Dec. 17, 1929. R. F. BERNDT ET AL 1,739,492

MACHINE FOR PRODUCING RAISED PRINTING

Filed Jan. 8, 1925 4 Sheets-Sheet 1

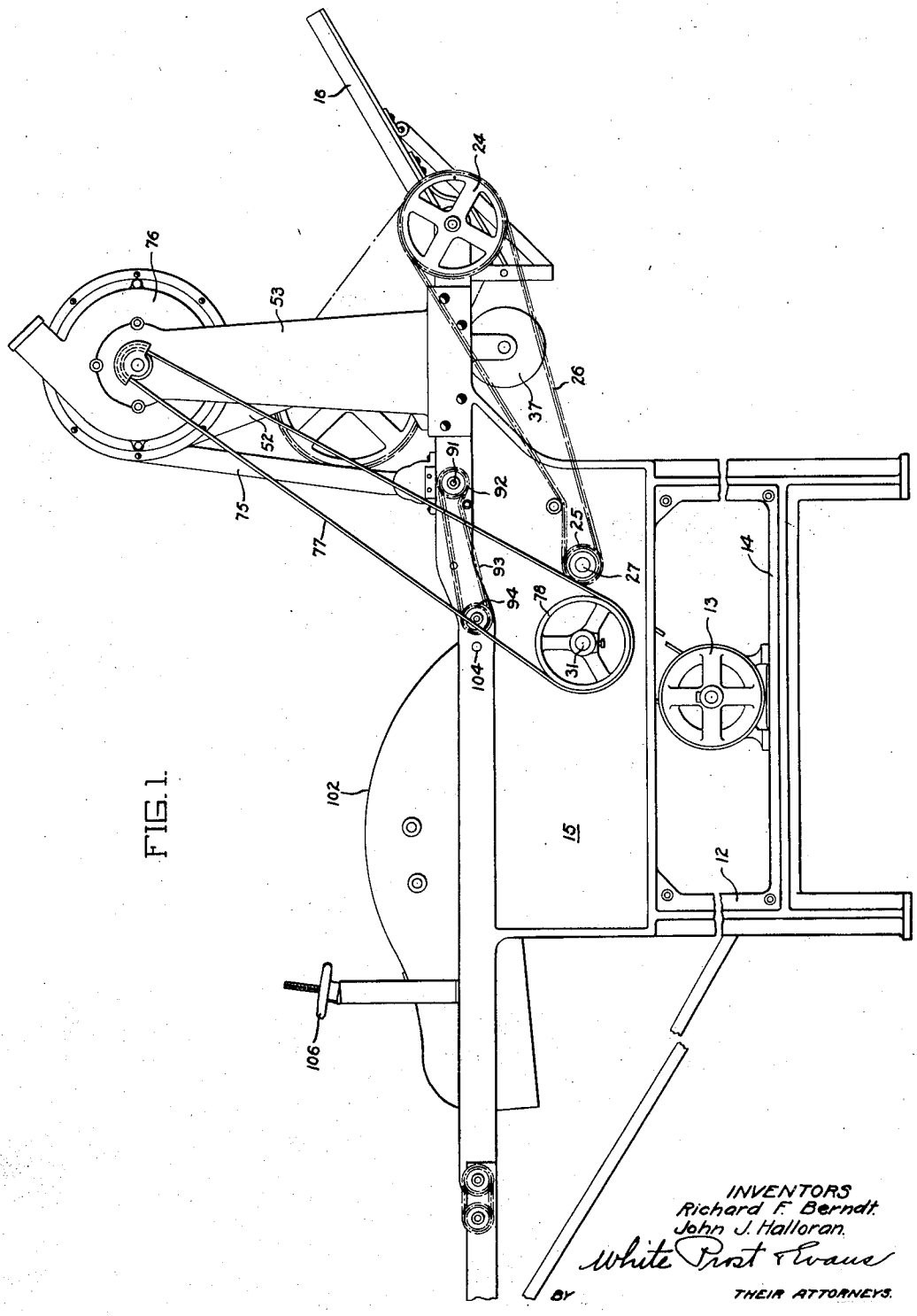


FIG. 1.

