Nov. 21, 1967 O. GREINER 3,353,193

SELF-ADJUSTING BEDS

Filed Jan. 26, 1966 2 Sheets-Sheet 1

Fig. 1

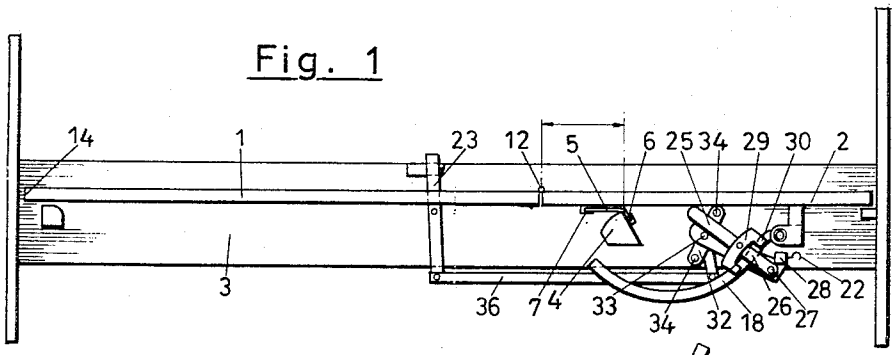


Fig. 2

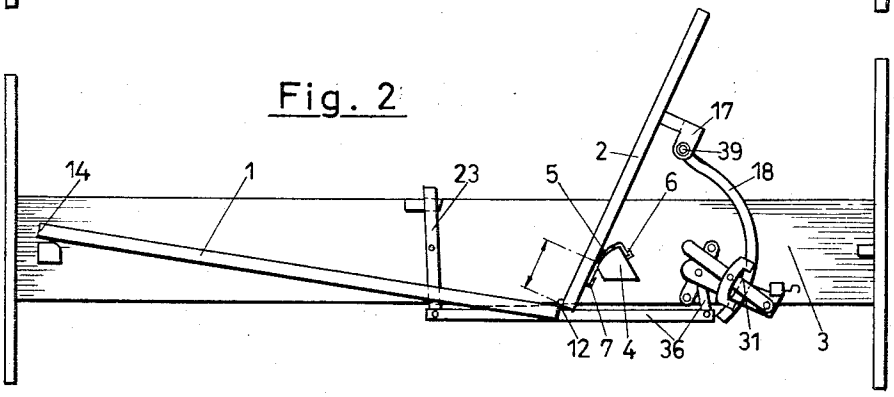


Fig. 3

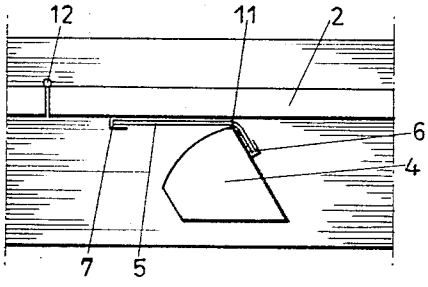
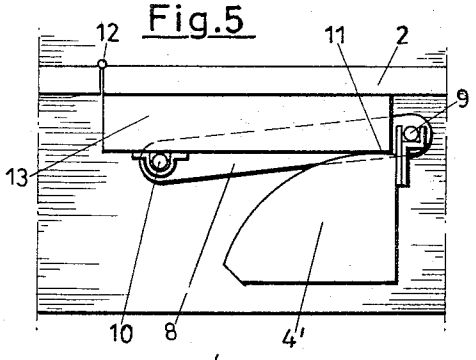


Fig. 5



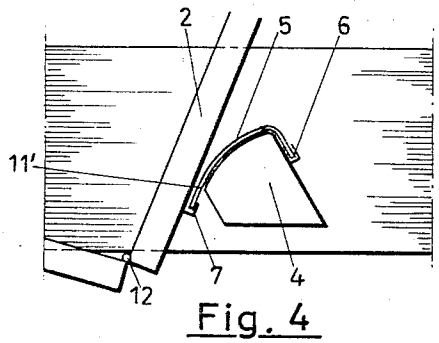


Fig. 4

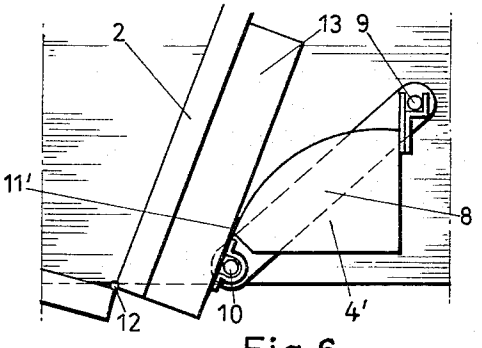


Fig. 6

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Nov. 21, 1967 O. GREINER 3,353,193

