The present invention relates to a pneumatic installation which enables greasy wool to be conveyed from the untreated wool warehouse or the work shop where the wool is sorted to the scouring room.

The greasy wool has not so far been successfully transported by pneumatic means, because the conduits and the fans in which the wool would have to circulate are quickly covered with a thick layer of grease mixed with dirt and vegetable materials. This layer, which is formed at a surprisingly high speed, very quickly reaches thicknesses such that the flow passages of the wool are reduced by half, it is readily appreciated that under these conditions such an installation is quite unsuitable for use.

The object of the invention is to provide a pneumatic installation for conveying greasy wool which does not have this disadvantage.

In order to obtain this result, a suitable liquid, such as for example water, which dissolves the grease and prevents the formation of any deposit in the conduit, is sprayed at least at the entrance to the conduit in which the wool is conveyed pneumatically.

The installation for conveying greasy wool according to the invention thus comprises a conduit having smooth internal wells, pneumatic means for conveying the wool from the entrance to this conduit to the outlet end thereof, preferably in the form of a suction fan disposed at the discharge end of the said conduit, and means for spraying a suitable liquid, such as water, at least into the entrance zone of the conduit.

The means which enable a liquid to be sprayed into the conduit are preferably formed by a constant level tank filled with liquid and communicating with the interior of the said conduit by means of an orifice formed in the wall of the latter at a height which is above the liquid level in said tank a distance less than that which corresponds to the vacuum which obtains in the conduit at the position of the said orifice.

The conduit is preferably supplied with wool by a feeding arrangement controlled by a device provided at the inlet end of the said conduit, said device being sensitive to the value of the vacuum or reduced pressure which exists at this point of the conduit and being operative in such manner as to stop the feeding arrangement as soon as the vacuum falls below a predetermined value so that there is no danger of the conduit or pipe being obstructed by an excess of wool. The device may be formed by a simple valve opening outwardly and urged in the direction of opening by a weak spring or a micro-contact.

The suction fan is in a preferred arrangement adapted for the opening of the wool, the blades of its rotor being inclined with respect to radii passing through their extremities at a predetermined angle forwardly with respect to the direction of rotation. The fan may comprise an opening plate which permits access to the interior of the casing and to the rotor, and it is preferably arranged that the outlet of the fan opens into a box provided with a metallic grid which ensures efficient extraction of dust from the wool.

In a preferred embodiment the box is provided with two photoelectric cells which are respectively disposed at the maximum and minimum levels at which the wool can be disposed inside the said box, the said cells being connected to an electronic device which controls the stopping and starting of the conveying installation so that this box is regularly provided with wool.

The invention will be better understood by reference to the following description and the accompanying drawings, which show one embodiment of the invention as a non-limitative example; in these drawings:

Fig. 1 is a diagrammatic view of a pneumatic installation for conveying greasy wool and designed in accordance with the invention.

Fig. 2 is a view to a larger scale showing a detail of a safety device in the installation according to Fig. 1, the purpose of this device being to prevent the formation of accumulations of wool in the pipe of the installation.

Fig. 3 is a diagrammatic view showing one example of a device for injecting water into the pipe shown in Fig. 1;

Fig. 4 is a diagrammatic view of the rotor of the turbine which causes the reduced pressure or vacuum necessary for conveying the wool;

Fig. 5 is a section taken substantially on the line V—V of Fig. 4;

Fig. 6 is an external view of the turbine with its inspection and cleaning door open; and

Fig. 7 is a general diagram of the electric circuits for controlling the installation.

Referring first of all to Fig. 1, there is to be seen the complete pneumatic installation for conveying the greasy wool from a crude or sorted wool warehouse to a washing installation, of which the feeding or charging device is apparent at 1 and the first scouring tank at 2.

The conveyor installation according to the invention comprises a charging arrangement 3 of any suitable conventional type adapted to supply wool at a constant rate to the installation, the motor thereof being controlled by a switch indicated at C. The outlet opening of the feeding arrangement 3 is disposed above a hopper 4 placed at the inlet end of a conduit or pipe 5 which extends over the entire length of the path through which the wool is to travel. This conduit must have a very smooth inside wall and it may be square, rectangular, circular, oval or of any other suitable cross-section. The conveyance of the wool is assured in this conduit by a reduced pressure caused by a centrifugal turbine 6, the central inlet of which is connected to the outlet end of the conduit 5. The rotor of the turbine is driven by any suitable means, for example by an electric motor 7, through a belt transmission system 8. The switch which controls the motor 7 is indicated at T. The casing of the turbine 6 opens into the upper part of a hopper 9 equipped internally with metallic grids, the air leaving the turbine expanding in the said box, which serves as a silo for wool storage above the charging arrangement 3 of the scouring unit. The metallic grids permit a very efficient extraction of dust from the wool.

