiting example as sliding through the shaft 330. It should be understood that the fasteners 375 may comprise any suitable fastening piece for the environment within the washing machine 310 (Figure 8), and additional fasteners 375 may be utilized to connect components within the washing machine 310 (Figure 8) as desired. Additionally, the first and second members 371, 372 can comprise any suitable connecting member such as threaded or unthreaded bolts or screws, in non-limiting examples.

It can be appreciated that as the hinged handle 390 is oscillated, the resulting motion of the first member 371 through the ball joints 373, 374 can cause the second member 372 (and therefore the shaft 330) to undergo rotational motion in the direction 332 as shown.

[0045] To the extent not already described, the different features and structures of the various embodiments may be used in combination with each other as desired. That one feature may not be illustrated in all of the embodiments is not meant to be construed that it cannot be, but is done for brevity of description. Thus, the various features of the different embodiments may be mixed and matched as desired to form new embodiments, whether or not the new embodiments are expressly described. In addition to the concepts covered by the below claims, the following concepts can also provide the basis for claims in any possible combination:

[0046] The manually operated clothes washer as described herein where the reciprocating to rotational motion converter comprises at least one of a rack and pinion, power screw, lead screw, ball screw, roller screw, slider crank, or scotch and yoke.

[0047] The manually operated clothes washer as described herein wherein the reciprocating to rotational motion converter (28) comprises a bearing element (164) fixedly mounted within the other of the first (140, 240) and second (141, 241) telescoping elements.

[0048] The manually operated clothes washer as described herein where the reciprocating to rotational motion converter further includes a one-way clutch coupling the first and second telescoping elements, wherein movement of the first telescoping element toward the manually operated clothes washer results in rotation of the second telescoping element.

[0049] The manually operated clothes washer as described herein where the damper includes a spring located within the collapsible housing.

[0050] A manually operated agitator assembly for a clothes washer including a damper, an impeller having at least one vane and rotatably mounted to the damper such that the at least one vane confronts the damper, and a drive system having a manually-operated, reciprocating input and a reciprocating to rotational motion converter operably coupling the manually operated, reciprocating input to the impeller, wherein a reciprocation of the reciprocating input rotates the impeller.

[0051] The manually operated agitator assembly as described herein wherein the manually operated, reciprocating input includes a reciprocating handle having at least first and second telescoping elements, with the second telescoping element mounted to the

impeller, and the reciprocating to rotational motion converter includes a screw located within the first telescoping element and a bearing element fixedly mounted within the second telescoping element and receiving the screw, wherein the reciprocation of the first telescoping element moves the screw through the bearing element, which effects a rotation of the second telescoping element.

[0052] The manually operated agitator assembly as described herein where the reciprocating to rotational motion converter further includes a one-way clutch coupling the first and second telescoping elements, wherein movement of the first telescoping element toward the manually operated clothes washer results in the rotation of the second telescoping element.

[0053] While the concepts have been specifically described in connection with certain specific embodiments thereof, it is to be understood that this is by way of illustration and not of limitation. Reasonable variation and modification are possible within the scope of the forgoing disclosure and drawings without departing from the spirit of the manually operated clothes washer which is defined in the appended claims.

CLAIMS

What is claimed is:

1. A manually operated clothes washer (10, 110, 310) comprising:
 - a tub (12, 112, 212, 312) having a bottom (14) and a peripheral wall (16, 116, 216) extending upwardly from the bottom (14) to define an open top (18);
 - a damper (20, 120) located within the tub (12, 112, 212, 312);
 - an impeller (22, 122) having at least one vane (24, 124, 324) and rotatably mounted to the damper (20, 120) such that the at least one vane (24, 124, 324) confronts the bottom (14); and
 - a drive system (148, 348) having a manually-operated, reciprocating input (26, 126, 226, 326) and a reciprocating to rotational motion converter (28, 128) operably coupling the reciprocating input to the impeller (22, 122), wherein reciprocating movement of the manually-operated, reciprocating input (26, 126, 226, 326) rotates the impeller (22, 122).
2. The manually operated clothes washer (10, 110, 310) of claim 1 wherein the damper (20, 120) comprises a biasing device.
3. The manually operated clothes washer (10, 110, 310) of claim 2 wherein the biasing device comprises a spring.
4. The manually operated clothes washer (10, 110, 310) of claim 3 wherein the damper (20, 120) comprises a collapsible housing (134) surrounding the spring.
5. The manually operated clothes washer (10, 110, 310) of claim 4 wherein the collapsible housing (134) has a cracking force threshold, which, when exceeded, the collapsible housing (134) collapses.
6. The manually operated clothes washer (10, 110, 310) of claim 5 wherein the collapsible housing (134) has at least one fluid opening (136) to permit liquid in the tub (12, 112, 212, 312) to pass in and out of the collapsible housing (134).
7. The manually operated clothes washer (10, 110, 310) of claim 1 wherein the damper (20, 120) is collapsible and has a cracking force threshold, wherein a force applied to the reciprocating input (26) below the threshold is fully converted to rotational movement

and force applied to the reciprocating input (26) above the threshold is only partially converted to rotational movement, with some of the force axially moving the impeller (22, 122) toward the bottom (14).

8. The manually operated clothes washer (10, 110, 310) of claim 1 wherein the reciprocating to rotational motion converter (28, 128) further comprises a one-way clutch (160) wherein reciprocation between opposing directions (33) results in rotation for only one of the opposing directions (33).

9. The manually operated clothes washer (10, 110, 310) of claim 1 wherein the manually operated, reciprocating input (26) comprises a telescoping handle having at least first (140, 240) and second (141, 241) telescoping elements, with the second telescoping element (141, 241) mounted to the impeller (22, 122).

10. The manually operated clothes washer (10, 110, 310) of claim 9 wherein the reciprocating to rotational motion converter (28, 128) comprises a screw (150) located within at least one of the first (140, 240) and second (141, 241) telescoping elements.

11. The manually operated clothes washer (10, 110, 310) of any of the preceding claims wherein the reciprocating to rotational motion converter (28, 128) further comprises a one-way clutch (160) coupling the first (140, 240) and second (141, 241) telescoping elements.

