June 13, 1933. R. E. RUPP 1,913,615

AGING PROCESS AND APPARATUS FOR PRINTED FABRIC

Filed April 6, 1931 2 Sheets-Sheet 1

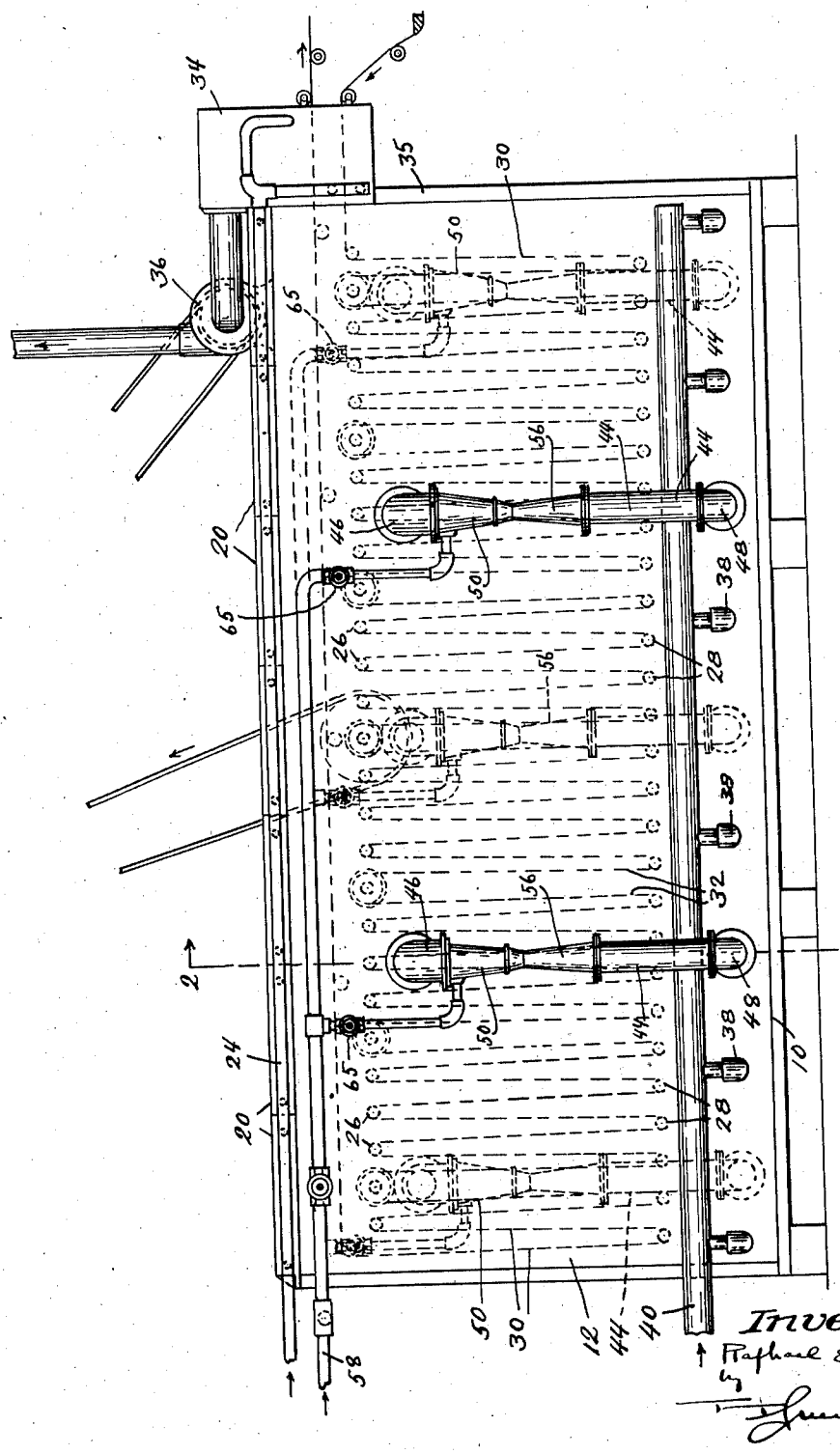


Fig. 1.

