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(54) **Trap device.**

(57) A washing machine drain pump has a tubular inlet (13) which tapers inwardly in the direction of fluid flow (F) into the pump. A plurality of slots (16) extend along the inlet (13) in the direction of fluid flow (F) such that any coin entrained in the fluid flow, and of a diameter within a predetermined range, will become lodged with opposite edge portions thereof in spaced-apart slots (16) and in a plane which extends substantially in the direction of fluid flow (F), so that this coin will not obstruct the flow passage.

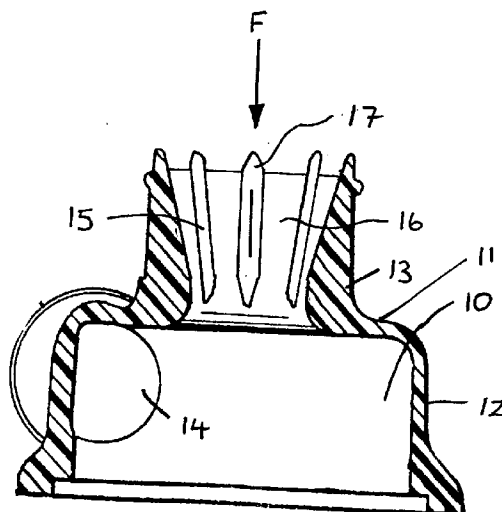


Figure 2

This invention relates to a trap device, particularly for trapping coins entrained in the outflow of a washing machine.

Coins and other foreign objects can sometimes be introduced accidentally into washing machines, and can then jam or block the drain pump of the washing machine if they get drawn into the outlet pipe. When the drain pump becomes jammed or blocked in this manner, the owner usually has to call out an engineer to rectify the fault: this is inconvenient and expensive, and reflects on the perceived reliability of his machine.

Filters can be fitted to prevent the drain pump becoming jammed or blocked in this way. However these filters become clogged and can block the pump unless they are cleaned regularly. Many washing machine manufacturers therefore prefer not to fit such filters to their washing machines.

British Patent Specification No. 1 346 571 discloses a washing machine drain pump having a tubular inlet which tapers inwardly in the direction of flow of water into the pump. Coins entrained in the flow of water become trapped by the tapering inlet and will be prevented from entering the pump. These coins lodge across the tapering inlet, either directly across or at an angle e.g. greater than 45° to the direction of flow, and therefore three elongate ribs are provided on the tapering inlet to hold the coins away from its wall and ensure that a small passage remains around the coins for the flow of water. However, the coins still lodge across the inlet and severely restrict the flow of water out of the washing machine during the rest of the operating cycle. At the end of that cycle a small amount of water is arranged to backwash through the pump, and this usually dislodges any coins trapped in the inlet. These dislodged coins drop into a small sump provided in front of the pump: in practice however, the coins do not always dislodge and those that remain severely restrict the flow of water on successive cycles of the machine.

We have now devised a trap device which alleviates the above-mentioned problems, and therefore increases the overall reliability of the appliance to which it is fitted.

In accordance with this invention there is provided a trap device comprising a flow duct which tapers in the direction of fluid flow, and a plurality of slots extending along the duct in the direction of fluid flow such that any coin entrained in the fluid flow, and of a diameter within a predetermined range, will become lodged with opposite edge portions thereof in spaced-apart said slots and in a plane which extends substantially in the direction of fluid flow.

The trap device may form the inlet of a washing machine drain or recirculation pump. Instead, the device may be separate from the pump and fitted into the flow pipe upstream of the pump.

Preferably the trap device is arranged so that co-

ins at least within a diameter range of 20 to 26mm will lodge at an angle of less than 25° to the axis of the tapered duct.

Any coin which becomes lodged in the trap device will be held substantially edge-on to the direction of fluid flow, and will therefore not unduly restrict the flow of fluid.

The flow duct is preferably frusto-conical for at least a major part of its length. Preferably the cone angle is in the range of 30 to 45° .

