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(72) Inventors:

• **Pulver, Dale A.****University Heights, Ohio 44118 (US)**• **Grebinoski, James J.****Westlake, Ohio 44145 (US)**• **Pogir, Hymie H.****Orange Village, Ohio 44022 (US)**

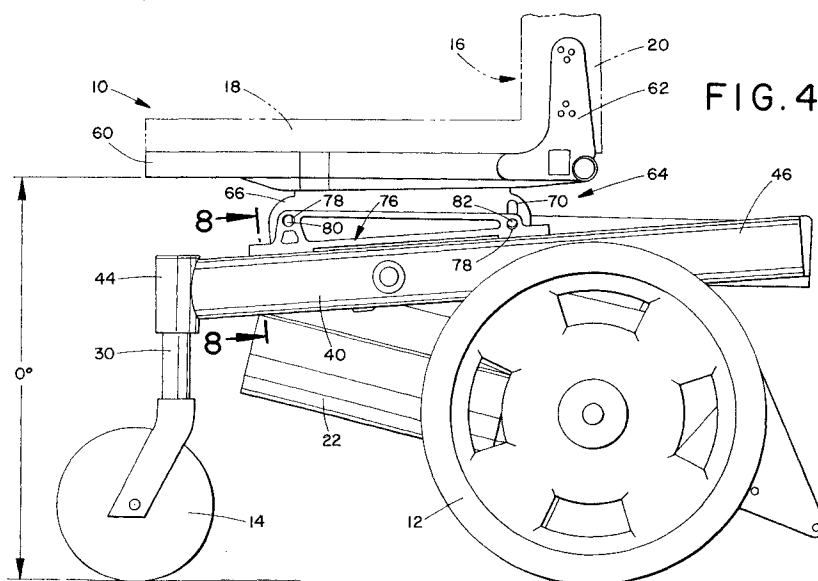
(74) Representative:

**Purvis, William Michael Cameron et al****D. Young & Co.,****21 New Fetter Lane****London EC4A 1DA (GB)**

(54) **Reversible seat for front wheel drive and rear wheel drive power wheelchair having stepless angular adjustment**

(57) A power wheelchair includes a seat support assembly (64) that allows both fore and aft, and angular, adjustment. The preferred configuration includes first (66) and second (76) seat support members, one secured to the seat (18) and the other mounted on the frame. A pin and elongated opening assembly (78) is provided at each end of the seat support assembly (64) to allow for angular adjustment of the seat. Moreover, a

channel is formed on the longitudinal frame members to receive a fastener associated with the seat support assembly. By selectively loosening and tightening the fasteners, the seat support assembly, and thus the seat, can be adjusted fore and aft. This allows the same component parts to be used with both front wheel and rear wheel drive arrangements, while providing infinite angular seat adjustment and desired fore and aft adjustment.

**FIG. 4****EP 0 908 167 A2**

## Description

**[0001]** This invention relates to wheelchairs, and more particularly to power wheelchairs, in which seat adjustment is desired. Additionally, the wheelchair may be converted from a front wheel drive arrangement to a rear wheel drive assembly without extensive changeover of structural elements of the seat.

**[0002]** Our U.S.A Patent No. 5,575,348 is directed to a power wheelchair of the general type under consideration. It shows and describes a power wheelchair having an H-shaped frame in which the intersecting corner of the seat and seat back is mounted for rotation about a pin and a link is disposed beneath the seat and frame adjacent a forward portion of the seat to adjust the seat angle. A bracket extends from the frame and includes spaced openings so that the link is secured to a selected one of the openings. By connecting the link to a different opening, the seat angle is varied.

**[0003]** Also disclosed is a conventional power wheelchair structure in which enlarged diameter wheels are motor driven and located toward a rear portion of the frame. Small diameter front wheels are typically caster-mounted for rotation about respective vertical axes in response to the drive of the rear wheels controlled by the wheelchair user via a motor controller such as a joystick.

**[0004]** It is becoming increasingly popular to provide a front wheel, or mid-frame, drive arrangement where the enlarged diameter drive wheels are located closer to the front of the chair, i.e., at a mid-frame location or more closely adjacent the front edge of the seat. For purposes of brevity, the front wheel and mid-frame drive arrangements will be referred to as front wheel drive wheelchairs in this specification, although it will be understood that the description applies to both unless particularly noted otherwise. Different design and engineering considerations are embodied in the front and rear wheel drive configurations. Nevertheless, it is desired that as many common structural components be used in the rear wheel drive and front wheel drive assemblies to simplify manufacturing and assembly, and consequently reduce cost. Thus, even though not all components of these two types of chairs are identical, it is preferred to use as many of the same components as possible.

**[0005]** Weight distribution affects the overall performance of the wheelchair. Tracking, steering, wear, etc., are all related to the weight distribution so that enhanced performance is closely linked to the weight distribution and the ability to easily adjust it. For example, if too much weight is distributed on the front wheels, steering becomes more difficult, particularly on softer surfaces such as carpeting.

**[0006]** As will also be appreciated, occupants of power wheelchairs are seated in the wheelchairs for extended periods of time. It is desirable, therefore, to provide a wide range of adjustment for the seat, either fore or

aft, as well as angular adjustment without unnecessary complication. In this manner, the basic wheelchair structure can accommodate the needs of different individuals.

**[0007]** According to one aspect of the invention there is provided a power wheelchair comprising:

a frame having first and second longitudinal frame members extending fore and aft and at least one interconnecting member extending between the first and second frame members;  
front and rear wheels operatively mounted to the frame;  
a seat to support an occupant;  
first and second channels on the first and second frame members, respectively, each channel having an elongate opening that extends in a direction generally fore and aft of the wheelchair; and  
a seat mount assembly interposed between the channels and the seat for securing the seat to the frame, the seat mount assembly being selectively slidably received in the elongate channel openings so that the seat can be adjusted forwardly and rearwardly as desired by the occupant.

**[0008]** According to another aspect of the invention there is provided a power wheelchair comprising:

a frame having first and second longitudinal frame members extending fore and aft and at least one interconnecting member extending between the first and second frame members;  
front and rear wheels operatively mounted to the frame;  
a seat to support an occupant;  
first and second channels on the first and second frame members, respectively, each channel having an elongate opening that extends in a direction generally fore and aft of the wheelchair; and  
a seat mount assembly interposed between the channels and the seat for securing the seat to the frame, the seat mount assembly being selectively slidably received in the elongate channel openings so that the seat can be adjusted forwardly and rearwardly as desired by the occupant.

**[0009]** According to a further aspect of the invention there is provided a power wheelchair comprising:

an H-shaped frame including first and second frame members that are interconnected by a cross frame member;  
a pair of enlarged diameter drive wheels and at least one small diameter wheel operatively connected to the frame;  
a seat;  
a seat support assembly interposed between the seat and the frame, the assembly including a first

seat support member secured to the seat and a second seat member;

first and second channels on the first and second frame members, respectively, that define a keyway that receives a key extending outwardly from the second seat member so that the seat is selectively slidably mounted to the first and second frame members for fore and aft adjustment.

