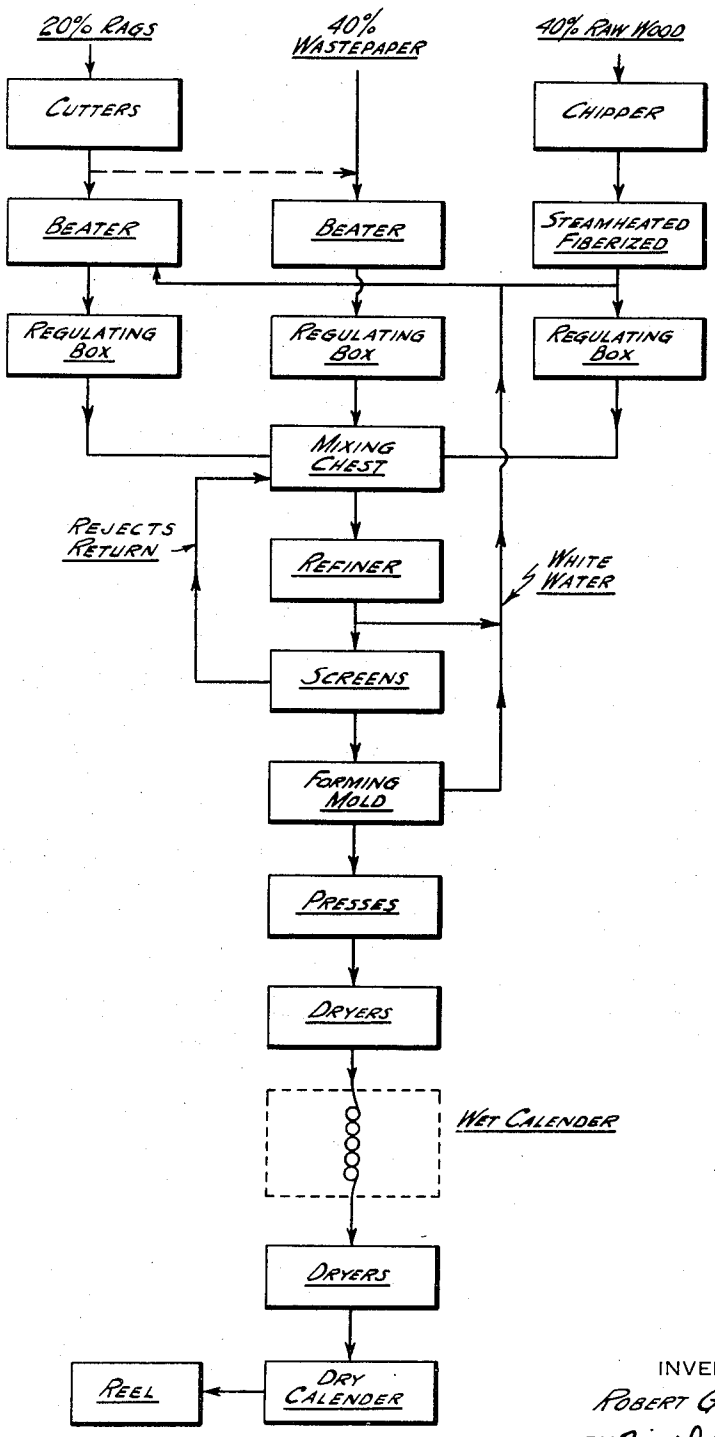
April 11, 1950 R. G. QUINN 2,503,454

ROOFING FELT

Filed Dec. 9, 1944



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Patented Apr. 11, 1950

2,503,454

UNITED STATES PATENT OFFICE

2,503,454

ROOFING FELT

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Application December 9, 1944, Serial No. 567,444

2 Claims. (Cl. 92—3)

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This invention relates to a felted sheet and a method of making the same. The invention is particularly concerned with a felted sheet of high wood fiber content impregnated, or adapted to be impregnated, with asphalt pitch or other waterproofing saturant commonly used in the manufacture of prepared roofing.