In order that the yoke of the wool may not be deposited on the walls of the conduit 5, spray devices are provided which introduce a suitable liquid and more especially water into the conduit. It is sufficient to introduce this liquid at a few points in the conduit, for example directly at the inlet end, as indicated at 11 in the drawing, and then at an intermediate point such as indicated at 12, which can be situated half-way along the conduit if the latter has for example a length of about 100 metres.
Owing to this arrangement, no deposit occurs and there is completely avoided the formation of a thick layer of a mixture of grease, dirt and vegetable materials which, if it was produced, would very quickly cover the walls of the conduit and of the turbine and would consequently make the installation incapable of operation. Moreover, a very regular delivery of wool is obtained.

In order to introduce the liquid into the conduit, it is for example possible to use an arrangement of the type which is shown in Fig. 3. A constant level tank 14 is connected by a pipe 15 to an orifice 16 in the wall of the conduit 5, this orifice being higher by a distance "h" than the level in the tank 5. The height "h" is calculated as the value of the reduced pressure or vacuum which exists at the position of the orifice 16, so that when the installation is set in operation, the vacuum which exists in the conduit automatically ensures the starting and the operation of the spraying device. By way of example, it is possible to have at the inlet end of the conduit a reduced pressure of the order of 80 mm. of water and, at the discharge end, i.e., at the inlet to the turbine, a reduced pressure of the order of 250 mm. In order to ensure that the level is constant, a float 17 in the example illustrated controls the opening and closing of a cock 18 for the liquid into the tank 5.

The liquid thus introduced into the conduit dissolves the yoke as it is deposited and the solution is carried away by the wool which slides in the bottom of the conduit. The same phenomenon is produced in the turbine, so that the entire installation always remains very clean.

In order to avoid the formation of accumulations of wool which would obstruct the conduit, a safety device formed by a valve 21 (Figs. 1 and 2) has been provided, this device being applied to a short pipe 22 communicating with the conduit 5 at its inlet end under the action of atmospheric pressure while there is a reduced pressure in the conduit. This valve is adjusted in such a manner as to open as soon as the reduced pressure at the inlet end of the conduit falls below a predetermined value which is estimated to be necessary for the good operation of the installation. The valve 21 is connected to a switch K. In the example illustrated, this valve is fixed directly on the control blade of a micro-switch. The switch controls the operation of the charging arrangement 3.

If for any reason very large bundles of wool are in the conduit, the vacuum in the latter decreases, particularly at its inlet end, and the valve 21 is opened and operates the switch K, which stops the charging arrangement 3. The conduit then clears, and when the vacuum has reassumed its normal value, the valve 21 is closed and operates the switch in the opposite sense so that the charging arrangement is re-started.

Furthermore, use is made of the presence of the turbine 6 by giving its rotor a particular design with the object of producing the opening of the wool while the latter is travelling in the turbine. To this end, each vane or blade 25 of the rotor forms a certain angle α with respect to the radius which passes through its end, so as to be displaced forwardly with respect to the direction of rotation (see Figs. 4 and 5). It has been found that an angle of the order of 30° gives good results. Owing to this structure, the wool which enters the turbine is subjected to true jetting actions by the blades of the rotor, its fibres are not broken, but it is well opened and cleansed. It is then possible to dispense with the conventional beater-type opener.

In addition, the casing of the turbine is equipped with an opening plate 26 (Fig. 6) mounted on hinges 27 so that it is possible to have access to the interior of the casing, for example, in order to check, clean or change the rotor.

As the grease is detached from the wool particularly at the moment when the latter is opened by the action of the turbine, it is desirable to arrange the turbine as close as possible to the box 9.

The complete installation can easily be made automatic by arranging on the hopper 9 two photoelectric cell devices 31 and 32 which correspond respectively to the maximum and minimum levels of the wool in the said hopper. By means of electronic apparatus, these two cells control two contacts CH and CB which form part of an electric control circuit 33 and the details of which will hereinafter be referred to. The contacts CH and CB control the switch T of the motor 7 controlling the turbine and the switch C controlling the feeding arrangement 3. Thus, when the level of the wool in the hopper reaches the maximum upper level, the cell 31 causes the turbine and the feeding arrangement 3 to stop, and conversely, when the wool falls below the minimum level, the cell 32 restarts the turbine and the feeding arrangement.