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MACHINE FOR PRODUCING RAISED PRINTING

Filed Jan. 8, 1925 4 Sheets-Sheet 2

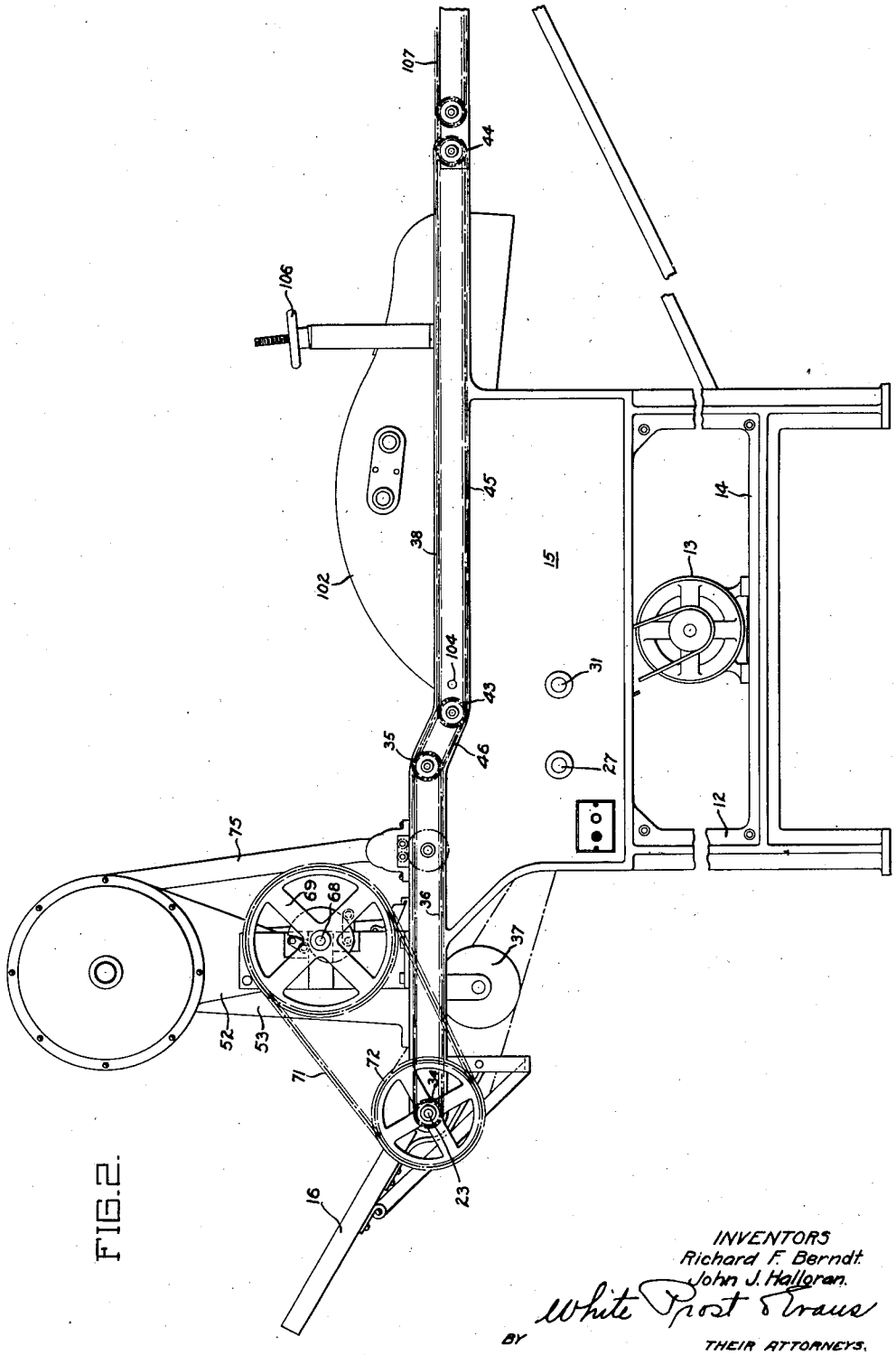


FIG.2.

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MACHINE FOR PRODUCING RAISED PRINTING

