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(54) **Actuation device with variable balancing for sliding doors of furniture.**

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GB-A- 382 220
GB-A- 754 832

(73) Proprietor : **B & B ITALIA S.p.A.**
Corso Europa 22
Milano (IT)

(72) Inventor : **Busnelli, Giorgio**
Via Privata del Carso S. Martino della Battaglia 8
Cabiate (Como) (IT)

(74) Representative : **Raimondi, Alfredo, Dott. Ing. Prof. et al**
Dott. Ing. Prof. RAIMONDI ALFREDO S.r.l.
Piazzale Cadorna 15
I-20123 Milano (IT)

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Jouve, 18, rue Saint-Denis, 75001 PARIS

Description

This invention relates to an actuation device with variable balancing for sliding doors of furniture and the like, especially of the type having shelves.

Many devices are known in the art for balancing sliding doors for closing items of furniture, which are normally based on the use of counterweights which, in addition to causing a doubling of the mass with consequent increase in the total weight of the product and of the inertia of the doors themselves, need to be housed in the back walls of the furniture, thereby requiring the provision of said wall, even when this would not be necessary, and causing a reduction in the effective useful space of the item of furniture or, in contrast, an increase in the overall bulk of the furniture for a given available useful space.

It is also known from DE 29 22 780 means corresponding to the preamble of claim 1.

The problem therefore arises of creating an actuation device which, in every position, shall maintain in equilibrium the forces acting on sliding doors of items of furniture and the like , especially of the type comprising shelves, for the purpose of keeping to a minimum the force to be exerted by the user for raising and lowering the door.

Said device must be of small bulk and weight, capable of being housed in correspondence with the lateral wall of the furniture, a wall which in any case must be present as it constitutes the load-bearing structure of same, and which shall be easy to install and maintain and of low cost.

This technical problem is solved by an actuation device according to the characterizing portion of claim 1, which provides means for balancing variable forces, especially for sliding doors of furniture, comprising supporting and guiding means for the sliding door, capable of engaging with movable suspension means adapted for enabling said door to be moved in translatory motion, said movable suspension means being firmly attached to elastic means adapted for imparting to said suspension means a variable reaction force, which in every possible position and at every instant balances the forces acting on them.

According to the present invention, said supporting and guiding means for the sliding door are constituted, for each side of the door, of a vertical carriage integral with the edge of said door, slidable on the side of the furniture item along lateral guides perpendicular to one another and fitted to the side of the furniture, and having a horizontal arm orientated towards the back wall, said arm bearing upon a wheel attached to a suspension link, onto which the weight of the door is transferred, said suspension link being, in turn, articulated to the free end of a rod pivotally mounted on the side wall of the furniture item, said free end being also connected to elastic reaction means for the automatic and instantaneous balancing of the weight of the door in whatever position it is situated.

Preferably said link with its associated wheel, on which each edge of the door rests in slidable manner, always remains in a vertical position, transferring the weight of the door in a constant manner in regard to both value and direction.

It is also arranged that said elastic reaction means shall be preferably constituted of a spring or the like, having one end fixed in adjustable manner to the wall of the furniture item and the other end to the free end of said rod, it being possible for said spring to be arranged with a variable line of action depending upon the position of the point of attachment to said rod, which in turn can be varied with the position of the door.

These and other characteristics will become more evident from the following description of an example of embodiment of an actuation device with variable balancing according to this invention, the description having been prepared with reference to the attached drawings, in which there are shown:

in Figure 1: a side view of the device on one internal side of the furniture item and in a position corresponding to the door fully raised;

in Figure 2: the device of Figure 1, seen in a position corresponding to the door fully lowered;

in Figure 3: a section on the plane III-III of Figure 2;

in Figure 4: a view of a variant of the device according to this invention, which can be used in the case of a door having twice the distance of travel.

With reference to the figures, the actuation device with variable balancing 1, according to this invention, is composed a rod 2 having one end 2a pivotally mounted in a predetermined position fixed to the side wall 100a of the furniture item 100, the other end 2b of said rod being free and having, articulated to it, a link 3, the free end of which supports a wheel 4, engaged to run on a horizontal arm 5 of a carriage 6 with vertical direction of travel, to which is attached one edge of the vertically slidable door 7.

