Oct. 24, 1967 C. SIMMONS 3,348,527

POWDER APPLICATION

Filed Feb. 17, 1966 2 Sheets-Sheet 1

FIG. 1.

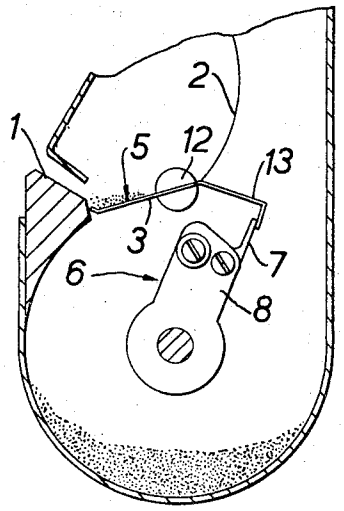
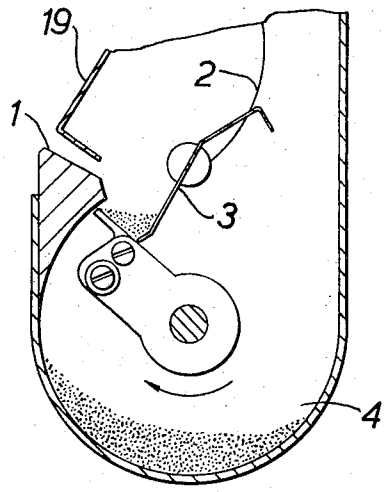


FIG. 2.



Oct. 24, 1967 C. SIMMONS 3,348,527

POWDER APPLICATION

Filed Feb. 17, 1966 2 Sheets-Sheet 2

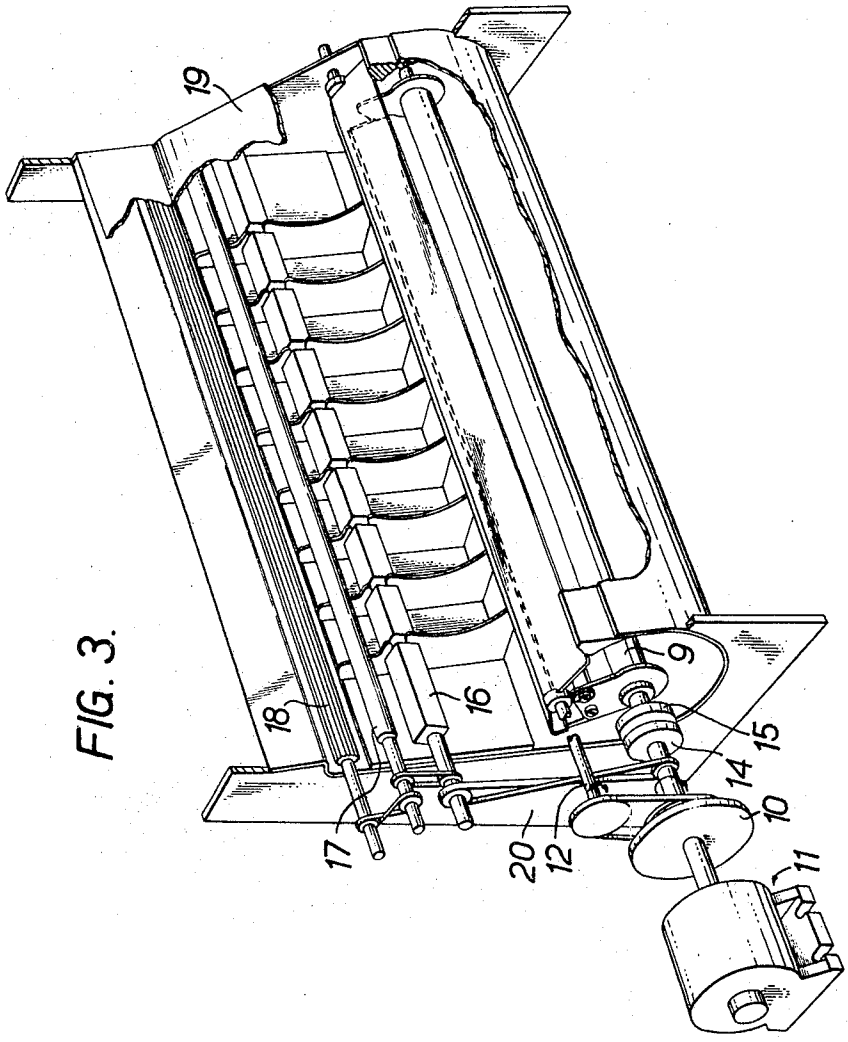


FIG. 3.

