

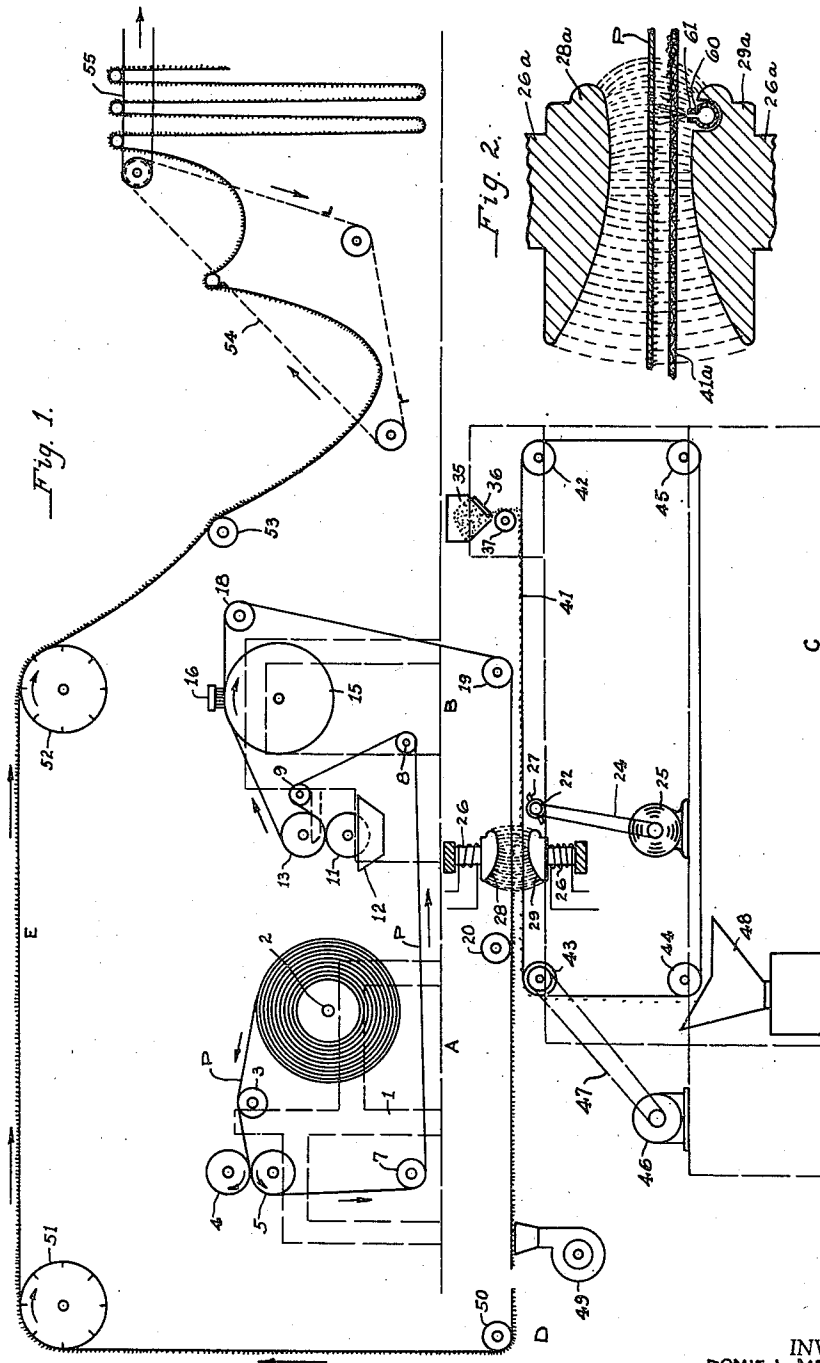
March 17, 1942.

R. L. MELTON ET AL

2,276,328

COATING APPARATUS

Filed April 2, 1935



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2,276,328

COATING APPARATUS

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Application April 2, 1935, Serial No. 14,312

4 Claims. (Cl. 91-18)

This invention relates to improved apparatus for the manufacture of abrasive coated webs of such material as paper, cloth and the like, and has for an object the provision of apparatus for the manufacture of superior articles.

