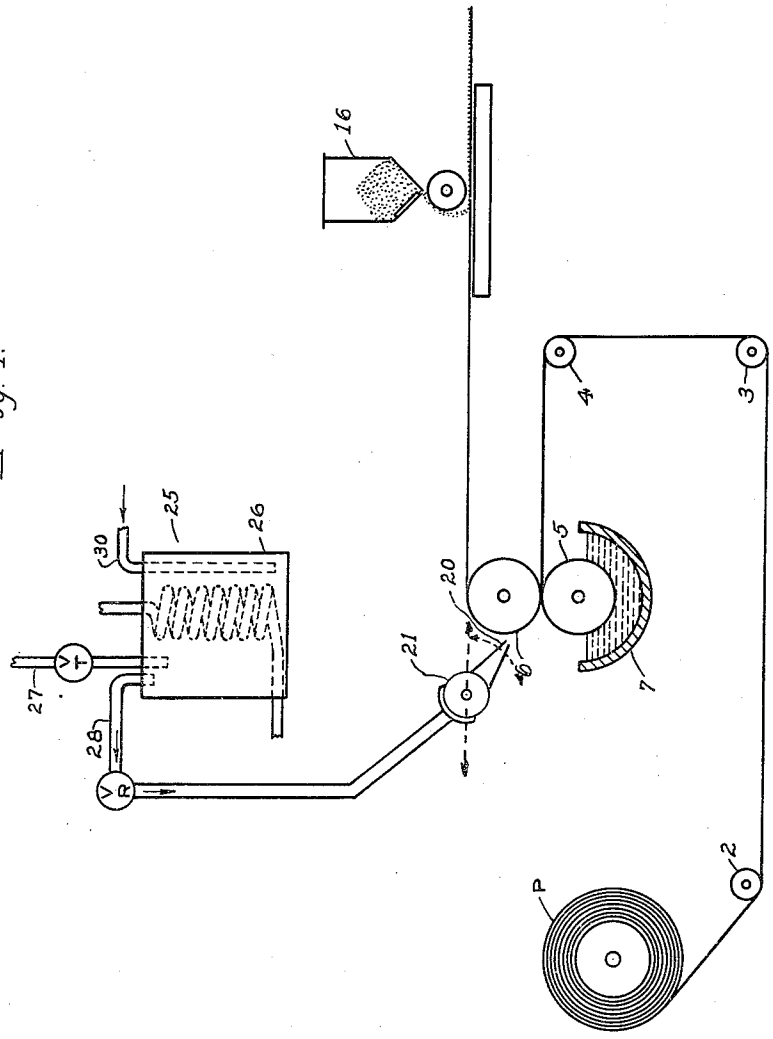
Dec. 24, 1940. J. A. WILLIAMSON 2,225,937

MANUFACTURE OF ABRASIVE COATED PRODUCTS

Filed May 23, 1939 2 Sheets-Sheet 1

Fig. 1.



