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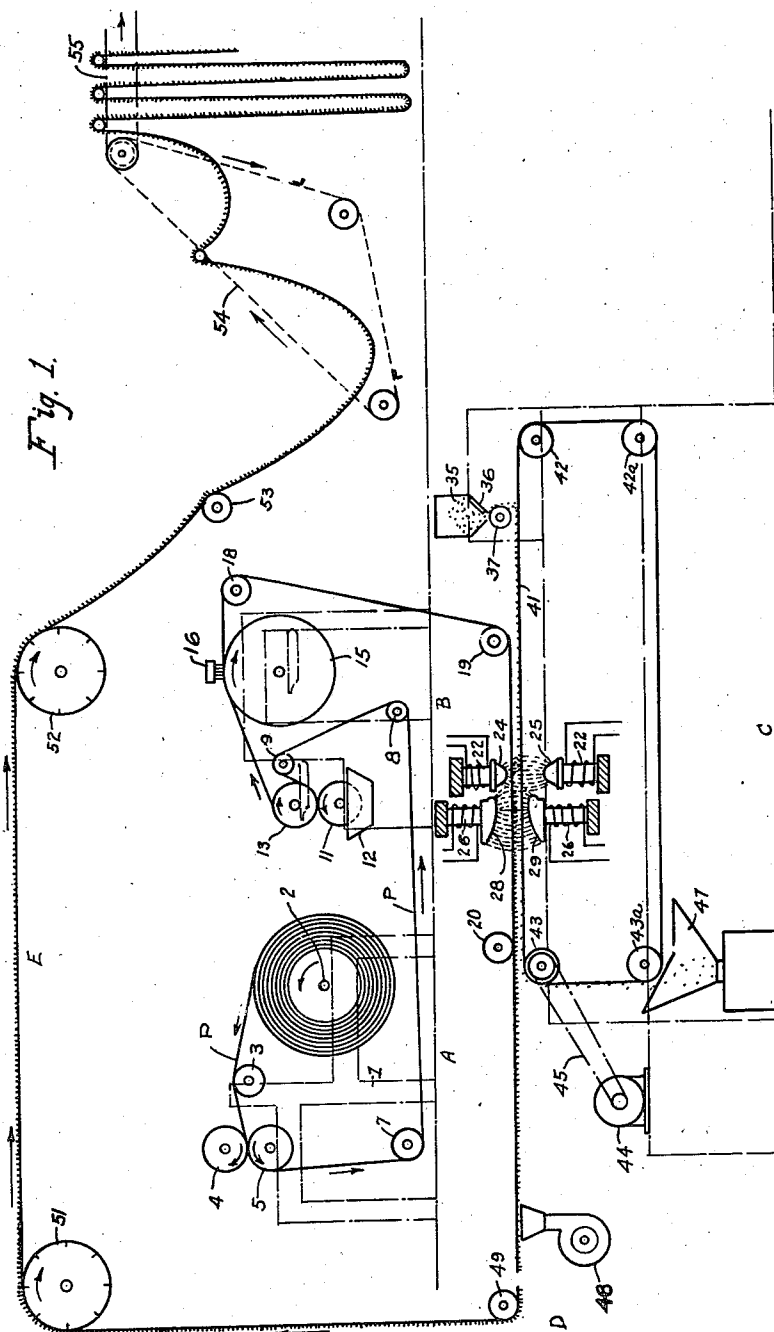
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2,254,531

COATING APPARATUS

Filed Oct. 10, 1932

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Fig. 2.