Abrasive particles commonly used in the manufacture of abrasive coated webs are of irregular shape and have some surfaces or edges that are sharper than others and more suitable for abrading operations when these sharper surfaces, edges or points are positioned to engage the material being abraded. The usual method of applying abrasive particles to a web has been by dropping the particles from a hopper onto an adhesive coated surface, and since the particles, when dropped, fall in a haphazard manner, the usual method has not resulted in an orderly orientation of the particles.

It has been found heretofore that better abrasive coated webs can be produced by causing at least some of the abrasive particles deposited upon the web to become so oriented that the longer dimension of each grain projects from the surface of the web.

One form of apparatus that has been found to give satisfactory results has included electromagnetic means for projecting the abrasive material upwardly and into engagement with the adhesively coated side of the web. In apparatus of this type, the adhesively coated web is supported with an adhesive coated side downward whereby the grains, when projected by the electromagnetic means, strike this downward positioned side and adhere thereto. The electromagnetic means used in such apparatus has included a magnet having one pole positioned beneath the coated web and a pole of opposite polarity positioned above the coated web, with a carrier means such as a canvas belt so positioned that the grain carrying side of the conveyor is between the one pole face and the adhesively coated web. This apparatus is fully disclosed and claimed in our copending application, Serial No. 637,016, filed October 10, 1932.

The apparatus of the foregoing description operates in the following manner: The abrasive material being carried by the conveyor comes into the magnetic field set up between the two poles of the magnet in such a position that it is projected upwardly and into engagement with the adhesively coated web. Apparatus of the kind just described produces a very strong orienting influence on the abrasive grains but has the disadvantage of a relatively weak translational force and it cannot always be made to project

the larger and heavier particles upwardly to a sufficient distance to engage the adhesive surface of the web. While it is possible to make adjustments in the field intensity to project grains of widely different sizes, practical limitations in the intensity of the magnetic field that can be produced cause this type of machine to be somewhat restricted in its application.

Another type of apparatus that has been found to possess considerable merit in the manufacture of granular coated webs comprises mechanical means for projecting the granular material from a conveyor upwardly and into engagement with the underside of an adhesively coated web. The orienting characteristics of machines of this type depend upon the capability of the projecting means to impart sufficient velocity to the particles to cause them to turn as they travel through the intervening space so that their longer axes are parallel to their direction of movement. Machines of this type are fully described and claimed in our copending application Serial No. 647,241, filed December 14, 1932.

In the machines of this type there is no difficulty in projecting even the largest and heaviest of particles but these machines do not have the strong orienting capabilities of the magnetic apparatus described above, because the particles, upon leaving the conveyor, are no longer under the influence of the projecting means; whereas in the magnetic apparatus described above, the particles are under the influence of the projecting means until they reach the adhesive coated web and are carried out of the magnetic field.

Apparatus built in accordance with our invention utilizes the combination of magnetic forces and mechanical forces to project and at the same time produce and maintain orientation of the moving granular material. Thus the apparatus is suitable for projecting large and heavy particles as well as the smaller and lighter particles.

We wish to have it understood that wherever the term "mechanical force" is used in the present specification, it shall be taken to mean any force excepting magnetic or electrical forces that produce or tend to produce motion of objects of appreciable size such as those ordinarily called granules or powders when such force is applied to those objects. We wish it to be understood also that the term "magnetic-mechanical", wherever used in the present specification and/or claims, shall be taken to mean the combination of magnetic and mechanical forces or a combina-

tion of such elements that produces a combination of magnetic and mechanical forces.

A better understanding of our invention can be had by referring to the accompanying drawing, in which:

Figure 1 is a diagrammatic side elevation of one form of our improved apparatus; and

Figure 2 is a section of a portion of another form of grain projector.

