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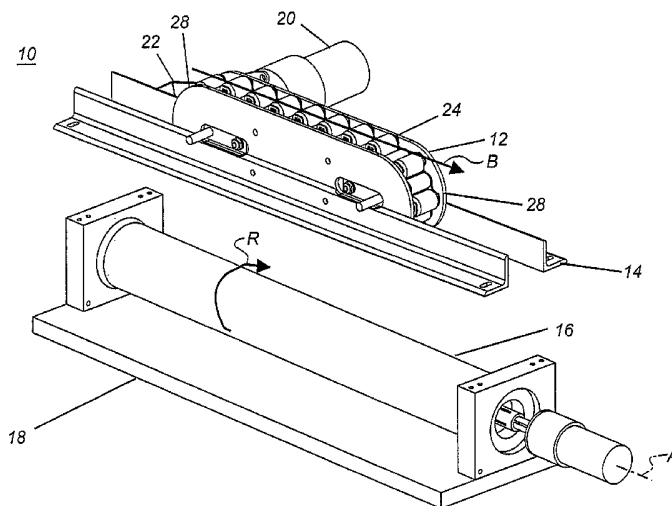
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[Continued on next page]

(54) Title: ROLLER CHAIN FOR APPLYING PRESSURE



(57) Abstract: An apparatus (10) applies pressure against a platen (16) using a linked series of contact members arranged in a closed loop. A drive apparatus rotates the loop about a support mechanism, thereby imparting movement to the linked series of contact members. The support mechanism is disposed to force a plurality of the moving contact members simultaneously into compressive contact against the platen (16).



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ROLLER CHAIN FOR APPLYING PRESSURE

FIELD OF THE INVENTION

This invention generally relates to apparatus for applying pressure onto the surface of a substrate and more particularly relates to an apparatus and
5 method for applying pressure by moving a linked series of contact members maintained in compressive contact with a portion of the substrate that is disposed between the contact members and a platen.

BACKGROUND OF THE INVENTION

There are a number of imaging applications that require, at some
10 stage in processing, the application of a uniform pressure onto the surface of a substrate. Conventional offset lithographic printing equipment, for example, uses applied pressure for transferring an ink colorant from a printing plate onto the print substrate. Various types of office duplicating equipment, such as xerographic copiers, use pressure from paired rollers for image transfer onto paper
15 or other suitable substrate. Laminators, such as that used with the "KODAK APPROVAL Digital Proofing System" TM available from the Eastman Kodak Company, located in Rochester, New York, also require application of controlled pressure, commonly combined with heat, for transfer of an image from an intermediate medium to a paper substrate or for application of a protective coating
20 over the substrate surface. Micro-encapsulated media, such as CYCOLOR TM print media, commercially available from Cymcolor, Inc. and described in U.S. Patent No. 5,916,727 (Camillus et al.), also require the controlled application of pressure for processing the final image from encapsulated leuco dye elements that are coated into an imaging substrate, after these elements are activated by
25 exposure to light.

With each of these applications, conventional drum rollers apply pressure uniformly onto a surface. In operation, opposing drum rollers are forced against each other to provide, at their interface, a linear nip for pressure application. With roller rotation, the substrate moves through the nip. In practice,
30 large drum rollers have proved to be an acceptable solution for lithographic printing and for many xerographic and other image transfer and lamination uses. As just a few examples: U.S. Patent No. 6,658,230 (Sato) discloses an apparatus

for transferring imaging toner using paired rollers; U.S. Patent No. 6,463,981 (Kerr) discloses the use of pressure rollers in a lamination apparatus; U.S. Patent No. 5,777,650 (Blank) discloses a pressure roller for transferring and fixing an ink-based image onto a substrate; and U.S. Patent No. 5,208,609 (Chung et al.)
5 discloses the use of a pressure-roller apparatus with the Cycholor media.

However, for some applications, particularly where it is necessary to apply a substantial amount of pressure uniformly onto a substrate surface, such as when processing the Cycholor print media, there are drawbacks to the conventional use of paired rollers. Thus, for example, the paired roller solution of
10 U.S. Patent No. 5,208,609 may work adequately with small-format Cycholor images, but be less than satisfactory if scaled to accommodate larger images, such as 8 x 10 inch images. Acknowledged among the drawbacks to the use of rollers are problems due to surface imperfections, insufficient overall pressure between rollers, sag, eccentricity about axes of rotation, and non-uniform force distribution
15 across the nip.

As an alternative to applying pressure using paired rollers, commonly-assigned U.S. Patent No. 6,390,694 (Allen et al.) discloses a pressure assembly that oscillates a point contact mechanism over the substrate surface in raster fashion. In a similar spirit, U.S. Patent No. 5,550,627 (Dowler et al.),
20 noting the above-cited problems with conventional roller use for microencapsulated media processing, discloses a combined exposure and pressure applicator head that oscillates over the substrate, where the pressure applicator portion drives a small number of contact points along the surface in a raster pattern, thereby providing a more uniform pressure. The solution of U.S. Patent
25 Nos. 6,390,694 and 5,550,627 may yield a suitable image output, provided that mechanical tolerances are highly accurate. However, the slow speed of the oscillating point-contact approach makes this approach commercially unattractive. The deployment of multiple contact points scanned simultaneously, as is used in U.S. Patent No. 5,550,627, may help to reduce the overall processing time
30 somewhat. Even this solution, however, does not boost throughput speed sufficiently for commercialization.

For Cycholor media processing and for other types of apparatus used for forming images, intense localized pressure must be uniformly applied over the surface of a substrate. However, prior art approaches have not yet provided a robust, low cost solution to the problem of applying, onto a sheet of substrate
5 having a range of possible dimensions, sufficient pressure with the needed level of uniformity and with the processing speed needed for imaging applications. Thus, it can be seen that there is a need for an apparatus and method for uniformly applying pressure onto a substrate.

SUMMARY OF THE INVENTION

10 It is an object of the present invention to meet the requirements for a pressure application apparatus that provides a uniform pressure onto a substrate. With this object in mind, the present invention provides an apparatus for applying pressure against a platen, comprising:

15 a linked series of contact members arranged in a closed loop;
a drive apparatus for rotating the loop about a support mechanism, thereby imparting movement to the linked series of contact members; and
the support mechanism disposed to force a plurality of the moving contact members simultaneously into compressive
20 contact against at least a portion of the platen.

It is a feature of the present invention that it directs pressure uniformly against a platen by means of a moving series of contact members, wherein the combined action of these contact members, providing pressure only onto a relatively small area at any instant, provides a uniform pressure onto the
25 full surface area over time.

It is an advantage of the present invention that it is suitable for processing a substrate that is held against a rotatable drum or against a movable flat platen.

It is an advantage of the present invention that, when used in
30 combination with a rotatable drum, the apparatus of the present invention can be configured both to provide pressure and to provide torque that causes drum rotation at a suitable speed for substrate processing.

It is an advantage of the present invention that it provides improved pressure uniformity, even where the underlying platen may have some amount of surface irregularity.

5 It is a further advantage of the present invention that it provides a scalable solution that can be appropriately sized for handling a range of different substrate sizes.

10 It is a further advantage of the apparatus of the present invention that it is capable of providing a high degree of crushing pressure against a substrate. A comparable pressure roller system of conventional design would require that considerable force be maintained between pressure rollers, and that highly accurate mechanical tolerances be maintained throughout pressure application, in order to achieve similarly high levels of crushing pressure in a uniform manner.

15 These and other objects, features, and advantages of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings wherein there is shown and described an illustrative embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

20 While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter of the present invention, it is believed that the invention will be better understood from the following description when taken in conjunction with the accompanying drawings, wherein:

Figures 1a and 1b are perspective views of embodiments of a pressure application apparatus according to the present invention;

25 Figure 1c is a top view showing the arrangement of a chained roller assembly with skewed link components in an alternate embodiment;

Figure 2 is an exploded view showing a chained roller assembly of the present invention in relationship with a revolving drum;

30 Figure 3 is a perspective view showing a chained roller assembly with one lateral guide plate removed;

Figure 4 is a perspective view showing a portion of the roller chain in position against the main support member;

Figure 5 is a side view showing the mechanical relationship of the roller chain with sprockets in the main support member;

Figure 6 is a perspective view of a single roller link;

Figure 7 is a partially exploded view showing components of the roller link of Figure 6;

Figure 8 is a perspective view showing a pressure application apparatus in an alternate embodiment, using a flat platen;

Figure 9 is a top view showing, in exaggerated form, the pattern of paths traveled by successive links of the roller chain along the substrate;

Figure 10 is a perspective view of a pressure application apparatus in an alternate embodiment, using a dual chain arrangement; and

Figure 11 is a front view of the dual chain arrangement of Figure 10.

DETAILED DESCRIPTION OF THE INVENTION

The present description is directed in particular to elements forming part of, or cooperating more directly with, apparatus in accordance with the invention. It is to be understood that elements not specifically shown or described may take various forms well known to those skilled in the art.