Filed Jan. 8, 1925 4 Sheets-Sheet 3

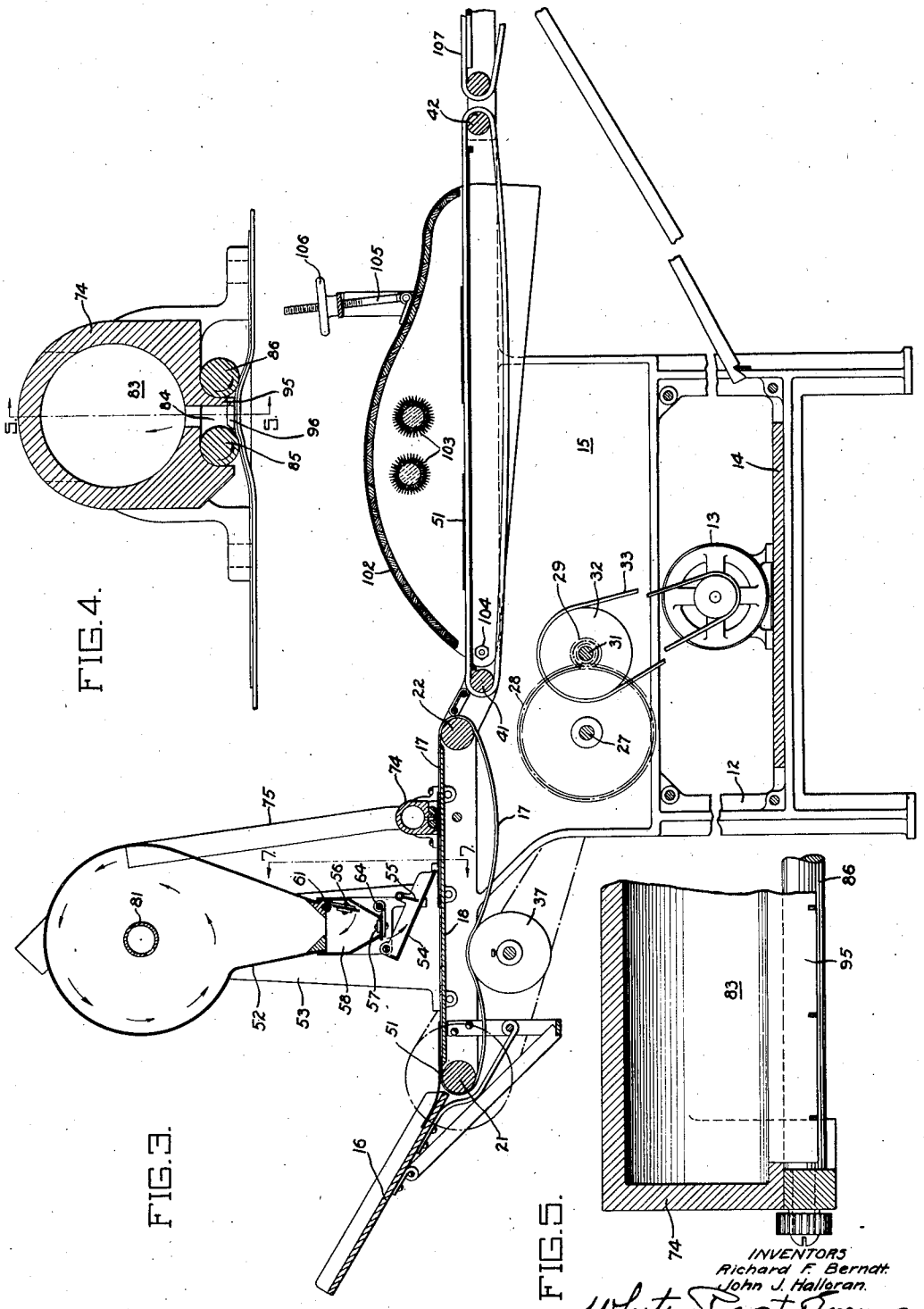


FIG. 4.

FIG. 5.

FIG. 3.

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MACHINE FOR PRODUCING RAISED PRINTING

