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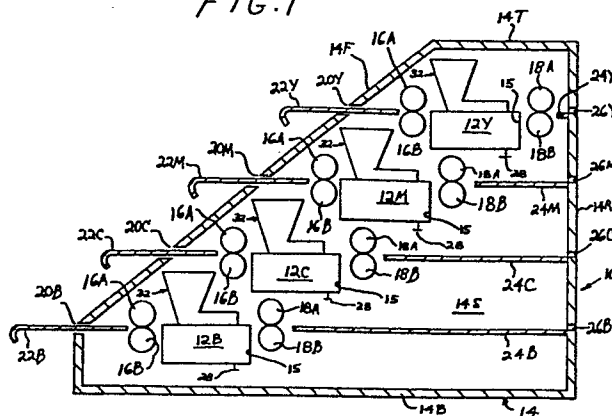
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Excess toner recovery arrangement for an automatic toning apparatus.

An automatic toning apparatus is characterized by a toner collection tray having a conveying element therein. Excess toner is collected within the tray and conveyed by the conveying element in a direction transverse to the path of travel of the photo-element to a receptacle.

FIG. 1



TITLEEXCESS TONER RECOVERY
ARRANGEMENT FOR AN AUTOMATIC
TONING APPARATUS5 BACKGROUND OF THE INVENTION

This invention relates to an apparatus for applying particulate toner to a photo-element and, in particular, to an automatic toning apparatus which includes an arrangement for recovering excess
10 particulate toner.

In the graphic arts photosensitive tacky surfaced elements are used to define images and, particularly, multicolor images. A photosensitive element is first given an imagewise exposure
15 resulting in the element exhibiting different degrees of tackiness in the exposed and unexposed areas. Following the imagewise exposure, the latent image is developed by the application of toner particles of a given color to the surface. The photo-element is
20 passed beneath a toning pad where toner particles are embedded into and adhere to the tacky portions of the surface while excess particles from the nonimage areas are brushed away. A tacky photosensitive layer is then laminated on and the process is repeated for
25 various other colors, resulting in a multicolor image on the surface of the photo-element.

In prior automatic toning apparatus, the excess toner removed from the surface of the photo-element is collected in a tray disposed beneath
30 the hopper and the toning pad. The excess toner so collected is manually recovered by the use of a hoe-like member, which when drawn through the tray moves the toner from the tray into a suitable collection receptacle for re-use. However, manual
35 recovery of excess toner is time consuming.

In view of the foregoing it is believed advantageous to provide an automatic toning apparatus wherein the excess toner is deposited on a conveying element, such as a continuous belt conveyor, and the toner is automatically conveyed into a suitable receptacle for re-use.

SUMMARY OF THE INVENTION

The instant invention relates to an automatic toning apparatus for applying toner particles to a photo-element which comprises a hopper having an opening therein through which toner particles are dispensed onto the surface of a photo-element passing therebeneath along a path of transport, a toning pad disposed downstream of the opening for embedding the toner particles into the photo-element and a conveying element disposed beneath the opening in the hopper and arranged so as to collect toner particles deflected by the pad from the photo-element and toner particles falling from the opening and to convey the collected particles in a direction substantially transversely to the path of transport. The conveying element preferably takes the form of a continuous belt conveyor disposed within a trough mounted beneath the opening and adjacent to the edge of the toning pad.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be more fully understood from the following detailed description thereof, taken in connection with the accompanying drawings, which form a part of this application and in which:

Figure 1 is a stylized pictorial representation of a side elevation of an automatic toning apparatus having a plurality of stacked toning modules each in accordance with the present invention;

Figure 2 is an enlarged side elevational view, in section, of a toning module having an excess toner collection arrangement in accordance the present invention taken along section lines 2-2 in
5 Figure 3;

Figure 3 is a plan view of a toner collection tray used in the toning module of Figure 2 showing the mounts for a conveying element used in the present invention;

10 Figure 4 is a side elevational view of the mount taken along view lines 4-4 in Figure 3;

Figure 5 is a section view taken along section lines 5-5 in Figure 4 showing a toner receiving receptacle mounted to the toning module;

15 Figure 6 is an elevational view of an oscillating arrangement for the hopper of a toning module in accordance with the present invention;

Figure 7 is a plan view taken along view lines 7-7 in Figure 6; and,

20 Figures 8A and 8B, 9A and 9B, and 10A and 10B are respectively front elevational and section views illustrating alternate embodiments of the conveying element used in the present invention.

DETAILED DESCRIPTION OF THE INVENTION

25 Throughout the following detailed description, similar reference numerals refer to similar elements in all Figures of the drawings.

Figure 1 is a stylized pictorial representation of a side elevational view of an
30 automatic toning apparatus generally indicated by reference character 10. Mounted within the apparatus 10 is a plurality of toning modules 12, each of which is adapted to automatically tone a photo-element (not shown in Figure 1) with a particulate toner. The
35 apparatus 10 shown in Figure 1 is sized to

accommodate four toner modules, 12Y, 12M, 12C and 12B, respectively provided for the application of yellow, magenta, cyan and black toner particles to the photo-element. 9077553

5 Each module 12 is suitably mounted within a casing or housing 14 formed of a front wall 14F, a rear wall 14R, a top wall 14T, a bottom wall 14B and a pair of opposed side support frames 14S. Sidewalls 14D (shown in Figures 8 through 10) are attached
10 between the top and bottom walls of the casing 14. The sidewalls 14D are provided with doors which afford access to the ends of the modules 12. Each side support frame 14S is provided with cutout portions 15 configured to correspond to the shape of
15 each module 12 to thereby assist in supporting the same within the apparatus 10.

