United States Patent [19]

Kennedy et al.

[11] **3,762,869**

[45] **Oct. 2, 1973**

[54] **WASHING MACHINES**

[75] Inventors: **Andrew Thomas Kennedy; Maurice Charles Lemon,** both of Sussex, England

[73] Assignees: **David Kennedy (Engineers) Limited; Universal Towel Company Limited,** Sussex, England

[22] Filed: **Nov. 2, 1971**

[21] Appl. No.: **194,942**

[30] **Foreign Application Priority Data**

Nov. 13, 1970 Great Britain 54,259/70

[52] **U.S. Cl.** ..... **8/151,** 68/22 R, 68/43, 68/205 R

[51] **Int. Cl.** **D06c 27/00,** D06f 29/00, D06f 35/00

[58] **Field of Search** ..... 8/151; 68/205 R, 68/22 R, 13 R, 5 D, 43

[56] **References Cited**

UNITED STATES PATENTS

2,533,248	12/1950	Helmus	68/205 R X
3,064,458	11/1962	Grimes	68/205 R X
3,162,033	12/1964	Grimes	68/205 R X
3,163,030	12/1964	Woodworth	68/205 R
3,320,776	5/1967	Gorodissky et al.	68/22 R X
3,349,580	10/1967	Valls	68/22 R
3,470,571	10/1969	Hrboticky	8/151
3,473,884	10/1969	Politzer et al.	68/22 R X
3,487,468	12/1969	Bahnsen	68/5 D X

Primary Examiner—John Petrakes
Assistant Examiner—Arthur O. Henderson
Attorney—Watson, Cole, Grindle & Watson

[57] **ABSTRACT**

A method of rinsing a continuous strip of towel comprises feeding the strip at an angle upwardly through a series of pairs of pinch rollers. Between the uppermost two pairs of rollers, clean water is poured onto the towel, some of which runs down the towel and some of which is carried up with it. The water is removed at the two sets of pinch rollers, collected, and passed under gravity to be poured onto the towel between the second and third pairs of rollers from the top. This is repeated for each pair of rollers, so that the water passes downwardly through the apparatus, being used several times and getting dirtier, while the towel passes upwardly, being rinsed several times, each time with cleaner water than before.