SELF-ADJUSTING BEDS

Filed Jan. 26, 1966 2 Sheets-Sheet 2

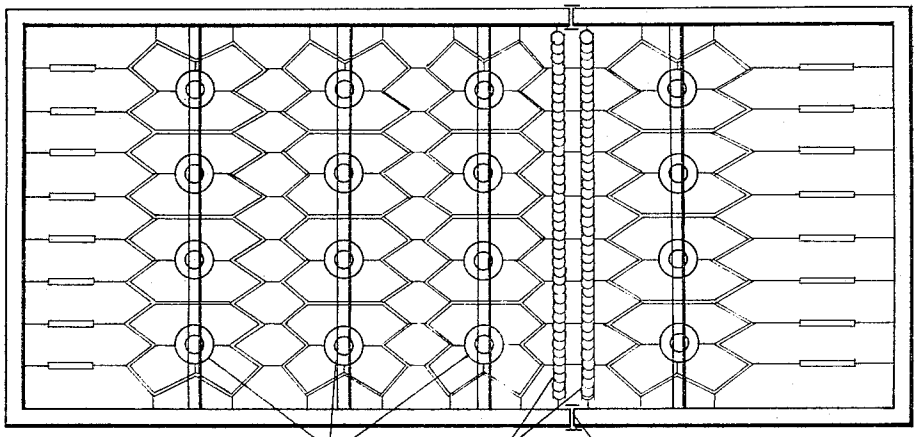


Fig. 7

Fig. 8

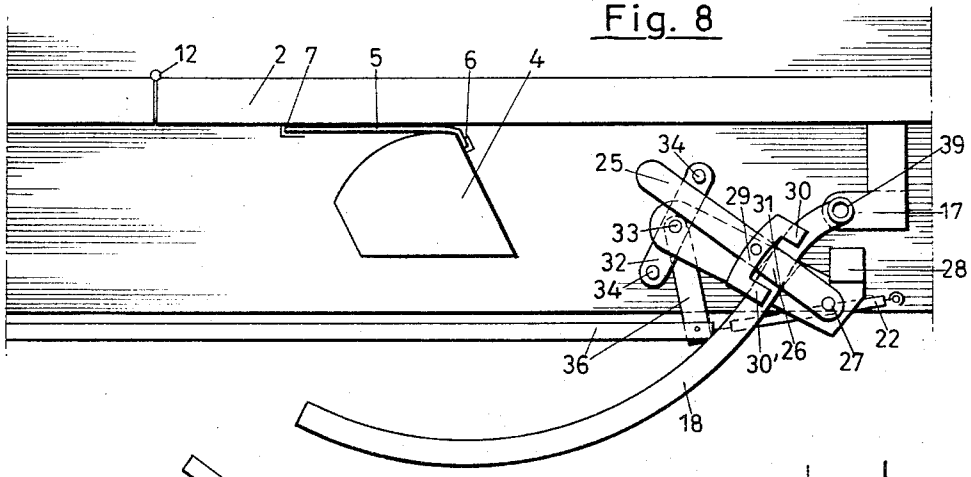
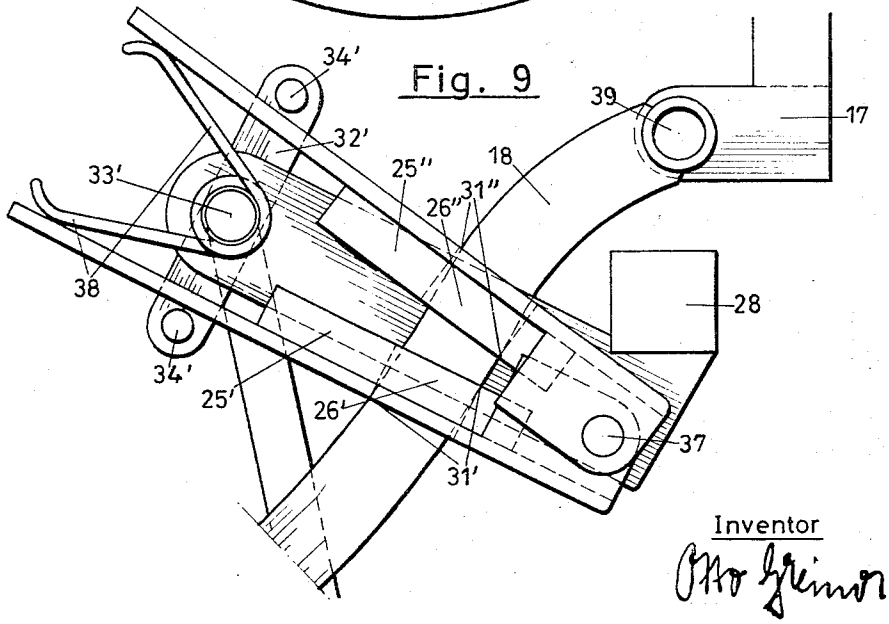