Each module 12 is disposed within the casing 14 intermediate a pair of inlet feed rolls 16A and 16B and outlet feed rolls 18A and 18B. The rolls 16
20 and 18 are each driven by a suitable drive arrangement arranged within the casing 14 in any convenient manner. In practice, the shafts of each of the inlet feed rolls 16B and each of the outlet feed rolls 18B extend beyond the side support frames
25 14S. The outlet feed rolls 18B are interconnected in a driven relationship by a chain and sprocket drive from a suitable drive motor (not shown). Each inlet feed roll 16B is driven by a chain drive derived from its associated outlet feed roll 18B. For compactness
30 of structure, the modules 12 are mounted in a pyramidal configuration although any convenient configuration may be used.

The photo-element P (not shown in Figure 1) is introduced through an appropriate slot 20Y, 20M,
35 20C and 20B in the front wall 14F of the apparatus 10

on an associated inlet feed tray 22. The tray 22 may be removably mounted to the front wall 14F. The toned photo-element is driven by the outlet feed rolls 18 along an outlet tray 24 and exits the casing 14 through associated outlet openings 26Y, 26M, 26C and 26B. The front wall 14F of the casing 14 may be removably mounted to provide access to the interior of the apparatus 10. Each module 12 is preferably transversely slidably receivable within the casing 14 on a suitable support member 28. The support member 28 may take the form of an inverted T shaped bracket which extends transversely across the interior of the casing 14. When received within the casing 14, each end of each module 12 projects through the cutout 15 provided in the side support frames 14S to support the module 12 in the casing 14. As shown in connection with Figure 4, one end of the module 12 is clipped to pins 30 integral with one of the side support frames 14S to secure the module 12 in place.

As better seen with reference to Figure 2, each toning module 12 includes a hopper 32 (only the lowermost portion of which is illustrated for clarity) which receives a charge of particulate toner of the appropriate color therein. The hopper 32 is formed by the cooperative association of a front wall member 32F and a rear wall member 32R. The lateral ends of the hopper 32 are closed the overlap of rearwardly extending plates (not shown) integral with the front wall 32F and forwardly extending plates (not shown) integral with the rear wall 32R. A suitable seal closes the space between the parallel plates. A brace bar 33 is secured to the front wall 32F for a purpose discussed herein. The hopper 32 tapers to a opening or throat 34 through which particulate toner exits the hopper 32. The throat 34

communicates with a path of transport, generally indicated at 35, along which the photo-element P is conveyed in a direction 36 through the module 12. A toning pad support plate 37 is attached to the rear wall 32R of the hopper 32. The plate 37 is supported by a suitable brace plate 37B. The portion of the front wall 32F upstream of the throat 34 is provided with a pile fabric 38. The rear wall 32R of the hopper 32 and the support plate 37 downstream of the throat 34 are provided with a pile fabric 39 which, together with the plate 37, defines a toning pad generally indicated by reference character 40. The fabric 39 extends upwardly along the rear wall 32R of the hopper 32 as shown in Figure 2.

The rear wall 32R and the pad support plate 37 in each module 12 are able to be laterally oscillated in a direction transverse to the direction of transport 36 with respect to the front wall 32F of the hopper by a suitable oscillator arrangement 41 (Figures 6 and 7) supported by the side support frame 14S of the casing 14. When the module 12 is inserted into the casing 14 a coupling is made with the oscillator arrangement 41 to connect the rear wall 32R in a driven relationship therewith. As an alternate embodiment the support plate 37 may be separate from the rear wall 32R of the hopper 32. In this event the pad 40 attached to these members is separated and separate oscillators are provided to reciprocate both the rear wall 32R and the plate 37 in directions transverse to the direction of transport 36.

The oscillating arrangement 41 for each of the modules 12 disposed within the casing 14, as well as a detailed view of the interconnection of the oscillating arrangement 41 with one of the modules 12

are seen in Figures 6 and 7. The oscillating arrangement 41 includes an oscillator drive motor 42 connected to an electric clutch 43 associated with each module 12 by a timing belt 44. The timing belt 44 which extends between a T-pulley 45A mounted to the shaft of the motor 42 and a T-pulley 45B connected to each clutch 43. Suitable for use as the drive motor 42 is a 1/4 HP capacitor motor, 1725 RPM, 115/208/230 VAC, Nema 48 frame, resilient mount, manufactured by Dayton Electric Company and sold under catalogue number 6K438. The timing belt 44 may be a dual grip timing belt such as that manufactured by Maurey Mfg. Company and sold under model number D660L050. The clutch 43, such as a device manufactured by Electroid Company, division of Valcor Engineering Corp. and sold under model number SEC-26C-10, Coil 1, Style L, is supported by a bearing 47 mounted in a plate 48. Suitable for use as the bearing 47 is a two-bolt pressed steel flange bearing device manufactured by Fafnir Bearing Company and sold under catalogue number RAT-5/8. The plate 48 is attached by a bracket 49 to the side support frame 14S of the casing 14. Suitable T-pulleys may be obtained from Maurey Mfg. Company under model number 30L050 Type MIF (for the pulley 45A) and model number 10L050 (for the pulley 45B). The motor 42 is connectable by the action of the clutch 43 into a driving relationship with an oscillator device 50 such as that sold by Norco Ltd. under model number B02626-14 with 1/4-28 tapped hole for alemite fitting. It is to be understood that any suitable motor, belt, pulleys, bearing, clutch and oscillator may be used and remain within the contemplation of the present invention.

