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(54) ELECTROMECHANICAL ADJUSTING DEVICE

(71) We, HANNING ELEKTRO-WERKE G.m.b.H. & Co., of Friedrichstrasse 16, Bielefeld, Federal Republic of Germany, a German Firm, 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:—

The invention relates to an electromechanical adjusting device for the bed frames of beds having a pivotable foot and/or head part via actuating arms pivoted by a rotatable rod which is mounted transversely of the frame and which may be, for example, constructed as a square tube, the adjustable rod being driven through gearing by an electric motor.

Such devices are apparent from German Offenlegungsschrift No. 2 326 709 and from British Patent Specification No. 1 044 500 in which linear servo motors are shown the drive rod of which moves the adjusting shaft via a lever fixed to it. Such constructions may, however, very easily give rise to severe injury if someone using it or the bed so equipped traps their limbs in the lever mechanism when moving the foot and/or head part. In fact the U.S. Patent Specification No. 2 807 174 and British Patent Specification No. 1 043 119 already show adjusting drives with friction couplings which do not of course serve to protect the patient from injuries due to crushing but rather to protect the motor from overloading, since they only slip through if a hard object is clamped by the parts of the bed frame which pivot.

The invention seeks to increase the safety of adjusting devices so that they are no longer able to cause any bodily harm when moving the head or foot part, while this was possible before.

According to the invention, there is provided an electromechanical adjusting device for pivotable head and/or foot parts of a bed frame comprising a rod rotatable to pivot the pivotable part via actuating arms and adapted to extend transversely of said bed frame, a reversible rotary electric motor in an insulating protective casing with its

rotor axis extending at right angles to the rod, a worm and worm gear driven by the motor and driving a pinion, drivingly connected with said rod, and the pinion being driven from the worm gear through spring one way slipping clutch means which can slip in one direction to allow manual raising of the head and/or foot parts, the rod additionally forming a supporting means for supporting the device on the bedframe.

A particularly preferred form of the invention can be achieved if the spring clutch comprises a clutch disc which is in active connection with the pinion, the pinion driving a toothed segment which is located on the rotatable rod and is restricted in its movements by end stops, the pinion driving the segment by way of a reduction gear wheel pair. Thus a construction which dispenses with drive levers and excludes bodily harm is achieved. The actuating arms of the device stop at any point as soon as they meet any obstacle during downward movements, because the free spring clutch then slips round and the drive is no longer in a position to apply dangerous shearing forces.

Another advantage of the device in accordance with the invention is provided if the worm gear engaging the drive worm of the electric motor, the clutch plate and the pinion are mounted on an axle displaceable longitudinally in a gear frame, for axial movement therewith, this axle passing through the worm gear so as to be freely movable relative thereto and a spring element acts on the end of the axle to bias the clutch disc into active engagement with the worm gear. The head or foot part may be lowered manually at any time by this measure when the current fails or during other faults in the device. The necessity of raising the head part suddenly when a patient is in danger of suffocating or choking which is just as important in the case of hospital beds and of releasing the head or foot part from the dangerous extended position lying on one's back, is taken into account by this spring clutch present in the device, this spring clutch preventing damage by crushing between the carrier frame and the pivotable

foot or head part during its downward movement.

The adjusting rod may have a square section, and a square section sleeve may be provided on which the gear segment is fixed and for receiving the rod, the sleeve extending between bearing bushes rotatable in apertures in side walls of a gear frame.

A clamp ring may be arranged on one of the bearing bushes of the square section sleeve, the clamping having control tracks for moving a longitudinally movable control rod which actuates switches for interrupting the supply of current to the electric motor in the end positions of the toothed segment.

Finally, a double adjusting device may be formed by two adjusting devices arranged in mirror image with respect to each other in a common casing, a first reversible electric motor being provided for moving the head part and a second reversible electric motor being provided for moving the foot part and two rotatable rods being provided acting on the head part and the foot part respectively and forming the sole supporting for the adjusting device. In this way there is the opportunity of developing the subject of the invention with the same constructional elements, as desired, either as a single or double device.

