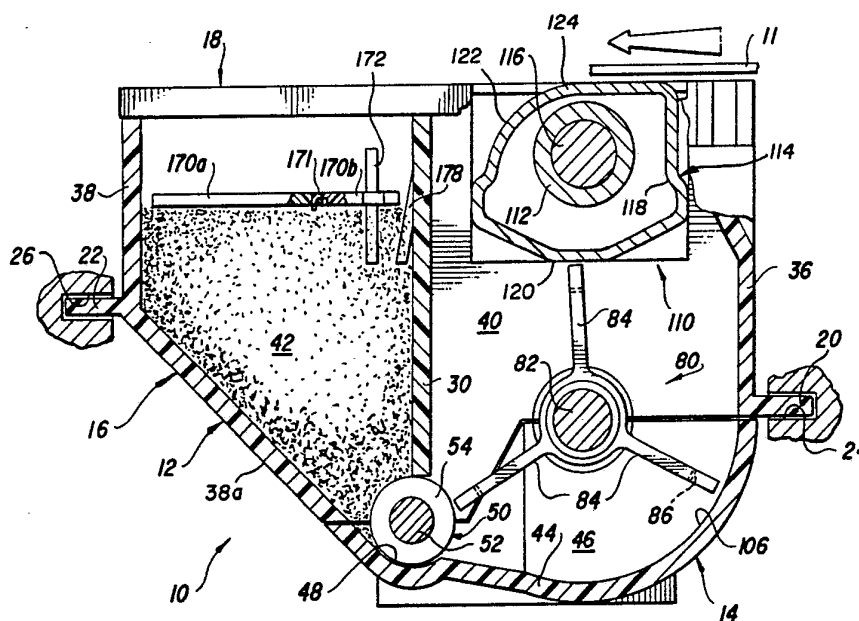




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(54) Title: DISPOSABLE DEVELOPMENT STATION FOR LOW COST COPIER OR PRINTER



(57) Abstract

A development station for a low cost copier or printer has a housing that is assembled from three molded plastic parts (14, 16, 18) that are sonically bonded together to form a unitary, substantially closed housing. Walls (30) in the housing divide the housing into two separate chambers (40, 42). The first chamber (40) contains a developer mix comprising carrier particles and toner. The second chamber (42) holds a supply of toner particles. The walls of the second chamber are vertical or slanted downwardly at a steep angle to facilitate flow of toner particles out of the second chamber through an opening into the first chamber under control of a foam dispensing roller (52). A mixing wheel (80) in the first chamber mixes the developer material and delivers some of it to a magnetic brush comprising a rotatable magnetic roller (112) and a stationary shell (114). The magnetic brush applies developer material through the housing to a latent image on a photoconductor advanced past the development station. The development station is relatively simple to assemble and load and inexpensive so that it can be disposed of when all of the toner has been used for development of latent images.

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DISPOSABLE DEVELOPMENT STATION FOR LOW COST
COPIER OR PRINTER

TECHNICAL FIELD

5 The present invention relates to a development station for use in a low cost copier or printer and, more specifically, to a development station which is disposable when its original supply of toner is exhausted.

10 BACKGROUND ART

 It is known to provide, as a unit, a process kit comprising a photosensitive drum, a corona charger, a developing device and a cleaner. The unit is detachably mounted into the main body of an image forming apparatus, such as a copier or printer. One example of such a unit is disclosed in U.S. Patent No. 4,591,258, which issued on May 27, 1986 in the names of F. Nishino et al and entitled "Safety Means for Process Kit".

20 Japanese Patent No. 56/779, published January 9, 1981 in the names of Masaaki Akita et al, relates to a development device having a magnetic roller, an inner wall which surrounds the roller and an outer wall located around and spaced from the inner wall. The walls define a container box that is filled with toner. In order to develop a latent image on a photoconductor advanced past the device, slits are provided in the box on opposite sides of the development roller so that rotation of the roller effects movement of the toner out of one slit, along a development zone adjacent the photoconductor and into the other slit. Toner can be transferred to the latent image as the toner is moved through the development zone. A lid covers the slits and is removed when the development station is to be loaded into a copier or the like. When the supply of toner is exhausted, the development device is removed and a

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new development device is loaded into the copier.

Both of the devices described above are intended for use with single component developers comprising a toner. No provision is made in either
5 device for handling a two-component developer material comprising carrier particles and toner particles and for replenishment of toner particles into the developer mix as such particles are depleted by development of latent images on the
10 photoconductor. Moreover, the unit as described in the before-mentioned U.S. Patent includes a photoconductor and other apparatus which results in the entire unit being relatively expensive to replace.

DISCLOSURE OF THE INVENTION

15 It is an object of the invention to provide a development station for a low cost copier or printer which station has a developer applicator and receives two-component developer material and a separate supply of fresh toner and is sufficiently
20 inexpensive to permit disposal of the station after the supply of toner is exhausted.

The station comprises an elongate plastic housing having guide means facilitating insertion of the housing in a copier or printer. A vertically
25 oriented separating wall runs longitudinally of the housing and divides the housing into first and second chambers. The first chamber is open at the top, and the second chamber has a slanted wall approximately opposite the opening in the first chamber. Toner
30 applying means is located in the opening, and toner mixing means is provided in said first chamber below the toner applying means. Access means below the separating wall permits the movement of toner from the second chamber to the first chamber as guided by
35 said slanted wall.

According to a preferred embodiment, both the first and second chambers are loadable from the

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top in manufacture and coverable by a single cover containing the opening for the applicator. A simple assembly operation can include the steps of filling the two chambers, then adding the applicator and then
5 the cover is sealed in place.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description of the invention presented below reference is made to the accompanying drawings, in which:

10 Fig. 1, comprising Figs. 1a, 1b and 1c, is an exploded perspective view illustrating a preferred embodiment of a disposable development station of the present invention;

15 Fig. 2 is an elevation view taken from the right end of the station as viewed in Fig. 1;

Fig. 3 is a transverse cross-section of the station showing the position of the feed plate in a toner supply chamber when the chamber is loaded with toner; and

20 Fig. 4 is a cross-section similar to Fig. 3 but showing the position of the plate when the toner supply is exhausted.

BEST MODE OF CARRYING OUT THE INVENTION

Referring now to the drawings, a disposable
25 development station of the present invention is generally designated 10. It can be used to develop latent electrostatic images on a photoconductor 11 (Fig. 2) of a copier or printer, for example, as the photoconductor is driven past the station in the
30 direction indicated by the arrow in Fig. 2. Station 10 comprises an elongate housing 12 that is assembled from three housing parts 14, 16 and 18 that extend the full length of the station. Preferably the housing parts are molded from a plastic material that
35 is relatively inexpensive and capable of being secured together by a sonic bonding technique.