INVENTOR.
JOHN A. WILLIAMSON

BY

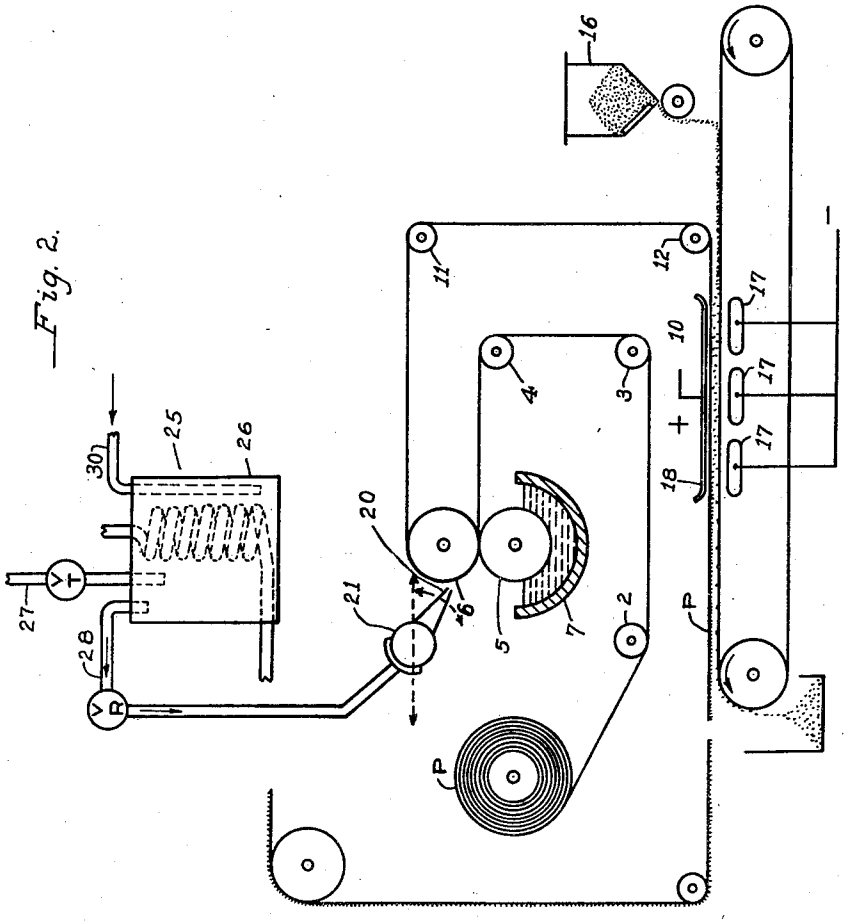
his ATTORNEY.

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MANUFACTURE OF ABRASIVE COATED PRODUCTS

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Fig. 2.



INVENTOR.
JOHN A. WILLIAMSON

BY

his ATTORNEY.

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2,225,937

MANUFACTURE OF ABRASIVE COATED PRODUCTS

John A. Williamson, Niagara Falls, N. Y., assignor to The Carborundum Company, Niagara Falls, N. Y., a corporation of Delaware

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11 Claims. (Cl. 51—293)

This invention relates to a new and improved method of making abrasive coated products and more particularly to that part of the said method which concerns the preparation of the backing material for the application of the abrasive grains.

The usual method employed in the manufacture of abrasive coated products, such as sandpaper, comprises the application of a liquid adhesive to one face of a web or strip of paper, cloth or the like and usually the method of applying adhesive is to pass the web or strip of paper, cloth or the like between two rolls, one of which is partially submerged in the adhesive in a reservoir. The roll that dips into the adhesive contained in the reservoir carries the adhesive to the surface of the web or strip of paper, cloth or the like and deposits it on the surface. The other roll is set apart from that first mentioned roll and thereby provides a gap between the rolls through which the web or strip of paper, cloth or the like and its surface coating of adhesive must pass on the way to the abrasive depositing mechanism.

Theoretically, it might be assumed that inasmuch as the web of paper, cloth or the like and its coating of adhesive material passes between revolving rolls that are spaced apart a controlled amount, the coating of adhesive on the web or strip of paper, cloth or the like would be of uniform thickness and free from waves, ripples and other irregularities. Experience, however, has shown that such an assumption is not correct and that it is necessary to provide some means for removing waves, ripples and other irregularities in the coating of adhesive material.

The users of abrasive coated products have become more and more insistent upon a greater and greater uniformity in those products and it has been found that the means once considered satisfactory for treatment of the adhesive layer after it and the web or strip of paper, cloth or the like emerged from the applicator rolls no longer are sufficient for the production of the uniformity demanded.

It therefore is an object of the present invention to provide a method of applying the adhesive to the web or strip of paper, cloth or the like that will produce a coating that will meet the rigid requirements demanded by the trade. More particularly it is an object of the present invention to provide a method of applying adhesive to a web or strip of paper, cloth or the like that is of a high degree of uniformity as to thickness and that is free from ripples and waves. Another object of the present invention is to provide a method of applying adhesive to a web or strip of paper, cloth or the like that will so condition that coating of adhesive for subsequent reception of the abrasive granules that the said granules will be more uniformly attached to the web or strip of paper, cloth or the like.

The accompanying drawings, in which like numerals refer to like parts, illustrate diagrammatically various methods of making abrasive coated products involving the present invention. Reference to these drawings is made for the purpose of giving a better understanding of the method described and claimed in the following part of this specification.

