Jan. 22, 1957 C. R. MacDONALD 2,778,284

METHOD OF AND APPARATUS FOR APPLYING AQUEOUS DISPERSIONS IN MANUFACTURE OF PAPERBOARD AND THE LIKE

Filed May 14, 1954 2 Sheets-Sheet 1

Fig 1.

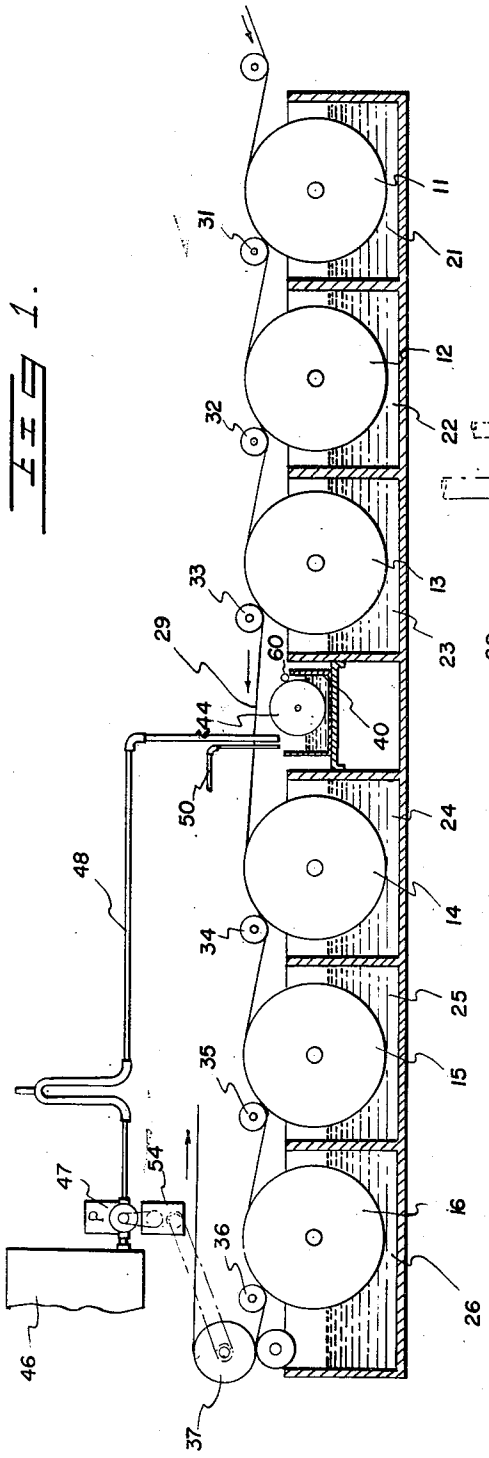
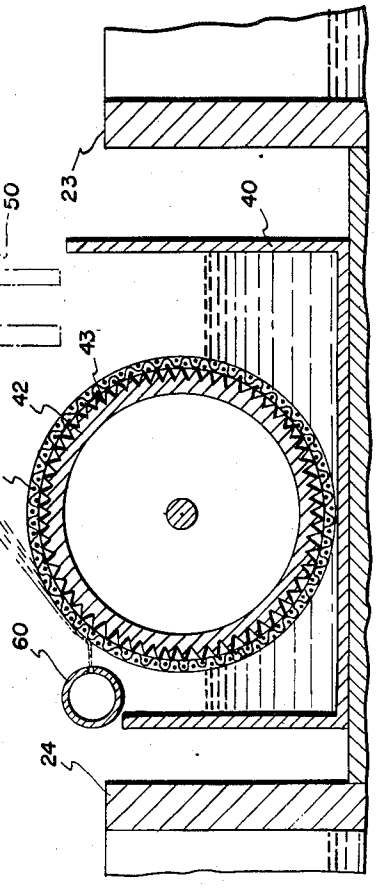


Fig 2.



INVENTOR
CHESTER R. MacDONALD

BY Samuel Pearlman

ATTORNEY

Jan. 22, 1957 C. R. MacDONALD 2,778,284

METHOD OF AND APPARATUS FOR APPLYING AQUEOUS DISPERSIONS IN MANUFACTURE OF PAPERBOARD AND THE LIKE

Filed May 14, 1954 2 Sheets-Sheet 2

Fig 3.