12. A manually operated clothes washer (10, 110, 310) comprising:
a tub (12, 112, 212, 312) having a bottom (14) and a peripheral wall (16, 116, 216) extending upwardly from the bottom (14) to define an open top (18);
a damper (20, 120) having a collapsible housing with a predetermined cracking threshold, which, when exceeded, the collapsible housing collapses;
an impeller (22, 122) having at least one vane (24, 124, 324) and rotatably mounted to the damper (20, 120) such that the at least one vane (24, 124, 324) confronts the bottom (14);
a manually reciprocating handle (290, 390) having at least first (140, 240) and second telescoping (141, 241) elements, with the second telescoping element (141, 241) mounted to the impeller (22, 122); and

a reciprocating to rotational motion converter (28, 128) operably coupling the first (140, 240) and second (141, 241) telescoping elements, wherein a relative reciprocation of the first (140, 240) and second (141, 241) telescoping elements results in rotation of the impeller (22, 122).

13. The manually operated clothes washer (10, 110, 310) of any of the preceding claims wherein the reciprocating to rotational motion converter (28, 128) comprises a screw (150) located within at least one of the first (140, 240) and second (141, 241) telescoping elements and a bearing element (164) fixedly mounted within the other of the first (140, 240) and second (141, 241) telescoping elements and receiving the screw (150), wherein the relative reciprocation of the first telescoping element (140, 240) moves the screw (150) through the bearing (164) element, which effects a rotation of the second telescoping element (141, 241).

14. A manually operated clothes washer (10, 110, 310) comprising:
a tub (12, 112, 212, 312) having a bottom (14) and a peripheral wall (16, 116, 216) extending upwardly from the bottom (14) to define an open top (18);
a damper (20, 120) located within the tub (12, 112, 212, 312);
an agitator (322) having at least one vane (24, 124, 324) and rotatably mounted to the damper (20, 120) such that the at least one vane (24, 124, 324) confronts the bottom (14); and

a drive system (148, 348) having a manually-operated, reciprocating input (26, 126, 226, 326) and a reciprocating to rotational motion converter (28, 128) operably coupling the reciprocating input to the agitator (322), wherein reciprocating movement of the manually-operated, reciprocating input (26, 126, 226, 326) rotates the agitator (322).

15. The manually operated clothes washer (10, 110, 310) of any of the preceding claims wherein the drive system (148, 348) includes a ball joint linkage (370).