Figure 1 of the drawing shows means A for holding and dispensing a roll 2 of the web P; means B for applying adhesive to one face of the web P; means C for applying abrasive material to the adhesive side of the web P; means D for causing a preliminary set of the adhesive; and means E for drawing the web through the coating apparatus and into a drying chamber.

The means A for holding and dispensing the web P comprises, as shown in the drawing, a frame 1 that supports the roll 2 of the web P; an idler roll 3 for guiding the web; printing rolls 4 and 5 for marking the web with any desired legend or identification; and an idler roll 7 for guiding the web.

The adhesive applying means B comprises, as shown in the drawing, idler rolls 8 and 9 for guiding the web; a roll 11 positioned to dip into a pan 12 of adhesive; a pressure roll 13 for maintaining contact between the web P and the roll 11; a drum 15 and an adhesive distributing brush 16 positioned above the said drum 15; and an idler roll 18 for guiding the web as it is brought from the adhesive distributing brush.

The means C for applying abrasive material to the web P comprises, as shown in the drawing, idler rolls 19 and 20 for guiding and positioning the adhesive coated web; an endless feed belt 41 positioned below and substantially parallel to the web P, and enclosing the pulleys 42, 43, 44 and 45, variable speed driving means 46 and 47 for operating the grain feed belt 41, a grain hopper 35 with an adjustable gate 36 and roll 37 for dispersing the abrasive particles onto the feed belt 41, mechanical means 22 for projecting the abrasive grains upwardly from the feed belt and an electromagnet 26 with upper and lower pole pieces 28 and 29 so designed as to produce a distributed magnetic field of relatively strong intensity at the area adjoining the projecting means 22 and of gradually decreasing intensity at its other end (as represented diagrammatically by the dotted lines of force).

The means D for causing the adhesive to acquire a preliminary set comprises, as shown in the drawing, an idler roll 50 and a fan blower 49 for supplying a large volume of air at a low velocity to the adhesive and granular coated side of the web P. The break in the web indicates a number of feet of travel of the web in a horizontal direction after the abrasive particles are applied to the under side.

The means E for moving the web P from the coating apparatus into the drying chamber comprises, as shown in the drawing, one or more suction drums 51 and 52; an idler roll 53; a rack 55 for supporting the web P; and an endless conveyor 54 for transporting loops of the web P to the rack 55.

In the normal operation of the apparatus illustrated herein, a roll of the uncoated web P, such as paper or cloth, is rotatably mounted on the frame 1 and the web is threaded over the roll 3 and between the printing rolls 4 and 5 and thence in contact with the idler rolls 7, 8 and 9 to the pressure roll 13 and the adhesive roll 11,

The adhesive roll 11 dips into liquid adhesive tank 12 and by its rotation applies a layer of adhesive to the web.

The adhesively coated material P passes between the brush drum 15 and a vibrating brush 16, which evenly distributes the adhesive and smooths out any ridges. It is then guided by the idler rolls 18, 19 and 20 into a position over a suitable grain projector which is adapted to project abrasive grains upwardly from the grain feed belt 41 and onto the downwardly facing adhesive surface of the web. The projector illustrated in Figure 1 comprises means for vibrating the belt 41, such as the beater 22 mounted on a suitable support not shown in the drawing. This beater is rotatable at speeds as desired, by means of the driving motor 25 and belt 24, and is so positioned with respect to the upper surface of the belt that upon rotation the projecting fins 27 deliver quick, sharp blows to the underside thereof.

The striking of the beaters 22 against the under side of the belt causes the abrasive grains carried by the belt to be projected upwardly, and because of their upward projection through space, a portion of the elongated grains become oriented with their major dimension parallel to the path of flight. In addition the forces produced by the magnetic field, which may be in very close proximity to the beater, cooperate with these previously described mechanical forces in producing a desired orientation of the granules being deposited on the web P.

While we have illustrated a rotating beater 22 as the belt vibrating means, it is to be understood that other types of vibrators, such as reciprocating, rocking and/or electromagnetic vibrators may be utilized for this purpose.

