March 14, 1967 G. HEYL ETAL 3,309,569

APPARATUS FOR DISCHARGING INSULATING ARTICLES ON A SUPPORT

Filed Jan. 30, 1963 2 Sheets-Sheet 1

FIG. 1

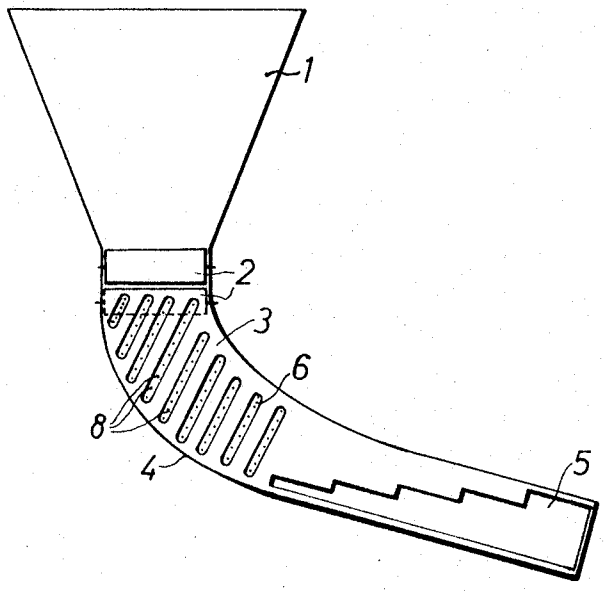
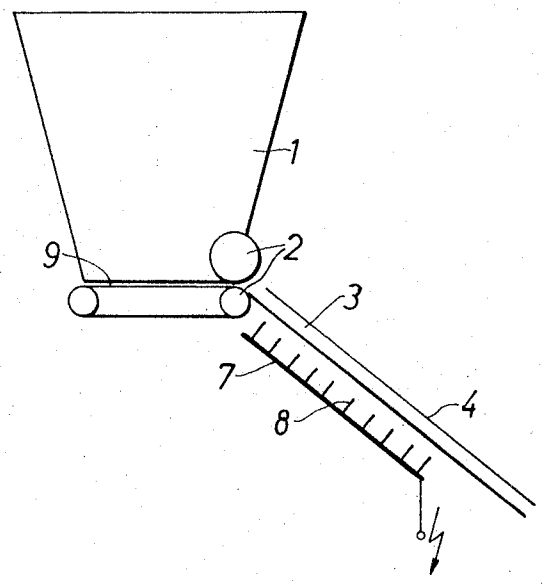


FIG. 2



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FIG. 3

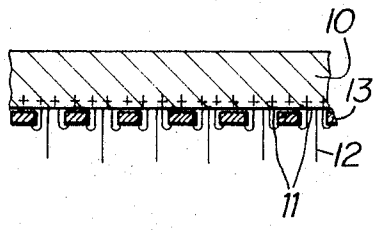
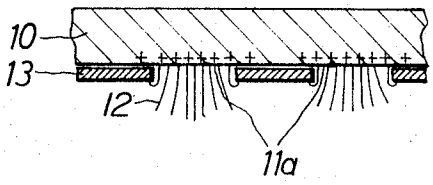


FIG. 4



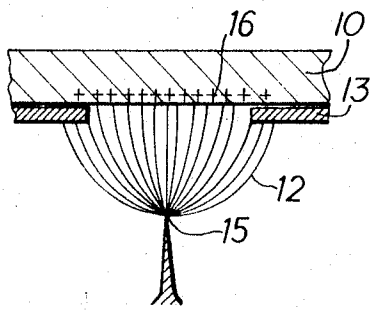


FIG. 5

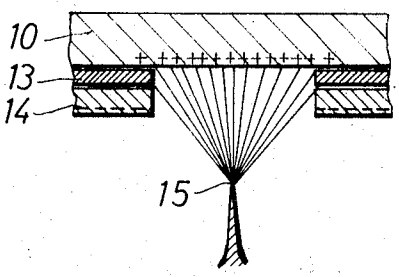


FIG. 6

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3,309,569

APPARATUS FOR DISCHARGING INSULATING ARTICLES ON A SUPPORT

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5 Claims. (Cl. 317—2)

The invention relates to an apparatus for discharging articles of insulating materials, consisting of a support for the articles and an apparatus for the ionisation of the atmosphere.

