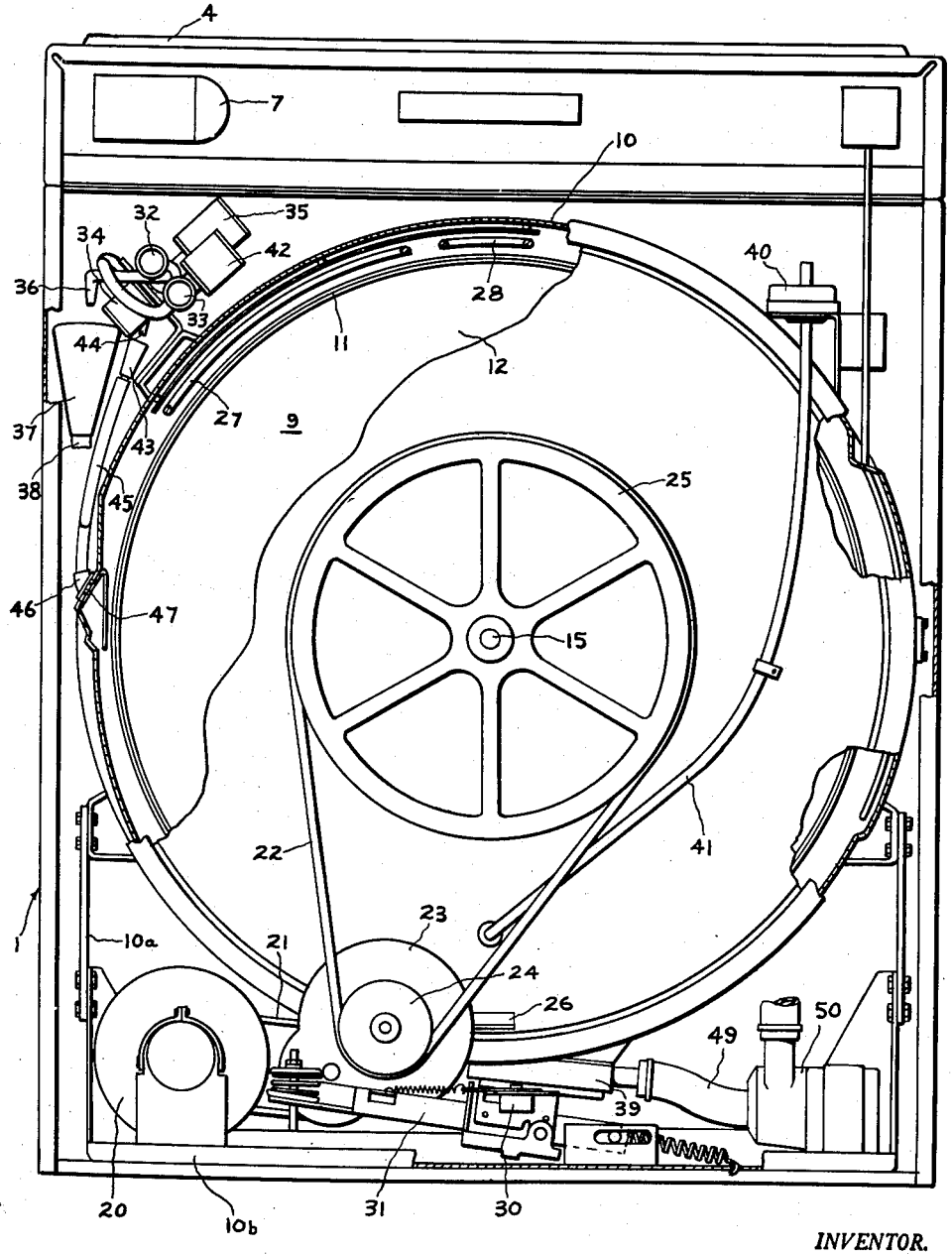
Jan. 10, 1961 J. BOCHAN 2,967,417

COMBINATION WASHER-DRYER CONSTRUCTION

Filed April 24, 1958 3 Sheets-Sheet 1

FIG. 1



INVENTOR.
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BY Jack P Lawrence