In Figure 1 there is shown a roll, P, of paper, cloth or the like which hereinafter will be referred to merely as "paper" for the sake of avoiding the repetition of the term "paper, cloth or the like." The paper passes from the roll P around idler rolls 2, 3 and 4 until it is brought to such a position that it can be passed readily between the adhesive roll 5 and the metering roll 6.

The paper proceeds from the space between the adhesive roll 5 and the metering roll 6 by passing partially around the metering roll 6 and thence to the abrasive applying mechanism, which, as illustrated in Figure 1, comprises a dispensing hopper 16 that releases the abrasive granules at the desired rate and permits them to drop onto the adhesive coated surface of the paper.

The abrasive applying device illustrated in Figure 2 comprises a feed belt 15 positioned to receive abrasive grains from the dispensing hopper 16 and to carry the abrasive grains thus received between the electrodes 17 and 18 and beneath the adhesive coated paper P which also passes between the electrodes 17 and 18 with the adhesive coated side positioned downwardly.

The methods so far described are the conventional ones employed in the manufacture of abrasive coated products; that shown in Figure 2 being for the manufacture of what is known to the trade as electrocoated abrasive paper, the term "electrocoated" being a part of the registered trade mark for abrasive coated paper in the manufacture of which electrostatic means are employed for the projection and/or propulsion of the abrasive granules to the adhesive coated surface of the paper P.

As was stated above, the conventional methods heretofore used, however, have failed to maintain the degree of uniformity demanded by the trade. In accordance with the present invention, the adhesive roll 5 and the metering roll 6 are so spaced that an excess of adhesive is applied to the paper and the adhesive coated paper P is moved upwardly as it emerges from the space between the adhesive roll 5 and the metering roll 6, and as it moves upwardly it has directed against it a high velocity jet of gas 20 directed downwardly by means of the nozzle 21, which is spaced from about $\frac{1}{8}$ inch to $\frac{3}{16}$ inch from the coating.

This jet of gas removes the excess adhesive and smooths out the coating.

The jet of gas directed against the liquid adhesive coating on the paper P extends the full width of the paper and is of a thickness from .002 to .020 inch. It has been found that too thick a jet of air causes splattering of the adhesive and produces a coating that is not smooth and uniform. Moreover, a thick jet of gas, because of its large volume, is difficult to maintain at a uniform velocity, and while, theoretically, the thickness of the jet could be of molecular dimension, providing the velocity was sufficiently high, practical considerations limit the minimum thickness to about .002 inch.

It has been found, moreover, that a jet of a thickness of approximately .005 inch is the most suitable for all practical purposes.

It is difficult to definitely express the velocity of the jet of gas in terms of units of length per unit of time, but it has been found that the velocity of a jet resulting from the escape of the gas through an orifice of the thickness expressed above, that is from .002 to .020 inch, when under a pressure of 2 to 15 lbs. per square inch gives the most satisfactory results with adhesives of a viscosity of that normally required for abrasive coating practices.

Another condition that must be carefully controlled in order to carry out satisfactorily the method of the present invention is the angle at which the jet of gas is directed at the surface of the adhesive coating on the paper P. It has been found that when the angle between the jet and the portion of the paper above the line of impingement is an acute angle and preferably between 20 to 70 degrees the most satisfactory results are obtained. More particularly, it has been found that the best results are obtained when the angle between the jet and the paper above the line of impingement is from 25 degrees to 50 degrees and preferably of approximately 35 degrees.

Still other factors that must be controlled in order to satisfactorily carry out the method of the present invention are the composition and condition of the jet of gas directed against the adhesive surface. A jet of gas that is dry and cold with respect to the liquid adhesive causes the adhesive to jell and also causes the adhesive removed from the paper to take the form of fine filaments or threads and these are blown into the atmosphere by the jet of gas. If on the other hand, the jet is dry and hot, it causes the adhesive to dry out. Both of these conditions of the adhesive makes it unreceptive to the abrasive grains later applied. In accordance with the present invention, the jet is composed of a mixture of gases or gas and vapor conducive to conditioning the adhesive coating for the best reception and retention of the abrasive grains applied later. For example, if the adhesive is hide or bone glue and it is desired to keep the glue in the same condition as applied, the jet is composed of air and water vapor in such proportions and at such a temperature that neither drying nor dilution of the glue results from the impingement of the jet upon the surface of the adhesive. In such cases the air used is at the saturation point and at the temperature of the glue.

