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MANUFACTURE OF BITUMINIZED FELTS

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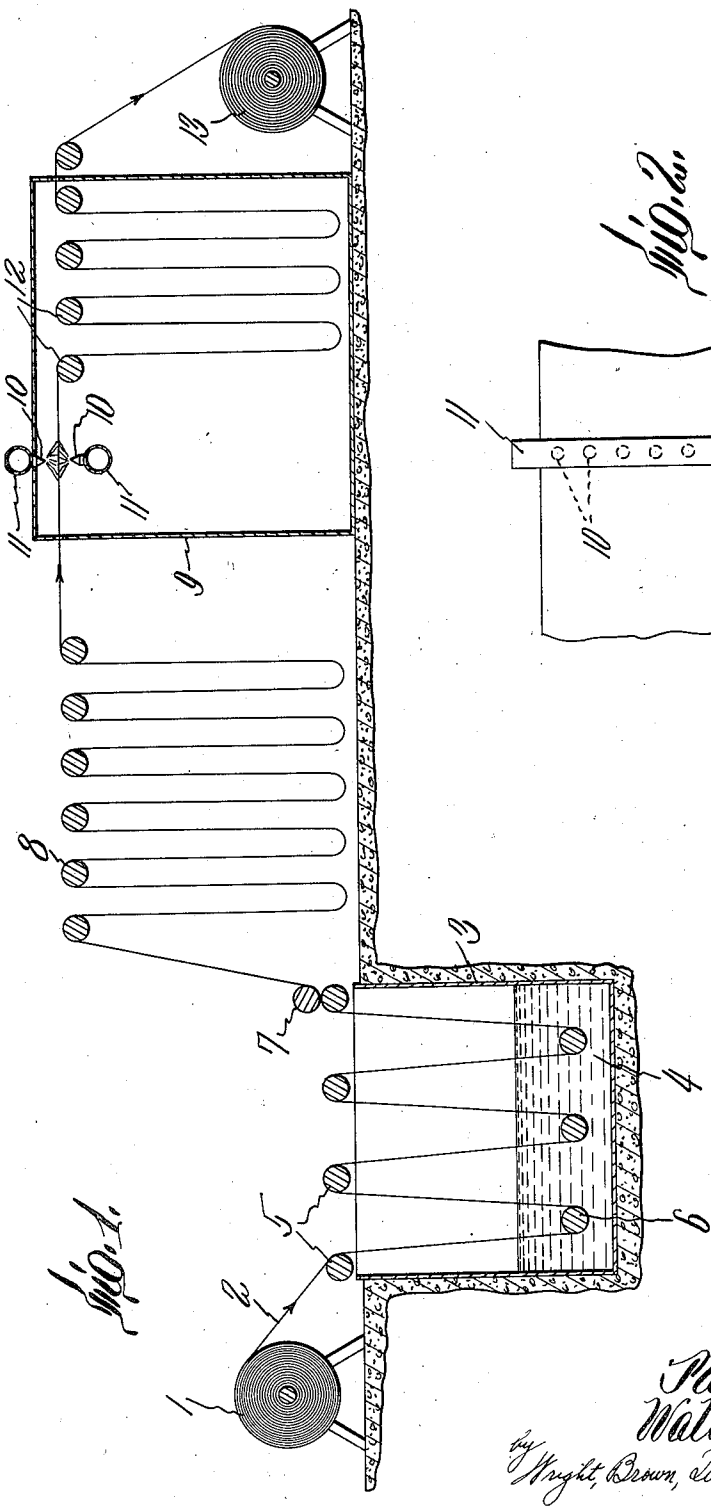


Fig. 1.

Fig. 2.

Inventors
Milton O. Schur
Walter L. Hearn
by Wright, Brown, Quinby & May Attys

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MANUFACTURE OF BITUMINIZED FELTS

Milton O. Schur and Walter L. Hearn, Berlin, N. H., assignors to Brown Company, Berlin, N. H., a corporation of Maine

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7 Claims. (Cl. 91—70)

This invention relates to the manufacture of bituminized felts such as are to serve for roofing, flooring, and similar purposes. Such bituminized felts are usually made by producing the felt essentially from cellulose fiber on machinery of the paper-making type and then running the felt through one or more baths of molten asphalt which enters uniformly into and throughout the felt as an impregnant imparting water-repellency, strength, tear resisistance, and other desired qualities to the product.