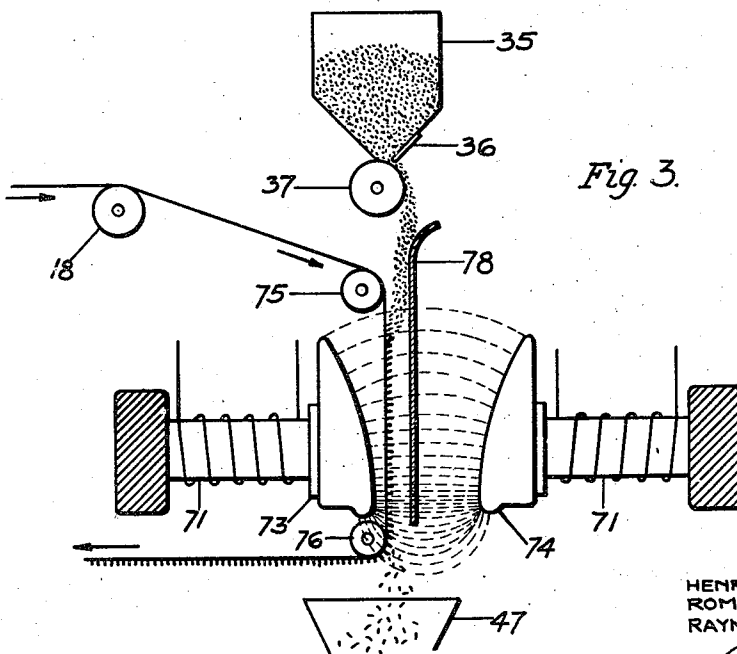
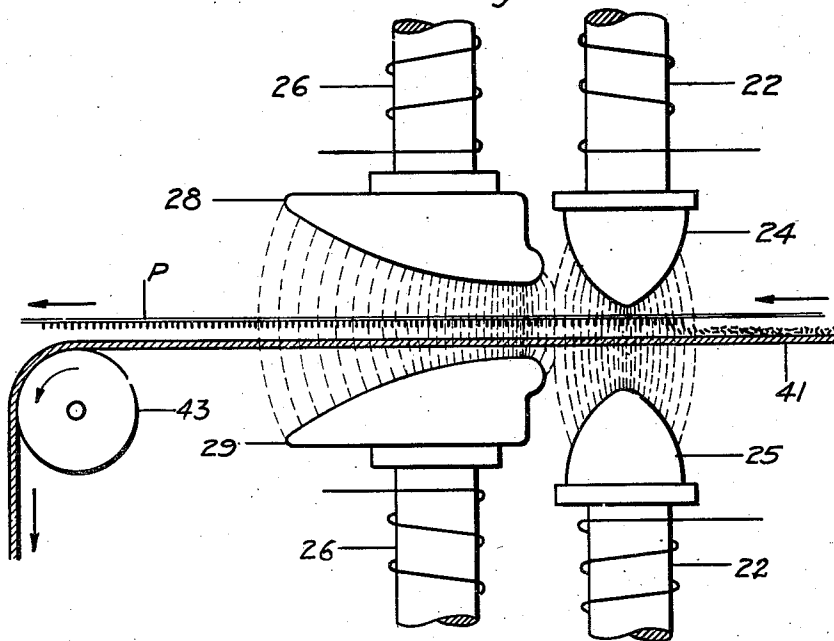


Fig. 3.

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COATING APPARATUS

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7 Claims. (Cl. 91—18)

This invention relates to improved apparatus for the manufacture of granular coated webs of such materials as paper, cloth, or the like, and has for an object the provision of improved means for securing a superior product, greater efficiency and/or lower cost of production of the coated article.

Abrasive particles commonly used in the manufacture of abrasive coated fabrics are of two general types; namely, elongated and blocky. The former type comprises splintery grain, in which the grain has one dimension longer than the others, and plate-like grain, in which the grain has one dimension materially smaller than the others. The blocky type of grain has all of its dimensions substantially the same. We have found that abrasive coated webs made by orienting a large proportion of the elongated particles in such a manner that their longer dimensions are normal to the web to which they are attached, are decidedly faster cutting and more efficient than coated webs in which the particles are haphazardly arranged, as happens in the usual method of coating webs, or in which but a relatively few of the particles are so oriented. The present invention relates to a machine for electro-magnetically securing such orientation of the granular particles.

We have found that a relatively large proportion of the granules used to coat webs can be oriented at will by the use of a new form of apparatus that we have invented, and which avoids certain disadvantages inherent in the previously disclosed apparatus and methods. Our apparatus does not require the employment of high voltages; it is rugged, easily built, easily operated, readily adjustable to varying conditions, and economical in operation. In addition, it has a number of other advantages that will be more apparent after our invention has been explained.

