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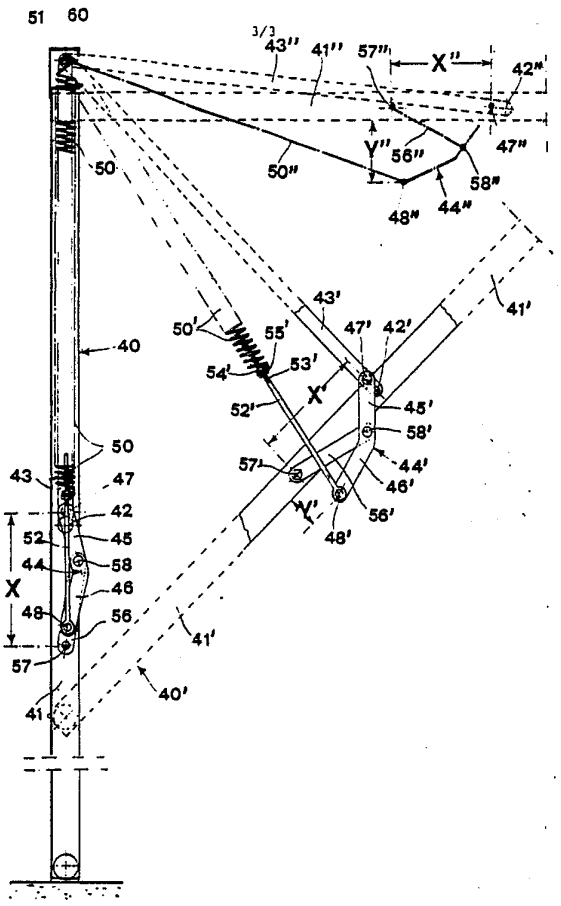
(54) Title: COUNTERPOISED DOOR FOR GARAGES WITH PRECISION BALANCING

(57) Abstract

Counterpoised door (10, 40) for garages, with balancing traction springs (18, 50) articulated below on an arm (14, 44) fixed to the side (11, 41) of the door (10, 40) and turned towards the inside, said arm, due to the effect produced by a strut (17, 57) articulated at one extremity on an intermediate point along the arm (14, 44) and at the other extremity on a point low down on the side (11, 41), operating by projecting considerably outwards from the internal plane of the door (10, 40), ensures optimum balancing of said door, while for purposes of transport, it is nearly all contained within the thickness of said door (10, 40).



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Title:

"COUNTERPOISED DOOR FOR GARAGES WITH PRECISION BALANCING"

Present state of the art

The counterpoised door is a well-known type, especially used for garages, the lower end being guided in relation to the fixed frame round the aperture for the door.

Such doors are articulated at their sides by supporting rocker levers coupled to the top of the frame.

The points at which the rocker levers articulate on the sides of the door are about halfway up its height.
To open the door inwards, balancing traction springs are articulated uppermost to the top of the frame, and below, by suitable means, to the sides of the counterpoised door occupying a position appreciably lower than those at which the rocker levers articulate.
Due to the effect of simultaneous action by the springs and levers, when the door is closed a couple is created which stabilizes the closed position while, when the door is pushed inwards, the couple acts so as to assist the opening movement until the door reaches a horizontal position practically at ceiling level.

Generally speaking the spring coupling device is bulky; the better the balance and the smoother the operation, the bulkier will the device be. These voluminous additions to the width of the door are particularly awkward during transport and storage.

The above invention avoids such drawbacks, at the same time providing considerable advantages as will be explained below.

Description of the invention

Subject of the invention is a counterpoised door, used especially for garages, each of the balancing traction springs being coupled at its lower end to the extremity of an arm on the side of the door so that said arm, due to the effect produced by a strut one end of which is articulated at an intermediate point along the arm and the other at a point low down on the side of the door, projects to some considerable extent beyond the internal plane of the door causing said door to attain an optimum state of balance.

The traction springs on each side are coupled to the extremity of the arm by a flexible tying means.

Between said tying means and the arm there is a guide lever, revolving round said tying means' axis of articulation on the arm, whose length practically corresponds to the projection of the arm in relation to the internal plane of the door.

Said guide lever is rectilinear but terminates in an arc of practically 90°.