6 Claims, 3 Drawing Figures

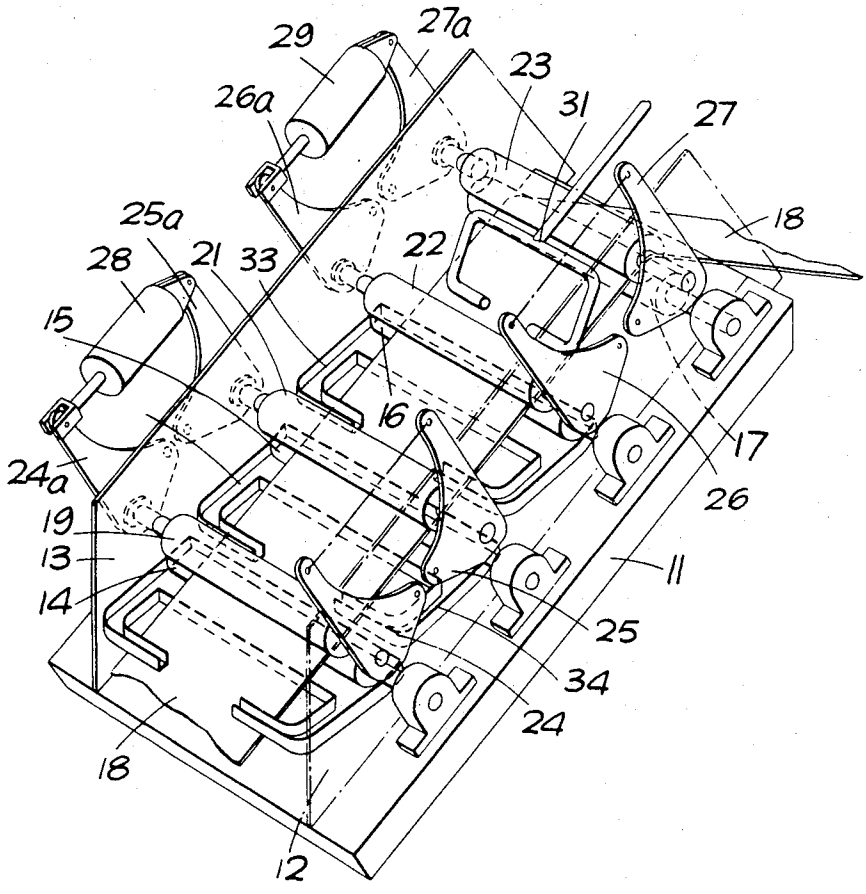


Fig. 1.

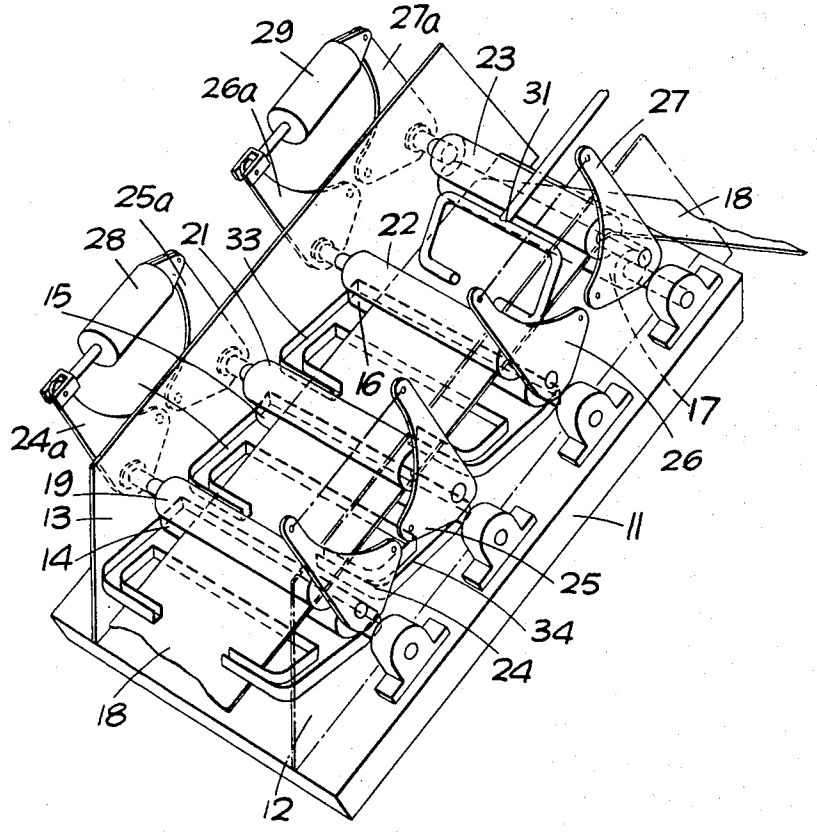

29
27a
23
26a
31
27
18
25a
28
21
33
22
15
16
17
24a
26
19
11
13
14
25
34
24
18
12

Fig. 2.