Referring to Figure 1a, there is shown a perspective view of a pressure application apparatus 10 according to one embodiment of the present invention. Arranged in a closed loop, a chained roller assembly 12, held by a mounting bracket 14, is pressed against a platen 16. In the configuration of Figure 1a, platen 16 is a rotatable drum mounted in a base 18 and rotated by a motor 50. However, other types of platen 16 could be employed, including a flat platen, as is described subsequently. In operation, a sheet 34 of substrate may be wrapped about the rotatable drum of base 18 for processing or may simply be fed between chained roller assembly 12 and platen 16. While motor 50 rotates platen 16, a second motor 20, mounted with a stabilizing motor bracket 22, provides rotational motion along a direction B for chained roller assembly 12. Here, direction B is parallel to the axis A of cylindrical platen 16. With motors 20 and 50 in operation, sheet 34 on platen 16 travels beneath chained roller assembly 12, thereby applying pressure, over time, onto the full surface area of sheet 34.

Referring to Figure 1b, an alternate embodiment of pressure application apparatus 10 is shown. Here, second motor 50 is not needed. Instead, as is somewhat exaggerated in the perspective view of Figure 1b, chained roller assembly 12 is mounted at a skewed angle, slightly offset relative to the drum axis A, so that direction B and axis A are not parallel. This arrangement allows chained roller assembly 12 to provide pressure against platen 16 and, at the same time as it rotates in direction B, to provide force causing rotational movement, in the R direction, of the rotatable drum that serves as platen 16.

The top view of Figure 1c shows yet another embodiment using a skewed angle for chained roller assembly 12 components themselves. With this arrangement, each link component 26 of a linked roller chain 24 is deployed at a slight skew K relative to rotation direction B. With reference to Figure 1c, angle ϕ between skew K and direction B is other than 90 degrees. Skew K results in additional force being applied during rotation of linked roller chain 12, capable of causing rotational movement, in the R direction (Figure 1b), of the rotatable drum that serves as platen 16. In one embodiment, direction B would be substantially parallel with axis A using the configuration of Figure 1c. A combination using both a skewed direction B relative to axis A and skew K relative to direction B could also be used.

Referring to Figure 2, there is shown an exploded view, with mounting bracket 14 disconnected from base 18 for better visibility of the component parts of pressure application apparatus 10. When motor 20 is energized, its rotational motion causes corresponding rotation of linked roller chain 24 around the perimeter of chained roller assembly 12, in similar fashion to the familiar transmission chain used in a bicycle or other apparatus. Linked roller chain 24 rotates in direction B, so that the lower span of linked roller chain travels in rolling contact with platen 16.

Referring to Figure 3, there is shown a perspective view of chained roller assembly 12, partially disassembled to show its structure. As is shown in Figures 1c and 2, two guide plates 28 are provided, one on each flat side of a support member 32, for maintaining linked roller chain 24 on its intended axis (that is, rotating in direction B as is shown with respect to Figures 1a, 1b, 1c, and

2). For clarity, only one guide plate 28 is shown in Figure 3; the other guide plate 28 is removed to allow visibility of chained roller assembly 12 components. A support member 32 has two sprockets 30 for providing movement to rotate linked roller chain 24. Linked roller chain 24 comprises a plurality of link components
5 26 that travel along top and bottom surfaces of support member 32.

Referring to Figure 4, there is shown support member 32 with only a portion of linked roller chain 24 mounted thereon. Sprockets 30 are partially visible in this view. As is shown in the side view of Figure 5, compressive contact onto platen 16 is maintained by a spring force F against a facing surface S of
10 support member 32. Figure 5 shows the arrangement of linked roller chain 24 between sprockets 30, providing a mechanism for applying pressure, in a series of small contact areas that are continuously shifted in position over substrate sheet 34 as linked roller chain 24 rotates.

Referring to Figures 6 and 7, there are shown assembled and
15 partially exploded perspective views, respectively, of link component 26 for this first embodiment. A contact roller 36 serves as a contact member. Contact roller 36 is fitted into a spring mounted bearing 44 and provides a contact surface that, in operation, is pressed against substrate sheet 34. Substrate sheet 34 is fitted between contact roller 36 and platen 16 (shown as a drum in Figures 1a, 1b, and
20 2). Two side plates 40 provide a support housing for contact roller 36 and for a transmission roller 38 that cooperates with sprockets 30 to obtain motive force from sprocket 30 rotation, using methods well known in the mechanical arts. As is shown in the exploded view of Figure 7, transmission roller 38 rides on a bushing 42. A pin 46 through bushing 42 provides the connector for joining each
25 successive link component 26 to the next. Because it provides the contact surface, contact roller 36 is fabricated of some suitable metal, such as steel. Transmission roller 38 can be metal or a durable synthetic material, such as Teflon or nylon, for example.

The operation of chained roller assembly 12 in this embodiment is
30 straightforward and allows some measure of flexibility. Each contact roller 36 provides a contact surface that is pressed against platen 16. The dimensional characteristics at the contact area depend, in part, on the overall geometry of

platen 16. For the drum embodiment of platen 16 shown in Figures 1a, 1b, and 2, the Hertzian contact area of contact roller 36 is generally elliptical in shape, with contact roller 36 and the drum that serves as platen 16 acting as crossed rollers. For an alternate embodiment in which platen 16 is substantially a flat platen, as is shown in Figure 8, the contact area of contact roller 36 would be along a line. With the non-skewed embodiment of Figure 1a, this line of contact would be orthogonal to direction B of linked roller chain 24 rotation. With skewed embodiments in which chained roller assembly 12 is skewed (as in Figure 1b), this line of contact would be offset from orthogonal. Sprockets 30, driven by motor 20, cause this contact area to move in direction B of linked roller chain 24 rotation, thus applying pressure over the surface of a substrate that is placed between chained roller assembly 12 and platen 16.

As the contact area of each contact roller 36 moves over the surface of the substrate in the direction of linked roller chain 24 rotation B, the substrate itself must be moved beneath chained roller assembly 12, where this movement is in a direction that is substantially orthogonal to rotation direction B. In the embodiment shown in Figure 1a, motor 50 is used to rotate the drum or other surface serving as platen 16 and holding the substrate. In the embodiments of Figures 1b and 1c, use of a slight skew angle with the rotation mechanism provides a sufficient force vector orthogonal to rotation direction B to effect movement of the substrate. As is readily apparent from the description of roller assembly 12 given above, the amount of offset between directions B and A (for the Figure 1b embodiment) or skew K and direction B (for the Figure 1c embodiment) is a factor in determining the relative rate at which the substrate moves beneath chained roller assembly 12 along platen 16.

Referring to Figure 8, there is shown another alternate embodiment of pressure application apparatus 10 in which platen 16 is a flat surface or platen. In a preferred embodiment, this flat surface is a slide, allowing movement of sheet 34 of substrate in a direction C that is substantially orthogonal to the direction of linked roller chain 24 rotation B. Here again, however, it is instructive to note that the direction B of linked roller chain 24 rotation may be skewed somewhat, so that the angle between directions B and C is offset from 90 degrees. As is shown with

respect to the rotatable drum shown as platen 16 in Figure 1b, the use of a skew angle can provide the necessary force for slide movement with the Figure 8 embodiment using a flat slide as platen 16. As was stated with reference to skew angle for embodiments of Figures 1b and 1c, the amount of offset used determines
5 the relative rate at which substrate sheet 34 moves in direction C. Alternately, an optional motor 50 (shown in phantom in Figure 8) could be used to urge platen 16 in direction C. Wherein motor 50 is coupled to platen 16, no skew angle of chained roller assembly 12 would be needed.

Where a separate motor is used for moving platen 16, such as
10 motor 50 in the Figure 1a embodiment, the relative speed of the motor determines how thoroughly the surface of substrate sheet 34 is subjected to pressure. Clearly, the slower the motor speed, the more thorough the coverage.

Referring to the top view of Figure 9, there is shown, exaggerated significantly and enlarged for the sake of description, how the tracking pattern for
15 contact rollers 36 runs across the surface of substrate sheet 34 when a skew angle is used, such as with the Figure 1b and 1c embodiments. Each contact roller 36 has a corresponding contact area 48 that it presses against substrate sheet 34 and moves along the surface of substrate sheet 34 as linked roller chain 24 rotates in direction B. As is represented in Figure 9, there is some overlap between contact
20 areas 48, along the vertical direction as Figure 9 is viewed. This means that the same point on the surface of substrate sheet 34 effectively undergoes this moving contact pressure two or more times as substrate sheet 34 passes between chained roller assembly 12 and platen 16. The pitch P between contact areas 48 is a
25 function of the offset angle by which rotation direction B is effectively skewed relative to drum axis A (Figure 1b), or by which link components 26 are skewed (Figure 1c). One benefit of the capability to adjust skew angle is an improvement in uniformity, since differences in contact pressure from one link component 26 to the next are averaged for each point on the surface of substrate sheet 34.