United States Patent Office

3,348,527

Patented Oct. 24, 1967

3,348,527

POWDER APPLICATION

Christopher Simmons, 174 Marsh Lane, Stanmore, England

Filed Feb. 17, 1966, Ser. No. 528,034
Claims priority, application Great Britain, Nov. 19, 1965, 49,191/65
5 Claims. (Cl. 118—429)

ABSTRACT OF THE DISCLOSURE

Applying powder to sheets by passing each sheet through a pile of powder on a tiltable platform. Between sheet passages, platform tilts down to drop excess powder into a reservoir beneath. Powder is conveyed from reservoir to platform by a rotating paddle contacting down-tilted end of platform (to be stopped by such end) and by subsequent rising of that end to powder-applying position. Paddle is driven by slip clutch and is given intermittent rotary motion synchronized with intermittent tilt motion of platform by a latch coupling of paddle to platform and by the said stopping action.

The present invention relates to the application of powder to sheets. For example powder may be applied to a printed sheet while the ink is still wet to produce raised letters in the bronzing process or, in a copying process, powder may be applied to a sheet carrying an electrostatic or condensed oil latent image so as to adhere to and thereby develop the image.

The present invention provides a device for applying powder to a sheet, comprising guide means which define a predetermined path for the sheet, a tiltable platform having an upper surface which in a normal position is located in said path, a reservoir for the powder located below said guide surface, and means for transferring a quantity of the powder up to the platform, the platform being arranged to be tilted down to a position to receive powder from the transfer means and then to be tilted back to its normal position so as to lift powder into the sheet path.

Generally the platform will be charged with powder as the sheet approaches the device. The platform will be charged by co-operating movements of the transfer means and the platform, the platform subsequently repositioning itself in its normal position in the predetermined sheet path before arrival of the sheet.

Preferably, the transfer means should be arranged to travel through the powder reservoir only once during charging and should raise a sufficient quantity of powder to completely charge the platform during this movement. This reduces the occurrence of dust through continuous disturbance of powder in the reservoir.

During the downward tilting of the platform, any surplus powder remaining on the platform from previous cycles of operation will tend to be tipped off the platform. This action improves the accuracy of dosing during each charging cycle since it reduces the likelihood of powder accumulating on the platform. The quantity of powder to be applied to the platform may be altered by altering the degree of tilting of the platform.

Arranging for the platform to tilt enables powder to be transferred thereto without employing a complex form of transfer means. The transfer means may be a rigidly fixed paddle which is arranged to travel through the powder reservoir to raise powder to a position adjacent the platform, where the platform, in its down-tilted position, will be waiting to lift the powder into the sheet path.

The guide means may be apertured or discontinuous to allow surplus powder to fall back into the reservoir, however it is preferable that the upper surface of the platform

should form a continuous path with the guide means, and in fact the use of a tilting platform facilitates this.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 shows a sectioned side elevation of a device for applying powder to a sheet of paper;

FIGURE 2 shows a similar view with the platform in a different position and

FIGURE 3 shows a perspective view of the device shown partly cut away for clarity.

The device comprises guide means **1**, **2** defining a predetermined path for the sheet, a tilting platform **3** and a reservoir **4** located beneath the platform and guide means. The platform **3** has an upper surface **5** which is normally located in the predetermined path defined by guide means **1**, **2**.

A transfer means **6** is located within the reservoir **4** and comprises a paddle **7** which is bolted to end plates **8** which are driven by a shaft **9**. The shaft **9** is connected via a 4:3 ratio gearbox **14**, a slipping clutch **15** and a one revolution clutch **10** to a driving motor **11**. During rotation of the shaft **9** the paddle is arranged to closely follow the internal surface of the reservoir **4** with a spacing which is small enough to prevent physical contact and consequent wear but large enough to prevent any appreciable quantity of powder falling through the spacing during rotation; and the angle of the paddle is capable of being adjusted to allow for different flow properties of different powders.

The guide means **1**, **2** consists of a lead-in guide **1** and a number of vertically upstanding plates **2**, whose edges are shaped to define the predetermined path. The tilting platform **3** when located in the sheet path provides, with the guide means **1**, **2** a virtually continuous path for the sheet, and spaces between the plates **2** allow surplus powder to fall back into the reservoir **4**. Provision of a virtually continuous path reduces the likelihood of faulty operation causing the sheet to be accidentally fed into the reservoir **4**.

The platform **3** is arranged to tilt about the axis of a shaft **12** between the positions shown in FIGURES 1 and 2. The mechanism for causing this tilting movement is not shown in detail in the drawings but consists of a cam and spring arrangement driven via the one revolution clutch **10** and the driving motor **11** to produce rotation of the shaft **12** in either of two directions at appropriate moments. The degree of tilting movement is adjustable to adjust the degree of dosing of the platform **3**.

