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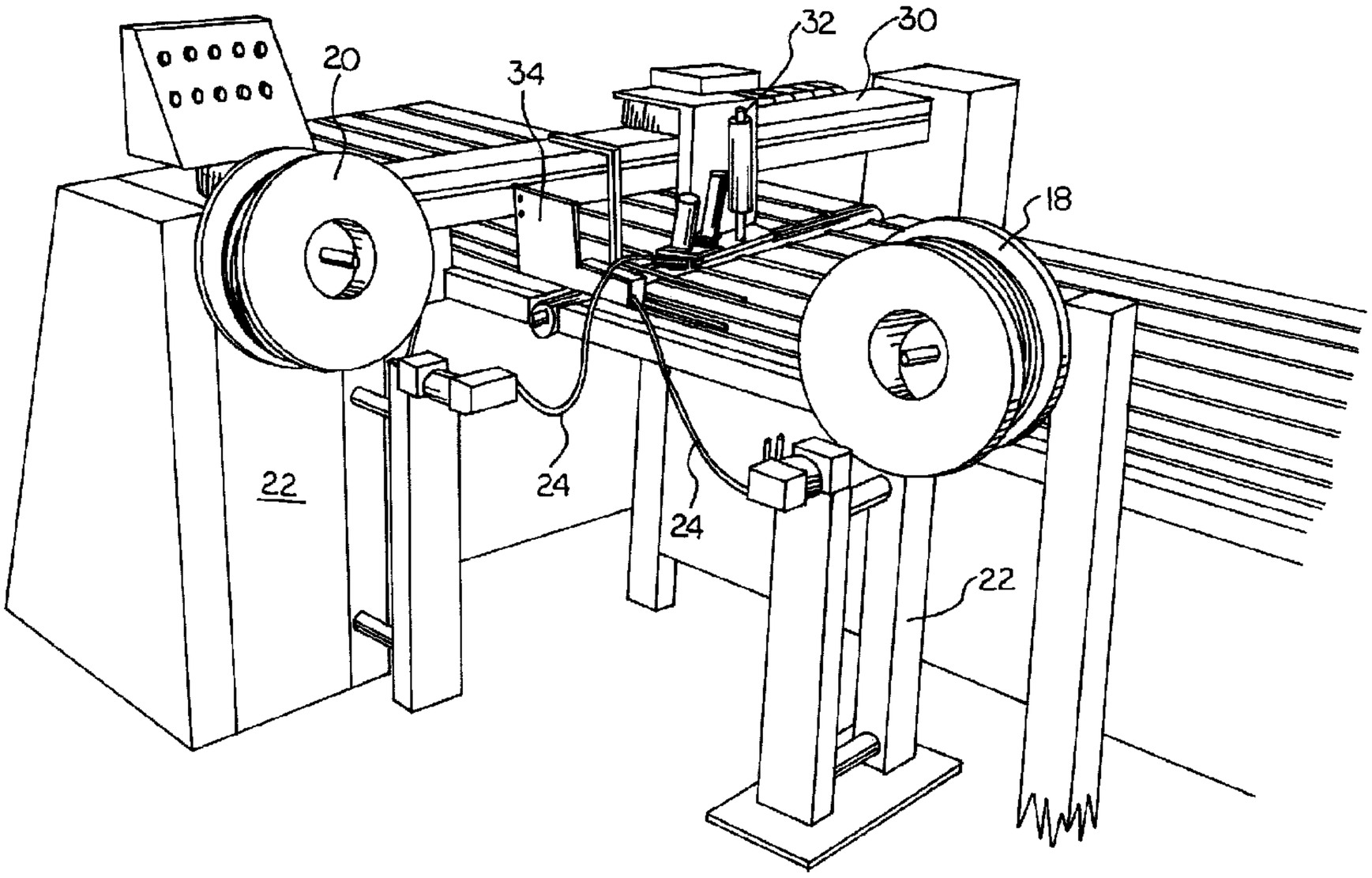
(54) Titre : APPAREIL POUR L'APPLICATION AUTOMATIQUE DE MATERIAU D'ESPACEMENT ET PROCEDE D'UTILISATION

(54) Title: APPARATUS FOR THE AUTOMATED APPLICATION OF SPACER MATERIAL AND METHOD OF USING SAME



(57) Abrégé/Abstract:
There is disclosed an apparatus for applying a length of spacer material to a substrate having sides and ends comprising advancing means for advancing a substrate from a first position to a second position, applying means for applying a length of spacer material to said substrate, said last-mentioned means having advancing means for advancing a length of spacer material from a supply thereof, means for placing said length of spacer material into juxtaposition with said substrate along at least one side and one end of said substrate, means for advancing said applying means along a length of said substrate, means for notching said spacer material at a corner position in the length of said spacer material. The apparatus has the advantage of simple construction and a very efficient operation eliminating the necessity for manual application of spacer strips to glass lites.

ABSTRACT OF THE DISCLOSURE

There is disclosed an apparatus for applying a length of spacer material to a substrate having sides and ends comprising advancing means for advancing a substrate from a first position to a second position, applying means for applying a length of spacer material to said substrate, said last-mentioned means having advancing means for advancing a length of spacer material from a supply thereof, means for placing said length of spacer material into juxtaposition with said substrate along at least one side and one end of said substrate, means for advancing said applying means along a length of said substrate, means for notching said spacer material at a corner position in the length of said spacer material. The apparatus has the advantage of simple construction and a very efficient operation eliminating the necessity for manual application of spacer strips to glass lites.

APPARATUS FOR THE AUTOMATED APPLICATION OF SPACER MATERIAL AND METHOD OF USING SAME

FIELD OF THE INVENTION

This invention relates to an apparatus and method for application of spacer material to a substrate such as a glass substrate for the manufacture of double-glazed or insulated windows.

BACKGROUND OF THE INVENTION

At present, most double glazed windows are formed by manually applying a length of spacer material about the peripheral edges of the glass. Various types of manual tools are known for this purpose in which the operator moves the tool along the sides and edges of a substrate while feeding a length of the strip or spacer material through or around the tool.

While very effective in applying strip or spacer material, manual operations are labour-intensive and consequently, the operations tend to become expensive.

SUMMARY OF THE INVENTION

With the present invention, applicant has developed a method and apparatus for automated application of spacer material to e.g. glass substrates. More particularly, the method and apparatus of the present invention are intended to automatically apply spacer material to glass-lite assemblies including in-line production.

In accordance with the present invention, according to one aspect thereof, there is provided an apparatus for applying a length of spacer material to a substrate having sides and ends comprising advancing means for advancing the

substrate laterally from a first position to a second position relative to an applying means; at least one applying means operatively spaced from the substrate for applying spacer material to at least one side and one end of the substrate including means for placing a length of spacer material into juxtaposition with the substrate and means for partially cutting the spacer material at a corner position in the length of the spacer material; and means for reciprocally advancing the applying means transversely relative to the substrate.

In a preferred embodiment of the present invention, the apparatus as defined above includes means for rotating the applying means from a first direction to a second direction in which spacer material is to be applied to the substrate during lateral movement of the substrate.

In a still further preferred embodiment, the above apparatus includes means for rotating the applying means to a third direction in which spacer material is to be applied to the substrate during reciprocal transverse movement relative to the substrate.

In another embodiment, preferably the apparatus includes a second means for applying an additional length of spacer material to one side of the substrate, the second means operating independently from the first means.

In a still further embodiment, the above apparatus includes advancing means comprising at least one endless belt extending from an inlet end towards a discharge end.

In a still further embodiment, the above apparatus includes advancing means which comprise a pair of spaced-apart endless belts extending from an inlet end of the apparatus to a discharge end, means for advancing the belts in a time related sequence, means for mounting the applying means above at least one of the belts to suspend the applying means over a length of substrate to which the spacer material

is to be applied, means for advancing the applying means between at least first and second spaced-apart positions where the spacer material is applied to the substrate during advancement.

In another preferred embodiment, the above apparatus includes the applying means which comprise first applicator means, the applicator means including means for receiving a length of spacer material and for advancing the same from a source thereof to dispense a continuous length of the spacer material relative to the substrate, means for effecting contact between the spacer material and the substrate to thereby apply the spacer material to at least one length of the substrate.

In a still further embodiment, the above apparatus includes means for notching the spacer material to permit the spacer material to form a corner.

In a still further embodiment of the present invention, the apparatus includes applying means which has second applicator means, the applicator means including means for receiving a length of spacer material and for advancing the same from a source thereof to dispense a continuous length of the spacer material relative to the substrate, means for effecting contact between the spacer material and the substrate to thereby apply the spacer material to a length of the substrate.

In a still further embodiment of the present invention, the apparatus includes a means for moving the second applicator means out of the way of the first applicator means.

Still further, another aspect of the present invention relates to a method of applying spacer material to a substrate, the method including the steps of advancing a substrate to a start position; receiving a length of spacer material in an applying means; discharging spacer onto the substrate surface at a start position; advancing the applying means and simultaneously applying spacer material to a first end of the substrate; cutting a discontinuity in the spacer material at the corner location;

rotating the applying means forming a corner fold in the spacer material at the cut; advancing the substrate to a second position and simultaneously applying spacer material to a first side.

Still further, another aspect of the invention includes a travelling applicator head for applying adhesive spacer material to a substrate in a spacer application station in the production of insulated windows, comprising a traveller for supporting the applicator head at a distance from the substrate, a drive means for selective transverse reciprocating movement of the traveller and the applicator head, a central housing rotatively supporting the applicator head on the traveller, a lead section comprising a pair of lead gripping members defining a first channel therebetween a lag section comprising a pair of lag gripping members defining a second channel therebetween, at least one of the lag section and the lead section being mounted for pivotal movement relative to the other at the lead section and the lag section, defining in combination an application channel for positioning the spacer material on the substrate.

A still further aspect of the present invention includes an apparatus for applying adhesive spacer material to a substrate, comprising a support means for supporting the substrate, a beam oriented transversely to the support means, at least one travelling applicator head for applying spacer material to the substrate supported on the beam spaced from the substrate, at least one feed reel for supplying spacer material to the at least one travelling applicator head, means for advancing the at least one travelling applicator head relative to the substrate, wherein the at least one applicator head includes drive means for providing reciprocal movement of the at least one applicator head on the beam, a central housing secured to the drive means about which the at least one applicator head is rotatable, a lead section and a lag section mounted to the central housing and defining an application channel for receiving the spacer material and applying it to the substrate, the lead and lag sections each comprising spaced-apart gripper members, at least one of the lead and lag sections being mounted for pivotal

movement relative to the other of the sections.

