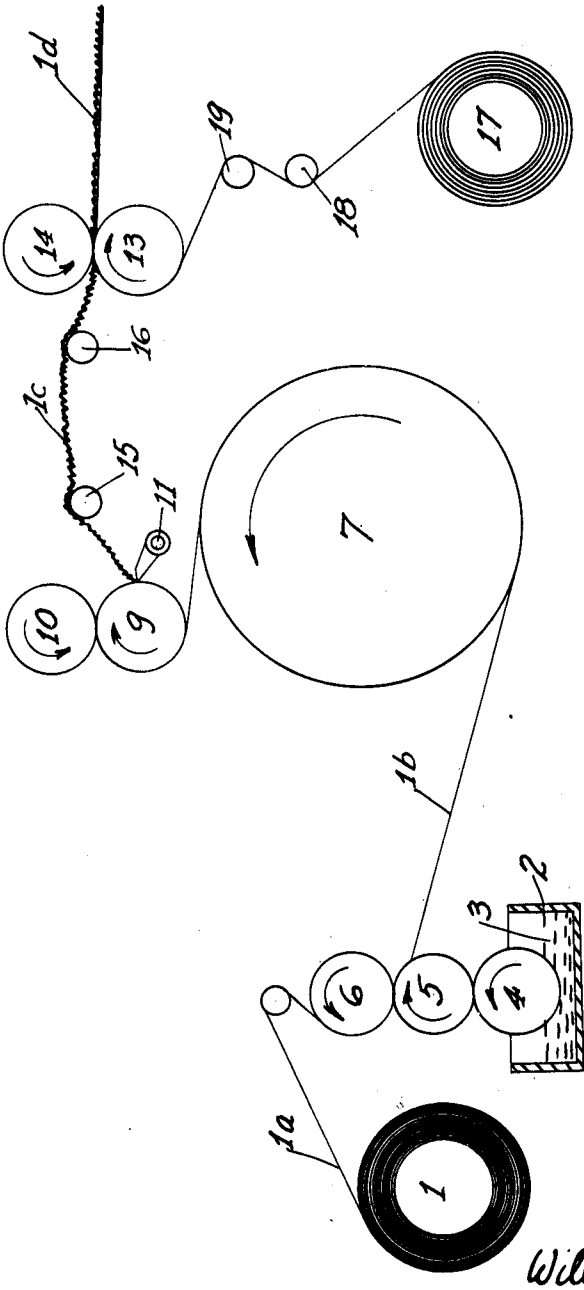
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CREPING PROCESS

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CREPING PROCESS

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In my Patent No. 1,628,515, I have described a process of creping materials which differs from ordinary creping processes in that the type of adhesive which I use to bind the paper to the creping roll is a water repellant, heat plastic substance such as asphaltum and no water need be used in the creping process at all. My present invention relates to this process and is in the nature of an improvement thereon.

In order to understand the nature of my present invention, it is necessary to consider first the differences between the process of creping by means of a heat plastic waterproofing substance, and the product obtained thereby, and the practices and products of the prior art, and secondly the general problems of creping and the specific problems presented by the process of creping through the use of a heat plastic adhesive.

In creping processes such as were practiced in the art before my invention, paper webs were wet with water and led over a creping cylinder to which they adhered. The chief reason for this adherence I believe to be the pressure of the air in holding the sheet of paper down against a cylinder into contact with which it has been tightly pressed, the water serving as a seal against the entrance of air between the paper and the roll. Consequently, a primary function of the water (aside from its softening effect upon the fibers) is to assist in forming a vacuum seal so that the sheet may be tightly bound against the creping cylinder until it is removed therefrom by the doctor blade which does the crinkling. While the crinkling action is very greatly facilitated by the softening of the fibers, nevertheless this process becomes less effective the heavier and stiffer the paper web becomes. In my process on the contrary, I am not relying upon any vacuum seal to bind the paper to the creping cylinder. No water need be used with my process and if used, its use is incidental to the process and valuable chiefly I believe, in the softening of the fibers and the production thereby of a somewhat different character of crepe. Of course, a vacuum seal may somewhat reinforce the adhesive action. However, I bind my paper to the creping roll through the positive adhesive action of a heat plastic substance; and in this way I achieve a creped product characterized by unusual uniformity and fineness of the crepe and absence of skips. In this way also I am enabled to crepe papers of such weight and stiffness as to be impossible of ordinary creping by any other process of which I am aware. That my process is not dependent upon a vacuum seal, I believe to be definitely shown in this, that I can obtain an excellent crepe with a discontinuous coating of asphalt or even a speckling of the sheet with interspaced dots of asphalt. The most of my work however, is concerned with the creping of heavy papers with comparatively thick films of asphalt thereon, such for example as kraft paper of say 30 pounds weight, asphalt coated, and either single or duplexed. Such papers when creped are adapted for a wide variety of uses. An exemplary use and one to which this invention is also addressed, is in the manufacture of bags and other articles from asphalt creped paper, backed with such a fabric as burlap.