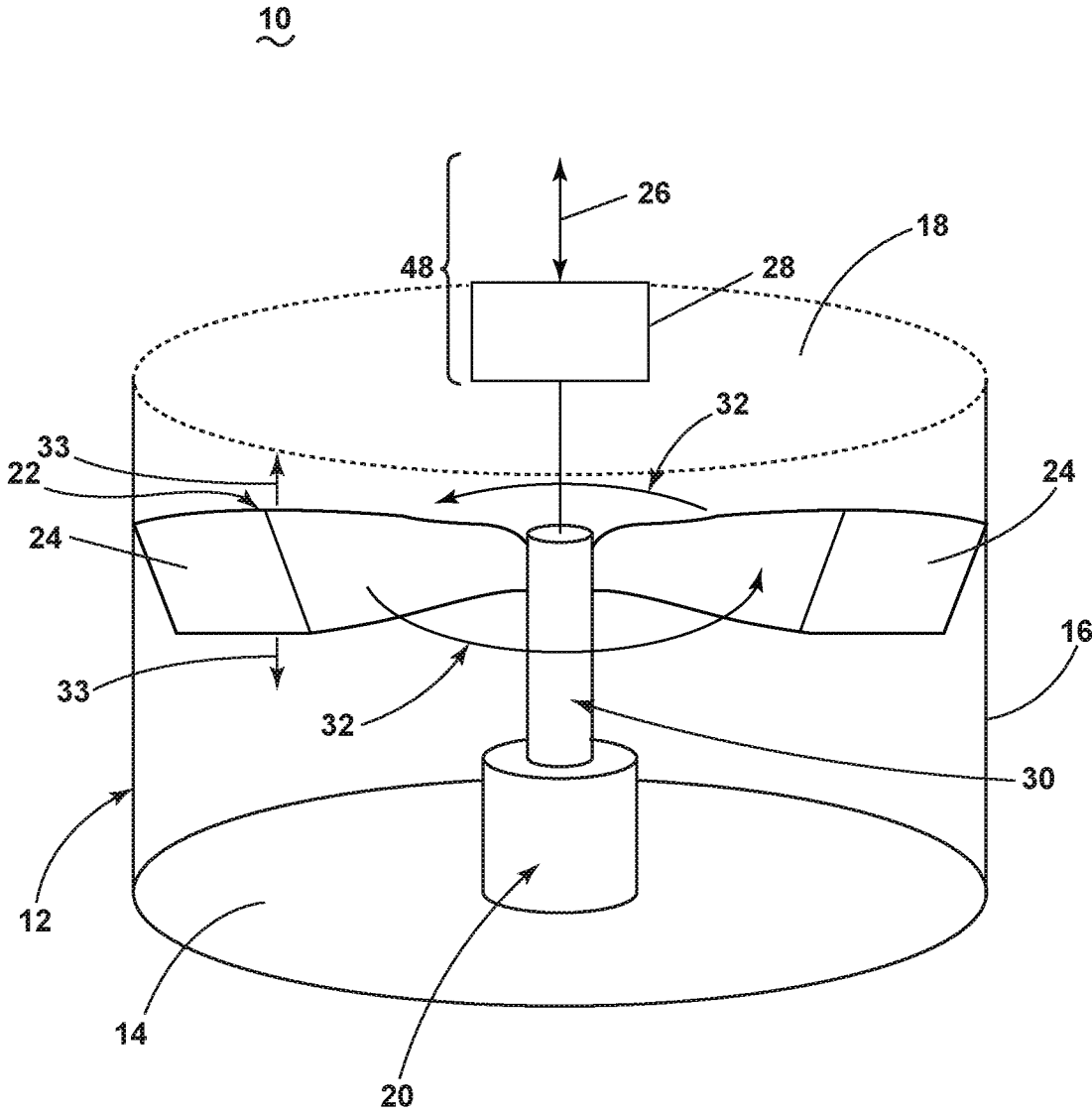


FIG. 1

2/11

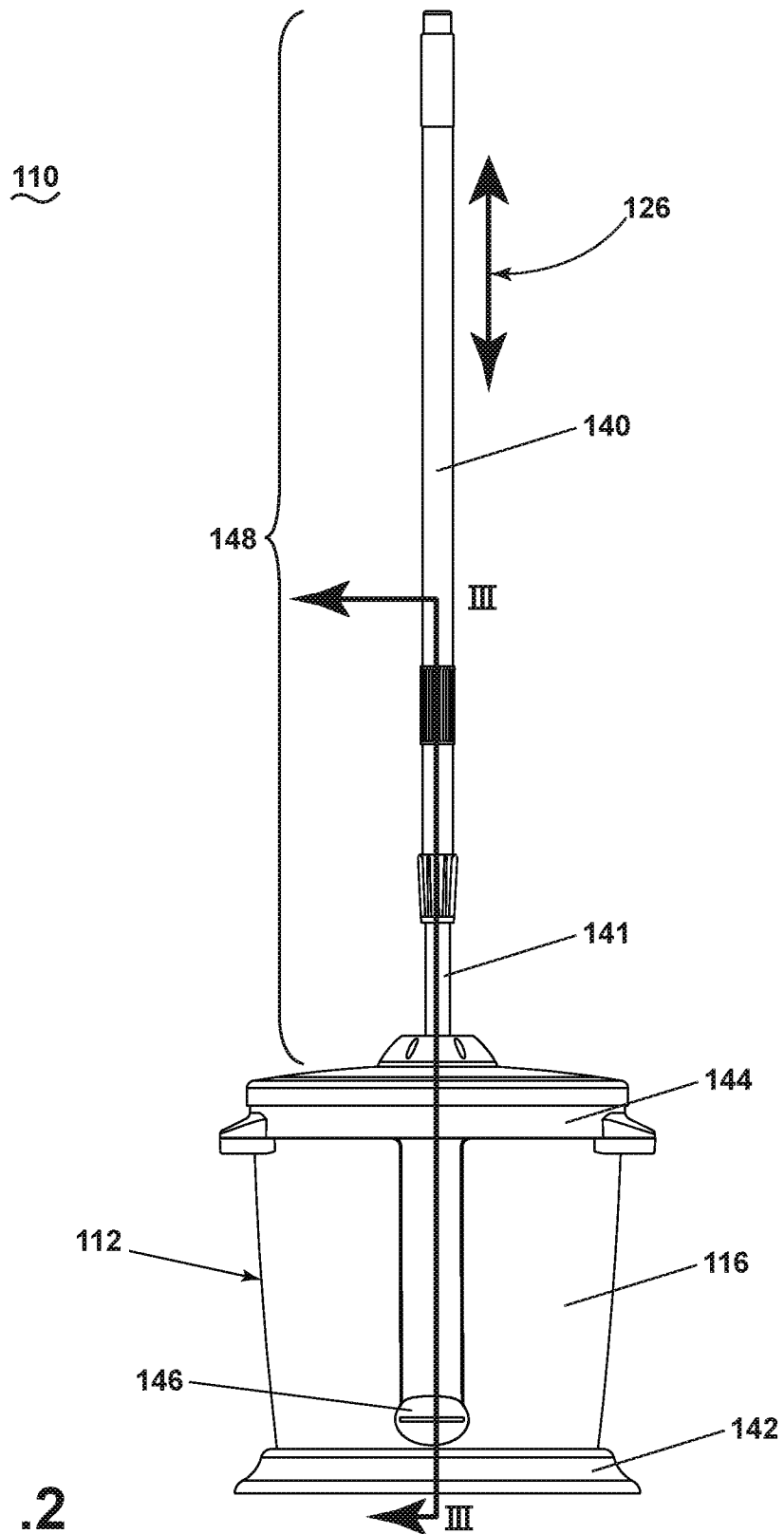


FIG. 2

3/11

