

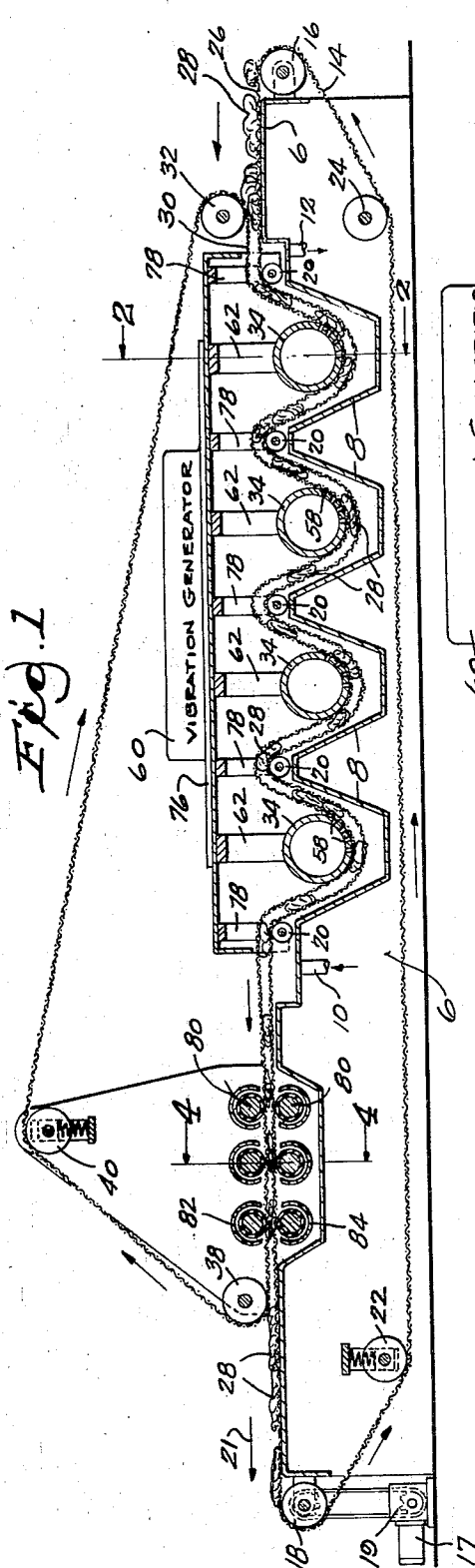
Dec. 20, 1966

C. E. WOOLIEVER

3,292,397

LAUNDRY APPARATUS

Filed May 15, 1964



1

3,292,397

LAUNDRY APPARATUS

Carl E. Woolliever, Rte. 4, Box 149,
Franklin, N.C. 28734Filed May 15, 1964, Ser. No. 367,805
10 Claims. (Cl. 68—19)

This invention relates to laundry apparatus. While the disclosure is primarily directed to and exemplified by a washer such as is used in a commercial laundry for cleansing garments and other work in an aqueous washing solution, it is intended that the term "laundry apparatus" be construed broadly to include drying equipment and also cleansing equipment using solvents other than water, and any related apparatus.

The invention contemplates an arrangement whereby the work is confined between paired foraminous belts guided successively through a series of tubs in which the work is subjected not alone to the action of a solvent but also, in the presence of the solvent, to high frequency vibration which may be, and desirably is, at supersonic frequencies.

Upon leaving the last tub of the series of tubs, the work, still confined between the paired belts, may pass between wringer rollers and between hoods through which drying air is forced at one side of the work and withdrawn at the other side of the work. Either without drying or after the work is at least partially dried, it is discharged from the equipment.

In the preferred organization of the washing section of the machine, all of the guides about which the paired belts and intervening work is caused to pass are yieldably mounted and attached to a bed with which the vibration generator is connected. The guides about which the belts are trained may conveniently be provided with supports in yokes attached to the bed and in the preferred arrangement disclosed there are elastomeric cushions supporting each yoke to allow the entire assembly of the yokes and guides to vibrate freely with the bed in response to the vibrations developed in the generator.

