Aug. 17, 1965 H. P. DOETSCH 3,201,079

ADJUSTING DEVICE

Filed Nov. 21, 1962 2 Sheets-Sheet 1

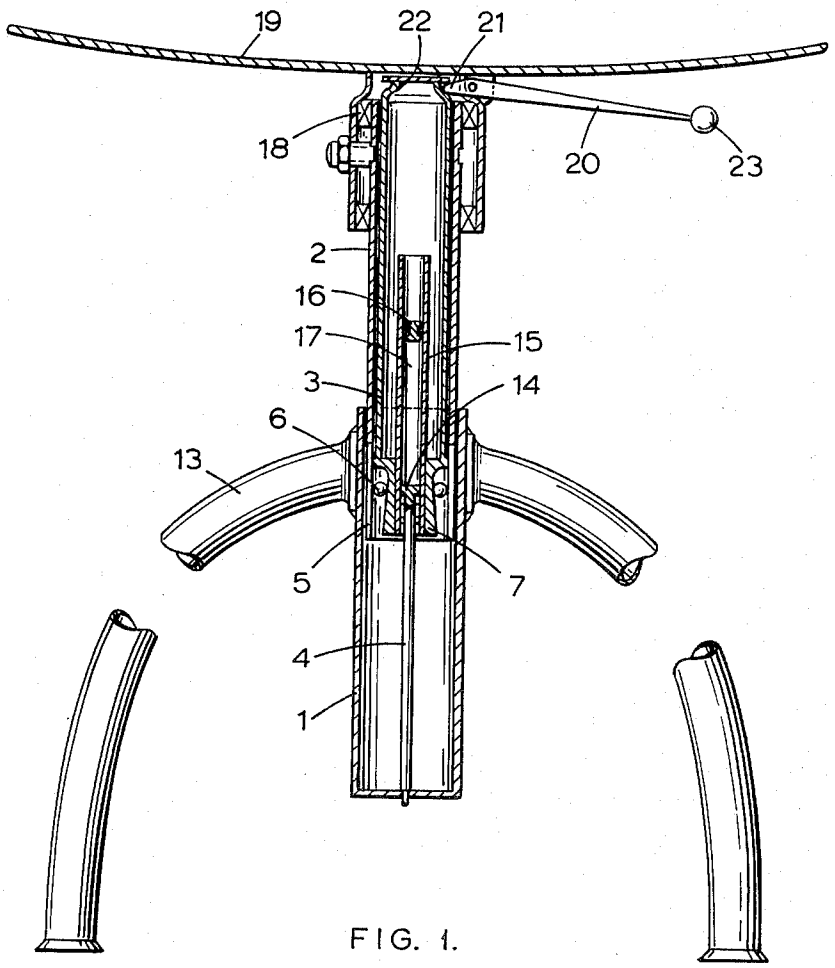

FIG. 1.

Aug. 17, 1965 H. P. DOETSCH 3,201,079

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Filed Nov. 21, 1962 2 Sheets-Sheet 2

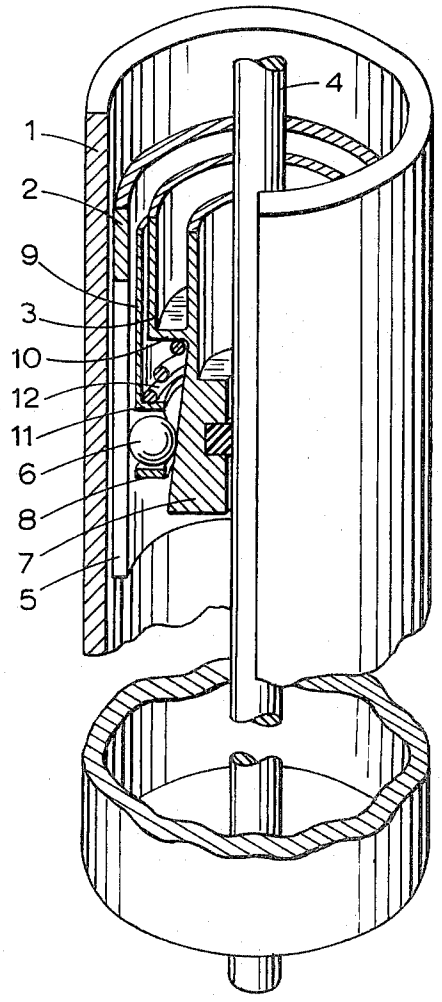

FIG. 2.