The present invention has numerous advantages over manual or other types of spacer element application to substrates. For example, the present invention provides an apparatus which can be adapted for in-line production, thus eliminating slow-downs and stockpiling of materials. Still further, the present invention provides an economical alternative to very complex apparatus which has been proposed previously. Prior art proposals involve numerous components which are movable about the periphery of the glass substrate whereas in contrast, the present invention utilizes an apparatus which has a significantly reduced number of movements and consequently, is much simpler to construct and operate.

BRIEF DESCRIPTION OF THE DRAWINGS

Having thus generally described the invention, reference will now be made to the accompanying drawings illustrating preferred embodiments and in which

FIGURE 1 is a perspective view of an apparatus according to the present invention which shows the advancing means for a glass lite production line;

FIGURE 2 is a similar perspective view of the apparatus of Figure 1 showing the sources of the spacer material;

FIGURE 3 is a perspective view of the discharge side of the apparatus with the supporting means for the application means being shown which extends transversely of the conveyor systems;

FIGURE 4 is an enlarged perspective view or close-up of the two applying means showing the construction in greater detail;

FIGURE 5 is a close-up view of one of the applying means;

FIGURE 6 is a general perspective view from one end showing a first applying means at one end of its travel and in a start position for commencing the strip-applying operation;

FIGURE 7 is an enlarged view showing the first applying means and its components including the drive system and notching means;

FIGURE 8 is an enlarged view showing the drive means in larger detail;

FIGURE 9 is an enlarged view of the portion of the first applying means after it has travelled from a first position to a second position for application of a spacer to a second side or length of the substrate;

FIGURE 10 is an enlarged view similar to Figure 9;

FIGURE 11 is an enlarged view showing a rack and pinion assembly with piston assemblies attached to the racks which thus slide the racks to rotate the gears which in turn rotate the first applying means;

FIGURE 12A is an enlarged view showing the supporting means for maintaining a spacer strip out of contact with a substrate while it is being fed to the first applying means and as well illustrates a portion of the second applying component;

FIGURE 12B is an enlarged view of the second applying component of Figure 12A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and in particular Figure 1, an example of an apparatus according to the present invention is shown which includes a pair of spaced-apart conveyors indicated generally by reference numerals 12 and 14 forming a conveying surface from an inlet end 10 to an outlet end 16 which would typically be encountered in a continuous production line. The conveyors 12 and 14 are in-line and meet at approximately the mid-point of the overall apparatus. The conveyors, of course, can be any suitable endless belt or other devices which perform the same function. An edge member 26 provides an alignment guide.

The apparatus also includes, in the embodiment illustrated, a pair of supply means 18 and 20 for supplying a length of spacer material. The supply means are roles of spacer material mounted for rotation about supporting stands 22, with a lead end of the spacer material being fed to the apparatus (as described hereinafter). Thus, the two sources provide two separate lengths of spacer material 24, each being a separate feed source for separate application means.

Referring to Figure 3, the apparatus includes an overhead support beam or member 30 extending transversely of the conveyor belts and which is adapted to mount at least one spacer material dispensing head or body, and preferably both dispenser heads, the latter being indicated by reference numerals 32 and 34 (Figure 3).

Referring to Figure 4, in the embodiment illustrated, one spacer dispensing applying means 32 is preferably a device which applies spacer material to at least two and preferably three sides of a substrate. To that end, the applying means is mounted in a movable manner along the frame 30. Suitable means such as a rack and pinion arrangement, the rack being indicated by reference numeral 36, and a pinion (not shown). Alternatively an endless belt can be used, driven on the beam

30 and attached to the head 32. Movement is effected by suitable drive means for movement of the assembly transversely of the belts 36.

As also shown in Figure 4, the apparatus may include means for suspending the strip applying material above a substrate as it is being fed to the applying means 32. To this end, a pair of spaced-apart L-shaped brackets may be movably journalled along the transverse assembly , the brackets being indicated by reference numerals 41 and 43. The bracket 43 is connected by a rod 45 to the frame assembly of the applying means 32; the bracket 41 is likewise connected by a rod 47 (and journalled through bracket 43) to connect to the same frame assembly to applying means 32. In this manner, the brackets 41 and 43 may be collapsed together (see Figure 6) upon movement of the assembly 32 to its start position. Movement of the assembly 32 to the right (viewed from Figure 6) will result in the first bracket 43 being advanced and thereafter, in a spaced-apart manner, bracket 41. As shown in Figure 4, the strip 24 is suspended on the lower arms of the respective brackets 41 and 43 to be spaced above the substrate.

The applying means 32 includes a lower tape dispensing and feeding component associated with it (see e.g. Figure 6 and enlarged view Figure 7 and also Figure 8), which as illustrated, includes a guide pulley 40 for guiding the spacer material 24 to turn the latter from its feeding direction to its application direction. A motor 42 is associated with the applying means 32 and operates a pair of drive wheels 44 (only one being shown in Figure 7). Strip 24 passes from guide roller 40 between the drive rollers 44 to effect movement of the strip. From between the drive rollers 44, the strip 24 is fed through the lower housing indicated generally by reference numeral 48 of the applying means 32 (a suitable channel being formed by appropriate frame members for that purpose); the strip 24 exits from the lower housing through a gap in between adjacent frame members indicated generally by reference numeral 50. Although a substrate is not illustrated in Figure 7, the strip is shown as it would have been applied to the surface of a substrate with the assembly 32 moving from left to right as portrayed in Figure 7.

The assembly 32 may include suitable means such as a pressure roller within the lower portion of the assembly to apply pressure to the strip as it is dispensed onto the substrate in order to have the strip 24 firmly engage the surface of the substrate. Depending on the type of strip materials the latter may be provided with suitable adhesive to thereby effect a bond between substrate and the strip.

As shown in Figures 6, 7 and 10, the assembly or applying means 32 has two strip guiding and applying sections 46 and 47. These sections are conveniently defined as the lag section and the lead section respectively. Each section is mounted on the assembly 32, with hydraulic means 51 for raising and lowering the respective sections. In Figures 6 and 10 both sections are in a lowered position, and in Figure 7 the section 46, conveniently considered as the lag section, is shown raised.

Pressure devices, for example wheels 45 and 45a as indicated in dotted outline in Figure 10, apply pressure to the strip. These wheels can be mounted for vertical movement towards and away from the strip.

In operation, to apply a length of strip material across a lite, both sections are down and the strip applied. At the corner, it is desired to rotate the assembly 32 and move the lite for application of a strip of material along a side edge. For this to occur, the section 46 is raised to be above the length of strip material already applied. That is, the section 46 must be raised clear of the strip. Rotation of the assembly 32 can then occur. Once the assembly 32 has rotated and the lite starts to move, the section 46 is lowered to assist in applying the strip material.

Associated with the applying means 32 is an optional notcher which can be seen in greater detail in Figure 10. The notcher may have a punch portion indicated generally by reference numeral 60, actuated by a piston assembly 62. Thus, as the strip material is fed between the drive rollers 44, the apparatus (through suitable sensing means) senses the position of a corner and will notch the spacer material

(by punching out a portion of the thickness of the material) to permit the material to form a "tight" corner bend (such as a 90° angle) when the assembly 32 is rotated from a first side to a second side or end of the glass panel.

Referring now to Figure 11, the mechanism for rotating the first applying means 32 to permit it to apply a strip in the second direction is illustrated in greater detail. To that end, a rack and pinion arrangement may typically be used but other arrangements may equally be employed for that purpose. The applying means 32 at its upper end journals a first gear 100 as well as a second gear 103 which engage a pair of racks 102 and 104 respectively. A piston assembly 106 (through connecting members 108) is effective to move rack 102. This rotates gear 100 and thus rotates applying means 32. Rotation of gear 100 also rotates gear 103, in engagement with rack 104 moving it laterally.

To reverse the movement, piston assembly 110, through brackets 112, is effective to move rack 104 in the reverse direction with the rack 104 engaging gear 103. This rotates the applying means 32 and also via gear 100 moves rack 102 back to the original position.

In operation, the two applying means or heads are initially positioned as shown in Figure 6. A sheet of glass is delivered to the applying station by virtue of movement of one of the conveyors. Suitable sensing means, for example mounted on applying means 32, will position the glass below the application station - i.e. to halt movement of the conveyor beneath the applying heads. Application head 32 will then be actuated to move transversely across the conveyor and apply a first length of spacer material along one side of the glass lite. Sensing means, again for example, mounted on the applying means 32, may be provided to detect the corner of the glass lite and thus halt advancement of the assembly 32 at an appropriate point. Actuation of the rotation means for the assembly to change the direction of the movement of the assembly 32 will then take place. Prior to changing the direction of the head 32, the notching apparatus will be used to provide a notch in

the length of sealant material at the point where the sealant material is to be bent to form a corner. The assembly 32 is thus in a position to apply the next side of the spacer material (see Figure 10).

At the same time the piston assembly of the other applying head 34 is then actuated to lower the body into operative relationship with the glass lite. The conveyor systems are then actuated to advance the glass lite from one conveyor over to the second conveyor and during the advancement, the spacer material is then applied to both edges of the glass.

Thereafter, rotation of the applying head 32 is again effected to rotate the same approximately e.g. 90°; the length of spacer material is further notched to form the corner. Thereafter, the applying body 32 is again moved back to its initial position (i.e. its home position) to thus complete application of spacer material to all four sides of the glass. If desired, at the initial and terminal points of movement of the applying means, the notcher may also be actuated to provide notches at the lead and terminal ends of the spacer material to accommodate the length of spacer material laid down by the applying means 34. Still further, the applying means 34 may also be provided with a notcher as illustrated in Figure 12B; the notcher being actuated by piston assembly 214 and being constructed in a similar manner to that described with reference to the previous Figures.

Each of the applying means 32 and 34 may be provided with appropriate severing means to sever the spacer material at the end of the operation. For example, as shown in Figure 12B a piston assembly 216 may be connected to a vertically aligned knife to sever the spacer material at a desired length.

Referring now to Figures 12A and 12B, the second applying means 34 includes a general frame assembly 200 mounting guiding means 202 for guiding a length of strip material into guide bodies 210m 211 of the assembly 34. Bodies 210, 211 include one or more pressure rollers, shown dotted in Figure 12B at 212, for

placing the strip material into engagement with a substrate surface. Rollers 212 can be movable vertically.

To move assembly 34 out of the path of assembly 32, when required, a piston assembly 206 is provided which is intended to engage with the lower body portion to raise the same. Suitable means may be provided for a time-actuated sequence (such as through use of a sensor) to raise and lower the assembly 34 as required.