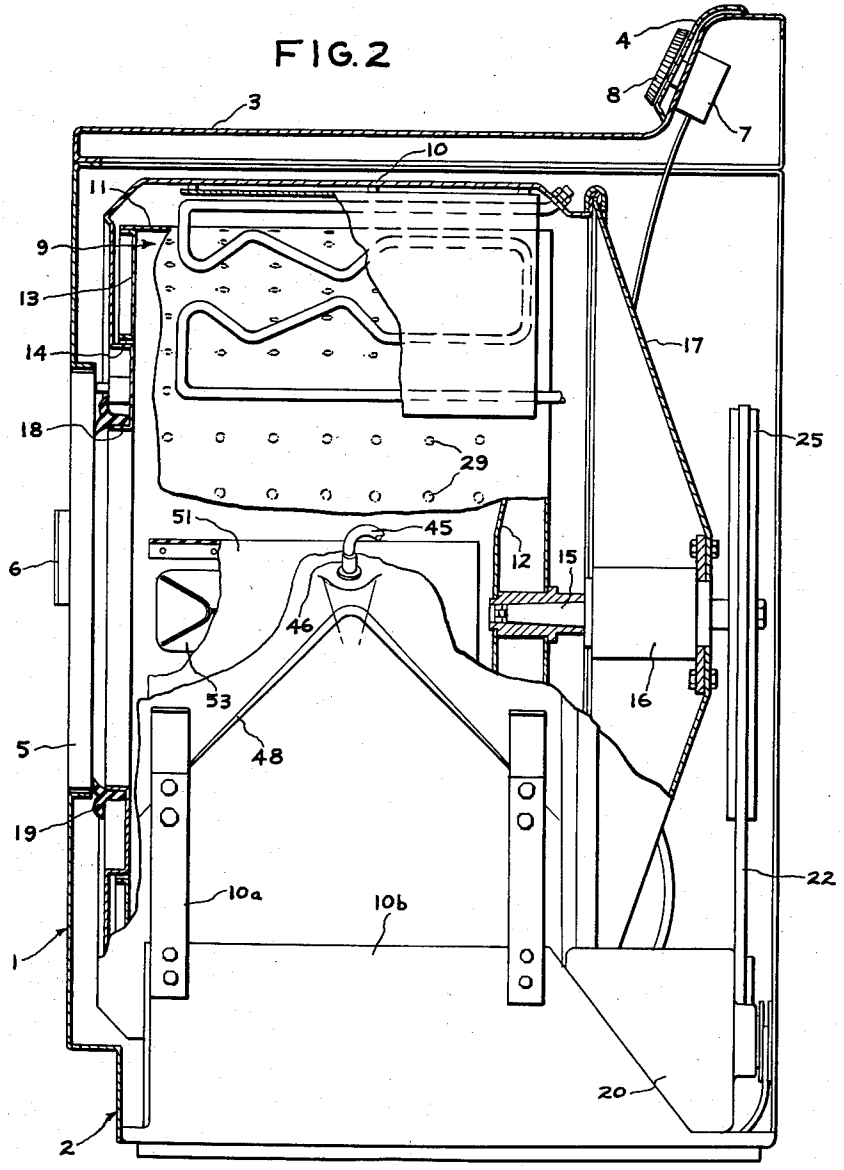
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COMBINATION WASHER-DRYER CONSTRUCTION

Filed April 24, 1958 3 Sheets-Sheet 2

FIG. 2



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COMBINATION WASHER-DRYER CONSTRUCTION