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ADJUSTING DEVICE

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25 Claims. (Cl. 248—412)

The invention relates to an adjusting device for adjusting the relative position of any two objects and provided with an energy reservoir. It is important with such adjusting devices for the displacement force exerted by the energy reservoir to be substantially constant in all positions.

According to the invention a reservoir filled with a highly compressed gas is mounted between the two objects to be adjusted, and has a piston which is acted on by the gas pressure and of which the movements are preferably damped, the piston being lockable in any position and its output force being substantially constant in all positions.

It is an advantage for the reservoir to be arranged in two tubes which are relatively displaceable in telescopic fashion, the end of the piston which projects from the reservoir being fixed to the base of one tube and the reservoir itself being mounted in the second tube for limited axial displacement.

In order to fix the two telescopic tubes in position relatively to each other, the telescopic tube of smaller diameter has longitudinal slots at the end projecting into the other tube. In the region of the slots in the smaller tube the reservoir has a frustum, of which the diameter is chosen so that enough space is left between the outer surface of the frustum and the inner surface of the slotted telescopic tube for wedges to be accommodated, the wedges being pressed into the narrowing space between the frustum and the telescopic tube either by gravity or, if necessary, by spring force.

By means of a lever mechanism at the opposite end of the telescopic tube, the reservoir can be moved in an axial direction so that the wedges penetrate still further into the narrowing space between the frustum and the slotted tube, thus pressing the slotted tube fast against the inner wall of the second telescopic tube. In this way a positive connection is formed between the two telescopic tubes, i.e. they are secured in their relative positions. All that is required to release the connection is for the lever mechanism to be moved in the opposite direction to that used for securing.

In order to prevent the wedges from becoming jammed in different radial planes due to the frustum being slightly non-concentric with the telescopic tube surrounding it, thus producing considerable bending moments in the wedging system which may cause the frustum to become bent or in extreme cases even to break off, a further construction of the invention provides for the wedges to be mounted in an axially movable guide which does not prevent them from moving radially but which keeps them in the same radial plane in every position.

It is desirable for the guide to be provided with a thin-walled cylindrical projection, the diameter of which is chosen so that its outer surface slides along the inner surface of the telescopic tube surrounding it or so that its inner surface slides along the outer surface of the reservoir. This ensures that there are no bending moments in the region of the wedging device, due to the wedges becoming jammed in different radial planes.

It is an advantage to provide a compression spring in the annular space between the guide and the end surface of the reservoir to press the wedges into the wedging position.

Assembly is greatly simplified if the wedges are mounted in the guide so that they can move radially but cannot fall out of the guide.

In order to improve the positive connection between the two telescopic tubes it is desirable for one of the tubes to be made of hard and the other of comparatively soft material or, if for any reason both tubes have to be made of the same type of material, for one tube to be coated with softer material on the surface which forms a positive connection with the other tube.

In order to explain the invention more fully, an example of its application is shown in the drawing in the form of a chair frame which is adjustable in height, but the invention is not restricted to this example. In the drawings:

FIG. 1 is a section through a chair frame employing an adjusting device according to the invention, and

FIG. 2 is a perspective view of a slightly modified form of the wedging device shown in FIG. 1 in section.

The tube 1, which is closed at one end and rigidly connected to the legs 13 of the chair, receives the tube 2, which is movable in telescopic fashion relatively thereto and which accommodates the reservoir 3 filled with a highly compressed gas. One end of a piston rod 4 is fixed to the base of the tube 1, and the other end, which is inserted in the reservoir 3 in a gas-tight manner, carries a damping piston 14. Associated with the damping piston 14 is a damping cylinder 15 with a floating piston 16, so that a space 17 is formed which is sealed off from the gas and filled with damping fluid. The damping fluid can however be dispensed with and the piston 14 braked directly by the gas. The term "damping piston" as used herein means a piston which has a bleed passage therethrough or which is a loose fit in its cylinder.

On the same side as that on which the piston rod 4 is inserted, the reservoir 3 carries a frustum 7, its dimensions being chosen so that a tapering annular space is formed between the outer surface of the frustum and the inner surface of the tube 2 to receive wedges 6. The tube 2 has one or more longitudinal slots 5 in the region of the frustum 7 to facilitate its deformation. At the opposite end the tube 2 carries a rotary bearing 18 which is rigidly connected to the seat plate 19 of the chair. On the bearing 18 there is mounted a two-armed lever 20, of which one arm 21 engages an annular groove 22 in the reservoir 3 and the free arm 23 is designed as an actuating lever.