Creping processes involve a number of variables and are capable of modification in several ways as by the configuration of the creping knife, the angle of the creping knife, the pressure used and the like. Water creping processes with the heavier papers have uniformly been characterized by a comparative coarseness of crepe, and skips, at the edges of the sheet and elsewhere where a chance perforation broke the vacuum seal. Sometimes in addition to being merely wet, the paper has been treated with glue in water solution so as to increase the adhesion of the paper to the creping roll. In all water creping processes, the paper had to be dried by passing it over drying cylinders, or otherwise, after the creping step. The product was not waterproof of course, unless the paper itself had previously been treated to make it so, and even then the product was waterproof only in the sense that one side thereof had been treated with a water repellant substance. A heavy sheet rendered waterproof by impregnation, could not of course, be creped, because

it could not be sufficiently water softened or caused to adhere sufficiently to the creping cylinder by water.

A further characteristic of water creped products is this, that during the wetting step the fibers become softened somewhat by the moisture, and the size of their surfaces is to a considerable degree softened. The creping step is a severe deformation of the web structure; the impermeability due to the original sizing is never entirely restored when the web is dried, but to the extent that it is restored, it results in a stiffer product because of the resetting of the web in the deformed state. In other words, such creping processes result in a comparatively stiff crepe and a loss of certain valuable characteristics.

As already pointed out, the process of my Patent #1,628,515 involved the coating of a web with a water repellant heat plastic substance such as asphalt, and the use of this substance, while plastic and adhesive under heat, for causing the positive adhesion of the web to the creping roll from which the doctor blade removes it. The result of this process is a much more positive crinkling, a more uniform and finer crepe with a velvety appearance, an absence of skips in commercial practice, and a softer product which is suitable for many purposes for which the products of the prior art are not so effective. Again, my product is crinkled after the application of a uniform water repellant coat so that I obtain a waterproof product without being confronted with the problems involved in coating an already crinkled sheet and without having to provide means for drying the wet crinkled product. With a light coating of bitumen, the coated layer would be practically uniform within and without the crinkles; and with both heavy and light coatings, I am enabled to secure complete coverage. Further, the adhesive may be used in such amounts as to permit the fastening of a backing material to the creped web without the necessity of additional coats of adhesive. Further, as already pointed out, the nature of the adhesive substance and its positive adhesive characteristics make it possible for me to crepe materials which hitherto could not be creped, or could only be creped with the utmost difficulty. I am thus able to handle heavier paper webs, duplex paper webs cemented together by waterproofing substances, reinforced webs, composite webs of paper and cloth, and the like; furthermore, I am not restricted to the use merely of coated webs but I am able to crepe saturated webs as well, since it is not necessary to leave the web itself unsaturated and permeable to moisture or water dissolved adhesive.

The old creping processes resulted in a coarse crepe characterized by skips but otherwise uniform, and were susceptible of some variation through the temperature of the water, the filing of the knife, the use of water soluble adhesive in solution, and the finish of the paper. Similarly the process described in my patent #1,628,515 turns out a uniform and satisfactory product characterized by fine crepe, absence of skips, softness and the like, but one not capable of very wide variations. The filing and angle of the knife will of course produce different characteristics; but my process is largely independent of the finish on the paper, and the lack of variations is largely due to lack of temperature control, since in the process described the temperature of the asphalt applied by the roll running in the asphalt bath, is to a very considerable extent, at least, modified by the temperature of the fluid asphalt bath itself.

