Nov. 28, 1961 H. FÜHRING 3,010,217

CLEANING MACHINES FOR TEXTILES

Filed Oct. 9, 1958 3 Sheets-Sheet 1

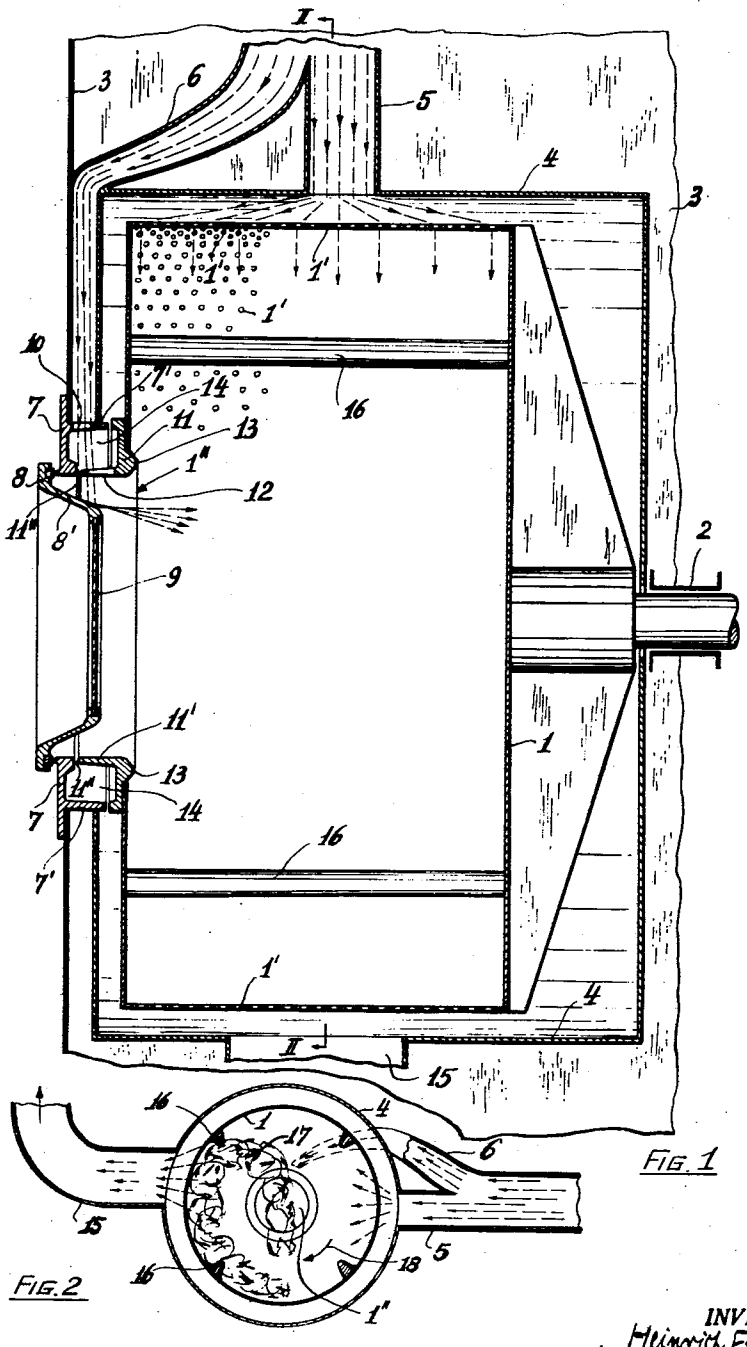


FIG. 1

FIG. 2