In this example the output force of the reservoir 3 is about 40 kg., so that a person using the chair can lower the seat plate by his own weight when the lock is released, and all that is required to adjust the height of the seat 1 plate is to relieve it of the load. When the seat plate 19 has reached the height desired by the user the actuating lever 23 is merely pressed downwardly, whereby the reservoir 3 is moved axially relatively to the telescopic tube 2. This displacment moves the wedges 6 into the narrowing space between the frustum 7 and the inner surface of the tube 2, so that the latter is pressed firmly against the telescopic tube 1. In this way a positive connection is formed between the two telescopic tubes 1 and 2, which can be released only by movement of the reservoir 3 in the opposite direction, i.e. by moving the actuating lever 23 upwardly.

In order to keep the wedges 6 in the same radial plane in every position of the wedging device, they are mounted, as shown in FIG. 2, in a guide 8 similar to the cage of a ball bearing, in such a way that they can move freely in a radial direction but in the axial direction are secured in position relatively to the guide 8. In order to prevent the guide 8 from canting from the longitudinal axis of the system, a thin-walled cylindrical projection 9 is pro-

vided on the guide 8, its diameter being chosen so that the projection slides either along the outer surface of the reservoir 3 or along the inner surface of the tube 2.

To ensure that the wedging device is effective whatever the position of the adjusting device, a compression spring 12 is mounted between the end surface 10 of the reservoir 3 and the annular surface 11 of the guide 8.

I claim:

1. An adjusting device for adjusting the relative position of two objects which comprises two tubes telescopically slidable one within the other, a gas reservoir filled with a highly compressed gas and mounted within one of said tubes so as to be capable of limited axial displacement relatively thereto, piston means fixed longitudinally within the other of said tubes, and arranged to compress the gas in said reservoir when said tubes are telescoped and means for locking said tubes relatively to each other, said means being operable by axially displacing said reservoir slightly with respect to said one tube.

2. An adjusting device according to claim 1, wherein said reservoir is mounted within the inner of said tubes.

3. An adjusting device according to claim 2, wherein said locking means comprises at least one wedge member disposed within said inner tube adjacent its inner end and tapered means operatively connected to said reservoir whereby slight axial displacement of said reservoir relative to said inner tube can force said wedge member radially outwardly, thereby elastically deforming said inner tube and jamming it against the inner surface of the outer of said two tubes.

4. A device according to claim 3, wherein movements of the piston are damped.

5. A device according to claim 3, wherein the reservoir is arranged in two tubes which are relatively displaceable in telescopic fashion, the end of the piston which projects from the reservoir being fixed to the base of the tube and the reservoir itself being mounted in the tube for limited axial displacement.

6. A device according to claim 5, wherein, on the side of the reservoir where the piston is inserted in a gas-tight manner a frustum is mounted coaxially with its smaller diameter towards the reservoir.

7. A device according to claim 6, wherein the tube has one or more longitudinal slots in the region of the frustum.

8. A device according to claim 7 wherein wedges are arranged in the narrowing annular space between the frustum and the inner wall of the tube.

9. A device according to claim 8, wherein a two-armed lever is used to actuate the wedging device, one arm engaging the annular groove in the reservoir and the other arm being designed as an actuating lever.

10. A device according to claim 9, wherein the two tubes are made from materials of different hardness.

11. A device according to claim 9, wherein either the inner surface of the tube or the outer surface of the tube is coated with a material which is less hard than the material from which the tube is made.

12. A device according to claim 3, which includes an axially movable guide in said inner tube adjacent its inner end and carrying a plurality of wedge members, said guide maintaining said wedge members in the same radial plane.

13. A device according to claim 12, wherein said guide has a thin-walled cylindrical projection having an outer surface which slides along the inner surface of said inner tube.

14. A device according to claim 12, wherein said guide comprises a thin-walled cylindrical projection having an inner surface which slides along the outer surface of the reservoir.