Nevertheless variation in the creped product is highly desirable. The purpose of creping paper is usually to give it one or more of the following qualities, among others:

1. Elasticity or resiliency.
2. A cushion effect.
3. Insulation value from air pockets in the crepe.
4. Pliability or softness.
5. Strength through stretch.
6. Stiffness parallel with the lines of the crepe.
7. Limpness transverse to the lines of crepe.
8. Ability to conform to irregular or uneven surfaces.

It can readily be seen that some of these qualities are best attained with coarse crinkling and others with fine crinkling. A mill therefore to produce satisfactory products for a wide range of uses with a minimum number of different raw materials and a minimum of productive machinery must have in addition to such control of the process as will turn out a uniform product, a means for controlling the kind and character of the creping. In creping paper with water repellent heat plastic adhesives, the character of crepe obtained upon a given grade and weight of paper is influenced by the nature of the coating agent used as a binder, by the amount of the coating applied and by the temperature of the coating. The desirability of control is two-fold: it enables the production of different kinds of crepe from the same or different materials; it enables the production of a more desirable and more controllably uniform crepe from the same materials.

It is an object of my present invention to obtain quick, positive and accurate temperature regulation of the coated paper so that the degree of adhesion between it and the creping roll may be controlled at will.

It is an object of my invention to provide for the production of a variety of crinkled

products on one machine from any one character of raw material to be creped.

It is still another object of my invention to provide a crinkled and coated product which is more suitable for the application of backing materials.

It is still another object of my invention to provide for the crinkling of heavier webs than hitherto, with accurate control.

It is still another object of my invention to provide a new character of crinkling in heavy webs.

These and other objects of my invention I accomplish by that certain series of process steps and by those agencies of which I shall now describe a perferred embodiment, reference being had to the drawing which accompanies this specification.

In the drawing, I have shown a diagrammatic illustration of my process, and a mechanism suitable for the practice thereof.

Broadly, my invention comprises steps whereby I secure a temperature control primarily at the point of creping, which involves concomitant temperature control before and after that step. My present invention is addressed particularly to the creping of webs which have been treated with a comparatively thick coating of asphalt or other bitumen, although its use is not confined thereto. The creping of bitumen-treated webs involves primarily the problem of adhesion and secondarily, the problems of creping unsoftened webs where desired, and of creping along with the web a resident film of substance which has its own characteristics.

In order to attain suitable temperature control upon the creping cylinder, I divorce the coating step from the creping step so that I may coat the sheet with the desired amount of water repellant, heat plastic adhesive, and afterwards I eliminate so far as may be necessary, the temperature effect of the coating operation; secondly, I control the temperature to gain the desired adhesion at the point of creping; and thirdly, I may, where necessary, afterward and similarly control the temperature for some other purpose, such as joining the sheet to a backing material.

In the diagram I have shown a starting roll of paper material 1, which may, for illustration, comprise a roll of kraft paper. I provide coating apparatus which may comprise a pan or container 2 for the bituminous plastic 3, which container will be thought of as equipped with a suitable means of supply and suitable means for heating to maintain the substances in a suitable fluid or semi-fluid state for coating. A preliminary roll 4 may turn in this pan of bitumen and transfer to the surface of a coating roll 5, a film thereof. The distance between the rolls 4 and 5 will control the thickness of the film and can be varied at will. The web of uncrinkled kraft 1^a may be led around a riding roll 6 so that one surface of it is presented to the coating roll 5 and receives a coating of the desired thickness. After this, the coated web 1^b will be so treated that the temperature effect of the coating step becomes no longer controlling, to the end that I may separately control the heat at the point of creping. In ordinary practice, I destroy this temperature effect by conducting the coated sheet 1^b through an air gap and thence around the surface of a cooling drum 7 in which is maintained a circulation of cool water. It will be noted in the diagrammatic illustration that the web is led around the cooling drum with its uncoated surface next it, and thence to the creping rolls. This particular procedure has a number of advantages which will be pointed out hereinafter.

