Aug. 28, 1962 K. H. BURZLAFF 3,051,270

LOCKING MECHANISM FOR MOBILE UNITS

Filed Dec. 3, 1958 4 Sheets-Sheet 1

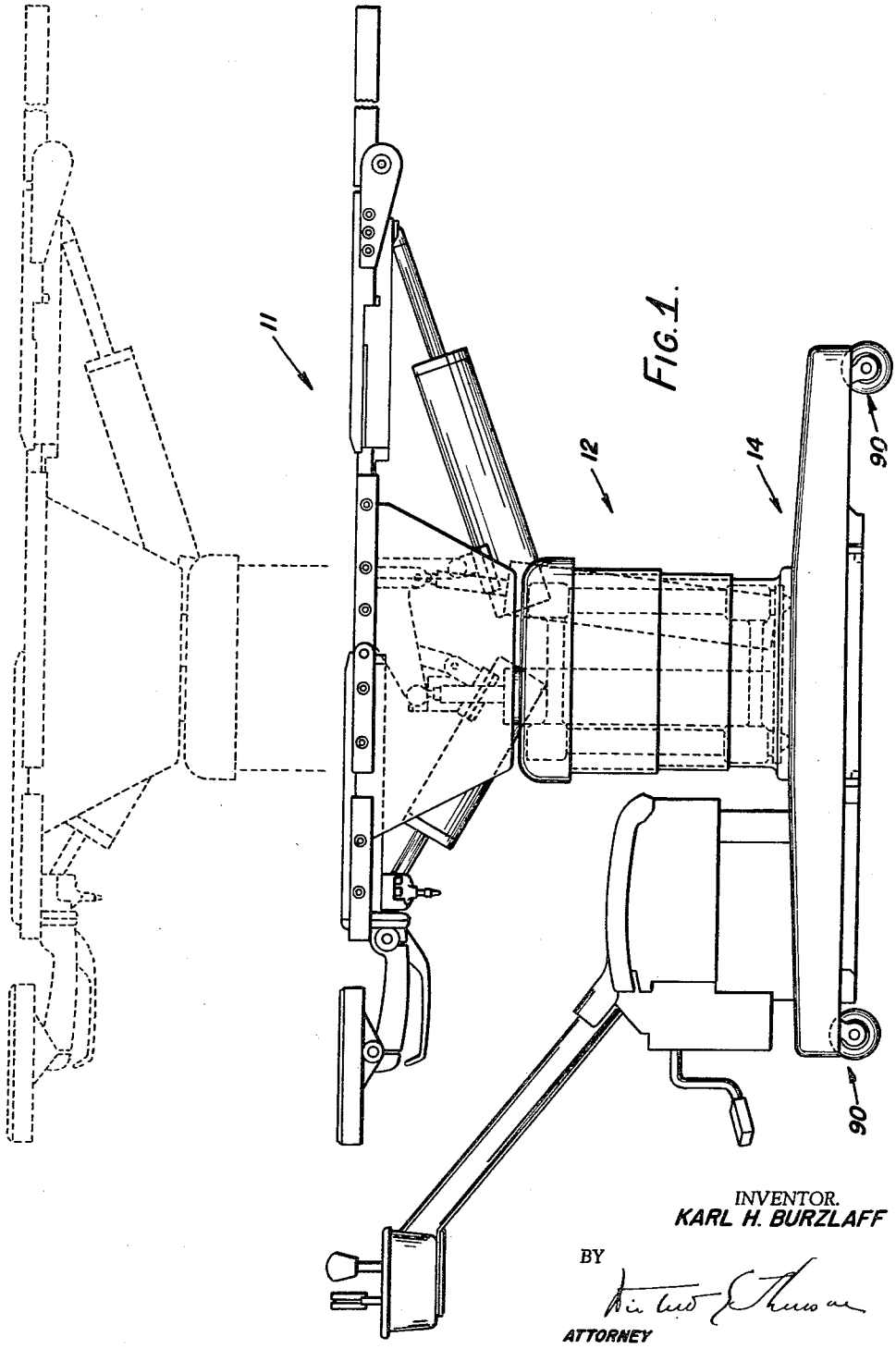


FIG. 1.