Since assembly 34 is actuated when the conveyors are actuated for movement of a substrate thereon, no drive means are required. Also, in the embodiment illustrated, assembly 34 is only utilized for the application of one length of sealing material along the axis of travel of the substrate; it will be understood that assembly 34 may be constructed similar to assembly 32 so that assembly 34 may provide a sealing member along two sides if desired. In the latter case, assembly 32 would only apply sealing material along two sides.

It will be understood that various modifications can be made to the above-described embodiments without departing from the spirit and scope of the invention and the preferred embodiments described.

I CLAIM:

1. An apparatus for applying a length of spacer material to a substrate having sides and ends comprising:

advancing means for advancing the substrate laterally from a first position to a second position relative to a spacer applying means;

at least one pair of spacer applying means, wherein said applying means is mounted such that at least one of said applying means is able to pivot relative to the other of said pair of applying means, said applying means being operatively spaced from the substrate for applying spacer material to at least one side and one end of the substrate including means for placing a length of spacer material onto juxtaposition with said substrate and means for partially cutting said spacer material at a corner position in the length of said spacer material; and

means for reciprocally advancing the applying means transversely relative to the substrate.

2. An apparatus as defined in claim 1, wherein the applying means further includes means for rotating said applying means from a first direction to a second direction in which spacer material is to be applied to said substrate during lateral movement of the substrate.

3. An apparatus as defined in claim 2, wherein said apparatus includes means for rotating said applying means to a third direction in which spacer material is to be applied to said substrate during reciprocal transverse movement relative to the substrate.

4. An apparatus as defined in claim 1, wherein said applying means further includes feeding and dispensing means for placing the spacer material on the substrate.

5. An apparatus as defined in claim 4, wherein said dispensing means comprises a suitable channel in a lower housing portion of the applying means.

6. An apparatus as defined in claim 5, wherein said feeding means comprises a controlled drive means for advancing spacer material through the channel in the lower housing.

7. An apparatus as defined in claim 6, wherein applying means further includes pressure means within the channel.

8. An apparatus as defined in claim 7, wherein said pressure means comprise at least one pressure roller for applying pressure on the spacer material as it is dispensed onto the substrate.

9. An apparatus as defined in claim 1, wherein means for partially cutting the spacer material comprise a punch and piston assembly.

10. An apparatus as defined in claim 9, wherein the applying means further includes means for severing the spacer material.

11. An apparatus as defined in claim 1, wherein said advancing means comprises at least one endless belt extending from an inlet end towards a discharge end.

12. An apparatus as defined in claim 11, including a transverse beam for supporting applying means operatively spaced from the substrate, and including means for reciprocally advancing applying means transversely relative to the substrate.

13. An apparatus as defined in claim 12, wherein the applying means are vertically movable above the surface of the substrate.

14. An apparatus as defined in claim 13, further including at least one bracket telescopically linked to the applying means for supporting the spacer material above the substrate.

15. An apparatus as defined in claim 12, including a second means for applying an additional length of spacer material to one side of said substrate, said second means operating independently from said first means.

16. An apparatus as defined in claim 15, wherein the second means for applying spacer material includes dispensing means comprising a channel in a lower portion of a housing of the applying means.

17. An apparatus as defined in claim 16, wherein the second means for applying spacer material includes means for partially cutting the spacer material.

18. An apparatus as defined in claim 17, wherein the second applying means further includes means for severing the spacer material.

19. An apparatus as defined in claim 15, wherein there is included a means for moving the second applying means out of the way of the first applying means at certain points in the travel of the first applying means.

20. An apparatus as defined in claim 1, including at least one sensor for indicating the presence of a substrate in a first position on the conveyor.

21. An apparatus as defined in claim 1, including at least one sensor for indicating the edge of the substance.

22. An apparatus as defined in claim 1, including a supply roll associated with each applying means for providing a continuous length of spacer material to the applying means.

23. A method of applying a length of spacer material to at least one side and one end of a substrate comprising the steps of:

advancing a substrate to a start position;

receiving a length of spacer material in an applying means;

discharging spacer onto the substrate surface at a start position;

advancing said applying means and simultaneously applying spacer material to a first end of the substrate;

cutting a discontinuity in the spacer material at the corner location;

rotating said applying means forming a corner fold in the spacer material at the cut;

advancing the substrate to a second position and simultaneously applying spacer material to a first side.

24. A method as defined in claim 23, wherein a second applying means simultaneously applies spacer material to a second side while the substrate advances.

25. A method as defined in claim 24, including the further steps of:

cutting a discontinuity in the spacer material at a second corner location;

rotating said first applying means forming a corner fold in the spacer material at the cut;

advancing said first applying means in a reciprocal direction and simultaneously applying spacer material to a second end of the substrate.

26. A method as defined in claim 23, including the initial step of sensing the substrate at the start position and stopping the advance of the substrate in the start position.

27. A method as defined in claim 23, including the step of sensing the edge of the substrate to determine the corner location prior to cutting a discontinuity in the spacer material.

28. A method as defined in claim 25, including the steps of severing the length of spacer material applied to the substrate by each applying means from a continuous length of spacer material.

29. A method as defined in claim 28, wherein the severing step cuts a notch in the spacer material to form a corner between the severed ends of the spacer material.

30. A travelling applicator head for applying adhesive spacer material to a substrate in a spacer application station in the production of insulated windows, comprising:

a traveller for supporting the applicator head at a distance from the substrate;

a drive means for selective transverse reciprocating movement of the traveller and the applicator head;

a central housing rotatively supporting the applicator head on the traveller;

a lead section comprising a pair of lead gripping members defining a first channel therebetween;

a lag section comprising a pair of lag gripping members defining a second channel therebetween, at least one of said lag section and said lead section being mounted for pivotal movement relative to the other at said lead section and said lag section, defining in combination an application channel for positioning the spacer material on the substrate.

31. The travelling applicator head as defined in claim 30 further comprising a pressure means within the application channel for applying pressure to the spacer material received therein against the substrate.

32. The travelling applicator head as defined in claim 31, wherein the pressure means comprises a first pressure wheel within the lead section and a second pressure wheel within the lag section, each vertically moveable from an engaged

position impinging on the spacer material within the application channel to a released position above the spacer material.

33. The travelling applicator head as defined in claim 31, further comprising a controlled feed means for advancing the spacer material into the application channel.

34. The travelling applicator head as defined in claim 30, wherein the applicator head is vertically moveable above the surface of the substrate.

35. A travelling applicator head as defined in claim 30, wherein the central housing comprises two concentric shafts pivotally connecting the lead and lag sections for movement from a first substantially aligned position wherein said lead and lag sections are substantially aligned relative to each other, for applying spacer material to a second configuration wherein the lead and lag sections are disposed at substantially 90° relative to each other for applying the spacer material to corners of the substrate.

36. The travelling applicator head as defined in claim 35, wherein the lead section and the lag section are each selectively moveable from an operative position permitting the spacer material to pass through the application channel to an immobilized position securing the spacer material within the application channel independently of one another in a coordinated sequence.

37. The travelling applicator head as defined in claim 30 wherein the lag section is additionally selectively moveable in a vertical orientation above the substrate to permit the lag section to pivot over the spacer material in a coordinated sequence as the lag section returns to said aligned position from said second configuration after applying the spacer material to at least one of said corners.

38. The travelling applicator head as defined in claim 30, further comprising a cutting member and a cooperating anvil for cutting a notch in the spacer material in the area of the spacer material which is bent when applied to at least one of said corners.

39. The travelling applicator head as defined in claim 30, further including at least one follower telescopically linked to the traveller for supporting the spacer material above the substrate.

40. The travelling applicator head as defined in claim 30, wherein said lag section is mounted for pivotal movement relative to said lead section.

41. An apparatus for applying adhesive spacer material to a substrate, comprising:

a support means for supporting the substrate;

a beam oriented transversely to the support means;

at least one travelling applicator head for applying spacer material to the substrate supported on the beam spaced from the substrate;

at least one feed reel for supplying spacer material to the at least one travelling applicator head;

means for advancing the at least one travelling applicator head relative to the substrate;

wherein the at least one applicator head includes:

drive means for providing reciprocal movement of the at least one applicator head on the beam;

a central housing secured to the drive means about which the at least one applicator head is rotatable;

a lead section and a lag section mounted to the central housing and defining an application channel for receiving the spacer material and applying it to the substrate, said lead and lag sections each comprising spaced-apart gripper

members, at least one of said lead and lag sections being mounted for pivotal movement relative to the other of said sections.

42. An apparatus as defined in claim 41, further comprising a stationary applicator head for applying a length of spacer material while the substrate is advanced relative to the stationary head and feed means for supplying spacer material to the stationary applicator head.

43. An apparatus as defined in claim 42, wherein the stationary head can be advanced from a first resting position to a second operational position for applying a length of spacer material sequentially in cooperation with the travelling head, and returned to the first storage position when not in use.

44. An apparatus as defined in claim 41, further including a CPU controller, and a conveying means for conveying a substrate to and away from said apparatus for applying said spacer material to said substrate, and at least one sensor for indicating the presence of a substrate on the conveyors to the CPU controller.

45. An apparatus as defined in claim 42, wherein the stationary applicator head further includes a pair of aligned grippers independently moveable relative to one another defining an application channel in the stationary applicator head.

46. An apparatus as defined in claim 42, wherein the stationary applicator head is supported on the beam above the support means and includes drive means for advancing the stationary applicator head from a resting position to an operative position above the substrate.

47. An apparatus as defined in claim 41, wherein the stationary applicator head includes a pressure wheel within each gripper, each pressure wheel vertically moveable from an engaged position impinging on the spacer material in the

application channel to a released position above the spacer material in the application channel.

48. An apparatus as defined in claim 41, wherein the support means comprises an infeed conveyor and an outfeed conveyor for advancing the substrate while the applicator head applies spacer material.