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FIG. 3

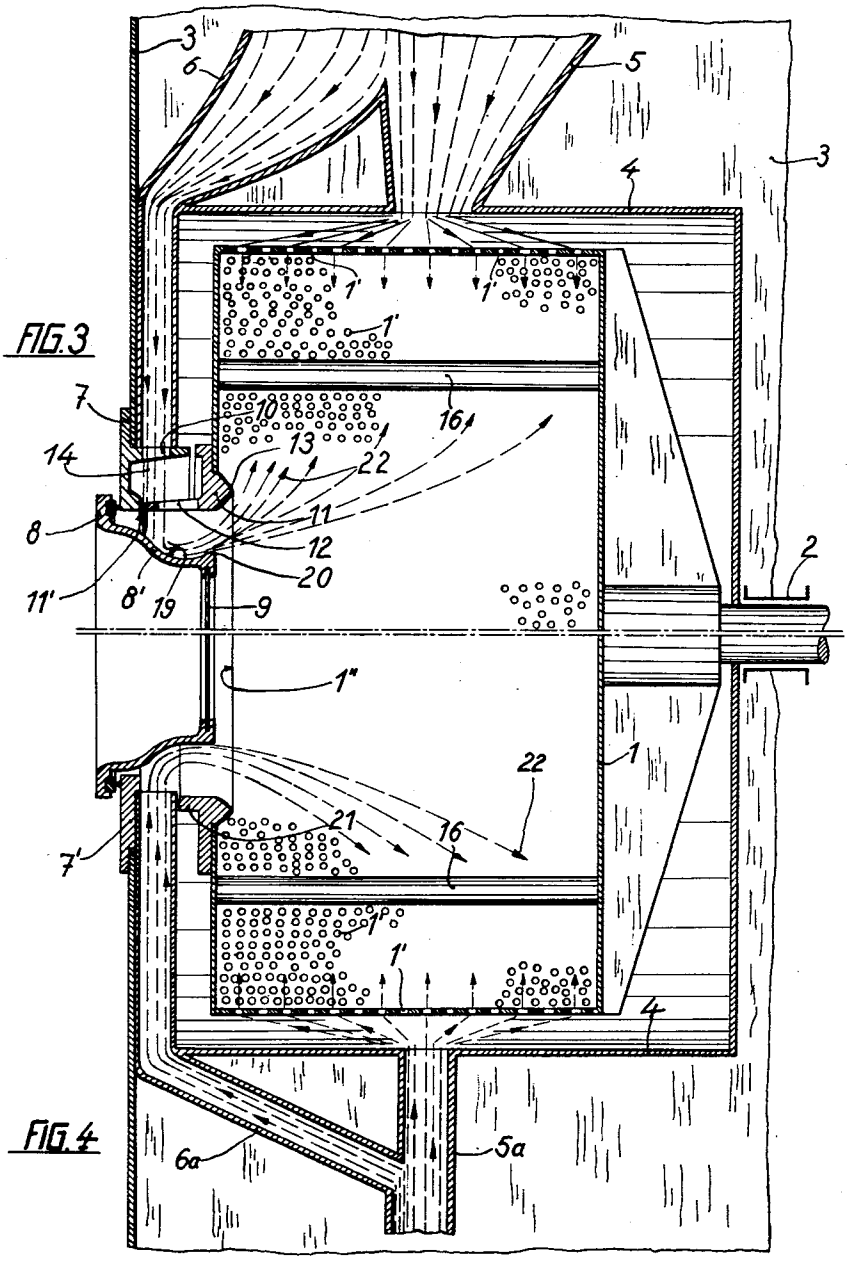


FIG. 4

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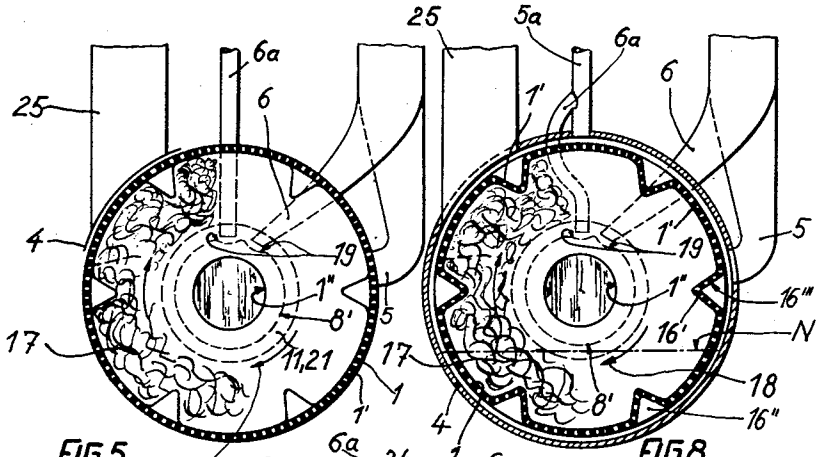