Filed April 24, 1958

3 Sheets-Sheet 3

FIG. 3

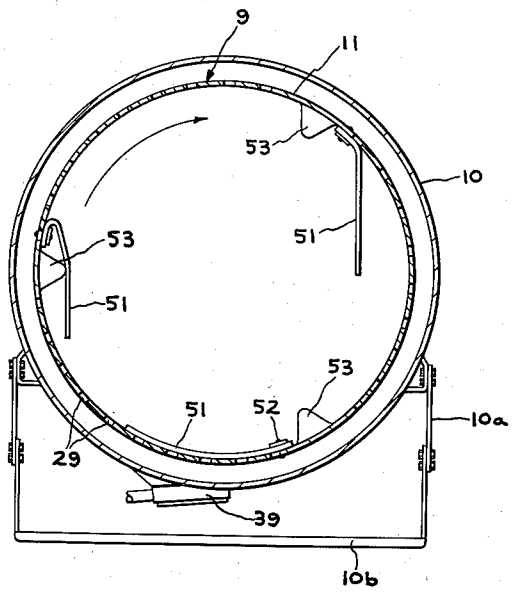
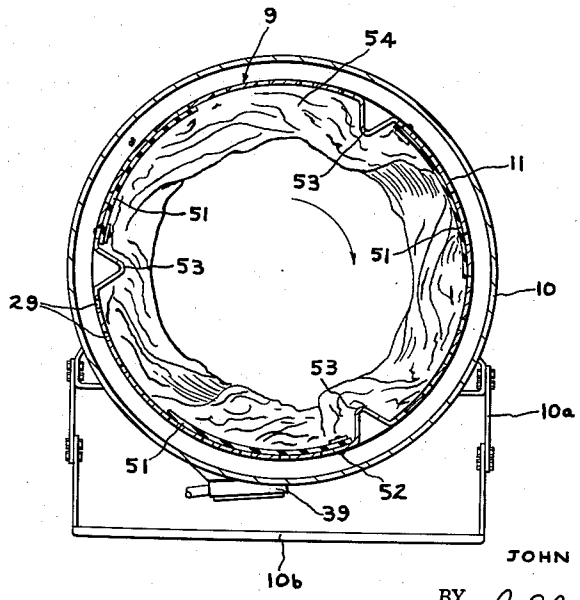


FIG. 4



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United States Patent Office

2,967,417

Patented Jan. 10, 1961

2,967,417

COMBINATION WASHER-DRYER CONSTRUCTION

John Bochan, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Filed Apr. 24, 1958, Ser. No. 730,579

2 Claims. (Cl. 68—24)

This invention relates to combination washer-dryers which provide a washing cycle which includes centrifugal extraction of the clothes and a subsequent heated drying cycle; more particularly, it relates to an arrangement for inhibiting sticking of clothes to the inner surface of the clothes receptacle of the machine after the termination of the centrifugal extraction phase of the operation.

Combination washer-dryers perform the combined function of washing machines and drying machines, that is, the same machine washes the clothes and then dries them completely. The washing portion of the sequence which is provided is in general approximately the same as that of standard washing machines in that it includes a washing cycle, at least one rinse cycle to get rid of the washing liquid, and a centrifuging or spin operation to get most of the rinse liquid out of the clothes. These operations are immediately followed by the drying operation in which heat is provided to vaporize moisture from the clothes as they are tumbled in the clothes receptacle. One problem which has presented itself in such machines is the tendency of the clothes in the rotating receptacle, or basket, to adhere to the walls of the basket after the last centrifuging operation if that operation is conducted at a sufficiently high speed to remove a substantial proportion of the liquid in the clothes. This occurs to the extent that, if no corrective measures are taken, the clothes remain in a relatively tight annulus, adhering to the inner basket surface during heat drying instead of tumbling about in the receptacle. This results in the clothes remaining wet because only a small portion thereof is directly exposed to the heat.

