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(71) Applicant:
White Consolidated Industries, Inc.
Cleveland Ohio 44111 (US)

(72) Inventor: **Dries, John**
Greenwood, Indiana 46143 (US)

(74) Representative:
Busca, Luciano et al
PROPRIA S.r.l.
Via Mazzini 13
33170 Pordenone (IT)

(54) Shunt drain system

(57) A dishwasher including a tub forming a wash chamber and a sump, a drain pump, a separate circulation pump, and a shunt drain system. The sump has a macerating chamber and a pump chamber each adapted to hold liquid from the wash chamber. The drain pump directly connects the macerating chamber to a drain line to move liquid from the macerating chamber to a household drain. The circulation pump moves liquid from the pump chamber to the wash chamber. The circulation pump has a shaft which extends into the macerating chamber and a blade attached to the shaft within the macerating chamber for chopping food particles therein. A tight space about the shaft forms a restricted passage between the pump chamber and the macerating chamber so that the drain pump can move liquid from the pump chamber to the household drain. The shunt drain system provides a direct flow path for liquid from the pump chamber to the drain pump. The shunt drain system includes a shunt drain conduit connecting the pump chamber with the drain pump and a shunt check valve in the shunt drain conduit movable between a closed position and an open position. The shunt check valve is moved between the open and closed positions in response to a pressure difference between the pump chamber and the shunt drain conduit.

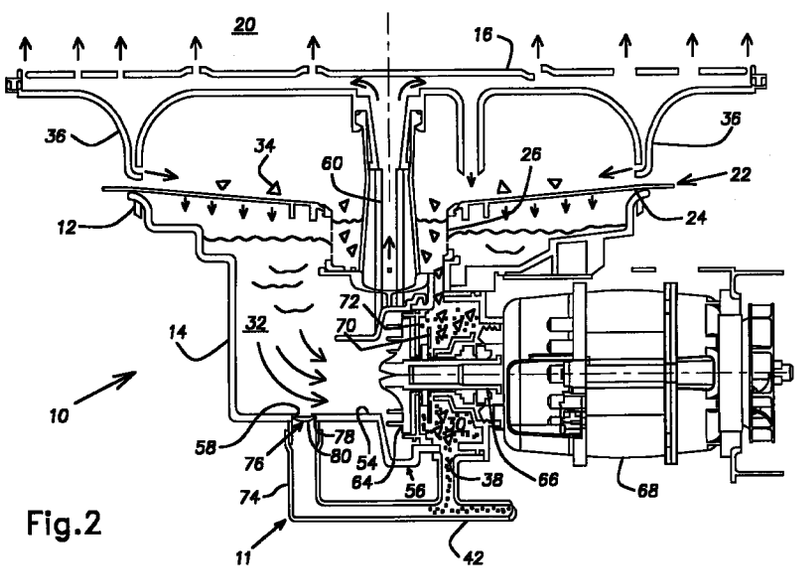

Fig.2

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention generally relates to washers and, more particularly, to shunt drain systems for washers having separate sump chambers.

[0002] Washers, particularly domestic dishwashers, rely on a combination of filtration and dilution to remove food and detergent or soil particles from wash liquid or water which is recirculated to spray arms to wash dishes or other objects to be cleaned. Filtration of the wash liquid removes all of the soil particles larger than the holes in the filtering media, but cannot remove dissolved soil particles smaller than the holes in the filtering media. Dilution of the wash liquid however, does remove the dissolved soil particles which are not removed by filtration. Dilution requires removing as much of the wash liquid from the dishwasher during each pump-out or drain phase as possible so that it can be replaced with fresh water.

[0003] Dishwashers commonly have a sump with separate chambers for holding the wash liquid such as, for example, a first chamber for collecting soil particles removed from the wash liquid and a second chamber for holding filtered or "clean" wash liquid to be recirculated to the spray arms. The contents of each chamber must eventually be pumped to a household drain.

[0004] In some dishwasher configurations, however, some wash liquid is trapped within the sump which reduces the effectiveness of the dilution process. For example, a dishwasher having a circulation pump separating the first and second chambers, for pumping wash liquid from the second chamber to the spray arms, and a separate drain pump connected to the first chamber, for pumping the contents of each chamber to the drain, often does not remove all of the wash liquid from the second chamber. To remove all of the wash liquid from the second chamber, the drain pump must first draw the wash liquid from the second chamber into the first chamber through a restricted passage formed by the pump. The passage must be restricted in order to substantially prevent the migration of soil particles from the first chamber to the second chamber. Because of the restriction, however, the drain pump quickly drains all of the wash liquid from the first chamber and breaks prime (air enters the volute) as soon as all of the wash liquid is removed from the first chamber. The performance of the drain pump drops off significantly once it breaks prime and, as a result, most of the wash liquid in the second chamber is left in the second chamber after the drain phase is complete.

[0005] Accordingly, there is a need in the art for a washer having an improved drain system wherein substantially all of the contents of the sump are removed from both the soiled and the clean chambers during the drain phase of operation. Additionally, the drain system should substantially prevent the migration of soil particles from the soiled chamber to the clean chamber. Furthermore, the drain system should be relatively inexpensive to produce, be simple to assemble and repair, have a relatively small number of parts, and utilize relatively small pumps.