In some cases it is desirable to cause a slight drying out or congealing to occur on the surface of the adhesive; that is, it sometimes is desirable to cause a slight skin to form. In such cases the ratio of the air and water vapor and temperature of the jet are so controlled as to give the desired skin on the adhesive, for example, by using less water vapor and/or a slightly higher air temperature. In other cases it is desirable to have the surface of the adhesive slightly wet with respect to the body of the adhesive in order that the grain applied later may become better attached to the paper. In such cases the ratio of air to water vapor and the temperature of the jet are so controlled as to cause the slight wetting of the surface of the glue by the impingement of the jet thereon. For example, a jet of saturated air at a temperature above that of the glue will give up moisture to the cooler glue surface.

Of course, other adhesives than water soluble ones, like hide glue, are used in the manufacture of abrasive coated products and when the other adhesives that are used are not water soluble a solvent for the adhesive is substituted for the water vapor used with glue adhesives.

The drawings show, in diagrammatic fashion, a mixing chamber **25** for the control of the above mentioned conditions of the jet. As illustrated, it comprises a chamber **26** with a compressed air inlet **27** and a compressed air outlet **28**, which outlet is connected to the angularly variable nozzle **21** and controlled by the reducing valve VR. The mixing chamber, as illustrated, also contains a steam coil **29** for heating the air and an inlet pipe **30** for introducing steam into the air for the purpose of producing the desired ratio of air to water vapor.

The jet applied in the manner described above and controlled as to composition and condition, also described above, causes the adhesive film to be reduced to such thickness as is desired. It causes this reduction to be effected accurately and at the same time leaves the residual coating on adhesive in the most suitable condition for the reception and retention of the abrasive grains later applied.

The method of the present invention has many practical advantages, among them being that of readily obtaining a full coating of granular material. The condition of the adhesive obtained by the practice of the present invention is such that a greater quantity of the granular material becomes attached to the backing and the difficulty heretofore experienced in obtaining a desired degree of coating thereby is obviated.

Having thus described my invention, I claim

1. The method of making abrasive coated products which comprises applying a liquid adhesive coating of excess thickness to a moving web, applying at an acute angle to said liquid adhesive coating a jet of gas containing a vapor of a solvent of said adhesive, the said jet having a thickness of less than 0.02 of an inch and extending across the full width of said web, whereby the excess adhesive is removed and the residual coating of adhesive is levelled and conditioned, and applying abrasive particles to the levelled and conditioned adhesive coating.

2. The method of making abrasive coated products which comprises applying a liquid adhesive coating of excess thickness to a moving web, applying at an acute angle to said liquid adhesive coating a jet of gas containing the vapor of a solvent for said adhesive, the said jet having a thickness of from 0.002 to 0.02 of an inch and extending across the full width of said web, whereby the excess adhesive is removed and the residual coating of adhesive is levelled and con-

ditioned, and applying abrasive particles to the levelled and conditioned adhesive coating.

3. The method of making abrasive coated products which comprises applying a liquid adhesive coating of excess thickness to a moving web, moving the said liquid adhesive coated web in an upward direction while applying downwardly at an acute angle to said liquid adhesive coating a jet of gas containing the vapor of a solvent for said adhesive, the said jet having a thickness of from 0.002 to 0.02 of an inch and extending across the full width of said web, whereby the excess adhesive is removed and the residual coating of adhesive is levelled and conditioned, and applying abrasive particles to the levelled and conditioned adhesive coating.

4. The method of making abrasive coated products which comprises applying a liquid adhesive coating of excess thickness to a moving web, moving the said liquid adhesive coated web in an upward direction while applying downwardly at an acute angle to said liquid adhesive coating a jet of gas containing the vapor of a solvent for said adhesive, the said jet having a thickness of approximately 0.005 of an inch and extending across the full width of said web, whereby the excess adhesive is removed and the residual coating of adhesive is levelled and conditioned, and applying abrasive particles to the levelled and conditioned adhesive coating.

