US 20050067772A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2005/0067772 A1

Lockhart et al. (43) Pub. Date: Mar. 31, 2005

(54) METHOD OF AND APPARATUS FOR OPTICAL SENSING OF MEDIA THROUGH A SUCTION OR MESH BELT

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(21) Appl. No.: **10/945,370**

(22) Filed: **Sep. 20, 2004**

Related U.S. Application Data

(60) Provisional application No. 60/507,455, filed on Sep. 30, 2003.

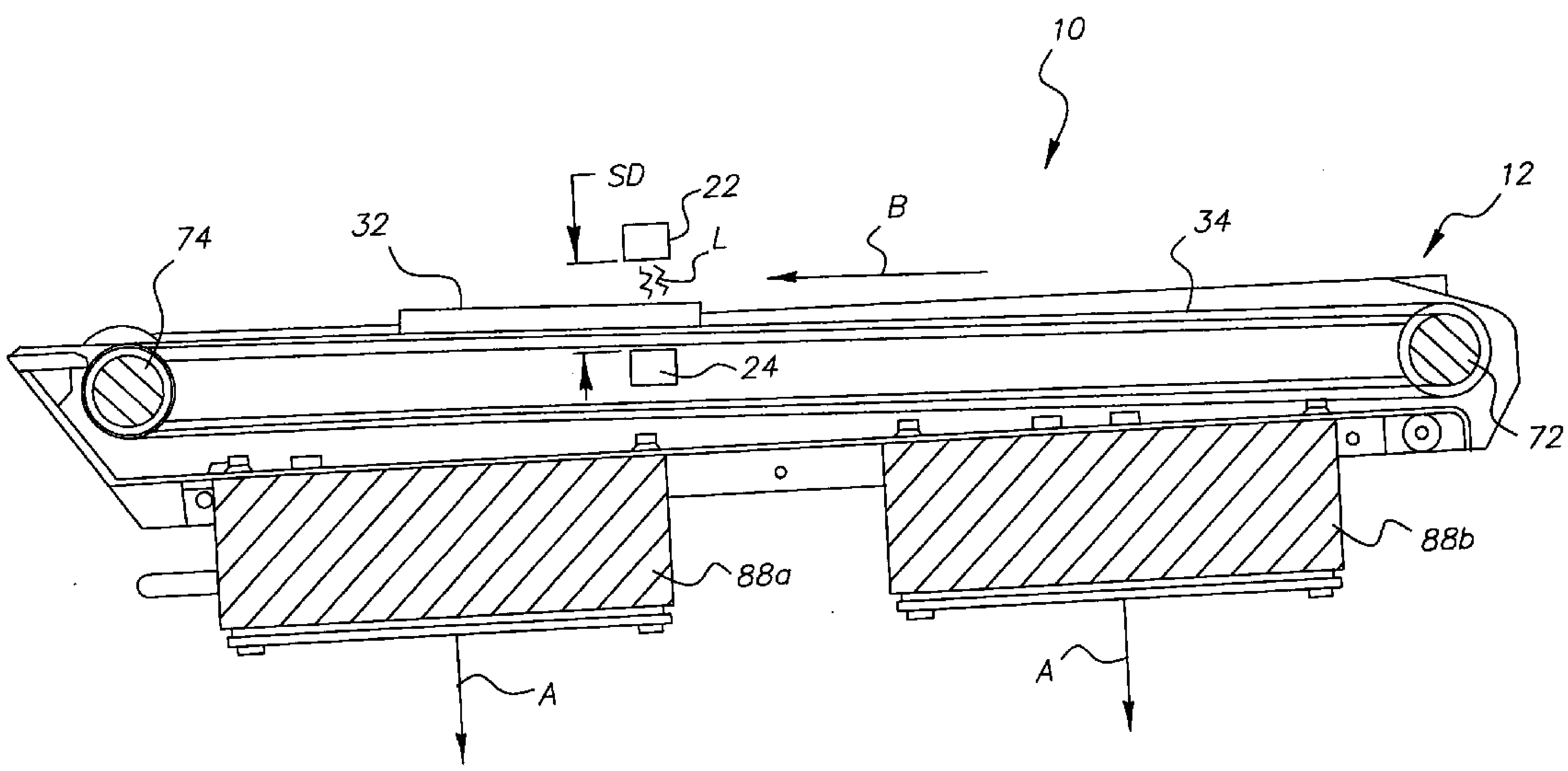
Publication Classification

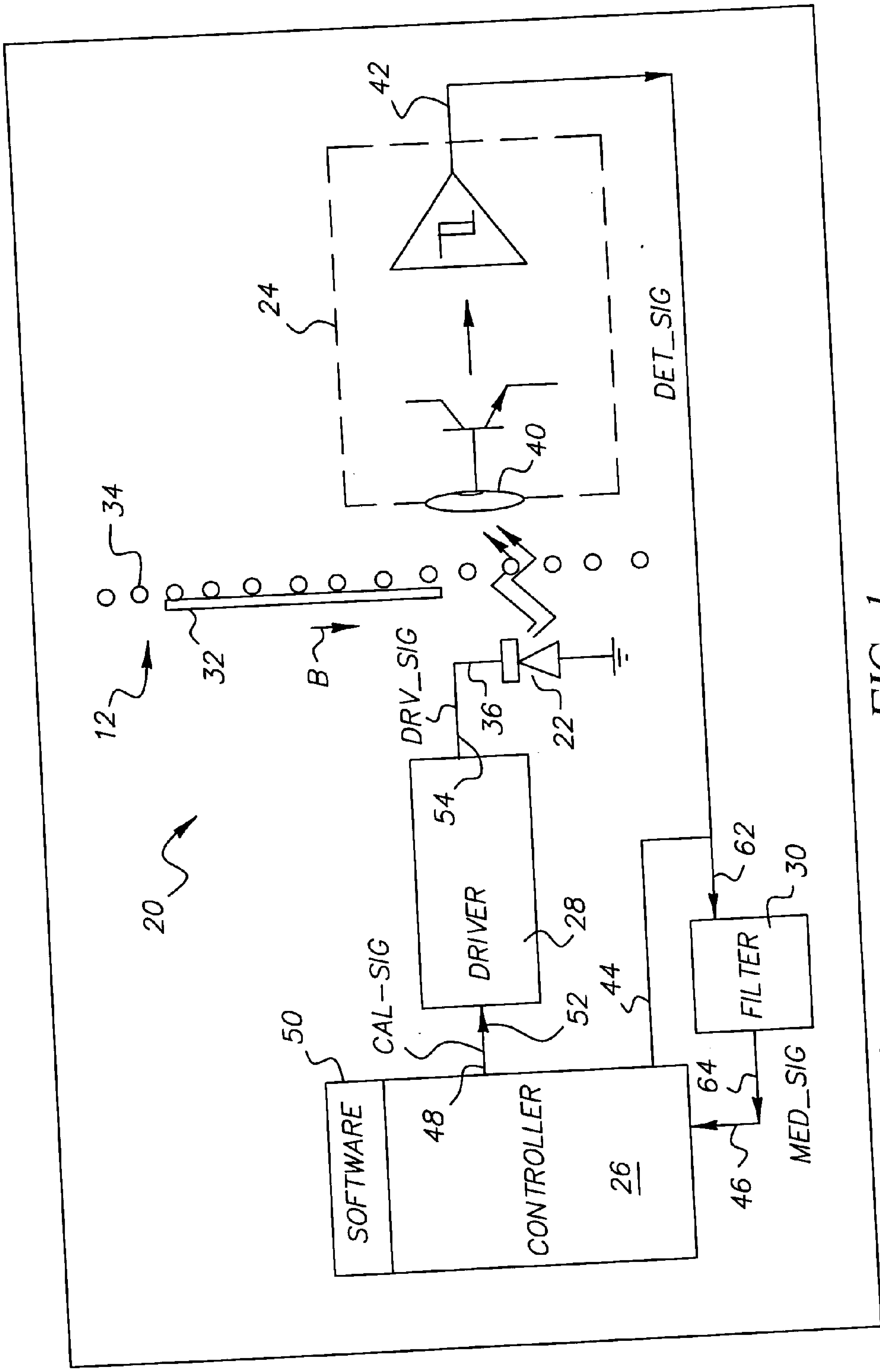
(51) Int. Cl.[7] **B65H 7/02**

(52) U.S. Cl. **271/258.01**

(57) **ABSTRACT**

An optical sensing assembly **(20)** detects media **(32)** carried by a traveling mesh or suction belt **(34)** having material portions **(82)** that define therebetween open portions **(84)**. An emitter **(22)** is disposed opposite and spaced apart from the first side of the belt **(34)**. The emitter **(22)** emits light in a direction from the first side toward the second side of the belt **(34)**. A detector **(24)** is disposed opposite and spaced apart from the second side of the belt **(34)** and generally opposite the emitter **(22)**. A portion of the light emitted by the emitter **(22)** passes through the open portions **(84)** of the mesh belt **(34)** and impinges upon the detector **(24)**. The detector **(24)** issues a detect signal (DET_SIG) indicative of a reduction in the detected portion of light. The detect signal (DET_SIG) is filtered to reject reductions in the detected portion of light that are not due to the presence of media **(32)** on the belt **(34)**.





DET_SIG
DRV_SIG
CAL-SIG
MED_SIG
DRIVER
FILTER
SOFTWARE
CONTROLLER
26
B
12
20
22
24
28
30
32
34
36
40
42
44
46
48
50
52
54
62
64
10

