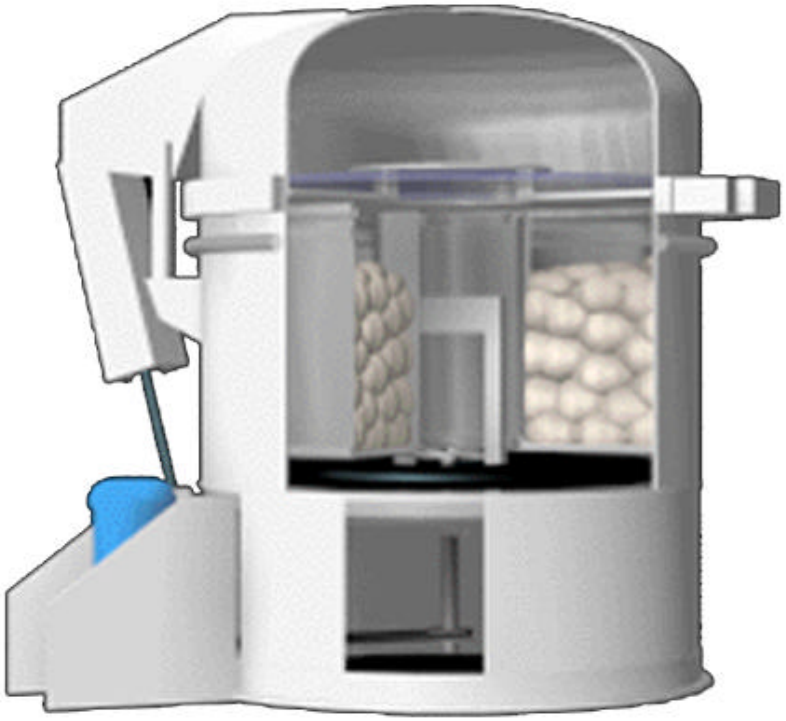
TCC



STATIC DYEING MACHINE FOR HOSIERY

LORIS BELLINI

Dyeing machines

TCC

STATIC DYEING MACHINE FOR HOSIERY

The TCC machines are a modern development for dyeing of nylon and nylon/elastomer tights, pantyhose and stockings as well as textured nylon yarns in muffs in modular carriers designed for direct centrifugal hydroextraction.

TCC is based on more than 40 years of engineering and manufacturing experience in hosiery dyeing machines and it has been designed to offer significant improvements in quality with parallel reductions in dyeing costs and labour.

The TCC machines ensure top-quality dyeing of hosiery and can be used for several other jobs that are current in hosiery manufacturing plants, such as packaged dyeing of **textured nylon yarns** on muffs, dyeing of **men's socks,** dyeing of " **Velcro" strips and nylon ready-made garments.**