As can be more readily seen from Figure 37 the suspension carriage 6 for the door 7 is guided on its vertical travel by two pairs of wheels 8a, 9a and 8b, 9b, disposed at 90° to one another and mounted on the carriage 6, which run in two guides 10 and 11 of a profile member 10a fixed to the side of the furniture item, thus assuring perfect linearity of the displacement and the absence of skidding during said travel.

At the free end of the rod 2 there is also attached the end 12a of a spring 12, of which the other end 12b

is attached to the side of the furniture item by means of an adjustable fixing 13; said spring 12 extending between one end and the other with bearing on an idling change-direction pulley 14, on which it can run and which makes possible a greater effective length. The arrangement of the arm of the spring connected to the rod 2 in the initial direction is intended for the uppermost position of the door 7.

When the door passes from the fully raised position of Figure 1 to the fully lowered position of Figure 2, the free end of the rod 2 completes an arc of a circle 2c (indicated in broken line), along which a constant weight force P is applied, which generates a moment proportional to the distance D_j, which varies during the entire travel.

Because of the displacement of the point of action 2b of the suspension link 3 along the arc 2c with the rotation of the rod 2, the couple to be balanced is given by the product of the constant weight P times the arm D_j. The balancing action of the spring 12, acting along the line of action 12c, varies with the position of the end 2b of the rod 2 and will increase linearly with the extension of the spring during the travel of the rod 2, while the lever arm "d_i" will decrease with the same movement of the rod 2.

In this way a moment is generated between the fixed centre of rotation of the rod 2 and the line of action of the spring 12, which moment is applied to the end of the rod 2 in such a way as to balance, instant by instant, the aforementioned variable couple generated by the weight of the door 7 during the travel of the rod 2.

The values of the forces in play and of the action arms are, of course, dependent upon the dimensions of travel and upon the weight of the doors which make up the furniture item.

In Figure 4, there is shown a variant of the device according to this invention, which can be used in the case of a double door 7′; in this case, the carriage 6 is attached to the door 7′ in an intermediate position and bears on a wheel 4′, attached to one end of a cable 15, fixed at its other end to the side of the item of furniture and passing over a pulley 16, connected to the lever 2 in the form of a simple tackle.

In this manner there is obtained, by means of the transmission system described, a doubling of the effective travel of the door, without changing the total angular movement of the rod 2.

Given the possibility of variation in forces in action and the frictions which the moving elements encounter, even if the arrangement of the elements according to this invention remains fixed for each item of furniture, it is always possible for the reaction force provided by the elastic means for balancing the door in every position to be different, even though by only a small amount, from one case to another. For the purpose of achieving perfect balancing when the device is installed, it is provided, in the case where a spring 12 is used as in the example shown, that the end 12b connected to the pin 13 shall be capable of being displaced by acting on the fixing itself, in this way varying the initial tension of the spring 12.

Furthermore, said elastic reaction means may be realized by means of equivalent elements, such as air springs, fluid springs, rubber springs or the like, of known type adapted for providing an action which varies with the extension and a line of action which also is variable, but in the opposite sense for the purpose of achieving at every instant and in every position the balancing of the couples acting on the rod 2.

Claims

1. Actuation device with balancing of variable forces especially for vertically slidable doors (7) of a furniture item (100), this furniture item (100) presenting lateral (100a) and back walls, in which the actuation device comprises a supporting and guiding carriage (6) fixed on each lateral side edge of the door (7) which is slidable on the lateral wall of the furniture item along lateral guides characterized by the fact that said lateral guides are formed by profiled members (10a) having two mutually perpendicular tracks (10, 11) fitted to the lateral wall (100a) of the furniture and the supporting and guiding carriage having a horizontal arm (5) pointing away from the door (7) towards the back wall, said arm (5) bearing on a wheel (4) suspended from a suspension link (3), onto which the weight of the door (7) is transferred, said link being, in its turn, articulated to the free end (2b) of a rod (2), pivoted on the lateral wall (100a) of the item furniture (100), said free end (2b) being also connected to elastic reaction means (12) for the automatic and instantaneous balancing of the weight of the door in whatever position it is situated.

2. Actuation device on a furniture item with balancing of variable forces according to Claim 1, characterized by the fact that said link (3) with its associated wheel (4) on which each lateral side edge of the door (7) rests in slidable manner, always remains in a vertical position, transferring the weight of the door (7) in a manner constant both in value and in direction.