Filed Jan. 8, 1925 4 Sheets-Sheet 4

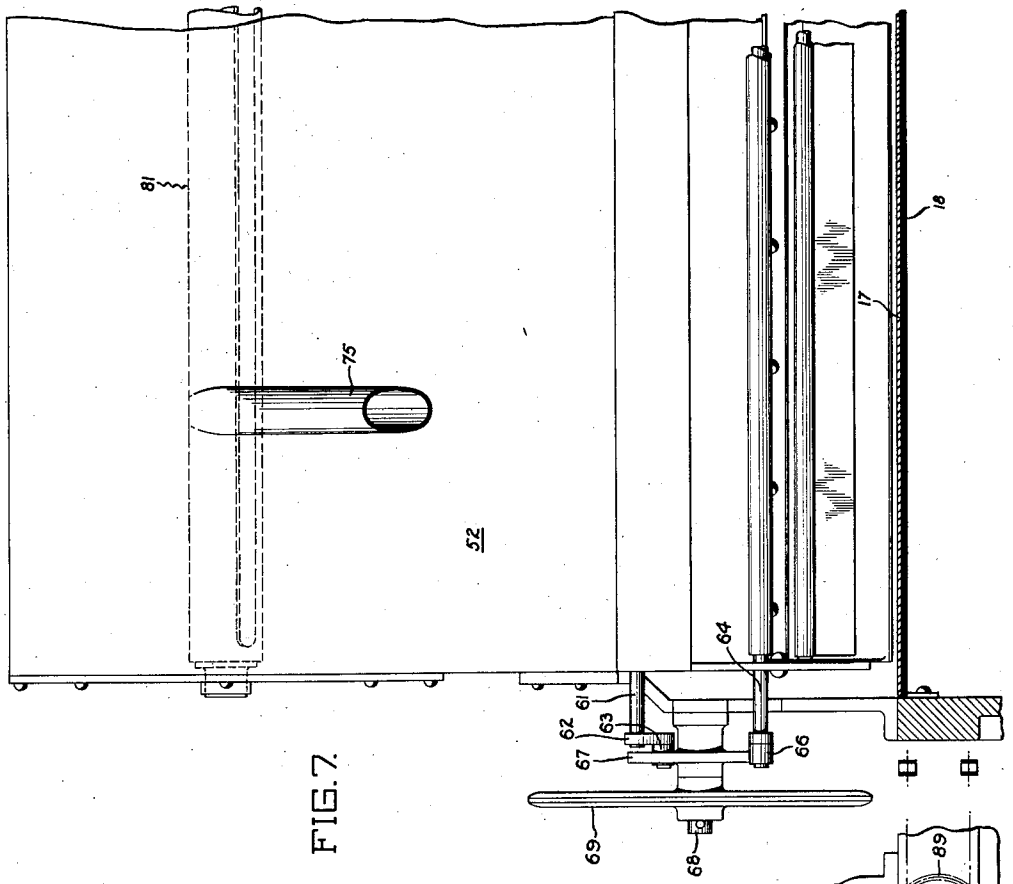


FIG. 7.

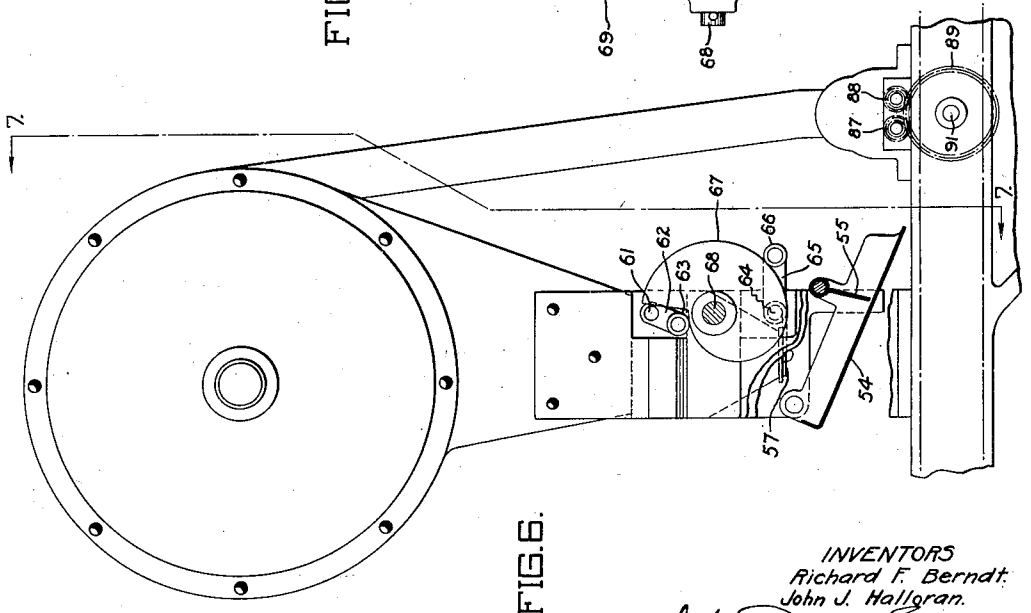


FIG. 6.

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UNITED STATES PATENT OFFICE

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MACHINE FOR PRODUCING RAISED PRINTING

Application filed January 8, 1925. Serial No. 1,190.

The invention relates to a machine whereby printed matter may be subjected to a process of applying a layer of material over the printed lines, so that the printed characters become raised above the plane of the paper. In this way it is possible, by careful manipulation, to simulate engraved printing so closely as to make the product substantially indistinguishable from such work, altho performed without cut dies and therefore at relatively small expense. In addition, other embossed effects may be obtained which are impossible in ordinary engraving.

