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(71) Applicant: BURROUGHS CORPORATION (a Michigan corporation)
Burroughs Place
Detroit, Michigan 48232(US)

(72) Inventor: Kasu, Abdullatif M.
8008 Cote Ct.
Orlando, FL-32819(US)

(72) Inventor: Robson Thomas
1120 Hall Lane
Orlando, FL-32809(US)

(72) Inventor: Fedder, Richard C.
106 Easern Fork
Longwood, FL-32750(US)

(72) Inventor: Thompson, Aubrey E.
5647 Tomoka Dr.
Orlando, FL-32809(US)

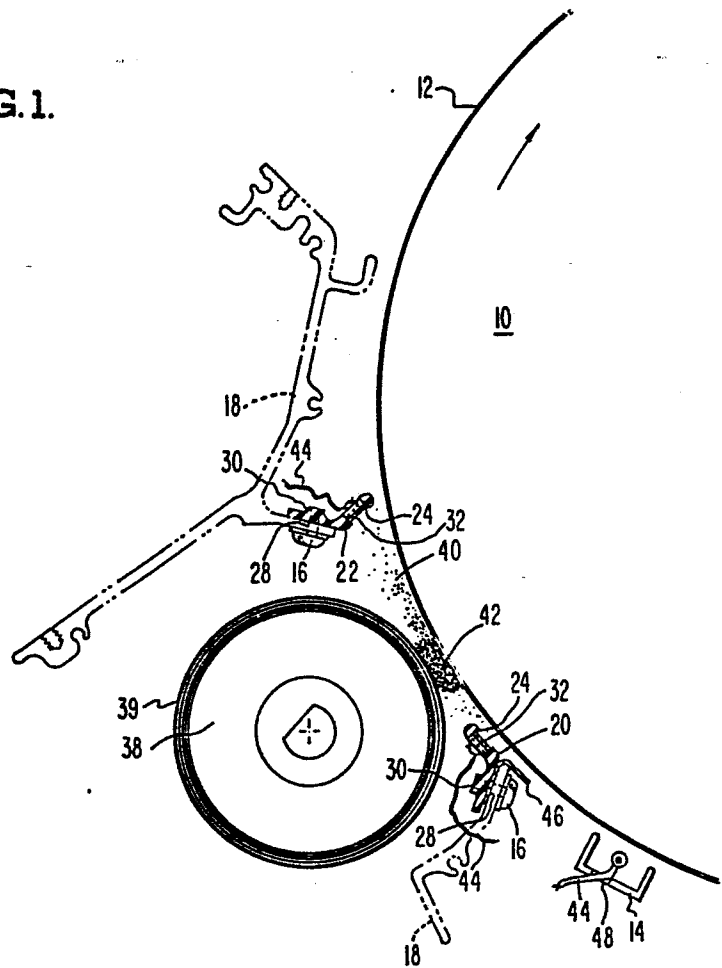
(74) Representative: EGLI-EUROPEAN PATENT ATTORNEYS
Widenmayerstrasse 5
D-8000 München 22(DE)

(54) Electrostatic dust repeller for electrophotographic apparatus.

(57) Automatic toner dust repelling apparatus for electrophotographic printers including oppositely disposed electrically charged members arranged on opposite sides of the magnetic brush generating roll with the respective electrical charges on the toner material and the electrically charged member being the same electrical polarity effective to repel toner dust from the adjacent edges of the magnetic brush roller and to concentrate the toner at the magnetic brush area thereby eliminating the toner dust problem.

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FIG. 1.



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ELECTROSTATIC DUST REPELLER
FOR ELECTROPHOTOGRAPHIC APPARATUS

Background of The Invention

1. Field of the Invention

5 The present invention relates to
electrographic apparatus and to automatic means for
preventing toner dust from migrating from the developer
station to other parts of the apparatus.