3. Actuation device on a furniture item with balancing of variable forces according to Claim 1, characterized by the fact that said elastic reaction means are preferably constituted of a spring (12) attached to the lateral

wall (100a) of the furniture item (100), the free end (12b) of said spring (12) being conducted around a change-direction pulley (14) and being anchored to the furniture by means of an adjustable fixing (13) to enable the initial tension of the spring to be varied according to the action of the door.

Patentansprüche

1. Betätigungsvorrichtung mit Ausgleich von variablen Kräften, insbesondere für vertikal verschiebbare Türen (7) eines Möbelstückes (100), wobei dieses Möbelstück (100) seitliche (100a) und rückwärtige Wände aufweist und wobei die Betätigungsvorrichtung einen Träger- und FührungsSchlitten (6) aufweist, der an einer jeden seitlichen Kante der Tür (7) befestigt ist, die auf der Seiten-Wand des Möbelstückes entlang seitlicher Führungen verschiebbar ist, **gekennzeichnet durch** die Tatsache, daß die seitlichen Führungen durch Profil-Elemente (10a) mit zwei zueinander senkrecht gerichteten Führungsschienen (10, 11) gebildet sind, die an der seitlichen Wand (100a) des Mobels angebracht sind, und daß der Träger- und FuhrungsSchlitten einen horizontalen Arm (5) aufweist, welcher von der Tür (7) weg in Richtung zu der rückseitigen Wand hin weist, wobei der Arm (5) auf einem Rad (4) gelagert ist, welches an einem Hänge-Gelenk (3) aufgehängt ist, auf welches das Gewicht der Tür (7) übertragen ist, und wobei dieses Gelenk seinerseits an dem freien Ende (2b) einer Stange (2) angelenkt ist, welche an der seitlichen Wand (100a) des Möbelstückes (100) drehbar gelagert ist, wobei ferner das freie Ende (2b) mit elastischen Reaktionsmitteln (12) verbunden ist, welche zum automatischen und augenblicklichen Ausgleichen des Gewichtes der Tür dienen, in welcher Stellung sich diese auch immer befindet.

2. Betätigungsvorrichtung an einem Möbelstuck, mit Ausgleich von variablen Kräften, nach Anspruch 1, **gekennzeichnet** durch die Tatsache, daß das genannte Gelenk (3) mit seinem ihm zugeordneten Rad (4), auf welchem eine jede seitliche Kante der Tür (7) in verschiebbarer Weise ruht, immer in einer vertikalen Stellung verbleibt, wobei das Gewicht der Tür (7) in einer konstanten Art und Weise sowohl hinsichtlich der Größe als auch hinsichtlich der Richtung übertragen wird.

3. Betätigungsvorrichtung an einem Möbelstuck, mit Ausgleich von variablen Kräften, nach Anspruch 1, **gekennzeichnet** durch die Tatsache, daß die erwähnten elastischen Reaktionsmittel vorzugsweise durch eine Feder (12) gebildet sind, welche mit der seitlichen Wand (100a) des Möbelstückes (100) befestigt ist, die freie Ende (12b) der genannten -Feder (12) um eine Umlenk-Rolle (14) herumgeführt und mittels einer einstellbaren Befestigungsvorrichtung (13) mit dem Möbel verankert ist, um zu ermöglichen, daß die Vorspannung der Feder entsprechend der Funktion der Tür variiert wird.

Revendications

1. Dispositif d'actionnement assurant l'équilibrage de forces variables, notamment destiné à des portes (7) coulissant verticalement dans un meuble (100), le meuble (100) ayant une paroi latérale (100a) et une paroi arrière, l'appareil de manoeuvre comprenant un chariot (6) de support et de guidage fixé sur chaque bord latéral de la porte et pouvant coulisser sur la paroi latérale du meuble le long de guides latéraux, caractérisé par le fait que les guides latéraux sont formés par des profilés (10a) ayant deux voies de guidage perpendiculaires entre elles (10, 11) montées sur la paroi latérale (100a) du meuble et le chariot de support et de guidage ayant un bras horizontal (5) dirigé du côté opposé à la porte (7) vers la paroi arrière, le bras (5) étant en appui sur une roue (4) suspendue à une bielle de suspension (3) à laquelle est transféré le poids de la porte (7), la bielle étant elle-même articulée à l'extrémité libre (2b) d'une barre (2) articulée sur la paroi latérale (100a) du meuble (100), l'extrémité libre (2b) étant aussi raccordée à un dispositif élastique (12) de rappel destiné à assurer l'équilibrage automatique et instantané du poids de la porte quelle que soit la position de celle-ci.