Under these conditions, it is certain that the feeding arrangement for the washing system 1 is always supplied in a regular manner.

In order that there may be no danger to the wool entering the conduit 5 before the normal vacuum is developed therein, the starting of the feeding arrangement 3 is arranged to take place a certain time (for example about 20 seconds) after starting the turbine. Conversely, at the time of stoppage, the feeding arrangement is stopped a certain time (for example 40 seconds) before the turbine so that the conduit can be completely emptied into the hopper.

By way of example, Fig. 7 shows an electric circuit diagram 33 for controlling the installation. This diagram shows the switch T of the turbine motor, the switch C of the charging motor for the untreated wool, the contacts CH and CB of the photoelectric cells for the maximum and minimum levels and the contact K of the safety valve. The diagram also shows a timing mechanism M provided with three contacts M1, M2, M3, the contact M1 being arranged to close instantaneously and to open within a lag of 40 seconds, the contact M2 being arranged to open instantaneously and to close with a lag of 20 seconds and the contact M3 being arranged to open and close instantaneously; there are also shown starting buttons Ma, stopping buttons Ar, an intermediate relay R with two contacts R1, R2, a warning lamp L for indicating the minimum level, two thermal circuit breakers, the contacts of which are indicated at RT and RC and which serve respectively to stop the turbine 6 and the untreated wool charging device 3 when the currents received by the motors of these apparatus exceed a certain intensity which is considered to be dangerous. There is also shown a relay P adapted to control the water-spraying systems in the case where the operation of the latter is not ensured automatically by the vacuum obtaining in the conduit. The control circuit arrangement is fed with two lines L1 and L2 of the electrical distribution system.

The operation of these electric circuits is as follows: in order to start the installation, one of the buttons Ma is operated and the timing mechanism M is supplied by the following circuit: line L1, the opening contacts Ar, Ar, RT and CH, which are now closed, the closed button Ma, the timing mechanism M and the line L2. The contact M3 of the timing mechanism is immediately closed and ensures the automatic supply of the latter, the contact M1 is also closed immediately and the starting switch for the turbine is fed by the following circuit: line L1, contacts Ar, Ar, RT, M1, switch T and line L2. The wool-feeding arrangement will only be started somewhat later by the closing of the delay contact M2 of the timing mechanism, which makes the following circuit: line L1, contacts Ar, Ar, RT, M1, M2, K (if the vacuum in the conduit reaches a sufficient value), RC, switch C and line L2.

The installation is now operating. If for any reason the level of the wool in the hopper 9 exceeds the prescribed maximum height, the contact CH is operated by the photoelectric cell 31, so that it is opened and consequently the breaking stop the timing mechanism.
nism. As the latter is no longer being fed, its contact M3 is opened and thus stops the automatic supply thereof; at the same time, the contact M2 is also immediately opened and the feeding arrangement for the untreated wool is stopped due to the opening of the switch C, but the turbine continues to run for another 40 seconds because of the time lag in the opening of the contact M1.

The level of the wool now reaches the minimum level. The contact CB is closed and feeds the intermediate relay R which closes its contacts R1 and R2. The closing of the contact R2 causes the lighting up of the warning lamp L indicating the minimum level. The closing of the contact R1 in exactly the same way as the closing of the starting button Mo, ensures that the entire installation is restarted. It will be seen that the operation of the installation is entirely automatic, the level of the wool in the hopper oscillating between the two prescribed minimum and maximum levels.

When it is desired to stop the installation, pressure is applied to one of the stopping buttons Ar, and this causes the breaking of the holding circuit of the timing mechanism, and the installation is stopped in the same conditions as indicated above when the maximum level had been reached.

It will be noted that the thermal contact RT of the turbine, in stopping the turbine, also causes the stopping of the charging arrangement, but the thermal contact RC of the charging arrangement, in stopping the latter, allows the turbine to continue rotating, so that there is no danger of the installation being clogged in the event of the turbine stopping.

