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Bold et al.

[11] **3,768,283**

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[54] **DE-SOILING APPARATUS**

[75] Inventors: **John Bold, John Scribens,** both of London, England

[73] Assignee: **National Research Development Corporation,** London, England

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[30] **Foreign Application Priority Data**

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Apr. 13, 1971 Great Britain 9,216/71

[52] **U.S. Cl.** ..... **68/205 R,** 68/22 R
[51] **Int. Cl.** **D06f 29/02,** D06f 35/00
[58] **Field of Search** ..... 68/205 R, 3 R, 10, 68/20, 23, 62, 22 R; 99/443 C; 223/60, 76

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Primary Examiner—Harvey C. Hornsby
Assistant Examiner—Arthur O. Henderson
Attorney—Cushman, Darby & Cushman

[57] **ABSTRACT**

A continuous de-soiling machine in which articles pass through slots or like clearances and are sprayed by jets as they pass through. The articles are carried through the machine by a conveyor on which they are carried by hangers which hold them by one end, allowing the other end to trail or hang. The articles pass through the slots in their end-to-end direction, preferably supported end first. The machine may also include occasional pairs of nip rollers to squeeze fluid out of the articles, which pass through nips end-to-end also but preferably unsupported end first. Jets may be arranged to spread articles as they pass through the slots.

5 Claims, 10 Drawing Figures

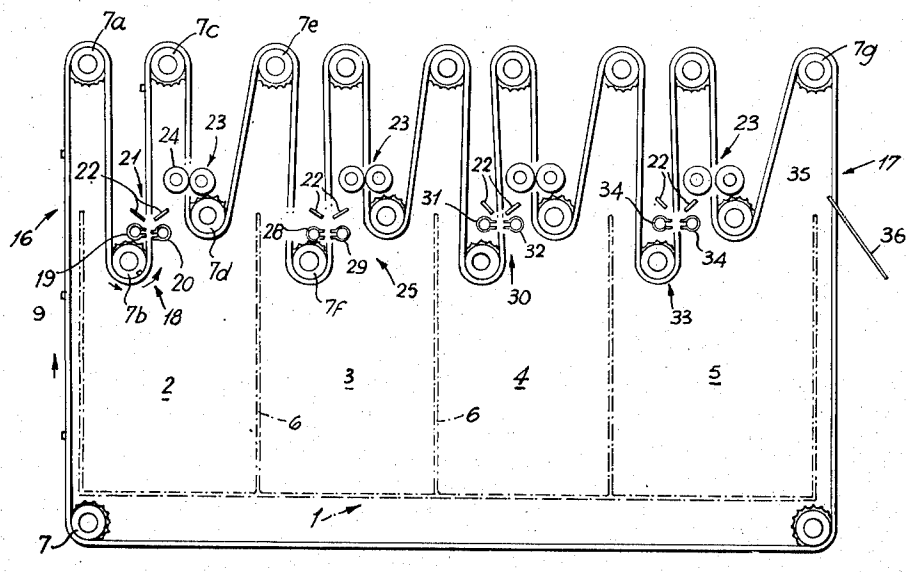

Fig. 1.

