

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
8 March 2007 (08.03.2007)

PCT

(10) International Publication Number  
**WO 2007/027650 A1**

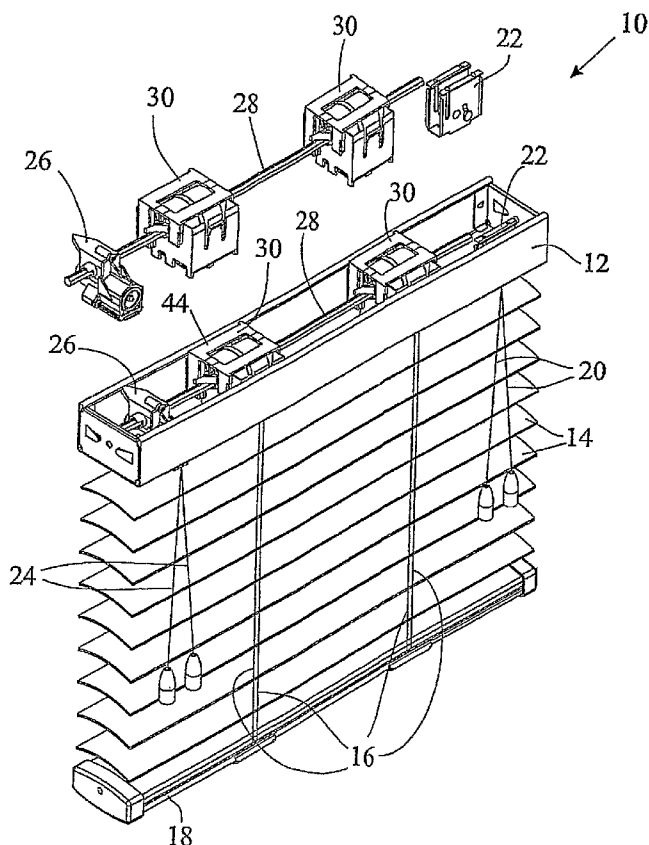
- (51) International Patent Classification:  
E06B 9/322 (2006.01)
- (21) International Application Number:  
PCT/US2006/033619
- (22) International Filing Date: 28 August 2006 (28.08.2006)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
60/714,139 2 September 2005 (02.09.2005) US
- (71) Applicant (for all designated States except US): **HUNTER DOUGLAS INC.** [US/US]; 2 Park Way, Upper Saddle River, New Jersey 07458 (US).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **FRASER, Donald, E** [US/US]; 1836 Fawn Creek Drive, Owensboro, Kentucky 42303 (US).
- (74) Agent: **CAMORIANO, Theresa, Fritz**; 8225 Shelbyville Road, Louisville, Kentucky 40223 (US).

- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:  
— with international search report

[Continued on next page]

(54) Title: SELECTIVE TILTING ARRANGEMENT FOR A BLIND SYSTEM FOR COVERINGS FOR ARCHITECTURAL OPENINGS



(57) Abstract: A tilter system for a window blind permits the slats of the blind to be tilted open or closed in a number of different configurations depending on the routing of tilt cables or actuator cords.

WO 2007/027650 A1



---

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## SELECTIVE TILTING ARRANGEMENT FOR A BLIND SYSTEM FOR COVERINGS FOR ARCHITECTURAL OPENINGS

### BACKGROUND OF THE INVENTION

5 This application claims priority from U. S. Provisional Application S/N 60/714,139 filed September 2, 2005, which is hereby incorporated by reference.

The present invention relates to coverings for architectural openings, and, more specifically, to horizontal blinds, such as Venetian blinds, designed to selectively tilt open or tilt closed portions of the blind, or to tilt open at double the  
10 standard pitch, while having the look of a conventional blind when tilted closed with either the room-side up or the room-side down.

Typically, a Venetian blind has a top head rail or other frame member, which both supports the blind and hides the mechanisms used to raise and lower or open and close the blind. The raising and lowering is done by a lift cord attached to the  
15 bottom rail (or bottom slat). The slats, which are supported from the head rail, may be allowed to tilt so as to open the blind to allow a maximum of light through the blind, or to close the blind with the room-side down (the edges of the slats which are closest to the room are facing down, which means that the other edges of the slats, the edges which are closest to the window or the wall, will be facing up), or to close  
20 the blind with the room-side up.

Tilting the blind closed may be done for the purpose of blocking out light, or for obtaining privacy, or both. In order to obtain the optimum performance from the blind, it may be desirable to open one portion of the blind while closing another portion of the blind. For instance, it may be desirable, in an office setting, to tilt  
25 closed the lower portion of the blind in order to block the glare of sunlight on a computer screen, or to provide privacy so someone standing outside the window cannot stare through the window and see what is on going on inside the room. However, at the same time, it may be desirable to have the upper portion of the blind tilted open to allow some natural light and/or ventilation into the room. Another  
30 instance of an application for such a "split" blind design may be in a home where the floor of the house is at a higher elevation than the ground outside. A person standing in the house could freely see outside, but a person from the outside could

not effectively see inside except for the uppermost reaches as allowed by the open section of the blind.

In addition to the issue of privacy and glare elimination, the light control feature of the split blind design (also referred to as selective tilt design) is also beneficial in that it minimizes the ultraviolet light deterioration resulting from sunlight impacting on interior furnishings, rugs, hardwood floors, etc. while still maintaining indirect lighting from the outside as well as a clear view of the outside. This is particularly practical and applicable in buildings with a roof overhang over the window area or where the windows are recessed into the wall, creating an overhang.

In some instances it is desirable to "tilt open" the blind as much as possible in order to allow more light through the blind or to allow more unhindered viewing area. In this instance, it is possible to achieve this using standard width slats wherein adjacent pairs of slats move together to stack against each other when tilted open, resulting in a "double pitch" arrangement. In this double pitch arrangement, the open area between adjacent pairs of slats is essentially twice the open area that would be achieved if the slats were spaced apart equally in the normal arrangement, thus the "double pitch" designation.

In still other instances, it is desirable to tilt a slat closed in one direction (say, room-side up) while the slats immediately adjacent this slat are closed in the other direction (room-side down). This results in an aesthetically-pleasing "pleated look" (also sometimes referred to as a Tiffany look) of the blind when in the closed position.

## SUMMARY

In one embodiment, a blind system allows the user to tilt open or tilt closed the entire blind, as well as to selectively tilt open one portion of the blind while another portion of the blind is tilted closed.

In another embodiment, a blind system allows the user to tilt closed the slats as in a conventional blind (either room-side up or room-side down), but tilt open to double the standard pitch.

In another embodiment, a blind system allows the user to tilt the slats open as in a conventional blind but tilt the slats closed in alternating directions (one is room-side up while the next slat is room-side down) to create a "pleated" look.

5 Various embodiments of the present invention provide drum portions with tilt cables and/or actuator cords connected to the various drum portions. Since both the tilt cables and the actuator cords serve to actuate the slats of the blind, the terms "tilt cable" and "actuator cord" are sometimes used interchangeably in this specification.

10 One tilt mechanism uses two drums that are co-axially aligned, mounted in a housing, and with a tilt rod extending through the axis of rotation of the drums. The tilt rod engages a drum driver which, in turn, engages one or the other of the two drums of the spool.

Another tilt mechanism uses two drums that are substantially parallel but not co-axial to each other. These two drums are independently driven by separate tilt rods extending through the axes of rotation of their respective drums.

15 Various securing and routing arrangements of the tilt cables (or actuator cords) to the drums result in both types of tilt mechanisms being able to achieve any of the desired capabilities.

#### **BRIEF DESCRIPTION OF THE DRAWINGS:**

20 Figure 1 is a perspective view of a first embodiment of a blind system made in accordance with the present invention, with a partially exploded perspective view of the mechanism inside the head rail also shown above the blind;

Figure 2 is a perspective view of one of the tilt stations of Figure 1, with the housing cover removed for clarity;

25 Figure 3 is an exploded, perspective view of the tilt station of Figure 2;

Figure 3B is a perspective view of a vertical section taken along the axis of rotation, of the tilt station of Figure 2;

Figure 4 is a perspective view of one of the drums of Figure 3;

Figure 5 is an opposite end, perspective view of the drum of Figure 4;

30 Figure 6 is a front end view of the drum of Figure 5;

Figure 7 is a perspective view of the other drum of Figure 3;

Figure 8 is an opposite end, perspective view of the drum of Figure 7;

Figure 9 is a perspective view of the housing of the tilt station of Figure 3;

Figure 10 is a lower angle, opposite end, perspective view of the housing of

5 Figure 9;

Figure 11 is a perspective view of the drum driver of the tilt station of Figure 3;

Figure 12 is an opposite end, perspective view of the drum driver of Figure 11;

Figures 13-15 are a series of perspective views depicting the assembly

process of the two drums, the drum driver, and the spring of Figure 3;

10 Figure 16 is a section view through the drum of Figure 5;

Figures 17-19 are a continuation of the series of perspective views depicting the assembly process of the two drums, the drum driver, and the spring of Figure 3;

Figure 20 is schematic, perspective view, partially broken away, of the blind of Figure 1, showing the position of the drums and the routing of the tilt cables for a double pitch configuration, as well as corresponding end views of the drums to more clearly indicate the relative rotational positions of the drums;

15 Figure 21 is similar to Figure 20 but showing the positions of the slats of the blind and of the drums when the blind is closed room-side down;

Figure 22 is similar to Figure 20 but showing the positions of the slats of the blind, and of the drums when the blind is closed room-side up;

20 Figure 23 is schematic, perspective view, partially broken away, of the blind of Figure 1, showing the position of the drums and the routing of the tilt cables for a tilting configuration that permits opening of one portion of the blind while another is closed, as well as corresponding end views of the drums to more clearly indicate the relative rotational positions of the drums;

25 Figure 24 is similar to Figure 23 but showing the positions of the slats of the blind and of the drums when the blind is closed room-side up;

Figure 25 is similar to Figure 23 but showing the positions of the slats of the blind, and of the drums when the lower portion of the blind is closed room-side down while the upper portion of the blind remains tilted open;

30

Figure 26 is schematic, perspective view, partially broken away, of the blind of Figure 1, showing the position of the drums and the routing of the tilt cables for a pleated look and double pitch configuration, as well as corresponding end views of the drums to more clearly indicate the relative rotational positions of the drums;

5 Figure 27 is similar to Figure 26 but showing the positions of the slats of the blind, and of the drums when the blind is pleated closed in one direction;

Figure 28 is similar to Figure 27 but showing the positions of the slats of the blind, and of the drums when the blind is pleated closed in an opposite direction;

10 Figure 29 is a perspective view of another embodiment of a blind system made in accordance the present invention, with a partially exploded perspective view of the mechanism inside the head rail also shown above the blind;

Figure 30 is a perspective view of the indexing gear mechanism of the blind of Figure 29;

15 Figure 31 is an exploded perspective view of the indexing gear mechanism of Figure 30;

Figure 32 is a partially exploded perspective view of the indexing gear mechanism of Figure 30;

Figure 33 is a view along line 33-33 of Figure 32;

20 Figure 34 is a perspective view of the housing cover for the indexing gear mechanism of Figure 31;

Figure 35 is a perspective view of one of the driven gears of the indexing gear mechanism of Figure 31;

Figure 36 is a perspective view of the indexing gear of the indexing gear mechanism of Figure 31;

25 Figure 37 is a perspective view of one of the tilt stations of the blind of Figure 29;

Figure 38 is an exploded perspective view of the tilt station of Figure 37;

30 Figure 39 is a perspective view of one of the drums of the tilt station of Figure 37;

Figure 40 is a perspective view of the housing of the tilt station of Figure 37;

Figure 41 is schematic, perspective view, partially broken away, of the blind of Figure 29, showing the position of the drums and the routing of the tilt cables for a double pitch configuration, as well as the corresponding view of the indexing gear mechanism to more clearly indicate the relative rotational positions of the driven  
5 gears;

Figure 42 is similar to Figure 41 but showing the positions of the slats of the blind, of the drums, and of the indexing gear mechanism when the blind is closed room-side down;

Figure 43 is similar to Figure 42 but showing the positions of the slats of the  
10 blind, of the drums, and of the indexing gear mechanism when the blind is closed room-side up;

Figure 44 is schematic, perspective view, partially broken away, of the blind of Figure 29, showing the position of the drums and the routing of the tilt cables for a tilting configuration that permits part of the blind to be open while another part is  
15 closed, as well as the corresponding view of the indexing gear mechanism to more clearly indicate the relative rotational positions of the driven gears;

Figure 45 is similar to Figure 44 but shows the positions of the slats of the blind, of the drums, and of the indexing gear mechanism when the lower portion of the blind is closed room-side down while the upper portion of the blind remains tilted  
20 open;

Figure 46 is similar to Figure 44 but shows the positions of the slats of the blind, of the drums, and of the indexing gear mechanism when the upper portion of the blind is closed room-side up while the lower portion of the blind remains tilted  
open;

Figure 47 is schematic, perspective view, partially broken away, of the blind of Figure 29, showing the position of the drums and the routing of the tilt cables for a pleated look and double pitch configuration, as well as the corresponding view of the indexing gear mechanism to more clearly indicate the relative rotational positions of  
25 the driven gears;



Figure 48 is similar to Figure 47 but shows the positions of the slats of the blind, of the drums, and of the indexing gear mechanism when the blind is pleated closed in one direction; and

5 Figure 49 is similar to Figure 47 but shows the positions of the slats of the blind, of the drums, and of the indexing gear mechanism when the blind is pleated closed in the opposite direction.

## DESCRIPTION:

### Single Tilt Rod, Co-axial drum design

10 The blind 10 of Figure 1 includes a head rail 12 and a plurality of slats 14 suspended from the head rail 12 by means of tilt cables 16 and their associated cross cords 16t (See Figure 20), which together comprise the ladder tapes. Lift cords 20 are fastened at the bottom of the bottom slat (or bottom rail) 18, which typically is heavier than the other slats 14. As is well-known in the art, the lift cords  
15 20 are routed through rout holes in the slats 14, through the head rail 12, and out through a cord lock mechanism 22. Tilt cords 24 operate a cord tilter 26, which is used to rotate a tilt rod 28 about its longitudinal axis in order to actuate the tilt stations 30. In this embodiment, there are two sets of tilt cables 16, which are given more specific designations in Figure 20 as follows:

- 20
- 16 is the generic designation for tilt cables
  - the suffix "a" is used for the first set and "b" is used for the second set of tilt cables
  - the additional suffix "f" or "r" is used to indicate front (room side) or rear (wall side or window side)

25 Note that in some instances, there is no second set of tilt cables. An actuator cord also may be used in some instances (such as in Figure 23) and designated as 16x. The actuator cord 16x runs parallel to the tilt cables 16 and attaches to one of the tilt cables 16 via a knot 32 (See Figure 23) or other fixing means such as via a clip attachment 32, which is described in detail in U. S. Patent No. 6,845,802,

30 Selective Tilting Arrangement for a Blind System for Coverings for Architectural

Openings, which is hereby incorporated herein by reference. While the tilt rod 28 in this embodiment is actuated by a cord tilter 26 (which is described in detail in Canadian Patent No. 2,206,932 "Anderson", dated December 4, 1997 (1997/12/04), which is hereby incorporated herein by reference), it is understood that other types of  
5 actuators may be used, such as a wand tilter or a motorized tilter.

Referring briefly to Figures 2 and 3, the tilt station 30 includes a first drum 34, a second drum 36, a drum driver 38, a lash spring 40, a housing 42, and a housing cover 44.

Referring to Figures 4, 5, 6, and 16, the first drum 34 includes two concentric  
10 cylinders 46, 48 interconnected by a centrally located web 50. The outer cylinder 46 defines two axially-extending slotted openings 52 approximately one hundred twenty (120) degrees apart, as well as an axially-projecting limit stop 54 approximately sixty (60) degrees from one of the two slotted openings 52.

Approximately halfway through its axial dimension, the inner cylinder 48  
15 expands abruptly to a larger diameter inner cylinder 58 throughout a substantial portion of its circumference. This results in a crescent-shaped flange 56 (See Figure 6) extending for approximately two hundred twenty (220) degrees around the circumference of the inner cylinder 48, and this flange 56 terminates at radially-extending shoulders 60, 62. As explained in more detail below, the flange 56 acts to  
20 position and contain the drum driver 38 within the tilt station 30, and the shoulders 60, 62 allow the drum driver 38 to rotationally drive each of the drums 34, 36. The web 50 defines a through opening 64 (See Figure 6) which is used to attach the lash spring 40 to the drums 34, 36, as explained in more detail below.

Referring to Figures 7 and 8, the second drum 36 is identical to the first drum  
25 34, except that the second drum 36 includes an axially-extending, circumferential ring 66 with an inner diameter which is slightly larger than the outer diameter of the outer cylinder 46. This ring 66 is found only on the end of the drum 36 opposite the end defining the slotted openings 52 and the limit stop 54, and this end where the ring 66 is located is referred to as the inner end 68 of the second drum 36, making  
30 the other end the outer end 70. Similarly, the first drum 34 has an inner end 72, and

an outer end 74. When the drums 34, 36 are assembled together, the ring 66 of the second drum 36 overlaps the inner end 72 of the first drum 34 to prevent any of the tilt cables 16 from falling in between the first and second drums 34, 36, as will become apparent below.

5 Referring to Figures 11 and 12, the cylindrically-shaped drum driver 38 defines a non-cylindrically profiled, inner, hollow shaft 76 designed to engage the tilt rod 28 such that rotation of the tilt rod 28 causes rotation of the drum driver 38. The drum driver 38 also includes an axially-extending, rectangular key 78 located halfway  
10 longer than the length of the two drums 34, 36 when assembled together, such that the ends of the drum driver 38 extend beyond the drum assembly, and these ends may be used for rotational support of the drum assembly on the saddles 96, 98 of the housing 42, as described in more detail below. The length of the key 78 is substantially equal to the distance from the flange 56 of the first drum 34 to the  
15 flange 56 of the second drum 36 when the two drums 34, 36 are assembled together. The outside diameter of the drum driver 38 is slightly smaller than the diameter of the inner cylinder 48 of the first and second drums 34, 36. When the drum driver 38 is inserted into the two drums 34, 36, as described in more detail below, the drum driver 38 lies inside of, and is co-axially aligned with, the two drums  
20 34, 36. The key 78 selectively engages the shoulders 60, 62 of the drums 34, 36 depending on the direction of rotation of the tilt rod 28, as explained in more detail below.

As shown in Figure 3, the lash spring 40 includes two axially-extending ends 80, 82 which, as explained in more detail below, extend through the openings 64 in  
25 the webs 50 of the drums 34, 36, respectively, which ties the first and second drums 34, 36 together and preloads them against the key 78 of the drum driver 38. As shown also in Figure 3B, the coils of the lash spring 40 lie in the cavity formed between the outer cylinders 46, the larger diameter portions 58 of the inner cylinders 48 and the webs 50 of the drums 34, 36.

Figures 13-15 and 17-19 depict the process of assembling the two drums 34, 36, the drum driver 38, and the spring 40. Figure 13 indicates that the first step is to insert the end 82 of the spring 40 through the opening 64 (see Fig. 6) in the second drum 36. The next step (Figure 14) is to insert the drum driver 38 into the inner  
5 cylinder 48 of the second drum 36, with one end of the key 78 pushed in (See Figure 15) until it abuts the flange 56 of the second drum 36. Next, the first drum 34 is assembled by inserting the second end 80 of the spring 40 through the opening 64 in the first drum 34, and then bringing the two drums 34, 36 together until their corresponding inner ends 72, 68 meet, and the ring 66 on the second drum 36  
10 overlaps the inner end 72 of the first drum 34 (See Figure 17).

The next step is to bend the ends 80, 82 of the spring 40 which project through the respective openings 64 of the drums 34, 36 in order to secure the ends 80, 82 onto their respective drums 34, 36. A tool 84 (as shown in Figure 17) may be used for this purpose, or the ends may simply be bent using needlenose pliers, a  
15 flathead screwdriver, or other known means. The drums 34, 36 are now assembled with the lash spring 40 and the drum driver 38 inside the assembly. The spring 40 holds the drums 34, 36 together (because the ends 80, 82 of the spring 40 have been bent sideways so they will not slide back out of the drums 34, 36).

The next step (See Figure 18) is to preload the drums 34, 36 against the key  
20 78 of the drum driver 38. This is accomplished by grabbing each drum 34, 36 and separating them just enough for one of the drums 34, 36 to move axially away far enough to clear the key 78 of the drum driver 38. The drum 34 is then rotated counterclockwise 360 degrees relative to the drum 36, and the drums are brought back together once again, and are then released. Both drums 34, 36 immediately  
25 rotate in opposite directions, urged by the biasing force of the lash spring 40, until the first shoulder 60 of the first drum 34 and the second shoulder 62 of the second drum 36 both impact against the key 78 of the drum driver 38. The two drums 34, 36 are now preloaded against the key 78 of the drum driver 38.

As indicated in Figure 19, either drum 34, 36 may be rotated about their  
30 common axis of rotation (which also corresponds to the axis of rotation of the drum

driver 38). If the first drum 34 is rotated clockwise (as seen from the vantage point of Figure 19) while holding the second drum 36 stationary, the second shoulder 62 of the first drum 34 impacts against the key 78 of the drum driver 38, causing the drum driver 38 to rotate clockwise as well. This key 78 in turn impacts against the second  
5 shoulder 62 of the second drum 36 such that the second drum 36 is also caused to rotate clockwise, and the entire assembly rotates as a unit unless and until something impedes such rotation (which, as is discussed below, is precisely what may happen when the limit stop 54 on the drums 34, 36 hits against one of the limit stops on the housing 42).

10 On the other hand, if the first drum 34 is rotated counterclockwise, its second shoulder 62 is moving away from the key 78, such that the first drum 34 may rotate relative to the second drum 36 which may thus remain stationary. However, in order to rotate the first drum 34, one must overcome the preload force of the spring 40.

The same situation is true of the second drum 36, provided that the vantage  
15 point is the opposite end of that of Figure 19. That is, as seen from the rear of Figure 19, the second drum 36 can be rotated clockwise only if the entire assembly rotates with it, and it can be rotated counterclockwise while the first drum 34 remains stationary, provided that the user overcomes the preload force of the spring 40. Throughout the rest of this specification, we will refer to the position of the drums 34,  
20 36 where no external force is acting to overcome the preload force of the spring 40 as the neutral position for the tilt station 30. That is the position in which the first drum 34 has its second shoulder 62 against the key 78 and the second drum 36 has its second shoulder 62 against the key 78.

Referring now to Figures 3, 9, and 10, the housing 42 includes two side walls  
25 86, 88, two end walls 90, 92, and a bottom wall 94. The end walls 90, 92 define "U"-shaped saddles 96, 98 respectively, which provide rotational support of the drum assembly by supporting the ends of the drum driver 38. Arms 100, 102 extend at approximately a 45 degree angle from the planes defined by the end walls 90, 92, and they project over and above the centerline of the tilt rod 28 as it passes through  
30 the drum driver 38, thus preventing the drum assembly from lifting up out of the

housing 42. The ends of the inner cylinders 48 of the drums 34, 46 are larger in diameter than the saddles 96, 98, and the distance between the ends of the inner cylinders 48 is just slightly less than the distance between the saddles 96, 98, so the inner cylinders 48 will abut one of the saddles 96, 98 if the drums 34, 36 are shifted  
5 in an axial direction, thus preventing the drums 34, 36 from shifting very much in the axial direction.

On either side of each saddle 96, 98 there are two shelves 110, 112 (best seen in Figure 3, against the end wall 92, but also present in the opposite end wall 90), with the upper shelf 110 being less recessed (at a higher elevation) than the  
10 lower shelf 112. These shelves 110, 112 act as limit stops by cooperating with the limit stop 54 on their respective drums 34, 36 to limit the degree to which the drums 34, 36 are free to rotate in either direction. This limit stop feature is explained in more detail below.

The bottom wall 94 of the housing 42 defines two elongated slotted openings  
15 104, 106, and a shorter rectangular opening 108. The elongated slotted openings 104, 106 are for the front and rear tilt cables to pass through the housing 42 and through corresponding openings (not shown) in the head rail 12. The shorter rectangular opening 108 is for the lift cords 20.

Referring to Figures 3 and 3B, a housing cover 44 snaps over and onto the  
20 housing 42 to add dimensional integrity to the housing 42 and to prevent the tilt cables 16 from getting tangled or falling off of the drums 34, 36 in the event of a slack condition on the cables 16 (such as when someone physically picks up some of the slats 14 of the blind 10).

Referring to Figures 1 and 3, once the drum assembly has been assembled  
25 and preloaded as described in Figures 13–19, it is dropped into the housing 42, with the ends of the drum driver 38 being rotationally supported by the saddles 96, 98 of the housing 42. The tilt rod 28 is inserted through the hollow shaft 76 of the drum driver 38, and one end of the tilt rod 28 is connected to the cord drive tilter mechanism 26, as shown in Figure 1. Typically, two or more tilt stations 30 are

mounted to the tilt rod 28, and the entire tilt drive assembly is installed in the head rail 12 of the blind 10.

At some point either before or after the installation of the tilt drive assembly onto the head rail 12, the tilt cables 16 are attached to the drums 34, 36 according to the required routing to obtain the desired configuration as explained in more detail below. To attach the tilt cables 16 to the drums 34, 36, an enlargement (such as a knot or bead) is tied to the end of the tilt cable which is to be secured, and this enlargement is inserted behind the desired slotted opening 52 in the outer cylinder 46 of the desired drum 34, 36, with the rest of the tilt cable 16 extending through that slotted opening 52. The enlargement prevents the tilt cable 16 from pulling out of the respective drum 34, 36 and thereby quickly and effectively attaches the tilt cable 16 to its respective drum 34, 36.

### **Double Pitch Configuration**

Figures 20-22 depict the routing of the tilt cables for a typical double pitch blind configuration. In these three figures, and in all similar figures to follow, the routing of the tilt cables 16 and the position of the drums 34, 36 (particularly to depict the relative location of the tie-off points of the ends of the tilt cables 16 to the drums 34, 36) are shown relative to the corresponding position of the slats 14 of the blind 10. For greater clarity, end views of the corresponding drums 34, 36 are included as part of these views in order to help show the location of the tie-off point for each of the tilt cables 16 (tied off at the slotted openings 52 of the drums 34, 36), or the location of the limit stop 54.

As was explained earlier, the tilt cables are generically designated as item 16, but are further identified by the following suffixes:

- "a" is for the first set of tilt cables, those supporting the upper (or top) slat 14t in each pair of top and bottom slats 14t, 14b

- "b" is for the second set of tilt cables, those supporting the lower (or bottom) slat 14b in each pair 14t, 14b

- "f" is for the front tilt cables, those on the room side of the blind
- "r" is for the rear tilt cables, those on the wall side (also referred to as the window side) of the blind
- "x" is for an actuator cord which is typically secured to one of the tilt cables

5 16

Referring briefly to Figure 1, note that the tilter mechanism 26 is a worm gear cord drive mechanism, as taught in U.S. Patent 6,561,252, which is hereby incorporated herein by reference. The cord pulley is directly connected to a worm which drives a gear to which the tilt rod 28 is connected. As is well known in the art, in a worm gear mechanism, the worm is able to drive the gear in either clockwise or counterclockwise directions. However, the gear is unable to back drive the worm; the mechanism locks up the moment the gear begins to back drive the worm. While a worm gear is a very convenient and expedient manner for ensuring that the tilter mechanism 26 cannot be back driven, other means (such as ratchets, one way brakes, or clutches, all with suitable release mechanisms) may be employed in alternative embodiments to ensure this same condition.

The ability to drive the tilt rod 28 in either direction (clockwise or counterclockwise) from the input end (using the cord tilter 26), but not to be able to back drive the tilt rod 28 from the output end is a useful characteristic for the operation of the tilt station 30, as is discussed in more detail below.

Referring to Figure 20, the drums 34, 36 are in their neutral position (again, this neutral position refers to the position of the drums 34, 36 where no external force is acting to overcome the preload force of the spring 40, and thus when the first drum 34 has its second shoulder 62 against the key 78, and the second drum 36 has its second shoulder 62 against the key 78). The slats 14 are open in a double pitch configuration, wherein each pair of adjacent slats 14t, 14b is stacked right up against each other, and there is a large empty space between this pair of adjacent slats 14t, 14b and the next pair of adjacent slats 14t, 14b. This large empty space is approximately twice the standard distance, or double the pitch (dp) between slats of a conventional blind having evenly-spaced slats.



The top slat 14t of each pair of top and bottom slats 14t, 14b is supported by a cross cord 16t extending between the first set of front and rear tilt cables 16af, 16ar. (For expediency, we will sometimes refer to the tilt cables when we mean the entire associated ladder tape including both the front and rear tilt cables and cross cords connecting those front and rear tilt cables, and this usage will be obvious within the context in which it used). The first rear tilt cable 16ar is routed over the first drum 34 of the tilt station 30 and is secured to one of the slotted openings 52ar in the first drum 34 (note that the generic designation of the slotted opening is 52, as shown, for instance, in Figure 5, but this designation has been modified with the suffix ar, which corresponds to the suffix of the tilt cable 16ar which is secured to this particular slotted opening. This nomenclature will be followed throughout this specification). The first front tilt cable 16af is routed over the second drum 36 and is secured to the slotted opening 52af on the second drum 36. The ring 66 of the second drum 36 prevents the tilt cables from falling in between the two drums 34, 36.