The housing preferably has suitable guides

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for facilitating location of the station in a copier or printer. For example, the center housing part 16 can have along its opposite side edges a pair of longitudinally extending and asymmetrically positioned guides 20, 22. These guides are shown received in slots 24, 26, respectively, in a copier or printer as station 10 is loaded into the copier or printer. The asymmetrical location of the guides permits insertion of the station 10 into the copier or printer in only one orientation. The left end of the station, as viewed in Fig. 1, is the inner end of the station, i.e., it is the end that first enters the copier or printer. A handle 28 on the right end of housing part 16 is grasped by an operator during insertion and removal of the station.

The center housing part 16 has a vertically oriented wall 30 that extends the full length of the housing between end walls 32, 34 and is spaced from each of the side walls 36, 38 of the center housing part. The top edge of wall 30 is closely adjacent the inner surface of top housing part 18, and the lower edge of wall 30 is spaced from the inner surface of bottom part 14. Wall 30 divides the housing into two separate chambers 40 and 42 positioned in side-by-side relationship with the space beneath wall 30 providing access between the chambers. Chamber 40 is adapted to receive a two-component developer material comprising carrier particles and toner particles that are to be furnished to latent images on photoconductor 11. Chamber 42, on the other hand, holds a supply of fresh toner particles. As described later, toner particles are periodically metered from chamber 42 to chamber 40 to maintain the desired toner concentration in the developer mix.

Wall 38 of the center housing part 16 includes a lower portion 38a that extends from

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approximately the guide 22 to the lower end of housing part 16 and merges with a bottom wall 44 of the bottom housing part 14. Wall portion 38a is tapered or slanted downwardly and inwardly at a relatively steep angle, as shown in Fig. 2. This slanted or tapered wall portion 38a facilitates the flow of toner particles from the upper portion of chamber 42 downwardly toward wall 30 and roller 50, thus avoiding the formation of areas where toner can be deposited or remain in clumps.

As best shown in Fig. 3, a wall 44 of the bottom housing part 14 defines a sump 46 for a supply of developer material. Wall 44 includes an elongate semi-cylindrical recess 48 that is located generally below and spaced from the lower end of vertical wall 30 in housing part 16. Thus the recess in wall 44 and the lower end of wall 30 define a passageway providing access for fresh toner to be delivered from chamber 42 to chamber 40.

A toner dispensing roller 50 is positioned in the passageway between the lower end of wall 30 and the recess 48 in wall 44 and substantially fills that passageway. The dispensing roller 50 comprises an elongate cylindrical shaft 52 that is covered with a cylindrical layer of foam material 54 with the outer circumference of the foam layer being in contact with the lower end of wall 30 and the surface of recess 48 in wall 44.

The ends of shaft 52 project beyond the ends of the foam covering 54, as best illustrated in Fig. 1c. Bearings 56, 58 fit over the ends of shaft 52. Recesses 60 and 62 in the bottom housing part 14 and corresponding recesses 64, 66 in the bottom of walls 32, 34 of the center housing part 16 have slots that receive annular flanges on the bearings to locate the bearings in the housing.

The end of the shaft 52 shown at the left in

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Fig. 1 projects through the recesses 60, 64 in end wall 68 of the bottom housing part and in wall 32 in the center housing part. This projecting end portion of the shaft has gear teeth 70 that are engaged by a drive mechanism (not shown) inside the copier or printer when the station is fully inserted into the copier or printer. On the other end of the housing, a cover 72 of generally semi-cylindrical shape projects from the end wall 74 of the bottom housing part 14 and encloses the lower half of shaft 52 located in recesses 62 and 66. A corresponding cover 75 projects from the outside of wall 34 and encloses the upper half of the shaft 52. Thus the end of the shaft 52 is not exposed at the right or front end of the development station as viewed in Fig. 1. This is the end of the station normally engaged by the operator, and the covers 72 and 75 prevent inadvertent contact by the operator of the rotating shaft 52.

As indicated earlier, chamber 40 contains a developer material comprising carrier particles and toner particles. These particles need to be mixed together to triboelectrically charge the particles before they are applied to a latent image on a photoconductor. Accordingly, a mixing wheel generally designated 80 is provided in chamber 40. The mixing wheel comprises an elongate shaft 82 and a plurality of mixing blades or paddles 84 that are secured to the shaft and project radially outwardly therefrom. Three such blades 84 are illustrated in the drawings positioned at 120 degree intervals about the axis of shaft 82. Each blade has a plurality of openings 86 that extend from adjacent the shaft 82 to a position adjacent the outer edge of the blades so that some of the developer material falls through the openings during rotation of the blades.

A seal 90 and bearing 92 are provided on the

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left end of shaft 82, as viewed in Fig. 1, and a similar seal 94 and bearing 96 are provided on the right end of shaft 82. The bearings 92, 96 fit in recesses 98, 100 in end walls 68, 74, respectively of the bottom housing part 14. The bearings are also received in corresponding cylindrical recesses 102 in end wall 32 of the center housing part 16 and a similar opening in the wall 34 of part 16. A flange on the outer surface of each of bearings 92, 96 fits in grooves in the recesses 98, 100 and 102 to accurately locate the bearings with respect to the housing. The end of shaft 82 at the front end of the station is enclosed by covers 101 and 103 on housing parts 14 and 16, respectively.