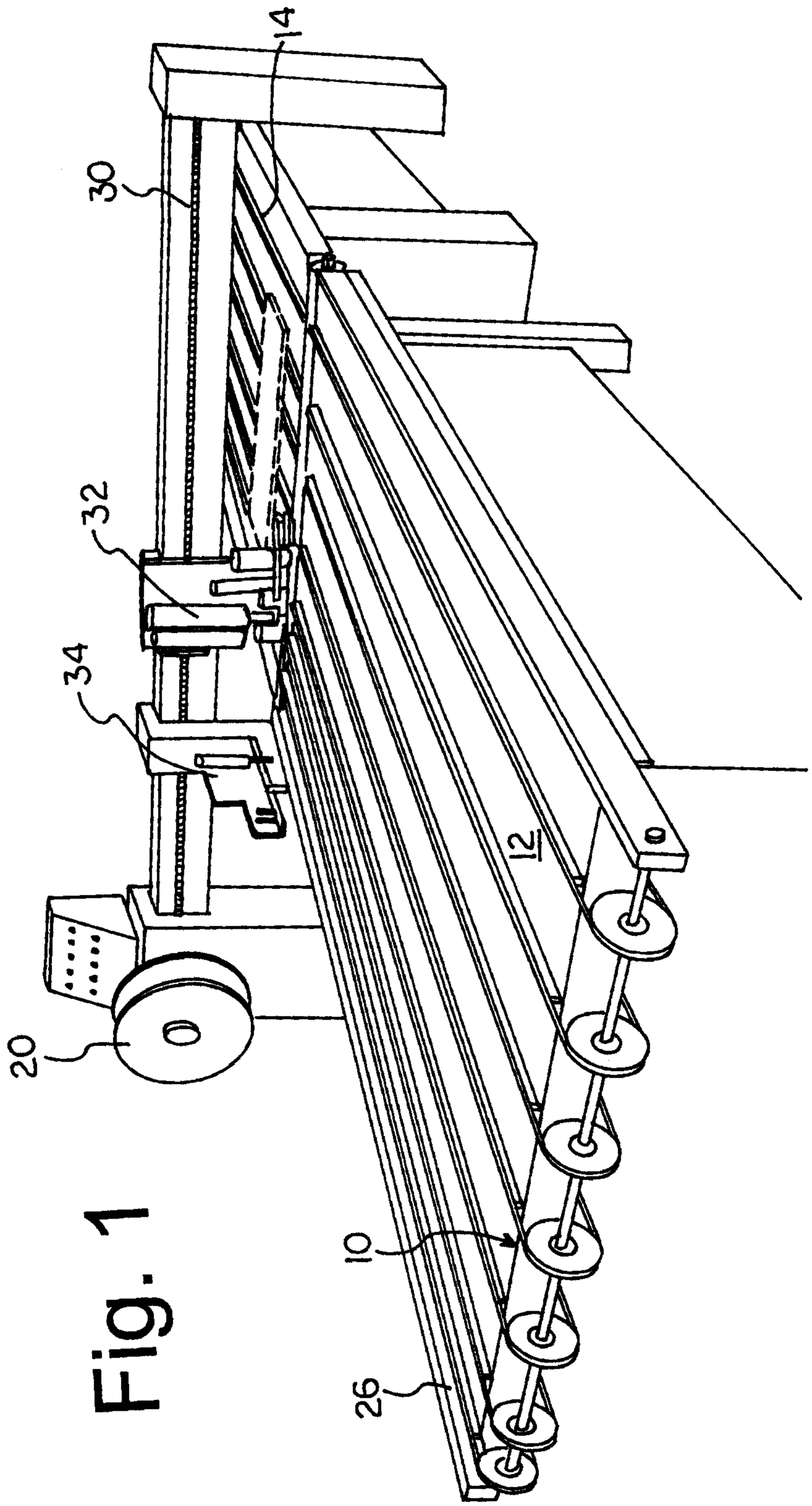


Fig. 1

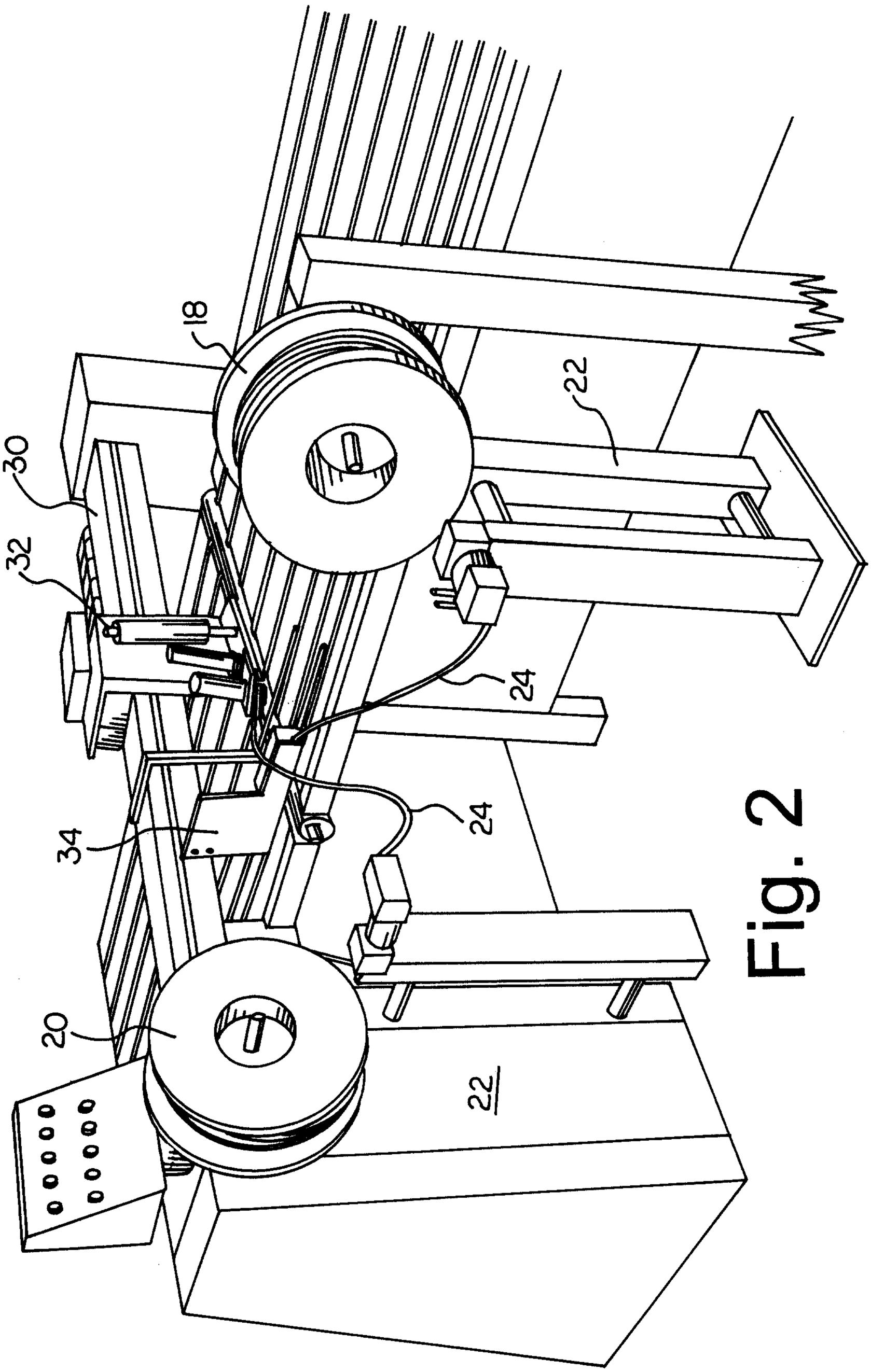


Fig. 2

