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(54) Apparatus for powdering solid product and spraying the powdered product

(57) Apparatus for powdering solid product 2 and spraying the powdered product comprises: a rotatable cutter 1; means 3, 15 for advancing the product 1 against the cutter to effect powdering of the product by the cutter; a channel through which the powdered product passes from the cutter; and outlet means through which powdered product from the channel is sprayed. The product may in the form of bars of different coloured pigments which are fed by motors 3 against the cutter. Liquid and compressed air are fed at 5 and 6 to the spray nozzle. A motor-driven needle 12 meters the liquid flow. The elements may be under computer control.

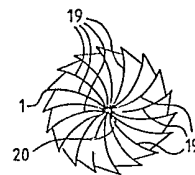
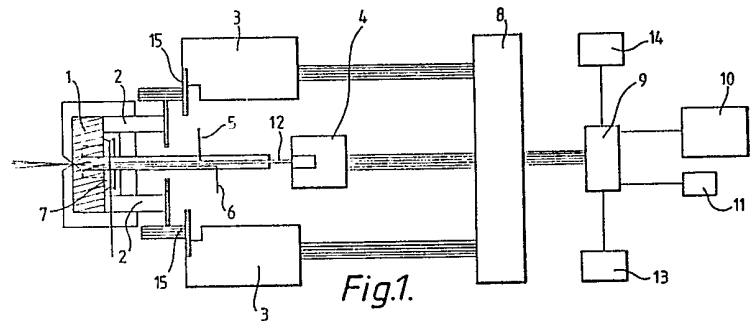


Fig. 2.

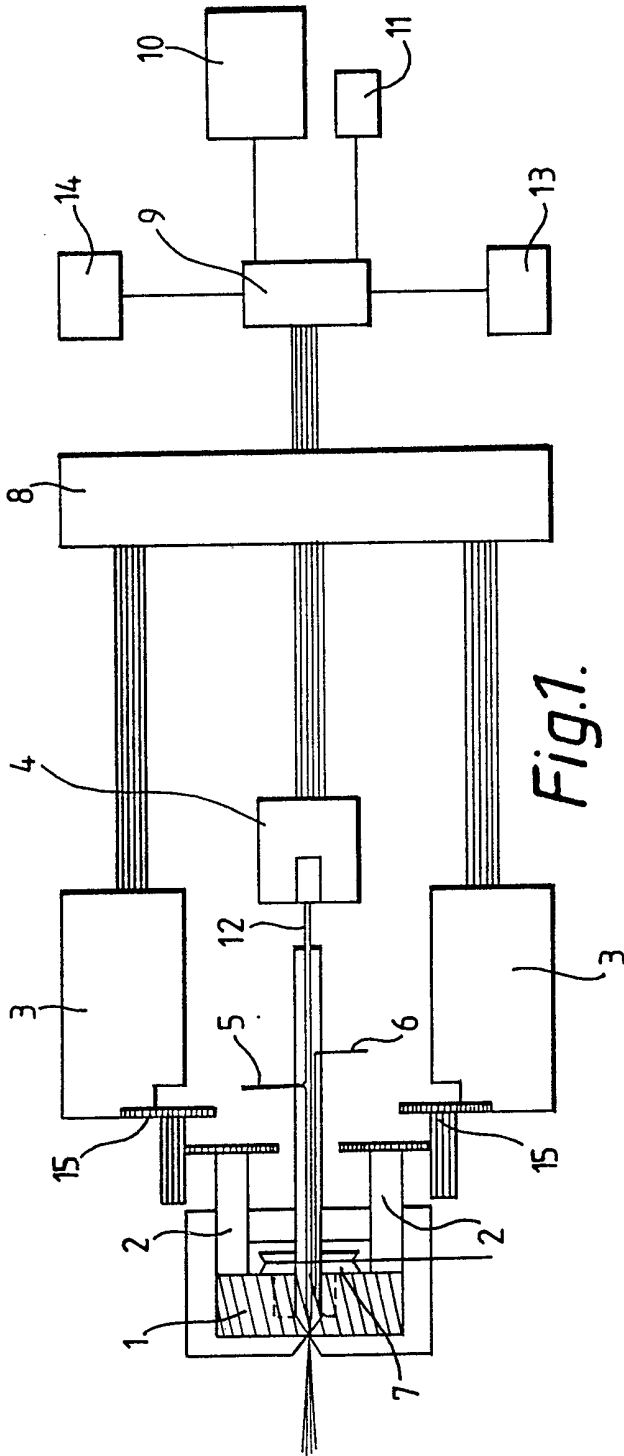


Fig. 1.