FIG.5

FIG.8

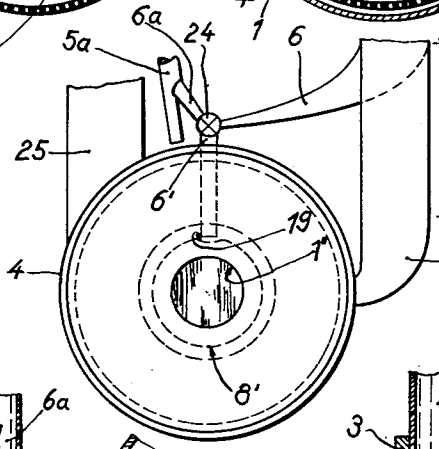


FIG.9

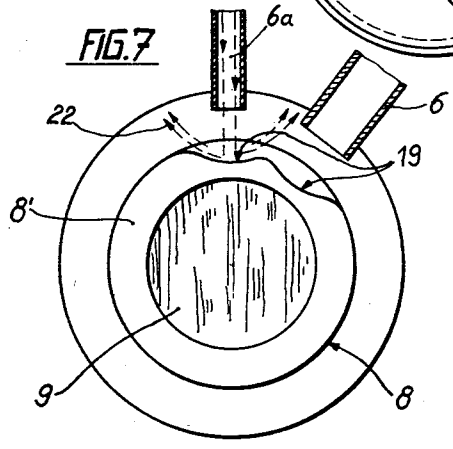


FIG.7

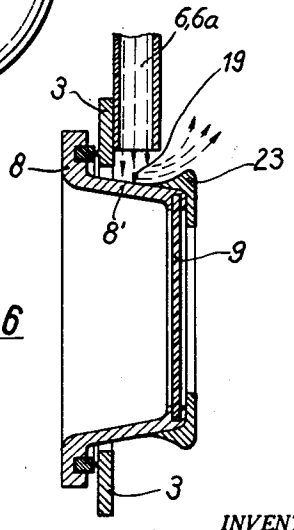


FIG.6

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CLEANING MACHINES FOR TEXTILES

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7 Claims. (Cl. 34—133)

This application is a continuation in part of my co-pending application Serial No. 724,043, now Patent No. 2,908,-086.

The present invention concerns a machine used for chemically cleaning textiles, for example garments, which are disposed in a rotating drum provided peripherally with slots or bores, whereby through the bores or slots solvents are at first introduced and discharged and subsequently drying air is passed through the materials for cleaning.

In known drum-type cleaning machines a single air-supply pipe is arranged so that the air can enter directly through the openings formed in the periphery of the drum. Consequently an air stream directed transversely to the drum axis is created, which is deflected to a negligeable extent by the textile articles contained in the drum. The effective degree of drying and ventilation is not very favorable as certain points, despite the rotation of the drum, are not directly affected by the drying air and therefore dry slowly. Moreover it is a disadvantage that the textile articles during the rotation of the drum collect in front of the inspection glass of the charging door, thus not allowing the state of dryness to be clearly judged from the outside.

Moreover the textile articles come into frictional contact with the charging door and with the lines of contact between the drum and the housing wall in the region of the drum charging opening, thus often causing damage to the textile articles by for example buttons or fasteners becoming detached.

To remove this disadvantage it has already been proposed to guide the drying air axially into the drum, yet even in that case the textile articles, though kept away from the charging door, did not allow the efficiency of the drying and ventilating to be substantially improved.

Due to the known purely axial introduction of drying air or solvent respectively into the drum the textile articles are kept away from the charging door. When the medium is axially introduced however it is immediately deflected by the garments and is forced out of the drum by the shortest route. The intensity of the effect on the textile articles is therefore very low and when drying air is introduced only axially into the drum a temperature difference between the housing and the external surface of the drum and the drum interior is created which leads immediately to the recondensation of the liquid cleaning medium on the housing, inspection glass and the like and leads to further decreasing efficiency.

The object of the present invention is to provide, in a cleaning and drying machine of the general type described, improved means for thoroughly contacting the articles to be cleaned with a treatment fluid such as a solvent used as a cleaning medium and/or another fluid (generally air) employed to dry the articles by expelling the cleaning fluid therefrom.

A more particular object of this invention is to provide an improvement over the system described and claimed in my aforementioned U.S. patent in which a stream of cleaning and/or drying fluid is directed generally axially into the drum in such concentrated manner as to be utilizable in the turning or agitating of the articles concurrently with the soaking thereof by the cleaning fluid and/or the drying thereof by an air current.