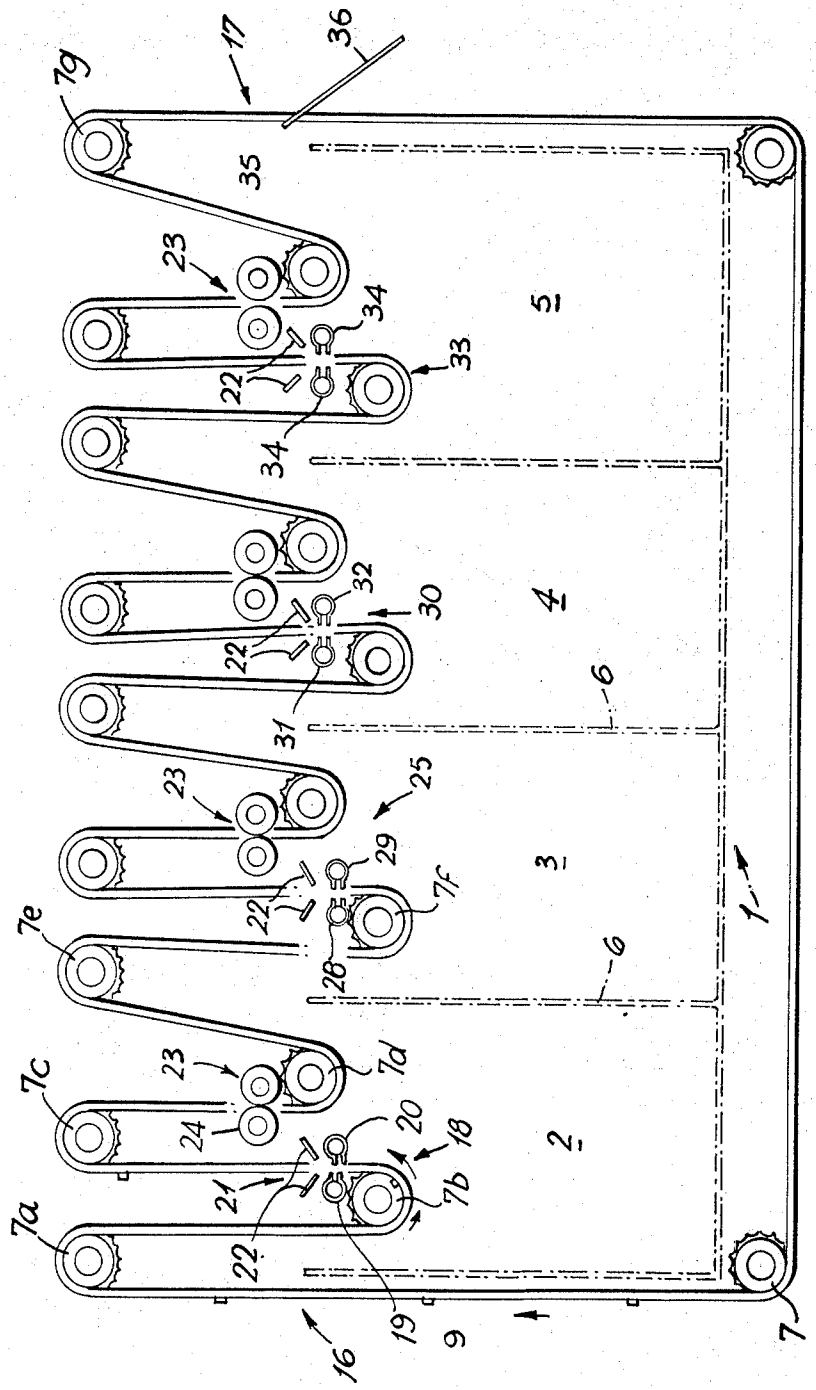
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Fig. 2.

