

Feb. 14, 1967 C. W. RANSON 3,304,063
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CIRCULATIVE FLOW AND TANGENTIAL INLET
Filed March 29, 1965 2 Sheets-Sheet 1

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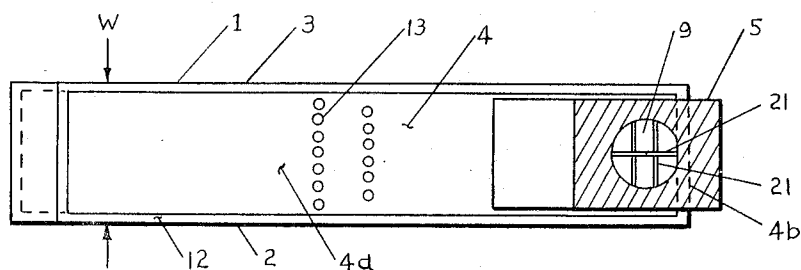


FIG. 2

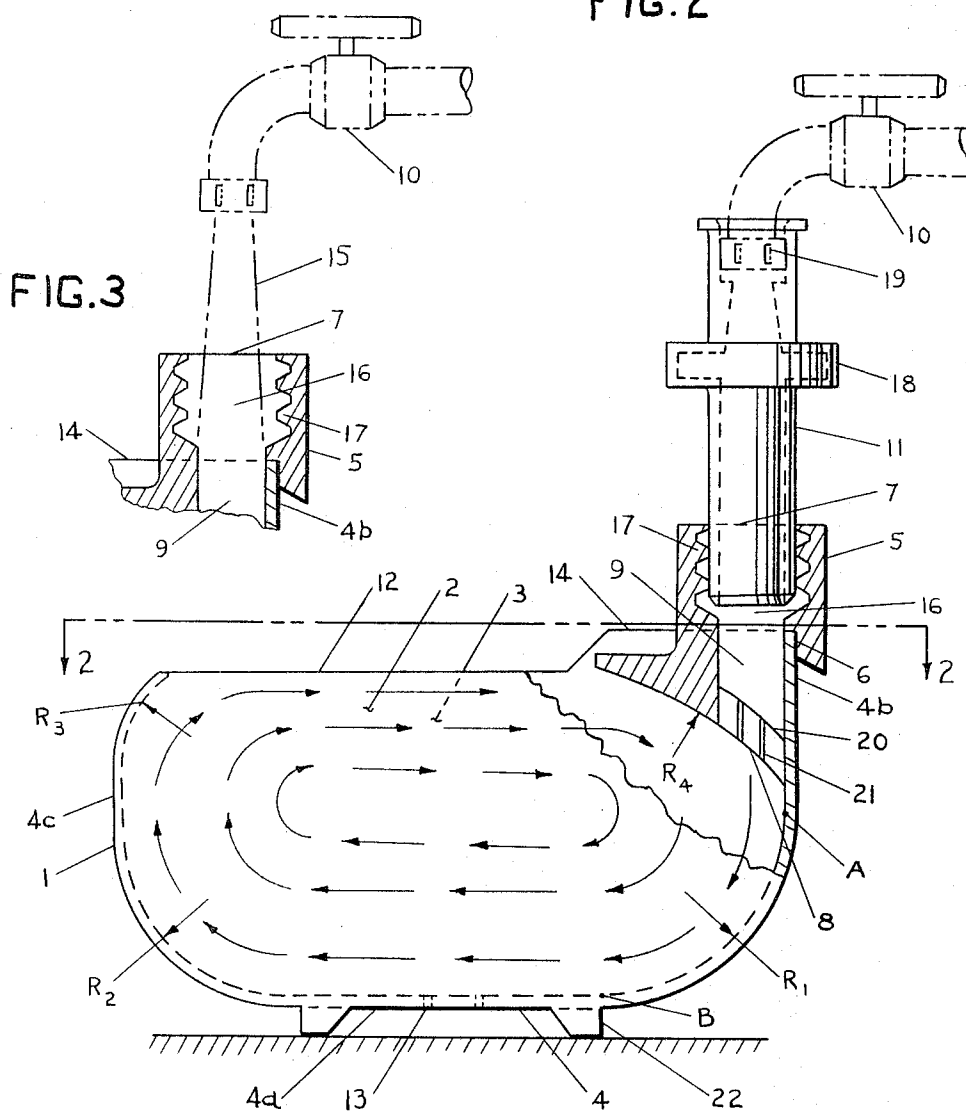


FIG. 1

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FRUIT AND VEGETABLE WASHING DEVICE WITH VERTICAL
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LEGEND

