



(86) Date de dépôt PCT/PCT Filing Date: 2001/04/27
(87) Date publication PCT/PCT Publication Date: 2001/11/08
(45) Date de délivrance/Issue Date: 2008/12/30
(85) Entrée phase nationale/National Entry: 2002/10/11
(86) N° demande PCT/PCT Application No.: CA 2001/000573
(87) N° publication PCT/PCT Publication No.: 2001/083925
(30) Priorité/Priority: 2000/04/27 (US60/199,965)

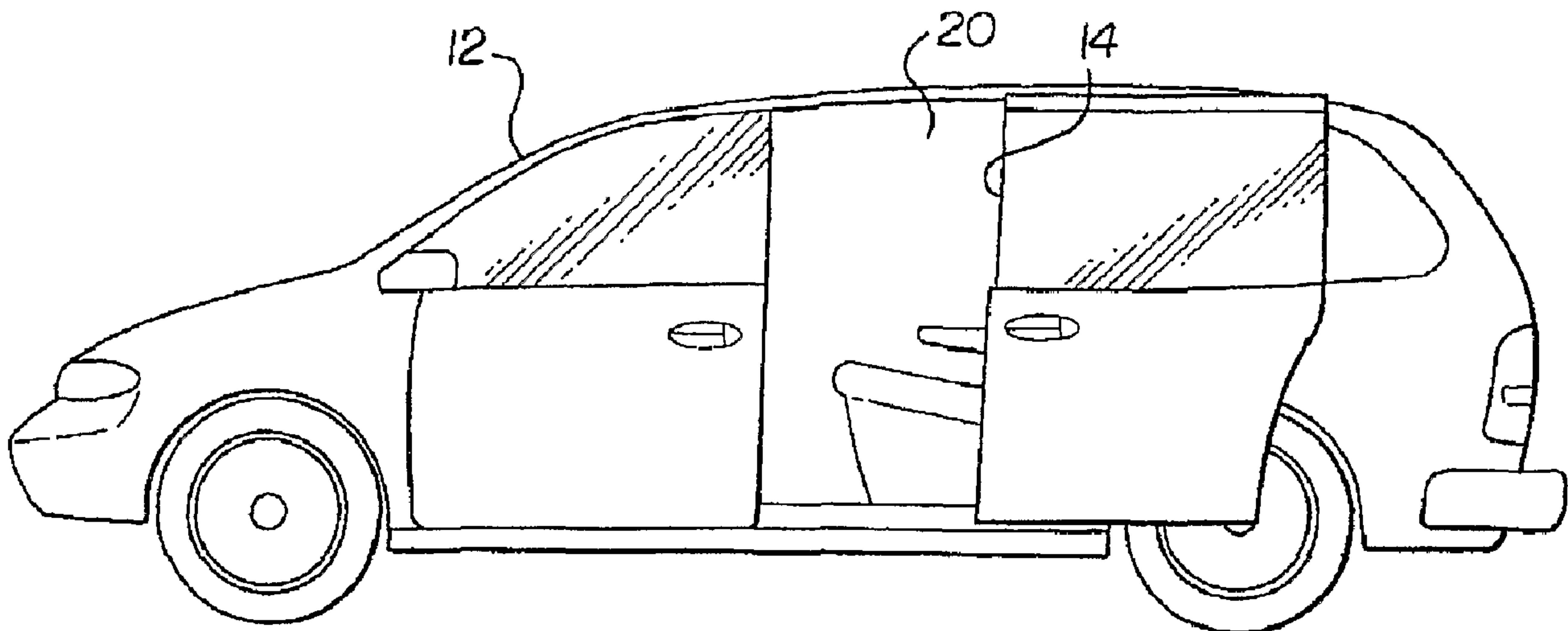
(51) Cl.Int./Int.Cl. *E05F 15/14* (2006.01),
B60J 5/00 (2006.01), *E05F 15/18* (2006.01),
H02K 23/58 (2006.01)

(72) Inventeurs/Inventors:
OBERHEIDE, G. CLARKE, US;
OXLEY, PETER LANCE, CA;
MRKOVIC, DRAGAN, CA;
PRIBISIC, MIRKO, CA

(73) Propriétaire/Owner:
ATOMA INTERNATIONAL CORP., CA

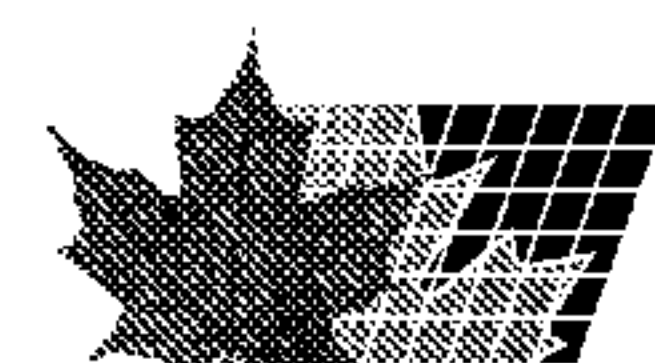
(74) Agent: PORAT, ALEX

(54) Titre : SYSTÈME DE FERMETURE DE PORTES MOTORISÉ SANS NOYAU
(54) Title: CORELESS MOTOR DOOR CLOSURE SYSTEM



(57) Abrégé/Abstract:

An automation assembly is adapted to be connected to a door system of a motor vehicle. The automation assembly is modular and includes a frame that is fixedly secured to the motor vehicle. A motor is fixedly secured to the frame and adapted to receive power. The motor converts the power into a rotational output force. The motor includes a non-ferrous core. A set of pulleys and rollers are fixedly secured to the frame at predetermined positions to direct the path of a continuous belt. The continuous belt is fixedly secured to the door system such that the motor moves the continuous belt and the door system bidirectionally between an open position and a closed position. Sensors are used to determine the position of the door, the speed thereof and whether the door is being moved manually.