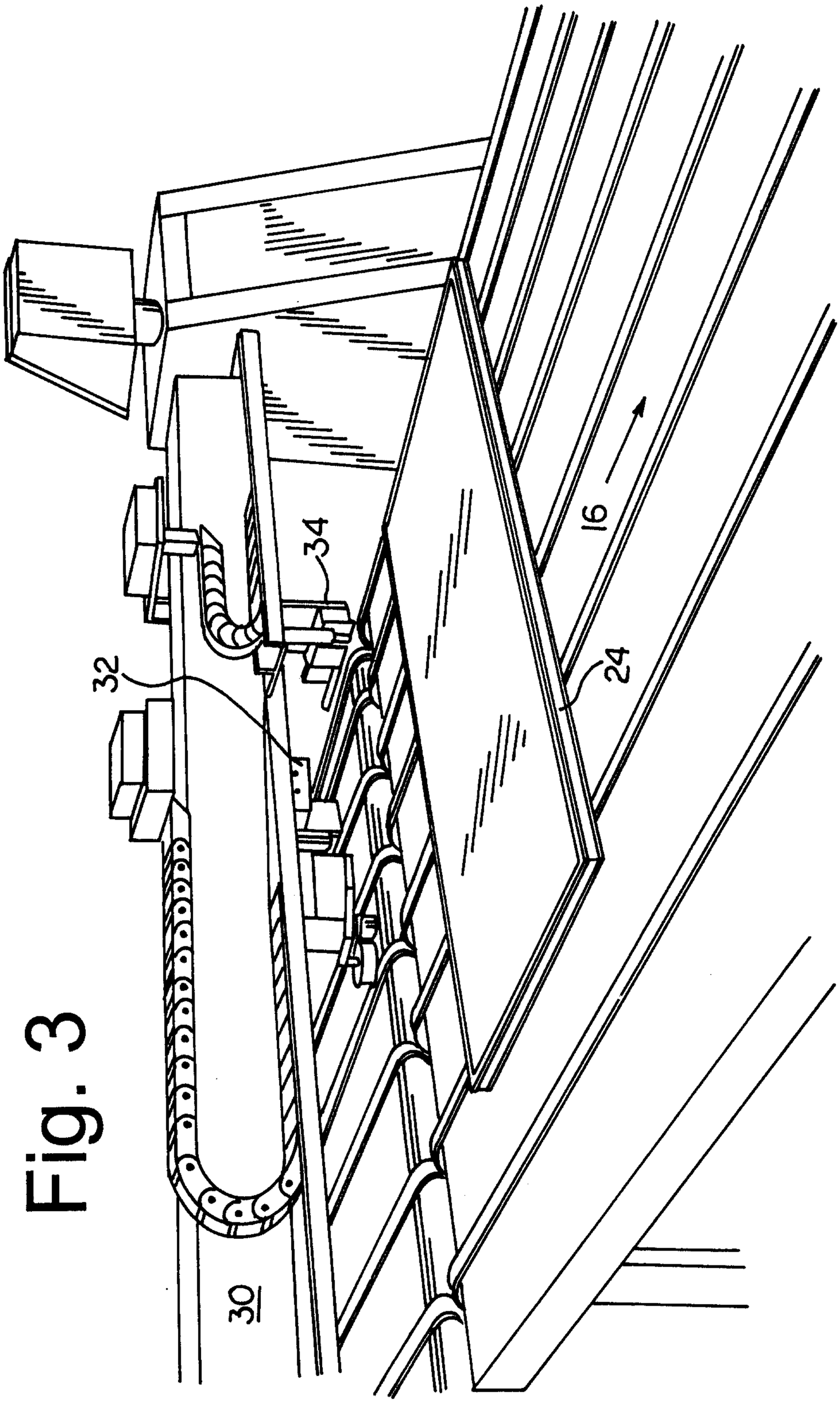


Fig. 3

4/12

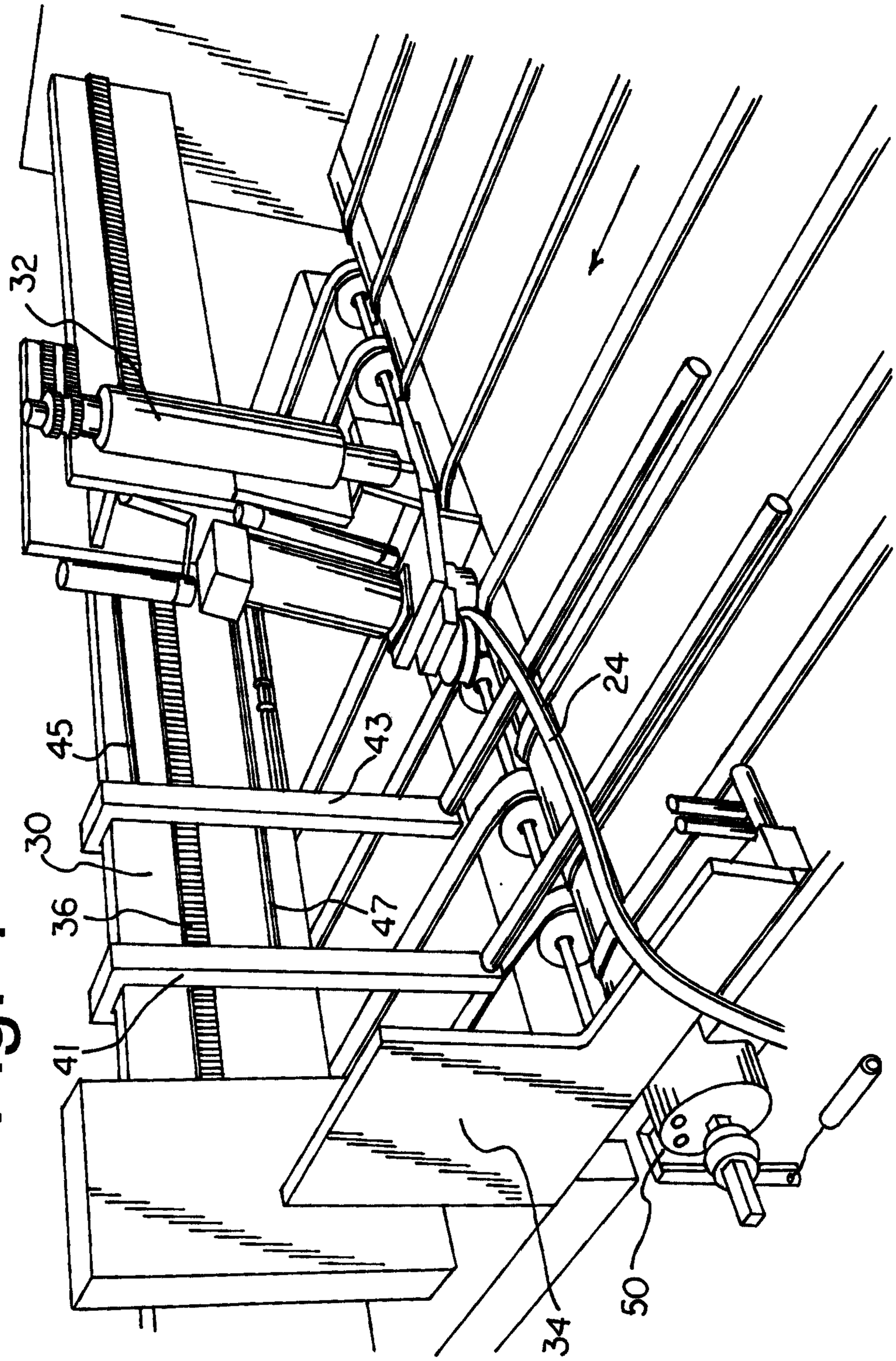


Fig. 4