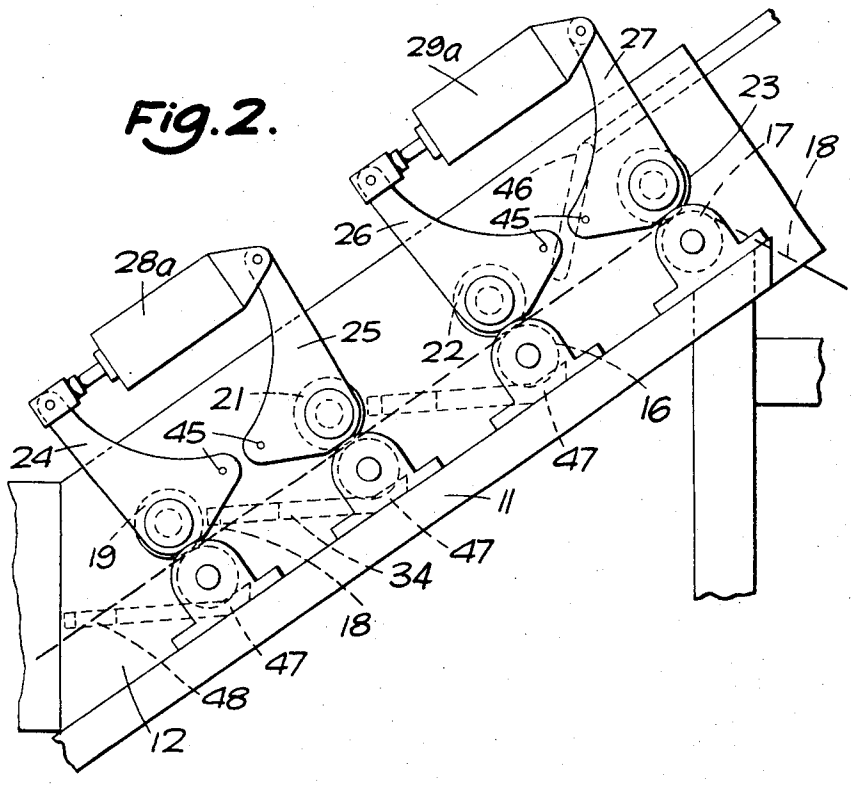
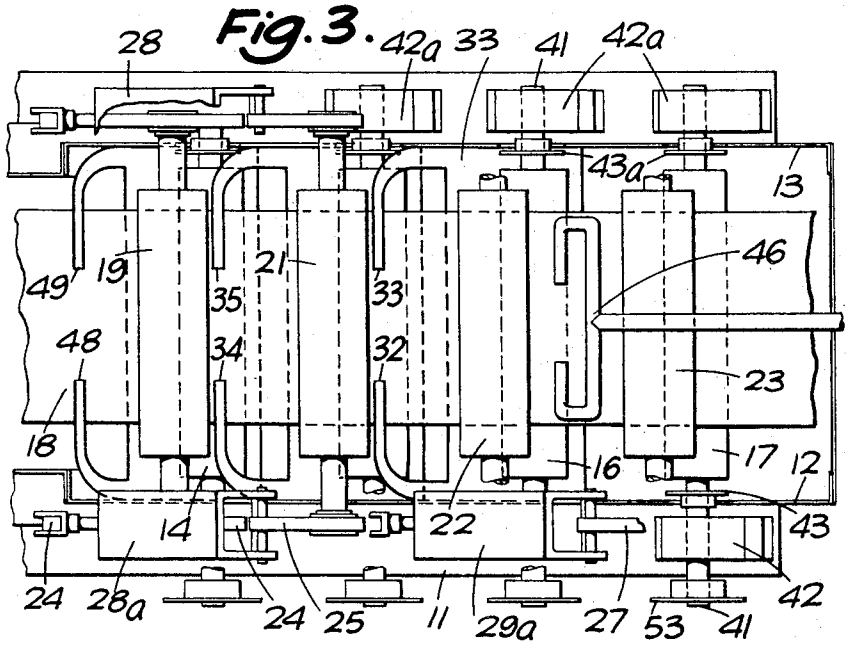

29a
27
23
17
18
46
45
26
28a
25
22
21
16
45
24
47
11
19
47
34
18
47
48
12

Fig. 3.


28
42a
33
41
42a
43a
13
49
19
21
46
35
33
48
34
32
23
18
16
17
12
14
22
43
24
28a
24
25
11
29a
27
53
41
42

WASHING MACHINES

This invention relates to the treatment of a continuous strip of material, as for example in the washing of strips of fabric.

The invention provides a method of treating a continuous strip of material, comprising moving the strip in an upwards direction past a liquid supply element, applying a stream of liquid to the strip through said supply element in such quantity that part of the liquid runs down the material under the influence of gravity, and thereafter removing some of the liquid from the strip.

Preferably the strip is fed at an angle to the vertical and liquid is applied only to the upper surface thereof.

