March 3, 1942. A. L. JENNINGS ET AL 2,274,792

METHOD OF IMPREGNATING WEBS

Filed Aug. 30, 1938

Fig 1

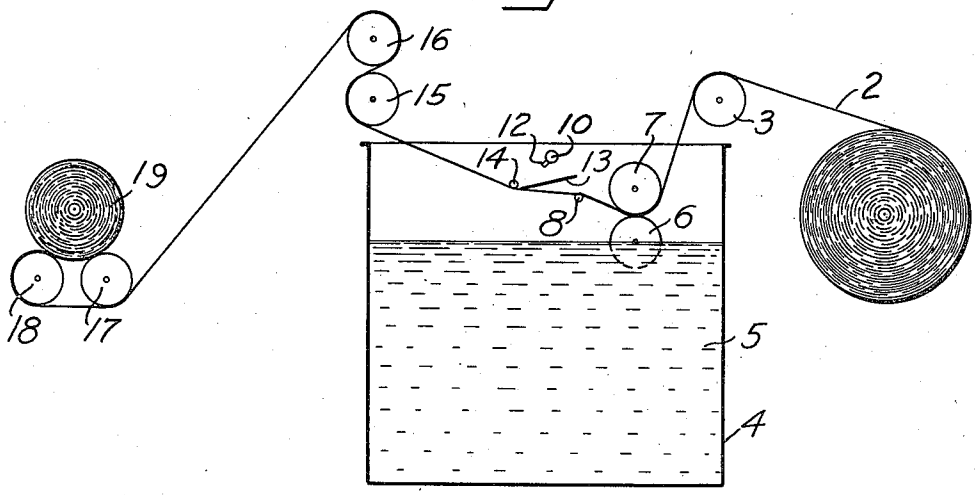


Fig 2

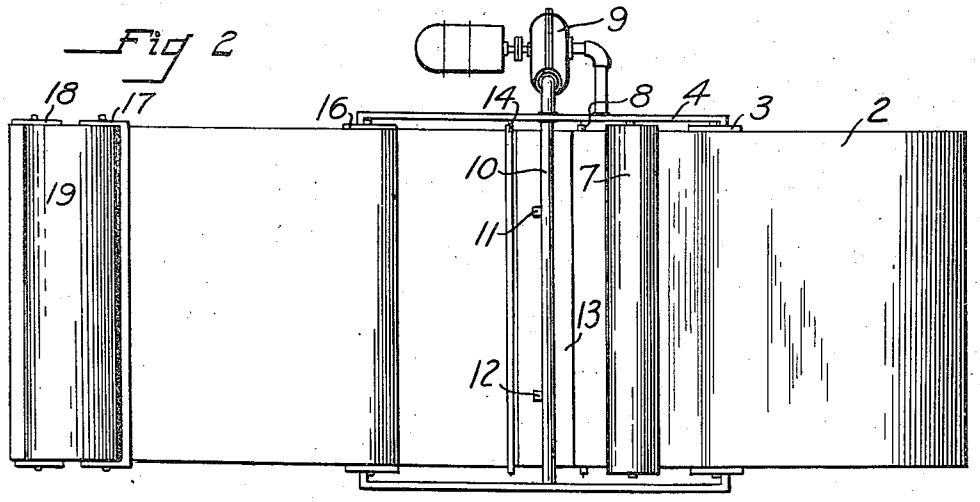


Fig 3

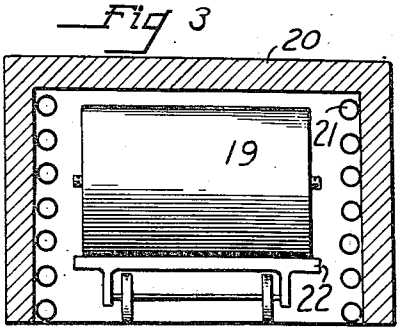
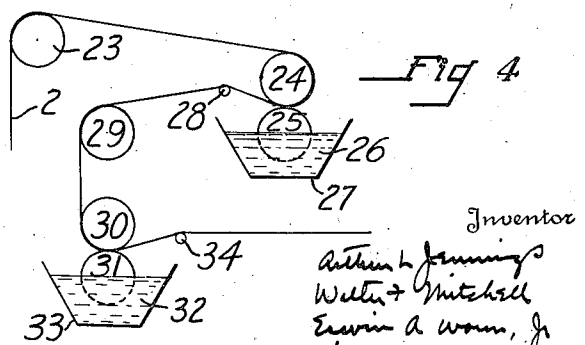