**[0010]** Thus, advantageously, the wheelchair includes a frame having a longitudinal frame portion that extends fore and aft and a lateral frame member that extends generally perpendicular thereto. Front and rear wheels are mounted to the frame and a seat is mounted to the frame through a seat mount assembly. The seat mount assembly allows for selective fore and aft adjustment of the seat relative to the frame.

**[0011]** The seat mount assembly may include first and second seat support members secured to the frame and the seat, respectively. The seat support members can be connected together by elongate slots and pins so that an angular adjustment can be achieved.

**[0012]** Preferably the seat mount assembly can be adjusted fore and aft via a channel. In a preferred arrangement, the channel is integrally formed on the frame.

**[0013]** A principal advantage is the ability to provide increased adjustment for the wheelchair user.

**[0014]** Still another advantage resides in the angular adjustment that is available.

**[0015]** Yet another advantage resides in the fore and aft adjustment of the seat relative to the frame.

**[0016]** A still further advantage resides in the ability to reverse the position of the seat relative to the frame to accommodate front wheel drive or rear wheel drive units.

**[0017]** The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:-

**[0018]** Figure 1 is a perspective view of a power wheelchair of the type to which the subject invention may pertain.

**[0019]** Figure 2 is an exploded perspective view of a conventional frame used in these types of wheelchairs.

**[0020]** Figure 3 is an exploded perspective view of the components of the reversible, adjustable seat support assembly of the present invention.

**[0021]** Figure 4 is an elevational view of a rear wheel drive power wheelchair with the seat at a 0° inclination.

**[0022]** Figure 5 is an elevational view similar to Figure 3 but showing the seat at a 10° angle.

**[0023]** Figure 6 shows an elevational view of a front wheel drive arrangement where the seat has been reversed from the position of Figures 4 and 5, and the seat is disposed at a 0° orientation.

**[0024]** Figure 7 is an elevational view similar to that of Figure 5 with the seat at an angle of approximately 10°.

**[0025]** Figure 8 is a cross sectional view taken generally along the lines 8-8 in Figure 4.

**[0026]** Referring now to the drawings which illustrate the preferred embodiment of the invention only and are not intended to limit the invention, the Figures show a wheelchair, preferably a power wheelchair **A**. For convenience, the drawings occasionally identify the components by a suffix "a" or "b" which is intended to represent that the wheelchair includes a pair of the described component, it being understood that description of one is applicable to the other unless noted to the contrary.

**[0027]** Generally, the wheelchair **A** includes a frame 10 to which enlarged diameter wheels 12, also referred to as drive wheels, are operatively connected. Small diameter or driven wheels 14a, 14b are also operatively mounted to the frame. A seat 16 comprised of a seat portion 18 and a seat back 20 is mounted on the frame. The prior art power wheelchair of Figure 1 has a basic seat assembly, although it will be understood that the seat can be customized with special cushions, bolsters, pads, etc., to meet the needs of the individual user.

**[0028]** First and second motors 22a, 22b, preferably one associated with each drive wheel, are mounted on the frame and operatively connected to the drive wheels through a gear box or other conventional structure. The motors are typically electrically operated and, thus, the wheelchair carries an on-board source of power such as batteries 24. A control, such as joy stick control 26, is mounted on one of the arm rests 28 so that power is selectively provided to the left or right motor to selectively drive the wheels 12 in a forward or reverse direction. Details of a battery operated, joy stick controlled power wheelchair are generally known in the art so that further discussion herein is deemed unnecessary to a full and complete understanding of the present invention. As will be appreciated, powered rotation of the drive wheels steers the wheelchair since the driven wheels 14 are rotatably connected to the frame via caster assemblies 30. Again, details of the caster assemblies are well known in the art so that further discussion is not warranted.

**[0029]** With continued reference to Figure 1, and additional reference to Figure 2, the preferred frame 10 is shown in greater detail. It is preferably an H-shaped configuration formed of rigid metal tubing having a hollow rectangular cross section. First and second longitudinal frame members 40a, 40b extend fore and aft in the general direction of the drive and driven wheels. A cross or interconnecting frame member 42 is disposed substantially perpendicular and rigidly connected at opposite ends to the longitudinal frame members, for instance by welding or the like. Each longitudinal frame member has a first end 44 and a second end 46. In a preferred arrangement, the first ends 44 terminate in a generally cylindrical housing that receives the caster assembly of the small diameter driven wheels 14a. A shock absorber assembly 48 (Figure 2) is preferably mounted adjacent the second ends 46 of the longitudinal frame members

while the drive wheels are secured through a linkage assembly (unnumbered). Again, details of the structure shown in Figure 2 are set forth in greater detail in our U. S. A. Patent No. 5,575,348 so that familiarity with that structure is presumed and further description herein is deemed unnecessary.

[0030] Attention is additionally directed to Figure 3 which shows an exploded view of the seat support assembly, as well as Figures 4 and 5 which schematically illustrate a rear wheel drive version of a power wheelchair of the present invention. Where possible, like reference numerals will refer to like parts and the features of the present invention will be identified by new reference numerals. In the rear wheel drive version, the enlarged diameter drive wheels **12** are more closely positioned adjacent the seat back **20** than the front of the seat portion **18**. Similarly, the small diameter driven wheels **14** are more closely located adjacent the front of the seat **18** than to the seat back **20**.

[0031] The seat **16** includes rigid seat frame portions **60**, **62** that are typically disposed beneath the cushion or upholstery portions of the wheelchair seat. As shown, seat frame member **60** is a rigid structure adapted to receive the seat cushion **18** while the angle bracket **62** is fixedly secured to the seat frame portion **60** in a generally perpendicular relation, and thus forms a part of the seat back **20**. A seat support assembly **64** (Figure 4) interconnects the seat assembly **16** to the frame. It includes a first or upper seat support member **66** that is secured to an underside of the seat frame **60**. In accordance with the preferred embodiment, the seat support member **66** includes a pair of elongated slots **68**, **70** generally disposed at opposite ends thereof. As will be more fully developed below, the elongated slots allow for desired angular adjustment of the seat relative to the frame.

[0032] Additionally, the seat support assembly includes a second or lower seat support member **76**. It is adapted for connection to the frame, particularly the longitudinal members **40a**, **40b** in a manner to be described further below. Moreover, the second seat support member has a generally triangular conformation that is mounted so that the higher end is disposed toward the first end **44** of the frame. Since the frame is preferably disposed at an angle, the triangular conformation provides that an upper surface of the second seat support is disposed in a generally horizontal plane.