It has been found that bituminized felts of greatly improved characteristics, including strength and tear resistance, may be had by using refined cellulose pulp in substantially unhydrated condition as a component in the felt-making furnish. Indeed, it has been found possible through the use of refined wood pulp in substantially unhydrated condition as the main raw material for felt-making to arrive at felts which, notwithstanding their lack of high strength and tear resistance in their raw or unimpregnated state, yield bituminized sheets which are practically tearproof. In applying this knowledge to actual practice, however, it was found that there was great variability in the toughness of bituminized sheets made at different times, despite the fact that all were prepared in the same way, that is, from the same kinds and amounts of fiber and impregnant. In some instances, the bituminized sheet would have remarkably high toughness, whereas in other instances, a bituminized sheet of similar composition would be of comparatively poor tear resistance and other physical qualities.

We have discovered that the physical qualities possessed by bituminized sheets of the foregoing character are tied up with the amount of moisture present in such sheets and more especially that such bituminized sheets will not display optimum physical characteristics unless moisture in appropriate amount is distributed therethrough. It is thus seen that when the bituminized sheets are prepared in an atmosphere of relatively low humidity, they will not acquire the same toughness as they do in a comparatively humid atmosphere. This accounts for what appeared to be the freakish and inconsistent results heretofore realized in preparing the bituminized sheets. In this connection, it is to be remarked that the hot molten asphalt, with which the felt contacts during the bituminizing operation, evidently expels all the free moisture present in the felt, so that the toughness developed in the bituminized sheet heretofore depended upon the moisture which the bituminized felt picked up from the atmosphere while passing from the saturator to the wind-up roll. Once wound up into a roll, the sheet material constituting the interior of the roll remains practically unchanged even though the surface layers of the roll undergo improvement by virtue of being humidified by the moisture in the atmosphere.

In accordance with the present invention, therefore, the bituminized sheet is humidified with sufficient moisture so that it becomes possessed of the maximum potential strength, tear resistance, and other physical qualities. In the case of a bituminized sheet designed for roofing purposes, the humidification of the sheet may be effected from either or both faces, whereas a bituminized sheet to serve as a floor covering may be humidified from its back face after it has undergone ornamentation as with linseed-oil-paint and has gone through the baking oven wherein the linseed-oil-paint is oxidized or dried, thereby avoiding any tendency for the moisture to impair the linseed-oil-paint or other ornamental finish. In both cases, however, the finished sheet is wound up tightly as a roll wherein the moisture has ample opportunity to diffuse with minimum loss by evaporation into the air. In some instances, as when the roll is to be stored for a considerable period in a dry atmosphere, it may be desirable to keep the rolls sealed from the atmosphere as by wrapping them in moisture-proof paper, cellophane, or the like, thereby preserving the bituminized sheet throughout in the proper humor until it is to be used. Once having become humidified throughout, the bituminized sheet parts reluctantly with its moisture content and, under most prevailing atmospheric conditions, retains sufficient moisture therein to remain at its maximum potential toughness. Once having been used or laid, it is not so essential that the bituminized sheet possess optimum qualities, but even when it is exposed to comparatively dry atmosphere, it loses but little of its toughness, as it practically never meets in service with conditions under which it becomes dehydrated to the bone-dry condition which it sometimes acquires as a result of the bituminizing operation and wind-up into a roll before it has had an opportunity to pick up moisture from the atmosphere.

While there are various ways in which to humidify the bituminized sheet, as for instance by exposing it to an atmosphere saturated with water vapor, it is preferable to spray a fine mist

of water onto either or both faces of the sheet immediately before it is wound up tightly as a roll. In the case of a sheet which is being impregnated in a roofing machine, spray nozzles may be set up across the machine near the wind-up roll and water may be supplied to the nozzles by a positive pressure pump geared to the machine so that the sheet will receive on either or both its faces the appropriate amount of water as it is being wound up. Although the exact amount of water added to the sheet does not appear to be a critical matter, it is preferable that the sheet take on at least about 5% to 10% of water, based on the weight of fiber, as this amount of moisture ensures a development in the sheet of optimum physical qualities.