FIG. 1

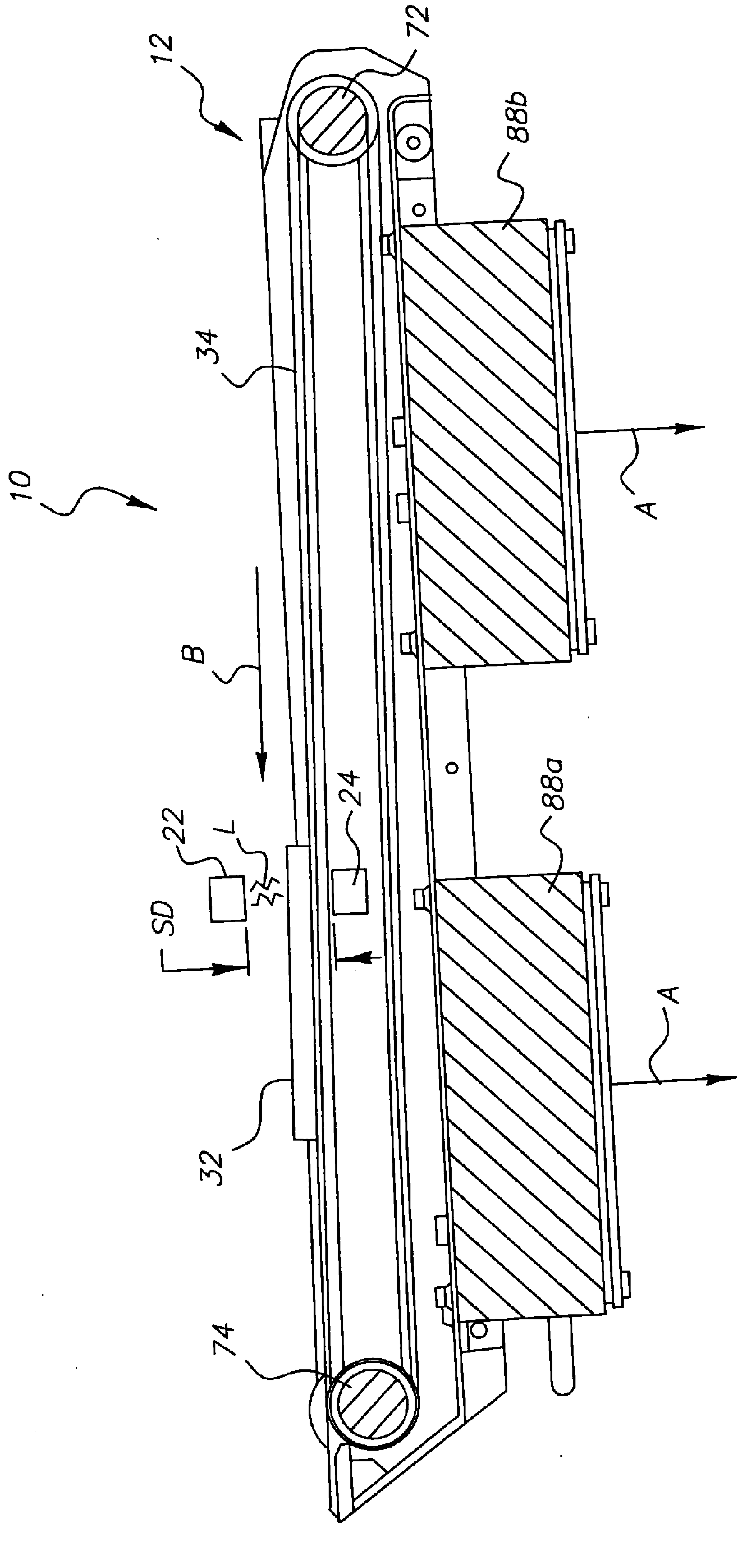


FIG. 2

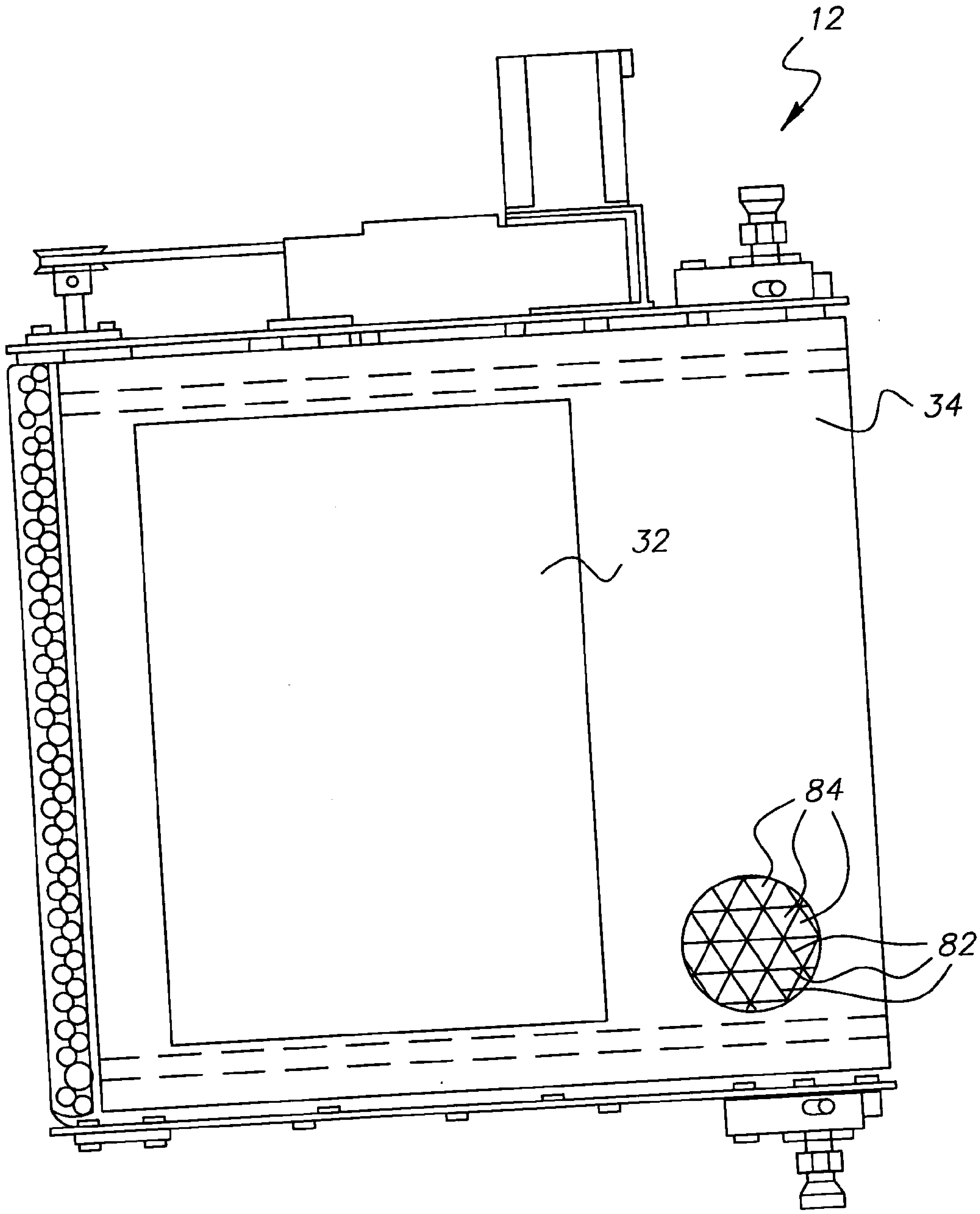


FIG. 3

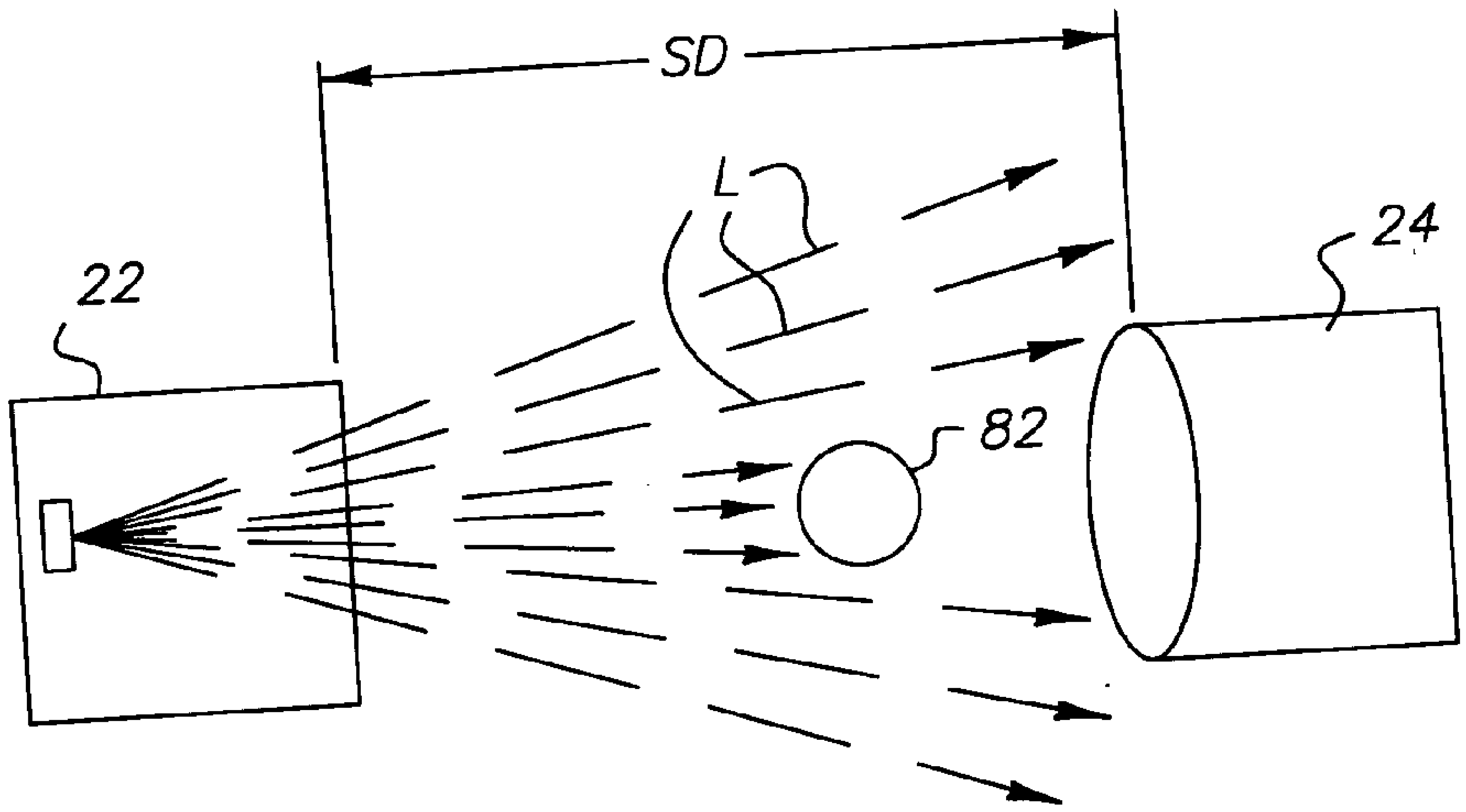


FIG. 4A

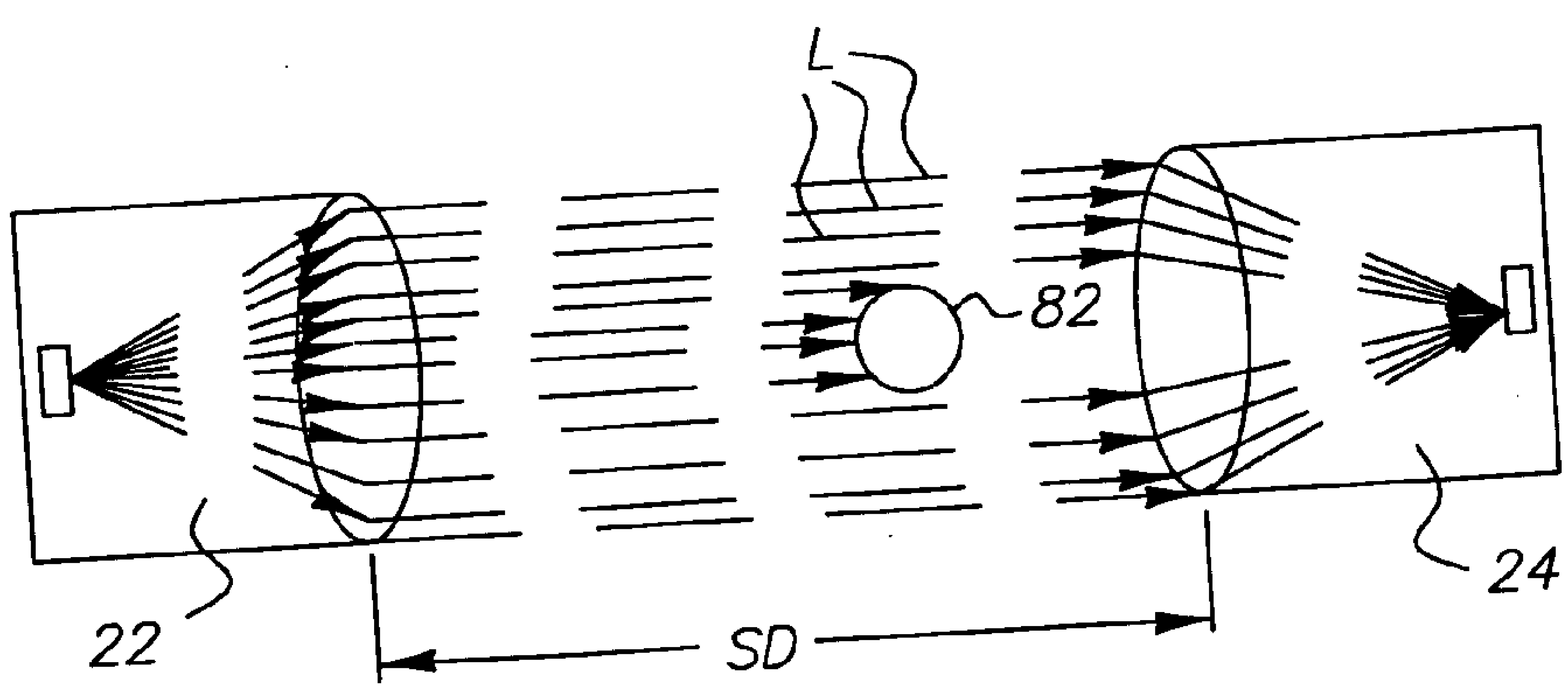


FIG. 4B

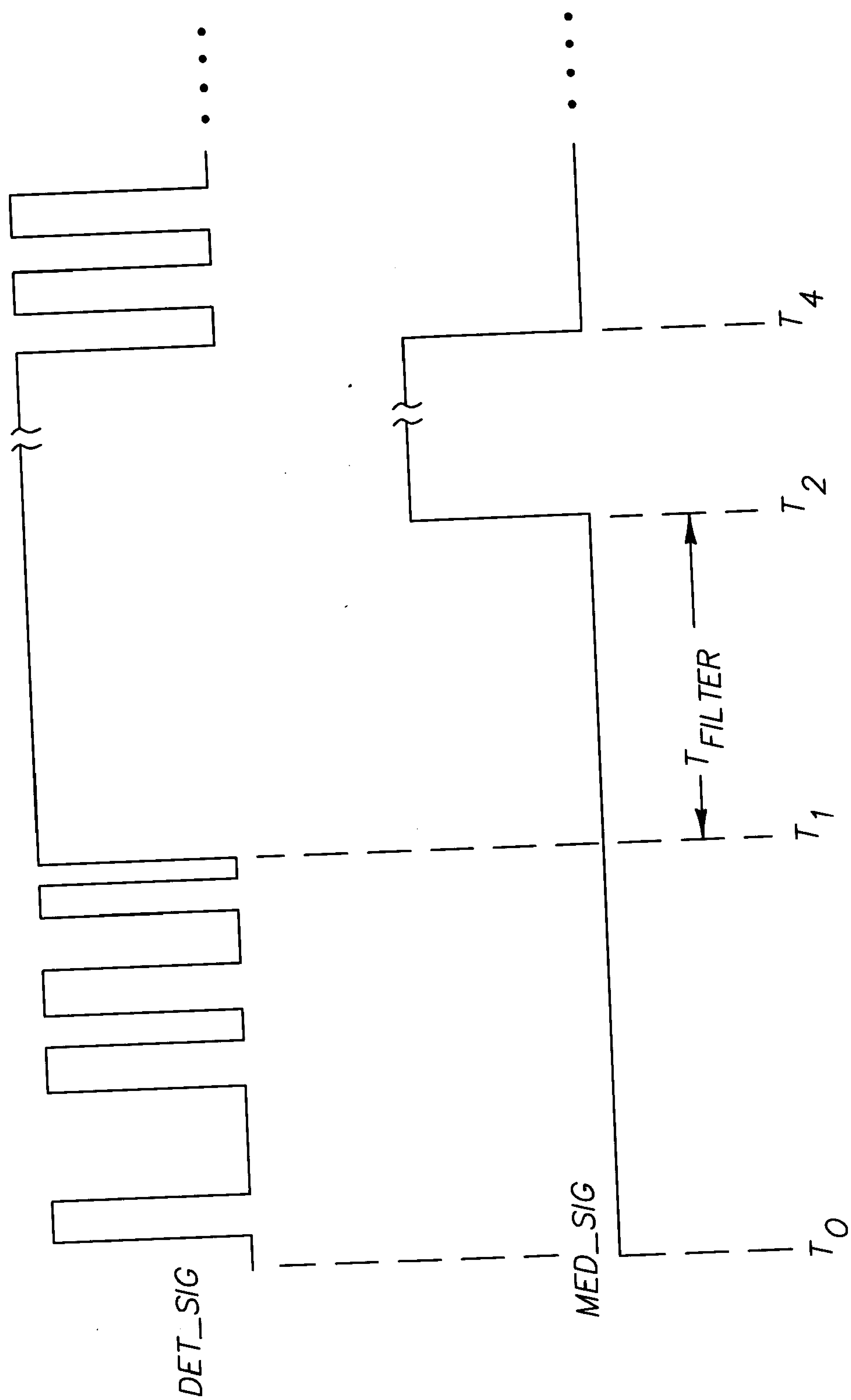


FIG. 5

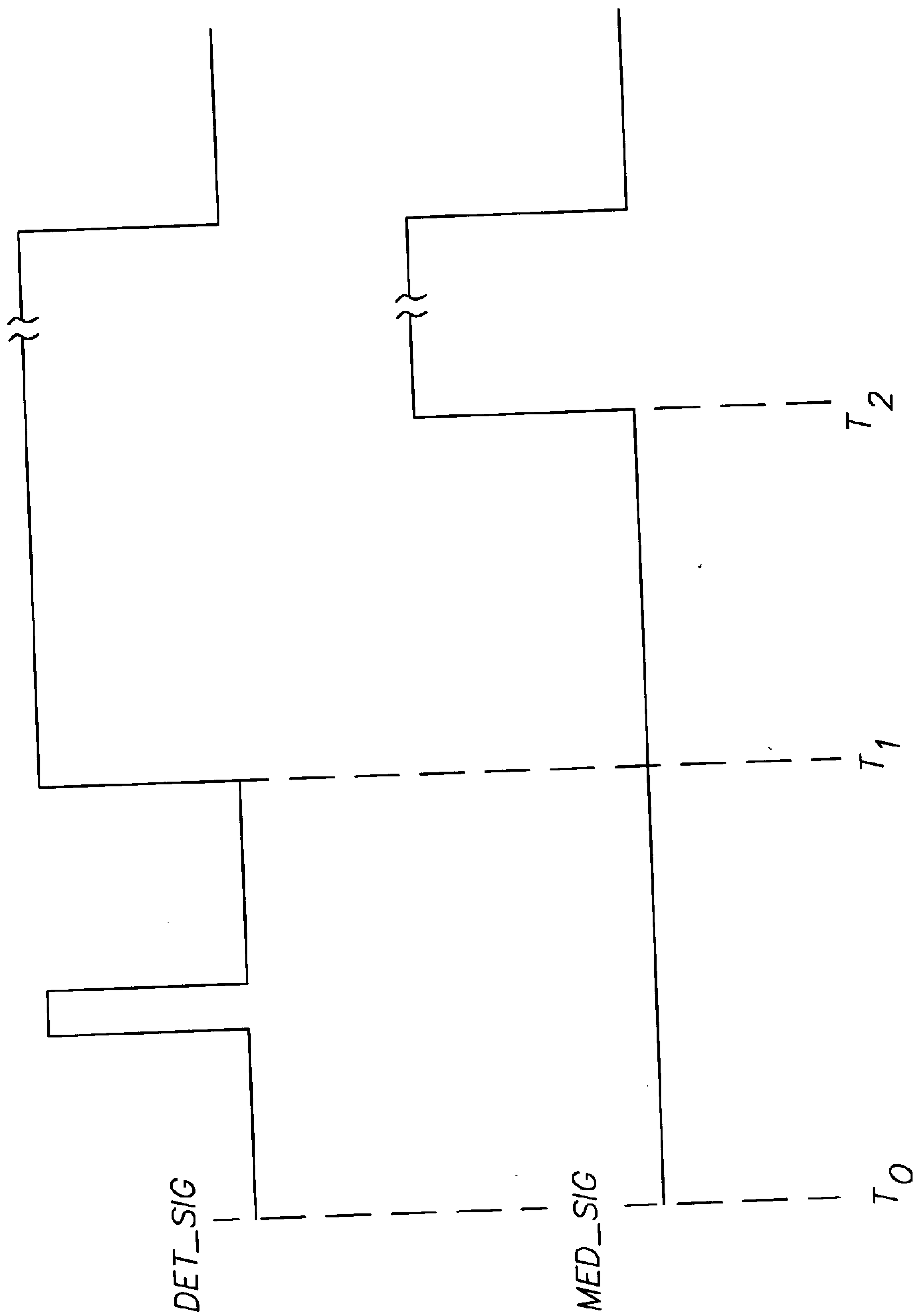


FIG. 6

METHOD OF AND APPARATUS FOR OPTICAL SENSING OF MEDIA THROUGH A SUCTION OR MESH BELT

FIELD OF THE INVENTION

[0001] The present invention relates generally to electrophotographic printing and/or copying machines and, more particularly, to such machines having a media-carrying conveyor belt of the suction or mesh type.

BACKGROUND OF THE INVENTION

[0002] The process of electrophotography involves forming an electrostatic charge pattern on a dielectric surface, such as the surface of a photoconductive recording element, creating a latent image to which charged toner particles are attracted. The toner image is, in turn, transferred onto an image-receiving media, such as, for example, a piece of paper, that is brought or carried into contact with the dielectric surface.

[0003] The imaged media is typically carried by a conveyor belt into a fusing station having a heating device that applies heat to the media and thereby fixes or fuses the toner to the media. The conveyor belt may be configured as a suction or mesh belt. Suction or mesh belts are constructed of a porous or mesh material, such as, for example, a loose-weave fabric or metal mesh belt. One or more fans or other air-moving devices disposed below the belt are configured to draw air through the porous or mesh belt thereby creating a partial vacuum that holds the media in place on the moving conveyor belt.