The invention will now be described in greater detail, by way of example, with reference to the drawings, in which:—

Figure 1 shows a plan view partially in section of an electromechanical adjusting device formed in accordance with the invention for actuating the pivotable foot and head parts of frames for beds,

Figure 2 shows the section view of the device from Figure 1 in the region of the line A—B,

Figure 3 shows the perspective view of frame equipped with the adjusting device from Figures 1 and 2, and

Figure 4 shows a head frame in perspective view having only one pivotable head part as well as an adjusting device suitable therefor.

The adjusting device 1 shown in Figures 1 and 2 is housed in a protective casing 2 manufactured from insulating plastics. This contains two electric motors 3 and 4 arranged in mirror image manner which serve to move the pivotable head part 5 which may be seen from Figure 3 and the foot part 6 of a bed frame 7. Actuating arms 8, which are fixed to a rotatable rod 9 mounted crosswise of the bed frame 7 and formed from a square tubing 9 are connected to the head part 5 or the foot part 6 and raise and lower the appropriate part by angular movement. The adjusting device 1 is carried by these rotatable rods 9 below the carrier frame 7. Control of the device takes place by means of an air-actuated switch

10 which eliminates contact with current-carrying parts of the circuit arrangement.

The rotor shafts 11 are each equipped with a drive worm 12 for transmitting the rotary motions of the rotor shafts 11 of the electric motors 3/4, which are reversible, to the rotatable rods 9 running at right angles to the shafts 11 of the electric motors 3/4. A respective worm gear 13 engages each drive worm 12, said worm gear being in driving connection with a pinion 15, connected to a clutch plate 14, via the clutch plate 14 which forms a one way slipping clutch with the worm gear 13. The pinion 15 drives a toothed segment 18, having limited movement limited by end stops 17, by way of a reduction toothed gear pair 16, the toothed segment 18 being set on a square sleeve 19 accommodating the rotatable rod 9 in positive manner in its free inner area, the square sleeve being mounted in the gear frame 22 on bearing bushes 23 which may be rotated in bearing orifices 20 of the side walls 21 of a gear frame 22.

A clamp ring 25 provided with control tracks 24 is arranged on a bearing bush 23 of the square sleeve 19 associated with each rod 9. Its control tracks 24 actuate a longitudinally moved control rod 27 acting on electrical switches 26. The supply of current to the electric motor 3 or 4 is switched off by switches 26 when the toothed segment 18 is located in its end positions determined by the stops 17. The control for this limit switch arrangement for the electric motors 3 and 4 is accessible from outside by moving the clamp rings 25 when the adjusting device 1 is in its assembled state, without its insulating protective casing 2 having to be opened for this.

The worm gear 13 in engagement with the drive worm 12 of the electric motor 3 or 4 respectively, the clutch plate 14 forming a one way slipping clutch with the gear 13 and its pinion 15 are provided with an axle 28 which may be displaced longitudinally in the gear frame 22, said axle passing through the gear wheel 13 which is mounted unchangeably in its position by a stop 29, so that the axle is freely movable. A spring 30 fixed to the gear frame 22 and pressing towards the worm gear 13 is located at the end of the axle 28 and acts to engage the clutch plate 14. The said spring 30 keeps the clutch plate 14 in engagement with the worm gear 13. By slipping of this clutch the head part 5 or the foot part 6 may also be raised manually in the case of a fault or an emergency. Moreover, because of this measure, damage by crushing between the head part 5 or the foot part 6 and the carrier frame 7 is eliminated because the clutch plate 14 may slip in this direction in relation to the worm gear 13. In order that, in exceptional cases, the foot part 6 or head

part 5 may be lowered independently of the drive, axial pressure must be exercised on the end of the longitudinally displaceable axle 28 which is remote from the spring 30. It disengages the clutch plate 14 from the worm gear 13 and thus causes separation of the adjustable shafts 9 from the electric motor 3/4 normally moving these adjustable shafts.

If according to Figure 4 adjustment only of the head part 5 is envisaged then a single device 31 may be created by halving the adjusting device 1 which has been described and has two drive units operating independently of each other. Fastening of the device to a transverse member 32 replacing the adjustable shaft 9 of the foot part 6 is achieved by means of a support rod 33 while all remaining components of the adjusting device 1, apart from the protective casing 2, may be used unchanged for the device 31.