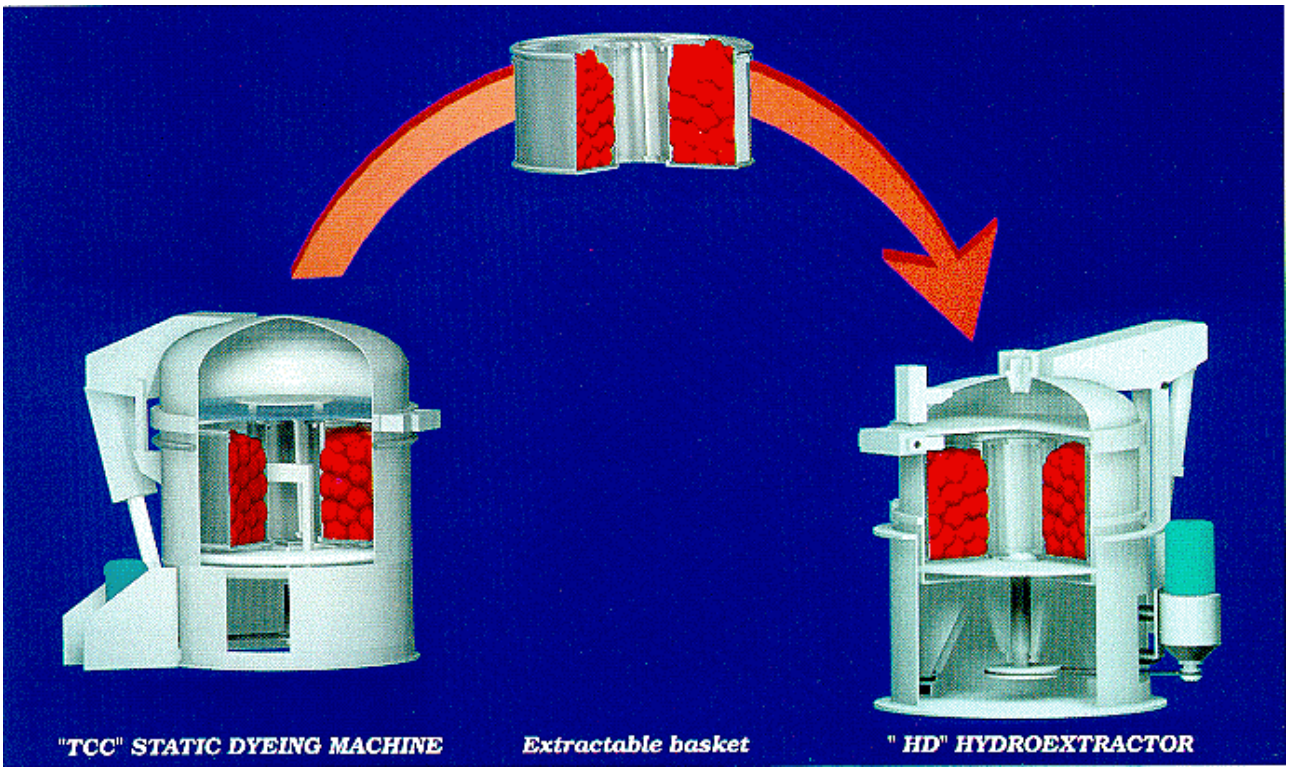
As compared with the well known series APPC cabinets with drawers or grids, the new TCC machines substantially lower dyeing costs, as they operate at almost half liquor ratio: consumption of water, steam and chemicals added in proportion to liquor volume are reduced in direct proportion

TCC ensures **total absence of picks & pulls, snags and surface abrasion on delicate hosiery.**
In addition the dyeing process duration is accelerated: some 60 minutes for light colour shades and some 100 minutes for medium-to-dark colour shades.

An important advantage is that the hosiery **extractable carrier** after dyeing is dropped directly into a high-speed centrifuge, without any intermediate material handling..
As compared to conventional rotary drum dyeing machines, the TCC operates by **static dyeing:** hosiery remains steady and only the dyeing liquor circulates in order to prevent abrasion and tangling of stockings and pantyhose which can be packed on automatic high-speed wrapping lines.

Main technical data:

- **Pressurized operation up to 0.4 bar; maximum temperature 110°C**
- **Pressure testing certification in accordance with Italian ISPESL Standards.**
- **Construction completely in AISI 316 stainless steel.**
- **Nominal loading capacities from 20 up to 300 kgs.**
- **Motor protection to IEC standards, Class IP 54**
- **Two-level operator safety system**
- **Magneto-thermal relays for motor protection**
- **Pneumatic lid lifting and lowering with rapid locking device**
- **Automatic pneumatic valves for water fill, drain, overflow rinse, dye injection, pressurization**



AUTOMATIC AIR-PAD PRESSURIZATION

TCC machines operate pressurized at 0.4 bar static pressure and up to 110°C temperature.
Static pressure is obtained by a compressed air pad in the upper part of the dyeing chamber, which also acts as an expansion chamber when liquor volume increases with temperature.
Air-pad pressurization offers several practical advantages:

Expansion volume internal to the machine
Continuous liquor recirculation to an external expansion tank is no longer needed.
Dyehouse environment is healthier and more comfortable due to absence of chemical vapours.
Colour kitchen or dye add tanks can be located up to 70 meters away from the dyeing machine, nearest to the dyestuffs and chemicals storage or automatic distribution systems.