Similarly, the bottom slat 14b of each pair of slats 14t, 14b is supported by the cross cords 16t extending between the second set of front and rear tilt cables 16bf, 16br. The rear tilt cable 16br of the second set is routed over the second drum 36 and is secured to the slotted opening 52br in the second drum 36. Finally, the front tilt cable 16bf of the second set of tilt cables is routed over the first drum 34 and is secured to the slotted opening 52bf on that first drum 34.

All of the tilt cables 16 are tied off to the drums 34, 36 such that, when the drums are in their "neutral" position, as shown in Figure 20, the slats 14 are arranged in the double pitch configuration, wherein the pairs of adjacent top and bottom slats 14t, 14b are stacked up against each other, creating a large, double pitch gap "dp" between the sets of paired slats 14t, 14b.

Referring now to Figures 1 and 21, one of the tilt cords 24 is pulled so as to cause rotation of the tilt rod 28 in the clockwise direction (as seen from the vantage point of Figures 1 and 21). The clockwise rotation of the tilt rod 28 causes clockwise rotation of the drum driver 38 (and of the key 78) in the tilt station 30. As the key 78 rotates, it pushes against the first shoulder 60 (See Figure 5) of the first drum 34,

thus causing the first drum 34 to rotate clockwise as well. The second drum 36 also wants to follow the key 78, since the lash spring 40 is preloading the second drum 36 against the key 78. However, very shortly after the second drum 36 begins to rotate clockwise, its limit stop 54 impacts against the upper shelf limit stop 110 (See Figure 3) on its end of the housing 42, stopping any further clockwise rotation of the second drum 36, despite the urging of the lash spring 40. Naturally, since the second drum 36 has stopped rotating, the user now must exert enough force to overcome the biasing force of the lash spring in order to continue rotating the tilt rod 28, the drum driver 38, and the first drum 34. As the user continues to rotate the tilt rod 28 in the clockwise direction, the first drum 34 continues to rotate until its limit stop 54 impacts against the lower shelf limit stop 112 on its respective end wall 90 of the housing 42. At this point, the slats are in the closed position, room side down, as shown in Figure 21. The change in positions of the drums 34, 36 can be seen more clearly by comparing the starting position of the limit stop 54 on the first drum 34, shown in Figure 20 (at the neutral position), with the ending position of the limit stop 54 on the first drum 34 shown in Figure 21, which indicates that the first drum 34 has rotated clockwise through almost a full 180 degrees of travel.

The slotted openings 52ar and 52bf on the first drum 34, which are connected to the first rear tilt cable 16ar and the second front tilt cable 16bf, also have rotated the same distance of approximately 180 degrees of travel. As a result, the rear tilt cable 16ar of the top slat 14t has been pulled up a distance approximately equal to  $\pi X r$  (where  $r$  is the radius of the drum 34), and the front tilt cable 16bf of the bottom slat 14b has been extended the same distance. The other two tilt cables 16af, 16br, which are connected to the second drum 36, remain practically motionless. As a result, the front (room side) edges of the top slats 14t do not move, while the rear (wall side) edges of these top slats 14t swing up for a room-side down tilted closed orientation (as seen in Figure 21). Similarly the rear (wall side) edges of the bottom slats 14b move up only a very short distance, while the front (room side) edges of these bottom slats 14b swing down to complete the room-side down tilted closed orientation of the blind as shown in Figure 21.

To summarize, in Figure 21, the second drum 36 does not rotate (or rotates a very short distance of just a few degrees of travel before the limit stops prevent its further rotation), and the first drum 34 rotates clockwise (as seen from the left Figure 21) in order to move the double pitch fully open blind of Figure 20 to the closed room-side down blind of Figure 21. The very short rotation of the second drum 36 allow the edges of adjacent pairs of slats 14 to overlap each other so that there is no light gap visible when the blind is closed.

Note that the limit stops 110, 112 (See Figure 3) are designated upper limit stop 110 and lower limit stop 112 as this is how they are depicted in the figures and this designation makes it easier to distinguish the two stops 110, 112. However, the limit stops 110, 112 may both be at the same height relative to each other, so it may be more accurate simply to refer to them as a first stop 110 and a second stop 112.

The lash spring 40 urges the drums 34, 36 back to the neutral position, urging the first drum 34 to rotate counterclockwise and urging the second drum 36 to rotate clockwise. However, there are mechanisms in place that prevent both of these rotations, as explained below. The second drum 36 cannot rotate clockwise any further due to the interaction of its limit stop 54 with the limit stop 110 of the housing 42. The first drum 34 cannot rotate counterclockwise, because it is stopped by the cord tilter 26. In order for the first drum 34 to rotate counterclockwise, it would have to push the drum driver 38 in the counterclockwise direction, since the key 78 of the drum driver 38 is in contact with the first shoulder 60 of the first drum 34. Rotating the drum driver 38 would also require rotation of the tilt rod 28, since the mating non-circular cross-sections of the drum driver 38 and the tilt rod 28 cause them to rotate together. However, in order for the tilt rod 28 to be driven counterclockwise by the drum 34, it would have to drive the worm gear of the tilter 26 (as indicated earlier, this tilter 26 is described in Canadian Patent No. 2,206,932 "Anderson", dated December 4, 1997 (1997/12/04), which is hereby incorporated by reference). However, as was explained earlier, the worm gear cannot be back driven, so any attempt by the tilt rod 28 to drive the tilter 26 causes the tilter mechanism 26 to lock up. Therefore, the slats 14 of the blind 10 remain in the position desired by the user

unless and until the user drives them to a new position by pulling on one of the tilt cords 24 on the input end of the tilter 26. To return the blind from this position to the neutral position of Figure 20, the user would pull on the other tilt cord 24, driving the tilt mechanism, tilt rod 28, and the drum driver 38 in the counterclockwise direction.

5 This allows the spring 40 to bring the first drum 34 back to the neutral position, while the second drum 36 remains in the same position.

Figure 22 depicts the same double pitch blind as Figure 20 but with the tilt mechanism having moved the blind to the position in which the slats are tilted closed room-side up. To achieve this from the neutral position of Figure 20, the user pulls  
10 on the other tilt cord 24 (See Figure 1) (not the one that was pulled to obtain the tilted closed room-side down position of Figure 21). This causes counterclockwise rotation of the tilt rod 28, as well as the counterclockwise rotation of the drums 34, 36. However, the limit stop 54 on the first drum 34 almost immediately impacts the upper shelf limit stop 110 on its respective wall 90 of the housing 42, bringing further  
15 rotation of the first drum 34 to a stop. The second drum 36 continues to rotate counterclockwise until eventually its limit stop 54 impacts against the lower shelf limit stop 112 at its respective end 92 of the housing 42, bringing this second drum 36 to a stop. The second drum 36 will have rotated counterclockwise approximately 180 degrees (as evidenced by comparing the positions of the limit stop 54 on the second  
20 drum 36, in Figures 20 and 22).

The first rear tilt cable 16ar and the second front tilt cable 16bf, which are secured to the first drum 34, remain practically stationary, while the ends of the first front and second rear tilt cables 16af and 16br rotate counterclockwise with the second drum 36. The first front tilt cable 16af winds onto the second drum 36,  
25 pulling the room-side edges of the top slats 14t up a distance of approximately  $\pi \times r$ . At the same time, the second rear tilt cable 16br unwinds from the second drum 36, dropping the wall-side edges of the bottom slats 14b by the same  $\pi \times r$  distance. The end result is the tilted closed room-side up blind of Figure 22.

### Selective Tilt Configuration

Figures 23-25 depict a routing of tilt cables 16 on a mechanism very similar to that described above in order to achieve an arrangement in which one part of the blind can be closed while another part remains open. Referring to Figure 23, there are a few hardware differences between this configuration the configuration shown in Figure 20. First, instead of having two sets of double-pitch ladder tapes, this blind has one standard single-pitch ladder tape with a rear tilt cable 16r, a front tilt cable 16f, and cross cords 16t extending between the front and rear tilt cables 16f, 16r. Second, another tilt cable or actuator cord 16x is secured to the rear tilt cable 16r at the knot 32 or other fixing means such as a cord attachment clip 32. Third, the first drum 34 does not have a limit stop 54 (the limit stop 54 simply may be cut off from a standard first drum 34 to accommodate this configuration).

In this configuration, the rear tilt cable 16r wraps counterclockwise around the second drum 36 and attaches to the second drum 36 at the slotted opening 52r. The front tilt cable 16f wraps clockwise around the second drum 36 and attaches to the second drum 36 at the slotted opening 52f. The third tilt cable or actuator cord 16x wraps clockwise around the first drum 34 and attaches to the first drum 34 at the slotted opening 52x. The other slotted opening 52 of the first drum 34 is not used for anchoring a cord in this embodiment. In Figure 23, the drums 34, 36 are shown in their neutral position, with the slats 14 are all tilted open in a single pitch configuration, with all the slats 14 evenly spaced apart.

In Figure 24, one of the tilt cords has been pulled, causing the tilter 26 to drive the tilt rod 28 counterclockwise, which also drives the drum driver 38 and both drums 34, 36 counterclockwise. The second drum 36 is driven counterclockwise by the key 78 on the drum driver 38, stopping when its limit stop 54 reaches the lower shelf limit stop 112 on the wall 92. Since the limit stop 54 on the first drum 34 has been removed, there is nothing to prevent the spring 40 from driving the first drum 34 counterclockwise along with the second drum 36. As the second drum 36 rotates counterclockwise, it raises the front cable 16f and lowers the rear cable 16r. As the first drum 34 rotates counterclockwise, it lowers the actuator cable 16x the same

distance as the rear tilt cable 16r. Thus, the entire blind tilts closed room-side up. When the tilt cord 24 is released, the worm gear on the tilt drive 26 locks the tilt rod 28 in position, which causes both drums 34, 36 to remain in the position they were in when the tilt cord 24 was released.

5 To rotate back to the neutral position and beyond, the other tilt cord 24 is pulled, causing the tilt rod 28 to rotate clockwise. Figure 25 shows the position of the blind when the tilt rod 28 has been rotated clockwise beyond the neutral position of Figure 23. As the tilt rod 28 is driven clockwise by the tilt drive 26, it drives the drum driver 38 clockwise, and the key 78 of the drum driver 38 contacts a shoulder on the  
10 first drum 34, driving the first drum 34 clockwise. The spring 40 begins to cause the second drum 36 to rotate clockwise along with the first drum 34, but its limit stop 54 impacts the upper shelf limit stop 110 on the wall 92 of the housing 42 at the neutral position, preventing any further clockwise rotation of the second drum 36. The first drum 34 continues to rotate clockwise, causing the actuator cable 16x to wind up  
15 onto the first drum 34, which raises the actuator cord 16x. Since the actuator cable 16x is connected to the rear tilt cable 16r at the point 32, it lifts the rear tilt cable 16r at that point 32. All the slats 14 supported by cross cords 16t below the point 32 are affected as the rear tilt cable 16r raises the wall-side edges of those slats 14. The result is that all the slats 14 below the tie off point 32 of the actuator cable 16x to the  
20 rear tilt cable 16r are tilted closed room-side down, and the balance of the slats 14 remain tilted open, as shown in Figure 25.

The location of the tie-off point 32 relative to the rear tilt cable 16r determines the point at which the "break" occurs between the slats which are tilted closed and those which remain tilted open. If the actuator cable 16x alternatively were tied to  
25 the front tilt cable 16f instead of the rear tilt cable 16r, then the portion of the blind below the tie-off point 32 would close in the room-side up position rather than room-side down as shown here. It also follows that, by reversing the position of the drums 34, 36 in the housing 42, the action of the blind 10 can be reversed from the previous description. For instance, in going from Figure 23 to Figure 24, the slats 14 would  
30 close room-side up instead of the room-side down shown.

### Pleated Look Configuration

Figures 26-28 depict the routing of the tilt cables for a typical pleated look blind configuration. Referring to Figure 26, there are no hardware differences  
5 between this pleated look configuration and the double pitch configuration of Figure 20. In both instances, the two sets of tilt cables 16af, 16ar and 16bf, 16br are double the standard pitch. The only differences are in the routing of the tilt cables 16.

In this arrangement, again, there are two sets of tilt cables. The first front tilt cable 16af of the top slats 14t wraps counterclockwise around the second drum 36  
10 and attaches to the second drum 36 at the slotted opening 52af. The first rear tilt cable 16ar of the top slats 14t wraps clockwise around the first drum 34 and attaches to the first drum 34 at the slotted opening 52ar. The second front tilt cable 16bf of the bottom slats 14b wraps clockwise around the second drum 36 and attaches to the second drum 36 at the slotted opening 52bf. Finally, the second rear tilt cable  
15 16br of the bottom slats 14b wraps counterclockwise around the first drum 34, and attaches to the first drum 34 at the slotted opening 52br.

As in the case of the double pitch blind depicted in Figure 20, the pleated look configuration of Figure 26 also starts with the slats 14 in a double pitch configuration when the drums 34, 36 are in the neutral position. Referring now to Figure 27, as  
20 the tilt drive 26 drives the tilt rod 28 in the clockwise direction, the key 78 contacts the first drum 34, driving it clockwise, and the spring 40 urges the second drum 36 to rotate clockwise as well. However, the limit stop 54 on the second drum 36 almost immediately impacts against the upper shelf limit stop 110 at the end 92 of the housing 42, preventing any further clockwise rotation of the second drum 36 beyond  
25 the neutral position. The first drum 34 continues to rotate until its limit stop 54 impacts against the lower shelf limit stop 112 in the wall 90 of the housing 42.

Since the front (or room-side) tilt cables 16af, 16bf of both top and bottom slats 14t, 14b, respectively, are tied off to the second drum 36, and this second drum 36 rotates only a very few degrees before its limit stop impedes further clockwise  
30 rotation, the front (or room-side) edges of these slats 14t, 14b remain nearly

stationary. On the other hand, the rear tilt cable 16ar and 16br are tied off to the first drum 34, which is rotating. When the first drum 34 rotates clockwise, the first rear tilt cable 16ar winds up onto the first drum 34, lifting up the rear (or wall-side) edges of the top slats 14t to the position shown in Figure 27. At the same time, the rear tilt cable 16br of the bottom slat 14b is unwrapping from the first drum 34, dropping the rear (or wall-side) edges of the bottom slats 14b to the position shown in Figure 27, resulting in a pleated look tilted closed blind, with the top slats 14t tilted room-side down, and the bottom slats 14b tilted room-side up.

Figure 28 depicts the pleated look blind of Figure 26 but tilted closed in the opposite direction from that of Figure 27. In this instance the tilt rod 28 is rotated counterclockwise and only the second drum 36 rotates counterclockwise with it (the first drum 34 only starts to rotate and is immediately stopped by its limit stop 54 contacting the upper shelf limit stop 110 on the wall 90 of the housing 42). In this instance, since the first and second rear tilt cables 16ar and 16br are attached to the first drum 34, and the first drum 34 does not rotate, then the rear (wall-side) edges of the top and bottom slats 14t, 14b remain essentially stationary. At the same time, the first and second front tilt cables 16af, 16bf rotate with the second drum 36, with the first front cable 16af wrapping up on the second drum 36 as the drum 36 rotates counterclockwise, thereby lifting the front (room-side) edges of the top slats 14t. The second front tilt cable 16bf of the bottom slats 14b unwraps from the second drum 36 as the drum 36 rotates counterclockwise, and this drops the front (room-side) edges of the bottom slats 14b. The result is a pleated look tilted closed blind, with the top slats 14t tilted room-side up, and the bottom slats 14b tilted room-side down, as shown in Figure 28.

It may be noted that, in order to get closure of the slats 14 when tilted in opposite directions, as is the case in the pleated look configuration described above, it may be advantageous to notch both front and back edges of one of each pair of slats 14 in order to allow clearance for the cross ladder 16t. This notch can be on the bottom slats 14b only, or on the top slats 14t only, or it could be on both top and



bottom slats 14t, 14b, or it could be on just one edge of each slat 14 (opposite edges).

### **Twin Tilt Rod, Parallel Drum design**

5 Referring now to Figure 29, the blind 120 is very similar to the blind 10 of Figure 1 except that, instead of using the tilt stations 30, the tilting function is accomplished using twin tilt rods 28 which functionally interconnect the parallel-drum tilt stations 122 with the indexing gear mechanism 124, as described in more detail below. The indexing gear mechanism 124 is in turn connected to a tilter mechanism,  
10 such as the worm gear tilter 26, via a short tilt rod 28'.

Referring briefly to Figures 30–33, the indexing gear mechanism 124 includes an indexing gear 126, a room-side driven gear 128, a wall-side driven gear 130, an indexing gear housing 132, and a housing cover 134.

Referring to Figure 36, the indexing gear 126 is a generally cylindrical gear  
15 defining a left portion 136 and a right portion 138. The left portion 136 includes a toothed portion 140 extending in an arc of approximately 200 degrees, with the balance of the left portion 136 being a smooth, toothless portion 142. Similarly, the right portion 138 defines a smooth, toothless portion 144 which extends through the same arc of approximately 200 degrees, corresponding to the toothed portion 140.  
20 However, a solid boss 146 extends along the balance of the right portion 138. The indexing gear 126 also defines a non-cylindrically profiled hollow shaft 148 sized to receive the similarly-profiled tilt rod 28'. The outside of this shaft 148 defines a cylindrical axle 150.

Referring now to Figure 35, the wall-side driven gear 130 is a generally  
25 cylindrical element defining a left portion 152 and a right portion 154, and these portions 152, 154 are separated by a radially projecting flange 155. The right cylindrical portion 154 defines a non-cylindrically profiled hollow shaft 156 sized to receive the similarly-profiled tilt rod 28. The left portion 152 includes a first smooth portion 158 with a concave section 160 (See also Figure 31) precisely manufactured  
30 to mate with the locking hub or boss 146 on the indexing gear 126, to prevent

movement of the driven gear 130 during dwell, as is explained in more detail below. The left portion 152 also includes a toothed portion 162 which engages the toothed portion 140 of the indexing gear 126. Finally, a short axle 164 projects leftwardly from the toothed portion 162. The room-side driven gear 128 is identical to the wall-side driven gear 130.

Referring to Figure 34, the housing 132 defines a main cavity 166 which accommodates the indexing gear 126. A through opening 168 (See also Figure 31) rotationally supports the axle 150 of the indexing gear 126, which projects leftwardly beyond the toothed portion 140. Two smaller diameter cavities 172 on either side of the through opening 168 receive and rotationally support the left ends 164 of the driven gears 128, 130.

Referring to Figure 31, the housing cover 134 includes a plate 174 defining a through opening 176 which rotationally supports the right end of the axle 150 of the indexing gear 126. The plate 174 also defines two hollow cylindrical projections 178 sized to rotationally accommodate and support the right ends 154 of the driven gears 128, 130.

To assemble the indexing gear mechanism 124, the indexing gear 126 and the driven gears 128, 130 are inserted into their respective cavities 166, 170 of the housing 132 (see Fig. 34) such that the left end of the axle 150 of the indexing gear 126 extends through the opening 168 in the housing 132, and the axles 164 of the driven gears 128, 130 are received in the recesses 172 in the housing 132. The housing cover 134 then is snapped onto the housing 132 (with projections 135 on the housing 132 snap-fitting into openings 137 on the cover, such that the right end of the axle 150 of the indexing gear 126 extends through the opening 176 in the housing cover 134, and the right end portions 154 of the driven gears 128, 130 extend into the two hollow cylindrical projections 178 of the housing cover 134. The driven gears 128, 130 are aligned with the indexing gear 126 as shown in Figures 32 and 33, with the concave sections 160 of the driven gears 128, 130 just about to engage the boss 146 of the indexing gear 126. We will refer to this position of the

driven gears 128, 130 relative to the indexing gear 126 (and the corresponding position of the tilt drums 184, 182 as described below) as the neutral position.

The indexing gear mechanism 124 works using the principle of a Geneva indexing drive which converts continuous rotational motion into intermittent motion, providing repeatable indexing to the same position. In this instance, as the indexing gear 126 rotates clockwise from the neutral position (as seen from the vantage point of Figures 31–33) the room-side driven gear 128 briefly rotates counterclockwise until its concave section 160 mates with the boss 146 of the indexing gear 126. The toothed portion 162 of the room-side driven gear 128 then encounters the smooth, toothless portion 142 of the indexing gear 126. The indexing gear 126 can thus continue to rotate clockwise while the room-side driven gear 128 remains stationary, prevented from rotation by the boss 146 of the indexing gear 126 abutting the concave section 160 of the room-side driven gear 128.

However, as the indexing gear 126 continues to rotate clockwise, the wall-side driven gear 130 rotates counterclockwise and continues to do so for several rotations before its concave section 160 abuts the boss 146 of the indexing gear 126, bringing further rotation to a stop.

If the indexing gear 126 rotates counterclockwise from the neutral position, the opposite situation occurs. Namely, the wall-side driven gear 130 rotates clockwise very briefly before it is prevented from further rotation by its concave section 160 abutting the boss 146 of the indexing gear 126. The room-side driven gear 128 also rotates clockwise and continues to do so for several rotations before its concave section 160 abuts the boss 146 of the indexing gear 126, bringing further rotation to a stop. Of course, tilt rods 28 extend into the hollow cylindrical projections 178 and are received in the hollow shafts 156 of the right portions 154 of the driven gears 128, 130, so the tilt rods 28 rotate with their respective driven gears 128, 130.

Referring now to Figures 37 and 38, each tilt station 122 includes a housing 180, a wall-side tilt drum 182, and a room-side tilt drum 184.

Figure 39 depicts a wall side tilt drum 182 which is a cylindrical element defining cylindrical axles 185 projecting from both ends, each cylindrical axle 185

defining a non-cylindrical, inner, hollow shaft 186 sized to receive and engage the similarly-profiled tilt rod 28. The wall side tilt drum 182 also defines an outer cylindrical surface 188 which is connected to the inner, cylindrical axle 185 via webs 190. Two elongated openings 192 are defined through the outer cylindrical surface. One of the openings 192 is located near one end of the cylinder 188, and the other near the other end, with the two openings 192 lying about 180 degrees apart from each other. Both of the openings 192 can be seen in Figure 39. The tilt cables 16 are secured to these openings as described in more detail below. The room-side tilt drum 184 is identical to the wall-side tilt drum 182.

Figure 40 is a perspective view of the housing 180 of the tilt station 122 of Figures 37 and 38. The housing 180 includes two side walls 194, 196, two end walls 198, 200, and a bottom wall 202. The end walls 198, 200 each define two "U"-shaped saddles 204a, 204b, and 206a, 206b, respectively, which provide rotational support of the axles 185 of the drums 182, 184 as seen in Figure 37. Arms 208a, 208b and 210a, 210b extend at approximately a 45 degree angle from the planes defined by the end walls 198, 200, and they project across and above the centerline of the tilt rods 28 which extend through the hollow shafts 186 of the drums 182, 184, thus serving to prevent the drums 182, 184 from lifting out of the housing 180.

The bottom wall 202 of the housing 180 defines two longitudinally aligned slotted openings 212, with a shorter rectangular opening 216 between the two slotted openings 212. The slotted openings 212 are for the front and rear tilt cables to pass through the housing 180 and through corresponding openings (not shown) in the head rail 12. The rectangular opening 216 provides a passageway for the lift cords 20.

To assemble the tilt mechanism shown in Figure 29, first the tilt stations 122 are assembled. The tilt cables 16 are routed through the slotted openings 212 in the bottom surface 202 of the housing 180. The ends of the tilt cables 16 are secured to their respective drums 182, 184 at their respective slotted openings 192. The routing and attachment of these tilt cables 16 is done in accordance with the explanation below in order to obtain the desired tilting configuration.

The drums 182, 184 are installed in their respective U-shaped saddles 204a, 204b and 206a, 206b, respectively. The tilt rods 28 are inserted through the hollow shafts 186 of the tilt drums 182, 184, and the ends of these tilt rods 28 are inserted into the hollow shafts 156 of the driven gears 130, 128 respectively. The driven  
5 gears 130, 128 will already have been assembled onto the indexing gear mechanism 124 as described earlier. A short tilt rod 28' is used to connect the output from the cord tilter mechanism 26 to the hollow shaft 148 of the indexing gear 126. Note that the cord tilter mechanism 26 shown here is just one type of many tilter mechanisms which may be used for this application. While a cord tilter 26 is shown, it is  
10 understood that the tilt rod 28' may be rotated by other means such as a wand tilter or a motorized tilter. It is even possible to have the indexing gear mechanism 124 be an integral part of the tilter mechanism 26, such that no tilt rod 28' is needed.

### **Double Pitch Configuration**

15 Figures 41–43 depict the routing of the tilt cables 16 for a double pitch blind configuration. As has already been discussed above, in these three figures, and in all similar figures to follow, the routing of the cables 16 and the position of the tilt drums 182, 184 (particularly to depict the relative location of the tie-off points of the ends of the tilt cables 16 to the tilt drums 182, 184) are shown relative to the  
20 corresponding position of the slats 14 of the blind 120. For greater clarity, a perspective end view of the corresponding indexing gear mechanism 124 is included as part of these views (with the housing 132 removed for clarity) to show the orientation of the indexing gear 126 and of the driven gears 128, 130 corresponding to the orientation of the tilt drums 182, 184 and of the slats 14.

25 As was explained earlier, the tilt cables are generically designated as item 16, but are further identified by the following suffixes:

- "a" is for the first set of tilt cables, those supporting the upper (or top) slats 14t in each pair

- "b" is for the second set of tilt cables, those supporting the lower (or bottom ) slats 14b in each pair

- "f" is for the front tilt cables, those on the room side of the blind

5 - "r" is for the rear tilt cables, those on the wall side (also referred to as the window side) of the blind

- "x" is for an actuator tilt cable which is typically secured to one of the front or rear tilt cables 16

Referring to Figure 41, the tilt drums 182, 184 are in their neutral position (as a reminder, this neutral position refers to the position of the tilt drums 182, 184  
10 corresponding to the position of the driven gears 128, 130 where they are aligned with the indexing gear 126 as shown in Figures 32 and 33, with the concave sections 160 of the driven gears 128, 130 just about to engage the boss 146 of the indexing gear 126) and with the slats open in a double pitch configuration. The first room-side tilt cable 16af is routed counterclockwise around and is secured to the wall-side drum  
15 182 at the slotted opening 192af. The first wall-side tilt cable 16ar is routed clockwise over and is secured to the room-side drum 184 at the slotted opening 192ar. The second room-side tilt cable 16bf is routed counterclockwise onto and is secured to the room-side drum 184 at the slotted opening 192bf (not shown in Figure 41, but visible in Figure 42). Finally, the second wall-side tilt cable 16br is routed  
20 clockwise onto and is secured to the wall-side drum 182 at the slotted opening 192br (not shown in Figure 41, but visible in Figure 43). In this routing and configuration of the tilt cables 16, the slats 14 are tilted open in a double pitch configuration as shown in Figures 41 and 29 when the drums and gears are in the neutral position.

Referring now to Figure 42, as the indexing gear 126 is rotated  
25 counterclockwise from the neutral position (by pulling on one of the two tilt cords 24 which makes the tilter mechanism 26 rotate the tilt rod 28' counterclockwise), the wall-side driven gear 130 (and with it, its corresponding tilt drum 182, connected to the wall-side driven gear 130 by the tilt rod 28) just begins to rotate clockwise before its concave section 160 abuts the boss 146 of the indexing gear 126, preventing any  
30 further rotation of the wall-side driven gear 130. This condition is shown in Figure 42

where the tie-off point 192af for the room-side tilt cable 16af of the top slat 14t is shown to have rotated just a few degrees in the clockwise direction, creating the overlap desired between adjacent pairs of slats 14 (as discussed earlier with respect to a previous embodiment 10). Thus, the first front and second rear tilt cables 16af, 5 16br secured to the wall-side tilt drum 182 remain essentially stationary.

However, as the indexing gear 126 is rotated counterclockwise from the neutral position, the toothed portion 162 of the room-side driven gear 128 engages the toothed portion 140 of the indexing gear 126, such that this room-side driven gear 128 (and its corresponding room-side tilt drum 184) are driven clockwise and 10 continue to rotate in a clockwise direction for several rotations before its concave section 160 contacts the boss 146 of the indexing gear 126 to prevent any further rotation. The first rear tilt cable 16ar secured to the room-side tilt drum 184 at slotted opening 192ar winds up onto the room-side tilt drum 184, pulling up on the wall-side of the top slats 14t. At the same time, the second front tilt cable 16bf unwinds from 15 the room-side tilt drum 184, lowering the room-side of the bottom slats 14b. The result is the tilted closed, room-side down configuration of the slats 14 as shown in Figure 42.