With some machines, an attempt to solve the problem has been made by keeping the centrifuging speed under the "sticking speed"; this, of course, leaves more liquid remaining in the clothes than if a higher speed were permissible. Other machines have provided other solutions such as compound spin cycles where the unsticking effect is provided by predetermined variations in the centrifuging speed of rotation of the basket. In any event, all combination machines have to meet the problem in some manner or other: the clothes cannot be permitted to remain stuck to the periphery of the receptacle after the last spin of the washing portion of the operation since otherwise they would not present enough surface to the heat for drying to be effected as desired.

It is accordingly a primary object of the invention to provide new and improved "anti-sticking means" for use in a combination washer-dryer machine, automatic in its operation, permits without sticking speeds which would otherwise have resulted in sticking.

A further object of the invention is to provide means within the clothes receptacle which will automatically prevent sticking of clothes to the receptacle after the centrifuging operation.

Another object of the invention is to provide such anti-sticking means at a minimum of expense and with a minimum of change from previously provided constructions.

It is known that adherence results as water is forced outwardly through the clothes during the centrifuging operation; the fabric of the clothes and the surface of the basket are brought into intimate contact as the water passes through, and therefore the clothes remain stuck to the basket at the end of the spin operation to the extent that the force of gravity is not sufficient to cause the clothes to fall away. It has further been ascertained by experimentation that if a substantial number of clothes are precluded from the intimate contact with the basket, not only will they not stick but they will knock the other stuck clothes loose from the basket during a tumbling operation subsequent to the spin; thus, even though part of the clothes stick to the basket during the spin part of the cycle, the final effect is to have all the clothes tumbling freely. In pursuance of this experimentally established fact, I carry out my invention by providing, in a washer-dryer machine, a construction within the basket which will permit the centrifuging operation to remove most of the liquid from the fabrics therein but which will insure that a substantial part of the fabrics being washed are precluded from contacting the basket surface so that even though some of the fabrics should stick to the basket the tumbling action of the unstuck fabrics will knock the rest of the fabrics loose. The machine includes the usual substantially cylindrical clothes receptacle rotatable on a non-vertical axis, together with means for rotating the receptacle both at tumbling speed and spin speed, means for introducing liquid into the receptacle for treating the clothes at an appropriate time during the tumbling operation, and means for heat drying the clothes. Within the receptacle, flap means of flexible non-hygroscopic material, substantially free from any tendency to stick to the basket wall, is secured to the cylindrical wall of the receptacle so as to lie against that wall by centrifugal force when the basket is spinning, but so as to hang down from the wall by its own weight when the basket is either stopped or rotating at tumble speed. The flap means, which is preferably imperforate, covers a substantial part of the cylindrical wall when it lies thereagainst. The cylindrical wall has a substantial number of perforations formed therein in the portion thereof which is not coverable by the flap means so as to provide for removal of the liquid from the clothes during the centrifugal extraction.

A substantial part of the clothes lies against the flap means during the spinning operation. As soon as the speed of the basket is slowed down to tumble again, the flap means, which of course do not stick to the basket since they are flexible and non-hygroscopic, fall away from the basket wall taking with them the clothes which are lying thereagainst. These clothes are therefore free to tumble as soon as the speed decreases, and they in turn knock loose the other clothes which lie against the wall of the basket so that within a very short period after tumbling speed is resumed all the clothes are tumbling freely.

The subject matter which constitutes the invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. The invention itself however, both as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a rear elevational view of a combination washer-dryer with the rear panel thereof removed, partially sectionalized and with certain surfaces broken away to illustrate details;

Fig. 2 is a side elevational view, also partly in sec-

tion and with certain surfaces broken away to show the details of the invention;

Fig. 3 is a rear elevational view of the improved construction within the clothes container of a washer-dryer machine constructed in accordance with the invention; and

Fig. 4 is a view similar to that of Fig. 3, with clothes in the container and with the container being rotated at a speed appropriate for centrifugal extraction of liquid from the clothes.