Controlled dyeing conditions.
Dyestuffs exhaustion is perfectly even.
Loris Bellini kitchens operate by a high-pressure pump with air-exhaust valve.
Dyes and chemicals are injected directly in TCCs circulation system at a controlled and repeatable speed.
Liquor temperature remains steady at preset value, without continuous cooling-reheating.

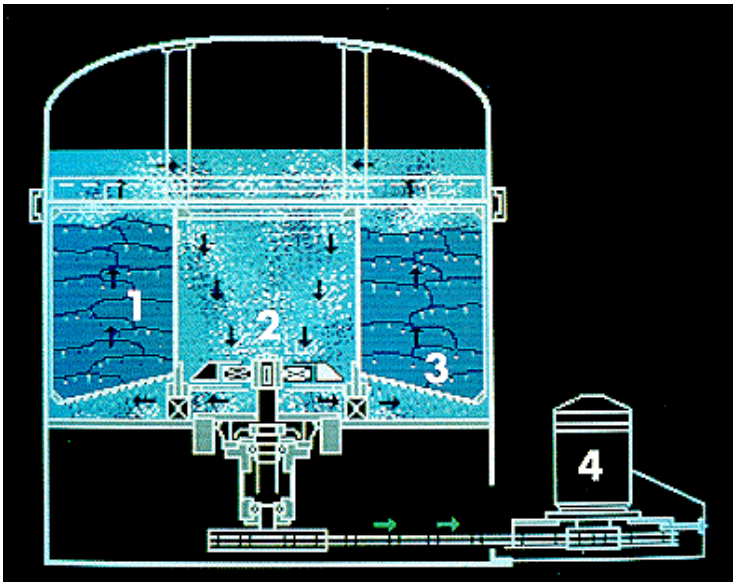
Economy and ecology.
No cooling water and steam consumption for cooling and reheating the liquor.
No power consumption by static pump in continuous operation.

Cold pressurization.
TCC is pressurized immediately at startup.
Vertical liquor flow and static pressure eliminate air pockets from inside the material.
Dyeing evenness is improved by absence of white uncolored spots.
Pressurization enables high-speed drain of the liquor after dyeing, to cut the total dyeing cycle duration.

LOW AND CONTROLLED LIQUOR RATIO

TCC's design and pressurization system enable to operate at actual liquor ratio of 10:1.
Hosiery is always fully immersed in dyeing liquor with bidirectional liquor flow Upside-Down and Downside-Up reversed at preset time intervals.
TCC slashes dyeing costs compared with static dyeing machines running at 20:1 liquor ratio
- Steam (by more than 50%)
- Electricity (by more than 30%)
- Water (approx. 50%) therefore lower water softening / effluent treatment costs
- Lower recipe costs for detergents, salts, acetic acid and all products added in fixed percentages on liquor volume.

The value of liquor ratio is adjustable by automatic levels or by an optional water predeterminer counter.
Liquor ratio can be increased up to 30% in case of technological needs (ex. solubility of disperse dyestuffs) and for reducing washoff times.



Section of TCC static dyeing machine.

