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(54) **Device for physical training of the para-vertebral muscles**

(57) A device for physical training of mobilisation of para-vertebral muscles comprises at least a frame (2) housing a reacting mechanism (12), supports (3) guiding a shaft (4) supporting a back (6), the back (6) being capable of moving from a rest position to a maximum extension position by rotating around the axis of the shaft (4); the reacting mechanism (12) contrasts the

moving of the back (6) from the rest position towards the maximum extension position and causes the return stroke of the back (6) from the maximum extension position to the rest position; a system (16, 17) is further provided for regulating the push due to the reacting mechanism (12), said regulation occurring when the back (6) is in the rest position.

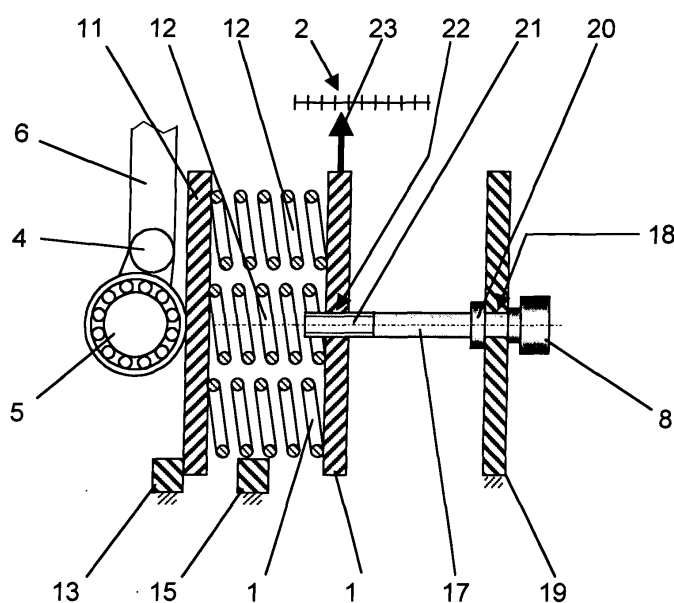


Fig. 8

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a mechanical device capable of helping the treatment of spinal column pathologies or, more precisely, of the rachis, since it allows to carry out the exercises for making stronger the para-vertebral muscles in order to limit or delaying the use of surgical therapies by resorting to a "physiotherapy conservative treatment". The non-surgical treatment of the pain due to the rachis pathologies begins with a de-contraction therapy carrying on the teaching of correct positions to be respected and the teaching of proper exercises. In order to stabilise the applied therapy and reduce the probability of relapse it is necessary to make stronger the rear and para-vertebral musculature of the rachis extensors. The aim of this mobilisation consists in strongly stabilising the column by making stronger the muscles directly connected to its vertebrae; this muscles forming a natural "corset" for the lumbar section. More the musculature is strong, more it is improbable that the assumption of improper positions determines a movement of the disc towards structures causing pain, that is towards the spinal marrow and its nerves.

[0002] For the strengthening of para-vertebral muscles a movement or exercise must be carried out according to particular modalities of execution.

PRIOR ART

[0003] The correct execution of the exercise for the training of spinal par-vertebral muscles, by concentrating the job exclusively on this musculature, is carried out by means of recovery apparatuses.

[0004] The companies operating in the recovery and sport field are most numerous, and produce apparatuses or tools capable of satisfying any requirement. In the specific case, apparatuses exist suitable to make the back-lumbar para-vertebral musculature stronger.

[0005] For the correct execution of the exercise the patient must assume, on the apparatus or tool, a starting seated erected position. The column and the femur form an angle of approximately 90°, the knee is bent of 90°, and the feet rest on a fixed support.

[0006] From this starting position, extending the back against a resistance carries out the exercise. The back rests on a roller connected to some weights by means of ropes and pulleys. The extension must occur for an amplitude of approximately 40° with respect to the starting erected position. When the pre-established amplitude is reached, the starting position is reached back by inverting the back motion.

[0007] It is essential that the reversal movement finishes when the back is in vertical position: if the back bends over this position, the abdominal muscles begin to work; said muscles oppositely acting with respect to

the para-vertebral muscles and the bending in ahead crushes again the disc in the rear.