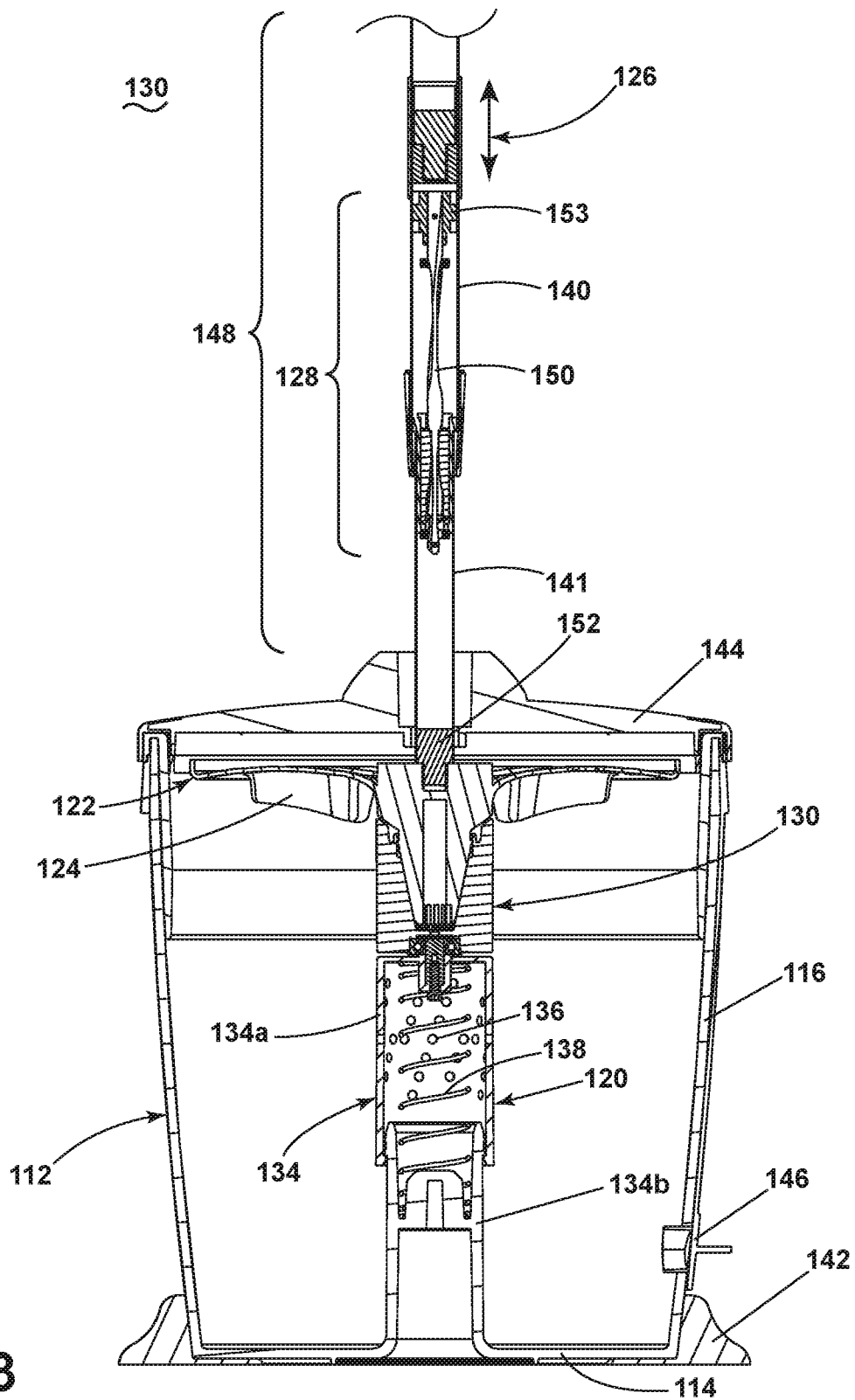


FIG .3

4/11

148

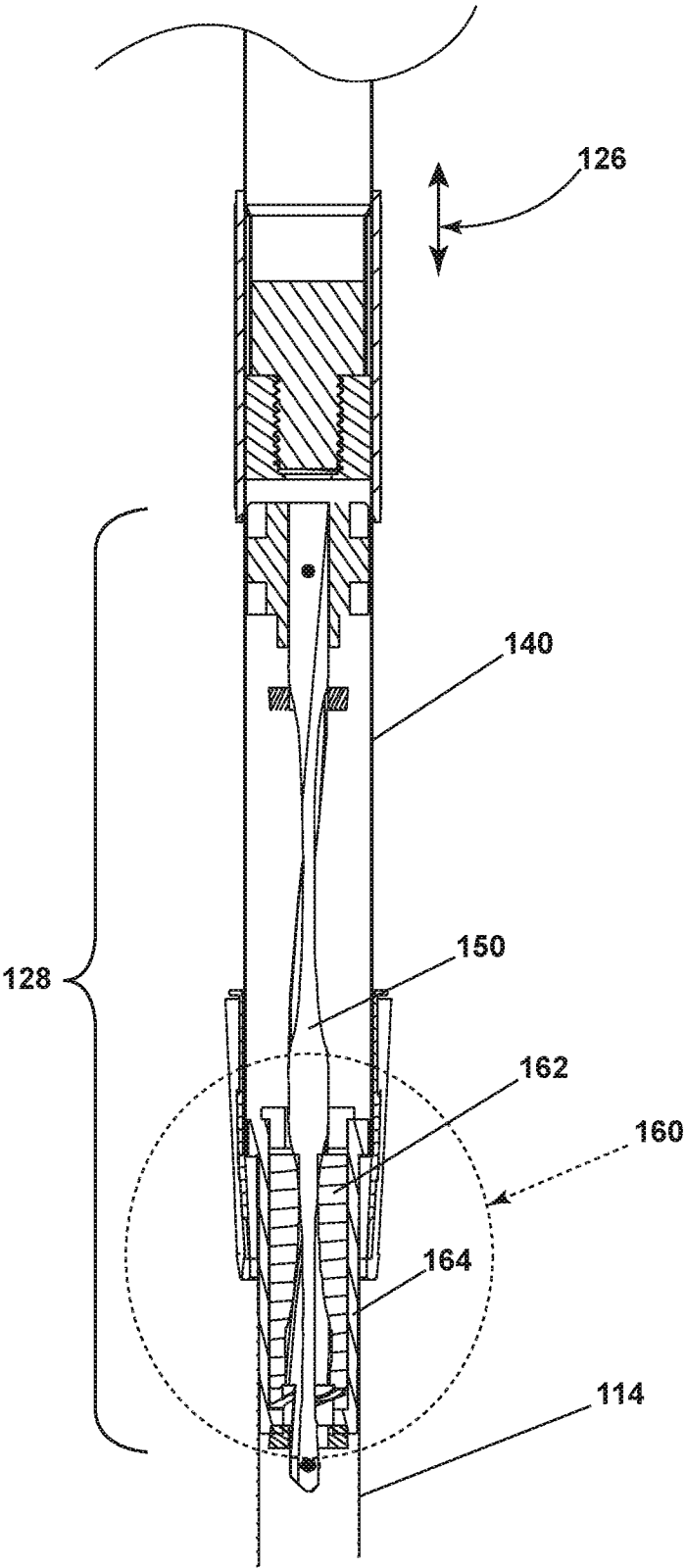


FIG. 4

5/11