1-Hosiery into sacks

2-Reversible axial pump with high-flowrate low-pressure impeller design

3-Removable dyeing carrier

4-AC motor driven at variable speed by Inverter

STATIC DYEING

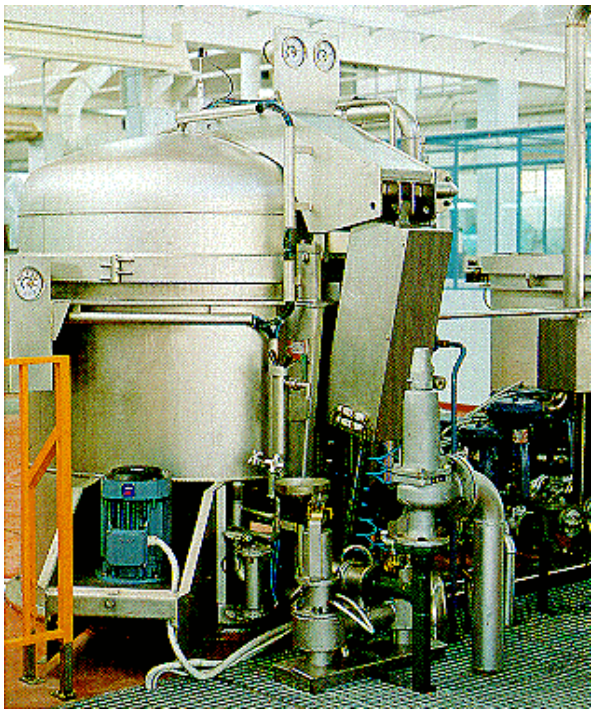
TCC machines benefit from 40 years of experience in manufacturing of dyeing cabinets for static dyeing of knitting yarns on hanks and hosiery. Their liquor circulation system is designed around the principle adopted in several thousands of our APPC cabinets.

Liquor flows freely across the hosiery in vertical direction.
The axial (turbine) circulation pump forces the liquor through the full area of the carrier.
Flow direction reversal is operated automatically at preset time intervals.
Perforations in the circular base of carrier and in the upper plate installed at the bottom of the lid distribute evenly the liquor flowing across the hosiery, with an excellent evenness of dyeing.
The perforations in the outside shell of the carrier are used exclusively for discharging water during the hydroextraction following the dyeing process and remain locked during the dyeing phase.
The perfect liquor distribution on the full volume of the carrier occupied by the hosiery generates homogeneous dyeing even in the

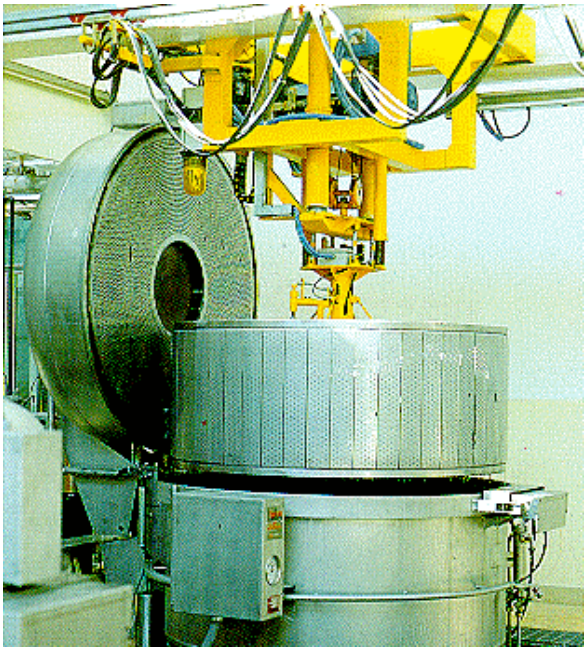
REVERSIBLE, HIGH FLOW RATE CIRCULATION PUMP

The reversible axial pump of TCC is expressly designed and manufactured by Loris Bellini & C. for hosiery dyeing machines. Liquor flow rate / differential pressure diagrams have been engineered by CAD Computer-Aided-Design workstations and on a pilot plant duplicating the pressure, circulation and temperature conditions of the dyeing machine and interfaced with a computer for data acquisition.
The axial pump's high liquor flow rate at low head pressure and the large section of hydraulic circuitry of TCC allow for removing completely the air trapped in the high-permeability hosiery material.

The high number of liquor exchanges / minute permits rapid dyeing cycles and high productivity.
Mechanical seals of pump are cooled direct by dyeing liquor.
The pump can be rapidly disassembled for maintenance in a few minutes.
The compact design and short shaft of the pump ensure total absence of vibrations.



Rear side of TCC with Inverter-driven AC motor, pneumatic lid lifting and automatic valves for liquor drain separation in function of heat recovery.



Robotized carrier loading in TCC 1650/690.
Dyeing machine capacity 160 kgs/batch.
Fully automatic operation.

