Advances In Process Controls For Jig Dyeing Machinery

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Introduction

A Jig represents the oldest and most popular machine for processing fabrics in open width. Years ago, a New Jersey company, Van Vlaanderen, dominated the American market. Their jigs were supplied with crude but simple mechanical drives that provided satisfactory results for dyeing simple cotton fabrics.

The development of man-made fibers and new styles of fabric put much stricter requirements on the dyeing process, so that it became necessary to control the speed and tension of fabric during the complete dyeing cycle, Control of temperature not only in the bath but also in the ambient environment became important. Installing enclosures over processed fabric with steam coils and jets allowed for maintaining a uniform temperature throughout the dyeing lot. Minhorst & Schultes went even further by introducing main rolls heated by electrical elements.

In the early 60's, Vald. Henrlksen introduced its VH-Super, and Van Vlaanderen its model 1200, equipped with new friction type drives. The friction drive allowed for better speed control within 10% to 20%, compared to almost 100% on differential drives (Fig. 1). Soon after, Poensgen improved friction drives by adding a hydraulic compensator connected to a pendulum roll in its new Cyclotric drive. Cyclotric drives not only improved speed control but allowed for compensation of tension fluctuation during theirpopularity in the US, but problems with maintenance caused them to vanish from the mills.

Further attempts to improve the way a jig is driven brought about several unique solutions. A Sulzer drive featured water jets which spun vanes connected to main beams. Another solution was to drive only one roll in the center on which rolls of fabric would rest. This roll in turn would spin rolls of fabric by friction. None of these or other designs went far beyond the prototype phase.

At this stage it seemed no more improvements on the jig dyeing process were possible. Nothing happened for years. In the early 80's, a Spanish company ASISA, sold jigs in the US which were designed based on a new concept. The jig was driven by hydraulic

Figure 1-

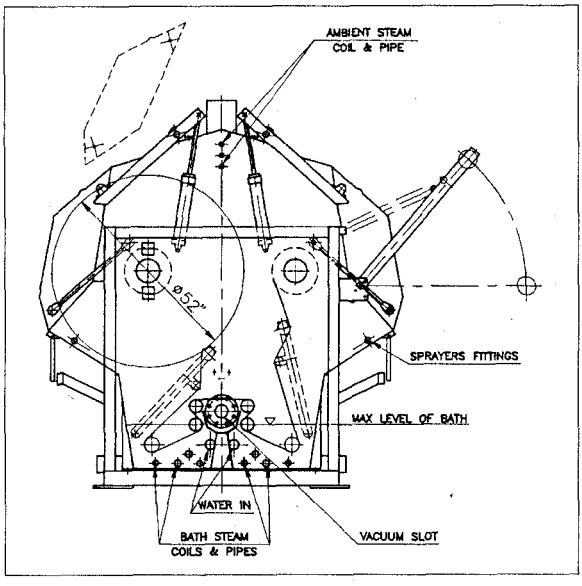


Figure 2-

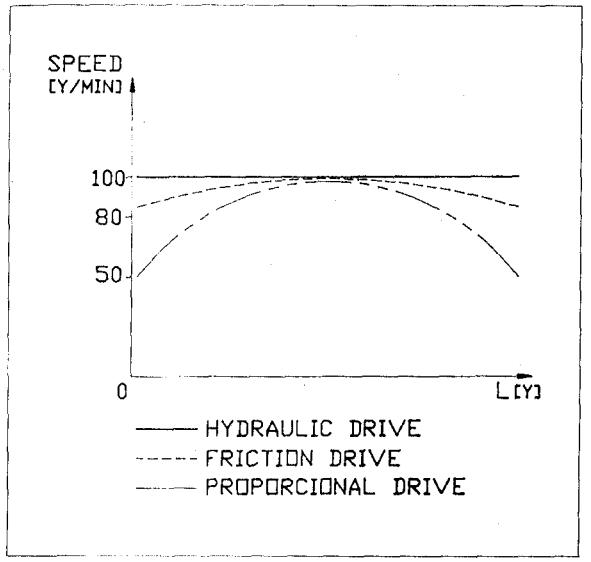
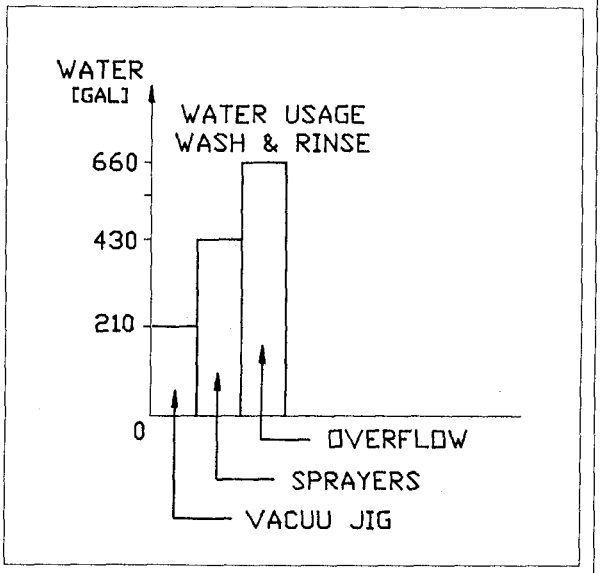


