Nov. 30, 1965 T. NELSON 3,220,019

MATTRESS SUPPORT TILT REGULATOR

Filed Dec. 16, 1963 3 Sheets-Sheet 1

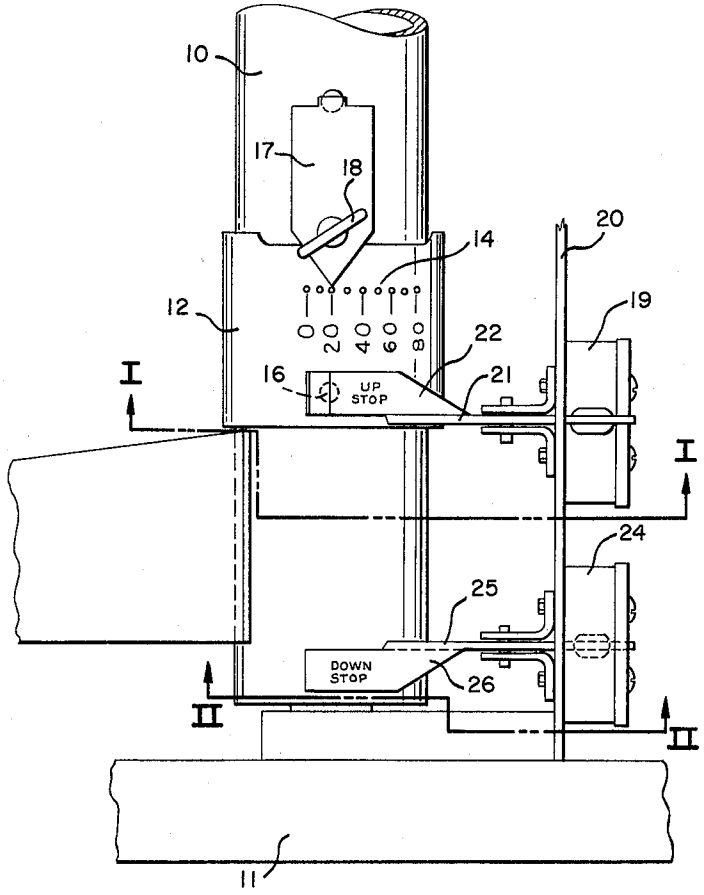


FIG. 1

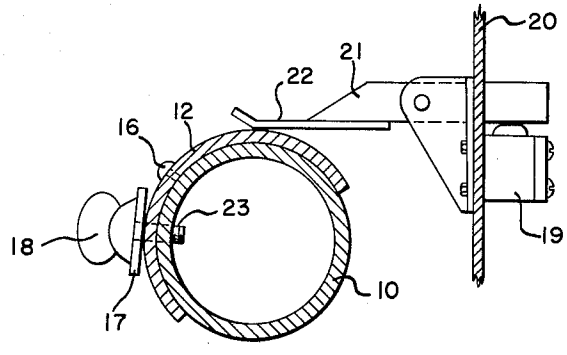


FIG. 2

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MATTRESS SUPPORT TILT REGULATOR

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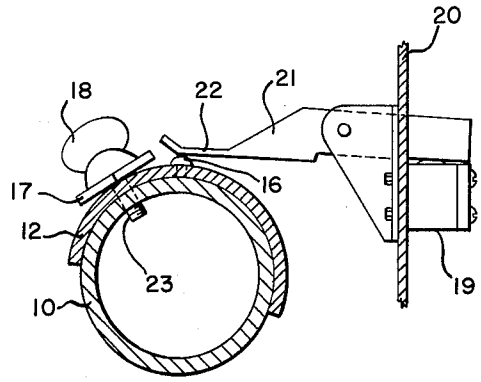


