Aug. 26, 1941. J. L. HILL 2,254,145

WASHING MACHINE

Filed Aug. 21, 1939 5 Sheets-Sheet 1

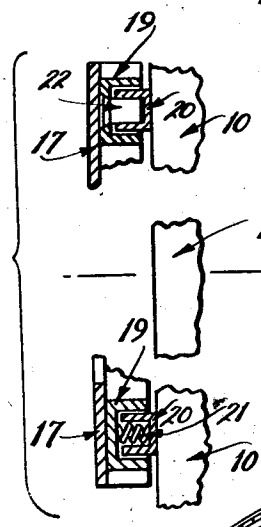


FIG. 3.

FIG. 1.

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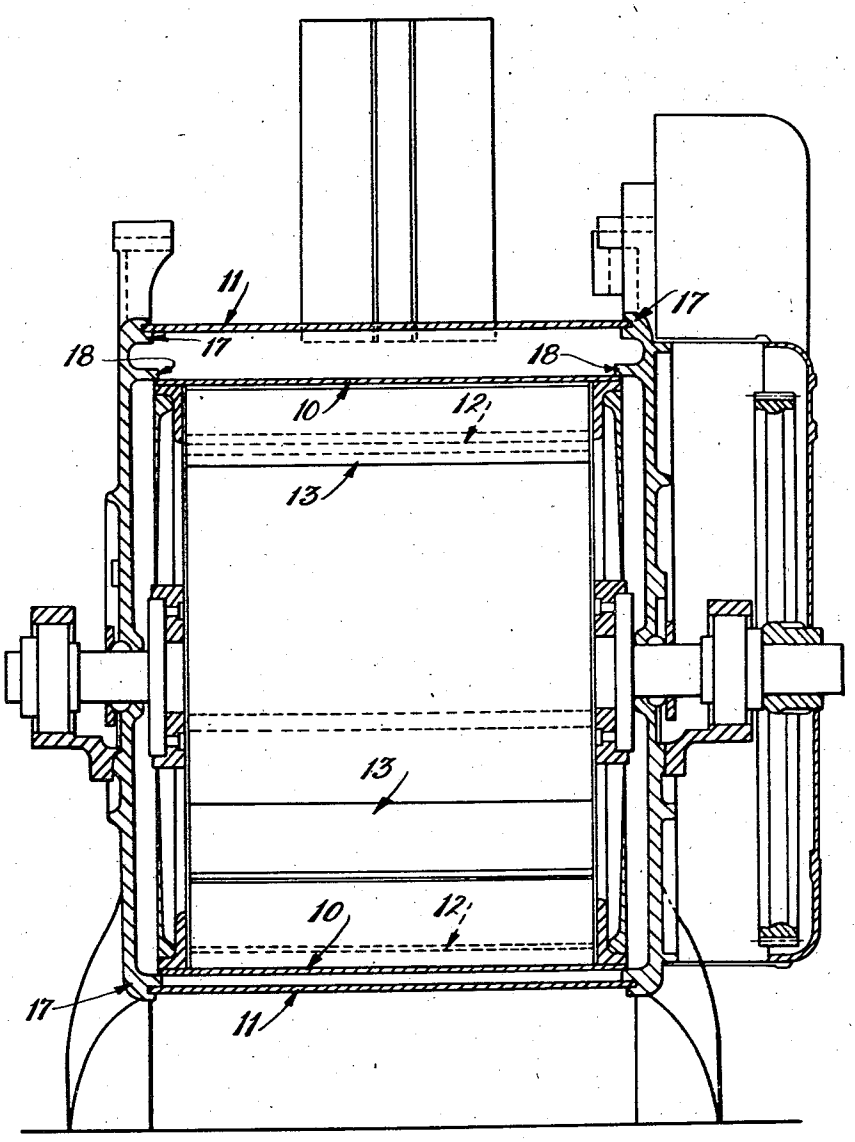


FIG. 2.