- A — FREE JET WITHOUT INLET UNIT, $W=.35$ LENGTH (TYP)
- B — OPEN JET WITH INLET UNIT PER FIG.3
- C — CONNECTED CONDUIT AND INLET UNIT PER FIG.1
- D --- OPEN JET WITH INLET UNIT PER FIG.3, $W=.5$ LENGTH

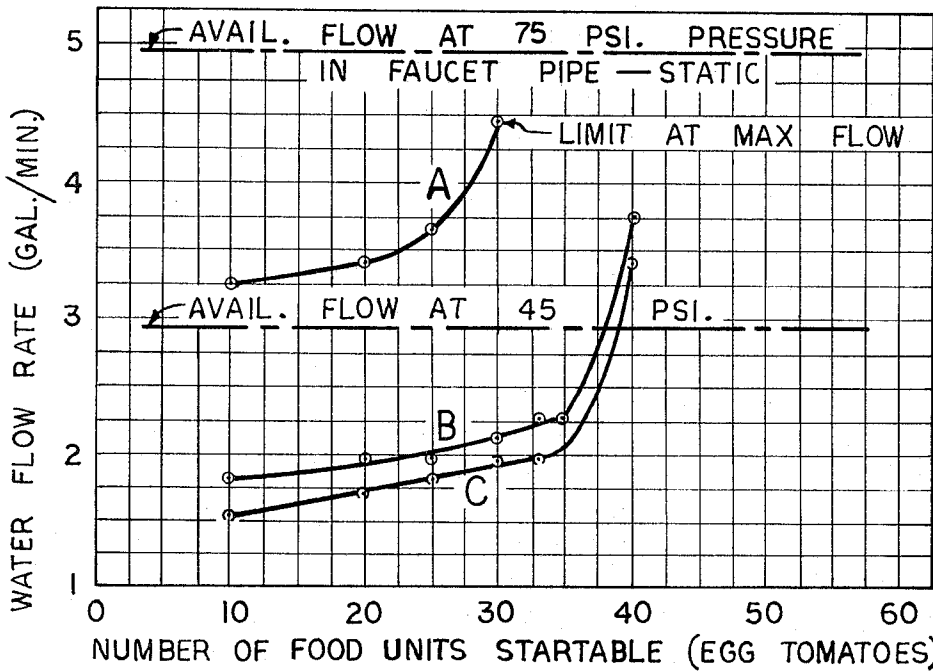


FIG 4

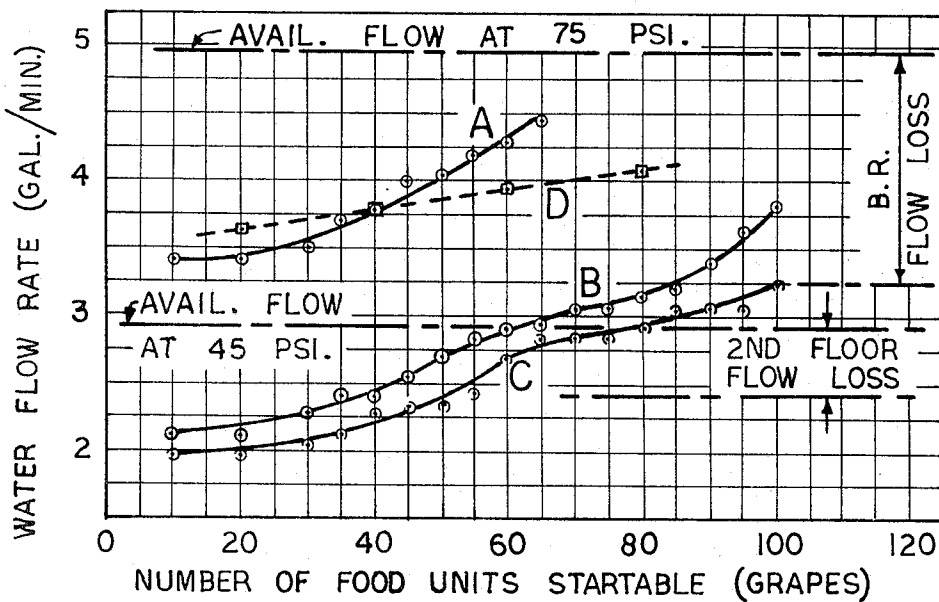


FIG.5

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3,304,063
**FRUIT AND VEGETABLE WASHING DEVICE
WITH VERTICAL CIRCULATIVE FLOW AND
TANGENTIAL INLET**

Charles W. Ranson, 7906 Agnew Ave.,
Los Angeles, Calif. 90045
Filed Mar. 29, 1965, Ser. No. 445,857
8 Claims. (Cl. 259—18)

This is a continuation in part of application Serial No. 240,786 filed Nov. 29, 1962, now abandoned. The present invention relates to a washing device for fruits, vegetables, and other solid food units. The device provides for imparting to contained liquid a two dimensional circulative flow in a vertical plane. Provision is included for the circulative liquid flow to receive sufficient kinetic energy from tangential inlet liquid flow to effect continuous vertical circulative motion of contained food units.

