April 27, 1965 J. F. CLEARMAN 3,180,348

ARTICLE WASHING APPARATUS

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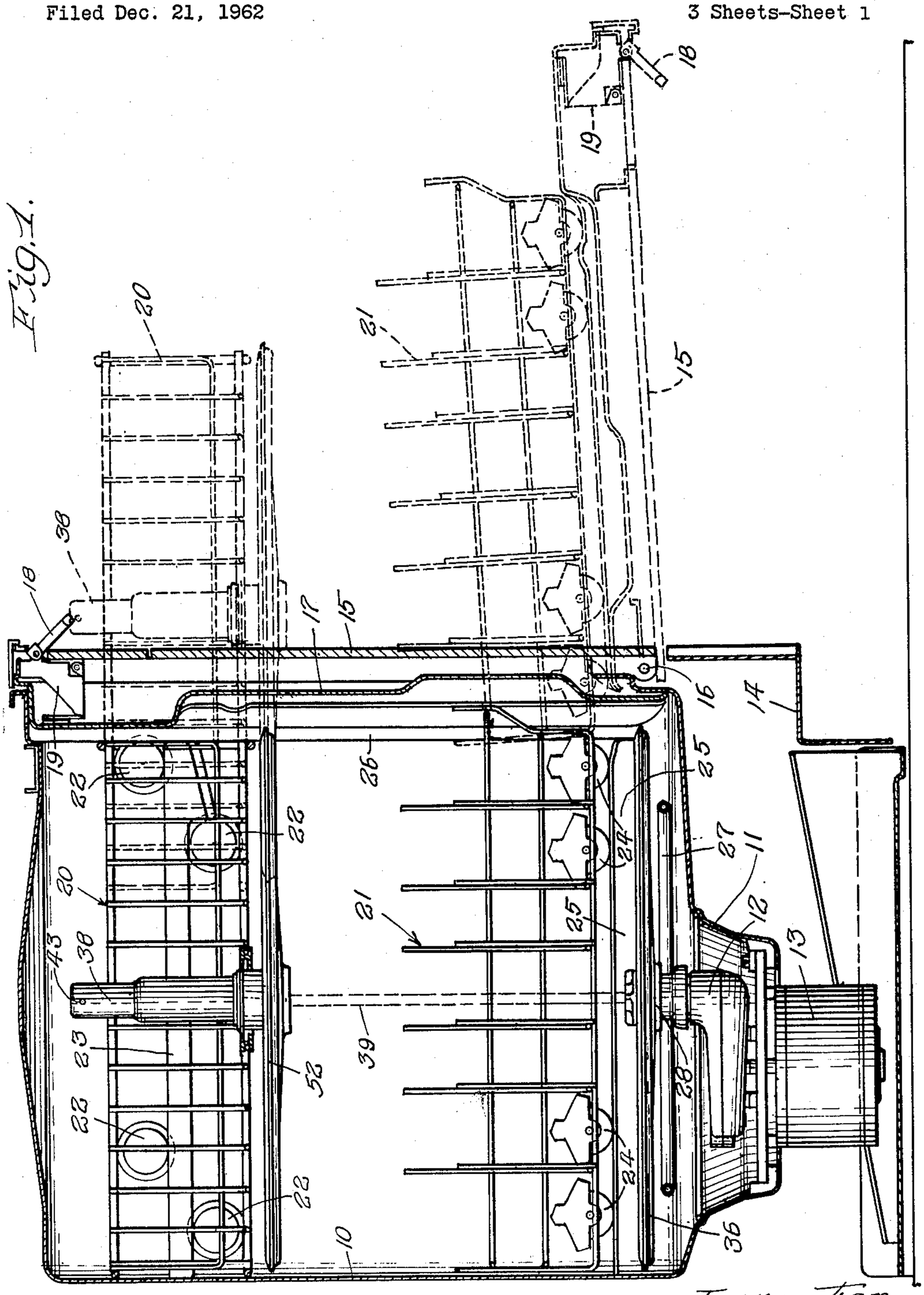
Fig. 1.