Depending on the substrate type and dimensions, various
30 arrangements could be used for coupling sheet 34 of substrate to platen 16. This may be necessary due to a tendency of chained roller assembly 12 to urge sheet 34 along its direction of motion B in some configurations. In one embodiment,

platen 16 is a grooved cylinder having a recessed area for securing sheet 34 of substrate in place at its edges, with respect to the B direction. Sheet 34 can be held in place using adhesive tape or other adhesive means, or using fasteners, clamps, or vacuum for example.

5 It can be appreciated that chained roller assembly 12 is capable of providing, at any instant, a very high compressive force over the contact area of contact roller 36. Moreover, as linked roller chain 24 rotates, essentially the same level of compressive force is applied, thus providing a highly uniform effective pressure onto the substrate, such as would be useful as a crushing force for
10 microencapsulated colorants, for example.

 The present invention provides an apparatus and method for applying a uniform pressure over the surface of a substrate. While pressure application apparatus 10 is described for use with an imaging substrate, this apparatus could alternately be applied for other substrate types or for other
15 processes requiring high pressure over a surface, such as lamination. Significantly, pressure application apparatus 10 is scalable in size. For example, by adding link components 26 and by extending the length of support member 32, pressure application apparatus 10 can be sized to handle a dimensionally larger substrate sheet 34. The overall dimensions of link components 26 can be sized to
20 be suitable for characteristics of substrate sheet 34 or of platen 16.

Alternate Embodiment Using Small-Diameter Contact Members

 Other embodiments of the present invention employ the same basic principle, applying continuously moving contact members, in a linked series, in compressive contact against a sheet of substrate supported against a platen.
25 Referring now to the perspective view of Figure 10 and front view of Figure 11, there is shown an alternate embodiment of a portion of pressure application apparatus 10 using small diameter wires 62 as contact members. With this arrangement, two chain sections 60 are rotated in order to move wires 62 in a direction G, with multiple wires 62 moved and maintained in simultaneous
30 compressive contact against platen 16. In operation, substrate sheet 34 (not shown in Figures 10 or 11) is placed between wires 62 and platen 16. Chain sections 60

can be fabricated from conventional links, with added brackets 64 clipped on to provide bearings for each wire 62 and wheels 68.

Compressive contact is provided using the inherent spring force of wires 62. Wheels 68 rotate against a support surface 70, which effectively
5 provides a downward force F_2 against each chain section 60, bending wire 62 slightly and resulting in spring action. Support surfaces 70 thus keep wires 62 in flexure against platen 16 as wires 62 move along in direction G. The apparatus of this embodiment provides a highly uniform pressure against platen 16 and is capable of higher processing speeds than are available using single-point pressure
10 sources, such as those conventionally available for Cycholor printing media, for example. Wires 62 may be fabricated from steel or other metal that provides sufficient spring force under flexure. Wires 62 themselves serve as contact members in the embodiment of Figures 10 and 11; however, wires 62 could alternately serve as axles for rotatable bushings that serve as contact members.

15 While contact roller 36 is a cylindrical contact member as shown in Figures 6 and 7, some variation of the contact surface could be appropriate, such as using a convex shape to yield a smaller effective contact area. A linked series of partially encased ball bearings or other suitable mechanisms could be used as contact members. Contact surfaces are preferably metal, but can be fabricated
20 from other materials suitable for the application. Any of a number of types of motor 20 could be used for rotating linked roller chain 24 (Figures 1a-5 and 9) or chain sections 60 (Figures 10 and 11) or other linked series of contact members. Similarly, use of motor 50 for moving platen 16 admits a wide range of types. Where some amount of skew angle is provided, a manual embodiment, in which
25 rotational power would be provided by turning a crank or handle, could even be useful, particularly for small-format substrate sizes. Various mounting arrangements could be employed for positioning contact members in compressive contact with platen 16 and maintaining compressive contact, using techniques well known in the mechanical arts. Support member 32, surface 70, or other
30 support mechanism could have any number of mechanical arrangements, provided that a facing surface S is provided to oppose the spring force F, as was shown in Figure 5. With the dual-chain arrangement of Figures 10 and 11, support surface

70 may be embodied using one or more suitable components positioned appropriately for providing force F2 onto wires 62. The support mechanism could provide some measure of adjustability, such as for relative height, for example. This would allow variable pressure application over a range of settings, for
5 example.

In the above description, the term "cylindrical" has been used to describe the shape of platen 16 or of contact roller 36 or other types of contact members in various embodiments. It must be noted that the familiar right circular cylinder, with circular bases with a central axis perpendicular to these bases, is the
10 most familiar type of cylindrical body; however, the right circular cylinder is only one type of cylinder. Other types of cylinders could be used for platen 16 or contact roller 36 or other contact member, including non-circular cylinders (whose bases have closed shapes that are other than circular) and oblique cylinders (whose axis is not perpendicular to the bases).

15 The drive apparatus also admits a number of possible embodiments, based on how the closed loop having the linked series of contact members is arranged. For linked roller chain 24 of Figure 3, one or more of sprockets 30 may be mounted on, or mounted separately from, support member 32. In an alternate embodiment, the linked series of contact members is provided
20 by a belt or, for the embodiment of Figures 10 and 11 by a pair of belts, each belt rotated by a drive wheel or other suitable mechanism.

It can be appreciated that the apparatus of the present invention has advantages over the conventional arrangement using opposing rollers, as described in the background section above, particularly for applying pressure over
25 larger areas. The apparatus of the present invention is also advantaged over pressure application apparatus using reciprocating pressure points. Chained roller assembly 12 or chained sections 60 with wires 62 could be used in combination with a heated platen 16 in applications requiring both heat energy and compressive force.

30 The particular embodiment of pressure application apparatus 10 described hereinabove is adapted particularly for use in processing Cycolor imaging media or other types of sheet substrates. However, it must be

emphasized that pressure application apparatus 10 may be more broadly adapted to a number of alternate uses, including applications not using a substrate in sheet form. For example, pressure application apparatus 10, suitably sized, could be used in place of a conventional paired-roller device for crushing various types of
5 particulate material.

Thus, what is provided is an apparatus and method using a linked series of contact members for applying pressure against a platen.

PARTS LIST

10	pressure application apparatus
12	chained roller assembly
14	mounting bracket
16	platen
18	base
20	motor
22	motor bracket
24	linked roller chain
26	link component
28	guide plates
30	sprocket
32	support member
34	sheet
36	contact roller
38	transmission roller
40	side plate
42	bushing
44	spring mounted bearing
46	pin
48	contact area
50	motor
60	chain section
62	wire
64	bracket
68	wheel
70	surface

CLAIMS:

1. An apparatus for applying pressure against a platen,
comprising:
a linked series of contact members arranged in a closed
5 loop;
a drive apparatus for rotating the loop about a support
mechanism, thereby imparting movement to the linked series of contact members;
and
the support mechanism disposed to force a plurality of the
10 moving contact members simultaneously into compressive contact against at least
a portion of the platen.
2. An apparatus for applying pressure according to claim 1
wherein the linked series of contact members comprises a plurality of roller links.
15
3. An apparatus for applying pressure according to claim 1
wherein the platen is cylindrical.
4. An apparatus for applying pressure according to claim 1
20 wherein the platen is flat.
5. An apparatus for applying pressure according to claim 1
wherein the contact member is substantially cylindrical.
- 25 6. An apparatus for applying pressure according to claim 1
wherein the contact member is circumferentially rotatable about an axis.
7. An apparatus for applying pressure according to claim 3
wherein the closed loop rotates in a travel direction that is at a non-zero offset
30 angle with respect to the axis of the cylindrical platen.

8. An apparatus for applying pressure according to claim 4 wherein the platen is a slide.

9. An apparatus for applying pressure according to claim 1
5 wherein the drive apparatus comprises at least one sprocket.

10. An apparatus for applying pressure according to claim 1 wherein the drive apparatus comprises a motor.

10 11. An apparatus for applying pressure according to claim 1 wherein the drive apparatus is manually operable.

12. An apparatus for applying pressure according to claim 1 wherein the drive apparatus comprises a pair of sprockets.
15

13. An apparatus for applying pressure according to claim 3 wherein a sheet of substrate is wrapped onto the cylindrical platen.

14. An apparatus for applying pressure according to claim 1
20 wherein spring force is applied to each contact member.

15. An apparatus for applying pressure according to claim 3 further comprising a motor for rotating the platen.

25 16. An apparatus for applying pressure according to claim 4 further comprising a motor coupled to the platen.

17. An apparatus for applying pressure according to claim 1 wherein the linked series of contact members rotates in a travel direction and the
30 axis of each contact member is other than orthogonal relative to the travel direction.