Objects of the invention are to provide for the thorough cleaning of all surface areas of fruits and vegetables in minimum time and without bruises or damage.

Other objects are to provide a simple cleaning device having no moving mechanical parts, and which can be used conveniently in household kitchen sinks, and which can utilize efficiently the limited kinetic energy available from conventional household faucet water.

Another object is to provide for cleaning a larger load of fruits or vegetables in a given size of container with a fixed water faucet pressure.

Another object is to reduce or eliminate liquid splashing from the location of liquid inlet to the washing device.

An object is to eliminate the need for an extension conduit from the faucet to the inlet unit of the washing device to result in greater convenience of use.

Another object is to eliminate the complex problem and cost of providing a satisfactory universal faucet adapter for an extension conduit.

A number of other objects and advantages will become apparent as the description proceeds.

One form of the present invention is illustrated in the accompanying drawings wherein similar numerals refer to similar parts throughout the views.

FIGURE 1 is a side view of the fruit and vegetable washing device with a faucet extension conduit properly positioned beneath a water faucet. The arrows indicate the flow path of the circulative liquid flow.

FIGURE 2 is a plan view along line 2—2 of FIGURE 1 showing the comparatively narrow width of the washing device.

FIGURE 3 is a fragmentary view of a portion of FIGURE 1 showing the extension conduit of FIGURE 1 removed for the preferred mode of operation, using an open jet directed into a vertically extending inlet unit.

FIGURE 4 is a graphical plot of test data showing the water flow rates available from kitchen faucets and the water flow rates required to circulate various numbers of egg or cherry tomatoes. The performance of three types of water jet inlets is compared.

FIGURE 5 is a graphical plot of test data showing the water flow rates available from kitchen faucets and the water flow rates required to circulate various numbers of red skinned grapes. The performance of three types of water jet inlet units is compared.

The washing of fruits and vegetables in the kitchen has heretofore been accomplished by the use of a colander, a conventional kitchen pan, or by hand rubbing under an open faucet.

The colander is a bowl-shaped sieve with a base. For washing purposes the colander is held under an open faucet while containing a pile of food units. The bulk of the water follows the path of least resistance and flows

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around rather than through the pile of food units. The velocity of the water seeping between the food units is low due to resistance so that liquid scouring and dissolving action is relatively inefficient and slow. Also the food units lie static so that areas of mutual contact and areas of contact with the container receive no washing.

The conventional kitchen pan is generally used for washing by filling the bottom of the pan with food units and most of the remainder with water. The pan is then shaken by hand to simulate the action of a tumbling barrel. The cleaning action is highly erratic and inconsistent. Rinsing is only partial as the liquid is poured out. Bruises and damage to the surfaces can be done to berries and delicate skin fruits by the shifting weight of the total load.

The prior art has also provided other articles related technically to the present washing device. The most basic of these is a jet type washer of Patent No. 2,760,365, by O. C. Norton, issued August 28, 1956. In this device, a jet of water is directed downwardly to impinge on the surface of water contained within a circular bucket. The jet penetrates into the contained liquid causing turbulence and agitation of articles being cleaned. The inlet jet of water is in no way confined by structure and this elementary basic mode of operation is hereinafter referred to as a free jet mode.

Another prior mode of operation for washers has been provided in Patent No. 1,245,768, by F. C. Randall, issued Nov. 6, 1917. In this device, an open top container having spaced flat side walls and a wrap around curved bottom and end walls, is designed to operate from an overhead faucet. The wall at one end of the container is slanted outwardly at 30 degrees to vertical. This slanted end wall and the attached side walls function in use as a chute for inlet water from an overhead faucet. The inlet jet impinges on the slanted open channel or chute and flows down the slanted surface into the liquid below. At high rates of water flow the elevation of the contained liquid may be high and the inlet jet may impinge directly on the surface of contained liquid. In this event, the mode of operation approaches that of the free jet mode described above. In general, the mode of operation of Randall's device is hereinafter referred to as an inclined open channel mode.