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



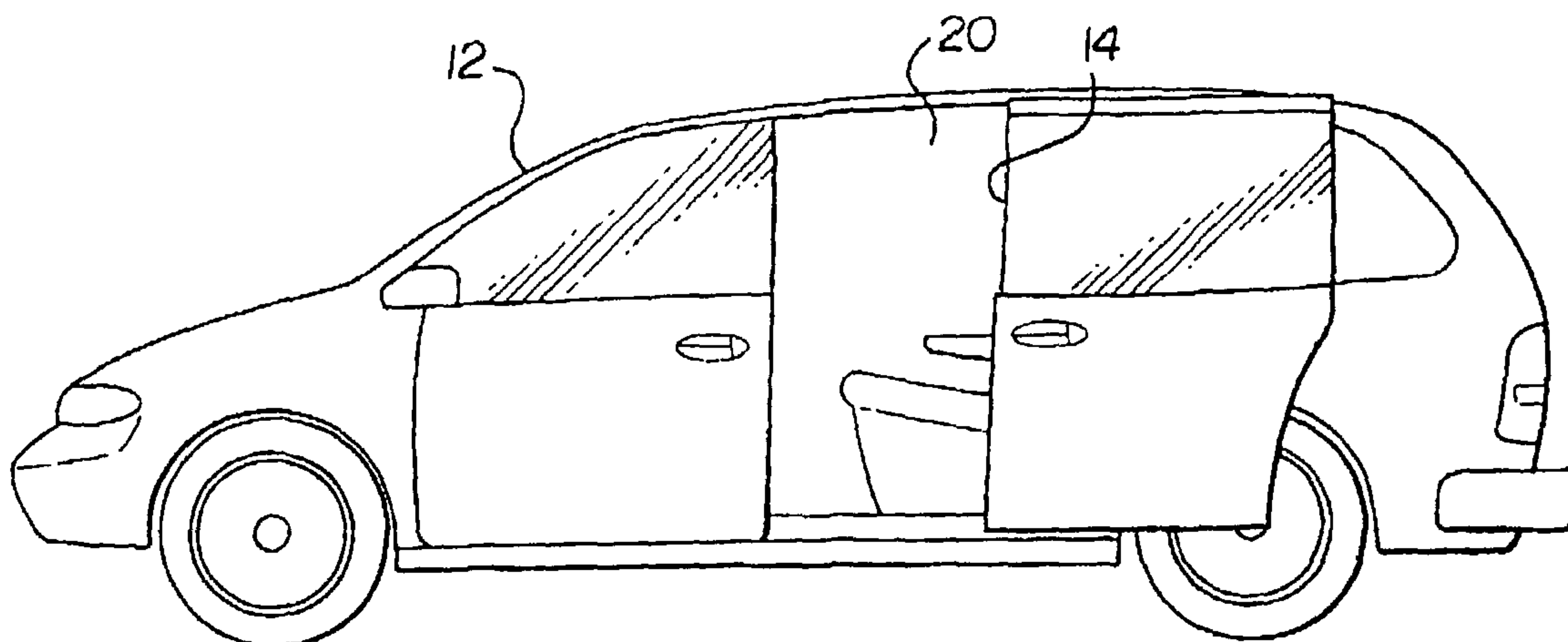
(43) International Publication Date
8 November 2001 (08.11.2001)

PCT

(10) International Publication Number
WO 01/83925 A1

- (51) International Patent Classification⁷: **E05F 15/14**, 15/18, H02K 23/58
- (74) Agent: **IMAI, Jeffrey, T.**; Magna International Inc., 337 Magna Drive, Aurora, Ontario L4G 7K1 (CA).
- (21) International Application Number: PCT/CA01/00573
- (22) International Filing Date: 27 April 2001 (27.04.2001)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/199,965 27 April 2000 (27.04.2000) US
- (71) Applicant (*for all designated States except US*): **ATOMA INTERNATIONAL CORP.** [CA/CA]; 521 Newpark Boulevard, Newmarket, Ontario L3Y 4X7 (CA).
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): **OBERHEIDE, G., Clarke** [US/US]; 4401 Deacon Court, Troy, MI 43098 (US). **OXLEY, Peter, Lance** [CA/CA]; 18372 9th Line, R.R. #3, Mount Albert, Ontario, L0G 1M0 (CA). **MRKOVIC, Dragan** [CA/CA]; Apt. 301, 1175 Broadview Avenue, Toronto, Ontario M4K 2S9 (CA). **PRIBISIC, Mirko** [CA/CA]; 6 Ballymena Court, North York, Ontario M3C 2B9 (CA).
- Published:**
- with international search report
 - before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments
- 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.*

(54) Title: CORELESS MOTOR DOOR CLOSURE SYSTEM



(57) Abstract: An automation assembly is adapted to be connected to a door system of a motor vehicle. The automation assembly is modular and includes a frame that is fixedly secured to the motor vehicle. A motor is fixedly secured to the frame and adapted to receive power. The motor converts the power into a rotational output force. The motor includes a non-ferrous core. A set of pulleys and rollers are fixedly secured to the frame at predetermined positions to direct the path of a continuous belt. The continuous belt is fixedly secured to the door system such that the motor moves the continuous belt and the door system bidirectionally between an open position and a closed position. Sensors are used to determine the position of the door, the speed thereof and whether the door is being moved manually.



WO 01/83925 A1

CORELESS MOTOR DOOR CLOSURE SYSTEM**Field of the Invention**

The invention relates to a system for moving a component part of a motor vehicle.
5 In particular, the invention relates to an actuator used to selectively provide access to an enclosure of a motor vehicle.

Description of the Related Art

As motor vehicles characterized by their utility become a mainstream choice,
10 consumers demand certain luxuries primarily associated with passenger cars, either due to their inherent design and/or size. One of the features desired by consumers is the automated movement of such items as sliding doors and lift gates. While features providing automated motion are available, the designs for mechanisms used to accommodate manual overrides are lacking in capability and functionality.

15 United States Patent 5,144,769 discloses an automatic door operating system. This system requires a great deal of control, both by an electronic controller and an operator of the motor vehicle. To overcome forces due to manual operation, the manually operated seesaw switch used by the operator to electromechanically operate the door is in an open state, preventing current from passing through the motor. While this system may not
20 generate a current, the iron core of the motor armature must move with respect thereto and this will create an inertial force and a magnetic loss that must be overcome. Further, there is no contemplation of overcoming the friction forces generated by the belt and transmission system that incorporates the use of the motor.

25 Summary Of The Invention

An automation assembly is adapted to be connected to a door system of a motor vehicle. The automation assembly includes a frame that is fixedly secured to the motor vehicle. A motor is fixedly secured to the frame and adapted to receive power. The motor converts the power into a rotational output force. The motor includes a non-ferrous core.
30 A set of rollers are fixedly secured to the frame at predetermined positions. A continuous belt extends around the set of rollers and the motor. The belt is fixedly secured to the door

system such that the motor moves the continuous belt and the door system bidirectionally between an open position and a closed position.

Brief Description Of The Drawings

5 Advantages of the invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Figure 1 is a side view of a motor vehicle with a sliding side door in its open position;

10 Figure 2 is a top view of one embodiment of the invention;

Figure 3 is a top view of a second embodiment of the invention;

Figure 4 is a top view, partially cut away, of a third embodiment of the invention;

Figure 5 is a cross-sectional side view of the frame and motor utilized by the third embodiment of the invention;

15 Figure 6 is a cross-sectional side view of a portion of the frame in a track utilized by the third embodiment of the invention;

Figure 7 is a top view of a fourth embodiment of the invention;

Figure 8 is an exploded perspective view of the fourth embodiment of the invention;

20 Figure 9 is an exploded perspective view of the motor incorporated into the four embodiments of the invention; and

Figure 10 is a cross-sectional side view of a portion of the frame incorporated into the fourth embodiment of the invention.

