PATENT SPECIFICATION (11) 1 569 166

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(21) Application No. 51420/76 (22) Filed 9 Dec. 1976
(23) Complete Specification Filed 6 Dec. 1977
(44) Complete Specification Published 11 Jun. 1980
(51) INT. CL.[3] B62B 11/00
(52) Index at Acceptance
B7D X3

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(19)

(54) ATTACHMENTS ENABLING VEHICLES TO NEGOTIATE OBSTACLES

(71) We, VESSA LIMITED, a British Company, of, Paper Mill Lane, Alton, Hampshire, GU34 2PY, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to a wheelchair fitted with one or more attachments for enabling small diameter wheels fitted to the wheelchair to negotiate obstructions that lie in the path of the wheels. The obstructions that the attachments are primarily designed to assist in negotiating are kerbs at the edges of side-walks or pavements. However, it will be readily apparent that the invention can be applied to other forms of vehicle and used to traverse other forms of obstructions.

Devices are known in which lever means or a strut pivoted to a vehicle frame adjacent each wheel to be assisted over an obstruction are arranged to engage the obstruction to raise the vehicle at the wheel zone to a position in which the wheel can negotiate and pass over the obstruction.

The invention provides a wheelchair, at least one wheel of which is fitted with an attachment for facilitating negotiation by said wheel of a kerb or similar obstruction, the attachment comprising a strut arranged to be pivoted to the wheelchair about a horizontal axis higher than the wheel, and a prestressed spring connected so as to hold the strut set in a ready position, determined by abutting members one of which is rigidly connected to the strut and the other is rigidly connected to the wheelchair, such that when the free end of the strut encounters a kerb, or other obstruction, it rocks on the obstruction, separating the abutting members, increasing the stress in the spring and lifting the wheelchair in the wheel zone until the wheel passes onto the obstruction and the strut then reaching a position relatively to the wheel such that the spring can return the strut to the ready position.

It is particularly desirable that precise control should be provided of the position of the strut both in regard to its initial position in which it is located to negotiate a kerb, or other obstruction, when encountered, and in regard to its easy transfer to an idle position. Very advantageously, means are provided for holding the strut in an idle or inoperative position. This may be effected by latching the strut in an ineffective position, or by providing mechanism whereby the spring is effective for holding the strut in an idle position or, as another alternative by providing a sub-assembly comprising the strut and spring, arranged to be turned as a unit to a position in which the strut is in an idle position.

The attachment may be constructed as a removable addition to the wheelchair or it may be fixed permanently thereto. When as is usually the case there are two side-by-side wheels to be assisted, an attachment is provided for each wheel.

The wheelchair may be either motor driven or manually propelled or pushed. However, the invention is particularly beneficial when applied to a wheelchair having two power wheels differentially driven to provide for steering and two comparatively small freely rotating front castor wheels.

In order that the invention may be clearly understood and readily carried into effect, a wheelchair having kerb-climbing attachments will now be described, by way of example with reference to the accompanying drawings, in which:-

Figure 1 is a side elevation of one kerb-climbing attachment;

Figure 2 is a sectional plan of a portion of the attachment of Figure 1;

Figure 3 is a rear elevation of another portion of the attachment of Figure 1;

Figure 4 shows a wheelchair furnished with a kerb-climbing attachment, shown very diagrammatically, the chair and attachment being shown in four different operative conditions a, b, c and d;

Figure 5 is a side elevation of a second kerb-climbing attachment;

Figure 6 is a sectional plan of a portion of the kerb-climbing attachment of Figure 5;

Figure 7 is a diagram indicating the mode of action of spring mechanism in the construction of Figures 5 and 6;

Figure 8 is a sectional plan of a modified form of spring mechanism, the section being on line VIII-VIII in Figure 9; and

Figures 9 and *10* are cross-sections through the mechanism of Figure 8.

This particular example of the invention comprises a wheelchair having power driven rear wheels provided with independent motor drives which are differentially controlled for steering. Two freely rotating castor wheels 20 (Figure 4) are provided at the front of the chair and a mechanism as shown in Figure 1 is mounted on each side of the chair outside the castor wheel.

