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(54) **WASH FLUID DISTRIBUTION SYSTEM FOR A DISHWASHER**

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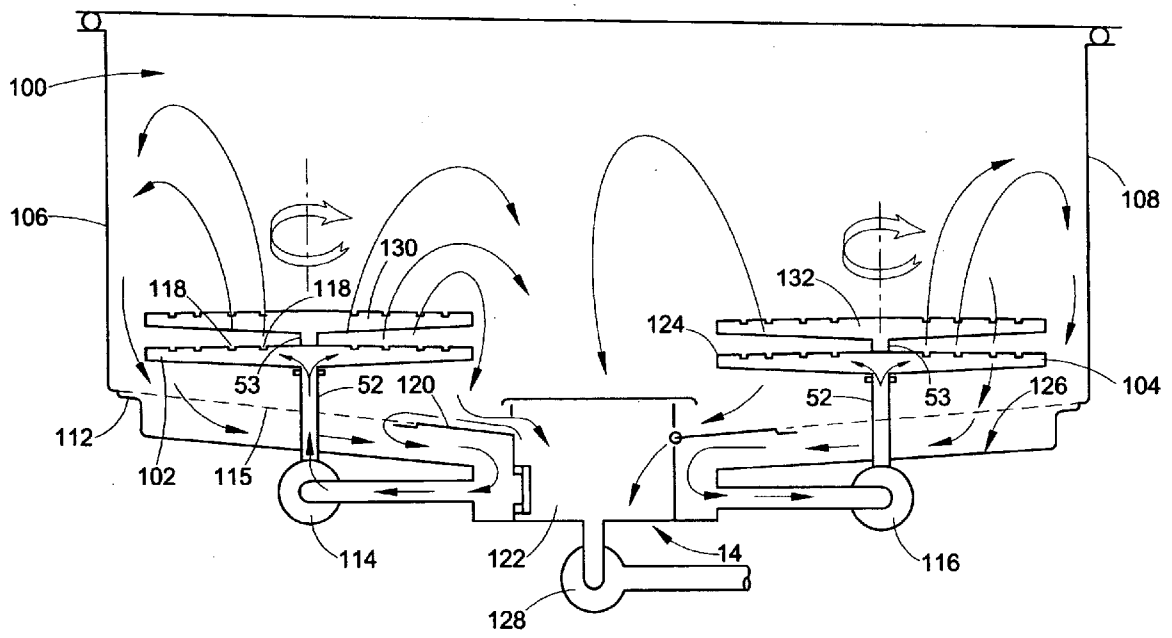
(57) **ABSTRACT**

A wash fluid distribution system for dishwashers includes a spray arm mounted in one of four quadrants of a chamber floor. The spray arms can have lengths that maintain full rotation within their respective quadrant. Spray arms can also have lengths that impinge or overlap into an adjacent quadrant during full rotation of the spray arms. Each spray arm operates with a corresponding, independently controlled wash pump system. Adjacent spray arms can rotate at a same speed in opposing clockwise or counter-clockwise directions. Spray arms can also rotate in different rotation planes. A slanted surface on the chamber floor terminates at a shared particle collection area, which is centered on the chamber floor.