18. An apparatus for applying pressure according to claim 1 further comprising a transmission roller associated with at least one of the contact members for mechanical coupling with the drive apparatus.
- 5 19. An apparatus for applying pressure according to claim 1 further comprising at least one guide plate for maintaining the rotational motion of the closed loop in a predetermined direction.
- 10 20. An apparatus for applying pressure according to claim 1 wherein the platen is heated.
21. An apparatus for applying pressure according to claim 1 wherein the contact members are substantially spherical.
- 15 22. An apparatus for applying pressure according to claim 1 wherein at least one contact member is a wire.
- 20 23. An apparatus for applying pressure according to claim 1 wherein the position of the support mechanism is adjustable.
24. An apparatus for applying pressure according to claim 4 wherein a sheet of substrate lies against the platen.
- 25 25. An apparatus for applying pressure onto a sheet of substrate supported against a platen, comprising:
a linked series of contact members arranged in a closed loop;
a drive apparatus for rotating the loop about a support mechanism, thereby imparting movement to the linked series of contact members;
30 and

the support mechanism disposed to force a plurality of the moving contact members simultaneously into compressive contact against at least a portion of the sheet of substrate that is supported against the platen.

5 26. An apparatus for applying pressure according to claim 25 wherein the linked series of contact members comprises a plurality of roller links.

 27. An apparatus for applying pressure according to claim 25 wherein the platen is cylindrical.

10 28. An apparatus for applying pressure according to claim 25 wherein the platen is flat.

 29. An apparatus for applying pressure according to claim 25 wherein the contact member is substantially cylindrical.

 30. An apparatus for applying pressure according to claim 25 wherein the contact member is circumferentially rotatable about an axis.

20 31. An apparatus for applying pressure according to claim 27 wherein the closed loop rotates in a travel direction that is at a non-zero offset angle with respect to the axis of the cylindrical platen.

 32. An apparatus for applying pressure according to claim 28 wherein the platen is a slide.

 33. An apparatus for applying pressure according to claim 25 wherein the drive apparatus comprises at least one sprocket.

30 34. An apparatus for applying pressure according to claim 25 wherein the drive apparatus comprises a motor.

35. An apparatus for applying pressure according to claim 25 wherein the drive apparatus is manually operable.

36. An apparatus for applying pressure according to claim 27
5 wherein the substrate is wrapped onto the cylindrical platen.

37. An apparatus for applying pressure according to claim 25 wherein the drive apparatus comprises a pair of sprockets.

10 38. An apparatus for applying pressure according to claim 27 wherein the sheet of substrate is wrapped onto the cylindrical platen.

39. An apparatus for applying pressure according to 25 wherein spring force is applied to each contact member.

15 40. An apparatus for applying pressure according to claim 27 further comprising a motor for rotating the platen.

41. An apparatus for applying pressure according to claim 28
20 further comprising a motor coupled to the platen.

42. An apparatus for applying pressure according to claim 25 wherein the linked series of contact members rotates in a travel direction and the axis of each contact member is other than orthogonal relative to the travel
25 direction.

43. An apparatus for applying pressure according to claim 25 further comprising a transmission roller associated with at least one of the contact members for mechanical coupling with the drive apparatus.

44. An apparatus for applying pressure according to claim 25 further comprising at least one guide plate for maintaining the rotational motion of the closed loop in a predetermined direction.

5 45. An apparatus for applying pressure according to claim 25 wherein the platen is heated.

46. An apparatus for applying pressure according to claim 25 wherein the contact members are substantially spherical.

10 47. An apparatus for applying pressure according to claim 25 wherein at least one contact member is a wire.

48. An apparatus for applying pressure according to claim 25
15 wherein the position of the support mechanism is adjustable.

49. An apparatus for applying pressure onto a sheet of substrate, comprising:
a linked chain comprising a plurality of contact member
20 links, each contact member link comprising at least one contact member;
a drive apparatus for rotating the linked chain about a support mechanism; and
the support mechanism disposed to force a plurality of the moving contact members simultaneously into compressive contact against the
25 sheet of substrate that is supported against a platen.

50. An apparatus for applying pressure according to claim 49 wherein the platen is substantially cylindrical.

30 51. An apparatus for applying pressure according to claim 49 wherein the platen is substantially flat.

52. An apparatus for applying pressure according to claim 49 wherein the contact member is substantially cylindrical.

53. An apparatus for applying pressure according to claim 49
5 wherein the contact member is circumferentially rotatable about an axis.

54. An apparatus for applying pressure according to claim 50 wherein the linked chain rotates in a travel direction that is at a non-zero offset angle with respect to the axis of the cylindrical platen.
10

55. An apparatus for applying pressure according to claim 51 wherein the platen is a slide.

56. An apparatus for applying pressure according to claim 49
15 wherein the drive apparatus comprises a sprocket.

57. An apparatus for applying pressure according to claim 49 wherein the drive apparatus comprises a motor.

58. An apparatus for applying pressure according to claim 49
20 wherein the drive apparatus is manually operable.

59. An apparatus for applying pressure according to claim 50 wherein the substrate is wrapped onto the cylindrical platen.
25

60. An apparatus for applying pressure according to claim 49 wherein the drive apparatus comprises a pair of sprockets.

61. An apparatus for applying pressure according to claim 49
30 wherein spring force is applied to each contact member.

62. An apparatus for applying pressure according to claim 50 further comprising a motor for rotating the platen.

63. An apparatus for applying pressure according to claim 51
5 further comprising a motor coupled to the platen.

64. An apparatus for applying pressure according to claim 49 wherein the linked chain rotates in a travel direction and the axis of each contact member is other than orthogonal relative to the travel direction.
10

65. An apparatus for applying pressure according to claim 49 further comprising a transmission roller link associated with at least one of the contact members for mechanical coupling with the drive apparatus.

66. An apparatus for applying pressure according to claim 49 further comprising at least one guide plate for maintaining the rotational motion of the linked chain in a predetermined direction.
15

67. An apparatus for applying pressure according to claim 49
20 wherein the platen is heated.

68. An apparatus for applying pressure according to claim 49 wherein the contact members are substantially spherical.

69. An apparatus for applying pressure according to claim 49 wherein the sheet of substrate is held in place against the platen by vacuum force.
25

70. A method for applying pressure onto a sheet of substrate, comprising:
30 (a) forming a linked series of contact members arranged in a closed loop;

(b) disposing a support mechanism to force a plurality of contact members simultaneously into compressive contact against the sheet of substrate that is supported against a platen; and

(c) rotating the loop about the support mechanism,
5 imparting movement to the linked series of contact members and pressing a moving series of contact members against the sheet of substrate thereby.

71. A method for applying pressure according to claim 70 wherein the platen is cylindrical about a platen axis and wherein the step of
10 disposing the support mechanism comprises the step of orienting the direction of loop rotation at a non-zero offset angle relative to the platen axis.

72. A method for applying pressure according to claim 70 wherein the step of rotating the loop comprises the step of activating a motor.
15

73. A method for applying pressure according to claim 70 wherein the step of rotating the loop comprises the step of rotating a mechanical member.

20 74. A method for applying pressure according to claim 71 wherein the step of forming a linked series of contact members comprises the step of adjusting a contact member axis for each contact member to be other than orthogonal relative to the platen axis.

25 75. A method for applying pressure according to claim 70 further comprising the step of coupling the sheet of substrate to the platen.

76. A method for applying pressure according to claim 75 wherein the step of coupling the sheet of substrate to the platen comprises the step
30 of adhering the sheet of substrate to a cylindrical drum.

77. A method for applying pressure according to claim 75 wherein the step of coupling the sheet of substrate to the platen comprises the step of applying a vacuum.

5 78. A method for applying pressure according to claim 75 wherein the step of coupling the sheet of substrate to the platen comprises the step of applying a clamp.

79. A method for applying pressure onto a sheet of substrate,
10 comprising:

(a) forming a linked chain comprising a plurality of roller links, each roller link comprising a contact member, wherein the contact member is circumferentially rotatable about a first axis;

(b) rotating the linked chain, in a travel direction, about a
15 support member; and

(c) mounting the support member to force a plurality of roller links into compressive contact with the sheet of substrate, compressing the sheet of substrate against a platen thereby.

20 80. A method for applying pressure according to claim 79 wherein the platen is cylindrical about a second axis and wherein the step of mounting the support member comprises the step of orienting the travel direction at a non-zero offset angle relative to the second axis.

25 81. A method for applying pressure according to claim 79 wherein the step of rotating the linked chain comprises the step of activating a motor.

82. A method for applying pressure according to claim 79
30 wherein the step of rotating the linked chain comprises the step of rotating a mechanical member.

83. A method for applying pressure according to claim 79 wherein the step of forming a linked chain comprises the step of adjusting the first axis to be other than orthogonal relative to the travel direction.