The width of the slots preferably reduces in the direction of fluid flow so that smaller coins, which are also generally thinner, also lodge with their planes extending in substantially the direction of fluid flow.

The angle at which a coin lodges depends on several factors including the width of the slots, the thickness of the coin, the angle of taper of the flow duct, and the diameters of the opposite ends of the flow duct of the device.

Preferably the flow duct of the device has an internal diameter in the range of 26-40mm at its wider end, i.e. at its upstream end. Preferably the flow duct has an internal diameter in the range of 15 - 25mm at its narrower end, i.e. at its downstream end. Coins which are smaller than the diameter of the narrower end of the flow duct are able to pass straight through the device and into the pump: however, such small coins are able to pass through and out of the pump without causing any harm to the pump impeller.

Preferably the flow duct of the device has at least six said slots. Preferably the flow duct has ten or less said slots. Typically, the flow duct may have eight said slots.

The slots may be of substantially uniform depth along the length of the flow duct, in which case the slots may be represented by the spaces between a plurality of elongate ribs formed on a frusto-conical surface.

Alternatively, the slots may progressively deepen, in the direction of fluid flow, but are closed at their downstream ends.

An embodiment of this invention will now be described by way of example only, and with reference to the accompanying drawings, in which:

FIGURE 1 is an elevation of a pump chamber housing, having an inlet which incorporates a trap device in accordance with the invention;

FIGURE 2 is a sectional view along the line II-II of Figure 1;

FIGURE 3 is an enlarged elevation of the inlet of the pump chamber housing of Figure 1, showing some coins trapped in the inlet; and

FIGURE 4 is a sectional view through a modified form of tubular inlet of the pump chamber housing.

Referring to Figures 1 and 2 of the drawings there is shown a moulded plastics pump chamber housing of a washing machine drain pump. The pump further

comprises an electrical motor having a centrifugal type impeller fitted to its output shaft and the impeller projects into a cylindrical chamber 10 formed inside the housing; the motor and impeller are omitted from the drawings.

The housing is generally cup-shaped, and comprises a circular end wall 11 and a cylindrical side wall 12 projecting from it. A tubular inlet 13 projects axially from the end wall 11 and a tubular outlet 14 projects tangentially from the side wall 12. In use the inlet 13 of the pump connects to the sump portion of a washing machine drum assembly via an elastomeric hose. The outlet 14 connects to the drain outlet of the washing machine.

The tubular inlet 13 forms a trap device in accordance with this invention. The wall of the tubular inlet 13 is progressively thicker towards the end wall 11 of the housing, so that its inner peripheral surface is frusto-conical. The frusto-conical surface faces away from the housing, i.e. in a direction opposite to the direction F of water flow. A plurality of elongate ribs 15 (e.g. eight such ribs) extend in a generally axial direction along the frusto-conical peripheral wall of the inlet 13. The ribs are equally spaced apart, so that identical slots 16 are formed between adjacent pairs of ribs 15. The slots 16 are arranged in diametrically opposite pairs. The ribs 15 are triangular in section and taper inwardly at their inner and outer ends. The outer end 17 of the ribs 15 projects axially from the inlet 13, so that when a hose is fitted to the inlet 13 the slots 16 commence prior to the inlet 13. The ribs 15 are generally parallel-sided along their length, thus each slot 16 progressively narrows towards the chamber 10 owing to the frusto-conical shape of the inlet 13. The inlet 13 tapers from a diameter of 35mm at its upstream end to a diameter of 18mm at its downstream end, where it is connected to the end wall 11. The inlet 13 is approximately 25mm in length, thus the angle of taper is approximately 37.5°.

Referring to Figure 3, any coins entrained in the water being pumped out of the washing machine will enter the inlet 13 to the pump. The water flow tends to be quite turbulent, thus the coins could be oriented at any angle when they enter the inlet. However, the ribs 15 and the tapering shape of the inlet 13 serve to orientate the coins 30 so that they become lodged, in a stable position, with their planes extending substantially in the direction of water flow, i.e. edge-on to the water flow. Any coins having a diameter less than the narrower part of the inlet 13 (i.e. 18mm) will pass into the pump chamber. The clearance between the impeller and the walls 11, 12 of the chamber 10 is sufficient to allow these smaller coins to pass directly through the pump without harm. The trapped coins 30 may become lodged diametrically across the inlet 13 with their opposite edge portions in opposite slots 16. Alternatively coins 30 may become lodged along a chord across the inlet 13.