A bracket 51 is affixed to the oscillator device 50. The bracket 51 is slidable over a bearing block 52 mounted to the side support frame 14S. The end of the bracket 51 is pinned by a pin 53 to a hinge block 54 connected to the movable portion of the hopper 32 (i.e., the rear wall 32R in the embodiment shown in Figure 2). The pin 53 is held in position by a retaining spring 55. A hinge pin 56 is provided for quickly connecting and disconnecting the rear wall 32R of the hopper 32 from the oscillating arrangement 41. In operation, when coupled to the oscillating device 50, rotary motion derived from the motor 42 is converted to reciprocating rectilinear motion (in the direction of arrows 57). The rectilinear motion is imparted to the rear wall 32R of the hopper 32 to thereby reciprocate the rear wall 32R and the plate 37 in directions transverse to the direction of transport 36 of the photo-element P through the module 12.

With reference to Figure 2, a channel-shaped tray or trough 58 is formed by a suitably configured plate 59 closed at each lateral end by a sidewall 60A and 60B (Figure 3) to which the plate 59 is connected, as by welding. The bottom edges of the sidewalls 60 are notched, as at 60N, to engage the inverted T-shaped bracket 28 to support the module 12 as it is inserted into the apparatus 10. The trough 58 exhibits an open top. The plate portion 59 of the trough 58 is supported by transversely extending cross-ties 61 (Figure 2). The forward edge of the trough 58 is bent downwardly, as at 63, and in cooperation with the exterior of the upstream portion of the front wall 32F of the hopper 32, define a lead-in for the photo-element P. The brace bar 33 attached to the front wall 32F of the hopper 32 is

secured to the sidewalls 60 of the trough 58 by bolts (not shown) to thereby interconnect the hopper 32 to the trough 58.

As seen in Figure 2, a shelf member 64 in the form of an inverted channel is mounted as by welding at each lateral end to the interior of the sidewalls 60 of the trough 58. The shelf 64 extends transversely across the interior of the trough 58 and lies beneath the toning pad 40. The back surface 65 of the channel-shaped shelf 64 defines a toning support table against which the toning pad 40 acts to embed particulate toner into the surface of the photo-element.

A first elongated member 68 (Figure 2) is attached, as by bolts 70, to the downstream leg of the channel-shaped shelf member 64. A second elongated member 72 is affixed as by bolts 74 to the inside surface of the upwardly extending leg of the channel-shaped trough 58. The upper surfaces of the members 68 and 72 are provided with stiff upstanding bristles 76 and 78, respectively. The bristles 76 and 78 act to scrape particulate toner from the support side of the photo-element P and the toning pad 40 disposed thereabove. The toner falls through an opening 80 defined by the members 68 and 72 into the interior volume of the channel-shaped trough 58.

A conveyor guide frame assembly 84 extends transversely across the interior of the trough 58 beneath both the throat 34 and the upstream edge of the shelf member 64. The frame guide 84 is substantially H-shaped and is formed from sidewall members 86A and 86B joined by an inverted channel shaped cross member 86C. If desired, the guide frame assembly may be integrally formed, as by extruding. The upper surface of the cross member 86C forms an

upper planar guide surface 86G for a conveying element 134, such as a belt conveyor 136, as discussed herein. The lower ends of the sidewalls 86A and 86B are bent inwardly toward each other, as
5 at 87, to define a lower guide for the belt conveying surface. Each lateral end of the guide frame assembly 84 is respectively provided with a mounting bracket arrangement 88 and 89. As seen in Figure 3, the brackets 88 and 89 are respectively formed of a
10 pair of opposed plate-like members 88A and 88B and 89A and 89B secured to the sidewalls of the guide frame assembly 84 at the appropriate ends thereof by suitable mounting bolts 90. The brackets 88A and 88B rest against the bottom of the trough 58. Each of
15 the brackets 88 is provided with an aperture 92 which receives the shaft 94 of a roller 96. The roller 96 is confined between the sidewalls of the guide frame 84. Each of the brackets 89A and 89B is provided with an aperture 98. The apertures 98 are surrounded
20 by an annular collar 100 for a purpose discussed herein. The collar has an aperture 102 therein.

As seen in Figure 3, the end of the conveyor guide frame assembly 84 which receives the brackets 89 extends laterally past the corresponding sidewall
25 60B of the trough 58. A drive mounting adapter generally indicated by reference numeral 104 is connected to the sidewall 60B of the trough 58. The adapter 104 includes a planar base portion 106 from which projects an upstanding hood member 108 (in the
30 shape of an inverted channel). The adapter 104 is secured to the sidewall 60B by bolts 110 extending thereinto through the planar base 106. Each downwardly depending arm 112A and 112B (Figure 4) of the hood member 108 has an opening 114 therein which
35 registers with the apertures 98 and 102 provided in

the corresponding brackets 89 and collars 100, respectively.

A bearing shaft 116 extends through the registered apertures 98, 102 and openings 114. The shaft 116 carries a roller 118 confined between the sidewalls of the frame 84. The shaft 116 is pinned, as at 120 and 121 and extends past the arm 112B where it is mounted to a pinnion 122. The pinnion 122 is mounted on the centerline of the inlet feed rollers 16 (Figure 1). The pinnion 122 is engaged by a helical gear 124 (Figure 4). The gear 124 is driven by the same drive that rotates the inlet feed rolls 16 of the module. The rotation of the helical gear 124 drives the shaft 116 which, in turn, drives the roller 118.

Upstanding posts 126 are mounted to the base portion 106 of the mounting adapter 108. The posts 126 receive slide fasteners 128 which clip the module 12 to the pins 30 formed on the side support frame 14S of the casing. The upper edges of the hood 108 are provided with tabs 130 by which a suitable receptacle or pail 132 may be mounted adjacent to the end of the trough 58 (Figure 5).