FIG. 3

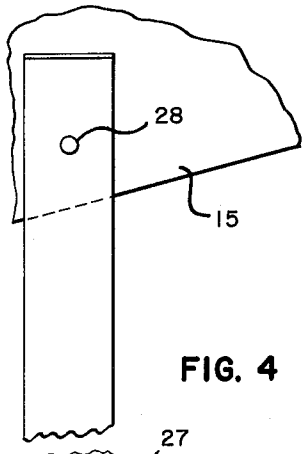
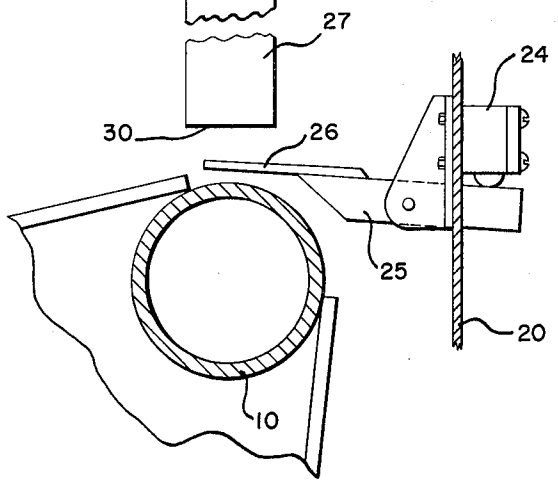


FIG. 4



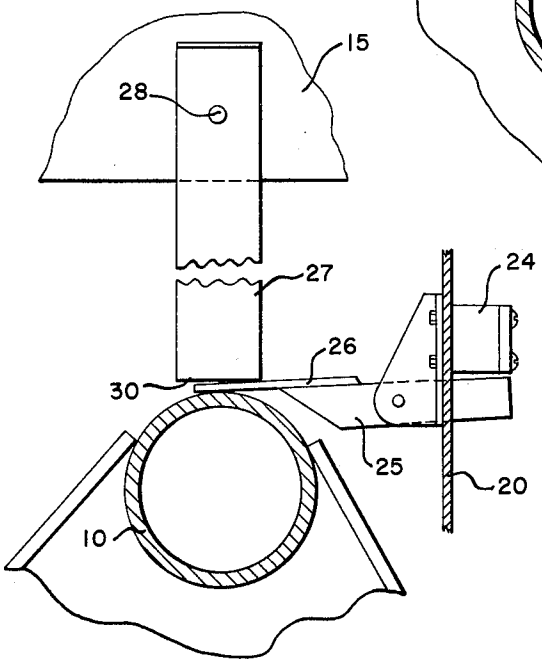


FIG. 5

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MATTRESS SUPPORT TILT REGULATOR

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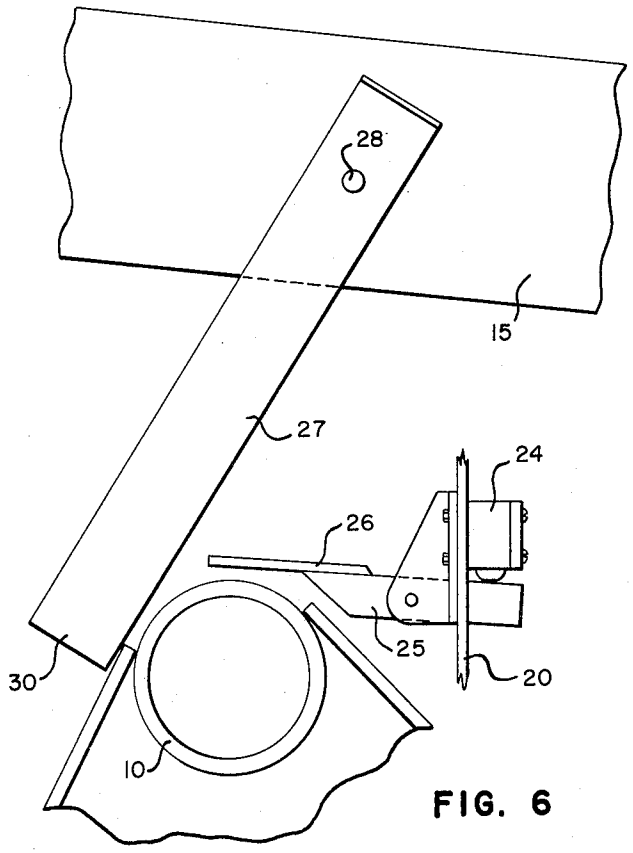


FIG. 6

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3,220,019

MATTRESS SUPPORT TILT REGULATOR

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11 Claims. (Cl. 5—62)

This invention relates to adjustable tilt regulators for power tilt beds capable of tilting mattress supports to high forward angles up to 87° and reverse tilts. More particularly, this invention relates to mattress support tilt regulators in which the maximum degree of forward and reverse tilt can be pre-set in accordance with the requirements of the physician.