As the abrasive particles enter the magnetic field they are energized and become, in effect, miniature magnets with magnetic poles of opposite polarity at their extreme ends or in other words, in such a manner that the magnetic axes lie along their major axes. Forces produced by the magnetic field then produce a turning moment which tends to turn the individual particles so that their major axes are parallel to the magnetic lines of force. By passing the web through and out of the magnetic field at an angle normal to the magnetic lines of force the abrasive grains can be oriented or positioned so that their longest dimensions are substantially perpendicular to the backing material.

Provision for causing the adhesive to acquire at least a preliminary set after the granules have been deposited on the web is made by incorporating a blower 49 capable of delivering a large volume of air at a low velocity against the adhesive coated surface. This blower 49 is located between the grain projecting means and the idler roll 50 and causes the adhesive to set or acquire sufficient firmness to prevent the granules from being positioned in any other manner than that desired before the direction of movement of the web is changed.

From the roll 50 the coated web is drawn over the suction drums 51 and 52 to a suitable drying rack 55 where the adhesive is caused to set.

A bin 48 receives the particles or surplus grain which do not adhere to the coated web, but fall back onto the feed belt and are carried out of the coating zone.

The modification shown in Figure 2 is similar to that shown in Figure 1 except that fluid pressure means is used in combination with electromagnetic means for orienting and projecting

granular particles upward onto an adhesively coated web. The apparatus illustrated herewith comprises an endless permeable belt 41a of such material as mesh woven silk, positioned parallel to the web P and supported by driving pulleys not shown. Located beneath the upper surface of the mesh belt and within the magnetic field set up between the pole faces 28a and 29a is a duct 60 provided with a restricted orifice 61. The orifice 61 is of a length as great as the width of the web P and adapted to direct a stream or curtain of compressed air or other gas upward through the mesh belt 41a at a high velocity and low volume. This curtain of high velocity gas projects the granules from the mesh belt upward onto the underside of the adhesively coated web. As the granules move through the intervening space air resistance causes them to become oriented so that their major dimensions are parallel to the direction of flight. In addition the forces produced by the electromagnetic field set up between the upper pole face 28a and the lower pole face 29a coact with the orienting force, due to air resistance, in producing a desired orientation and uniform distribution of the particles being deposited on the web P.

Apparatus constructed in accordance with our invention utilizes the magnetic susceptibility of abrasive particles of the type commonly used in the manufacture of abrasive coated webs or the readiness with which such particles can be made magnetic. While all granular particles are acted upon to a greater or less degree by magnetic forces, a very strong magnetic field is required to exert an appreciable force on some types of abrasive grain commonly employed in the manufacture of abrasive fabric materials. We have found that suitable grain can be obtained by selecting particles each of which contains sufficient magnetic impurity so as to render said granular particles readily susceptible to magnetic forces. This particular type of grain may be selected from the regular run of crushed grain by means of magnetic separator units, which are well known in the art.

With certain types of abrasive grain such as garnet, flint, emery, silicon carbide, etc., it may be impractical or difficult to secure particles that are sufficiently magnetic to be properly oriented by available magnetic forces. In such instances, the abrasive particles can be coated with a layer of magnetic material such as metallic iron, iron oxide (Fe_3O_4), or the like. In applying the magnetic material, the abrasive particles can be coated first with an adhesive such as lacquer, varnish or the like and then coated with a layer of the magnetic substance. After the adhesive sets the grains are ready for use.

Our invention provides apparatus for positioning elongated, magnetically susceptible abrasive particles on adhesively coated materials in such a manner that a substantial proportion, frequently exceeding fifty per cent (50%) of these abrasive particles are uniformly and individually oriented so that their largest dimensions are at a predetermined angle with respect to the surface of the fabric material.