Figure 43 illustrates the position of the indexing gear 126, the driven gears 128, 130, and the tilt drums 182, 184 for the slats 14 of the blind in the tilted closed, 20 room-side up configuration. In this case, the indexing gear 126 is rotated clockwise from the neutral position shown in Figure 41. This causes the room-side driven gear 128 to begin rotating counterclockwise, but its concave portion 160 promptly abuts the boss 146 of the indexing gear 126, locking the room-side driven gear 128 (and its corresponding room-side tilt drum 184) from any further counterclockwise rotation. 25 As a result, the first rear and second front tilt cables 16ar, 16bf, which are secured to the room-side tilt drum 184, remain essentially stationary. However, the wall-side driven gear 130 and its corresponding wall-side tilt drum 182 rotate counterclockwise for several rotations, raising the first front tilt cable 16af as it winds onto the wall-side tilt drum 182, and lowering the second rear tilt cable 16br as it unwinds from the wall-

side tilt drum 182. The result is the tilting closed of the slats 14 in the room-side up configuration shown in Figure 43.

### **Alternative Configuration**

5 Figures 44-46 depict an alternative routing of the tilt cables 16 on the same parallel drum mechanism described above in order to be able to tilt one portion of the blind closed while another portion remains open. Referring to Figure 44, the hardware differences between this blind and the double pitch configuration blind in Figure 41 are as follows:

10 Instead of having two sets of double-pitch ladder tapes at each tilt station, this blind has only a single ladder tape of standard pitch configuration, including front and rear cables and cross cords 16f, 16r, 16t. It also has an actuator tilt cable 16x secured to the rear tilt cable 16r at the knot or cord attachment clip 32. The routing of these tilt cables 16 is as described below.

15 The rear (wall-side) tilt cable 16r wraps clockwise around the wall-side tilt drum 182 and attaches to the wall-side tilt drum 182 at the slotted opening 192r (not visible in Figure 44 but seen in Figure 46). The front (room-side) tilt cable 16f wraps counterclockwise around the wall-side tilt drum 182 and attaches to the wall-side tilt drum 182 at the slotted opening 192f. The actuator tilt cable 16x wraps clockwise around the room-side tilt drum 184 and attaches to the room-side tilt drum 184 at the  
20 slotted opening 192x. In Figure 44, the mechanism (indexing gear 126, driven drums 128, 130, and tilt drums 182, 184) is in its neutral position, and the slats 14 are all tilted open.

In Figure 45, the indexing gear 126 has been rotated counterclockwise via the  
25 tilter 26 and the tilt rod 28', which rotates the driven gears 128, 130 (and their corresponding tilt drums 184, 182) in a clockwise direction. The wall-side driven gear 130 stops rotating almost immediately as its concave section 160 mates with the boss 146 of the indexing gear 126, while the room-side driven gear 128 (and its corresponding tilt drum 184) continues to rotate for several rotations. This means that the front and rear tilt cables 16f, 16r are not pulled upwardly or released from  
30 their drum 182 any substantial distance. However, the actuator cable 16x, which is



attached to the room-side tilt drum 184 at 192x, winds onto the room-side tilt drum 184. This raises the actuator cable 16x, and it also raises the rear tilt cable 16r at the point 32 where the actuator cord 16x is attached to the rear tilt cable 16r, as shown in Figure 45. The end result is the tilting configuration of Figure 45, where the  
5 upper portion of the blind remains open while the lower section of the blind is tilted closed room-side down.

In Figure 46, the indexing gear 126 has been rotated clockwise from its neutral position (via the tilter 26 and the tilt rod 28'), which rotates the driven gears 128, 130 (and their corresponding tilt drums 184, 182) in a counterclockwise  
10 direction. The room-side driven gear 128 (and its corresponding room-side tilt drum 184) begins to rotate counterclockwise and is immediately prevented from further rotation as the concave portion 160 of the room-side driven gear 128 mates with the boss 146 of the indexing gear 126. The actuator cord 16x, which is attached to the room-side tilt drum 184 thus remains essentially motionless.

The wall-side driven gear 130 continues to rotate counterclockwise, causing the wall-side driven drum 182 to rotate counterclockwise as well. This causes the front tilt cable 16f to wind up onto the wall-side tilt drum 182 while the rear tilt cable 16r unwinds from the wall-side tilt drum 182. However, since the actuator cord 16x is attached to the rear tilt cable 16r at the tie-off point 32, and since the actuator cord  
20 16x remains substantially motionless, the rear tilt cable 16r drops only for those slats 14 which are above the tie-off point 32. Below the tie-off point 32, the actuator cord 16x holds on to the rear tilt cable 16r, preventing it from dropping. Thus, the slats 14 above the tie-off point are tilted closed, room-side up, while the balance of the slats 14 tilt closed only partially, approximately at a 45 degree angle.

It will be obvious to those skilled in the art that the location of the tie-off point 32 relative to the rear tilt cable 16r affects the point at which the "break" occurs between the slats which are tilted closed and those which remain tilted open. It will also be obvious that connecting the actuator tilt cable to the front tilt cable 16f rather than to the rear tilt cable as shown here would result in the blind tilting closed below

the break point in the room side up direction rather than in the room side down configuration shown in Figure 45.

### **Pleated Look Configuration**

5 Figures 47-49 depict an alternative routing of the tilt cables for a pleated look blind configuration. Referring to Figure 47, there are no hardware differences between this pleated look configuration and the double pitch configuration of Figure 41. The only differences are in the routing of the tilt cables 16.

10 The front tilt cable 16af of the top slats 14t wraps clockwise around and is secured to the room-side tilt drum 184 at the point 192af. The rear tilt cable 16ar of the top slats 14t wraps counterclockwise around and is secured to the wall-side tilt drum 182 at 192ar. The front tilt cable 16bf of the bottom slats 14b wraps counterclockwise around and is secured to the room-side tilt drum 184 at the point 192bf. Finally, the rear tilt cable 16br of the bottom slats 14b wraps clockwise around and is secured to the wall-side tilt drum 182 at the point 192br.

15 As in the case of the double pitch blind depicted in Figure 41, the pleated look configuration also starts with the slats 14 in a double pitch configuration when the mechanism is in the neutral position as shown in Figure 47. Referring now to Figure 48, as the tilt rod 28' is rotated clockwise, it drives the indexing gear 126 clockwise, and the driven drums 128, 130 (and their corresponding tilt drums 184, 182) are urged to rotate counterclockwise. The room-side driven gear 128 and its  
20 corresponding room-side tilt drum 184 almost immediately are prevented from further counterclockwise rotation as the concave portion 160 of the room-side driven gear 128 mates with the boss 146 of the indexing gear 126. Therefore, the front tilt cables 16af, 16bf, which are secured to the room side drum 184, remain essentially  
25 stationary, and the fronts of the slats 14t, 14b remain essentially stationary.

The wall-side driven gear 130 and its corresponding wall-side tilt drum 182 continue to rotate counterclockwise for several rotations. This winds up the first rear tilt cable 16ar onto the wall-side tilt drum 182 and unwinds the second rear tilt cable 16br, thus causing the rear side of the upper slats to be raised and the rear side of

the lower slats to be lowered, thereby resulting in the pleated look of Figure 48, with the top slats 14t tilted room-side down, and the bottom slats 14b tilted room-side up.

Figure 49 depicts the pleated look blind of Figure 48 but tilted closed in the opposite direction. In this case, the tilt rod 28' has been rotated counterclockwise from the neutral position, rotating the indexing gear 126 counterclockwise and driving  
5 the driven gears 182, 184 clockwise. Since the wall-side driven gear 130 promptly stops, because its concave section 160 mates with the boss 146 of the indexing gear 126, only the room-side driven gear 128 and its corresponding room-side tilt drum 184 continue to rotate clockwise. In this instance, since the first and second rear tilt  
10 cables 16ar and 16br are attached to the wall-side tilt drum 182, and since the wall-side tilt drum 182 does not rotate, then the rear (wall-side) edges of the top and bottom slats 14t, 14b remain essentially stationary. At the same time, the front tilt cable 16af of the top slats 14t wraps onto the room-side tilt drum 184 and the front tilt cable 16bf of the bottom slats 14b unwraps from the room-side tilt drum 184, thereby  
15 raising the front edge of the top slats 14t and lowering the front edge of the bottom slats 14b, creating the pleated look shown in Figure 49, with the upper slats in the room side up position and the lower slats in the room side down position.

While several embodiments have been shown and described, it is understood that it is not practical to describe all the possible variations and combinations that  
20 could be made within the scope of the present invention. It will be obvious to those skilled in the art that modifications may be made to the embodiments described above without departing from the scope of the invention as claimed.

What is claimed is:

1. A tilter mechanism for tilting a covering for architectural openings, comprising:

a tilt rod having a first axis of rotation;

5 a driver mounted for rotation in first and second directions with said tilt rod;  
first and second driven drums rotationally driven by said driver;

10 first and second tilt cables, wherein said first tilt cable is connected to said first driven drum, and said second tilt cable is connected to said second driven drum, such that said first and second tilt cables are raised and lowered with the rotation of their respective driven drums;

means for stopping the rotation of said first drum while driving said second drum; and

means for stopping the rotation of said second drum while driving said first drum.

15

2. A tilter mechanism for tilting a covering for architectural openings as recited in claim 1,

wherein said driver is a drum driver mounted for rotation about said first axis of rotation and includes first and second driving surfaces;

20 wherein said first and second driven drums are mounted for rotation about said first axis;

25 wherein rotation of said tilt rod and drum driver in a first direction causes the first driving surface of said drum driver to drive said first driven drum, and rotation of said drum driver in the opposite direction causes the second driving surface of said drum driver to drive said second driven drum; and further comprising

a spring connected to both said first and second driven drums and biasing said first and second driven drums into contact with said first and second driving surfaces, respectively.

3. A tilter mechanism for tilting a covering for architectural openings as recited in claim 2, wherein one of said first and second tilt cables is an actuator cable, and further comprising a third tilt cable which is part of a ladder tape, wherein said actuator cable is secured to said third tilt cable.

5

4. A tilter mechanism for tilting a covering for architectural openings as recited in claim 2, and further comprising:

a housing supporting said first and second driven drums for rotation, said housing defining at least one housing limit stop, and at least one of said first and second driven drums defining a drum limit stop which cooperates with said housing limit stop to stop the rotation of said respective driven drum in at least one direction while permitting the other of said driven drums to continue rotating.

10

5. A tilter mechanism for tilting a covering for architectural openings as recited in claim 1, wherein said driver is a drive gear, mounted for rotation about said first axis, and further comprising first and second driven gears mounted for rotation with said first and second driven drums, respectively, said first driven gear and first driven drum mounted for rotation about a second axis, parallel to said first axis, and said second driven gear and second driven drum mounted for rotation about a third axis, parallel to said first axis.

15

20

6. A tilter mechanism for tilting a covering for architectural openings, comprising:

first and second tilt drums mounted for rotation about separate, parallel, first and second axes, respectively;

25

first and second tilt cables, said first tilt cable being connected to said first tilt drum and said second tilt cable being connected to said second tilt drum, such that each of said tilt cables is raised and lowered with the rotation of its respective tilt drum.

30

7. A tilter mechanism as recited in claim 6, and further comprising a drive gear drivingly connected to said first and second tilt drums and mounted for rotation about a third axis parallel to said first and second axes.

5 8. A tilter mechanism as recited in claim 7, and further comprising a first driven gear mounted for rotation with said first tilt drum and a second driven gear mounted for rotation with said second tilt drum, wherein said first and second driven gears are mounted so as to mesh with and be driven by said driven gear, and further comprising a stop which stops the rotation of one of said driven gears while allowing  
10 said drive gear to continue driving the other of said driven gears.

9. A tilter mechanism for tilting a covering for architectural openings, as recited in claim 7, and further comprising:

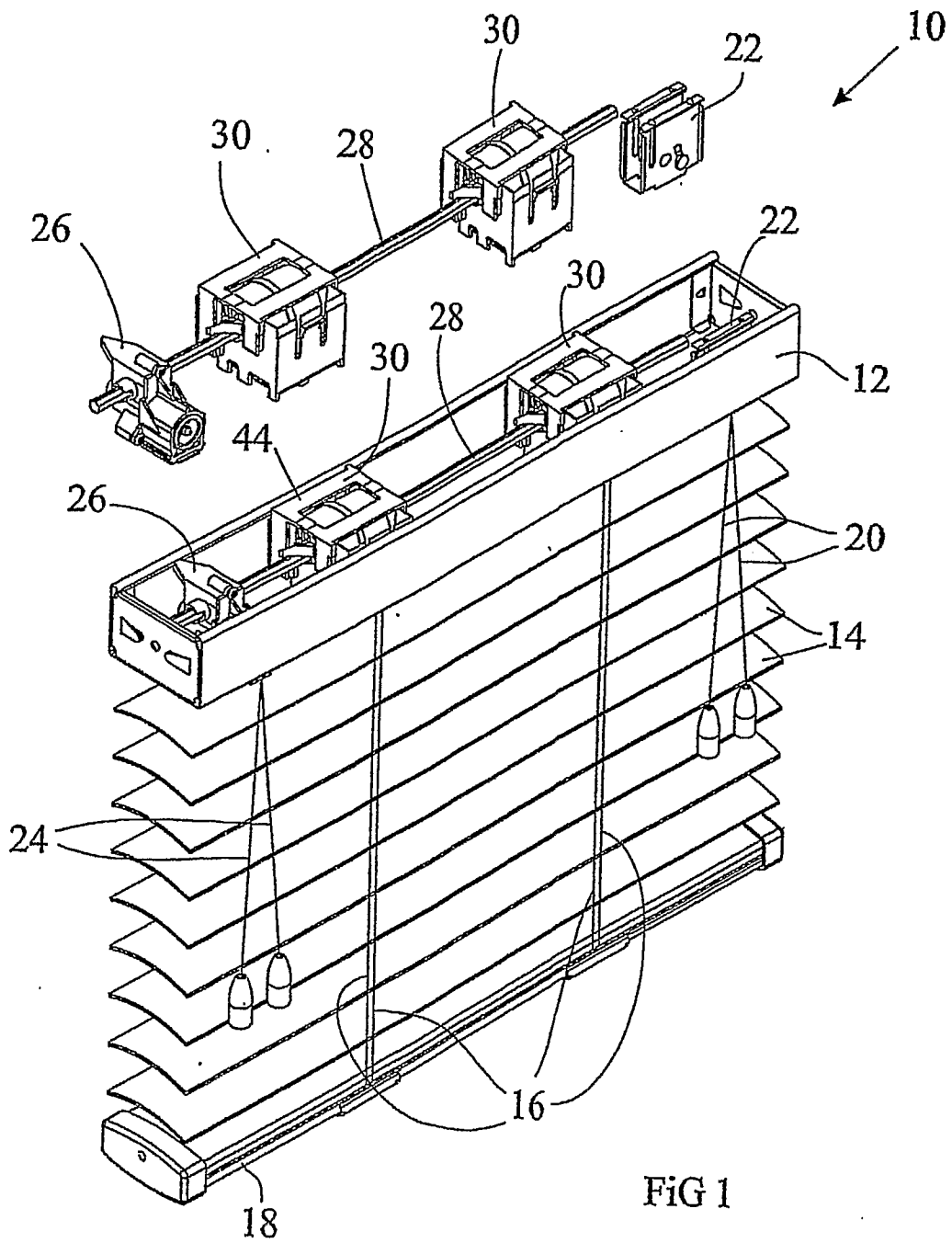
a first driven gear mounted for rotation with said first tilt drum;  
15 a second driven gear mounted for rotation with said second tilt drum;  
said first and second driven gears each defining a geared portion and a substantially cylindrical smooth portion, wherein said smooth portion includes a concave section;  
said drive gear including first and second substantially cylindrical portions,  
20 said first portion defining a toothed portion and a smooth portion, said second portion defining a raised boss portion; and  
wherein, at some angular positions, said toothed portion of said drive gear meshes with said geared portions of said first driven gear while said raised boss portion of said drive gear mates with said concave section of said second driven  
25 gear so as to drive said first driven gear while stopping said second driven gear, and at some other angular positions, said toothed portion of said drive gear meshes with said geared portions of said second driven gear, while said raised boss portion of said drive gear mates with said concave section of said first driven gear so as to drive said second driven gear while stopping said first driven gear.

30

10. A tilter mechanism for tilting a covering for architectural openings as recited in claim 7, and further comprising:

third and fourth tilt drums axially aligned with said first and second tilt drums, respectively; and

5 first and second tilt rods, wherein said first tilt rod connects said first and third tilt drums and said second tilt rod connects said second and fourth tilt drums.