A beater **16** consisting of a square cross-section shank arranged to be driven continuously via the motor **11** in opposition to the direction of the feed of the paper, is provided to knock surplus powder off the sheet as it passes through, and a guide roller **17** and pinion shaft **18** control passage of the sheet at this stage. Deflector plates (not shown) also assist in maintaining the correct path of the sheet at this stage.

The device has a cover **19** and side walls **20** which may be part of some larger apparatus with which the device may be associated. The resulting structure is thus almost-fully enclosed, except for the sheet entry and exit points, so that in operation powder disturbed by the paddle **7** or beater **16** will be unlikely to pervade any associated adjacent mechanisms, for example other parts of a copying machine.

In operation, the tilting platform **3** and the transfer means **6** will maintain the positions shown in FIGURE 1 until actuation of a micro-switch by an approaching copy sheet starts the dosing cycle. At the FIGURE 1 position the paddle **7** is maintained in position by an L-shaped extension **13** of the tilting platform **3**, the one revolution clutch **10** being de-actuated at this time.

When the micro-switch actuates the one revolution clutch **10** this causes the platform **3** to tilt from the position shown in FIGURE 1 to the position shown in FIGURE 2. Initially during this tilting movement, the paddle **7** will be restrained from movement by the extension **13**, the slipping clutch **15** slipping at this time. The paddle **7** will then be released, as the platform **3** tilts, and will be rotated through two-thirds of a revolution from the position shown in FIGURE 1 to the position shown in FIGURE 2 picking up powder from the reservoir on the way.

When the paddle **7** reaches the position shown in FIGURE 2 it is again restrained against motion by bearing against the tilting platform **3**, while the slipping clutch **15** slips. The tilting platform **3** is then actuated to tilt back to the position of FIGURE 1 during which it lifts powder off the paddle **7** and allows the rotor **8** to continue rotation to the position shown in FIGURE 1, the 4:3 gearbox **14** ensuring that the paddle reaches this position despite the lost motion produced by the slipping clutch **15** and any backlash.

The device will now have completed its sequence of movements, the upper surface **5** of the platform **3** will be back in the path of the sheet and it will carry a dosed quantity of powder ready for the sheet.

The sheet of paper, bearing an image on its upper side to which powder will adhere, then passes into the device via the lead-in guide **1** and is directed under the dosed pile of powder on the platform surface **5**. The sheet will pick up a quantity of powder and as it progresses upwards through the device, the powder will fall down the surface of the sheet and eventually back into the reservoir. Powder will adhere to the image on the sheet and the beater will knock any surplus powder off the non-image areas.

In an actual example of the invention, the tilting platform **3** was provided with a dosed quantity, 1.5 grams, of powder in 1.5 seconds. Foolscap sized sheets were capable of being driven through the machine at 45 ft. per minute and the beater **16** rotated at 2,000 r.p.m. in opposition to the direction of feed of paper through the machine.

What is claimed is:

1. A device for applying powder to a sheet, comprising guide means which define a predetermined path for the sheet, a tiltable platform having an upper surface which in a normal position is located in said path, a reservoir for the powder located below said guide surface, and means for transferring a quantity of the powder up to the platform, the platform being arranged to be tilted down to a position to receive powder from the transfer means and then to be tilted back to its normal position so as to lift powder into the sheet path.

2. A device according to claim **1** in which the transfer means is arranged to raise a sufficient quantity of powder to completely charge the platform after a single passage of the transfer means through the reservoir.

3. A device according to claim **1** in which the quantity of powder to be applied to the platform is adjustable by adjustment of the degree of tilting of the platform.

4. A device according to claim **1** in which the arrangement for tilting said platform is adapted to tilt said platform downward to an angle of inclination greater than the slippage angle of powder on said platform so as to remove any surplus powder from the platform prior to the charging of the platform with further powder.

5. In apparatus adapted to apply powder to separate sheets and comprised of guide means definitive of a predetermined feed path for said sheets and disposed on the underside of said path, said apparatus having a surface disposed on the underside of said path and adapted to hold powder in the way of movement in said path of said sheets, and said sheets being relatively moved in time succession in said path and over said surface to pick up powder therefrom on the upper side of each sheet, the improvement comprising, a powder reservoir having a greater storage capacity for powder than said surface, powder transfer means adapted only upon selective actuation thereof to convey powder from said reservoir and to charge said surface with conveyed powder, and means to selectively actuate said transfer means to convey powder in synchronism with the feeding into said path of each of said succession of sheets so as to produce by the charging of said surface by said transfer means a fresh pile of powder on said surface for each sheet just fed in.

References Cited

UNITED STATES PATENTS

3,021,817 2/1962 Limberger ------- 117—17.5 X

MORRIS KAPLAN, *Primary Examiner.*