[0004] For proper operation of the electrophotographic printing or copying machine, it is necessary to sense the presence and/or absence of media on the conveyor belt. More particularly, it is necessary to accurately infer the position of the leading and/or trailing edge of the media. Reflective-type optical sensors have been used for this purpose. However, the reflectance or reflection density of the typical types of media (imaged and non-imaged) used in the printing or copying machines varies substantially, and thus makes reliable detection of media using reflective-type optical sensors problematic. More particularly, the reflection densities of a piece of paper and an image on a piece of paper can overlap substantially with the reflection density of a loose-weave or mesh conveyor belt of the machine.

[0005] As an example of this overlap, the reflection density of a bare piece of paper is typically from approximately 0.04 to approximately 0.1 units, a full image on the piece of paper can increase the reflection density up to approximately 2.0 units, and the reflectance of the loose-weave fabric belt can be from approximately 0.04 to 2.0 units. This substantial variation in and overlap of the reflection densities of the media and the conveyor belt render it difficult at best to distinguish between the media and the belt, and thereby makes it difficult to repeatably and reliably detect the media with a reflective-type sensor.

[0006] Therefore, what is needed in the art is a method and apparatus for optically sensing media traveling upon a loose-weave fabric or mesh belt.

SUMMARY OF THE INVENTION

[0007] The present invention provides a method and apparatus for optically detecting the presence and/or absence of media being carried upon a traveling mesh or suction belt.

[0008] The invention includes, in one form thereof, an emitter disposed opposite and spaced apart from the first side of the belt. The emitter emits light in a direction from the first side toward the second side of the belt. A detector is disposed opposite and spaced apart from the second side of the belt and generally opposite the emitter. A portion of the light emitted by the emitter passes through