Apparatus constructed in accordance with our invention utilizes the magnetic susceptibility of granular particles of the type commonly used in the manufacture of granular 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 oriented or projected by available magnetic forces. In such instances, the granular particles can be coated with a layer of magnetic material such as metallic iron, iron oxide (Fe_2O_3), or the like. In applying the magnetic material, the granular 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 granular particles on adhesively coated materials in such a manner that a substantial proportion, frequently exceeding fifty per cent (50%) of these granular 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.

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

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

Figure 2 is an enlarged view of the electro-magnetic orienting zone of Figure 1; and

Figure 3 is a diagrammatic side elevation of another form of our apparatus.

Figure 1 of the drawings 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 granular 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 drawings, a frame 1 that supports the roll 2 of 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 drawings, idler rolls 8 and 9 for guiding the web; a roll 11 positioned to dip into a pan 12 of adhesive; a 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 distributing brush.

The means C for applying granular material to the web P comprises, as shown in the drawings, idler rolls 19 and 20 for guiding and positioning the web; an electromagnet 22 having upper and lower pole pieces 24 and 25 respectively, which are so designed as to produce a strong, concentrated magnetic field; 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 field of magnet 22 and of gradually decreasing intensity at its other end (as represented diagrammatically by the dotted lines of force) magnet 26 being so placed with respect to magnet 22 that the two fields are substantially continuous and substantially vertical; an endless feed belt 41, positioned below and substantially parallel to the web P, and enclosing the pulleys 42, 42a, 43 and 43a; a hopper 35 with an adjustable gate 36 and a roll 37 for dispensing the granular material to the feed belt 41; and variable speed driving means 44 and 45 for operating the feed belt 41.

The means D for causing the adhesive to acquire a preliminary set comprises, as shown in the drawings, an idler roll 49 and a fan blower 48 for supplying a large volume of air at a low velocity to the adhesive and granular coated side of the web P.

The means E for moving the web P from the coating apparatus into the drying chamber comprises, as shown in the drawings, 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 magnetic field set up between the pole pieces of the electromagnets 22 and 26.

Granular particles are distributed from the grain hopper 35 onto the grain feed belt 41, which moves through the magnetic field parallel to the web P and in the same direction as shown in an enlarged view as Figure 2. The field of magnet 22 energizes the granular particles, causing them to become, in effect, miniature magnets with poles at their extreme ends or in other words, in such a manner that their magnetic axes lie along their major axes. Since the feed belt 41 is positioned nearer to the face of the upper pole piece 24, the particles are attracted to the upper pole 24 of this magnet and propelled toward it while so positioned that their major axis are coincident with the magnetic lines of force, which are substantially vertical. Thus the longitudinally oriented granules strike the

adhesive coating on the underside of the material P and adhere in an upright or oriented position.

Upon passing out of the field of magnet 22 the coated web immediately enters the field of magnet 26, the two being preferably so positioned as to be practically continuous, and leaves this field where it is of low flux density. The magnet 22, the upper pole piece 24 of which is close to the upper side of the coated web, causes the abrasive particles to move upwardly and attach themselves to the bottom of the web in an oriented position; and the magnet 26, the pole pieces of which are symmetrically and evenly spaced from the web, insures that the particles are oriented vertically as the paper passes between and out from the poles of this magnet.

Immediately after leaving the grain deposition zone, the adhesive carried by the web is subjected to a preliminary setting operation so that the granules will be retained in their oriented position. The coated web then passes around the idler roll 49 and suction drums 51 and 52 to a drying rack 55 where the adhesive is permitted to set fully.

Figure 3 represents, diagrammatically, a modification of apparatus adapted to orient granular particles that are fed into the magnetic zone by gravity. This apparatus comprises an electromagnet 71 with pole pieces 73 and 74 of a design similar to those of magnet 26 of Figure 1; a grain-deflecting member 78; rolls 18, 75 and 76 for guiding and positioning the adhesive coated web through and away from the grain deposition zone; and grain dispensing means 35, 36 and 37.