Referring now to Figs. 1 and 2 of the drawing, there is shown a combination washer-dryer machine where the operating elements of the machine are included within the outer cabinet structure which may include, by way of example, a wrap-around central section **1** supported on a base assembly **2** and carrying a separate top **3** provided with an integral backsplash panel **4**. Access to the interior of the machine is provided by a door **5** mounted on concealed hinges and opened by means of a knee operated latch control **6**. The machine is so constructed that when a load of soiled clothes is placed therein it proceeds through a sequence of operations, first washing the clothes and then drying them. In order to provide complete flexibility of operation of the machine a number of operator controls may be included therein. The controls themselves form no part of this invention and are normally contained within a casing such as **7**, for instance, secured to the backsplash panel **4** and connected to one or more suitable rotatable control knobs **8** provided on the front of the backsplash panel for convenient operator selection of a suitable sequence of operations.

As shown in the figures, the machine is of the non-vertical type; in the specific embodiment illustrated, the axis is horizontal, that is, the machine has a clothes basket or receptacle **9** mounted for rotation on a generally horizontal axis within an outer enclosing tub structure **10**. Tub **10** is mounted to base **2** by means of arms **10***a* which are secured to plate **10***b* fixedly attached to the base. The basket includes a cylindrical shell or wall **11** which is closed at its rear end by means of a suitable wall or plate **12**. The basket also includes a front wall **13** which is formed so as to define a loading access opening **14**. The basket is rotatably supported by a shaft **15** which is mounted in an elongated bearing **16** supported from rear wall **17** of tub **10**. The tub is provided with an opening **18** in the front wall thereof which is aligned with the access opening **14** to the basket and door **5** so that clothes may be placed into and removed from the basket. Door **5** seals against a suitable gasket **19** during operation of the machine.

During the operation of the machine, the basket **9** is rotatably driven by any suitable means such as an electric motor **20** through a drive including a pair of flexible belts **21** and **22**. Belt **21** connects the output pulley (not shown) of motor **20** to the input pulley (not shown) of a transmission assembly **23**. Belt **22** connects the output pulley **24** of transmission assembly **23** to a basket drive pulley **25** mounted on shaft **15** of basket **9**. Transmission assembly **23** is of the multiple speed type, that is, the ratio thereof can be changed so that the basket is driven at two different speeds. The transmisison assembly thus provides one basket speed for clothes tumbling and another basket speed for centrifugal extraction or spin. The ratio of the transmission assembly may be changed by means of a suitable spring biased solenoid actuated plunger **26**. In one position of the solenoid plunger the transmission ratio is such that the basket is driven at a suitable speed for washing and tumbling the clothes, for example, 44 revolutions per minute. In the other position of the plunger, the ratio of transmission is changed so that the basket is driven at a suitable speed for centrifugal extraction, normally in excess of 200 revolutions per minute. During the operation of the machine the basket **9** is continuously rotated by means of this drive.

To heat the clothes during the drying portion of the cycle, there is provided in the machine a suitable heater assembly such as the one illustrated which includes two heaters **27** and **28**. These heaters, which may be used to warm the wash water during the washing portion of the cycle when desired, are normally mounted within the upper portion of tub **10** so that when energized they heat the basket **9**. The heating elements are preferably of the sheathed type in which a resistance wire is maintained in spaced relation with an outer sheath by a highly compressed granulated heat conducting electrically insulating compound such as magnesium oxide. Such heating elements are sold under the trademark "Calrod" and are available commercially. When the heaters are energized during the washing cycle they heat the water by first heating the basket. Then, as the basket dips into the wash water at the bottom of the tub, it in turn heats the water, serving as a heat transfer means between the heating elements and the washing liquid. When the heaters are energized during the drying cycle, the heat transferred to the clothes basket is then passed on to the clothes to cause vapor migration out of the clothes. Since the outer cylindrical wall of the basket is perforated, as shown by small spaced openings **29** (which will be further discussed below) some of the heat from the heating elements passes directly to the clothes by radiation.