The mechanism of the attachment shown in Figure 1 comprises a strut assembly 2 having a main strut 21 to which is welded an arcuate rocker end 22 braced by a strut 23. A rubber tyre 16 is fixed along the underside of the rocker end 22 in an arcuate cavity therein by screws 19.

The main strut 21 has an arcuate upper end which is pivoted about a horizontal axis to a vertical arm 24 welded to a bracket 1 that is arranged to be a sliding fit in a tube 32 on the wheelchair. A horizontal sleeve 25 (Figure 2) is fixed to the top of the arm 24 and a tube 26 coaxial with the sleeve 25 is rotatably mounted therein with intervening oilite bearings 8, the tube 26 being fixed to a tubular element 27 welded to the end of the main strut 21. The opposed ends of the sleeve 25 and tubular element 27 are closed by plugs 11, 17.

A torsion spring 6 is secured between a dowel 9 fixed to the element 27 and a dowel 10 fixed to the sleeve 25. This spring is prestressed so that it would cause the strut assembly 2 to swing round in a counter clockwise direction, as viewed in Figure 1, if it was not held by an abutment in the form of a locking plunger 3 in the position of Figure 1, ready for kerb-climbing action. The axis of the spring is substantially above the castor wheels.

The plunger 3 is engaged by a link 13 pivoted at 12 between ears 28 welded to the tubular element 27 and connected at the opposite end by a member 29 to the near end of a tension spring 14 in a tube 30 welded to the main strut 21. The spring 14 is anchored at its inner end by a dowel 15 in the tube 30. Normally the spring 14 holds the link 13 in contact with the end of the tube 30 so that the strut assembly 2, link 13 and tube 30 can swing as a unit about the axis of the torsion spring 6 in a clockwise direction away from the locking plunger 3 when the rocker end encounters a kerb. However, if an abnormal force in the opposite direction acts on the strut assembly 2, as when the wheelchair is descending a kerb backwards, the spring 14 yields while the link 13 remains in contact with the locking plunger 3 and no damage is done.

In operation, the attachment is secured onto one side of a wheelchair by sliding the bracket 1 into the tube 32 and fixing a bifurcated tongue 33, welded to the sleeve 25, to a member 34 on the wheelchair by means of a bolt and wing nut 35. When the arcuate tyre 16 engages the top edge of a kerb (Figure 4a) while the wheelchair is being driven forward, the strut assembly swings counter-clockwise about the instantaneous centre of rotation at the point of contact and also counter-clockwise about the axis of the torsion spring 6 so that while the stress in the spring 6 is increased, the front of the wheelchair is lifted while moving forward (Figure 4b). The similar attachment on the other side of the chair, of course, acts simultaneously in the same way. At the end of this movement the castor wheels roll over the top edge of the kerb freeing the tyres 16 from the kerb (Figure 4c) to return to the position of Figure 1 relatively to the brackets 1.

The arcuate formation of the rocker end 22 provides for a considerable variation in the height of kerb, or like obstruction, that the mechanism can negotiate. The centre of the arcuate curve of the rocker end is on the axis of the torsion spring 6 so that the strut assembly rolls like a wheel over the kerb. The motor driven rear wheels 83 are of considerably greater diameter and so can negotiate the kerb without assistance.

In descending a kerb (Figure 4d), the rocker end strikes the ground first breaking the fall and then rolls until the castor wheels contact the ground and lift the strut assembly clear.

The locking plunger 3, is mounted to reciprocate in a tube 32 welded to the arm 24, and can withdraw manually from the plane of the link 13 against the action of a spring 5 (Figure 3) by a knurled pin 4, fixed to the plunger 3, which can travel along a slot 35 in the tube 32. To render the lever 21 and tyre 16 inactive, the lever 21 is manually swung clockwise and the plunger 3 withdrawn for the lever 21 to travel to the left-hand side of plunger 3 (as viewed in Figure 1), the stress in the torsion spring 6 being correspondingly increased. The plunger 3 is then released so as to bear on the lever 21 and hold it in the idle position. To

permit this movement to take place the end of the plunger may be bevelled so that the lever 21 can snap past the plunger. To cause the tyre 16 to return to the position of Figure 1 under the action of the torsion spring 6, the plunger is withdrawn by the pin 4.