The water flow rate will reduce as the number of trapped coins increases, but in practice only one or two coins may get trapped in the pump inlet of a machine during its life. These trapped coins will therefore not substantially affect the rate at which water is pumped out of the machine.

Figure 4 shows a modified form for the tubular inlet 13. This still forms a flow duct which tapers in the direction of fluid flow (being defined by the radially inner surfaces of the ribs 15), with a plurality of slots 16 extending along the duct in the direction of fluid flow (the slots 16 alternating with the ribs 15). However, the slots 16 become progressively deeper in the direction of fluid flow, the inner or bottom surfaces of the slots 16 lying on a newly-cylindrical surface co-axial with the outer cylindrical surface of the tubular inlet 13. The downstream ends of the slots 16 are closed by an annular wall 11a, leaving the flow duct with a central circular opening 13a. The final portion of the flow duct, leading up to the opening 13a, is parallel-sided, i.e. the radially inner edges of the ribs 15 are parallel-sided over this final portion.

In other aspects of construction, and in operation, the modified tubular inlet of Figure 4 is the same as the tubular inlet of Figures 1 to 3. However, because the wall thickness of the tubular inlet 13 of Figure 4 is, on average, somewhat less than in the tubular inlet of Figures 1 to 3, it presents less difficulties in moulding.

It will be appreciated that the drawings show a trap device in accordance with the invention, forming the inlet of a washing machine drain pump. Instead however, the trap device may be separate from the pump and fitted into the drain pipe upstream of the pump.

Claims

1) A trap device comprising a flow duct which tapers in the direction of fluid flow, and a plurality of slots extending along the duct in the direction of fluid flow such that any coin entrained in the fluid flow, and of diameter within a predetermined range, will become lodged with opposite edge portions thereof in spaced-apart said slots and in a plane which extends substantially in the direction of fluid flow.

2) A trap device as claimed in claim 1, arranged such that coins at least within a diameter of 20 to 26mm will lodge at an angle of less than 25° to the axis of the tapered duct.

3) A trap device as claimed in claims 1 or 2, in which the width of the slots reduces in the direction of fluid flow.

4) A trap device as claimed in any preceding claim, in which the flow duct is frusto-conical for at least a major part of its length.

5) A trap device as claimed in claim 4, in which

the cone angle is in the range of 30 to 45°.

6) A trap device as claimed in claims 4 or 5, in which the flow duct has an internal diameter in the range of 26 to 40mm at its wider upstream end.

7) A trap device as claimed in any of claims 4 to 6, in which the flow duct has an internal diameter in the range of 15 to 25mm at its narrower downstream end. 5

8) A trap device as claimed in any preceding claim, comprising six to ten said slots. 10

9) A trap device as claimed in any preceding claim, in which said slots are of a substantially uniform depth along the length of the flow duct.

10) A trap device as claimed in claim 9, in which said slots are formed by a plurality of elongate ribs formed on a frusto-conical surface. 15

11) A trap device as claimed in any of claims 1 to 10, in which the slots progressively deepen, in the direction of fluid flow, but are closed at their downstream ends. 20

12) A washing machine pump having an inlet which includes a trap device as claimed in any preceding claim.