the open portions of the mesh belt and impinges upon the detector. The detector issues a detect signal indicative of a reduction in the detected portion of light. The detect signal is filtered to reject reductions in the detected portion of light that are not due to the presence of media on the belt.

[0009] An advantage of the present invention is that a transmissive, rather than reflective, detecting/sensing device is used.

[0010] Yet another advantage of the present invention is that the substantial variation in and overlap of the reflection densities of various media types do not substantially impact the reliability of the detecting/sensing device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become apparent and be better understood by reference to the following description of one embodiment of the invention in conjunction with the accompanying drawings, wherein:

[0012] **FIG. 1** is a schematic representation of an electrophotographic printing and/or copying machine having one embodiment of an apparatus for the optical sensing of media through a suction or mesh belt of the present invention;

[0013] **FIG. 2** is a partially longitudinally cross-sectional view of the belt, transport mechanism and optical sensor assembly of **FIG. 1**;

[0014] **FIG. 3** is a detail view of a portion of the belt of **FIGS. 1 and 2**;

[0015] **FIG. 4***a* illustrates an exemplary irradiance pattern of a non-lens-type emitter;

[0016] **FIG. 4***b* illustrates an exemplary irradiance pattern of a lens-type emitter; and

[0017] **FIGS. 5 and 6** show the electronic signals issued by the optical sensor assembly of **FIG. 1**.

[0018] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrate one preferred embodiment of the invention, in one form, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION OF THE DRAWINGS