The invention provides electro-mechanical structure which adjustably limits the tilt of power tilt beds, expressly those having mattress supports pivotally mounted for movement to sitting, lying and reverse tilt attitudes in relation to a stationary bed frame. This is accomplished in the upward tilt position by a positive structure pre-set to the required maximum angularity and rotating with the pivoting of the mattress support and striking a limit switch on the bed frame when the maximum set angularity has been reached. In the preferred embodiment the positive structure includes a rotatable member releasably clamped around a pivot means which rotates as the mattress support pivots. By releasing the clamp and rotating the rotatable member about its mounting, the angle of the mattress support at which the limit switch is opened can be varied and pre-set as desired. In the reverse tilt movement, a stop is pivotally mounted on a section of the mattress support and normally bears against a reverse limit switch to maintain the horizontal attitude. To permit a reverse tilt, the stop is pivoted to one side to close the limit switch and permit the downward tilt of the head portion of the mattress support. In every case when the limit of rotation has been accomplished, the switches are opened so that even if the control switch is still in engagement there will be no overload or strain on the motors.

An advantage of the invention is that the doctor or nurse can pre-set the maximum angles through which a bed will pivot. In the past there have been no pivot controls other than those on the outer face of the bed which cannot be seen by any one in the bed. When the controls are patient operated, he has only his judgment in stopping the angularity of tilt at the right attitude. It is not a safe or reasonable premise to leave such matters to the judgment of a person who is either ill or convalescing. Excessive or accidental pivoting to a forward near vertical position or to a head down position could have serious consequence when a very ill patient is involved. For near vertical tilts it is customary to strap the patient into bed and even where this precaution is taken to prevent injury to the patient, there is still no means of controlling the angularity of the bed attitude to precisely follow the doctor's instructions.

Another advantage of the mattress support tilt regulator of the invention is that the upward and/or reverse tilts permitted for the patient can be gradually changed as the patient improves or requires additional therapy. The progressive increase in tilt permitted for the patient can be arranged during a single day or over a greater period of time. Even though an extreme tilt is required for therapy during the day time, the maximum upward angle and reverse tilt can still be decreased during sleeping periods so that the patient will not accidentally manipulate the controls until an undesirable angle or attitude is attained.

Another advantage of the invention is that a patient in an ill or weakened condition can be permitted to operate the tilt mechanism himself, once the tilt regulator has been set by the nurse or doctor. This is an advantage because a patient in a serious condition would not perhaps be sufficiently aware of the movement to stop the mattress support from tilting beyond the limits prescribed by the doctor. Furthermore, self-help is a time saver, since the patient need not await and require the aid of a nurse to change the tilt. Once the degree of tilt has been pre-set, normally no aid to the patient whatever is required to manipulate the controls to secure any mattress support attitude desired by the patient within the limits of the setting.

A further advantage of the tilt regulator of the invention is that the mechanism is simple, easy to understand and easy to operate.

Another advantage is that the adjustable regulator is entirely mechanical, save for the limit switches, with no complicated electrical circuits to be maintained.

Another advantage is that the regulator is compact and may be located at a central point where it will not interfere with the other functions of the tilt bed and is easily available for setting.

Accordingly, an object of the invention is to provide a simple and positive regulation and control of the tilt or slant of the mattress support of a power tilt bed.

Another object is to provide a limit switch which operates automatically at a pre-selected upward angle of tilt of the mattress support of a power tilt bed to limit the angularity of the tilt.

Another object is to provide such a switch for the upward angle of movement and the reverse tilt of the mattress support.

A further object of the invention is to provide a limit switch that operates automatically when the mattress support of a power tilt bed returns to a level or horizontal attitude.

A further object is to enable the operator to pivot the mattress support to a reverse tilt position yet to automatically prevent a second pivot to this position upon return to a level horizontal attitude.

Another object of the invention is to provide variably positionable positive structure in conjunction with a pivotable mattress support which will strike and open a limit switch to limit the angular pivot of the mattress support in accordance with the positioning of said positive structure.

Another object is to provide a rotatable member about the rotating point of a pivotable mattress support which can be positioned to contact a limit switch on the bed frame of any angular attitude of said mattress support desired.

Further objects are to provide a construction of maximum simplicity, economy and ease of assembly and disassembly, also such further objects, advantages and capabilities as will fully appear and as are inherently possessed by the device and invention described herein.

The invention further resides in the combination, construction and arrangement of parts illustrated in the accompanying drawings, and while there is shown therein

a preferred embodiment thereof, it is to be understood that the same is illustrative of the invention and that the invention is capable of modification and change and comprehends other details of construction without departing from the spirit thereof or the scope of the appended claims.