SUMMARY OF THE INVENTION

[0006] The present invention provides a washer which overcomes at least some of the above-noted problems of the related art. According to the invention, the washer includes a circulation pump, a separate drain pump, a shunt drain system, and a tub forming a wash chamber and a sump. The sump has first and second sump chambers adapted to hold liquid from the wash chamber. The drain pump connects the first sump chamber and a drain line to move liquid from the first sump chamber to the household drain. The circulation pump is adapted to move liquid from the second sump chamber to the wash chamber. The shunt drain system is adapted to provide a direct path for the wash liquid from the second sump chamber to the drain pump, The shunt drain system includes a shunt drain conduit directly connecting the second sump chamber with the drain pump and a shunt check valve in the shunt drain conduit movable between a closed position and an open position. The shunt drain conduit provides a good, generally restriction free connection between the second sump chamber and the drain pump so that the drain pump can simultaneously draw wash liquid from both the first and second sump chambers which are each directly connected to the drain pump inlet. The shunt drain conduit also allows wash liquid to be removed, although at a reduced rate, from the second sump chamber after the first sump chamber is empty and the drain pump loses prime.

[0007] According to another aspect of the invention, the shunt check valve is moved between the open and closed positions in response to a pressure difference between the second sump chamber and the shunt drain conduit. In a preferred embodiment, the shunt check valve is held in the closed position when the circulation pump is operating by a lower pressure in the second sump chamber than in the shunt drain conduit. The shunt check valve is preferably held in the closed position when both the circulation pump and the drain pump are operating by a lower pressure in the second sump chamber than in the shunt drain conduit. The shunt check valve is also preferably held in the open position when the circulation pump is not operating and the drain pump is operating by a lower pressure in the shunt drain conduit than in the second sump chamber.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0008] These and further features of the present invention will be apparent with reference to the following

description and drawings, wherein:

FIG. 1 is an elevational view, partially in cross-section, of a washing apparatus according to the present invention having a circulation pump and a drain pump;

FIG. 2 is an elevational view, partially in cross-section, of a portion of the washing apparatus of FIG. 1 during a wash phase, wherein the circulation pump is operating and the drain pump is off;

FIG. 3 is an elevational view similar to FIG. 2 but during an initial portion of a drain phase, wherein both the circulation pump and the drain pump are operating;

FIG. 4 is an elevational view similar to FIG. 3 but during the drain phase, wherein the circulation pump is off and the drain pump is operating; and

FIG. 5 is an elevational view similar to FIG. 4 but during a final portion of the drain phase, wherein a first sump chamber is completely drained and the drain pump has lost full prime.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] FIGS. 1 and 2 illustrate a washer or washing apparatus 10, more particularly a domestic dishwasher, having a shunt drain system 11 according to the present invention. The washing apparatus 10 includes a molded plastic tub 12 having a sump 14 at a lower end thereof. The sump 14 collects and holds wash liquid that is sprayed from spray arms 16 onto objects stored on racks 18 inside a wash chamber 20. Gravity forces wash liquid to fall into the sump 14 from the wash chamber 20. A fine filter 22 having a sloped, generally horizontal filter component 24 and an annular vertical filter component 26 is disposed between the sump 14 and the wash chamber 20. The fine filter 22 is preferably a molded mesh screen having 4 mm (.015 in.) openings therein.

[0010] An inner wall 28 of the sump 14 and the vertical filter component 26 separate the sump 14 into a first chamber 30, referred to hereafter as the collection or macerator chamber, and a second chamber 32, referred to hereafter as the pump or "clean water" chamber. The fine filter 22 and the inner wall 28 isolate the pump chamber 32 from the wash chamber 20.

[0011] Wash liquid flows downwardly from the wash chamber 20 and into the pump chamber 32 through the horizontal filter component 24. Food soils or particles 34 in the wash liquid are filtered out by the fine filter 22 as the wash liquid enters the pump chamber 32. The horizontal filter component 24 is sloped downwardly toward the collection chamber 30 to "funnel" the food particles 34 into the collection chamber 30. Food particles 34 are retained in the collection chamber 30 and macerated therein as described in more detail hereafter. When the liquid level in the collection chamber 30 is high enough, some of the wash liquid in the collection chamber 30 flows into the pump chamber 32 through the vertical filter component 26.

[0012] In the illustrated embodiment of the invention, the horizontal filter component 24 is located directly below the spray arm 16 and spray nozzles or jets 36 are provided on the spray arm 16 to clean the fine filter 22. The spray nozzles 36 are adapted to direct wash liquid at the horizontal filter component 24 and to propel food particles 34 located on the horizontal filter component 24 into the collection chamber 30. It is noted that other filter and wall arrangements which filter food particles from wash liquid entering a pump chamber and collect the food particles in a collection chamber can be utilized within the scope of the present invention.

[0013] The collection chamber 30 has an exit port or outlet 38 in communication with an inlet of a drain pump 40 so that wash liquid and food particles 34 within the collection chamber 30 can be pumped to a household drain (not specifically shown). A drain hose or conduit 42 connects the collection chamber outlet 38, which is located at the bottom of the collection chamber 30, with the inlet of the drain pump 40. Preferably, the inlet of the drain pump 40 is located at a position lower than the collection chamber outlet 38. A drain line or pipe 44, preferably having a high loop, connects the outlet of the drain pump 40 with the household drain.

[0014] The drain pump 40 is a small synchronous centrifugal pump and includes an impeller 46 secured to a shaft 48 driven by an electric motor 50. The drain pump impeller 46 moves wash liquid and minced food particles from the collection chamber 30 to the household drain through the drain conduit 42. The drain pump 40 also includes a drain check valve 52 located at the inlet of the drain pump 40. The drain check valve 52 allows flow only in one direction, toward the household drain, to prevent reverse flow back into the drain conduit 42. The drain check valve 52 can alternatively be located between the outlet of the drain pump 40 and the household drain.