Referring now to Figures 5 to 7 wherein similar reference numerals are used, where possible, to those used for equivalent parts in the construction of Figures 1 to 3, it will be seen that the main strut 21 is again welded to a tube 26 pivotable about its axis in a sleeve 25, but in this case the torsion spring is replaced by an external compression spring 40 (described below) and an axial tie rod 41 is mounted in the tube 26 and anchored to plates 42, 43 respectively fixed across the tube 26 and sleeve 25 to prevent axial movement of the tube 26.

A pillar 44 is fixed to the sleeve 25 and is provided at its upper end with a pivotable support 45 for an oscillatable cylinder 46 in which the spring 40 is located. In the condition shown in Figure 6, the upper end of the cylinder is closed by a disc 47 bearing on a circlip 53 and through which an axial rod 48 is guided. The compression spring 40 is compressed between this disc 47 and a disc 49 which is free to move upwards relative to the rod 48 but which is urged downwardly by the spring 40 against a circlip through which the thrust of the spring is transmitted to the rod 48. Beyond the cylinder 46, the rod 48 has fixed thereto a fork 50 pivoted to a radial crank arm 51 fixed to the sleeve 25.

As shown in Figure 7, the cylinder 46 can oscillate between the full line position and the broken line position, passing through a dead-centre position shown in Figure 6 wherein the crank arm 51 is in alignment with the rod 48. Clearly, in the dead-centre position the spring 40 is in its most compressed condition and the mechanism can be caused to snap over to either one of the extreme positions of Figure 7. In the extreme position shown in Figure 5, the spring is holding the main strut 21 and rocker end 22 in the ready position. In this condition the spring, now slightly relaxed but still under some compressive stress, is holding the disc 49 in contact with a circlip 52 at the lowe end of the cylinder 46. Furthermore, a circlip 54 at the upper end of the rod 48 is now in contact with the disc 47. Therefore, when the rocker end 22 is caused by a kerb to swing in the clockwise direction (as viewed in Figure 5) the spring 40 is compressed by the downward movement of the crank arm 51 and the rod 48 with the circlip 54 thrusting the abutment member consisting of the disc 47 downwards away from the abutment member consisting of the circlip 53. This compression continues until the rocker end 22 is clear of the kerb. Whereupon the spring returns the mechanism to the condition of Figure 5.

When it is desired to put the rocker end 22 into the inoperative position, the strut 21 is swung so that the crank arm passes over the aforesaid dead-centre position so that the crank arm 51 snaps over to the opposite side of the axis of the tube 26 with the cylinder 46 and rod 48 occupying approximately a mirror image position with respect to that shown in Figure 5 and the rocker end 22 being correspondingly lifted.

Referring now to Figures 8 to 10, it will be seen that an assembly 25, 26, 41 is again employed, but it will be seen that the spring mechanism now comprises a helical torsion spring 60 surrounding the sleeve 25. The main strut 21 is again fixed to the tube 26. The torsion spring 60 is prestressed and during the idle condition of the mechanism, the ends 61, 62 of the spring press on opposite edges of projections 63, 64. The projection 63 is fixed to a plate 65 fixed to the tube 26 and the projection 64 is fixed to an inwardly projecting circumferential flange 66A on a cylinder 66 surrounding the spring 60. The cylinder 66 is locked by means described below to an annulus 67 secured to the sleeve 25. To provide precise adjustment of the annulus 67 about the axis of the tube 26, the annulus 67 is provided with opposed brackets 68 carrying set screws 69 that engage opposite faces of a tongue 70 fixed to the sleeve 25.