15. A device according to claim 12, which includes a compression spring mounted between said reservoir and said guide.

16. An adjusting device for adjusting the relative positions of two objects, which comprises two tubes telescopically slidable one within the other, a gas reservoir filled with highly compressed gas and mounted within at least one of said tubes, a cylinder disposed in one of said tubes and in communication with said reservoir, a piston which is slidable in said cylinder between two extreme working positions and which is acted on by the gas pressure in the cylinder, said cylinder being operatively connected to one of said tubes and said piston being operatively connected to the other of said tubes whereby the gas in said reservoir tends to extend the device and whereby said piston further compresses said gas when said tubes are telescoped, the pressure of the gas in the reservoir, the volume of the reservoir and the area of the piston being such that the force applied to said piston is substantially constant throughout the whole extension range between said two extreme working positions.

17. A device according to claim 16, wherein said locking means is adapted to elastically locally deform one of said tubes in a portion thereof which overlaps the other of said tubes.

18. An adjusting device for adjusting the relative position of two objects which comprises two tubes telescopically slidable one within the other between two extreme working positions, a gas reservoir filled with highly compressed gas and mounted within one of said tubes, piston means fixed longitudinally within the other of said tubes and arranged to further compress the gas in said reservoir when said tubes are telescoped, and means for locking said tubes relatively to each other, the pressure of the gas in the reservoir, the volume of the reservoir and the area of the piston means being such that the force applied by said gas to said piston means is substantially constant over the whole extension range of the device between said two extreme working positions, said locking means being adapted to elastically locally deform one of said tubes in a portion thereof which overlaps the other of said tubes.

19. A chair frame comprising a seat member, a base member, and adjusting means for raising and lowering said seat member relatively to said base member, said adjusting means comprising two tubes telescopically slidable one within the other between two extreme working positions, one of said tubes being connected to said seat member and the other of said tubes being connected to said base member, a gas reservoir filled with highly compressed gas and mounted within one of said tubes, piston means fixed longitudinally within the other of said tubes and arranged to further compress the gas in said reservoir when said tubes are telescoped, and means for locking said tubes relatively to each other, the pressure of the gas in the reservoir, the volume of the reservoir and the area of the piston means being such that the force applied by said gas to said piston means is substantially constant over the whole extension range of the device between said two extreme working positions.

20. A chair frame comprising a seat member, a base member and adjusting means for adjusting the height of said seat member relatively to said base member, said adjusting means comprising two tubes telescopically slidable one within the other, one of said tubes being connected to said seat member and the other of said tubes being connected to said base member, a gas reservoir filled with highly compressed gas and mounted within at least one of said tubes, a cylinder disposed in one of said tubes and in communication with said reservoir, a piston which is slidable in said cylinder between two extreme working positions and which is acted on by the gas pressure in the cylinder, said cylinder being operatively connected to one of said tubes and said cylinder being operatively connected to the other of said tubes whereby the gas in said reservoir tends to raise the seat member and whereby said piston further compresses said gas when said seat member is depressed, and means for locking said

piston with respect to said cylinder, the pressure of the gas in the reservoir, the volume of the reservoir and the area of the piston being such that the force applied to said piston is substantially constant throughout the whole extension between said two extreme working positions.

21. A chair frame according to claim **20**, wherein said locking means is adapted to elastically deform one of said tubes in a portion thereof which overlaps the other of said tubes.

22. A chair frame comprising a seat member, a base member and adjusting means for adjusting the height of said seat member relatively to said base member, said adjusting means comprising two tubes telescopically slidable one with the other, one of said tubes being connected to said seat member and the other of said tubes being connected to said base member, a gas reservoir filled with a highly compressed gas and mounted within one of said tubes so as to be capable of limited axial displacement relatively thereto, piston means fixed longitudinally within the other of said tubes and arranged to further compress the gas in said reservoir when said tubes are telescoped and means for locking said tubes relatively to each other, said locking means being operable by axially displacing said reservoir slightly with respect to said one tube.

23. A chair frame according to claim **22**, wherein said reservoir is mounted within the inner of said tubes and said locking means comprises at least one wedge member disposed within said inner tube adjacent its inner end and tapered means operatively connected to said reservoir whereby slight axial displacement of said reservoir relative to said inner tube can force said wedge member radially outwardly, thereby elastically deforming said inner tube and jamming it against the inner surface of the outer of said two tubes.

24. A chair frame according to claim **19**, wherein the movements of said piston means are damped.

25. A chair frame according to claim **20**, wherein the movements of said piston are damped.

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