[0008] The physical training is very easy, but it is necessary a suitable support allowing the contrast of a proper resistant couple opportunely calibrated for all extension stroke. This support will have to act at the height of the shoulders and allow, anyway, the extension of the back.

[0009] The physical training consists in more repetitions and more series according to the doctor's instructions.

[0010] All the existing apparatuses have adjusting systems suitable for users' physical characteristics. The height of eventual seats, backs, supports for the limbs, is adjustable thanks to particular adjusting systems, which can be easily used by the customer.

[0011] Because of the costs of the space and the weight, these apparatuses are suitable for the activities of recovery centres and particular sport structures, but they cannot be widely diffused in the domestic field.

[0012] On the contrary, the therapeutic training should be continuously executed, better if forever, even if the training requires just few minutes a day. Of course, because of many kind of these pathologies existing and expensive, bulky and heavy apparatuses available in few qualified centres only, it is impossible to meet all the daily requirements of many people.

AIMS AND FEATURES OF THE INVENTION

[0013] The aim of the invention is to remedy above drawbacks. The invention, as claimed, solves the problem of creating a device for physical training of mobilisation of para-vertebral muscles presenting limited mass and dimensions, easily transportable and usable anywhere, suitable for training following the best modalities according to the therapy phases proposed by the clinician with all the requested adjusting options being available.

[0014] The present invention allows the correct physical training of mobilisation of para-vertebral muscles with a suitable support capable of contrasting a proper resistant couple opportunely adjusted for all extension stroke.

[0015] The advantages offered by the present invention are mainly the adaptability to all the physical conformations of several patients, the possibility to adjust the resistant couple according to the medical prescription with reference to a graduated scale, the variation of the resistant couple during the execution of each extension according to the pre-established clinical parameters and the reproducibility of the provided resistant couple.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Other advantages, features and aims of the invention, may be more readily understood by referring to

the accompanying drawings, which concern preferred embodiments, in which:

- Fig. 1 shows the device when transported;
- Fig. 2 shows the device when installed;
- Fig. 3 shows the device in working conditions;
- Fig. 4 represents a bracket for engaging the device on a seat;
- Fig. 5 illustrates a cam mechanism capable of pressing a plurality of springs;
- Fig. 6 illustrates the cam mechanism moved by the back during the training towards a maximum extension position and a rest position respectively indicated by a continuous line and a short dashes line;
- Fig. 7 is a working scheme of a mechanism contrasting the extension action of the back represented in Fig. 6;
- Fig. 8 represents a schematic plane section of a mechanism of Fig. 6;
- Fig. 9 shows a portion of the mechanism of Fig. 8 in order to clarify the run of the forces in the compensation mechanism.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0017] Fig. 1 represents the device 1 for physical training of mobilisation of para-vertebral muscles comprising: a frame 2 housing a reacting mechanism, supports 3 for guiding a shaft 4, a cam 5, preferably placed on the shaft, to press a plurality of springs. The supports 3 are integral with the frame and the shaft 4 holds the back 6 by a prismatic coupling. So doing, the rotation of the back 6 around the axis of the shaft 4 transmits the couple applied to the back 6 to the cam 5.

[0018] Fig. 2 shows the device 1 in the very instant when the back 6 is moved from the transporting position to the working position of Fig. 3.

[0019] The back 6 is fitted with a telescopic mechanism modifying the distance between the axis of the shaft 4 and the support for the back 7, in working conditions with respect to the transporting condition the support 7 is connected to the back 6.

[0020] In Fig. 3 the frame 2, connected to the back 6 by means of the shaft 4, allows the training by resting the back on the support 7 and sitting on the frame 2. A seat (not shown) holds the frame 2. A knob 8 for an adjusting screw protrudes from the front of the frame 2 considering the back 6.

[0021] A bracket 9 represented in Fig. 4 fixes the frame 2 to the seat by means of a clamp 10.