STEPLESS FLOWRATE CONTROL BY INVERTER

TCC machines can be optionally delivered with stepless speed control of liquor flow rate by Inverter AC power frequency converter.

The inverter receives signals form dyeing machines microprocessor to operate at:

- High speed during critical dye exhaust temperature.
- Low speed during preliminary scouring and aftertreatments.
- Smooth progressive start and stop of pump during flow reversal.

The materials to be dyed can be therefore processed in ideal conditions of flow rate:

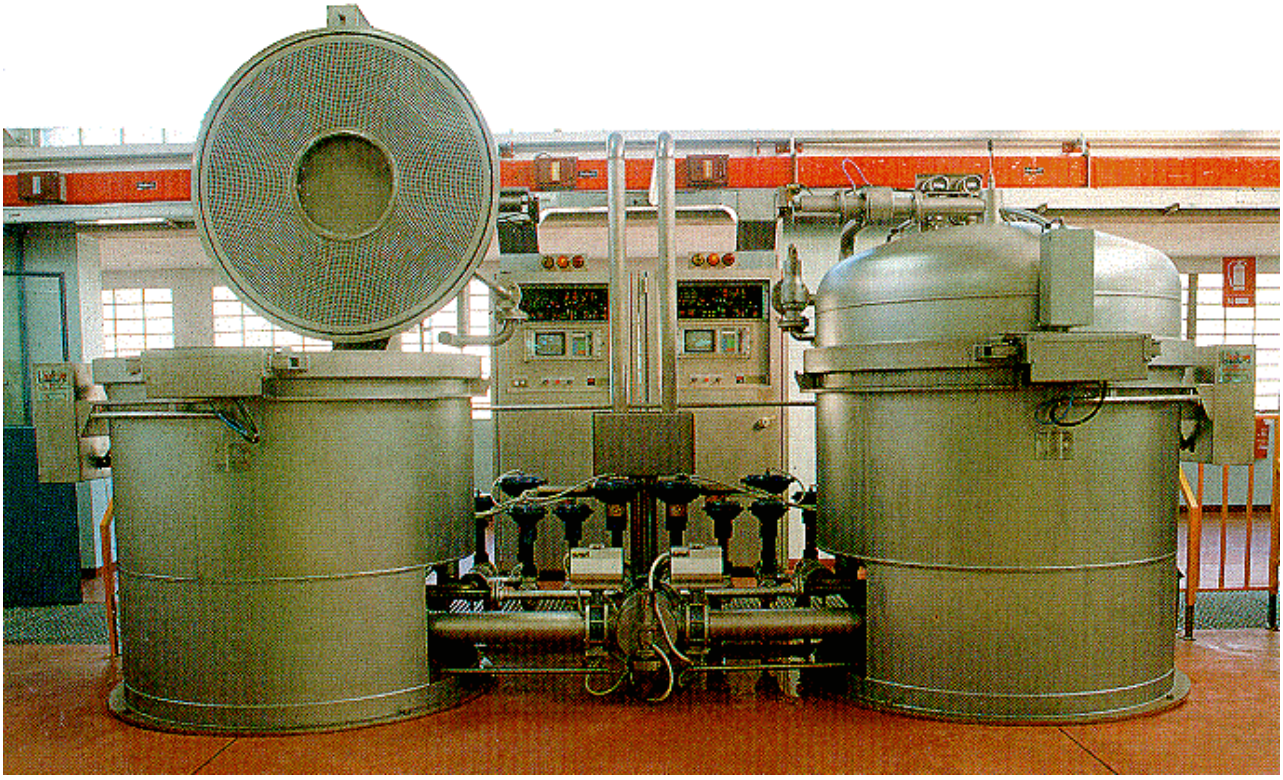
- High flow rate for low-permeability materials as textured nylon yarns on centerless muffs and mens socks
- Low flow rate in delicate fine hosiery in microfibre and elastomers.

Inverter generates a power consumption variable in function of the torque of the motor, with average power savings of 30-40% which determine a rapid payback of the investment.