It is preferred that the method includes feeding the strip through at least one set of pinch rollers for removing liquid therefrom, applying liquid to the strip both above and below said rollers, and thereafter carrying out the aforesaid step of removing some of the liquid from the strip. It is further preferred that the liquid applied to the strip above said rollers is removed from the strip and thereafter fed under gravity to the strip below said rollers.

The invention also provides apparatus for treating a continuous strip of material, comprising means for moving the strip in an upwards direction, means for applying a stream of liquid to the strip as it moves upwardly, and means for removing some of the liquid from the strip.

Preferably the means for feeding the strip and for removing the liquid comprises a pair of pinch rollers arranged after the liquid applying means. Preferably there are provided a plurality of pairs of rollers in series and means for applying liquid to the strip a plurality of times, each below a different pair of rollers. There may also be provided means for collecting the liquid removed from the strip by one set of rollers and applying said liquid to the strip at an earlier stage of the apparatus, whereby the liquid is re-used. Such collecting means preferably comprise a trough arranged below the said one set of rollers and channels leading from the trough to means for applying liquid to the strip.

It is preferred that the rollers are supported by bearings arranged outside an enclosure through which the strip passes.

Preferably the apparatus includes means for varying the pressure of the pinch rollers.

Some specific examples of apparatus for rinsing a strip of towel material will now be described with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of prototype apparatus;

FIG. 2 is a sectional side view of an improved apparatus; and

FIG. 3 is a plan view of the apparatus of FIG. 2.

Referring to FIG. 1 towel rinsing apparatus comprises a base 11 and two side walls 12, 13. Mounted in bearings on the base 11 are four rollers 14, 15, 16 and 17, over which a strip of towel 18 is passed. Four further rollers 19, 21, 22 and 23 are supported in bearings on bell-crank levers 24, 25, 26 and 27 and 24*a*, 25*a*, 26*a* and 27*a* which are in turn pivotally supported on the side walls 12 and 13, outside the enclosure formed by the said walls. The rollers 19 to 23 co-operate with the rollers 14 to 17 to grip the towel 18 and thereby squeeze the liquid out of it. To increase the pressure exerted by these rollers, air cylinders 28 and 29 are provided between each pair of bell-crank levers 24*a* and 25*a*, and 26*a* and 27*a*, and similar cylinders are provided on the other side. An increase of air pressure within these cylinders will force the ends of the bell-crank levers apart and thereby force the rollers together. The whole assembly is arranged such that the towel moves in a substantially straight line in an upward direction at an angle of approximately 35° from the horizontal.

Between the uppermost two sets of rollers 16, 22 and 17, 23 there is provided a water input 31 through which clean water is sprayed on to the towel to give it a final rinse. Underneath each of the intermediate sets of rollers 16, 22 and 15, 21 there is arranged a collecting trough (not shown) from which extend trough-like members 32, 33, 34 and 35 which lead horizontally from the collecting trough below the line of travel of the towel 18 and terminate at points above the line of travel of the towel. Thus, in operation, the water applied to the towel through the input 31 will rinse it as it runs down the slope of the towel towards the rollers 16, 22. When it reaches these rollers it will drip off them and off the towel into the trough arranged underneath the rollers, and as the water level builds up in that trough the water will flow through the arms 32 and 33 and then will flow on to the towel below the rollers 16 and 22 but above the rollers 15 and 21. The water will then flow down the towel again giving it a second rinse, and the process will be repeated at the next set of intermediate rollers 15 and 21. When the water reaches the lowest set of rollers 14 and 19 it will be collected and passed to the wash tank.

It will be appreciated that as the towel moves upwards through the machine while the water flows downwards, the towel receives its first rinse with the dirtiest water and its final rinse with the cleanest water. Further, this construction is much more economical in the use of water than some previously known constructions in which fresh water has been used at every stage of the rinsing process.

A disadvantage of previous constructions has been that the rollers have all been supported on bearings within the enclosure formed by the walls 12 and 13. As a result, lubrication and maintenance of these bearings in a very humid atmosphere has been difficult. This disadvantage has been obviated in the machine of the present invention by mounting the rollers on long shafts and supporting them in bearings outside the walls 13 and 14. To prevent water leaking from the machine, on each end of the rubber rollers there is fitted a "thrower ring" and this prevents most of the water from trickling along the roller shaft.