In the operation of this form of apparatus the granular particles fall toward the magnetic field, the weaker part of which is positioned upward. The particles, deflected toward the pole piece 73 by the grain deflector 78, are gradually charged magnetically and are then attracted toward pole piece 73 while oriented with their major axes substantially horizontal. They are intercepted, however, by the adhesive coated web, and produce thereon a coating of particles so oriented that their major axes are normal to the web. The coated web is immediately passed around roll 76 in such a manner that it will assume a horizontal position so that the orientation of the particles will not be destroyed by gravitational attraction.

In the operation of apparatus constructed as illustrated, the intensity of the magnetic field is adjusted to such a value that the abrasive particles on the feed belt 41 become charged and are propelled toward the pole piece 24 and strike the adhesive coating on the web P with sufficient force to partially embed themselves and adhere thereto. Other factors remaining constant, we have found that the field intensity required to magnetically propel the charged granules into engagement with the adhesively coated web varies in proportion to the size or mass of the granules; that is, a greater intensity is required for the larger grain than for smaller size grains. Thus, by changing the current flowing in the coils of the electromagnet 22, the magnetic intensity can be adjusted to such a value that grain of a certain specific size will be magnetically deposited on the adhesive coating, whereas any grain of a larger size, which might be present on the feed belt, will remain and be carried into the bin 47.

We have found it desirable, in general, to apply a surplus of grain to the feed belt 41 as this

assists in producing a coating of uniform density. Different densities of grain coatings can be obtained by varying the current that energizes the magnet so that the lifting power of the magnet is increased or decreased to raise more or less particles from the feed belt. The density of the coating of the granular material on the web also can be increased or decreased by adjusting the upper pole of the magnet closer to or further from the surface of the granular material on the feed belt.

Not all granular materials are equally affected by magnetic forces, some being readily affected and others being slightly affected or requiring intense or highly concentrated forces to produce an appreciable effect. Apparatus constructed in accordance with our invention is readily adaptable to these different degrees of susceptibility and is positive in action. When used with material that is readily susceptible to magnetic forces the intensity of the field set up between the poles of the magnet can be adjusted to produce a granular coated web of the desired characteristics. By adjustment of the intensity of the magnetic field to a higher concentration or greater flux density less susceptible particles are caused to act in the same manner as more susceptible particles act in a lower intensity field.

Abrasive granular material, as delivered by the roll crushers ordinarily used to break up the crude material, consists of grains of irregular shape and proportions. Such grain may be designated in general as of two types, blocky grain and elongated grain. Elongated grain may consist of splintery or needle-like particles having one dimension appreciably longer than the others or of platey particles in which two of the dimensions will be greater than the other.

It is the elongated type of material that is particularly susceptible to orientation and which can be advantageously oriented since particles that are similar in all dimensions will act in much the same way regardless of the position they are caused to assume on the backing. Our apparatus will orient a large part if not substantially all of the elongated grains which occur. If it is desired to make a particularly sharp product, the elongated type of grain can be separated from the blocky particles, for example by an air separation and used exclusively.

While our apparatus is not adapted to deposit and orient materials that are totally devoid of magnetic properties, it operates efficiently to deposit and orient magnetic granular materials or non-magnetic materials that have been rendered magnetic. It is particularly adaptable to such materials in that the magnetic field has an orienting influence greater than that of an electrostatic field in such materials. Moreover, in our apparatus, the very high voltages necessary for electrostatic apparatus are dispensed with. It has a further advantage over electrostatic apparatus in handling materials that are electrically conductive, as well as being magnetic, since the conductivity of granular material interferes with the efficient operation of electrostatic apparatus.

Another advantage which our apparatus has over previous machines resides in the fact that the granular materials are made to strike the adhesive coated web endwise. When elongated particles are deposited by the action of gravity, as is the case with apparatus heretofore known, elongated particles tend to strike the adhesive in such a position that their long dimension lies

along the plane of the web. Obviously such a position is contrary to that desired where a product having the long dimensions normal to the web is being made and it is difficult to cause such particles to change their position and assume the desired normal position once they have become embedded in the adhesive.