25 Detailed Description Of The Preferred Embodiment

Referring to the Figures, wherein like primed reference characters represent similar elements through the different embodiments of the invention, the invention 10 is generally a closure assembly for a motor vehicle 12. Although the invention 10 will be described to be incorporated into and/or working in conjunction with a sliding door 14 of a minivan-styled motor vehicle 12, it should be appreciated by those skilled in the art that the invention 10 is not limited to this style closure and motor vehicle.

Referring to Figures 2 and 3, a coreless motor is generally indicated at 18. The coreless motor 18 is used in an assembly to automatically move the sliding door 14 with

respect to a specific frame of reference, i.e., the door opening 20. The coreless motor 18 includes a housing 22 within which an ironless disk 24 is housed. Motor brushes (not shown) are connected to an electrical current via electrical leads (not shown). The disk 24 is secured to a motor output shaft 26. A pinion gear 28 is mounted to the motor output shaft 26 and rotates therewith.

The pinion gear 28 rotates the drive gear 30. The ratio of the pinion gear 28 with respect to the drive gear 30 is between 1:6 and 1:8. This allows the disk to have a smaller diameter than would otherwise be possible if the drive gear 30 was closer in diameter to the pinion gear 24. In the preferred embodiment, the disk 24 has a diameter of approximately 10mm. A pulley 32 is secured to the drive gear 30 such that there is no lost motion therebetween. The pulley 32 drives a belt 34, discussed subsequently.

The coreless motor 18 is a direct current (DC) electrodynamic machine having its armature coil-turn windings (not shown) within the magnetic air-gap without using a ferrous material for a flux linkage. The absence of the ferrous core for flux linkage requires the diameter of the disk to be larger than would otherwise be needed. The coreless motor 18 does, however, generate less current when it is manually rotated in a direction opposite that in which the current flowing through the brushes would dictate. Likewise, less current is generated in the coreless motor 18 if the coreless motor 18 is not being operated. Therefore, a smaller force is needed to move the sliding door 14 manually without the aid of the automatic opening features. For a brush-commutated motor, the armature is the rotor and the field is the stator. For a brushless motor, the field rotates and the armature is the stator.

An electronic controller 36 controls the coreless motor 18. It does so by receiving inputs from a motor encoder sensor 38 that determines the position of the belt 34 and the sliding door 14 with respect to the motor vehicle 12.

Tensioning devices 40 are used to take up slack when the sliding door is moved manually. In the embodiment shown in Figure 2, the tensioning devices 40 are pulleys with spring loaded plungers 42. In the embodiment shown in Figure 3, a spring 42' extends between two pulleys 44'. A potentiometric sensor 46' is used to identify the amount of potential stored within the spring 42'. If the spring 42' is unbalanced, the electronic controller 36' operates the coreless motor 18' to return the spring 42' to balance.

The presence of a back-driving force may be sensed in the interfacing transmission, i.e., the pinion gear 28', the drive gear 30' and the pulley 32'. Once sensed, the information is in a manner similar to feedback wherein the information is transmitted back to the electronic controller 36' allowing it to then operate the coreless motor 18'. In
5 this manner, the coreless motor 18' would be operated to keep up with the movement of the sliding door 14' eliminating the need for the operator to manually overcome the losses due to the coreless motor 18' and the interfacing transmission. Sensing such movement may be accomplished using the belt path shown in Figure 3. This embodiment of the belt path includes a center spring 41 and the potentiometric sensor 46'. When the belt 34' is
10 being forced one direction or another, the center spring 41 is unbalanced. This unbalance is sensed by the potentiometric sensor 46' and then transmitted to the electronic controller 36' which, in turn, operates the coreless motor 18' to attempt to return the center spring 41 to balance. Once the center spring 41 returns to steady state or balance, typically by the operator ceasing to move the sliding door 14', the electronic controller 36' stops the
15 coreless motor 18'.

Referring to Figures 4 through 6, a third embodiment of the invention 10'' is shown. The invention is an automated assembly 10'' adapted to operate the sliding door 14'' of the motor vehicle. The automated assembly 10'' includes a frame 48. The frame 48 is moveable with respect to a track 50 used by the sliding door 14'' to move between the
20 open and closed positions. The frame 48 slides along the track 50 using rollers (not shown).

The coreless motor 18'' is fixedly secured to the frame 48. The coreless motor 18'' moves the frame 48 by rotating its output shaft 26'' to move a pulley (not shown). The pulley forces the frame 48 to move along the belt 34''. The belt 34'' in this embodiment is
25 not continuous. The belt 34'' extends along a curved path between a first end 52 and a second end, graphically represented at 54 in Figure 4. In this embodiment, three guide pulleys 56 are shown directing the belt 34'' through its curved path.

Referring to Figure 5, the coreless motor 18'' is secured to the frame and driving the pinion gear 28''. The pinion gear 28'' then drives an intermediate spur gear set 58.
30 The intermediate spur gear set 58 drives a spur gear 60 and a bevel gear 62.

Referring to Figure 6, the sliding door 14'' is shown with the lower hinge, i.e., the frame 48 attached thereto. A toothed drive pulley 64 drives the sliding door 14'' between its open and closed positions by rotating and forcing itself along the belt 34''. The bevel

gear 62 rotates a second bevel gear 66 which, in turn, rotates a drive shaft 68 that drives the toothed drive pulley 64.

Referring to Figures 7 through 10, a fourth embodiment of the invention 10''' is shown. The belt 34''' is continuous in this embodiment as it was in the first two
5 embodiments. The belt 34''' rolls along pulleys 70 and rollers 72. An attachment clip 74 secures the sliding door 14''' to a single position with respect to the belt 34'''. Therefore, the sliding door 14''' follows the belt 34''' as the belt 34''' moves between its extreme positions.

A frame 48''' positions the pulleys 70 and rollers 72 and is secured to the coreless
10 motor 18'''. The frame 48''' and the coreless motor 18''' are secured together via an intermediate bracket 76 and motor housing 78. The intermediate bracket 76 includes an elongated opening 80 that allows the belt 34''' to move around the coreless motor 18''' and around the frame 48'''.