A third relevant mode of operation previously provided in the art is described in Patent No. 1,053,223, by J. A. Robertson, issued Feb. 18, 1913. This device includes a container generally shaped as in FIGURES 1 and 2 herein but having parallel side walls spaced far apart to provide very large width. The device has a liquid inlet unit located upwardly at one end wall and oriented to direct inlet flow tangentially down along the wall surface. The inlet unit connects with a pressurized water supply system through a flexible or other conduit. The inlet unit includes a plurality of small exhaust apertures and right angle elbows so that substantial liquid pressure is required to force the inlet water through the high flow resistance of the inlet unit. This mode of operation wherein a conduit is connected to a faucet or other pressurized water supply and extended to provide tangential inlet flow to the container is hereinafter referred to as a connected conduit mode.

Each of the free jet, the inclined open channel, and the connected conduit has certain advantageous and disadvantages as applied to the present type of washing device. The free jet has low cost, is very convenient to use, but has poor operating efficiency as shown in FIGURES 4 and 5. These figures will be discussed in detail further on. The inclined open channel was tested with a container similar to that of FIGURES 1 and 2. The container was modified to have an end wall slanted outwardly at 30

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degrees from vertical and extended upwardly above normal liquid level. The slanted wall was flanged inwardly to provide a chute or channel. A vertical free jet when directed against the inclined channel, fanned out downwardly with an included angle of about 120 degrees from the point of impact resulting in wasted lateral components of flow. Also kinetic energy was lost by liquid impact on the inclined wall and by local turbulence and eddies at the impact region. The tests showed that the inclined open channel mode of operation is substantially less efficient than the free jet mode of operation as applied to a washing device of the present type. Hence, the following discussion will exclude the inclined open channel in preference to the free jet.

The connected conduit provides greater operating efficiency than the free jet, as will be discussed presently with reference to FIGURES 4 and 5, but has the disadvantages of inconvenience in use, greater cost, and the difficulties of providing universal connectors suitable for attaching the conduit to many types and sizes of faucets quickly, easily, and without leaking under pressure. Also, in order to conform with national and local plumbing codes, the connected conduit configuration requires a vacuum breaker, not shown, to prevent back siphonage in the event of the loss of water pressure.

The present invention provides a different mode of operation. This mode is illustrated in FIGURE 3 wherein an open jet from a faucet is recaptured and confined within a short length of vertical conduit, also shown in FIGURE 1. This configuration has been found in carefully conducted and calibrated tests to provide an efficiency only a little less than that of the connected conduit, while retaining the exceptional convenience of use and low cost of the free jet. The tests will be described in conjunction with the subsequent discussion of FIGURES 4 and 5. It has also been found that the inlet unit of FIGURE 3 when combined with a relatively narrow width two dimensional container, as shown in FIGURE 2, results in a washing device having high overall efficiency and having the capability of operating effectively while using the very limited power available from conventional, municipal water supply systems.

The connected conduit mode of operation as applied to the present narrow width, two dimensional flow device is illustrated in FIGURE 1. Water pressure from the faucet is exerted directly on contained liquid within the washing container to cause rotation thereof.

The mode of operation illustrated by FIGURE 3 is greatly different from that of FIGURE 1. The open jet from the faucet is captured at the terminal end by an inlet conduit which prevents lateral expansion and which directs the jet axially into contained liquid with effective penetration. The pressure of the liquid within the faucet conduit is converted to the kinetic energy of motion of the open jet. The pressure within the open jet goes to zero so that there is no pressure link between the water faucet conduit and the mass of liquid within the container. All of the motion of the contained liquid must be derived from the utilization of kinetic energy from the open jet. The energy gain from loss of liquid elevation is the same as in the connected conduit mode of operation. Tests have shown that the efficiency of the mode of operation of FIGURE 3 is far superior to that of a free jet without an inlet unit. These test results were greatly in excess of those expected. The tests show that the short, open, vertical inlet conduit when properly expanded upwardly to capture the entire expanded jet (the diameter of the open jet increases considerably as a function of the amount of faucet valve opening) and when combined with a two dimensional container wherein the kinetic energy of the inlet liquid is almost fully utilized, makes it feasible to utilize the mode of operation as in FIGURE 3 for the practical everyday washing of fruits and vegetables at the kitchen sink, where the power available from the faucet is

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very marginal. The mode of operation illustrated by FIGURE 3 wherein a terminal inlet unit is used to laterally confine and axially guide an open jet is hereinafter referred to as the open jet with inlet unit mode.