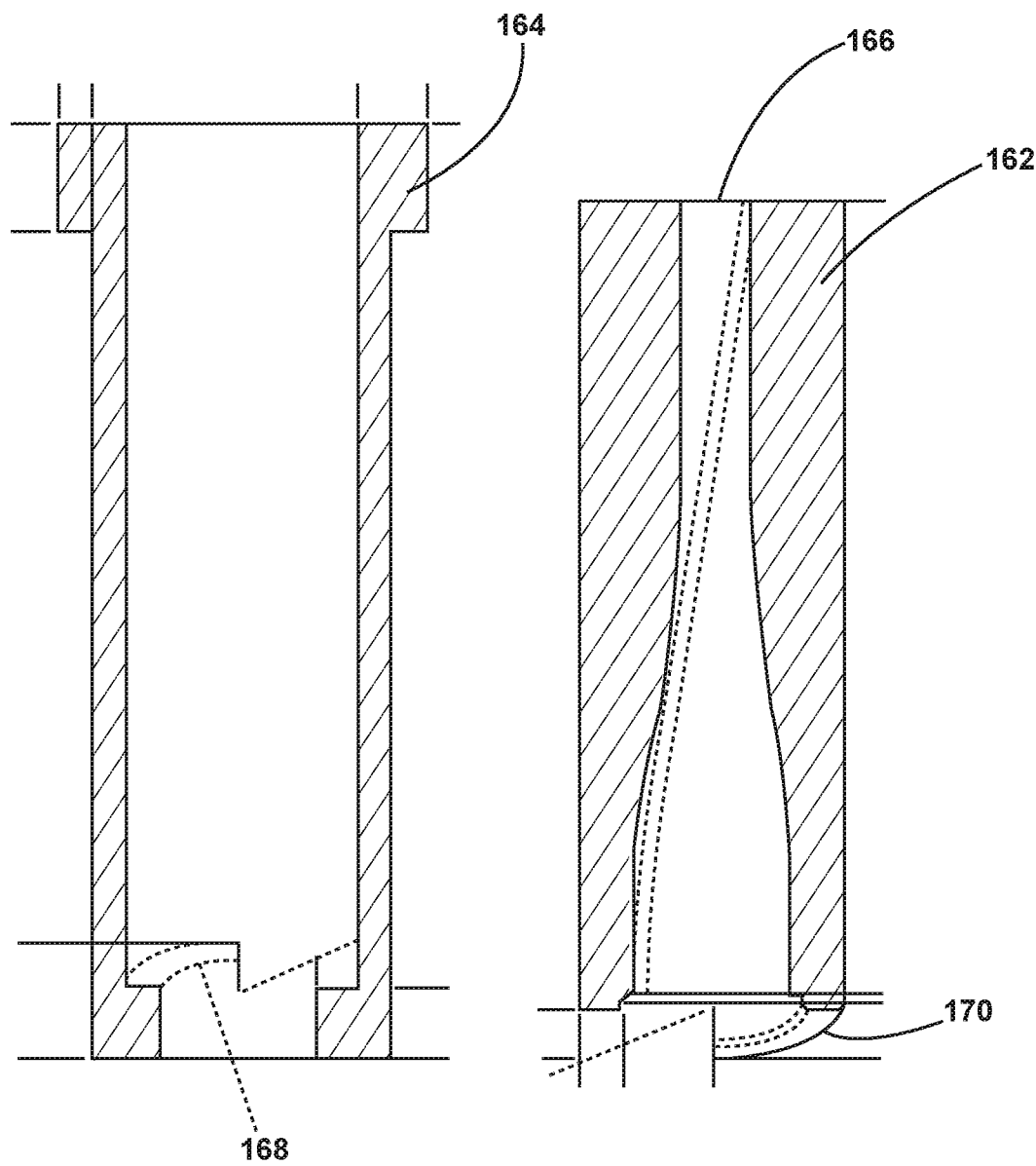


FIG. 5

6/11

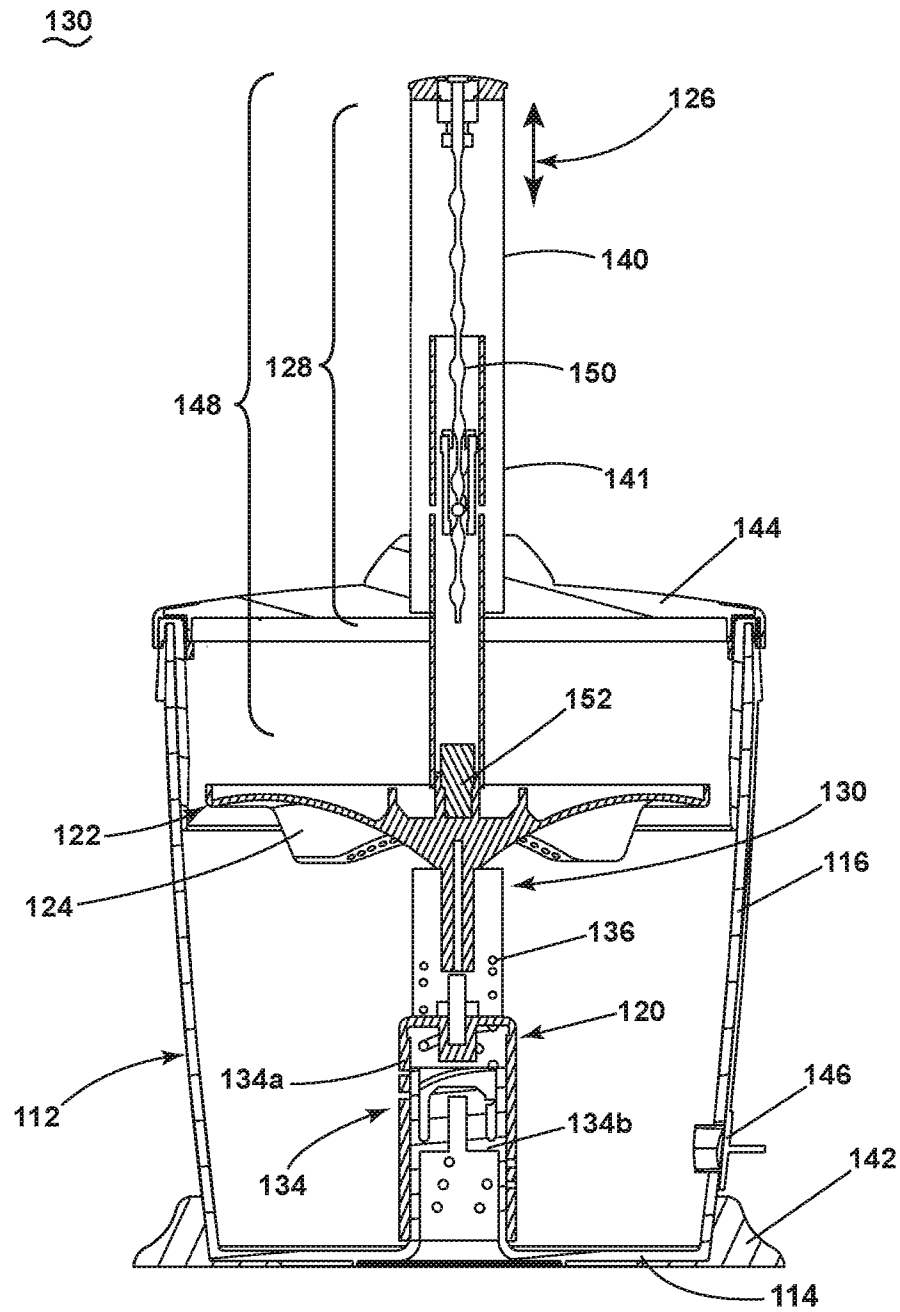


FIG. 6

7/11