The improved apparatus shown in FIGS. 2 and 3 is in many respects the same as that shown in FIG. 1, and where appropriate like parts have been given the same reference numerals. Again, the apparatus comprises a base 11 and two side walls 12 and 13. Four stainless steel rollers 14, 15, 16 and 17 are mounted on shafts 41 which are supported in bearings 42 and 42*a* on the base 11. The shafts 41 pass through holes in the side walls 12 and 13, and two thrower rings 43 and 43*a* are fitted to each shaft 41 adjacent the holes to prevent the passage of water therethrough. On one end of each shaft 41 there is fitted a sprocket 44 so that the rollers may be driven to propel a length of towel 18 through the apparatus.

Four rubber rollers 19, 21, 22 and 23 are mounted on shafts 44 which are in turn journalled in bearings in

bell-crank levers **24, 25, 26** and **27**, and **24***a*, **25***a*, **26***a* and **27***a*. The bell-crank levers are located outside the enclosure formed by the walls **12** and **13**, and each pair of bell-crank levers (e.g. **24** and **24***a*) is pivoted about an axis **45**. The rollers **19** to **23** are positioned to co-operate with the rollers **14** to **17** to grip a towel **18** passing therebetween. Air cylinders **28**, **28***a*, **29** and **29***a* are provided between the various bell-crank levers as shown so that air pressure within the cylinders will force the ends of the levers apart and thereby increase the pressure of the rubber rollers **19** to **23** on the metal rollers **14** to **17**.

The whole assembly is arranged such that a towel **18** may be introduced between the lowermost pair of rollers **14** and **19** and pass upwards through the apparatus between the various pairs of rollers at an angle of about 35° to the horizontal. The towel would enter from a washing apparatus (which may be of the kind described in U.S. Pat. No. 3,526,106) and after rinsing in the apparatus of the present invention would pass to further apparatus for drying the towel. The towel is propelled by the rotation of the rollers **14** to **17**.

Arranged between the uppermost two pairs of rollers **16, 22** and **17, 23** is a water spray **46** from which clean rinsing water is applied to the top surface of the towel passing between the said pairs of rollers. This is the final rinse for the towel, and thus clean water must be used. Arranged underneath the two pairs of rollers are collecting troughs **47**, and as the towel travels upwards the water that is sprayed onto it will either be carried upwards and be removed by the rollers **17** and **23** or will flow downwards under the influence of gravity and be removed by the rollers **16** and **22**; in both cases the water that is removed from a towel by the rollers will be collected in the troughs **47**. The water so collected then passes along channels **32** and **33** which extend from the troughs **47** around the strip of towel passing between the rollers **15, 21** and **16, 22** and is poured from these channels onto that strip of towel to rinse it. THe channels are arranged at a very slight angle to the horizontal to ensure that no water accumulates in the troughs **47**. The water passing out of the channels **32** and **33** onto the towel gives it its penultimate rinse and again some of the water is carried upwards to the rollers **16** and **22** while other water flows downward and is removed at the rollers **15** and **21**. The water removed at the upper pair of rollers **16** and **22** is of course recirculated while the water removed at the lower rollers **15** and **21** is collected by a further trough **47** and is used to rinse the towel between the rollers **14, 19** and **15, 21**. The process here is the same as just described, and finally any water that is removed at the rollers **14** and **19** is collected in the lowest trough **47** and is passed through channels **48** and **49** to give the towel **18** a preliminary rinse before it reaches the first set of rollers. Of this preliminary rinse water, that which is carried upwards is recirculated while the water which runs downwards under the influence of gravity continues down the towel into the washing apparatus and is used for washing the dirty towels.