[0022] Fig. 5 schematically shows the cam 5 moving with the shaft 4. When the shaft 4 moves, owing to the movement of the back 6, the cam 5 acts on a tappet 11, a plurality of springs 12 acting on the tappet 11 against the action of the cam 5. A limit stop 13 stopping the tappet 11 limits the extension of the springs 12 towards the axis of the shaft 4. The contact between the cam 5 and the tappet 11 occurs by means of an antifriction bearing

14 for limiting the frictions and wears.

[0023] Fig. 6 demonstrates how a correspondence between the angular positions of the back 6 and the angular position of the cam 5 exists. In the maximum extension position, shown in Fig. 6a, the back 6 has reached the limit stop defined by an abutment 15 stopping the tappet 11 and limiting the compression of the springs 12. In the rest position, shown in Fig. 7, the back 6 is in vertical position and the cam 5 does not act on the tappet 11 resting on the limit stop 13.

[0024] In Fig. 8 the cam 5 integral with the shaft 4 acts on the tappet 11 to compress the springs 12 when the back 6 is in a position comprised between the extreme positions of Fig. 6.

[0025] The ends of the springs 12 press on the tappet 11, said ends being opposite to the ends resting on a support 16. The distance of the support 16 from the tappet 11 is adjustable by means of an adjusting screw 17 acted by the knob 8. The distance is adjusted when the back 6 is in vertical rest position as in Fig. 6. Because of this adjusting the screw 17 rotates within housing 18 finding in a wall 19 of the frame 2 as shown in Fig. 8. The axial translation of the screw 17 is prevented by an abutment 20 in the direction of the action of the springs 12 and the knob 8 in the opposite direction.

[0026] By rotating the screw 17 by means of the knob 8 the threaded end 21 of the screw 17 engaging a threaded hole 22 of the support 16 causes the axial translation so that it approaches or leaves from the tappet 11 according to the rotation direction of the knob 8.

[0027] The translation of the support 16 allows to adjust the pre-stressing of the springs 12 when the back 6 is in vertical rest position. An index 23 situated in a position visible for the trainer indicates, on a graduated scale 24, the value of the pre-stressing of the springs 12.

[0028] The counter stress F contrasting the action of the back against the support 7 is caused by the push S of the springs 12 against the cam 5. The adjusting of the push S is due to the adjusting of the position of the support 16 with respect to the tappet 11 in rest position.

[0029] Both stresses F and S are in equilibrium during the training. In rest position the push S is equilibrated by the reaction of the abutment 13. The reaction S of the support 16 discharges on the screw 17 either during the training or in rest position of the back 6.

[0030] Owing to the push S being necessary for the training and to the efficiency of the helical coupling consisting of the end 21 and the hole 22, the couple to be applied to the knob 8 for said adjusting cannot be reached by fingers without proper tools. Therefore, in order to obtain the adjusting by using the fingers only, the mechanism of Fig. 8 is suggested. In this mechanism the elements as shown in Fig. 8 exist together with a compensating mechanism of the push S when the back 6 is in rest position.

[0031] This mechanism consists of two opposite spring groups 25, 26 resting on a supporting sleeve 27 where the screw 17 slides. The springs 25, 26 act, re-

spectively, on the lowest parts 28,29 to compress two symmetrical couples of connecting rods 30,31. The couple of connecting rods 30 symmetrically discharges on the support 16, while the couple 31 symmetrically acts on the wall 19 of the frame 2. According to this configuration the springs 12 and the springs 25,26, properly planned, exchange elastic energy during the moving of the support 16 for the adjusting. Therefore, when the back 6 is in rest position, the adjusting of the push S, owing to the adjusting of the position of the support 16 with respect to the tappet 11 in rest position, does not require a stress stronger than the one due to the frictions. Consequently, the adjusting is carried out by rotating the knob 8 by using the fingers only aside the value of the push S. In the configuration of Fig. 9 just the difference between the strongest value of the push S reached in the position of the longest extension of the back 6 and the weakest value of the push S in rest position of the back 6 discharges. The consequence of this feature is that the screw 17 in rest position is unloaded for any position of the support 16; this is the reason why the adjusting of the push S in rest position of the back 6 is carried out by rotating the knob 8 by fingers only.