In order that the machine will not be damaged by the heat produced by heaters **27** and **28**, it is necessary that the basket **9** be rotating whenever they are energized. If either of belts **21** and **22** should fail, the basket **9** stops rotating since it is then no longer connected to the motor **20**. Therefore, safety means are generally provided in the machine whereby the heaters **27** and **28** are de-energized whenever either belt fails. The safety means comprise a belt switch **30** which is arranged on a pivotally mounted sled **31** which supports transmission assembly **23**. Upon the failure of either belt the sled **31** is moved by spring biasing means attached thereto and this movement results in the operation of switch **30** to open the heater circuit. The arrangement of sled **31** and switch **30** is fully described and claimed in Patent Number 2,750,782, issued to Daniel L. Du Hamell, Jr. and assigned to the General Electric Company, owner of the present invention.

The means whereby water is admitted to and discharged from tub **10** during operation of the machine is best shown in Fig. 1. The water supply means includes connections **32** and **33** through which hot and cold water is supplied to the machine for the washing operation. A valve controlled by a solenoid **34** admits hot water to the machine and a valve controlled by an opposed solenoid **35** admits cold water to the machine. The hot and cold water valves under the control of the solenoids **34** and **35** discharge through a common outlet conduit **36**, through a suitable air gap, and into a funnel **37** which discharges into a line **38** leading to the interior of tub **10** through sump **39** formed at the bottom of tub **10** (the connection of line **38** and sump **39** not being shown). The air gap provided by funnel **37** makes it impossible for water to be syphoned from the machine to contaminate the incoming water supply line. In the illustrated machine, a pressure actuated sensing device, or water level control, **40** controls both solenoids **34** and **35** to maintain the proper water level in the machine during the washing operation. This sensing device is connected to the interior of tub **10** by a suitable line **41**.

The illustrated machine is of the type which uses cold water during the drying cycle for condensing the moisture extracted from the clothes. This condenser water is admitted to the machine through an additional solenoid actuated valve controlled by a solenoid **42**. Solenoid **42** is energized during the drying operation so that the valve passes water at a slow rate sufficient to condense from the air the moisture vaporized from the clothes. As

shown, the condenser water valve discharges into funnel 43 through a separate conduit 44, with an air gap between conduit 44 and funnel 43 preventing supply line contamination as before. From the funnel, the condenser water flows through a line 45 and a connection 46 to an opening 47 formed in the wall of the tub 10. The wall below opening 47, as shown in Fig. 2, is formed with an inverted V-shaped bead 48 so that the condenser water is spread over the side of the tub as it flows down. In being so spread out, the water cools a substantial portion of the area of the side wall to provide a large cool surface for condensing moisture extracted from the clothes during the heat drying operation.

The wash and rinse water used during the washing portion of the operation, and the condenser water and the moisture extracted from the clothes during the drying operation, are discharged from the machine through sump 39 at the bottom of tub 10. A suitable discharge hose 49 leads from the sump to a motor driven drain pump 50 which discharges to the household drain.

With the apparatus shown, any suitable sequence dederived from the basic sequence of washing, rinsing, and spinning may be utilized to effect the washing portion of the cycle, and is followed by tumbling of basket 9 with suitable heating of the clothes being provided by the heating elements 27 and 28. One such suitable washing and drying cycle in a machine of the same general type is completely described in Patent 2,819,540, issued January 14, 1958 to John W. Toma et al., assigned to the General Electric Company, the owner of the present invention. However, it will be understood that other control arrangements are possible, that many deviations from the sequence of wash, rinse and spin may be followed, and that other heat drying cycles besides the particular one shown in the Toma et al. patent may be used. The important point is that it is important to terminate the wash portion of the operation with a spin to make the clothes as dry as possible prior to the heat drying operation, and that this spin should be at a relatively high speed since the higher the rotational speed the greater will be the amount of liquid centrifugally extracted from the clothes prior to the heat drying operation.