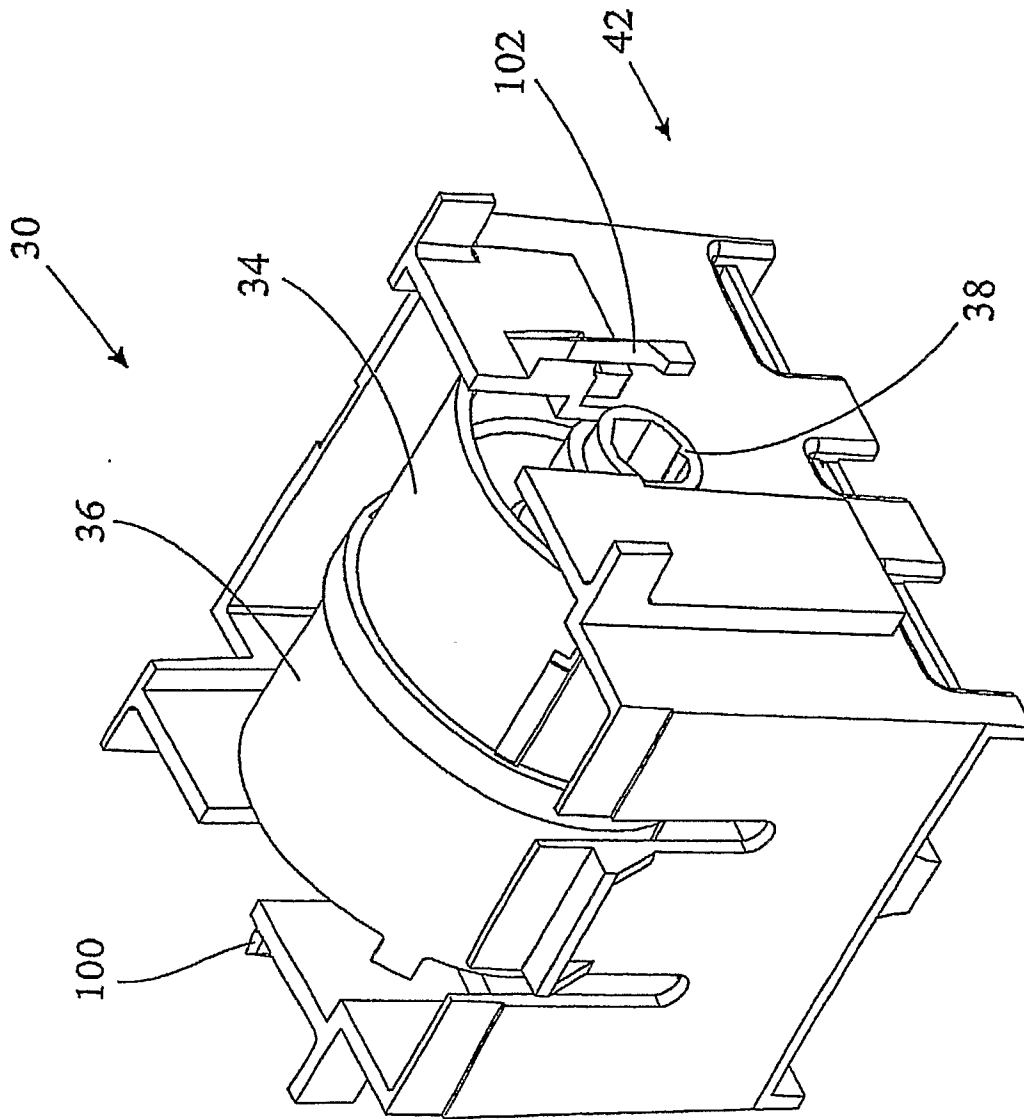


FIG 2

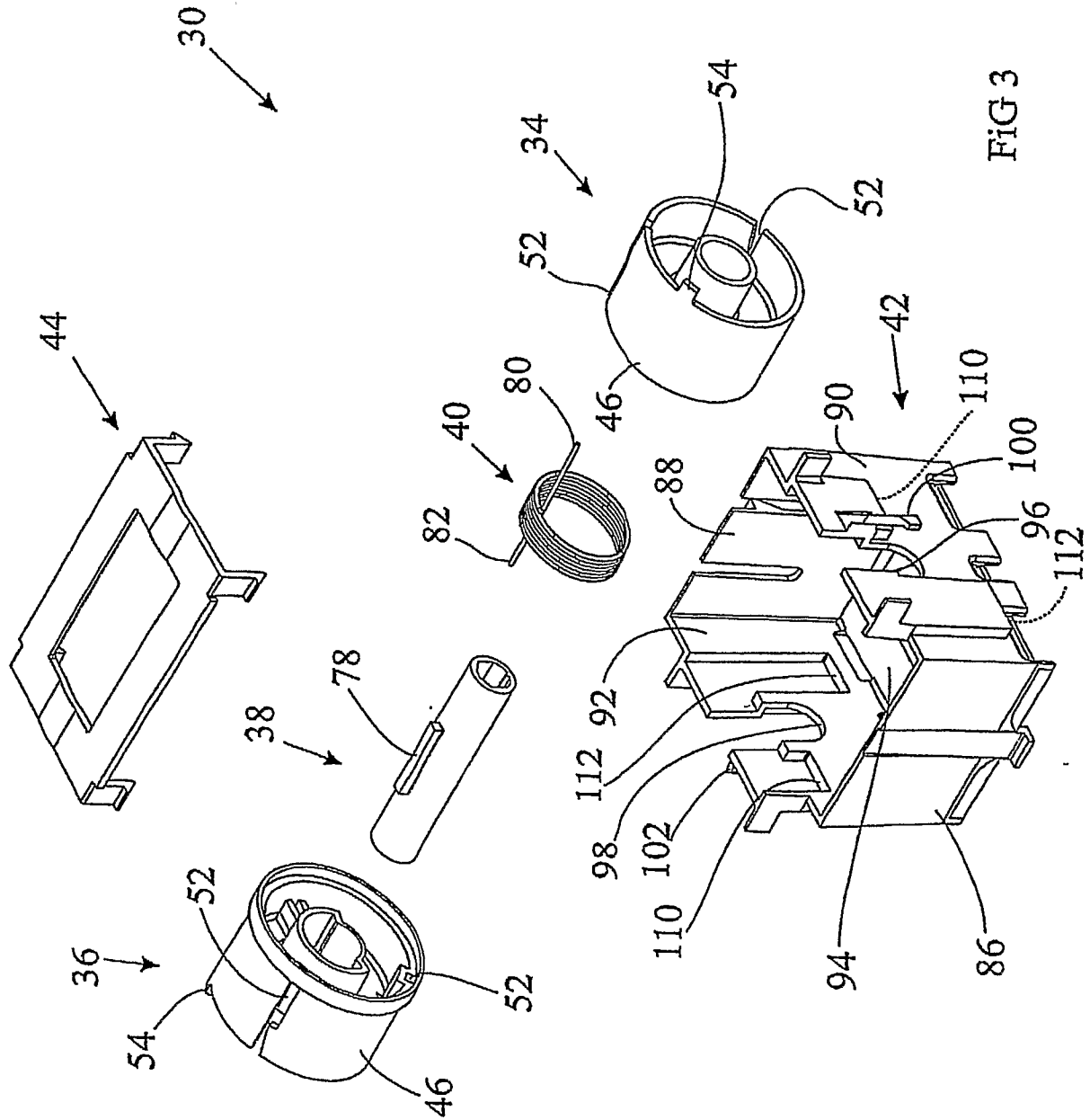


FIG 3

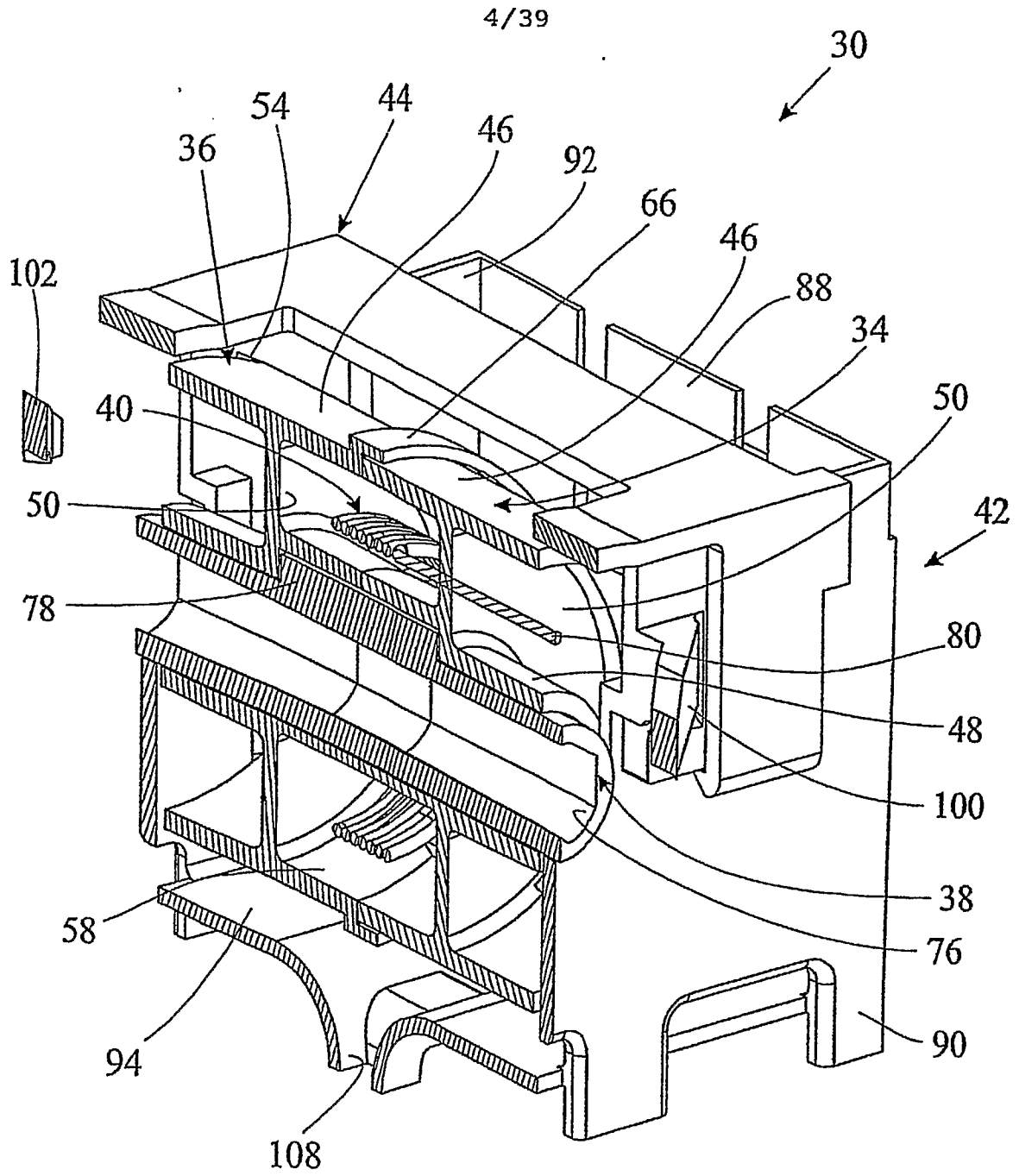


FIG 3B

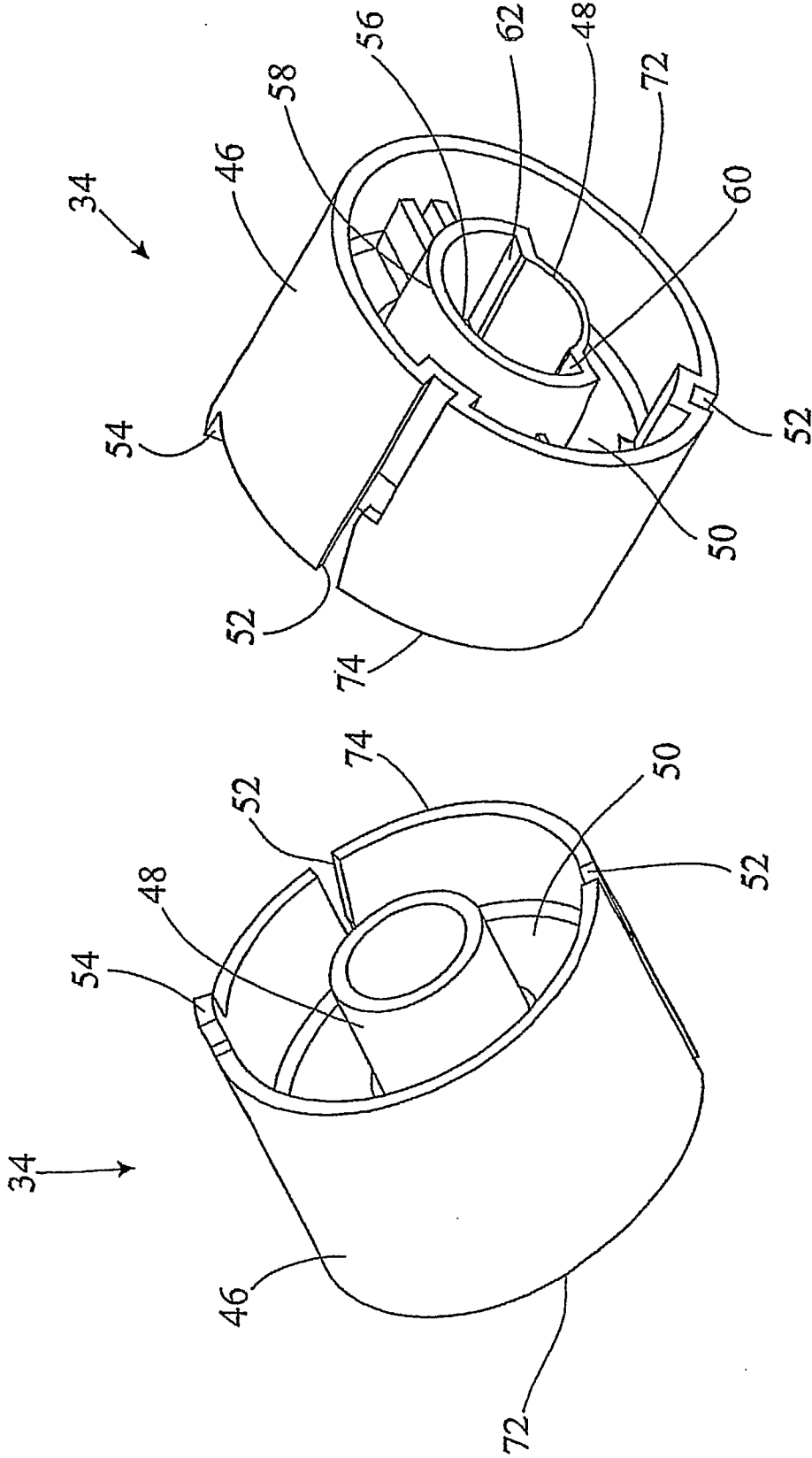


FIG 5

FIG 4

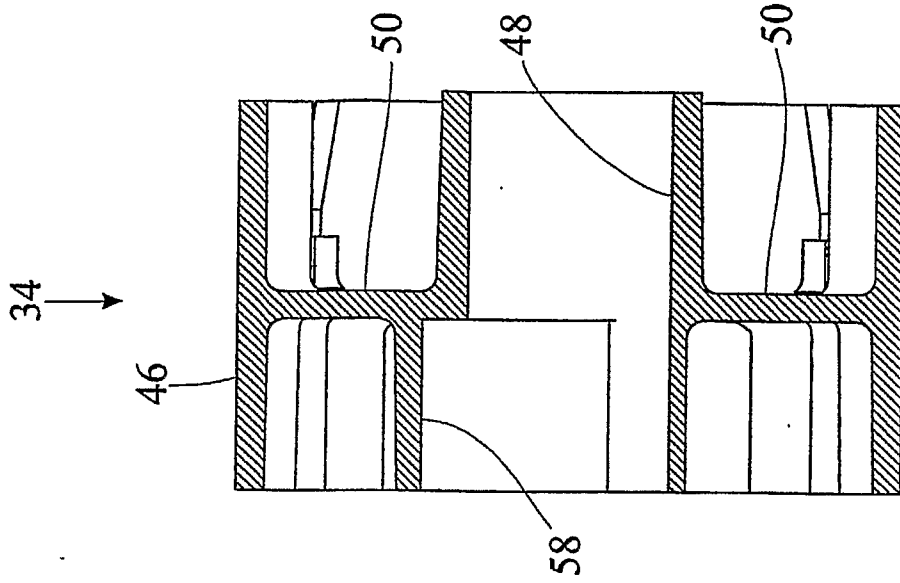


FIG 16

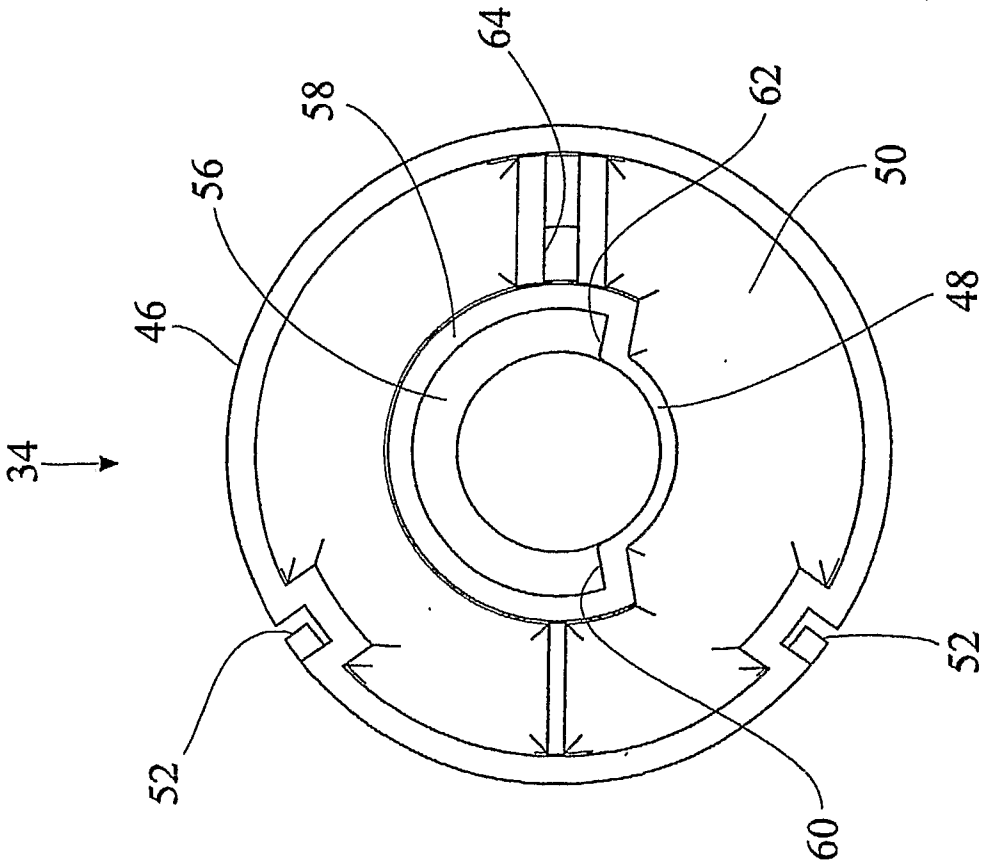


FIG 6

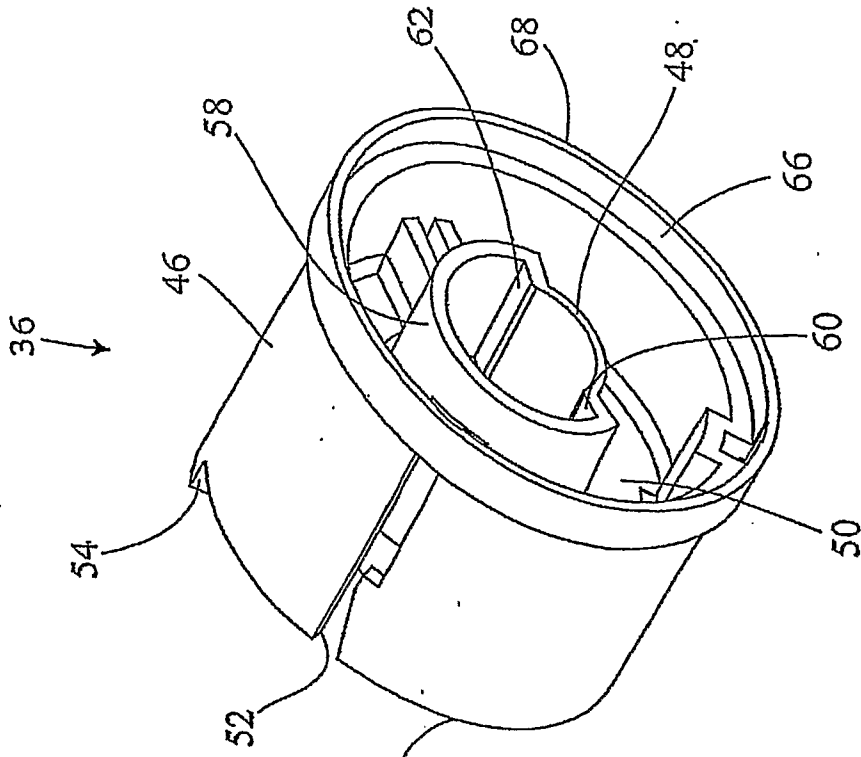


FIG 8

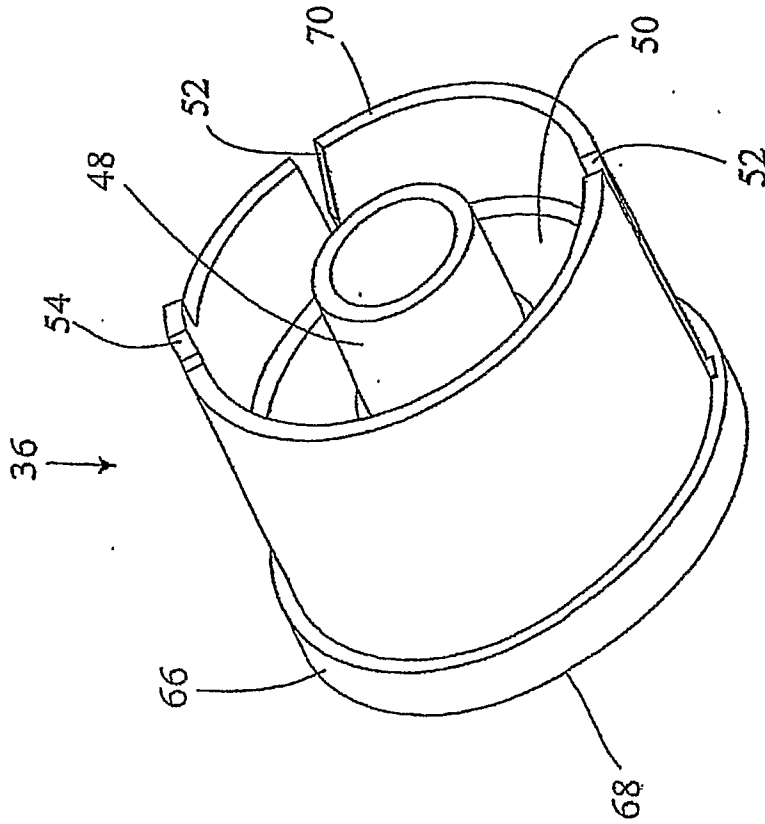


FIG 7

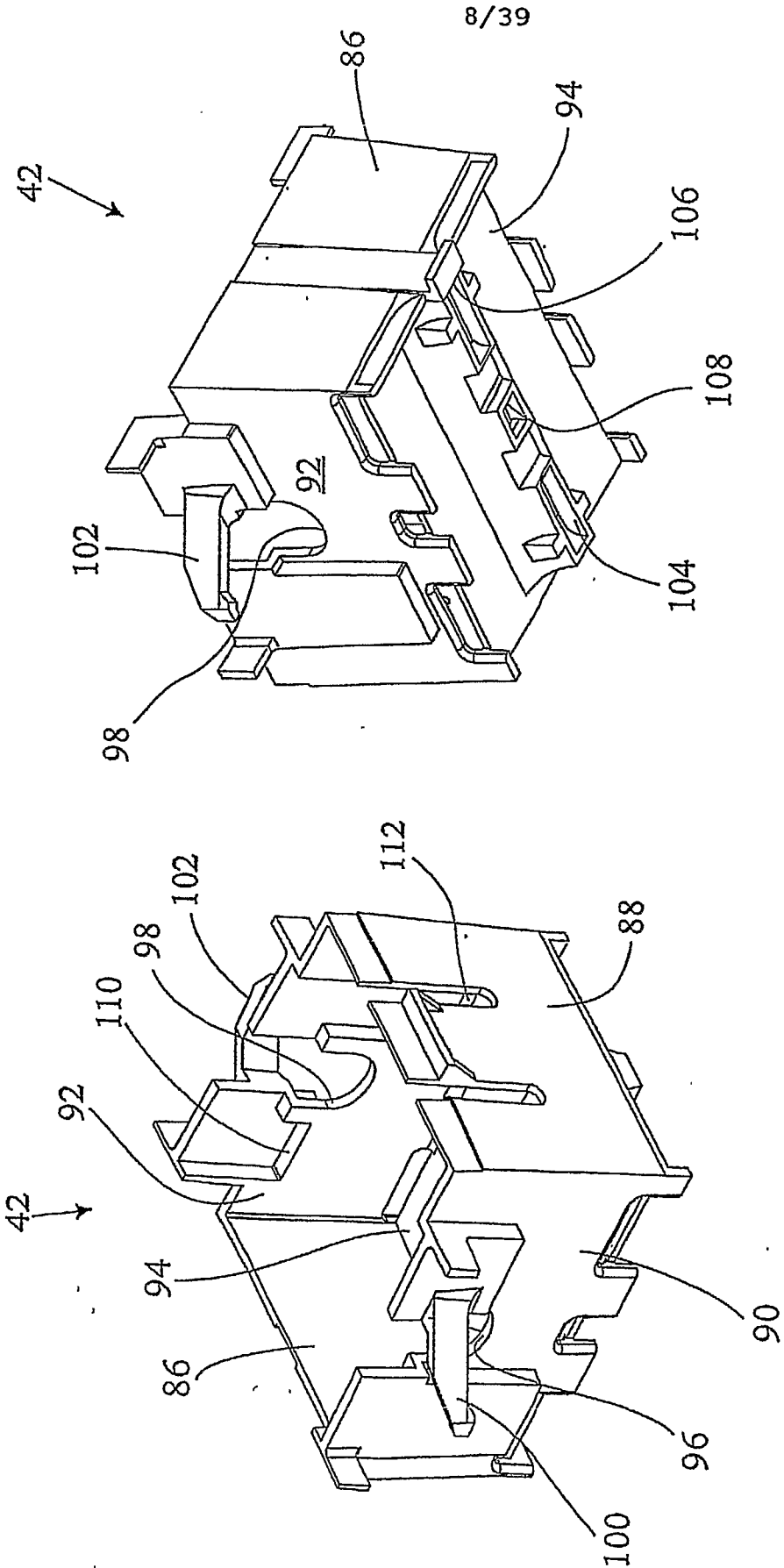


FIG 10

FIG 9

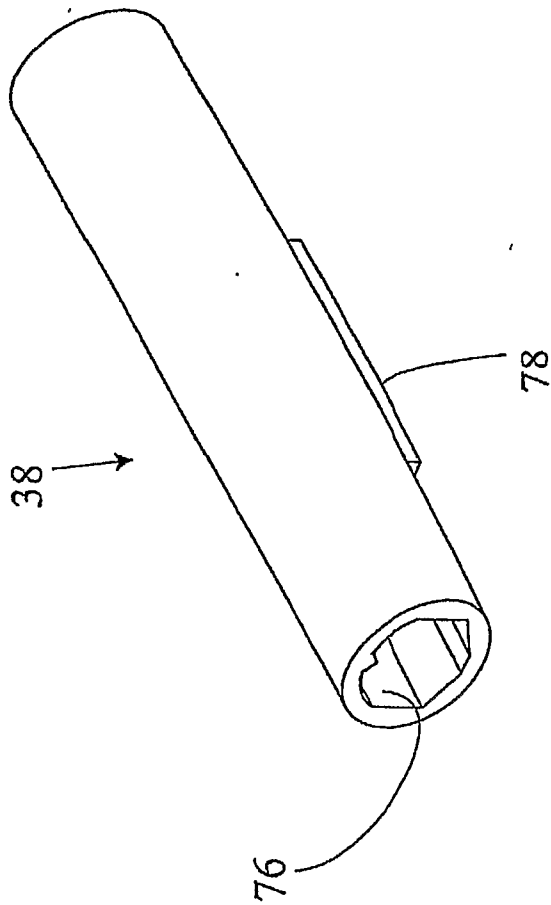


FIG 11

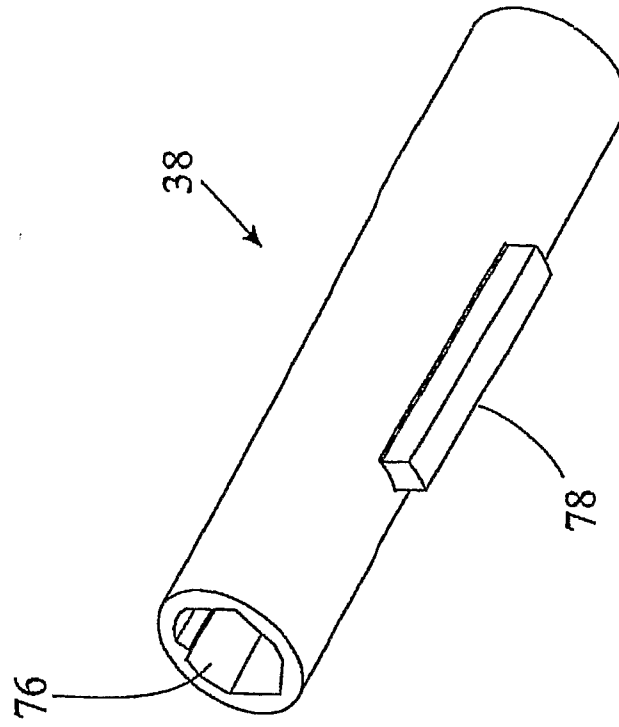


FIG 12



10/39

FIG 13

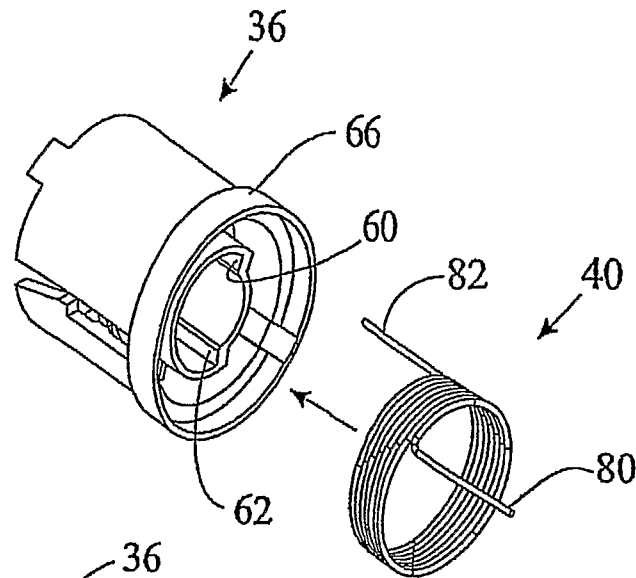


FIG 14

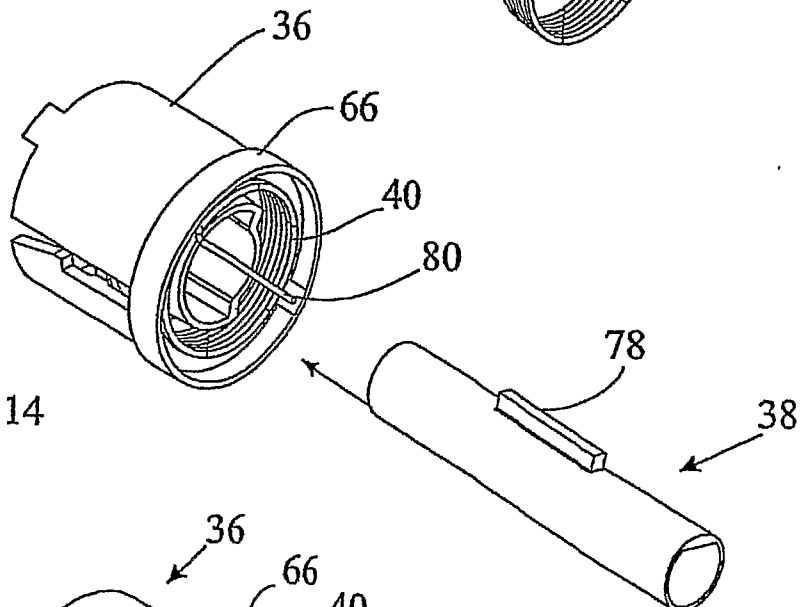
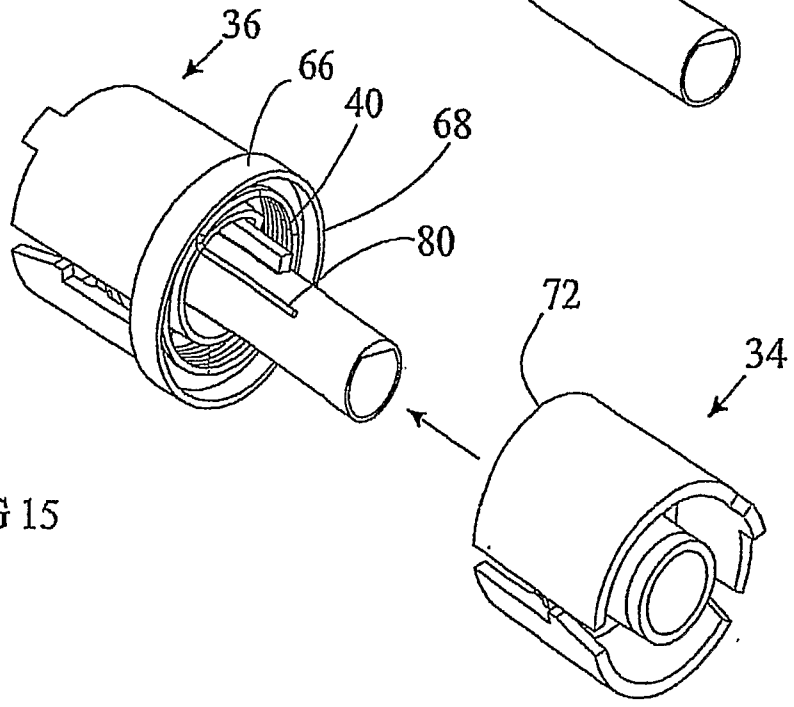
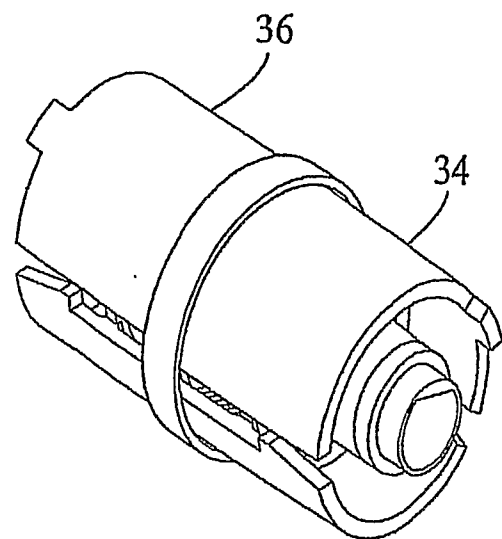
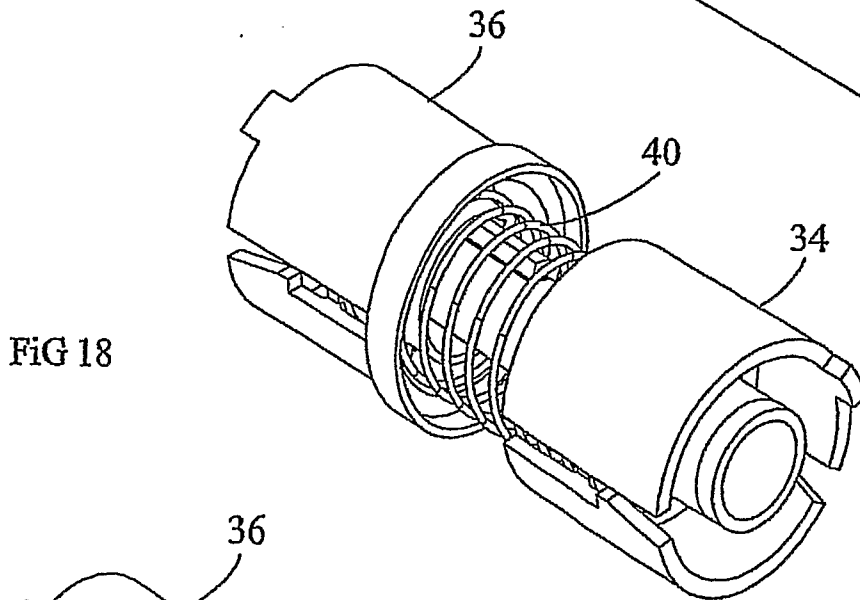
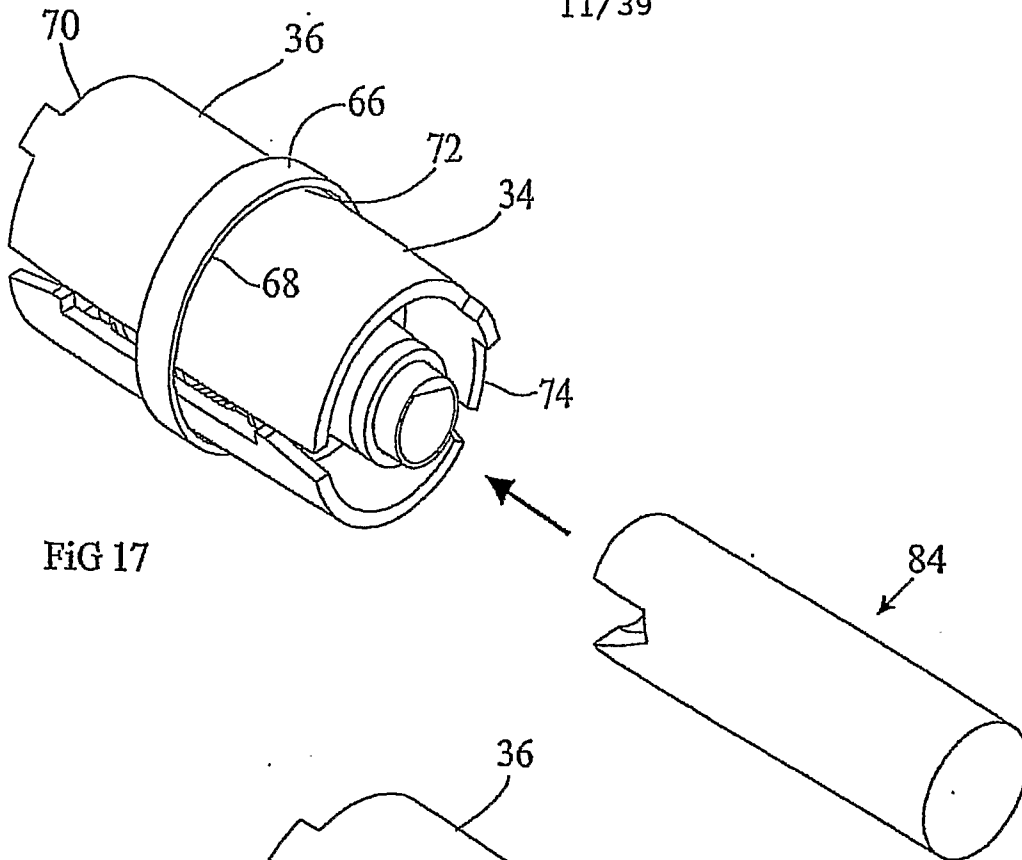