The arm fixed to each of the sides of the door articulates at the top in the same axis as that of the lower articulation of the rocker levers and is rendered stable by means of a strut articulated through a slot at its lower end onto a locking pin in the side of the door and, at its upper end, about halfway along said arm. Therefore, by moving the strut upwards till it reaches the top of the slot, the arm will make its maximum projection. By moving the strut in the opposite direction both strut and arm can be made to coincide substantially within the width of the side of the door thus occupying a minimum space.

A pin is placed perpendicularly on said strut at an intermediate point between the slot and the upper articulation of the strut.

When the door is closed, as said pin will be practically at the same level as that of the articulation point of the guide lever, it will keep said guide lever in a practically

horizontal position so that its curved end practically coincides with the longitudinal axis of the side of the door.

When however the door opens and is pushed causing rotation of its lower part guided upwards by the frame, movement of the arm fixed to said door causes gradual and considerable contraction of the spring.

The frame round the aperture is made so that its constant horizontal cross section is similar to an "L" in shape. The long side of the "L" lies parallel to the plane of the door and towards the inside of the garage, while the short side of the "L" lies on the opposite side in relation to the door and is shaped like a "C".

On the side of the door there is a perpendicular pin fitted with a bearing which revolves inside the "L", and with an end bushing which revolves inside the "C". The bearing ensures maximum smooth sliding and the bushing maximum operational safety.

Alternative execution

In an alternative execution the door arm is articulated on the rocker lever at a short distance from the point where said lever articulates on the side of the door.

This distance plus that between the articulations of the rocker lever and of the strut on the side of the door, is slightly less than the length of the first section of the arm between its articulations on the rocker lever and on the strut plus the length of said strut.

The first section of the arm lies, in relation to the second section, between the strut articulation and the traction spring coupling, at an angle with its vertex inwards, said angle being almost the same as the angle made by the first section of the arm with the strut when the door is closed.

Therefore, to pull the traction spring practically aligned with the axis of the rocker lever, a couple is created

which assists the door's closing movement while, when the upper part of the door is pushed inwards to open it, with spring alignment passing to a lower level on the axis of the rocker lever, the couple so created tends to assist the opening movement.

Due to progressive sharpening of the angle between the rocker lever and the lower part of the door, and therefore of the angle between the first section of the arm and the strut with consequent progressive projection by the arm to whose extremity the spring is coupled, the value of said couple of forces progressively increases and produces optimum balancing.

The spring is coupled to the arm of the door by means of a threaded rod whose position, in relation to said spring, can be adjusted by a pair of nuts or by some similar means.

The angle between the two sections of the arm, the size of the arm and of the strut, and their positions are such that when the rocker lever is made to align with the spring, practically the whole coupling and balancing device automatically stows itself away inside the thickness of the door thus offering appreciable advantages for storage and transport.

The characteristics and purposes of the invention will be made still clearer by the following examples of its execution illustrated by drawings.

Examples of execution

First example

Fig. 1 Side view of the door in a closed and a semi-open position,

Fig. 2 Side view of the door ready for transport,

Fig. 3 Section according to the A A axis in Fig. 4,

Fig. 4 Door seen from the front.

Second example

Fig. 5 Side view of the door in three positions: closed, half open, open.

The various component parts are given the same numbering in the three positions shown for the door, Figures 1 to 5.

In the half open position however, the sign (') is placed after the numbers, and the sign (") for the fully open position.

Example 1

In the side (11) of the door (10) there is an articulation (12) of the supporting rocker lever (13) and of the arm (14) for the balancing traction spring (18).

On the same side of the door there is the locking pin(15) on which slides the slot (16) of the strut (17) articulated at (31) on the arm (14). The spring (18) is coupled above to the cross piece (19) of the frame (26) round the door aperture, and below to the tie (20) consisting of a flexible metal strip articulated at (21) on the arm.

The guide lever (22) with its curved extremity (23) also revolves on said articulation. The perpendicular pin(25) is fitted onto the strut.

The upright of the frame (26) has an L-shaped cross section (Fig.3) with a long side (31) and a short side (27) curved to form a "C".

On the door (10) there is a pin (28) which carries the bearing (29) and the bushing (30).

Operation

When the door is closed the spring (18),by means of the tie (20) and guide lever (22), exerts a couping tending to assist the closing movement.

Pushing the door inwards as far as position (11") (marked with a dotted line), from the intermediate position (11'), the spring (18) is gradually shortened to (18'),(18")due to rotation of the arm (14) together with the door.