Instruments for removing electrostatic charges on insulating articles are known in various forms. The atmosphere is ionised by ultraviolet, X-ray or radioactive radiation or by a corona discharge on thin wires or fine points. This ionisation apparatus is brought near the articles that are to be discharged. Its charges produce an electrostatic field in its surroundings, this field discharging ions of the opposite sign on the surface until the charges on the article have been neutralised. The discharge is necessary in order to prevent ignitable sparks or disturbances due, for example, to the attraction or adhesion of dust particles.

With the known apparatuses, it is often not possible or only incompletely possible to remove the charges directly at the point where they are formed or where they actually produce a disturbance. This will be explained with the aid of an example as follows:

There are many processes and instruments in which articles of insulating material have to slide down an inclined plane. These articles generally get stuck because there is considerable attraction between the charged articles and the metal support owing to their slight separation. This charge may either have already been present on the article from the beginning or have been produced as a result of the sliding motion. An ionisation device of known type arranged above the sliding article is in in that case ineffective. The electrostatic field is situated between the undersurface of the article and the influence charges on the support. There is practically no electrostatic field in the surrounding atmosphere, so that no ions can be attracted or brought near the charges.

Chips of synthetic material (e.g. polystyrene, polyvinyl chloride, polyethylene, polyamide, polyurethane, polyester, methacrylate, acetyl cellulose or polycarbonate) are excellent insulators which are very easily charged. These chips will adhere even to very steep surfaces because the forces of attraction may be several times greater than the force of gravity. These forces cannot be removed by insulating the metal sliding surface or by making the surface of insulating material, because in both cases charges are produced on the support and moreover, the insulating surface becomes charged with the opposite sign of that of the synthetic material sliding over it.

It is the object of the invention to obviate this difficulty and to enable articles of synthetic insulating materials to slide smoothly and without interruption over supports. In accordance with the invention, this object is achieved by providing the support with suitable perforations and arranging ionisation apparatus on the side of the support remote from these articles.

The invention will be described with reference to a constructional example illustrated in the drawing.

FIGURES 1 and 2 show diagrammatically sorting and counting apparatus for chips of synthetic material. FIGURE 1 is a plan view and FIGURE 2 is a side view.

FIGURES 3, 4, 5 and 6 show various forms of breaks

or perforations in the supporting plate which is a sliding surface for chips.

The chips of synthetic material drop into a funnel **1** and are conveyed on a conveyor band **9** and by roller pairs **2** on to an inclined plane **3** which is broken at **6**. The size and arrangement of these perforations in the surface must be so chosen that even the smallest type of chips will not fall through. It has been found particularly advantageous to use slots **6** that run obliquely to the direction of sliding and which are so arranged that the steps are narrow and even the smallest chip will cover more than one step and two slots. Below the sliding surface there is a plate **7** which is connected to a high voltage source of 5–10 kv. (not shown). The distance between the points **8** and the supporting plate **3** must be adjusted to avoid the passage of electricity between them. The distances between the points should be greater than the distance between the points **8** and the supporting plate **3** because the points would otherwise impair each other's action. When the delivery rollers push a chip on to the supporting plate, the parts of the surface on the underside of the chip which pass over a break in the supporting plate are discharged. This amounts to practically the whole of the undersurface when the slots are arranged obliquely. The chip now slides under the force of gravity over the inclined plane, unhindered by electrostatic forces. The new charge due to the sliding action is small owing to the small area of the frictional surface and in any case this charge is immediately removed when the chip passes over the next slot. The chip reaches the edge **4** and rolls unhindered over the stepped slot **5** because the new charges produced there are too small to hinder the movement of the chip. If necessary, arrangements may of course be made to discharge the chip there as well.

The chips are sorted according to size and width by means of the fact that each type of chip will fall through a certain step in the stepped slot **5**, according to its width and diameter, and is caught up after it falls through the slot and the chips are then counted.

It is important to note that the break in the sliding surface of the supporting plate is not in itself sufficient to ensure undisturbed movement of the chips. Discharge is also necessary. The transport of ions from the point to the underside of the chips is assisted by the electrostatic wind starting from the point. This wind furthermore counteracts the friction due to adhesion and any remaining electrical forces.

The invention is, of course, not limited to the example described but may be applied wherever the forces between a charged synthetic material and the supporting surface or where spark discharges on separating synthetic materials from their supports are inconvenient.

The supporting plate may be curved or plane. The breaks in the surface need not necessarily be in the form of slots but may be of any suitable shape, for example circular or polygonyl. The support may, moreover, be in the form of a net or screen. The ratio between the area of the aperture and the area of the remaining surface should be large.