The process, for its successful operation, must be carried out while the printing is still moist or tacky, and serves to bind the supplementary layer of material until a later step in the process fuses the material to the printing. This material is in the form of a very finely divided powder, which can be fused by the application of heat and thus made to unite intimately with the printing ink. For this purpose resinous material has been found to be very adaptable, since it requires a heating temperature for fusing that is well below the danger point, and since it may readily serve as a color carrying medium that adheres very well to the printed matter. In order that the process be productive of clean-cut characters, free from any blur, it is necessary to insure against an excess of the powder and for this purpose, the paper on which the printing appears is manipulated in such manner that all of the excess powder, that is, the powder that does not actually adhere to the printed matter, is removed before the powder is subjected to heat. The last step in the process is the heating of the printed matter to fuse the powder and then permitting it to cool.

Altho machinery has been devised in the past to carry on this process automatically, yet the character of the product has not been very high. This we attribute to the fact that the manipulation of the paper by mechanical elements, such as grippers, cams, gears, etc., requires the use of many moving parts near the paper, and consequently some of the powder, as it is sprinkled over the sheet and removed therefrom, can readily find lodgment in crevices and corners of the moving parts. This deposited powder may at least partly return to the sheet later on and may cause either blurred characters or small spots on the paper, or both, after the material has been heated. It is one of the objects of the present invention to insure the removal of all excess powder from the sheet.

In order to secure this result, we provide means for removing from the sheet all of the powder which does not adhere to the printing and this excess powder is preferably removed by passing over the sheet a current of air at sufficient velocity to remove all of the excess powder, while permitting the powder which has adhered to the ink, to remain.

It is another object of our invention to improve such processing machines in general, whereby they are more reliable in service and simple in operation.

It is still another object of our invention to provide a novel form of powdering device, whereby powder is evenly distributed over the surface of the sheet, so that all of the printed lines on the sheet are covered with powder.

It is a further object of our invention to provide a circulatory system for the powder, whereby the excess powder that is removed from the sheet is returned to the source of supply of the powder, which is subsequently sprinkled on the sheet, so that the excess powder is reused many times, only that portion of the powder being removed from the supply which actually adheres to the printed matter.

The invention possesses other advantageous features, some of which with the foregoing, will be set forth at length in the following description, where we shall outline in full that form of our invention which we have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings we have shown one form of device embodying our invention, but it is to be understood that we do not limit ourselves to such form, since the invention, as set forth in the claims, may be embodied in a plurality of forms.

Referring to said drawings:

Figure 1 is a side elevation of a machine embodying our invention, a portion thereof

being broken away to reduce the size of the figure.

Figure 2 is a side elevation of the opposite side of the machine, a portion thereof being broken away to reduce the size of the figure.

Figure 3 is a vertical longitudinal section through the machine, parts thereof being broken away to reduce the size of the figure.

Figure 4 is a vertical section on a larger scale of the suction head under which the powdered sheet is passed, to remove the excess powder.

Figure 5 is a fragmentary vertical section of the suction head taken on the line 5—5, Figure 4.

Figure 6 is an elevation on a larger scale of the mechanism for applying powder to the sheet.

Figure 7 is a vertical section of the mechanism taken on the line 7—7, Figure 6.

The machine comprises a suitable stand 12, shown in this instance as a casting, which serves as a support for all of the parts of the machine. The stand may rest directly on the floor, in which case it is made high enough to facilitate use of the machine by an operator. As a source of motive power for the mechanism, we have shown a small electric motor 13, which may be of any desired type. This motor is conveniently supported by the table or stand 14 near the bottom of the frame. A pair of side plates 15 serve to provide bearing supports and the like for the various elements of the mechanism.

The machine is preferably located near the delivery end of a printing press, so that the printed matter may either be disposited manually or automatically on the inclined feed table 16. Arranged on the frame, with its receiving end adjacent the discharge end of the inclined feed table 16, is an endless conveyor 17, preferably comprising a belt of canvas or other fabric. On its upper run, the conveyor moves over a platen or plate 18 by which it is supported in a fixed plane. The conveyor 17 travels over rollers 21 and 22, arranged at the opposite ends of the plate 18, the rollers 21 and 22 being driven to impart uniform motion to the conveyor. The rollers are provided on their ends with stub shafts journalled in bearings and secured to the stub shaft 23 of the roller 21 is a sprocket wheel 24 which is connected to the sprocket wheel 25 by the chain 26. The sprocket 25 is secured to the shaft 27, which is provided with a gear 28 which is in mesh with a gear 29 carried by the shaft 31. The shaft 31 is provided with a pulley 32, which is connected to the pulley of the motor 13 by the belt 33. The various pulleys, gears and sprockets are made of the proper relative size to produce the desired speed of movement of the conveyor 17. Secured to the shaft 23 of the roller 21 is a sprocket 34 which is connected to the sprocket 35, secured to the shaft of the roller 22 by the chain 36. Both of the rollers 21 and 22 are thus driven and an idler control roller 37 engaging the lower run of the conveyor, is provided to cause the upper run of the conveyor to run true.