[0032] The above description relates to one of the possible embodiments of the invention and it can be fully modified.

[0033] In a not represented embodiment, a rod adjusts the position of the support 16 with respect to the tappet 11 in rest position of the back 6. The rod is fitted with holes or notches where a stopping ratchet gear engages.

[0034] In a second not represented embodiment the distance between the axis of the shaft 4 and the support for the back 7 is adjusted by a telescopic mechanism, advantageously fitted with holes where elastic stopping elements engage to fix the telescopic mechanism at the distance suitable for the physical features of the patient for a correct training.

[0035] In a further not represented embodiment a zero setting counter-cycles connected to the mechanism of the back 6 is provided to counter the bending number for each session.

es the return stroke of the back (6) from the maximum extension position to the rest position; a system (16, 17) is further provided for regulating the push due to the reacting mechanism (12), said regulation occurring when the back (6) is in the rest position.

2. Device as in claim 1, wherein the back (6) is closed around the frame (2) in a position allowing the transport of the device and it is open to carry out the training.
3. Device as in claims 1 and 2, wherein a mechanism is provided changing the distance between the axis of the shaft (4) and a support for the back (7) connected to the back (6).
4. Device as in claim 1, wherein the regulating system (16, 17) of the push due to the reacting mechanism (12) consists of an adjusting screw (17) acted by a knob (8) regulating the distance of a support (16) with respect to a tappet (11); the adjusting of the distance occurs when the back (6) is in rest position; in order to obtain the adjusting the screw (17) rotates within a housing (18) found in a wall (19) of the frame (2), the axial translation of the screw (17) is prevented by an abutment (29) in the direction of the action of the springs (12) and by the knob (8) in the opposite direction.
5. Device as in claims 1 and 4, wherein the regulating system (16, 17) comprises also a compensating mechanism.

Claims

1. Device for physical training of mobilisation of paravertebral muscles, **characterised by** the fact that it comprises at least a frame (2) housing a reacting mechanism (12), the patient sitting on the frame (2); supports (3) guiding a shaft (4) supporting a back (6), the back (6) being capable of moving from a rest position to a position of maximum extension by rotating around the axis of the shaft (4) under the action of the back of the patient and the reacting mechanism (12); the reacting mechanism (12) contrasts the displacement of the back (6) from the rest position to the position of maximum extension and caus-