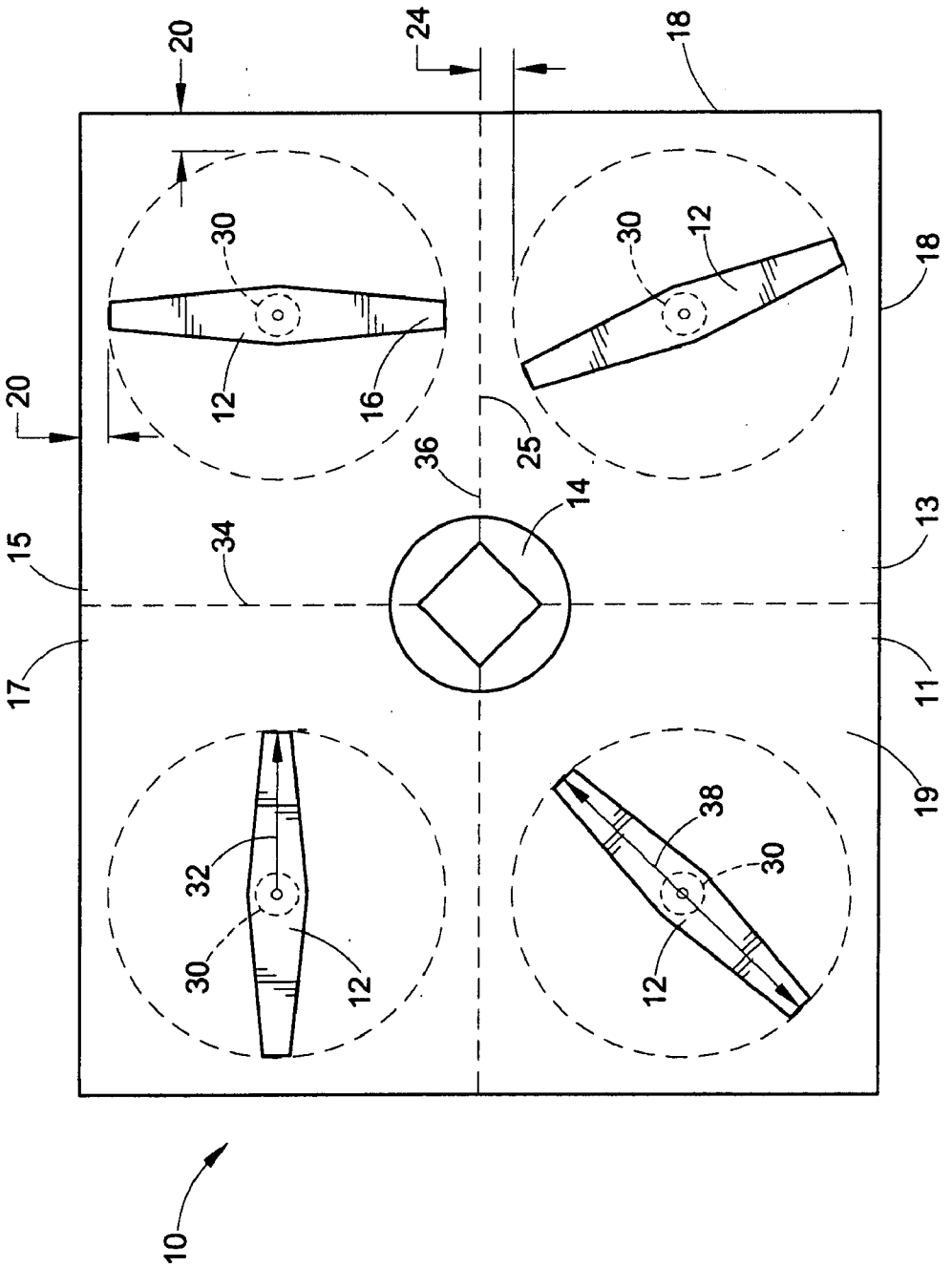


FIG. 1