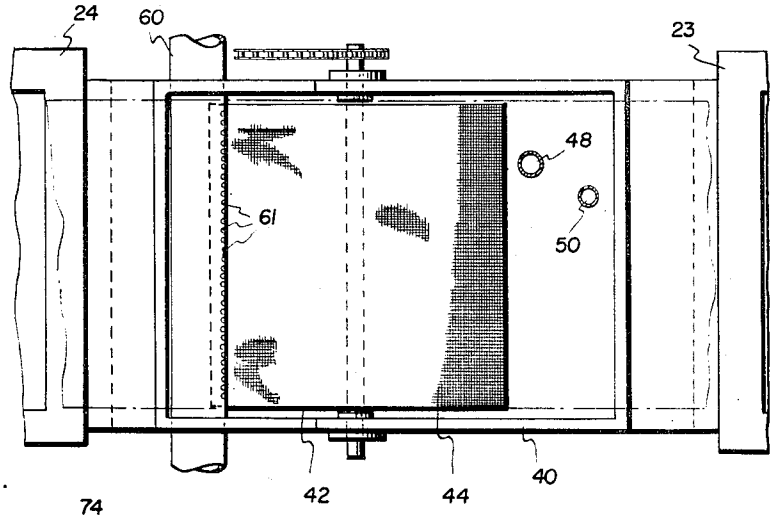


Fig 5.

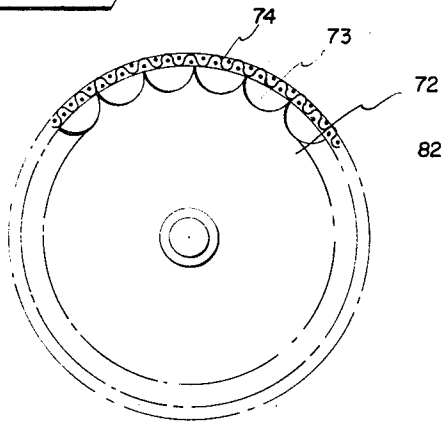


Fig 6

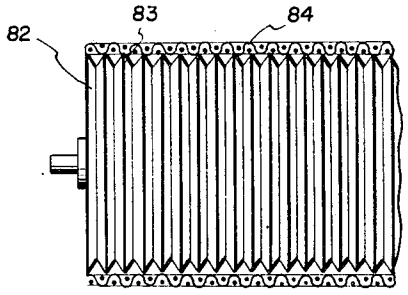


Fig 4.

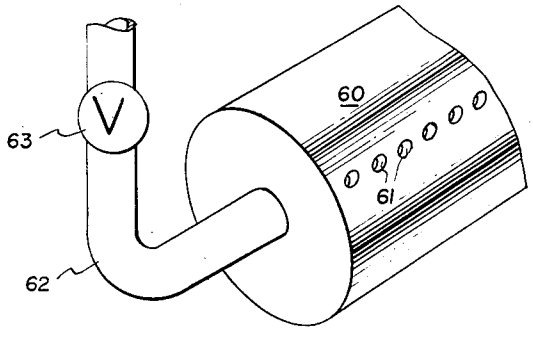
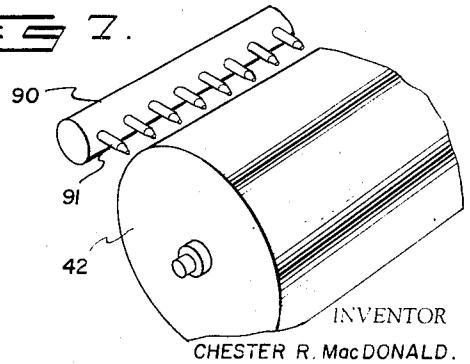


Fig 7.



INVENTOR
CHESTER R. MacDONALD.

BY Samuel Steinman

ATTORNEY

United States Patent Office 2,778,284 Patented Jan. 22, 1957

2,778,284

METHOD OF AND APPARATUS FOR APPLYING AQUEOUS DISPERSIONS IN MANUFACTURE OF PAPERBOARD AND THE LIKE

Chester R. MacDonald, Ramsey, N. J., assignor to The Patent and Licensing Corporation, New York, N. Y., a corporation of Massachusetts

Application May 14, 1954, Serial No. 429,750

11 Claims. (Cl. 92—41)

This invention relates to the production of paperboard, and is more particularly concerned with production of so-called multi-cylinder board wherein a film of asphalt or the like in the form of an aqueous dispersion is interposed between certain plies of the board during the course of its manufacture on a multi-cylinder machine.