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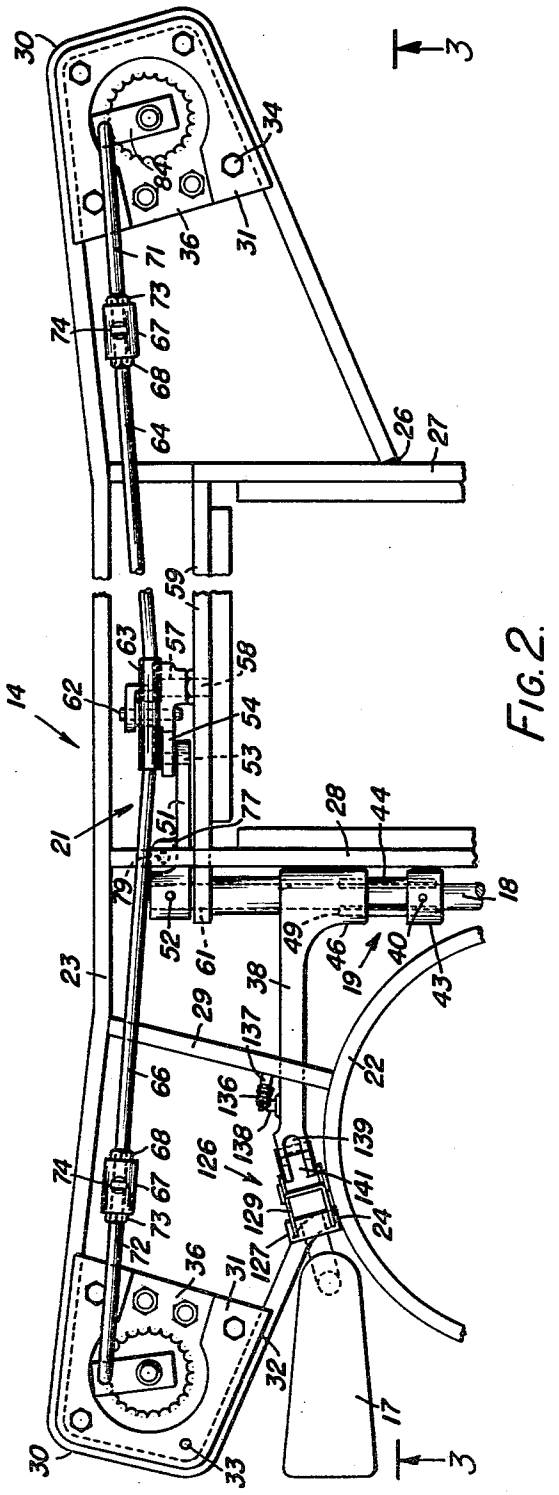


FIG. 2.

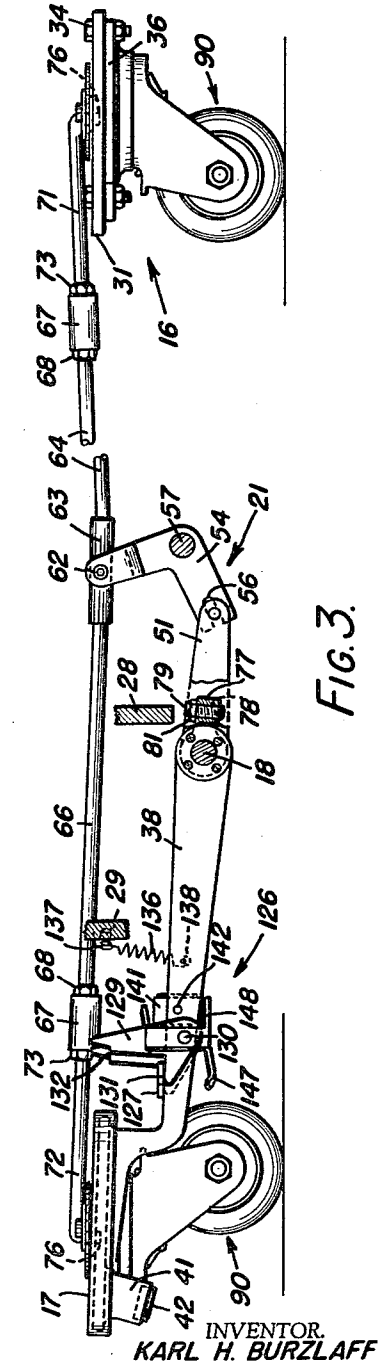


FIG. 3.