It will thus be appreciated that the towel receives four rinses, and this is achieved very economically as the only time that clean water is used is in the final rinse stage. For this final rinse only the clean water supplied through the spray **46** is used but for the previous rinses water that has at least been used for the next following rinse is used so that the water used for the preliminary rinse is quite dirty. By arranging the apparatus at an angle of 35°, it is ensured that the water deposited on the towel by either the spray **46** or the various channels is divided, some of the water running down to the lower set of rollers while other water is carried upwards by the towel to the upper set of rollers in that run. If the angle of the apparatus was too steep then all the water would run downwards and there would not be the extra soaking action that is obtained by the water being carried upwards by the towel and furthermore the water would pass through the apparatus much more quickly. On the other hand, if the angle was too shallow then all the water would be carried upwards which means that, for instance, the water deposited on the towel by the troughs **32** and **33** would all be re-collected at the rollers **16** and **22** and passed through those same troughs again and again. This would clearly mean that the lower rinsing stages would not receive any water, and furthermore the water applied by the spray **46** would eventually cause the troughs **32** and **33** to overflow so that the water would run down the base **11** without doing any rinsing at all. The apparatus achieves a further economy in that the preliminary rinse water passes straight into the washing machine by running down the towel rather than having to be collected and re-introduced as in previous apparatus (where, indeed, previous apparatus have used rinse water for washing at all). It will be appreciated of course that the angle of 35° is not unchangeable but where the towel is passed through the apparatus at a high speed then the angle should be steeper and where it is passed at a low speed the angle should be shallower; a particular figure of 35° has been found to be most satisfactory for a mean towel speed of 150 ft. per minute.

Another advantage of this apparatus over many previous arrangements is that it uses "flood" rinsing as opposed to "spray" rinsing, i.e. the towel is thoroughly soaked by a large amount of water rather than being permeated by a high pressure spray using little water. This absence of high pressure sprays means that there is less water suspended in the air so that the bearings for the rollers are less likely to be corroded. Further, the arrangement makes it possible to place the bearings outside the casing formed by the walls **12** and **13** so that they are still further removed from attack by water. Various improvements and modifications to the invention will be apparent to the skilled man and may be made without departing from the scope thereof.

We claim:

1. A method of treating a continuous strip of towelling material in a flat condition, comprising moving the strip between a succession of pairs of pinch rollers spaced apart along a straight upward path at an angle to the horizontal, applying a stream of liquid to the upper surface of the strip at a point between the last two pairs of said rollers in such quantity that part of the liquid runs down the strip towards the last but one pair of said rollers, employing said last but one pair of said rollers to remove some of the liquid from the strip, collecting the liquid removed from the strip in a collection tray disposed beneath the strip, feeding liquid from the collection tray under gravity onto the upper surface of the strip at a point between the last but one pair of said rollers and the preceding pair of said rollers whereby the liquid again runs down the strip, and successively repeating the above said steps of removing some of the liquid from the strip, collecting the liquid in further col-

lection trays and feeding liquid therefrom onto the upper surface of the strip for each preceding pair of said rollers in turn.

2. A method as claimed in claim 1, wherein the strip is moved at a mean speed of 150 feet per minute along said path which is at an angle of about 35° to the horizontal.

3. Apparatus for treating a continuous strip of towelling material in a flat condition, comprising a conveyor formed of a succession of pairs of pinch rollers spaced apart along a straight upward path at an angle to the horizontal, a liquid supply element disposed above the strip for applying a stream of liquid to the upper surface of the strip at a point between the last two pairs of said rollers in such quantity that the liquid runs down the strip towards the last but one pair of said rollers which will remove some of the liquid from the strip, a collection tray disposed beneath the strip for collecting the liquid removed from the strip, said collection tray having channels extending to a point above the strip between the last but one pair of said rollers and the preceding pair of said rollers for feeding liquid from the collection tray under gravity onto the upper surface of the strip whereby the liquid again runs down the strip, and further said collection trays disposed beneath the strip for successively collecting liquid removed by each preceding pair of said rollers in turn and for feeding liquid therefrom onto the upper surface of the strip.

4. Apparatus as claimed in claim 3, wherein the path defined by the rollers is at an angle of about 35° to the horizontal.

5. Apparatus as claimed in claim 3, wherein the rollers are mounted in an enclosure and supported in bearings arranged outside the enclosure.

6. Apparatus as claimed in claim 3 and including means for varying the pressure of the pinch rollers.

* * * * *