Multi-cylinder board is used for a wide variety of purposes. Among its principal uses is the manufacture of boxes.

In many of such commodities, it is desirable that the moisture content of the goods packed in the box shall remain constant during storage, shipment and shelf life, i. e., be not subject to material change by passage of moisture vapor from the goods in the box to the surrounding atmosphere, or vice versa.

With that in view, multi-cylinder board has heretofore been manufactured by processes involving the interposition of asphalt in aqueously dispersed form, as a film between certain of the plies, whereby to provide, in the subsequently dried board, a barrier designed to resist the transmission of moisture vapor therethrough. This type of operation is shown, for example, in patent to Kirschbraun 1,616,901.

Thus, in prior practise, the film has been applied by means of an applicator device disposed between the selected cylinders of the multi-cylinder machine, the applicator device comprising essentially a rotatable roll partially submerged in the bath of the dispersion so as to pick up a quantity of the dispersion on its surface and transfer it by contact with a surface of one of the wet plies formed by one of the cylinders immediately ahead of the device.

In order to secure maximum benefits, it is desirable that the film thus applied be uniform and continuous, i. e., free of so-called pinholes or other imperfections throughout the area of the sheet, and of predetermined thickness, depending upon the requirement for resistance to moisture vapor transmission in the finished product.

Bearing in mind particularly that in this operation the aqueous dispersion is applied between wet, freshly formed, plies of the paper which are themselves relatively thin, and moreover, highly tender at this stage, the attainment of a perfectly continuous film of uniform predetermined thickness throughout its area has entailed numerous difficulties in actual practise.

In my prior patent, 2,622,491, there are disclosed certain features including means for metering the flow of the dispersion to, and maintaining it at a desired concentration and level in, the supply box for the applicator roll. In my co-pending application, Serial Number 86,162, filed April 8, 1949, now Patent No. 2,694,963, there are disclosed means whereby the rate of delivery of the dispersion to the supply box, as well as the speed of rotation of the applicator roll itself, are made responsive to variations in the rate of travel of the wet, freshly formed ply or plies of paper to which a film of the dispersion is transferred by the roll.

Although the means disclosed in my aforesaid prior

patent and co-pending application have served to improve the operation in actual practise, there nevertheless remain various heretofore unattained desiderata, centering chiefly around the difficulties in securing uniformity and continuity of the applied film, as well as other difficulties of operation.

As will be clear from the foregoing, the film of dispersion is applied, in the prior practise, by the pressure of the applicator roll during the rotation thereof against the surface of the wet ply or plies in their wet, freshly-formed, and hence tender, stage. Accordingly, the rotational speed of the roll, as well as the pressure exerted by the roll upon the wet sheet for transferring the film thereto, are important considerations governing the final results achieved. Although the expedients disclosed in my above identified patent and co-pending application have, as above stated, improved the operation, it is found in actual practise that the best results are in many cases difficult, if not impossible, to attain.

The principal object of the invention, accordingly, is to provide a new method and apparatus whereby these deficiencies may be overcome.

Another object of the invention is to provide a process of and an apparatus for the production of multi-cylinder paperboard of the type having a film of material capable of serving as a moisture vapor barrier or other similar function, interposed between certain of the plies of which the board is composed, and wherein the film may be applied during the manufacture of the multi-cylinder board in a manner independent of the rotational speed of the applicator roll, and independent also of, and indeed without relying upon, pressure between the applicator roll and the wet ply or plies.

These and other objects and advantages of the invention will be more readily apparent from the detailed description below.

Briefly stated, these objects of the invention may be achieved by employing between selected adjacent ones of the cylinders for forming the desired number of plies, an applicator mechanism comprising in its essentials, a box for maintaining a supply of the desired dispersion, a rotatable roll partially submerged in the box for picking up during the rotation thereof a layer of the dispersion, the box and the roll being positioned so that the surface of the latter is at a considerable distance away from the surface of the ply or plies of paper in its movement thereabove, and a device whereby under the influence of jets of air moving in a substantially horizontal direction and impinging upon the roll near the top thereof, dispersion from the layer picked up by the rotating roll is blown therefrom and caused to be propelled into contact with, and form a smooth, continuous uniform film upon, the downwardly facing surface of the paper during the passage thereof from one of the machine cylinders to the next.