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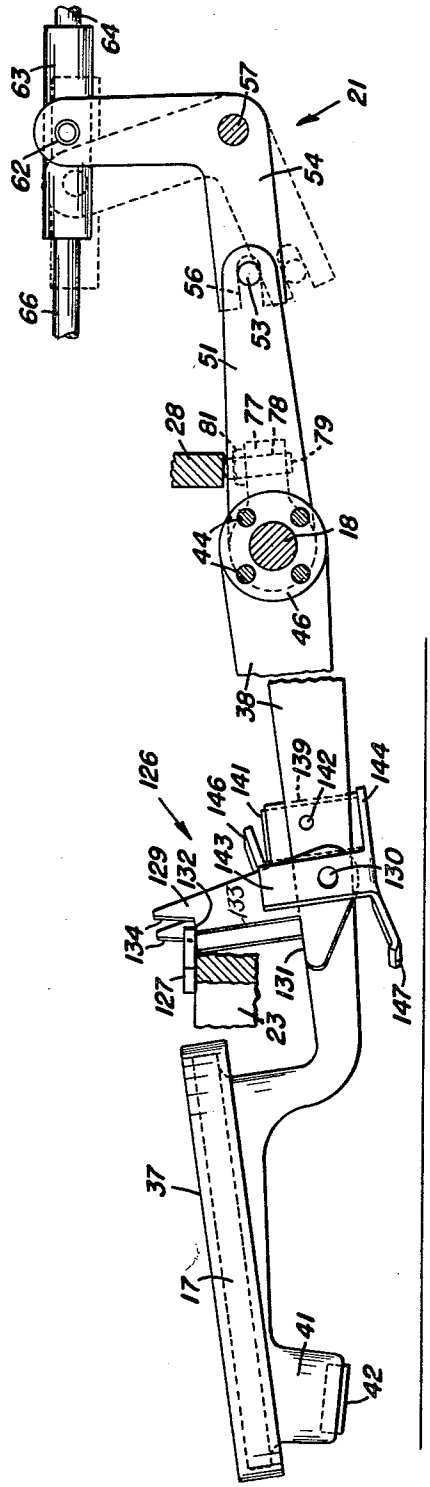


FIG. 4.

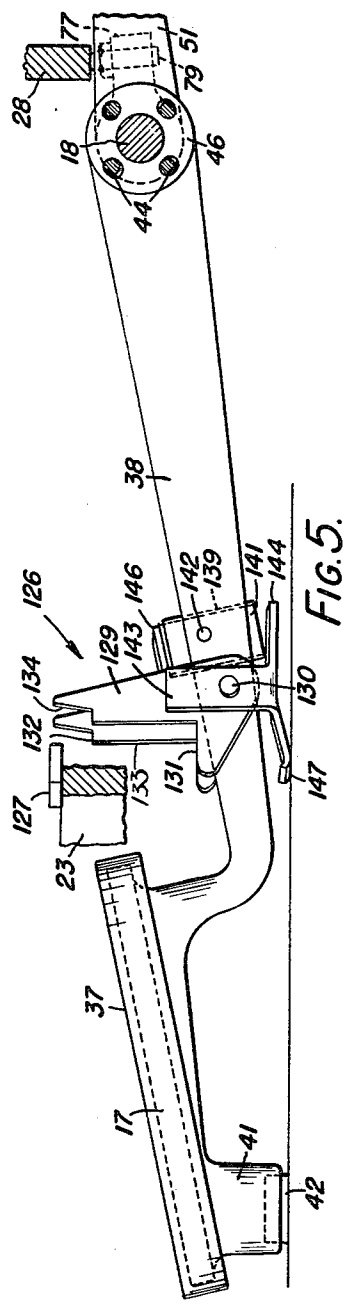


FIG. 5.

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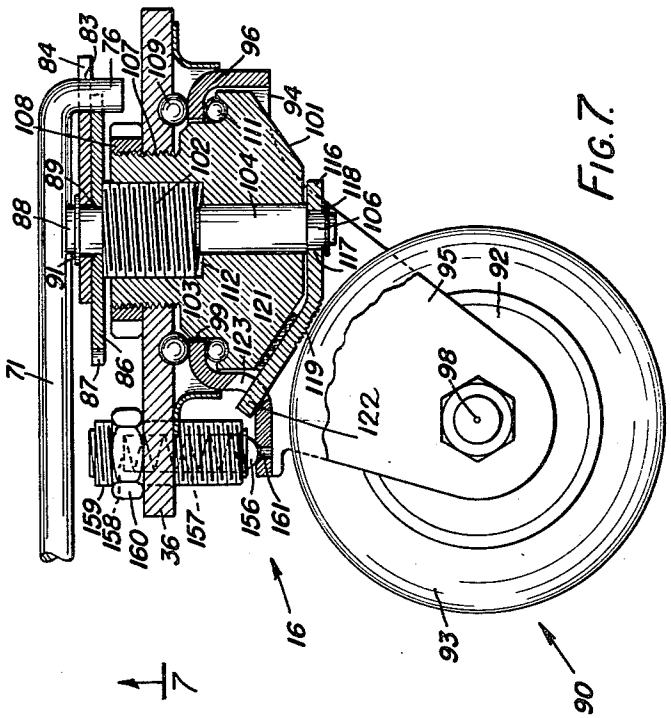


FIG. 7.