10 2. Background of The Invention

Electrographic printer apparatus which
utilize two-component toners i.e. toner plus carrier
beads, generally operate the magnetic brush or toner
applicator roll at a higher rotative rate than those
15 systems which employ single component toners since the
quantity of toner is much less with the two component
system. All toner material consists of extremely fine
powder-like material which can become airborne. Toner
particles in a two component system are lighter in
20 weight and non-magnetic whereas in a single component
system the toner particles are heavier and hence cannot

drift as readily in air and are magnetic so they can be held to the applicator roll by its negative field. The problem of toner migration due to the air turbulence created by the movement of the toner-carrier particles thus becomes a particular problem.

Brush-like seals at the edges of the rotatable photoreceptor drum tend to limit the ambient dust to a certain degree. Still, there is sufficient migration of the toner dust to other portions of the apparatus to produce unwanted deposits on bearings, moving parts such as gear trains, etc., and onto the copy itself making for unreliable and relatively dirty apparatus.

No commercially available electrostatic precipitation means has so far been economically adapted to correct the problem.

The problem becomes especially critical in high speed printers due to the high rotational speed of the magnetic roll carrying the so-called magnetic brush when the carrier beads become worn hence, reducing the charge to mass ratio (Q/M). A low Q/M reduces the attractive force between the toner particles and the carrier beads which results in free toner particles which migrate with the air flow in the apparatus. The airborne dust particles are thus a considerable nuisance.

Summary of The Invention

As is known in the reprographic art, mixing toner material with the carrier material (usually nonconductive beads) to form the developer generates a triboelectric charge. The carrier beads usually have a (positive) $+V_e$ charge while the toner particles have a (negative) $-V_e$ charge. Some toner particles, however, are mechanically freed causing the aforementioned dusting problem.

Electrostatic attraction and replusion are well known phenomena. Electrostatic precipitators are used industrially to capture and remove all manner of waste products from the stack and flue effluent.

The present invention makes use of the repulsive effect of electrostatics.

A pair of substantially similar conducting and electrostatically charged members, albeit carrying a $-V_e$ (negative) charge, are arranged in spaced apart relation to the photoreceptor recording drum of an electrophotographic apparatus. The charged members are disposed across the width of the drum and adjacent to the developer station (or unit) in the apparatus. Dielectric support members maintain the charged electrostatic elements in close proximity (but not touching) to the drum surface. A spacing of a few ten thousandths of an inch is sufficient to effectively seal the area adjacent the drum and toner station against dust. Application of a negative potential to the electrostatic charged members causes the negatively charged toner dust to be completely repelled from the area adjacent to each electrostatic member.

More specifically, the present invention comprises a pair of conductive (e.g. copper) elongated, thin, strips mounted to respective dielectric, molded members. The two assemblies are positioned adjacent to but separated from the periphery of the photoreceptor drum of an electrophotographic printer. So as to prevent the electrical field produced by the adjacent positively charged corotron from attracting toner dust a shunt or ground in the form of a grounded conductive member secured to the lowermost of the two electrostatic repeller members effectively shunts or grounds the field lines from the corotron preventing negatively charged toner from being attracted to the corotron.

This arrangement completely eliminates the toner dusting problem and keeps the area around the photoreceptor drum clean and assuring more legible copy.

Brief Description of The Drawings

Figure 1 is a side elevational view, partially in phantom illustrating a portion of electrophotographic apparatus embodying the present invention;

Figure 2 is a front view (partially broken away) of a portion of the apparatus of Figure 1;

Figure 3 is a view (partially broken away) of the electrostatic repeller member of Figures 1 and 2, and

Figure 4 is a view (partially broken away) of the shunt means of the present invention.

Description of A Preferred Embodiment

The present invention relates to reprographic electrophotographic apparatus of the type described and claimed in USSN 429,861 filed September 30, 1982 in the name of Richard C. Fedder for "Toner Concentration Sensor For Electrographic Apparatus" assigned to the same assignee as the present invention.