In accordance with this invention a conveying element 134 for conveying excess toner collected into the trough 58 is provided. In the preferred embodiment the conveying element 134 takes the form of a belt conveyor 136 (shown in section in Figures 2, 4 and 5) trained over the rollers 96 and 118. As the inlet feed rolls 16 are driven to carry a photo-element P through the module the helical gear 124 is driven at a speed functionally related thereto. Excess toner material falling under the influence of gravity from the opening in the hopper or from the pad 40 is collected on the belt conveyor

136. As the feed rolls 16 are driven, the belt conveyor 136 moves in a direction substantially transversely to the path of transport 36 of the photo-element P. The excess toner material collected
5 on the belt conveyor 136 is deposited into the receptacle 132. In this manner excess particulate toner material is withdrawn from the toning module.

Referring to Figures 8, 9 and 10, shown are alternate embodiments of the conveying element 134.
10 In Figures 8A and 8B, the conveying element 134 takes the form of a sprocket and chain arrangement 140 carried in the trough 58. In Figures 9A and 9B, the conveying element 134 takes the form of an auger 142 driven by a suitable drive element 144. The auger
15 142 rotates within the trough 58 to displace toner collected therein toward the receptacle 132. In Figures 10A and 10B, a chute and vibrator arrangement 146 is disposed to vibrate the chute to move the collected toner toward the receptacle 132.

20 Those skilled in the art, having the benefit of the teachings hereinabove set forth may effect numerous modifications thereto. It is to be understood, however, that these and other modifications lie within the contemplation of the
25 instant invention, as defined in the appended claims.

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WHAT IS CLAIMED IS:

1. Apparatus for applying toner particles to a photo-element comprising:
 - 5 a hopper having an opening, therein through which toner particles are dispensed;
 - means for advancing a photo-element along a transport path beneath the opening;
 - 10 a conveying element disposed beneath the opening in the hopper and beneath the transport path, the conveying element being disposed to collect toner particles falling under the influence of gravity from the opening and adapted to convey the toner particles collected thereon in a direction transverse to the path of transport.
2. Apparatus according to claim 1 further comprising:
 - 20 a receptacle disposed in adjacency to the end of the conveying element for receiving toner particles from the surface.
3. Apparatus according to claims 1 or 2 wherein the conveying element comprises a belt conveyor.
- 25 4. Apparatus according to claim 3 wherein the speed of the belt conveyor is functionally related to the speed at which the photo-element is advanced beneath the opening.
5. Apparatus according to claim 1 further comprising
 - 30 a vibrating toner pad disposed downstream of the hopper and wherein the conveying element is disposed beneath at least the edge of the pad adjacent to the hopper.
6. Apparatus according to claim 5 wherein the hopper
 - 35 comprises a front wall and a rear wall, the rear

wall being able to be vibrated with respect to the front wall, and wherein the vibrating toner pad is attached to the rear wall.

- 5 7. Apparatus according to claims 1 or 2 wherein the conveying element comprises a chain conveyor.
8. Apparatus according to claims 1 or 2 wherein the conveying element comprises an auger.
9. Apparatus according to claims 1 or 2 wherein the conveying element comprises a vibrating chute.

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FIG. 1

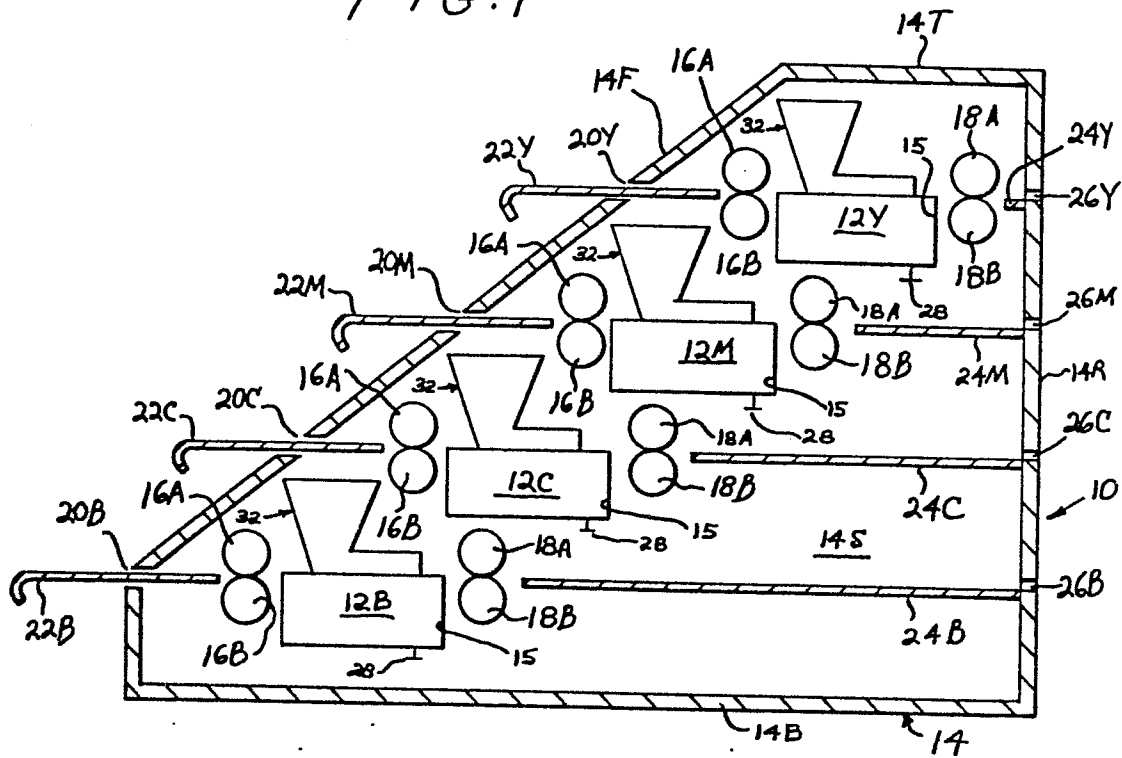
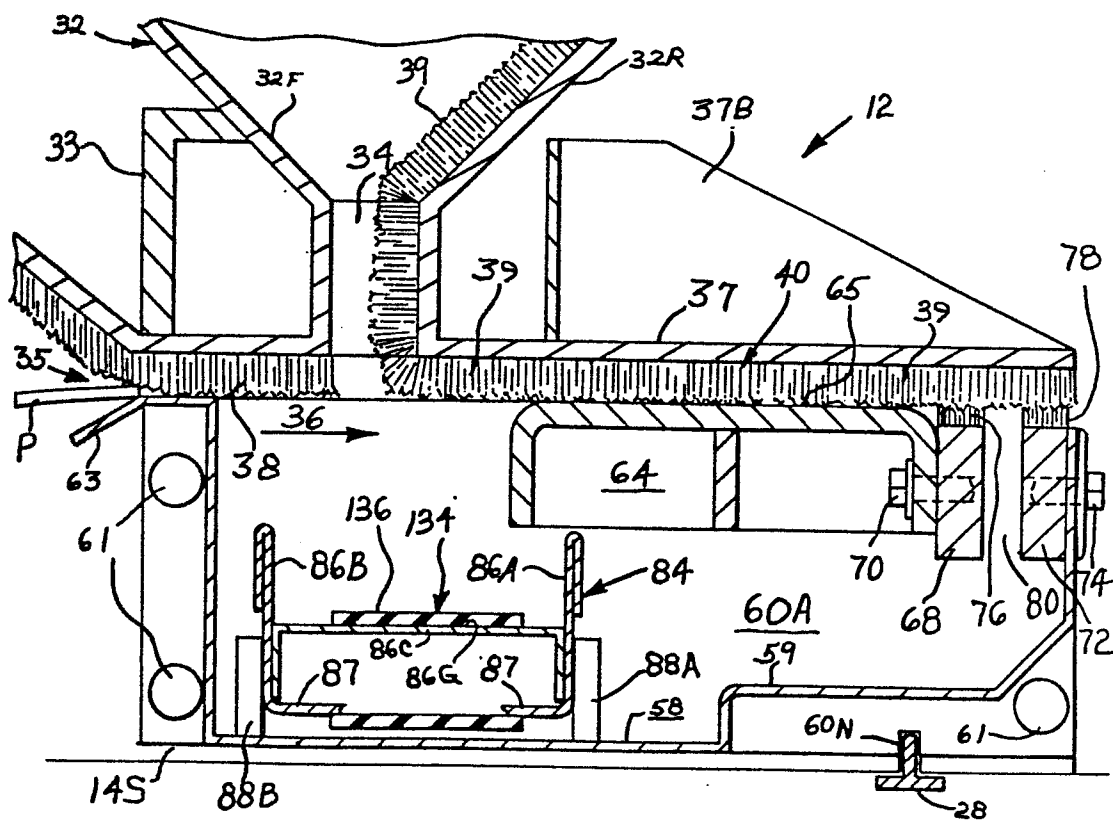