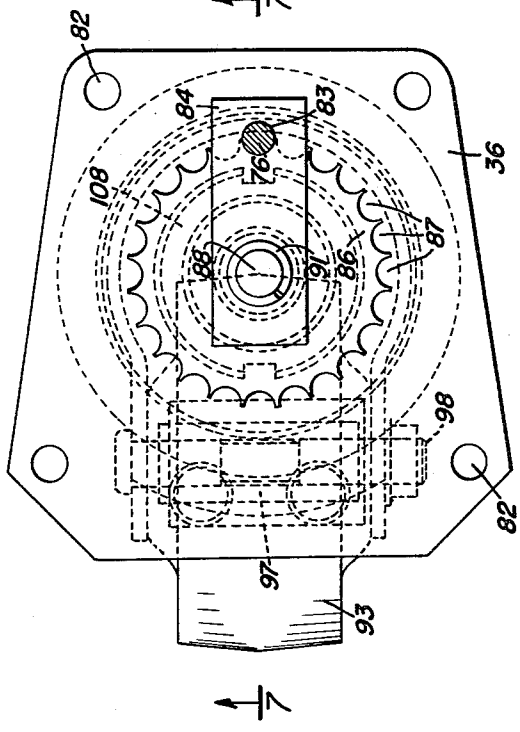


FIG. 6.

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LOCKING MECHANISM FOR MOBILE UNITS

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13 Claims. (Cl. 188—2)

This invention relates to mobile units and more particularly to mechanisms for locking the casters of mobile units, especially surgical tables. Reference is made to my copending application entitled "Caster Mechanism and Locks Therefor" filed simultaneously herewith.

The invention has application to any wheeled unit whether power driven or manually pushed. The braking or locking mechanism has been particularly designed for use in connection with means for locking the casters of surgical tables adapted to be rolled through the corridors of hospitals and about a surgical room thereof.

Surgical tables must be capable of being pushed through the corridors of hospitals; in bringing the patient from his room; moving the table from one surgery room to another; or shifting the table in an operating room. For this reason, the table is usually provided with an undercarriage or frame mounted on casters which are, of course, rotatable about both a vertical and a horizontal axis. While the table should be freely movable from place to place, it is still more important that it be capable of being firmly and positively locked against even slight movement during the performance of an operation. Moreover, the mechanism for locking the casters must be operable with a minimum of effort and fully fool-proof in its action. Any accidental shifting of the table while the surgeon is performing an operation could have extremely serious consequences.

An object of my invention is to provide a mechanism for locking all four wheels or casters of a mobile unit, such as a surgical table, simultaneously with a single operation of a manually operated device in which the locking force may be easily and simply applied.

A further object of my invention is to provide a mechanism for locking all four wheels, particularly the casters of a surgical table with one manual operation, the locking force being applied to prevent rotation of the casters about both a horizontal axis and a vertical axis.

Another object of my invention is to provide a single foot pedal, preferably located at the head end of the surgical table in a position to be applied by the person pushing the table, which upon application of a locking force, applies a positive and fool-proof lock for each caster to prevent rotation of each caster about both its horizontal axis or its vertical axis.

A further object of my invention is to include in the locking mechanism torsion means or bars to enable actuation of the latching mechanism to apply a locking force upon each of the casters upon depression of a foot pedal; and, the release of the latching mechanism upon further depression of the foot pedal so as to avoid the use of separate toggle release means, the torsion bar permitting the further movement of the foot pedal without increasing the locking force on the casters to avoid setting up of additional stresses in the force transmitting mechanism between the foot pedal and the casters.

Still another object of my invention is the provision of a mechanism for locking the casters of a wheeled vehicle against rotation about both a vertical and a horizontal axis in which the locking force on the casters may be predetermined without creating internal stresses in the linkage system between the manually operated locking element and the casters.

My invention further contemplates a foot pedal operated mechanism for locking the casters of a wheeled mobile unit, such as a surgical table, wherein means are provided for taking up for wear on the casters so that the locking force may be predetermined under all conditions and the same locking force may be applied whether the casters be new or well worn, the links to each of the casters being individually adjustable so that the same locking force may be applied to each of the casters.

My invention further contemplates a novel latching mechanism employing a magnetically actuated latch which is positive in its operation and controls the latch in such a manner that the operation of the latch is not affected by how slowly the foot pedal locking motion is performed or how slowly the release motion of the foot pedal is performed.

Other objects and advantages of this invention will be particularly set forth in the claims and will be apparent from the following description, when taken in connection with the accompanying drawings, in which:

FIG. 1 is a side elevation of a mobile unit or surgical table to which my invention may be applied;

FIG. 2 is a top plan view of approximately one-half of the base of the surgical table of FIG. 1;

FIG. 3 is a sectional view taken substantially on the line 3—3 of FIG. 2 in the direction indicated by the arrows and showing the position the parts occupy when the casters are free to rotate about both a vertical and a horizontal axis;

FIG. 4 is a view of a portion of FIG. 3 showing the position of the parts when the casters are locked;

FIG. 5 is a view similar to FIG. 4 showing the position of the parts when the casters are to be released;

FIG. 6 is a top plan view of one of the casters; and

FIG. 7 is a sectional view taken substantially on the line 7—7 of FIG. 6 in the direction indicated by the arrows.