[0019] Referring now to the drawings, there is shown an electrophotographic printing and/or copying machine that includes one embodiment of an apparatus for the optical sensing of media through a suction or mesh belt of the present invention.

[0020] Electrophotographic printing and/or copying machine **10** (hereinafter referred to as machine **10**) includes fuser transport assembly **12**. Machine **10** and fuser transport assembly **12** are generally similar to the electrophotographic printing and/or copying machine that is described in co-pending U.S. Patent Application Serial No. 2002/0139264, filed 18 Dec. 2001 and published on 3 Oct. 2002, and which is entitled DIGITAL PRINTER OR COPIER MACHINE, the disclosure of which is incorporated herein by reference. Therefore, many of the structural and operational details of machine **10** and fuser transport assembly **12** are not reproduced at length herein. Rather, only the structural and operational details of machine **10** and fuser transport assembly **12** that are relevant to the present invention are discussed.

[**0021**] As shown in **FIG. 1**, machine **10** includes optical sensing assembly **20**, which includes emitter **22**, detector **24**, controller **26**, driver **28** and filter **30**. As is described more particularly hereinafter, optical sensing assembly **20** senses or detects the presence and/or absence of media **32**, such as, for example, a piece of paper or vellum, through suction or mesh belt **34**. Thus, optical sensing assembly **20** detects the presence and/or absence of media on belt **34** by transmissive means, i.e., by detecting light that has been transmitted or passed through belt **34**, rather than by reflective means. The use of transmissive instead of reflective detection renders optical sensing assembly **20** substantially less sensitive to the varying reflectance of various types of media. Therefore, optical sensing assembly **20** more reliably detects various types of media when compared to conventional reflective detection.