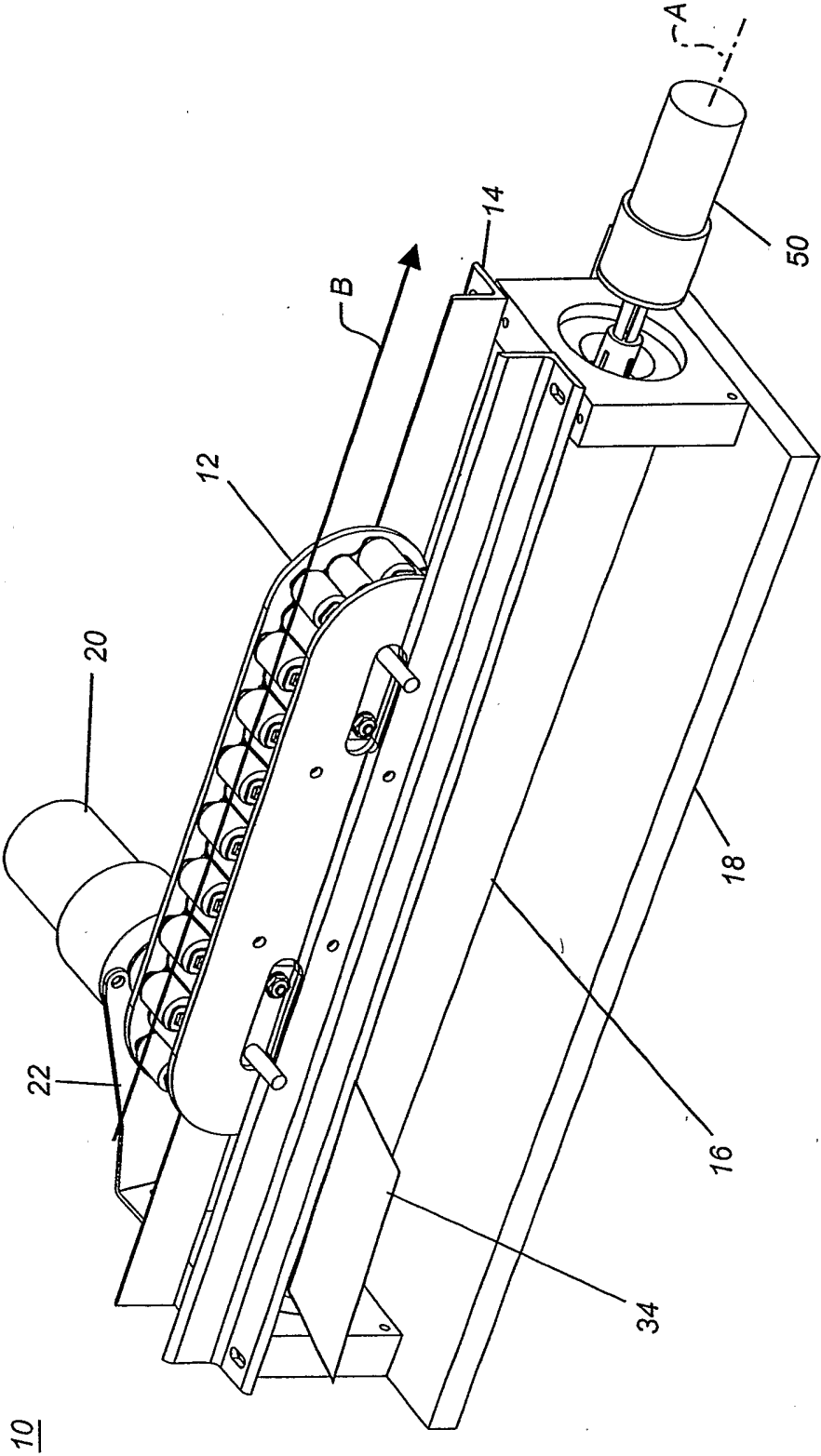
5 84. A method for applying pressure according to claim 79 further comprising the step of coupling the sheet of substrate to the platen.

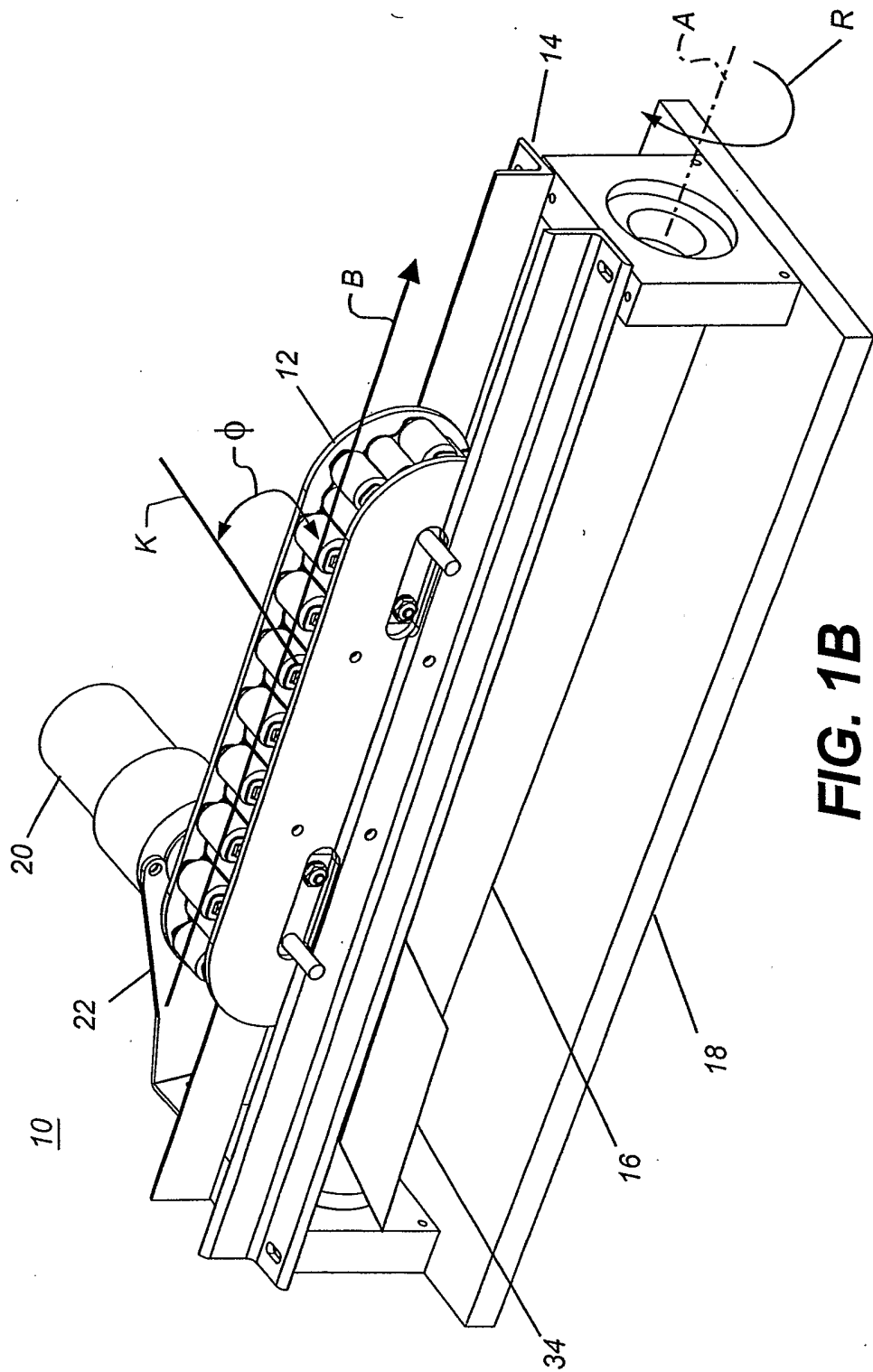
85. A method for applying pressure according to claim 84 wherein the step of coupling the sheet of substrate to the platen comprises the step
10 of adhering the sheet of substrate to a cylindrical drum.

86. A method for applying pressure according to claim 84 wherein the step of coupling the sheet of substrate to the platen comprises the step
15 of applying a vacuum.

87. A method for applying pressure according to claim 84 wherein the step of coupling the sheet of substrate to the platen comprises the step
20 of applying a clamp.

88. A method for applying pressure against a platen,
25 comprising:
(a) arranging a linked series of contact members in a closed loop;
(b) disposing a support mechanism to force a plurality of
the contact members simultaneously into compressive contact against the platen;
and
(c) rotating the loop about the support mechanism,
imparting movement to the linked series of contact members and pressing a
moving series of contact members against the platen thereby.