FIGURES 3 and 4 are intended to show that for a given ratio between these areas it is advantageous not to subdivide the apertures into a large number of small ones. The lines of force **12** from the charged article **10** will partly pass through the breaks **11** and **11***a* (FIG. 4) and partly return to the earthed support **13** (FIG. 3). The lines of force of this marginal portion will therefore not be able to penetrate to the same extent into the ionic cloud around the point and will therefore not be able to attract the same number of ions. The total marginal zone will be smaller the greater the individual

breaks 11*a* (FIG. 4). If these breaks are large the spray elements may be brought close to the supporting plate without the risk of sparking over.

The effectiveness of the spray elements may be enhanced by concentrating the field to the breaks in the plate 13 as indicated in FIGS. 5 and 6. It will be supposed that the article 10 is a chip of synthetic material with a positive charge. The ions leaving the point 15 will follow the lines of force 12 in FIG. 5 and some of them will land on the charged surface 16 of the article 10, as desired, but some will flow to the earthed supporting plate 13. As shown in FIGURE 6, the proportion flowing to the earthed support may be reduced by applying a layer of insulating material 14 about 1 mm. to 1 cm. in thickness on to the side of the supporting plate 13 facing the point 15. At the beginning of the negative half wave, ions will charge this surface and direct the field towards the article 10 to be discharged. By such an arrangement it is possible to reduce the ratio between the area of the apertures and the area of the unbroken surface of the support 10. Thinner layers of synthetic material, for example layers of varnish, have less effect in concentrating the field but reduce the danger of sparking over.

Depending on the conditions, all ionising rays (UV, X-ray, α, β, γ) or spray elements operating with high voltage direct, alternating or high frequency current may be used as ionisation media. Points or wires may be used as spray elements.

A number of examples for which the apparatus may be used will now be given:

In packaging machinery, in which plastic packages are processed, the sliding of the packages along supporting surfaces is to a certain extent obstructed by electrical forces. The same applies quite generally to the manufacture and processing of insulating articles.

Perforated cards (e.g. for Hollerith machines) are being made to an increasing extent of plastic owing to the greater wear resistance of this material. Electrostatic charges may prevent these cards sliding over the conveyor pathways. The same difficulties are encountered with perforated cards of dry and therefore well insulated paper, particularly paper backed or coated with plastic. These difficulties are generally encountered in the treatment and manufacture of foils or sheet material of insulating substances and in the treatment of textiles.

When insulating articles are transported on conveyor bands it may happen that, quite apart from the intrinsic conductivity of the material of the conveyor band, these articles will not slide off the deflecting rollers but adhere to the conveyor band owing to the electrostatic forces and are carried along on the band. In such cases, the band will be perforated in a suitable manner or constructed as a net of metal or textile material with an appropriate mesh size. The discharge apparatus will be arranged immediately in front of the deflecting roller. If the articles are displaced on the band while they are being conveyed on it, it is advisable to arrange discharge apparatuses at several points underneath the conveyor band.

In the case of sheets of synthetic material (e.g. foils) which have to be coated in a spraying machine, the sheets tend to adhere to the rollers owing to the electrostatic forces when attempts are made to lift then off. When this happens, the tension increases until the forces holding the sheet to the rollers are overcome so that the sheet comes off the roller with a sudden jerk. This interferes with the application of the coating on the sheet. In that case, the roller will be fixed in position and a longitudinal slot will be made on it at the point where the band comes off it. An ionisation apparatus is arranged inside the roller so that, in accordance with the principle of the invention, the undersurface of the sheet will be discharged and this will prevent the sudden detachment of the sheet from the roller.

We claim:

1. In the production of small discontinuous articles of insulating material, wherein the produced articles are transported by gravity from a feed hopper to a size-sorting device down an inclined plane and wherein said articles pick up a static charge by reason of their transportation down said inclined plane; the improvement which comprises providing perforations of a size smaller than the smallest dimension of said articles in said inclined plane; providing an electrostatic discharging means below said inclined plane operatively associated such as to discharge static electricity from said gravity transported articles, wherein said electrostatic discharge means is spaced at a distance from said inclined plane such that there will be substantially no passage of electricity between said discharge means and said plane.

2. The improved production claimed in claim 1, wherein said inclined plane has an insulating material on the side thereof facing said electrostatic discharge means.

3. The improved production claimed in claim 1, wherein said perforations are disposed obliquely to the direction of movement of said articles.

4. The improved production claimed in claim 1, wherein said articles are plastic chips.

5. The improved production claimed in claim 1, wherein said electrostatic discharge means is an ionisation means.

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