In dry copying apparatus in order to produce clean, clear, crisp, black printing (copy) on white paper for example, to a line definition generally acceptable to the eye as regular or standard printing, it is necessary to employ an extremely fine dry powder toner material. The subject apparatus also utilizes what is characterized as a two component developer i.e. a finely powdered toner and larger carrier beads.

Mixing the toner and carrier beads to form the so called developer generates a tribo-electric charge. The carrier beads acquire a positive (+V_e) charge while the toner material acquires a negative (-V_e) charge. Inevitably, some toner particles remain uncharged or go free to produce an ambient dust which migrates at random to all parts of the surrounding atmosphere and hardware.

Physical seals cannot be placed along the cylindrical surface of the photo drum for obvious reasons. Anything that touches the polished surface of the drum would tend to disturb the surface charge and thus interfere with the printing.

The problem is solved by utilizing the phenomenon of attraction and repulsion i.e. like charges repel one another while unlike charges attract.

Viewing Figure 1 of the drawings, the present invention is seen to include a rotatable photoreceptor drum 10 having a photoconductive surface 12 for receiving a visual image of information or data thereon. Below, and slightly to the left, (off center) is one of two corotrons 14. (The other corotron to the right of the first is not shown since it forms no part of this invention). Immediately to the left and above the corotron 14, secured as by bolts 16 to the extrusion hardware frame 18, is an L-shaped glass filled nylon lower bar member 20. Member 20 is arranged to extend (from side to side) across the drum 10 in very close but noncontacting proximity thereto. Adjacent to but above and separated from the lower bar member 20 is an upper L-shaped glass filled nylon bar member 22. Each bar member 20 and 22 is provided with a elongated fairly wide channel or groove 24 extending from end to end of the respective member. One end of each member 20 and 22 is provided with a substantially rectangular aperture 26, which will be explained shortly. An opposite integral portion of each bar member 20 and 22 is provided with a plurality of attachment holes 28 arranged in spaced apart relation on a thickened or raised land portion 30. The latter portion 30 extends from end to end of each bar strengthening element for retaining the attachment bolts 16. The two mounting-support members 20 and 22 are otherwise identical in cross section, only their physical orientation is different. The upper member 22 is angled as seen in Figure 1 so as to take advantage of the available hardware to which it is physically attached. The lower member 20 is likewise situated to

enable its attachment to available hardware structure. Since no corotron is used above the member 22 there is no need for a second shunt (to be described shortly) as is used with the lower member 22.

An elongated, relatively thin, conductive copper strip 32, one end of which is provided with an integral bent tang 34, Figure 2 including an attachment hole 36, is seated in the longitudinal groove or channel 24 in respective members 20 and 22. The bent tang 34 is received within the rectangular aperture 26. The physical mounting arrangement of the two members 20 and 22 is such that the flat planar facing portion of each copper strip 32 is generally oriented toward the surface of drum 10 with the strip 32 of lower member 20 being substantially parallel to the drum surface. As seen in Figure 1 the two (upper and lower) electrostatic repelling devices 20 and 22 are disposed relative to a magnetic brush development roller member 38 mounted in close but non contacting proximity to drum 10. The outer shell 39 of member 38 rotates past a plurality of internally disposed fixed magnets (not shown) to carry developer 40 (toner plus carrier) from a source (not shown) upwardly by the rotatable magnet member 38 into surface contact with drum 10 as members 10 and 38 are rotated during machine operation. At the interface between the member 38 and drum 10 the lines of force due to the internal magnet arrangement of member 38 and the electrostatic charge on drum 10 causes the developer 40 to assume a longitudinal ridge, land or magnetic brush 42 between the periphery of member 38 and drum 10 parallel to the

axis of rotation of member 38. The shell of member 38 carries a B+ potential charge of approximately 300 volts. The drum 10 is provided with a B+ potential of 750-800 volts. The two electrostatic repeller devices are each provided with a negative potential of approximately - 1200 volts over leads 44 from a source (not shown).