As best illustrated in Fig. 3 the mixing blades 84 are located in chamber 40 so that when rotated the outer edges thereof sweep along an arcuate surface 106 on the inside of wall 44 of the bottom housing part. When the blades rotate they move substantially all of the developer material in the sump portion 46 of the chamber 40. As the blades sweep along surface 106 some of the developer material will pass through the openings 86 to tumble and mix the developer material, thereby providing the desired triboelectric mixing of the carrier and toner particles in the sump. The blades 84 will lift some of the developer material and move it vertically in chamber 40 to a developer applicator generally designated 110.

A preferred embodiment of the applicator 110 illustrated in Figs. 1b and 3 of the drawings comprises a magnetic brush having a rotatable magnetic roller 112 positioned within a stationary shell 114. The magnetic roller 112 can be of a conventional construction comprising a plurality of magnetic poles that extend longitudinally along a shaft 116 with alternate poles in a circumferential

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direction comprising north and south poles. The stationary shell 114 is generally rectangular in cross-section and comprises walls 118, 120, 122, and 124. Wall 124 has a curved portion that is generally semi-cylindrical in shape and comprises approximately 90 degrees or a quadrant of a cylinder. Wall 124 is connected at its edges to the top of wall 118 and the top of wall 122. Rotation of the magnetic roller 112 in a clockwise direction as viewed in Fig. 3 feeds developer material upwardly along wall 118, then along wall 124 to wall 122. Thus developer material travels along wall 124 in the same direction as photoconductor 11.

The applicator 110 is supported in the housing parts 16 and 18 by end caps 128, 130 (Fig. 1b) which receive the ends of shaft 116. The end caps, in turn, fit into recesses 132, 134 in housing part 16 and corresponding recesses 136, 138, respectively in housing part 18. The end portion of shaft 116 that projects through end cap 128 has a plurality of gear teeth 140 thereon which can be engaged by a drive mechanism (not shown) in the copier or printer for rotating the magnetic roller 112. The other end of shaft 116 is enclosed by a cover 137 adjacent recess 134 and a corresponding cover 139 adjacent recess 138.

The housing part 18 is a cover for the top of the development station. The cover has an elongate, generally rectangular opening 144 (Fig. 1a) that extends substantially the full length of the cover. The length and width of the opening is slightly greater than the upper portion of the shell 114 of applicator 110. The upper portion of the shell projects up through the opening 144 and is in close proximity to the photoconductor as it is driven past the station 10. Other portions of cover 18 fully enclose the top of chambers 40 and 42 and are

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secured to the housing part 16.

The cover and other portions of the housing completely enclose chamber 42. Thus the housing is void of openings, etc. that might be used for adding
5 new toner particles to the chamber 42 after the initial supply of such particles in chamber 42 has been fed to chamber 40.

As is known in the art, an electrical bias can be applied to the applicator 110 for controlling
10 transfer of toner particles from the applicator to the photoconductor. A metallic, electrically conductive clip generally designated 150 (Fig. 1a) is provided for applying a bias to applicator 110. Clip 150 comprises a base member 152 having legs 154 and
15 156. The base portion and legs are shaped to straddle a portion of wall 124 of applicator shell 114 with the leg 156 extending along wall 118. Leg 154 has a tab 158 struck from it which projects upwardly from the leg and is adapted to engage the
20 bottom surface of cover housing part 18 to hold the clip firmly in contact with the applicator shell 114. A tongue 160 of the clip projects through opening 144 in the housing part 18 and has a flat contact portion 162 that fits in a slot 164 formed in
25 the outer surface of the left or inner end of housing part 18, as viewed in Fig. 1. Slot 164 is open at the inner end of the station, and the sides of the slot protect the contact 162. When the development station of the invention is loaded into a copier or
30 printer, contact 162 engages a conductive element 166 in the copier or printer. Element 166 is connected to a voltage source 168 so that the bias can be applied from the voltage source through element 166 to contact 162 and then through the bias clip to the
35 shell 114 of the applicator 110. Voltage source 168 is illustrated as a d.c. source, but can be an a.c. source or a combination of a.c. and d.c. voltages, if

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desired.

Referring now to Figs. 1b, 3 and 4, a feed assist plate generally designated 170 is located in chamber 42 and rests on the top of the toner supply in that chamber. The length of the plate is substantially equal to the length of chamber 42 so that it fills substantially the entire space between walls 32 and 34 of the center housing part 16. The width of the feed plate is slightly less than the width of chamber 42 at its top, i.e., above tapered wall portion 38a, but the plate is wider than most of the chamber below the top of wall portion 38a. As the toner supply is depleted by feeding from the bottom of the chamber 42, the feed plate can move downwardly through the wider upper portion of the chamber 42, and enter the lower portion thereof as defined by vertical wall 30 and the tapered wall portion 38a.

Preferably, the plate 170 comprises a relatively wide portion 170a and a narrower portion 170b, that are joined by one or more hinges 171. The plate portions can be formed from a suitable material, such as stainless steel. The hinges are illustrated as a plurality of ears projecting from plate portion 170b through slots in plate portion 170a, thus enabling plate portions 170a and 170b to flex about the hinge.

The feed plate 170 is positively located in a horizontal plane and vertically guided by a pair of guide rails 172, 174 mounted on end walls 32, 34 of housing part 16. These rails project through rectangular notches 175, 177, respectively, in the rear and front edges of the plate 170 and near the side edge of the plate that is nearest to wall 30. In this manner the plate 170 is moveable in a horizontal plane toward and away from walls 30, 38 only to the extent notches 175, 177 are wider than

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the corresponding guide rails 172, 174. At the same time, the plate is free to move vertically without interference from the rails 172, 174.

It is desirable that the feed plate be urged
5 toward wall 38, and especially portion 38a of that wall, so that as the plate moves downwardly it will scrape from wall portion 38a any toner that may tend to adhere to that wall. This is accomplished by a guide rail 176 on the right end of wall 30 near wall
10 34, and a corresponding rail 178 on the left end of wall 30 near wall 32. Rails 176, 178 slope downwardly and toward wall portion 38a. They define a small acute angle with respect to the surface of wall 30. As a result, when gravity moves the feed
15 plate downwardly in response to toner being fed from the bottom of the chamber 42, the side edge of the plate nearest wall 30 will engage rails 176, 178 to thereby urge the plate toward wall 38. When the feed plate portion 170a contacts wall 38a, plate portion
20 170a can flex about hinges 171, thus permitting further downward movement of the plate. When plate portion 170b passes beneath the lower end of rails 172, 174, 176 and 178, the plate portion 170b is urged into engagement with wall 30 due to the contact
25 between wall 38a and plate portion 170a. Thereafter downward movement of the feed plate results in walls 30, 38a being wiped substantially clean of toner by the side edges of plate 170.