In position (11"), the tie (20") and guide lever (22") have moved away from the pin (25").

Fig. 2 shows the position of the strut (17) when the pin (15) is at the upper end of the slot (16).
In that position all the parts: spring (18), tie (20), arm (14) and strut (17) fit into the thickness of the door.

Fig. 3 clearly shows how the bearing (29) slides smoothly inside the upright of the frame (26) and also the sliding movement of the bushing (30) against the C-shaped part of said frame.

Example 2

The lower articulation (42) of the rocker lever (43) is situated in the side (41) of the door (40). The arm (44) is articulated on said lever in the pin (47).

The balancing spring (50) is held to the cross bar (51) of the frame by an upper coupling (60), and below to the pin (48) of the extremity (46) of the arm by means of a tie rod (52) with threading (53) and lock nuts (54),(55).

The strut (56) connects the intermediate section of the arm to the side of the door by means of articulations (58) and (57) respectively, creating the two sections of the arm (45), (46).

The extremity (46) of the arm (44) is set at an angle, in relation to the first section (45), almost equivalent to the angle made by the strut in relation to said section (45) when the door is being closed.

In that position the distance X between articulation (47) of the arm on the rocker lever (43) and articulation (57) of the strut on the side of the door is the greater distance and therefore the angle between section (45) of the arm and that of the strut is the minimum angle, and similarly minimum is projection of the arm.

Operation

Little by little as the door opens inwards, the distance X is shortened from X' to X", and also little by little the arm projects further Y' in relation to the plane of the door, reaching its maximum Y" when the door is open.

When the door is closed the angle between the strut and the second section of the arm causes the axis of the balancing spring to align with the axis of the rocker lever and this creates a couple tending towards closure of the door.

When rocker lever alignment reaches a level higher than alignment of the spring, a couple, created to assist the opening movement of the door and keep it balanced, is greater in proportion to the extent of arm projection.

When the door is being closed, the whole series of parts comprising levers, struts and the rest is almost entirely "contained" within the thickness of the door, and this is done automatically, requiring no action from outside.

Advantages

Door operation is smooth and sensitive to the maximum while at the same time the door itself presents a minimum bulk for storage and transport.

Balancing can be regulated according to specific installation characteristics and to those of the door itself.

The door slides easily on its frame and offers a high degree of guarantee against accidental displacement.

As the applications of the invention have been described as examples only not limited to these, it is understood that any equivalent application of the inventive concepts explained and any product executed and/or in operation according to the characteristics of the invention will be covered by its field of protection.

CLAIMS

1. Counterpoised door, especially for garages, comprising lateral rocker levers to support it, articulated at the top of the fixed frame on the sides of the door, and balancing springs articulated at their upper ends to the top of the frame, characterized in that each of the springs (18), (50) is coupled below to the extremity of an arm(14), (44) on the side (11), (41) of the door (10), (40), said arm, due to the effect produced by a strut (17), (56) articulated at one end onto an intermediate point along said arm (14), (44) and at its other end onto a point low down on the side (11), (41) of the door, projecting to a considerable extent beyond the internal plane of the door (10), (40) causes said door to attain an optimum state of balance.

2. Counterpoised door, especially for garages, as in claim 1, characterized in that the traction spring (18)is coupled to the extremity of the arm (14) by means of a flexible tie (20), there being placed between said tie (20) and the arm (14), and below the supporting rocker lever (13), a guide lever (22) revolving round the axis of articulation (21) of the flexible tie on the arm (14), the length of said guide lever (22) being practically the same as the projection X of the arm (14) in relation to the longitudinal axis of the side (11) of the door (10), its end being shaped in the form of an upward facing arc (23) of about 90°, there being at an intermediate point of the above strut a pin(25) perpendicular to the side (11) which pin, reacting to the guide lever (22), when the door (10) is being closed,causes said guide lever (22) to take up a practically horizontal position and therefore the flexible tie (20), encompassing its curved extremity (23), to pull the spring (18) practically in the direction of the longitudinal side (11) of the door (10) while, when the door (10) is opened,causing upward rotation of the lower guided section of the frame (26), the pin (25) perpendicular to the side (11) permits upward rotation of the guide lever (22) and therefore align

ment of the axis of the spring (18) and of its tie (20) with articulation (21) of the arm (14).