The invention realizes the foregoing objects primarily by so shaping the deflecting annular wall of the charging door, against which a stream of fluid is directed generally radially in accordance with the teachings of my aforementioned patent, that the fluid after deflection is no longer dispersed within the interior of the drum but is given a predetermined direction preferably oriented inclinedly upwardly and away from the horizontal drum axis. For this purpose the annular door wall is provided with one or more depressions facing one or more pipes through which the aforementioned fluids, or at least one of them, are admitted at the charging opening of the drum. This depression is advantageously given a gentle concave curvature designed to deflect the impinging fluid stream through an angle of 90° or more.

The pipe or pipes terminating adjacent the deflecting door surface may be secondary inlets for the respective fluids branched off from primary inlets which open substantially radially at the perforated peripheral wall of the drum. It is particularly advantageous to position the primary inlet for the drying air at a descending portion of the drum wall and the corresponding outlet, which preferably is of considerably larger cross-sectional area, at a diametrically opposite ascending portion while letting the cleaning fluid and the secondary drying air enter the drum from above. The suction created under these circumstances at the outlet will help in the upward entrainment of the charge of the drum, i.e. the garments or other articles to be cleaned, by the inner periphery of the rotating drum, which may be suitably provided with inwardly projecting ledges for the same purpose, whereby such charge will be carried above the median plane of the drum and will then tumble through the inwardly and upwardly directed fluid stream for thorough soaking or drying.

The invention will be described further, by way of example, with reference to the accompanying drawing, in which:

FIG. 1 is a horizontal section through a part of the cleaning machine with the drum, charging door and air pipes;

FIG. 2 is a section taken on the line II—II of FIG. 1 but on a smaller scale;

FIG. 3 is a partial section through a drum having a charging door, branch pipes and air-supply and solvent-inlet pipes leading radially against the drum wall;

FIG. 4 is an alternative embodiment to FIG. 3;

FIG. 5 is a diagrammatic sectional elevation of a drum with separate branch pipes for air and solvents;

FIG. 6 is a sectional detail through a charging door;

FIG. 7 is a rear view of the charging door in accordance with the embodiment of FIG. 4, showing the undulatory depression;

FIG. 8 is a cross-sectional elevation through the drum corresponding to FIG. 5, in which the entraining ledges are formed by the drum jacket; and

FIG. 9 is a diagrammatic detail of an assembly in accordance with FIG. 5, having a single branch pipe for the air and solvent supply.

The drum **1** of the cleaning machine shown in section in FIG. 1 is mounted unilaterally in the bearing **2** of a housing **3** of the cleaning machine in the same manner as in hitherto known arrangements. Arranged around the drum **1** is a cage **4** closed on all sides and having a discharge opening for the solvents (not shown in FIG. 1) and the extraction pipe **15** for the drying air. An air-injection pipe **5**, through which the drying air is injected in the direction of the jacket of the drum **1** provided with openings **1'**, is connected with the cage **4**. The drying air arrives in the drum **1** in which garments and the like, not shown in the drawing, are kept in motion during the rotation of the drum, so that, when the solvent has been discharged, residues thereof are evaporated and discharged.

On the air-injection pipe 5 there is provided a branch pipe 6 the cross section of which tapers considerably, thus causing the air passing through to travel at an increased speed.

In the embodiment of FIG. 1, the branch pipe 6 is disposed between the housing wall 3 and the cage 4. It may, however, also be laid within the wall of the housing 3. The branch pipe 6 leads in at the shoulder 7' projecting in the direction towards the drum 1 of the seat 7 for the charging door 8, in which there is also provided an inspection glass 9. At the point where the branch pipe 6 and the shoulder 7' meet there is formed a bore 10 which corresponds approximately to the inner cross section of the branch pipe 6. The air passing through the branch pipe 6 thus impinges through the bore 10 onto the frame 8' of the inspection glass 9 of the charging door 8 from where it is deflected axially in a direction towards the drum 1 and gets into the interior of the drum 1 through the charging opening 1''. For this purpose the frame 8' is drawn forwards in the direction towards the drum 1 and is of conical design.

