

[54] **PROCESS FOR PRODUCING DYED AND CLEANED MATERIAL**

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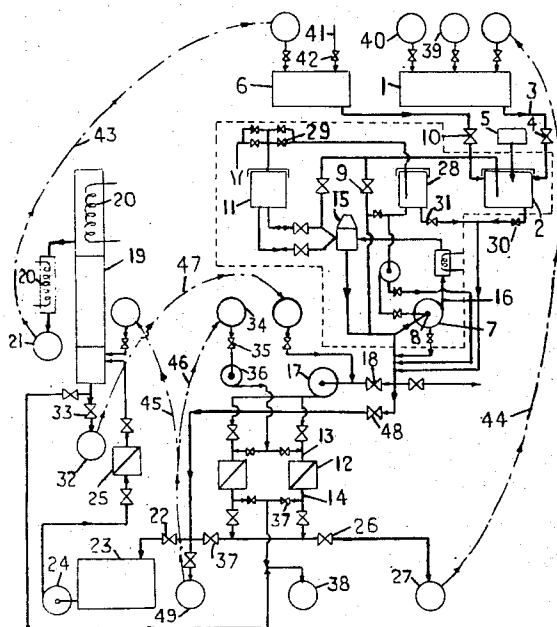
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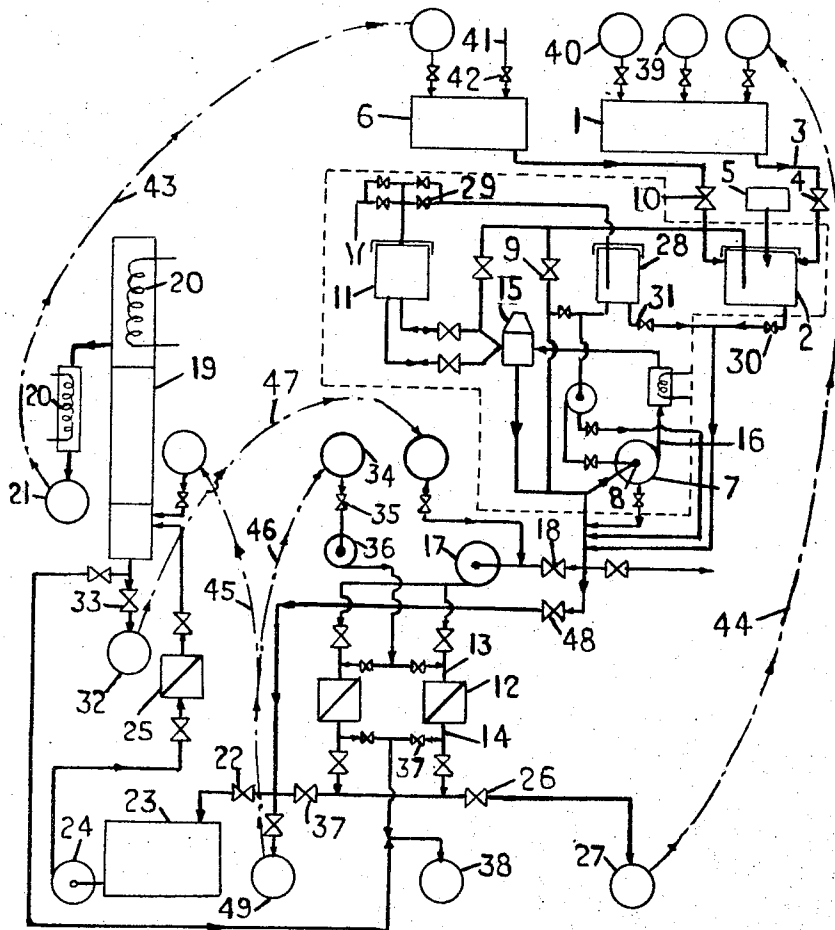
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[57] **ABSTRACT**

A process and apparatus for producing dyed and cleaned material. A mixture of a dye and a dye carrier is passed through a batch of material to be processed. The dye remaining in the mixture is separated from the dye carrier after it has passed through the material and the dye and the dye carrier are separately stored. Cleaning fluid is passed first through the batch of material which it cleans of loose dye and then through the store of dye so that the cleaning fluid already containing removed loose dye absorbs the stored dye. The cleaning fluid is separated from the dye and stored and the process is repeated using the stored dye carrier mixed with fresh dye and the stored cleaning fluid.