My invention however, is not limited to any particular coating or cooling means; thus instead of roll-coating I may coat the sheet by dipping it into a bath of asphalt or other bitumen and then scraping it; I may saturate the sheet by any one of a large number of suitable saturation processes or I may double-roll-coat the sheet as by the concurrent use of a second roll coating apparatus which will coat the other side. Further, the cooling means may be varied as desired without departing from the spirit of my invention. As exemplary of such variations, instead of using the combination of an air gap and a cooling drum, I may use one or more cooling drums alone, an air gap alone providing it be of sufficient length; a cooling device making use of blasts of cooled air or any one or combination of a very large number of other cooling expedients. The essential feature of my process is that I first coat the sheet and then I bring the sheet into condition for separate and carefully controlled temperature regulation upon the creping roll.

In the diagram, 9, is a steel creping roll equipped with heating means for which means of careful temperature control are provided. In ordinary practice, I prefer to equip this roll with electrical heating means which may be provided with automatic thermostatic controls. Above the creping roll 9 is a pressure roll 10 preferably of rubber, the function of which is to press the web into close contact with the creping roll. This roll is made adjustable since the amount of pressure it exerts will modify the crepe to some extent. Creping may be done without any pressure roll under some conditions. In the embodiment described, a sheet coated upon one side is led through the pinch between the rolls 9 and 10 with the coated side against the creping roll 9 to which it adheres strongly, and it is removed from the creping roll by a creping doctor 11. It then is in the form of a crinkled sheet which I have designated as 1^c. The sheet by the coating device is surfaced with asphalt, let

us say, at a temperature close to 400° F., depending, of course, upon the asphalt used. As it passes through the air gap and around the surface of the cooling drum it is cooled to a point at which it is substantially non-tacky. Because it is led around the cooling drum with the paper side next the drum's surface, not only is the asphalt surface cooled, but the body of the asphalt layer is cooled also. In ordinary practice, there is very little heat if any above ordinary room temperature in the web as it reaches the creping roll. Consequently, it is only necessary to maintain the creping roll at such a temperature that the desired tackiness will be produced in the asphalt layer at the surface thereof. This is valuable in a number of ways. In the first place, if a heavy body of asphalt is uniformly quite plastic and adhesive throughout, there may be such bodily slippage of the asphalt coating as to produce an unsatisfactory crepe. If the asphalt coating is too hot, the required adhesion to the creping cylinder will not be obtained. Similarly if the asphaltic substance is too cold, a proper adhesion will not be obtained. In practice, it is necessary to keep the temperature of the creping cylinder only slightly warm, and in commercial operation, it is possible to place the hand upon the creping cylinder without great discomfort. Of course the temperature will vary greatly with the characteristics of the asphalt used and the thickness of the asphaltic coating. It is my practice to crepe paper coated with a very thin asphaltic layer at a much higher temperature than that at which I crepe paper coated with a very heavy asphaltic layer.

Again it is to be pointed out that in creping papers with a very heavy asphaltic layer, the problem is not only to crepe a possibly heavy and stiff sheet of paper but also to deform and crepe a heavy body of asphaltic substance. This can best be done when the body of the asphaltic substance is firmly plastic while the surface thereof is sufficiently softened to bring about the desired strong and positive adhesion. This temperature control is obtained in accordance with my invention by first coating the sheet (with or without impregnation thereof), and then tempering the body of the asphalt coating to the desired consistency, and finally, separately softening the surface thereof to produce the desired adhesiveness. With thick asphaltic coatings, also, I find that the physical nature of the asphaltic layer is of value in the creping, and by a separate coating operation as distinct from the creping operation I can secure the full value of this factor. Thus, although a very smooth asphaltic surface may be obtained by running the coating mechanism quite hot, or by smoothing after coating, with thick coats I find that a good creping may be done with an asphalt coating which is not smooth. By the separate temperature control of the coating step which my process permits, I can produce a sheet with a thick coating which has a naturally grained or "alligatored" surface, and this type of coated sheet I find crepes with advantage. The reasons why this is so are somewhat obscure. The pressure roll 10 probably does not iron out the corrugated surface of the asphaltic coating upon the sheet against the creping cylinder surface, but rather the corrugations in the asphalt coating produce in the pinch of the rolls a correspondingly corrugated paper surface which assists the creping. The latter is possible because the pressure roll 10 is of rubber and has a yielding surface. In any event I do know that I can secure enhanced results by varying the nature of the surface of the asphaltic coating, and this variation in surface is made possible through the divorce of the coating and creping steps and the saparate temperature controls which I am thereby able to provide.