It is further evident from FIG. 1 that the drum 1 has an annular flange 11 at the charging opening 1'', the collar-like extension 11' of which projecting in the direction of the seat 7 of the charging door and extends closely past the mounting 7, thus preventing the garments contained in the drum from becoming wedged between the seat 7 and the collar-like enlargement 11'. This collar-like extension 11' has openings 12, such as slots, holes and the like distributed over the whole periphery thereof through which the air issuing from the branch pipe 6 passes. The air striking the material of the annular extension 11' between the openings 12 is distributed in the annular space 14 formed between the shoulder 7' and the extension 11', from where it is deflated into the drum 1. The openings 12 have a cross section which is smaller than buttons, so that garments cannot be caught therein. Similarly, the distance between the front edge 11'' of the collar-like extension 11' and the seat 7 of the charging door 8 is very small, and the front edge 11'' is remote from the drum charging opening 1'', thus preventing any textile articles from getting into the region of the parting line.

The function of the cleaning machine is evident from FIG. 2. The articles to be dried are contained in the drum 1 and during rotation thereof are carried along by means of entraining ledges 16 in the direction indicated by the arrow 18 to approximately the level of the suction pipe 15 where they are then allowed to turn and drop down again. During the falling movement the textile articles 17 pass through the flow of air entering through the charging opening 1'' so that in addition to the turning movement caused by the drum they are subjected to a transverse turn. By virtue of this tumbling movement all parts of the articles to be dried are in fact in contact with the air stream, thus causing a substantially more favorable drying time and intensity than in known apparatus. Moreover a negative pressure is created in the drum which assists the drying operation, as the cross sectional dimensions on the suction side are greater than on the pressure side. With a constantly circulated air supply, the pipe of smaller cross sectional area put up a greater resistance to the air stream thus causing the pressure differences between the pressure pipes and the drum to be smaller than between the drum and the suction pipe. Thus a sharp pressure drop is created in the drum.

The embodiment illustrated in FIG. 3 of the drawing has the drum 1 mounted unilaterally in the drum bearing 2 and surrounded by the cage 4 within the housing 3 of the cleaning machine as in FIG. 1. From the inlet pipe 5 there branches a pipe 6, which may form one of a plurality of branch pipes, the cross section thereof tapering considerably. The branch pipe 6 leads along the inside of the housing wall 3 in the direction of the charging door 8, where it terminates in the frame 7 of the housing 3. It is assumed in this case that through the pipe 5 and the branch pipe 6 drying air is conducted. This branch 6 may also be led along the outer wall of the housing 3 in the direction of the charging door in which case it will then have to lead into the interior of the housing in such a way that the medium emerging from this branch pipe is allowed to flow in the direction of the frame 8' of the charging door 8 or a similarly shaped deflecting agent.

In the modification of FIG. 4 the inlet pipe 5*a* has a branch pipe 6*a* which also leads to the annular opening of the door in a similar manner. In actual practice the inlet pipes 5 and 5*a* and the branch pipes 6, 6*a* preferably assume a position corresponding to that of FIG. 8 wherein it is assumed that the branch pipe 6 is directed obliquely from above against the charging door 8 and the other branch pipe 6*a* for the solvent is directed vertically against the charging door.

The drum 1 is also provided on the periphery thereof with sieve-like openings 1' in a similar manner to FIG. 1 through which the medium passing through the pipes 5 and 5*a* can enter radially into the drum. At the free end face of the drum 1 in the region of the charging door 8 there is provided the opening 1'' defined by the flange-like extension 11, 21.

The embodiment of FIG. 3 shows a construction solution, in which the flange-like extension 11 is herewith provided with numerous slots, openings or other recesses 12, through which the medium emerging from the branch pipe 6 has to pass to impinge upon the frame of the charging door 8. In contrast to this, the embodiment of FIG. 4 shows a constructional alternative in which it is evident that the flange-like extension 21 reaches almost to the branch pipe 6*a*, which in turn terminates with less clearance from the charging door 8 than the branch pipe 6, hence with the flange 21 the recesses 12 are no longer functionally required; they may, nevertheless, be provided. On the inner surface of the flange-like extension 11 or 21 an annular bead 13 is developed, which tends to deflect the articles to be cleaned in a direction towards the interior space of the drum to prevent them from making contact with the end face of the drum.