FIG 15



11/39



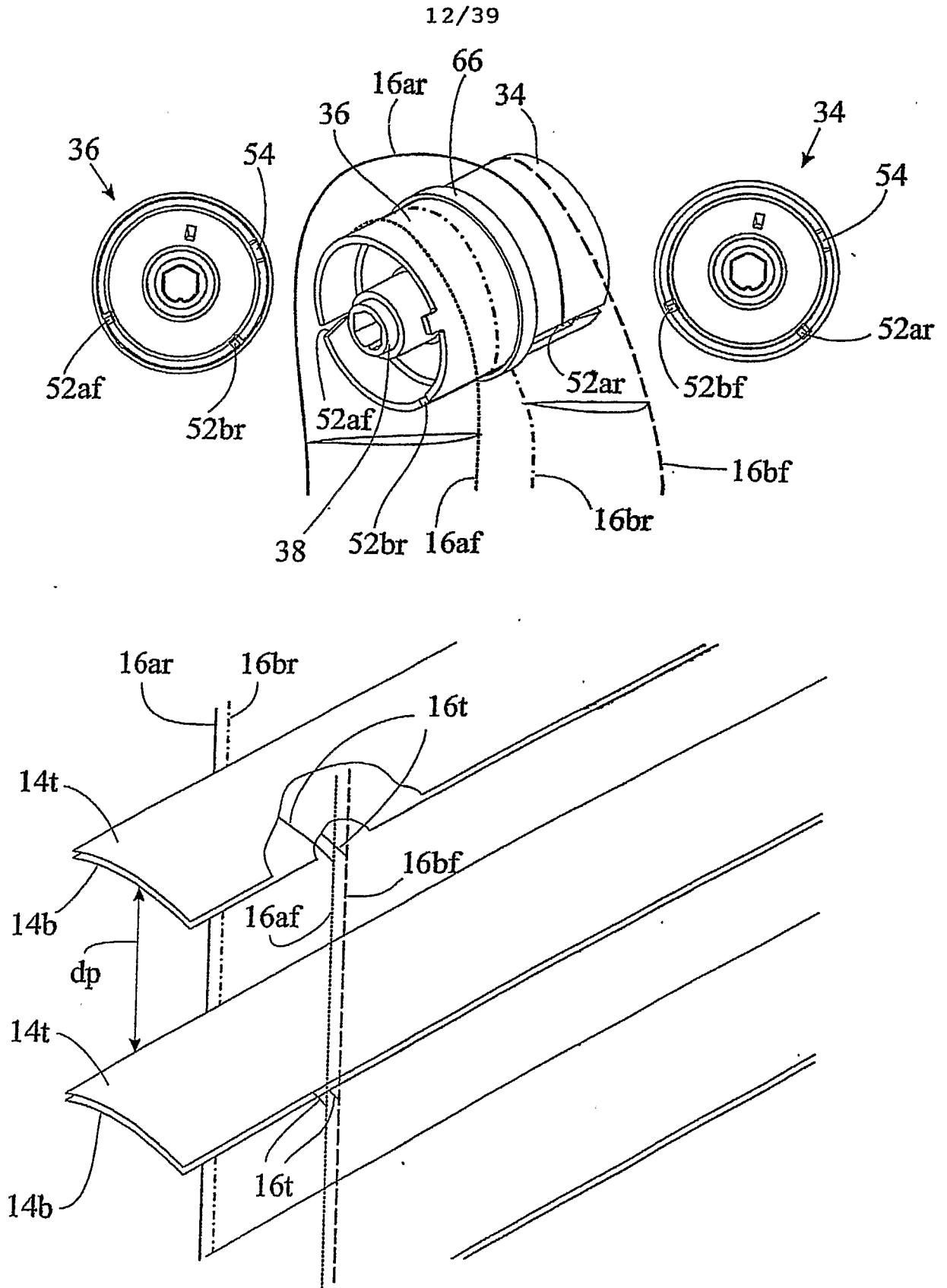


FIG 20

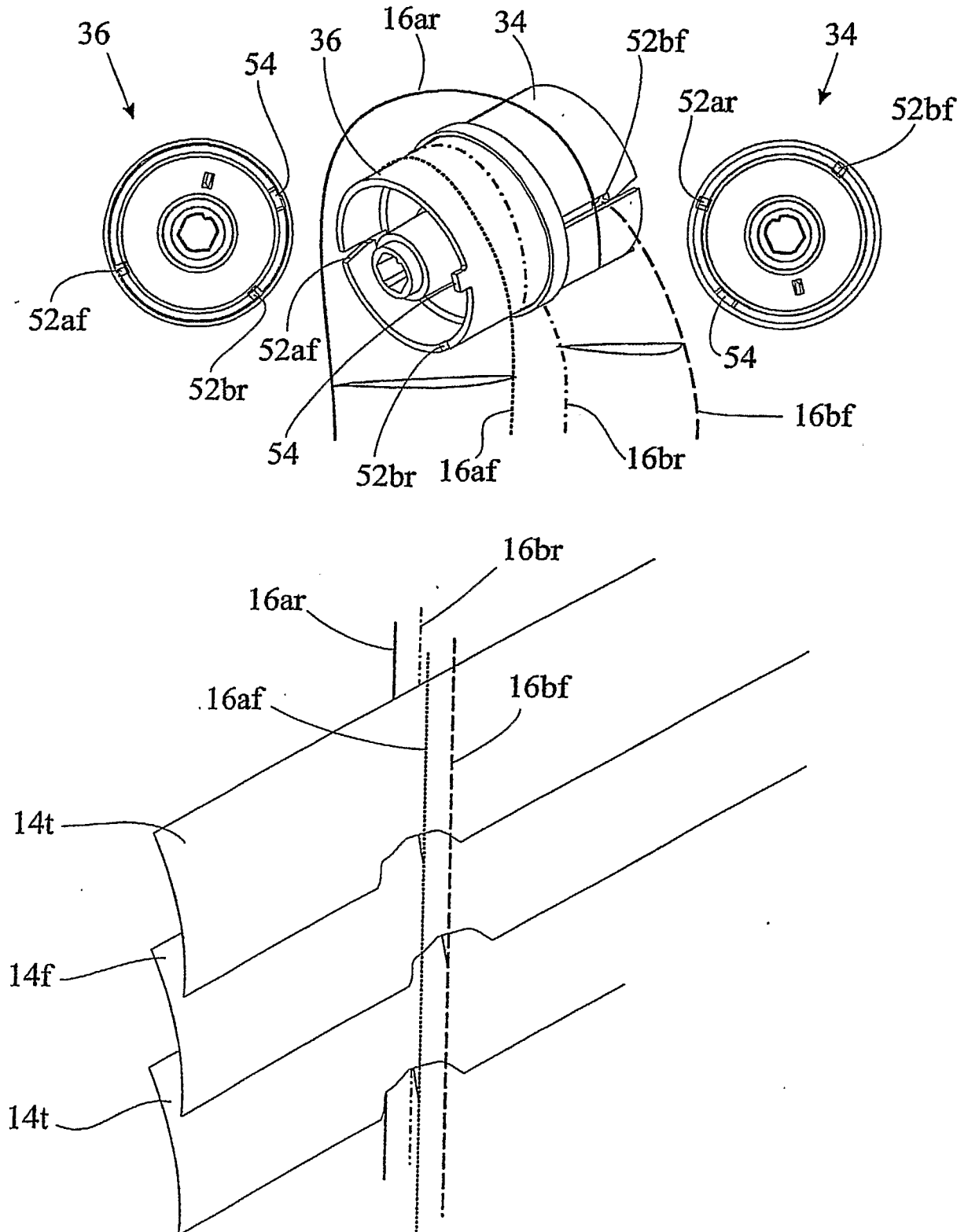


FIG 21

14/39

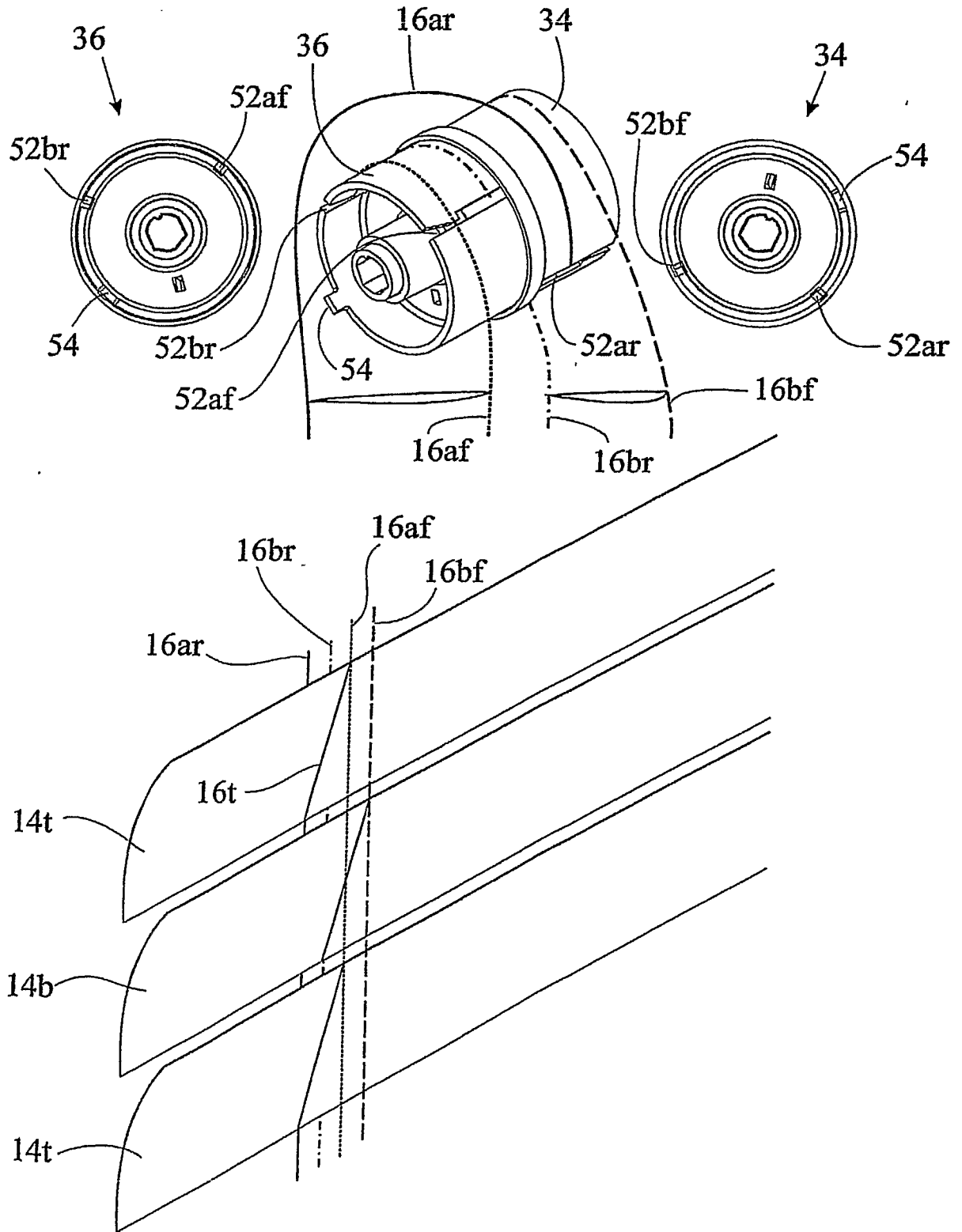


FIG 22

15/39

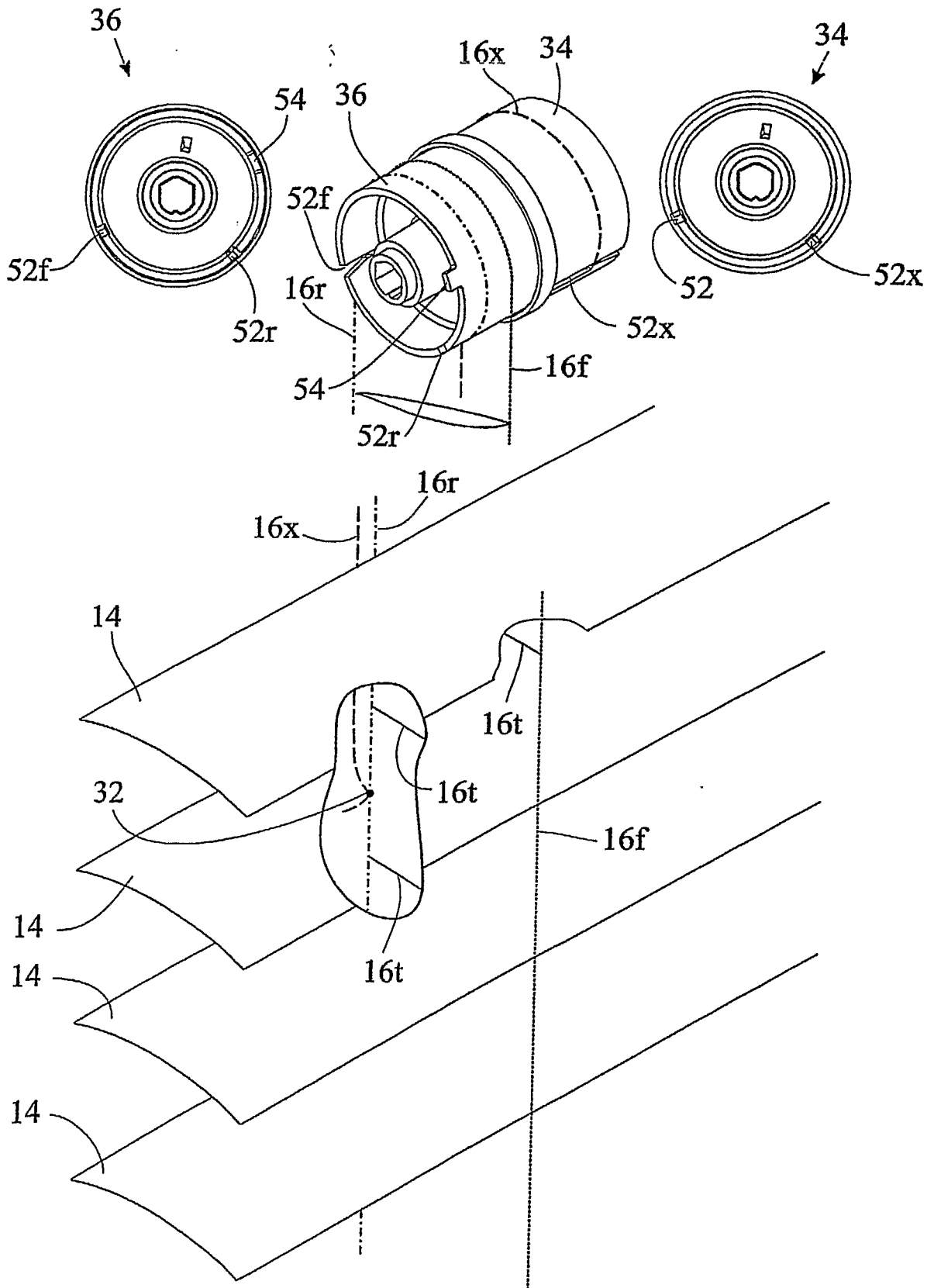


FIG 23

16/39

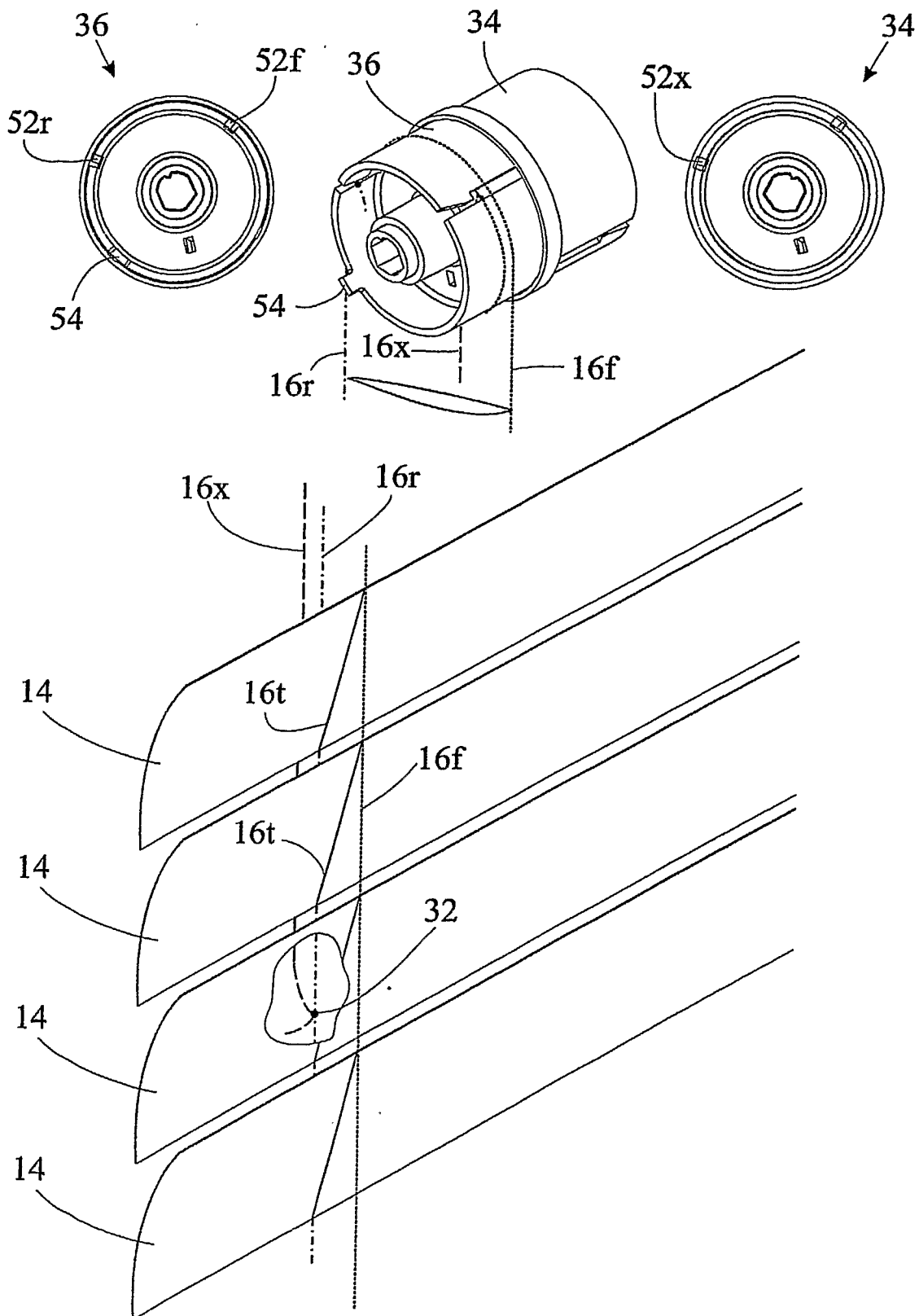


FIG 24

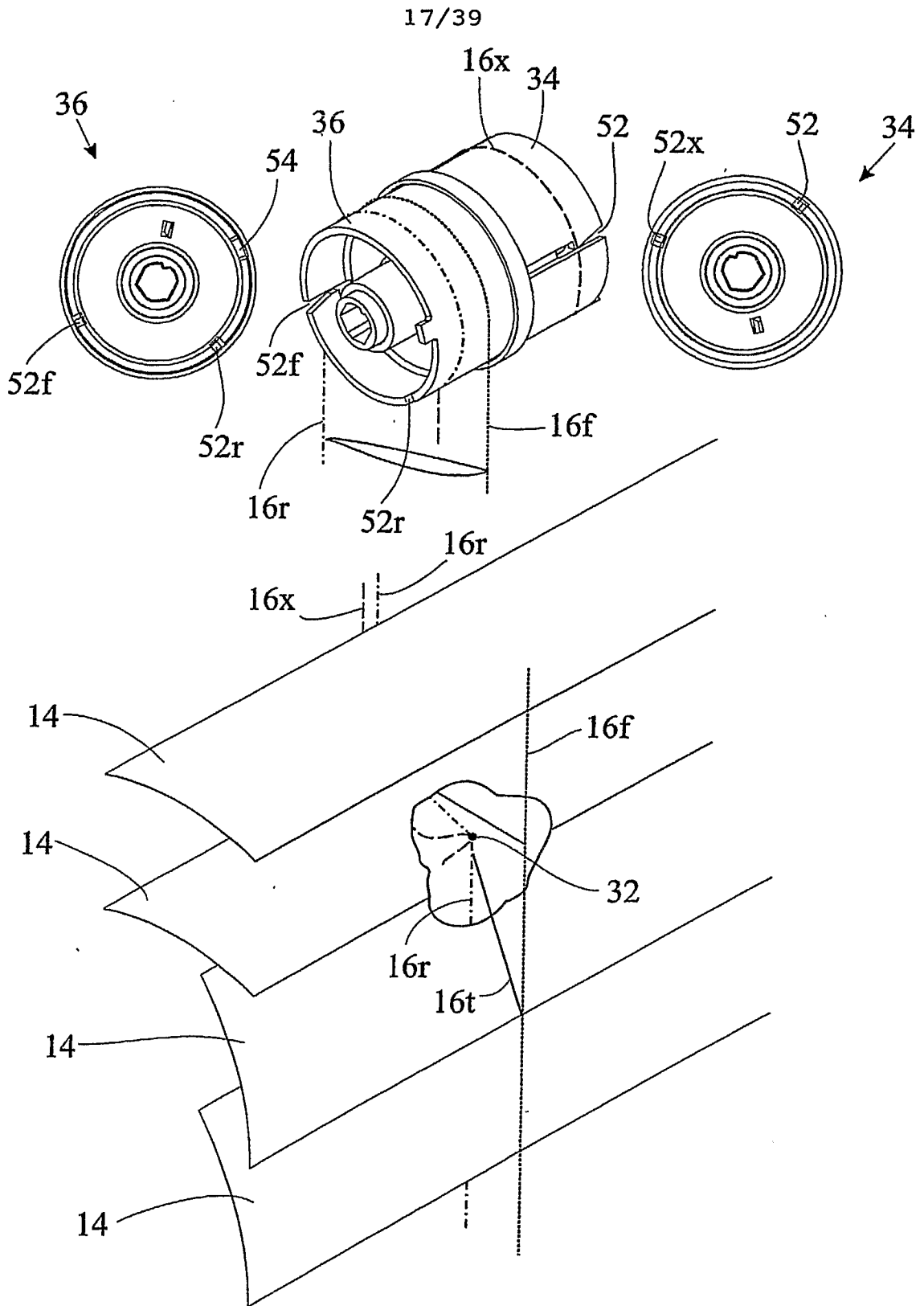


FIG 25



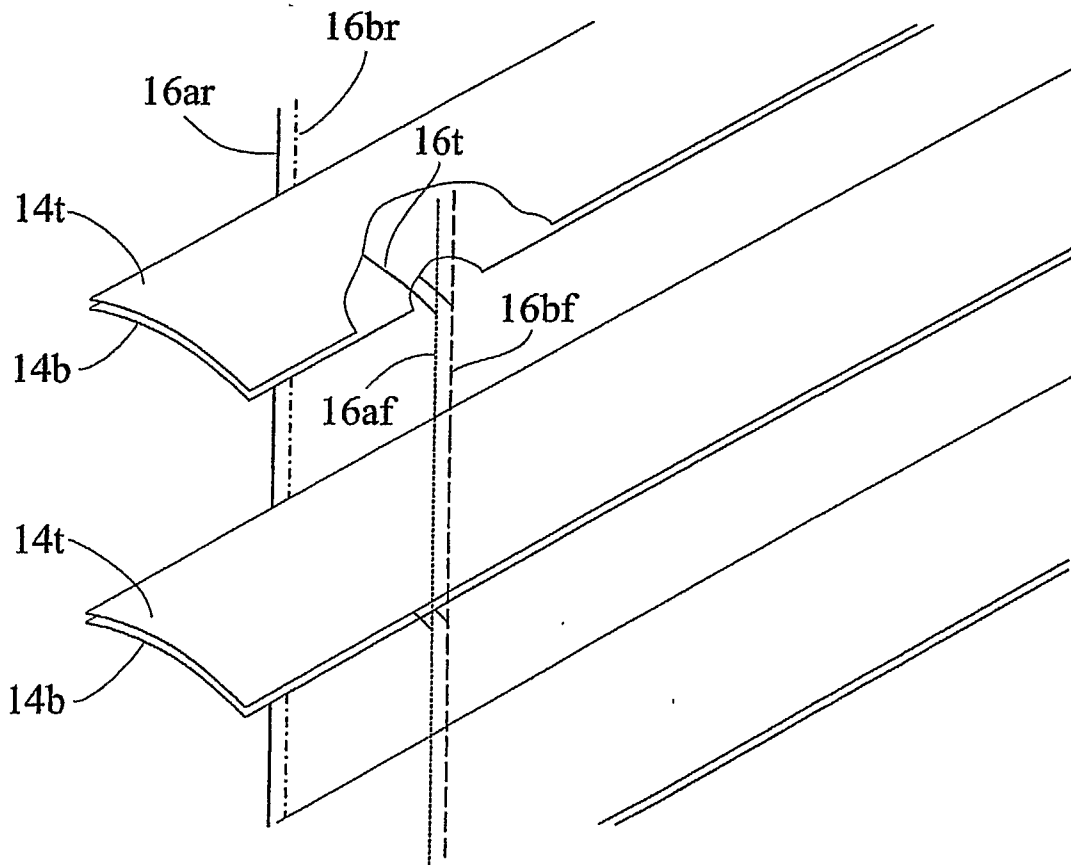
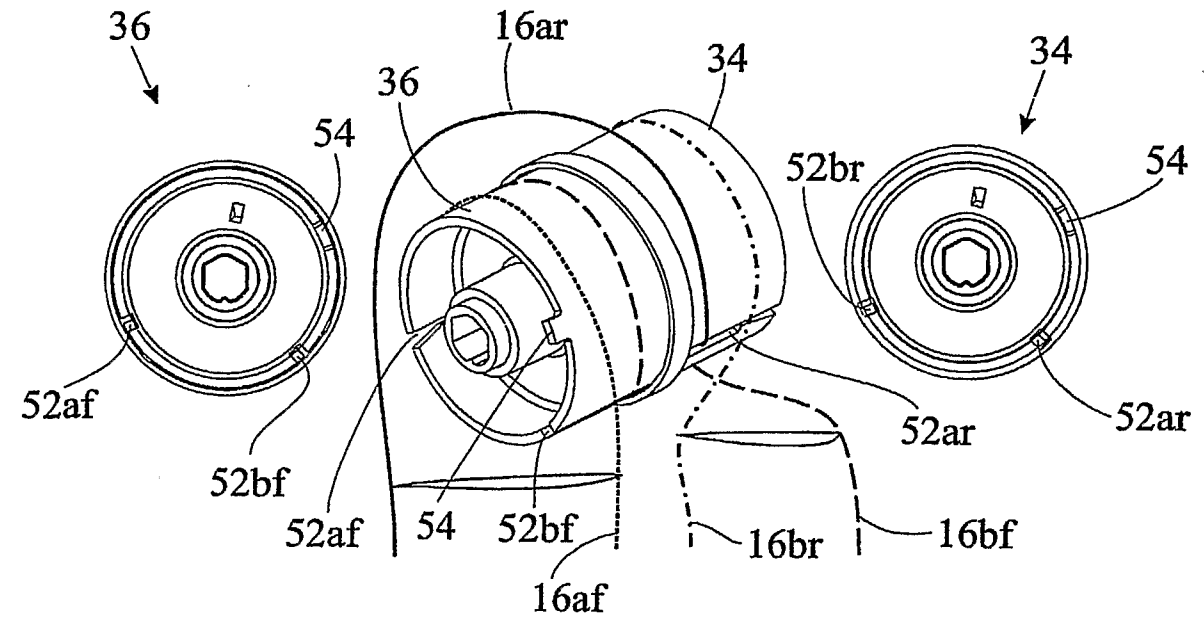