WHAT WE CLAIM IS:—

1. An electromechanical adjusting device for pivotable head and/or foot parts of a bed frame comprising a rod rotatable to pivot the pivotable part via actuating arms and adapted to extend transversely of the said bed frame, a reversible rotary electric motor in an insulating protective casing with its rotor axis extending at right angles to the rod, a worm and worm gear driven by the motor and driving a pinion, drivingly connected with said rod, and the pinion being driven from the worm gear through spring one way slipping clutch means which can slip in one direction to allow manual raising of the head and/or foot parts, the rod additionally forming a supporting means for supporting the device on the bedframe.

2. An adjusting device according to Claim 1, wherein the spring clutch means comprises a clutch plate which is in driving connection with the pinion, the pinion driving a toothed segment which is located on the rotatable rod and which is restricted in its movement by end stops, the pinion driv-

ing the segment by way of a reduction gear wheel pair.

3. An adjusting device according to Claim 2, wherein the worm gear engaging the drive worm of the electric motor, the clutch plate and the pinion are mounted on an axle displaceable longitudinally in a gear frame for axial movement therewith, this axle passing through the worm gear so as to be freely movable relative thereto and a spring element acts on one end of the axle to bias the clutch plate into active connection with the worm gear.

4. An adjusting device as claimed in Claim 2 or 3 wherein, the rod has a square section, and a square section sleeve is provided on which the gear segment is fixed and for receiving the rod, the sleeve extending between bearing bushes rotatable in apertures in side walls of a gear frame.

5. An adjusting device as claimed in Claim 4, wherein a clamp ring is arranged on one of the bearing bushes of the square section sleeve, the clamp ring having control tracks for moving a longitudinally movable control rod which actuates switches for interrupting the supply of current to the electric motor in the end positions of the toothed segment.

6. A double adjusting device comprising two adjusting devices as claimed in any one of claims 1 to 5, wherein the second adjusting device is provided arranged in mirror image with respect to the first adjusting device in a common insulating protective casing, a first reversible rotary electric motor being provided for moving the head part, a second reversible rotary electric motor being provided for moving the foot part and two rotatable rods being provided acting on the head part and the foot part respectively and forming the sole supporting means for the adjusting device.

7. An electromechanical adjusting device for pivotable head and/or foot parts of a bed frame substantially as described herein with reference to the drawings.

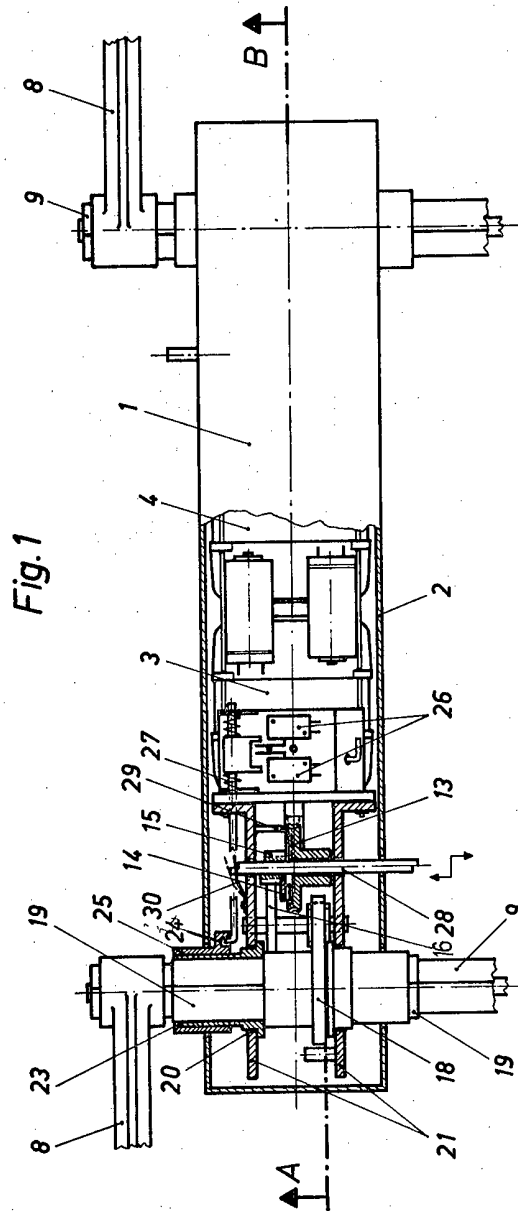
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COMPLETE SPECIFICATION