The invention will be described with particular reference to the use of aqueous dispersions of bituminous material such as asphalt, designed to serve as a vapor barrier material in the finished paperboard made therewith. It will be apparent from the description, however, that the invention is equally applicable to the production of multi-cylinder board wherein aqueous dispersion of other film-forming materials, as for example, resins, tars, waxes, rubber, both natural and synthetic, and suitable combinations thereof, are to be interposed as a layer between certain plies of the board during the manufacture thereof.

In the accompanying drawings:

Fig. 1 is a diagrammatic view illustrating certain parts of a multi-cylinder machine, having apparatus installed thereon in accordance with my invention;

Fig. 2 is a view on a larger scale and partly in cross-section, showing an embodiment of the invention;

Fig. 3 is a view, in plan, of the apparatus illustrated in Fig. 2;

Fig. 4 is an enlarged fragmentary view, in perspective, of part of the apparatus, illustrated in Figs. 1–3;

Fig. 5 is a view in transverse cross-section of a modified form of applicator roll that may be employed;

Fig. 6 is a fragmentary view partly in elevation and partly in section, of another form of applicator roll that may be employed; and

Fig. 7 is a fragmentary view, in perspective, of a modified form of the apparatus of Fig. 4.

Referring to Fig. 1 of the drawings, there is shown schematically the wet end of a multi-cylinder machine for making six-ply paperboard. The conventional cylinders, one for each ply, are indicated at 11, 12, 13, 14, 15 and 16, for rotation respectively in vats 21, 22, 23, 24, 25, and 26, so as to form plies of desired thickness from the aqueous suspensions of fibrous stock maintained in their respective vats. In accordance with the conventional practise, an endless carrier or so-called felt or blanket 29 is mounted over the cylinders to receive therefrom in succession while travelling in the direction indicated by the arrows, the several plies formed on the cylinders. Conventional couch rolls for the respective cylinders are indicated at 31, 32, 33, 34, 35 and 36, and a reversing roll for the blanket 29 at one end of the machine is indicated at 37 (the corresponding roll at the opposite end not being shown). As will be understood, the superposed wet plies are carried by the felt or blanket 29 to a point where the sheet is sufficiently self-sustaining to be passed over the conventional driers for drying and calendering the board.

Positioned intermediate two of the cylinder vats, as for example vats 23 and 24, is a supply box 40 for maintaining a supply of aqueous dispersion of the desired film-forming material. As stated, this may be an emulsion or dispersion of asphalt to serve as moisture vapor barrier in the finished board. Conveniently, this may be an asphalt emulsion made with clay as emulsifying agent for the asphalt, in accordance with the process set forth in Kirschbraun Patent No. 1,969,308.

Mounted for rotation in the supply box 40 is a roll 42, preferably constructed as shown in Fig. 2. In this embodiment, the roll is formed on its outer circumferential surface with relatively closely spaced flutes or ribs 43, preferably triangular in cross-section, extending longitudinally throughout its length. The roll may conveniently be approximately nine inches in diameter and of a length corresponding to the width of the machines. Secured around the roll 29 so as to be in firm contact with the outer apices of the flutes is a wire screen 44, preferably of copper and desirably of about fourteen mesh.

The asphalt emulsion is delivered to the supply box 40 from a tank 46, preferably by a positive displacement pump, indicated at 47, through pipe 48. A pipe 50 is also preferably positioned for feeding water from a suitable source of supply to the box 40 in order to dilute the emulsion from the tank 46 to the desired solids concentration. The concentration and desired liquid level of the emulsion in the supply box is preferably controlled in the manner shown in my above-mentioned Patent No. 2,622,491.

Although not necessary to the successful practice of the present invention, the rate at which the emulsion is delivered to the box 40 from tank 46 by the pump 47 may desirably be regulated in accordance with the speed of the blanket 29. For that purpose, the pump 47 may have its drive shaft connected to the output shaft of a conventional variable speed transmission device, such as a Reeves drive, having its drive shaft connected to the shaft of the roll 37, the last-named shaft preferably being provided with a suitable clutch for disengaging roll 37 from its connection with the pump 47.

As will be seen from Fig. 1, the box 40 is positioned

at an elevation with respect to the path of the blanket 29 such that the uppermost point in the path of rotation of the roll is at a considerable distance below the blanket 29. Desirably, this distance may be approximately one-third the diameter of the roll 42.