As already explained above, if an accumulation of wool is formed in the conduit, the vacuum at the inlet end is considerably reduced and the valve 21 is opened, thus causing the opening of the switch K. At this moment, it is seen that the charging switches, in combination, are also opened while the turbine continues to rotate. Consequently, no more wool enters the conduit. The accumulation of wool is displaced towards the discharge end without any other wool being able to accumulate behind it and when it has left the installation, the vacuum immediately reattains its normal value, the valve 21 is closed again under the action of the atmospheric pressure and the contact K is also closed and restarts the charging arrangement which alone had been stopped.

In the case of a water-spraying system which does not operate automatically under the action of the vacuum existing in the conduit, it is seen that the relay P ensures this spraying action as long as the charging arrangement is in operation.

Obviously, the invention is not limited to the embodiment which has been described and illustrated, as this is only given by way of example, and it is possible to incorporate numerous modifications available to the person skilled in the art without thereby departing from the scope of the invention.

I claim:
1. A pneumatic installation for conveying greasy wool from a first point to a second point to present the wool suitable for processing which comprises, in combination, an elongated conduit having smooth internal walls extending from an inlet end to an outlet end, means for inducing an air stream in said conduit to convey the wool from said inlet end to said outlet end, and means for introducing a liquid having at least a partial solvent action for wool grease at least adjacent the inlet end of said conduit and being effective to introduce said liquid substantially along said smooth walls, said liquid introducing means leaving the interior of said conduit free from obstruction, whereby free flow of the wool across the entire cross section of said conduit is permitted at all times during introduction of said liquid.
2. An installation according to claim 1, wherein said means for spraying liquid into the conduit are formed by a constant level tank filled with liquid and communicating with the interior of the said conduit by means of an orifice formed in the wall of the latter at a height which is above the said tank at a distance smaller than that which corresponds to the vacuum which exists in the conduit at the position of the said inlet end.
3. An installation according to claim 1, wherein the conduit is adapted to be supplied with wool by a feeding arrangement controlled by a device provided at the inlet end of the said conduit, said device being sensitive to the value of the vacuum which exists at this point of the conduit and being operative in such manners as to stop the feeding arrangement as soon as the vacuum falls below a predetermined value so that there is no danger of the conduit getting clogged by an excess of wool.
4. An installation according to claim 3, wherein said device is formed by a valve opening outwardly and urged in the direction of opening by a weak spring.
5. An installation according to claim 1, wherein said pneumatic means for conveying the wool comprise a suction fan disposed at the discharge end of the said conduit.
6. An installation according to claim 5, wherein the suction fan is adapted at the same time for the opening of the wool, the blades of the rotor of the fan being inclined with respect to radii passing through their extremities at a predetermined angle forwardly with respect to the direction of rotation.
7. An installation according to claim 5, wherein the fan comprises an opening plate which permits access to the interior of the casing and to the rotor of said fan.
8. An installation according to claim 5, wherein the outlet of the fan opens into a hopper and wherein the hopper is provided with two photoelectric cells which are respectively disposed at the maximum and minimum levels at which the wool should be disposed inside the said hopper, the said cells being connected to an electronic device which controls the stopping and starting of the conveying means so that this hopper is regularly provided with wool.
9. An installation according to claim 1, wherein said means for spraying liquid into the conduit are formed by a constant level tank filled with liquid and communicating with the interior of the said conduit by means of an orifice formed in the wall of the latter at a height which is above the said tank at a distance smaller than that which corresponds to the vacuum which exists in the conduit at the position of the said orifice, and wherein the conduit is adapted to be supplied with wool by a feeding arrangement controlled by a device provided at the inlet end of the said conduit, said device being sensitive to the value of the vacuum which exists at this point of the conduit and being operative in such manners as to stop the feeding arrangement as soon as the vacuum falls below a predetermined value so that there is no danger of the conduit being clogged by an excess of wool.
10. An installation according to claim 9, wherein said pneumatic means for conveying the wool comprises a suction fan disposed at the discharge end of the said conduit.
11. An installation according to claim 10, wherein said fan is adapted at the same time for the opening of the wool, the blades of the rotor of the fan being inclined with respect to radii passing through their extremities at a predetermined angle forwardly with respect to the direction of rotation.
12. An installation according to claim 10, wherein the outlet of the fan opens into a hopper provided with two photoelectric cells which are respectively disposed at the maximum and minimum levels at which the wool can be disposed inside the said hopper, the said cells being connected to an electronic device which controls the stopping and starting of the conveying means so that this hopper is regularly provided with wool.

(References on following page)