Referring to the several figures, washing device 1 is comprised of side walls 2 and 3 extending longitudinally and vertically and spaced apart in relative proximity. A lateral wall 4 extends between side walls 2 and 3 to provide a bottom wall 4a and two opposite end walls 4b and 4c. The bottom wall 4a and end wall 4b are faired together by radius R_1 to provide a curved inner surface as shown.

The inner surface of end wall 4b extends vertically above point A, which is the point of tangency with radius R_1 . Point B indicates the lower point of tangency with radius R_1 . Other portions of lateral wall 4 are curved and faired as indicated by radius R_2 and radius R_3 . The internal surface of lateral wall 4 provides a smooth curved perimeter flow path for contained liquid.

Washing device 1 includes a liquid inlet portion or unit 5 which clips to end wall 4b by notch 6 in the inlet unit. Inlet unit 5 includes an upper admission port 7, a normally submerged exit port 8, and an interconnecting duct portion 9. Duct portion 9 extends substantially vertically over at least upper portions thereof to effectively engage the flow of a downwardly directed water jet without appreciable shock impact or splashing. Duct portion 9 may be straight, slanted, or curved to provide tangential inlet flow as described below. Duct portion 9 is adjacent to end wall 4b so that wall 4b forms a short arc portion of the wall of the inlet duct as shown in FIGURE 2. As an option, duct portion 9 may be offset from end wall 4b a small distance. The proximity of the inlet duct to end wall 4b provides a tangential liquid inlet flow with a smooth transition to a curved flow path below point of tangency A.

For operation, the device is partially filled with fruits or vegetables or other food units and placed under an open faucet 10. Device 1 is positioned so the water jet enters port 7 of inlet portion or unit 5. The water may enter as an open jet, FIGURE 3, or as captive flow through conduit 11, FIGURE 1, as will be discussed. The water jet passes through inlet unit 5 and exits at port 8 entering the container portion of the washing device. The water jet enters adjacent to end wall 4b, passes tangent point A, and is guided by the surface at R_1 into a circulative path. The liquid is further directed into a circulative path by the surfaces at R_2 and R_3 as well as the curved surface R_4 of the inlet unit. The established flow path is in accordance with the arrows shown in FIGURE 1. The liquid major exhaust occurs as overflow along the length of upper perimeter 12. Auxiliary exhaust ports 13 in bottom lateral wall 4a provide for the continuous exhausting of small liquid jets to remove sand and solid particles.

Washing device 1 contains liquid vertically within a width, W of relatively narrow proportions as shown in FIGURE 2. This lateral confinement provides for two dimensional liquid flow in a vertical plane. The circulative flow pattern is induced by the tangential inlet jet and the curved inner surfaces of the lateral side wall, FIGURE 1. Two dimensional confinement contributes greatly to liquid flow control and reduces dissipation of kinetic energy from lateral flow and turbulence.

As stated previously, side walls 2 and 3 are spaced apart in relative proximity or in the state of being mutually near. This proximity endows the device with a width smaller than the length or height or each. The device has been found to be satisfactorily operable using conventional household faucets and a reasonable container volume when width, W is nearly one half or less of the length or height of the device. As the width of the height decreases with respect to the length or height, the efficiency and load capacity increase. For optimum, practical operation, the ratio of width to maximum length or height of the container portion is about one third. The

preferred largest ratio for practical use is less than one half. When the width of the device is relatively large with respect to the length or height the two dimensional flow pattern is lost and localized random liquid agitation occurs. This results in erratic and negligible washing action. Consequently, side walls 2 and 3 are spaced apart in relative proximity suitable for the establishment of stable two dimensional liquid flow. The specific wall proximity for satisfactory performance in any given installation depends upon variables including the liquid mass flow rate, the height and length of the device, contours of the device, the density and dimensions of the food units to be washed, and the size of the wash load.

The kinetic energy of the inlet jet is conserved by the relatively large proportions of radii R_1 , R_2 , R_3 , and R_4 , and by the substantially two dimensional liquid flow pattern. The overflow liquid is of low velocity and low kinetic energy loss. Viscosity functions to maintain the entire liquid body in a state of circulative flow.

The two dimensional circulative liquid flow in a vertical plane imparts similar circulative motion to contained food units. The submerged food units are buoyed by forces equal to the weights of the displaced liquid. Consequently, only a relatively small amount of liquid drag force is required to lift a given food unit vertically against the gravity force. The drag force of a solid body in non-laminar liquid flow is proportional to the relative velocity squared. Hence, by constructing washing device 1 as described, to conserve kinetic energy and to maintain high liquid rotative velocity, the food units are forced to rise and circulate with the liquid. In tests it was found that the food units experience local tumbling as they move in general circulative flow. This tumbling action adds to the liquid scouring effect and to the cleaning by mutual attrition between food units.