In our apparatus, the magnetic granular material is projected onto the adhesive coated web as well as being oriented. The particles, in their travel toward the adhesive coated surface, have become oriented with their longest dimensions substantially vertical to the surface so that they embed themselves in the adhesive in such position. In both forms of apparatus illustrated, the orientation at right angles to the face of the web is maintained as the web passes beyond the magnetic field. In the form of apparatus shown in Figure 2, the magnetic field of the magnet 28 is symmetrical so that the lines of magnetic force are vertical. As the coated web passes from beyond this field, the force of gravity tends to hold the particles with their longest axes vertical. In the form of apparatus shown in Figure 3, the magnetic lines of force below the bottoms of the pole pieces are preferably normal to the surface of the web as it passes over the roller 70 and thus tends to retain the particles with their longest axes normal to the face of the web. As the web passes beyond the roller 70, and into horizontal position, the force of gravity tends to hold the particles in such oriented position until the adhesive has become at least initially set.

The electromagnets may be energized either by direct or by a pulsating electric current such as a rectified alternating current, an intermittent direct current or even an alternating current. Where a pulsating current is employed, the direction of the pulsations should be great enough to effectively attract and orient the particles.

Other advantages will be apparent from the foregoing disclosure to those skilled in the art and while specific embodiments have been used to illustrate our invention, it is to be understood that the invention is not limited to those embodiments but is defined by the appended claims.

We claim:

1. Apparatus for the manufacture of granular coated webs comprising an electromagnet having upper and lower pole pieces so designed as to set up a relatively concentrated magnetic field of high intensity, another electromagnet with upper and lower pole pieces so designed and so positioned with respect to the first mentioned magnet as to set up a distributed magnetic field having a relatively high intensity at the end adjoining the concentrated field and a decreasing intensity away from the concentrated field, means for passing an electric current around the cores of said magnets, means for supporting an adhesive coated web in the field and nearer the upper than the lower pole pieces of said magnets and with an adhesive coated side down, and means for introducing granular material into said field between the lower pole pieces of the magnets and the adhesive coated web.

2. Apparatus for the manufacture of granular coated webs comprising a magnet with two oppositely positioned poles so located as to set up a substantially horizontal magnetic field of relatively low intensity at its upper side and of gradually increasing intensity downward, means for energizing said magnet, means for conducting an adhesive coated web into and downward through said field nearer one pole of the mag-

net with an adhesive coated side facing the more remote pole, and means for supplying granular material to said field from above to a place between an adhesive side of the web and the pole that the adhesive coated side faces but nearer to the opposite pole.

3. Apparatus for the manufacture of webs coated with oriented granular material comprising means for supporting an adhesive coated web with the adhesive surface facing downwardly, means for projecting magnetically susceptible particles upwardly against the adhesive coated surface of the web, and magnetic means for orienting the particles with respect to the web.

4. Apparatus for the manufacture of webs coated with oriented granular material comprising a magnet having oppositely positioned poles for producing a magnetic field therebetween, means for supporting a web between said oppositely positioned poles and within said magnetic field and nearer one of the said poles, said web being coated with an adhesive on that surface facing the more distant pole, and means for conveying magnetically susceptible granular material into the magnetic field adjacent the adhesively coated side of the web.

5. Apparatus for the manufacture of webs coated with oriented granular particles comprising a magnet having oppositely positioned upper and lower poles, means for passing between said magnetic poles a web coated with adhesive on its lower surface, a feed belt movable between

the adhesive coated surface of the web and the said lower pole for conveying magnetically susceptible granular particles, and means for projecting the particles upwardly from the feed belt against the adhesive coated surface of the web as it passes to said poles.

6. Apparatus for the manufacture of webs coated with oriented granular particles comprising a magnet having oppositely positioned upper and lower poles, means for passing a web coated on one surface with an adhesive between said poles with its adhesive coated surface positioned downwardly, and means for projecting magnetically susceptible granular particles upwardly against the downwardly facing adhesive coated surface of the web as it passes to said poles.

7. Apparatus for the manufacture of webs coated with oriented particles comprising a magnet having oppositely positioned poles one of which is rounded for producing a magnetic field which converges toward said rounded pole, means for passing an adhesively coated web through said converging magnetic field and with its adhesive coated surface positioned away from said one of the poles, and means for conveying magnetically susceptible particles into the magnetic field adjacent the adhesively coated surface of the web.

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