3 Claims, 1 Drawing Figure





PROCESS FOR PRODUCING DYED AND CLEANED MATERIAL

The subject of this invention is a process for producing dyed and cleaned material. The process is applicable to any textile or non-textile material capable of being dyed.

The present applicants have previously invented and made a prior patent application for a process of producing cleaned dyed material consisting in treating dyed material with a cleaning substance consisting of acetone in a proportion from 100 to 50 percent and diluent in a proportion from 0 to 50 percent. Other cleaning substances are known but they suffer from various disadvantages which render them less useful than acetone.

The process of the present application combines the dyeing operation and the cleaning operation into one integrated process to produce dyed cleaned material in one combined operation.

The process for producing dyed articles may be any known process of using a dye dissolved in a solvent or may be the process previously invented by the present applicants in which there is applied to the article a first component substance incorporating a dye contained in a solvent and a second component substance incorporating a material for which the solvent has a higher affinity than it has for the dye, the component substances being mixed before application to the article or being applied consecutively to the article. This process of producing dyed articles is also the subject of a prior patent application by the present applicants.

A process for producing dyed and cleaned material according to the present invention consists in passing a mixture of a dye and a dye carrier through a batch of material to be processed, separating the dye remaining in the mixture from the dye carrier after it has passed through the material and storing separately the dye and the dye carrier, passing cleaning fluid first through the batch of material which it cleans of loose dye and then through the store of dye so that the cleaning fluid already containing removed loose dye absorbs the stored dye, separating and storing the cleaning fluid from the dye and repeating the process using the stored dye carrier mixed with fresh dye and the stored cleaning fluid.

The dye and dye carrier mixture may be the mixture of a solvent for the dye and a material having a higher affinity for the solvent than it has for the dye according to the previous invention made by the present applicants mentioned above.

The process may include the step of reclaiming the dye separated from the cleaning fluid for re-use.

Apparatus for performing the process incorporates a dye carrier stock tank, a cleaning fluid stock tank, a mixing vessel connected to the dye carrier stock tank and the cleaning fluid stock tank by way of valve means, a kier for receiving material to be processed, a main pump having inlet and outlet connections, valve means associated with the mixing vessel, the kier and the pump and operative to be set to connect the inlet of the pump to the mixing vessel and the outlet of the pump to the kier or to connect the kier to the inlet and the outlet of the pump at the same time to permit recirculation of the liquid contents of the kier, a filter capable of removing dye from the dye/dye carrier mixture and having an inlet and an outlet, the inlet being con-

nectible by way of valve means to the kier and the outlet being connectible by way of valve means to a discharge outlet, and a cleaning fluid separator capable of separating cleaning fluid from the dye carrier and any dye contained therein, the cleaning fluid separator having an inlet connected by way of valve means to the outlet of the filter and discharge outlets for discharge of separated cleaning fluid and dye carrier with any dye remaining therein.

The cleaning fluid and dye carrier discharge outlets of the cleaning fluid separator may be arranged to discharge to respective removable receptacles or may be connected by permanent pipe connections incorporating valve and pump means to the cleaning fluid stock tank and to the inlet of the filter respectively.

The discharge outlet of the filter may be arranged to discharge to a removable receptacle or may be connected by a permanent pipe connection incorporating valve and pump means to the dye carrier stock tank.

The cleaning fluid separator may be fitted with an inlet for introducing cleaning fluid for rinsing purposes into the still.

An additional discharge outlet for cleaning fluid discharge may be provided at the discharge end of the filter. The additional discharge outlet may be arranged to discharge to a removable receptacle or may be connected by a permanent pipe connection incorporating valve and pump means to the rinsing cleaning fluid inlet to the cleaning fluid separator and/or to the inlet to the filter. The kier may be connected by way of valve means to the said additional discharge outlet, by-passing the filter.

A second additional discharge outlet for cleaning fluid containing dyestuff may be provided at the discharge end of the filter, said second additional discharge outlet being arranged to discharge to a removable receptacle or may be connected by a permanent pipe connection incorporating valve and pump means to a dye recovery device.

The changeover valve may be so arranged as to be capable of reversing the connections of the kier to the pump so that the liquid contents of the kier may be recirculated alternately in opposite directions through the kier.

Preferably the kier is so arranged that the liquid contents of the kier are circulated in the kier in a radial direction.

The apparatus may include an expansion tank connected to the kier to ensure that the kier is filled with either dye mixture or cleaning fluid during the appropriate steps in the process. The expansion tank is preferably connected by way of valves to the top of the kier and to the inlet of the pump.