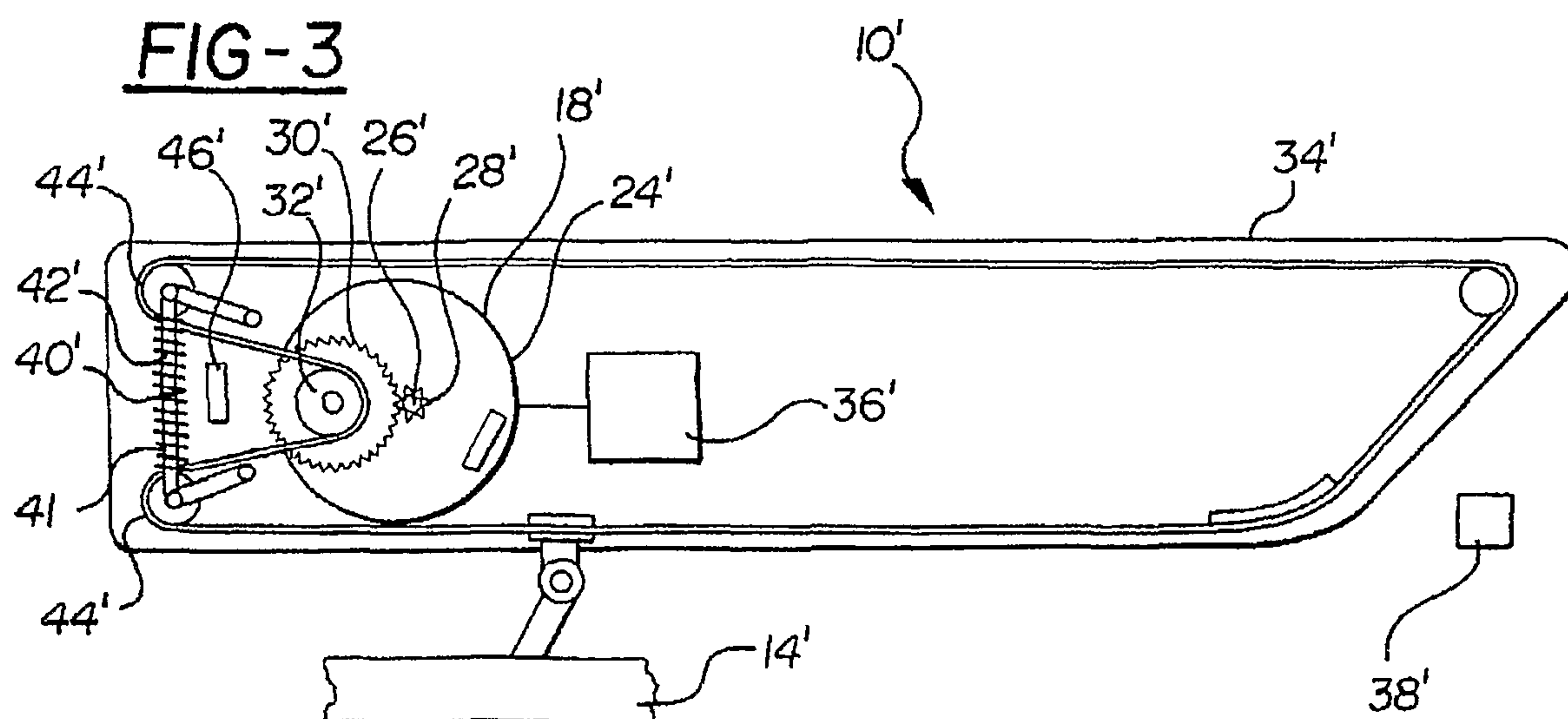
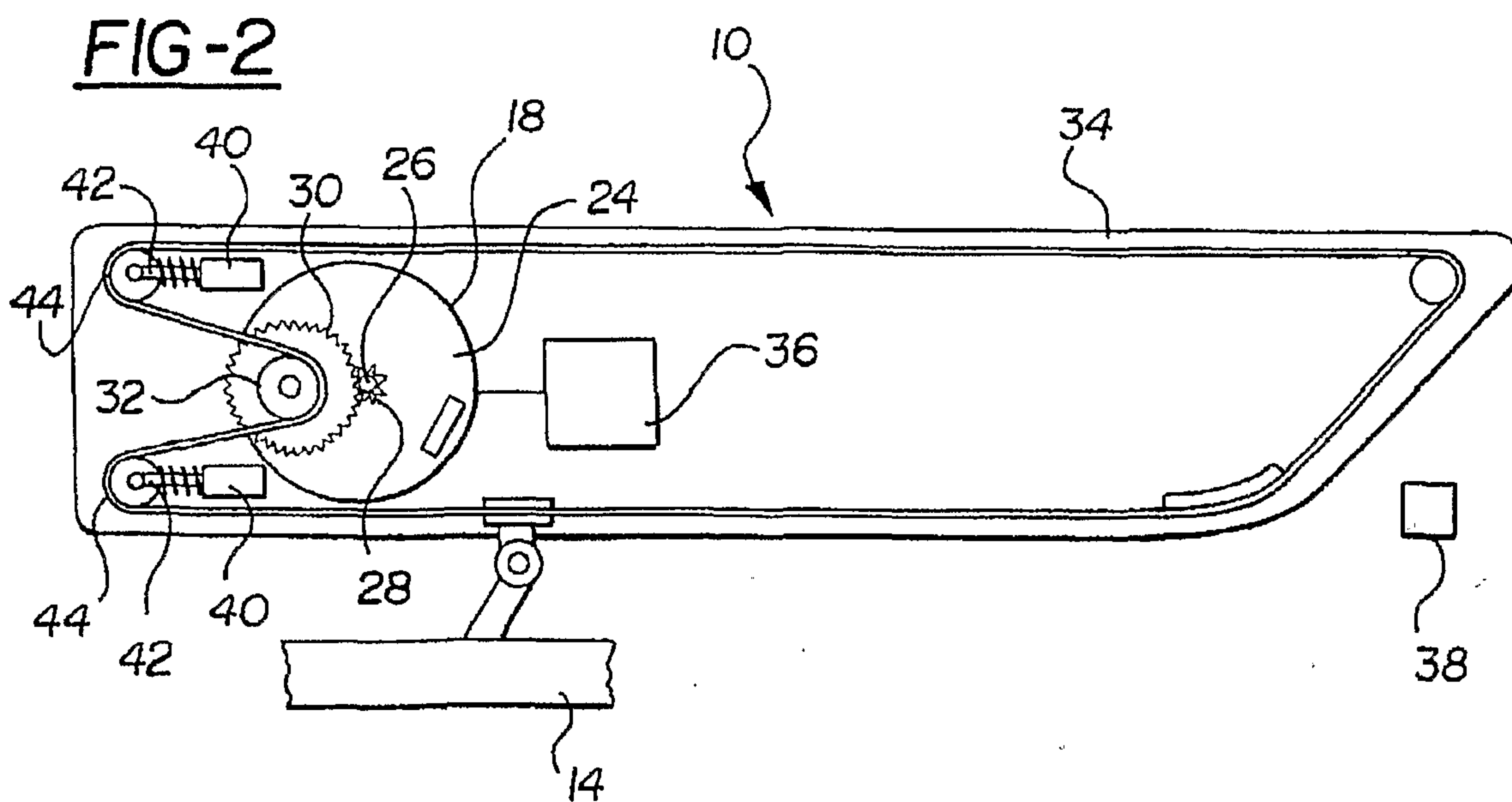
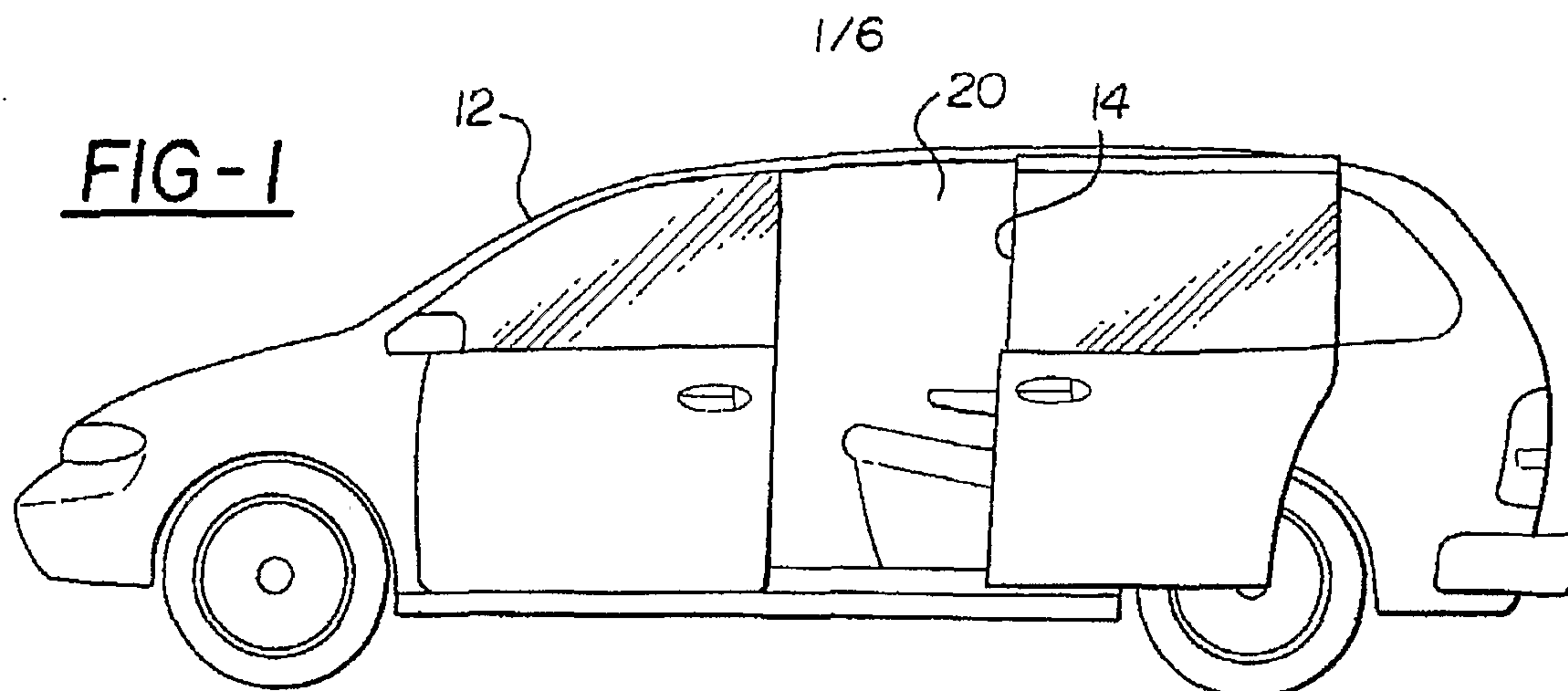
Figure 10 illustrates the belt 34''' and how it is secured to the frame 48'''. A load
15 roller 82 aids in the movement of the sliding door 14'''. The belt 34''' moves through a channel 84 in the frame 48''' as the coreless motor 18''' moves the belt 34''' therearound. The positioning clip 74''' includes an upper clip 86 and a lower clip 88. The positioning clip 74''' clamps on one portion of the belt 34'''. A guide roller 90 moves through the track 50''' to help guide the sliding door 14''' as it moves between the open and closed
20 positions.