A desirable feature of the machine is the provision of tubular guides which are located deep in the respective tubs and are non-rotatable, having downwardly directed openings through which the cleansing solvent passes either upwardly or downwardly at a relatively high velocity to traverse the work while the work is being vibrated in the body of solvent in the tub. The solvent of each tub is constantly being circulated by a pump through the work and the interior of the perforated tubular guide in the respective tub. Thus, in each tub, work is not merely subjected to high frequency vibration but is exposed concurrently to such vibration in the presence of a rapidly moving current of solvent.

In the drawings:

FIG. 1 is a diagrammatic view in longitudinal section through laundry apparatus embodying the invention.

FIG. 2 is a view on a somewhat enlarged scale taken in section on the line 2—2 of FIG. 1.

FIG. 3 is a further enlarged detail view taken in section on the line 3—3 of FIG. 2.

FIG. 4 is an enlarged fragmentary detail view taken in section on the line 4—4 of FIG. 1 and supplemented by a diagrammatic showing of the apparatus through which air is cleansed, recirculated and heated in the dryer section of the device.

Machine frame 6 supports a series of any desired number of tubs 8 which communicate over the intervening partitions. Arrangements are made for circulating water or other solvent through the tubs successively from a supply pipe 10 to a discharge pipe 12. Water is also circulated in each individual tub, the circulating water

2

being required to traverse the work which is passing through the tubs, as will hereinafter be described.

A supporting belt 14 for the work to be washed passes about suitable guide rolls 16 and 18 at the ends of the apparatus. A motor 17 drives roller 18 through speed reducer 19 to actuate the belt 14 in the direction indicated by arrow 21. Smaller guide rolls 20 support the belt 14 at the points where it enters and leaves the several tubs 8. Additional guide rolls 22 and 24 determine the path of the belt 14 when it passes beneath the tubs on its return to roll 16.

A portion 26 of the belt 14 is exposed to receive the work 28 placed on the belt for passage through the washer. A retaining belt 30 which need not necessarily be positively driven serves to hold the work on belt 14. In traversing the washer it is spaced from belt 14 only by the intervening work 28 and may derive motion from belt 14. It is brought into engagement with the work after passage over the guide roll 32. At least one belt, and preferably both belts, are desirably made of screen cloth or are otherwise foraminous to let the solvent have free access to the work. The belts and intervening work are forced below the level of the solvent in each tub 8 by non-rotatable tubular guides 34, one of which is shown in enlarged detail in FIG. 2. At the delivery end of the machine, the retaining belt 30 leaves belt 14 to expose the work 28 for removal from the machine. Belt 30 passes about roll 38 and over an elevated spring-supported roll 40 for return to roll 32 at the admission end of the machine.

Each of the tubular guides 34 is provided with heads 42 and 44 from which project the supporting trunnions 46 and 48 respectively. Trunnion 48 is tubular, having a passage 50 connected by hose 52 with a centrifugal pump 54. A hose 56 connects the pump inlet with the bottom of the respective tub 8. During operation of the washer, the respective pump is constantly withdrawing solvent from each tub and returning it through passage 50 to the interior of the tubular guide 34. Thence the water flows through the openings 58 in the bottom of the non-rotatable tubular guide 34 to pass through the work confined between the foraminous belts. As clearly shown in FIG. 2, the work 28 is confined between the belts 14 and 30 and exposed to the flow of solvent through the ports 58. The direction of solvent flow in the circulating system is relatively unimportant.