Fig 4



Inventor

Arthur L. Jennings

Walter T. Mitchell

Erwin A. Worm, Jr.

by Walter T. Kaufman

Attorney

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METHOD OF IMPREGNATING WEBS

Arthur L. Jennings, Lancaster, Pa., and Walter F. Mitchell, Fulton, and Erwin A. Worm, Jr., Oswego, N. Y., assignors to Armstrong Cork Company, Lancaster, Pa., a corporation of Pennsylvania

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14 Claims. (Cl. 91—70)

This invention relates to a method of impregnating webs and more particularly to a method whereby a light bibulous web may be uniformly impregnated with a minor proportion, by weight of the web, of a relatively low penetration impregnant, in the range between 10% and 30%, and preferably between 14% and 25%, of the total impregnant carrying or absorbing capacity of the web.

The invention finds particular usefulness in the manufacture of webs used in the vibration damping of vehicle bodies where the material must possess characteristics which will permit it to readily conform to the contours encountered in the metal panels to be treated, which is water repellant, which will satisfactorily receive and hold an adhesive, which will permit free escape of solvents used in the adhesive and which will effectively deaden vibrations and, incidentally, absorb air borne sound waves. These requirements necessitate a web that is relatively soft, open and porous, that is substantially waterproofed, and possesses sufficient mass to effectively deaden the vibrations encountered. Thus, the article contemplated has physical characteristics which differ materially from any commercially available saturated or partially saturated webs. Roofing felt, for example, is not satisfactory for the purpose. It has generally the following characteristics:

Weight per 480 square feet	pounds	60
Caliper	inches	.070
Bulk factor		1.16
Kerosene saturation value	per cent	200
Density	seconds	8

Flooring felt which is of a somewhat similar character but is not so highly impregnated is also lacking in certain fundamental requisites. It possesses generally the following characteristics:

Weight per 480 square feet	pounds	53
Caliper	inches	.056
Bulk factor		1.06
Kerosene saturation value	per cent	180
Density	seconds	10

We have found after much experimentation that, in order to obtain the optimum efficiency through the desired characteristics in the sheet, the impregnating processes commonly used cannot be employed and further that the physical characteristics of the base web must be carefully controlled within certain definite limits in order to obtain a uniform but partial impregnation of a bibulous, highly absorptive web. It has generally been considered that to obtain low impregnation, a relatively dense sheet should be used so that the area of pore space to fiber is relatively low, and, therefore, the proportion of impregnant to fiber will be commensurately low, and, conversely, to obtain a high degree of impregnation a relatively open porous sheet should be employed to insure a high pore space to fiber ratio.

The product here under consideration, however, must possess the divergent characteristics of a light, porous body and a relatively small amount of impregnant uniformly deposited throughout the web. The problems involved in accomplishing this result will be immediately apparent. If the web be dipped into a bath of impregnant, as is the usual practice in web impregnation, it will, due to its light, open character, immediately absorb a large amount of impregnant, much more than is desired in a product having the characteristics above recited. If the density of the web be increased to decrease the absorption, then the product will not have the quality of lightness and an open porous body. If it be coated with impregnant on the opposite faces, there will be a lack of penetration of the material into the body resulting in a web having a high degree of impregnation at the surface and a central portion entirely devoid of impregnant, and thus subject to delamination at the unimpregnated area under the force of vibration in use.

According to our preferred practice, a felt paper sheet is prepared consisting of 75% of rag fiber and 25% wood fiber. The beating and forming operations are so carried out that the felt web produced on a conventional type paper machine possesses extreme bulk and porosity. A sheet weighing 62 pounds for 480 square feet and measuring .085" in thickness is suitable for this purpose. We have found that a bulk factor ranging from 1.25 to 1.45, and preferably 1.37, is desirable. The bulk factor of a felt web is determined by multiplying the thickness in inches by 1000 and dividing the product by the weight in pounds of the sheet for 480 square feet.