In the drawings:

FIGURE 1 is a top view of the mattress support tilt regulator of the invention including the upward angle limit switch and the reverse tilt limit switch, with the upward tilt set and stopped at 20° above the horizontal;

FIGURE 2 is a cross-sectional view taken along the line I—I of FIGURE 1 through the torque tube showing a side view of the upward angle limit switch system, but with the switch closed and set to a maximum angle of 50°;

FIGURE 3 is the same view as in FIGURE 2 except that the switch is open, the mounting having rotated and the mattress support having pivoted to the pre-selected upward angle of the setting;

FIGURE 4 is a cross-sectional view taken along the line II—II of FIGURE 1 through the torque tube but showing a side view of the reverse or down tilt limit switch system with the switch closed and the pivotable mattress support at an upward angle with the head portion raised above the horizontal and the foot portion below the horizontal;

FIGURE 5 is a view similar to that of FIGURE 4 except that the reverse or down tilt switch is open and the pivotable mattress support is in a horizontal attitude; and

FIGURE 6 is a view similar to that of FIGURE 4 except that the pivotable mattress support is in the reverse or downward tilt position with the head section below the horizontal and the foot section above the horizontal.

In the practice of the invention there is provided a powered bed having a mattress support which pivots with respect to the frame of the bed both to forward angles up to 87° in which the patient is in a near vertical attitude and to reverse or downward tilt attitude in which the head end of the mattress support is lower than the foot end. The bed need not be of any particular type or construction except that it is electrically actuated and provided with a rotating means on the frame which rotates as the mattress support pivots. For example, the rotating means may be a part of the linkage of the tilt mechanism mounted on the frame of the power bed, and the tilt mechanism may be powered by electrically operated hydraulic cylinders.

Referring now to the several figures of the drawings in which like numerals indicate like parts, and particularly to FIGURES 1 to 3, there is shown a torque tube **10** rotatably mounted on a frame member **11**. The torque tube **10** forms part of the mattress support pivot means and may be mounted conveniently on the frame of the bed. A partial metal sleeve **12** is loosely fitted around the upper face of the torque tube **10**. The sleeve **12** has upon its supper surface a scale **14** in angular degrees correlated with the angle of the mattress support **15** (see FIGURES 4, 5 and 6) with respect to the frame **11** between the extreme upward tilt in which the patient is nearly vertical and the horizontal. The sleeve has a button **16** permanently affixed to its which serves as an actuating cam against a switch arm as will be described hereinafter. It is to be noted that the relative position of the button **16** and the pointer clamp **17** has been changed in FIGURE 1 in order to better illustrate the invention. The sleeve **12** can be easily rotated about the torque tube **10** by fingertip pressure when unrestrained. However, a pointer clamp **17** having wing screw **18** serves to position and clamp the sleeve against tube **10** in any adjusted position with respect to the maximum angle desired.

A conventional two-pole electric limit switch **19** is mounted upside down on a transverse frame member **20** adjacent to the torque bar **10** and the sleeve **12**. Operating switch blade **21** which opens and closes the switch **19** has a flat cam follower **22** which extends out over the path of button **16** as its rotates with tube **10**, the cam follower **22** having an upturned end so that the button **16** tends to push the lever upwardly as it comes into contact. As long as the switch blade **21** is held by its spring in the down position shown in FIGURE 2 slightly touching the sleeve, the switch **19** is closed and the electric circuit of the bed tilt mechanism continues uninterrupted. However, when the button **16** passes under the cam follower **22** and blade **21** is forced upwardly as shown in FIGURE 3, opening the switch **19**, the electric circuit is broken and the tilt mechanism stops, even though the control button is still in contact. The tilt of the mattress support therefore cannot pivot to an upper angle further than indicated by the setting of the scale **14**.

Since the location of pointer clamp **17** is always the same, being held in the threaded bore **23** by wing screw **18**, it forms a point of reference for the scale **14**. The pointer can therefore be used to position the sleeve **12** at a desired angular location with respect to the tube **10**, using the scale **14** as a guide. The position of the button **16** is thereby also fixed with respect to the tube **10**. When the sleeve is in the clamped position, the sleeve **12** and button **16** turn with the tube **10** and will always have the same position for a given angle of rotation on scale **14**. By properly positioning the button, the switch, and the scale with respect to each other, the scale **14** may be adjusted to show the maximum angle of the mattress support tilt which is the point at which the limit switch follower **22** will be contacted. In this manner the maximum angle of upward tilt of the mattress support can be regulated by changing the angular rotation on the sleeve opposite the pointer.