[0015] The pump chamber 32 has a first exit port or outlet 54 in communication with an inlet of a circulation pump 56 so that wash liquid can be recirculated from the sump 14 to the wash chamber 20 and a second exit port or outlet 58 in communication with the drain pump 40 so that any wash liquid remaining in the sump 14 can be pumped to the household drain. The first outlet 54 of the pump chamber 32 is located at the lower end of the pump chamber 32 and the wash liquid enters the circulation pump 56 in a generally horizontal direction. Conduits 60, 62 connect the outlet of the circulation pump 56 with the spray arms 16.

[0016] The circulation pump 56 is a synchronous centrifugal pump, preferably larger than the drain pump 40, and includes an impeller 64 secured to a shaft 66 driven by an electric motor 68. The circulation pump impeller 64 moves wash liquid from the pump chamber 32 to the spray arms 16 through the conduits 60, 62. A mincing blade 70 is disposed on the shaft 66 of the circulation

pump 56 within the collection chamber 30. The blade 70 is made from a hard, corrosion resistant material, such as stainless steel or aluminum. The blade 70 has sharp edges that chop food particles 34 located in the collection chamber 30. The edges of the blade 70 can be angled slightly from the plane in which the blade 70 rotates to circulate wash liquid and food particles within the collection chamber 30 for more efficient mincing. The blade 70 is rotated by the shaft 66 whenever the circulation pump 56 is operating.

[0017] Circulation created by the blade 70 and the rotation of the shaft 66 can cause wash liquid to migrate or flow toward the circulation pump 56 around the shaft 66. Therefore, a seal 72, such as the illustrated labyrinth seal, and/or balancing vanes on a rear face of the circulation pump impeller 64 are provided to prevent such migration or flow. The circulation pump 56 does form a restricted flow passage between the pump chamber 32 and the collection chamber 30 through which the drain pump 40 draws wash liquid during a drain phase of operation. The wash liquid flows through the clearance around the impeller shaft 66 which is very tight and does not allow the wash liquid to leak into the collection chamber 30 very fast.

[0018] The shunt drain system 11 includes the second outlet 58 of the pump chamber 32, a shunt drain hose or conduit 74, and a shunt check valve 76. The second outlet 58 of the pump chamber 32 is located at the bottom of the pump chamber 32 and at the lowest point of the pump chamber 32. The second outlet 58 is spaced-apart from the first outlet 54 as described in more detail hereafter. The shunt drain conduit 74 connects the second outlet 58 with the drain conduit 42 so that the second outlet 58 is in communication with the inlet of the drain pump 40. Therefore, both the collection chamber 30 and the pump chamber 32 are directly connected to the inlet of the drain pump 40. Preferably, the inlet of the drain pump 40 is located at a position lower than the second outlet 58 of the pump chamber 32. The drain pump impeller 46 simultaneously moves wash liquid from the pump chamber 32 to the household drain through the shunt drain conduit 74 and the drain conduit 42 and from the collection chamber 30 to the household drain through the drain conduit 42.

[0019] The shunt check valve 76 is provided in the shunt drain conduit 74 to prevent macerated and/or dissolved food particles from migrating from the collection chamber 30 to the pump chamber 32. The shunt check valve 76, therefore, prevents the food particles 34 from bypassing the filtration system. The shunt check valve 76 preferably operates in response to a pressure difference between the pump chamber 32 and the shunt conduit 74. The shunt check valve 76, however, can be actuated in other manners such as, for example, an electric signal to an electro-mechanical valve.

[0020] The shunt check valve 76 of the illustrated embodiment is directly located at the second outlet 58 of the pump chamber 32 and includes a valve seat 78 and a valve element 80 which cooperates with the valve seat 78 to form a tight seal therebetween. The valve element 80 is movable and pivots between an open position and a closed position. The valve element 80 is oriented to open when wash liquid flows through the valve seat 78 from the pump chamber 32 to the shunt drain conduit 74.

[0021] When the circulation pump 56 is operating and the drain pump 40 is not operating, low pressure within the pump chamber 32 holds the valve element 80 in the closed position to prevent migration of food particles 34 into the pump chamber 32. Note that the high velocity wash liquid flowing to the circulation pump 56 within the pump chamber 32 causes lower static pressure over the top of the valve element 80 (within the pump chamber 32) than the static pressure under the bottom of the valve element 80 (within the shunt drain conduit 74). When the circulation pump 56 is not operating and the drain motor 40 is operating, low pressure in the shunt drain conduit 74 pulls the valve element 80 to the open position to draw wash liquid from the pump chamber 32 to the drain pump 40 through the shunt drain conduit 74. Note that wash liquid flowing into the drain pump 40 causes lower static pressure under the bottom of the valve element 80 (within the shunt drain conduit 74) than the static pressure over the top of the valve element 80 (within the pump chamber 32). When both the circulation and drain pumps 56, 40 are operating, there is preferably a slight pressure differential holding the valve element 80 in the closed position so that wash liquid is quickly drawn from the collection chamber 30 rather than from the pump chamber 32. This allows the spray system to keep operating for a period of time sufficient for the spray jets 36 to clear the horizontal filter component 24 of food particles 34 which would otherwise remain on the fine filter 22.

[0022] The distance between the first and second outlets 54, 58 of the pump chamber 32 must be large enough so that the pressure differential is not too high. If the pressure differential is too high, the valve element 80 could be pulled through the valve seat 78 so that the valve element 80 will not properly pivot to the open position when required. The distance between the first and second outlets 54, 58 of the pump chamber 34, however, must be small enough so that the pressure differential is adequate to properly seat and hold the valve element 80 in the closed position when required.