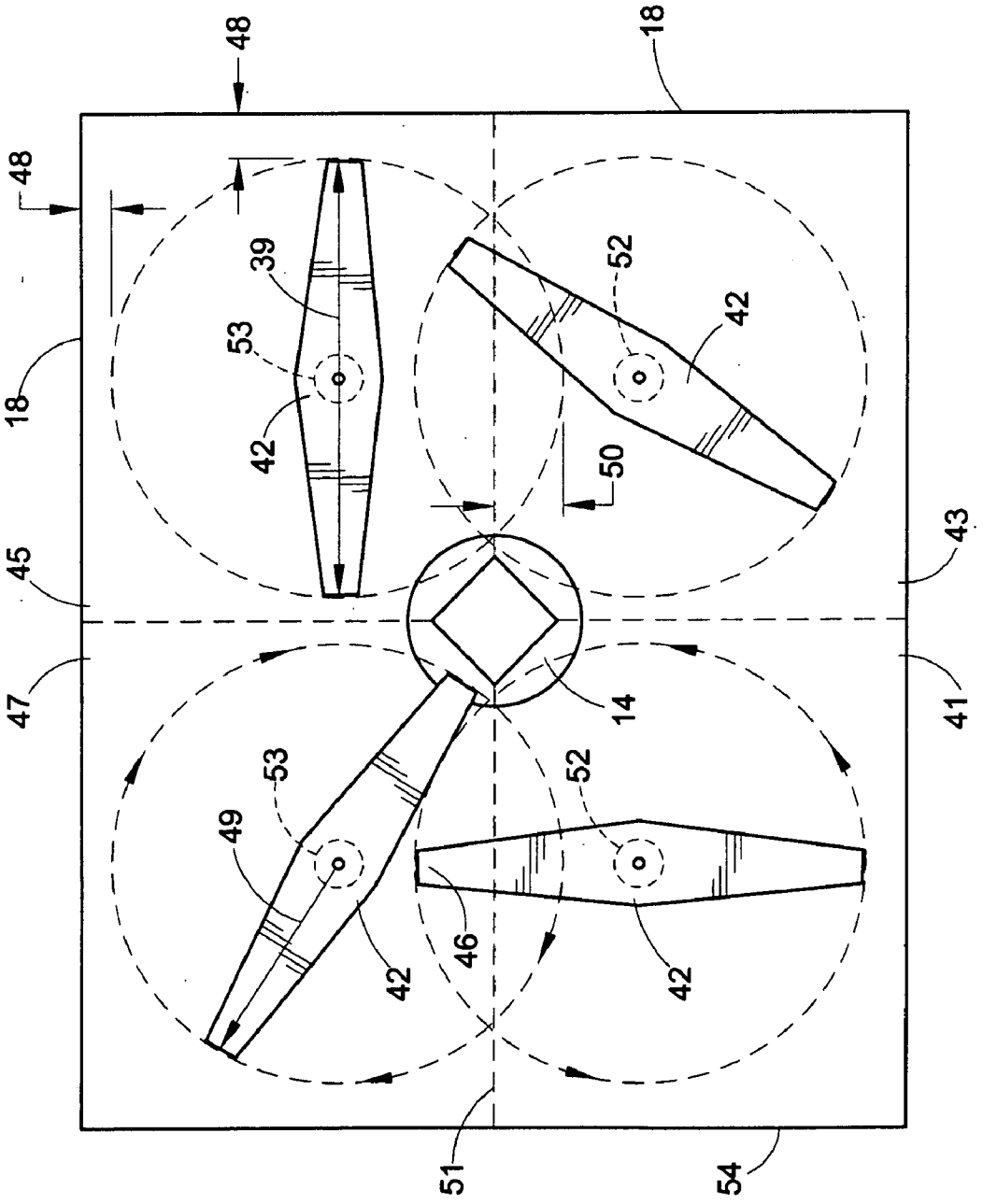
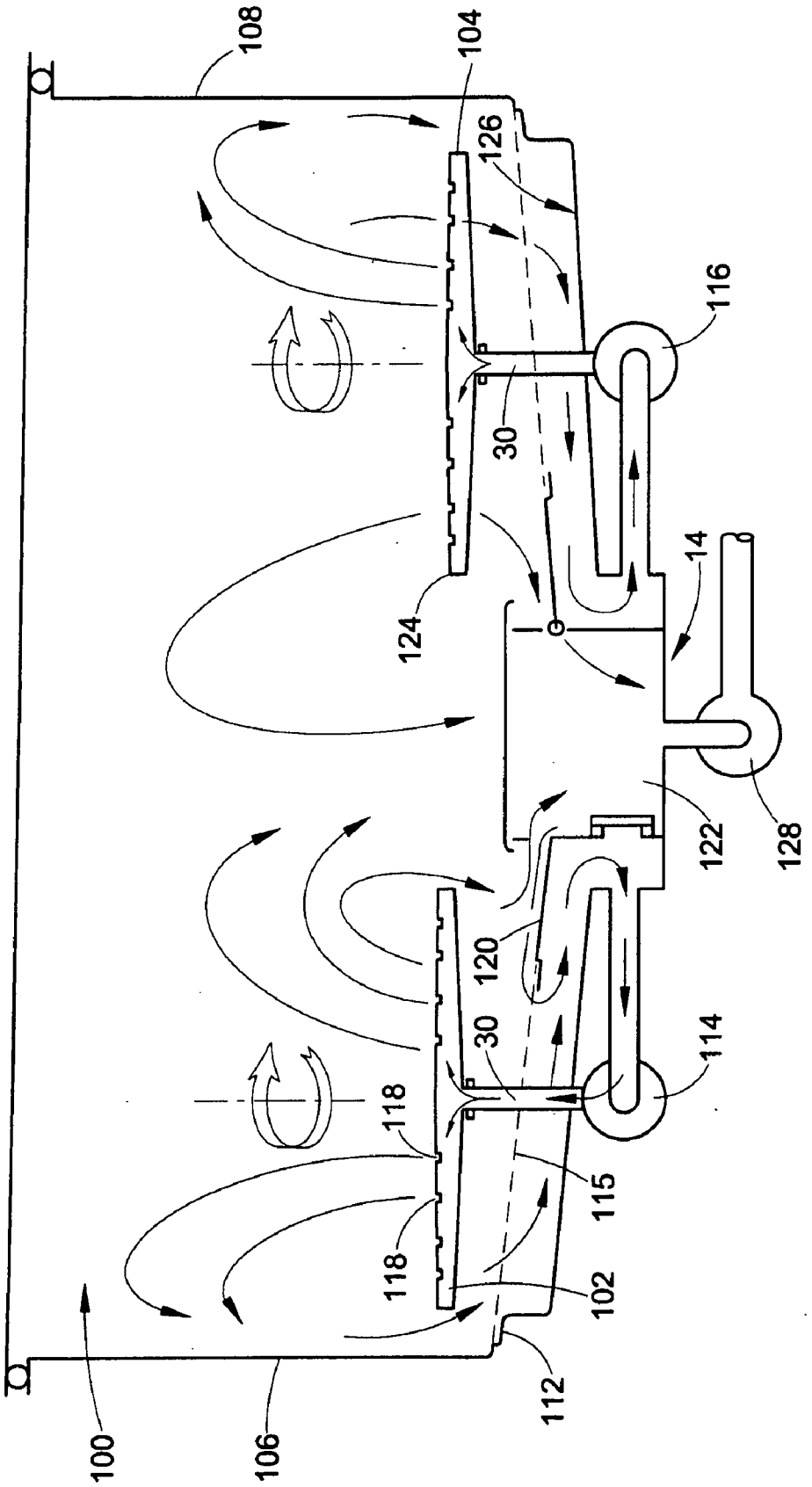