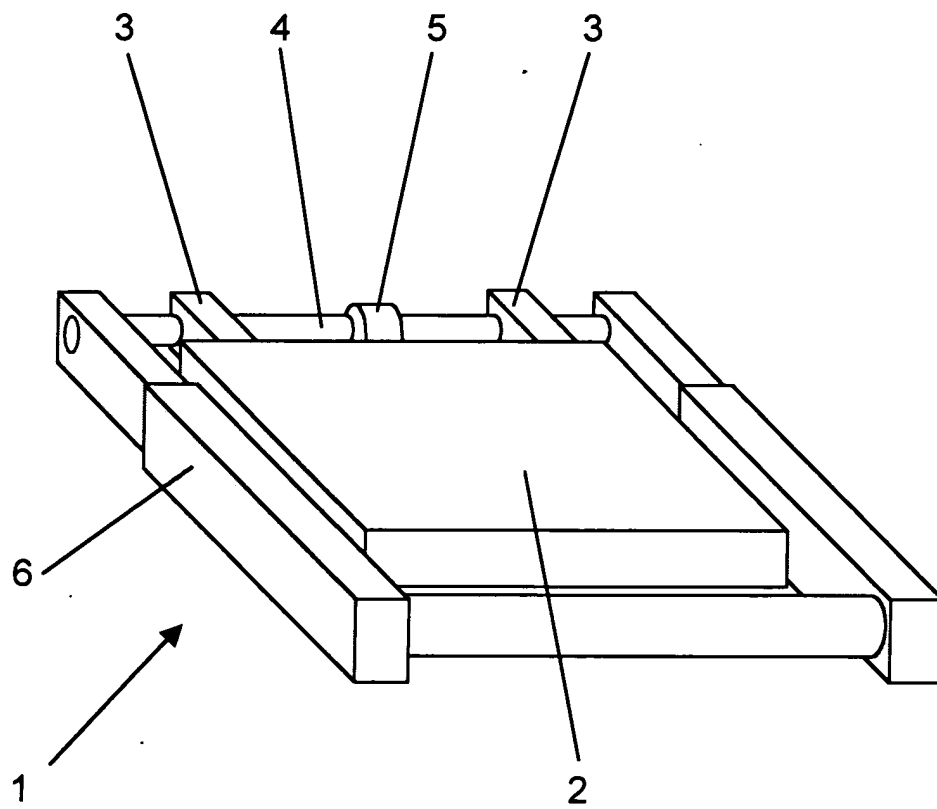


Fig. 1