[0033] Openings **78** disposed at opposite ends of a second seat support member are adapted to receive a pin-type fastener, such as a nut and bolt **80**, that passes through the respective openings **68**, **70** of the first seat support member. By selectively loosening and tightening the fastener **80**, the angular location of the seat may be adjusted. For example, as shown in Figure 4, the fastener **80** is disposed adjacent an upper region of elongated opening **68**, while fastener **82** is disposed adjacent a lower region of the elongated opening **70**. This attitude of the seat support assembly places the seat at

a 0° orientation relative to the ground surface, i.e., an upright seat position.

[0034] When comparing the angle of the seat in Figure 4 with that of Figure 5, it is evident that the seat has been adjusted to define an approximately 10° angle between the seat **18** and the ground surface. This change-over is achieved by loosening the fasteners **80**, **82** and situating the fastener **80** adjacent the lower region of the elongated opening **68** and moving the fastener **82** adjacent the upper region of the elongated opening **70**.

[0035] As will be appreciated, although only the 0° and 10° angular positions of the seat are illustrated, an infinite number of angular positions may be adopted therebetween by altering the positions of the fasteners **80** in the respective elongated openings **68**, **70**. The use of a pair of elongated openings provides for incremental adjustment over the maximum range.

[0036] Figures 6 and 7 illustrate a front wheel drive wheelchair. Substantially, the same components are used in this front wheel drive version as were used in the rear wheel drive arrangement of Figures 4 and 5. The seat support assembly uses the identical two seat support members **66** and **76**, although the seat support members are reversed relative to one another. That is, the seat support member **66** remains secured to the seat frame member **60** in the same relationship so that the seat and seat support member **66** are merely reversed (i.e., rotated 180°) relative to the seat support member **76** and the frame. As will be appreciated, to achieve the 0° angle illustrated in Figure 6, the fastener **80** is disposed adjacent the lower region of the elongated opening **70** while fastener **82** is disposed adjacent the upper region of the elongated opening **68**. A 10° adjustment of the seat angle can be accomplished in the front wheel drive version, again, by loosening the fasteners, re-orienting the seat support members (without disassembly), and tightening the fasteners at the desired new position. Thus, as represented in Figure 7, a 10° angle is defined between the seat **18** and the ground surface by positioning the fastener **82** adjacent the lower end of the elongated opening **68** while the fastener **80** is disposed adjacent the upper end of elongated opening **70**. Of course, it will be appreciated, that the arrangement of the elongated openings and pins can be reversed, i.e., elongated openings provided on a seat support member secured to the frame while the fasteners **80**, **82** could be provided on the seat support member secured to the seat, without substantially altering the seat adjustment function.

[0037] For ease of adjustment of the seat angle, the fasteners **80**, **82** are preferably received through the first and second seat support members **66**, **76** and secured in elongated bar **84** (Figure 3). Particularly, each bar **84** includes threaded openings **86**, **88** at opposite ends that allow the user to merely tighten the fasteners from a region easily accessible from outside of the wheelchair and without concern for holding a nut or the like in place at a region that would be difficult to access underneath

the seat.

**[0038]** As will also be understood by comparing Figures 4 and 5 with Figures 6 and 7, the seat support assembly, and thus the seat, has been moved rearwardly along the longitudinal frame **40**. This fore and aft adjustment is a key concept of the present invention since it allows easy fore and aft adjustment without disassembling the entire seat. This is an important consideration where the weight to be carried by the caster wheels is to be altered. Moreover, and although the seat **16** is mounted in a reverse relationship, the identical components can be used for the rear wheel drive and front wheel drive assemblies.

**[0039]** Additional reference to Figure 8 illustrates a cross-sectional view of one of the longitudinal frame members **40**, again, it being understood that the structure of the other longitudinal frame member is the same unless noted otherwise. The longitudinal frame member is a generally hollow rectangular structure having side walls **90, 92** and generally perpendicular upper and lower walls **94, 96**. The hollow rectangular tube construction provides the desired rigidity and strength required for the power wheelchair frame. In addition, channel 100 is defined by inverted Lshaped arms **102, 104**. In the preferred embodiment, the channel is integrally formed on an upper surface of the wall **94** of the longitudinal frame member. It will be appreciated, however, that the channel could also be defined by a separate components secured to the longitudinal frame members. In any event, the channel 100 has an opening **106** defined between the arms that preferably faces upwardly. The opening receives at least one fastener **108**, preferably a fastener at each end, extending from the second seat support member **76**. For example, the fastener is a threaded nut and bolt assembly where the nut 110 is locked against rotation in the channel 100 while bolt **108** can be selectively tightened from above. When fully tightened, the fore to aft location of the seat support assembly is fixed relative to the frame. By merely loosening these fasteners, the entire seat support assembly can be moved fore and aft along the longitudinal frame members, i.e., to various locations over the wheels **12, 14** as desired. Again, as briefly indicated above, this allows for alteration of the weight carried by the different wheels.

**[0040]** The invention has been described with reference to the preferred embodiment. Obviously, modifications and alterations will occur to others upon a reading and understanding of this specification. It is intended to include all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

## Claims

1. A power wheelchair comprising:

a frame (10) having first and second longitudinal

frame members (40a,40b) extending fore and aft and at least one interconnecting member (42) extending between the first and second frame members (40a,40b);

front and rear wheels (14,12) operatively mounted to the frame;

a seat (18) to support an occupant;

first and second channels (100) on the first and second frame members (40a,40b), respectively, each channel having an elongate opening that extends in a direction generally fore and aft of the wheelchair; and

a seat mount assembly (64) interposed between the channels and the seat (18) for securing the seat (18) to the frame, the seat mount assembly being selectively slidably received in the elongate channel openings so that the seat (18) can be adjusted forwardly and rearwardly as desired by the occupant.

2. A wheelchair according to claim 1, wherein the channels (100) are integrally formed in the first and second longitudinal members (40a,40b).

3. A wheelchair according to claim 1, wherein the seat mount assembly (64) further comprises first and second seat support members (66,76) having a first pivotal mounting at at least one end so that the seat can be adjusted through a predetermined angular range of movement relative to the frame.

4. A wheelchair according to claim 3, wherein the seat support members further have a second pivotal mounting adjacent a second end of the seat so that the seat can be adjusted through a predetermined range of movement.

5. A wheelchair according to claim 4, wherein the first pivotal mounting includes an elongate slot in the first seat support member and a pin extending from the second seat support member for receipt in the elongate slot.

