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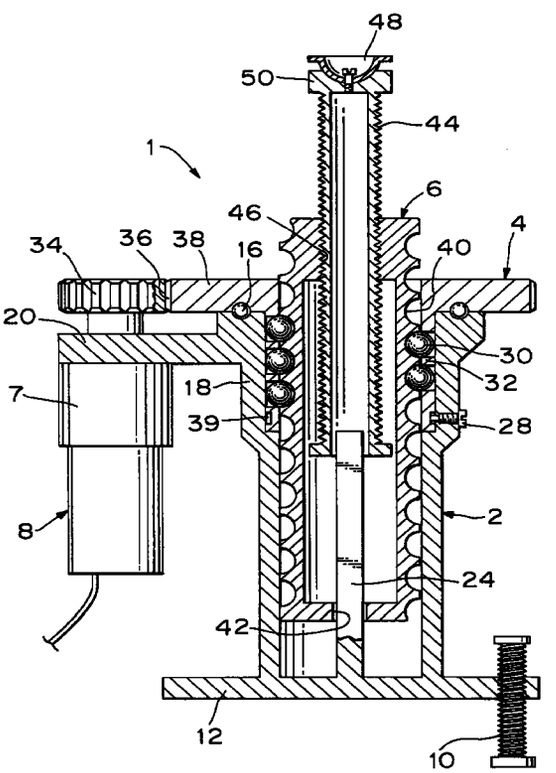
(54) Jack

(57) A jack (1) utilizing a bearing ball and screw assembly (30, 32) comprises a fixed sleeve (2), a drive screw section (4) rotatable supported in the fixed sleeve (2), an output screw section (6) engaged with the drive screw section (4) by means of a bearing ball and screw assembly (30, 32) and a drive mechanism (7, 8) provided with a reduction gear (34, 36, 38) supported by the fixed sleeve (2) and interlocked with the drive screw section (4). The jack (1) is lightweight and compacts and produces an astounding output power.

FIG. 1



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Description

FIELD OF THE INVENTION

This invention relates to a jack utilizing a bearing ball and screw assembly and, more particularly, it relates to a jack that can be used as a small electric jack.

PRIOR ART

Known technologies concerning the jack of the type under consideration include the following;

Japanese Patent Publication No. 4-56956 discloses a bearing ball and screw assembly comprising a fixed sleeve, an lifting sleeve arranged within said fixed sleeve and a male screw member arranged within said lifting sleeve. Said male screw member is secured to a driven gear arranged at a lower portion of the fixed sleeve and located at the center of the fixed sleeve. Said lifting sleeve retains a plurality of bearing balls engaged with the male screw of said male screw member and is provided on the outer surface thereof with a vertical groove for engagedly receiving a rotation check ball. As the driven gear and the male screw member are rotated, the bearing balls rotate and move inside the male screw to raise and lower said bearing ball and said lifting sleeve.

An assembly having the above described configuration is accompanied by a problem that the lifting sleeve has to be made thick and heavy to show a predetermined strength, since a vertical groove is formed there.

Japanese Patent Publication No. 4-74761 discloses another bearing ball and screw assembly comprising a fixed sleeve, a lifting sleeve arranged within said fixed sleeve and a rotary shaft arranged within said fixed sleeve. Said rotary shaft is secured to a driven gear arranged at a lower portion of the fixed sleeve and located at the center of the fixed sleeve. Said lifting sleeve is provided on the outer surface thereof with a vertical rotation check groove and on the inner surface thereof with a male screw. Said rotary shaft retains a plurality of baring balls engaged with said male screw. As said driven gear and said rotary shaft are rotated, the bearing balls rotate and move inside the male screw to raise and lower the lifting sleeve.

An assembly having the above described configuration is accompanied by a problem that the process of arranging a female screw on the lifting sleeve costs considerably and the lifting sleeve has to be made thick and heavy to show a predetermined strength, since a male screw and a rotation check groove are arranged there. Further, the rotary shaft has to made thick and heavy so as to retain the plurality of bearing balls on the outer surface thereof.