Arranged in the frame beyond the conveyor 17 is a second conveyor 38, the receiving end of which is preferably spaced below the discharge end of the conveyor 17, to facilitate the discharge of sheets from the conveyor 17 to the conveyor 38. The conveyor 38 passes over rolls 41 and 42, which rolls are provided with sprockets 43–44, which are engaged by the drive chain 45. Roll 22 and roll 42 are each provided with an additional sprocket, these sprockets being connected together by the drive chain 46, so that the conveyors 17 and 38 are driven in synchronism.

The sheet to be treated is fed into the machine from the inclined feed table 16 and is carried by the conveyor 17 into operative relation with the device for applying powder to the sheet and with the device for removing the excess powder from the sheet, and is discharged from the conveyor 17 onto the conveyor 38. Arranged above the conveyor 17 are means for applying powder to the printed sheet 51 as it is carried along by the conveyor and means for removing the excess powder from the sheet while it is being conveyed by the conveyor. These two devices are preferably arranged adjacent each other, so that the excess powder is removed from the sheet, directly after it has been applied thereto. The excess powder removed from the sheet is returned to the device for applying powder to the sheet, so that it may be subsequently applied to a following sheet.

The device for applying powder to the sheet comprises a receiver 52 supported above the conveyor 17 on the standards 53. The receiver is charged with a quantity of powder and the powder is discharged from the receiver and is distributed over the surface of the sheet carried by the conveyor 17. Supported at the lower end of the receiver and below the discharge opening therein, is an inclined spreader plate 54 which is attached to the receiver at one end and which is made of light metal, so that it vibrates due to the vibration caused by the operation of the machine. The spreader plate 54 is provided with a gate 55 which holds back and causes a spreading of the powder, so that the powder is discharged in a uniform stream over the whole width of the discharge lip of the plate 54.

As will appear hereinafter, the receiver constitutes a separator for separating powder from an air stream and a condition of vacuum or reduction of pressure exists in the receiver 2. Means are provided for accomplishing separation of the powder from the air stream and the discharge of powder from the receiver under the condition of reduced

pressure therein. The receiver is provided with a pair of discharge gates or valves 56—57 arranged in spaced superposed relation. The gate 56 controls the discharge of powder from the receiver into the trap 58 and the gate 57 controls the discharge of powder from the trap onto the distributing plate 54. Means are provided for moving the gates, so that when one gate is open the other gate is closed, and vice versa, so that powder may discharge from the receiver during the existence of a condition of vacuum therein. The gate 56 is secured to a shaft 61, which is provided on its outer end with a lever 62, which is provided at its free end with a roller 63. The gate 57 is secured to a shaft 64 to which is secured a lever 65, which is provided on its free end with a roller 66. The rollers 63 and 66 are disposed in operative relation to a cam 67, secured to a shaft 68 disposed adjacent the shafts 61 and 64. The cam 67 is so designed that in its rotation it alternately opens and closes the gates 56 and 57, the cam operating to fully close one gate before the other gate is opened. Secured to the shaft 68 is a sprocket 69, which is driven by the chain 71, which engages a sprocket 72 secured to the shaft 23. Therefore, as the machine operates, charges of powder are intermittently discharged from the receiver into the trap 58 and from the trap onto the distributor plate 54. From the plate 54 the powder is discharged in a uniform stream onto the sheet 51, passing under the discharge lip of the distributor plate. In the operation of the machine, the receiver contains only a small amount of powder at any one time, its principal function being that of a separator.

In the operation of the machine, the entire surface of the sheet is covered with powder and it is necessary to remove all of the powder which does not adhere to the printing. This excess powder we remove by subjecting the sheet to a current of air of sufficient velocity to remove all of the powder which does not adhere to the printing. This is preferably accomplished by passing the sheet 51 under a suction head, so that the excess powder is removed from the sheet by the air entering the narrow slot in the suction head. The surface of the paper is positioned in close contact to the narrow slot, so that the air passes over the paper at sufficient velocity to remove the excess powder.