3. Counterpoised door, especially for garages, as in claim 2, characterized in that the arm (14) is articulated on the side (11) at a point corresponding to the lower articulation (12) of the rocker lever (13), while the strut (17) is articulated onto the side (11) of the door (10), by means of a slot (16) holding a pin (15) with lock nut or other similar means, placed on the side (11) of the door (10) so that when the strut (17) moves upwards the arm (14) attains its maximum projection while, when said strut moves in the opposite direction, the arm (14) can rotate until it and the strut (17) are contained within the width of the side (11) reducing bulk to the minimum, of great use when transporting the door.

4. Counterpoised door, especially for garages, as in claim 1, characterized in that the constant horizontal section of the fixed frame (26) is shaped like an "L" with the internal long side (31) parallel to the plane of the door and with the short C-shaped side (27) placed on the opposite side in relation to the door (10), there being on the side of the door a perpendicular pin (28) and a bearing (29) which rolls on the long L-shaped side (31) and an end bushing (30) which revolves inside the "C", the bearing (29) providing maximum smooth sliding and the bushing (30) guaranteeing maximum safety.

5. Counterpoised door, especially for garages, as in claim 1, characterized in that the arm (44) of the door (40) is articulated on the rocker lever (43) at a short distance from said rocker lever's articulation (42) on the side (41) the sum of said distance with that between the articulation (42) of the rocker lever (43) and of the articulation (57) of the strut (56) on said side, being slightly less than the sum of the first section (45) of the arm (44), between its articulations (47) on the rocker lever (43) and (58) on the strut (56) plus the length of this

latter, the second section (46) of the arm (44), between the articulation (58) of the strut and the coupling (48) of the traction spring, being at an angle, with its vertex inwards, in relation to the first section (45) practically equal to the angle of the first section (45) of the arm (44) and the strut (56) when the door (40) is closed, so that to pull the spring (50) more or less aligned with the axis of the rocker lever (43), a couple of forces is created oriented so as to assist said closure while, when the upper part of the door (40) is pushed inwards to be opened, alignment of the spring (50) passing to a lower level of the rocker lever (43) creates a couple of forces which tend to assist the opening movement of the door (40) and is progressively increased due to the effect of progressive sharpening of the angle between the rocker lever (43) and the lower part of the door (50) and therefore of the angle between the first section (45) of the arm (44) and the strut (56) and therefore of the progressive projection Y of the arm (44) at the extremity of which the spring (50) is coupled, all the above to secure optimum and automatic balancing of the door (40).

6. Counterpoised door, especially for garages, as in claim 5, characterized in that the spring (50) is coupled to the arm (44) of the door (40) by a threaded rod (52) and a pair of nuts (54), (55) or similar means, so that it is easy to adjust the tension of the spring (50).

7. Counterpoised door, especially for garages, as in claim 5, characterized in that the angle between the two sections (45), (46) of the arm (44), the size of the arm(44) and of the strut (56) and their positions on the rocker lever (43) and on the side (41) of the door (40), are such that, when the rocker lever (43) is lined up with the spring (50), the whole coupling and balancing device can nearly all be contained in the thickness of the door(40) to ensure minimum bulk in storage and transport.