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ARTICLE WASHING APPARATUS

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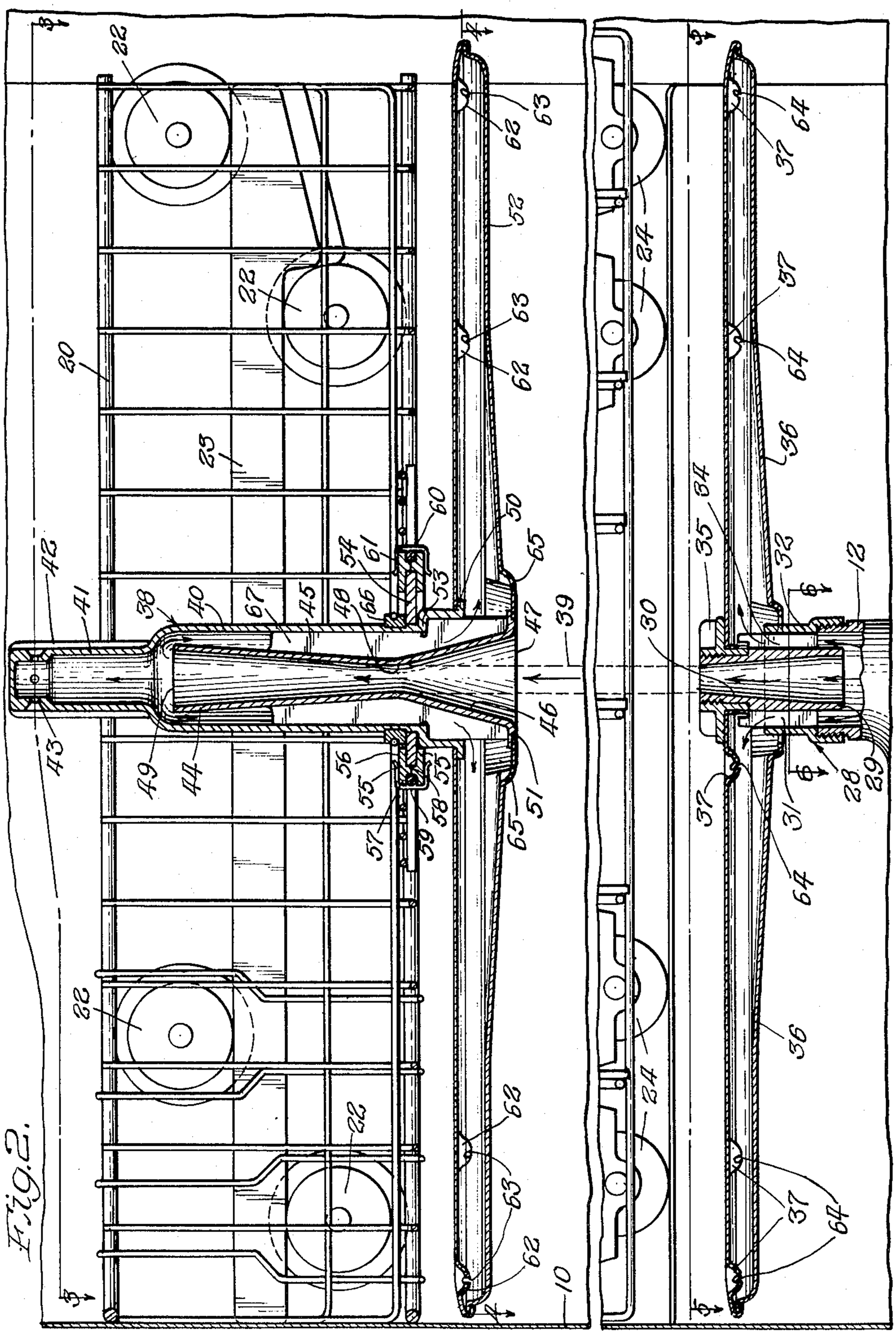

Fig. 2.