In order to permit a relatively high spin speed without the attendant difficulty of the clothes sticking to wall 11 of the machine after the speed drops back to tumble, the following arrangement is provided in accordance with the invention, with particular reference to Figs. 2, 3 and 4. Within the basket 9, and secured to the cylindrical wall 11 thereof, appropriate flap means are secured so that when the basket is at standstill or rotating at tumble speed the tendency of the flap means will be to hang down by their own weight. In the embodiment shown in Figs. 3 and 4, the flap means consist of three individual flaps 51 each secured to the basket wall 11 at one end by suitable means such as, for instance, rivets 52. The basket 9 is normally provided on its inner wall 11 with a suitable number of projecting ribs or vanes 53 (three in the illustrated construction) so that during rotation at tumble speed the clothes will be lifted up from the bottom of the basket and raised to a predetermined level before they again fall to the bottom of the basket thereby providing a desirable free circulation of the clothes in the basket in a so-called tumble pattern. Preferably, the flaps 51 are secured by rivets 52 adjacent the vanes 53 and just ahead of them with respect to the direction of rotation; with this arrangement, each flap during high speed spin stretches out along wall 11 of the basket to cover a substantial part of the wall area between the vane 53 adjacent which it is attached and the next vane ahead is in the direction of rotation. As shown in Fig. 2 each flap 51 is preferably imperforate as will be further discussed herebelow. It is important that each flap be formed of a non-hygroscopic material which also has the quality of flexibility without undue resilience so that it will have substantially no tendency to adhere to the basket wall. It has been found that relatively thin strips of rubber of 0.032 inch thickness provide the necessary qualities.

During a complete operation, a suitable load of clothes, illustrated at 54 in Fig. 4, is washed, the machine proceeding through the appropriate washing and rinsing cycles and then going into a high speed spin to effect centrifugal extraction of liquid from the clothes. As the speed of rotation becomes high enough to overcome the force of gravity on the flap members 51 and on the clothes 54, they are flung out to the inner surface of wall 11 of basket 9. Normally, as shown in Fig. 4, the flaps 54 being relatively light are flung out first so that they lie against the wall 11. However, it will be understood that in some cases small articles of clothing may be flung out first and that the flaps will then lie against the articles of clothes, holding them between the flaps and the peripheral wall 11. However, this possibility is substantially immaterial to the operation of my improved anti-sticking construction.

It is to be noted at this point that it is important that the basket peripheral wall 11 be provided with perforations 29 over that area thereof which is not covered by flaps 51 when they are in the position shown in Fig. 4, but that if so desired the perforations 29 may be omitted in that part of the basket which is so covered by flaps 51 during centrifugal spin as shown in Fig. 4.

As the basket comes up to spin speed, the flaps are held against the wall 11 of the basket by centrifugal force and the clothes in turn are then plastered around the basket, as shown, with the extraction of liquid proceeding as the centrifugal force causes the liquid to move in a generally radially outward direction until it passes through the perforations 29 and flows down into sump 39 to be disposed of. Of course, the liquid in the clothes which are in contact with the flaps 51 will flow to one side or the other of a flap to find its way out of the rotating basket under the influence of the centrifugal force. Thus, the flaps have very little effect on the amount of liquid which is removed from the basket at any given speed. This action is continued for a period of time suitable for removal of the major part of the liquid in clothes 54. The speed of rotation is then brought back to tumble. At this point, there is insufficient centrifugal force to overcome the force of gravity on the clothes which were plastered against the flaps and on the flaps themselves. There is no sticking of the clothes to the flaps, partly because of the non-hygroscopic nature of the material of the flaps, partly because of their flexibility which causes the flaps in effect to change shape as they fall downward by their own weight, and to a minor extent, where the preferred construction is provided, because there are no perforations in the flaps through which the water can migrate with a tendency to bring the clothes into more intimate contact with the flaps. A second more important benefit of having the flaps imperforate is that there is no tendency for hooks, buttons and the like on the clothes to tear the flaps by catching in the perforations as would be the case where perforations were so provided. However, the general action of the flaps is primarily a result of their flexible non-hygroscopic characteristics which also preclude adherence of the flaps to the surface of basket wall 11.