Fig. 9



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3,353,193

SELF-ADJUSTING BEDS

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3 Claims. (Cl. 5—66)

There are several types of camp beds, ordinary beds and hospital beds where, in accordance with the body proportions of man, the surface area is transversely divided into a lower main part (seat) and an upper part (back) which are connected by a hinge, and where the back can be moved up or down by transmission of pressure from the seat to the back and vice versa without the user having to rise from the bed.

Such constructions have either not found practical application or have been used only to a very limited extent, because they lacked the following important requirement:

A device of this nature will be regarded as comfortable in use only if the back can be moved upwards and downwards with equal facility at all angles of inclination within its range of movement.

This requirement presents the following difficulty: When the bed is in a lying position, the user will exert relatively little pressure onto the lower main part and a comparatively large amount of pressure onto the back, whereas in the sitting position the pressure onto the seat is relatively large and that against the back comparatively small.

In this respect the present invention is an improvement on several constructions of a known type of adjustable camp bed or bed, where the back joined to the seat by a hinge is suspended in a rigid base by means of tenons attached on both sides at a certain distance from the hinge, and can be moved about a horizontal axle.

With the scale-like suspension of this construction, by choosing an appropriate distance of the suspension axle of the back from the pivot between seat and back, it is possible to obtain a balance, at a given median inclination of the back, between the user's pressure on the seat and the pressure exerted by the upper part of the user's body onto that portion of the back which is situated above the suspension axle.

However, with this transmission of pressure, in the sitting position the back will tend to press the upper part of the user's body forward, whereas in the lying position the back falls downward, with the upper part of the user's body losing all support.

FIGURES 1 to 9 show a new construction which eliminates these shortcomings:

FIG. 1 is a side view of a bed with divided surface area and the novel device in the lying position, the side of the bed frame nearest to the observer not being shown.

FIG. 2 shows the same bed in the sitting position.

FIG. 3 shows, on a larger scale and in the lying position, the device which ensures the balance, where a flexible band prevents the co-acting surfaces from sliding against each other.

FIG. 4 shows the same device in the sitting position.

FIG. 5 shows, in the lying position, the device ensuring the balance in a somewhat modified form, where a metal bracket is used instead of the flexible band.

FIG. 6 shows the same device in the sitting position.

FIG. 7 shows the covering of the surface area required for the bottom of a bed with a movable back.

FIG. 8 shows a clamping device for a bow-shaped member movably attached to the back.

FIGURE 9 shows a modification of the clamping device for the bow-shaped member.

In the new construction the back **2** (FIGS. 1 to 4) does not turn about a fixed fulcrum, but the lower surface of the back frame rests on a curbed support **4** or **4'** connected to the bed frame **3**, which is directed forward and downwards.

Devices are envisaged which will prevent the back **2** from sliding on the curved block and will only allow the back to tilt. Of a variety of possible devices for this purpose, the following are the simplest:

A flexible band **5** (FIGS. 3 and 4) is inserted between the bottom side of the back frame **2** and the curved block **4**. One end **6** of the band is attached to the upper end of the curved block **4**, whereas its lower end **7** is firmly joined to the frame of the back **2**.