FIG. 2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128
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106

FIG. 3

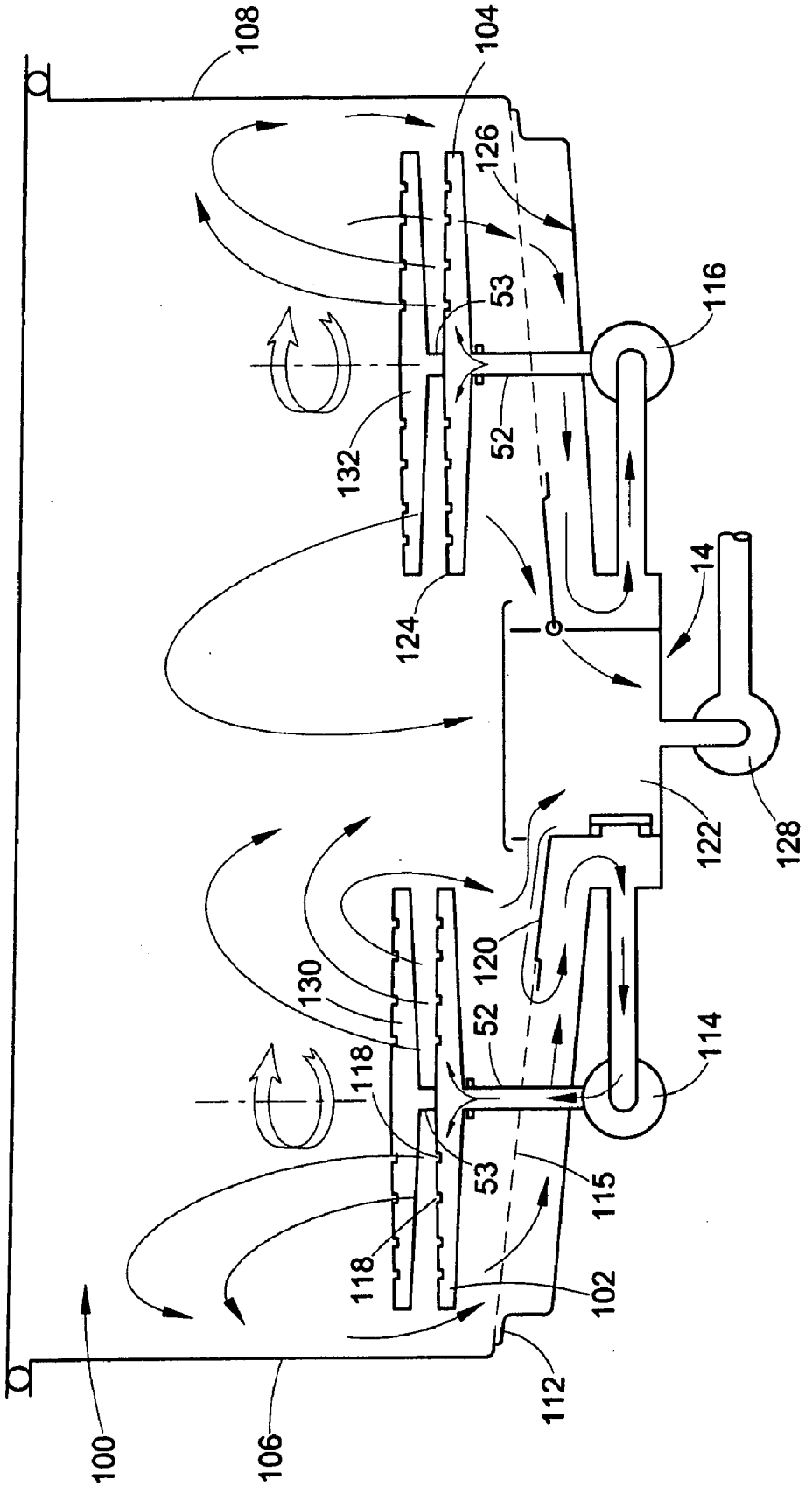
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FIG. 4

WASH FLUID DISTRIBUTION SYSTEM FOR A DISHWASHER

BACKGROUND OF THE DISCLOSURE

[0001] The present disclosure relates generally to a dishwasher fluid distribution system and, more specifically, to a system that includes a plurality of spray arms repositioned towards opposing chamber corners to accommodate greater appliance widths.

[0002] Modern, built-in dishwashers have been included as standard kitchen fixtures since the 1970s. While a great number of improvements have been made to their construction over time, their dimensions have remained essentially unchanged; hence, features may vary from dishwasher to dishwasher, but sizes are relatively standard. Conventional dishwashers are 24-inches wide by 24-inches deep; they are conveniently received in pre-fabricated cabinet spaces. Taller dishwashers generally provide for greater loading capacities.