When the assembly is in the normal, ready position, the spring ends 61, 62 and projections 63, 64 are in the relative positions shown diagrammatically at A in Figure 10. However, when the rocker end 22 encounters an obstacle so that it is turned about the axis of the tube 26, the plate 65 and projection 63 are rotated towards one of the positions as indicated at B and C in Figure 10, the direction depending on the direction in which the rocker end 22 is moved, either the spring end 61 or 62 being moved. The stress in the spring is, therefore, increased ready to return the parts to position A when allowed to do so.

A reciprocable pin 71 is mounted in a sleeve 72 on the cylinder 66. The pin is provided with a circular head 73 arranged to be held by a compression spring 74 in either one of two notches 75, 76 (Figure 9) in the annulus 67. In one of the two positions determined by these notches, the assembly operates as described above. In the other one of the two positions, the rocker end and main strut are set in the inactive position. This is due to the sub-assembly consisting of the strut 21 (not shown in Figures 8 to 10), the tube 26, the plate 65, the cylinder 66 and the entire spring 60 (without altering the stress therein) being shifted through a sub-

stantial angle about the tube axis.

WHAT WE CLAIM IS:

1. A wheelchair, at least one wheel of which is fitted with an attachment for facilitating negotiation by said wheel of a kerb or similar obstruction, the attachment comprising a strut, arranged to be pivoted to the wheelchair about a horizontal axis higher than the wheel, and a prestressed spring connected so as to hold the strut set in a ready position, determined by abutting members one of which is rigidly connected to the strut and the other is rigidly connected to the wheelchair such that when the free end of the strut encounters a kerb, or other obstruction, it rocks on the obstruction, separating the abutting members, increasing the stress in the spring and lifting the wheelchair in the wheel zone until the wheel passes onto the obstruction and the strut then reaching a position relatively to the wheel such that the spring can return the strut to the ready position.

2. A wheelchair according to Claim 1, provided with means for holding the strut in an idle position, the spring then being prestressed so as to return the strut to the ready position when released from the holding means.

3. A wheelchair according to Claim 1, comprising mechanism whereby the spring is effective also for holding the strut in an idle position, the mechanism being such that the strut can be manually caused to snap over from the ready position to the idle position.

4. A wheelchair according to Claim 1, in which a sub-assembly comprising the strut and the prestressed spring can be turned as a unit to a position in which the strut is in the idle position.

5. A wheelchair according to Claim 1 or Claim 2, in which the strut is fixed to a tube mounted to rotate in a sleeve and containing an axial torsion spring anchored between the tube and sleeve and prestressed so as to maintain the abutting members in engagement with the strut in the ready position.

6. A wheelchair according to Claim 2 or Claims 2 and 5, in which one of the abutting members is a spring loaded plunger which is withdrawn to enable the strut to pass to the opposite side of the plunger and released to hold the strut in the idle position.

7. A wheelchair according to Claim 5 or Claim 6, in which the strut is incorporated in a linkage that is normally rigid and swings in one direction without distortion about the pivot of the strut when the obstruction is negotiated, the linkage incorporating a second spring that yields when the strut is subjected to a load in the opposite direction while the abutting members remain in contact.

8. A wheelchair according to Claim 3, in which the mechanism comprises a cylinder, a rod axially reciprocable in the cylinder and pivoted at one end to a crank arm extending radially from a tube mounted to rotate about its axis, the spring being a compression spring arranged in the cylinder to exert axial pressure on the rod, whereby the spring force can turn the crank arm in either direction from a dead-centre position in which the rod and crank arm are in axial alignment, the crank arm turning in one direction to carry the strut towards the ready position and in the other direction to carry the strut towards the idle position.

9. A wheelchair according to Claim 8, in which the compression spring is extended to a maximum permitted amount when the strut is in the ready position and the rod is arranged to compress the spring by acting at the end remote from the crank arm when the strut is moving from that position in negotiating an obstacle.

10. A wheelchair according to Claim 1 or Claim 4, in which the spring is a helical torsion spring prestressed so that its ends serve as first and second abutment members respectively acting on a third abutment member fixed to the strut and a fourth abutment member fixed to a member fixed with respect to the strut, whereby movement of the strut in either direction from the ready position results in the spring stress increasing.