A corotron 14, disposed below and to the right of roll 38 is maintained at a B+ potential of 4500 to 6000 volts over lead 48, from a source (not shown).

Because of the high voltage applied to corotron 14 the field lines generated by this element spread outwardly therefrom and into the area adjacent to the magnetic brush 42. Ordinarily, this would result in the negatively charged toner developer being attracted away from the brush area to the corotron 14. However, the present invention utilizes a shunt member 46, e.g. a copper strip, bent out of the main plane into a v-shape as seen in Figure 1. Attachment notches 48 are provided along its length so as to secure member 46 to the lower member 20 as by bolts 16. Shunt member 46 is coextensive with lower repeller member 32 attached as shown to the frame 18 which is at ground potential.

In operation, with the electrical potentials applied to respective members as stated hereinbefore the toner developer dust generated during operation of the withindescribed apparatus is confined to the area between the drum 10 and members 20 and 22 and the brush generating member 38. No toner is permitted to escape into the ambient or surrounding atmosphere.

This structural arrangement effectively directs or shunts the lines of force from corotron 14 to ground thus preventing any ambient toner dust from spreading outwardly away from the brush area 42 overcoming the dusting problem.

An additional benefit derived from this structural combination is that the optical density of the print is enhanced by the concentration of toner adjacent the printing area on drum 10.

What Is Claimed IS:

1. Electrostatic toner dust repeller apparatus
for an electrophotographic printing device in which the
rotation of a magnetic toner applicator brush roller
generates a particular atmosphere of toner dust
comprising:

a first electrostatic toner repelling means,
a second electrostatic toner repelling
means,

said first and second repelling means being
arranged on opposite sides of said toner applicator
brush roller and adjacent to the peripheral surface of
a photoreceptor drum,

means for applying an electrical potential
to each of said repelling means said potential being
opposite in polarity to the polarity of said toner
effective to repel said toner from the area immediately
adjacent to said repelling means and to concentrate
said toner at said magnetic toner applicator roller
adjacent to the peripheral surface of said drum.

2. The invention in accordance with Claim 1
further including means for shunting and grounding the
electric field from a charging corotron disposed
adjacent to one of said electrostatic repeller means.

3. The invention in accordance with Claim 2
wherein said shunt means comprises an elongated
conductive plate-like member having means grounding
said members to the frame of said apparatus.

4. The invention in accordance with Claim 1 wherein said shunt means comprises a substantially v-shaped, thin, flat planar copper member bent to accommodate the radial curvature of said receptor drum.

5. The invention in accordance with Claim 1 wherein each of said first and second electrostatic repeller means comprises a thin, flat, planar copper member, each one of which is supported longitudinally within a groove of a respective dielectric member.

6. The invention in accordance with Claim 5 wherein said dielectric members are substantially identical in configuration.

FIG. 1.