The sheet being relatively open and porous will have a relatively high kerosene absorption value. The preferred saturation value should range from 260% to 295%, with 285% considered as ideal, by the standard kerosene saturation value method as established by the Technical Association of the Pulp and Paper Industry.

The density of the sheet should be somewhat in the range of 2 to 6 seconds and preferably 3 to 4 seconds as measured on a standard Gurley

densometer in which an orifice of one square inch in area is used and the time in seconds required for 400 cc. of air to pass through the sheet is measured.

The contrast between a sheet having the above characteristics and felt webs of the type used for roofing and flooring purposes is readily observable from the following recapitulation of the characteristics recited above:

Felt body	Roofing	Flooring	Sound deadening
Weight per 480 square feet.....lbs..	60	53	62
Caliper.....inches..	.070	.056	.085
Bulk factor.....	1.16	1.06	1.37
Kerosene saturation value..percent..	200	180	285
Density.....seconds..	8	10	3 to 4

We have found that felt sheets of the type used for roofing and flooring cannot be uniformly saturated with a low percentage of saturation, in the order of 10% to 30% of the kerosene saturation value, for the reason that the dense fiber arrangement in such felts impedes the flow of asphalt to such an extent that it cools off and hardens before penetration is complete. When attempts have been made to effect such limited impregnation, the center of the web remains unimpregnated and is thus subject to splitting or delamination along the non-impregnated zone.

Additionally, roofing and flooring felts are unsatisfactory for use in vibration damping for the reason that they are relatively stiff and board-like as compared with a loose porous felt and their relatively high density inhibits the free passage of solvent vapors and consequently the adhesive employed in securing the material to the body to be damped does not readily set up and as a result vertical and inverted panels cannot be satisfactorily secured and will become loose upon subsequent vibration of the body.

Likewise, roofing and flooring felts are designed for specific purposes and their characteristics are not ideal for sound deadening work.

The impregnant used will depend to a considerable extent upon the use to which the finally formed sheet is to be put. We have found in the manufacture of sound deadening felt that steam refined asphalt having a melting point of 90° F. to 110° F. determined by the ball and ring method, established as standard by the American Society for Testing Materials and a penetration of 200 to 275 at 77° F., also determined in accordance with the standard method of the American Society for Testing Materials, forms an impregnant which when used in our method with a sheet having the characteristics above described produces a sound deadening web having the optimum desired characteristics.

We have determined that by using a relatively low penetration asphalt in the range between 200 to 275 that the bond between the fibers constituting the web is enhanced and thus a stronger sheet is produced without materially sacrificing its characteristics of flexibility. In sound deadening work the best results are obtained if the sheet possesses some stiffness and considerable mass. Our process permits the production of a sheet which is more rigid than a similar web treated with oils or other water repellant material having a penetration above 350. By our method the range of penetration of the saturant usable depends largely upon the contours encountered in the sound deadening work and we have been able to incorporate uniformly a relatively low percentage of impregnant, in the order of 14% to 25% of the total absorption capacity of the web, using an asphalt impregnant having a penetration as low as 200.

The method of saturating will, for convenience, be described in conjunction with the attached drawing in which

Figure 1 is a diagrammatic view in end elevation showing mechanism which may be employed in carrying out the process;

Figure 2 is a top plan view of the equipment shown in Figure 1;

Figure 3 is a sectional view in diagram form showing a heating chamber used in carrying out the process; and

Figure 4 is a diagrammatic sketch of an alternate method of impregnating.