[0003] Single and double drawer dishwashers are the most recent designs which accommodate user lifestyles. Two 24-inch drawers stack to measure a height equal to that of a conventional dishwasher; alternatively, one or two 24-inch drawers install in different regions of a kitchen space. One drawer is oftentimes too small and two drawers are oftentimes two much. Contemporary kitchens move away from traditional trends; they adopt cabinet spaces that design around fashionable, yet practicable, appliances. The present disclosure is directed towards a 30-inch dishwasher drawer which rests immediately below a counter space, and it is directed towards a fluid distribution subsystem which sprays water in the chamber. This drawer includes at least one rack having a greater width so that a user is provided with at least **144**-square-inches of additional rack space.

[0004] A 30-inch drawer requires a custom fluid distribution system to realize efficient chamber coverage. Existing dishwashers which have multiple spray arms assign one arm per rack: a first spray arm placed proximate to a lower rack; and, a second spray arm placed proximate to a mounted, upper rack. Conventional spray arms (hereinafter referred to as "primary spray arms") have diameters that travel most of the width and depth of a rack, so the corresponding jet spray tower is mounted at a center of the dishwasher. The tower delivers wash fluid to the spray arms, which then direct the fluid through the chamber in a specific spray pattern.

[0005] The primary spray arm is not efficient for wider dishwasher drawers because the chamber's width is unequal to its depth. The diameter of a primary spray arm can only approximate the depth of the dishwasher. The primary spray arm cannot be lengthened to cover any additional span because the chamber's shorter depth precludes the arm's travel. A longer primary spray arm will essentially collide with the front and rear chamber walls if it aims to complete a full rotation. The spray pattern of a shortened or standard-sized, primary spray arm will essentially fail to deliver water to dishes on the outermost regions of the longer rack.

[0006] A second disadvantage to the primary spray arm system occurs when a dish inadvertently blocks the sprayer. This results in the sprayer's entire range of motion being compromised, so no dishes in the load are cleaned and the wash cycle must be repeated. This results in inefficiencies in time and energy. Accordingly, there exists a need for a fluid distribution system that includes a plurality of shorter, regionally spaced spray arms that each directs a wash fluid spray pattern to the dishes supported in its corresponding region.

SUMMARY OF THE DISCLOSURE

[0007] A wash fluid distribution system for dishwashers includes four spray arms mounted proximate opposing corners of a chamber floor. A spray arm mounts to a corresponding tower in each quadrant of the chamber floor. The multiple spray arm system accommodates dishwashers having unequal width-by-depth dimensions. A 30-inch wide by 24-inch deep dishwasher includes shortened spray arms, each having lengths no greater than **15**-inches less a maximum two-inch clearance. The clearance is measured between distal ends of the four spray arms and a nearest dishwasher sidewall.

[0008] One aspect of the disclosure includes spray arms having approximately 8 to 11-inch lengths that maintain full rotations within their respective quadrants. A second embodiment includes spray arms having approximately 11 to 13-inch lengths that impinge a neighboring quadrant during full rotation. There are several methods to avoid collision of spray arms: (1) rotate the spray arms at a same speed in opposing clockwise and counter-clockwise directions; or, (2) rotate the spray arms in at least two different rotation planes.

[0009] Another aspect of the disclosure is at least one slanted surface on the chamber floor. The slanted surface sloped in a same direction for at least an entire length of the spray arm supported above it. The slanted surface orients towards and terminates at a shared particle collection chamber, which is centered on the chamber floor where innermost corners of the quadrants meet.

[0010] Each spray arm runs by a corresponding, independently controlled wash pump system. The wash pump systems pump wash fluid though the towers to the spray arms, which then directs the wash fluid towards the rack spaces within their respective regions. The wash fluid drops either to the slanted surface, where it is directed to the closest wash pump for recirculation, or to a conical section area surrounding the particle collection chamber, where it is directed therein for draining of soil particles.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a top plan view of a dishwasher chamber floor utilizing a fluid distribution system according to one aspect of the present disclosure;

[0012] FIG. **2** is a top plan view of a dishwasher chamber floor utilizing a fluid distribution system according to a second aspect of the present disclosure;

[0013] FIG. **3** is a front elevational view of a chamber body shown in FIG. **1**; and,

[0014] FIG. **4** is a front elevational view of a chamber body shown in FIG. **2**.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0015] The present disclosure is directed to a wash fluid distribution system (hereinafter synonymously referred to as the "fluid distribution system", the "spray arm system", and the "spray arm subsystem") for a dishwasher drawer. Specifically, the disclosure is directed to a thirty-inch (30-inch) dishwasher drawer. The spray arm system is mainly designed for purposes of even, efficient, and complete wash fluid coverage in extended dishwashers. For purposes of the present disclosure, an extended width dishwasher is an automatic

dishwashing appliance having a conventional 24-inch depth, but one having an extended width greater than 24-inches. The spray arm system is designed for any dishwasher having a rectangular footprint. The fluid distribution system can be adapted for use with dual rack dishwashers having standard 35-inch height dimensions, or they can be utilized with single drawers. The present disclosure is directed to a spray arm system for use with one rack; however, dual rack dishwashers are also contemplated by this disclosure.