FIG. 2



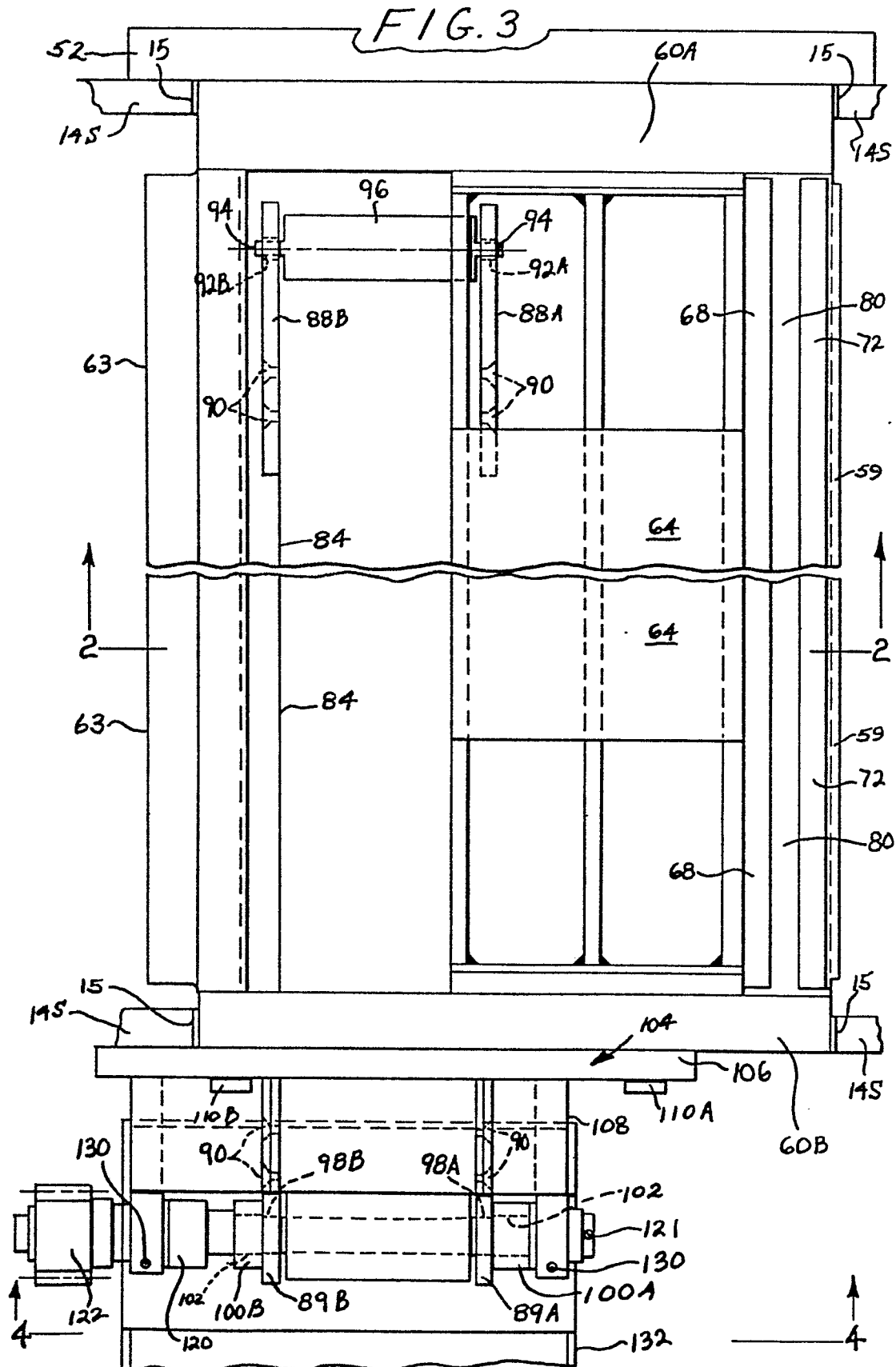


FIG. 4