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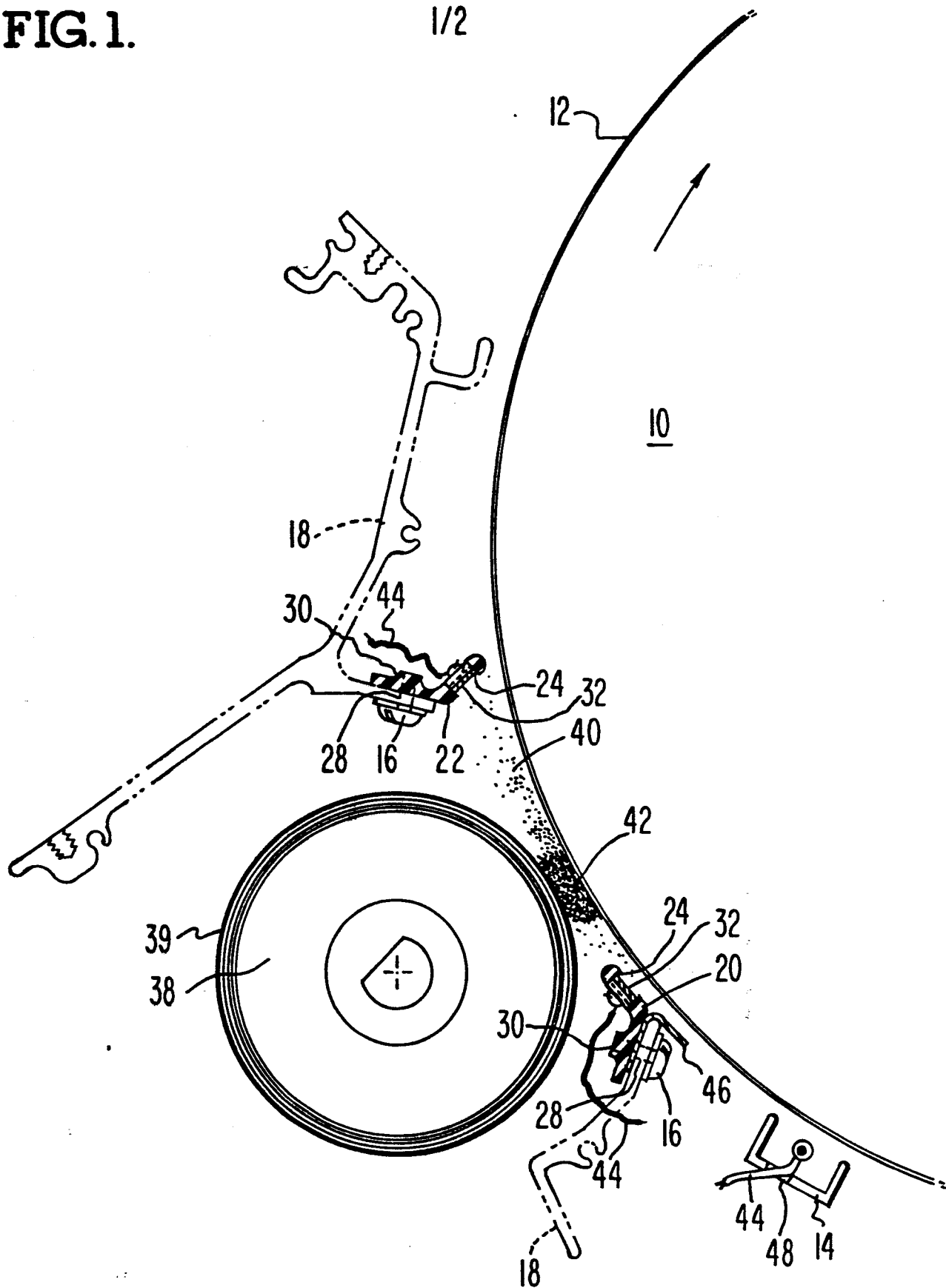


FIG. 2.