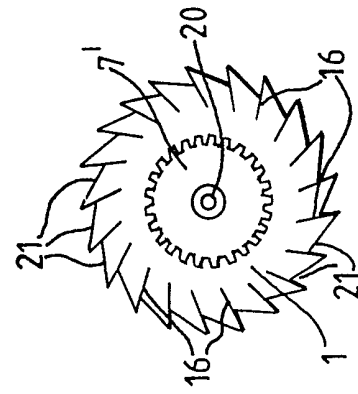


Fig. 2.

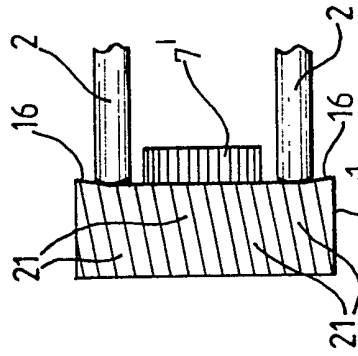


Fig. 3.

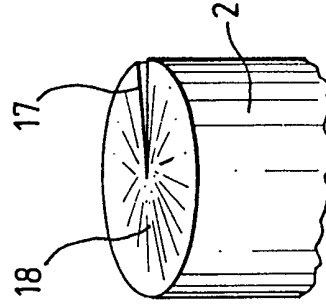


Fig. 4.

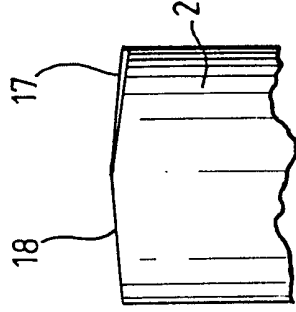


Fig. 5.

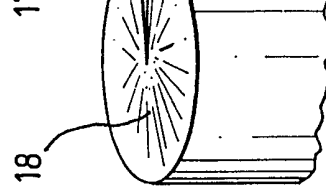


Fig. 6.

SPECIFICATION

An apparatus for powdering solid product and spraying the powdered product

5 The invention relates to an apparatus for powdering solid product and spraying the powdered product and in particular relates to a machine for the mixing and application of colours which is able to provide a coloured marking on the basis of pigments pulverised from a compressed bar of solid pigment; the said machine may be programmed with a computer for instantaneous colour change and for mixing all or part of them. Depending on the type of pigments used, it may be necessary to fix the said colour marking at the moment when it is produced, using a chemical size such as lacquer or any other sizing composition of similar characteristics. It should be noted that both the powder pigment marking and the fixative are produced in pulverised form, using the air as a carrier.

With the introduction of blocks, preferably cylindrical in shape, of powder-based pigment including some type of agglutinant, arranged around a circular cutter so that its rotation produces aspiration towards the centre, the said cutter powders the bars and, with the suction air current created by the cutter and the mechanical impulsion of the blades, sets up a blast of air and pigment outwards from the centre, the cutter being housed inside an enclosure which has a port or nozzle in the centre from which there is a pressurised escape producing the blast of pigment and air.

The mechanism can contain as many sticks of colour as will fit on the periphery of the cutter; however, the three primary colours with white and black may be sufficient for the function for which it has been created. The said bars of colour are pulverised as the rotary cutter advances and the powder released is carried inwards; the said bars are moved by motors which may be of the stepping type, through speed reduction gears, and the speed of these motors controlled by a computer with an intervening interface, so that the computer program controls the dosification of the pigment and, at each speed for each motor, a quantity of primary colour emerges plus the white and black so that the resulting colour at any time is the mixture of all of these.

If, in addition, the nozzle through which the mixed colours emerge is moved through three dimensions with a suitable mechanical structure, and its movement is controlled by three stepping motors, using the computer program we will be able to create a colour and movement which has been programmed, in other words, to create an image which is thus recorded in some type of computer memory, e.g. a cassette tape, and can be reproduced without limit, when the jet meets a fixed material support of any type.