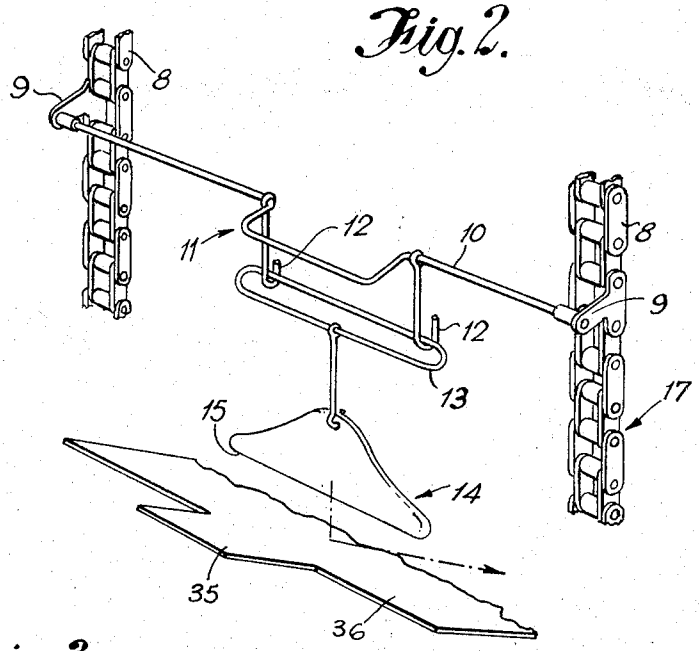


Fig. 3.

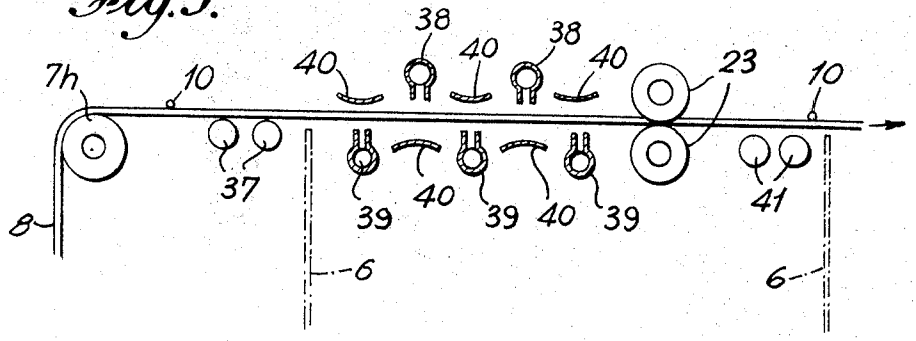
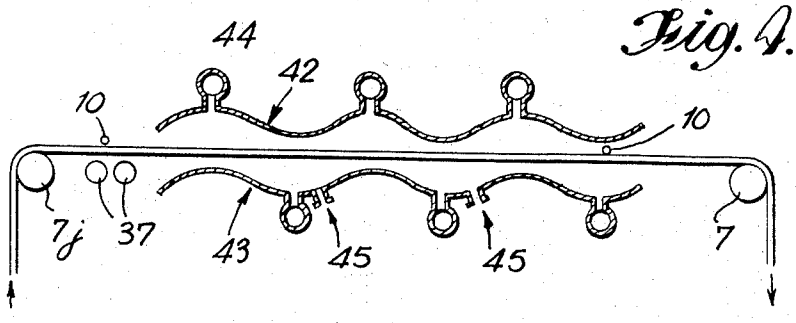


Fig. 4.



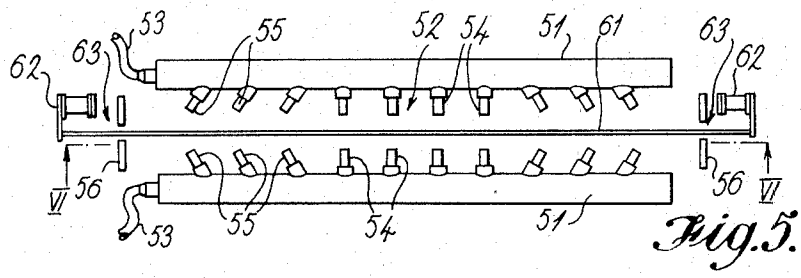


Fig.5.