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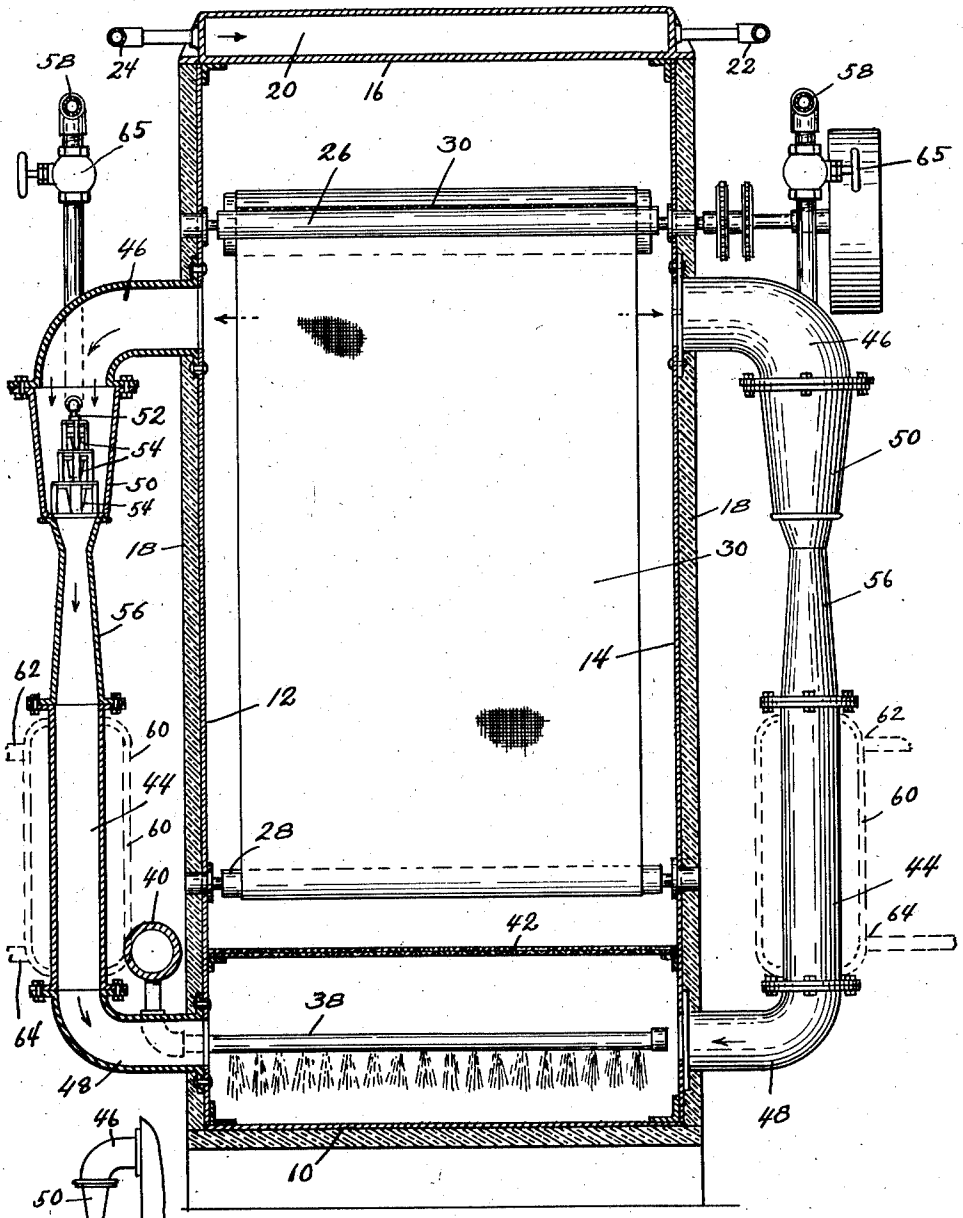


Fig. 2.

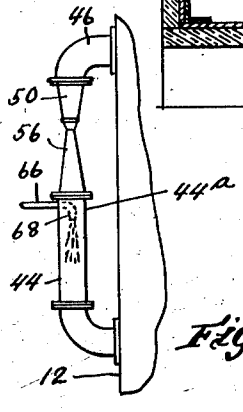


Fig. 3.

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UNITED STATES PATENT OFFICE

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AGING PROCESS AND APPARATUS FOR PRINTED FABRIC

Application filed April 6, 1931. Serial No. 528,056.

This invention relates to an improved method and apparatus for treating or aging textile fabrics printed with vat colors.

After a textile fabric has been printed with a vat color and a suitable reducing agent, the printed fabric is treated under conditions to reduce the color to its water soluble form and to carry the reduced color into the fibres of the fabric. This treatment is usually effected in what is known as an aging box and the process is known as aging process. In this process the aging box is filled with air-free steam in contact with the printed fabric which, usually, is arranged in loop-form, the steam supplying the necessary water to the color. The aging or reducing process is an exothermic process or heat is generated and is absorbed by the steam, the temperature of which is consequently raised. It is important to keep down the temperature of the steam to as low a point as is practicable, or to around 212° F. to 215° F., in order to obtain a good development of the color and to carry the color well into the fibres of the fabric, for the higher the temperature of the steam the less moisture is held by the fabric and consequently a poorer dyeing of the color into the fibres.