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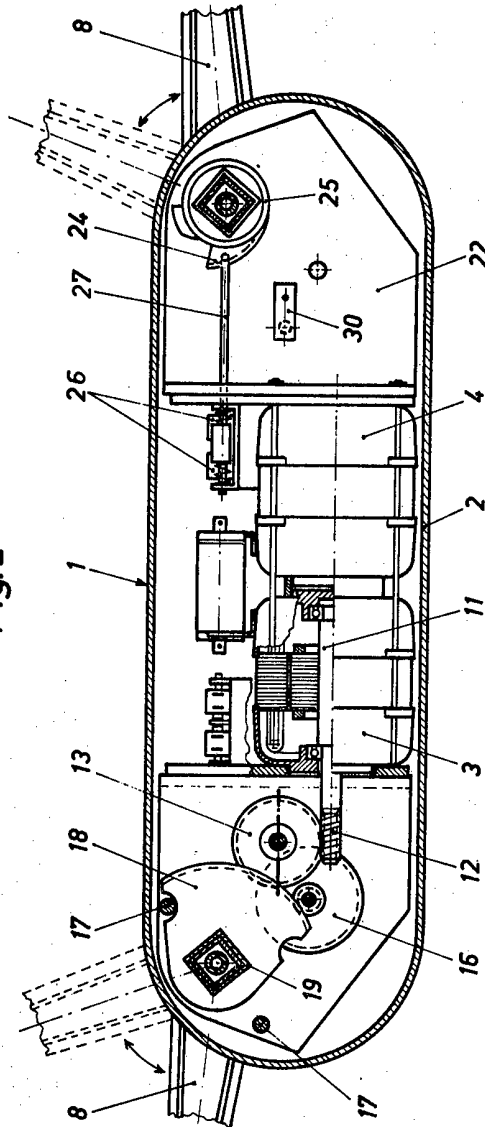
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Fig. 2



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Fig. 3

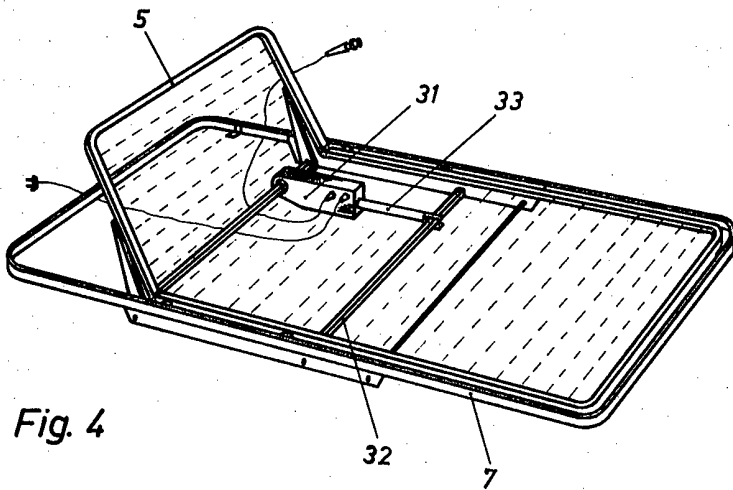
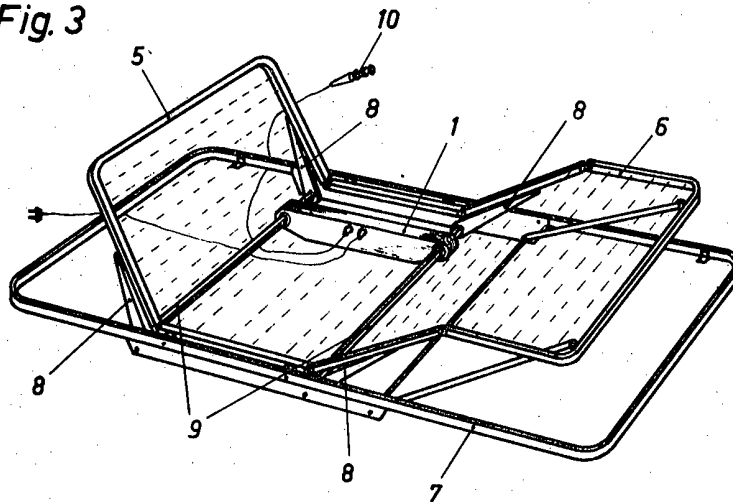


Fig. 4