11. A wheelchair according to Claims 4 and 10, in which the strut and third abutment member are fixed to a tube rotatable in a sleeve surrounded by the torsion spring, the strut, tube, abutment members and spring being arranged as the sub-assembly rotatably mounted on the sleeve, and latch means being provided for securing the sub-assembly in either one of two positions corresponding to the ready and idle positions of the strut.

12. A wheelchair according to any one of the preceding claims, in which the strut includes at the lower end thereof a member presenting an arcuate surface centred on the pivotal axis of the strut for engaging the obstruction.

13. A wheelchair substantially as de-

scribed with reference to Figures 1 to 3 of the accompanying drawings.

14. A wheelchair substantially as described with reference to Figures 5 to 7 of the accompanying drawings.

15. A wheelchair substantially as described with reference to Figures 8 to 10 of the accompanying drawings.

16. A wheelchair according to any of claims 1 to 16 having two castoring front wheels and power driven rear wheels, and two attachments one mounted beside each castoring wheel with the strut pivot at a level higher than the castoring wheel.

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Printed for Her Majesty's Stationery Office,
by Croydon Printing Company Limited, Croydon, Surrey, 1980.
Published by The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.

1569166 COMPLETE SPECIFICATION

7 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

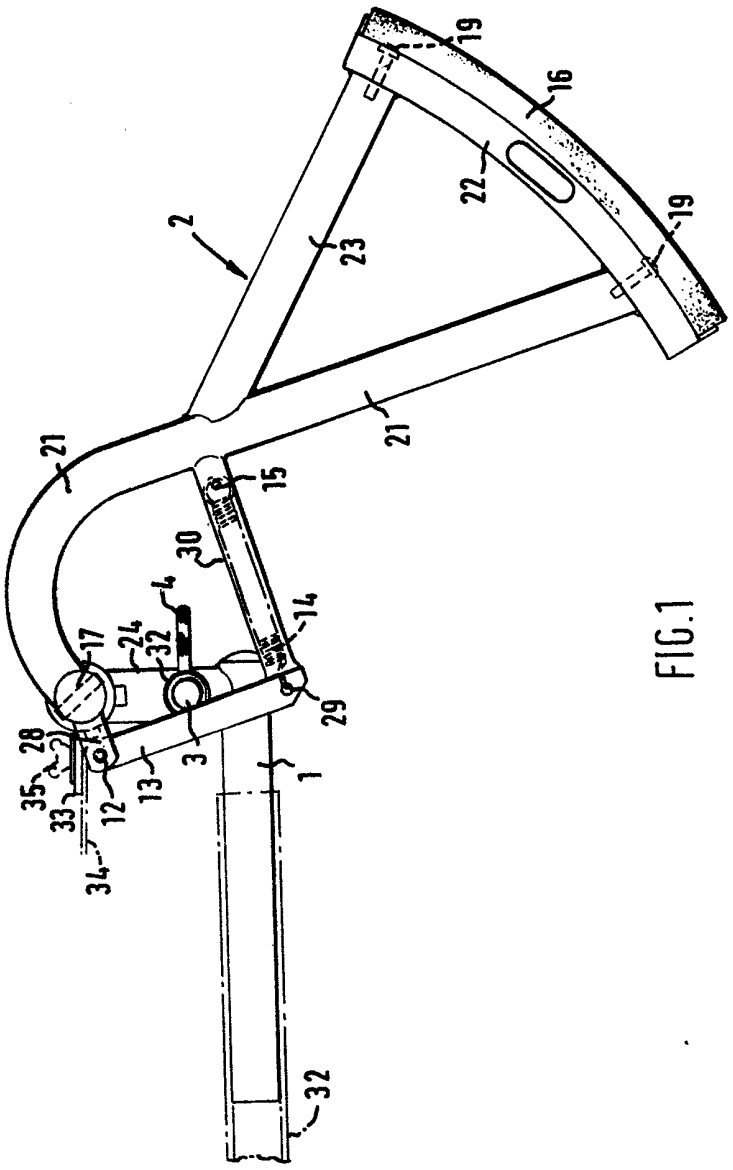


FIG.1

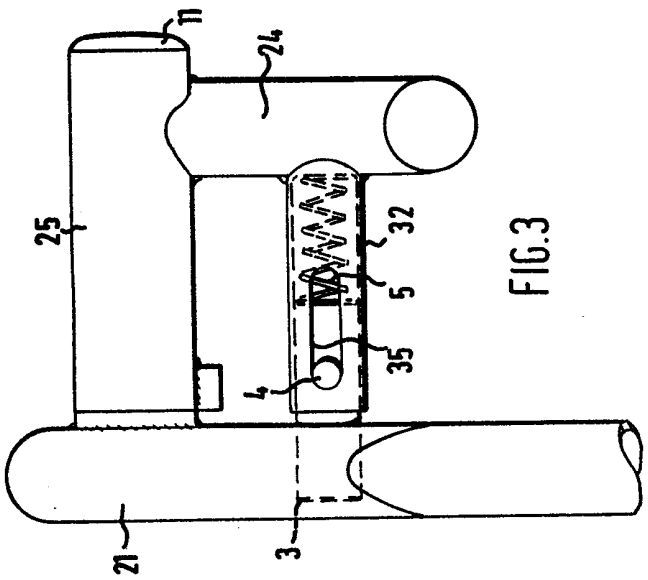


FIG.3

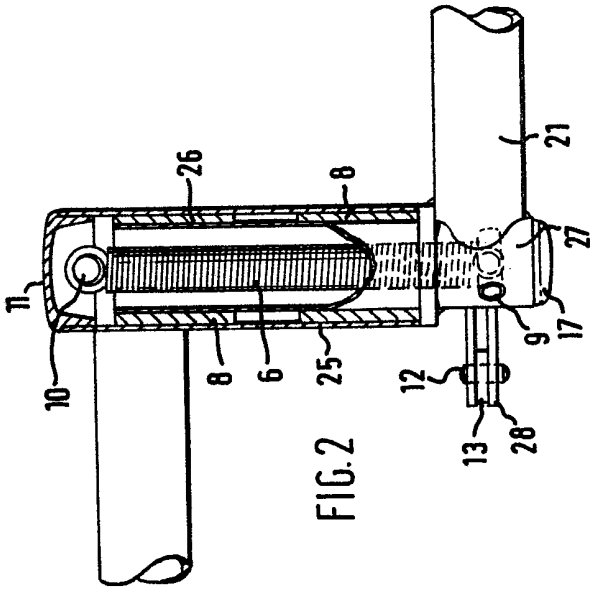


FIG.2

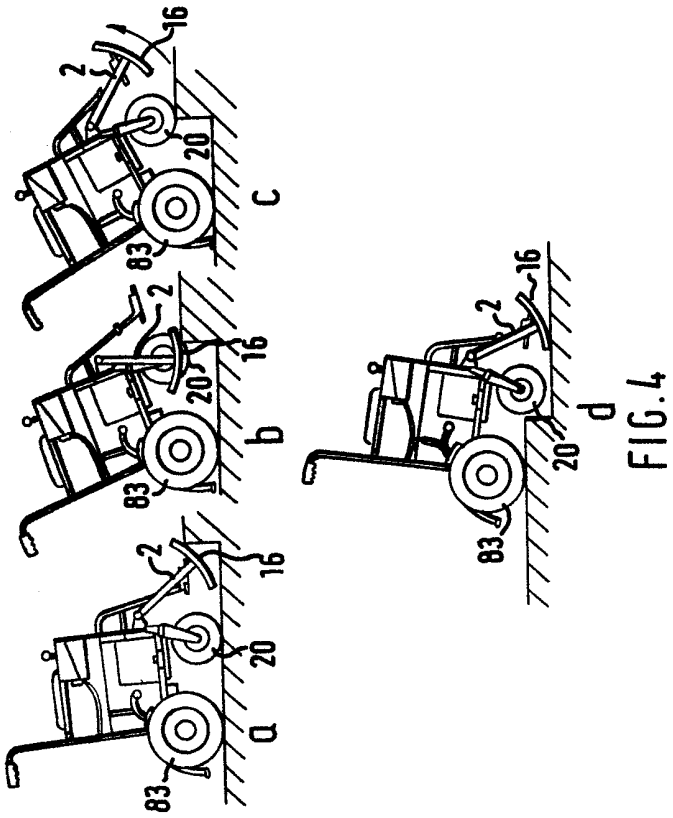


FIG.4

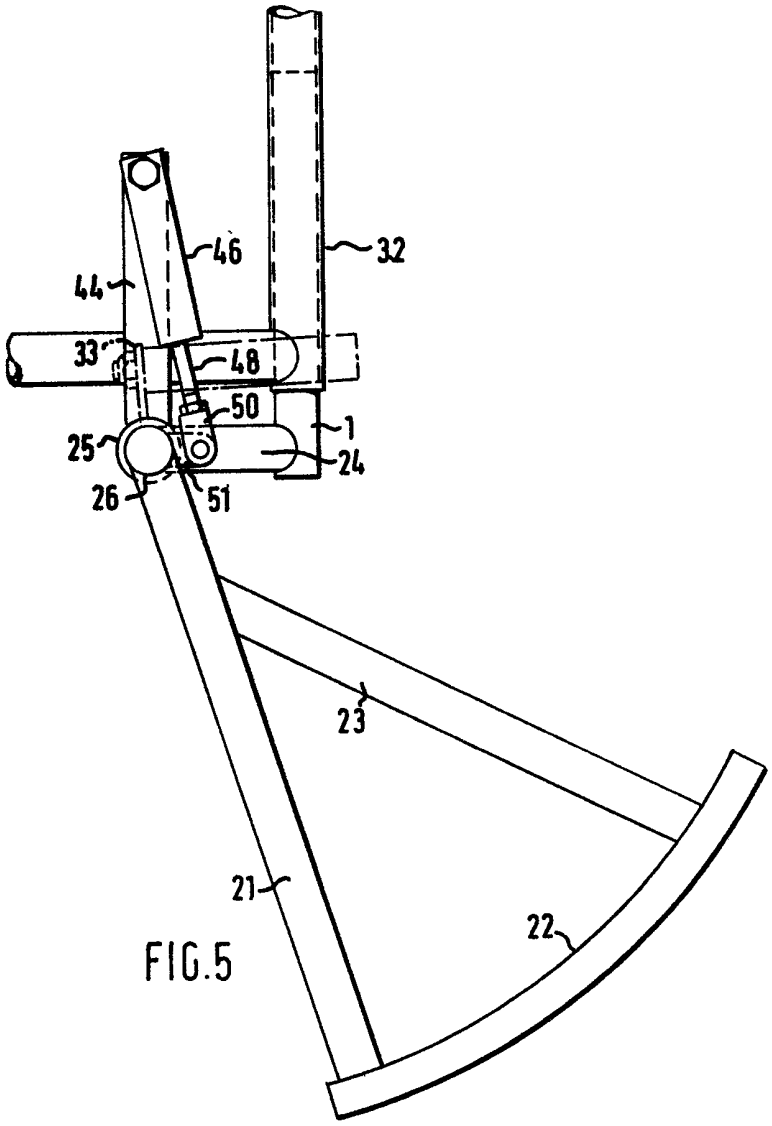
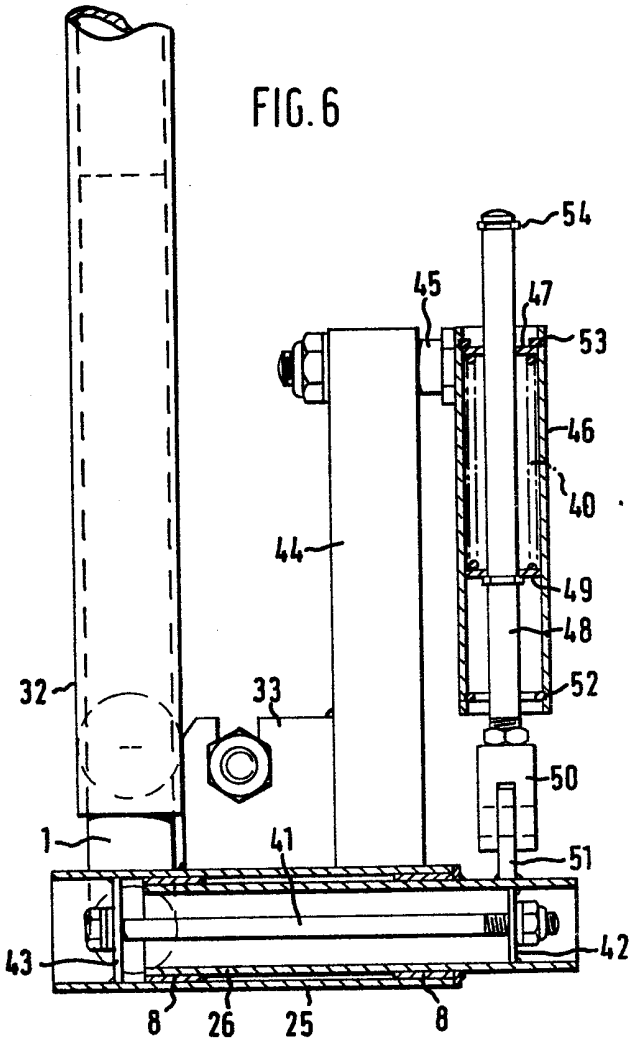