Positioned at one side of the roll 42 and substantially above the center line thereof, is a pipe 60 having a diameter conveniently from one-third to one-seventh the diameter of roll 42 and having its axis parallel to the axis of the roll 42. For a roll having the diameter above-mentioned, the pipe 60 may be 1½ inches in diameter, and its longitudinal axis may lie in a plane at a distance below the blanket 29 equal to approximately one-half the outside diameter of the roll 42. Thus, the axis of pipe 60 is located above the axis of roll 42 a distance equal to approximately three-fourths the radius of roll 42.

As shown more in detail in Fig. 4, the pipe 60 is provided with a row of relatively closely spaced equi-sized perforations 61, desirably ten #68 drill holes per inch, and with a connection 62 controlled by a valve 63, for admitting compressed air to the pipe. The row of holes 61 is located, as shown, so that air will be discharged from the pipe in a substantially horizontal direction and impinge on the roll 42 near the top thereof.

By this procedure, emulsion carried up from the box 40 by the fluted, screen covered roll 42, is blown from the screen outwardly and upwardly at an angle in the direction of movement of the blanket 29 and deposited on the downwardly facing side of the wet, freshly-formed ply or plies of paper being carried forwardly by the blanket 29.

The pressure at which the air is delivered to pipe 60 may vary quite widely, depending upon the viscosity of the emulsion, the amount thereof to be deposited per unit area of the paper, the proximity of pipe 60 to the roll 42, and the size and spacing of holes 61.

In general terms, it may be stated that an air pressure of from say 30 to 100 pounds per square inch will suffice.

The procedure described possesses among its important advantages, the freedom during operation, from dependence upon the pressure of an applicator roll against the surface of the wet, freshly-formed tender ply or plies to which the emulsion is applied, and likewise the freedom from dependence upon the speed of the applicator roll for controlling the amount of emulsion applied to the sheet per unit interval of time.

Furthermore, the invention makes it possible to dispense with the operation of the device when utilizing the paper-making machine for making products requiring no interposed film of asphalt or the like, simply by turning off the supply of air to pipe 60, without necessitating lowering or dismantling of the supply box 40 and its associated parts in such cases, as in prior practise.

Still further, by transferring emulsion from the screen roll 42 to the wet ply or plies of paper through the medium of the jets of air issuing from the perforated pipe 60 in the manner described, the jets are made to serve for improving the "lay-down" of the fibers in the freshly-formed plies, and for minimizing or eliminating bubbles otherwise formed or present on the surface of the paper at this stage, and which are objectionable because of their tendency to cause imperfect bonding of the plies as well as decreased resistance of the dried film to moisture vapor transmission.

Equally important is the fact that this mode of procedure results in the deposition of the emulsion in the form of a completely uniform, smooth and continuous film and hence affords, in the finished dry board, a markedly superior resistance to the passage of moisture or other vapor therethrough.

Moreover, by utilizing the jets of air for transferring the emulsion to the wet ply or plies the latter are simultaneously urged and held more firmly at this stage in contact with the surface of the blanket 29, in contrast to their

tendency to pull away from the latter, as in the prior practise of utilizing an applicator roll operating to transfer the emulsion by contact with the wet plies of paper.

In Fig. 5 there is shown a modified form of roll **72**, differing from roll **42** in that in lieu of the cross-sectionally triangular flutes **43** of roll **42**, the surface of roll **72** is formed with a circumferential series of semi-circular, concave recesses **73**, extending longitudinally of the roll and supporting the wire screen **74** at their outer ends.

Fig. 6 illustrates still another form of roll that may be employed. In this embodiment, the roll **82** is formed on its surface with a series of relatively closely-spaced circumferential ribs, preferably triangular in longitudinal cross-section and supporting the wire screen at the outer ends.

In Fig. 7 there is illustrated a modified form of the air jet applying means. This takes the form of a pipe **90** having connected thereto a series of aligned small diameter nozzles **91** extending radially outward therefrom in a row parallel to the longitudinal axis of the pipe. As will be understood, the pipe **90** will be positioned with its axis at a horizontal distance from the axis of the associated rotatable roll **42** (or **72** or **82**) sufficient to accommodate the nozzles **91** in a position to function in a manner corresponding to that described in connection with the embodiment of Figs. 1–4.

Although I have fully set forth my invention herein, it will be understood that the several embodiments herein described are not to be regarded as restrictive thereof. On the contrary, numerous modifications and changes may be made in the practise of the invention, within the scope of the appended claims.