[0023] Operation of the washing apparatus 10 typically includes at least one wash phase and at least one drain phase. As best shown in FIG. 2, during the wash phase the circulation pump 56 is operating and the drain pump 40 is not operating. Wash liquid in the pump chamber 32 of the sump 14 is drawn into the circulation pump 56 and pumped through the conduits 60, 62 to the spray arms. The wash liquid is sprayed out of the spray arms 16 onto objects being washed which are stored on the racks 18 within the wash chamber 20. After the wash liquid strikes the objects, wash liquid and food par-

ticles 34 fall downwardly to the fine filter 22. The wash liquid flows downwardly through the fine filter 22, which filters out food particles 34. The filtered wash liquid flows into the pump chamber 32, from where it is recirculated to the wash arms 16 by the circulation pump 56.

[0024] The filtered food particles 34 tend to move down the sloped horizontal component 24 of the fine filter 26 toward the collection chamber 30. Additionally, the spray jets 36 of the spray arms 16 propel the food particles 34 located on the horizontal filter component 24 into the collection chamber 30. Wash liquid, containing food particles 34, that does not flow through the fine filter 22 flows into the collection chamber 30, where the food particles are collected. Food particles 34 located in the collection chamber 30 are macerated by the wash liquid and chopped or minced by the blade 70 when the circulation pump 56 is operating. Low pressure within the pump chamber 32 holds the valve element 80 of the shunt check valve 76 in the closed position to prevent migration of food particles 34 from the collection chamber 30 to the pump chamber 32.

[0025] When the wash phase is completed, the drain phase is initiated. As best shown in FIG. 3, the drain pump 40 is energized so that initially both the circulation and drain pumps 56, 40 are operating. The drain pump 40 draws wash liquid, which carries food particles, from the collection chamber 30 through the drain conduit 42 and pumps the wash liquid and food particles to the household drain through the drain pipe 44. Draining of the collection chamber 30 continues until the collection chamber 30 is nearly empty. Substantially all of the food particles 34 are thereby discharged from the washing apparatus 10. The slight pressure differential holds the valve element 80 in the closed position so that wash liquid is quickly drawn from the collection chamber 30 rather than from the pump chamber 32.

[0026] The circulation pump 56 continues to operate so that wash liquid from the pump chamber 32 is recirculated to the spray arms. Therefore, the spray jets 36 continue to rinse food particles from the horizontal filter component 24 which would otherwise remain on the fine filter 22 if the circulation pump 56 was stopped when the drain pump 40 was initiated. This "rinsing" effect has a very positive effect on soil particle removal and ultimately on wash performance.

[0027] As best shown in FIG. 4, the circulation pump 56 is stopped during the drain phase so that only the drain pump 40 is operating. Low pressure in the shunt drain conduit 74 pulls the valve element 80 to the open position and the drain pump 40 simultaneously draws wash liquid from both chambers 30, 32 of the sump 14. Wash liquid is drawn from the pump chamber 32 through the shunt drain conduit 74 and the drain conduit 42 and wash liquid is drawn from the collection chamber 32 through the drain conduit 42. The drain pump 40 moves the wash liquid and soil particles to the household drain through the drain pipe 44.

[0028] As best shown in FIG. 5, when the collection chamber 30 is completely drained, and the drain pump 40 has lost full prime, the drain pump continues to draw wash liquid from the pump chamber 32, although at a slower rate. Once the pump chamber 32 is substantially empty and substantially all of the wash liquid and substantially all of the soil particles are removed from the washing apparatus 10, the drain pump 40 is stopped.

[0029] Although particular embodiments of the present invention have been described in detail, it is understood that the invention is not limited correspondingly in scope, but includes all changes and modifications coming within the spirit and terms of the claims appended hereto.

Claims

1. A washer comprising:

   a tub forming a wash chamber and a sump, said sump having first and second sump chambers adapted to hold liquid from said wash chamber;
   a drain line;
   a drain pump connecting said first sump chamber and said drain line to move liquid from said first sump chamber to said drain line;
   a circulation pump adapted to move liquid from said second sump chamber to said wash chamber; and
   a shunt drain system forming a flow path for liquid from said second sump chamber to said drain pump, said shunt drain system including a shunt drain conduit connecting said second sump chamber with said drain pump and a shunt check valve in said shunt drain conduit movable between a closed position and an open position.

2. The washer according to claim 1, wherein said shunt check valve is operable in response to a pressure difference between said second sump chamber and said shunt drain conduit.

3. The washer according to claim 1, wherein said shunt check valve is held in said closed position when said circulation pump is operating by a lower pressure in said second sump chamber than in said shunt drain conduit.

4. The washer according to claim 3, wherein said shunt check valve is held in said closed position when both said circulation pump and said drain pump are operating by a lower pressure in said second sump chamber than in said shunt drain conduit.

5. The washer according to claim 1, wherein said shunt check valve is held in said open position when said circulation pump is not operating and

said drain pump is operating by a lower pressure in said shunt drain conduit than in said second sump chamber.

6. The washer according to claim 1, wherein said shunt check valve is located at an outlet of said second sump chamber.

7. The washer according to claim 1, wherein said shunt check valve includes a valve seat and a pivotable valve element which cooperates with said valve seat in said closed position to close said shunt drain conduit.

8. The washer according to claim 1, wherein said circulation and drain pumps are separate pumps.

9. The washer according to claim 1, wherein said circulation pump forms a passage connecting said fist and second pump chambers and adapted to move liquid from said second sump chamber to said drain line.

10. A washer comprising:

a tub forming a wash chamber and a sump, said sump having first and second sump chambers adapted to hold liquid from said wash chamber;
a drain line;
a drain pump adapted to move liquid from said first sump chamber to said drain line;
a circulation pump adapted to move liquid from said second sump chamber to said wash chamber; and
A shunt drain system forming a flow path for liquid from said second sump chamber to said drain pump, said shunt drain system including a shunt drain conduit connecting said second sump chamber with said drain pump and a shunt check valve in said shunt drain conduit movable between a closed position and an open position, wherein said shunt check valve is moved between said open and closed positions in response to a pressure difference between said second sump chamber and said shunt drain conduit.