Japanese Patent Publication No. 4-077049 discloses a bearing ball and screw assembly comprising a fixed sleeve, a rotary sleeve rotatably supported in said fixed sleeve and a lifting sleeve arranged within said fixed sleeve. Said lifting sleeve is provided on the outer surface thereof with a male screw and a plurality of bearing balls are arranged on said rotary sleeve and engaged with said male screw. Said lifting sleeve is additionally provided at a lower portion of the outer surface with a vertical rotation check groove. A rotation check pin is arranged at a lower portion of the inside of said fixed sleeve where said rotary sleeve is not extending. Said rotary sleeve is provided on the outer surface thereof with a pawl that engages with a ratchet arranged on said fixed sleeve. As the rotary sleeve is manually rotated in a selected direction, said bearing balls rotate and move inside said male screw to raise the lifting sleeve. When the hand rotating the rotary sleeve is released, said lifting sleeve is pulled downward by a weight supporting said lifting sleeve, trying to rotate said rotary sleeve in the other direction but any rotary motion on the part of the rotary sleeve is checked by said ratchet. Once the ratchet is released, said rotary sleeve rotates to lower said lifting sleeve.

An assembly having the above described configuration is accompanied by a problem that, when said ratchet is released to allow the weight supporting said lifting sleeve to fall, said weight requires to be slightly lifted by means other than the assembly, an operation impossible to be carried out in most cases.

Japanese Patent Publication No. 6-40360 discloses an assembly substantially same as the one in the above Japanese Patent Publication No. 4-77049 but does not comprise a ratchet for preventing the weight from falling down. Thus, an assembly as disclosed in Japanese Patent Publication No. 6-40360 can be used only for the purpose of lifting the weight is lifted or enlarging the distance between the weight and the underlying structure.

SUMMARY OF THE INVENTION

In view of the above identified problems of the prior art, it is therefore the object of the invention to provide a jack that is lightweight and compact and can be electrically driven and further reliably controlled to extend and contract itself in order to lift an object.

According to the invention, the above object is achieved by providing a toggle joint characterized in that it comprises a fixed sleeve, a drive screw section rotatably supported in said fixed sleeve, an output screw section engaged with said drive screw section by means of a ball and screw assembly and a drive mechanism provided with a reduction gear supported by said fixed sleeve and interlocked with said drive screw section.

In a preferred mode of carrying out the invention, bearing balls are arranged between said fixed sleeve and said drive screw section. In another preferred mode, said output screw section is provided with a device for controlling the height of the output. In still another preferred mode, the axial line of said output screw section and that of said drive mechanism are parallel relative to each other. In still another preferred mode, the axial line of said output screw section and that of said drive mechanism rectangularly intersect each other and said drive mechanism and said drive screw section are engaged with each other by means of a worm gear. In a further pre-

ferred mode, said fixed sleeve, said drive screw section and said output screw section that is engaged with said drive screw section by means of a ball and screw assembly and blocked against any rotary movement are housed in a waterproof box and an extension of said output screw section is housed in a waterproof bellows device.

BRIEF DESCRIPTION OF THE INVENTION

Fig. 1 is a cross sectional view of a first embodiment of jack according to the invention.

Fig. 2 is a cross sectional view of a second embodiment of jack according to the invention.

Fig. 3 is a cross sectional view of a third embodiment of jack according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

Now, the present invention will be described by referring to the accompanying drawings that illustrate preferred embodiments of the invention.

Referring firstly to fig. 1 that illustrates a first embodiment of the invention, a jack 1 comprises a fixed sleeve 2, a drive screw section 4 rotatably supported in said fixed sleeve 2, an output screw section 6 engaged with said drive screw section 4 by means of bearing ball and screw assembly, and a drive motor 8 provided with a reduction gear 7 supported by said fixed sleeve 2 and interlocked with said drive screw section 4. Said motor 8 may be a DC motor or an AC motor.

The fixed sleeve 2 is constituted by a base section 12 provided with a plurality of height adjusting screws 10 for adjusting the inclination of the base section, a sleeve section 18 for axially supporting a drive screw section 4 at an upper portion thereof and bearing the weight of the drive screw section 4 on the upper surface thereof by way of a plurality of first bearing balls 16 and an arm section 20 for supporting the motor 8 such that the axis of rotation of the motor 8 is vertically held. The fixed sleeve 2 additionally has in the inside, upright anti-rotation member 24 for checking any rotation movement of the output screw section 6. A slip-out check screw 28 is arranged at a lower portion of the sleeve 18 for preventing the drive screw section 4 from coming out of the fixed sleeve 2.

