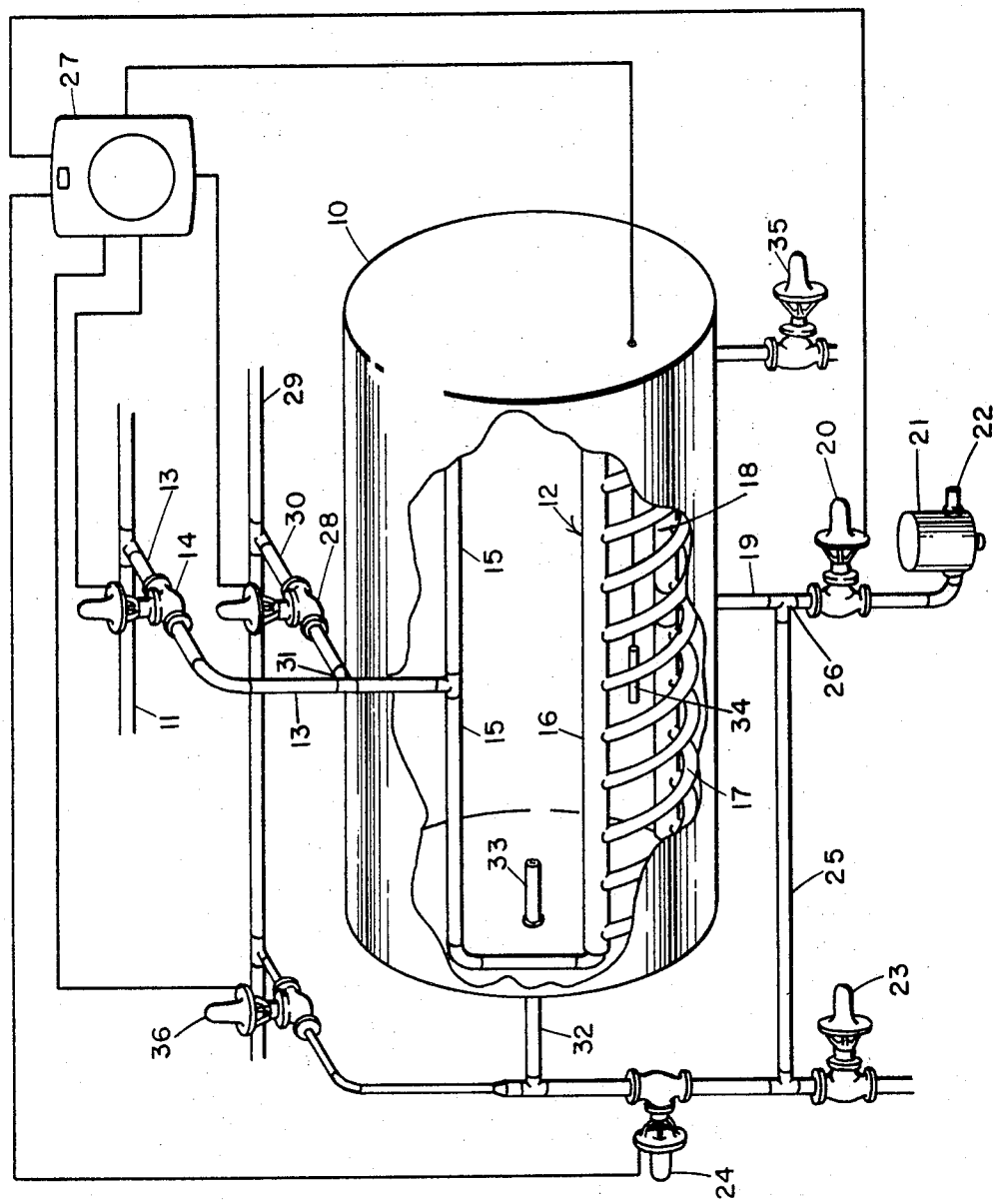
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METHOD AND APPARATUS FOR COOLING AND RINSING

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INVENTOR.
WALTER H. RIDLEY
BY David C. Hoffke
ATTORNEY

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METHOD AND APPARATUS FOR COOLING AND RINSING

Walter H. Ridley, Foxboro, Mass., assignor to The Foxboro Company, Foxboro, Mass., a corporation of Massachusetts

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ABSTRACT OF THE DISCLOSURE

A heat exchanger is mounted in a dye vat in heat exchanging relationship with the dye liquor. Steam is admitted to the heat exchanger to raise the temperature of the dye liquor for the dyeing step. The dyeing step is terminated by circulating cold water through the heat exchanger directly into the dye liquor.