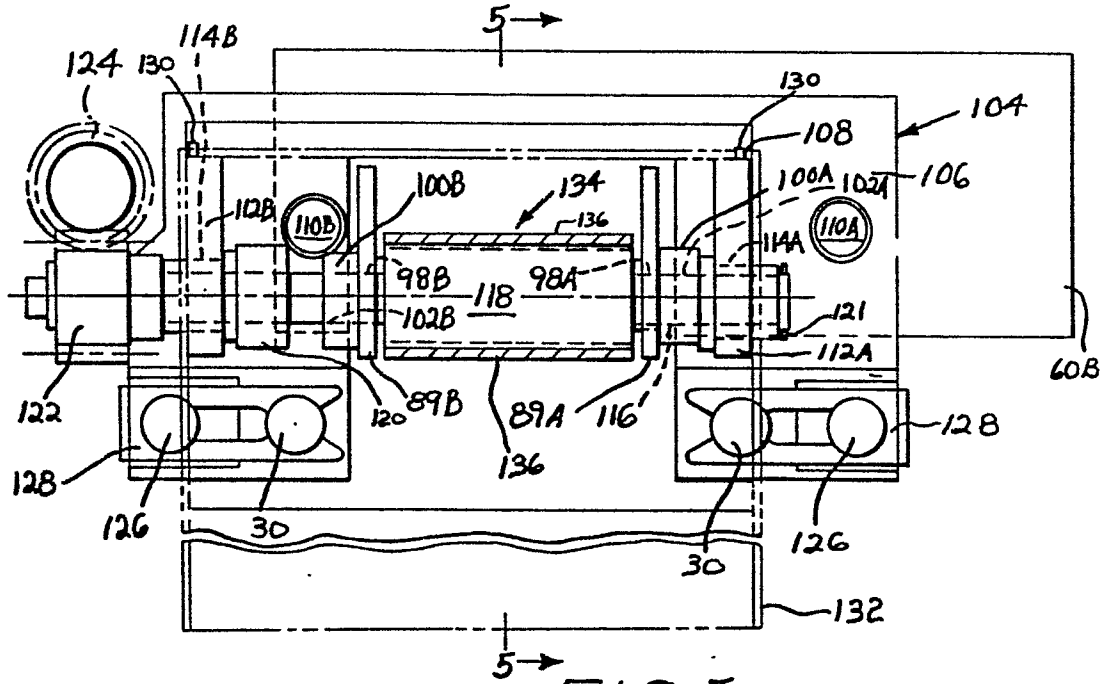


FIG. 5

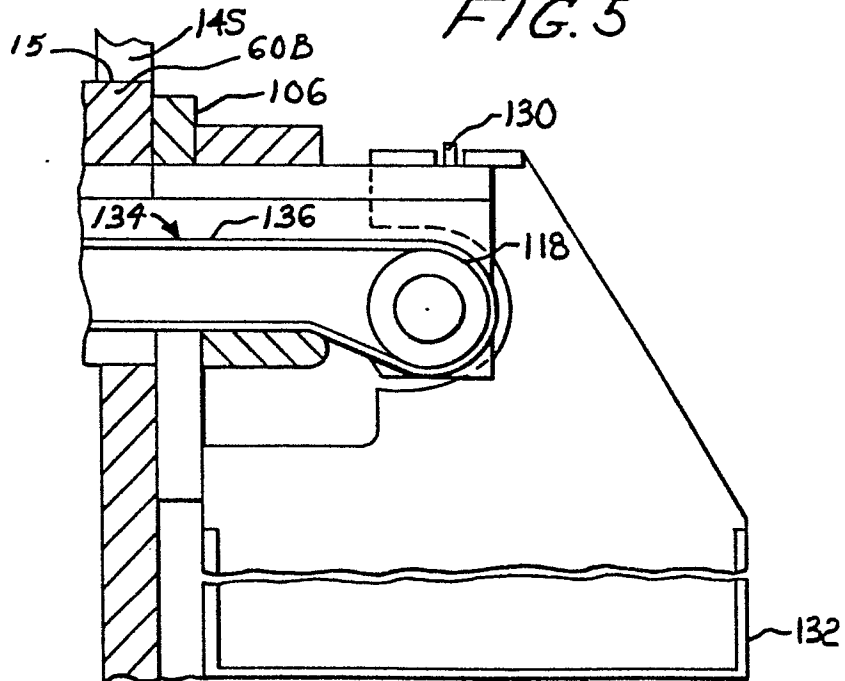