While the invention of this application may be applied to any type of unit having wheels or casters for rendering the unit mobile, it has been particularly designed for application to a mobile surgical table. This application will describe the complete locking mechanism together with the unique caster lock employed. However, this application will claim only the locking mechanism and linkage employed to actuate the caster locks. The caster locks and associated elements of the casters will be reserved for a separate companion application.

As shown in FIG. 1, the surgical table to which the caster locking mechanism of my invention is applied comprises a table surface, generally indicated by the numeral 11; mechanism for raising and lowering the table surface and tilting or actuating portions of it, generally indicated by the numeral 12; and an undercarriage or frame, generally indicated by the numeral 14. The locking mechanism for the casters, generally indicated by the numeral 15, comprises a manually operated lever, in this case a foot pedal 17, a shaft 18, a torsion bar assembly, generally indicated by the numeral 19, through which the shaft 18 is rotated and linkage, generally indicated by the numeral 21, for transmitting the force applied by the foot pedal to the individual caster assemblies.

The undercarriage or frame 14 is comprised of a multiplicity of welded steel bar sections including a circular section 22. The circular section 22 is joined by weldments to two irregularly shaped bent sections 23 as shown at 24. The other ends of the irregularly shaped sections 23 are joined by welding, as shown at 26, to crossbars 27. The irregularly shaped sections are also joined by weldments to a crossbar 28 and to the circular section 22 by fixed bars 29. At each of the corners 30, formed by

the irregularly shaped sections 23, caster support plates 31 are welded, as indicated at 32. The support plates are provided with bolt openings 33 adapted to receive bolts 34 which extend through corresponding openings formed in caster mounting plates 36. (See also FIGS. 6 and 7.)

Foot pedal 17 has a rubber padded surface 37 and is connected to a long bar or lever 38 pivotally mounted on shaft 18 which extends across the machine from one side to the other. The foot pedal also carries a boss 41 on its underside adapted to receive a rubber bumper 42 if the foot pedal strikes the floor when depressed.

The torsion mechanism may be of any suitable type but preferably comprises a torsion cage 43 rigidly secured to the shaft 18 by a pin 40. The torsion cage 43 in this case has four bores for the reception of four preferably steel torsion bars 44. A boss 46 on lever 38 is likewise bored, as indicated at 49, for the reception of the torsion bars 44. For the present, it is sufficient to state that when the foot pedal 17 is depressed a force is applied on the torsion bars 44 to rotate the torsion cage 43 and thereby rotate the shaft 18.

The connections between the shaft 18 and the caster locks on each side of the unit are the same so that a description of one side of the unit will suffice. The linkage 21 between the shaft 18 and the caster locking mechanism comprises a link 51 pinned to the shaft as shown at 52. The link 51 carries a pin 53 and operates a bell crank 54. For this purpose, the end of the bell crank is bifurcated, as shown at 56, to receive the pin 53. The bell crank 54 is pivotally mounted on a pivot pin 57 which is fixed, as shown at 58, to a longitudinal bar 59 welded to the frame crossbars 27, and 28. The longitudinal bars 59 each has an opening 61 forming a bearing support for the shaft 18. The other arm of the bell crank is bifurcated, the bifurcations straddling a member 63. A pin 62 extends through member 63 and the bifurcated ends of the bell crank pivot on the pin 62. The member 63 constitutes a part of push-pull linkage for actuating the caster locks.

The linkage includes push-pull rods 64 and 66 which extend into bores formed in the member 63 and which are welded or soldered in position. The other ends of the links are threaded into turnbuckles 67. Nuts 68 hold the turnbuckles 67 against rotation. The other ends of the turnbuckles 67 are threaded to receive the threaded ends of links 71 and 72 which are also held rigidly in position by lock nuts 73. An opening 74 in each of the turnbuckles for reception of a bar enables turning of the turnbuckles upon loosening nuts 68 and 73.

The ends of the links 71 and 72 have downwardly turned hooks 76 which actuate the caster locks, as presently will appear. The turnbuckles 67, as well known in the art, are right and left hand threaded to receive right and left hand threads on links 64, 66, 71, and 72. The purpose of the turnbuckles will later appear.

Formed as part of the link member 51 is a boss 77 which has a threaded bore 78 adapted to receive a threaded screw 79 which may be locked in an adjusted position by a nut 81. The upper end of the screw or stop 79 is adapted to engage underside of crossbar 28 under certain conditions of operation for a purpose which will presently appear.