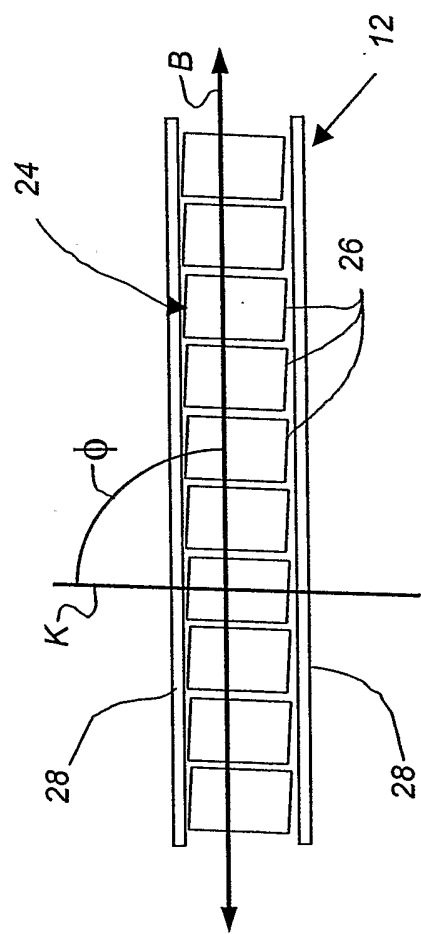


FIG. 1C

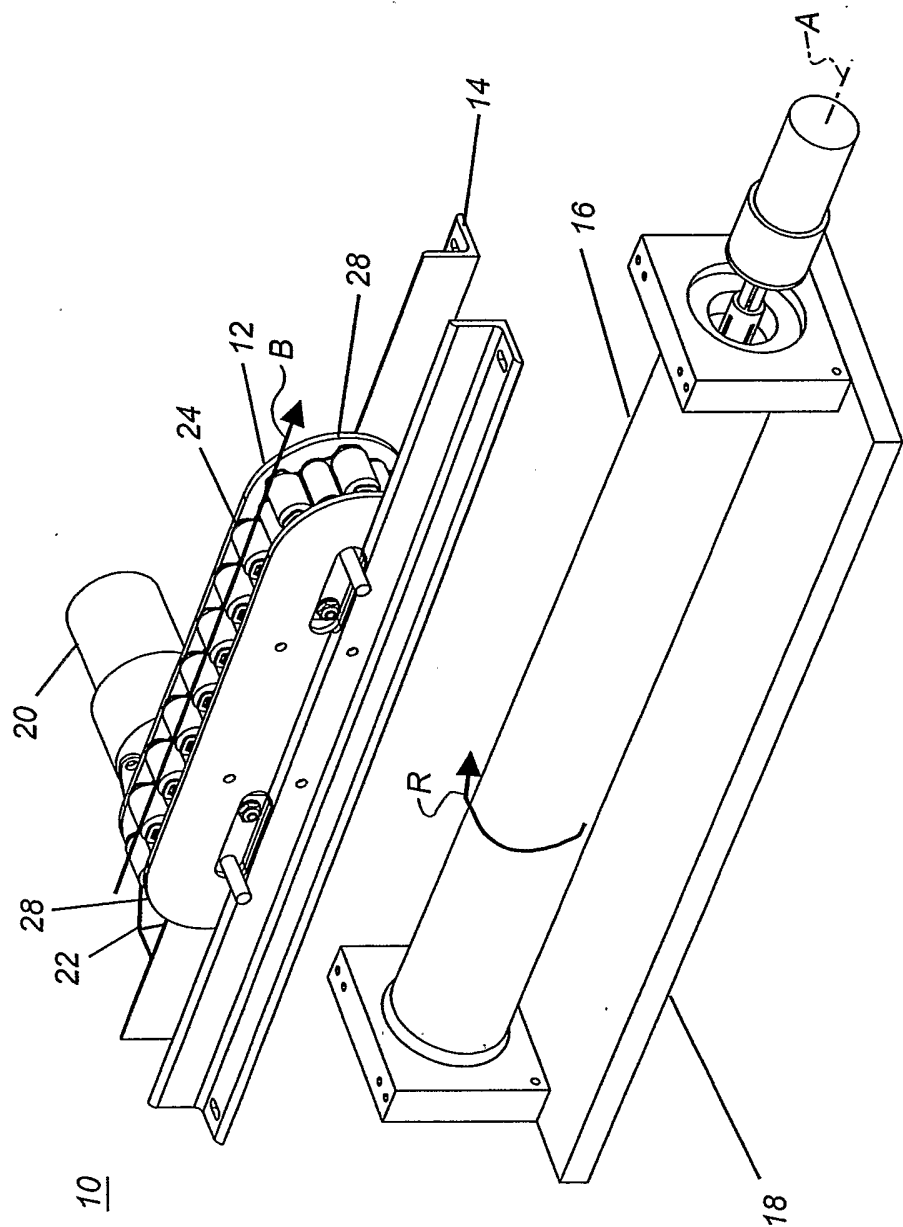


FIG. 2

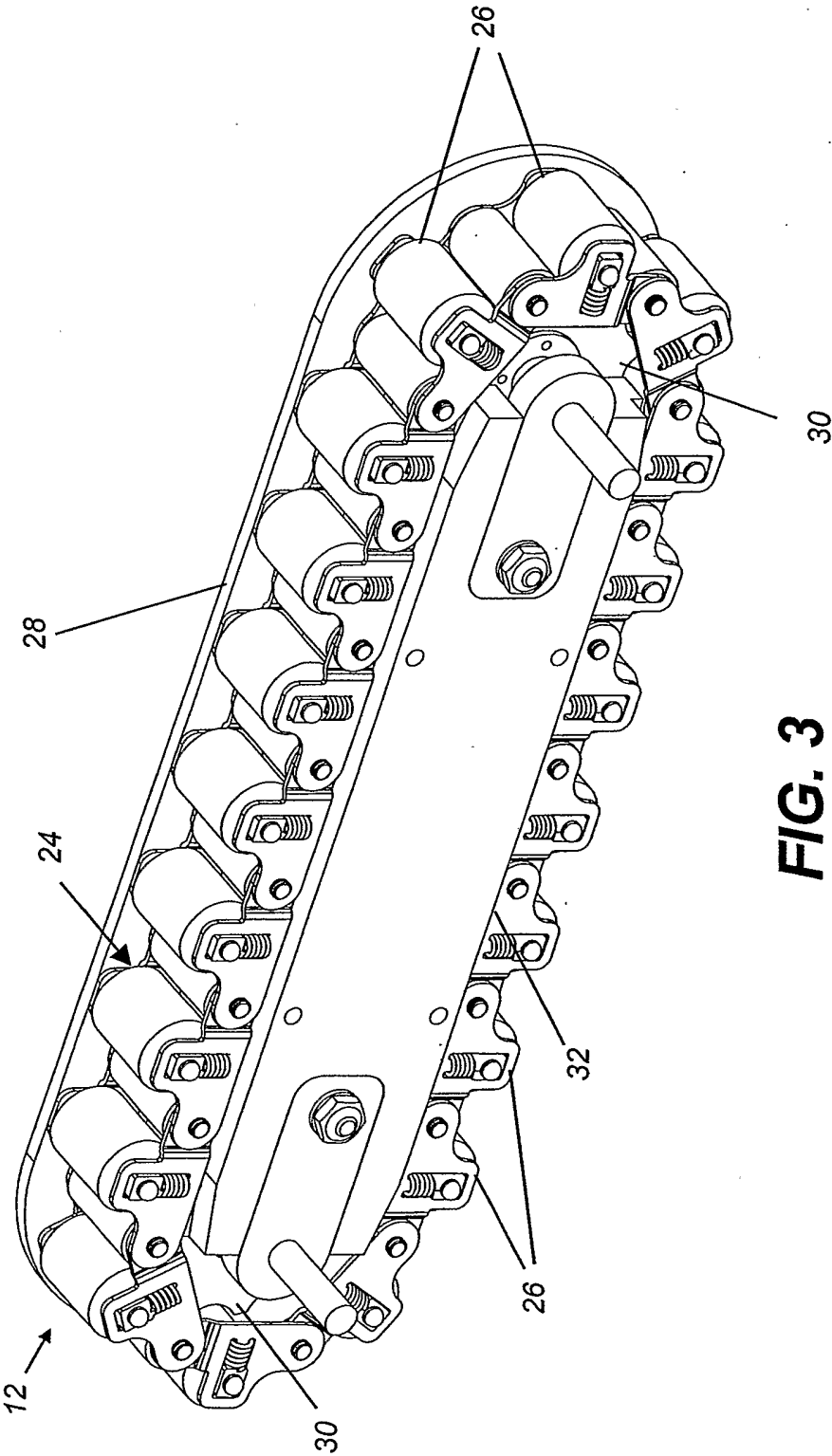
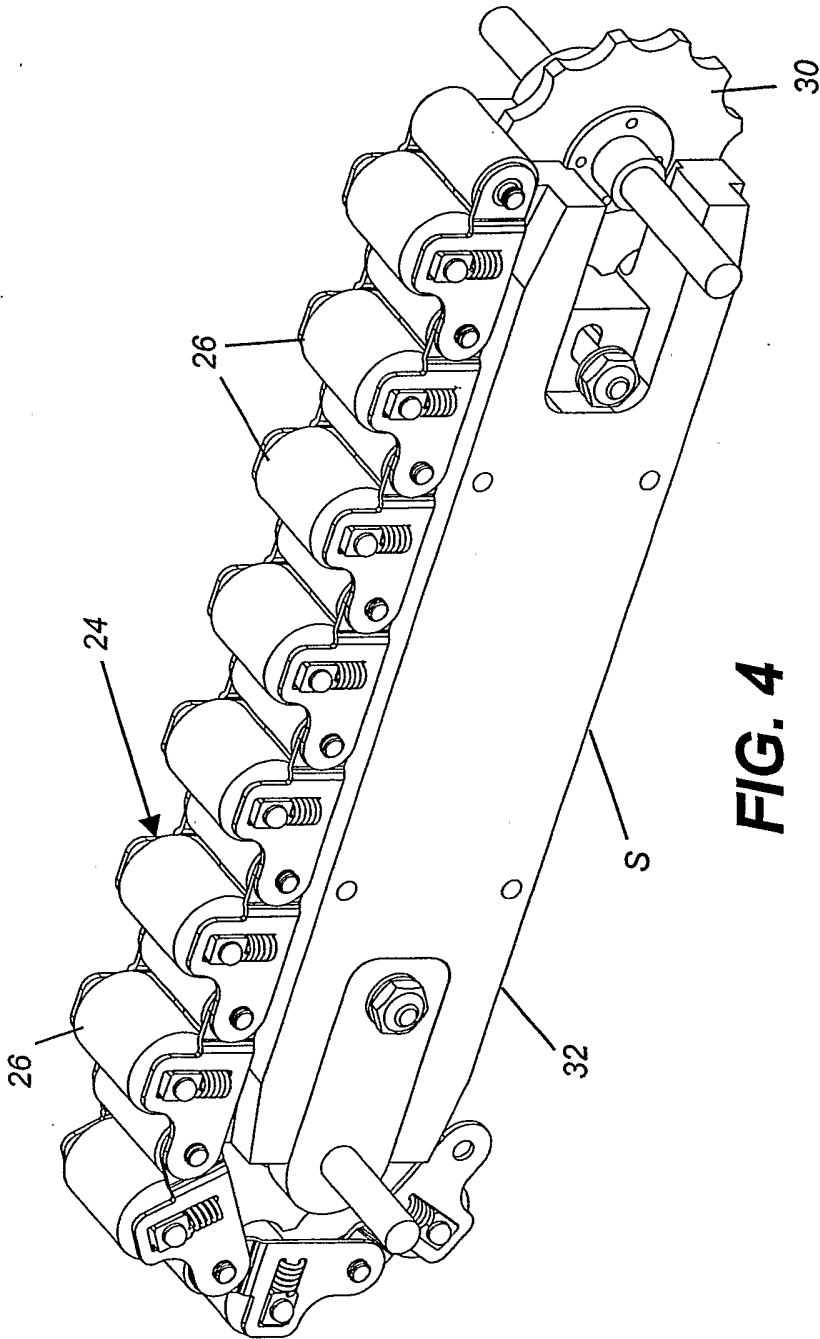