The drive screw section 4 is constituted by a ball sleeve section 32 for rotatably supporting a plurality of second bearing balls 30 in a plurality of penetrate holes thereon, respectively, and a gear section 38 provided on the lower surface thereof with an annular groove for receiving first bearing balls 16 and along the periphery thereof with teeth 36 for engaging with output teeth 34 of the motor 8. The sleeve section 32 is provided a a lower portion on the outer surface thereof with an annular groove 39 for engaging with the check screw 28. The sleeve section 32 has a thickness equal to a radius of the second bearing balls 30.

The output screw section 6 is provided on the outer surface thereof with a helical groove 40 for engaging with the second bearing balls, at a lower portion thereof with a anti-rotation bore 42 through which the anti-rotation member 24 slidingly moves and at an upper portion thereof with a thread 46 for engaging with an output height adjusting screw member 44. The output height adjusting screw member 44 has at the top thereof a large diameter section 50 to be manually rotated. The large diameter section 50 pivots a receiving member 48 on the sperical surface thereof.

The above described embodiment of jack 1 is operated in a manner as described blow. Firstly, the fixed sleeve 2 is directed to a desired direction such as a vertical direction by appropriately rotating some height adjusting screws 10. Then, the receiving member 48 is made to abut an object to be lifted (not shown) by appropriately rotating the height adjusting member 44. Thereafter, the motor 8 is energized to drive the drive screw section 4 to rotate. As the drive screw section 4 rotates, the second bearing balls 30 slidingly move within the helical groove 40 of the output screw section 6 which is blocked against any rotary movement to lift the output screw section 6.

The above described jack 1 is lightweight and compact and, in addition, can produce an astounding power of lifting 1.25 tons, if it is connected a 6 to 12 volt battery of an automobile or a motor bicycle and selected a reduction ratio of 1/100 to 1/250 for the reduction gear 7, a reduction ratio of 1/3.5g of the output teeth 34 to the gear section 38, and a pitch of 8mm of the helical groove 40 of the output screw section 6.

Fig. 2 shows a second embodiment of jack according to the invention. The components of this embodiment that are similar to those of the first embodiment will be denoted respectively by the same reference numerals and will not be described here any further. The jack 100 comprises a motor 104 provided with a reduction gear 102 is supported horizontally on an arm 110 of the fixed sleeve 2. The output gear of the motor 104 is a worm gear 112 that engages with a bevel gear 122 arranged in a gear section 120 of the drive screw section 4.

Fig. 3 shows a third embodiment of jack according to the invention which is a waterproof type apparatus. Referring to Fig. 3, the jack 200 comprises, as in the case of the first embodiment, a fixed sleeve 2 (not shown), a drive screw section 4 (not shown) rotatably supported in the fixed sleeve 2, said fixed sleeve 2 and said drive screw section 4 being housed in a waterproof box 210, an output screw section 6 and a height adjusting screw member 44 having an extension 202, said output screw section 6 and said extension 202 being airtightly covered by a waterproof bellows 204 and a bellows supporting member 206 for supporting the bellows 206 by way of a packing 208.

A fourth embodiment of jack according to the invention is similar to the first embodiment. The second bearing ball 30 in the first embodiment is located in the penetrate hole, but the two second bearing balls 30 in the fourth embodiment are located in each penetrate hole so that the sleeve section has a thickness of one

and half diameter of the second bearing ball 30. The fourth embodiment is characterized to be strongly built, compared with the first embodiment.

Claims

1. A jack (1; 100; 200) characterized in that it comprises a fixed sleeve (2), a drive screw section (4) rotatable supported in said fixed sleeve (2), an output screw section (6) engaged with said drive screw section (4) by means of a bearing ball and screw assembly (30, 40) and a drive mechanism (8, 7; 104, 102) provided with a reduction means (7; 102) supported by said fixed sleeve (2) and interlocked with said drive screw section (4).

2. A jack according to claim 1, wherein bearing balls (16) are arranged between said fixed sleeve (2) and said drive screw section (4).

3. A jack according to claim 1, wherein said output screw section (6) is provided with a device (50, 44, 46) for controlling the axial extension of the output screw section (6).

4. A jack according to claim 1, wherein the axial line of said output screw section (6) and that of said drive mechanism (8, 7) are parallel relative to each other.

5. A jack according to claim 1, wherein the axial line of said output screw section (6) and that of said drive mechanism (104, 102) are arranged rectangularly with respect to each other and said drive mechanism (104, 102) and said drive screw section (4) are engaged with each other by means of a worm gear (112).