This means that an autonomous colour marking can be obtained, or, at the same time, it can be fixed with a chemical product or in any other form; the colour and fixative can be joined in many ways, broadly divided into two categories - internally and

externally.

In the former, the air emerges from a fine nozzle which creates suction or negative pressure, internally aspirating the fixative liquid or agglutinant liquid, and externally aspirating the colour in pigment form from the cutter. In addition, there is an internal liquid mixing needle. In the other category, the liquid and the powder are brought together in two separate parts of a blast of air created by the suction, mixing and pulverising the two components, pigment and fixative; the input of fixative can be controlled by means of a needle with a back-and-forth movement which means that the amount of liquid can be controlled as required.

Independently, it is possible to use only the powder and fix it using other procedures, e.g. by using pigments which are sufficiently fatty so as to fix the powder themselves, or by previously wetting the paper along the route on which the pigment is to be subsequently projected, with suction from behind the paper so that the said paper acts as a filter, projecting onto warm wax or providing an electrical discharge at the jet outlet, of positive type; the medium to be painted is earthed, so that each positively charged particle of the pigment will seek its negative medium or cathode. Likewise, any other method may be used to fix the pulverised pigment.

With this system, it is possible to measure the colour and control the path so that all types of algebraic operations can be carried out with precision, with representation of the results in colour, i.e. with a colour assigned to each number, and with colour representation of functions; according to the type of fixative, the colour will be left with a different vibration.

The colour dosification and application system using the machine to which we are referring has multiple applications at the industrial level, offering particular interest in the ceramic industries for the decoration of slabs and tiles, in the pharmaceutical and chemical industries, for the reproduction of works of art, for a variety of artistic representations and for other applications not specified here.

The invention will now be described, by way of example only, with reference to the accompanying drawings Figures 1 - 6 in which:-

Figure 1 is a diagrammatic projection of the colour dosification-application machine operated by computer, programmed to run a group of stepping motors with gearbox for moving the pigment bars forward; there is a needle positioner and flow control motor and a cutter for the release of the pigments from the bars for their application.

Figure 2 is an external frontal view of the cutter along the channels for the movement of the pigment powder to the central opening for application on a surface, in programmed form.

Figure 3 is a rear view of the cutter showing, in the first place, a gear-wheel or pulley transmission with the protruding peripheral blades for impinging on the colour pigment bars.

Figure 4 is a side view of the cutter and protruding axial pinion which turns it, showing the cutting blades emerging slightly and inclined along the internal plane; when they turn in combination with

the rotation and movement forward of the bars of pigment, an inclined cut takes place to release powder or part of the pigment.

Figure 5 is a scaled-up detail of the end of one of the pigment bars, showing the slightly conical form with which the cut takes place, preventing the material from hardening as the result of a head-on approach.

Figure 6 is also a scaled-up view, in perspective, of the end of one of the pigment bars, showing the cut cross-section being done by the cutter; the part released is converted into colour powder and directed by the cutter itself to a pressurised air outlet duct fed from a compressor, for application with a fixative medium.

To assist in the location of the different elements making up this machine for the dosification and application of colours, numbered annotations have been incorporated in to the figures on the attached page of drawings, related to the description given by way of continuation of their characteristics and function. The rotary cutter (1) acts directly on the bars of pigment (2) which may be of any colour, including black and white, and all of which are located facing the internal plane of the cutter (1) in an equidistant and peripheral arrangement. They are all operated by the respective stepping motors (3) which are fitted with gear boxes, so as to impinge upon the centre of the cutter (1) with the needle (12) which is a fluid dosification element acting according to the positioner motor (4) to control the flow of liquid inwards at 5. The air from the compressor enters at point (6) while the cutter (1) is turned by a pulley (7) which is axially fixed to the cutter (1) and driven by a belt, and movable with a turbine using air from the compressor or, in addition, with a gear wheel (7'), with the pertinent transmission.

All the mechanical components making up the colour dosification-application machine which is the subject of this invention are controlled by a computer (9) connected to an interface (8), which may incorporate other elements such as a TV monitor (10), a cassette recorder (11), an artificial display control (13) or a remote telephone connection or other modern (14) which supply data to the computer (9). For its part, the said computer governs the operation of the motors and elements of the machine as a whole in an orderly manner so as to obtain the function required.