FIG.5

FIG. 6



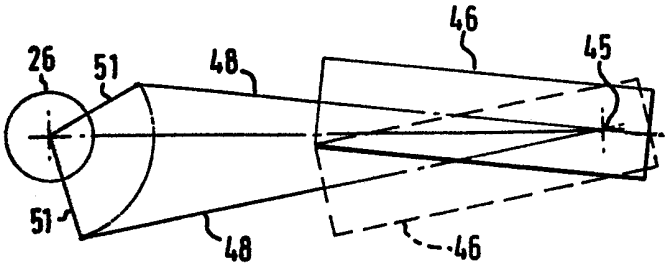

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FIG.7

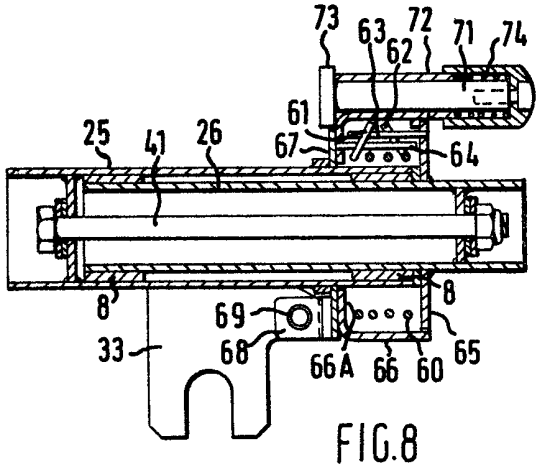
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FIG.8

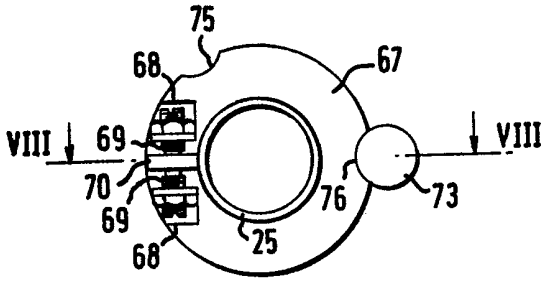
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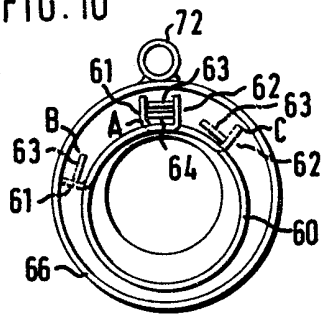
FIG.9

FIG.10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