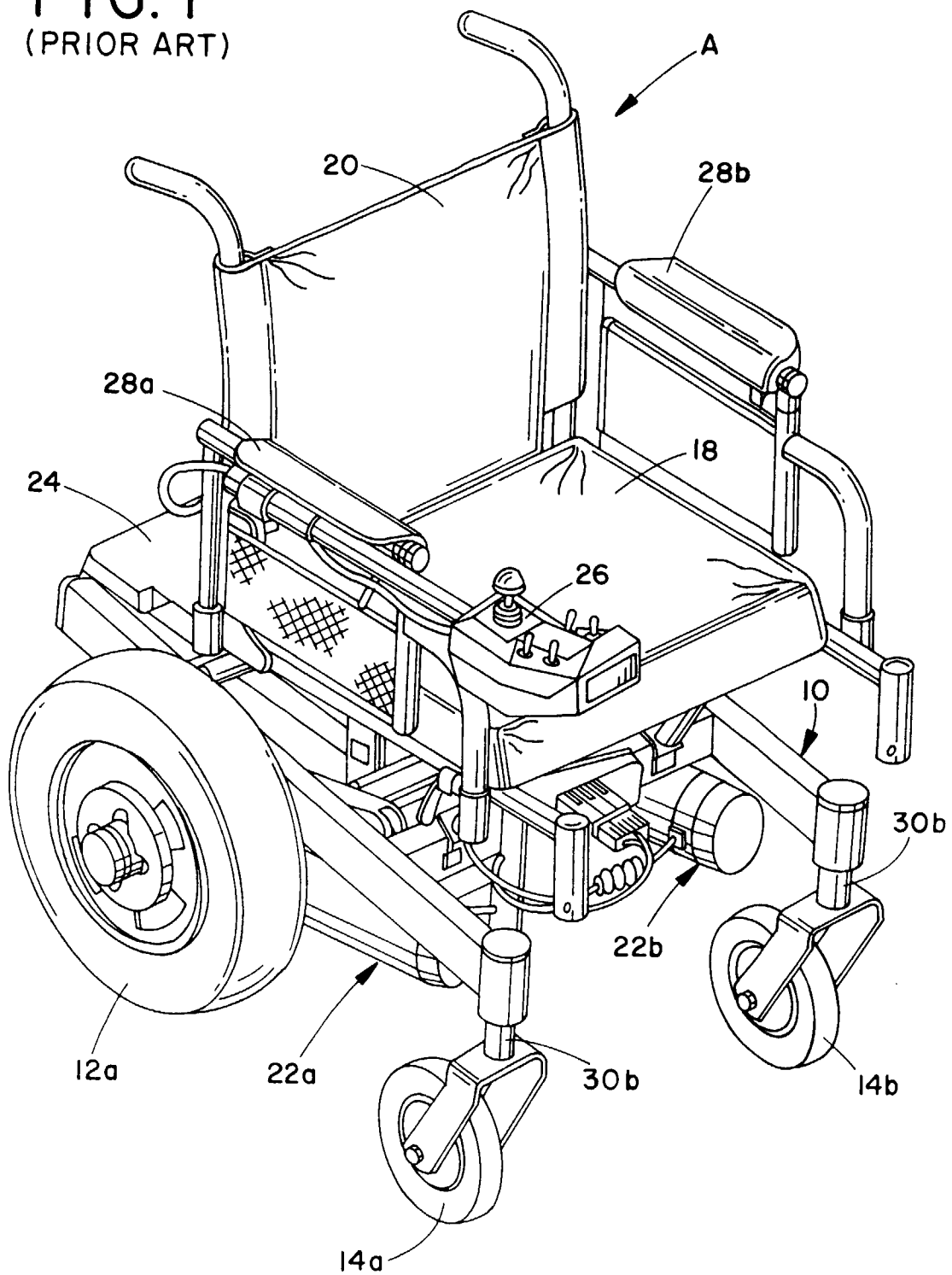
6. A wheelchair according to claim 5, wherein the second pivotal mounting includes a second elongate slot in the first seat support member and a second pin extending from the second seat support member for receipt in the second elongate slot.

7. A wheelchair according to claim 3, wherein the first pivotal mounting includes an elongate slot in the first seat support member and a pin extending from the second seat support member for receipt in the elongate slot.

8. A wheelchair according to claim 3, wherein the angular range of movement extends over approximately ten degrees.

9. A wheelchair according to claim 1, wherein the seat mount assembly may be selectively reversibly mounted in the channels to convert the wheelchair from a rear wheel drive arrangement to a front wheel drive arrangement, or vice versa. 5
10. A wheelchair according to claim 1, wherein the seat mount assembly includes a key member received in the channel through the opening to define a key/keyway connection between the seat and the frame. 10
11. A power wheelchair comprising:
- a frame (10) having first and second longitudinal frame members (40a, 40b) extending fore and aft and at least one interconnecting member (42) extending between the first and second frame members (40a, 40b); 15
  - front and rear wheels (14, 12) operatively mounted to the frame; 20
  - a seat (18) to support an occupant;
  - first and second channels (100) on the first and second frame members (40a, 40b), respectively, each channel having an elongate opening that extends in a direction generally fore and aft of the wheelchair; and 25
  - a seat mount assembly (64) interposed between the channels and the seat (18) for securing the seat (18) to the frame, the seat mount assembly being selectively slidably received in the elongate channel openings so that the seat (18) can be adjusted forwardly and rearwardly as desired by the occupant. 30
12. A wheelchair according to claim 11, wherein one of the first and second seat support members includes a first elongate slot that receives a first pin extending from the other of the first and second seat members to allow angular adjustment of the seat relative to the frame. 35
13. A wheelchair according to claim 12, wherein the one seat support member includes a second elongate slot that receives a second pin extending from the other seat support member whereby angular adjustment of the seat can be provided by altering one of the positions of one pin/slot assembly, the second pin/slot assembly, and both pin/slot assemblies. 40
14. A wheelchair according to claim 13, wherein the range of angular adjustment is approximately ten degrees. 45
15. A wheelchair according to claim 11, further comprising a channel provided on the longitudinal frame member that slidably receives the second seat support member so that the seat may be selectively adjusted fore and aft. 50
16. A wheelchair according to claim 15, wherein the seat can be reversed relative to the frame and the drive and driven wheels by sliding the seat relative to the longitudinal frame member and reinserting the seat in a reversed position. 55
17. A wheelchair according to claim 11, wherein the longitudinal frame member includes a channel extending over a major portion thereof that receives the second seat support member.
18. A wheelchair according to claim 17, wherein the channel is integrally formed in the longitudinal frame member.
19. A power wheelchair comprising:
- an H-shaped frame (10) including first and second frame members (40a, 40b) that are interconnected by a cross frame member (42);
  - a pair of enlarged diameter drive wheels (12) and at least one small diameter wheel (14) operatively connected to the frame;
  - a seat (18);
  - a seat support assembly (64) interposed between the seat and the frame, the assembly including a first seat support member (66) secured to the seat and a second seat member (76);
  - first and second channels (100) on the first and second frame members (40a, 40b), respectively, that define a keyway that receives a key (108) extending outwardly from the second seat member (76) so that the seat is selectively slidably mounted to the first and second frame members (40a, 40b) for fore and aft adjustment.
20. A wheelchair according to claim 19, wherein the channels are open at one end so that the seat can be removed and rotated through 180° to a reversed position.
21. A wheelchair according to claim 19, wherein the first and second seat support members are connected at opposite ends by an enlarged opening and cooperating pin allowing angular adjustment of the seat relative to the frame at each end.