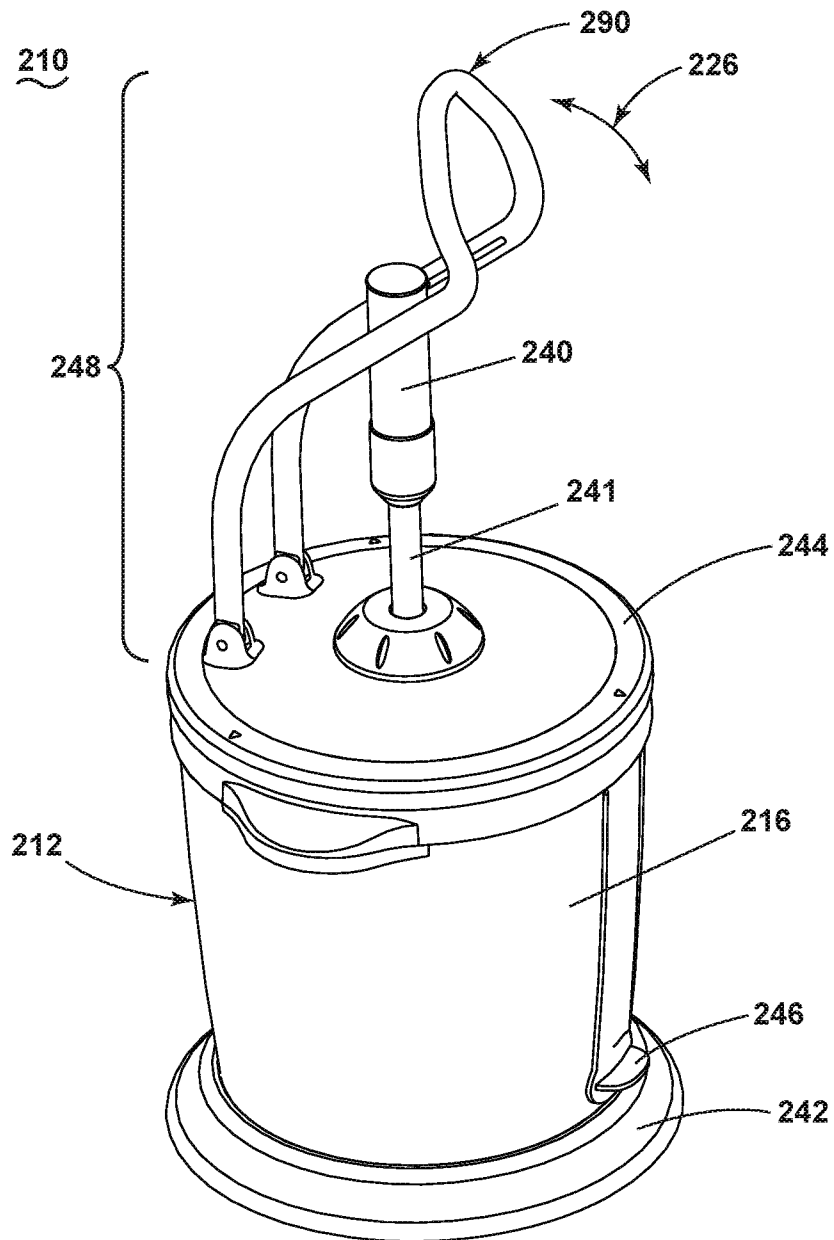


FIG .7

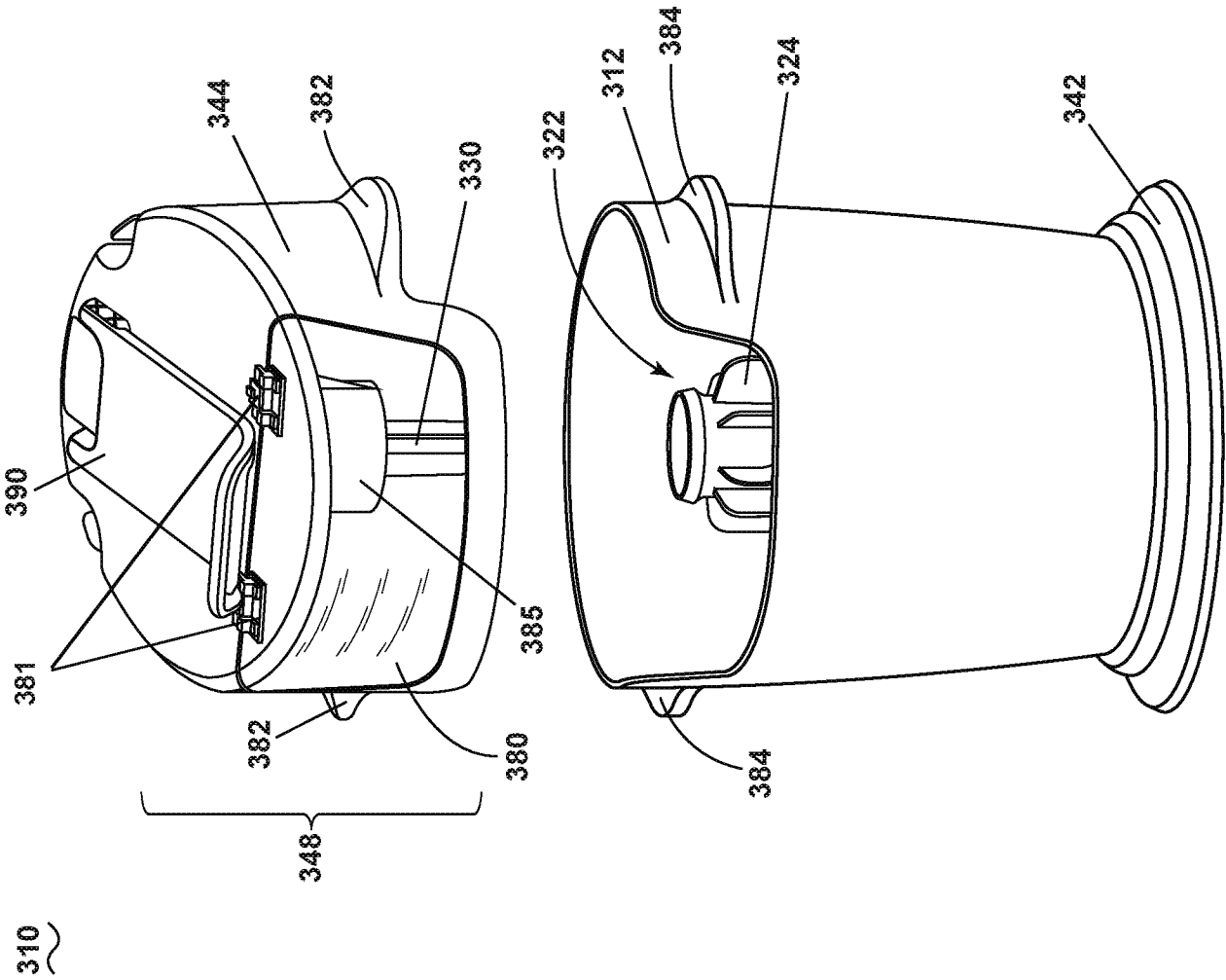
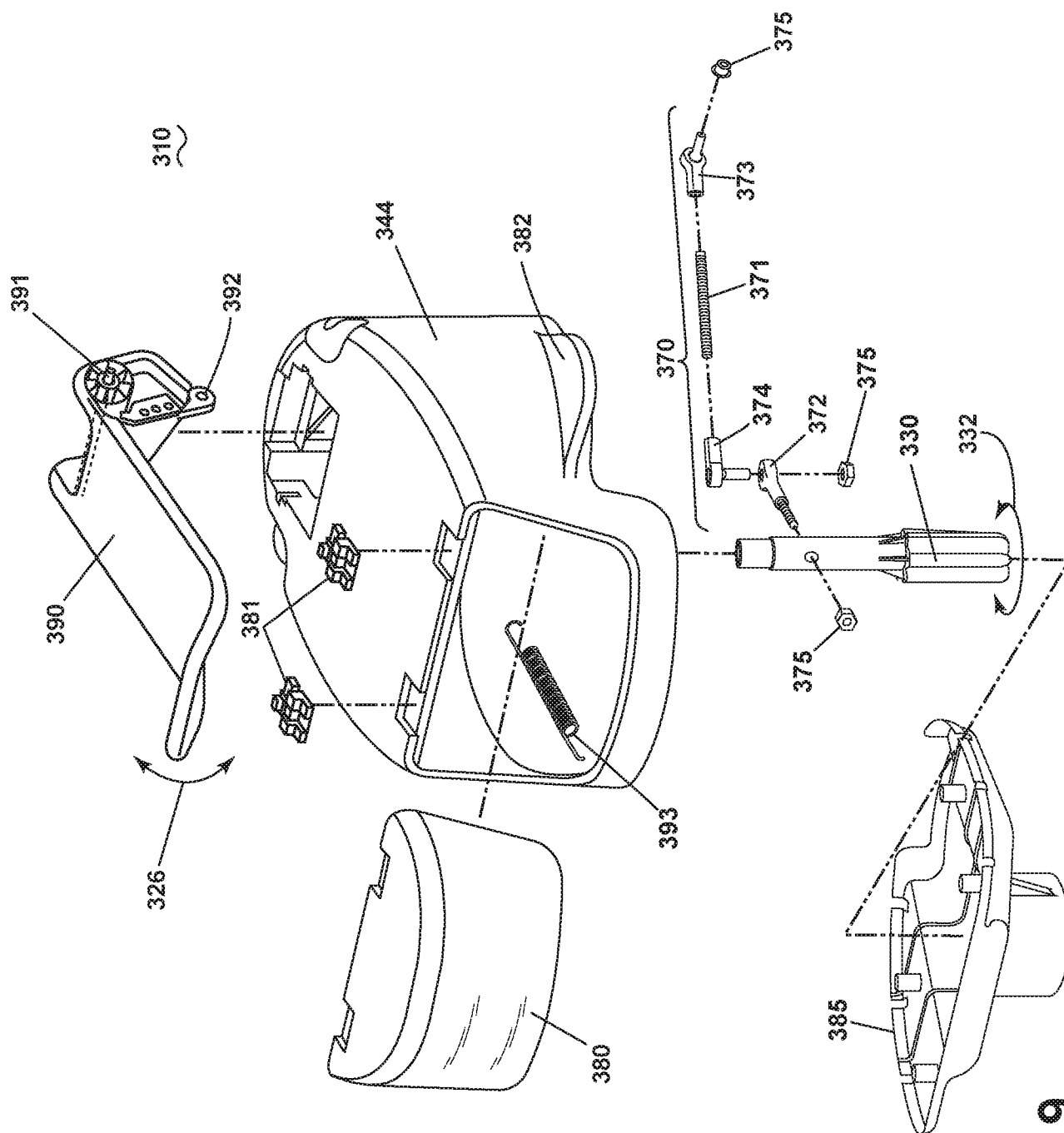