In all of the embodiments disclosed herein, the invention 10, 10', 10'', 10''' is designed to be modular. More specifically, the automation assembly 10, 10', 10'', 10''' is designed to be fit into a motor vehicle that was designed to have the option of whether the sliding door 14 is to be automatically driven or whether the sliding door 14 is to be strictly
25 manually operated. Except for the belt in some of the embodiments, the entire assembly is designed to be secured to the motor vehicle as a single entity. This allows the assembly of the invention 10 to the motor vehicle 12 to be simple.

The invention has been described in an illustrative manner. It is to be understood that the terminology which has been used is intended to be in the nature of words of
30 description rather than of limitation. Many modifications and variations of the invention are possible in light of the above teachings. Therefore, within the scope of the appended claims, the invention may be practiced other than as specifically described.

We claim:

1. An automation assembly (10'') comprising a door system adapted to be connected to a motor vehicle, the door system having a door (14'') and a track (50) for movement of the door system therealong, said automation assembly (10'') comprising:
 - a frame (48);
 - a motor (18'') fixedly secured to said frame (48) and adapted to receive power and to convert the power into a rotational output force for moving said door (14'');
 - a set of rollers (56) fixedly secured to said frame (48) at predetermined positions therealong; and
 - a belt (34'') interacting with said motor (18'') and extending around said rollers (56) between a first end (52) and a second end (54);
 characterized in that said frame (48) is fixedly secured to the door (14'') and slideably engaged with the track (50) of the door system, and in that each of said first and second ends (52, 54) is secured to the motor vehicle in mounted position, said rotational output force generated by said motor (18'') moving said frame (48) and the door assembly (14'') along the track (50) between an open position and a closed position.
2. An automation assembly as set forth in claim 1, characterized by including a tensioning device for absorbing tension in said belt (34'') when the door (14'') is moved manually.
3. An automation assembly as set forth in claim 1 or 2, characterized in that said coreless motor (18'') includes a pinion gear (28'').
4. An automation assembly as set forth in claim 3, characterized by including a drive gear (64) engageable with said pinion gear (28'').