**FIG. 1**  
(PRIOR ART)



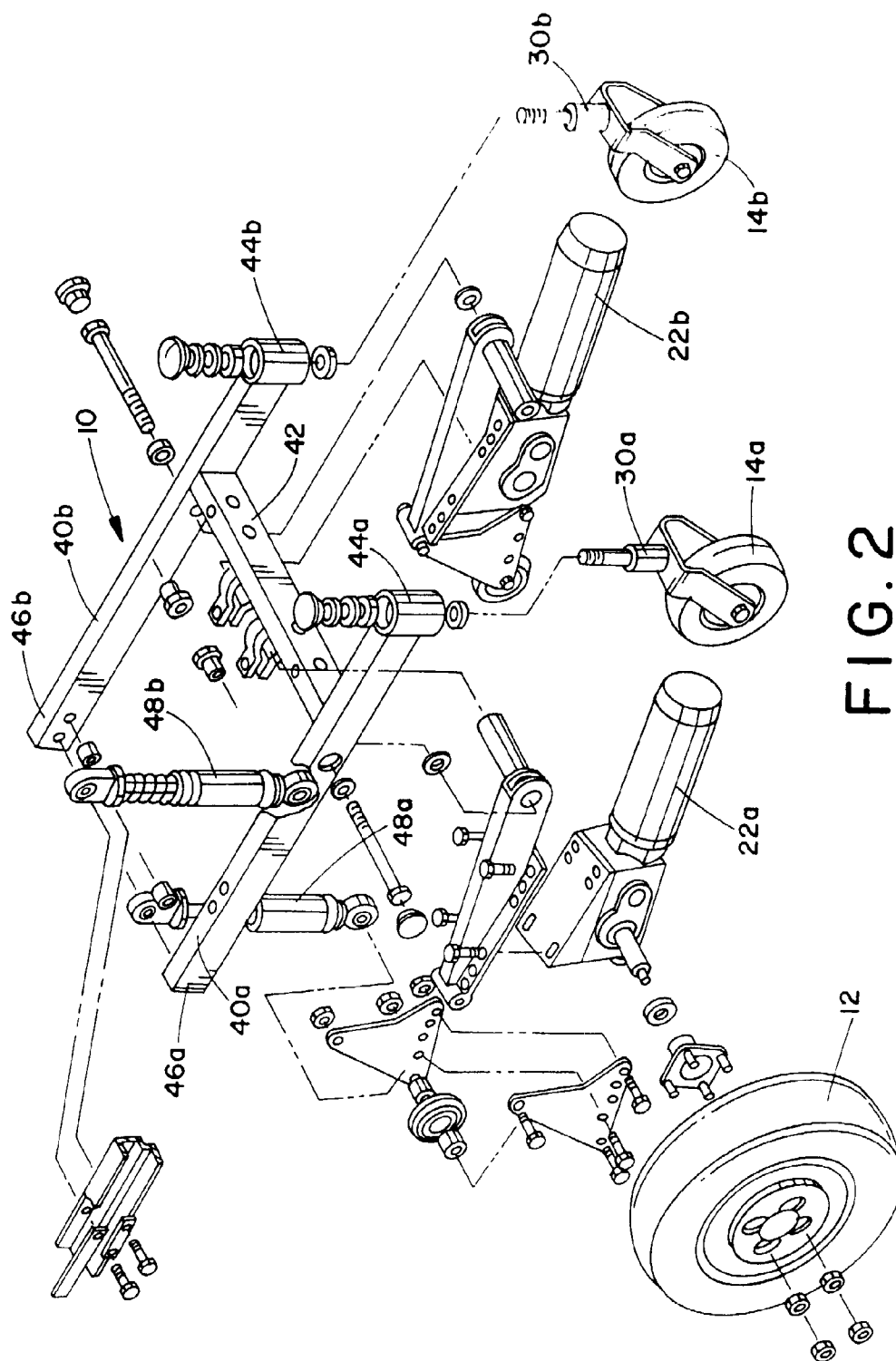
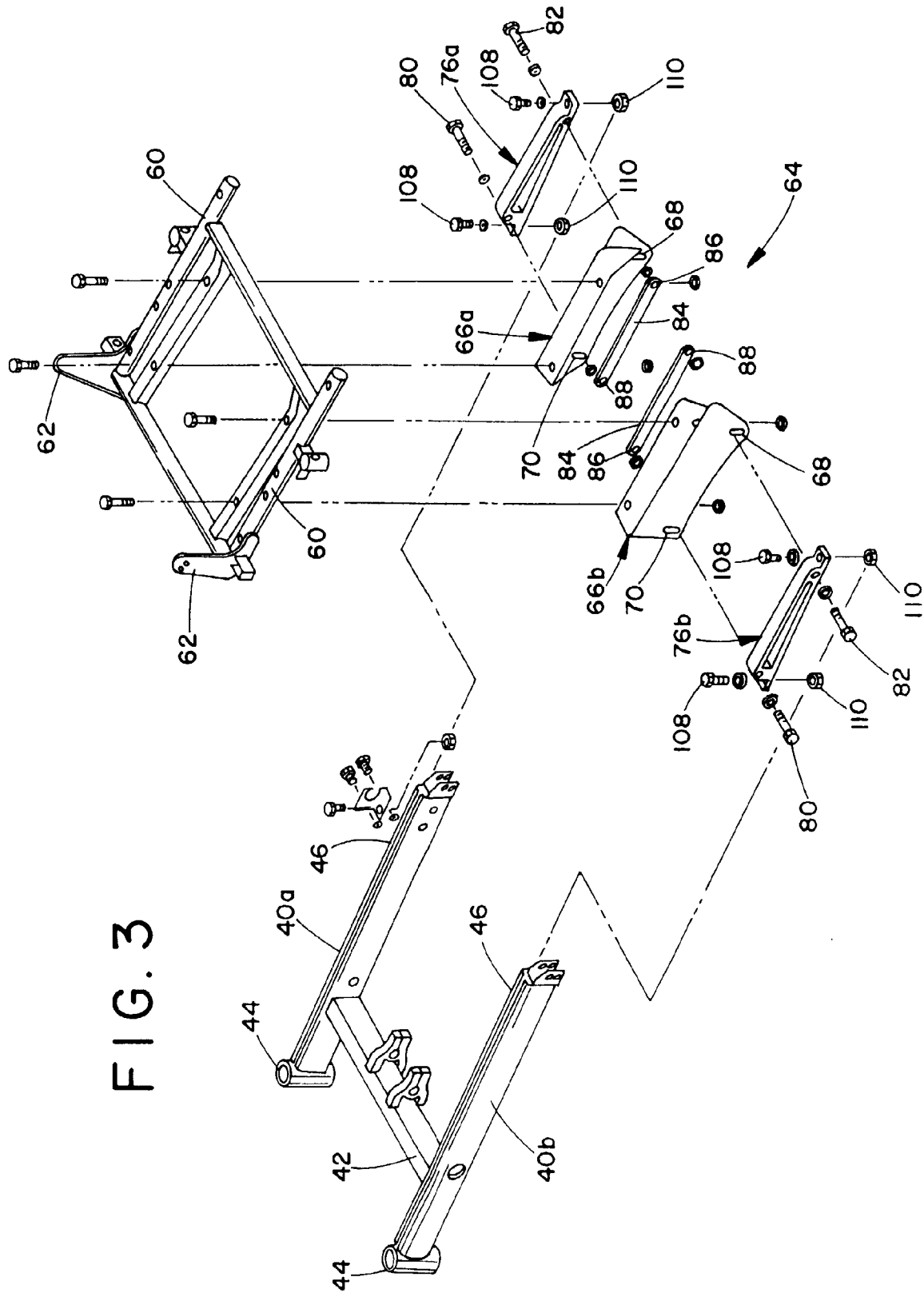
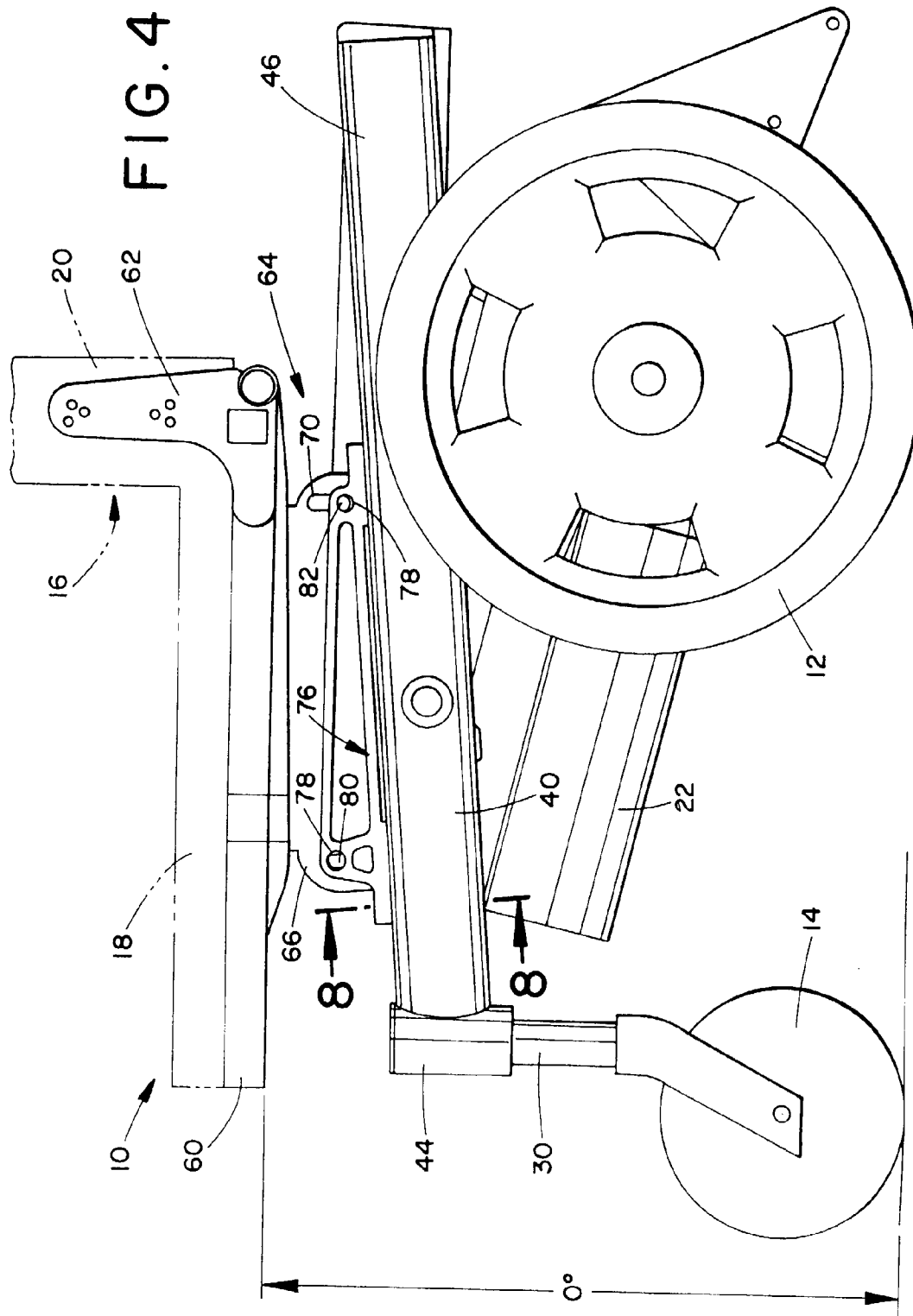