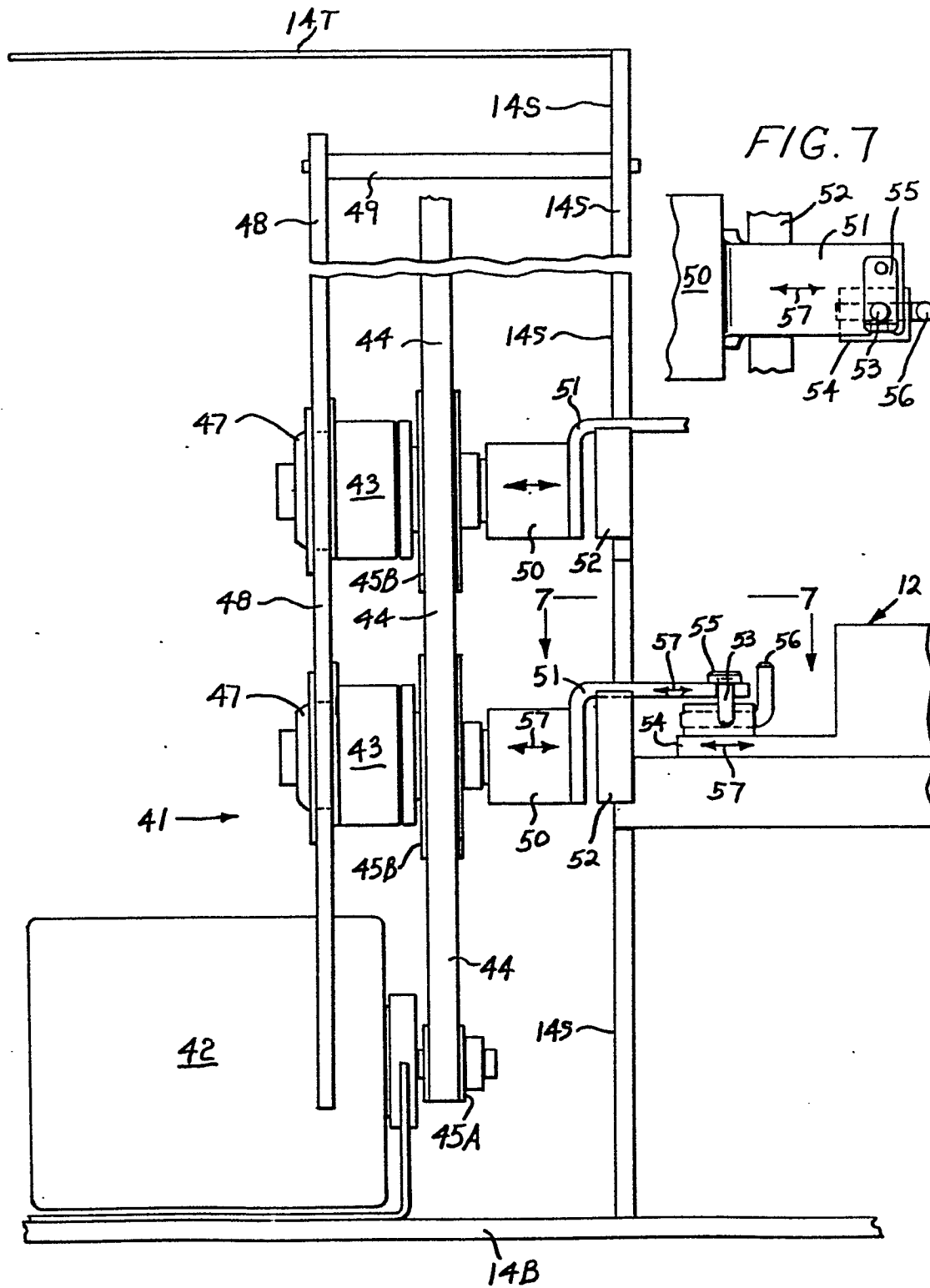
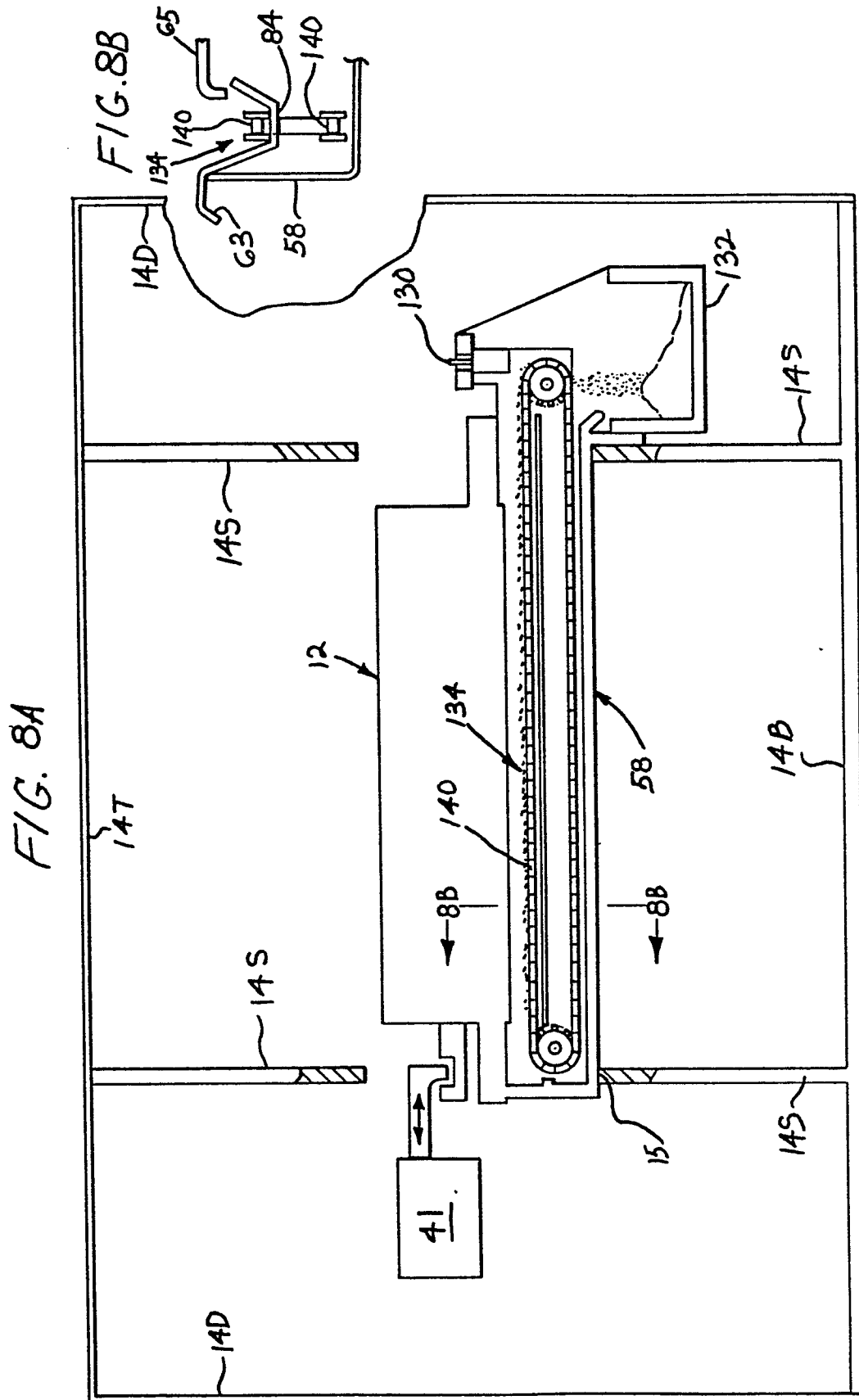