During operation of the washing device, insecticides, fungicides, and other chemicals and soil particles are progressively removed from food units by a continuously diluting liquid flow. The impurities are carried away in the bulk liquid overflow along perimeter 12. The length of the perimeter is relatively long to provide a small liquid overflow rate per unit length of weir. This reduces or prevents the loss overboard of food units as they circulate with the circulative liquid flow. Heavier non-soluble impurities are discharged through auxiliary exhaust ports 13 as the impurities are swept by liquid along the surface of bottom wall 4a. Ports 13, by the removal of the liquid boundary layer, retard the formation of turbulence and improve efficiency by conserving kinetic energy of the main liquid circulative flow. When faucet 10 is closed, drainage occurs automatically through ports 13 permitting food units conveniently to be poured from spout 14 without liquid.

For normal operation with an open jet and inlet unit as in FIGURE 3, inlet unit 5 of device 1 is placed in line with an open water jet 15 from faucet 10. Tests have shown that much larger loads of food units can be washed at one time using inlet unit 5 than without the unit. In dynamic tests, water flow and pressure were stabilized and uniform food units were added progressively until there was insufficient kinetic energy for the food and water mass to revolve. At this point the washing device stalls and the food units settle on the bottom in a pile. Inlet unit 5 allows operation with a larger number of food units before stall occurs. Conversely, inlet unit 5 allows the same load size to be cleaned with a lower water pressure. Inlet unit 5 directs the open inlet jet 15 into the circulative water flow with less turbulence and improved blending characteristics as compared to an unguided free jet.

Inlet 5 is provided with an anti-splash chamber 16 as in FIGURE 3. The chamber has annular grooves 17 in the inner surface of the wall at the inlet end. Duct portion 9 is aligned with inlet jet 15. Water which splashes is trapped by grooves 17 and chamber 16. This protects

the operator and surrounding environment from being splashed with water. The lowest groove 17 tapers downwardly to provide a gunnel or nozzle-like entrance to duct portion 9. This taper may be short as shown or gradual and extend the full length of duct portion 9. Since open jet 15 expands in diameter as a function of distance from faucet 10 and as a function of the amount of faucet valve opening, it is important to provide an upper admission port 7 which is oversized with respect to duct portion 9. This assures full capture of the jet and avoids serious losses of kinetic energy.

The performance of washing device 1 has been verified by tests to be improved by the addition of extension conduit 11 as in FIGURE 1. Conduit 11 is preferably made of flexible rubber. Expansion joint 18 permits easier installation in inlet unit 5 and over faucet 10. Annular grooves 17 aid in sealing the lower joint to prevent water leakage at admission port 7. Conduit 11 slips over faucet 10 with an interference fit to seal the upper joint from water leakage. Conduit 11 covers aerator holes 19 of faucet 10 to shut off the air bleed which otherwise would dilute the water flow with air bubbles, reduce the mass flow, and reduce the performance of the washing device. Conduit 11 may be grooved or otherwise modified to provide a suitable faucet adapter.

Inlet unit 5 includes a local honeycomb 20 at lower exit port 8. As shown in FIGURES 1 and 2, the vanes 21 of honeycomb 20 are vertical and parallel to the water flow direction to reduce local liquid turbulence and provide more stable flow.

Inlet portion or unit 5 may be separable from washing device 1, or the inlet portion may be bonded or otherwise integrally associated with the washing device within the scope of the invention. Similarly, the inlet portion or unit may be separable into sections which combine in use to perform as described.

The washing device is supported by legs 22 which provide elevation clearance for liquid jets at auxiliary exhaust ports 13.

The above portions of this specification have discussed performance in general terms. However, the character of the present invention cannot be fully understood without considering the specific limitations imposed by the relatively small amount of water power available from conventional kitchen faucets. The relation of power available to power required for three washing devices is illustrated by FIGURES 4 and 5. The tests from which this data was obtained are discussed below.

FIGURES 4 and 5 are generally similar except that FIGURE 4 relates to the washing of egg or cherry tomatoes of uniform diameter (one and one-eighth inch), and FIGURE 5 relates to the washing of red skin grapes of uniform size (seven-eighths inch long and three-fourths inch in diameter).