[0016] The chamber floor of a conventional dishwasher is square-shaped with a width equaling its depth. A primary wash arm approximates 20-inches in length; it extends across a majority portion of the chamber's diameter. The wash arm has a tower usually positioned centrally on the floor. The chamber floor of the present disclosure is rectangular-shaped because its width is greater than its depth; hence, it requires a customized spray arm system.

[0017] Referring now to FIG. **1**, the fluid distribution system **10** disclosed herein includes a chamber floor **19** and a plurality of spray arms **12** and associated pump mechanisms to be used with a main rack, an upper rack, or a lower rack. Each of the spray arms is shorter in length than the primary arms used in conventional dishwashers; namely, their lengths that are no greater than one-half the width of the dishwasher. The lengths are shorter because each spray arm **12** is associated with a region or quadrant of the rack as opposed to an entire rack. Each of the spray arms **12** is spaced apart towards opposing walls, opposing ends, or opposing corners of the dishwasher compartment. FIGS. **1** and **2** are top plan views of chamber floor **19**, wherein various embodiments of spatial relationships of the spray arms are shown. Both figures show a dishwasher chamber floor utilizing a fluid distribution system having at least four spray arms **12** mounted proximate opposing chamber corners.

[0018] The embodiment of FIG. **1** includes four spray arms **12** that surround a central, shared particle collection area **14**. The collection area **14** is placed proximate to a centerpoint of the chamber floor **10**. The floor **10** is divided into four quadrants **11**, **13**, **15**, **17**, each of which is about 15 inches by 12 inches in size. One spray arm **12** is placed in each of the quadrants **11**, **13**, **15**, **17**. In FIG. **1**, the spray arms **12** are spaced apart such that opposite halves of the floor **10** substantially mirror each other.

[0019] In conventional dishwashers, an approximately two-inch clearance exists between the distal ends of a primary spray arm and the chamber inner sidewalls. A clearance dimension (shown as reference numeral "**20**") for the present disclosure is no greater than a maximum two-inch clearance. Furthermore, no spray arm **12** in this first embodiment impinges or overlaps onto a neighboring quadrant **11**, **13**, **15**, **17**. For example, a spray arm in quadrant **11** would not overlap into quadrants **13** and **17**. It is therefore anticipated that a length of a spray arm is no greater than about 11-inches for a one-inch clearance **20**, and the length of the spray arm is no greater than 10-inches for a two-inch clearance **20**. There also exists an inside clearance dimension or distance (shown as reference numeral "**24**") between the radius swept by the distal end **16** of each spray arm **12** and an inner dimension **25** of each of the quadrants **11**, **13**, **15**, **17**. The embodiment shown in FIG. **1** includes a clearance **20** of about two inches, a distance **24** of about two inches from the inside edges, and a spray arm length of about ten inches.

[0020] The spray arms **12** in the first embodiment are shown installed or mounted at substantially symmetrical spacing, but other spacings are contemplated by the disclosure. An associated tower **30** for each spray arm **12** mounts below the spray arm in its respective quadrant **11**, **13**, **15**, **17** where the following locations intersect: one half the clearance **20** plus the spray arm's radius **32** inward of the quadrant's outermost short edge; and, one half the clearance **24** plus the spray arm's radius inward the quadrant's outermost long edge. The clearances **20**, the distances **24**, and the radii **32** may vary for each of the four spray arms **12** in the first embodiment, but no spray arm ever extends beyond central axes **34**, **36** (which are perpendicular to each other) of the chamber floor. More specifically, a full rotation (shown in dotted lines in FIG. **1**) of each spray arm **12** is fully maintained within its respective quadrant **11**, **13**, **15**, **17**. The diameters of spray arms **12** are dependent upon the lengths of quadrant short edges if each spray arm is to maintain complete rotation within its own respective quadrant.

[0021] A second embodiment is shown in FIG. **2** to include spray arms **42** having a length **39** which sweeps a circular area having a radii **49** dependent upon the quadrant's long edge; hence, some overlap (shown as "**50**") is anticipated into neighboring quadrants. Lengths **38** of spray arms **12** in the first embodiment are no greater than the quadrant's short edge length minus the combined clearance **20** and distance **24**. These lengths are anticipated to fall within a range of between about 8 and 11 inches. Lengths **39** of the spray arms **42** in this second embodiment are no greater than the quadrant's long edge length minus twice the outside clearance **48**. It is anticipated that a clearance **20** is between one and two inches from the chamber sidewalls **18**; hence, the length **39** of each spray arm **42** is between about 11 and 13 inches. FIG. **2** shows spray arms **42** having a 13-inch length **39**. One-inch clearances **48** exist between the distal ends **46** of those spray arms **42** and the chamber sidewalls **18**. The rotational sweep of distal ends **46** (shown in dotted lines) of each spray arm **42** encroach upon or overlap into the quadrant (**41**, **43**, **45**, **47**) adjacent to its own quadrant's inside long edge **51**. The 13-inch long spray arms provide an approximately three-inch overlap **50**. A tower **52**, **53** for each spray arm **42** mounts in its respective quadrant **41**, **43**, **45**, **47** at the intersection of the following lines: the clearance **48** plus the spray arm radius inward the outside quadrant short edge **54**; and, the clearance plus the spray arm radius inward the outside quadrant short edge.