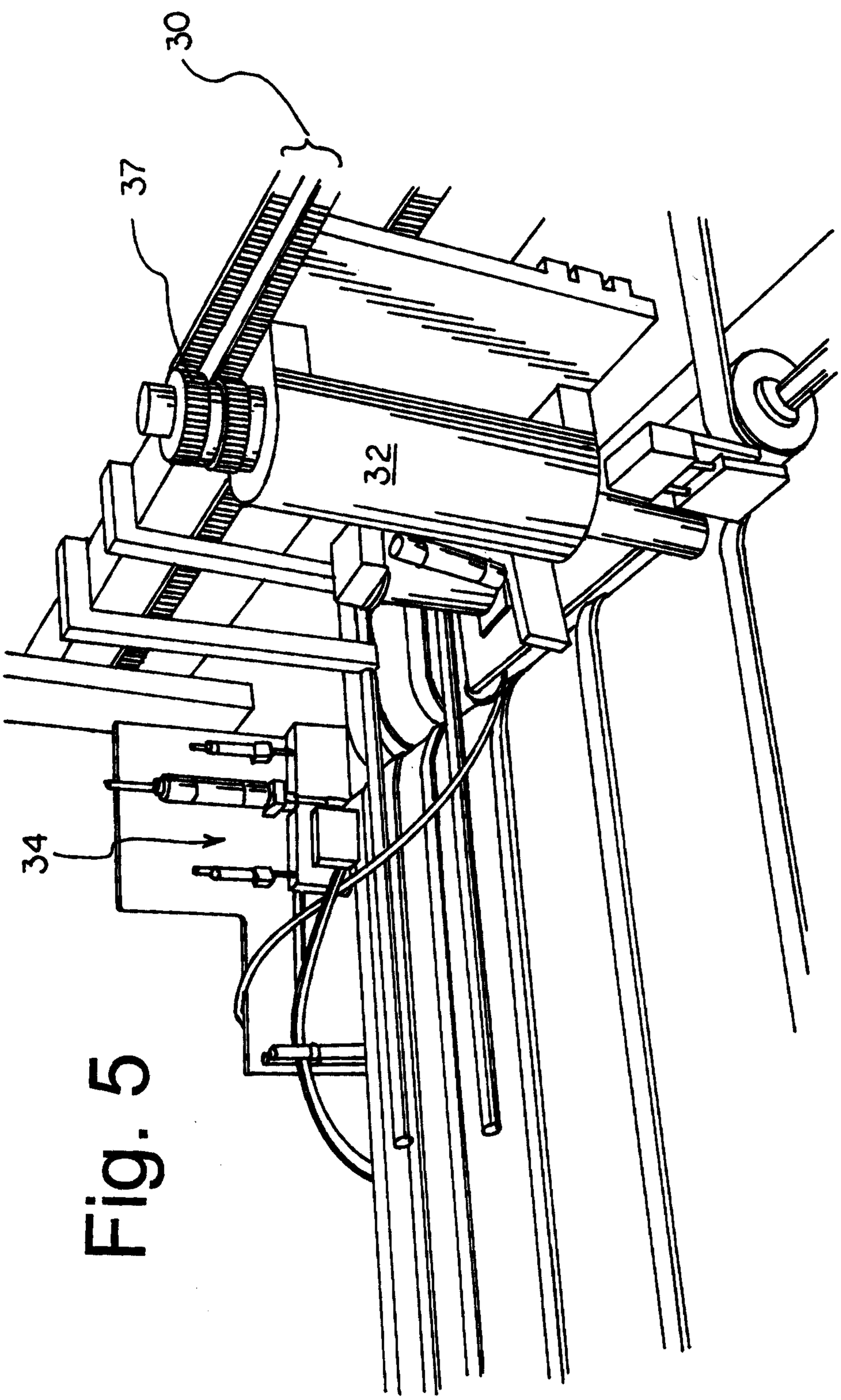


Fig. 5

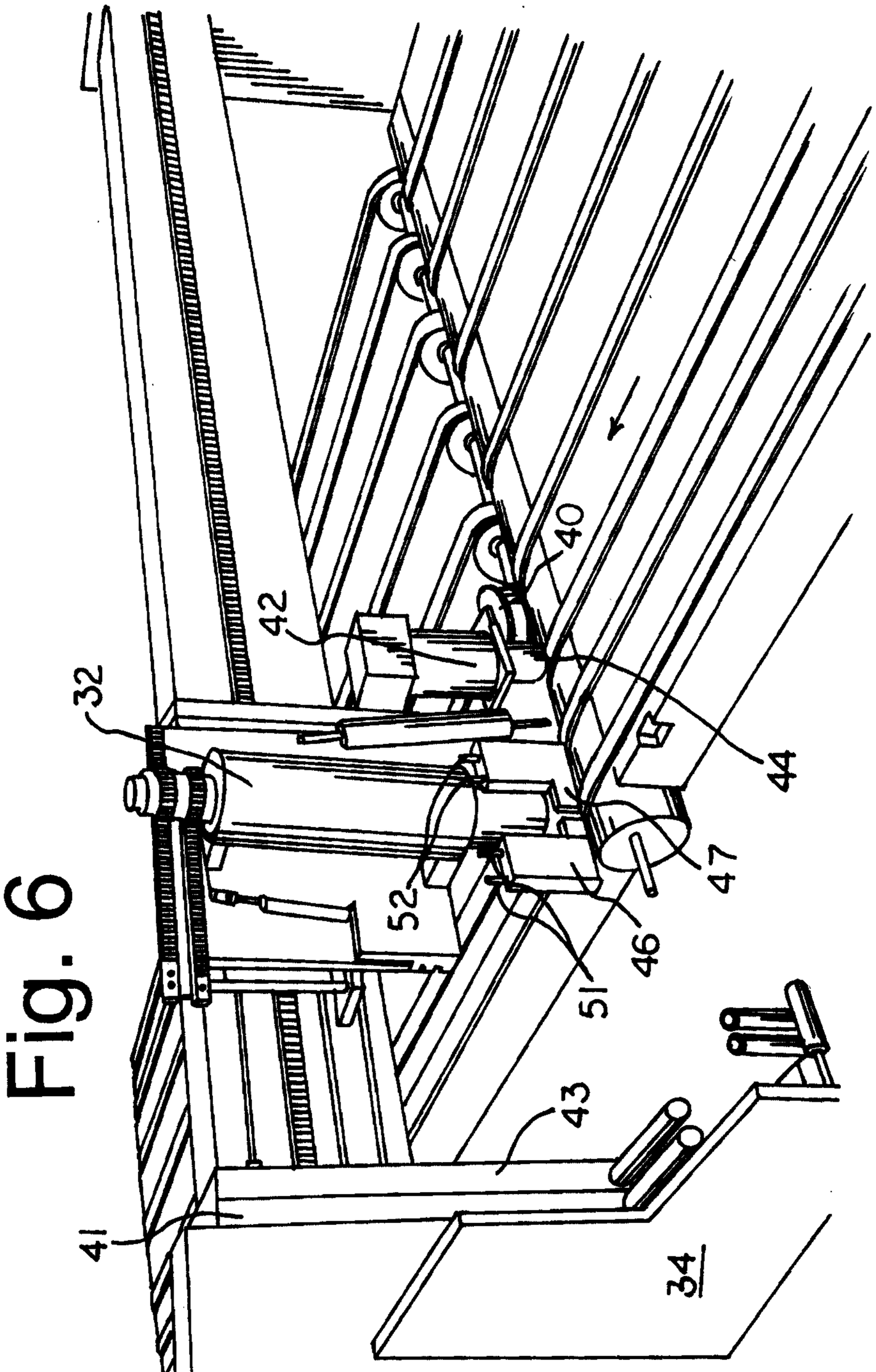
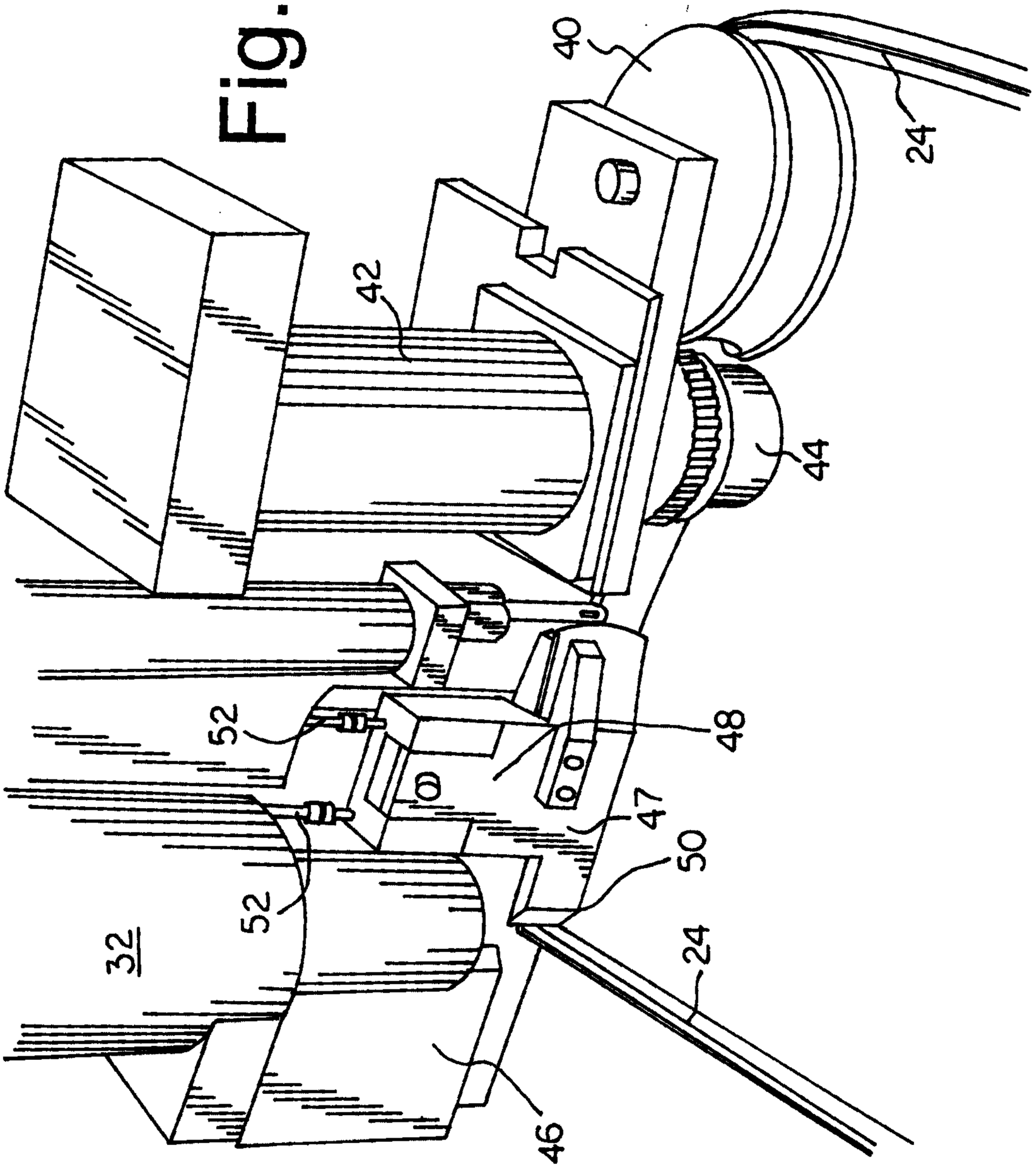