In the manufacture of felted fiber sheets for roofing and similar purposes, it is customary to use a minimum of about 50% by weight of rag fibers, mixed with smaller proportions of raw wood fibers and waste paper. The raw wood fibers and waste paper are relatively inexpensive as compared to the rags. In addition, the wood fibers and waste paper require less expenditure of power to put them into condition suitable for felting. However, use of large proportions of raw wood fibers is generally avoided in the manufacture of satisfactory felted sheets because of the tendency of a large proportion of raw wood fibers to reduce strength, increase surface roughness and to develop excessive absorptiveness or bulk of the finished sheet. Moreover, use of large proportions of waste paper is generaly avoided in the manufacture of satisfactory felts because of the tendency of large proportions of paper to retard the drainage rate of water from the fibers in the felting stage and to produce sheets of insufficient pliability and absorptiveness or porosity.

A primary object of the present invention is to provide a method of imparting substantially optimum characteristics of pliability, bulk or absorptiveness and strength to roofing felts containing not to exceed 25% rag fiber by weight together with larger proportions of raw wood fibers and waste paper.

Another object is to provide a felted sheet containing larger proportions of raw wood fibers and waste paper and smaller proportions of rag fibers, as compared to prior practice, and having suitable pliability, absorptiveness, tensile and bursting strength and smooth surface characteristics for use as prepared roofing felt.

A still further object is to provide a simple and economical method of manufacturing roofing felts of high raw wood fiber content and low rag fiber content to meet conventional high rag fiber felt specifications.

With the above objects in view, the invention consists in the improved felted sheet and method of manufacture which are hereinafter described and more particularly defined in the accompanying claims.

In the following description of the invention

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reference will be made to the attached drawing, which shows a flow sheet of a preferred embodiment of the method for producing the improved product.

The felted sheets which form the subject of the present invention preferably incorporate at least 35% dry weight of raw wood fibers and at least 30% of disintegrated waste paper or news fibers, with not to exceed 25% of rag fibers. The process of the invention is such as to enable the use of the cheaper grades of rag fibers; for example, a preponderance of conventional rag fiber designation grades 3 and 4, containing fibers that in conventional beating and felt making steps would be excessively hydrated.

Raw soft wood fibers suitable for incorporation in the felted sheets of the present invention may be prepared by the Asplund process according to which raw wood chips are fiberized in the presence of steam. Suitable Asplund fibers for the present purpose have approximately the following optimum size classification:

10% retained on a standard 8 mesh screen,
56% retained on a standard 28 mesh screen; and
Not to exceed 20% through a 200 mesh screen.

A chemical analysis of pine wood chips which may be fed to the Asplund fiberizer shows about 61% cellulose, 25½% ash-free lignin, 8% pentosans, 2½% water soluble material and the balance chiefly materials soluble in alcohol and ether.

Waste paper may be disintegrated and dispersed by charging it to a conventional beater or pulper and subjecting a water suspension of the paper to the action of a beater roll for a period of about one-half hour, or until such time as the paper is fully disintegrated and dispersed in fine fiber form. A weighed portion of rags may be reduced to suitably fine fiber condition by subjecting them to the operation of rotary cutters. The cut rag fibers may then be subjected to treatment in a beater in the presence of water to further fiberize the rags and to effect hydration softening of the rag fibers.

The rag fibers which are charged to the rag beater may classify 30–40% through a standard 4 mesh screen and retained on a standard 8 mesh screen, 30–40% through an 8 mesh screen and retained on a 14 mesh screen, and not to exceed 10% through a 100 mesh screen. The disintegrated and pulped paper fibers are fine, short fibers which may classify 1–10% through an 8 mesh screen and retained on a 14 mesh screen, 30–60% through a 14 mesh and retained on a 100

mesh screen, and 35–50% through a 100 mesh screen.

After separate beater treatment of the rag fibers and waste paper, these fibers may be fed through regulating boxes to a suitable mixing chest or other mixing device. Alternatively, the dry fibrous rag material may be added to the beater operating on the waste paper, and the beating operation may be continued therein for a period sufficient to develop a uniform blend or dispersion of the fiberized paper and rag fibers. The raw wood fibers may be introduced through a regulating box to the mixing chest immediately prior to transferring a dilute charge of the rag fibers, paper fibers and raw wood fibers to a refiner of the Jordan type. The consistency of the fiber furnish which is introduced to the refiner may average about 3.6% solids.