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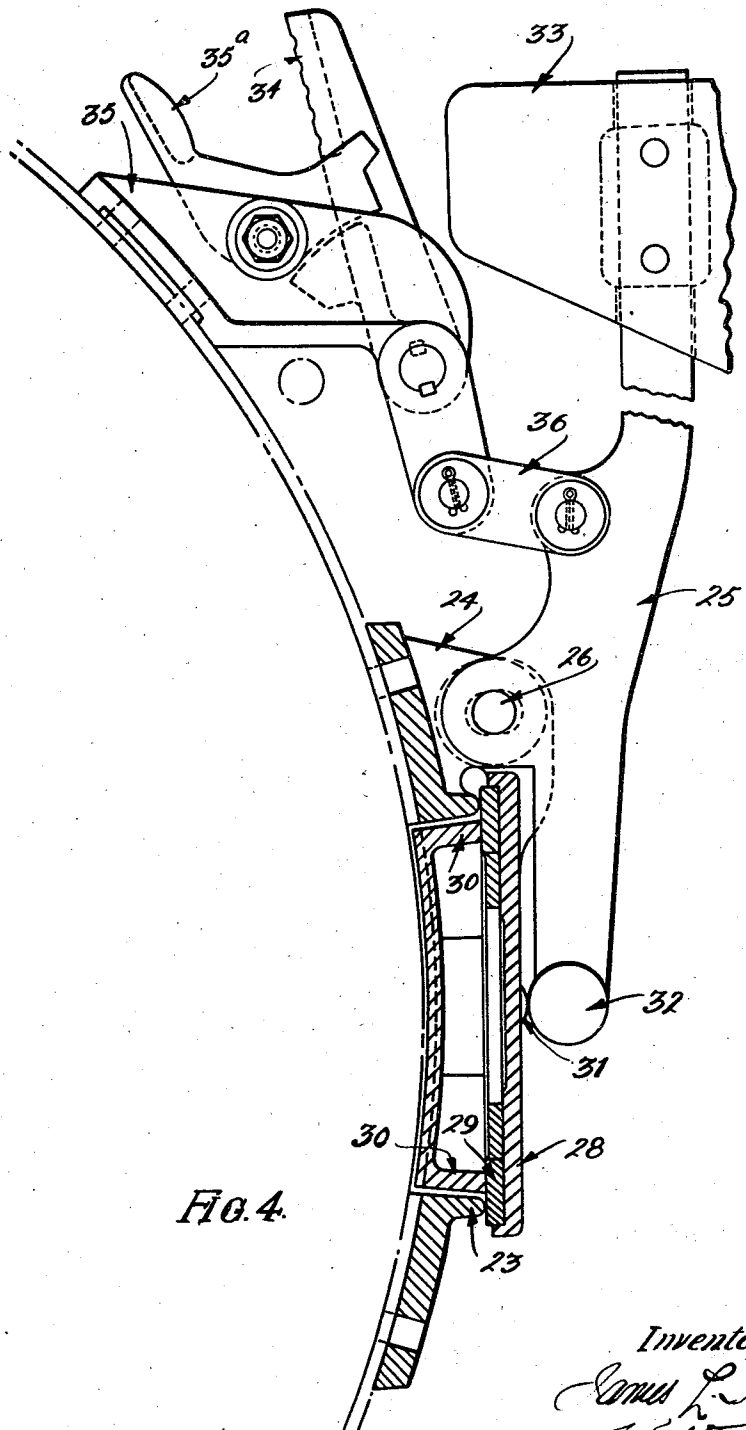


FIG. 4.