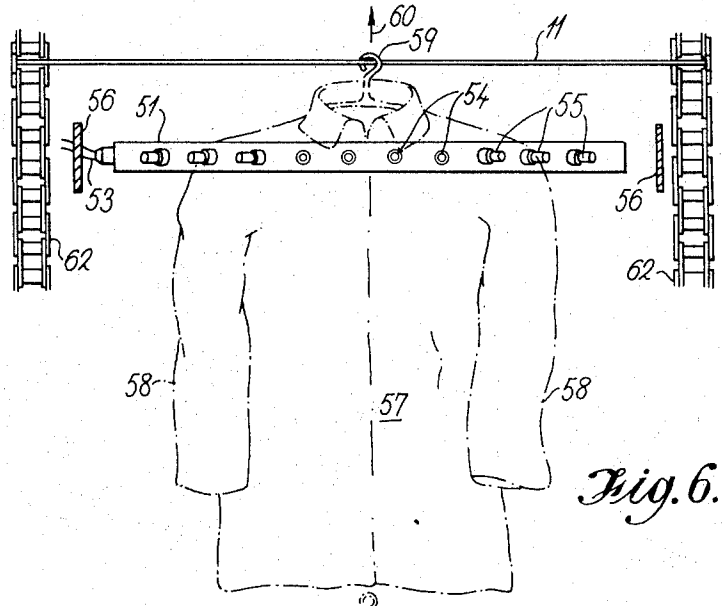


Fig.6.

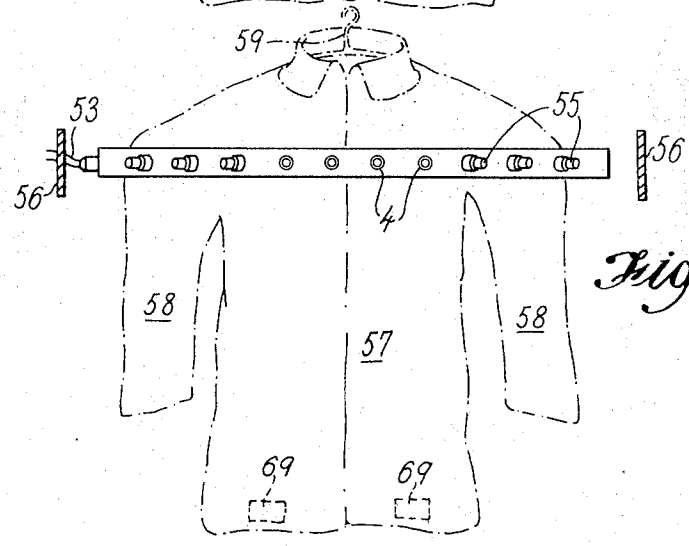


Fig.7.

Fig.8.

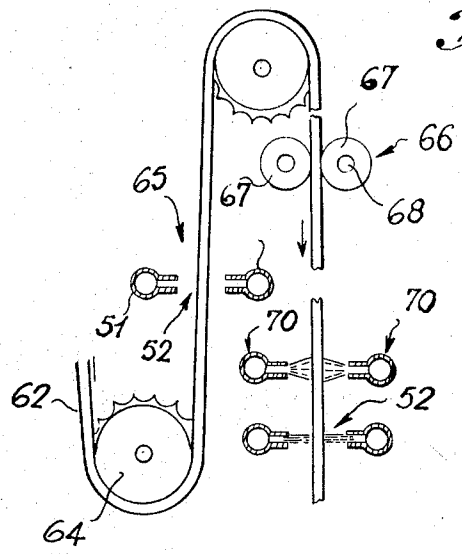
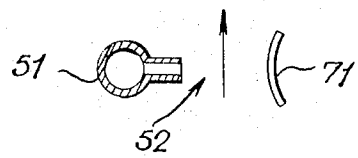


Fig.9.



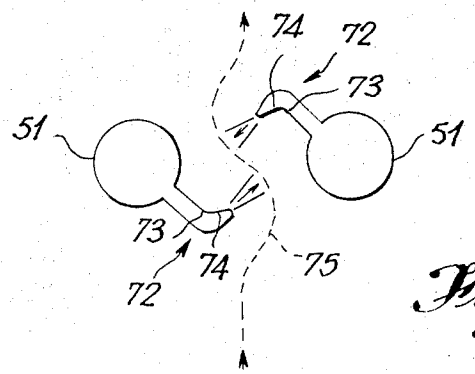


Fig.10.