The caster assemblies, only one of which will be described, have been shown most clearly in FIGS. 6 and 7. Each of them includes a mounting plate 36 having openings 82 at the corners thereof. Through bolts extend through the openings 82 in the mounting plates and through the openings 33 in the caster support plates 31. The hook shaped ends 76 of the links 71 and 72 extend downward through an opening 83 in lever 84. A notched disc 86 has an annular ring of notches 87 into one of which the hooked end 76 is selectively engaged as shown in FIG. 7. The notched disc is retained in rigid relation to a plunger 88 as by welding, as indicated at 89. A snap retaining ring 91 is snapped over the end of the plunger

and normally holds the apertured lever 84 in fixed relation to the notched disc 86.

Each of the casters, indicated as a whole by the numeral 90, comprises a wheel 92 covered with an annular rubber wear surface 93. The casters or wheels are carried by a roller yoke 94, the arms 95 of which are connected together by a bridge 96. A ball bearing assembly 97, diagrammatically illustrated (FIG. 6), enables free rotation of the caster 90 about a horizontal axis 98.

The bridge 96 of the roller yoke 94 has an opening 99 through which a stud 101 extends. The plunger 88 is enlarged at 102 and its periphery is threaded as indicated at 103, to mesh with complementary threads formed interiorly of the stud 101. Below the enlarged threaded portion 102 the plunger is decreased in diameter at 104 and a further decreased portion 106 projects below the stud 101.

The exterior of the stud 101 is threaded at 107 to receive a lock nut 108. After the stud 101 is adjusted toward and from the plate 36 so that ball bearing assemblies 109 and 111 will run freely, the lock nut 108 is tightened to hold the parts in this relationship. The ball bearing assemblies 109 and 111 are provided between the plate 36 and the top surface of the bridge of the roller yoke 96 and the bottom surface of the bridge of the roller yoke and a ball receiving flange on the stud 101 to enable free rotation of the caster about the vertical axis.

It now should be understood that the stud 101 is a fixed member locked to plate 36 by the nut 108. By providing clearance at 112, rotation of the notched disc 87 will cause threading or gearing in or out of the plunger on the threads 103 to shift the plunger part 104 upward or downward with respect to the stud. Due to the bearing assemblies 109 and 111, the roller yoke 94 and its arms 95 are free to rotate about the stud and with respect to the plate 36, the center of the plunger 88 being considered as a vertical axis.

A brake plate 116 has an opening 117 somewhat larger in diameter than the projecting end 106 of the plunger 88 freely extending therethrough. A snap ring 118 retains the parts in a loose fitting or spaced position. The brake plate 116 has a serrated or roughened braking surface 119 adapted to engage the periphery of the caster and a braking surface 121 adapted to engage the lower periphery of the stud 101. The end 122 of the brake plate extends through an opening 123 in the roller yoke so that when the force of the brake is not applied the brake rotates with the roller yoke. In the position of parts shown in FIG. 7, which is the unlocked position, I have shown a clearance between the braking surface 119 and the caster and between the braking surface 121 and the stud.

When the hook 76 is rotated in a clockwise direction, as viewed in FIG. 6, the lever 84 and the notched disc 86 are carried with it to rotate the plunger 88 with respect to the stud. This action shifts the brake plate 116 downward causing the braking surface 119 to engage the periphery of the caster and simultaneously the braking surface 121 to engage the stud 101. The caster is thus locked simultaneously against rotation about both a vertical and a horizontal axis.

This means for locking the casters of the mobile unit of my invention is provided with a latching mechanism, generally indicated by the numeral 126. In FIG. 3, I have shown the locking mechanism unlocked which position of the parts corresponds to the unlocked position of the casters as shown in FIG. 7.

Rigidly secured to the frame of the unit is a latch plate 127. A bifurcated latch 129 straddles the lever 38 and is pivoted thereto by means of a pin 130. The latch 129 has a catch 131 and a catch 132 between which angularly extending edge portions 133 of the arms of the bifurcated latch extend. The latch plate further includes inclined stop edge 134. A spring 136 mounted on a stud 137 carried by the bar 29 has its other end connected to a stud 138. The spring normally acts to pull the lever 38

in an upward direction or into the position of the parts shown in FIG. 3.

Lever 38 has an opening 139 in which a permanent magnet 141 is housed, the magnet being secured to the lever 38 by means of a pin 142. A pole piece carrier 143 is rigid with the latch 129 and mounted on the pivot 130. The pole piece carrier is bifurcated and straddles the latch 129. The pole piece carrier carries pole pieces 144 and 146 and an extended foot 147.

With the parts in position shown in FIG. 3, no space exists at 148 between the permanent magnet 141 and the pole piece 144. The pole piece 144 is drawn against the lower magnet pole.