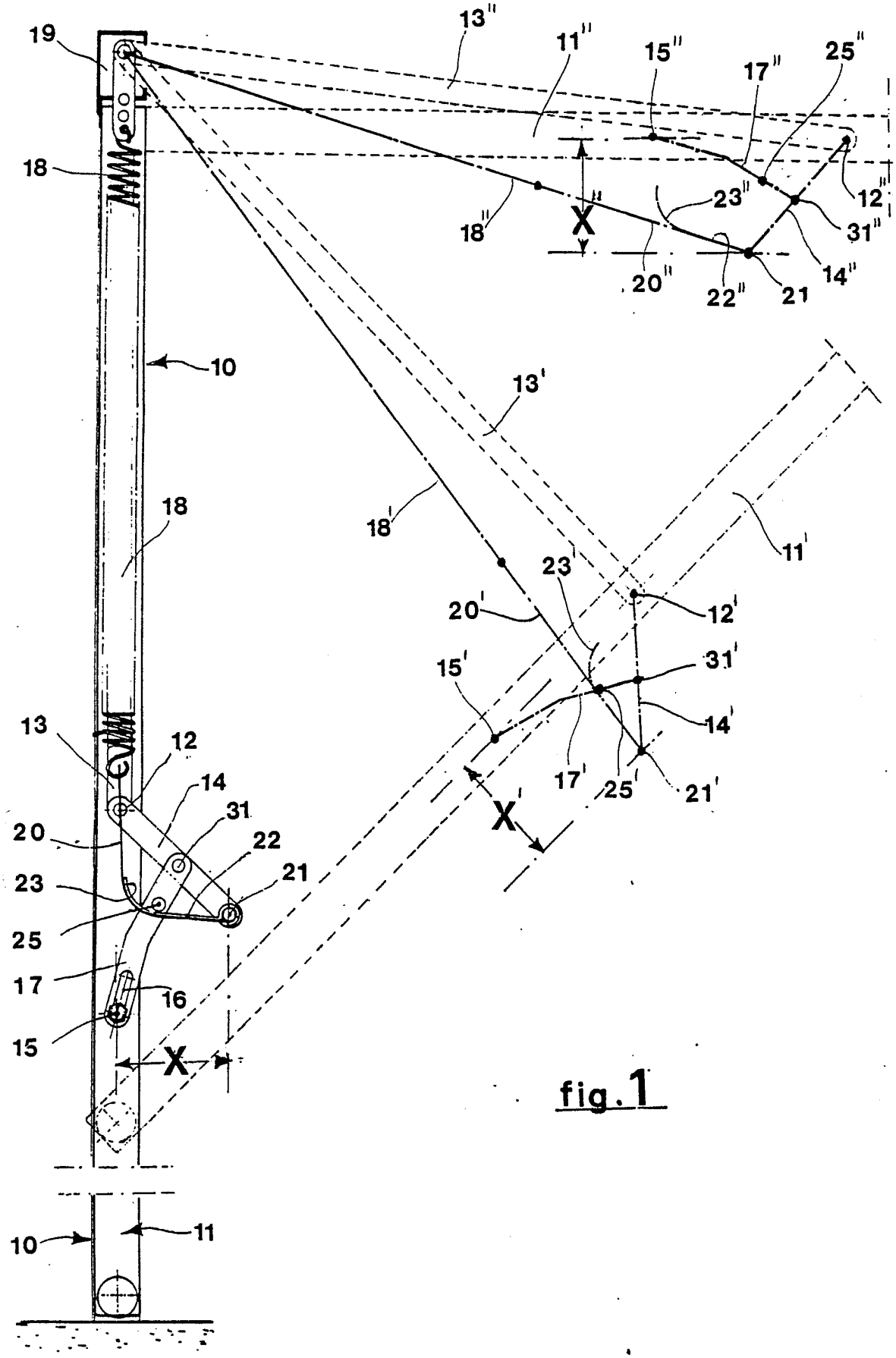
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fig.1