Thus, the return to tumble speed causes the flaps to fall away from the basket, and the clothes which were against the flaps to fall away from the flaps. This in turn brings these clothes into tumbling contact with any other clothes which may be stuck to the periphery of the basket because of the intimate contact therewith caused by the water passing through the clothes and out of the basket. As the clothes which have fallen free tumble about in the basket they knock more and more of the stuck clothes loose until, in a short time, all of the clothes are tumbling freely in the desired pattern.

It is preferable that each flap cover substantially the

width of the basket, as shown in Fig. 2, although it is the total area of basket peripheral surface area covered by the flaps which is important rather than the precise shape of any one flap. By way of example, a basket 26 inches in diameter and 16 inches long in an axial direction (and therefore having a peripheral surface area of 1306.24 square inches) was provided with three imperforate flaps secured substantially as shown, each of which had a length of 12 inches and a width of 14 inches, thus covering 504 square inches of the inner surface of the basket when in the position in Fig. 4. The flaps were formed of rubber, .032 inch in thickness. It was found that the provision of flaps such as these in the manner described hereabove permitted a load of 4 pounds of diapers to be spun at 366 r.p.m. without sticking, as opposed to a maximum speed of 207 r.p.m. which has been found to be permissible if no anti-sticking arrangement is provided. The difference in the amount of water removed as a result of the difference in speed was three pounds for this particular load, which would have taken approximately 20 additional minutes to remove by use of the heaters.

It will thus be seen that the invention provides a novel and economical method of inhibiting sticking of the clothes to the surface of a clothes container once the centrifuging action has been terminated.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and I therefore aim in the appended claims to cover all such changes and modifications, as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a laundry machine, a substantially cylindrical clothes receptacle rotatable on a non-vertical axis, means for rotating said receptacle at clothes tumbling speed, means for introducing liquid into said receptacle for treating clothes while they are being tumbled, means for thereafter rotating said receptacle at a relatively high centrifuging speed to extract liquid from the clothes, and at least one imperforate flap member of flexible non-hygroscopic material secured at one end only thereof to the cylindrical wall of said receptacle within said receptacle, said flap member being formed to lie against said cylindrical wall by centrifugal force when said basket is spinning and hanging down from said cylindrical wall by its own weight when the portion thereof to which it is secured is above it and said basket is stopped or rotating at tumbling speed, said flap member having a width extending substantially the axial length of said receptacle and covering a substantial part of said cylindrical wall when it lies thereagainst, said cylindrical wall having a plurality of perforation formed therein in the portion thereof which is uncovered by said flap member during spinning of said basket.

2. In a laundry machine, a substantially cylindrical clothes receptacle rotatable on a horizontal axis, means for rotating said receptacle at clothes tumbling speed, means for introducing liquid into said receptacle for treating clothes while they are being tumbled, means for thereafter rotating said receptacle in a predetermined direction at a relatively high centrifuging speed to extract liquid from the clothes, a plurality of equi-spaced vanes extending inwardly from the cylindrical wall of said receptacle, and a plurality of imperforate flaps of non-hygroscopic flexible material each secured at one end only to said cylidrical wall within said receptacle adjacent said vanes respectively, each of said flaps being secured directly ahead of each of said vanes relative to said predetermined direction of rotation, said flaps being formed to lie against said cylindrical wall by centrifugal force when said basket is spinning and hanging down from said centrifugal wall by their own weight when the portion of said cylindrical wall to which each flap is secured is above it and said basket is stopped or rotating at tumble speed, said flaps covering a substantial part of said cylindrical wall when they lie thereagainst, said cylindrical wall having a substantial number of perforations formed therein in the portion which is uncovered by said flaps during spinning of said basket.

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