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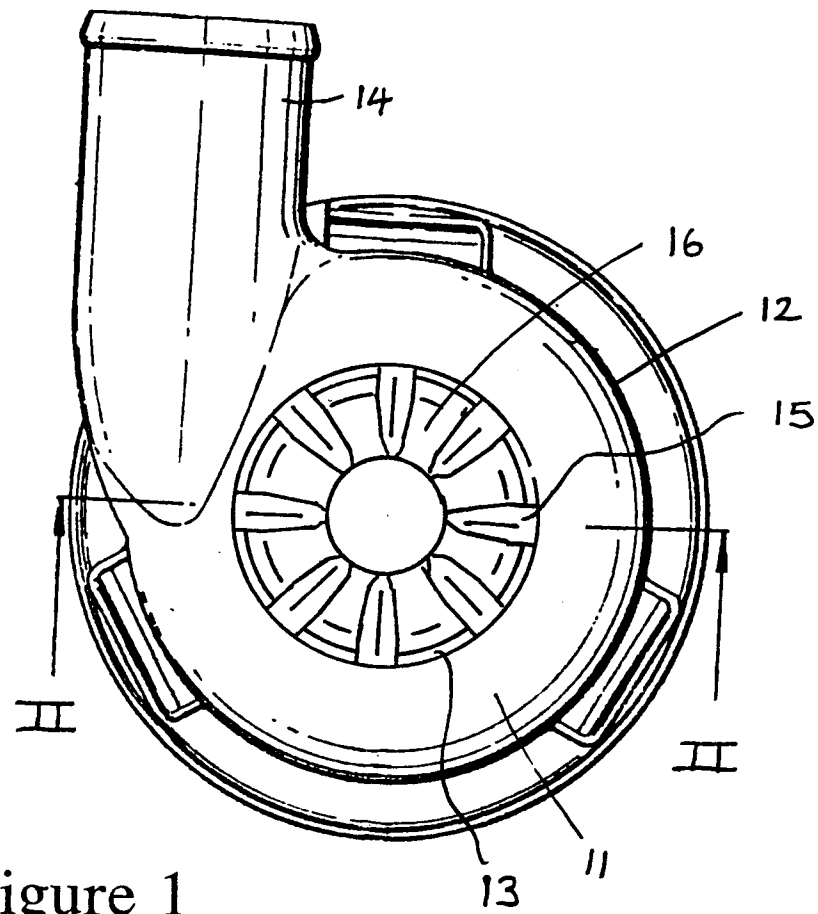