2/6

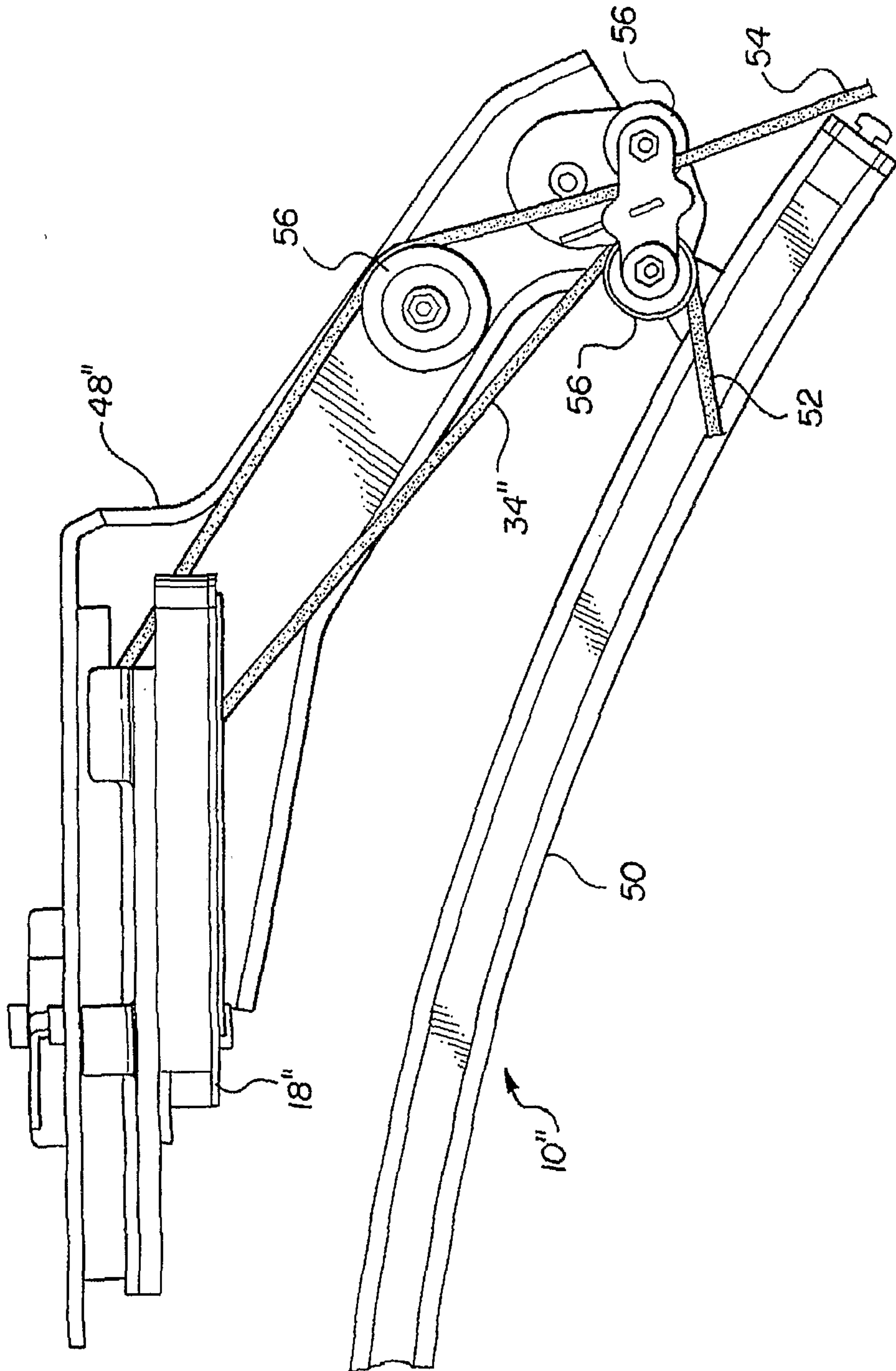


FIG-4

3/6

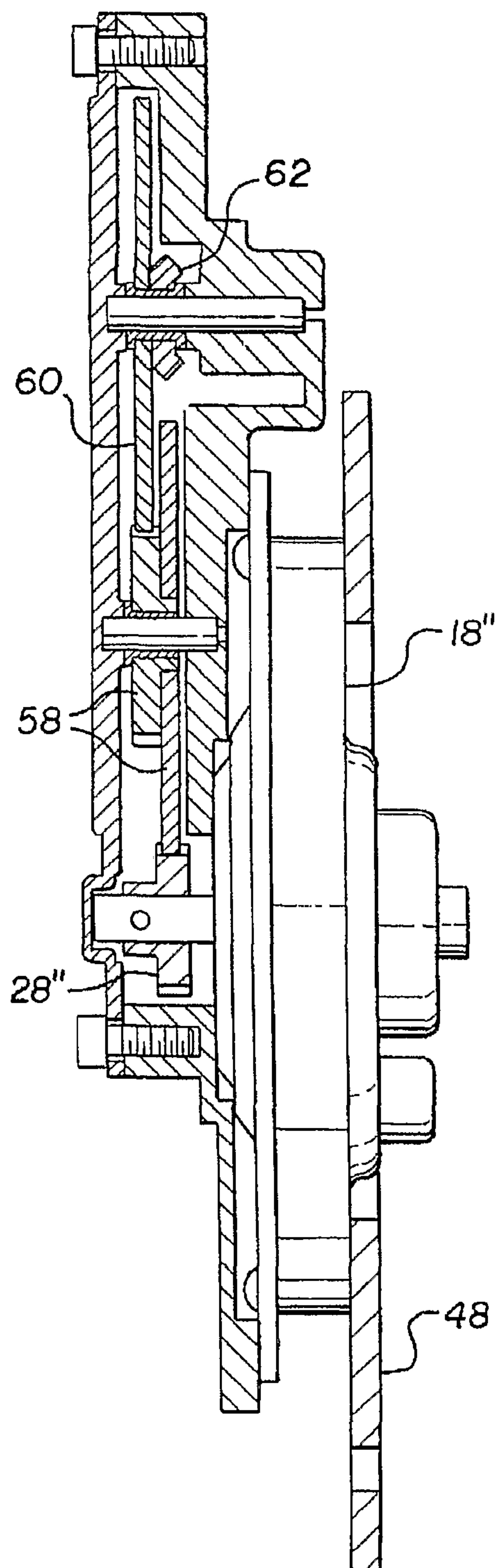