FIG 26

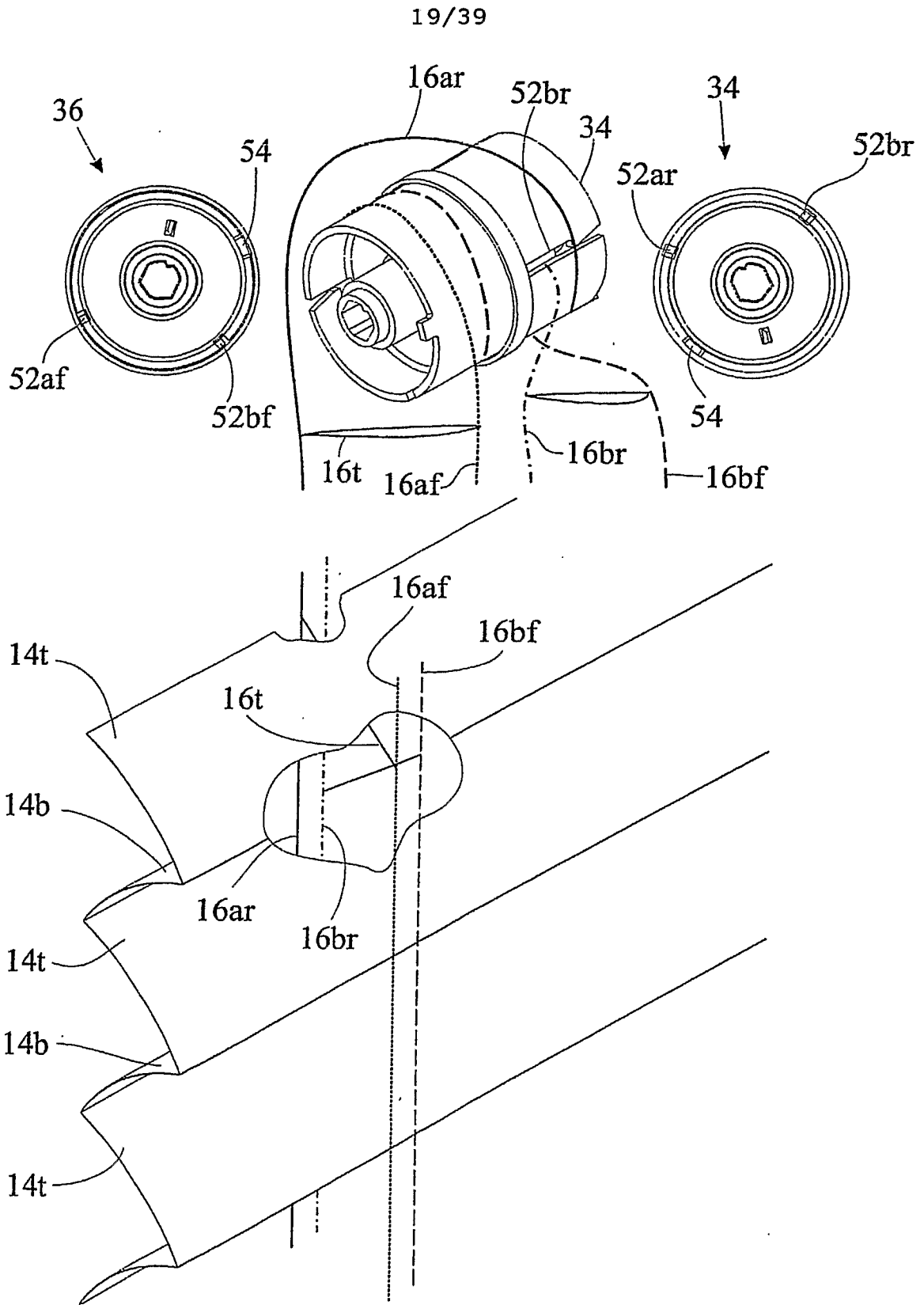


FIG 27

20/39

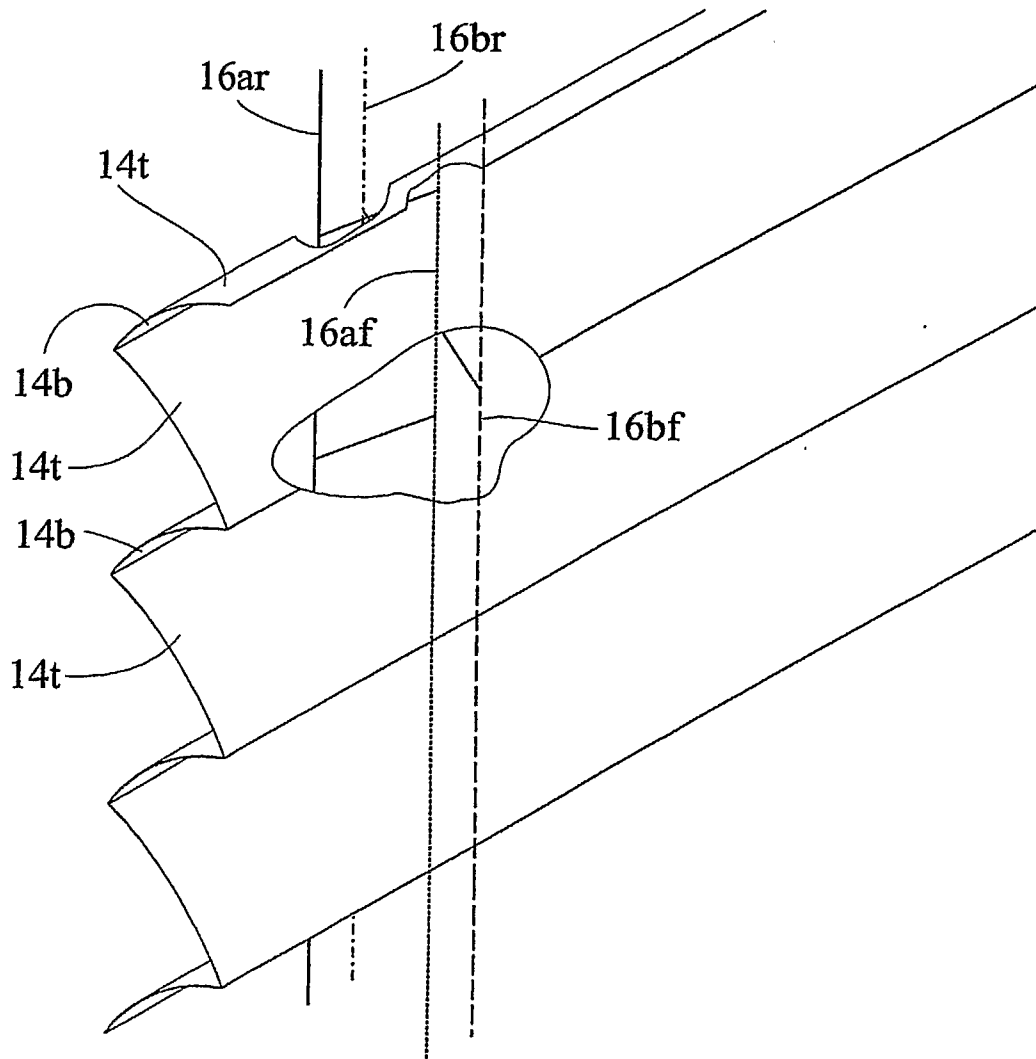
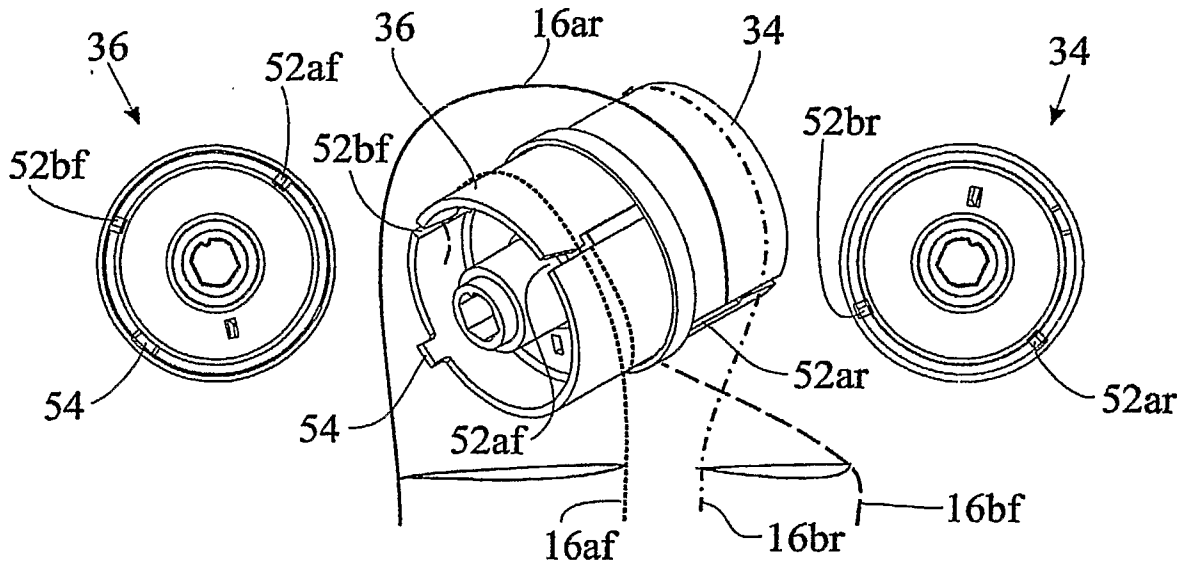


FIG 28

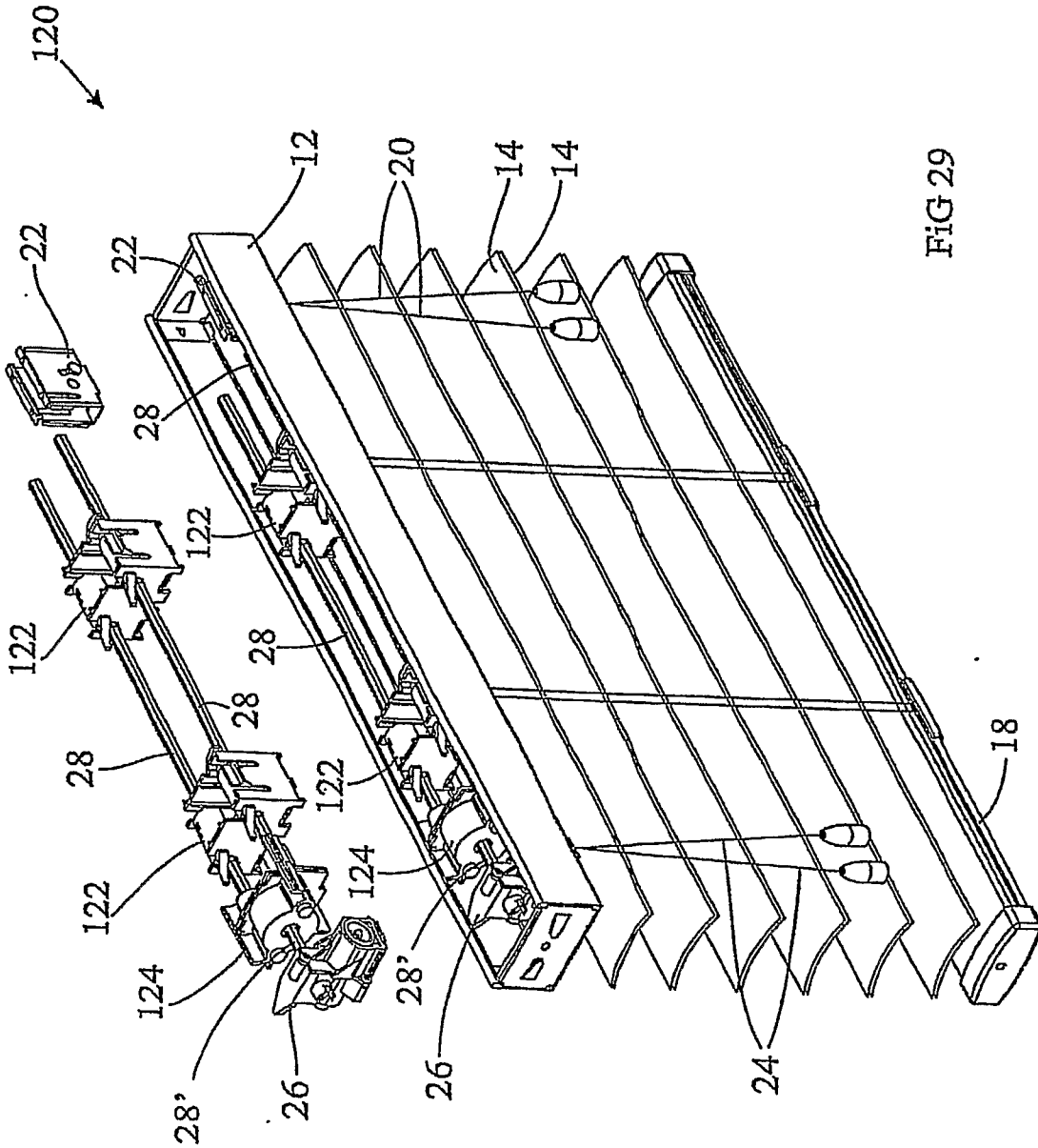


FIG 29

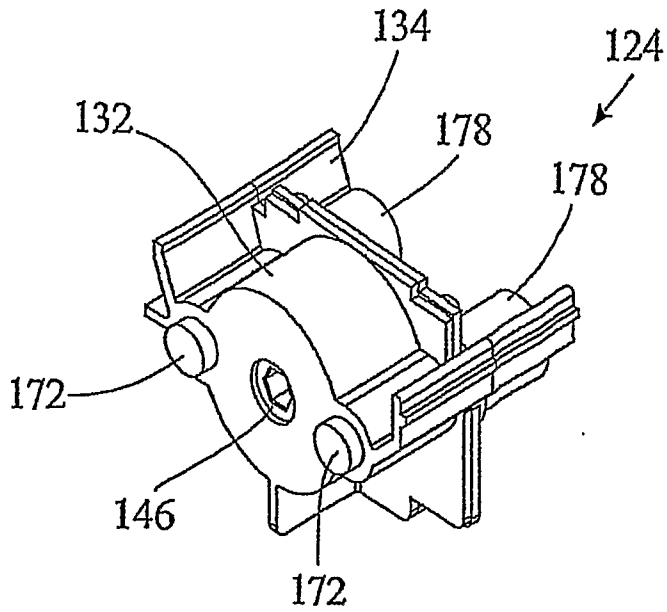
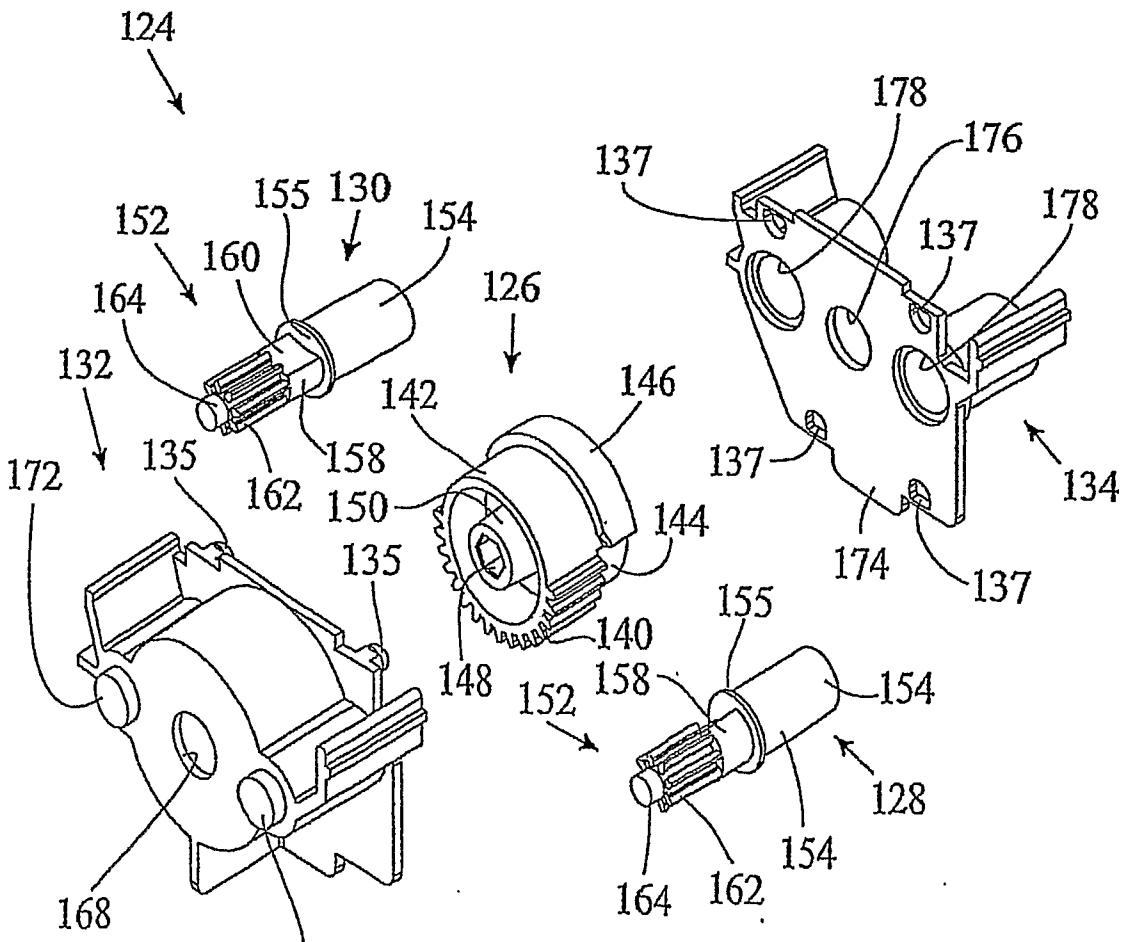
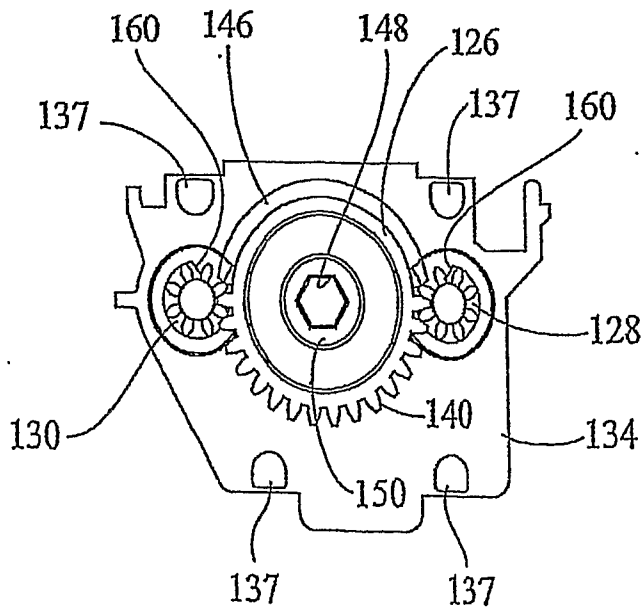
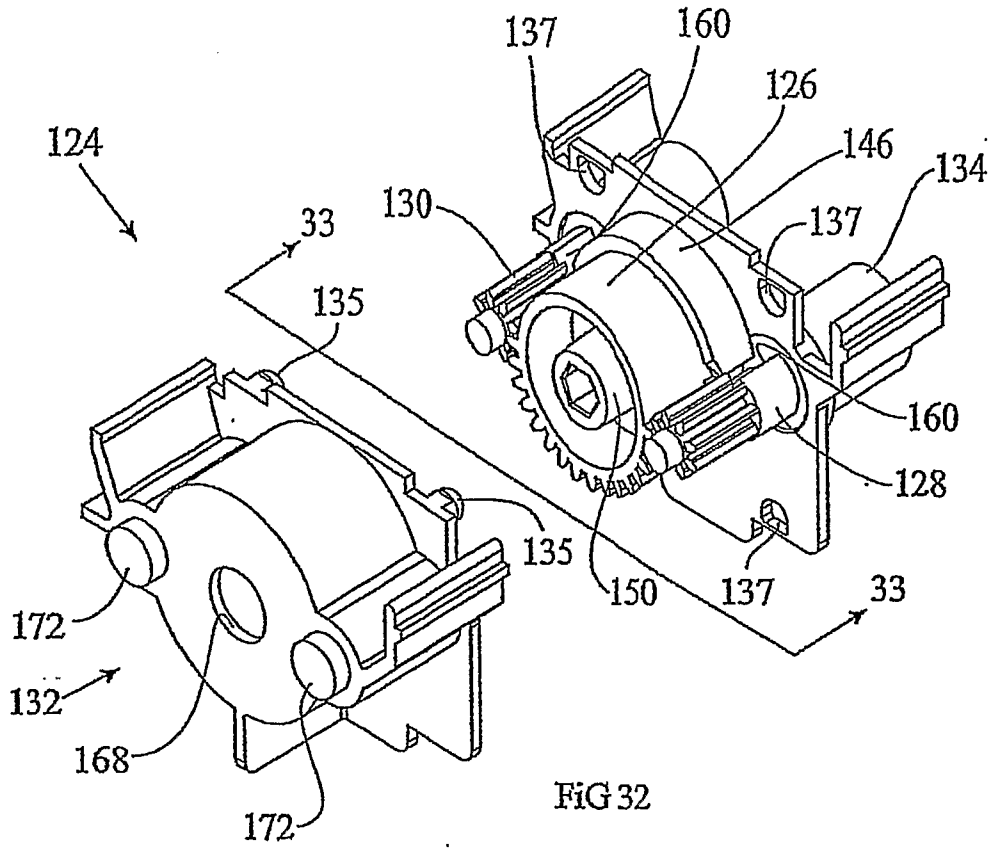