The tests were for three configurations of the present narrow-width washing device wherein the container size and shape were held constant and only the mode of liquid inlet was varied. The container was shaped substantially as shown in FIGURES 1 and 2, and the width of the container was 35 percent of the length to provide a narrow width for two dimensional liquid flow. Configuration A was a free jet which impacted directly on the liquid surface as in Patent No. 2,760,365, except that the jet was directed vertically from an open faucet. Configuration B was an open jet with a terminal inlet conduit as in FIGURE 3. Configuration C was a connected conduit as in FIGURE 1. The test articles deviated from FIGURES 1 and 3 in that simple conduits were used without a guide vane at the base (FIGURE 1). Such a guide vane has a minor effect in the type of test conducted and also cannot be applied to Configuration A. The inlet conduits were simply circular conduits positioned vertically and adjacent to the one end wall. The diameter of the faucet water jet at the faucet exit port was one-half inch approximately. The inside diameter

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of the connected conduit of Configuration C was substantially the same as that of the pet. The inside diameter of the short inlet conduit of Configuration B used with the open jet was five-eighths inch, since a one-half inch diameter conduit was found to choke. It was found necessary to taper this tube to a bigger diameter upwardly to accommodate expanded open jet 15 as in FIGURE 3.

In FIGURE 4, the water flow rate (gallons per minute) required to start various sizes of wash load is plotted. Each test point was repeated several times to assure repeatability and to evaluate scatter of test data. Scatter of test points was very small due to the uniform size of the egg tomatoes and due to laboratory standards of procedure. A calibration was performed for water flow rates versus faucet setting for an initial static water line pressure of 75 p.s.i. gauge. The calibration was verified for each test. The initial static line pressure was held constant throughout the testing program.

From FIGURE 4, Configuration B is seen to provide an unexpectedly large improvement over Configuration A and to approach Configuration C in capability.

With regard to FIGURE 4, it is to be noted that 24 to 27 egg tomatoes fill a commercial pint basket. A housewife could not be expected to tolerate a washing device which could not handle at least one pint. With this very practical consideration of true utility, which means the actual difference between success and failure of the present type of device, it is necessary to examine the amount of water flow rates available from conventional municipal water supply systems.

In the city of Los Angeles, California, the minimum static water pressure available at the water meter of each dwelling is reported to range between 45 p.s.i. and 75 p.s.i. These minimum values are known to be less in some other localities. The meter is located at the street curb. These minimum available water flow rates are shown superimposed on FIGURE 4. From FIGURE 4 it is seen that Configuration A cannot operate if the initial static water pressure is 45 p.s.i., as at some dwellings. Also, for an initial static pressure of 75 p.s.i., Configuration A cannot start up a load of more than 30 egg tomatoes, nor can Configuration B start up a load of more than 40 egg tomatoes. The starting condition is critical, and once the load is set in circulative motion the water flow can be reduced somewhat before the food units stall out and settle on the floor of the container.

FIGURE 5, for red skin grapes, is similar to FIGURE 4. However, FIGURE 4 shows even more clearly the vital importance of the water flow rates available. Configuration B is seen to have a large superiority over Configuration A and this improvement is of great practical significance, especially since Configuration B retains the exceptional convenience of use of Configuration A.

The available water flow rates are even more critical than generally indicated by FIGURE 5. This is due to the fact that the available water flow rate within a dwelling is reduced at the kitchen faucet whenever water is turned on elsewhere within the dwelling. For example, a full-on outside faucet at the dwelling reduces the available flow at the kitchen sink by an increment of one and five-tenths gallons per minute. Similarly, nominal water use in the bathroom reduces the available flow at the kitchen sink by an increment of one and seven-tenths gallons per minute. This water flow loss from bathroom use is indicated by the dimension B.R. in FIGURE 5. This loss would be more critical when superimposed on static line pressures less than the 75 p.s.i. shown. The loss of water flow due to elevation head at second floor apartments amounts to about one-half gallon per minute. This flow loss from elevation head is shown superimposed on the 45 p.s.i. static pressure line of FIGURE 5. Flow losses may be further increased by old, corroded piping and multiple piping elbows. Thus, it is clearly evident that water flow rates available are marginal for

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practical applications. Hence, the greatly improved performance of Configuration B over that of Configuration A is the critical difference between failure and success, especially since Configuration B retains the great convenience of use of Configuration A. Configuration B eliminates the inconvenience of attaching and detaching an extension conduit to the faucet at each use as is necessary with Configuration C. Thus, Configuration B, which is illustrated by FIGURE 3, in conjunction with the narrow container portion shown more fully in FIGURES 1 and 2, is an important advance in the art.