DE-SOILING APPARATUS

This invention relates to the de-soiling of flexible sheet materials, such as fabrics. In particular it relates to commercial machines for de-soiling discrete articles, such as items of clothing, in which the articles have to be passed through a number of de-soiling stations in succession. Many types of construction have been proposed for such machines. In particular, it has been proposed to treat the articles by exposing them to jets of de-soiled fluid. This offers the advantage that the de-soiling process can take place at a higher energy level than is easy to achieve if the articles are simply passed through baths of fluid.

If jets are used, however, it becomes difficult to find a satisfactory method of carrying the articles through the machine. It is known to carry such items through the machine sandwiched between open-work belts. However, such belts pose many problems, for instance the need for a belt material that is robust yet allows de-soiling fluid adequate access to the sandwiched garments, the guidance of the belts so that they maintain the sandwiched garment flat, etc.

It has been proposed to carry articles by clips or the like supported from a conveyor, but it would appear that many printed proposals for such constructions have not been put into practice and, if they had, would not have prevented the articles from waving on their clips as soon as they came within range of the jets, thus often avoiding the full intended force of the jets thereafter. It is also possible for articles thus supported, once struck by the jets, to fold and crumple so that some parts of the article are thereafter masked from the jets.

Our invention concerns new arrangements of jets and conveyors that may be less subject to such disadvantages. Our invention is defined by the claims, and constructions according to it will now be described by way of example only, with reference to the accompanying drawings in which:

FIG. 1 is a schematic layout of one apparatus in side elevation;

FIG. 2 is a perspective view of a detail of that apparatus;

FIG. 3 is a section through part of an alternative apparatus;

FIG. 4 is a similar section through part of another alternative apparatus;

FIG. 5 is a plan view of an alternative de-soiling station for the apparatus of FIG. 1;

FIG. 6 is a section on the line VI — VI in FIG. 5, showing also the outline of an article that has just entered the station;

FIG. 7 is a similar view to FIG. 6, taken when the article has proceeded further through the station;

FIG. 8 is a side elevation showing details of an alternative station and a conveyor adjacent to it, and

FIGS. 9 and 10 are side elevations of details of alternative stations.

The apparatus of FIGS. 1 and 2 comprises a trough-like container 1 divided into four tanks, 2, 3, 4 and 5 by baffles 6. To each side of the apparatus is arranged a series of sprockets 7, 7*a*, 7*b* etc., some of which are driven by means not shown. A continuously movable conveyor includes two endless chains 8, one at each side, which travel a tortuous path round all the sprockets at that side, and carry lugs 9 at intervals. These lugs are all at mirror image positions relative to similar lugs on the chain 8 at the opposite side of container 1, and

each opposed pair of lugs carry between them a cross-bar 10 having at its middle a cranked portion 11 and hooks 12. The latter are suitable to engage the specially shaped top part 13 of a clothes hanger 14, the lower part 15 of which is of conventional shape and suitable to support a coat, shirt, blouse etc. Such a garment, with hanger 14 in place, is taken up by the hooks 12 of a passing cross-bar 10 at a loading station 16, and hangs vertical at all times while the endless chains 8 carry it through the apparatus until it reaches the unloading station 17 where it may either be removed by hand or unhook itself automatically in a manner that will be described in relation to FIG. 2. For ease of description, the end of the garment which fits over and is thus supported by the hanger 14 will be described as the proximal end of the garment. In the case of the shirt, this will be the neck. The other end of the garment, i.e., the end that trails or hangs, which in the case of the shirt would be the tail, will be described as the distal end.