FIG 30





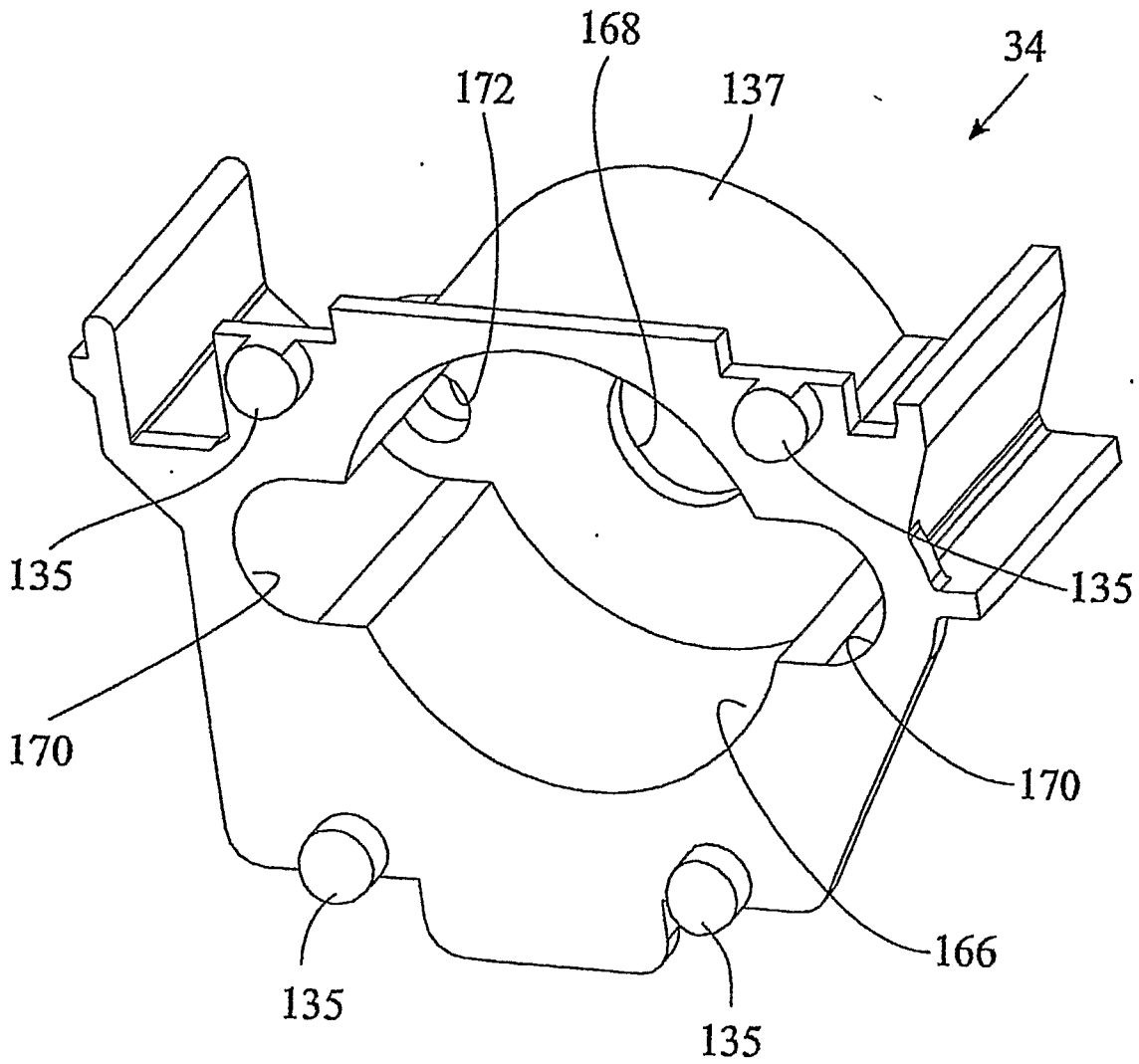


FIG 34

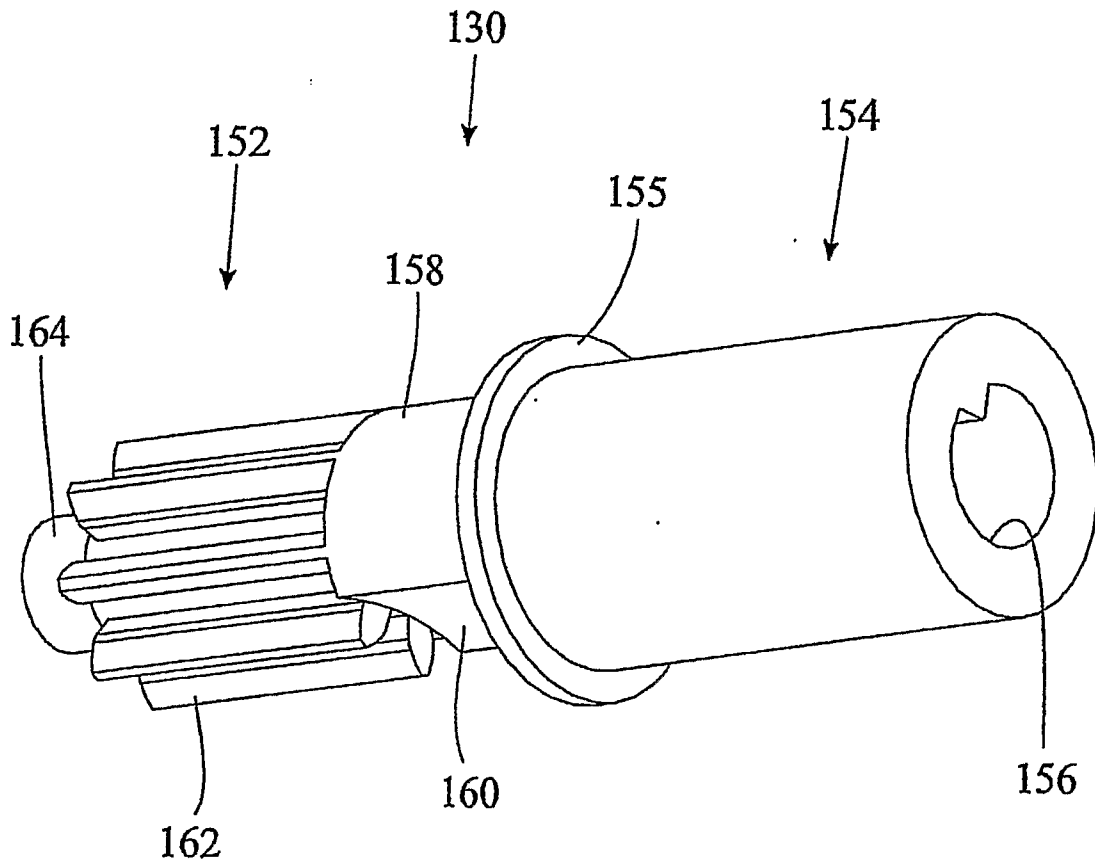


FIG 35



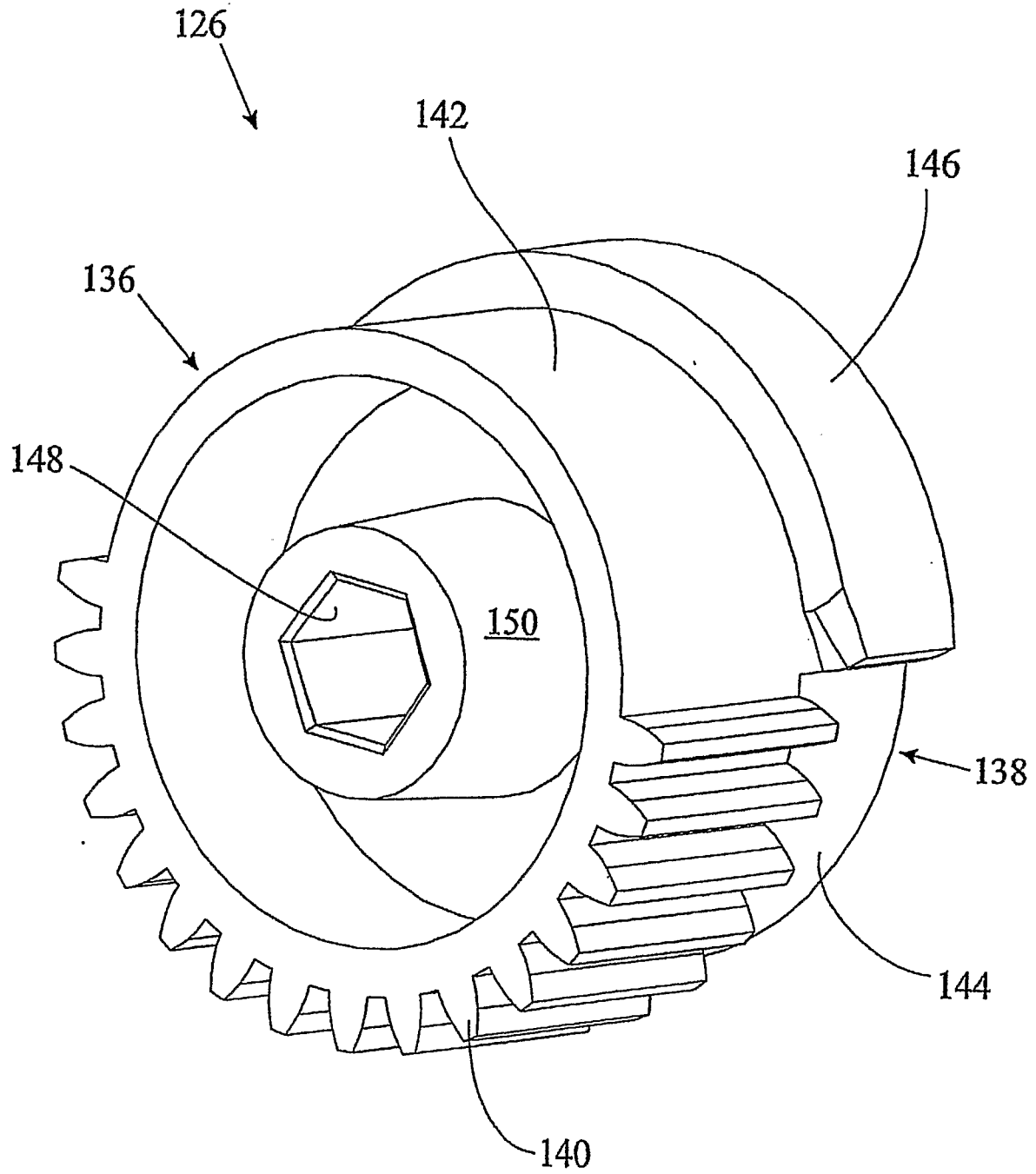


FIG 36

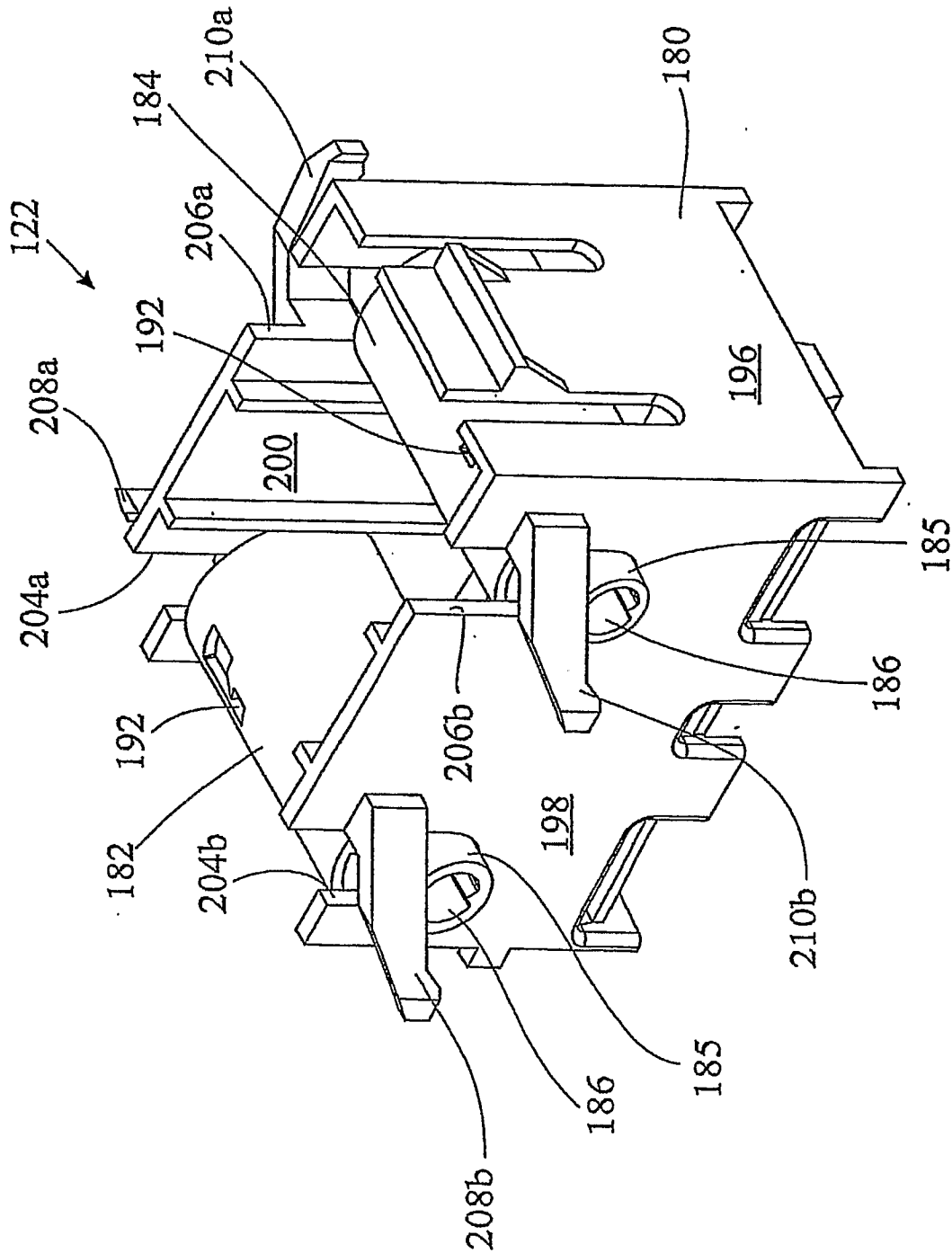


FIG 37

28/39

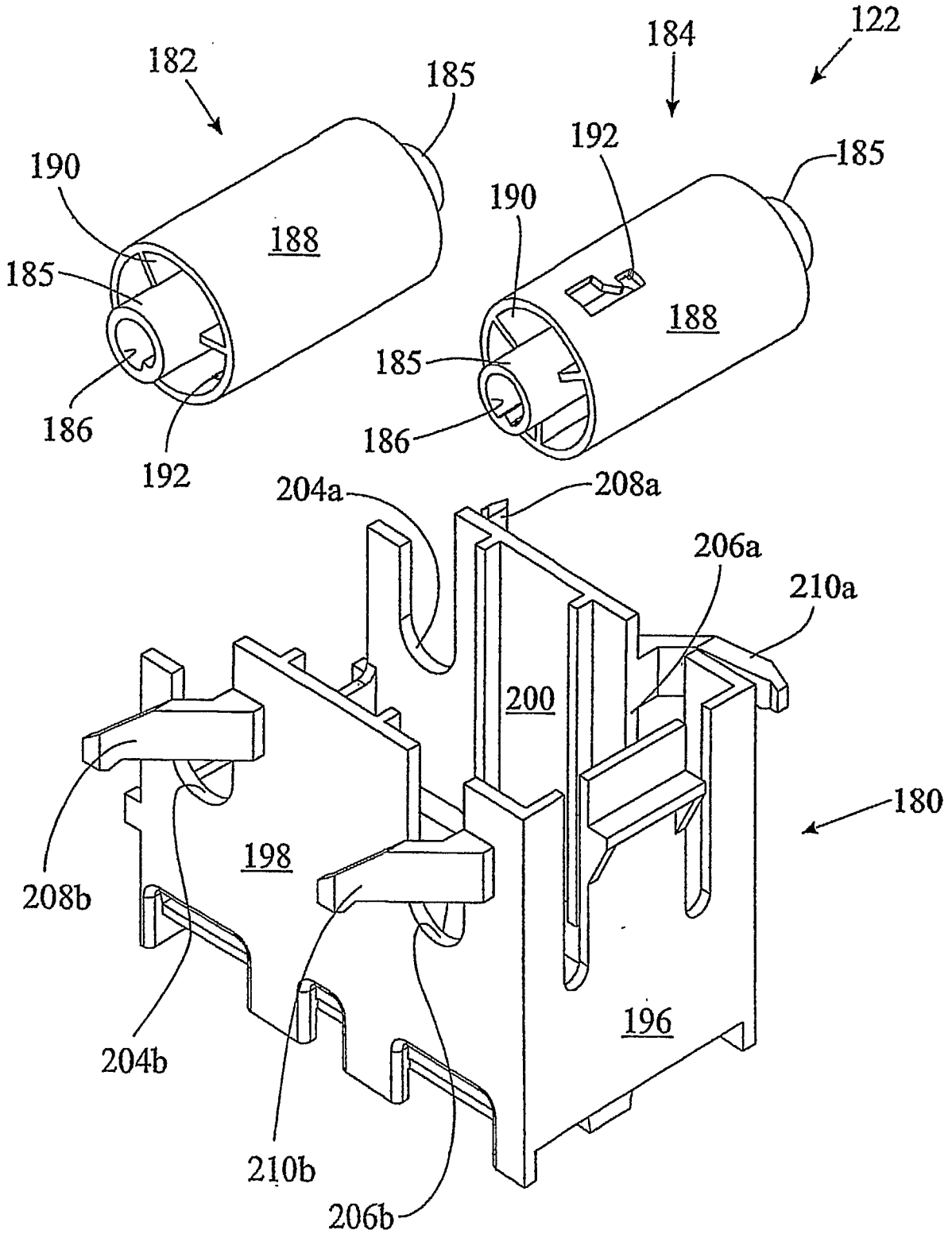


FIG 38

29/39

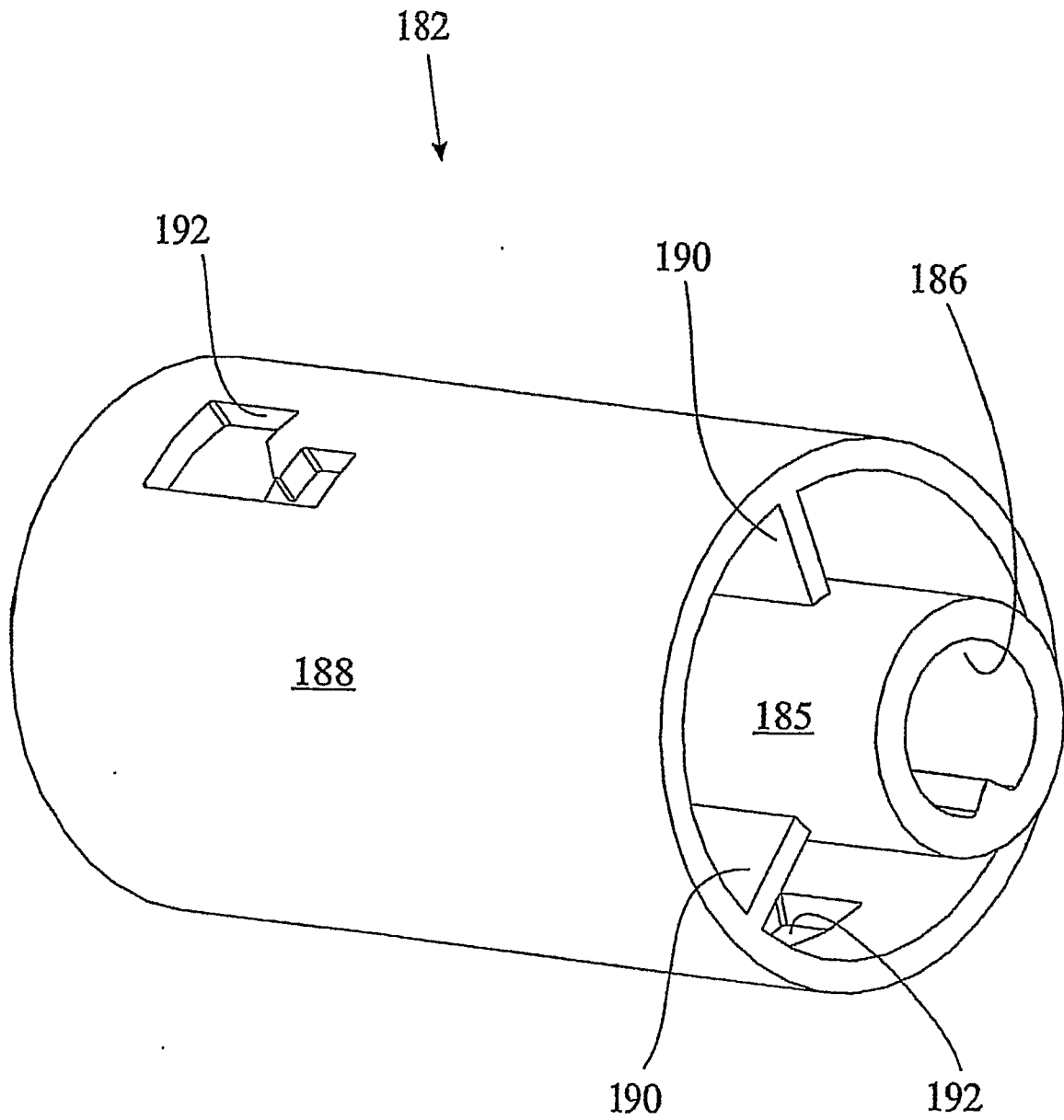


FIG 39

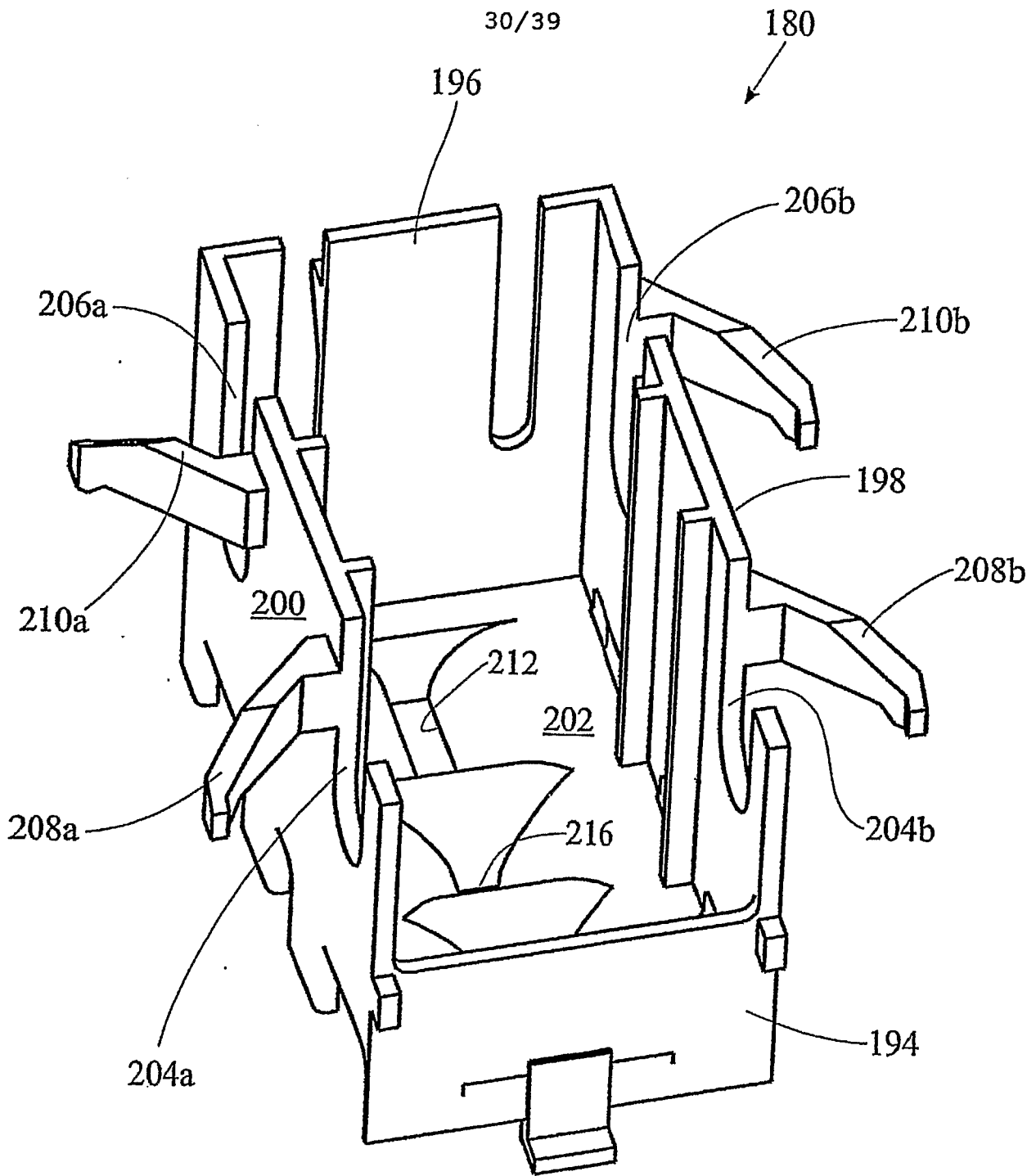
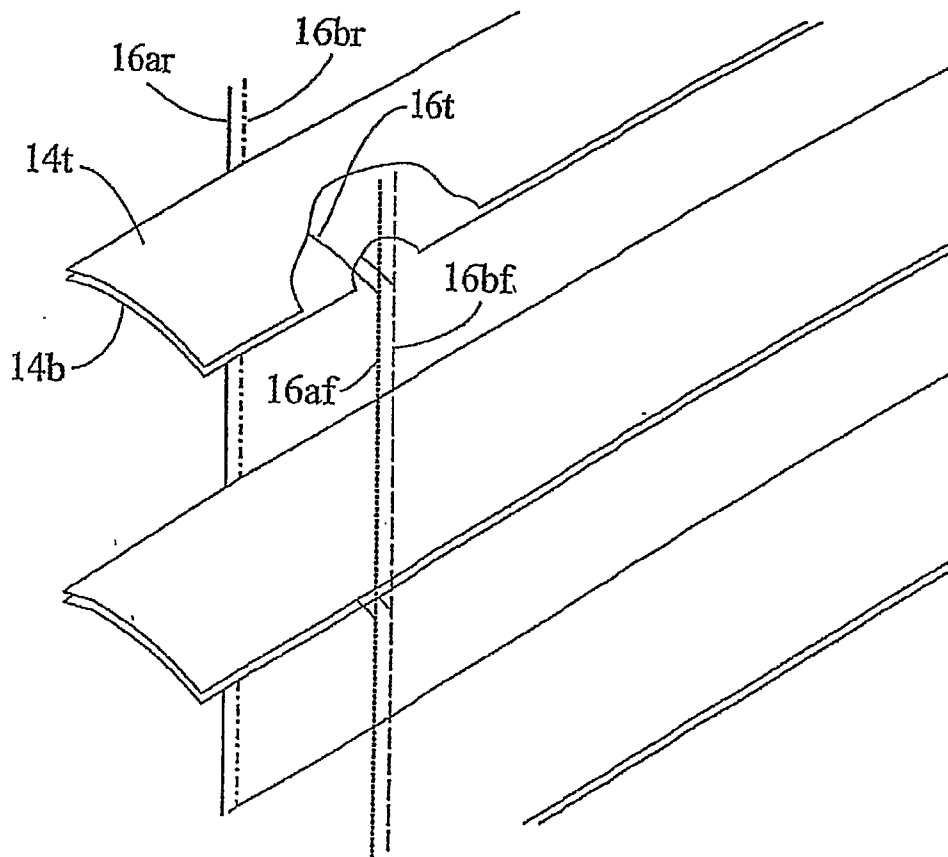
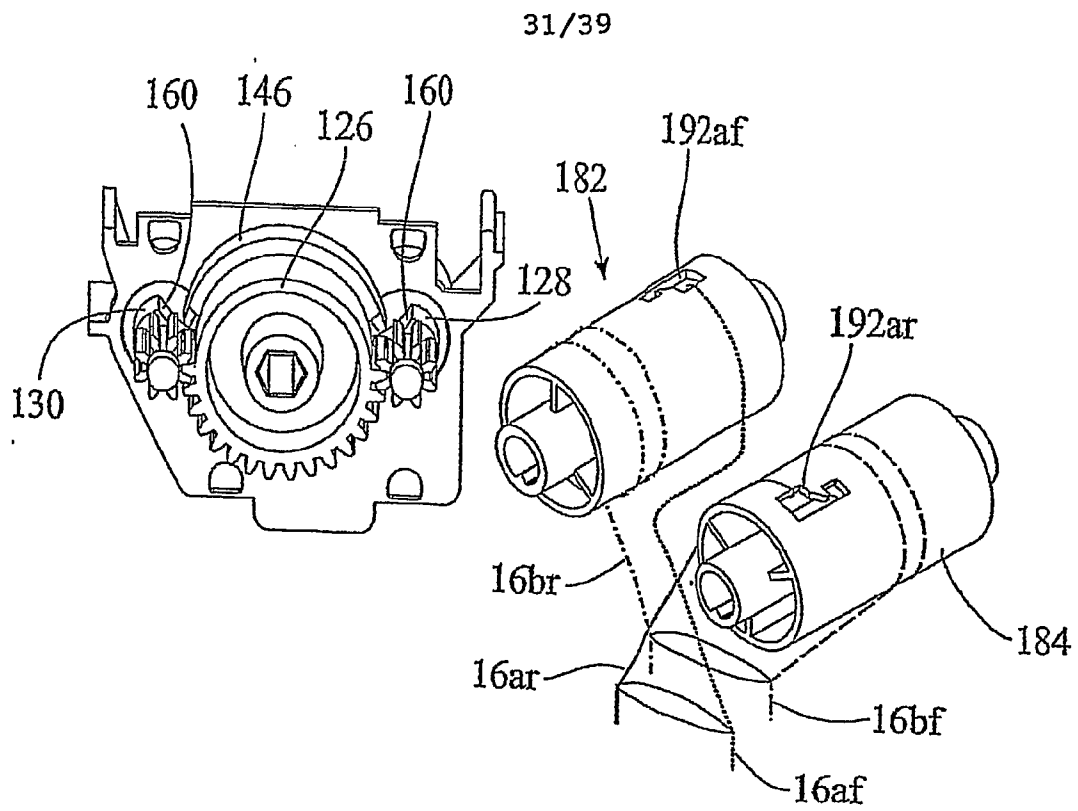


FIG 40



32/39

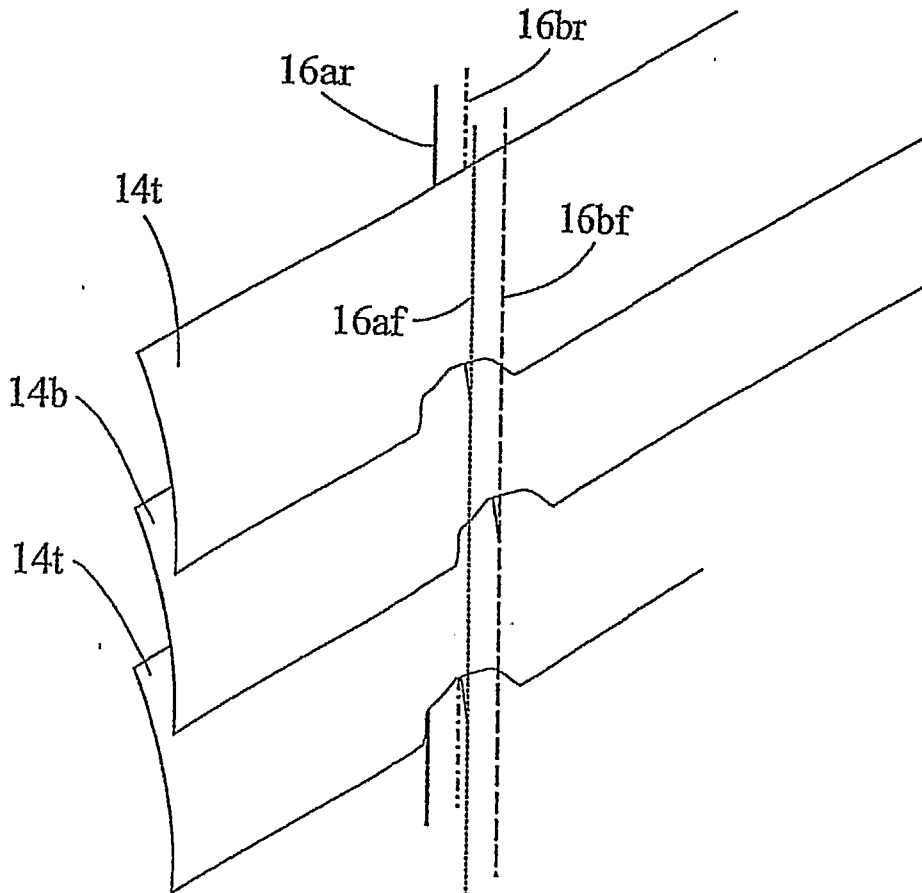
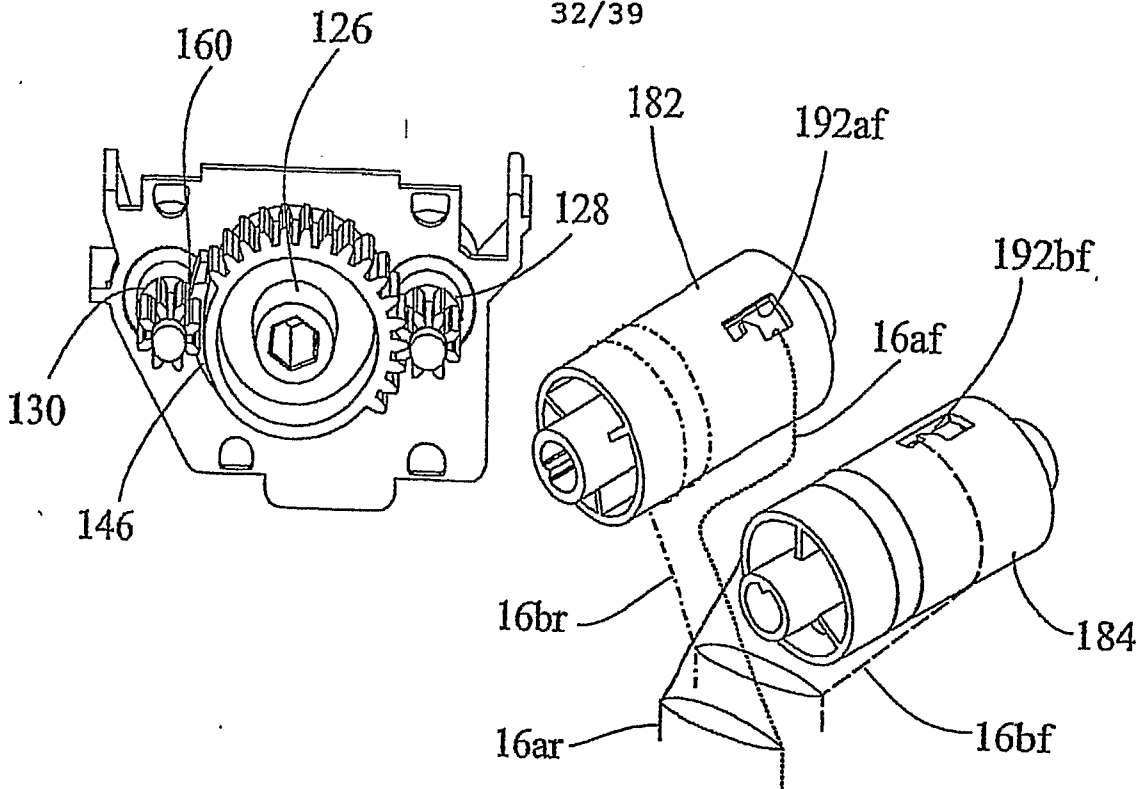