[**0022**] Emitter **22** is disposed a predetermined distance above or apart from a first or media-carrying side of belt **34**, and emits light that is directed from the top/media side of belt **34** toward the bottom/non-media side thereof. Emitter **22** is configured as a light emitting diode or infrared light emitting diode, such as, for example, a gallium aluminum arsenide hermetic infrared light emitting diode. Commercially available versions of such a diode suitable for use as emitter **22** include OP231W and OP232W manufactured by OPTEK Technologies, Inc., of Carrolton, Tex. Emitter **22** preferably has a broad irradiance pattern and provides relatively even illumination over a broad area. Emitter **22** includes an emitter input **36**. The amount of light emitted by emitter **22** is dependent at least in part upon the level of the signal applied to emitter input **36**.

[**0023**] Detector **24** is a light detecting unit, such as, for example, as a photodiode light detecting unit. Commercially available versions of detecting units suitable for use as detector **24** include the infrared photodiodes OPL820 and OPL821 also manufactured by OPTEK Technologies, Inc., of Carrolton, Tex. Detector **24** is disposed in general alignment with emitter **22**. As will be more particularly described hereinafter, detector **24** is disposed such that belt **34** is intermediate detector **24** and emitter **22**. Thus, detector **24** is disposed nearest, and is spaced a predetermined distance apart from, a second or non-media-carrying side of belt **34**.

[**0024**] Detector **24** includes a light input **40** that admits light and a detector output **42**. Detector **24** issues, on detector output **42**, a detect signal DET_SIG that is active, such as, for example, a logic high voltage level, when the detector is not illuminated or when a predetermined and sufficiently low-level of light is impinging upon detector **24**. Detect signal DET_SIG is otherwise inactive, such as, for example, a logic low voltage level, when a predetermined and sufficient level of light is impinging upon detector **24**. Detector **24** includes Schmitt trigger-type circuitry that reduces noise and other falsely active conditions that otherwise might appear on detect signal DET_SIG due to high frequency transitions on light input **40**.

[**0025**] Controller **26**, such as, for example, a microprocessor, includes calibration input **44**, controller input **46** and controller output **48**. Calibration input **44** is electrically connected to detector output **42**, and thus controller **26** receives detect signal DET_SIG. As will be more particularly described hereinafter, calibration input **44** is used during the calibration of optical sensing assembly **20**. Controller input **46** is electrically connected to filter **30**, and controller output **48** is electrically connected via driver **28** to emitter input **36**. Controller **26** executes control and calibration software **50** that is stored in on-board memory (not shown) of controller **26** or in other memory (not shown), such as, for example, non-volatile memory for storing calibration data, accessible to controller **26**. Controller **26** issues on controller output **48** a calibration signal CAL_SIG, the purpose of which will be more particularly described hereinafter.

[**0026**] Driver **28** includes a driver input **52** and a driver output **54**. Driver input **52** is electrically connected to controller output **48**, and thus driver **28** receives calibration signal CAL_SIG from controller **26**. Driver output **54** is electrically connected to emitter input **36**. Driver **28** issues, on driver output **54**, emitter drive signal DRV_SIG, and, since driver output **54** is electrically connected to emitter input **36**, emitter **22** receives emitter drive signal DRV_SIG. Emitter drive signal DRV_SIG is dependent at least in part upon calibration signal CAL_SIG issued by controller **26** and received by driver **28**. The amount of light emitted by emitter **22** is dependent at least in part upon emitter drive signal DRV_SIG. Thus, the amount of light emitted by emitter **22** is dependent at least in part upon calibration signal CAL_SIG.

[**0027**] Filter **30** includes a filter input **62** and a filter output **64**. Filter input **62** is electrically connected to detector output **42**, and thus filter **30** receives media-indicating signal DET_SIG from detector **24**. Filter output **64** is electrically connected to controller input **46**. Filter **30** issues on filter output **64** media-indicating signal MED_SIG that is received on controller input **46** by controller **26**. Media-indicating signal MED_SIG is active, such as, for example, a logic high level, when the presence of media is detected on belt **34** (i.e. detector **24** is not illuminated). More particularly, filter **30** is a digital filter that issues an active media-indicating signal MED_SIG in response to a predetermined number of sequential pulses occurring on detecting signal DET_SIG within a predetermined time period.

[**0028**] Belt **34**, as best shown in **FIG. 2**, is suspended between and runs in direction B around shafts **72** and **74**. More particularly, belt **34** is driven to run by drive shaft **74** and tensioned by tension shaft **72**. Drive shaft **74** is driven to rotate by a motor (not shown). Belt **34** is constructed as an endless loop, preferably seamless, from a fabric, such as, for example, a woven, knit or mesh fabric or the like. As best shown in **FIG. 3**, the mesh structure of belt **34** includes material portions **82** that are spaced apart in a fairly regular and uniform manner and define therebetween open portions **84**.

[0029] In use, and as best shown in **FIG. 2**, an emitter **22** and detector **24** pair are disposed in association with belt **34** such that emitter **22** is disposed a predetermined distance from the media-carrying side of belt **34** and detector **24** is disposed a predetermined distance from the non-media-carrying side thereof. The linear distance between emitter **22** and detector **24** is referred to as the separation distance SD. Separation distance SD is, for example, from approximately 0.1 inch to approximately 2.0 inches. However, separation distance SD is primarily determined by the electrical characteristics of the particular emitter **22** and detector **24** pair. The predetermined distance of the detector **24** from the belt **34** is appropriately one-third of the separation distance SD or less. Suction boxes **88***a* and **88***b* are disposed in association with belt **34** such that air is drawn through belt **34** in direction A from the media side toward the non-media side thereof.

[0030] Emitter **22** directs light through belt **34** towards detector **24**. As belt **34** travels in direction B past detector **24** at a substantially uniform and known rate, the material portions **82** of belt **34** temporarily interrupt or significantly reduce the impingement of light beams upon detector **24** on a predictable periodic basis. This temporary interruption or reduction in the impingement of light beams upon detector **24** due to material portions **82** of belt **34** is best shown in **FIGS. 4***a* and **4***b*.

[0031] **FIG. 4***a* shows emitter **22**, configured as a point-type emitter having a broad irradiance pattern that relatively evenly illuminates a broad area. Material portion **82** is disposed between emitter **22** and detector **24**, and thus temporarily interrupts or reduces the impingement of light beams L upon detector **24** as belt **34** travels past. Since the material portions **82** of belt **34** are spaced apart in a fairly regular and uniform manner, and since belt **34** is traveling at a known and substantially uniform rate, the reduction/interruption of light beams L occurs on a generally uniform periodic basis. Alternatively, as shown in **FIG. 4***b*, emitter **22** can also be configured as a lens-type emitter having a narrower and more focused irradiance pattern. The interruption of light beams L still occurs on a generally uniform periodic basis.

[0032] Using an emitter **22** having a broad irradiance pattern, as shown in **FIG. 4***a*, reduces the sensitivity of optical sensing assembly **20** to misalignment between emitter **22** and detector **24**. Further, an emitter **22** having a broad irradiance pattern distributes the light intensity over a broad area so that the light diffuses through the media in such a way that even thin paper or vellum will block (or not transmit) enough light beams L to ensure reliable detection of most types of media.

[0033] Referring now to **FIG. 5**, the above-described signals issued by optical sensing assembly **20** during calibration and use are now discussed. As shown in **FIG. 5**, each time a material portion **82** of belt **34** passes between emitter **22** and detector **24**, thereby interrupting or substantially reducing the level of light impinging upon detector **24**, a pulse occurs on detect signal DET_SIG. The generally periodic pulses occurring on detect signal DET_SIG from time t_0 to time t_1 are due to material portions **82** of belt **34** interrupting or substantially reducing the level of light impinging upon detector **24**, and are relatively short in duration. These relatively-short duration pulses occurring on detect signal DET_SIG are filtered out and/or rejected by filter **30** and thus media-indicating signal MED_SIG remains at an inactive, or logic low, state.