Figure 1

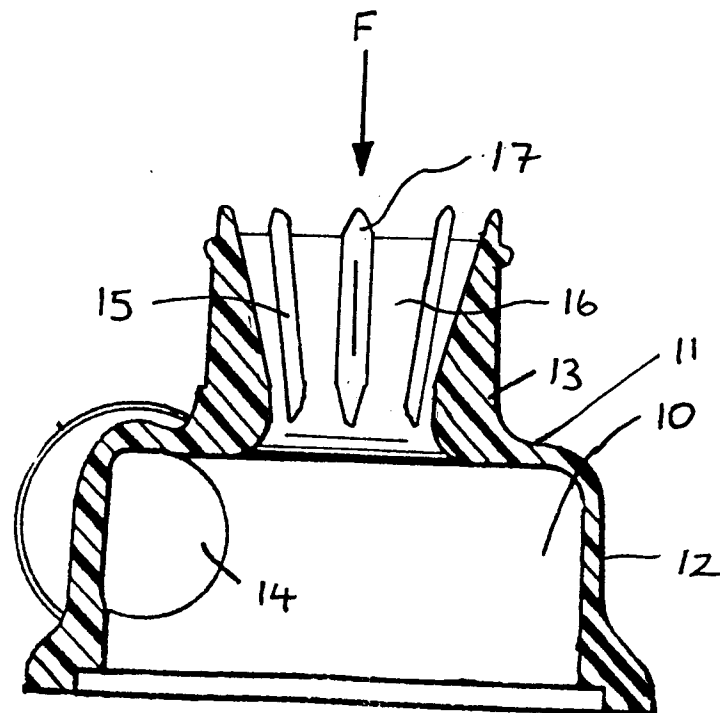


Figure 2

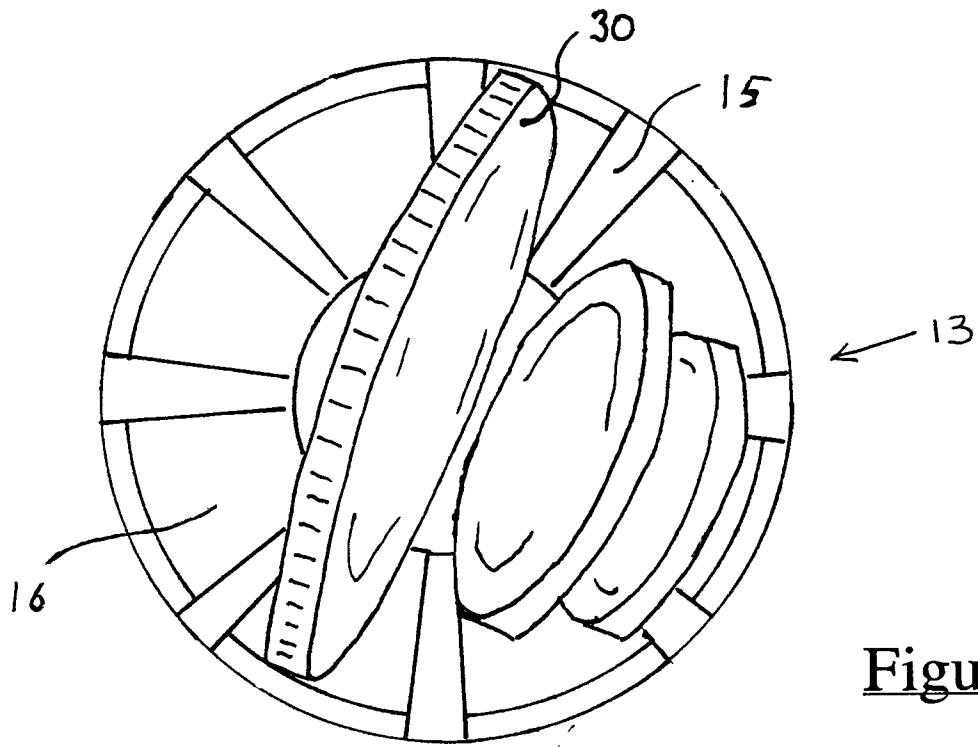


Figure 3

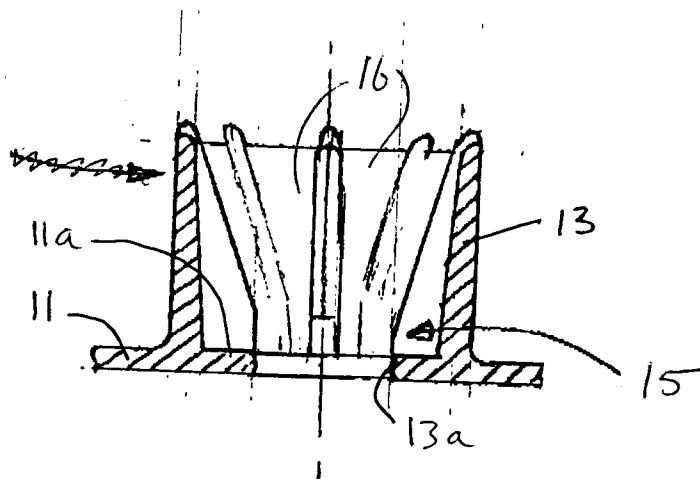


FIGURE 4



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 3656

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.5)
Y	FR-A-2 116 633 (SEDELEM) * page 4, line 9 - line 27; claims 1,2,7; figures 1-3 *	1,2	D06F39/10
A	---	4,12	
D,Y	DE-A-21 10 444 (HOOVER LTD.) * page 5, paragraph 2 - page 5, paragraph 3; claim 1; figures 5,6 *	1,2	
A	---	4,12	
A	US-A-3 228 525 (EVANS,J.T.ET AL) * column 2, line 29 - column 3, line 14; claim 1; figures 6,7 *	1	
A	US-A-4 485 645 (MULDER,J.R.ET AL) * column 2, line 59 - column 4, line 63; claim 1; figures 1,2 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			D06F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 September 1994	Examiner Munzer, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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