During the washing operation, the work 28 is subjected to vibration developed in a vibration generator 60 which is mounted on a series of yokes 62, one for each tub, in which the trunnions 46 and 48 are positioned, being held against rotation by set screws 64 as best shown in FIG. 3. The enlarged lower extremities 66 of each yoke 62 are yieldably supported, as by being mounted on an elastomeric cushion 68 disposed in a saddle 70 which is carried on, or is part of, bracket 72 mounted on the frame 6. The vibration generator may be of any desired type. Numerous devices for the purpose are known, including motors having unbalanced armature shafts and electromagnets having unbalanced armature shafts and electromagnets having vibratory armatures subjected to high frequency impulses. The frequency of the vibrations will preferably be very high and desirably supersonic.

It will be observed that the vibration generator 60 is mounted on a bed 76 from which the several yokes 62 project into respective tubs to support guides 34. The several guide rolls 20 may either be mounted from the tub assembly or carried from bed 76 by yokes 78. Thus the paired work confining belts, and the confined work, are in high frequency vibration which tends to dislodge the dirt. The solvent circulated through the work by the several pumps 54 carries the dirt off. Optionally the pump rotors may all be on a common shaft. In a laundry wash-

3

er in which water is used, water flows from tub to tub in counterflow to the direction of passage of the work through the machine, and the dirty fluid finally escapes through the discharge pipe 12. Any desired number of tubs can be included in this counterflow arrangement, according to where the respective inlet and outlet pipes 10 and 12 are located.

After the work reaches the last tub, the confining screen belts 14 and 30, with the intervening work, are carried through a succession of pressing and drying rolls 80. These rolls are partially enclosed in hoods 82 and 84 as best shown in FIG. 4. A drying gas under pressure (normally air) is delivered into the drying hoods through pipes 86 and withdrawn through the pipes 88, with entrained moisture. The pipes 88 lead into a centrifugal solvent extractor 90 which has a discharge pipe 92. The gas, free of most liquid and solid particles, leaves through the outlet 94 and a controlled volume of makeup is supplied through pipe 96 subject to regulation by valve 98. Since the gas at this stage may contain some moisture and dust particles, the gas preferably is passed through an electronic precipitator 100 to further clean and dry the gas before being admitted to the blower 102 which delivers the gas through the heater 104 and returns it via pipes 86 to the several hoods 82.

I claim:

1. A washing machine comprising tub means in combination with means for conveying work into and through and from said tub means, said conveying means including first and second belts, at least one of which is forminous, guide means about which the belts are trained and some of which are so disposed as to guide proximate portions of the belts into and through and from the tub means in work confining relation, other guide means being disposed to define return paths for the respective belts, a drying section having upper and lower rolls between which said belt portions are trained and means for directing a drying gas through said belt portions in the drying section for the removal of solvent from work confined between said portions, the upper and lower rolls between which said belt portions are trained having housings partially enclosing the rolls and open toward said belt portions, the means for directing drying gas including a circulatory system which receives gas from one of said housings, discharges some of said gas, replaces with additional gas the gas discharged, and returns gas to the other of said housings.

2. In a washing machine, the combination with tub means for a solvent, of means for supporting work in the tub means in a position to be exposed to the solvent therein, said supporting means including means for holding the work substantially free of contact with the tub means, and means for subjecting the work supporting means and work to high frequency vibration, the work holding means including a hollow guide, the tub means being provided with a solvent circulating system including a pump having an inlet connected to the tub means for the withdrawal of solvent therefrom and having an outlet connected to said hollow guide for the return of solvent to the tub means through said guide, said guide having apertures directed toward the supported work whereby such work is concurrently exposed to vibration and to a flow of solvent.

3. A washing machine comprising a tub for holding solvent at a predetermined level, paired belts having work confining portions extending into and from said tub, a guide means about which said portions are trained and which is disposed below solvent level in the tub, a vibration generator having operative connection with said guide means for the vibration thereof, said guide means being provided with a mounting having elastomeric support whereby the guide means and the paired belts trained thereabout and the work confined between such belt portions can vibrate in the solvent.

