

PATENT SPECIFICATION

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(54) ELECTROPHORETIC DYEING PLANT

(71) We, **HAJTÓMÜVEK ÉS FESTŐBERENDEZÉSEK GYÁRA** of 98, Fehérvári-út, Budapest XI., Hungary, a body corporate organized under the laws of Hungary, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to an electrophoretic dyeing or painting plant.

The total dye liquid content of the dye jig of known and ever more frequently used electrophoretic dyeing plants is constantly circulated and agitated. The circulation and heating of dye liquid are effected by a pump and heat exchanger arranged in a recirculating conduit bleeding the jig and returning dye thereto. The solid content of the dye liquid amounts to about 10%. The pump forces the dye liquid through an edge-type filter. During the electric dyeing a dye film of about 20 to 30 μ thickness settles down to the surface of the workpiece to be dyed under the effect of the direct current field, corresponding to a solid dye deposition of about 40 g/sq.m. When, after dyeing, the workpieces covered with dye film emerge from the dye jig of the plant, dye liquid adheres to their surfaces. The quantity of dye carried away by the workpiece depends on the shape of the object. This quantity means, however, a loss of about 10 to 40%, referred to the solid dyestuff of the coating. The dye liquid carried out is removed from the surface of the workpiece in a flushing apparatus by means of a jet flushout. The excess dye liquid washed away by the jet flushout is lost in the plants hitherto known, since the flushing liquid is discharged after coagulation, reduction and neutralization. The filtrate taken out of the edge-type filter gets similarly lost with the known equipment. The loss of the filtrate taken out of the filter and of the dyestuff discharged with the flushing water renders the electrophoretic dyeing process in practice very expensive. Another drawback consists in that the neutralization and purification of the waste products from the filter and flushing apparatus cause further expenses, taking

especially into consideration that for flushing out one square meter of workpiece an average of 150 to 20 litres of industrial water, often procured at high cost, is required. Finally, it is highly disadvantageous that with the hitherto known electrophoretic dyeing or painting plants no information could be obtained sufficiently rapidly during operation about phenomena causing chemical problems, about their reasons and locations, and therefore elimination of malfunctioning could be ensured only difficultly.

The invention aims at the provision of an electrophoretic dyeing plant which eliminates or reduces the above-mentioned drawbacks, and in which the solid dyestuff content of the filtered and removed dye liquid, and of the flushing water, are not completely wasted and at the same time, the troubles occurring in the chemical operation of the dyeing plant can be detected quickly and located.

The invention relates therefore to an electrophoretic dyeing or painting plant, which has a dye jig, a recirculating conduit for bleeding the jig and returning dye thereto, and a pump and a filter arranged in the said conduit, wherein the filtrate side of the filter is connected to an electrocoagulator, the outlet of which is connected to a flushing apparatus through a deionizer provided with cation and anion exchange columns, and an element for discharging the flushing apparatus is connected to the dye jig and/or to a dialyzer.

Preferably, the electrocoagulator is provided with a recirculating conduit.

Advantageously, the filter may be a membrane filter.

In the preferred plant embodied in the invention the dye liquid flows in the recirculating conduit of the dye jig through a membrane filter. In the membrane filter system the solid content of the dyestuff flows further towards the jig, apart from an insignificant permeation or filter loss. The filtrate and the solid content contained therein pass from the jig into the electrocoagulator where the solid dye stuff residue is separated from the filtrate by means of a direct current field. The filtrate freed of the solid content is conducted through a

deionizer where undesired ion contaminants are eliminated by ion exchange. The fully purified liquid is then conducted from the deionizer to the discharge element of the flushing system, e.g. to the flushing crowns, where it is utilized for the removal of excess dye content of the dyed object. The flushing liquid contaminated with dyestuff is returned from the flushing system into the dye jig, where the flushing liquid freed of undesirable ions renders the dye liquid considerably more stable. The flushing liquid can be conducted from the flushing system also to a dialyzer where it can be used for further processing.

The cation and anion columns present in the electrocoagulator and deionizer may be regenerated. The solid content separated on the electrodes of the electrocoagulator can be easily dissolved in an alkaline agent after the removal of the comb-shaped electrode assembly. The dissolved solid matter is settled and after being dried, it is removed from the settling tank.

The regeneration of the cation exchange column is carried out by means of hydrochloric acid. The hydrochloric acid reclaim may be boiled, according to the Sandmayer reaction, after sodium nitrite being added, in order to separate any amines occurring therein. The reaction being finished, any residual oxide bonds no longer impede the detection of the presence of any cations.

The anion exchange column is regenerated by means of NaOH and the reclaim is precipitated by baryta water. The baryta precipitate is tested in the known manner for carbonate, bicarbonate, phosphate, silicate and sulfate, that is generally for those ions which could originate from the dyeing equipment. These tests render it then possible to reach qualitative and quantitative conclusions about the contaminations. By means of such a test it may be determined which ions cause an increase of conductivity of the dye bath, or any other failure occurring in any point of the dyeing equipment.