Fig. 6

Fig. 7



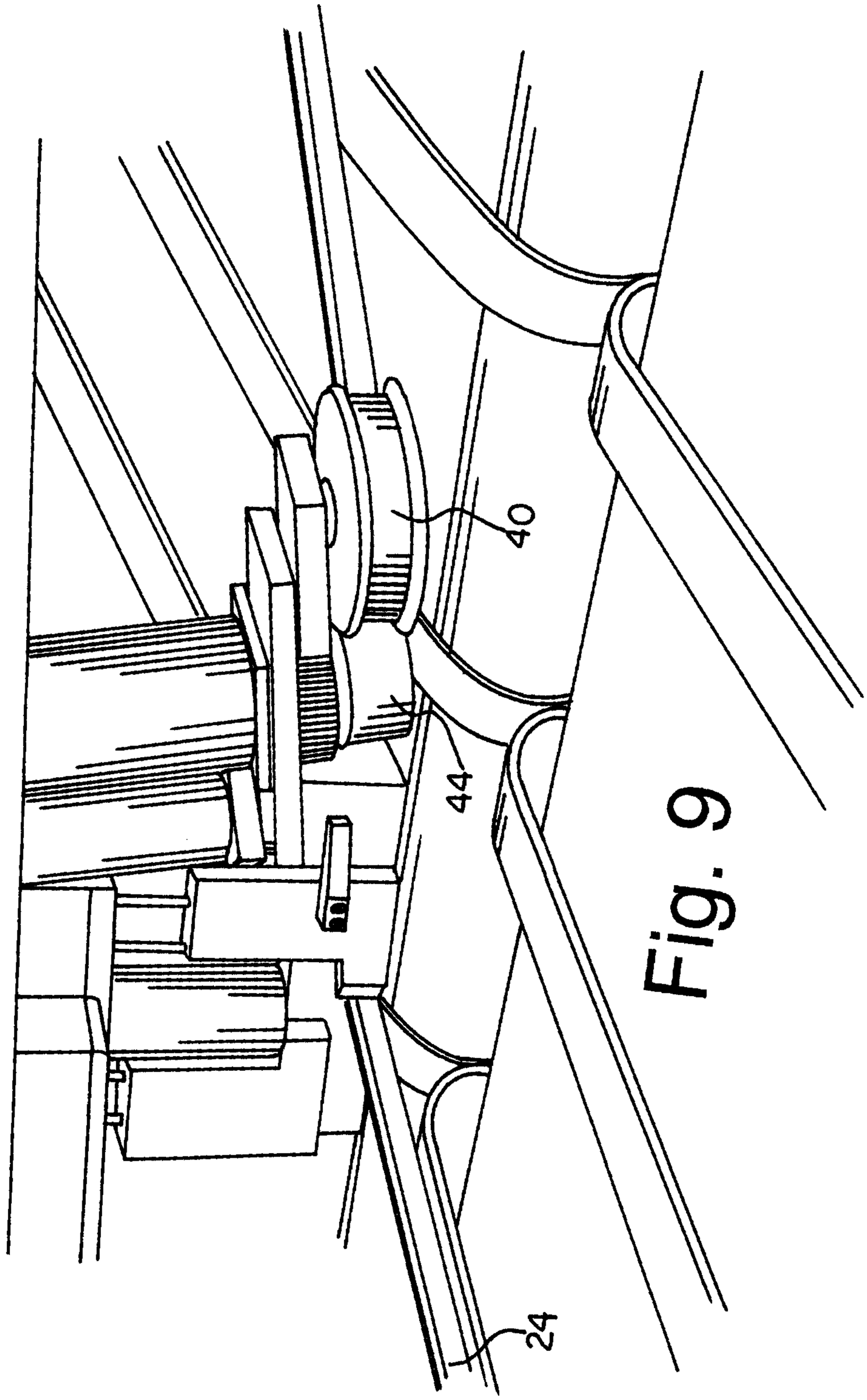


Fig. 6

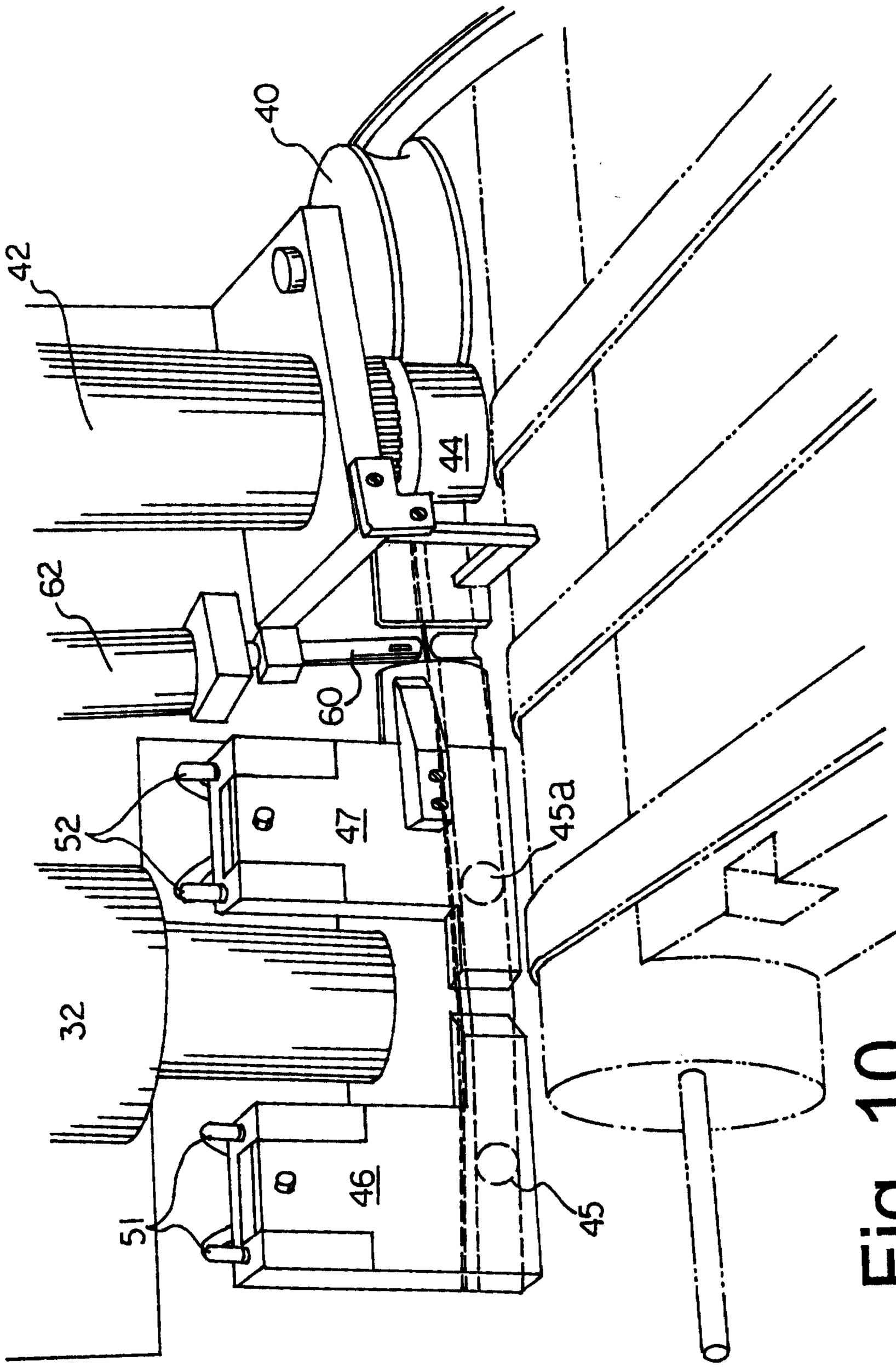


Fig. 10

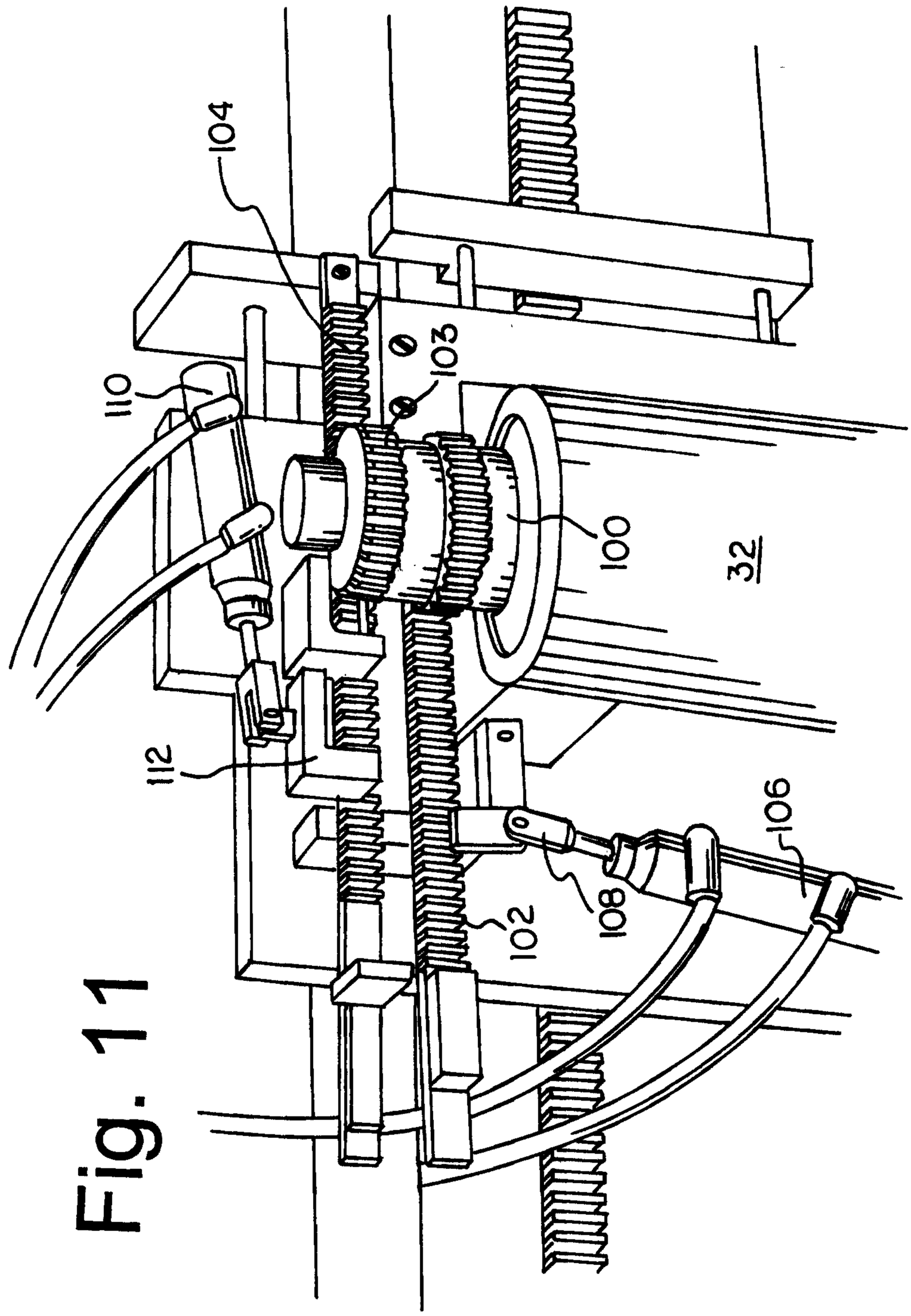


Fig. 11

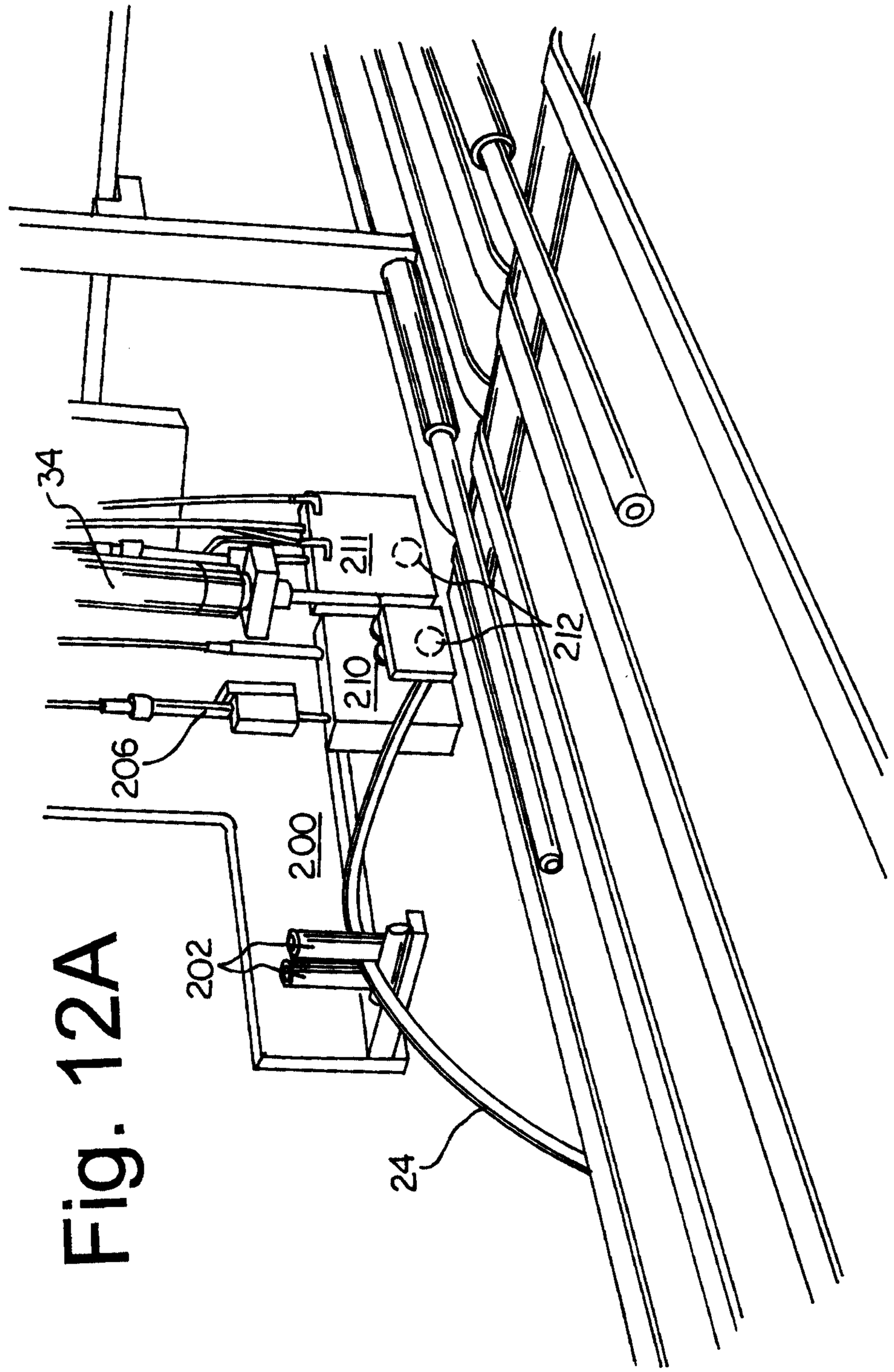