11. A washer according to claim 10, wherein said shunt check valve is held in said closed position when said circulation pump is operating by a lower pressure in said second sump chamber than in said shunt drain conduit.

12. A washer according to claim 11, wherein said shunt check valve is held in said closed position when both said circulation pump and said drain pump are operating by a lower pressure in said second sump chamber than in said shunt drain conduit.

13. A washer according to claim 10, wherein said shunt check valve is held in said open position when said circulation pump is not operating and said drain pump is operating by a lower pressure in said shunt drain conduit than in said second sump chamber.

14. A washer according to claim 10, wherein said shunt check valve is located at an outlet of said second sump chamber.

15. A washer according to claim 10, wherein said shunt check valve includes a valve seat and a pivotable valve element which cooperates with said valve seat in said closed position to close said shunt drain conduit.

16. A washer according to claim 10, wherein said circulation and drain pumps are separate pumps.

17. The washer according to claim 10, wherein said circulation pump forms a passage connecting said first and second pump chambers and adapted to move liquid from said second sump chamber to said drain line.

18. A dishwasher comprising:

a tub forming a wash chamber and a sump, said sump having macerating chamber and pump chamber each adapted to hold liquid from said wash chamber;
a drain line;
a drain pump connecting said macerating chamber and said drain line to move liquid from said macerating chamber to said drain line;
a circulation pump separate from said drain pump and adapted to move liquid from said pump chamber to said wash chamber, said circulation pump forming a restricted passage connecting said pump chamber and said macerating chamber; and
a shunt drain system forming a flow path for liquid from said pump chamber to said drain pump, said shunt drain system including a shunt drain conduit connecting said pump chamber with said drain pump and a shunt check valve in said shunt drain conduit movable between a closed position and an open position, wherein said shunt check valve is moved between said open and closed positions in response to a pressure difference between said pump chamber and said shunt drain conduit.

19. The dishwasher according to claim 18, wherein said circulation pump has a shaft extending through

said macerating chamber and a blade attached to said shaft within said macerating chamber.

20. A washer according to claim 18, wherein said shunt check valve is located at an outlet of said pump chamber.

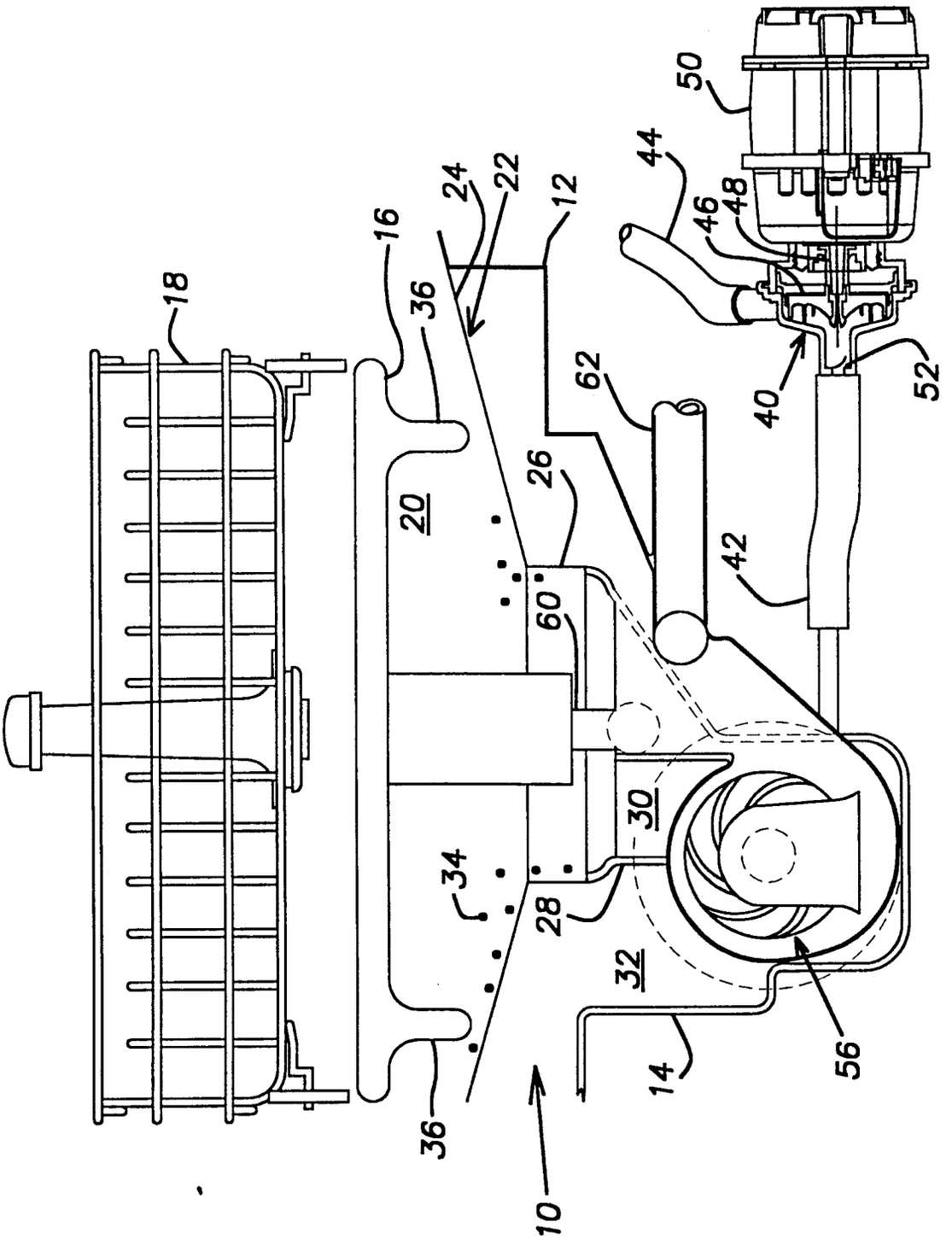
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Fig.1