6. A jack according to claim 1, wherein said fixed sleeve (2), said drive screw section (4) and said output screw section (6) that is engaged with said drive screw section (4) by means of the bearing ball and screw assembly (30, 40) and blocked against any rotary movement are housed in a waterproof box (210) and an extension of said output screw section is housed in a waterproof bellows device (204).

7. A jack according to claim 1, wherein reduction means is a said reduction gear assembly (7).

FIG. 1

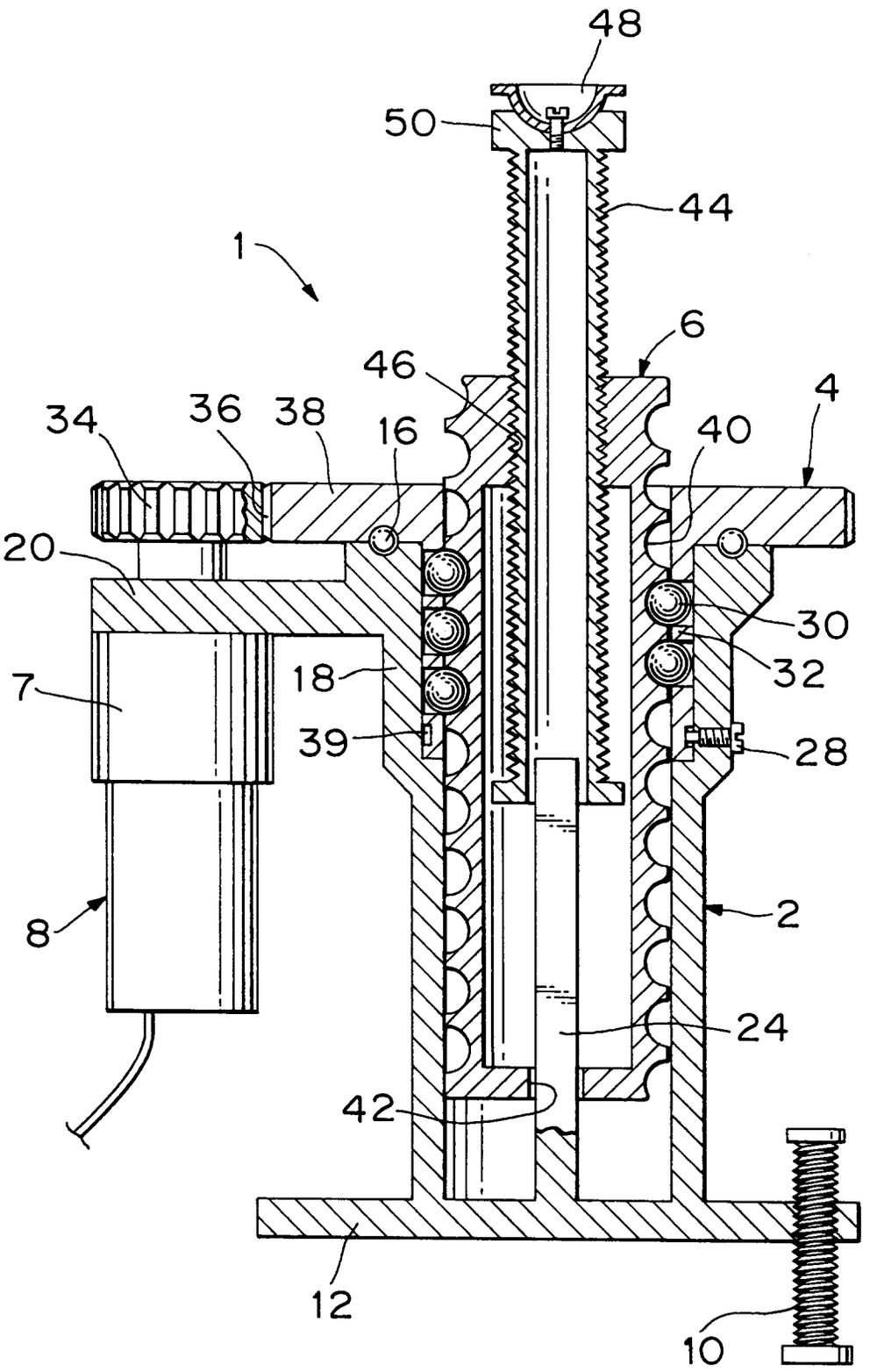


FIG. 2

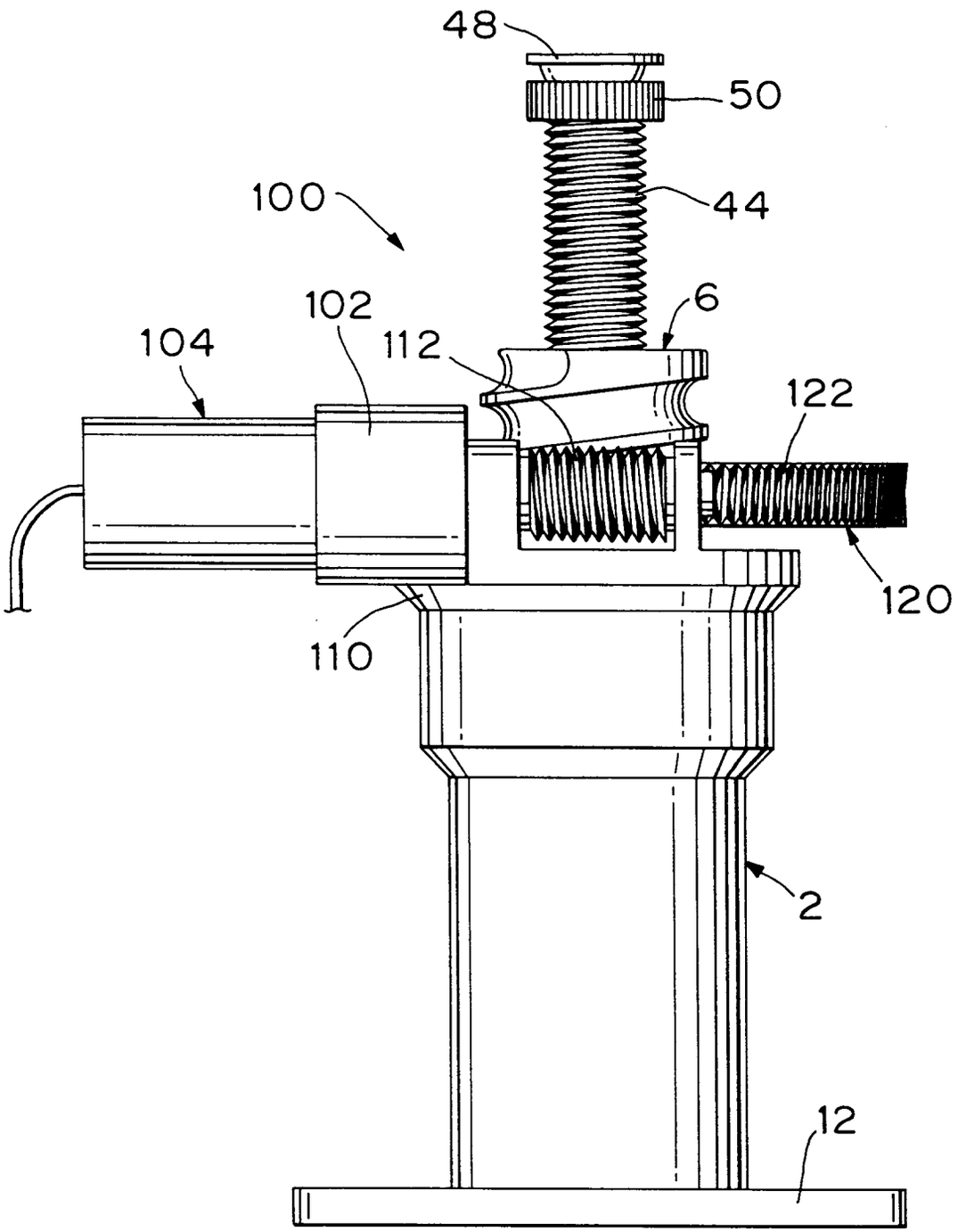
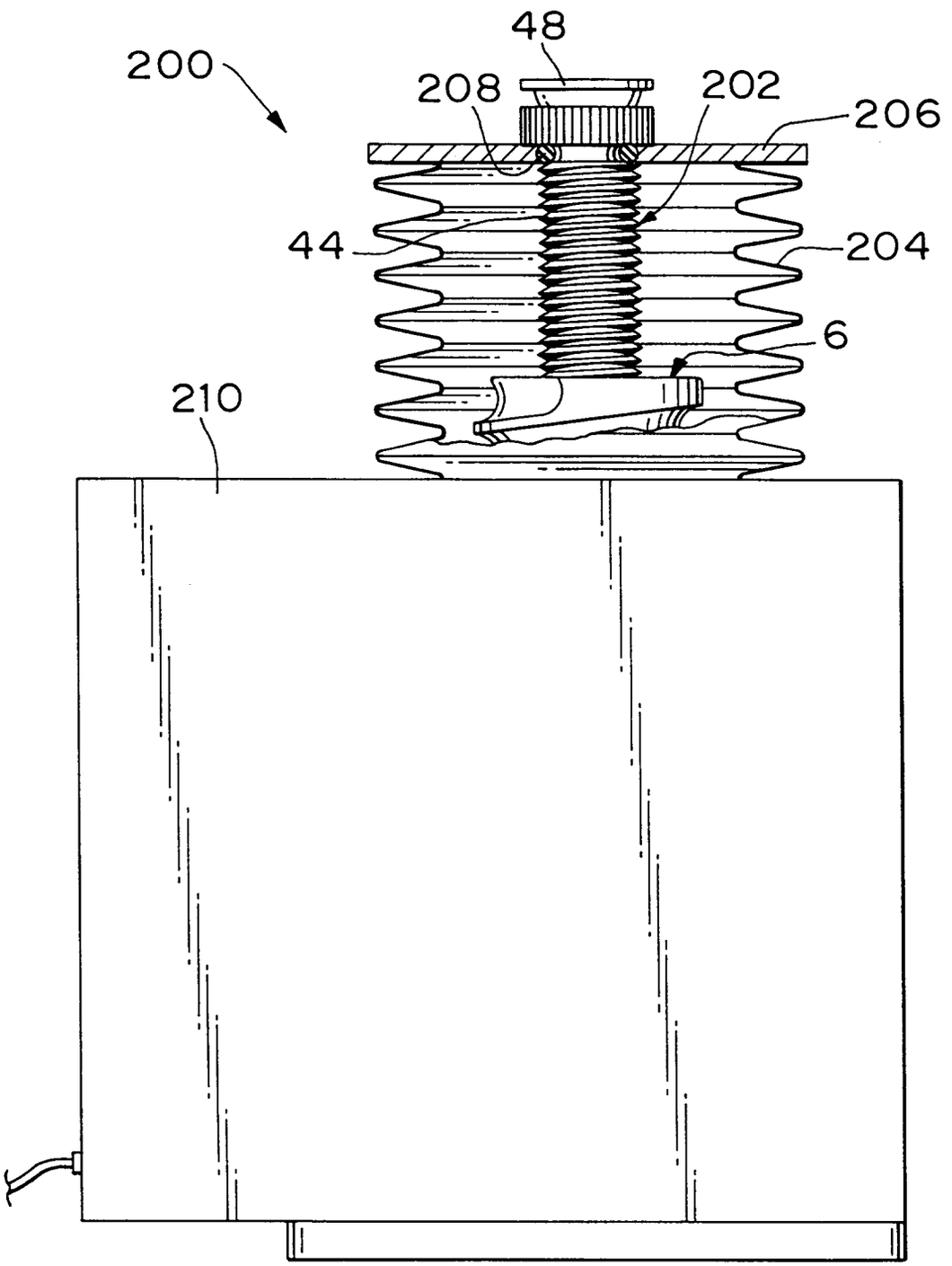


FIG. 3



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 10 8132

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	GB-A-145 991 (APPERLEY) * the whole document *	1-4,7	B66F3/44 B66F3/08 B66F3/18
Y	DE-U-18 38 870 (WEGMANN) * the whole document *	1-4,7	
A	US-A-1 423 834 (CRUM) * figure 2 *	1-4,7	
A	US-A-1 414 683 (ANGLADA) * figures 1-3 *	1,5,7	
A	FR-A-2 407 400 (WALLIS) * page 3, line 2 - line 10; claims 1-4; figures 1,4,5 *	6	
A	GB-A-J07038 (FOSTER) & GB-A-07038 A.D. 1909 * figures 1-3 *	1,4,7	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) B66F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	4 September 1995	Thomas, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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