FIG. 8



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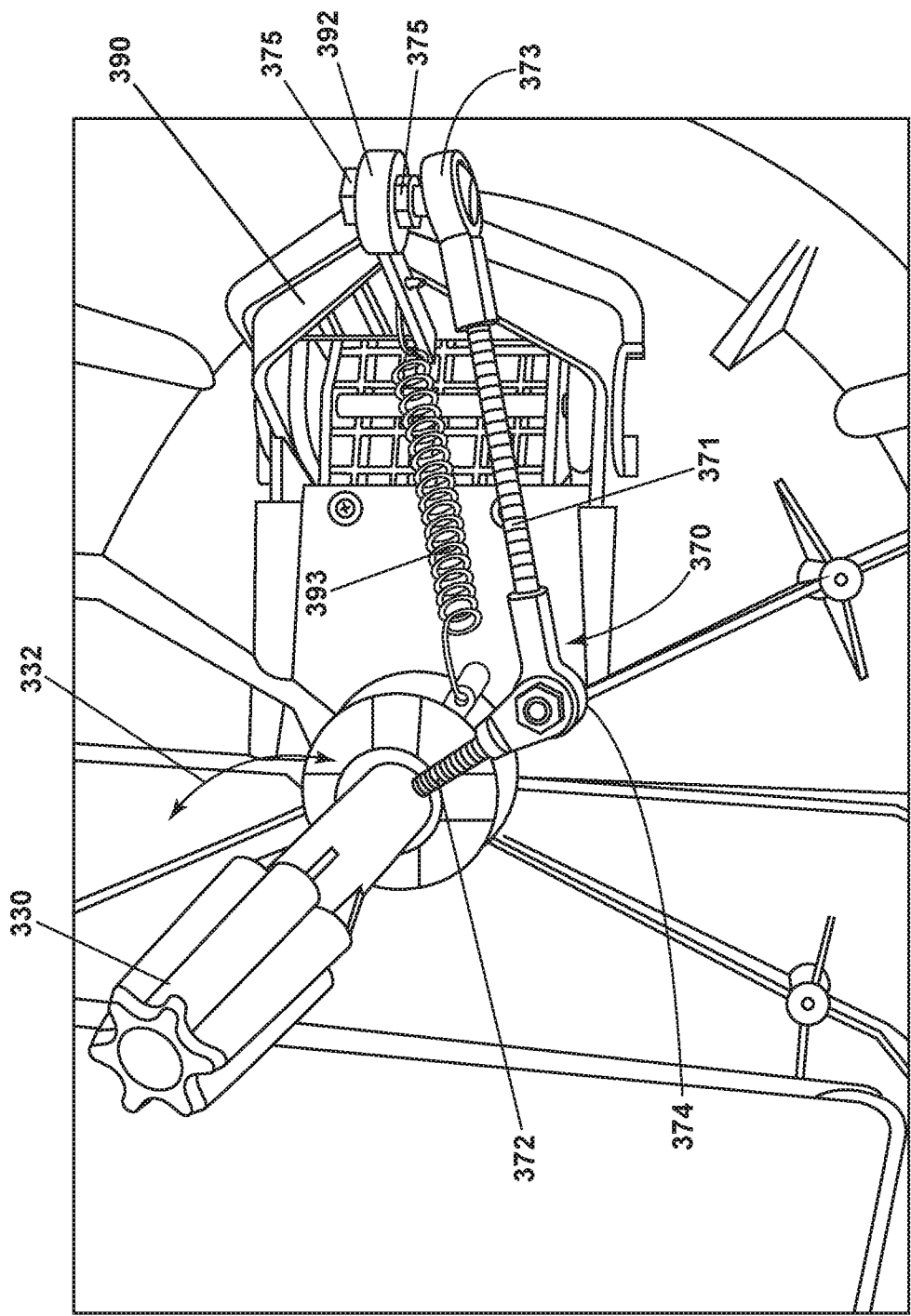


