Feb. 18, 1936. J. BRANDWOOD 2,031,094

IMPREGNATION OF TEXTILE MATERIALS WITH RUBBER CONTAINING LIQUIDS

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Fig. 1.

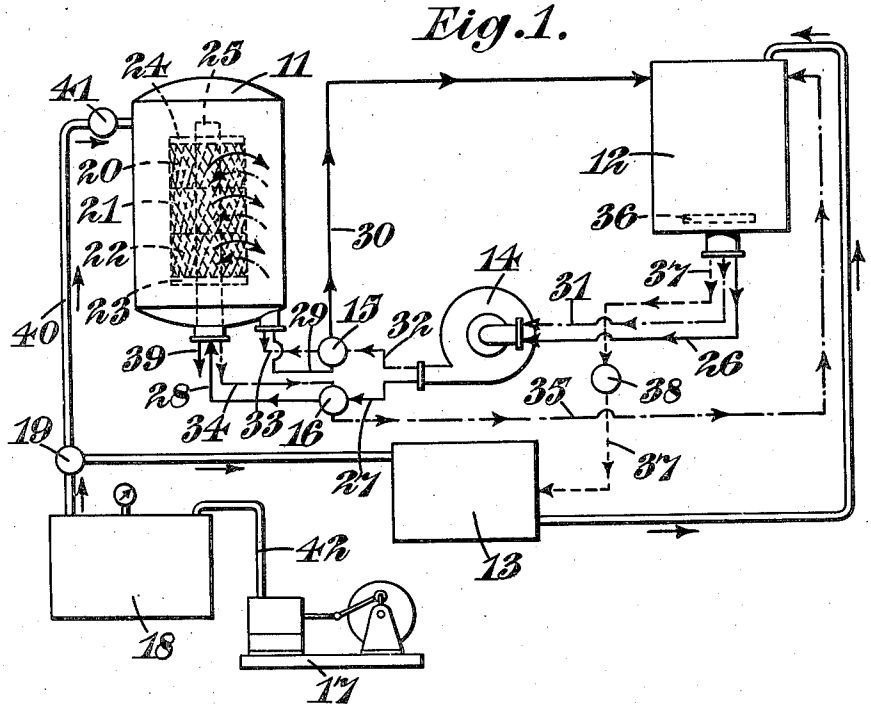
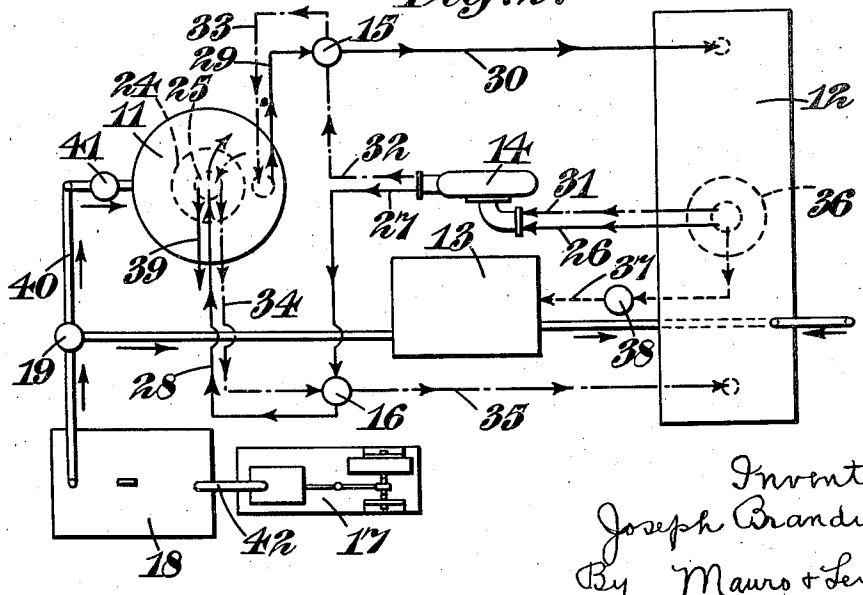



Fig. 2.




Inventor,
Joseph Brandwood
By Mauro & Lewis
Attorneys

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## IMPREGNATION OF TEXTILE MATERIALS WITH RUBBER-CONTAINING LIQUIDS

Joseph Brandwood, Southport, England

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4 Claims. (Cl. 91—68)

This invention is for improvements in or relating to the impregnation of textile yarns with rubber-containing liquids and has for its main object the production of a rubber-impregnated textile material in which the rubber can be vulcanized without removing the textile material from the support on which it was impregnated. Certain processes hitherto employed for the production of rubber-impregnated textile materials have involved winding e. g., yarns, threads, cords or the like into a cheese or packet, treating the cheese or packet with a rubber dispersion, containing vulcanizing agents if desired, and drying the impregnated yarn, thread, cord or the like by unwinding it over drying rollers and subsequently subjecting to vulcanizing conditions. The present invention enables the drying of the textile material, the coagulation of its content of rubber and if necessary the vulcanization of the rubber to be carried out while the textile materials are in the original cheese or packet without the risk of the threads becoming stuck to one another with rubber. This result is achieved by winding the cheese or packet in a somewhat open form so that rubber dispersion or solution may be passed under pressure through the interstices of the material and after impregnation and removal of the excess of the impregnating liquid a blast of air or other gas is passed through the packet to remove films of rubber-containing liquid from between the turns of the textile material. After removing the excess of the rubber-containing liquid the packet may be dried and if desired subjected to conditions such that coagulation and vulcanization of the rubber takes place without unwinding the textile material from the packet.