Fig. 4 shows the position of plate 170 when
30 substantially all of the toner has been removed from chamber 42. At this time the plate portion 170b is just above dispensing roller 50, and plate portion 170a is located at a small acute angle relative to wall 38a.

35 Feed plate 170 has several advantages. First of all it assists in feeding toner to the dispensing roller due to the weight of the plate on

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the top of the toner. This is important in assuring delivery of toner to the chamber 40. Also, the development station 10 can be quite small when used on low cost printers having a low utilization rate, and because the entire station is sealed when the housing parts are bonded together, it can be held in various orientations or positions by the machine operator prior to insertion into the copier or printer. As a result, the toner in chamber 42 may tend to be located primarily in one end or another of the chamber 42, or primarily along wall 30 or 38 of the chamber. If this occurs, fresh toner delivered from chamber 42 to chamber 40 may not be evenly distributed along the length of chamber 40. This can cause the concentration of toner to vary along the length of chamber 40. The weight of plate 170 tends to distribute the toner in chamber 42 and thus improve uniformity of distribution of fresh toner along the length of chamber 40.

Another advantage of the plate 170 is that it is almost impossible to return the plate to its original or elevated position in chamber 42 when the toner supply is exhausted without removing the permanently bonded cover part 18 of the housing from the station. Guide rails 172, 174, 176 and 178 block upward movement of the plate unless the notches 175 and 177 in the plate are exactly aligned with the lower ends of the guides 175, 177 in the plate are exactly aligned with the lower ends of the guides 172, 174. This alignment is very difficult to obtain without removing the cover part 18 and manually manipulating the plate in chamber 42.

The inability to raise the plate 170 effectively frustrates any attempt to reuse a disposable station by loading of a new supply of toner into the station after the original supply has been exhausted. This is important because the toner

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particles used in the development station must be compatible with the carrier particles in chamber 40 and also be useable with the other elements of the related copier or printer. Thus if someone attempted to place in chamber 42 a new supply of incompatible toner, it could prevent proper operation or contamination of the development station or the entire copier or printer. One way someone might attempt to refill chamber 42 with a fresh supply of toner particles is by forming an opening into the chamber 42 through the cover part 18, pouring the toner particles through such an opening into the chamber and then closing the opening to reseal the cover part 18. A station 10 refilled in this manner would not be operable because the toner particles will rest on top of the plate 170 and this will prevent delivery of the toner particles into the chamber 40.

As is apparent from the foregoing description, the entire development station comprises only a few parts, thus reducing its expense and permitting it to be disposable when all of the toner in chamber 42 is exhausted. In addition, the development station is quickly and easily assembled. More specifically, the bearings and seals can be positioned on dispensing roller 50 and the mixing wheel 80 and then loaded into the corresponding recesses 60, 62, 98 and 100 in housing part 14. Then housing part 16 is placed thereover. As this occurs, alignment of the parts is assured by a pin 180 on wall 32 of part 16 fitting in a socket 182 on wall 68 of the part 14. A similar socket 184 on wall 74 receives a pin 186 on wall 34. Also, bottom housing part 14 has an elevated wall portion 188 that fits in a similarly shaped recess 190 in wall 36 of part 16. Then the applicator 110 is assembled and placed in the mounting recesses 132, 134 in housing part 16. A

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supply of developer material comprising carrier particles and toner particles is placed in chamber 40 before the applicator is assembled onto housing part 16. A supply of toner particles is loaded into
5 chamber 42, and the feed plate is placed over the toner supply with the notches 175, 177 receiving guide rails 172, 174, respectively. Then the top housing part or cover 18 is placed over part 16. As this occurs, the bias clip 150 is positioned so that
10 its base member 152 is on the lower side of the housing part 18 where legs 154, 156 can engage the surface of shell 114. Tongue 160 of clip 150 projects through opening 144 and contact 162 fits into the recess 164. When the elements are thus
15 assembled the three housing parts are sealed to each other, preferably by a sonic bonding process, so that they are substantially inseparable and cannot be disassembled without effectively destroying the development station. Thus the useful life of the
20 station is determined by the single, initial supply of toner loaded into chamber 42 before the housing parts are bonded together.

Note that the first and second chambers 40 and 42 are both loadable from the top prior to the
25 insertion of the applicator 110 and cover 18. This arrangement greatly facilitates assembly, permitting the lower two housing portions 14 and 16 to be held in one position or by the same holding device for both loading operations. It further allows the
30 loading of the two chambers to be done by similar equipment, similarly located.

When the station is loaded into a copier or printer, the drives for the dispensing roller 50, mixing wheel 80 and applicator 110 are automatically
35 engaged with suitable drives in the copier or printer. Also, the electrical bias for the station is automatically established by the tongue 162

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engaging element 166 which in turn, is connected to the voltage source 168.

Mixing wheel 80 and magnetic roller 112 are constantly driven when developer material is to be provided to the photoconductor. As the mixing wheel sweeps through the sump portion 46 of chamber 40 it mixes the developer material in that chamber and triboelectrically charges the carrier and toner particles. The mixing wheel also delivers some of the material to the applicator 110, and the material is magnetically held to the applicator by the magnets of roller 112. As the roller 112 is rotated the developer material travels upwardly along wall 118 and then along wall 124 so that toner particles can contact the photoconductor as it moves past the development station for developing the latent images. When the concentration of toner in chamber 40 reaches a predetermined low level as determined by a toner concentration monitoring apparatus (not shown), the shaft 52 of the dispensing roller 50 is driven to provide new toner from chamber 42 into the sump 46 for mixing with toner depleted carrier particles. When the entire initial toner supply has been depleted, the station is easily removed and disposed of, and a fresh station is placed in the copier or printer.