The connection between the pump and the kier and the associated valves may be so arranged that dye mixture and cleaning fluid can each be circulated in opposite directions through material in the kier, preferably radially inwards and radially outwards.

The apparatus may incorporate heat exchangers at appropriate points to maintain the dye mixture and, if desired, the cleaning fluid at a desired operating temperature.

The cleaning fluid separator may be a still which includes a heat exchanger for evaporating the cleaning fluid and a condenser for condensing the evaporated cleaning fluid. Alternatively, the cleaning fluid separator may be of a non-thermal type. For example it may

contain a compartment for receiving unseparated fluid, a compartment for separated fluid, a permeable diaphragm separating the compartments and a pump for producing a pressure difference across the diaphragm, separation of the cleaning fluid being performed by the principle of reverse osmosis.

A schematic diagram of a dyeing and cleaning plant, according to one embodiment of the invention is illustrated in the accompanying drawing in which:

1 denotes a dye carrier stock tank, 2 denotes a mixing chamber connected to the dye carrier stock tank 1 by a pipe 3 containing a valve 4 and connectible to a supply of dye indicated at 5. 6 denotes a cleaning fluid stock tank and 7 denotes a main pump the inlet 8 of which is arranged to be connectible by valve means 9 to the mixing chamber 2 and by valve means 10 to the cleaning fluid stock tank 6. 11 denotes a kier for receiving material to be dyed and cleaned and 12 denotes a filter capable of removing dye from the dye/dye carrier mixture and having an inlet 13 and an outlet 14. The kier 11 has two connections for passage of fluid into and out of the kier connectible by a changeover valve 15 alternatively to the discharge 16 of the pump 7 or to the inlet 8 of the pump 7. The inlet 13 of the filter 12 is alternatively connectible by way of a secondary pump 17, a valve 18 and the changeover valve 15 to the kier 11 or to the outlet 16 of the pump 7. 19 denotes a cleaning fluid separator constituted by a still capable of separating cleaning fluid from dye carrier and any dye contained in the mixture. The still contains heating means for evaporating the cleaning fluid out of the cleaning fluid/dye carrier mixture and condenser coils 20 for condensing the evaporated cleaning fluid. 21 denotes a receptacle for collection of recovered cleaning fluid. The outlet end 14 of the filter and the kier are separately connectible by valve means 22, a tank 23, a pump 24 and a dust filter 25 to the still 19 and is also connectible by valve means 26 to a dye carrier receptacle 27. 28 denotes an expansion tank connected by way of valves 29 to the top of the kier 11. The valves 30 and 31 are drain valves for draining the mixing chamber 2 and the expansion tank 28 at the end of each dyeing and cleaning cycle and when the plant is to be taken out of use. 32 denotes a receptacle connectible by a valve 33 to the bottom of the still for receiving the dyestuff/dye carrier mixture remaining after the cleaning fluid has been removed by the action of the still. 34 denotes a receptacle for holding cleaning fluid connectible by a valve 35 and a pump 36 to the inlet 13 of the filter 12. The outlet 14 of the filter 12 is connectible by a valve 37 to a receptacle 38. 39 denotes a supply of dye solvent, for example, perchloroethylene, and 40 denotes a supply of a material for which the dye solvent has a higher affinity than it has for the dye 5, for example a silicone, both connectible by respective valve means to the dye carrier stock tank 1. 41 denotes a source of supply of water connectible by valve means 42 to the cleaning fluid tank 6 for use in diluting the cleaning fluid where required where aqueous dyes are being used in the plant. The chain-dotted line 43 shows the path to be taken by cleaning fluid recovered in the still for re-introduction to the cleaning fluid stock tank 6. 44 shows the path to be taken by recovered dye carrier for re-introduction to the dye carrier stock tank 1. 45 denotes the path to be taken by cleaning fluid from the kier which contains a low proportion of dye for introduction to the still for cleaning the apparatus, 46 de-

notes the path to be taken by cleaning fluid from the kier which contains a low proportion of dye to be passed through the filter 12 and 47 shows the path to be taken by the dye/dye carrier separated from the cleaning fluid in the still 19 for re-introduction to the filter 12. The paths 43, 44, 45, 46 and 47 as indicated may in a small plant represent the physical transfer of receptacles of the material but may, particularly in a large plant, be permanent pipe connections incorporating pumps and valves.