FIG. 3



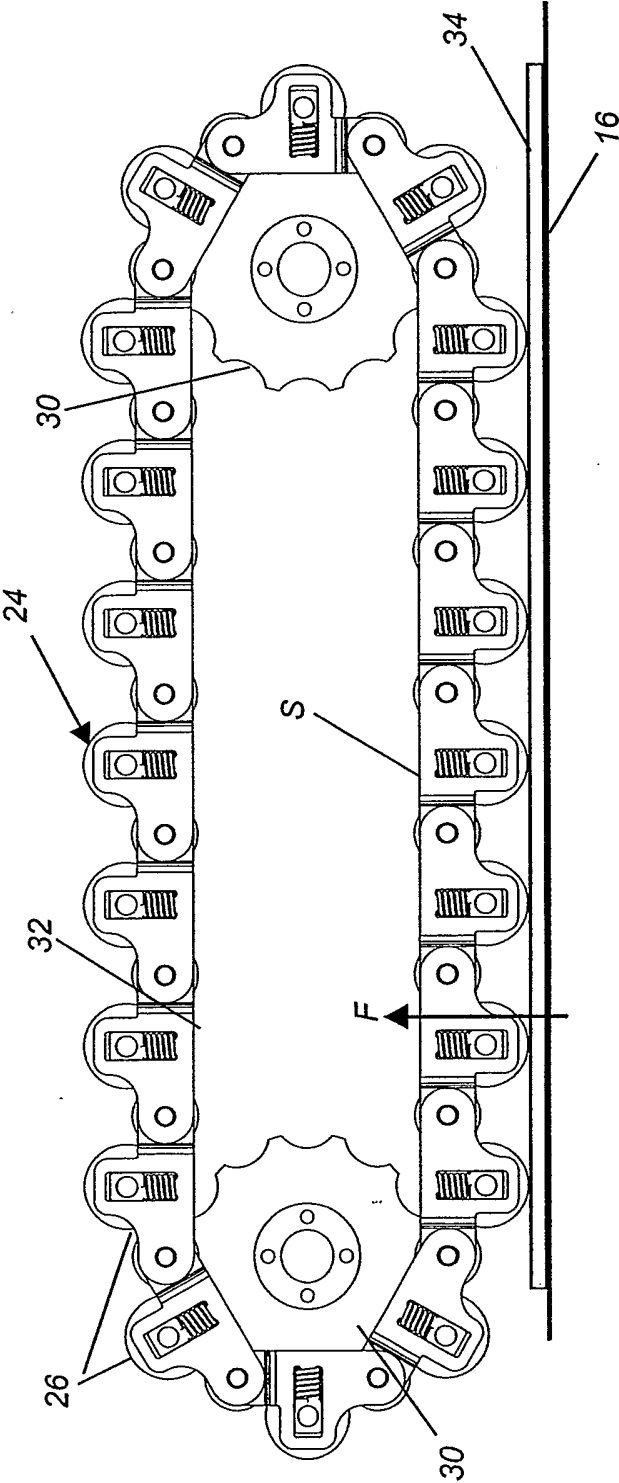


FIG. 5

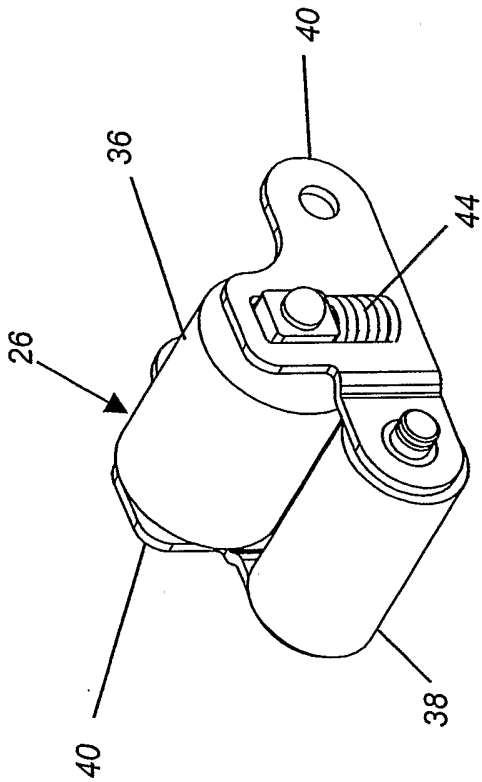


FIG. 6

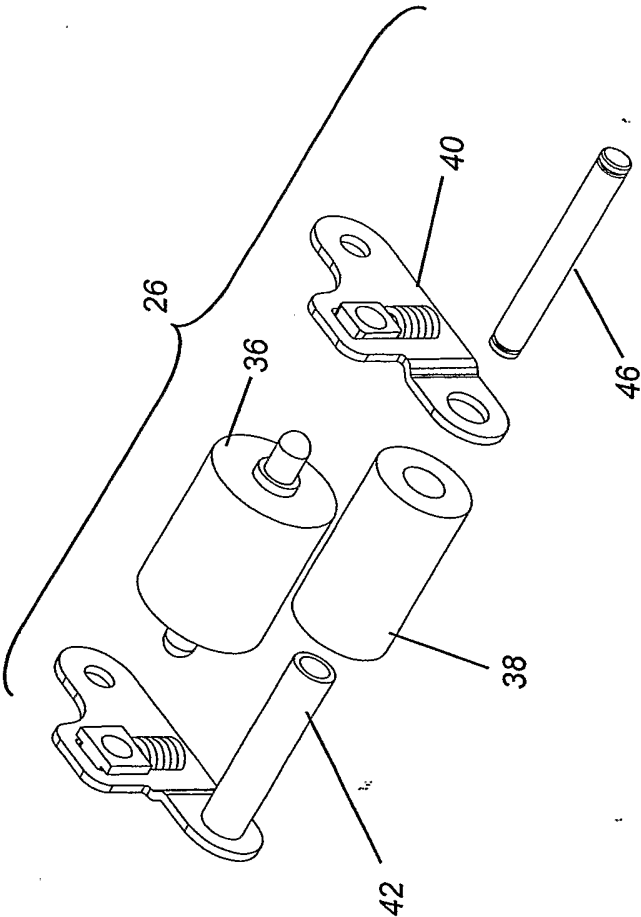


FIG. 7

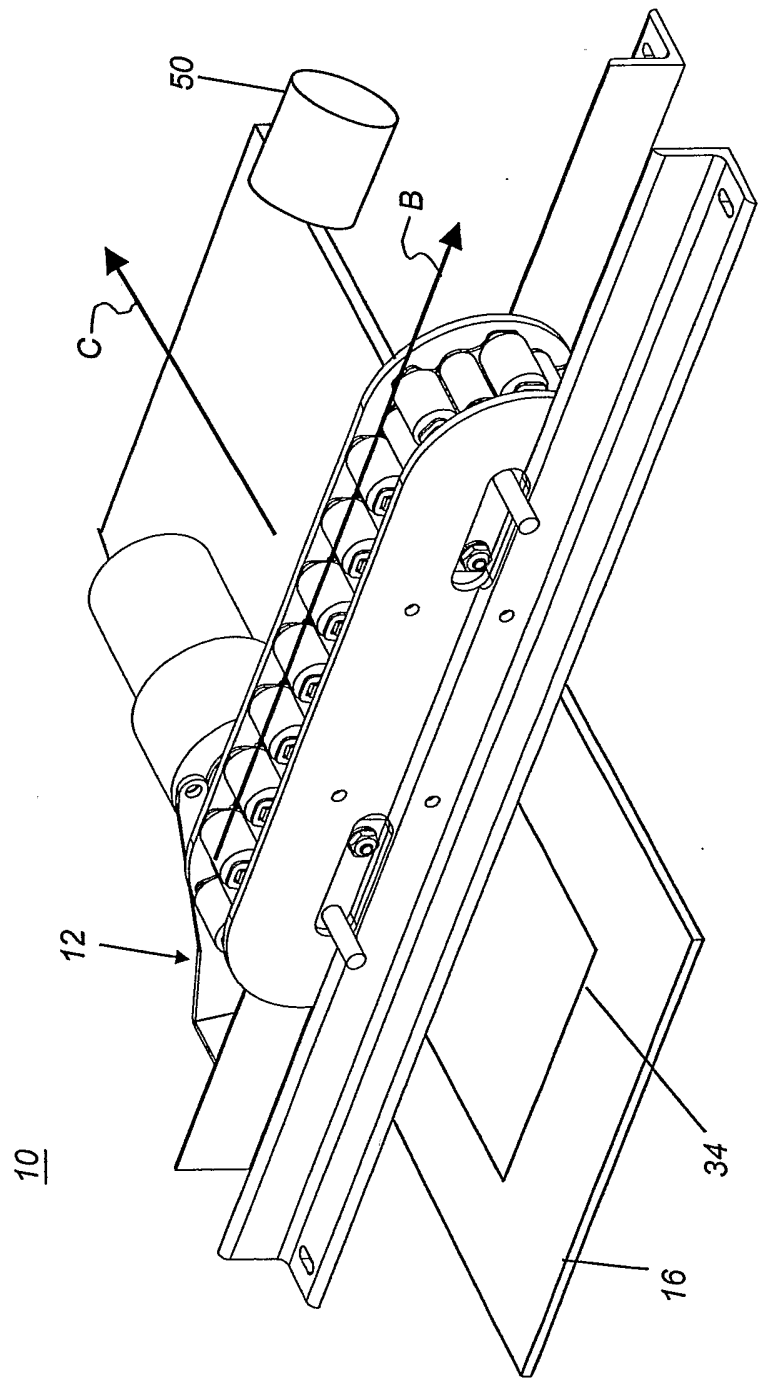