Arranged over the conveyor 17 adjacent the distributing plate 54 is a suction head 74 which is connected by the conduit 75 with the receiver or separator 52, so that the excess powder is returned to the distributing plate. The suction or reduction of pressure is produced by a blower 76 which is driven by a belt 77 engaging a pulley 78 secured to the shaft 31. The intake side of the blower 76 is connected to the pipe 81 which extends into the receiver 52, and which, within the receiver, is provided with apertures, to permit the air to enter the pipe. In order that the powder introduced into the receiver through the conduit 75 may not pass out through the suction pipe 81, the upper portion of the receiver is made cylindrical or circular and the pipe 81 is disposed at the center of the cylindrical portion. The pipe 75 discharges the powder tangentially into the receiver or separator and, due to the circular movement of the air in the separator, the powder is separated by centrifugal force from the air and is not withdrawn through the pipe 81.

The suction head 74 is suitably mounted on the frame of the machine and extends entirely across the conveyor 17, so that all of the excess powder is withdrawn from the sheet or conveyor. The suction head preferably comprises a casting having a chamber 83 therein with which the conduit 75 is in communication. On its lower side the head 74 is provided with an elongated slot 84 extending for the length of the head, and the sheet is moved in close proximity to the slot. In order to prevent smudging of the printing, as the printed sheet passes under the suction head, and to prevent the sheet from sticking to the suction head, we have provided rollers 85, 86 at opposite sides of the slot to facilitate the movement of the sheet past the slot. The suction of the air causes the printed powdered sheet to press against the rollers, thus pressing the powder overlying the printed lines into the ink, insuring a perfect bond with the ink, and resulting in a perfect finished product. The rollers are driven at a peripheral speed which is the same as the speed of the conveyor 17 and the lower surfaces of the rollers move in the same direction as the conveyor, so that the movement of the sheet past the suction head is facilitated, and so that there is no relative movement of the contiguous surfaces of the rollers and the sheet. This prevents smudging of the printing and since the dry powder overlies the ink, no ink comes into contact with the rollers, so that subsequent sheets are not smudged or marred. The rollers are provided on their ends with gears 87—88 and these gears are engaged by a driving gear 89, secured to a shaft 91, journalled in the frame. The shaft 91 is provided on its other end with a sprocket 92, which is engaged by a chain 93 which passes over a sprocket 94, which is secured to the stub shaft of the roller 41. The rolls 85 and 86 are therefore positively driven so that their peripheral speed is equal to the speed of movement of the conveyor 17. The roll 85 forms one side of the narrow slot 84, the other side being formed by a downwardly projecting lip 95, behind which the roller 86 is disposed. The inlet end of the narrow slot 84 is guarded by a guard comb 96, so that the sheet is prevented from entering the narrow slot.

The lower surfaces of the rollers 85 and 86 are preferably disposed below the lower surface of the comb, to hold the sheet from pressure contact with the comb. In passing under the suction head, all of the excess powder is removed from the sheet, only that powder remaining which has adhered to the printing and which has been pressed into the ink.

The sheet is conveyed and discharged by the conveyor 17 on to the second conveyor 38, which passes through an oven in which a sufficient temperature is maintained to fuse the powdered material. In the present instance the oven comprises a hood 102 overlying and surrounding the conveyor 38 and containing heating elements 103 to produce the necessary temperature for the fusing of the powdered material. This temperature is controlled by varying the distance between the heating elements and the sheet and this is accomplished by raising and lowering the hood 102, which, for this purpose, is pivoted on the shaft 104 at its forward end. Attached to the rear end of the hood is an adjusting screw 105 which is moved by the adjusting nut 106 to vary the position of the hood. From the conveyor 38 the sheet is preferably discharged onto a cooling conveyor 107 which is preferably driven from the roll 42. We have thus provided an automatic machine for applying powder to the printed sheet, for pressing the powder into the ink, for removing the excess powder from the sheet and returning it to the powder applying means, and for heating the powdered sheet to fuse the powdered material.

We claim:

1. In a machine of the character described, an endless conveyor, a suction head arranged above the conveyor and having an elongated slot therein extending across the conveyor, a roller arranged at each side of the slot and contiguous to the conveyor and means for driving the rollers.

2. In a machine of the character described, an endless conveyor, a suction head arranged above the conveyor and having an elongated slot extending across the conveyor, rollers disposed on opposite sides of the slot and a comb arranged between the rollers.