2. Dispositif d'actionnement placé sur un meuble et assurant un équilibrage de forces variables selon la revendication 1, caractérisé par le fait que la bielle (3), avec la roue associée (4) sur laquelle le bord latéral de la porte (7) repose de manière coulissante, reste toujours en position verticale et transfère le poids de la porte (7) de manière constante à la fois en valeur et en direction.

3. Dispositif d'actionnement placé sur un meuble et assurant l'équilibrage de forces variables selon la revendication 1, caractérisé par le fait que le dispositif élastique de rappel est de préférence constitué d'un

ressort (12) fixé à la paroi latérale (100a) du meuble (100), l'extrémité libre (12b) du ressort (12) est guidé sur une poulie (14) de renvoi et est fixé au meuble par une fixation réglable (13) afin que la tension initiale du ressort puisse être modifiée en fonction de l'action de la porte.

Fig.1

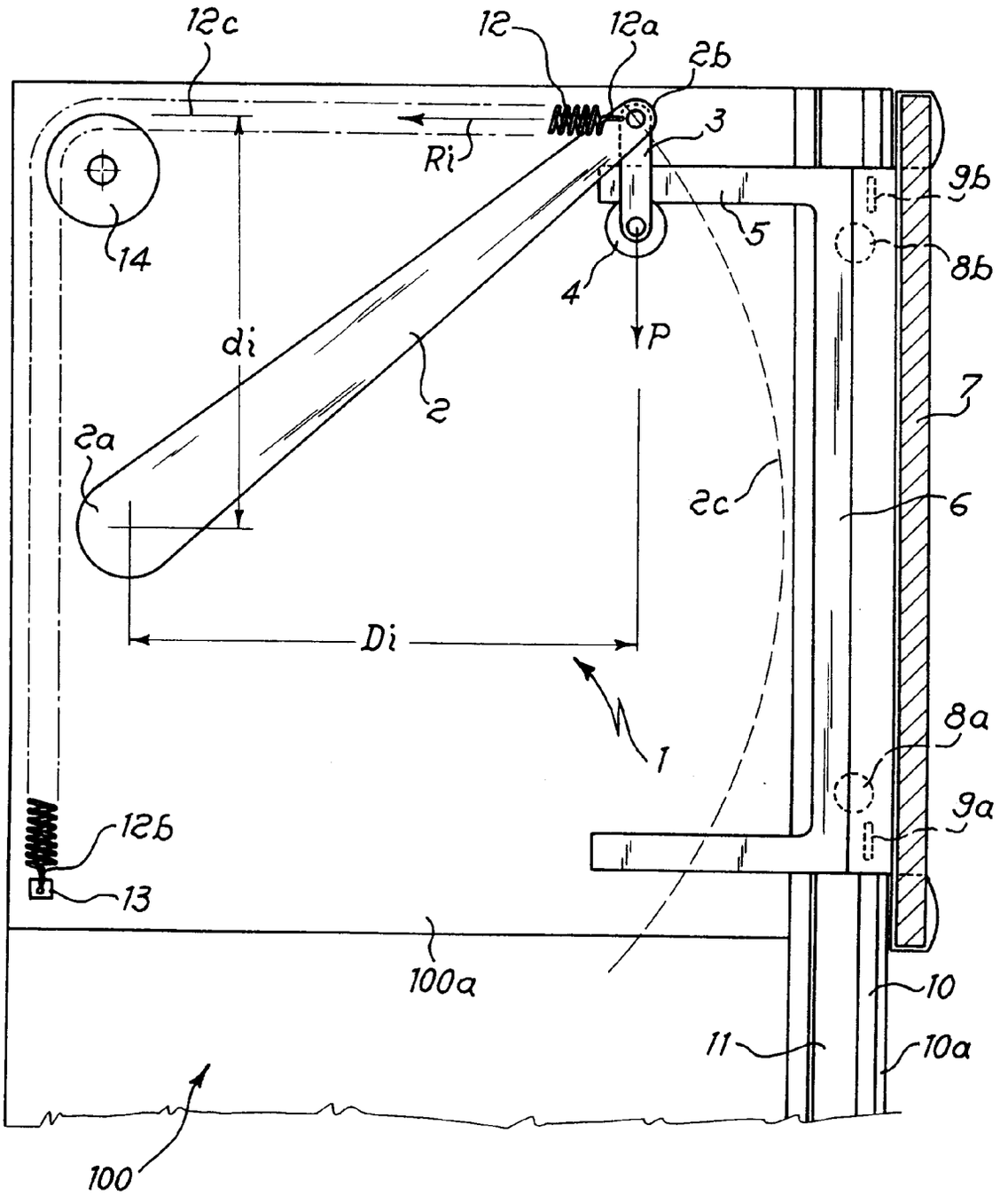

12c
12
12a
2b
3
Ri
14
9b
8b
5
4
P
di
2
2a
7
2c
6
Di
1
8a
9a
12b
13
100a
10
11
10a
100