The invention will be described in more detail with an exemplified embodiment on the basis of the accompanying drawing which is a schematic layout of a plant according to the invention.

According to the drawing, an object 2 to be dyed moves in the direction of the arrow along a guided path 1. Beneath the guided path 1 a dye jig (bath) 3 is arranged. The guided path 1 is arranged so that the object 2 is dipped into the dye jig 3 when moving, and removed therefrom after being coated.

The dye jig 3 is bled by means of a recirculating conduit 4. In the recirculating conduit 4 a pump 5 and a filter 6 are located. The filter 6 is expediently a membrane filter having a tubular or plane membrane filter surface. The filtrate side of the filter 6 is connected to a so-called electrocoagulator 8

by means of a conduit 7. The electrocoagulator 8 consists of electrodes arranged in a comb-shaped assembly between which the filtrate flows. The electrodes of the electrocoagulator 8 are in use supplied with a direct current charge.

The outlet of the electrocoagulator 8 may also be connected to a recirculating conduit which is not shown in the drawing. In the illustrated embodiment a deionizer 10 is connected to the discharge end of electrocoagulator 8 by means of a pipe 9, to which the filtrate flows through cation and anion exchange columns. The discharge end of the deionizer 10 is provided with a tap-off 11 for enabling sampling for analytical purposes to be performed. The deionizer 10 is connected by a pipe 12 to the discharge element of a flushing apparatus, shown in the embodiment as flushing crowns 13 and 13', respectively, through which the object 2 passes when leaving the dye jig 3. The flushing liquid of the flushing apparatus is returned to the dye jig 3 by means of a channel 14.

In operation the object 2 moving in the direction of the arrow along the guided path 1 passes into the dye jig 3 filled with dye liquid. The dye liquid is constantly agitated in the dye jig 3 by means of several pumps such as 5 arranged in the conduit 4. The pump 5 causes the dyestuff to pass through the filter 6 and through heat exchanger (not shown) into the dye jig 3. The capacity of the pumps 5 is expediently determined so that the total output in a given cycle amounts to about three- to fivefold of the normal volume of the dye in the dye jig 3. The dye liquid circulated by overpressure and flowing through the filter 6 is returned into the dye jig 3. The filtrate flowing through the filter, and its content of amines, possibly also other undesired ions, are contaminated by solid matter. The filtrate from the filter 6 is passed into the electrocoagulator 8 where the solid content settles. The solid matter precipitated on the comb-like electrodes can be dissolved in an alkaline agent.

The filtrate thus freed of its solid content passes through the deionizer 10, where, during its flow through, all undesired ion contaminations are separated in the cation and anion exchange columns.

The regeneration of the cation exchange column of the deionizer 10 is carried out in the known manner by means of hydrochloric acid. The regeneration of the anion exchange column is effected by NaOH and the highly alkaline reclaim of the column is expediently precipitated by means of baryta water.

For analytical purposes, a sample is taken when intermittently flushing the deionizer 10, by opening the tap off, then titrating the sample, whereafter any undesired ions occurring in the dye jig 3 due to the failure of the dyeing equipment can be easily determined.

Thus, for instance, a test with silver nitrate can be carried out on the sample from the anion exchange column, followed by the determination of chlorine. The precipitate of anion exchange column being treated with baryta water, the sample can be tested similarly in a known manner for carbonate, bicarbonate, phosphate, silicate and sulphate, that is, generally for those ions which can originate from the equipment pretreating the object to be dyed.

The filtrate, having already been purified, flows from the deionizer 10 to the flushing crowns 13 and 13', of the flushing system. The object 2 emerging from the dye jig 3 passes the flushing crowns 13 and 13' and the flushing water rinses drag-out dyestuff. The flushing liquid flows back from the flushing apparatus through channel 14 into the dye jig 3 and dilutes the dye liquid contained therein. The flushing liquid freed of undesirable ions renders the dye liquid considerably more stable.

According to the invention, the filtrate can be conducted from the deionizer also to a dialyzer for further processing.

WHAT WE CLAIM IS:—

1. Electrophoretic dyeing plant, having a

dye jig, a recirculating conduit for bleeding the dye jig and returning dye thereto, and a pump and a filter arranged in the said conduit wherein the filtrate side of the filter is connected to an electrocoagulator the outlet of which is in turn connected to flushing apparatus through a deionizer provided with cation and anion exchange columns, and an element for discharging the flushing apparatus is connected to the dye jig and/or to a dialyzer.

2. Plant according to Claim 1, in which the electrocoagulator is provided with a recirculating conduit.

3. Plant according to Claim 1 or 2, in which the filter is a membrane filter.

4. Electrophoretic dyeing plant substantially as herein described with reference to and as shown in the accompanying drawing.

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