While the invention has been described in connection with a preferred embodiment thereof, it will be understood that variations and modifications can be made within the spirit and scope of the claims.

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We Claim:

1. For use in developing latent electrostatic images in a low cost copier or printer, a disposable electrostatographic development station
5 including:

an elongate plastic housing having guide means facilitating insertion of said housing in a copier or printer, the housing having a vertically orientated separating wall running longitudinally of
10 the housing and dividing the housing into first and second chambers, the first chamber having an opening at the top, the second chamber being adapted to receive a supply of toner for developing latent images, the second chamber having a slanted wall
15 approximately opposite the opening in the first chamber with the slanted wall being oriented to direct toner in the second chamber generally toward the separating wall;

toner applying means located approximate the
20 opening to provide toner to a latent image adjacent the opening;

toner mixing means in the first chamber below the toner applying means; and

access means below the separating wall
25 permitting the movement of toner from the second chamber to the first chamber.

2. The invention according to Claim 1 wherein the access means has a driveable means for metering toner from said second chamber to said first
30 chamber, the driveable means being accessible from the exterior of said station.

3. The invention according to Claim 1 wherein the housing has an end wall intended to be the leading wall during insertion of the station into
35 a copier or printer, and electrical connecting means having a first portion positioned on the outside of the end wall and having a second portion connected to

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the applying means so that an electrical bias can be provided to the applying means from an electrical potential source in a copier or printer in response to insertion of the station into the copier or
5 printer.

4. The invention as set forth in Claim 1 wherein the housing comprises a first housing part, a second housing part and a third housing part, the three parts bonded together so that they are
10 substantially inseparable, the housing fully enclosing the second chamber and being void of openings into the second chamber through which toner could be added to the second chamber whereby the useful life of the station is determined by the
15 supply of toner in the second chamber before the housing parts are bonded together.

5. The invention as set forth in Claim 4 wherein the first housing part and the second housing part have cooperating means for locating therebetween
20 the driveable means of the access means and the mixing means, and the second housing part and the third housing part have cooperating means for locating therebetween the toner applying means.

6. The invention as set forth in Claim 1
25 wherein the housing includes a cover sealed to the rest of the housing, which cover defines the opening to the first chamber and covers the second chamber, and which cover when not in place permits both chambers to be loaded from the top of the housing.

30 7. A disposable development station adapted for use in developing latent images on a photoconductor advanced past the station, the station comprising:

an elongate housing having a plurality of
35 walls defining first and second chambers positioned in side-by-side relationship, one of the walls comprising a separating wall between the chambers,

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the separating wall being spaced from the bottom of the housing to provide a passageway between the chambers under the wall, the housing including a cover positioned over the chambers and above which a photoconductor can be advanced past the station, the cover having an opening communicating with the first chamber, the first chamber being adapted to receive a supply of developer material comprising carrier particles and toner particles, the second chamber being adapted to receive a supply of toner particles to be furnished to the first chamber through the passageway, the walls of the second chamber being positioned so that toner particles in that chamber are urged by gravity toward the passageway;

15 a toner applicator mounted in the upper portion of the first chamber of the housing and having a portion thereof projecting into the opening in the cover, the applicator being operable to receive developer material from the first chamber and to apply toner particles from such material to a latent image on a photoconductor advanced past the station;

a developer mixer mounted in the lower portion of the first chamber and below the applicator for mixing developer material in the first chamber and delivering such material to the applicator; and

a dispensing member mounted in the housing and located between the separating wall and the bottom of the housing for feeding toner particles from the second chamber to the first chamber periodically to maintain a predetermined concentration of toner particles in the first chamber,

the walls defining the housing being permanently bonded together after the applicator, mixer and dispensing member are mounted in the housing and after developer material and toner particles are loaded into the chambers, and the

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housing being void of means for adding new toner particles to the second chamber after the initial supply of such particles in the second chamber is fed to the first chamber.

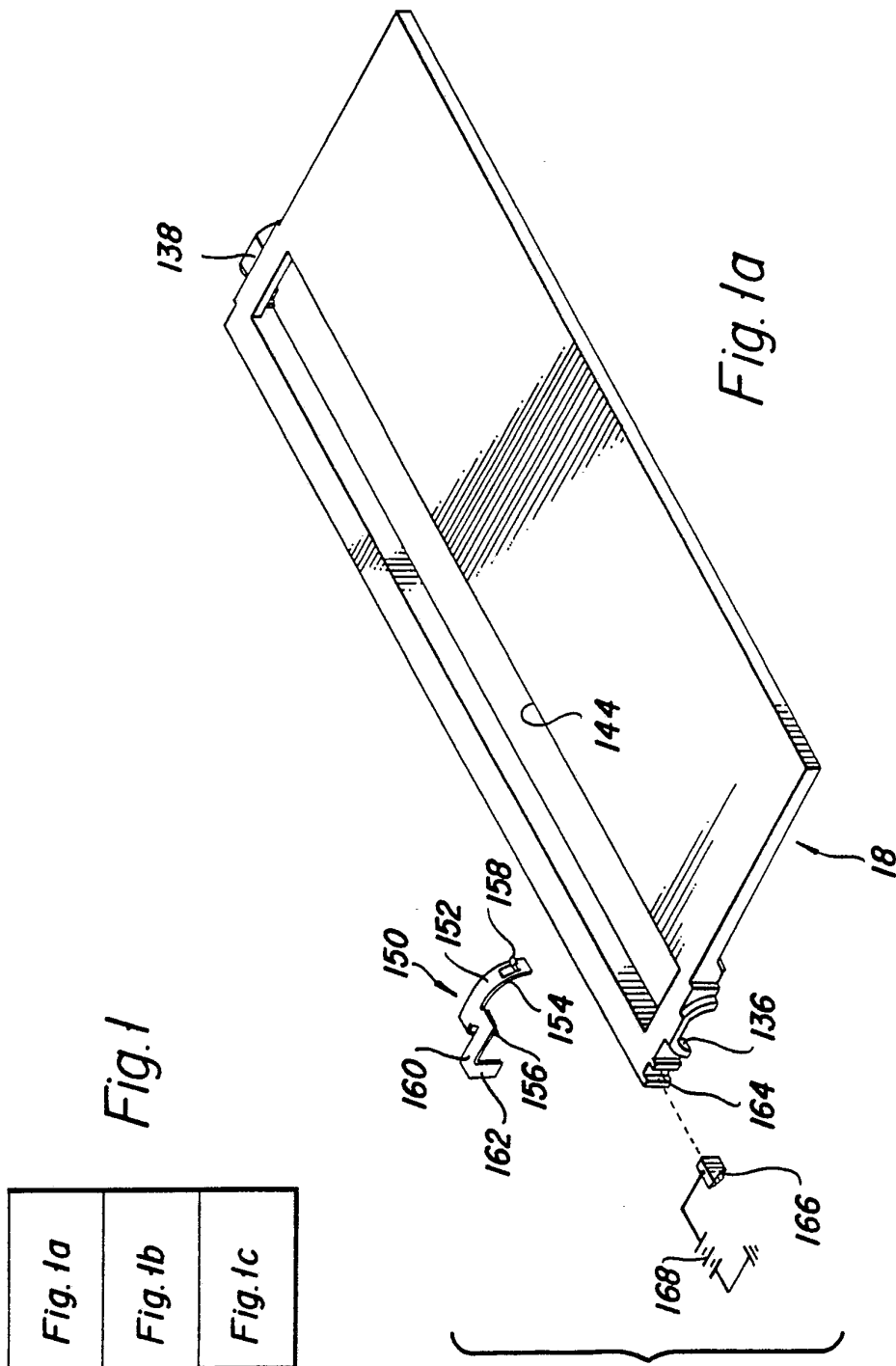
5 8. A station as set forth in Claim 7 wherein the applicator comprises a magnetic member and a shell positioned between the member and a photoconductor advanced past the station, and the station further comprises means for applying an
10 electrical potential to the shell of the applicator, the applying means comprising an electrically conductive member having 1) a first portion in contact with the shell, 2) a second portion projecting through the opening in the cover, and 3) a
15 third portion located at an exterior surface of the housing where it can be connected to a source of electrical potential.