Once loaded at 16, chains 8 carry a cross-bar 11 over sprockets 7*a* and the garment then descends, distal end first, into tank 2 where the cross-bar 10 passes under sprockets 7*b* and then carries the garment upwards through the gap 21 between opposed horizontal rows of jets 19, 20, lying one to each side of the path of the garments. This station constitutes the pre-wash stage of the apparatus and the jets spray soap or detergent solution in a direction normal to the surface of the passing garments. The jets are shielded by plates 22 which prevent spray from the jets escaping from the container. Having passed jets 19, 20 the cross-bar 10 carries the garment upwards, proximal end first, to pass over sprockets 7*c*. The garment then descends, distal end first to pass through a second half of station 18 which comprises squeegee rollers 23 faced with a thick layer of closed cell expanded polyurethane foam 24. Cross-bars 11 now pass round sprockets 7*d* then up and over sprockets 7*e* after which the garment descends distal end first into the second de-soiling station 25.

Station 25, lying within tank 3, is the hot wash stage in which the garments pass round sprockets 7*f* and then up, proximal end first, between jet rows 28, 29, appropriate detergent solutions being fed under pressure through these jets. As before, there are shield plates 22, and after passing through the jets the garments are raised proximal end first and then descend again distal end first to pass through squeegee rollers 23.

The third de-soiling station, reference 30, is the first rinse stage in which water is sprayed by jet rows 31, 32 through which the garment passes proximal end first. This station again concludes with a pass, distal end first, through squeegee rollers 23.

In the fourth and final de-soiling station 33, in tank 5, the garment passes proximal end first through jet rows 34, which again spray water, perhaps with a customary final rinse additive. This station is completed by a pass, distal end first, through squeegee rollers 23. Then the garment rises again so that the cross-bar 10 passes over sprockets 7*g*, and then the garment descends distal end first to unloading stage 17 (FIG. 2). Here an operator may simply remove the tops 13 of hangers 14 from hooks 12. Alternatively, the descending distal end may meet the projecting tongue 35 of an inclined chute 36. The rest of the garment will follow the distal end as the supporting cross-bar 10 continues to descend, until the tongue 35 arrests the hanger so that the hooks 12 disengage and cross-bar 10 continues

to cycle with chains **8** while garment and hanger together slide down chute **36** to a drying station (not shown) that is no part of the present invention.

It should be noted that in the apparatus illustrated in FIGS. **1** and **2** all the de-soiling is done by the jets and the squeegee rollers. Tanks **2, 3, 4** and **5** act only as receptacles for surplus liquid which may be recycled. Alternatively, the liquid level in the tanks could be raised and the garments could pass through this liquid as well as through the jets, or perhaps in place of them, at each or any station. In this case, however, it is of course important that the garments should not enter the liquid again after passing through the squeegee rollers **23** with which each station is completed. As will be seen, the axes of rollers **23** are at a higher level than the jets of the corresponding stations.

FIG. **3** shows an alternative form of de-soiling station according to the invention. Tank **3** and the main hot wash station **25** are illustrated, but this alternative is equally applicable to other stations. Starting from the left-hand side of the Figure, cross-bars **10** carrying the garments are carried by chains **8** which pass over sprockets **7***h*. Shortly afterwards, just before coming level with the left-hand baffle **6** of tank **3**, chains **8** pass level with the top surface of idler rollers **37** which span the width of the tank. The hangers **14** now turn horizontal to pass over these, pulling the garments horizontal after them. The hangers now proceed, with the garments trailing behind them, through the washing station comprising two upper rows of jets **38** and three lower rows **39.** Each row of jets registers with a baffle **40** to support the garments as the jets play upon them, and the garments are sprayed from alternate sides as they pass through the station. As before, the jets supply detergent solution under pressure. After the five rows of jets, hangers and garments pass through squeegee rollers **23,** then over idler rollers **41** to support the garments horizontal until they are clear of the right-hand baffle of the tank. The clearance between jets **38, 39** and baffles **40** must of course be sufficient to allow easy clearance for the thickness of cross-bars **10,** the bulky area of the garments where they fit over and are supported by the hangers **14,** and especially the hooks **12** which hold the hangers to the cross-bars **10.**