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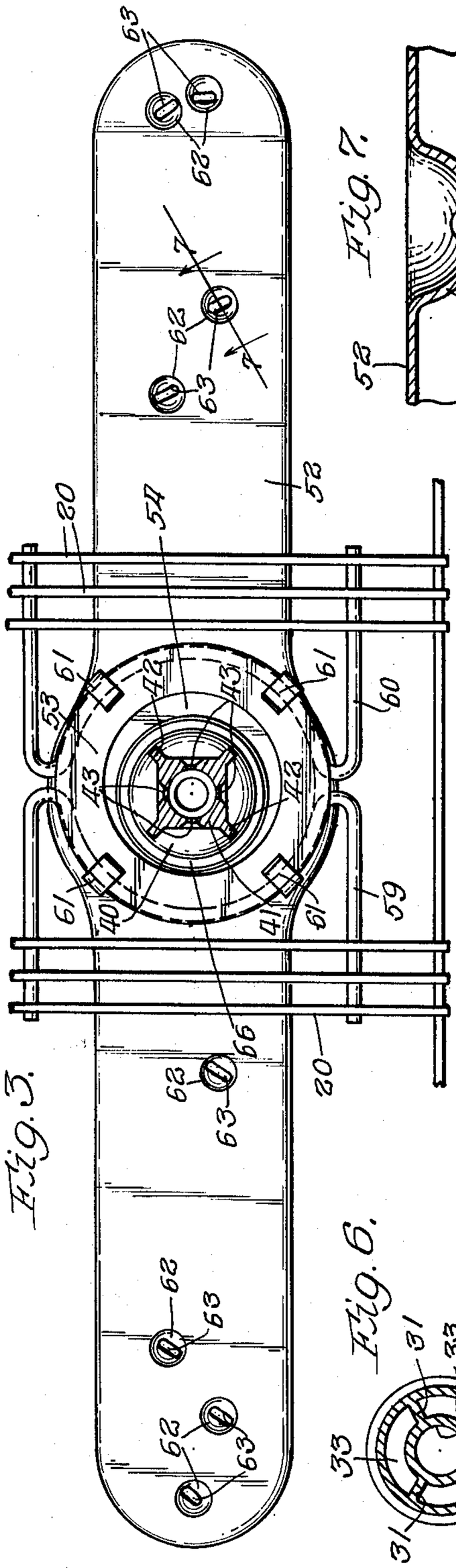

Fig. 3.

Fig. 7.

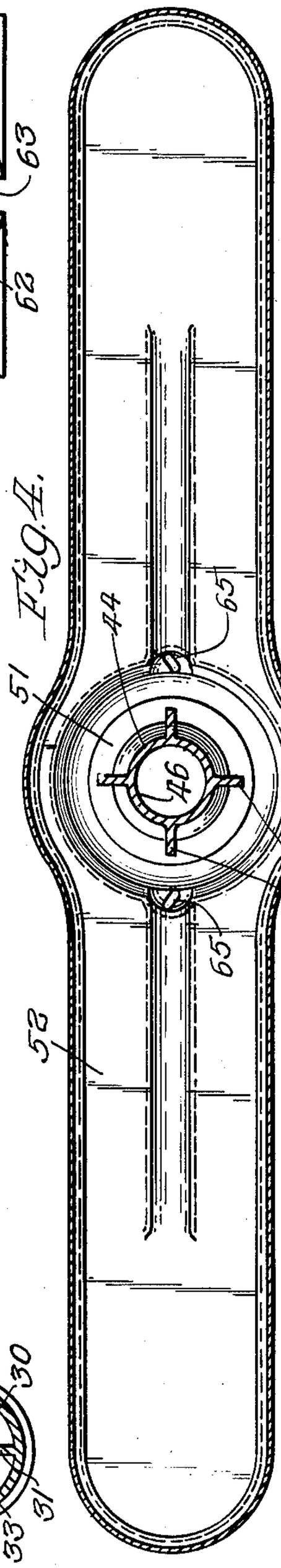

Fig. 4.