Referring to Figure 1, a web of felt 2 is fed over an idler roll 3 into a tank 4 containing molten asphalt 5 of the type described above heated to a temperature of 400° F. to 425° F., materially above its melting point. The web is carefully controlled so that it contains but a normal moisture content of 3% to 4% and is held at room temperature to avoid the imbibition of too much impregnant which would result if the web were in heated condition when brought into contact with the impregnant. A metering roll 6 rotates in the bath of asphalt 5, the level of the impregnant in the tank being so maintained that the metering roll 6 is always about half submerged therein. The felt web 2 passes between the metering roll 6 and a pressure roll 7 and the asphalt impregnant which is picked up by the metering roll 6 is transferred to the surface of the felt web 2 as it comes into engagement therewith. Substantially immediately after the felt web 2 passes beyond the metering roll 6, all excess impregnant is scraped from the surface by a stationary bar 8 over which the web 2 is flexed. The rolls 6 and 7 are arranged to press lightly against the web 2 and are rotated by frictional engagement with the web so that only a limited portion of the asphalt carried by the metering roll 6 is transferred thereto, the excess impregnant flowing back into the tank 4. The sheet is moved rapidly through the machine and past the scraper bar 8 and the bar is placed closely adjacent the metering roll 6 in order to obviate the impregnant striking deeply into the body of the web prior to scraping away of any excess which would increase the degree of impregnation above that desired. In actual practice by our method, we have found that a speed of 250 to 325 feet per minute of the felt web 2 is desirable with the scraper bar 8 spaced about 26" from the nip of the rolls 6 and 7. At this speed there is an elapsed time of $\frac{1}{15}$ to $\frac{1}{10}$ of a second between the time of application of the impregnant and the time of engagement thereof by the scraper bar 8.

The felt web then passes to a station where the opposite plane face is coated with impregnant which is pumped from the tank 4 by pump 9 (Figure 2) to a discharge pipe 10 provided with a pair of discharge openings 11 and 12. When operating upon a sheet 48" wide, we have used a 2" feeder pipe with two 1¼" discharge openings. This will, of course, supply an amount of impregnant which is materially in excess of the amount required. This has been found to be desirable, however, because it avoids any material cooling of the impregnant which would militate against proper control of the degree of impregnation.

The liquid impregnant fed from the openings 11 and 12 is directed by a metal dam 13, which is inclined with respect to the web 2 with one edge in engagement therewith, onto the surface of the web 2 as a pool, the temperature of the impregnant being about the same as the impregnant in the tank 4. The excess liquid flows over the longitudinal edge of the web back into the tank. Since such an excess of liquid impregnant is applied to the surface of the web, it is imperative that the excess be immediately scraped off to avoid over impregnation. Accordingly, scraper bar 14 which engages the surface of the web 2 is positioned closely adjacent the point of contact of the liquid impregnant. In fact, it may serve as a confining wall and with the dam 13 constitute a chamber for the reception of the impregnant with the web 2 itself serving as a moving bottom wall. In the device under consideration, operating at the speeds above recited, we have found that satisfactory results are obtained if the scraper bar 14 is positioned about 1" away from the edge of the metal dam 13 so that the pool of impregnating liquid is in contact with the surface of the sheet for but 1/50 to 1/60 of a second.

The web as it leaves the imprenating equipment presents a brownish colored surface on both plane faces and when severed presents an interior portion which is entirely devoid of impregnant, the depth of penetration of the impregnant at the point of emergence from the machine being substantially nil.

The web 2 immediately passes over guide rolls 15 and 16 to a pair of driven wind-up rolls 17 and 18. Care is exercised to avoid any material cooling of the web which is rolled into a fairly tight convolute body 19. The web is fed into the impregnating equipment at room temperature (between 70° F. and 90° F.) and the heat of the impregnant applied increases the temperature of the web to about 200° F. to 250° F.— materially above the melting point of the impregnant used. This temperature is not materially lowered in the passage of the web from the impregnating equipment to the rolling up operation since the speed of travel of the material is so rapid.

The thin film of applied impregnant is caused to penetrate throughout the thickness of the web by placing the rolled body 19 in a heated chamber or oven. In Figure 3 there is shown a chamber 20 having heating coils 21 provided along the side walls thereof. The roll 19 supported upon a trunk 22 is rolled into the chamber 20, and the door or curtain for the entrance opening is closed. The temperature of the chamber is maintained at between 220° F. and 250° F., and the roll 19 is subjected to such heat for about five hours during which time the impregnant which is still fluid gradually penetrates through the entire body of the felt and a uniformly impregnated sheet results. The web is then fed through a festoon type cooling chamber which reduces its temperature to about 80° F to 100° F., suitable for shipment or fabrication.