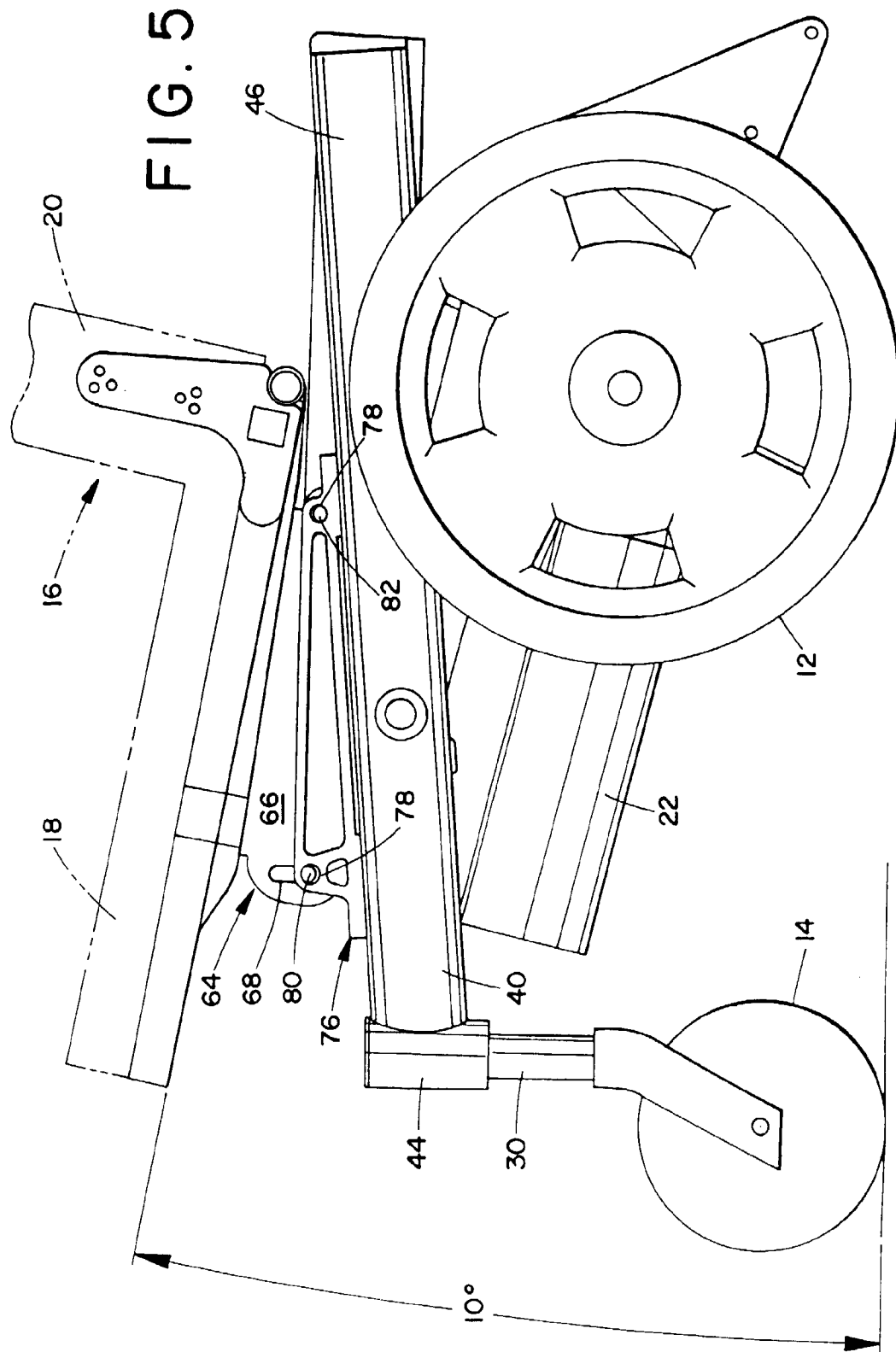
FIG. 2  
(PRIOR ART)