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WASHING MACHINE

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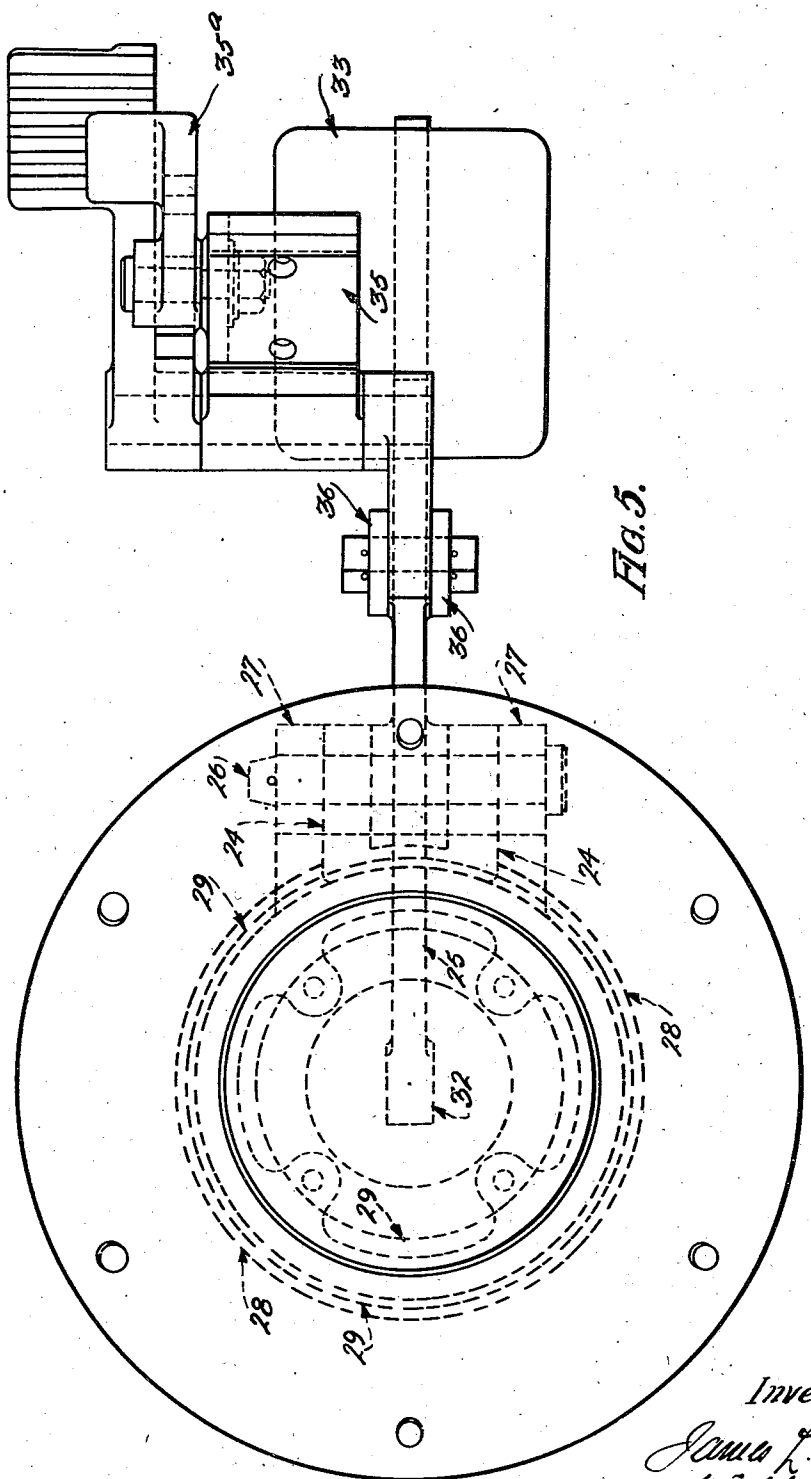


Fig. 5.

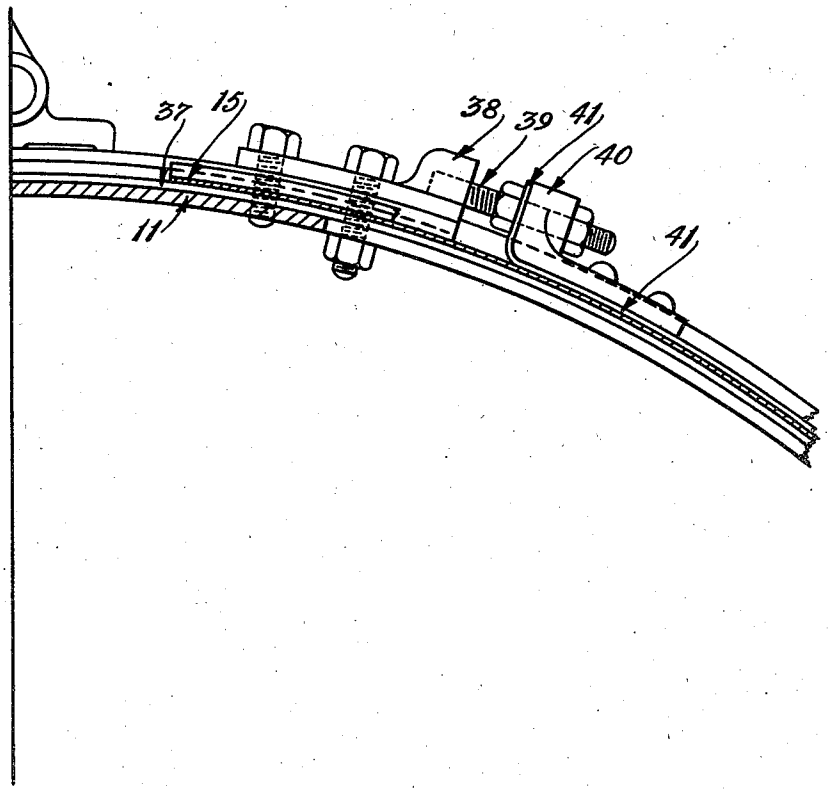
Inventor:
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By his Attorney: Walter Gunn