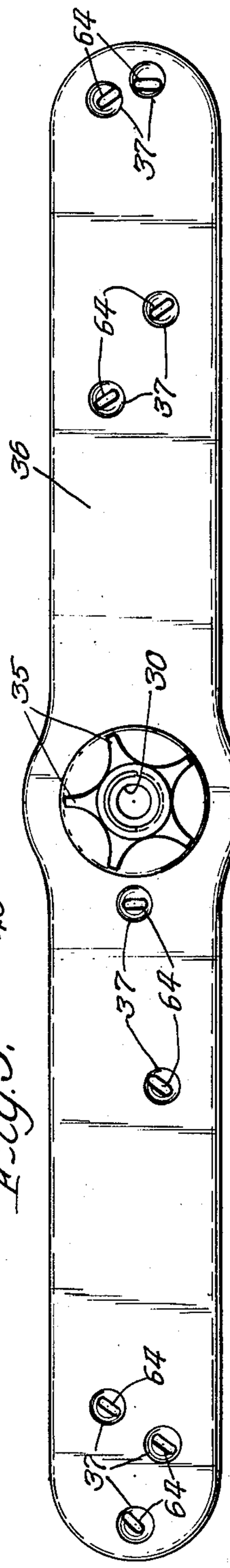

Fig. 5.

Fig. 6.

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ARTICLE WASHING APPARATUS

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This invention relates to an article washing apparatus specifically embodied in an automatic dishwashing machine.

The ordinary dishwashing machine customarily uses a sump in the bottom to collect washing solution such as the detergent solution, and this solution is dispersed at high velocity over dishes held in an open holder such as a wire mesh basket to clean the dishes. Ordinarily, even when the dishes are held in upper and lower baskets there is only one solution dispensing means such as a rotatable arm with a hollow interior through which the solution is forced under pressure and openings to propel sprays of solution over the dishes.

One of the features of this invention is to provide an article such as a dishwashing apparatus having improved means for spraying spaced portions of a propelled jet of washing solution over opposite sides of an article holder such as the dish holder basket in which the spraying means and jet projecting means are spaced from each other so that the jet is projected across this space.

Other features and advantages of the invention will be apparent from the following description of one embodiment thereof taken in conjunction with the accompanying drawings. Of the drawings:

FIGURE 1 is a vertical sectional view through a dishwasher of the undercounter type embodying the invention with the upper and lower dish holding baskets being shown in withdrawn positions by dotted lines, the hinged front door being shown in open position in dotted lines and the propelled jet of water also being shown in dotted lines.

FIGURE 2 is an enlarged fragmentary view similar to FIGURE 1 but showing only portions of the structure of FIGURE 1.

FIGURE 3 is a fragmentary horizontal sectional view taken substantially along line 3—3 of FIGURE 2.

FIGURE 4 is a fragmentary horizontal sectional view taken substantially along line 4—4 of FIGURE 2.

FIGURE 5 is a fragmentary horizontal sectional view taken substantially along line 5—5 of FIGURE 2.

FIGURE 6 is a fragmentary horizontal sectional view taken substantially along line 6—6 of FIGURE 2.

FIGURE 7 is an enlarged detail fragmentary sectional view taken substantially along line 7—7 of FIGURE 3.

In the embodiment of the drawings there is disclosed a dishwashing machine having an enclosing tub 10 with a solution collecting sump 11 in the bottom thereof in which is located a solution pump 12 driven by an external electric motor 13. The enclosing cabinet 14 for the tub 10 is provided with a door 15 hinged at the bottom as indicated at 16 and carrying a closure 17 for the open front of the tub 10. The door is provided with the customary handle 18 at the top and latch mechanism 19.