3. In a machine of the character described, a conveyor for a sheet, a receiver for powder arranged above the conveyor, means for automatically controlling the discharge of powder from the receiver and means for uniformly distributing the discharged powder as it falls upon the sheet.

4. In a machine of the character described, a conveyor for a sheet, a receiver for powder arranged above the conveyor, a distributor arranged below the receiver, means for automatically discharging charges of powder intermittently from the receiver to the distributor, and means for causing a uniform flow of powder from the distributor to the sheet.

5. A machine of the class described comprising a cyclonic separator, means for removing air from said separator, means for removing powder from said separator for distribution on a printed sheet, and means including a suction pipe connected to the separator for conveying excess powder away from the sheet to the separator.

6. A machine of the class described comprising a hopper for powder, a trap below the hopper, valve means for controlling passage of powder from the hopper to the trap, valve means for controlling passage of powder from the trap to the surface of a printed sheet, and means interconnecting said valves whereby when the one is opened the other is caused to close.

7. In a machine of the character described, an endless conveyor, a suction head arranged over the conveyor and a driven roller disposed between the conveyor and the suction head.

8. In a machine of the character described, an endless conveyor, a suction head arranged over the conveyor, a roller interposed between the conveyor and the suction head and means for driving said roller at a peripheral speed equal to the speed of the conveyor.

9. In a machine for producing raised printing, a conveyor for a printed sheet, a receiver for fusible powder arranged above the conveyor, means for distributing powder from the receiver over a printed sheet carried by the conveyor, a suction head arranged over the conveyor, a conduit connected to the suction head and opening tangentially into the receiver, and a blower connected on the suction side to a central portion of the receiver.

10. In a machine of the character described, means for applying powder to a freshly printed sheet, a suction head, a conveyor upon which the sheet is arranged for moving the same into operative relation with the suction head, and rollers adjacent said head against which the sheet is adapted to be pressed by the stream of air entering the suction head, said rollers serving to prevent sliding contact between the sheet and said head.

11. The process of producing raised printing comprising distributing a fusible powder upon a freshly inked sheet, lifting the excess powder from the printed surface by suction, and fusing the powder adhering to the surface by heat, the outlines of the freshly inked surfaces being the sole factor in determining the outlines of the finished raised printing.

12. In a machine for producing raised printing, a suction head, means for causing a flow of air thru said suction head, a conveyor for carrying a printed sheet into operative relationship with the suction head, and means in addition to said conveyor and adja-

cent said suction head for preventing sliding contact between the sheet and said head.

13. In a machine for producing raised printing, a suction head, means for causing a flow of air thru said head, a conveyor traveling past the end of said suction head and adapted to carry a printed sheet, an auxiliary conveying means positioned adjacent said suction head for preventing sliding contact between the sheet and said head.

14. In a machine for producing raised printing, a suction head, means for causing a flow of air thru said suction head, a conveyor traveling past the end of said suction head and adapted to carry a printed sheet, and means adjacent said suction head for preventing sliding contact between the printed sheet and said head while being carried past said suction head, and for preventing arrest of movement of said sheet.

15. In a machine for producing raised printing, a conveyor for carrying a freshly inked sheet, means for applying a fusible powder to said sheet, means for rolling said powder into the sheet over an area substantially greater than the area of the inked surfaces, and means for removing excess powder.

16. In a process of producing raised printing, the steps of applying fusible powder to a freshly inked sheet, rolling the powder into the sheet over an area substantially greater than the area of the inked surfaces, and removing excess powder from the sheet.

17. In a process of producing raised printing, the steps of printing a sheet to form definitely outlined inked surfaces, applying a fusible powder to said sheet over greater than the area of the inked surfaces, evenly pressing said powder into the sheet over said area, removing powder from the sheet except that adhering to the inked surfaces, and fusing said adhering powder by heat, the outlines of the raised printing resulting from said process being determined by the outlines of the inked surfaces prior to applying and pressing the fusible powder.

18. In a process of producing raised printing, the steps of printing a sheet to form definitely outlined inked surfaces, applying a fusible powder to said sheet over the area of extent of said inked surfaces, rolling a pressing surface over said sheet to evenly press the powder upon the sheet over said area, removing powder from the sheet except that adhering to the inked surfaces, and fusing said adhering powder by heat, the outlines of the raised printing being determined by the outlines of the inked surfaces prior to applying the fusible powder.

In testimony whereof, we have hereunto set our hands.

JOHN J. HALLORAN.
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