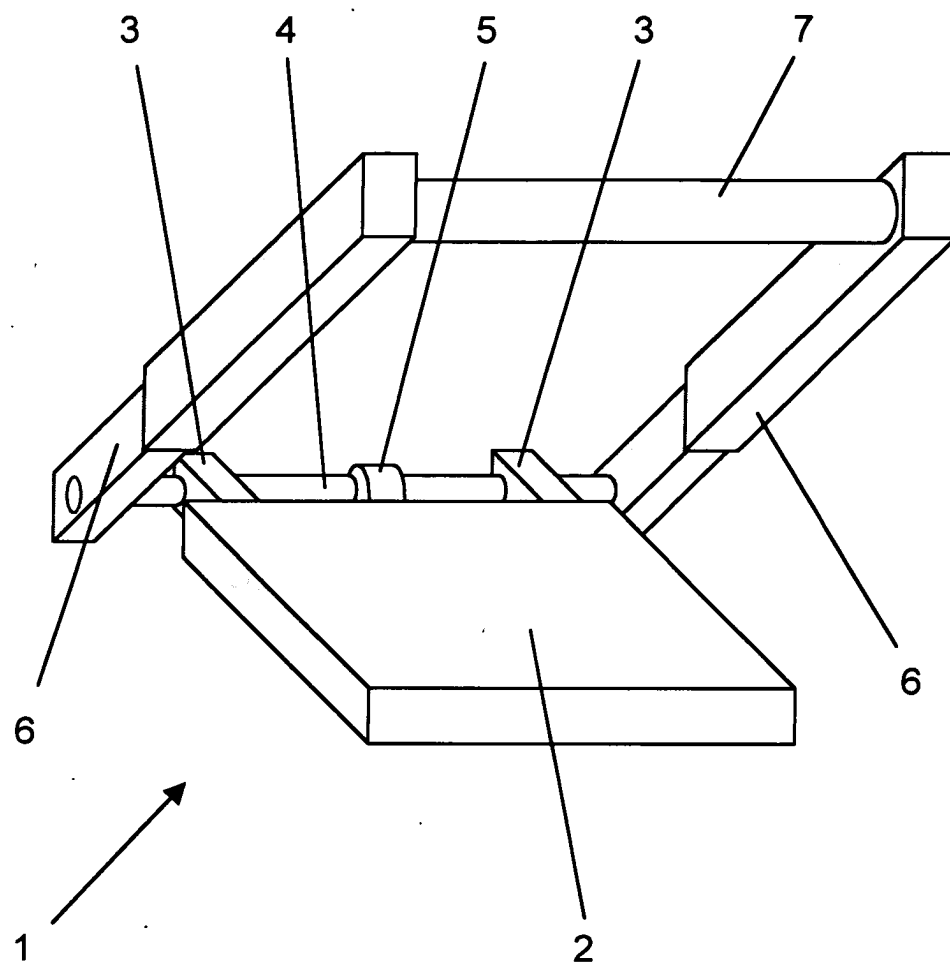
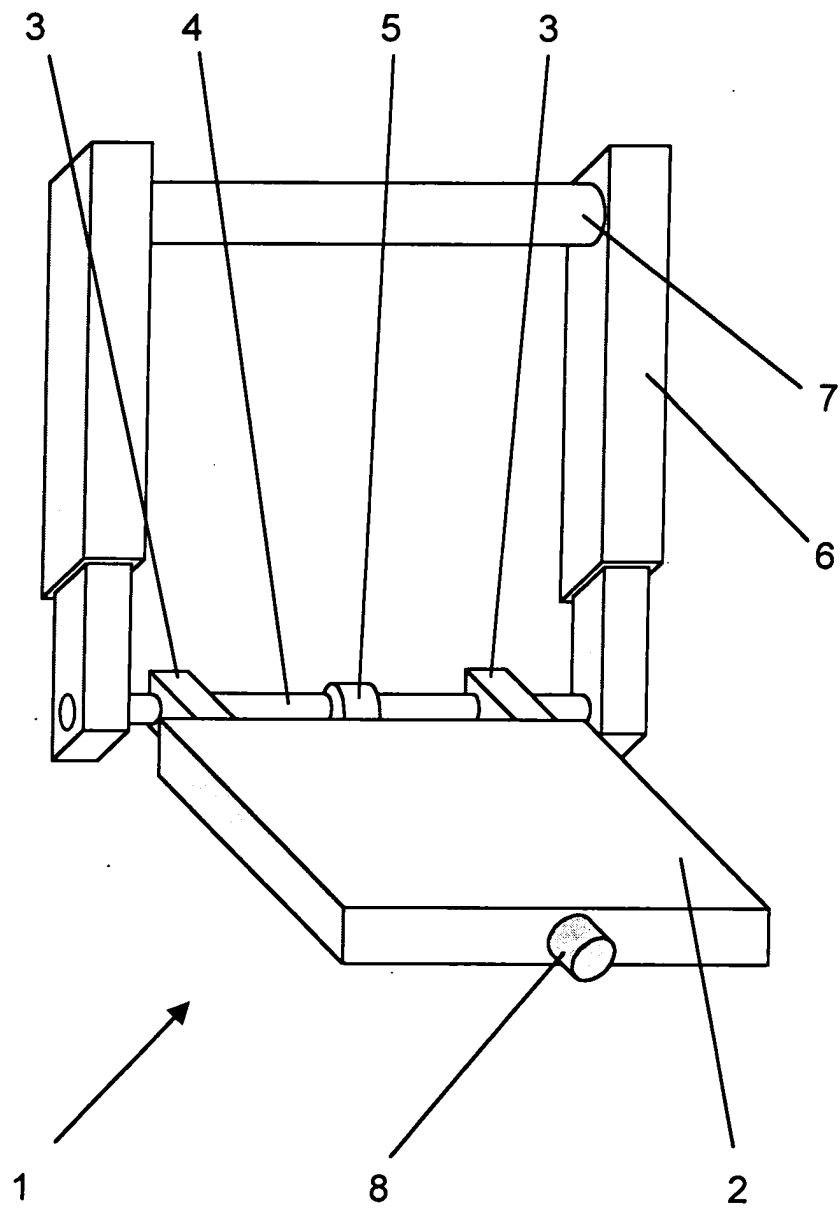