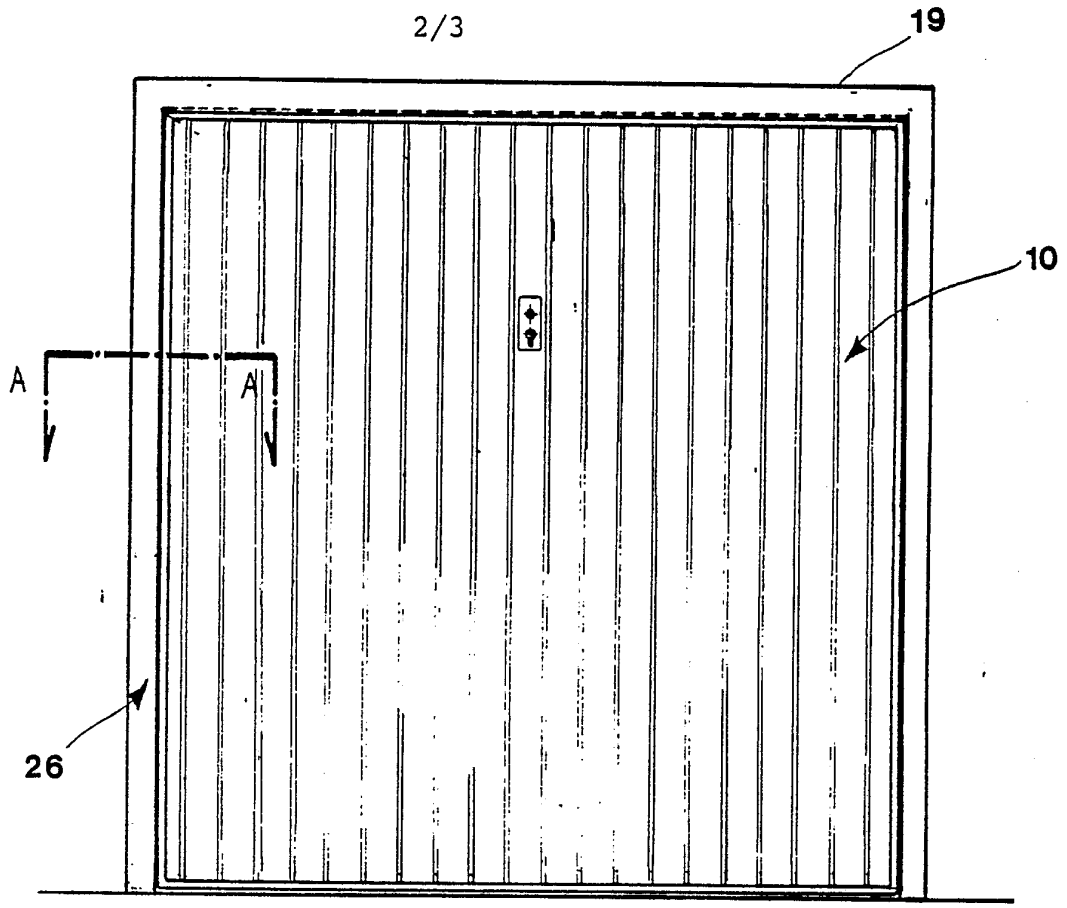


fig.4

fig.2

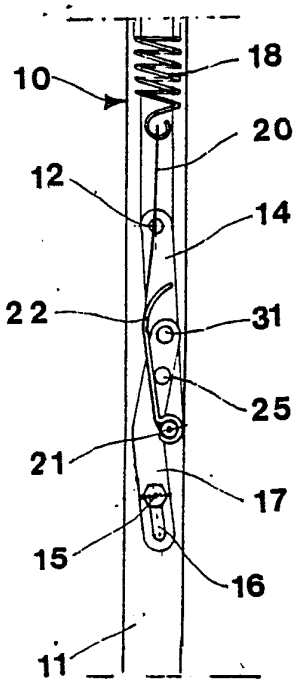
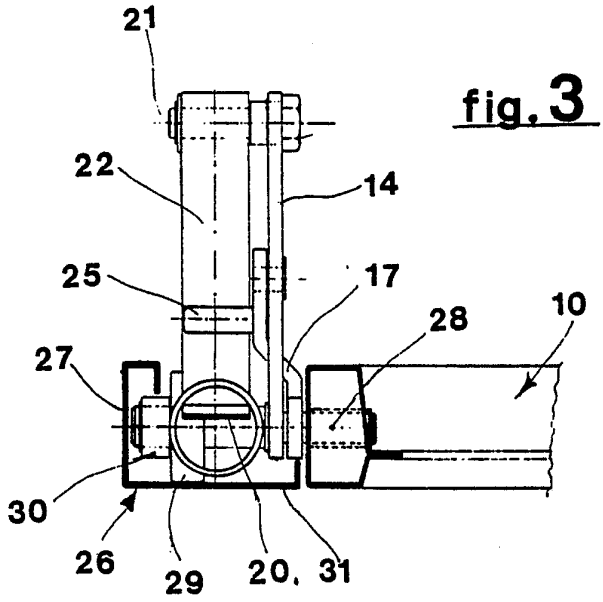