Located in the top portion of the tub 10 is a first article holder 20, here shown as the typical wire basket, for holding dishes, glassware and the like during the washing operation. This first wire basket is located above a second article holder 21, also shown as a wire basket, positioned in the bottom of the tub 10. The first basket 20 is provided with upper and lower side wheels 22 on each side engaging opposite sides of a track 23 formed in the sides of the tub 10. These wheels engaging the track 23 permit the basket 20 to be withdrawn to the

dotted line position of FIGURE 1 for loading and unloading in the customary manner.

The lower or second wire basket 21 is provided with a plurality of side wheels 24 engaging a track 25 also formed in the side walls of the tub 10 so that this basket can also be withdrawn to the dotted line position, as shown in FIGURE 1. As is shown here, when the lower basket 21 is withdrawn the wheels 24 ride on tracks 26 that are located on the inner surface of the closure 17.

Positioned in the bottom of the tub 10 is a customary electric resistance heater rod 27.

The pump 12 is substantially centrally located beneath the lower or second wire basket 21. This pump is provided at its top with a nozzle structure 28. The pump 12 and the nozzle structure 28 impart velocity energy to the mass of washing solution that is circulated through the dishwasher during the washing cycles.

As shown in FIGURE 2, nozzle structure 28 comprises a central member 29 provided with a nozzle portion 30 that is upwardly and inwardly tapered so as to have a restricted outlet. This central member 29 is provided with three radial vanes 31, as shown in FIGURE 6, in order to space the nozzle portion 30 from the outer cylindrical wall 32 to provide vertical passages 33 therebetween. The tops of these vanes 31 are provided with shoulders 34. The upper end of the nozzle portion 30 is threaded and is provided with a similarly threaded nut 35. This nut 35 is open at the center to surround the upper end of the nozzle portion 30.

Rotatably mounted about the cylindrical wall 32 is a lower spray arm 36 extending radially therefrom. This spray arm is hollow and operates as a spraying means for spraying solution forced by the pump up to the passages 33 into the hollow interior of the spray arm 36. In order to provide the plurality of sprays and also to rotate the arm 36 by reaction of the sprays against the arm, the upper surface of the arm is provided with a plurality of depressions 37 in each of which is located an elongated slot 64. As is shown in FIGURE 5, some of these slots 64 are positioned at an angle to the longitudinal axis of the spray arm and are arranged to spray a plurality of streams of washing solution under pressure against the lower side of the lower or second wire basket 21 and articles such as dishes and the like held therein. In FIGURE 2, the spray arm 36 is shown in the position it occupies when the dishwasher is undergoing a washing cycle. The pressure of solution flowing up the passages 33 into the hollow interior of the arm 36 lifts the arm from the shoulders 34 and against the bottom of the nut 35, as shown. When the washing cycle stops, the arm settles back on the top of the shoulders 34.

Positioned in the upper or first wire basket 20 is a tubular receiving means 38 located substantially centrally of the wire basket 20 and vertically above the nozzle structure 28. This tubular receiving means 38 is open at the bottom in order to provide an entrance for the jet 39 of washing solution propelled upwardly by the nozzle structure 28. Although the description herein speaks of the nozzle projecting a jet of washing solution, it is of course obvious that during a rinsing cycle the jet will be made up of rinse water in the customary manner.

The tubular receiving means 38 is in two parts with the lower part 40 being generally cylindrical and an upper square part 41 with these two parts being coaxial. As is shown in FIGURE 3 the upper part is provided with corner ribs 42 and the upper end is provided with four substantially horizontal openings 43 communicating with the interior of the receiving means 38.

Located within the interior of the lower cylindrical part 40 is an energy converting member 44 that is held spaced from the interior surface of the cylindrical part 40 by radial vanes 45 here shown as four in number.