According to the embodiment of FIGS. 4 and 5, the frame 8' of the charging door 8 surrounding the glass pane 9 is provided with undulatory depressions 19, which are located opposite the outlet opening of the branch pipes 6 and 6*a*. These depressions 19 are so arranged that the fluids emerging from the branch pipes 6, 6*a* are deflected by the depressions 19 through angles upwards of 90° relative to the direction of flow into the interior drum space with a minimum of splash loss. The deflections experienced by the fluids are indicated by the arrows 22, it being further perceptible that the bead-like elevation 20 adjoining the depression 19 also determines the deflecting direction 22 of the impinging fluid. The deflection is so arranged as to effect the distribution of the medium over the whole depth of the drum so that all parts of the articles to be cleaned may be affected. The articles 17 to be cleaned are engaged within the drum 1 by the entraining ledges 16 and the friction of the articles against the drum jacket during rotation of the drum. When the articles to be cleaned have traveled upwardly against the drum jacket, they reach a point where they start to drop away from the drum periphery by gravity and as they fall, are passed through the deflected stream of drying air or solvent from pipe 6 or 6*a* respectively, in such a manner that they are readily turned or whirled about. The sooner the deflected stream strikes the garments which are in the course of dropping, the less effort is required to turn the garments. This turning effect is yet increased by the fact that, in the region where the garments have become detached from the drum wall, the drying air or the solvent is also radially introduced into the drum 1 so that three forces acting in three different directions act simultaneously on the garments. In this way it is ensured that each part of the garments is affected by the solvent or the drying-air stream whereby

the cleaning effect may be attained within the shortest period.

FIG. 5 shows how the solvent is introduced into the drum 1 axially exclusively through the branch pipe 6a and is deflected against the frame of the charging door 8' without the use of the radial pipe 4a illustrated in FIG. 8. The drying air, however, is introduced into the drum 1 radially through the pipe 5 and also axially through the branch pipe 6. Branch pipe 6 and pipe 5 branch off at a heater (not shown) in the manner of a siphon pipe, the branch pipe 6 being more considerably tapered than the pipe 5.

FIG. 6 shows an alternative construction of the charging door frame 8' of FIG. 3, which has been modified by the pressure of an annular attachment 23 whereby the transition between frame 8' and the shoulder 23 serves to form an undulatory depression corresponding to that designated 19 in FIG. 3. The shoulder 23 need only be provided at those points where the medium emitted from the branch pipes 6, 6a strikes the charging door 8. The shoulder need not be internally designed as a rotary body; it may be flattened at the point of impact of the fluid, so that the whole medium stream is deflected into the direction desired. For simplicity, only one branch pipe is shown in this embodiment.

According to FIG. 7, the undulatory and gently curved depressions 19 may also be machined into the frame 8' of the charging door 8. In this case the fluid is deflected upwardly generally as an oblique cone, the downward or lateral current no longer having a substantial effect on the dropping articles 17 to be dried.

Whilst in the example of FIGS. 3 and 4 the entraining members or ledges 16 are fitted on the inner wall surface of the drum jacket 1, the entraining members 16' according to FIG. 8 are formed integrally with the drum jacket. The particular advantage of this measure resides in the fact that in the region of these members 16' the drum wall may be provided with openings 1'. When an individual entraining member 16' on rotation of the drum 1 engages the garments 17 in the direction of the arrow 18, then it is possible for the solvent or drying air also to enter the angular recesses 16'', formed by the members 16', through the radial inlet pipes 5, 5a; from these recesses the medium can be directed with full effect against the garments 17 engaged by the member 16' through the perforations 1' as the recesses 16'' act as temporary reservoirs for the solvent.

Further, before reaching and after passing the inlets 5, 5a it is possible for the recesses 16'' to be filled with the solvent partly running down over the drum jacket, so that the solvent supplied is led completely through the articles 17 to be cleaned.

The entraining members 16' provided with perforations 1', and forming the recesses 16'' in the perforated drum wall when being immersed in the liquor give use to an additional pulsation effect by virtue of the fact that the lateral surface 16''' of the individual members 16' strike the liquor surface N substantially parallel thereto which causes the liquor to be driven forcefully through the perforations 1' into the drum interior. Practical observation shows that with each immersion of a ledge 16' a flood of solvent is projected against the descending articles 17 to be cleaned and that the flooding effect, taking place in rapid succession, causes a pulsation of the solvent.