Actual proportions of fibers which were present in a furnish employed in the manufacture of a suitable roofing felt by the present method were as follows:

	Per cent
Mechanically fiberized raw wood fibers	41.7
Rag fiber	20.6
Waste paper fiber	37.6

The dilute furnish which is discharged from the Jordan refiner may be transferred to riffles or screens which operate to separate oversized materials which may be present in the furnish. After passing these riffles or screens, the fiber content of the furnish is formed into a water laid felt, as on a forming wire or the mold of a cylinder paper machine. The interfelted fiber web which collects on the forming screen of the paper machine is subjected to partial dewatering by the conventional press rolls and preliminary drying rolls of a standard paper machine. The water which is separated from the felt on the paper machine may be recycled through a white water return system for addition to the fibers at beater and refiner stages in the fiber preparation steps of the process.

The felt is very free, as determined by testing the fiber stock from which the felt is formed. In a typical run, the mixed fiber furnish delivered from the refiner to the forming screen had a slowness of 17.3 seconds per gram for a 2 gram sample, tested by the Motschman slowness test. This freeness, as measured by the slowness test, indicates the readiness of water removal during the felting stage, and also the readiness with which the felted sheet may be impregnated when the felt is later saturated with a material such as asphalt. The mixed fibers in the furnish charged to the machine had a size classification of 5.8% retained on an 8 mesh screen, 41.6% retained on a 28 mesh screen, 12.8% retained on a 48 mesh screen, 10.3% retained on a 200 mesh screen, and 29.5% through a 200 mesh screen.

No paper or felt of satisfactory pliability, kerosene absorption number and smooth surface characteristics can be produced by following conventional paper machine practice, when employing a furnish containing the high proportions of raw wood and paper fibers which are present in the felts forming the subject of this invention. For this reason the conventional paper machine cycle is modified in the practice of the present method, to the extent of interposing a multi-roll calender stack having at least 4 superposed rolls, in the drying drum section of a conventional paper machine, at a point about one-third of the way through the drying drum section. This

modification of conventional paper machine practice rests on the discovery that roofing felts consisting chiefly of fiberized raw wood fibers and waste paper fibers, and containing not to exceed approximately 25% of rag fibers, have imparted thereto properties substantially identical with conventional felts of about 50% rag fiber content if, in the manufacturing cycle, the felt is subjected to a wet calendering treatment at a period in its drying cycle when it contains 25–45% water. Such wet calendering treatment is designed to effect a permanent caliper reduction of about one-fourth at this point of the manufacturing cycle.

A moisture test taken on a felt immediately after it passes the press roll section of the paper machine, showed a moisture content of approximately 64%. This moisture content is reduced during passage of the felt over approximately the first one-third of the drying drums, to about 25–45%. The initial caliper of a wet felt of about 38% moisture was .080". When a felt of .080 caliper and 38% moisture was subjected to a wet calendering operation involving four successive nips between the bites of super-imposed calender rolls, it was reduced to a final caliper of approximately .060". The sheet was thereafter completely dried by traversing the remainder of the drying drums on a conventional machine. A final dry calendering treatment produced a dry sheet of about .057" caliper. A roofing felt of the previously indicated composition which was manufactured in accordance with the cycle just described, exhibited the following properties:

Weight, 52.2 lbs. per unit of 480 sq. ft.
Caliper, .057".
Mullen, 29 lbs. per sq. in.
Longitudinal tensile strength, 26 lbs. per sq. in.
Sufficient flexibility to be bent around a ½" mandrel without cracking.
Kerosene absorption, 150%.

When a roofing felt of the above specified composition was completely dried, omitting the wet calendering step, and was then dry calendered to a caliper of about .060", the caliper of such felt increased by swelling to approximately .075" when the sheet was passed through a saturating bath of hot asphalt impregnant. In other words, any reduction of caliper which is effected solely by dry calendering is not effective for producing felts which resist excessive increase of caliper, with resultant excessive absorption of saturant, when passed through a bath of hot saturating asphalt. On the other hand felts which are subjected to a wet calendering treatment by the present method may be saturated with hot asphalt without increasing the caliper by more than 6% and without serious affect on the pliability and optimum absorptive properties of the sheet.