Fig. 12A

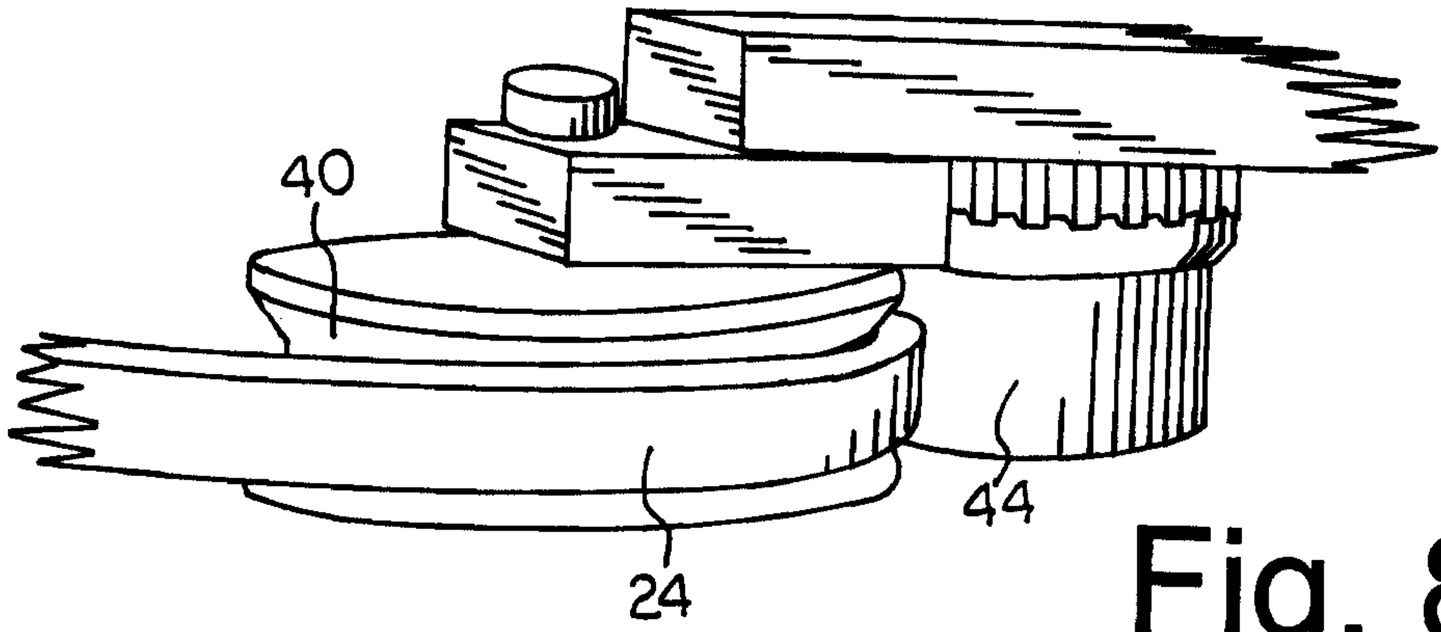


Fig. 8

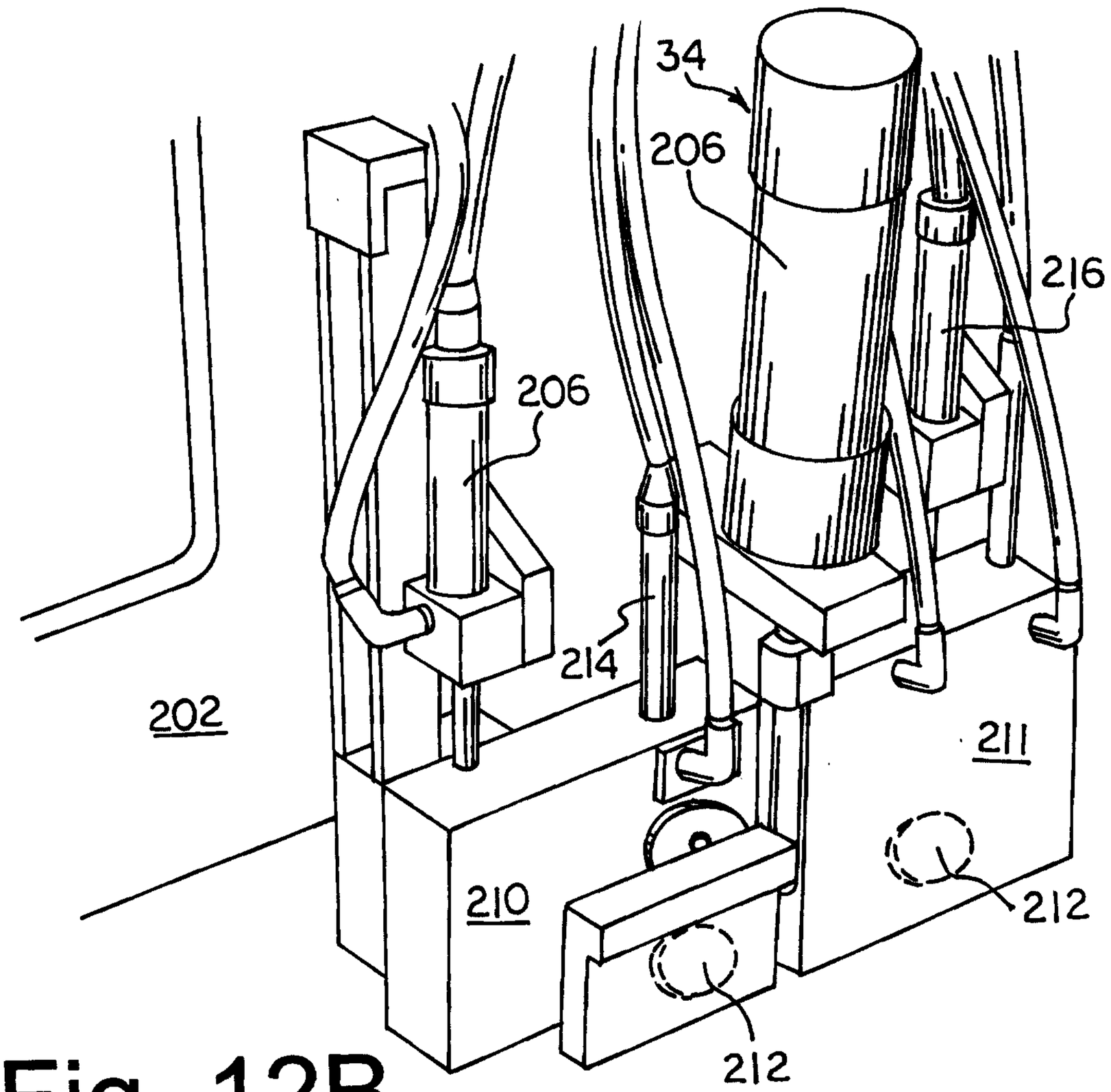
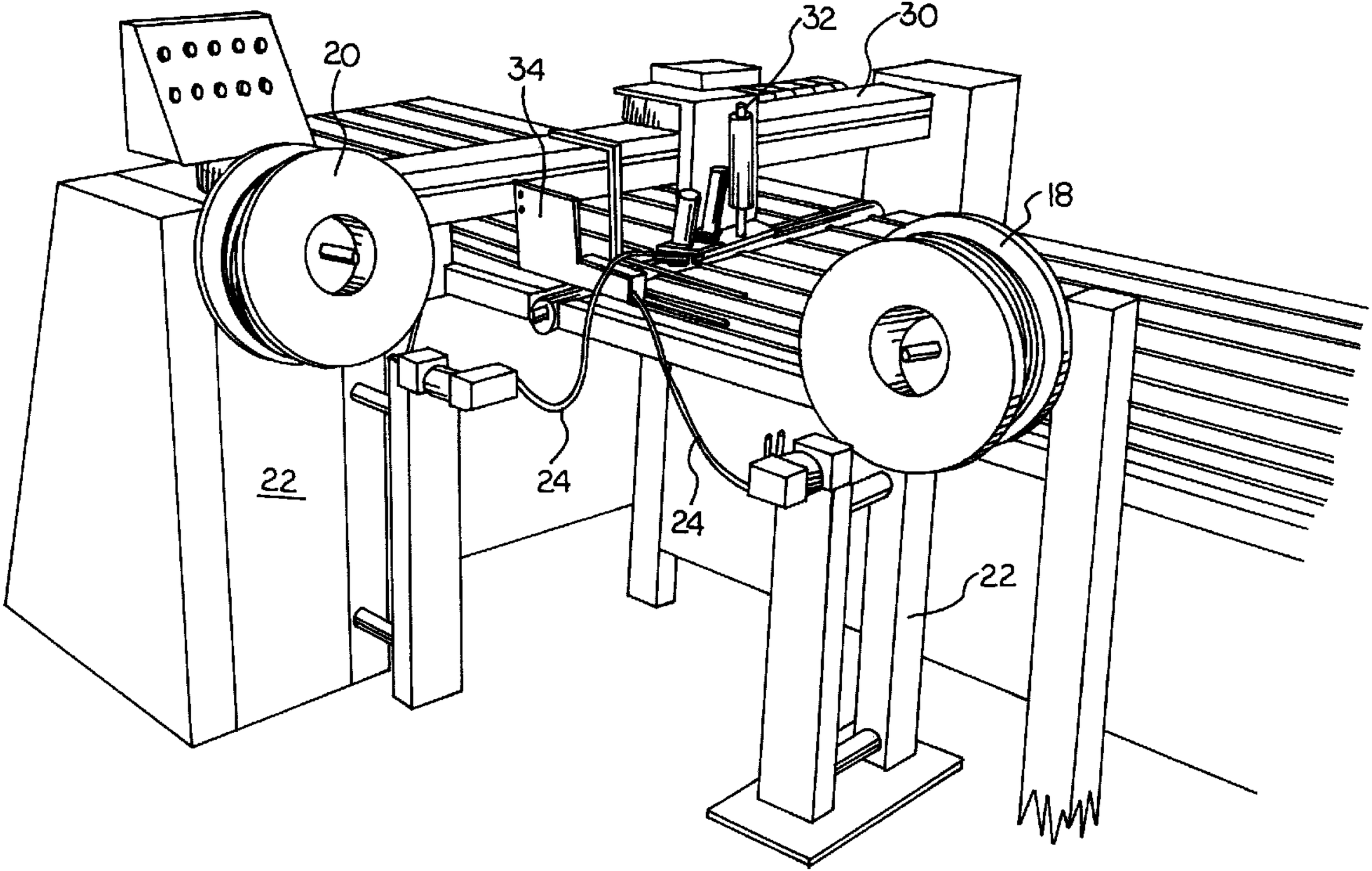


Fig. 12B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