[0022] Each of spray arms **12**, **42** of each embodiment can be run either by a shared pump system or by independent pump systems. An independent pump system utilizes a plurality of pumps equal to the number of spray arms; a corresponding pump works in conjunction with one spray arm. Each of the pumps is independently controlled to provide flexible duty cycles. There are inherent advantages to flexible duty cycles: a reduction in energy consumption; a reduction in noise pollution; a decrease in water usage; an increase in target wash options; and, an availability of partial load washings.

[0023] FIG. **3** shows a front elevational view of a dishwasher chamber **100** for the fluid distribution embodiments shown in FIG. **1**. The front spray arms **102**, **104** and rear spray arms (not shown) are in alignment, so a view of the latter pair of arms is obstructed. The front spray arms **102**, **104** mount to towers **30** spaced a distance from sidewalls **106**, **108**. The towers **30** support the spray arms **102**, **104** at a height slightly above the chamber floor **112**. At least one rack (not shown) is supported above the spray arms **102**, **104** in the chamber

space **100**. For dishwashers utilizing at least a second, upper rack, additional spray arms are fixed to at least one manifold proximate to the upper rack.

[0024] Each spray arm **102**, **104** utilizes its own wash pump **114**, **116** that forces a jet of wash fluid (hereinafter synonymously referred to as "water") through the tower and outwards at least one nozzle **118** at or past its distal end. Certain jet system embodiments utilize a conduit that delivers water to a plurality of nozzles **118** spaced along the length of each spray arm **102**, **104**. The spray arms **102**, **104** rotate (shown as outlined arrows) as the wash fluid is delivered through the tower **30** to force water to travel in patterns (shown as single-lined arrows) that cover the entire chamber **100**. The spray arms **102**, **104** in FIG. **3** are shown to rotate in a clockwise direction, but counter-clockwise rotation is also contemplated by the disclosure. At least one spray arm **102** or **104** can travel or rotate in the clockwise direction while the other spray arm **102** or **104** can travel or rotate in the counter-clockwise direction. The direction of rotation of the spray arms may be established by the direction of the jet system in a manner well known in the art.

[0025] The wash fluid performs certain functions dependent on the wash cycle: it rinses dishes and removes soils in a pre-wash; it also circulates detergent and removes stuck on food or particles in the main wash; and, it rinses all detergent and remaining soil in the rinse period. The spray arms **102**, **104** direct wash fluid at the dishes supported on the racks. Between ten to twenty percent of water drops onto a conical section area **120** that delivers it to a sump **122** as part of the particle collection area **14**. The remaining water drops to a slanted surface **126** in the floor **112** for recirculation.

[0026] Primary wash arms in conventional dishwashers utilize pump systems that downwardly slope towards sump portions that exist underneath the spray arm's travel circumference; hence, the lowest point of the collection chamber is typically beneath the primary spray arm on the chamber floor. Essentially, the chamber floor slopes downwards from the outside chamber walls towards the chamber center. The slope stops at the collection chamber. The present fluid distribution system relocates the sump **122** (FIGS. **3** and **4**) to a central area or region removed from underneath the spray arms **12**, **42** (FIGS. **1** and **2**) and **102**, **104** (FIGS. **3** and **4**). Slanted surface **126** terminates past the distal end **124** of the spray arms **102**, **104**.

[0027] Each slanted surface **126** causes fallen water to travel to the closest of the plurality of wash pumps **114**. The water becomes coarse because it carries soil and detergent, so eighty to ninety percent of the water is filtered through coarse filter **115** before it is returned to the respective wash pumps **114**. The wash pumps **114** re-circulate the water during the next wash period in the sequence selected.

[0028] The sump **122** is located at a central area of the rectangular chamber floor **112** at the innermost quadrant corners so all the spray arms **102**, **104** share the same sump. The bottom wall of the sump **122** rests on the lowest point of the dishwasher chamber floor **112**. The top wall of the sump **122** rests at a height below the plane in which the spray arms **102**, **104** rest. The conical collection area **120** surrounds the sump **122**. Ten to twenty percent of the water drops in the conical collection area **120** and is directed to the sump **122** and settles into the chamber. While the sump **122** prevents a re-entry of the particles collected by the sump into the dishwasher chamber **100**, clean water is displaced out of the sump for recirculation. A check valve **128** in communication with the sump **122** evacuates both the particle collection area **14** and the rest of the system. It activates a drain pump to empty the particle and soil contents from the sump **122**.