We have determined that, by proceeding as above described using raw materials of the type referred to as constituting a preferred example, the weight of impregnant applied will be about 24.8 pounds for 480 square feet of felt or about 14% of the impregnant required to completely saturate the sheet. If the amount of saturant be increased to 43½ pounds for 480 square feet, then 24.6% of the asphalt required to completely saturate the sheet will be applied.

To again compare products prepared in accordance with the method of our invention with the commercially available saturated felts, the following table indicates the relative characteristics:

Saturant	Roofing	Flooring	Sound deadening
Melting point ..... °F..	140	160	90–110
Penetration factor	40	25	200–275
Weight per 480 square feet of felt ..... lbs..	94	67	24.8 to 43.5
Percentage of total saturation ..... percent..	76	69	14 to 25

We have found in our experiments that it is not practicable to coat the surfaces of the sheet and after cooling of the impregnant effect migration of the saturant through the sheet, even though the temperature of the sheet be elevated to a degree materially in excess of the melting point of the impregnant. There is apparently some reaction which takes place in the impregnant which prevents its reliquefication and penetration. Even though the temperature be elevated to the point where the felt web is scorched, the saturant still does not completely penetrate through the depth of the sheet. Our theory is that the asphalt is absorbed into the individual fibers and thus is not free to permeate the entire body of the mass since there is insufficient asphalt present to effect such coating of the fibers if any material portion is absorbed into the fibers themselves.

In Figure 4, we have illustrated diagrammatically another device for carrying out our method. In this arrangement, the web 2 is directed over a tensioning roll 23 and then about a roll 24 which is operative with a metering roll 25 bathed in a pool of impregnant 26 carried in a trough 27. The level of the impregnant 26 in the trough 27 is suitably controlled so that the metering roll is partially immersed therein and the amount of impregnant applied to the surface of the web 22 is thus effectively measured. A scraper bar 28 is positioned closely adjacent the nip of the rolls 24 and 25 to remove excess coating material. The positioning of roll 28, as in the preferred embodiment, is correlated with the speed of movement of the web through the machine to carefully meter the amount of impregnant applied. The web 22 then passes over an idler roll 29 and between the nip of a pair of rolls 30 and 31, the latter of which serves as a metering roll and is immersed in a bath of impregnant 32 carried in a trough 33, provision being made for maintaining a constant level in this trough as in the trough 27. A scraper bar 34 is positioned so as to engage the coated surface of the web and performs a function the same as the scraper bar 28. By this system it is possible to accurately control the application of the saturant to each of the plane surfaces of the felt, but it requires careful control of the temperature of the liquid in each of the troughs in order that the degree of impregnation may be uniform from each of the plane surfaces.

From the foregoing it will be clear that our method requires that the time of contact of a coating or bath of impregnating material be limited and that the temperature of the liquid impregnant be maintained well above its melting point throughout the process in order to obtain proper diffusion of the impregnating liquid throughout the body of the web. This will clearly indicate the difference between our process and those processes heretofore contemplated in which

the felt web is drawn through a tank containing the liquid saturant and subsequently passed between a pair of squeeze rolls to express the excess saturant from the sheet and from those processes wherein the saturant is applied to the plane faces of the web by means of an atomizing spray. In this latter practice, the temperature of the saturant is materially reduced and it has a tendency to immediately congeal upon contact with the surface being treated. As pointed out above, when congelation has occurred, it is difficult to effect uniform penetration.

By the process which we have devised, it is possible for the first time to uniformly impregnate an open porous sheet, with a water repellant impregnant having a relatively low penetration factor, to the extent of only 10% to 30% of the impregnant required to completely saturate the sheet. Our invention contemplates a water repellant impregnant such as steam refined asphalt which is to be contrasted with oils and oil-cut asphalts having a penetration factor above 350 and consequently permanently in a liquid condition and at which the melting point is at or below room temperature. Products made with such impregnants do not possess the requisite characteristics. The sheet produced by our invention is ideally suited for sound deadening work in vehicles and is producible economically without any major capital investment.

While we have described and illustrated certain preferred embodiments of our invention, it will be understood that the invention may be otherwise embodied and practiced within the scope of the following claims.