One arm **9** (FIGS. 5 and 6) of a U-shaped metal bracket **8** of appropriate width is movably attached to the upper end of the curved block, while the other arm **10** is movably connected to the bottom surface of the back frame.

The effect of this construction is based on the fact that the fulcrum of the back, that is its point of contact **11–11'** with the curved block, moves towards the hinge **12** when the back is tilted up, and away from the hinge when the back is moved downwards. Thus the back **2** acts as a two-armed lever during movement, the lower portion (lever arm) of which is shortened and the upper portion (lever arm) lengthened when the back is moved upwards, and vice versa when it is moved downwards. Therefore, in the sitting position the user's increased pressure onto the seat is exerted via the hinge **12** onto a shortened lever arm and the reduced pressure of the upper part of his body onto a lengthened lever arm, whereas in the lying position the user's reduced pressure onto the seat is exerted via the hinge **12** onto a lengthened lever arm and the increased pressure of the upper part of his body onto a shortened lever arm.

In manufacture, the form of the curved block **4** or **4'** can be determined in empirical fashion in such a way as to ensure exact balance of the opposing pressures at all points within the range of movement. Once the form of the curved block **4** or **4'** has been determined, any differences in the body proportions of users will cause only a very slight change in balance, which will not affect the facility of use. A very heavy person can move the back upwards or downwards with the same ease as a child of low body-weight.

The curved block **4'** (FIGS. 5 and 6) can be modified in that the lower surface **13** of the back is placed in a lower position in relation to the hinge **12**. In order to obtain balance in all positions, the bow-shaped support **4'** must be lengthened. This is achieved by the fact that the foot end **14** of the seat **1** undergoes hardly any longitudinal movement when the back is tilted.

In order to maintain the degree of comfort achieved by means of this new construction, there are, however, two further essential requirements which must be met.

The surface area **1** and **2** which is normally provided with an elastic net-like covering on which the mattress is placed, must not have any longitudinal stress extending beyond the break, and it must be possible to lock the back **2** in any position by means of a brake which will meet modern requirements only if it locks the back at any angle, without the use of toothed notches, and can be easily operated.

Apart from hospital beds where the surface area is usually provided with strong trnasverse spring bands in a strong metal frame, the surface area of a normal bed usually has a net-like covering which is supported by vertical conical springs **15** (FIG. 7) mounted on stirrups and evenly distributed over the surface, thus maintaining its springiness and ensuring equal tension in both directions of the frame. If the back portion of the mattress were tilted, the longitudinal tension would interfere with smooth movement and the elastic net-like covering would be rounded rather than sharply bent at the break.

Since firm transverse rods cannot be used at the break on the same level with the surface of the net-like covering, the present construction only provides for one or more transverse spring bands **16** at the rear end of the seat and at the lower end of the back which, unless the frame is subjected to undue stress, form a firm rim for the covering of both areas and will not be found uncomfortable by the user.

In order to be able to lock the back at any desired angle of inclination, a bow-shaped member **18** (FIG. 1, FIG. 2, FIG. 8) of round or trapeze-like cross-section is attached in pendulum fashion to the bottom side of the back frame, either laterally below the frame or on a transverse bow **17** in the middle. For the locking of the back a known device is used where the bow-shaped member **18** slides through the bore **26** of a flat bar **25** which is somewhat larger than the cross-section of the bow-shaped member. With the conventional type, the end **27** of the flat bar (tipping bar) **25** is movably connected with the bed frame **3** or a cross-bar **28** fixed to it, and the flat bar **25** the bore **26** of which, at the point of contact in the normal position, runs in the same direction as the bow-shaped member **18**, is moved by means of a spring to such an extent that opposite edges **31** of the bore **26** firmly rest against the bow-shaped member **18**. If the back is to be tilted in such a way that the bow-shaped member **18** seeks to move the tipping bar **25** in the same direction in which it is already being moved by the spring, this will result in a strong clamping action of the edges **31** of the bore on the bow-shaped member **18** which will increase with increasing pressure in the said direction and will prevent any movement.