[0029] FIG. **4** is a front view of an alternate dishwasher chamber **100** for the fluid distribution embodiment shown in FIG. **2**. The spray arms are offset in different horizontal or rotational planes to avoid contacting each other. Thus, a height of a tower **52** associated with a front spray arm **102**, **104** is not equal to that of a tower **53** associated with the rear arm **130**, **132** behind it; hence, a first pair of towers **52** is shorter or taller than a second pair of towers **53**. There is no limitation to which pair of towers share heights: both front towers may be of equal height and shorter than the rear tower; or both front towers may be of equal height and taller than the rear towers; or, a first pair of towers at opposite corners (i.e., a front and an opposing rear tower) can be a first height while the remaining pair of towers at the other opposite corners is of a second height, where the first and second heights are different from each other.

[0030] The towers are oriented to avoid collisions in both embodiments by the lateral spatial relationship in the first embodiment; and, the vertical spatial or planar relationship in the second embodiment. The towers **52**, **53** for the second embodiment, however, can be equal in height if the spray arms **102**, **104**, **130**, **132** run in certain sequences which avoid their contacting one another. Rotational direction can also lessen chances of spray arm collision. For example, front spray arms **102**, **104** can rotate in the clockwise direction while the rear spray arms rotate in the counter clock-wise direction. A central control maintains that the speed of rotation for each spray arm is identical for all spray arm systems. The spray arms **102**, **104**, **130**, **132** are timed to not collide.

[0031] The present spray arm **102**, **104**, **132**, **134** is not limited to only the embodiment shown in FIGS. **1-4**; rather, a routine spray pattern can be achieved with many different spray arm designs. The spray arm can have any of a plurality of sizes, shapes, and dimensions, s.a., e.g., planar, angled, curved, straight, bent, rounded, tapered, winged, oval, and petal-shaped, etc.

[0032] The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations.

What is claimed is:

1. A wash fluid distribution system for dishwashers having a chamber having a chamber floor having a width equal to or greater than a depth, said fluid distribution system comprises:

a plurality of spray arms;

a particle collection area shared by said plurality of spray arms;

wherein the chamber floor comprises four quadrants, one of each of said spray arms is mounted in an associated one of said four quadrants of said chamber floor.

2. The wash fluid distribution system of claim **1**, wherein said depth is about 24-inches and said width is greater than 24-inches.

3. The wash fluid distribution system of claim **2**, wherein said width is about 30-inches.

4. The wash fluid distribution system of claim **1**, wherein each of said plurality of spray arms comprises a length that is no greater than one-half of said width of the dishwasher chamber floor.

5. The wash fluid distribution system of claim **1**, wherein a clearance between a distal end of each of said spray arms and an adjacent dishwasher sidewall is a maximum of two-inches.

6. The wash fluid distribution system of claim **4**, wherein each of said spray arms comprises a length such that a distal end of each of said spray arms remains within its associated quadrant throughout a full rotation.

7. The wash fluid distribution system of claim **4**, wherein each of said four spray arms comprises a length that causes the spray arms to protrude into an adjacent quadrant during a full rotation of said spray arm.

8. The wash fluid distribution system of claim **1**, wherein said spray arms each run by a corresponding wash pump system independently controlled to provide flexible duty cycles.

9. The wash fluid distribution system of claim **1**, wherein said spray arms are each mounted to a respective tower each of which is fixed to said chamber floor.

10. The wash fluid distribution system of claim **1**, wherein said spray arms each rotates in a clockwise direction.

11. The wash fluid distribution system of claim **1**, wherein said spray arms each rotates in a counter-clockwise direction.

12. The wash fluid distribution system of claim **1**, wherein at least one of said spray arms rotates in a clockwise direction and at least one of said spray arms rotates in a counter-clockwise direction, and wherein said spray arms rotating in opposite directions are mounted on a same side of said chamber floor.

13. The wash fluid distribution system of claim **1** further comprising a slanted surface in said chamber floor, said slanted surface is oriented towards and terminates at said particle collection chamber.

14. The wash fluid distribution system of claim **13**, further comprising a conical section area that surrounds said particle collection chamber, said conical section area partially formed by said slanted surface, wherein wash fluid that falls into said conical collection area is directed into said particle collection chamber.

15. The wash fluid distribution system of claim **1**, wherein said particle collection chamber is centrally positioned on said chamber floor adjacent to where innermost corners of said quadrants abut.

16. The wash fluid distribution system of claim **7**, wherein said spray arms are vertically offset in at least two rotation planes to avoid collision with each other.

17. The wash fluid distribution system of claim **1**, wherein said spray arms rotate at a same speed.

18. The wash fluid distribution system of claim **1**, wherein said plurality of said spray arms comprises four spray arms.

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