[0034] As belt **34** carries a sheet of media **32** between emitter **22** and detector **24**, the interruption of and/or reduction in the impingement of light upon detector **24** occurs over a much longer duration relative to an interruption and/or reduction in the impingement of light upon detector **24** due to a material portion **82** of belt **34** moving between emitter **22** and detector **24**. Thus, only when the level of light impinging upon detector **24** is interrupted or substantially reduced over a continuous and predetermined minimum period of time does filter **30** issue an active media-indicating signal MED_SIG indicating the presence of a sheet of media. This is illustrated at time t_1. When a piece of media carried by belt **34** is interposed between emitter **22** and detector **24** causing detect signal DET_SIG to become active for a relatively long duration. At time t_2, an active media-indicating signal MED_SIG is issued by filter **30**.

[0035] Filter **30** delays issuing an active media-indicating signal MED_SIG from time t_1 to time t_2 to ensure that the interruption of and/or reduction in the impingement of light upon detector **24** is due to a piece of media **32** rather than one or more material portions **82** of belt **34** or other sources. The time between, or separating, time t_1 and time t_2 is identified in **FIG. 5** and referred to hereinafter as time t_{FILTER}. For example, with belt **34** traveling at a rate such that material portions **82** thereof block or substantially reduce the amount of light impinging upon detector **24** at a period of approximately every 2 milliseconds (mS). Filter **30** is configured, for example, with t_{FILTER} equal to 10 mS, i.e., as a 10 mS digital filter, and thus detect signal DET_SIG must remain active for at least 5 (five) consecutive periods of 2 mS, or for a total of at least 10 mS, before filter **30** issues an active media-indicating signal MED_SIG.

[0036] It is to be understood that the actual period of the pulses due to material portions **82** of belt **34** and the time period t_{FILTER} over which the detect signal DET_SIG must remain active for reliable detection of media **32** by optical sensing assembly **20** within a particular electrophotographic printing machine is relatively easily determined by one skilled in the art dependent at least in part upon the rate of travel of belt **34**, the spacing between material portions **82** thereof, and the size of media **32** to be detected by optical sensing assembly **20**.

[0037] As discussed above, the purpose of filter **30** is to distinguish between the relatively short-duration interruptions and/or reductions in the impingement of light upon detector **24** that are due to material portions **82** of belt **34** (also referred to as thread shadows) and the relatively long-duration interruptions and/or reductions in the impingement of light upon detector **24** that are due to media **32**. The filtering process makes this distinction at least in part by issuing an active media-indicating signal MED_SIG only when a given interruption and/or reduction in the impingement of light upon detector **24** has a duration that is a predetermined amount of time greater than or a factor of the duration of a typical thread shadow. Thus, if the duration of a typical thread shadow is reduced, the time required by the filtering process (i.e., t_{FILTER}) to distinguish between thread and media shadows is also reduced. It is therefore advantageous to reduce and/or minimize the duration of the thread shadows.

[0038] By positioning detector **24** close to belt **34** the size, and thus the duration, of the thread shadows are reduced in much the same manner as the size of a person's shadow shrinks as he or she moves away from the light source and toward the surface upon which the shadow is being cast. Thus, by disposing emitter **22** at a substantial portion of the separation distance SD away from the media side of belt **34** and disposing detector **24** at the remaining relatively small portion of the separation distance SD from the non-media side of belt **34** the duration and size of the thread shadows is reduced. Preferably, detector **24** is positioned no further than one-third of the separation distance SD from belt **34**. Most preferably, detector **24** is positioned as close as is practicable to the non-image side of belt **34** while emitter **22** is placed as far away from belt **34** as possible without exceeding the recommended or ideal separation distance between emitter **22** detector **24**.

[0039] Calibration of optical sensing assembly **20** is performed by the execution of calibration software **50** in order to eliminate the occurrence of most, if not all, of the generally periodic pulses occurring on detect signal DET_SIG due to the passage of material portions **82** of belt **34** between emitter **22** and detector **24**. Calibration software **50** sets the amount of light emitted by emitter **22** to a sufficiently high level that material portions **82** of belt **34** do not block or reduce the light impinging upon detector **24** by an amount sufficient to cause detector **24** to issue an active detect signal DET_SIG. The amount of light emitted by emitter **22** must not be set so low that detect signal DET_SIG is falsely made active. Thus, emitter drive signal DRV_SIG must be set to a level that corresponds to this desired amount of light output.

[0040] Emitter drive signal DRV_SIG is dependent at least in part upon calibration signal CAL_SIG issued by controller **26**. Calibration software **50** adjusts the level of calibration signal CAL_SIG when no media is being carried upon belt **34** to ensure that detector **24** does not issue an active detect signal DET_SIG when material portions **82** of belt **34** pass between emitter **22** and detector **24**.

[0041] More particularly, controller **26** receives on calibration input **44** detect signal DET_SIG. Calibration software **50** initially sets calibration signal CAL_SIG, and thereby emitter drive signal DRV_SIG, to a low level. Calibration software **50** gradually increases the level of calibration signal CAL_SIG, and thereby increases emitter drive signal DRV_SIG, until emitter **22** emits an amount of light that is sufficient to keep detector **24** illuminated at a level above the threshold of a detection event. Alternatively stated, the level of calibration signal CAL_SIG, and thereby the level of emitter drive signal DRV_SIG, are increased to a level where enough light is passing through mesh belt **34** and impinging upon detector **24** that detect signal DET_SIG remains inactive as material portions **82** of belt **34** pass between emitter **22** and detector **24**. Thus, most if not all of the generally periodic pulses occurring between times time t_0 to time t_1 on detect signal DET_SIG prior to calibration of sensor assembly **20** (and shown in **FIG. 5**) are eliminated.

[0042] An exemplary detect signal DET_SIG occurring subsequent to the completion of the calibration process is shown in **FIG. 6**. Brief-duration pulses may nonetheless issue on detect signal DET_SIG as a result of, for example, events that are outside the parameters that existed during calibration and/or that exceed the safety margin and yet are not indicative of the presence of media between emitter **22** and detector **24**. Such a pulse is shown occurring between times t_0 and t_1. As described above, filter **30** rejects such brief-duration "noise" pulses, and does not issue an active media indicating signal MED_SIG in response thereto. Rather, only at time t_2 when media is present between emitter **22** and detector **24** does filter **30** issue an active media indicating signal MED_SIG.

[0043] The level of calibration signal CAL_SIG is further increased a predetermined amount beyond or above the point where most if not all of the generally periodic pulses that occur due to the material portions **82** of belt **34** passing between emitter **22** and detector **24** by calibration software **50** to provide for a safety margin or a margin of error. Since the level of emitter drive signal DRV_SIG issued by driver **28** is dependent at least in part upon and/or is proportional to the level of calibration signal CAL_SIG, the light output of emitter **22** is thereby set to a level that prevents material portions **82** of belt **34** from blocking enough light to activate detect signal DET_SIG. Thus, reliable and repeatable detection of media by optical sensing assembly **20** is obtained.

[0044] In the embodiment shown, emitter **22** is disposed on the media-carrying side of belt **34** and detector **24** is disposed on the non-media-carrying side of belt **34**. However, it is to be understood that the optical sensing assembly of the present invention can be alternately configured, such as, for example, with emitter **22** disposed on the non-media-carrying side and detector **24** disposed on the media-carrying side of belt **34**.

[0045] In the embodiment shown, filter **30** is disclosed as a digital filter. However, it is to be understood that filter **30** can be alternately configured, such as, for example, as a software-based filter using known digital or analog filtering and/or debouncing algorithms.