The energy converting member 44 is provided on its interior with a venturi passage 46 having the usual relatively wide entrance 47 and tapering to a narrow throat 48 before widening again to an exit 49 beneath and spaced from the lower end of the hollow upper part 41.

The bottom of the cylindrical part 40 of the receiving means 38 is provided with an annular shoulder 50. Spaced beneath this shoulder 50 is a second annular shoulder 51 formed on the bottom of the venturi member 44. Mounted on these shoulders 50 and 51 is an upper spray arm 52 which is hollow and which is attached to the shoulders 50 and 51 so that the tubular receiving means 38 and the spray arm 52 are rigidly attached together to form a rotatable unit.

In order to mount this unit for rotation the cylindrical part 40 which of course is a hollow shell is formed with an outwardly extending annular shoulder part 53 spaced above the bottom shoulder 50. Immediately above this shoulder 53 is located an eccentric bearing 54 that has a circular outer edge and a circular inner opening surrounding the shell 38 with the two circles being eccentric to each other. The bearing 54 is fixed and does not rotate and has its outer edge held between complementary adapter rings 55 that are also eccentric. These upper and lower adapter rings 55 have inner edges 56 embracing the outer periphery of the bearing 54 and outer edges 57 that are spaced apart. The adapter rings 55 are also provided with intermediate engaging ridges 58 in order that the inner edges 56 will be spaced apart.

As is shown most clearly in FIGURE 3 the spaced apart outer edges 56 of the adapter rings 55 embrace opposite semi-circular wire portions 59 and 60 of the upper basket 20. The upper and lower adapters 55 are held in this embracing position by four equally spaced spring clips 61 in the embodiment shown, although more or less can be used as desired.

The upper spray arm 52 which is located beneath the upper basket 20 is also provided with spaced spraying means shown as depressions 62 in the upper surface of the arm 52 each containing an elongated spray slot 63. These slots 63 like the similar slots 64 in the lower arm provide a multiple of sprays and also serve to rotate the arm 52 and the attached structure during operation. As is shown in FIGURE 3 some of the slots 63 are arranged at an angle to the longitudinal axis of the arm 52.

Located in the bottom of the upper arm 52 as shown in FIGURE 4 are a pair of diametrically opposite slots 65 each at an angle to the longitudinal axis of the spray arm and arranged to spray liquid outwardly and downwardly as the arm 52 rotates.

As can be seen from the above description, operation of the apparatus of this invention results in rotation of the lower spray arm 36 and the upper spray arm 52 together with the tubular receiving means 38. Thus, the upper arm 52 being attached to the shell 40 rotates this shaft and the contained venturi device 44. This assembly rotates within the bearing 54 and the assembly is held within the bearing by means of a snap ring 66 located above the shoulder 53 and on the side of the bearing 54 opposite this shoulder.

Because of the eccentric construction of the bearing 54 as well as the adapter rings 55 it is easy to position the receiving means 38 relative to the nozzle structure 28 so that the jet 39 will be centered with respect to the venturi entrance 47.

Because of the provision of the adapter rings 55 and removable spring clips 61 it is very easy to remove the tubular receiving means 38 and attached spray arm 52 when such is desired.

The operation of the article washing apparatus of this invention is as follows: During the washing and rinsing cycles liquid is circulated by means of the pump 12 that is located in the sump 11. The pump 12 is the ordinary recirculating pump and draws liquid in from the sump 11 and projects it upwardly. A portion of this liquid

which is now under pressure from the pumping is forced upwardly through the passages 33 in the nozzle structure 28 into the hollow interior of spray arm 36. This liquid under pressure is sprayed through the spray slots 64 against the underside of the lower or second wire basket 21 and articles contained therein and at the same time reaction of the spray liquid against the spray arm 36 as the liquid emerges from the slots 64 causes the spray arm to rotate in the customary manner. A portion of the pumped liquid passes up through the nozzle 30 where velocity energy is given to this liquid to propel it upwardly in the form of a vertical jet 39. This jet is received in the entrance 47 of the venturi 44 and the venturi serves to convert a portion of the velocity energy back to pressure energy. The liquid from the jet is confined by the closed upper end of the receiving means 38 so that the liquid is under relatively high pressure therein which also serves to dissipate some of the energy.