Operating conditions of pump speed are systematically reproduced batch-to-batch for color repeatability under blind dyeing conditions.

FLOOR-LEVEL INSTALLATION

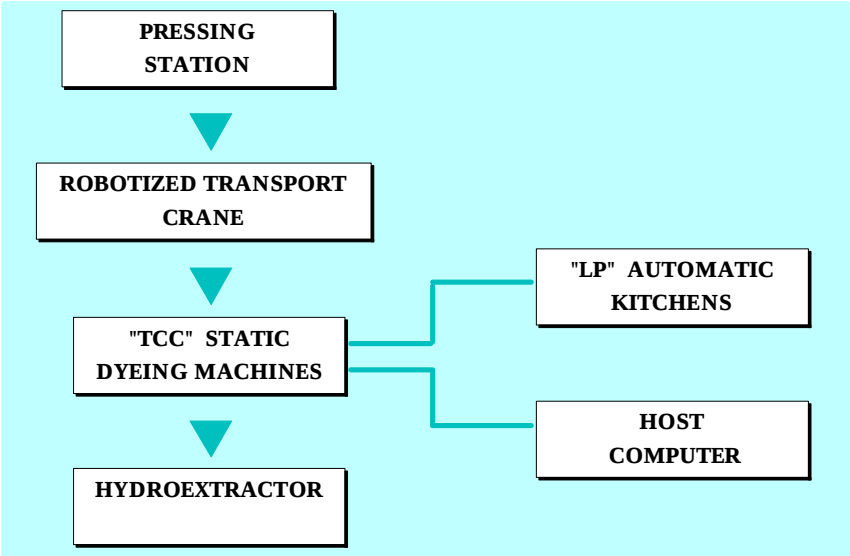
TCC has a compact shape designed for rapid installation at floor level.
All components are above the floor for easy inspection and maintenance, except a simple underground channel for effluents discharge.
TCC is delivered in a fully reassembled packaged form before shipment for immediate operation



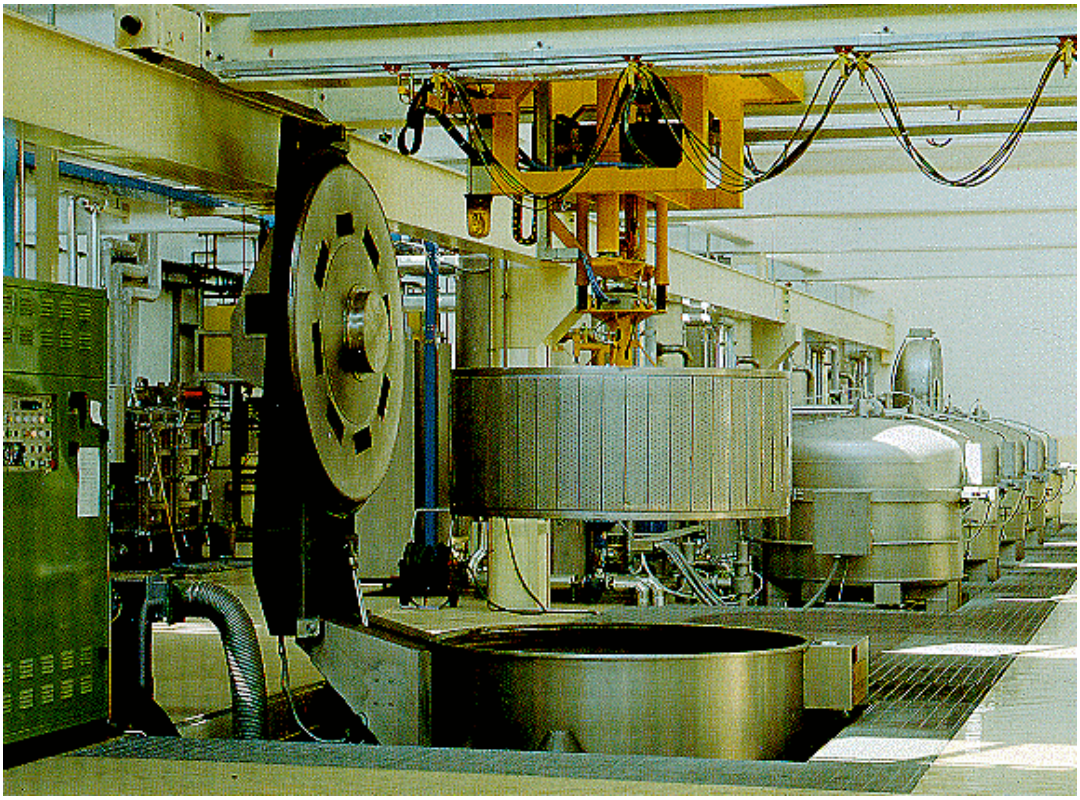
Pressurized static dyeing machines TCC 1500/1000 for dyeing of ladies hosiery, textured yarns and mans socks.
Automatic coupling system for flexibility.
Robotized carrier loading/unloading.