I claim as my invention:

1. Apparatus of the class described, comprising the combination with a multi-cylinder paper machine, of means positioned between an adjacent pair of the paper-forming cylinders for interposing a film of an aqueous dispersion of waterproofing material or the like between the moving paper plies formed in succession on said pair of cylinders, said means comprising: (1) a supply box for maintaining a bath of said dispersion; (2) a roll partially submerged in and rotatable in said bath, said box and roll being located at a position such that the path of rotation of the roll is at a considerable distance below the path of movement of said plies; and (3) a perforated pipe positioned adjacent said roll with its axis parallel to and above the axis of said roll, the diameter of said pipe being less than that of said roll, said perforations extending along the peripheral surface of the pipe in a manner such that air forced therethrough will be directed substantially horizontally against the surface of said roll adjacent the top thereof in the direction of travel of the plies.

2. Apparatus as defined in claim 1, wherein said roll is formed on its peripheral surface with relatively closely spaced flutes, and carries a wire mesh screen in contact with the outer ends of the flutes.

3. Apparatus as defined in claim 2, wherein said flutes extend in a direction parallel to the axis of the roll.

4. Apparatus as defined in claim 1, wherein the diameter of said pipe is from one-third to one-seventh that of said roll, and said perforations are dimensioned and spaced approximately ten to the inch.

5. Apparatus as defined in claim 1, wherein the perforated pipe is located with its axis above the axis of the roll a distance less than the radius of the roll.

6. Apparatus as defined in claim 5, wherein said roll has its peripheral surface fluted and carries a wire mesh screen supported by said flutes.

7. Apparatus as defined in claim 5, wherein the diameter of said pipe is from one-third to one-seventh that of said roll.

8. Apparatus as defined in claim 7, wherein the perforations in said pipe are dimensioned and spaced in a row approximately ten to an inch.

9. The process of interposing a film of aqueous dispersion of waterproofing material between the confronting surfaces of wet, freshly formed forwardly traveling plies of paperboard simultaneously with the formation of said plies, which comprises establishing a layer of said material moving in a circular path at a distance considerably below the path of travel of said plies, causing jets of air to blow dispersion continuously from said layer and propel the same outwardly and upwardly at an angle in the direction of travel of said plies and onto the surface of one of said plies, whereby to form a smooth, continuous uniform film of dispersion thereon before the other of said plies is joined therewith, then joining said other ply with said film-carrying ply, said jets of air impinging horizontally against said circularly moving layer from positions above the axis of the path of movement of said layer.

10. An applicator device for applying an aqueous dispersion of waterproofing material to a wet, freshly-formed ply of paper moving thereabove, comprising a supply box; a roll partially submerged in said box and rotatable therein in a path at a considerable distance below the path of movement of said ply, and air-jet means positioned adjacent said roll for causing dispersion picked up from the box by the roll during the rotation thereof to be blown outwardly and upwardly from the roll at an angle in the direction of movement of the web, said means comprising a pipe positioned with its axis above the axis of said roll and having a row of perforations therein so arranged that air forced therethrough will impinge in a substantially horizontal direction against the surface of the roll adjacent the top thereof.

11. An applicator device for applying an aqueous dispersion of waterproofing material to a wet, freshly-formed ply of paper moving thereabove, comprising a supply box, a roll partially submerged in said box and rotatable therein in a path at a considerable distance below the path of movement of said ply, and air-jet means positioned adjacent said roll for causing dispersion picked up from the box by the roll during rotation thereof to be blown outwardly and upwardly from the roll at an angle in the direction of movement of the web, said means comprising a pipe positioned with its axis above the axis of said roll and having a row of perforations therein so arranged that air forced therethrough will impinge in a substantially horizontal direction against the surface of the roll adjacent the top thereof, said roll being fluted on its peripheral surface and having a wire-mesh screen mounted on the outer ends of its flutes.

UNITED STATES PATENTS

References Cited in the file of this patent

629,937	Trotman	Aug. 1, 1899
1,616,901	Kirschbraun	Feb. 8, 1927
1,616,902	Kirschbraun	Feb. 8, 1927
1,686,818	Kirschbraun	Oct. 9, 1928
1,790,822	Ledeboer	Feb. 3, 1931
1,847,269	Schur	Mar. 1, 1932
1,945,173	Woodruff	Jan. 30, 1934
2,184,619	Leonard	Dec. 26, 1939
2,573,659	Bollaert	Oct. 30, 1951
2,622,491	MacDonald	Dec. 23, 1952

FOREIGN PATENTS

7,977	Great Britain	of 1839
47,170	Holland	Nov. 15, 1899
30,217	Austria	Oct. 10, 1907