Figure 3-



motors, and an electronic controller operated a system of elector valves. The controller would also operate valves for incoming water, steam and drain.

In 1991, Jig-matics made by JM Engineering, Inc. featured hydraulic drives controlled by computer with a Windows®based program. This program which was further developed by Zimmer's Jig-matic division, became the most advanced control of the dyeing process available on jig dyeing machines.

Vacu-matic is the latest model of Zimmer's jig which may be considered the most advanced in the world. It is operated by a state of the art hydraulic

drive and sophisticated video controller. In addition, it features a split dyeing bath with a vacuum slot installed in between (Fig. 2).

Vacu-matic's computer precisely controls all process parameters such as speed, tension, four-way temperature of bath and ambient, fill of hot, cold and soft water in mixed, regular, overflow, or drop/fill mode. It will automatically monitor and adjust pH levels throughout the cycle. When there is a need for sampling of goods. The machine will alert an operator when a sample needs to be taken and will continue the program according to the test results. The computer will bring in chemicals when necessary, from auxiliary tanks, either split over a pre-programmed number of ends, or in a continuous mode, injecting small amounts of dye every few yards during the entire passage. Interfacing with a fully automatic dye kitchen is possible through serial RS 485 ports.

User friendly process

The operator can enter an unlimited number of programs into the memory of the computer. Creative graphics on subsequent screens will lead the operator through entering a program and then executing it. The computer's famous "one finger" operation mode requires simple answers from the operator for a sequence of questions. This method eliminates the possibility of entry errors and will not allow the omission of any steps. The colorful graphics appearing on the screen remind one more of a video game, rather than an industrial computer. These graphics eliminated the fear of using a computer and made programming not only easy but also fun.

Complete status of the machine is stored every six seconds on its hard drive. If, at a later date, problems with the quality of fabric are reported, the dyer may zip through the records of previously run programs to look for any deviation of the process. Any irregularity, manual overrides, etc. could be highlighted for easy access.

Zimmer's jig-matics may run a program in which a vacuum slot will be used during a particular passage. During the dye cycle, a vacuum slot may be used to improve the dye penetration through the thickness of the fabric. The computer controls the amount of vacuum while the automatic seal seals edges of the slot to minimize the amount of liquor running through the system. Extracted dyestuff is recirculated back into the bath, and both dye pans are connected. The circulation pump ensures even dye distribution in the entire bath. This method which was used before only on continuous dye machines, improves even dye distribution from side-to-side of the fabrics processed on the jig. This is especially important while processing wide fabrics.

Today's environmental necessity to conserve water puts strict requirements on new dye machines. When many dyehouses reach their maximum capacity for waste water treatment plants, the only way of increasing dyeing capacity is by replacing older machines with new ones which will process more fabric using less water. Zimmer's Vacu-matic offers exactly that. The application of a vacuum slot during the wash and rinse cycles, in conjunction with the use of sprayers equipped with special flat jet nozzles, reduces water usage by 70% as compared to traditional methods (Fig. 3).

The computer has become a popular tool for a dyer. There are a number of software selections available on the market covering more or fewer aspects of dyehouse operation. One of the systems, Maximus, was created to bring total control of the jigs into the dyehouse office. It allows the user to manage all jigs from a central location, monitor status of each machine and intervene immediately when problems are noticed. Various reports such as production statistics, efficiency and work load which the system generates can be easily customized for the needs of a particular user.

Conclusions

It has been proven over the years that the advancement of technology brought meaningful changes to the simple process of dyeing on a jig. Only the future will show if the current sophisticated controls can still be improved. □ □ □

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