FIG. 3







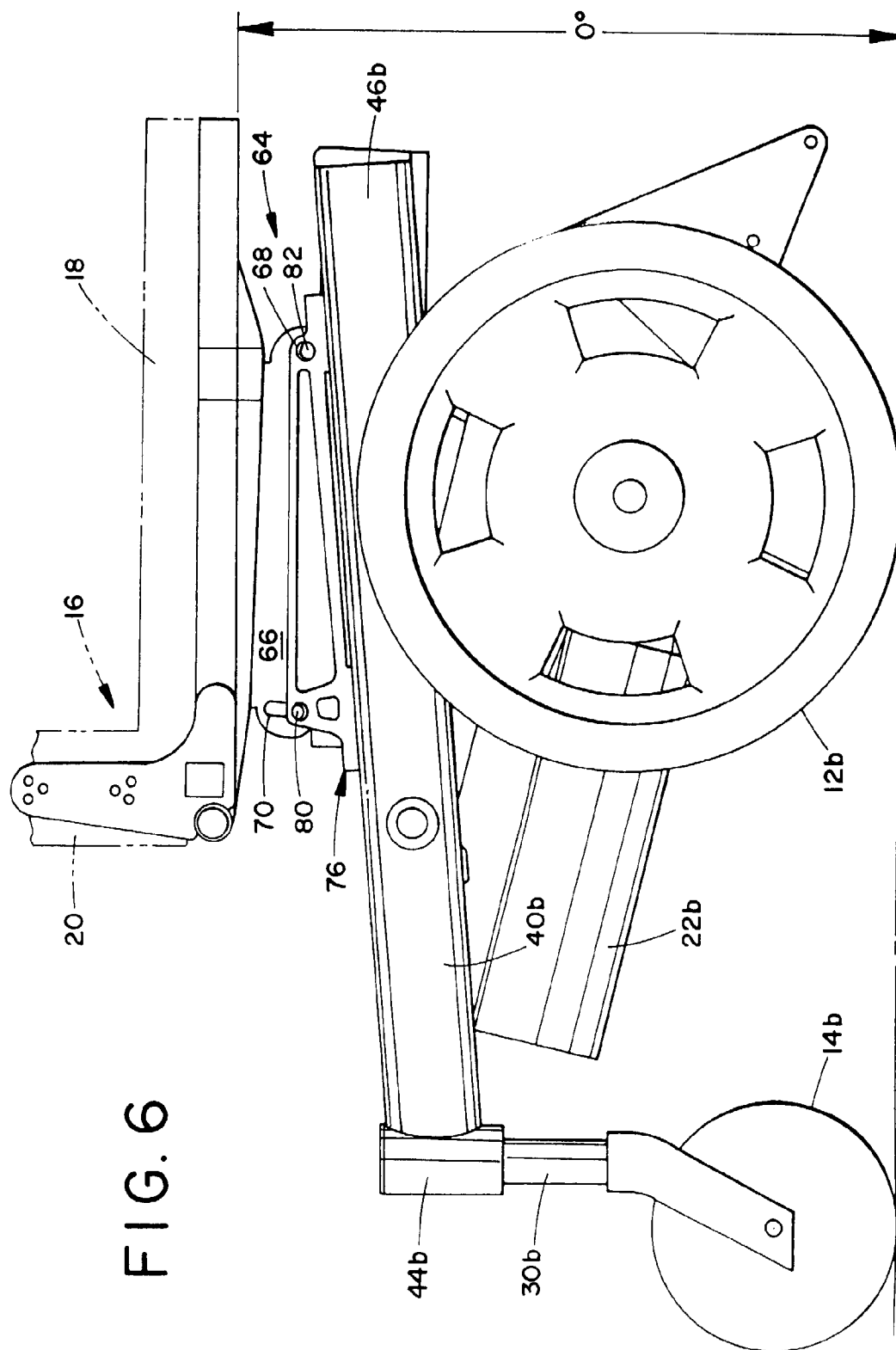
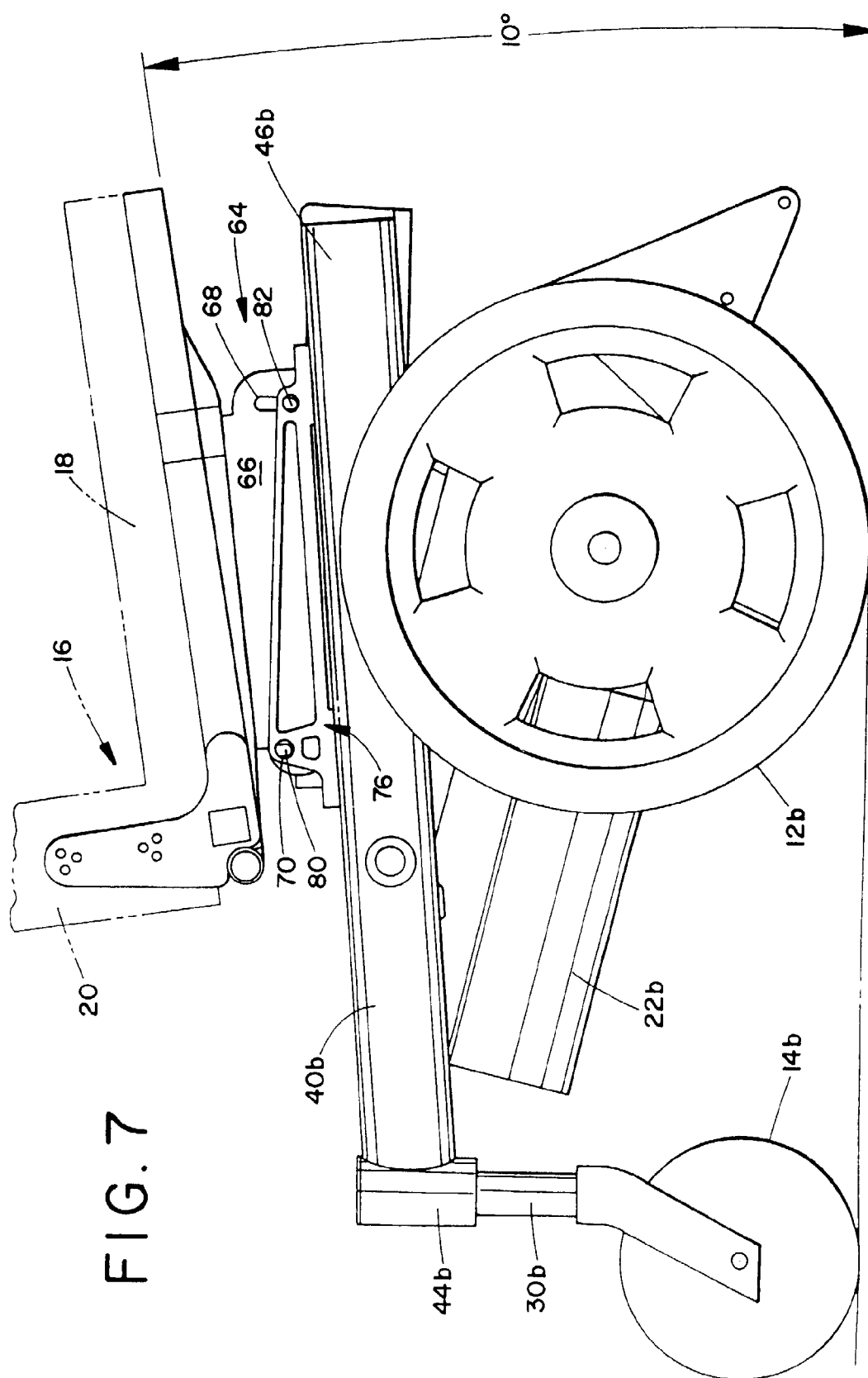