Fig.2

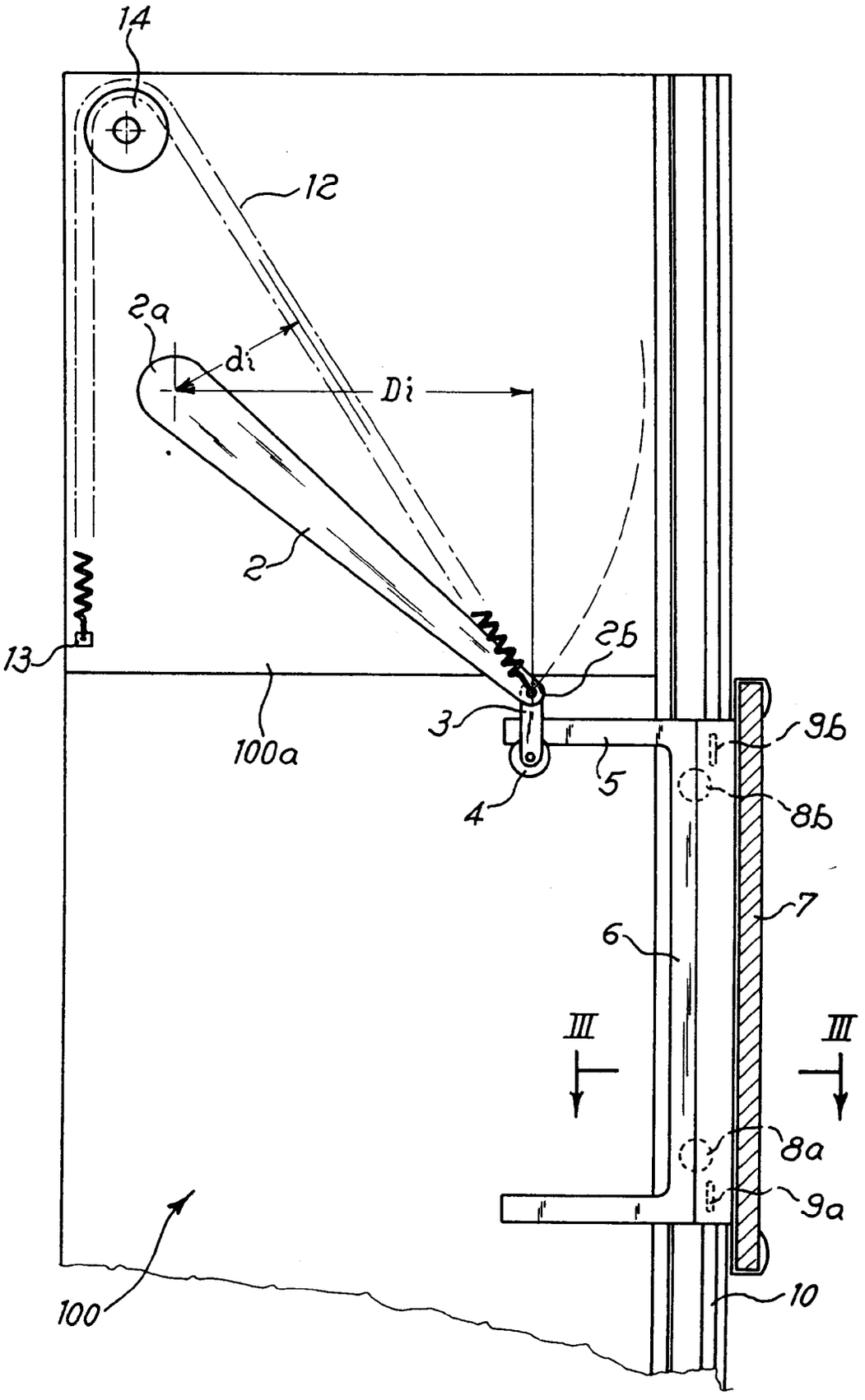
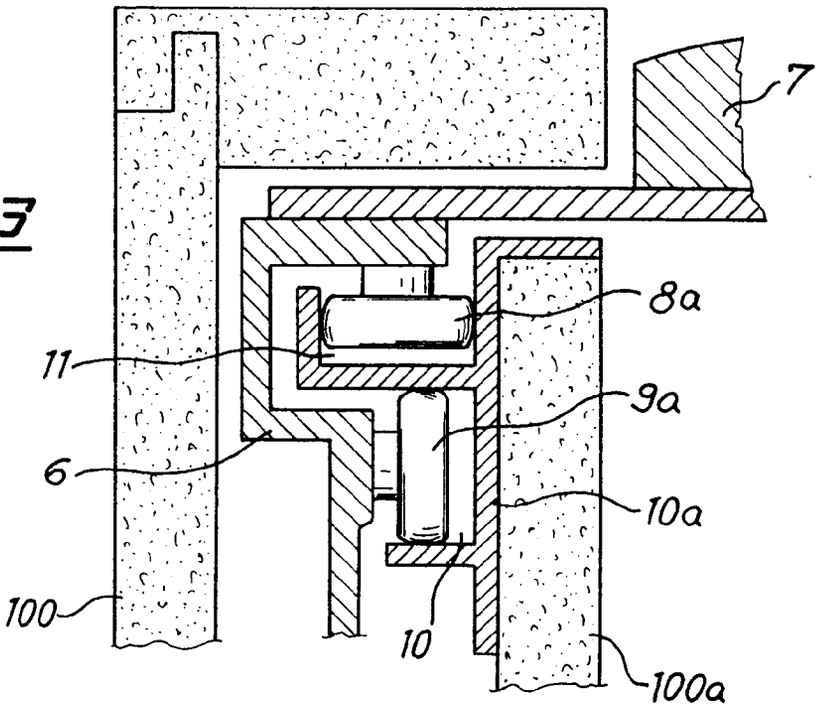