The two dimensional container of narrow width, as discussed above, is an important feature of the present invention in order to develop the necessary overall fluid flow efficiency to operate effectively with the very small amount of power available from conventional faucet water flow. Relatively wide containers of the present type, as for example that of Randall's patent, referenced above, are too wide to develop two dimensional flow. The width of Randall's device scales 62 percent of the length. Fluid flow tests with devices built to this proportion reveal steep diagonal flow components, lateral flow components, and localized eddies. These flows all represent kinetic energy losses. The flow is erratic and three dimensional as clearly revealed in flow tests. The same type of three dimensional flow has been observed in tests of washing devices of this kind in which the width was only fifty percent of the length of the container portion. Four test points for such a relatively wide device are shown plotted along dotted line D in FIGURE 5. These tests used the Configuration B inlet and food units were started by imparting continuous motion having the same vertical amplitude as in previous tests. The test points show the flow rates of water required to start loads of 20, 40, 60, and 80 red skinned grapes. This shows prohibitive degradation of performance from that of a device having a width ratio of 0.35 which was the ratio for all other plotted curves in FIGURES 4 and 5. Of additional significance is that the motion of the food units in the wider container, once started, was quite sluggish and lacked the scouring ability of the much more energetic motion of the food units when using a width ratio of 0.35. Hence, it is evident that the narrow width is an important feature of the present invention. This concept is contrary to prior general design principles wherein large volume has heretofore been believed to be meritorious in providing conventional appearance, adequate size wash load, and suitable turbulence and agitation.

The conventional three dimensional flow type of washing device is not generally suitable for use with the small amount of power available from conventional faucets. For example, conventional circular tub washers and annular torus flow washers of the type shown by Patent No. 1,025,206 issued May 7, 1912 require the movement of relatively large volumes of liquid subject to high liquid internal shear gradients and to skin friction over large surface areas which result in excessive eddies and kinetic energy dissipation. These devices require more available power than is generally available from conventional kitchen faucets.

In contrast, the present invention provides a two dimensional flow washing device which can simply be placed under a kitchen faucet without attachment and which is efficient to the degree required to be practical for nominal daily usage. Significant related inventions are disclosed in my Patents No. 3,207,481 issued September 21, 1965 and No. 3,257,101 issued June 21, 1966.

While one embodiment of the present invention has been illustrated it is to be understood that what is defined by Letters Patent is specified by the appended claims.

What is claimed is:

1. A washing device comprising two side walls extending longitudinally and vertically and spaced apart, a lateral wall extending between said side walls to provide a bottom wall and two opposite end walls and connecting

with said side walls in unitary relation to provide a container cavity, and the inner surface of said bottom wall and the inner surface of at least one of said end walls substantially faired to provide a substantially curved inner surface at the region of juncture, and said spaced side walls separated a distance less than one half of the largest single dimension of the container cavity in the direction of length or height and a liquid inlet portion, said inlet portion including a duct portion having an upper admission port portion open upwardly to the atmosphere and a lower normally submerged exit port portion, and said duct portion extending substantially vertically over at least upper portions thereof to substantially align axially with vertical downwardly directed liquid jets in normal operation, and said exit port portion having a liquid discharge direction substantially tangential to contained liquid to provide circulative flow.

2. A washing device as in claim 1, and said duct portion tapered internally over at least a portion of the length thereof to larger transverse cross-sectional areas upwardly.

3. A washing device as in claim 1, and said duct portion having relatively enlarged transverse cross-sectional areas upwardly to provide an anti-splash chamber.

4. A washing device as in claim 1, and the upper portion of said duct portion grooved internally.

5. A washing device as in claim 1, and said duct portion extending substantially straight and substantially vertical.

6. A washing device as in claim 1, and said duct portion extending substantially straight and substantially vertical and positioned substantially above said curved inner surface and adjacent to said end wall.

7. A washing device as in claim 1, and said inlet duct portion extending substantially vertically above said curved inner surface and substantially within said walls and substantially within upward vertical projections of said walls.

8. A washing device comprising two side walls extending longitudinally and vertically and spaced apart, a lateral wall extending between said side walls to provide a bottom wall and two opposite end walls and connecting with said side walls in unitary relation to provide a container cavity, and the inner surface of said bottom wall and the inner surface of at least one of said end walls substantially faired to provide a substantially curved inner surface at the region of juncture, and a liquid inlet portion normally positioned substantially above said curved inner surface and substantially adjacent to said end wall, and said inlet portion including a substantially straight and substantially vertically extending duct portion having an upper admission port portion open upwardly to the atmosphere and a lower normally submerged exit port portion.

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