Aug. 26, 1941. J. L. HILL 2,254,145

WASHING MACHINE

Filed Aug. 21, 1939 5 Sheets-Sheet 5



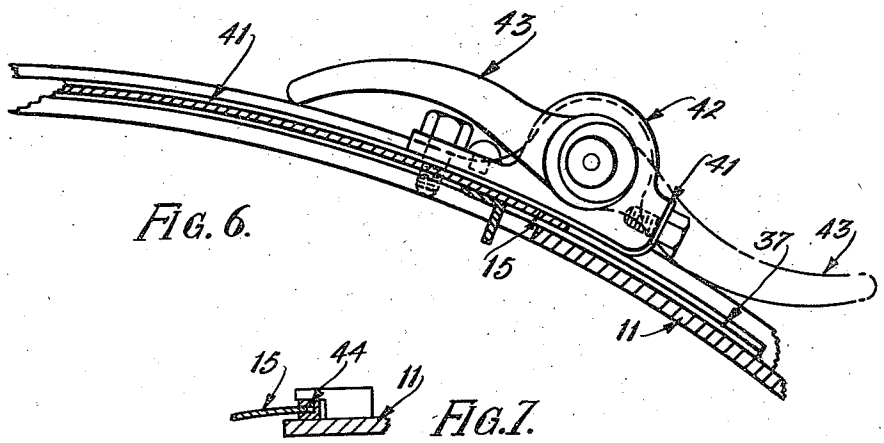


FIG. 6.

FIG. 7.

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Patented Aug. 26, 1941 2,254,145

UNITED STATES PATENT OFFICE

2,254,145

WASHING MACHINE

James Lambert Hill, Chorley, England

Application August 21, 1939, Serial No. 291,219
In Great Britain August 19, 1938

1 Claim. (Cl. 68—139)

This invention relates to washing machines of the kind comprising a perforated drum mounted to rotate about an approximately horizontal axis within a casing.

Washing machines of that kind operate generally with a reversing action, the drum being rotated rapidly, say, three revolutions in one direction, and then three revolutions in the reverse direction. They function mainly by a combination of a tumbling and rubbing action of the goods within the drum and by centrifugal ejection of the washing liquor from and through the goods during revolution of the drum. Whilst the centrifugal ejection of the liquor follows by merely rotating the drum, it is obviously necessary to provide for return of the liquor to the drum in order that such action may continue or be repeated. Probably, with washing machines at present in use, if they were run at the higher speeds herein recommended, the return flow of the liquor would occur mainly, if not almost entirely, during the reversal period for the drum and whilst the drum is substantially at rest or moving only slowly; because whilst the drum is rotating, the centrifugal action within the drum operates to resist re-entry of the liquor by creating an outward flow pressure and by causing pressure of the goods against the inside of the drum. Obviously resistance to return flow of the liquor is greatest at the bottom and least at the top of the drum owing to the opposition of gravity to centrifugal force. Also, it is obvious that in any such machine although the water level will rise outside the drum due to cerntifugal ejection from within, this rise of level is in proportion only to its speed of revolution, and therefore, allowing for frictional losses, the level will not for that reason ever rise high enough for the outside static head to overcome the internal centrifugal pressures. There is, however, the further factor that the liquor is carried round by contact with the surface of the drum especially where the latter is formed or provided with external ribs, and this causes some false level increase on the rising side of the drum. However, such false level increase is similarly opposed and overpowered by a corresponding false level within the drum due to the lifting action given to the liquor by the tumblers provided within the drum. The rise of level outside the drum obtained by rotation of the latter cannot therefore of itself cause re-entry of the liquor.