fig.3



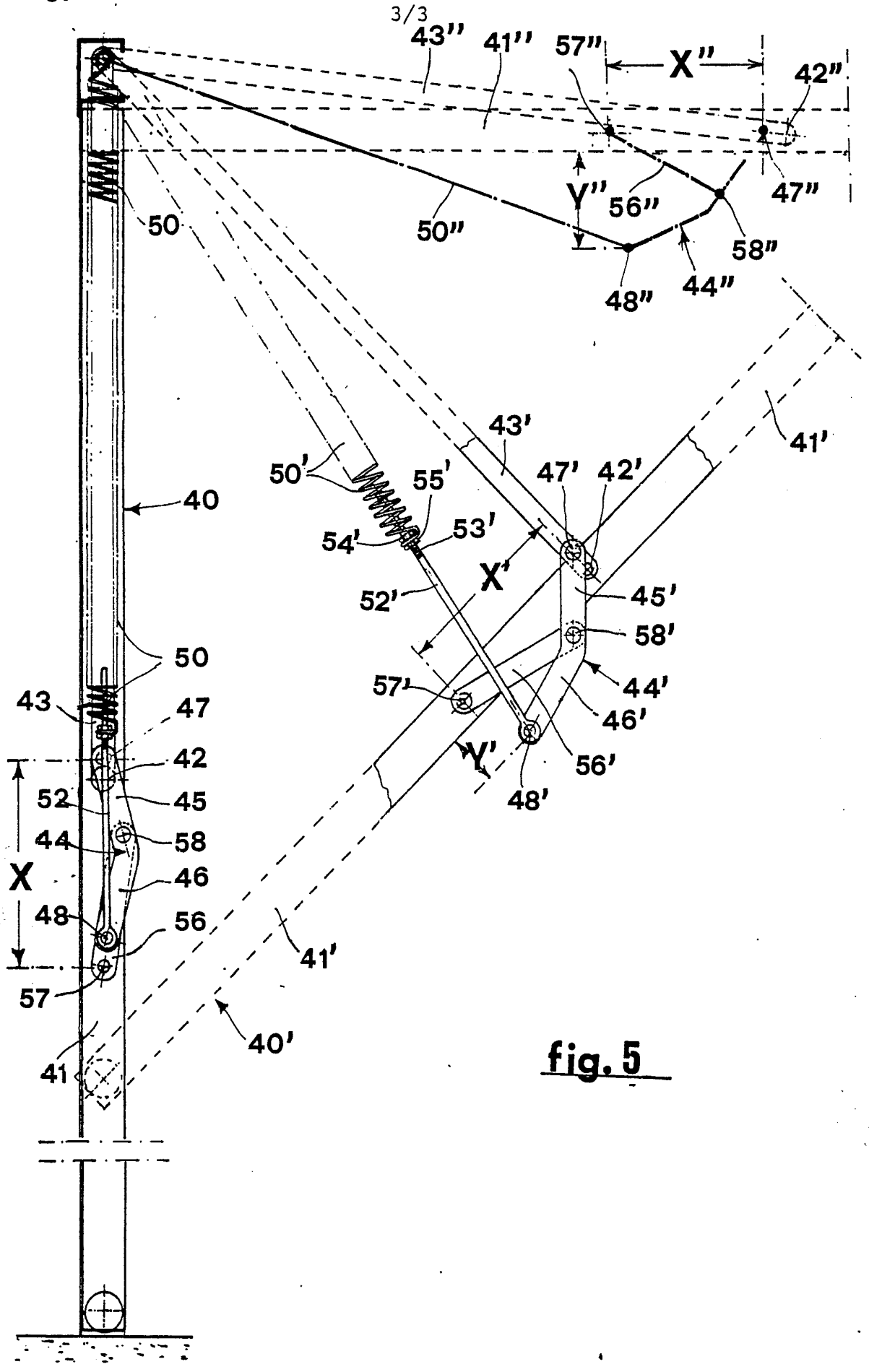

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fig. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/IT 86/00071

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: E 05 D 15/44

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	E 05 D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [9]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	FR, A, 2501772 (G. MULLER) 17 September 1982 see page 6, lines 16-29; claim 1; figures 1,2	1-3
A	DE, A, 3317322 (HÖRMANN K.G. AMSHAUSEN) 15 November 1984 see claim 1; figures 1-4	1
A	DE, A, 1759490 (H. and E. TEWS) 26 February 1970 see figures 1,3	4
A	FR, A, 1313680 (TH. MÖHLE INHABER J. FLÜCHTER) 19 November 1962 see page 2, column 2, lines 50-57; figures 1,2	6

* Special categories of cited documents: [10]

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
2nd December 1986	16 JAN 1987
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	M. VAN MOL

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/IT 86/00071 (SA 14646)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 10/12/86

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A- 2501772	17/09/82	NL-A- 8200952	01/10/82
		BE-A- 892447	10/09/82
DE-A- 3317322	15/11/84	None	
DE-A- 1759490	26/02/70	BE-A- 805082	16/01/74
FR-A- 1313680		None	