In the heretofore common aging process and apparatus, the temperature is kept down by blowing a large amount of steam in at one end of the box and discharging it out of the other end, the amount of steam being so great as to absorb the heat of the aging process without an excessive increase in its temperature. This method, however, is a very expensive way of keeping down the temperature as the box thus requires many thousands of pounds of steam per hour.

It has been proposed, heretofore, to cool the steam contents of the aging box by the introduction of water into the box in contact with the steam. A serious objection to the introduction of water directly into the box is that free water is liable to be deposited onto the fabric and ruin its saleability at least as first quality merchandise, as the effect of a drop of water is often noticeable on the finished goods. Furthermore this method of cooling the steam is not considered to be particularly successful. Consequently an object of this invention is the provision of an improved method and apparatus for cooling the steam atmosphere of the aging box and for effecting a substantial saving of steam used for the aging process.

A further object of the present invention is the provision of a method and apparatus for circulating the steam contents of the box in a closed cycle and for cooling the steam in a part of the cycle to maintain the steam at a temperature and condition best suited for the aging process.

A further object is the provision of a method and apparatus for circulating the steam contents of the aging box in a closed cycle by the use of small amounts of outside steam in quantities sufficient to effect the performance of the cycle and to make up for steam lost in various ways as by absorption in the color and the fabric, by escape from the box, and the like.

A further object of the invention is the provision of a method and apparatus for passing the fabric through an atmosphere of air-free moving steam and withdrawing steam and conditioning it to give it the desired temperature and then returning the reconditioned steam to the vicinity of the fabric.

Another object of the invention is in a method of and apparatus for circulating the steam in a closed cycle and for cooling the steam and utilizing the excess temperature of the steam to make additional low temperature steam without the use of external heat.

Another object of the invention is generally to improve upon aging processes and apparatus.

Fig. 1 is a side elevation of an aging box embodying the present invention.

Fig. 2 is a sectional elevation taken along line 2—2 of Fig. 1.

Fig. 3 is a diagrammatic sectional detail generally similar to Fig. 2, and illustrating a modified arrangement for cooling the steam contents of the box and for utilizing the excess temperature thereof to make additional steam.

The aging box as here shown is relatively long as compared with its cross sectional dimensions and has the bottom wall 10, the opposed vertical side walls 12 and 14 and the top wall 16. The bottom and side walls may be covered with a suitable lagging, or heat-insulating, material 18 to prevent loss of heat through the walls and the outer face of the top wall 16 is enclosed by steam jackets 20 through which steam circulates by means of the pipes 22 and 24 for the purpose of preventing condensation of steam on the inner face of said wall 16 and the consequent danger of drops of moisture falling upon the printed fabric and damaging it. The box is provided with an upper row of horizontally spaced parallel rolls 26 and a horizontal row of similar lower rolls 28 over which the web of printed fabric 30 is passed in succession to form a series of loops 32. The fabric moves in a continuous manner through the box and enters and also leaves the box through narrow slots provided in the end wall of an entrance cabinet 34 that is carried by an end wall 35 of the box. An exhauster 36 communicates with the interior of the cabinet and through this cabinet with the interior of the aging box for the purpose of keeping air out of the box and also to remove surplus steam. The interior of the box is supplied with steam through a plurality of perforated steam pipes 38 which extend horizontally in spaced relation into the interior of the box immediately above the lower wall thereof and are supplied with steam approximately at atmospheric pressure and a temperature corresponding to the pressure of the steam by a steam header 40. A water-separating screen 42 extends transversely across the aging box between the side walls 12 and 14 and from end to end of the box above said steam entrance pipes and through which screen the steam is constrained to pass to enter the fabric-portion of the box and at which screen the steam is freed from priming or any particles of moisture that may be suspended therein. The aging box as thus described is or may be of more or less common construction.

Heretofore large quantities of steam have been passed through the aging box to absorb the heat of the aging reaction and thereby to keep down the temperature of the steam and the fabric. In accordance with the present invention, the amount of steam is greatly reduced and the temperature of the steam atmosphere of the box is controlled by withdrawing steam from the box in as many places and to such an extent as need be and conditioning the withdrawn steam as to its temperature and then returning the conditioned steam to the box. The steam is caused to be circulated in a closed cycle repeatedly into and out of contact with the fabric and the heat imparted to the steam in one pass over the fabric due to the aging reaction is removed before the steam again passes over the fabric so that the temperature of the steam is kept down to as low a point as is practicable and yet to maintain the steam free from priming or free particles of moisture. To this end the steam contents of the box is circulated preferably through a plurality of circulating pipes 44 disposed on opposite sides of the box and in longitudinally staggered relation and having their upper ends 46 opening into the upper portion, or fabric compartment, of the box immediately below the upper rolls 26 and their lower ends 48 opening into the lower portion, or steam-entrance compartment, of the box under the screen 42. The steam content of the box is circulated through said pipes preferably by steam-operated injectors or blowers 50 which are located in the upper portions of the circulating pipes. While the injectors can be of any suitable construction each here shown consists of a steam nozzle 52 which discharges a small blast of high velocity steam into the uppermost of a stack of axially aligned and spaced converging nozzles 54, the lowermost one of which discharges into the throat of an expanding nozzle 56. By the action of the small jet of high velocity steam a large quantity of steam is drawn from the aging box and is circulated through the injector and through the lower section 44 of the pipe and is discharged into the steam-entrance compartment of the box under the screen 42. The steam nozzles of the ejectors are supplied with steam through steam mains 58.