FIG. 8

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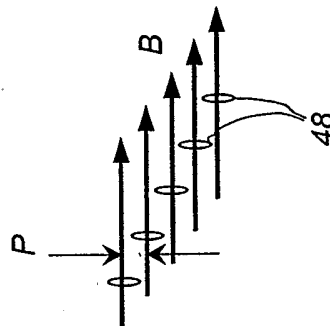
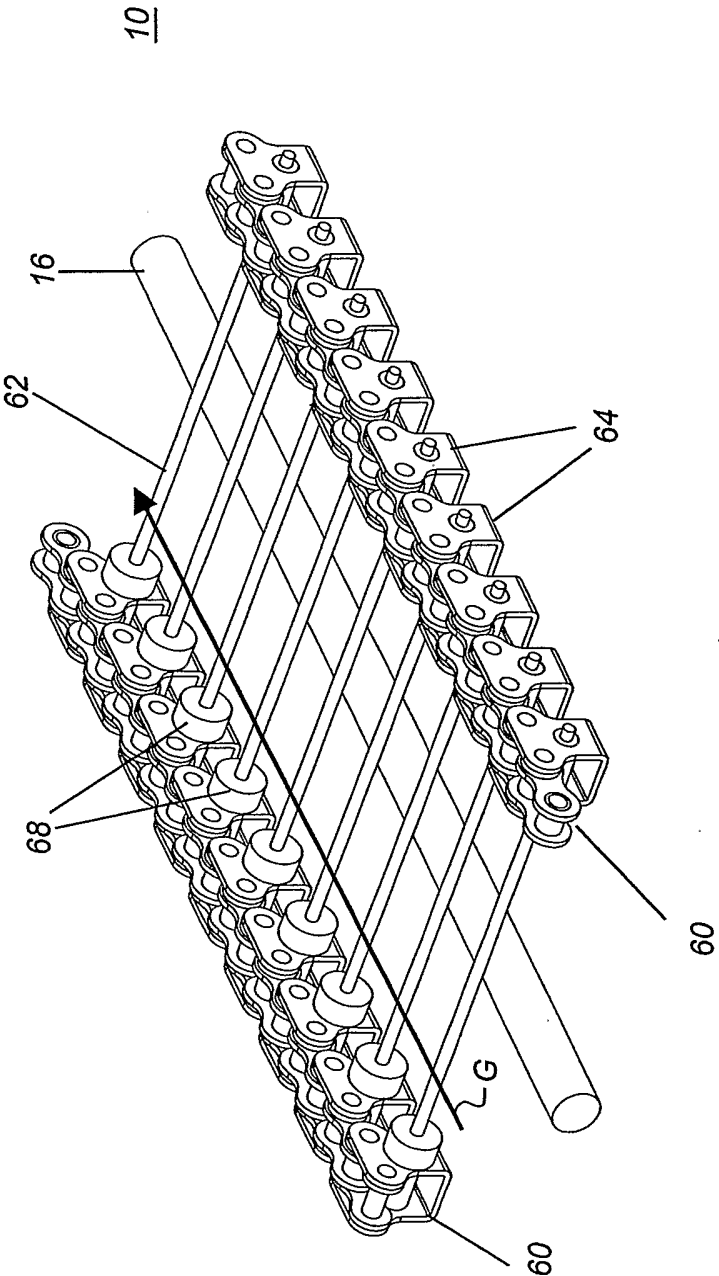


FIG. 9



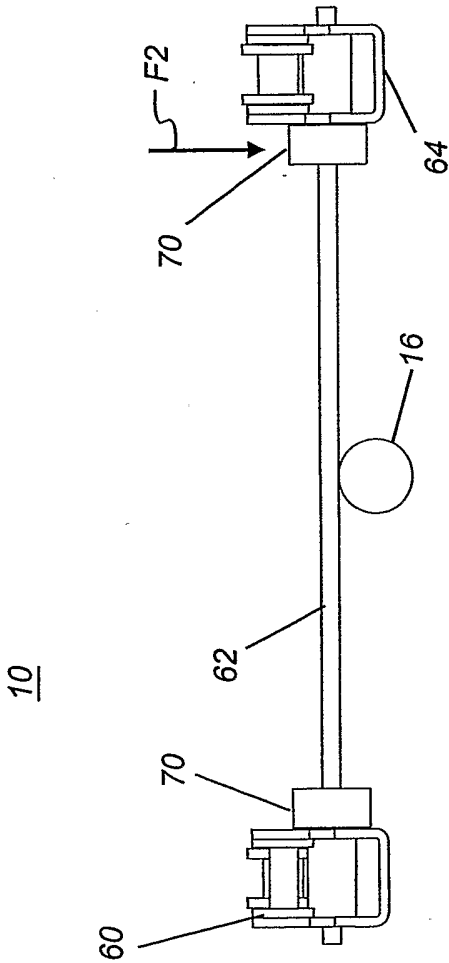


FIG. 11