In the further alternative shown in FIG. **4** the hangers and garments are guided horizontally, during a de-soiling stage, by passing between two corrugated plates **42, 43.** Rows of jets **44** are formed along the troughs of the corrugations, each of which registers with a crest in the opposite place. The garment is thus backed by the crest of a corrugation whenever it is subjected to jets. The liquid ejected by the jets may be released through drainholes **45** formed at intervals in the troughs of the lower plate **43.** This combination of the alternately-facing jets and the sinuous path that the garment travels between plates **42** and **43** maximises the amount of flexing that the garment undergoes as it passes through the de-soiling station. Sprockets **7***j* guide the chains **8** and the cross-bars **10** at either end of plates **42** and **43.**

In the apparatus of FIGS. **1** and **2** it is envisaged that the tanks **2, 3, 4** and **5** could each be 4 or 5 ft. high, and that the entire container could be 15 ft. long and 10–12 ft. high to the level of the upper sprockets **7.** It could take cross-bars **10** about 4 ft. long, and lugs **9** could be spaced along each chain **8** at about 4 ft. centres. A typical chain speed of 16 ft. per minute would give the apparatus a capacity of 250 garments per hour. Typical temperatures and pressures at the four stations are as follows:

Station reference No.	Jet temperature:	Jet pressure:
18	100°F	50 psi
25	180°F	100–150 psi
30	180°F	100–150 psi
33	180°F	50 psi

Water may be re-cycled between tanks, and a typical total water usage would be 200–250 gallons per hour.

Among many possible additions and modifications, it may be noted that the first (pre-wash) station **18** could be preceded by a station at which solvent is applied to remove soil that is insoluble in water. It may also be noted that the rollers **23,** shown in the drawings as having a resilient facing **24,** could be of many different constructions provided a resilient surface effect is obtained, and could in particular be pressurised, e.g., air pressurised.

FIG. **5** shows, in detail, a preferred alternative to the simple arrangement of jets already described with reference to items **19, 20** and **28, 29** in FIG. **1.** Parallel header pipes **51** define between them a slot-shaped gap **52** through which articles will be passed for de-soiling. Pipes **51** are fed with washing, rinsing or other suitable liquid under pressure via supply pipes **53,** and discharge this fluid into the gap through jets **54, 55.** The fluid from jets **54** will strike passing articles at right angles to the plane of their direction of movement, but the fluid from jets **55** will have a transverse component of motion and thus tend to spread the passing articles sideways. Guards **56** help to prevent the angled jets **55** from blowing the side extremities of the articles right out of the gap **52.** FIG. **6** shows one of the header pipes **51** in elevation, and illustrates the situation when the conveyor mechanism of the apparatus has just brought a garment within the range of the jets. Garment and conveyor are shown in dot-and-pick lines because they will be just in front of the section plane of the Figure. The garment is a shirt, workcoat or the like with body portion **57** and sleeves **58,** and is supported on a hanger **59.** This is being drawn in the upward direction **60** by a transverse bar **61** carried at each side of the apparatus by chains **62,** which are driven by sprockets not shown in this Figure. The guards **56** have central slots **63** (FIG. **5**) to allow the bars **61** to pass freely. It will be noticed that arms **58** overlap body portion **57.** If all the jets were aligned like jets **54** the arms could remain overlapping, and would not then be properly de-soiled by the station. However, the innermost of the angled jets **55** have already begun to impinge on the shoulders of the garment, helping to spread it sideways.

in FIG. **7** this process has gone further and the angled jets **55** have spread the arms **58** so that they are quite clear of the body portion **57.** The innermost of the jets **55** may also just catch the body portion and help to spread it also. Guards **56** prevent the sleeves from flying clear of the ends of the gap, although the best cleaning can be expected if the jets **55** keep the sleeves spread but in a natural hanging attitude, without hitting the guards **56.**