Apparatus constructed in accordance with our invention has certain distinct advantages over machines previously known and used for the purpose of producing an abrasive coated web in which the particles were so arranged on the web that their major axes made a substantial angle with the web. Among the advantages belonging to machines built in accordance with our in-

vention is the ability to project large and heavy particles, which the previously known magnetic machines would not do satisfactorily, and the ability to definitely orient abrasive particles as they are projected, which the previously known mechanically operated projecting machines would not do to the full extent desired in granular coated webs of this character.

Machines depending entirely upon magnetic forces for the propulsion and orientation of granular materials have not been entirely satisfactory in their application to the coarse particles which, because of their greater bulk, were more difficult to lift and orient. The mechanically operated projecting apparatus of the prior art has been such that it would lift and propel to the required height particles of all sizes including those sizes that the magnetic type of machine would lift only to a slight extent. The mechanically operated projecting apparatus of the prior art has not been entirely satisfactory, however, in the character of orientation produced by its use. Its operation, insofar as producing orientation is concerned, depends upon its imparting rather high velocities to the particles and, because of this requirement of high velocities, it has been found difficult to secure the desired degree of orientation with the mechanically operated projectors.

In apparatus built in accordance with our invention, magnetic and mechanical forces are caused to coact in producing results not obtainable heretofore with the apparatus known to the prior art. The application of mechanical forces to the particles assists the magnetic forces, particularly in the lifting and propulsion of the granules toward the adhesive coated web, whereby, not only may larger and heavier particles be projected and oriented than can be done with the magnetic machines of the prior art, but also lower field intensities can be used in connection with the projection of the smaller sizes of particles. This is a distinct advantage because the field intensity ordinarily required to project the particles is of such a magnitude that considerable difficulty is experienced in practical application.

While we have described our invention with specific illustrations, it is not intended that these illustrations shall define the scope of our invention. Various modifications may be made by those skilled in the art without departing from the spirit or scope of our invention as defined in the appended claims.

We claim:

1. Apparatus for applying a coating of oriented abrasive particles to a moving web, comprising a magnet having oppositely positioned upper and lower poles, means for passing the web to be coated between said poles with an adhesive coated surface facing downwardly, a feed belt movable between the adhesive coated web and the lower of said poles, means for supplying magnetically susceptible abrasive particles to said feed belt to be carried between the said poles and beneath the adhesive coated web, and mechanical means for projecting the abrasive particles upwardly from the belt against the downwardly facing adhesive coated surface of the web while said particles are subjected to the orienting action of the magnetic field between the said poles.

2. Apparatus for applying a coating of oriented abrasive particles to a moving web, comprising

a magnet having oppositely positioned upper and lower poles, means for passing the web to be coated between said poles with an adhesive coated surface facing downwardly, a feed belt movable between the adhesive coated web and the lower of said poles, means for supplying magnetically susceptible abrasive particles to said feed belt to be carried between the said poles and beneath the adhesive coated web, and means for vibrating said feed belt, said apparatus being adapted to project the particles upwardly from the said belt against the downwardly facing adhesive coated surface of the web while such particles are subjected to the orienting action of the magnetic field between the said poles.

3. Apparatus for applying a coating of oriented abrasive particles to a moving web, comprising a magnet having oppositely positioned upper and lower poles, means for passing the web to be coated between said poles with an adhesive coated surface facing downwardly, a permeable carrier passing over the lower pole face for carrying the magnetically susceptible abrasive particles into the magnetic field between the said poles, means for supplying abrasive particles

to the permeable carrier, and means for blowing a stream of gas through said permeable carrier, said apparatus being adapted to propel the abrasive particles upwardly from the said carrier against the downwardly facing adhesive coated surface of the web while such particles are subjected to the orienting action of the magnetic field.

4. Apparatus for applying a coating of oriented abrasive particles to a moving web, comprising a magnet having oppositely positioned poles located one above the other and adapted to produce an intense magnetic field therebetween, means for passing the web to be coated between said poles with an adhesive coated surface facing downwardly, a carrier for conveying magnetically susceptible particles into the magnetic field between said poles, and mechanical means located within said magnetic field for projecting the abrasive particles upwardly from the carrier against the adhesive coated surface of the web.

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