In this way I secure a more satisfactory creping operation, and one capable of greater variation and more careful control.

Further temperature control may however, be necessary after the creping process, and this also is comprised within the scope of my invention. It is well known that within the limits of commercial practice, the relationship of the creping roll and doctor may be varied to put into the paper a given stretch. Therefore, the resultant stretch of the creped web will depend upon how much of the stretch put into the paper by the creping step is subsequently removed by a stretching step which may be necessary to smooth out the paper. After the creping step, I carry the creped web between pinch rolls 13 and 14 which run at a somewhat greater speed than the travel of the creped web 1c just after it leaves the doctor, and thereby I stretch the web over bars or rolls 15 and 16 which have a smoothing action, these rolls may be driven, if desired. The members 15 and 16, when in the form of rolls may be driven if desired to assist in the stretching or smoothing action. The heavy asphaltic coat being plastic in the main and adhesive at the surface, and also being rapidly cooled, may tend in some measure to retard the smoothing out and stretching of the sheet. For this reason I effect a third temperature control by applying heat to the bars or rolls 15 and 16. This heat serves two purposes. It softens the body of the bituminous layer so as to facilitate the smoothing out of the bunches and secondly, it may render the bituminous surface more tacky to assist in the binding of that surface to a backing substance, which may be a fabric or other material. I have shown a roll of burlap or other backing substance 17 led over stretch-

ing and smoothing rolls 18 and 19 and into the pinch of the rolls 13 and 14. This results in the production of a composite product of bitumen-crinkled paper with a burlap backing which I have designated in the diagram as 1^d. Temperature control by means of the smoothing bars 15 and 16 may however be found non-essential in some uses, and it may also be otherwise effected, or supplemented by additional temperature control in what might be termed the third stage thereof. In commercial practice I run the bars 15 and 16 quite hot and the pinch rolls 13 and 14 cold. I may however, heat the roll 13 or the roll 14 or both, or I may heat both the pinch rolls and the smoothing bars or rolls.

It will be understood that at the close of my process the product 1^d is suitably cooled if necessary and then is rolled up or cut apart for use or for fabrication into useful articles.

Supplementary methods of control are applicable to my process. Some of these have already been set forth. Others will be apparent to one skilled in the art. My process is not restricted to the making of backed creped material. It is possible after the web is creped to blow against the coated side of the sheet to cool it or to apply to the coating some such substance as talc, which will destroy its adhesiveness. It is also possible to apply such substances as powdered or flake aluminum or bronze or some pigmenting agent, as well to destroy the adhesiveness, as to increase the proofness of the sheet and to give it a desired appearance. The heat plastic substance used is capable of wide variation in its own nature and characteristics, and it is capable of the wider variation in my present process because of the separate temperature controls which I effect. My invention is also capable of wide modification without departing from the spirit thereof. The particular instrumentalities which I have illustrated diagrammatically and described need not be used but other equivalents may be employed for the same purpose.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a creping process the steps of applying a water repellant heat plastic adhesive to a paper web, and then creping said web through the use of said substance to bind it to the creping roll, said substance being tempered between the coating step and the creping step and the proper adhesiveness for the creping step being effected at least in part by temperature control separately of the coating instrumentality.

2. In a creping process the steps of applying a water repellant heat plastic adhesive substance to a paper web under the influence of heat, and thereafter conducting said web to a creping device, cooling said web intermediate the coating and the creping device and creping said web under the influence of heat separately applied by said creping means.

3. In a creping process the steps of producing a desired type of coating of heat plastic adhesive substance upon a web by separate coating means, controlling the temperature of said web between said coating means and a creping means, subjecting said web to a separate heating means and creping said web by creping means when said coating has been brought to the desired consistency.