The process of impregnating and removing excess of rubber dispersion or solution may be carried out in a closed vessel connected with storage and circulating vessels and provided with a pump for circulating the liquid and includes the step of forcing the rubber-containing liquid (hereinafter referred to as a rubber dispersion, though it is to be understood that this expression is to be read as including rubber solutions) through the open-wound cheese or packet. In order that impregnation with and removal of rubber dispersion may be carried out conveniently the yarn, thread, cord or like continuous length of textile material is wound with an open wind into a packet on a hollow foraminous support through which packet and support rubber dispersion is continuously circulated at a pressure above atmospheric. The dispersion may be forced through the packet into the surrounding vessel and re-circulated. Alternatively, the direction of circulation may be reversed and the rubber dispersion passed through the packet from the surrounding vessel into the hollow support. The impregnation process may be carried out by circulating the rubber dispersion alternately first in one direction and then in the opposite direction and the direction of flow may be reversed as often as and at whatever intervals desired.

After impregnation of the textile material with the rubber dispersion has been carried out the excess dispersion is drained from the packet and a sudden and powerful blast of gas (preferably air) is passed through the packet to remove any excess dispersion adhering in films to and between the surfaces of the threads. The blast of gas is preferably passed through the packet from the outside to the foraminous support. In certain cases the gas may be passed in the opposite direction but in such cases allowance must be made for the decrease in velocity owing to the increase in the total area of the interstices presented to the gas stream.

The rubber dispersion employed for impregnation may consist of any type of stabilized latex. Thus for example one of the rubber dispersions known under the trade names "Jaytex" or "Revertex" may be used and these dispersions may if necessary be diluted with soft water containing a small amount of anti-coagulant e. g., 0.5% ammonia. Those rubber dispersions having the smallest particle size are in general preferred.

When the yarn, thread or cord to be impregnated is of jute or cotton and contains oil or like water-repellent substance the packages may with advantage first be boiled for half an hour in soft water to which a proportion of a detergent and wetting-out agent has been added, e.g., 0.25 to 1.0% of a sulphonated fatty alcohol product such as those commercially obtainable under the trade names Igepon T and Avirol. The boiled textile material may if desired then be cooled and freed from excess liquid by passing a blast of compressed air therethrough.

If a well-impregnated textile material having a heavy coating on its outer surface is required two baths of rubber dispersion may be used in succession, the first containing a low concentration of rubber and the second a higher concentration of rubber and excess of the liquid first applied may if desired be removed by means of a blast of air

before circulating the more concentrated dispersion through the textile material.

The impregnating liquid may contain vulcanizing agent such as sulphur in a soluble or colloidal form, e. g., ammonium polysulphide and subsidiary reagents such as accelerators, activators or antioxidants all in soluble or colloidal form and all mixed with the rubber dispersion under conditions which prevent coagulation of the rubber. When such impregnating liquids are employed the rubber may be vulcanized during the drying operation succeeding the impregnation.

The impregnation step of the process is normally carried out at ordinary atmospheric temperature but the temperature may if desired be raised somewhat provided coagulation of the rubber is prevented. On the other hand in operating this process in tropical countries the rubber dispersion may be cooled somewhat.

The pump for forcing the rubber dispersion through the textile material is conveniently a centrifugal pump and may be capable for example of delivering at a pressure of 40 lbs. per square inch about 2 gallons of dispersion per minute, per lb. of textile material in the batch undergoing treatment. Since coagulation of rubber dispersions is brought about by excessive friction between the dispersion and metallic surfaces the pump is preferably of non-metallic construction and may be of earthenware, iron earthenware lined or iron rubber lined. The pipes, valves and vessels may be constructed of mild steel or cast iron as convenient.

The supports upon which the packets are wound are preferably non-metallic and may consist, e. g., of tubes of compressed impregnated paper. For impregnation on the beam iron beams may be employed. In any case the arrangement of the supports must be such that the dispersion when passed in either direction is forced through the cheese or packet in a substantially radial direction.

Following is a description by way of example and with reference to the accompanying drawing of one process and apparatus suitable for carrying the present invention into effect. Figure 1 is an elevational view and Figure 2 a plan view (both in purely diagrammatic form) of one suitable arrangement of apparatus.

11 is the vessel in which impregnation with the rubber dispersion takes place.