Then, a portion of this confined liquid is sprayed out the upper end of the structure through the four openings 43 that are positioned 90° apart. At the same time another portion of the liquid passes down in the passages 67 between the venturi 44 and the shell 40 to pass between the annular shoulders 50 and 51 into the hollow interior of the upper spray arm 52. This liquid is then sprayed upwardly through the slots 63 against the bottom of the upper wire basket 20 and articles held therein and another portion of the liquid is sprayed downwardly through the slots 65 onto the top of the lower wire basket 21 and articles held therein. The liquid from this spraying operation then falls back into the sump 11 to be recirculated in the customary manner.

As can be seen from the above description the structure provides separate spray means for spraying the bottom of the lower basket, the top of the lower basket, the bottom of the upper basket and the top of the upper basket simultaneously with liquid which during the washing cycle will of course be the detergent solution and during the rinsing cycles will be rinse water. This multiple spraying as well as the energy for rotating the spraying means is provided solely by the energy imparted to the liquid by the pump 12. Furthermore, the energy required in the upper basket 20 for the spraying and rotation is transmitted solely through the jet 39 of liquid so that the jet not only provides the liquid in the upper portion of the apparatus but also provides energy for operating this upper portion.

In addition the apparatus is very easy to maintain as it is simple to assemble and disassemble the parts. Thus the nozzle structure 28 may be very easily disassembled by simply removing the single nut 35. The upper portion of the apparatus may be easily disassembled by merely removing the snap ring 66 and withdrawing the assembly of receiving means 38 and spray arm 52. Similarly, the structure is simplified by using a portion of the upper basket 20 to releasably support the upper portion of the washing apparatus.

Having described my invention as related to the embodiment shown in the accompanying drawings, it is my intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. Article washing apparatus, comprising: a first article holder; a second article holder spaced therefrom; means adjacent said second holder for imparting velocity energy to a mass of washing solution and projecting a jet thereof through space toward said first holder; a tubular receiving means spaced from said projecting means and adjacent said first holder having an entrance for said jet and an extension on said receiving means on the end opposite said entrance, said entrance being adjacent one side of said first holder and said extension being adjacent

the other side thereof; energy converting means in said tubular receiving means for converting a portion of said velocity energy to pressure energy, said energy converting means comprising means forming a venturi passage in said tubular receiving means; first spraying means adjacent one side of said first holder receiving solution from said converting means and spraying it on said one side and comprising a rotatable hollow arm adjacent said entrance having nozzle means therein for spraying from said first spraying means and rotatable by reaction from said nozzle means; second spraying means in said extension for spraying solution on said other side; rotatable spraying means associated with said jet projecting means for spraying solution over one side of said second holder and articles held therein, said rotatable arm and rotatable spraying means both being rotated by pressure of said liquid; and means associated with said rotatable arm for spraying liquid over a side of said second holder that is spaced from said one side.

2. Article washing apparatus, comprising: an article holder; means spaced from said holder for imparting velocity energy to a mass of washing solution and projecting a jet thereof through open space toward said holder; receiving means spaced from said projecting means and adjacent said holder for receiving said jet; means supported within said receiving means for converting a portion of said velocity energy of said jet to pressure energy; and spaced spraying means associated with said receiving means for spraying spaced portions of said jet over opposite sides of said holder and thus of articles held therein.