Felted sheets can be made by the present process having tensile strengths of 25–45 lbs. per square inch, sufficient pliability for bending around a ½–¾ inch mandrel without cracking, and having kerosene absorption values of 140–160%, in which the rag fiber content may range from 0–25%, the paper fiber content from 30–40%, and the raw wood fiber content from 35–60%. Such sheets have a bulk index which is relatively low for a given kerosene value, i. e. from 1.0 to 1.3. The bulk index is calculated by dividing the thickness of the felt in mils by the weight in pounds per 480 square feet.

The kerosene absorption measures the amount of saturant that may be absorbed, and is ob-

tained by immersing the dry felted sheet in kerosene for 1 minute, removing the sheet, allowing it to drip for two minutes, weighing the thus drained material, and calculating the increase in weight over that of the original sheet as percentage increase in weight.

By the present invention a felted sheet containing approximately 40% raw wood fibers, 40% news fibers and only 20% rag fibers, can be made to substantially the same pliability, strength, weight and saturant absorption specifications which are conventional for standard felted sheets of the same approximate weight containing 50% rag fibers. The following table presents comparative physical characteristics of a standard 50 lb. felt containing 50% rag fibers, 25% raw wood fibers and 25% news fibers, and a felt made in accordance with the present invention containing only 20% rag fibers.

	Standard 50# Felt 50% Rag Fibers	Present 50# Felt 20% Rag Fibers
Thickness.....inches..	.057	.057
Weight per 480 sq. ft.....	55.1	56.2
Saturating rate—Xylol.....seconds..	35.7	35.0
Kerosene Value—Dip Method .....percent..	152	150
Strength—2 inch Strip—Dry (Longitudinal).....pounds..	61.6	47.6
Saturated Asphalt—1 min. at 400° F., Hot Strength.....	29.0	29.3

The step of calendering the sheet at a period in its drying cycle when the sheet retains 25–45% moisture by weight, is carried out while the sheet is hot, i. e. at about 170° F. Optimum results have been obtained when the sheet is run through a stack of 4–5 calendering rolls, thereby reducing the caliper of the moist sheet by approximately 20–30% by 3 to 4 wet nips between calender rolls, followed by drying and by dry calendering with 3 to 4 dry nips. The wet calendering operation is made feasible by the presence of 30–40% of paper fiber in the furnish, which imparts to the sheet sufficient wet strength to bind and hold the raw wood fibers and rag fibers together during the wet calendering operation.

A dry felt of high wood fiber content made as herein described may be saturated for use as waterproof sheet roofing by impregnating with a bituminous saturant. For example, a dry felted web of about 1.1 bulk index was impregnated with an asphalt saturant having a melting point of about 125° F. (ring and ball test), by immersing the dry felt in a bath of the asphalt maintained at a temperature of about 400° F. A short period of immersion, as for example 2–5 minutes, is sufficient to impregnate the felt throughout with 130–150% of its weight of the asphalt saturant.

Since many variations may be made from the illustrative details given, without departing from the scope of the invention, it is intended that the invention should be limited only by the terms of the claims interpreted as broadly as consistent with novelty over the prior art.

What I claim is:

1. A pliable roofing felt which resists substantial increase of caliper during impregnation with hot asphalt, comprising 35–60% mechanically fiberized steam softened soft wood fibers by weight, together with 30–40% fiberized waste paper and 0%–25% mechanically fiberized rag fibers, said felt having a bulk index of 1.0–1.3, a kerosene absorption of about 150% and sufficient pliability for bending around a ½–¾" mandrel without cracking.

2. A pliable roofing felt which resists substantial increase of caliper during impregnation with hot asphalt, comprising approximately 60% mechanically fiberized steam softened pine wood fibers by weight, and approximately 40% fiberized waste paper, said felt having a bulk index of 1.0–1.3, a kerosene absorption of about 150%, and sufficient pliability for bending around a ½–¾" mandrel without cracking.

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