We claim:

1. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising wetting the plane faces of a felt web, having a bulb factor ranging from 1.25 to 1.45, the initial temperature of which is below 212° F., with a melted impregnant heated to a temperature materially above its melting point by applying said impregnant to the said faces individually; engaging the wetted surfaces prior to any material penetration of the impregnant into the body of the felt to remove impregnant from the surfaces thereof; and maintaining the temperature of said impregnant constantly above the point where congelation of the impregnant will occur until the impregnant has migrated substantially uniformly throughout the thickness of the web.

2. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising wetting each of the plane faces of a felt web, having a bulk factor ranging from 1.25 to 1.45, a kerosene saturation value ranging from 260% to 295% and a densometer reading of 2 to 6 seconds, with a melted impregnant having a penetration factor above 200 and below 350 at 77° F. heated to a temperature materially above its melting point by applying said impregnant to the said faces individually; substantially immediately thereafter removing impregnant from the surfaces of the said web; forming the web into a convolute roll prior to decrease in the temperature of the impregnant to a point where congelation thereof will occur; and maintaining said rolled felt web at a temperature materially above the melting point of the impregnant until the impregnant has migrated substantially uniformly throughout the thickness of the web from the faces thereof.

3. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising wetting the plane faces of a felt web comprising a major portion by weight of rag fiber and a minor portion by weight of wood fiber, said web having a bulk factor ranging from 1.25 to 1.45, with a melted impregnant at a temperature materially above its melting point and having a penetration factor in the range between 200 and 275 at 77° F., by applying said impregnant to the said faces individually; engaging the wetted surfaces prior to any material penetration of the impregnant into the body of the felt to remove impregnant from the surfaces thereof; and applying heat to said coated web to maintain the temperature of the impregnant materially above its melting point until the impregnant has migrated throughout the thickness of the web.

4. A method in accordance with claim 1 in which the impregnant has a melting point in the range from 90° F. to 110° F. and a penetration factor between 200 and 275 at 77° F. and in which the temperature of the impregnant applied is maintained at or above 200° F. from the time of application until the same has migrated throughout the extent of the web.

5. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising introducing a web of felt having a bulk factor ranging from 1.25 to 1.45 and a normal moisture content of about 3% to 4% to a film of impregnating material in melted condition and at a temperature materially above its melting point carried by a supporting surface to transfer a portion of said impregnant to said web; removing a portion of the impregnant thus applied; immediately after application of said coating, and prior to any material penetration of the same into the body of the felt, introducing said coated web to a bath of melted impregnant engageable with the face opposite the previously coated face; moving said web rapidly through the zone of said bath to apply a thin film of impregnant to the face of the web; and thereafter maintaining the temperature of said impregnant applied to said web at a temperature materially in excess of its melting point for a period of time sufficient to permit migration of said impregnant substantially uniformly throughout said web.

6. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising simultaneously applying to opposite faces of a felt web, having a bulk factor ranging from 1.25 to 1.45 and a kerosene saturation value ranging from 260 to 295, a thin film of steam refined asphalt in melted condition and at a temperature materially above its melting point and having a penetration factor in range of 200 to 275, by bringing the same into engagement with films of asphalt carried by supporting surfaces to transfer impregnant to the plane faces of said web; simultaneously scraping excess asphalt from each of the faces at a point closely adjacent the point of application, such step being

effected prior to any material penetration of said asphalt into the body of said web; rolling said web into a convolute roll; placing said roll in a heated chamber; and maintaining the temperature of said roll in excess of the melting point of said asphalt impregnant and at a temperature at which migration of the asphalt will occur until such time as said sheet exhibits a substantially uniform impregnation from face to face thereof.

7. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps consisting in simultaneously applying to opposite faces of a felt web having a bulk factor ranging from 1.25 to 1.45 and a kerosene saturation value ranging from 260 to 295, a thin film of impregnant heated to a temperature materially above its melting point and having a penetration factor in the range of 200 to 275; simultaneously scraping excess impregnant from each of the faces at a point closely adjacent to the point of application, such step being effected prior to any material penetration of said impregnant into the body of said web; rolling said web into a convolute roll; placing said roll in a heated chamber; and maintaining the temperature of said roll in excess of the melting point of said impregnant and at a temperature at which migration of the impregnant will occur until such time as said sheet exhibits a substantially uniform impregnation from face to face thereof.

8. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising wetting the plane faces of a felt web, the initial temperature of which is below 212° F., with a melted impregnant heated to a temperature materially above its melting point by applying said impregnant to the said faces individually; metering the quantity of impregnant by engaging the wetted surfaces, prior to any material penetration of the impregnant into the body of the felt, to remove impregnant from such surfaces; forming the web into a convolute roll prior to decrease in the temperature of the impregnant to a point where congelation thereof will occur; and maintaining said rolled felt web at a temperature materially above the melting point of the impregnant until the impregnant has migrated substantially uniformly throughout the thickness of the web from the faces thereof.

9. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising individually wetting each of the plane faces of a felt web having a normal moisture content of at least about 3%, the initial temperature of the web being below 212° F., with a metered quantity of a melted impregnant heated to a temperature materially above its melting point; and maintaining the temperature of said impregnant constantly above the point where congelation of the impregnant will occur until the metered quantity of impregnant has migrated substantially uniformly throughout the thickness of the web from the plane faces thereof.

10. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising individually wetting each of the plane faces of a felt web, the initial temperature of which is below 212° F., with a metered quantity of a melted impregnant having a melting point of about 90° to 110° F. heated to a temperature materially above such melting point; and applying heat to said coated web to maintain the temperature of the impregnant at or above about 200° F. from the time of application until the impregnant has migrated throughout the thickness of the web from the plane faces thereof.

11. In the method of forming a uniformly impregnated felt web incorporating in the range of about 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising individually wetting each of the plane faces of a felt web, the initial temperature of which is below 212° F., with a metered quantity of a melted impregnant heated to a temperature materially above its melting point; rolling said web into a convolute roll; placing said roll in a heated chamber; and maintaining the temperature of said roll in excess of the melting point of said impregnant and at a temperature at which migration of the impregnant will occur until such time as said sheet exhibits a substantially uniform impregnation from face to face thereof.

12. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising wetting the plane faces of a felt web with a melted impregnant by applying said impregnant to the said faces individually; engaging the wetted surfaces prior to any material penetration of the impregnant into the body of the felt to remove impregnant from the surfaces thereof; and maintaining the temperature of said impregnant constantly above the point where congelation of the impregnant will occur until the impregnant has migrated substantially uniformly throughout the thickness of the web.

13. In the method of forming a uniformly impregnated felt web incorporating materially less than the total impregnant carrying capacity of the web, the steps comprising wetting the plane faces of a felt web having a normal moisture content, the initial temperature of the web being below 212° F., with a melted impregnant heated to a temperature materially above its melting point, by applying said impregnant to the said faces individually, engaging the wetted surfaces prior to any material penetration of the impregnant into the body of felt to remove impregnant from the surfaces thereof, and maintaining the temperature of said impregnant constantly above a point where congelation of the impregnant will occur until the impregnant has migrated substantially uniformly throughout the thickness of the web from the faces thereof.

14. In the method of forming a uniformly impregnated felt web incorporating in the range of 10% to 30% impregnant calculated on the total impregnant carrying capacity of the web, the steps comprising wetting each of the plane faces of a felt web having a bulk factor ranging from 1.25 to 1.45, a kerosene saturation value ranging from 260% to 295%, a densometer reading of 2 to 6 seconds, and a normal moisture content of about 3% to 4%, the initial temperature of the web being below 212° F., with a melted impregnant having a penetration factor above 200 and below 350 at 77° F. heated to a tempera-

ture materially above its melting point by introducing one plane face to a film of said melted impregnant carried by a supporting surface, to transfer a portion thereof to said web; removing a portion of the impregnant thus applied to said web immediately after application thereof; and, prior to any material penetration of the same into the body of the felt, introducing the coated web to a bath of said melted impregnant engageable with the face opposite the previously coated face; moving said web rapidly through the zone of said bath to apply a thin film of impregnant to the face of the web; forming the web into a convolute roll prior to decrease in the temperature of the impregnant to a point where congelation thereof will occur; and maintaining said rolled felt web at a temperature materially above the melting point of the impregnant until the impregnant has migrated substantially uniformly throughout the thickness of the web from the faces thereof.

ARTHUR L. JENNINGS.
WALTER F. MITCHELL.
ERWIN A. WORM, JR