This invention relates to a method and apparatus for rinsing and cooling vessels, in particular in reference to cooling and rinsing dye baths.

It has long been the practice in the textile industry to dye materials by immersing them for specified periods of time in dye liquors and regulated temperatures, then removing or diluting the liquor and rinsing the material with clean water. This has been essentially a two-step process, for when the dye has sufficiently impregnated the material at the prescribed elevated temperature, the material must then be gradually cooled to avoid cold water shock to the material. When dyeing, the dye liquor is typically at an elevated temperature of 150–250° F., and at an elevated pressure when over 212° F. It has been convenient first to cool the dye liquor to an acceptable temperature such as 210° F., which temperature permits a check at atmospheric pressure of the dyeing shade picked up by the material. If the shade is correct, then typically, the dye is gradually cooled to 140° F., which temperature prevents cold water shock from affecting the material during the subsequent cold water rinsing step. The cooling of the dye liquor from its elevated temperature may be accomplished in a variety of ways: cooling of the dye vat by radiation, passing cold water through the closed heating coil, or by discharging cold water slowly into the dye liquor are typical. These forms of cooling the dye liquor take a considerable length of time, for example, one minute for each 1–1.5° F. reduction in temperature of the dye liquor from 200° F. down to 140° F. Further, if water is used in the cooling process, it is discharged and wasted.

Accordingly, the present invention proposes a new method of cooling and rinsing a dye bath, in which both objectives may be accomplished simultaneously. In addition, the cooling and rinsing process can be accomplished at a much faster rate, water is conserved, all with preventing cold water shock to the material.

It is an object of this invention to provide a method and apparatus for cooling and rinsing a dye kettle that performs quickly and efficiently, and provides for a quicker cut-off of the dyeing step while affording necessary shock protection to the material being dyed.

It is another object of this invention to provide a means of simultaneously cooling and rinsing a dye kettle that is readily adaptable to cool the dye bath at a controllable rate over a relatively short period of time.

It is another object of this invention to provide a method of cooling and rinsing a dye bath that is both efficient and conservative of water demand.

Briefly stated, the method of the invention passes cold water through a closed heat exchanger within the dye bath, and conducts the warmed effluent from the heat exchanger directly into the dye bath.

Other objects and advantages of this invention may be in part apparent from the detailed description hereof and in part from the sole drawing which illustrates apparatus for performing the method of the invention.

Dye kettle **10** is employed in the process of dyeing a textile material therewithin (not shown). Material is ordinarily dyed at an elevated temperature, typically between 150 and 250° F., and when the material is deemed to be sufficiently impregnated with the dye, the dye liquor is brought down in temperature as rapidly as may be practicable so as to terminate the dyeing step.

The heating cycle is performed as follows: steam from steam supply line **11** is conducted to heat exchanger **12** through steam valve **14** and heat exchanger inlet line **13**. Heat exchanger inlet line **13** leads into dye kettle **10** and connects through distribution pipes **15** therein to heat exchanger **12**, consisting of filler pipe **16**, cross pipes **17**, and manifold pipe **18**. Manifold pipe **18** connects to heat exchanger drain pipe **19**, which exits from dye kettle **10**.

During the heating cycle steam valve **14** is open, allowing steam into heat exchanger **12**, and heat exchanger drain pipe valve **20** is open allowing the cooled steam condensate to exit through condensate trap **21** to outlet **22** thereof. During the heating cycle valves **23** and **24** are closed, thereby effectively dead-ending pipe **25** which connects through T-joint **26** into heat exchanger drain pipe **19**.