However, this device locks the back only in one direction. If the movement is in the opposite direction, the friction of the bow-shaped device **18** on the edges **31** of the bore has a releasing effect and the movement is not impeded in any way. In order to be able to lock the back in both directions, a stirrup **29** is movably connected to the tipping bar **25**, being arranged square to it and parallel with the bow-shaped member, the ends of which **30** and **30'** lightly grip the bow-shaped member **18**. If it is attempted to move the back **2** and with it the bow-shaped member **18**, the stirrup **29**, as a result of the clamping action of its ends **30** and **30'**, and with it the tipping bar **25** are moved in the respective direction of movement. The edges **31** of the bore **26** press against the bow-shaped member **18** which in turn seeks to move the tipping bar **25** even more thereby further increasing the pressure, with the result that all movement is prevented.

If the movement is reversed, the same conditions apply after the tipping bar has moved slightly in the other direction.

In order to release the brake and to resume moving the back, a fork **32** which can be turned about its axis **33** which is arranged square to the longitudinal direction of the bed, overlaps the tipping bar **25** from the side.

In its normal position the fork **32** allows the tipping bar **25** sufficient room for movement. If, by means of transmission rods **36**, it is turned by the user to such an extent that its prongs **34** rest against the tipping bar **25** on both sides and hold it in the median position, the bow-shaped member **18** can slide unimpeded through the bore **26** running in the same direction. The locking action is eliminated and the back **2** can be moved freely.

It is apparent that the above described examples have been given solely by way of illustration and not by way of limitation and that they are capable of many variations and modifications within the scope of the present invention. All such variations and modifications are to be included within the scope of the present invention.

I claim:

1. A bed wherein the surface area is transversely divided into a lower main part and a back section which are connected by hinges, and where the back can be moved up or down by transmission of pressure from the seat to the back and vice versa without the user having to rise from the bed, and whereby the back tilts on curved blocks which slant forwards and are situated at a certain distance from the hinges below the side bars of the back frame and are firmly joined to the side rails of the base frame and—in order to prevent the back from sliding on the curved blocks—a U-shaped metal bracket of appropriate width is attached on each side, one arm of which is movably connected to the upper end of the curved block, square to the direction of movement, its other arm being movably attached to the bottom surface of the back frame, thus ensuring that the side bars of the back frame and the curved blocks always make contact at the same points, whereby at any inclination of the back there exists such a state of balance as to require the same amount of additional pressure by the user to move the back upwards and downwards.

2. A bed wherein the surface area is transversely divided into a lower main part and a back section which are connected by hinges, and where the back can be moved up or down by transmission of pressure from the seat to the back and vice versa without the user having to rise from the bed, and whereby the back tilts on curved blocks which slant forwards and are situated at a certain distance from the hinges below the side bars of the back frame and are firmly joined to the side rails of the base frame and—in order to prevent the back from sliding on the curved blocks—a U-shaped metal bracket of appropriate width is attached on each side, one arm of which is movably connected to the upper end of the curved block, square to the direction of movement, its other arm being movably attached to the bottom surface of the back frame, thus ensuring that the side bars of the back frame and the curved blocks always make contact at the same points, whereby at any inclination of the back there exists such a state of balance as to require the same amount of additional pressure by the user to move the back upwards and downwards, and wherein the undesirable longitudinal stress which would be caused by the movement of the back of a bed having the usual metal-link surface covering and upright conical springs mounted on stirrups, is eliminated by attaching one or more spring bands at the rear end of the main part and at the lower end of the back, which form the rim of the covering of the main part and the back.

3. A bed of claim **2**, wherein the locking of the back in intermediate positions is effected by a known bow-shaped member attached in pendulum fashion in longitudinal direction to the bottom side of the back frame, which is clamped in the bore of a tipping bar of somewhat larger diameter than the bow-shaped member, one end of said tipping bar being movably connected with an axle joined to a cross-bar of the bed frame, whereby the

movement of the tipping bar in the direction of movement of the bow-shaped member is effected in such a way that the ends of a stirrup which is movably connected to the tipping bar and situated square to the latter, lightly grip the bow-shaped member and thus move with it, and whereby the locking action is released in such a manner that a fork, the prongs of which overlap the tipping bar at an appropriate distance, is turned by the user about its axis by means of transmission rods, to such an extent that both prongs firmly rest against the tipping bar and hold it square to the bow-shaped member, so that the bore is in the same direction as the corresponding part of the bow-shaped member.

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CASMIR A. NUNBERG, *Primary Examiner.*