4. In a washing machine, the combination with a tub having brackets at its ends which are provided with

4

saddles, resilient means carried by the saddles, a belt guide having end supports mounted on the resilient means to be carried from the saddles, and a vibration generator connected with said supports for the vibration of said guide.

5. A washing machine according to claim 4 in further combination with paired endless belts having complementary work confining portions passing together about said guide and having other portions disposed on mutually remote paths to facilitate introduction and removal of work from the first said belt.

6. In a washing machine, the combination with a tub having brackets at its ends which are provided with saddles, resilient means carried by the saddles, a belt guide having end supports mounted on the resilient means to be carried from the saddles, and a vibration generator connected with said supports for the vibration of said guide, the belt guide being hollow and provided with openings in its belt guide surfaces, and the tub being provided with a solvent circulating system including means for passing solvent through said guide and the openings thereof.

7. A washing machine comprising a series of communicating tubs side by side and means for introducing solvent into a tub at one end of the series and for withdrawing it from a tub at the other end of the series whereby to establish solvent flow through successive tubs of the series and to maintain a predetermined level of solvent in the tubs, a set of paired work conveying belts having complementary work-confining portions traversing said tubs, the respective tubs having belt guides below solvent level and having belt guides between tubs, said belts having their work-confining portions trained about said guides, a frame comprising common means for the yieldable support of at least such of said belt guides as are below solvent level in the respective tubs, vibration generating means connected with said frame for the vibration thereof and the belt portions trained about the guides supported therefrom, belt guide means disposed externally of the tubs and remote therefrom and about which one of said belts is trained, said one belt having a return portion below said tubs, belt guide means externally of said tubs and about which the other belt is trained, said other belt having a return portion above said tubs, and means for driving at least said one belt in a direction which is counter to the flow of solvents through the successive tubs.

8. A washing machine according to claim 7 in which the belt guide means in the respective tubs comprise tubular supports having openings directed toward the belt portions trained thereover, the said belt portions being foraminous, and each of said tubs being provided with a solvent circulating system for forcing solvent through the hollow guide means aforesaid and through the foraminous belt portions trained thereover.

9. A washing machine according to claim 7 which includes a drying section to which said belt portions and confined work are exposed, said drying section including upper and lower rollers between which said belt portions and work are passed, upper and lower hoods partially encasing the respective rollers, means for blowing a drying gas into one of said hoods and for withdrawing gas from another.

10. A washing machine according to claim 9 including means for recirculating at least a portion of the drying gas and centrifugal and electronic means for removing liquids and solids from the gas recirculated.

References Cited by the Examiner

UNITED STATES PATENTS

241,118	8/1881	Beach et al.	68—44 X
273,078	2/1883	Higgins et al.	68—44
656,315	8/1900	Bottomley et al.	68—44

(Other references on following page)

3,292,397

5

UNITED STATES PATENTS

1,185,766	6/1916	Brunger	68—44	
1,387,072	8/1921	Putnam	68—20 X	
1,497,075	6/1924	Elliott	68—181 X	
2,070,204	2/1937	Hetzer	68—182 X	5
2,174,013	9/1939	Schrey.		
2,366,136	12/1944	Waldstein	68—158 X	
2,530,494	11/1950	Vigerust	68—44 X	
2,590,407	3/1952	Haas	68—184	
2,724,955	11/1955	Spooner	68—44 X	10
2,742,773	4/1956	Chambers et al.	68—44	

6

2,817,227	12/1957	Eriksson	68—20
2,881,610	4/1959	Leary	68—44 X
2,886,403	5/1959	Sellers	68—181 X
2,963,893	12/1960	Kusters	68—158 X
3,158,886	12/1964	Grimes	68—3 X
3,199,126	8/1965	Chaikin et al.	68—45 X

FOREIGN PATENTS

473,549	10/1937	Great Britain.
77,037	1/1955	Netherlands.

IRVING BUNEVICH, *Primary Examiner.*