A second conventional two-pole electric switch **24** is seen in FIGURE 1 adjacent to the switch **19** with blade **25** and its attached flat contact **26** extending over the torque tube **10** at a point spaced from the sleeve **12**. The switch **24** is normally held in the closed position by spring means (not shown) which positions the blade **25** and contact **26** slightly above torque tube **10**, as shown in FIGURE 4. Stop blade **27** is mounted at one end by pivot pin **28** for free swing pivotal movement on mattress support **15** as illustrated in FIGURES 4, 5 and 6. The stop blade **27** swings freely from its pivot as gravity dictates while the mattress support **15** pivots upwardly or downwardly above the horizontal. Usually the stop blade **27** is long enough so that when the mattress support **15** is in the precise horizontal position its butt end **30** engages the top of the bed frame **11**. However, in the present invention it is positioned so that the butt end **30** overhangs the operating flat contact **26** and, as mattress support **15** pivots toward the horizontal, it engages the operating flat contact **26** and pushes it downwardly against torque tube **10**. The length of the stop blade **27** is adjusted to touch the flat contact **26** when the mattress support is at a level attitude. The movement of the flat contact **26** downwardly against tube **10** also moves the blade **26** downwardly and opens the switch **24**. Thus, the electric circuit of the tilt mechanism is broken and the downward movement is stopped, e.g., an electric circuit through a solenoid valve in an electrohydraulic tilt mechanism is interrupted, all of which is not shown as it is not claimed per se as a part of this invention.

As the stop blade **27** comes to rest on the limit switch operating contact **26** and torque tube **10**, the mattress support is also restrained from further downward movement by the torque tube itself.

When it is desired to tilt the mattress support to a reverse tilt position with the head end lower than the foot end, the mattress support is pivoted upwardly a short distance so that the stop blade **27** may be manually pushed to one side making it inoperative, as in FIGURE 6. The mattress support **15** may then be pivoted in a downward angle to the full length of the stroke of the hydraulic piston, or to an angle of about 5° from the horizontal. When the mattress support **15** is to be returned

to the horizontal, it is moved upwardly to slightly above the horizontal where the stop blade **27** is again free to pivot over the operating contact **26** in the manner before described and then moved downwardly so that the butt end **30** operatively engages the contact **26**.

In the operation of the mattress support tilt regulator of the invention, the nurse or other operator first unclamps sleeve **12** by turning wing screw **18** to thereby release pressure of pointer clamp **17**. The operator then rotates sleeve **12** about the torque tube **10** until the desired maximum angle of tilt for the mattress support, as specified by the doctor, is indicated by the pointer. The wing screw **18** is then turned up causing sleeve **12** and button **16** to be securely clamped thereto so as to rotate with the torque tube **10**. The patient can now activate the tilt mechanism, as by pushing the up button on the control panel (not shown). Upon the control button contact, the mattress support **15** pivots the head thereof upwardly in an arc. The relative positions of the switch blade **21** and its cam blade **22** and the button **16** set for a maximum of 87°, is shown in FIGURE 2 as the pivot begins, the button **16** being far to the left of the cam blade **22**. As the mattress support **15** pivots upwardly, the tube **10** rotates clockwise, bringing the button **16** in contact with the cam blade **22** as shown in FIGURE 2, the switch blade **21** is lifted to open the circuit of the tilt mechanism. The mattress support can no longer continue its upward pivot, although it may return to a lower angle of tilt. In successive operations its maximum angle of tilt will remain the same until a setting permitting a higher or lower tilt is set on the regulator.

When the operator of the power bed wishes to return the bed to the horizontal, he merely energizes the tilt mechanism so that the mattress support **15** will pivot downwardly. As the mattress support reaches the horizontal position the stop blade **27**, swinging free by gravity, contacts the flat contact **26** as seen in FIGURE 5, and forces it downwardly until switch **24** opens the circuit of the power mechanism. The mattress support **15** is then not free to pivot to a reverse tilt from this, the horizontal position, until the stop blade **27** is manually moved to inoperative position to the left as shown in FIGURE 6. After stop blade **27** is moved aside, the mattress support **15** may then be pivoted downwardly.