In order to obtain a re-entry flow during rotation of the drum it has been proposed to mount the drum to rotate about an axis concentric within the casing but eccentric with the drum itself so that the eccentric movement of the outer periphery of the drum produces relative movement towards and away from the casing with the object to lift and force the liquor to return through the walls of the drum.

In order to obtain the same effect of forcing the water to re-enter the drum, but without having to make the rotary drum eccentric on its axis of rotation, it has been proposed to provide baffles or deflectors on the inner wall of the casing to force any water carried round on its periphery to return back into the drum, and in one form the drum was raised out of centre with the casing so that the converging upper wall of the casing would act as such a deflector. In so raising the drum however, the lifting effect on the outside of the drum is necessarily reduced by increasing the slip space between the drum and the casing at the bottom. Also a greater volume of liquor would be required to obtain the same level in the drum.

The object of the invention is a method of and means for stimulating re-entry of the washing liquor during rotation of the drum. From a practical point of view the object of the invention is to enable the user to obtain greater output of washing per unit of time and machine size.

This can best be obtained in relation to cleansing effect without damage to fabrics at certain rates of speed which have not been practicable hitherto on account of sluggish re-entry and therefore of bad penetration of heavy loads by the liquors at high running speeds. It is claimed that the high speeds made possible by this invention increase the beneficial possing action, reduce harmful friction to the most suitable point and so enable this type of machine to be loaded to a figure almost twice as high as has hitherto been considered good laundry practice.

According to the invention the drum is disposed eccentrically within the lower part of the casing and is provided on its outer periphery with vanes or blades adapted to pass close to the bottom of the casing in the manner of a pump, end clearance between the drum and the casing being reduced, or means being provided to close the ends, to prevent loss of lift effect.

In the accompanying drawings:

Fig. 1 is a sectional end elevation of one example of a machine made in accordance with the invention;

Fig. 2 is a sectional front elevation of Fig. 1;

Fig. 3 is a section of an alternative sealing means for the end of the drum;

Fig. 4 is an enlarged sectional view showing a preferred construction of outlet valve for use with the machine shown in Fig. 1;

Fig. 5 is a plan of the valve mechanism shown in Fig. 4;

Fig. 6 is a detail enlarged section of part of the casing;

Fig. 7 is a section showing the horizontal joint of the cover.

In the example of the invention illustrated in Figs. 1 and 2 of a washing machine of the usual size, the drum **10** is about 3 ft. external diameter and arranged so that there is about ¾ inch clearance at the bottom and 2¾ inches at the top between its periphery and the internal periphery of the casing **11**.

The drum is provided with 6 longitudinal ribs **12** of angle iron which just clear the bottom of the casing, allowing for working conditions, expansion by heat, etc. These ribs extend the full length of the drum.

The drum is provided internally with the usual "tumblers" **13** and with a hinged cover **14**, whilst the casing is provided with an aperture adapted to be covered by a sliding cover **15** in which is fixed an inspection window **16**. Means for sealing the joint of the sliding cover are described in detail later with reference to Fig. 6. As shown in Fig. 2 the ends **17** of the casing are each formed with an inwardly projecting ring **18** concentric with the drum and each of slightly larger internal diameter than the adjacent end of the drum, and of such depth as just to overhang such ends. By this means, the cylinder is permitted to expand in diameter as well as in length and also to float slightly endwise on its shaft without actually making rubbing contact with the ring.

In operation, the washing fluid or water is forced out of the drum by centrifugal force, particularly at the bottom. Up the sides, such centrifugal force still resists re-entry of the water, so that the water collects up the face of the drum as it is lifted by the ribs **12** acting like a pump and is relatively unable to return to the drum owing to the centrifugal pressure from within and also the centrifugal force on itself which tends to cause it to keep outwards against the wall of the casing. Towards the top of the drum and casing however, these forces reduce in the drum as is obvious, and outside the drum by reason of widening of the space and therefore permissive reduction of velocity of the fluid. The static head or pressure obtainable by the combined action of centrifugal pressure within the drum and the pumping action between the drum and the bottom of the casing can therefore be greater than the resistance to re-entry. Consequently the washing fluid or water is able to re-enter the drum at its upper part.