The pigment bars (2) are turned and advanced by means of transmission (15), pressing on the cutting edge (16) of the cutter (1) at a slight incline so that the consumption or removal of the material from the bars (2) is carried out in layer form (17) of a slightly triangular type from the centre of the bar (2) towards the periphery (*Figure 6*); the ends of the bars (2) become conical in shape (18) with a large angle at the tip (*Figure 5*), thus preventing the cutting edges (16) of the cutter (1) from meeting the bars head-on, so that the material does not harden or compact.

The external plane of the cutter (1) has a number of helical ducts (19) which run to the central opening or nozzle (20); the material removed from the pigment bars (2) and converted into powder, flows through

the peripheral channels (21) to the ducts (19) and the central nozzle (20) by means of the pressurised air and liquid. They are projected in order to complete the pigmentation function and the colours are applied in dosed form.

Having broadly described each and every one of the parts making up the colour dosification and application machine which is the subject of this invention, it remains only to point out that the different parts may be produced in a variety of materials, sizes and shapes and, likewise, that variations of a constructional type may be introduced to the design on the basis of practical experience, provided that these factors do not alter the essential points of the apparatus which is the subject of this Registration of Letters Patent.

The term "powder" used herein embraces particulate material and "powdering" is construed accordingly.

CLAIMS

1. Apparatus for powdering solid product and spraying the powdered product, the apparatus comprising: a movable cutter; drive means for moving the cutter; means for advancing the product against the cutter to effect powdering of the product by the cutter; a channel through which the powdered product passes from the cutter; and outlet means through which powdered product from the channel is sprayed.

2. Apparatus according to claim 1 in which the cutter has a plurality of cutting blades.

3. Apparatus according to claim 2 in which the channel is formed by opposed surfaces of adjacent cutting blades.

4. Apparatus according to claim 2 or 3 in which the cutting blades are transverse to the rotational axis of the cutter.

5. Apparatus according to claim 2, 3 or 4 in which the product is elongate and the cutting blades are, in use, transverse to the product.

6. Apparatus according to any preceding claim in which the outlet means is in communication with means for supplying air and/or other fluid under pressure.

7. Apparatus according to claim 6 in which the powder is mixed, in use, with the air and/or the other fluid before spraying.

8. Apparatus according to any preceding claim in which the size of the outlet means is controllable.

9. Apparatus according to any preceding claim in which the outlet means comprises a nozzle.

10. Apparatus according to claim 8 or 9 in which the position of the outlet means can be controlled to direct spraying of the product.

11. Apparatus according to any preceding claim in which at least one of said drive means, means for advancing the product, outlet means and means for supplying the air or other fluid, is controlled by a computer.

12. Apparatus according to claim 11 in which all of said means are controlled by the computer.

13. Apparatus according to claim 11 or 12 in which the computer is connected to at least one of a

data storage means, visual display means, and a modem.

14. Apparatus according to any preceding claim in which the solid product which is to be powdered, 5 in use, is a pigment.

15. Apparatus according to any preceding claim in which the other fluid is a fixative.

16. Colour dosification and application machine wherein, essentially, there is a rotary disc which has, 10 in the centre of its internal plane, a pulley, geared wheel or some other drive element; the internal plane has, at its periphery, a cutter made up of numerous blades which emerge slightly in an oblique position to impinge on the end of some 15 colour pigment bars so as to release portions or particles converted into, powder and which run along peripheral channels of the cutter itself to the face or frontal plane made up of ducts or grooves which run in helical form to the central hole or 20 nozzle; here they are mixed with the pressurised air and fluid emerging through the nozzle for the application of the colours on to a suitable medium.

17. A colour dosification and application machine as per the previous claim. Wherein, 25 essentially, the coordinated movements of the cutter and the rotation and forward movement of the pigment bars are produced through a computer connected to an interface, and incorporating a TV monitor and different command elements or 30 programmers such as a cassette recorder, an artificial display command, a remote telephone connection, etc. etc. which are controlled by means of the interface, the stepping motors with gearbox for the rotation and advance of the pigment bars and 35 the motor for the positioning of the needle applied to the central cutter opening or nozzle for the regulation of the pressure and flow of the air and liquid which mixes with the pigment.

18. Apparatus for powdering solid product and 40 spraying the powdered product substantially as herein described with reference to the accompanying drawings.