3. Article washing apparatus, comprising: an article holder; means spaced from said holder for imparting velocity energy to a mass of washing solution and projecting a jet thereof through space toward said holder; receiving means spaced from said projecting means and adjacent said holder for receiving said jet; means supported within said receiving means for converting a portion of said velocity energy of said jet to pressure energy; first spraying means adjacent one side of said holder receiving solution from said means for converting and spraying it on said one side; and second spraying means adjacent the other side of said holder receiving solution from said means for converting and spraying it on said other side.

4. Article washing apparatus, comprising: an article holder; means spaced from said holder for imparting velocity energy to a mass of washing solution and projecting a jet thereof through space toward said holder; a tubular receiving means spaced from said projecting means and adjacent said holder having an entrance for said jet and an extension on said receiving means on the end opposite said entrance, said entrance being adjacent one side of said holder and said extension being adjacent the other side thereof; means supported within said tubular receiving means for converting a portion of said velocity energy to pressure energy; first spraying means adjacent one side of said holder receiving solution from said means for converting and spraying it on said one side and comprising a rotatable hollow arm adjacent said entrance having nozzle means therein for spraying from said first spraying means and rotatable by reaction from said nozzle means; and second spraying means in said extension for spraying solution on said other side.

5. The apparatus of claim 4 wherein said means for converting a portion of said velocity energy comprises means forming a venturi passage in said tubular receiving means.

6. Article washing apparatus, comprising: a first article holder; a second article holder spaced therefrom; means adjacent said second holder for imparting velocity energy to a mass of washing solution and projecting a jet of said washing solution through space toward said first holder; receiving means spaced from said projecting means and adjacent said first holder for receiving said jet having an open entrance adjacent one side of said first holder and a restricted outlet to entrap said solution under pressure in said receiving means; means supported within said receiving means for converting a portion of said velocity energy to pressure energy; first spraying means operated by said entrapped pressure energy for spraying solution on one side of said first holder; second spraying means including said restricted outlet operated by said entrapped pressure energy for spraying solution on the other side of said first holder; and third spraying means operated by said entrapped pressure for spraying solution on one side of said second holder.

7. Article washing apparatus, comprising: a first article holder; a second article holder spaced therefrom; means adjacent said second holder for imparting velocity energy to a mass of washing solution and projecting a jet thereof through space toward said first holder; a tubular receiving means spaced from said projecting means and adjacent said first holder having an entrance for said jet and an extension on said receiving means on the end opposite said entrance; means supported within said tubular receiving means for converting a portion of said velocity energy to pressure energy; first spraying means adjacent one side of said first holder receiving solution from said means for converting and spraying it on said one side; second spraying means adjacent the other side of said first holder receiving solution from said means for converting and spraying it on said other side, said second spraying means being located in said extension; and spraying means associated with said jet projecting means for spraying solution over said second holder and articles held therein.

8. Article washing apparatus, comprising: an article holder; means spaced from said holder for imparting velocity energy to a mass of washing solution and projecting a jet thereof through open space toward said holder; means for receiving said jet spaced from said means for projecting said jet, said means for receiving including a venturi for converting a portion of said velocity energy of said jet to pressure energy, the venturi comprising a tubular member having outwardly flared outer ends connected by a constricted throat, one of said outer ends receiving said jet for flow through said one outer end, then through said throat and finally through the other of said flared outer ends; spraying means for spraying solution on said holder and thus on articles held therein; and means for directing solution from said other flared end of said venturi to said spraying means.

References Cited by the Examiner

UNITED STATES PATENTS

2,192,112	2/40	Vrusho	134—179 X
2,586,398	2/52	Vars	134—182 X
2,608,983	9/52	Idle	134—183
2,664,903	1/54	Sway	134—176
2,669,999	2/54	McMillan	134—182 X
3,051,182	8/62	Gibson	134—183 X
3,051,184	8/62	Gibson	134—183
3,067,759	12/62	Guth et al.	134—176

FOREIGN PATENTS

478,281	1/38	Great Britain.

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