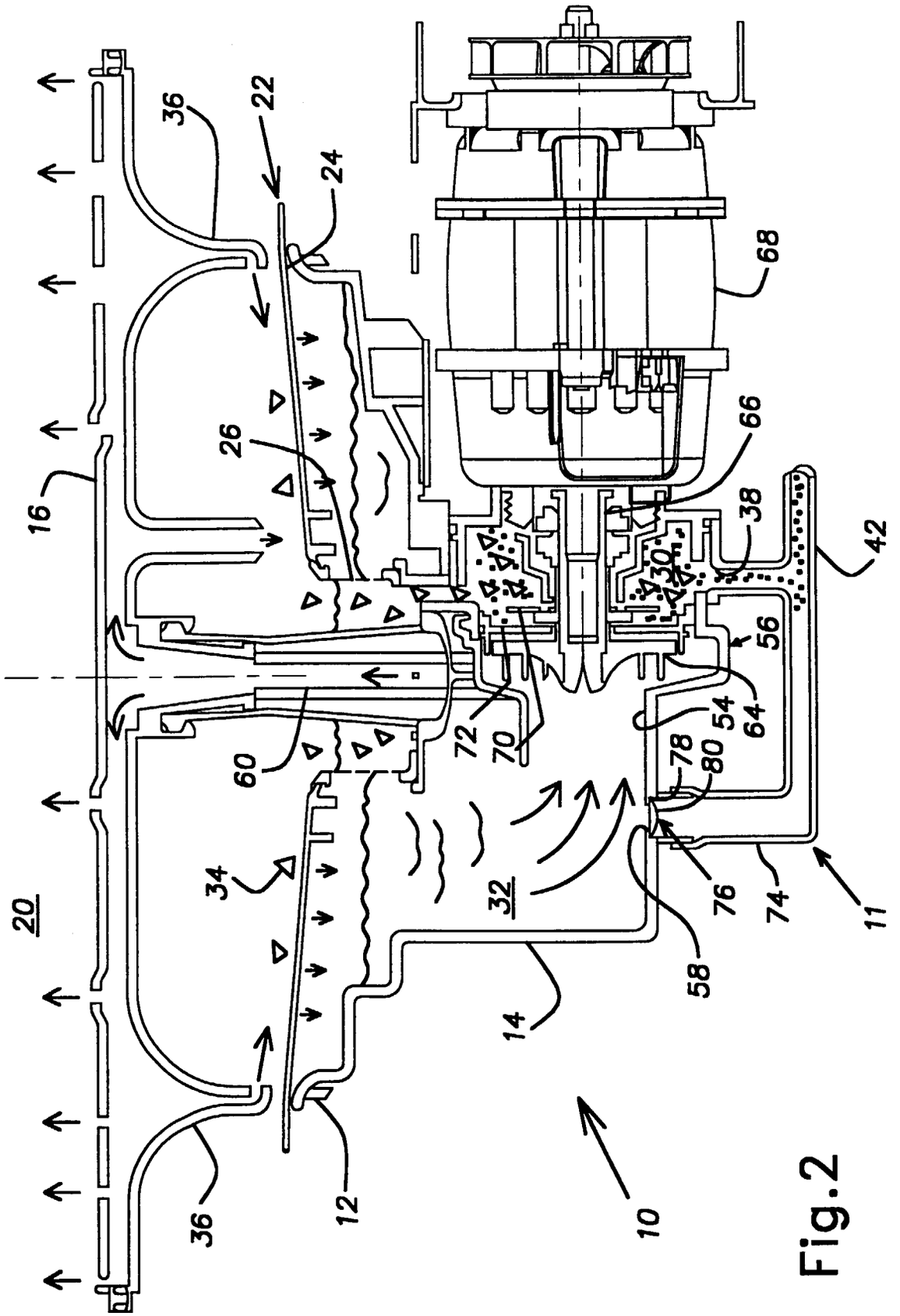
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Fig.2