Fig. 2

Fig. 3



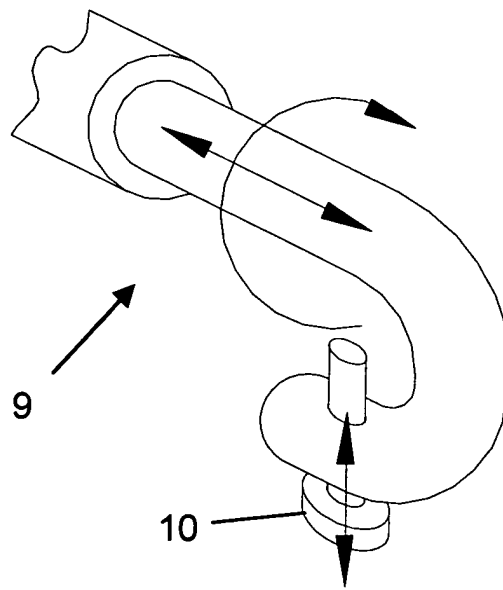


Fig. 4

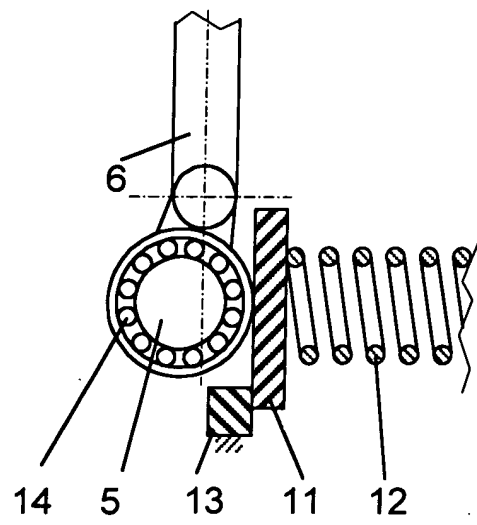


Fig. 5

Fig. 6

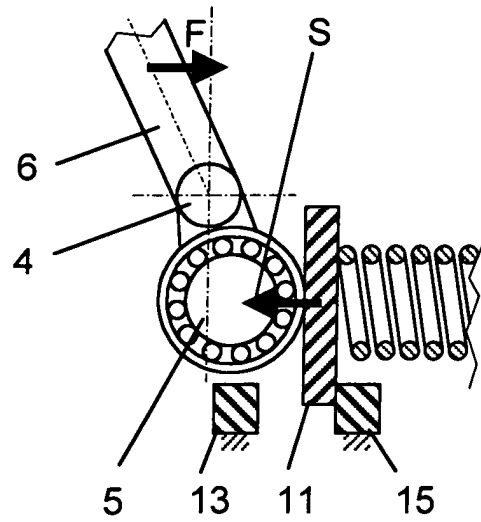
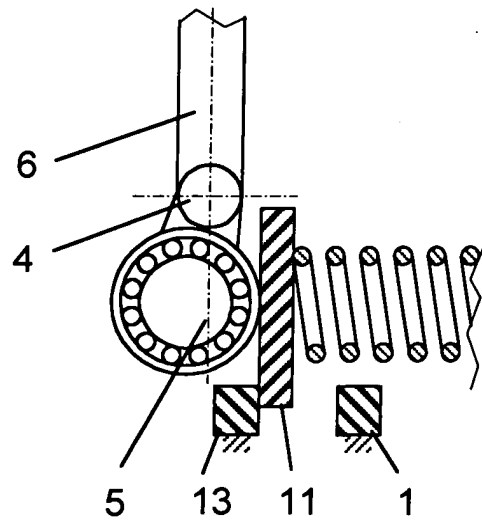