[0046] In the embodiment shown, detect signal DET_SIG is connected to calibration input **44** of controller **26**, and is therefore used during the calibration process and is read by calibration software **50**. However, it is understood that controller **26** and calibration software **50** can be alternately configured to use media-indicating signal MED_SIG alone, or in conjunction with detect signal DET_SIG.

[0047] While this invention has been described as having a preferred embodiment, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the present invention using the general principles disclosed herein. Further, this application is intended to cover such departures from the present disclosure as come within the known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

Parts List

[0048] **10**. Electrophotographic Machine DET_SIG—Detect Signal

[0049] **12**. Fuser Transport Assembly CAL_SIG—Calibration Signal

[0050] **20**. Optical Sensing Assembly DRV_SIG—Drive Signal

[0051] 22. Emitter MED_SIG—Media Signal

[0052] 24. Detector

[0053] 26. Controller

[0054] 28. Driver

[0055] 30. Filter

[0056] 32. Media

[0057] 34. Belt

[0058] 36. Emitter Input

[0059] 38. Emitter Output

[0060] 40. Detector Light Input

[0061] 42. Detector Output Line

[0062] 44. Calibration Input

[0063] 46. Controller Input

[0064] 48. Controller Output

[0065] 50. Calibration Software

[0066] 52. Driver Input

[0067] 54. Driver Output

[0068] 62. Filter Input

[0069] 64. Filter Output

[0070] 72. Tension Shaft

[0071] 74. Drive Shaft

[0072] 82. Material Portions

[0073] 84. Open Portions

[0074] 88. Suction Boxes (a, b)

What is claimed is:

1. An optical sensing assembly for detecting media carried by a traveling mesh or suction belt, the belt having material portions that define therebetween open portions, the belt further having a first side and a second side, said optical sensing assembly comprising:

an emitter disposed opposite to and spaced a predetermined distance from the first side of the belt, said emitter emitting light in a direction from the first side of the belt toward the second side of the belt; and

a detector disposed opposite to and spaced a predetermined distance from the second side of the belt, said detector being disposed in general alignment with said emitter, a detected portion of the light emitted by said emitter passing through the open portions of the belt and being detected by said detector, said detector issuing a detect signal indicative of a reduction in said detected portion of light upon transport of media by said belt between said emitter and said detector.

2. The optical sensing assembly of claim 1, further comprising filtering means, said filtering means electrically connected to said detector and receiving said detect signal, a media-indicating signal issued by said filter when said detect signal indicates the reduction in said detected portion of light is due to media being disposed between said emitter and said detector.

3. The optical sensing assembly of claim 2, wherein said filtering means comprises one of a digital, analog, and software-based filter.

4. The optical sensing assembly of claim 2, wherein said filtering means comprises software filtering.

5. The optical sensing assembly of claim 2, further comprising:

a controller electrically connected with said detector and receiving therefrom said detect signal, a calibration signal issued by said controller;

calibration software executed by said controller, said calibration software setting a level of said calibration signal dependent at least in part upon said detect signal; and

an emitter driver receiving said calibration signal, said emitter driver being electrically connected to said emitter and issuing thereto an emitter drive signal, said emitter drive signal being dependent at least in part upon said calibration signal.

6. The optical sensing assembly of claim 1, further comprising a separation distance separating said emitter and said detector, said detector being spaced a predetermined portion of said separation distance from the second side of the belt.

7. The optical sensing assembly of claim 6, wherein said predetermined portion of said separation distance comprises less than approximately thirty-three percent.

8. The optical sensing assembly of claim 1, wherein said emitter emits infra-red light and said detector detects infra-red light.

9. An electrophotographic printing or copying machine, comprising: a traveling suction belt having a first side and a second side, said belt configured for carrying sheets of media, said belt having material portions defining open portions therebetween; and

a transmissive optical sensing assembly associated with said belt for detecting at least one of the presence and absence of media upon said belt.

10. The electrophotographic machine of claim 9, wherein said transmissive optical sensing assembly comprises:

an emitter disposed opposite and spaced a predetermined distance from said first side of said belt, said emitter emitting light in a direction from said first side of said belt toward said second side of said belt; and

a detector disposed opposite and spaced a predetermined distance from said second side of said belt, said detector disposed in general alignment with said emitter, a detected portion of said light emitted by said emitter passing through said open portions of said belt and being detected by said detector, said detector issuing a detect signal indicative of a reduction in said detected portion of light upon transport of media by said belt between said emitter and said detector.

11. The electrophotographic machine of claim 10, further comprising filtering means, said filtering means electrically connected to said detector and receiving said detect signal, a media-indicating signal issued by said filter when said reduction in said detected portion of light is due to media being disposed between said emitter and said detector.

12. The electrophotographic machine of claim 11, wherein said filter comprises one of a digital, analog, and software-based filter.

13. The electrophotographic machine of claim 11, further comprising: a controller electrically connected with said detector and receiving therefrom said detect signal, a calibration signal issued by said controller;

calibration software executed by said controller, said calibration software setting a level of said calibration signal dependent at least in part upon said detect signal; and

an emitter driver receiving said calibration signal, said emitter driver being electrically connected to said emitter and issuing thereto an emitter drive signal, said emitter drive signal being dependent at least in part upon said calibration signal.

14. The electrophotographic machine of claim 11, further comprising a separation distance separating said emitter and said detector, said detector being spaced a predetermined portion of said separation distance from said second side of said belt.

15. The electrophotographic machine of claim 11, wherein said predetermined portion of said separation distance comprises less than approximately thirty-three percent.

16. The electrophotographic machine of claim 11, wherein emitter emits infra-red light and said detector detects infra-red light.

17. A method for detecting the presence or absence of media on a media-carrying mesh or suction belt traveling at a predetermined rate, the belt having material portions that define open portions therebetween, said method comprising: emitting light onto a first side of the belt;

receiving on the second side of the belt at least a portion of the emitted light that has passed through the open portions of the belt from the first side to the second side thereof;

detecting a reduction in the received portion of light; and

filtering the detected reductions in the received portion of light to thereby distinguish between reductions caused by media and reductions caused by material portions of the belt.

18. The method of claim 17, wherein said emitting step comprises driving an infra-red light emitting diode with a drive signal.

19. The method of claim 17, wherein said filtering step comprises rejecting reductions in the received portion of light having durations that are less than a predetermined minimum duration.

20. The method of claim 17, comprising the further step of calibrating the emitting step to emit a level of light that ensures the material portions of the belt do not reduce the received portion of received light by a sufficient amount to be detected while ensuring a sufficient level of light passes through the open portions of the belt to reduce erroneous detections of reductions due to sources other than media on the belt.

21. A fuser transport assembly, comprising:

a traveling suction belt having a first side and a second side, said belt configured for carrying sheets of media, said belt having material portions defining open portions therebetween; and

a transmissive optical sensing assembly associated with said belt for detecting at least one of the presence and absence of media upon said belt.

22. The fuser transport assembly of claim 21, wherein said transmissive optical sensing assembly comprises:

an emitter disposed opposite and spaced a predetermined distance from said first side of said belt, said emitter emitting light in a direction from said first side of said belt toward said second side of said belt; and

a detector disposed opposite and spaced a predetermined distance from said second side of said belt, said detector disposed in general alignment with said emitter, a detected portion of said light emitted by said emitter passing through said open portions of said belt and being detected by said detector, said detector issuing a detect signal indicative of a reduction in said detected portion of light.

23. The electrophotographic machine of claim 22, further comprising filtering means, said filtering means electrically connected to said detector and receiving said detect signal, a media-indicating signal issued by said filter when said reduction in said detected portion of light is due to media being disposed between said emitter and said detector.

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