When the foot pedal is depressed from the position of FIG. 3 to that of FIG. 4, the catch 131 moves downward away from the latch plate 127 and the edges 133 of the latch 129 ride on the edge of the latch plate 127. Due to the circular downward motion of the foot lever 38 and the continuous contact of edges 133 against latch plate 127, the latch 129 and the pole piece carrier 143 pivot clockwise with respect to the lever 38. A space 148 is thereby produced between the pole piece 144 and the lower magnet pole. Continued downward movement of the foot pedal and lever 38 brings the catch 132 to a position adjacent the latch plate 127. As soon as this occurs, the latch 129 and the pole piece carrier 143 are free to swing in a counterclockwise direction (FIG. 4), the swinging movement being caused by the snap action produced by the pole piece 144 being pulled back into engagement with the magnet 141. This position of the parts has been shown in FIG. 4 wherein the catch 132 lies beneath the latch plate 127 and the pole piece 144 is in engagement with the magnet 141. In this position of the parts all four casters are locked against rotation about either their horizontal or vertical axes.

When the casters are to be released the foot pedal is further depressed until the rubber bumper 42 strikes the floor. During this movement, the stop edge 134 is riding on the latch plate 127. During this additional downward movement of the foot pedal and lever 38, the screw or stop 79 is in engagement with the under side of the bar 28. The application of the stop 79 to the bar 28 of the frame results in the twisting of the torsion bars 44 without rotation of the shaft 18. Thus, the additional downward movement of the lever 38 does not result in the application of additional or excessive forces on the casters.

It will now be understood that the load to be applied to the casters to lock them against movement is predetermined by the position of adjustment of the screw or stop 79 in the threaded bore 78 and the locking force may be adjusted to a predetermined value sufficient to positively lock the casters. Any additional downward movement of the foot pedal 17 (movement from FIG. 4 to FIG. 5) does not result in additional pressure on the casters but instead causes a twisting movement of the torsion bars.

Continued downward movement of the lever 38 results in the extended foot 147 striking the floor which action pivots the latch 129 and the pole piece carrier 143 in a clockwise direction as viewed in FIG. 4. As soon as the pole piece 146 is in proximity to the magnet 141, the magnet attracts it and snaps the latch 129 in a clockwise direction. This position of the parts is shown in FIG. 5. In this position, latch plate 127 is clear of the catch 132 so that upon release of the foot pedal 17, the spring 146 will restore the parts to the caster unlocked position of FIG. 3. In the drawings I have shown the extended foot as striking the floor. This could just as well be a portion of the frame.

One of the important features of the caster locking mechanism of my invention lies in the fact that each connection to a caster includes a turnbuckle 67 and an individual adjustment of each caster lock. By rotating a turnbuckle 67 in one direction or the other, the link associated with the adjusted turnbuckle may be lengthened or shortened. Then by withdrawing the hook-shaped end 76 of the rod 71 (FIG. 7) from the opening 83 and rotating the lever 84 the hooked end may be reinserted to register with a different notch 87 in the disc 86. It will be understood that this adjustment enables the application of the same locking force on all casters and enables adjustment to compensate for wear on the caster wear surface 93. Thus each caster may be preloaded so that the preload on all casters is the same.

One of the problems encountered with surgical tables and other types of mobile units, lies in the fact that with casters that are freely rotatable about a vertical axis, it is difficult to push the table in a straight line. It is impossible for the person pushing the table to control the casters and quite frequently the table is bumped against the walls of the corridor or against a doorway jam. So prevalent is this condition that it is commonplace in hospitals to see the walls marked up and scuffed and plaster displaced.

A novel feature of the invention which will be reserved for the above mentioned companion application is provision of means in connection with the two front casters for holding them rigidly in a straight line position and against rotation about a vertical axis. This means, as shown in FIG. 7, comprises a detent 156 which is pressed to a downward position by a spring 157. In the form of the invention shown herein, the detent comprises a ball against which the spring bears. The other end of the spring seats against a threaded member or stop 158. The stop is threaded into a threaded casing 159 and the casing is threaded into the mounting plate 36. Lock nuts 160 hold the parts so that the detent 156 is in a desired position of adjustment. The ball detent is adapted to seat in an opening 161 formed in the bridge 96 of the roller yoke 94.

When the table is pushed through a corridor, the forward casters tend to move in a straight line and the detents automatically find the openings 161 to hold the casters in a line parallel to the longitudinal axis of the table. When it is desired to turn a corner, a slight sideward push on the table will release the detents 156 from the openings 161.

While I have shown and described the preferred forms of mechanisms of the invention, it will be apparent that various changes and modifications may be made therein, particularly in the form and relation of parts, without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A locking device for the casters of a frame, said casters being rotatable about at least their horizontal axis comprising, in combination, means for pressure locking each of the casters against rotation about at least their horizontal axis, a manually operated member movable from a caster released position to a caster locked position, latch means intermediate said manually operated member and said frame, said latching means being movable into latching relation upon actuation of said manually operated member, means interconnecting said manually operated member and said pressure locking means for each of the casters, said interconnecting means including pressure limiting means for limiting the pressure applied to each of the locking means for said casters upon operation of said manually operated means and resilient means intermediate said manually operated member and said interconnecting means enabling further movement of the manually operated member after said pressure limiting means has limited the pressure applied to the caster locking means.