5. The method of making abrasive coated products which comprises applying a liquid adhesive coating of excess thickness to a moving web, moving the said liquid adhesive coated web in an upward direction while applying downwardly to said liquid adhesive coating and at an angle of 20 to 70 degrees with respect to the surface of said liquid adhesive coating a jet of gas containing the vapor of a solvent for said adhesive, the said jet having a thickness of approximately 0.005 of an inch and extending across the full width of said web, whereby the excess adhesive is removed and the residual coating of adhesive is levelled and conditioned, and applying abrasive particles to the levelled and conditioned adhesive coating.

6. The method of making abrasive coated products which comprises applying a liquid adhesive coating of excess thickness to a moving web, moving the said liquid adhesive coated web in an upward direction while applying downwardly to said liquid adhesive coating at an angle of approximately 35 degrees with respect to the surface of said liquid adhesive coating a jet of gas containing the vapor of a solvent for said adhesive the said jet having a thickness of approximately 0.005 of an inch and extending across the full width of said web, whereby the excess adhesive is removed and the residual coating of adhesive is levelled and conditioned, and applying abrasive particles to the levelled and conditioned adhesive coating.

7. The method of making abrasive coated products which comprises applying a liquid adhesive coating of excess thickness to a moving web, moving the said liquid adhesive coated web in an upward direction while applying downwardly to said liquid adhesive coating at an angle of 20 to 70 degrees with respect to the surface of said liquid adhesive coating a jet of gas containing the vapor of a solvent for said adhesive the said jet having a thickness of from 0.02 to 0.002 of an inch and a nozzle pressure of from 2 to 15 pounds per square inch and extending across the full width of said web, whereby the excess adhesive is removed and the residual coating of adhesive is levelled and conditioned, and applying abrasive particles to the levelled and conditioned adhesive coating.

8. The method of making abrasive coated products which comprises applying a liquid adhesive coating of excess thickness to a moving web, moving the said liquid adhesive coated web in an upward direction while applying downwardly to said liquid adhesive coating at an angle of approximately 35 degrees with respect to the surface of said liquid adhesive coating a jet of gas containing the vapor of a solvent for said adhesive, the said jet having a thickness of approximately 0.005 of an inch and a nozzle pressure of approximately 2 to 15 pounds per square inch and extending across the full width of said web, whereby the excess adhesive is removed and the residual coating of adhesive is levelled and conditioned, and applying abrasive particles to the levelled and conditioned adhesive coating.

9. The method of making abrasive coated products which comprises applying a liquid glue coating of excess thickness to a moving web, moving the said liquid glue coated web in an upward direction while applying downwardly to said liquid glue coating at an angle of approximately 35 degrees with respect to the surface of said liquid glue coating a jet of gas containing water vapor, the said jet having a thickness of approximately 0.005 of an inch and a nozzle pressure of approximately 2 to 15 pounds per square inch and extending across the full width of said web, whereby the excess glue is removed and the residual coating of glue is levelled and conditioned, and applying abrasive particles to the levelled and conditioned glue coating.

10. The method of making abrasive coated products which comprises applying a liquid glue coating of excess thickness to a moving web, moving the said liquid glue coated web in an upward direction while applying downwardly to said liquid glue coating at an angle of approximately 35 degrees with respect to the surface of said liquid glue coating a jet of air substantially saturated with water vapor, the said jet having a thickness of approximately 0.005 of an inch and a nozzle pressure of approximately 2 to 15 pounds per square inch and extending across the full width of said web, whereby the excess glue is removed and the residual coating of glue is levelled and conditioned, and applying abrasive particles to the levelled and conditioned glue coating.

11. The method of making abrasive coated products which comprises applying a liquid glue coating of excess thickness to a moving web, moving the said liquid glue coated web in an upward direction while applying downwardly to said liquid glue coating at an angle of approximately 35 degrees with respect to the surface of said liquid glue coating a jet of air at a temperature substantially the same as that of the glue, and substantially saturated with water vapor, the said jet having a thickness of approximately 0.005 of an inch and a nozzle pressure of approximately 2 to 15 pounds per square inch and extending across the full width of said web, whereby the excess glue is removed and the residual coating of glue is levelled and conditioned, and applying abrasive particles to the levelled and conditioned glue coating.

JOHN A. WILLIAMSON.