In practice, dye is fed to the mixing chamber 2 from the dye source 5 and dye carrier which, as already stated, may be a mixture of silicone and perchloroethylene, from the dye carrier stock tank 1 is also fed to the mixing chamber 2 through the pipe 3 and the valve 4. The dye and the dye carrier are mixed in the mixing chamber 2. The valve 9 is then opened and the main pump 7 set in operation, also the changeover valve 15 is set so that the dye/dye carrier mixture is pumped out of the mixing chamber 2 and into the kier 11. The valve 9 is then closed and the changeover valve 15 is operated while the pump 7 remains in operation so that the mixture is recirculated first in one direction through the batch of material in the kier and then in the other until the dyeing operation of the material is complete. The valve 18 is opened and the pump 17 is set in operation so that the dye/dye carrier mixture is pumped out of the kier 11 and into and through the filter 12 in which the dye is extracted and the dye carrier then passes through the valve 26, the valve 37 being closed, to the receptacle 27 and returns by the path 44 to the dye carrier stock tank 1. The valve 10 is now opened so that the cleaning fluid which as stated previously may be acetone flows from the cleaning fluid stock tank 6 into the mixing chamber 2 and is pumped by the pump 7 into the kier 11 (the contents of which have been previously cooled if necessary) in the same manner as the dye/dye carrier mixture was previously pumped. The appropriate valves are then operated so that the pump 7 recirculates the cleaning fluid through the kier 11 in alternate directions exactly as the dye/dye carrier mixture was previously recirculated through the kier 11. When the cleaning fluid has taken up the loose dye from the material in the kier 11 the valve 48 is opened and the cleaning fluid/dye liquor is drained into the tank 23. The cleaning process is repeated as necessary with fresh cleaning fluid from the tank 6. When the cleaning fluid contains not more than a predetermined maximum quantity of dye it can either be passed to the receptacle 49 or may be pumped through the filter 12 as and when required to the receptacle 38. In passing the cleaning fluid through the filter 12 the cleaning fluid takes up the dye which had been previously removed by the filter 12 from the previously circulated dye/dye carrier mixture.

On occasions when the amount of dye in the cleaning fluid is considered to be small enough not to making cleaning of the filter necessary, for example after cleaning fluid has been circulated several times in succession through the same batch of material in the kier, the valve 48 will be set to cause the cleaning fluid to bypass the filter 12 until enough dye collects in the filter from several dyeing operations whereupon cleaning fluid is again passed through the filter 12 to clean it.

The cleaning fluid/dye/dye carrier mixture contained in the tank 23 is passed by means of the pump 24 through the dust filter 25 and is deposited in the still 19.

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In the still 19 the heating means evaporates the cleaning fluid and leaves the dye and dye carrier which had been removed from the material in the kier 11 and this remaining material is passed through the valve 33 into the receptacle 32 for subsequent returning to the system by the path 47. The cleaning fluid evaporated in the still is condensed by the condenser coils 20 and is then returned by the path 43 to the cleaning fluid stock tank 6. The filter 12 can be washed by cleaning fluid returned by the path 46 so that it can be passed by the pump 36 through the filter 12 to the receptacle 38. Also some of the cleaning fluid may be moved through the path 45 and introduced into the still for washing out the still. The cleaning fluid used for washing the still is returned to the receptacle 38. The material from the receptacle 38 may be passed to a dyestuff recovery unit if desired.

The expansion tank 28 is used to ensure that the kier 11 is completely filled either with dye/dye carrier mixture or with cleaning fluid during the appropriate parts of the operating cycle, the kier 11 being allowed to overflow so that the excess passes into the expansion tank 28.

After the cycle is completed as described the cleaning fluid remaining in the material in the kier may be removed, e.g. by blowing or sucking hot air through it

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before it is removed from the kier 11 in a state free from cleaning fluid. A fresh batch of material may then be introduced to the kier and the cycle repeated.

I claim:

1. A process for producing dyed and cleaned material including the steps of passing a mixture of a dye and a dye carrier through a batch of material to be processed, separating the dye remaining in the mixture from the dye carrier after it has passed through the material and storing separately the dye and the dye carrier, passing cleaning fluid for removing loose dye from said material first through the batch of material which it cleans of loose dye and then through the store of dye so that the cleaning fluid already containing removed loose dye absorbs the stored dye, separating and storing the cleaning fluid from the dye and repeating the process using the stored dye carrier mixed with fresh dye and the stored cleaning fluid on a fresh batch of material to be processed.

2. A process as claimed in claim 1 including the step of reclaiming the dye separated from the cleaning fluid for re-use.

3. A process as claimed in claim 1 including the step of passing a hot gas through the batch of material after the cleaning fluid has been passed therethrough.

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