In order to demonstrate the beneficial effects attending the practice of the present invention, I shall take as a concrete example, a tightly wound roll of smooth-surface roofing which was prepared without having undergone humidification. Although this roofing contained as its base a felt whereinto refined wood pulp in substantially unhydrated condition had entered as raw material, it was found that the interior of the roll was much lower in tear resistance than the exterior of the roll which had evidently picked up moisture from the atmosphere and had thus been improved in its physical qualities. This roll was unwound and sprayed on its surface with a very fine mist of water as it was being tightly rewound. For purposes of comparison, a second similar roll of roofing was unwound and rewound under similar conditions without, however, the addition of moisture to the sheet. After both rolls had stood about for a week, samples were taken from the interior of each roll and tested. The results follow:—

	Dry sample	Moistened sample
Starting tear	5.0	7.5
Running tear	1900	3300
Mullen test	225	250

The foregoing values for starting tear and running tear are expressed in arbitrary units.

It is thus seen that the improvements brought about through the spraying of water onto the sheet are striking and highly important. The fact is that whereas the sprayed sample was practically tear-proof, the other was comparatively easily torn by hand. There was no evidence of free moisture on the sprayed sample.

On the accompanying drawing,—

Figure 1 illustrates diagrammatically and conventionally apparatus, including spray nozzles, such as may be used in practicing the present invention.

Figure 2 is a fragmentary plan view of the apparatus showing a bank of nozzles arranged to spray across a face of the sheet.

The apparatus shown in Figure 1 is intended to illustrate the practice which may be adopted in preparing roofing in accordance with the present invention. As shown therein, a roll 1 of raw felt may be mounted for unwinding at one end of the apparatus. The felt sheet 2 coming progressively from the roll may be passed through a vat 3 holding a bath of molten asphalt 4 of the appropriate character. The asphalt may, for instance, be one having a melting point of about 130° F. (ball and ring test) and be at a temperature of about 385° to 400° F. in the bath. The sheet may be looped as between upper guide rolls 5 and lower guide rolls 6 as it is passing through the vat 3. Upon emerging from the vat, the bituminized sheet may be passed through a pair of squeeze rolls 7 which serve to remove excess asphalt from the sheet, the excess flowing back to the bath 4. The squeezed sheet may then be cooled so as to cause a congelation of its asphalt content. The sheet is shown passing upwardly from the rolls 7 to a set of rolls 8 on which the sheet is festooned with sufficient sheet area exposed to the atmosphere to ensure a congelation of the asphalt. Any other suitable cooling means, such as hollow drums through which cold water passes, may be provided for this purpose. The cooled sheet may then pass into a humidifying chamber 9, wherein both its surfaces may receive a fine mist of water delivered from a series of spray nozzles 10 arranged immediately above and below the sheet. The upper and lower bank of spray nozzles each communicate with a manifold 11 extending across the sheet and supplied with water under pressure from a suitable source (not shown). After thus being sprayed, the sheet may remain in the chamber as loops defined by a series of rolls 12, thereby ensuring good diffusion of the free water into the interior of the sheet before it emerges from the chamber. The humidified sheet may finally be rewound tightly into a roll 13 for storage and shipment.

While it is difficult to explain with accuracy the role which moisture plays in developing the qualities desired in the bituminized sheet, nevertheless it is probably the case that the moistened fibers are more pliant or flexible than fibers which are dehydrated or bone-dry. In a bituminized sheet containing a felt base, whose fibers are in a refined and substantially unhydrated condition, the tear resistance and other desired qualities apparently hinge upon the ability of the fibers to glide or move relatively when a tearing stress is applied to the sheet. In other words, a tearing stress cannot be concentrated locally and cause rupture or tearing of the sheet so easily as is the case when the fibers are bonded together by the gelatinized or hydrated cellulose present in a sheet prepared from beaten or hydrated pulp, or from pulp which, by virtue of impurities present therein, tends to form a comparatively dense and impenetrable sheet whose fibers are stuck together by the hydrated impurities. The function of the moisture is evidently that of improving the pliancy or flexibility of the fibers of the sheet, so that their tearing is inhibited, as well as to enhance the pliability of the saturated sheet as a whole, rendering it less brittle.