FIG. **8** shows one of the sprockets **64** that drive the chains **62,** and shows on the left-hand side the preferred arrangement by which articles are conveyed supported end first, i.e., hanger end first in an upward direction through a station **65,** comprising jets supplied from header pipes **51.** This station may later comprise

rollers **66**, like rollers **23** of previous Figures, to expel surplus fluid. The rollers comprise resilient faces **67** mounted on rigid mandrels **68**, and are preferably arranged on the next downward run of the conveyor, so as not to be directly over the previous jets and drip the expelled liquor upon them. If it is desired instead to pass articles tail end or traling end first through a station such as **65**, it may be necessary to weight the tail end of each article so that it is not at once blown out of gap **52** by first contact with the jets. Weights **69** (FIG. 7) may be added to each garment, preferably before it enters the apparatus. Alternatively, as illustrated on the right-hand side of FIG. **8**, a descending garment may be weighted by liquid, for instance by low pressure jets **70**, before entering the gap **52** between the main de-soiling high pressure jets.

FIG. **9** shows an alternative type of station in which the article passes through the gap between high pressure jets, supplied from header pipe **51**, and a baffle **71**. FIG. **10** shows another alternative arrangement of opposed jets **72** supplied from header pipes **1**. The jets have orifices **73** and angled deflector plates **74**, off-set so that the jets do not face each other directly from each side but lie parallel to each other, each jet using the body of the opposite header pipe as a baffle. The passage of an article through such a station is represented by arrow **75**.

The invention is also applicable to apparatus in which the articles travel horizontally through stations, although it will be obvious that further guides may be necessary to support such motion especially if it is desired to pass the articles through such stations tail end (i.e., trailing end) first. It is also desirable that the garments should be arranged so that appendages like pockets always hang downwards when passing through stations, otherwise they and the parts of the garment adjacent to them will overlap, and will not be properly treated. An advantage of passing articles downwardly, i.e., hanging end first, through squeegee rollers like **23** in FIG. **1** is that this helps to flush out the pockets, since the rollers catch the blind ends of the pockets first and roll towards the open end.

We claim:

1. De-soiling apparatus, comprising:

a conveyor including at least one continuous drive member and means supporting the continuous drive member for advancement along a path; and a plurality of support members secured on and projecting transversally from said continuous drive member at longitudinally spaced intervals therealong for transport thereby;

means defining a plurality of treatment stations beside said path and spaced longitudinally from one another paralleling said path, including means isolating the continuous drive member from the treatment stations;

each support member being configured to receive and carry an article such as clothing to be de-soiled, and the sense of the projection of said support members from the continuous drive member being such that the support members serially pass through the treatment stations;

and means in at least some of said treatment stations for applying treating fluid to the articles carried therethrough by said support members;

the support members each being configured to hangingly support a said article from one end of the article, so the articles are carried end-to-end through the treatment stations.

2. The de-soiling apparatus of claim **1** wherein at least one of the treatment stations further includes at least one pair of squeegee rollers positioned with their longitudinal axes transverse to the longitudinal axis of said path and further longitudinally therealong from at least one of said means for applying treating fluid, said support members being configured and arranged to draw the articles carried thereby between said at least one pair of squeege rollers.

3. The de-soiling apparatus of claim **1** wherein at least one of the means for applying treating fluid comprises a plurality of fluid spray jets aimed toward at least one of the front and back of the articles being de-soiled, the jets further being aimed in a sense to spread the articles being de-soiled in the sense transversally toward and away from the continuous drive members.

4. The de-soiling apparatus of claim **1** wherein the isolating means include a generally sinuous enclosure more elongated in its direction transversally toward and away from the continuous drive member than in its direction comparing to the front to back dimension of the articles being de-soiled.

5. The de-soiling apparatus of claim **4** wherein at least one of the means for applying treating fluid comprises a plurality of fluid spray jets within the sinuous enclosure aimed toward at least one of the front and back of the articles being de-soiled, the jets further being aimed in a sense to spread the articles being de-soiled in the sense transversally toward and away from the continuous drive member.

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