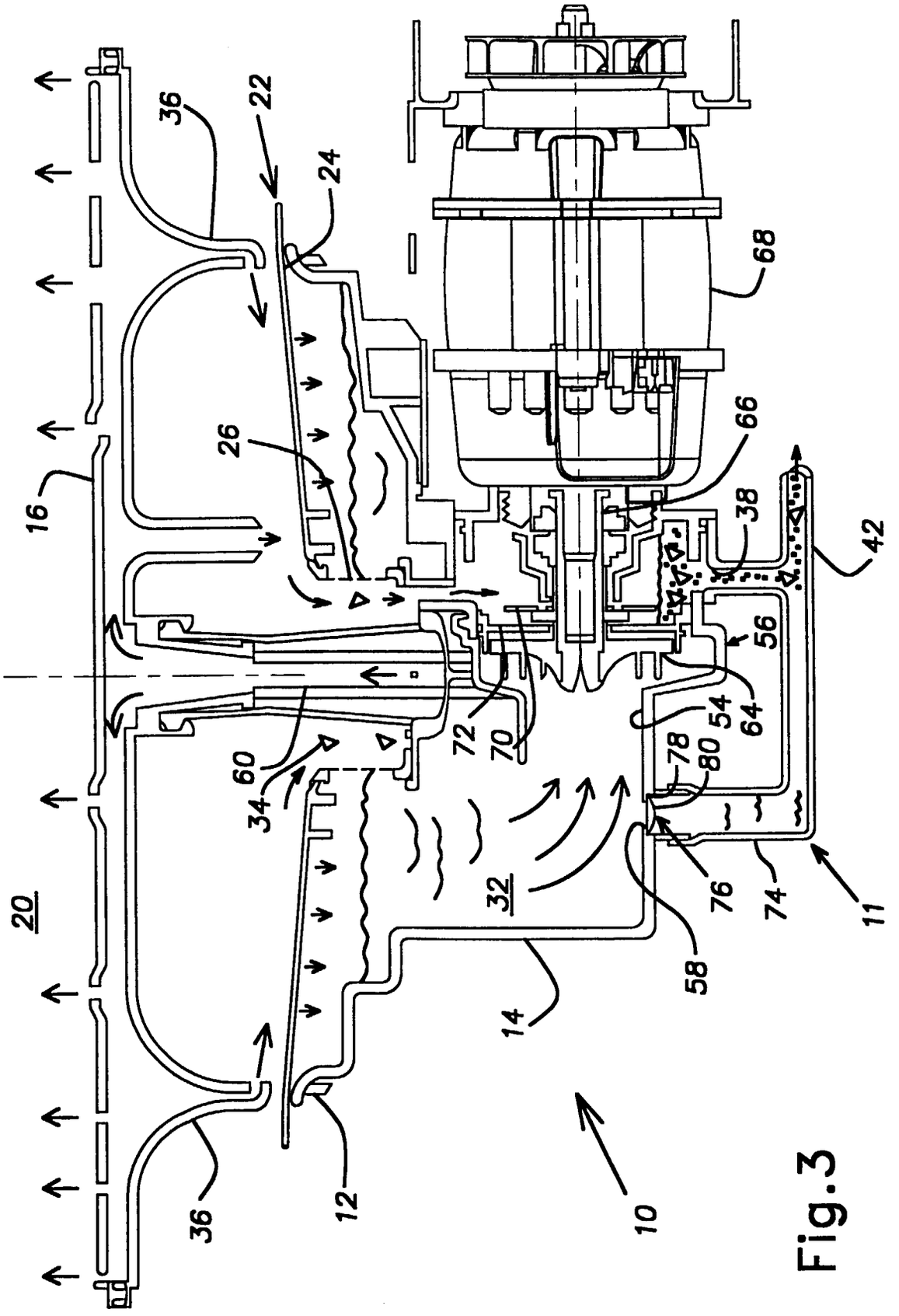
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Fig.3

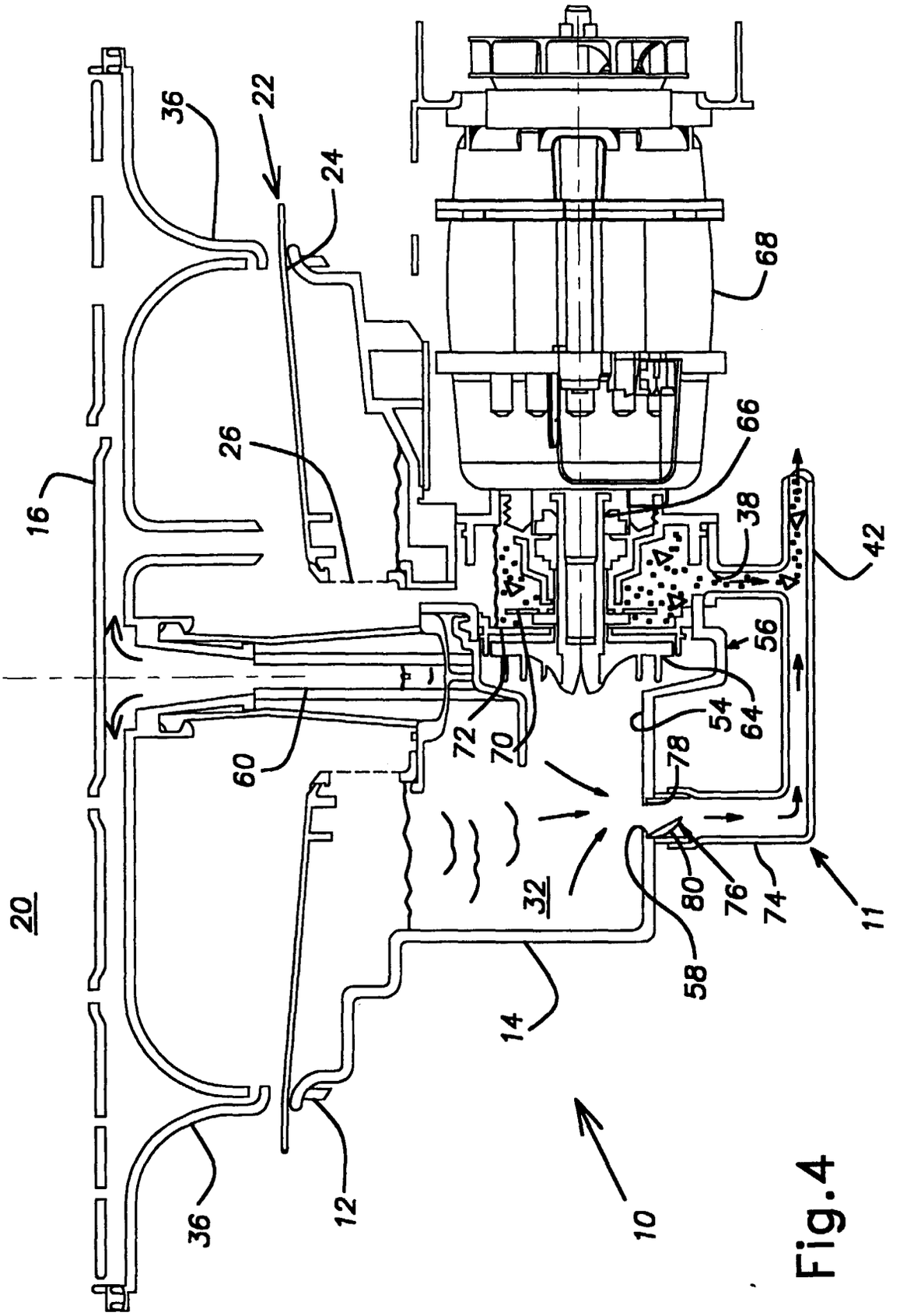
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Fig.4