Fig. 7



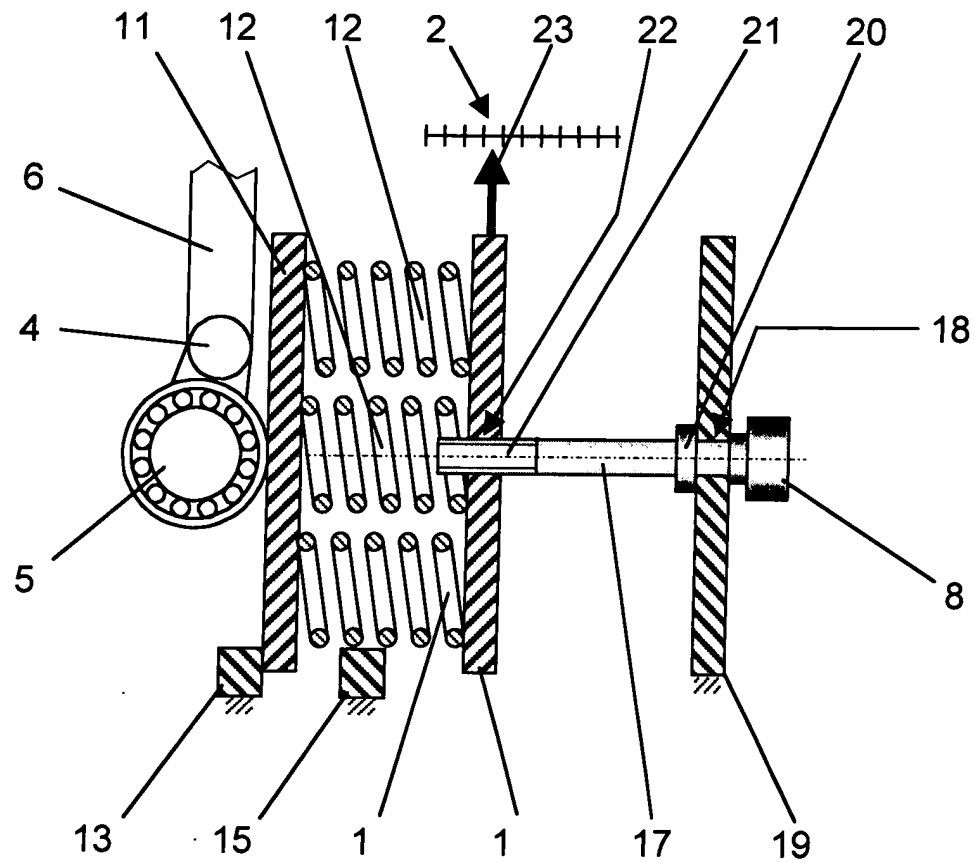


Fig. 8

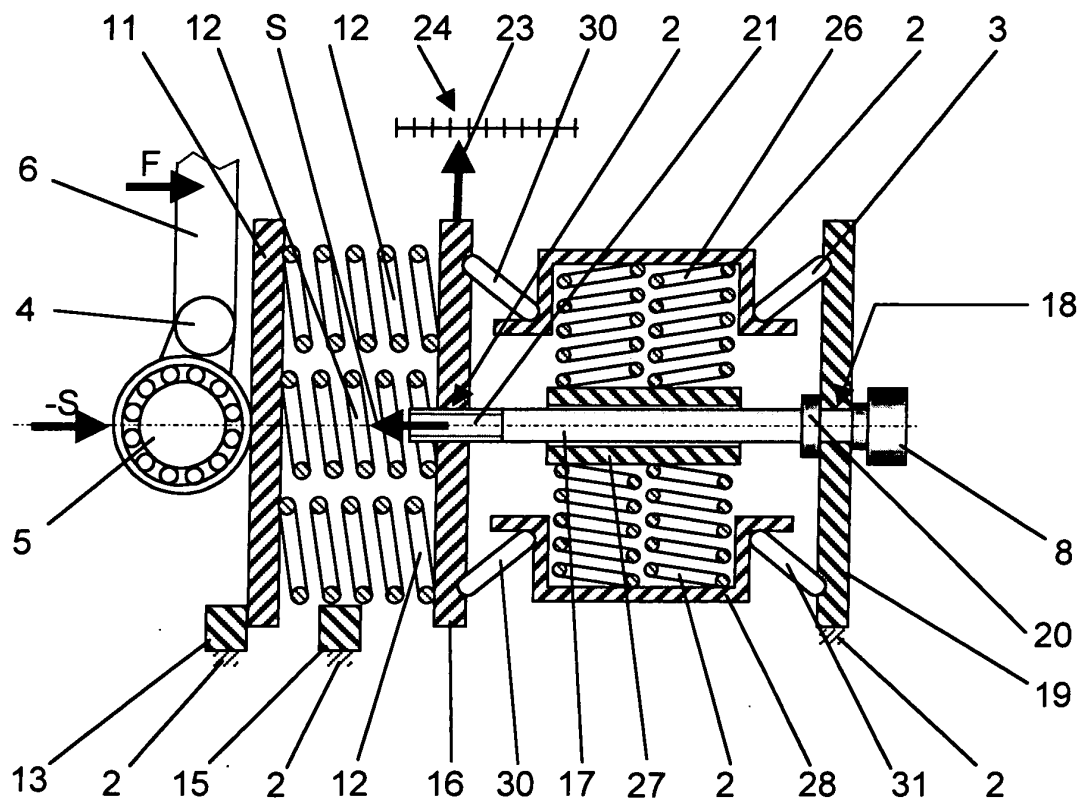


Fig. 9