Fig.3



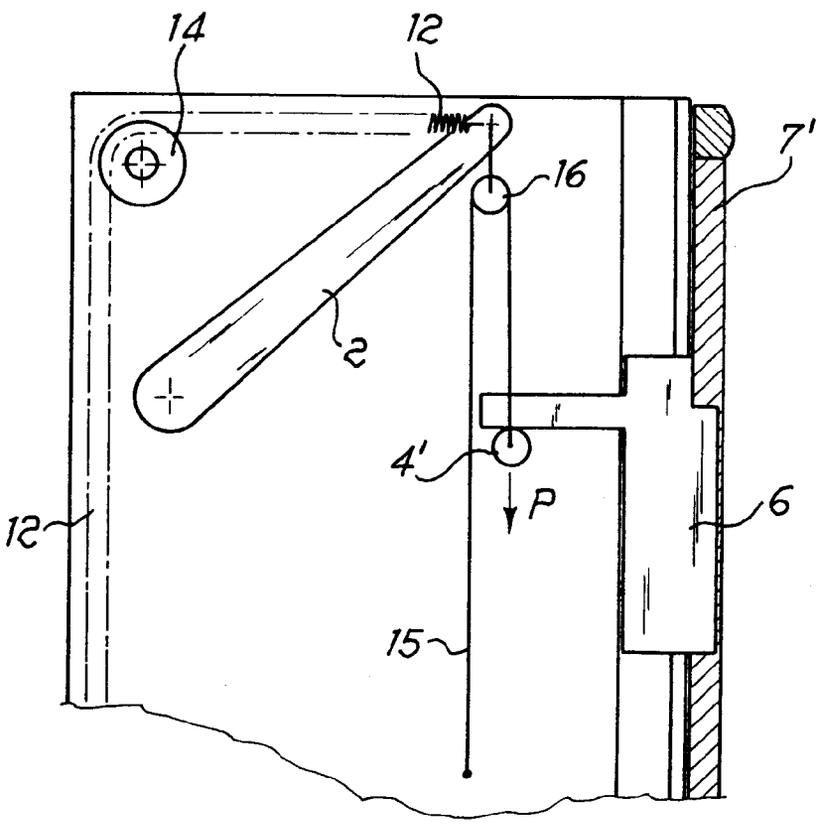


Fig.4