 9. A station as set forth in claim 7 wherein the housing comprises first, second and third
20 housing parts, the mixer and the dispensing member being positioned between the first and second housing parts, and the toner applicator being located between the second and third housing parts.

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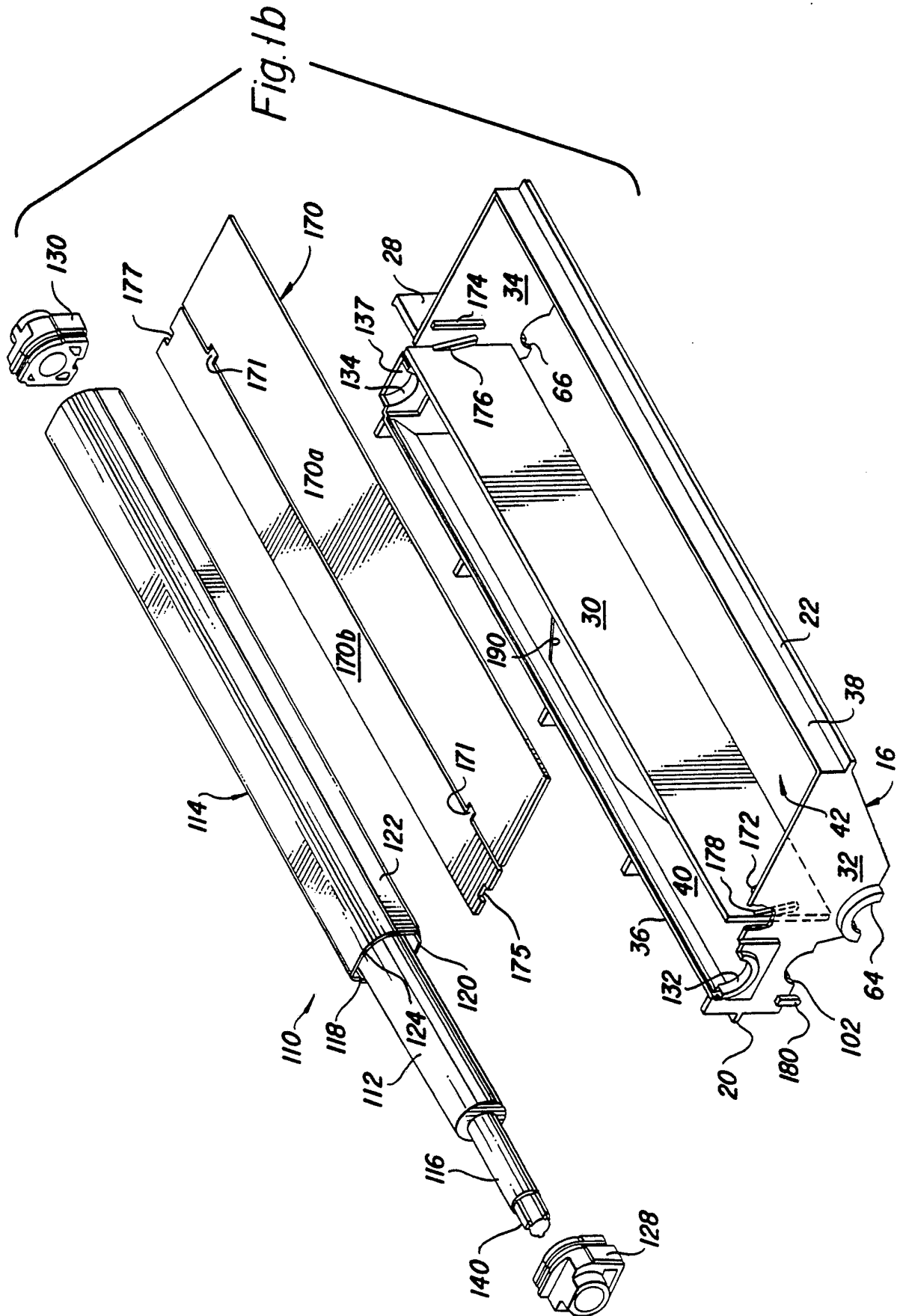
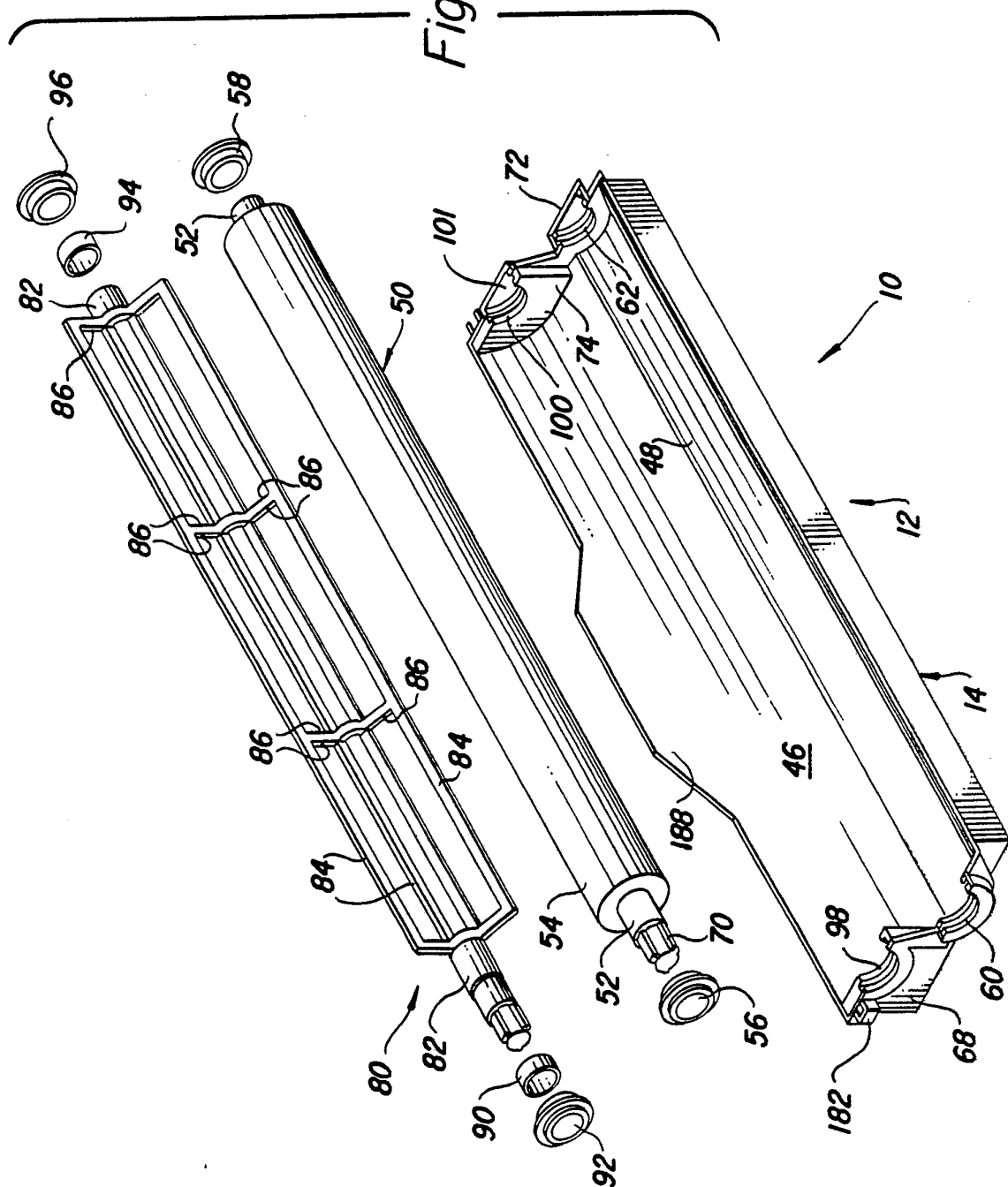
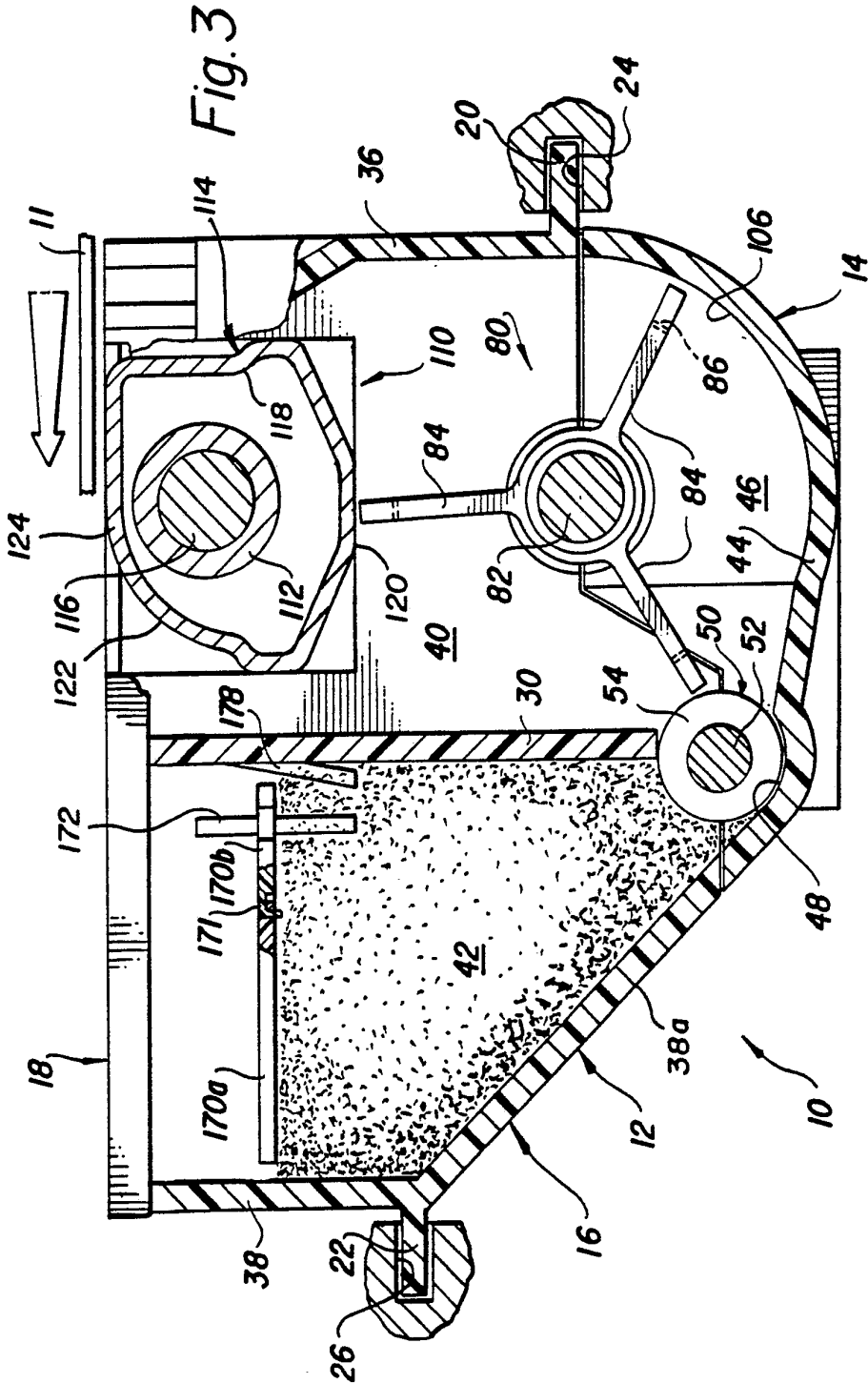