During the circulation of the steam through said pipes and before it re-enters the box, the steam is cooled sufficiently to remove the excess temperature produced by the aging process. To this end, the lower straight sections 44 of the various circulating pipes each can be enclosed within a jacket 60 having an entrance 62 for cooling fluid at the upper end and an outlet 64 at the lower end thereof for the warmed cooling fluid. The cooling fluid can be a liquid such as water or it can be a gaseous fluid as air. Ordinarily, however, it is found that the radiation of the circulating pipes directly to the surrounding atmosphere in itself is sufficient to dissipate the excess temperature produced by the heat of the reaction and to lower the temperature of the circulated steam by the required amount. Thus the expanding nozzles 56 of the ejectors and the straight sections 44 and the top and bottom ends 46 and 48 respectively of the circulating pipes constitute in themselves radiators of the heat produced by the reaction without the necessity for employing any special cooling means such as the cooling jackets illustrated in Fig. 2. The degree of cooling of the steam can be regulated by varying the rate of circulation of the steam,

as by varying the velocity of the steam jets issuing from the steam nozzles 52 of the injectors by the valves 65. Under certain conditions, where a relatively large amount of heat has to be abstracted from the steam contents of the box, I prefer for reasons of economy to reduce the temperature of the steam and to utilize the excess heat in making additional steam which is supplied to the aging box, in the manner illustrated in Fig. 3.

In this construction a water pipe 66 is introduced into the upper end of the pipe 44*a* corresponding to the pipe 44 of Fig. 2 and preferably immediately under the discharge end of the nozzle 56 of the injector or blower. The water pipe terminates in a spray head 68 which discharges a fine spray of water preferably in the direction of steam flow. The sprayed water is heated and vaporized by the steam and thereby cools the steam; and the amount of injected water is so regulated that all of it is converted into steam thereby not only cooling the circulating steam but also supplying the aging box with some of the necessary additional steam.

While the steam contents of the box can be circulated by blowers or other well known means, not necessary to be shown, the use of injectors arranged as described is greatly to be preferred since they operate without moving mechanical parts and in themselves supply some of the steam necessary for the performance of the aging process. A plurality of similar sets of circulating apparatus is provided which is in communication with the box at small intervals between them for the purpose of uniformly circulating the entire contents of the box in a uniform and well defined manner.

An advantage of my invention consists not only in the saving of steam but that the temperature of the steam can be readily controlled to be as uniform as necessary in all parts of the box.

The operator, by thermometers or otherwise not necessarily shown, keeps informed as to the temperature at various points in the box and any undesirable departure from normal in any section may be corrected by a suitable adjustment of the injector and cooler operating in that section.

I claim:

1. The method of aging fabric printed with vat colors which consists in passing the fabric through an atmosphere of moving steam from which air is excluded and maintaining the steam atmosphere at the desired temperature by withdrawing from the fabric a part of the steam atmosphere, adding additional steam to the withdrawn steam, treating the mixture of withdrawn and added steam to obtain a desired temperature thereof, and returning the treated steam to the fabric.

2. The method of aging fabric printed with vat colors which consists in passing the fabric through an atmosphere of moving steam from which air is excluded and maintaining the steam atmosphere at the desired temperature by withdrawing from the fabric a part of the steam atmosphere, treating the withdrawn steam to give it the desired temperature by adding water to the withdrawn steam in amounts sufficient to be completely vaporized by the excess heat of the withdrawn steam, and returning the treated steam to the fabric.

3. Aging apparatus for fabric printed with vat colors comprising an aging box which is relatively long compared with its cross section dimensions and which has an upper fabric-containing compartment and a lower steam-entrance compartment, a screen separating said compartments, a plurality of generally vertical pipes arranged in horizontally spaced relation along the long sides of said box and externally thereof and having their upper ends separately in communication with different parts of the top of said fabric compartment and their lower ends separately in communication with different parts of said steam entrance compartment, steam injectors in said conduits for circulating steam of said box through said conduits and between said compartments, and means for cooling the circulating steam as it traverses parts of said conduits.

In testimony whereof, I have signed my name to this specification.

RAPHAEL E. RUPP.