FIG. 10A

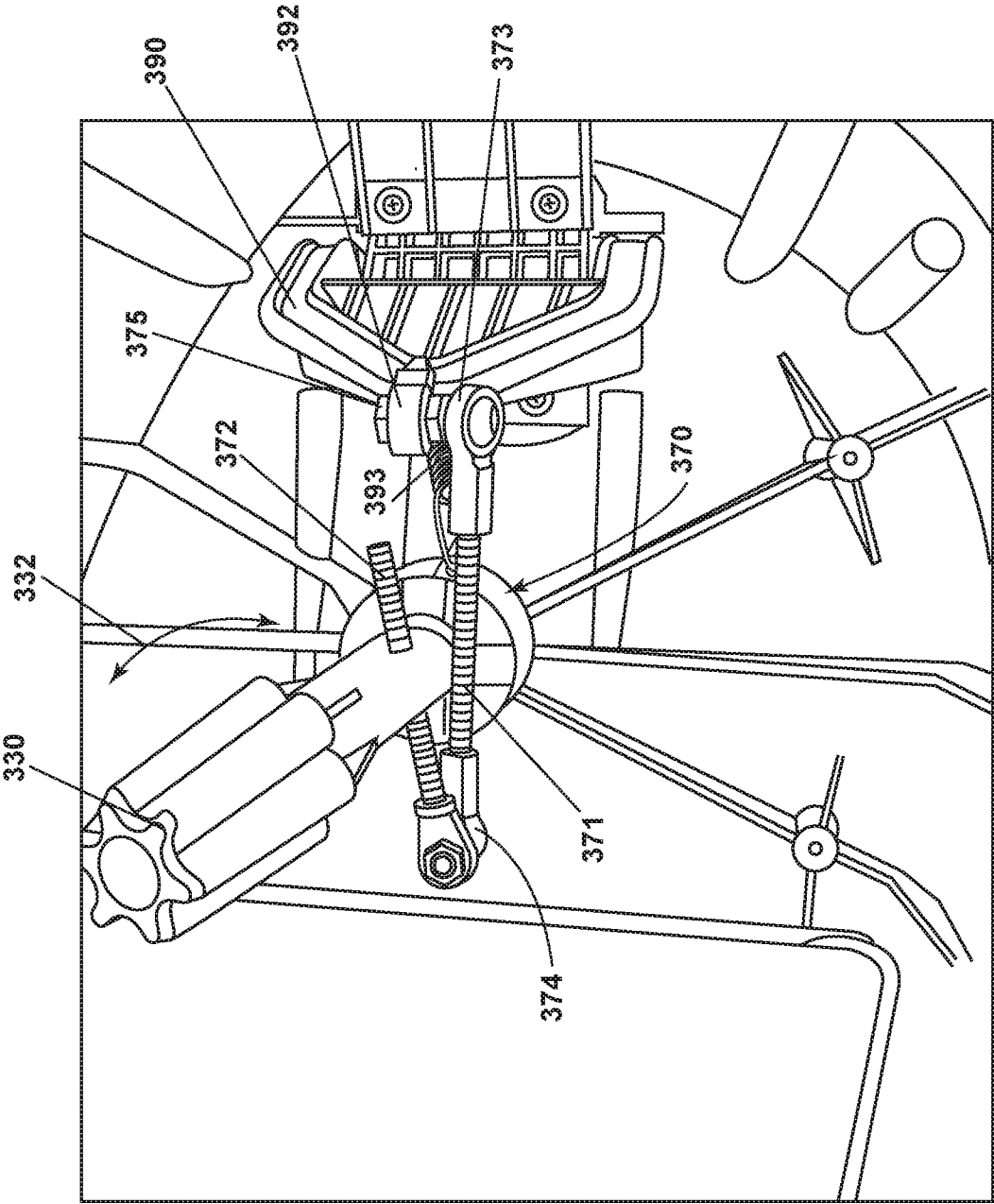


FIG. 10B

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2018/023054

A. CLASSIFICATION OF SUBJECT MATTER

IPC (2018.01) D06F 37/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC (2018.01) D06F 17/06, D06F 37/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Databases consulted: Orbit

Search terms used: MANUAL WASHING MACHINE DRIVE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 204780306 U JING YONGJUN YAO JIACHENG DU JUAN WANG MENGJIAO GE YUPENG LIU CHAO 18 Nov 2015 (2015/11/18) The whole document.	1-3,9,10,14,15
A	The whole document.	4-8,11-13
A	CN 103015112 A CHEN JIJUN 03 Apr 2013 (2013/04/03) The whole document.	1-15
A	CN 202426473 U ZHIBING ZHU 12 Sep 2012 (2012/09/12) The whole document.	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

04 Jul 2018

Date of mailing of the international search report

05 Jul 2018

Name and mailing address of the ISA:

Israel Patent Office

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Facsimile No. 972-2-5651616

Authorized officer

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Telephone No. 972-2-5651624

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/US2018/023054

Patent document cited search report	Publication date	Patent family member(s)	Publication Date
CN 204780306 U	18 Nov 2015	CN 204780306 U	18 Nov 2015
CN 103015112 A	03 Apr 2013	CN 103015112 A	03 Apr 2013
		CN 103015112 B	19 Jan 2018
CN 202426473 U	12 Sep 2012	CN 202426473 U	12 Sep 2012