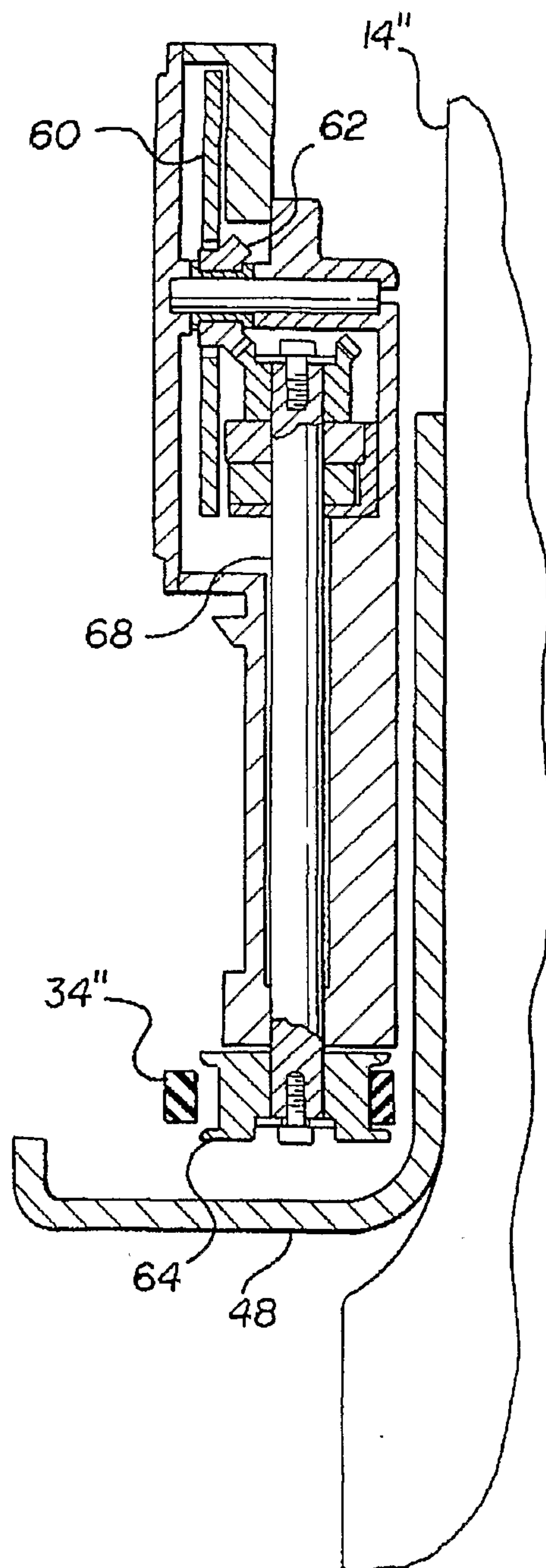
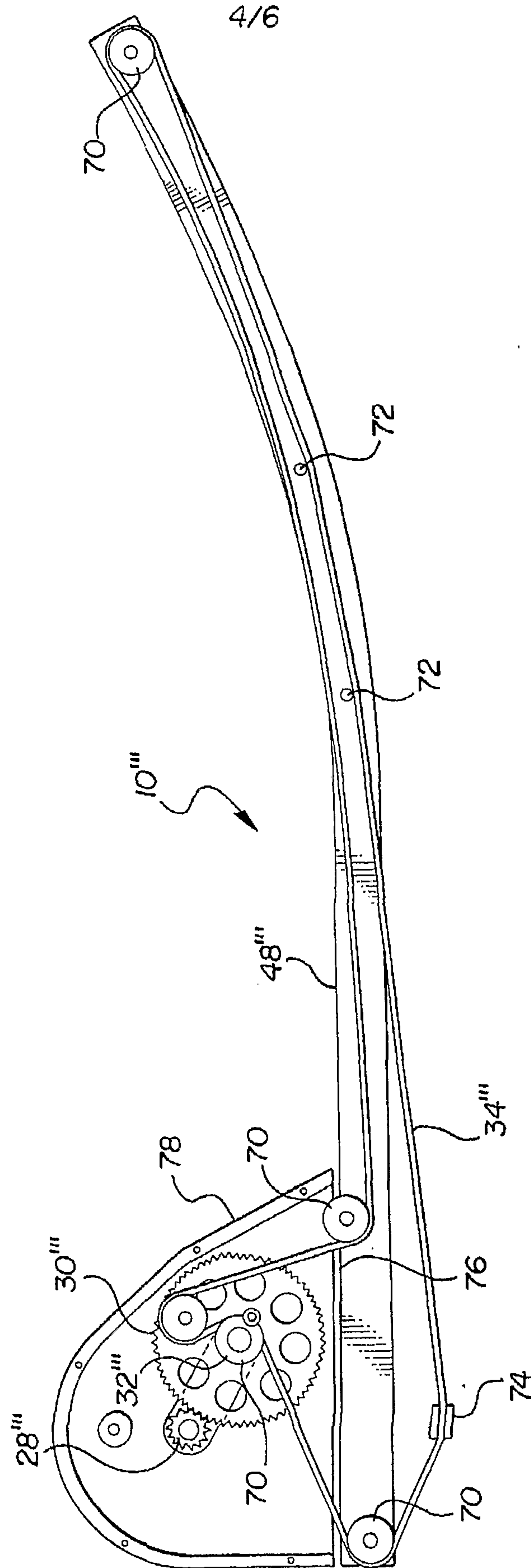
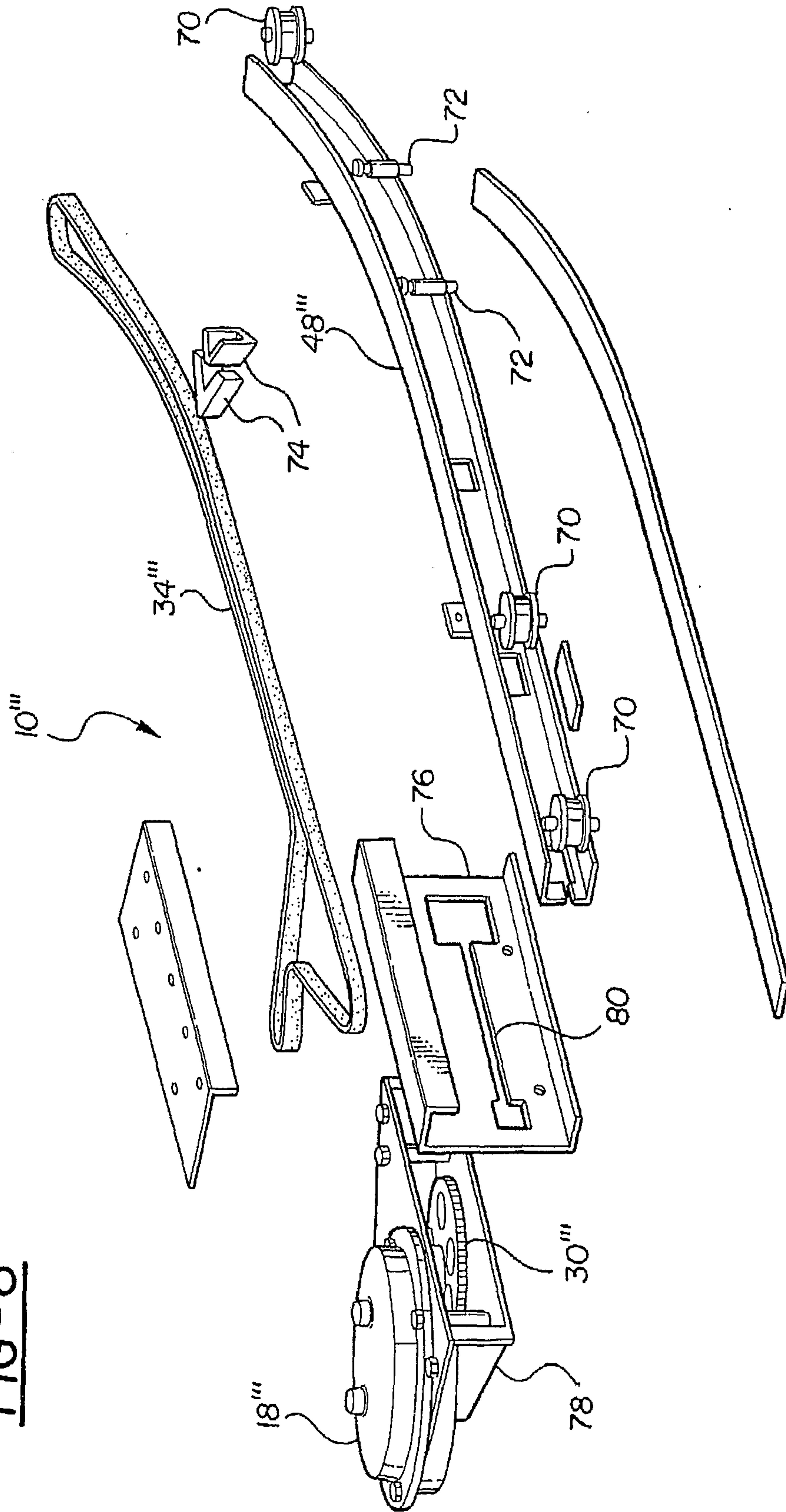
FIG-5FIG-6