Over and above this, the formation of a negative pressure within the drum 1 has an advantageous overall effect. The negative pressure is obtained by giving the extraction pipe 25 a relatively large cross-sectional area and by the special arrangement of the extraction pipe 25 relative to the direction of rotation of the drum 1 and also the position of the radial injection pipe 5 (compare FIGS. 5 and 8). The extraction pipe 25 is so arranged that the garments 17 always collect opposite the opening thereof. The air to be extracted has therefore to travel a roundabout way through the open space between the drum jacket 1 and the cage 4; it is thus repeatedly deflected and economically utilized. On the other hand a fresh supply of drying air is delivered from the pipe 5, entering obliquely from above, and also from the branch pipe 6 into the drum 1 in such a manner that it is actually caught by the garments dropping down and can become disentangled therefrom only after many detours.

Finally, FIG. 8 shows that it is also possible for only one branch pipe 6 to be provided for the drying air and also for the supply of solvent, this branch pipe 6' being adapted to be closed by a cut-off member or valve 24, with the result that either only drying air or only solvent can get from the main pipe 5 or 5a into the branch pipe 6'. Moreover, the valve 24 allows the branch pipe 6' to be cut off when drying air or solvent is to be introduced into the drum 1 only through the radial main pipe 5 or 5a, respectively.

I claim:

1. In a machine for the chemical cleaning of textile articles by means of a first fluid and the subsequent drying thereof by means of a second fluid, in combination, a housing, a drum mounted at one end in said housing for rotation about a substantially horizontal axis, said drum having a charging opening at its other end and being provided with a perforated peripheral wall, said housing having an aperture aligned with said opening and a door removably projecting through said aperture into said opening, said door having an annular wall received with clearance within said opening, and conduit means with in said housing terminating adjacent said annular wall externally of said drum in a length of pipe substantially in a vertical axial plane of said drum for directing a stream of at least one of said fluids substantially at right angles to said axis from above against said annular wall, said annular wall being formed with an external depression on facing said length of pipe and shaped to deflect said stream in the vicinity of said vertical axial plane into the interior of said drum obliquely upwardly toward said peripheral wall.

2. In a machine for the chemical cleaning of textile articles by means of a first fluid and the subsequent drying thereof by means of a second fluid, in combination, a housing, a drum mounted at one end in said housing for rotation about a substantially horizontal axis, said drum having a charging opening at its other end and being provided with a perforated peripheral wall, entrainment means in said drum adjacent said peripheral wall for carrying said articles toward the top of said drum upon rotation thereof, said housing having an aperture aligned with said opening and a door removably projecting through said aperture into said opening, said door having an annular wall received with clearance within said opening, primary inlet means for at least one of said fluids terminating substantially radially of said drum within said housing close to the outside of said peripheral wall, outlet means for said fluids terminating within said housing at a location remote from said primary inlet means and close to the outside of said peripheral wall, and secondary inlet means within said housing terminating adjacent said annular wall externally of said drum for sequentially directing streams of said first and second fluids substantially at right angles to said axis from above against said annular wall, said conduit means including a terminal length of pipe lying substantially in a vertical axial plane of said drum, said annular wall being formed with at least one external depression facing said conduit means and shaped to deflect said streams in the vicinity of said vertical axial plane into the interior of said drum obliquely upwardly toward said peripheral wall for interception by articles dropping within said drum upon having been carried upwardly by said entrainment means.

3. The combination according to claim 2 wherein said secondary inlet means includes at least one pipe branching off from said primary inlet means.

4. The combination according to claim 2 wherein said primary inlet means comprises a pair of main pipes for said first and second fluids, respectively, said secondary inlet means comprising a single conduit constituted by said length of pipes, branch pipes leading from said main pipes to said conduit, and valve means at a junction of said branch pipes with said conduit for selectively shutting off either of said fluids.

5. The combination according to claim 2 wherein said drum is provided with an axial flange surrounding said opening and extending outwardly toward said aperture while forming an annular space around said door, said secondary inlet means being positioned to direct said fluids into the interior of said drum through said annular space.

6. The combination according to claim 2 wherein said outlet means is positioned adjacent an ascending portion of said peripheral wall and has a cross-sectional area substantially greater than that of said primary inlet means, the latter being positioned substantially diametrically opposite said outlet means.

7. The combination according to claim 2 wherein said outlet means is positioned above the horizontal median plane of said drum and opens substantially tangentially onto said peripheral wall from above.

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