FIG 42

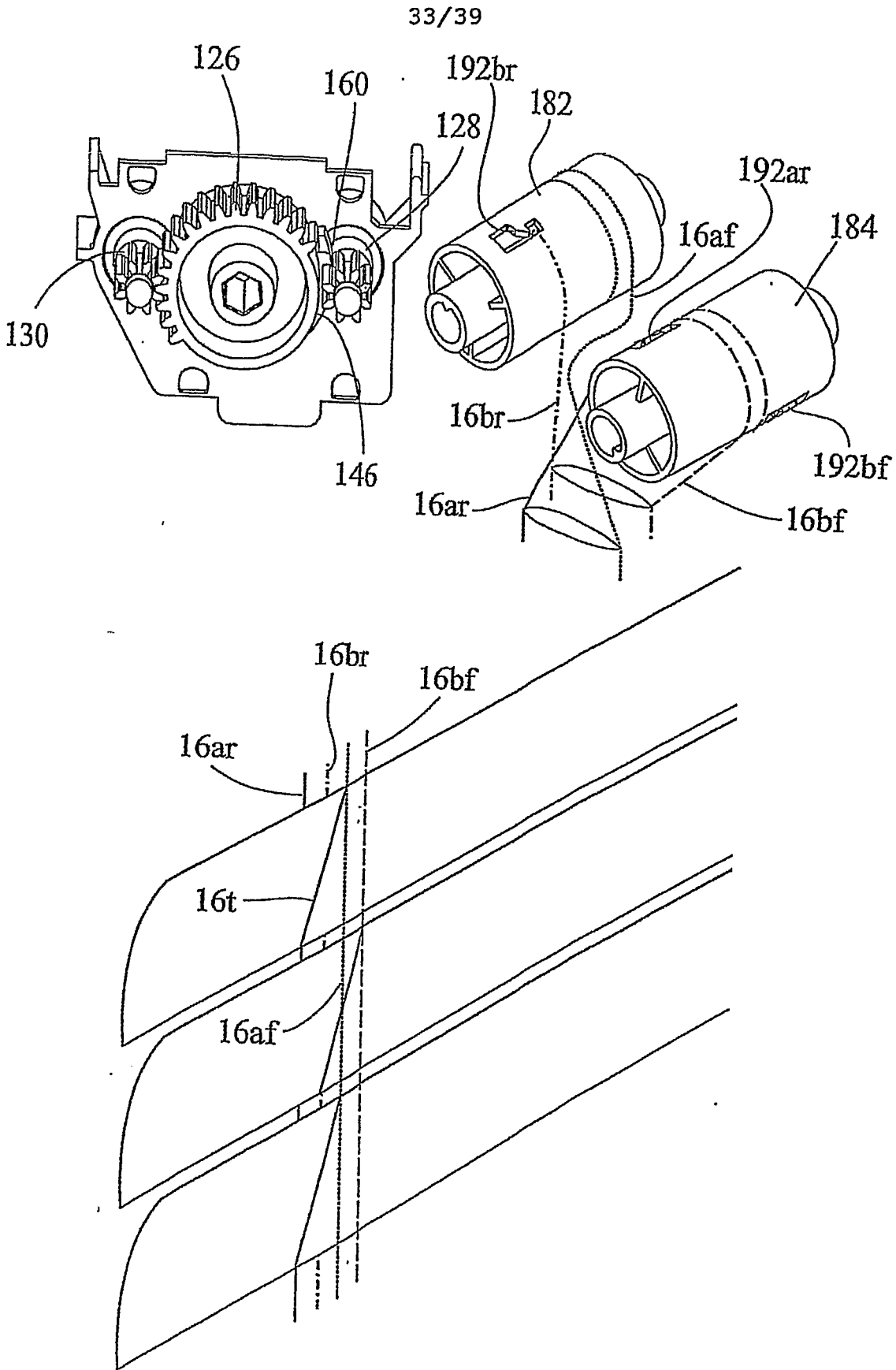
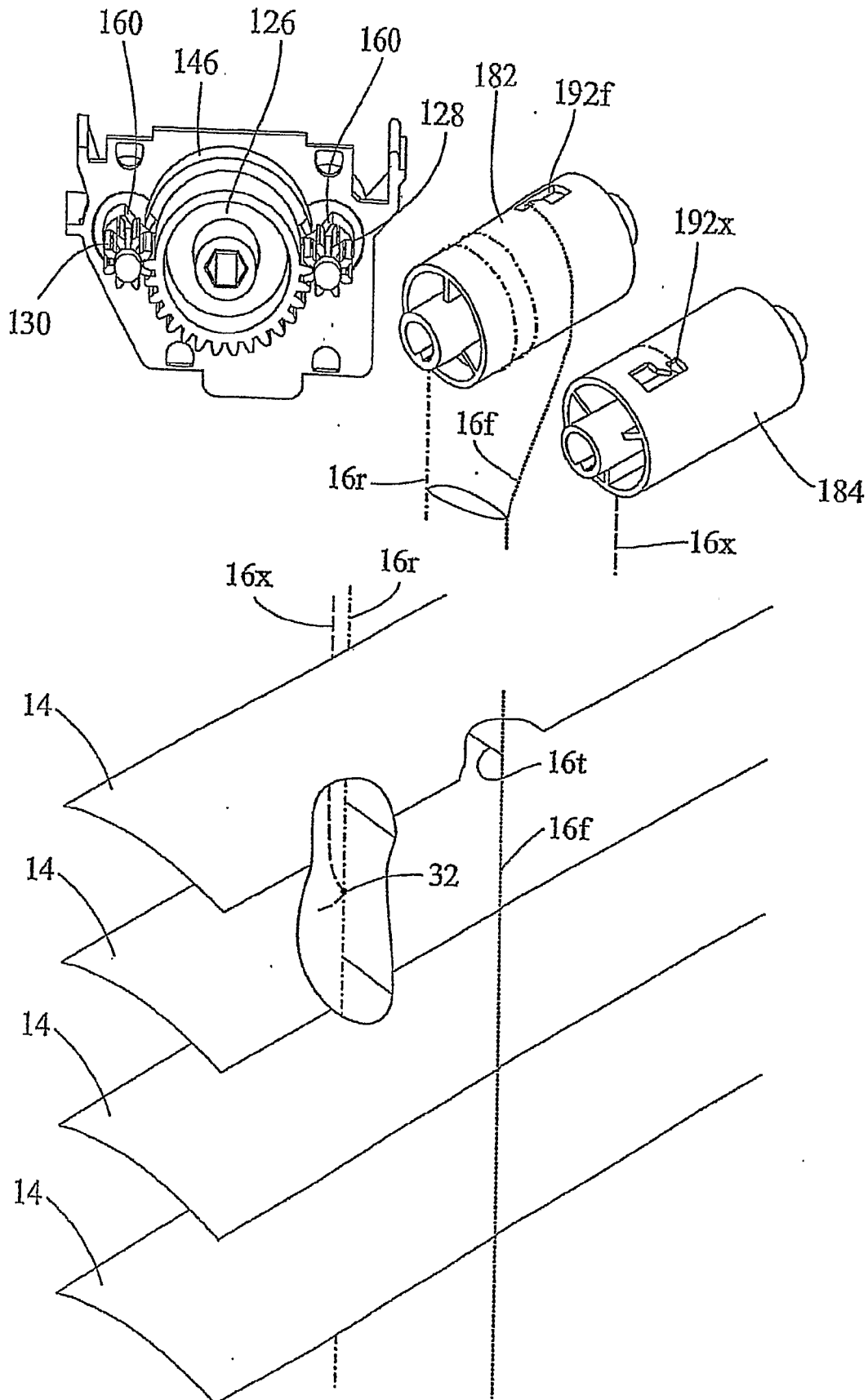


FIG 43



34/39



35/39

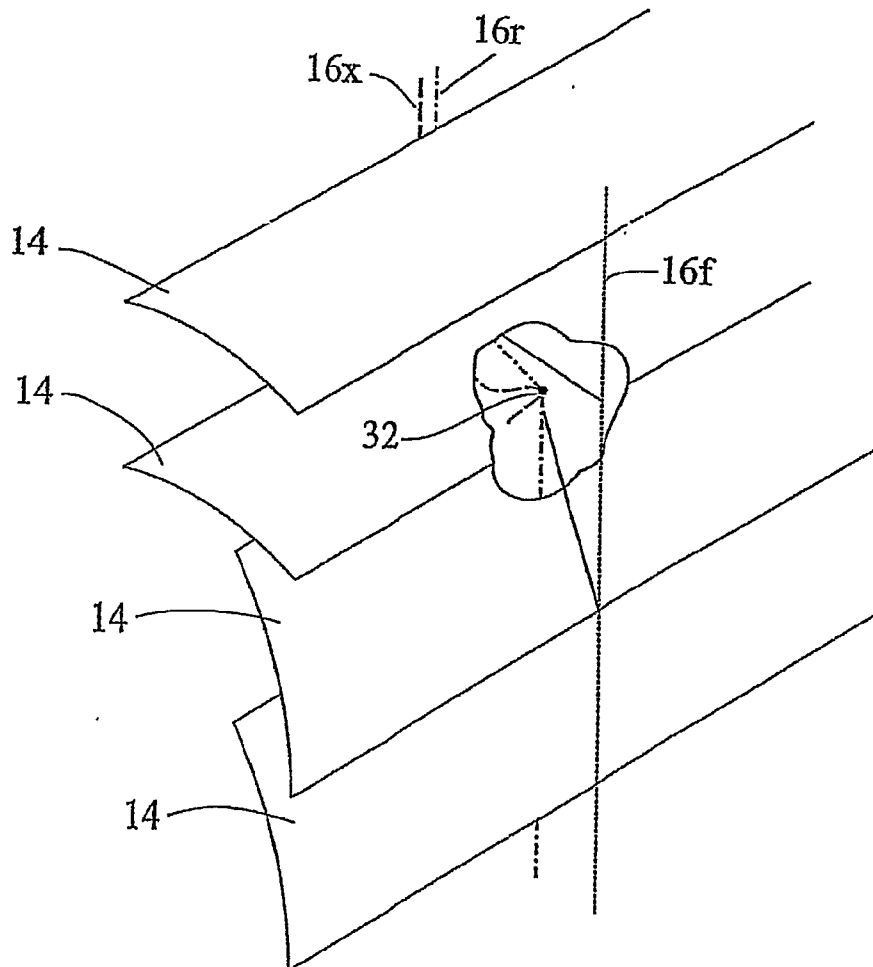
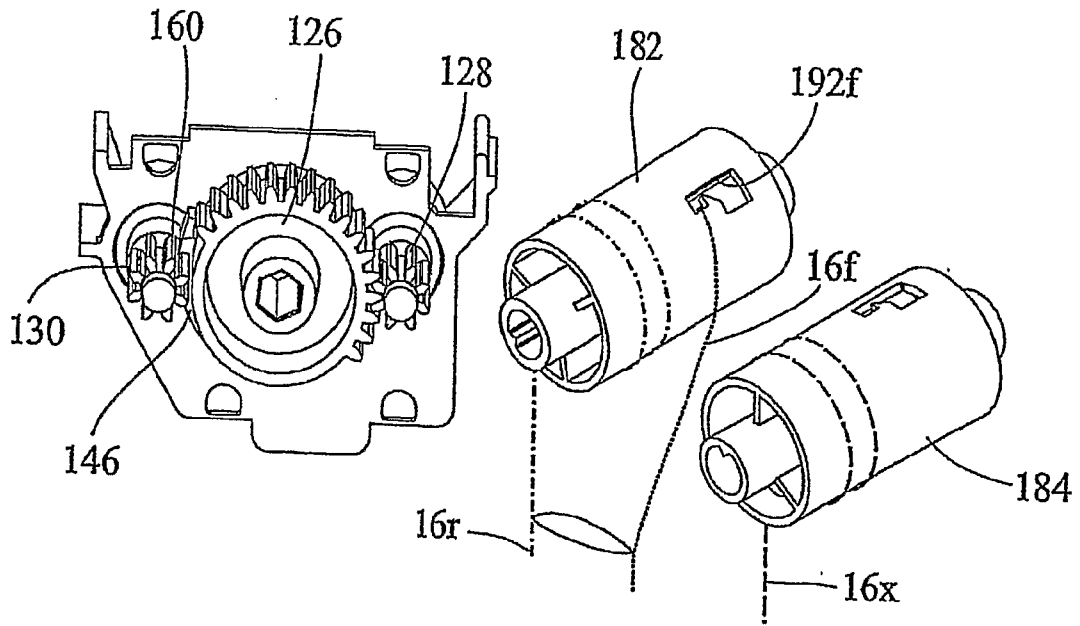


FIG 45

36/39

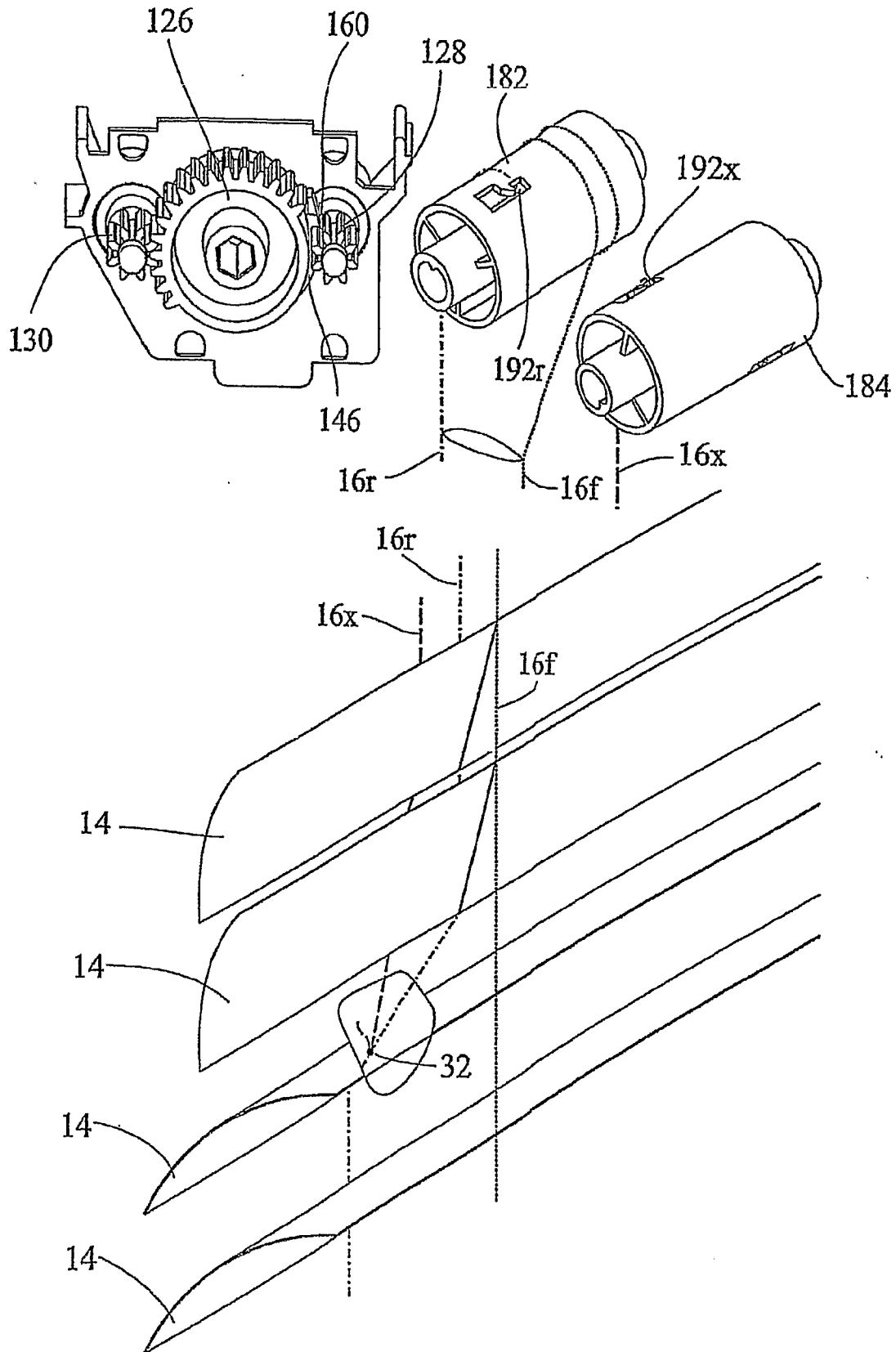
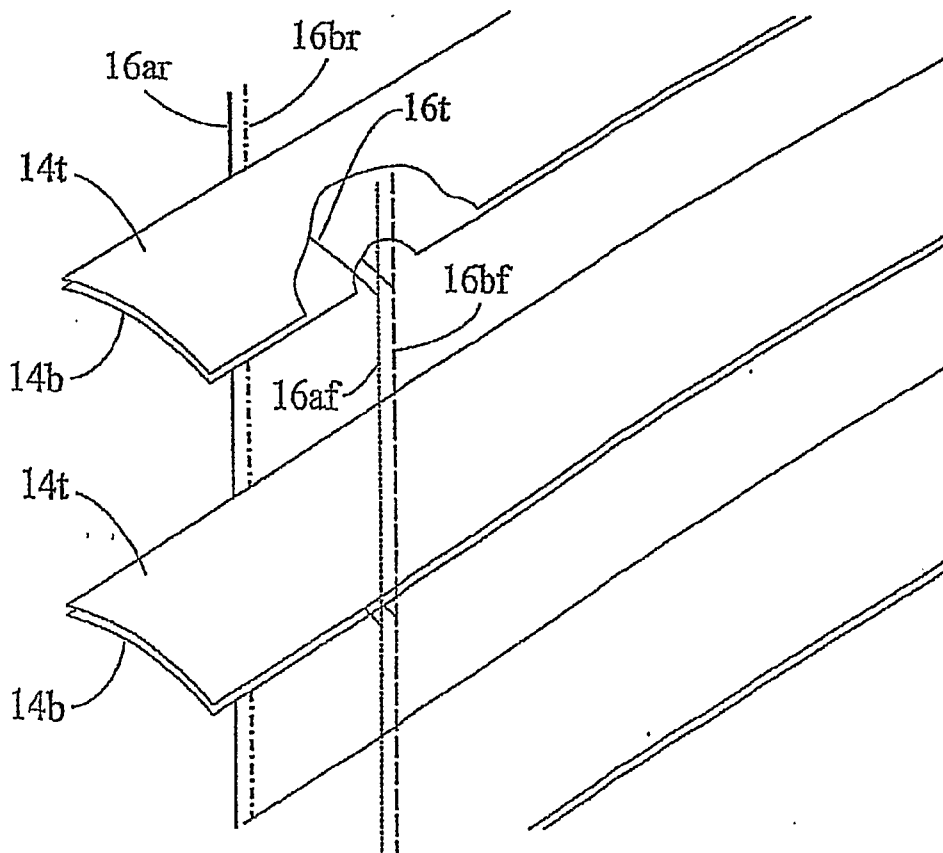
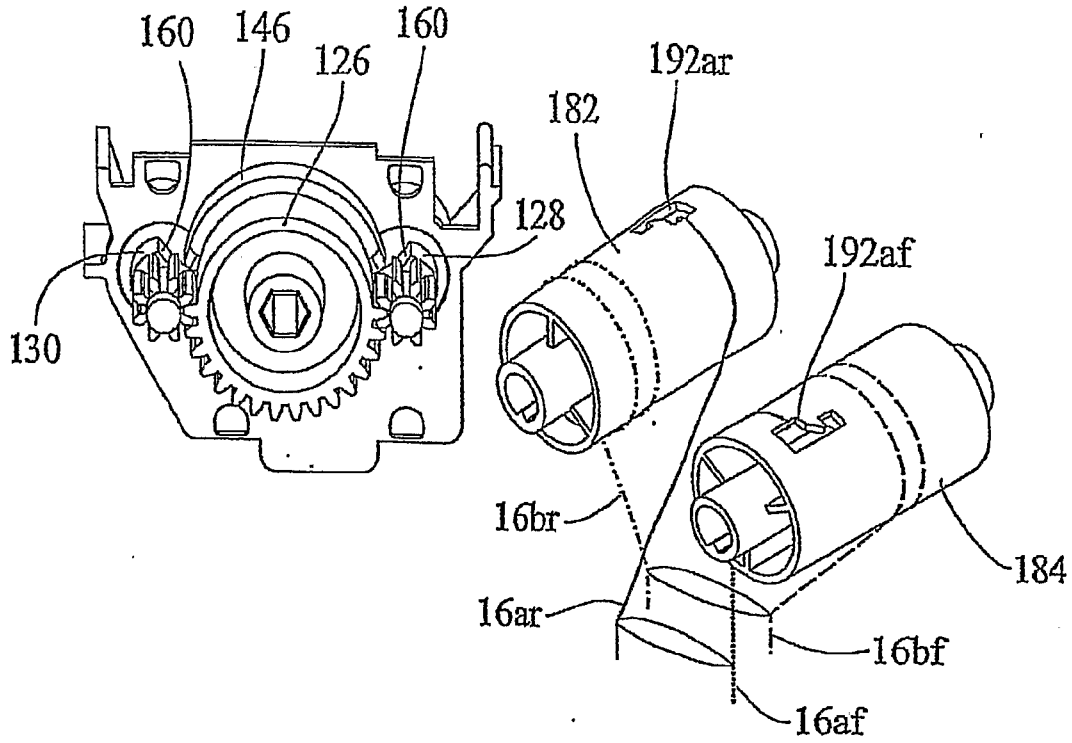


FIG 46

37/39



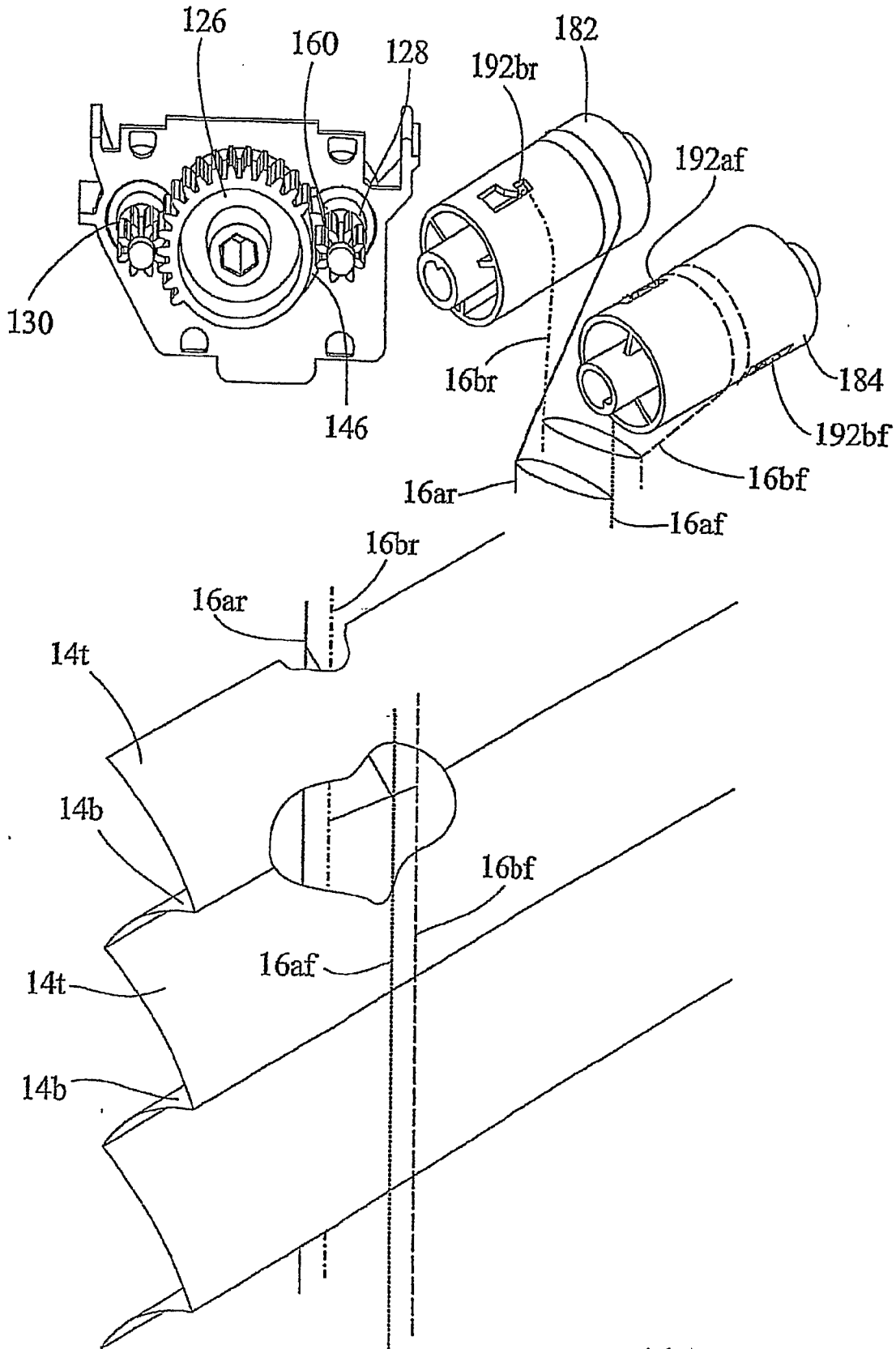


FIG 48

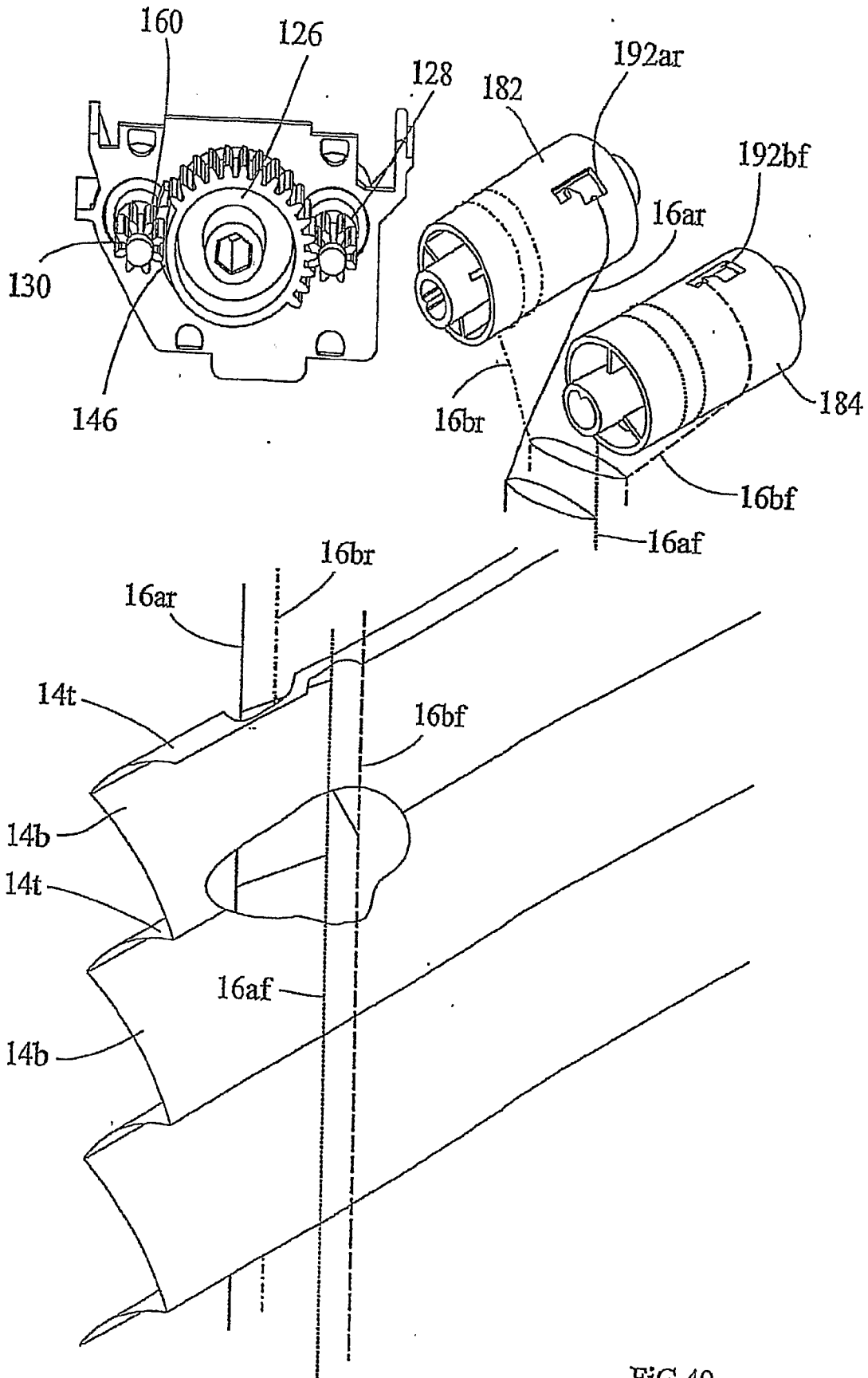


FIG 49

**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/US2006/033619

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. E06B9/322

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                 | Relevant to claim No. |
|-----------|--|-----------------------|
| X         | US 6 845 802 B1 (ANDERSON RICHARD N [US] ET AL) 25 January 2005 (2005-01-25)<br>the whole document | 1-5                   |
| A         | -----  | 8                     |
| X         | GB 2 158 137 A (BTW ENTERPRISES INC) 6 November 1985 (1985-11-06)<br>figures 11,12,23,24           | 6-10                  |
| X         | US 2001/052397 A1 (MATSUBARA MICHIO [JP]) 20 December 2001 (2001-12-20)<br>figures 11,12,23,24     | 6,7,10                |
| X         | DE 201 15 547 U1 (LIN SHIH MING [TW]) 31 January 2002 (2002-01-31)<br>figures 1-3                  | 1                     |
|           | -----<br>-/--  |                       |

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

13 December 2006

Date of mailing of the international search report

20/12/2006

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Severens, Gert

## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/033619

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
|-----------|--|-----------------------|
| A         | EP 0 887 507 A2 (HOLIS METAL IND LTD [IL]<br>HUNTER DOUGLAS IND BV [NL])<br>30 December 1998 (1998-12-30)<br>column 5, line 7 - column 6, line 8;<br>figures 1,2,5,6 | 1                     |
| A         | -----<br>US 5 119 868 A (WERNER JOHN L [US])<br>9 June 1992 (1992-06-09)<br>the whole document<br>figures 2-5<br>-----   | 1                     |



## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2006/033619

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date   |
|--|------------------|-------------------------|--|
| US 6845802                             | B1               | 25-01-2005              | NONE   |
| GB 2158137                             | A                | 06-11-1985              | AU 588800 B2 28-09-1989<br>AU 4033785 A 03-10-1985<br>BE 902024 A1 16-07-1985<br>CA 1264655 A1 23-01-1990<br>CH 670478 A5 15-06-1989<br>DE 3510817 A1 31-10-1985<br>FR 2561707 A1 27-09-1985<br>IT 1184210 B 22-10-1987<br>NL 8500880 A 16-10-1985<br>SE 461866 B 02-04-1990<br>SE 8501461 A 10-10-1985<br>US 4708188 A 24-11-1987 |
| US 2001052397                          | A1               | 20-12-2001              | NONE   |
| DE 20115547                            | U1               | 31-01-2002              | CA 2357612 A1 20-03-2003<br>FR 2831202 A1 25-04-2003<br>GB 2379705 A 19-03-2003<br>NL 1018995 C2 21-03-2003<br>US 2003051824 A1 20-03-2003   |
| EP 0887507                             | A2               | 30-12-1998              | AT 278096 T 15-10-2004<br>CA 2240206 A1 24-12-1998<br>DE 69826566 D1 04-11-2004<br>DE 69826566 T2 03-02-2005<br>US 6076587 A 20-06-2000  |
| US 5119868                             | A                | 09-06-1992              | AU 2221292 A 03-05-1993<br>WO 9307354 A1 15-04-1993  |