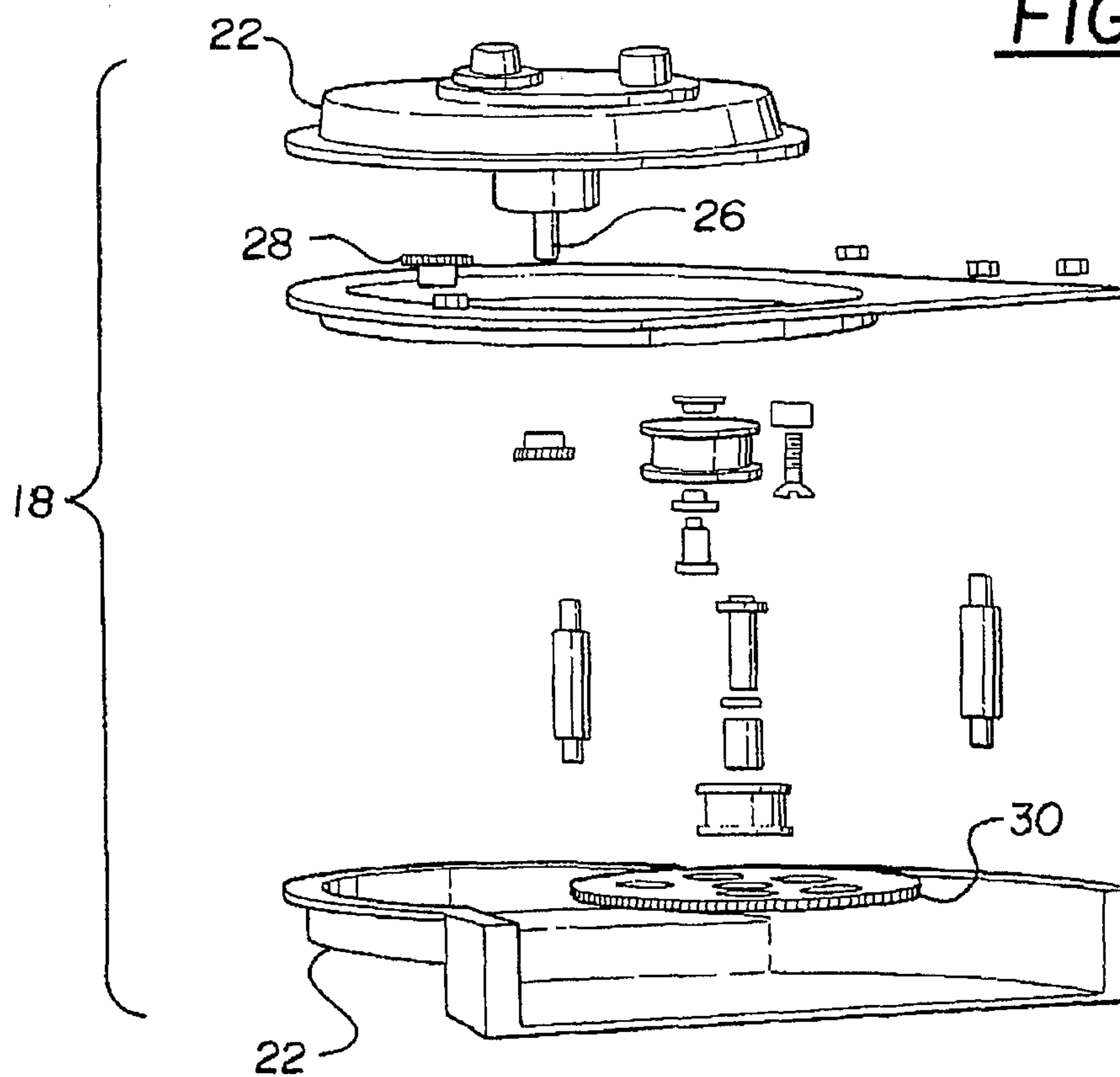
FIG - 7

5/6

FIG-8



6/6

FIG - 9FIG - 10