FIG. 6



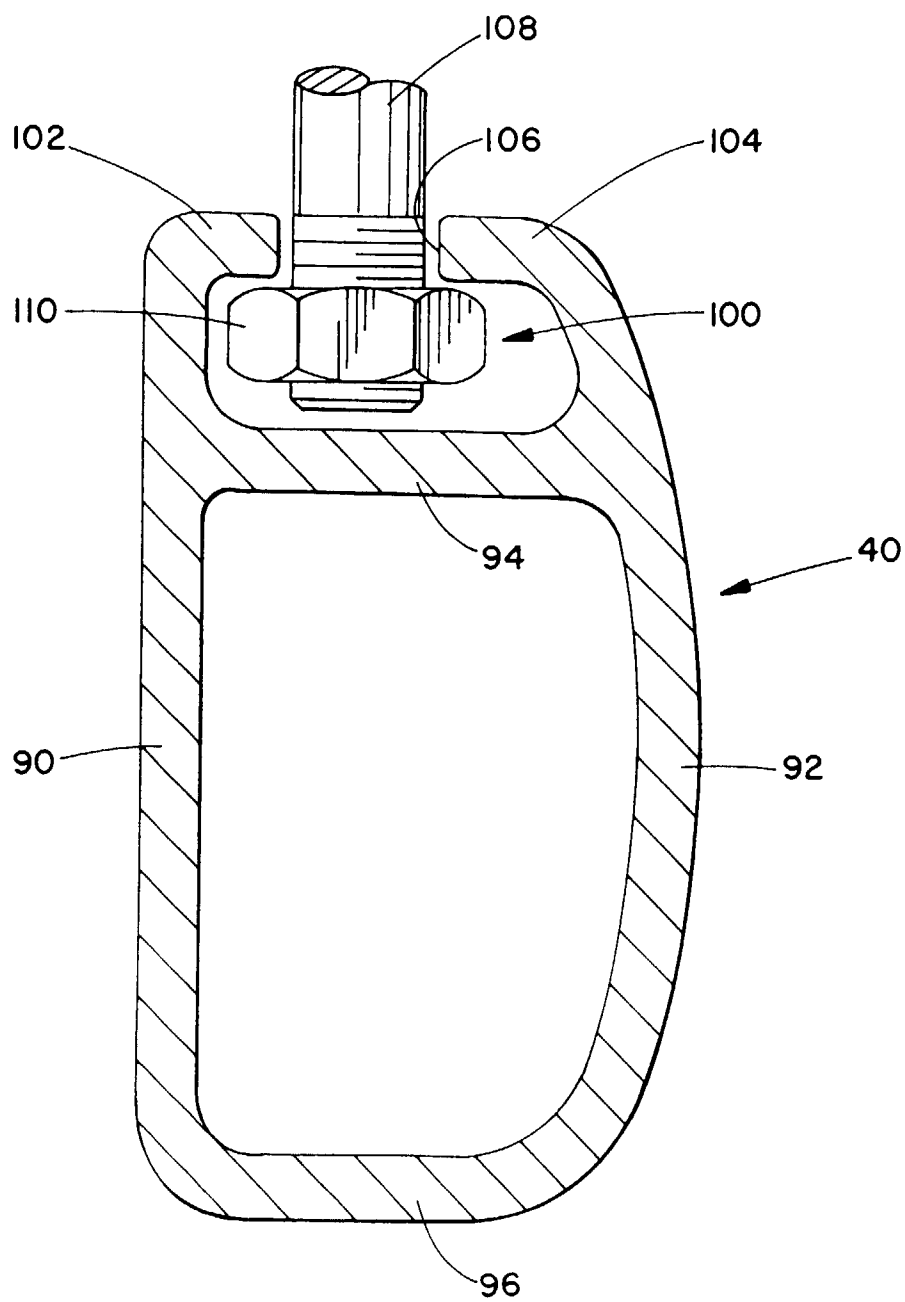


FIG. 8