FIG. 6





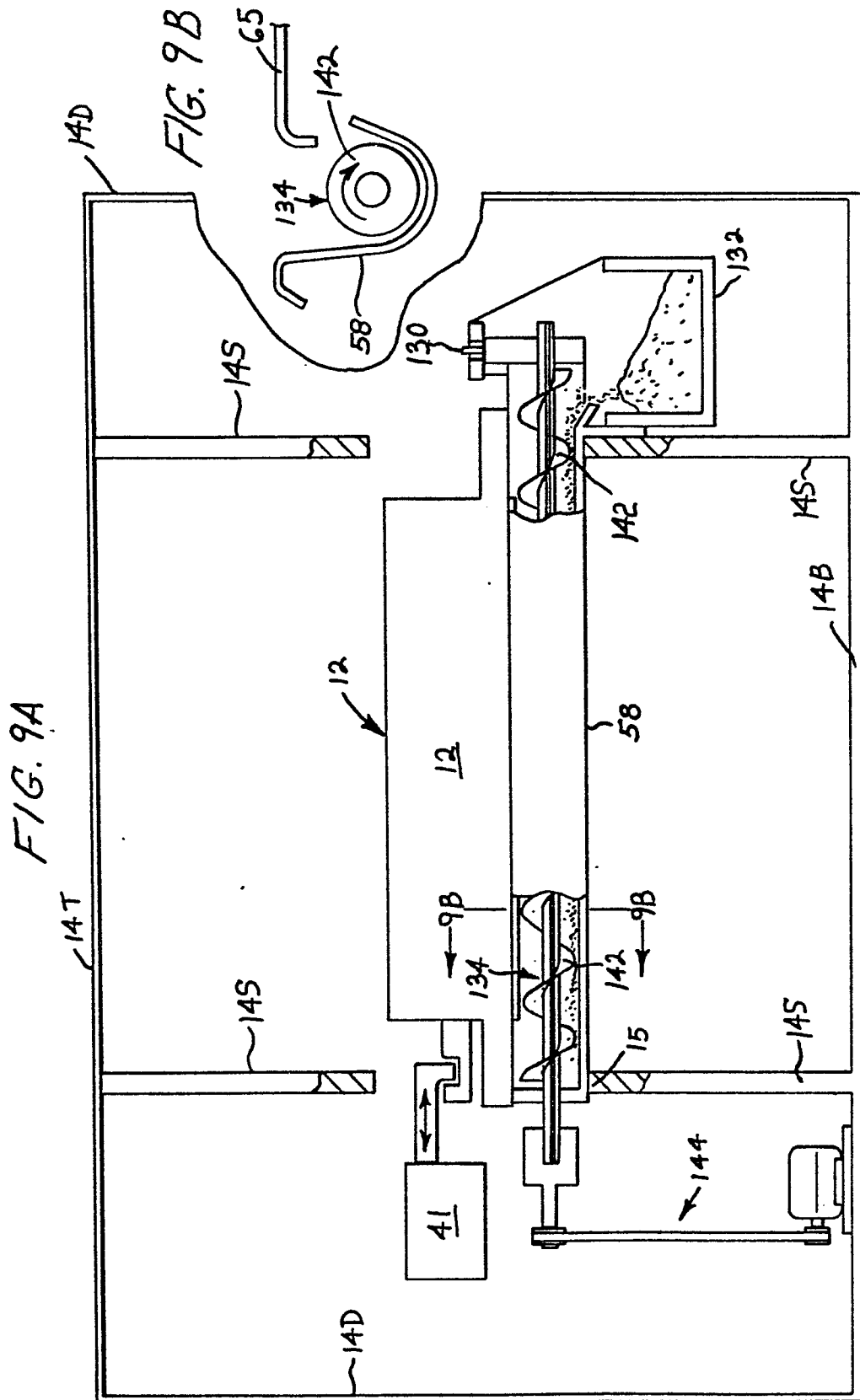


FIG. 10A