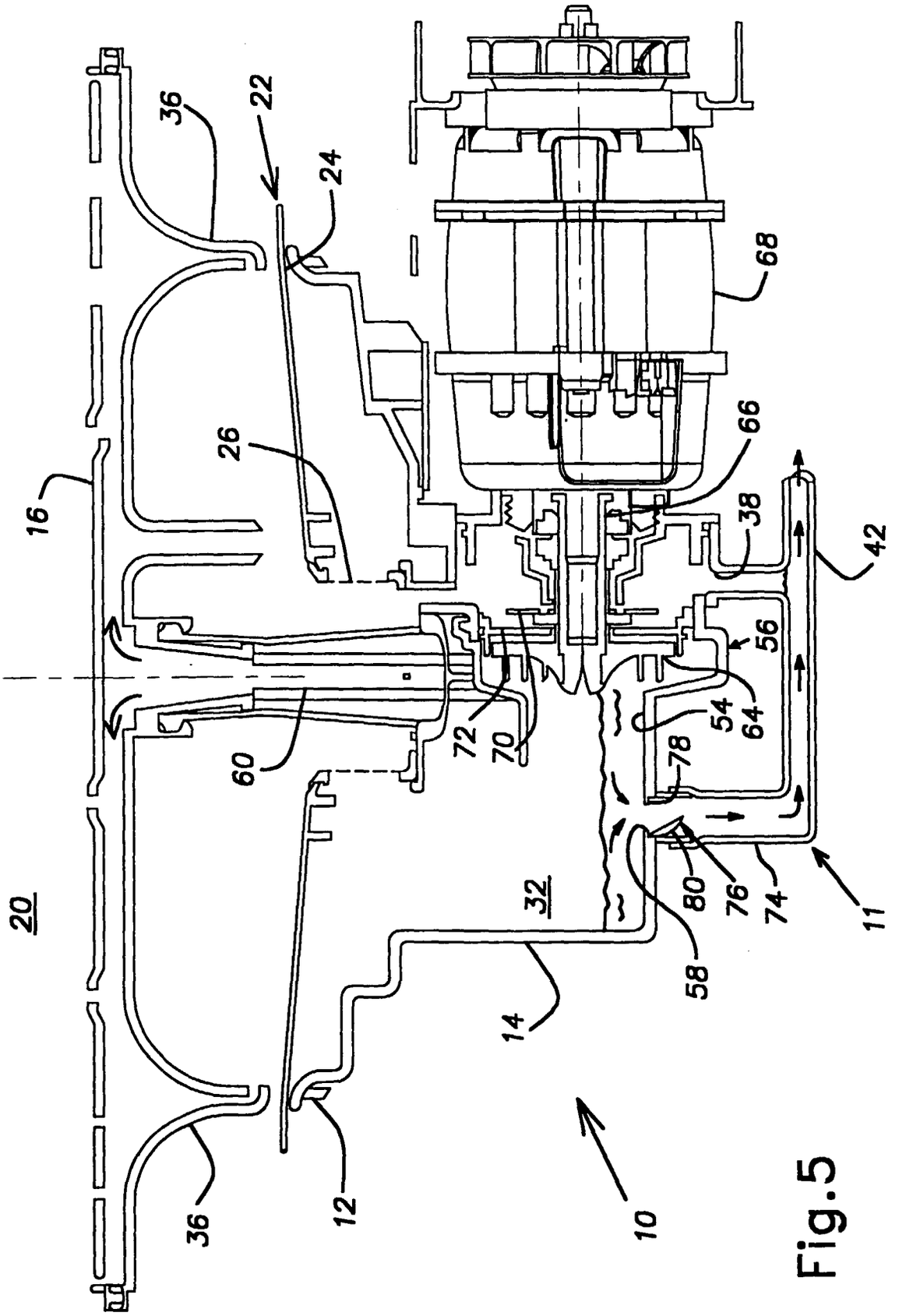
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Fig.5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 11 7020

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X,P	US 5 762 080 A (DRIES JOHN E ET AL) 9 June 1998 * the whole document *	1-20	A47L15/42
Y	US 5 320 120 A (HOFFMAN ROGER L ET AL) 14 June 1994 * column 1, line 40-57 * * column 2, line 54 - column 3, line 20 * * column 3, line 58 - column 5, line 3 * * column 5, line 37-48; figures 1-4 *	1-8, 10-16, 18,20	
Y	GB 1 151 958 A (BAUKNECHT GMBH) 14 May 1969 * page 1, line 13-47 * * page 1, column 63, line 2 - page 5; figures 1,2 *	1-8, 10-16, 18,20	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	11 February 1999	Laue, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 11 7020

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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11-02-1999

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82