The maximum pumping effect is obtained by reason of the rings **18** which prevent undue escape of the fluid between the ends of the drum and the ends of the casing.

In another example, as shown in Fig. 3 an alternative sealing means for the ends of the drum comprises a ring **19** of U-cross section fitting over a ring **20** on the drum between which are arranged springs **21** acting to press the U-section ring **19** outwards against the end **17** of the casing. The inner ring **20** is fixed to the drum near its outer periphery, and the outer ring is arranged to rotate also with the drum by providing a series of lugs, pins or dowels, **22**, fixed in the ring **19** and sliding in holes in the ring **20**.

As shown in Figs. 4 and 5 an outlet valve is provided in the bottom of the casing comprising a seating **23** secured to the outside and having a pair of lugs **24**. Pivoted between such lugs is an operating lever **25** whilst on the same pivot pin **26** and on the outside of the lugs are the arms **27** of a valve **28** having a seating insert **29** and a raised central boss **30** curved cylindrically to form a continuation of the inner periphery of the casing. This continuity avoids the pocket at the valve which occurs with the usual outlet valve and branch, as any such pocket would interfere with the pumping or lifting action of the ribs. On its under side the valve is formed at its centre with a raised part **31** adapted to be engaged by a head **32** on the end of the lever **25**. At its other end, the lever **25** is provided with an adjustable balance weight **33**. The valve operating mechanism comprises a pedal lever **34** mounted in a bracket **35** secured to the under side of the casing and connected at its inner end by links **36** to the lever **25**. Also mounted in the bracket **35** is a catch lever **35a** adapted to engage the pedal when depressed so as to hold the valve in the open position against the return action of the weight **33**.

As shown in Fig. 6, the cover **15** for the casing is slidably mounted on the casing, being guided at its ends in fixed guides **37**. Also adjacent such ends are lugs **38** each carrying a tension screw **39** on which is slidably located a further lug **40** secured to the end of a flexible band **41**. At its lower end each band has a lug **42**, such band being adapted to be quickly tensioned by means of a lever **43** operating an eccentric engaged in the end of the lug **42**. The lower edge of the cover enters a U shaped rubber seal **44** as shown more clearly in Fig. 7.

In use, when the cover has been brought to the closed position the levers **43** are pushed up to the "full line" position shown in Fig. 6 thus tensioning the bands **41** on the ends of the cover and pressing such ends firmly down onto the face of the casing or into their guides so as to make a substantially water-tight seal. The levers **43** are easily brought down into the position shown dotted, to release the tension on the bands so that the cover may easily be pushed back to the open position.

The cover is provided with an inspection window **16** and handle **16a** shown in Fig. 1 but omitted from Fig. 6 so as not to be confused with the sealing means. A safety pawl is provided, adapted to engage the upper edge of the cover so as to prevent it from being opened whilst the machine is in motion, such pawl being connected to the starting control. This feature is already well known for washing machines and no novelty is claimed therefor. No provision is shown for sealing the upper edge of the cover. Provision was made for effecting such sealing but it was found to be unnecessary.

The invention is obviously not limited to all the details above described, the principal features of which are the positive driving and lifting effect of the blades due initially to their close proximity to the bottom of the casing, the conversion of this kinetic energy to static pressure head within the casing due to the eccentric position of the cage within the casing, superimposed on the pressure of centrifugal ejection to provide a static head or pressure outside the drum greater than the resistance to re-entry.

What I claim is:

A washing machine comprising a cylindrical

casing with end closing members arranged with its axis approximately horizontal, a cylindrical perforated drum with end closing members within the casing mounted for rotation about its own axis with such axis below that of the casing, vanes on and standing out beyond the periphery of the drum, extending the full length thereof and adapted to pass close to the bottom of the casing to lift the washing fluid on one side of the drum in the manner of a rotary pump into a space of increasing cross section and sealing means between the ends of the drum and the ends of the cylinder to substantially prevent return flow round the ends of the drum, said sealing means comprising an annular projection extending between the adjacent ends of the casing and drum elements near the cylindrical surface of said drum, said annular projections being secured to one of said elements and contacting said other element in sealing relationship.

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