2. A locking device in accordance with claim 1 in which said resilient means comprises torsion means intermediate said manually operated member and said interconnecting means enabling further movement of the manually operated member after said pressure limiting

means has limited the pressure applied to the caster locking means.

3. A locking device for the casters of a frame, said casters being rotatable about at least their horizontal axes comprising, in combination, means for pressure locking each of the casters against rotation about at least their horizontal axes, a manually operated member movable from a caster released position to a caster locked position, a latch element carried by said manually operated member, a second latch element carried by said frame, one of said latch elements being movable into latching relation with the other upon actuation of said manually operated member, means interconnecting said manually operated member and said pressure locking means for each of the casters, said interconnecting means including pressure limiting means for limiting the pressure applied to each of the locking means for said casters upon operation of said manually operated means and torsion means intermediate said manually operated member and said interconnecting means enabling further movement of the manually operated member after said pressure limiting means has limited the pressure applied to the caster locking means.

4. A locking device in accordance with claim 3 in which said pressure limiting means comprises an adjustable stop adapted to engage a mating portion of said frame.

5. A locking device in accordance with claim 3 in which said interconnecting means includes a shaft about which said manually operated member is freely rotatable, said torsion means interconnecting said manually operated member and said shaft whereby said shaft is rotatable by said manually operated member through said torsion means when the manually operated member is actuated.

6. A locking device for the casters of a frame, said casters being rotatable about horizontal and vertical axes comprising, in combination, means actuated through the vertical axes of rotation of said casters for pressure locking each of the casters against rotation about their horizontal and vertical axes, a manually operated member movable from a caster released position to a caster locked position, a latch element carried by said manually operated member, a second latch element carried by said frame, one of said latching elements being movable into latching relation with the other upon actuation of said manually operated member, means interconnecting said manually operated member and said pressure locking means for each of the casters, said interconnecting means including pressure limiting means for limiting the pressure applied to the locking means for each of said casters upon operation of said manually operated means and torsion means intermediate said manually operated member and said interconnecting means enabling further movement of the manually operated member after said pressure limiting means has limited the pressure applied to the caster locking means.

7. A locking device for the casters of a frame, said casters being rotatable about horizontal and vertical axes comprising, in combination, means carried by said frame for pressure locking each of the casters against rotation about at least their horizontal axis; a manually operated member movable to one of three positions, a caster released position, a caster locked position, and a caster releasing position, said manually operated member being movable in the same direction to said caster locked and to said caster releasing positions; latching means including a first latch element carried by said manually operated member and a second latch element carried by said frame, one of said latching elements being movable into

latching relation with the other upon movement of said manually operated member from its first position to its second position; and means carried by said frame interconnecting said manually operated member and said pressure locking means for each of said casters, said interconnecting means including means for maintaining the same pressure on said casters when said manually operated member is moved from its second position to its third position.

8. A locking device in accordance with claim 7 in which said latching means includes a permanent magnet, one of said latch elements is pivoted and partly controlled in its pivotal movements by said permanent magnet.

9. A locking device in accordance with claim 7 in which the pressure maintaining means includes a stop between said interconnecting means and said frame and torsion means between said manually operated member and said stop for permitting movement of said manually operated member from its second position to its third position when said stop prevents additional pressure being exerted on said locking means.

10. A locking device in accordance with claim 7 in which said first latch element is pivotally mounted on said manually operated member and means including a permanent magnet connected to said manually operated member for maintaining said first latch element in either said released or locked positions.

11. In a locking device for locking an object connected to a frame, interconnecting means including a lock extending to the object to be locked, a manually operated member connecting to said interconnecting means, a latch plate connected to said frame, a latch pivotally mounted on said manually operated member and cooperating with said latch plate, a spring normally urging said manually operated member to an object unlocked position and means including a permanent magnet connected to said manually operated member for pivoting said latch into an object locking position and for maintaining said latch in said position when said manually operated member is actuated to oppose said spring.

12. A locking device in accordance with claim 11 wherein the interconnecting means includes a stop for limiting the locking force on said object and torsion means intermediate said stop and manually operated member permitting additional movement of said manually operated member beyond the position in which said stop has limited the locking force on said object to enable release of the latched relation of said latch plate and latch.

13. A locking device in accordance with claim 11 wherein the latch has metal parts cooperating with the opposite ends of said magnet to pivot the latch in either of two opposite directions responsive to and dependent in direction upon the actuation of the manually operated member.

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