In order to determine if the material is sufficiently dyed, it must be inspected at atmospheric pressure. The dye liquor, in order to maintain full strength in case of a need for further dyeing, must not be diluted with cooling water. Cooling for inspection is effected by passing cold water through the closed heat exchanger, until the temperature is reduced to about 210° F., permitting opening dye kettle **10** to atmosphere. This cooling step is effected by closing steam valve **14** and drain pipe valve **20**, and opening valves **28** and **23**; cold water passes into heat exchanger inlet line **13**, through heat exchanger **12**, out drain pipe **19**, through T-joint **26**, through pipe **25**, and through open valve **23** to sewer.

When the material is deemed to be sufficiently dyed, controller **27** is actuated by suitable means, typically manually, and the cooling and rinsing sequence is initiated. Steam valve **14** is shut, cold water valve **28** is opened under the regulation of controller **27**, valves **20** and **23** are shut and valve **24** is opened wide (valve **36** remains shut). Cold water from cold water supply line **29** flows through cold water inlet pipe **30** into heat exchanger inlet pipe **13** at T-joint **31**. Cold water then flows through heat exchanger **12** and out through heat exchanger drain pipe **19**, through T-joint **26**, pipe **25**, valve **24**, and pipe **32** through outlet **33** and into dye kettle **10**. In this manner, cold water is passed through heat exchanger **12**, picking up heat, and the warmed water is then passed from heat exchanger **12** directly into dye kettle **10**.

Controller **27** monitors the temperature of the dye liquor by means of temperature bulb **34**. Controller **27** regulates cold water valve **28** so that the rate of temperature decrease of the dye liquor is closely held to a predetermined rate. Thereby, rinsing commences at the same time as the cooling step, the entire cooling and rinsing process being precisely regulated by controller **27**. The cooled and diluted liquor is then allowed to drain to sewer through kettle drain valve **35**.

When the temperature of the dye liquor has been reduced at the desired rate to typically 140° F., controller **27** may be set to open secondary valve cold water valve **36**, which transfers cold water directly from cold water supply line **29** directly into rinse inlet pipe **32** and into dye kettle **10**. During this latter part of the rinse cycle in which valve **36** is open, controller **27** may be set to again open steam valve **14** and pass steam through heat exchanger **12** sufficiently to maintain the dye kettle con-

tents at 100° F., this being the desired temperature of a clear cold water rinse.

The invention may readily be employed with dye kettles having external recirculating means for pumping the dye liquor through the kettle and including external closed heat exchanging means in association with said external recirculating means.

While there has been shown what is considered to be a preferred embodiment of the invention, it will be manifest that many changes and modifications may be made therein without departing from the essential spirit of the invention. It is intended, therefore, in the annexed claims to cover all such changes and modifications as fall within the true scope of the invention.

What is claimed is:

1. A method for cooling and rinsing a dye kettle comprising the steps of:

passing fluid through a closed heat exchanger whereby said fluid absorbs heat from the dye liquor used with a dye kettle,

taking said fluid coming out of said heat exchanger and directing it directly into said dye liquor thereby diluting said dye liquor with said fluid.

2. The method of claim 1 wherein the rate of flow of said fluid is regulated to obtain a desired cooling rate for said dye liquor.

3. Apparatus for cooling and rinsing a dye kettle comprising:

a closed heat exchanger positioned in a heat exchanging relationship with a dye liquor,

means for directing fluid through said heat exchanger,

means for withdrawing said fluid from said heat exchanger and discharging the withdrawn fluid directly into said dye liquor thereby diluting it.

4. The apparatus of claim 3 including valve means regulating the flow of said fluid in order to obtain a desired cooling rate for said dye liquor.

5. The apparatus of claim 3 wherein valve means are interconnected with said closed heat exchanger for alternately incorporating said heat exchanger with a heating source and a cooling source.

6. The apparatus of claim 5 incorporating a controller for positioning said valve means in accordance with the desired heating and cooling functions and for regulating appropriate valve means to obtain a desired cooling rate.

7. The apparatus of claim 3 wherein said heat exchanger is employed externally to said dye kettle in a heat exchanging relationship with a dye liquor recirculating means.

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WILLIAM I. PRICE, *Primary Examiner.*