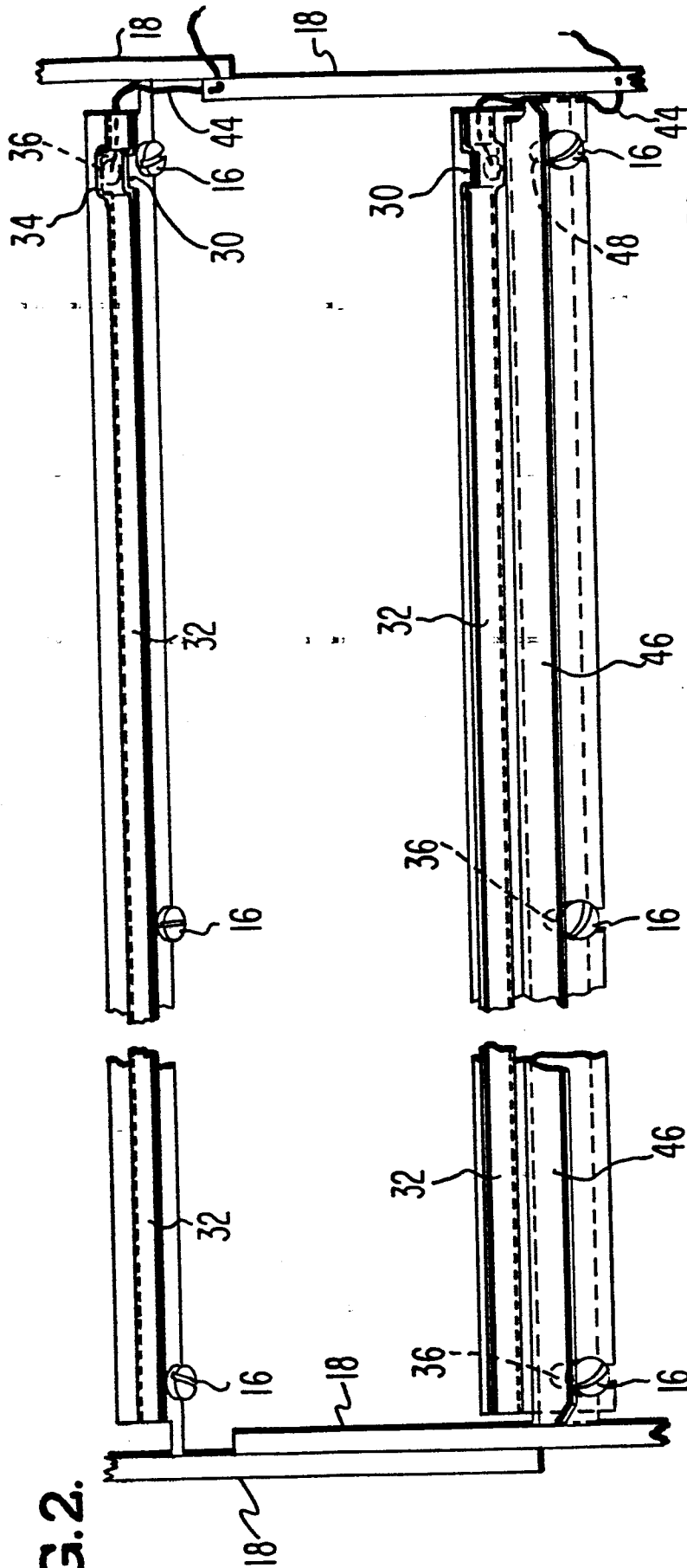


FIG. 3.

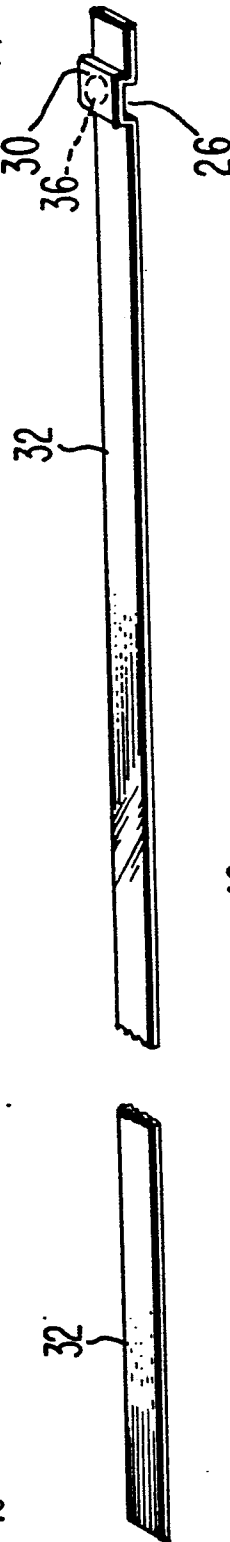


FIG. 4.