4. In a creping process the steps of applying a water repellant heat plastic adhesive to a paper web under the influence of heat, cooling said coated web to render the coating non-tacky, subjecting said web to a separate heating means and creping said web when said coating has been brought to the desired consistency.

5. In a creping process the steps of applying a water repellant, heat plastic adhesive to a paper web by separate coating means controlled to produce a layer of said substance on said web which will have an uneven surface and thereafter conducting said web to creping means and creping it under the influence of heat separately applied.

6. In a creping process the steps of applying a water repellant, heat plastic adhesive to a paper web by separate coating means controlled to produce a layer of said substance on said web which will have an uneven surface and thereafter conducting said web to creping means and creping it under the influence of heat separately applied by a creping means.

7. In a creping process the steps of applying a water repellant, heat plastic adhesive substance to a paper web under the influence of heat, cooling said web to bring said coating to a condition of substantial solidification, subjecting said web to a separate heating means and creping said web when said coating has thereby been brought to the desired consistency and adhesiveness.

8. In a creping process the steps of applying a water repellant, heat plastic adhesive substance to a paper web under the influence of heat, cooling said web to bring said coating to a condition of substantial solidification, subjecting said web to a separate heating means and creping said web when said coating has thereby been brought to the desired consistency and adhesiveness, and joining a material to said creped web before said coating has lost its adhesiveness.

9. In a creping process the steps of separately applying a water repellant heat plastic adhesive substance to a web under the influence of heat, cooling said web, separately heating and creping said web, and thereafter separately heating said web and joining it to a backing substance by means of said adhesive coating.

10. In a creping process the steps of applying to a web a uniform layer of controlled thickness of a waterproofing, heat plastic adhesive, cooling said web during the continuous travel thereof, heating and creping said web during the continuous travel thereof, and thereafter heating and joining said web to a backing substance during the continuous travel thereof.

11. In a machine for producing creped materials, the combination of coating means, cooling means, heating and creping means, and means for effecting the travel of a web to be creped.

12. In a creping machine, means for coating a web, means for cooling said web, means for heating and creping said web and means for heating and joining said web to a backing material.

13. In a creping process the steps of applying a layer of water repellant heat plastic adhesive to a paper web, tempering said layer to bring the body thereof at least to a semi-solid condition, afterward heating the surface of said layer to bring it to an adhesive a condition without destroying the semi-solid condition of the body thereof, and creping said web while the surface of said coating is in said adhesive condition.

14. In a creping process the steps of bringing a paper web coated with a water repellant heat plastic adhesive substance in non-tacky condition into contact with a heated creping roll whereby said substance is softened and rendered tacky, and removing the paper from said roll by means of a creping knive thereby creping it.

15. In a creping operation the steps of applying heat to paper coated with a heat plastic adhesive substance to soften said substance and creping said paper by causing the coated side thereof to adhere to a creping cylinder and removing the paper therefrom with a creping knife.

16. That process of creping paper which comprises separately coating paper with a water repellant heat plastic adhesive, controlling the temperature thereof, conducting said coated sheet to a position of adhesion to a creping roll, and creping the paper thereoff.

17. In a creping process the steps of applying a water repellant heat plastic adhesive to a paper web and then creping said web through the use of said substance to bind it to a creping roll, said substance being tempered between the coating step and the creping step.

18. In a creping process the steps of applying a water repellant heat plastic adhesive substance to a paper web under the influence of heat and creping said web by removing it with a doctor from a cylinder to which it is adhesively bound by said heat plastic adhesive substance, cooling said adhesive heat plastic substance between the point at which coating is done and the point at which creping is done.

19. In a creping process the steps of applying asphalt to a paper web under the influence of heat and creping said web by removing it with a doctor from a cylinder to which it is adhesively bound by said asphalt, cooling said asphalt between the point at which coating is done and the point at which creping is done.

20. In a creping process the steps of coating a sheet with bitumen and creping said sheet, using said bitumen as the creping adhesive, and intermediate the coating and creping steps causing the bituminous coating to assume a condition of non uniformity of thickness.

WILLIAM WALLACE ROWE.