When the mattress support **15** has been positioned in the downward tilt attitude as shown in FIGURE 6, and it is desired to return the mattress support to the horizontal attitude, the power tilt mechanism is operated in the up direction until the mattress support is a little above the horizontal attitude. This position frees the stop blade **27** to swing free by gravity over the operating blade **26**. The mattress support **15** is then lowered to the contact shown in FIGURE 5 and the mattress support is stopped at the horizontal. The mattress support cannot be moved to the downward tilt unless the stop blade is manually moved as described, out of the operative position each time.

I claim:

1. In a mattress support tilt regulator the combination comprising a power tilt bed including a frame, a pivotally mounted mattress support on said frame and operator control means for pivoting said mattress support with respect to said frame both to high upward angles toward the foot of the frame and downward angles toward the head of the frame, and separate dial means not operator controlled for limiting both the upward and downward pivotal movement of said mattress support to pre-set angles on said dial means.

2. The mattress support tilt regulator of claim **1** in which said separate dial means for limiting both the upward and downward pivot of said mattress support is adjustable for limit settings as to angle of pivot over the entire range of pivotal movement regardless of the operator control means.

3. The mattress support tilt regulator of claim **1** in which said means for limiting both the upward and downward pivot of said mattress support interrupts the electrical circuit of the power tilt machinery when the limiting angle of the mattress support has been attained.

4. In a mattress support tilt regulator, the combination comprising a power tilt bed including a frame, a pivotally mounted mattress support on said frame and operator control means for pivoting said mattress support both to high upward angles and downward angles with respect to said frame, at least one limit switch mounted on the frame of said bed separate and remotely located from said control means, and structure adjustably mounted on the pivot means of said mattress support for movement therewith to contact and open said limit switch when said mattress support pivots to a preselected maximum angle regardless of the operator control means.

5. In a tilt regulator, the combination comprising a frame member, pivot means rotatably mounted on said frame member, a limit switch mounted on said frame adjacent to said pivot means separate from the control means, and structure adjustably mounted on said pivot means for movement therewith to contact and open said limit switch when said pivot means has rotated to the maximum pre-selected angle regardless of the control means.

6. In a tilt regulator, the combination comprising a frame member, a torque tube rotatably mounted on said frame member, a rotatable selecting member rotatably mounted around said torque tube for limiting the rotation to the angle of the setting, means for releasably clamping said rotatable member to said torque tube in a selected position, cam means on said rotatable member, and a limit switch mounted on said frame for contact with said cam and stopping the rotation at the selected position.

7. In a mattress support tilt regulator, the combination comprising a power operated tilt bed having a frame, a mattress support pivotally mounted on said frame, power means mounted on said frame for pivoting said mattress support, a torque tube pivotally mounted on said frame for rotation with said mattress support, a sleeve rotatably mounted on said torque tube, a scale of angles indicated on said sleeve corresponding with the angles through which said mattress support pivots, cam means on said sleeve, means for clamping said sleeve onto said torque tube to pre-set the maximum angle of tilt, and a limit switch directly connected to said power means mounted on said bed frame adjacent said sleeve having a follower arm for contact with said cam, and opening said switch at the angle indicated on said scale.

8. The mattress support tilt regulator of claim **7** in which said torque tube is part of the tilt machinery of said bed.

9. The mattress support tilt regulator of claim **7** in which there are two limit switches, one for the upward pivotal movement and one for the downward pivotal movement.

10. In a mattress support level regulator preventing unintended downward pivotal movement beyond the horizontal in combination a power operated tilt bed having a frame, a mattress support pivotally mounted thereon and power means for pivoting said mattress support, a limit switch operably connected to said power means mounted on said bed frame, and a stop blade pivotally mounted at one end on said mattress support and swing freely by gravity to contact and open said limit switch when said mattress support arrives at the horizontal position.

11. In a mattress support tilt regulator preventing unintended downward pivotal movement beyond the horizontal in combination a power operated tilt bed having a frame, a mattress support pivotally mounted on said

frame and power means for pivoting said mattress support with respect to said frame, a limit switch operably connected to said power means mounted on said bed frame, a stop blade pivotally mounted on said mattress support to swing freely by gravity to contact and open said limit switch as said mattress support pivots and arrives at the horizontal position, and means for holding said stop blade out of contact with said limit switch for pivotal movement of said mattress support downwardly.

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