While the principles of the present invention are applicable to various kinds of bituminized felted sheets, they are, as already indicated, more especially of value in connection with bituminized felts containing refined cellulose pulp in substantially unhydrated condition as an essential raw material, as such latter sheets are capable of developing extraordinary toughness, whereas bituminized sheets as heretofore made, e. g., bituminized rag felts, inevitably possess a low order of toughness and can be improved comparatively little in this respect. The refined cellulose pulp employed in the sheets of the present invention may be prepared as by exposing the usual chemical wood pulps, e. g., kraft or sulphite pulp, to the action of alkaline liquors under conditions resulting in an extraction of a substantial proportion of the non-alpha cellulose components from

the pulp, for instance, bringing the alpha cellulose content of the pulp to at least, say, about 93% or greater. In some instances, as when sulphite pulp is being refined, a dilute alkaline liquor and comparatively high temperature may be advantageously relied upon in bringing about this refinement. On the other hand, a pulp may be refined in strong alkaline liquors at comparatively low temperatures, for instance, in liquors of sufficient concentration to mercerize the pulp. Rag or other cellulose pulp may be similarly refined. In any case, however, the pulp, refined or otherwise, entering into the felt-making furnish should be maintained in a substantially unhydrated condition in order to yield a bituminized sheet of the desired toughness. Even when extraneous binders, such as starch, gelatinized cellulose, etc., are added to the felt-making furnish so as to improve the flexing qualities of the felt, the course of keeping the refined cellulose pulp component in substantially unhydrated condition should be pursued in order to arrive at a bituminized felt having the desired physical characteristics. The moisture applied to the surface of the bituminized sheet undoubtedly works its way into the sheet through the tiny, almost microscopic imperfections in the bituminous films deposited on the surface of the sheet and on the fiber surfaces. This diffusion of moisture into the sheet is, as already indicated, quite rapid, but it may be desirable to add to the water sprayed onto the sheet surface a small quantity, say, 0.05% of a fungicide, such as sodium fluoride, sodium phenol-phenolate, mercuric chloride, or the like, so as to discourage molding which might under some circumstances otherwise occur while water is diffusing uniformly into and throughout a tightly rolled sheet.

We claim:—

1. A method which comprises ornamenting with siccative liquid coating material one face of a bituminized sheet containing interfelted cellulose fiber, drying the ornamentation, and then humidifying the sheet from its unornamented face.

2. A method which comprises ornamenting with linseed-oil-paint one face of a bituminized sheet containing interfelted cellulose fiber, baking the sheet, and introducing moisture into the sheet through its unornamented face.

3. A method which comprises ornamenting with linseed-oil-paint one face of a bituminized sheet containing interfelted cellulose fiber, baking the sheet, spraying water onto the unornamented face of the sheet, and winding the sprayed sheet into a roll.

4. A floor-covering consisting of a bituminized felt comprising cellulose fiber carrying an ornamental coating on one face and having at least about 5% to 10% of water, based on the weight of fiber, substantially uniformly distributed therethrough.

5. A floor-covering consisting of a bituminized felt comprising cellulose fiber carrying linseed-oil-paint ornamentation on one face and having at least about 5% to 10% of water, based on the weight of fiber, substantially uniformly distributed therethrough.

6. A rolled sheet of floor-covering consisting of a bituminized felt comprising substantially unhydrated cellulose fiber having an alpha cellulose content of at least about 93%, said covering carrying linseed-oil-paint ornamentation on one face and having at least about 5% to 10% of water, based on the weight of fiber, substantially uniformly distributed therethrough.

7. A method which comprises bituminizing a felt containing refined cellulose pulp of an alpha cellulose content of at least about 93% and in a substantially unhydrated condition, and humidifying the bituminized felt to a moisture content in an amount of at least about 5%, based on the weight of pulp, sufficient to produce therein optimum starting and running tear resistance and toughness characteristics.

MILTON O. SCHUR.
WALTER L. HEARN.