Fig. 1c





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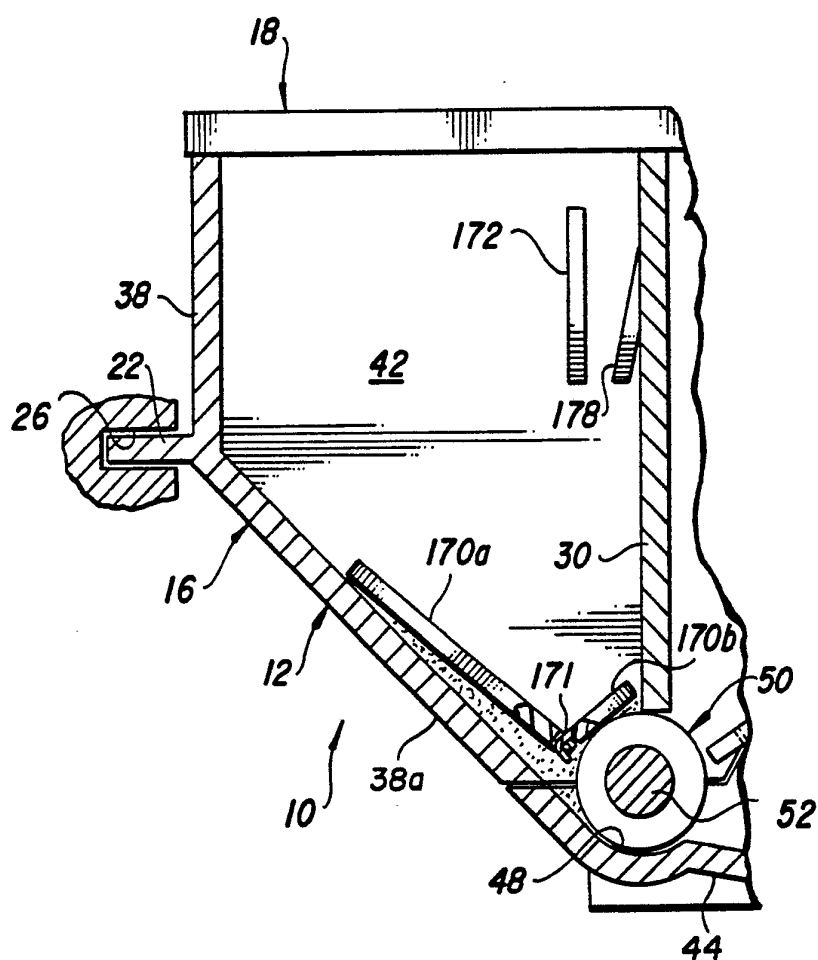
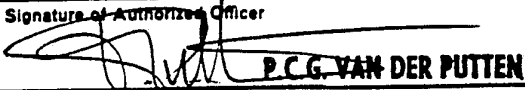


Fig. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 88/03703

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : G 03 G 15/08		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁴	G 03 G 15/08; G 03 G 15/00; G 03 G 15/09	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with Indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US, A, 3872829 (RATTIN) 25 March 1975, see column 2, line 49 - column 4, line 40; figures 1,2,4 --	1,2,7
Y	Research Disclosure, no. 257, September 1985, (Emsworth, Hampshire, GB) see page 464, disclosure no. 25737, "Low cost, light weight developer station" --	1,2
Y	US, A, 4538896 (TAJIMA et al.) 3 September 1985, see the abstract --	7
A	Patent Abstracts of Japan, vol. 8, no. 165 (P-291)(1602) 31 July 1984 & JP, A, 5961859 (CANON K.K.) 9 April 1984 --	1,7
A	DE, A1, 3428587 (HITACHI METALS LTD) 21 February 1985, see the abstract; figure 1 --	1,7
¹⁰ Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
16th February 1989	16.03.89	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	 P.C.G. VAN DER PUTTEN	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	Patent Abstracts of Japan, vol. 6, no. 84 (P-117)(962) 22 May 1982 & JP, A, 5720767 (IWASAKI TSUSHINKI K.K.) 3 February 1982 --	1,7
A	US, A, 4003335 (KURITA et al.) 18 January 1977, see the abstract --	
A	Patent Abstracts of Japan, vol. 8, no. 165 (P-291)(1602) 31 July 1984 & JP, A, 5961850 (CANON K.K.) 9 April 1984 --	1,7
A	FR, A, 2596536 (K.K. TOSHIBA et al.) 2 October 1987, see the abstract	1,3

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

US 8803703

SA 25331

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 07/03/89
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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		GB-A- 1430008	31-03-76
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