12 is a circulating tank for the dispersion and is connected to a storage tank 13, a centrifugal pump 14 and through three-way cocks 15 and 16 to the impregnating vessel 11. An air compressor 17 delivers air to a receiver 18 which in turn is connected to the impregnating vessel 11. A three-way cock 19 allows compressed air to be supplied to the storage tank 13 for forcing rubber dispersion into the circulating tank 12. Alternatively the dispersion may be drawn from the storage tank 13 by means of the pump 14 through a further three-way cock (not shown). Packets of textile yarn of which three, 20, 21 and 22, are shown are wound on hollow and perforated supports and clamped in position by clamping means 23, 24 and 25.

Pipe lines 26, 27, 28, 29 and 30 (shown in single continuous lines) convey the dispersion from the circulating tank 12 to the pump, through the three-way valve 16 to the inside of the foraminous support and back to the circulating tank via the three-way valve 15. Pipe lines 31, 32, 33, 34 and 35 (shown as single dot and dash lines) convey the rubber dispersion through the packets of textile material in the opposite direction by way of the pump 14, the three-way valve 15, the vessel 11 and three-way valve 16. The circulating tank 12 is open to the air and is provided with a filter 36 through which the rubber dispersion leaving the circulating tank passes.

A pipe line 37 (shown as a single dotted line) conveys rubber dispersion from the circulating tank 12 to the storage tank 13 via the cock 38 and a pipe 39 serves to drain liquid from within the support for the textile material.

The centrifugal pump 14 is constructed of iron covered with rubber and is capable of delivering at a pressure of 40 lbs. per square inch, 2 gallons of liquid per minute per lb. of textile material to be impregnated. The pipes, valves and vessels are constructed of mild steel or cast iron as convenient.

The receiver 18 of the air compressor system is connected to the impregnating vessel 11 by means of a 6 inch pipe 40 (in the case of apparatus suitable for treating 1000 lbs. of textile material at one time) and cock 41. The air receiver itself has a volume of about 1500 cubic feet and the compressor a capacity of 300 cubic feet free air per minute and is connected with the receiver by a 3 inch pipe 42.

The mode of operation of the apparatus is as follows:

Cotton yarn is wound with an open wind upon hollow supports made of compressed impregnated paper and the packets assembled in the impregnating vessel 11 and clamped in position on the central conduit so that liquid is forced to flow through the packets in a substantially radial direction. An impregnating liquid is made up in the storage tank 13 by diluting "Revertex" with soft water containing 0.5% ammonia and adding suitable amounts of ammonium polysulphide and of a colloidal dispersion of an accelerator, an activator and an antioxidant. The liquid mixture is transferred to the circulating tank 12 and is forced by the pump 14 through the yarn packets from the outside to the inside. After forcing the dispersion in this direction for ten minutes the direction of flow of the liquid is reversed by operation of the three-way valves 15 and 16. At the end of a further ten minutes the direction of flow is again reversed and so on until the total period of impregnation is 50 minutes. One or more times during the impregnation the rubber content of the liquid may be brought up to or increased beyond its original value by the addition of more concentrated latex.

The latex is now run into the storage tank 13 and liquid allowed to drain from the packets for a short time via the drain pipe 39. Compressed air is turned into the vessel 11 by operation of valves 19 and 41 and the excess of latex adhering to the surfaces of the threads and extending between contiguous turns is blown away by the rapid flow of air. The packages, now free from surplus latex, contain between 50% and 100% of their weight of water and are removed from the vessel and dried in any suitable form of textile drier. Vulcanization of the rubber takes place during drying and the vulcanized yarn may afterwards be unwound without any difficulty due to the sticking of one thread to another.

I claim:

1. A process for the impregnation of prepared textile yarns with a rubber-containing liquid which comprises winding the yarns in coil form with an open wind on a foraminous support, continously circulating the rubber-containing liquid

through the wound packet at a pressure above atmospheric, draining the liquid out of contact with the coiled yarns, and removing excess of liquid from the yarns by passing a compressed gas at a pressure above atmospheric between the wound coils.

2. A process for the impregnation of prepared textile yarns with a rubber-containing liquid which comprises winding the yarns in coil form with an open wind on a foraminous support, continuously circulating the rubber-containing liquid through the wound packet at a pressure above atmospheric in both radial directions alternately, drawing the liquid out of contact with the coiled yarns, and removing excess of liquid from the yarns by passing a compressed gas at a pressure above atmospheric between the wound coils.

3. A process for the impregnation of prepared textile yarns with a rubber-containing liquid which comprises winding the yarns in coil form with an open wind on a foraminous support, continuously circulating the rubber-containing liquid with vulcanizing agents therein through the wound packet at a pressure above atmospheric, draining the liquid out of contact with the coiled yarns, and removing excess of liquid from the yarns by passing a compressed gas at a pressure above atmospheric between the wound coils, and drying and vulcanizing the wound packet.

4. A process for the impregnation of prepared textile yarns with a rubber-containing liquid which comprises winding the yarns in coil form with an open wind on a foraminous support, continuously circulating the rubber-containing liquid with vulcanizing agents therein through the wound packet at a pressure above atmospheric in both radial directions alternately, draining the liquid out of contact with the coiled yarns, removing excess of liquid from the yarns by passing a compressed gas at a pressure above atmospheric between the wound coils, and drying and vulcanizing the wound packet.

JOSEPH BRANDWOOD.