INTEGRATED DYEHOUSE AUTOMATION

The lid of TCC is lifted and lowered by a pneumatic stainless steel jack hinged at the back of the machine. The same jack automatically connects and locks the extractable basket to the liquor circulation system.
Safety locking is by a locknut controlled by a quick acting, force-multiplying lever.
The TCC can be supplied on demand for integration in a fully automatic **robotized** line consisting of:



The first robotized hosiery dyeing plant worldwide.



No.1 Loading press
No.5 TCC dyeing machines cap.160 kgs/batch.
No.1 High-speed carrier hydroextractor
No.5 LP colour kitchens linked with computer dispensing of chemicals
No.1 Robotized crane for carrier transport, machines loading/unloading and parking

The presetting of TCC machines for robotized basket loading / unloading requires:

- Automation logics to check the safety conditions for machine opening (option)
- Pneumatic jack for lid opening / closing (standard)
- Electropneumatic safety interlocks for the lid
- Devices and software to enable and disable the safety devices and start a programmed dyeing cycle.
- Actuators and software for sequential execution of the programmed operations

The baskets are automatically inserted and removed in dyeing machines, extractor by an overhead crane positioned by encoders and designed for totally unmanned transport, parking and tracking of baskets.

EXTRACTABLE BASKET FOR DIRECT HYDROEXTRACTION

The basket has a structure for " controlled deflection" in order to lock automatically against the internal walls of the hydroextractor simply by centrifugal force.
The basket is loaded in the high-speed centrifuge directly after the dyeing process by means of a manual or robotized crane.
One centrifuge it is sufficient for a large number of TCC dyeing machines (6 to 8).
TCC eliminates manual handling of material in all phases.

The baskets holds ladies hosiery as pantyhose, tights and stockings into sacks as well as zippers, Velcro strips and ready-made nylon garments.

Perforated partition disks with spacers may be inserted inside the basket to generate several tiers of materials requiring an orderly arrangement, as for instance:

- Boxed preboarded hosiery
- Mans and children socks and sport socks in Cotton / Nylon, Acrylic / Nylon and Wool / Nylon.
- Muffs of textured filament nylon yarns in “packaged” centerless form.

Textured nylon yarns are processed completely tension-free.
Due to vertical liquor flow in TCC, the yarns can shrink freely and the resulting yarn elasticity is excellent as compared with the same yarn dyed in package dyeing machines.

ACCESSORIES

TCC machines can be easily customized based on individual Customers requirements.
A great number of special accessories is available:

- Automatic liquor preparation / recovery plant with 110% of liquor volume (standard or rapid versions)
- Robotized lid for robotized unmanned basket loading / unloading
- Leonardo PC computer preset for serial linking to a centralized host computer for dyehouse control and management.
- Fully automatic colour kitchens Model LP; with 2 to 6 tanks, dyestuffs and chemicals dosing, remote recirculation, stirrers, automatic flushing of connection pipes.
- Separate drain valves for splitting polluted / non polluted drain waters in function of effluent treatment and heat recovery.

IBM host computer system with “Tintoretto” software package for dyehouse planning and management.

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