

Nov. 26, 1935.

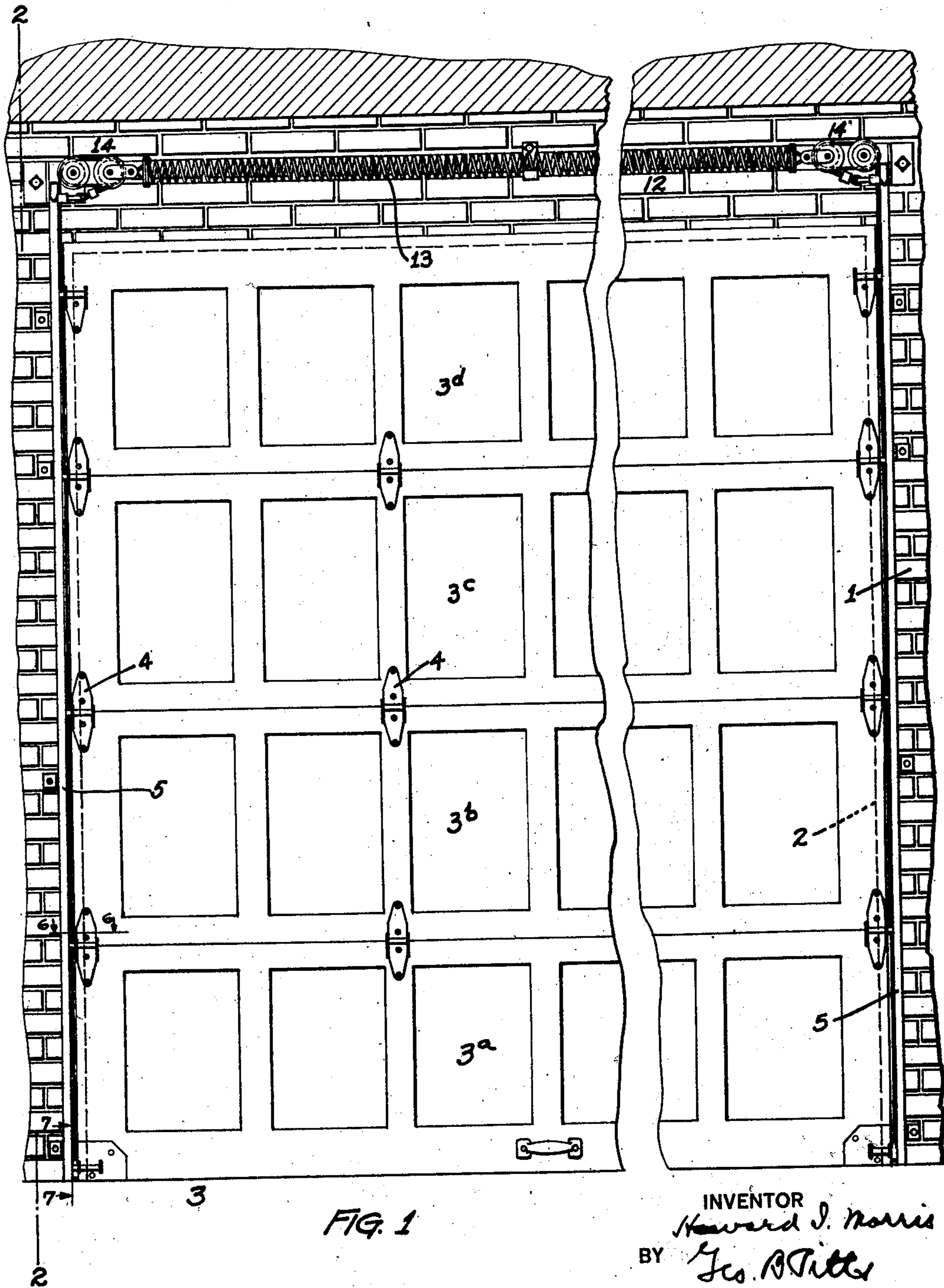
H. I. MORRIS

2,022,142

DOOR

Filed July 28, 1932

5 Sheets-Sheet 1

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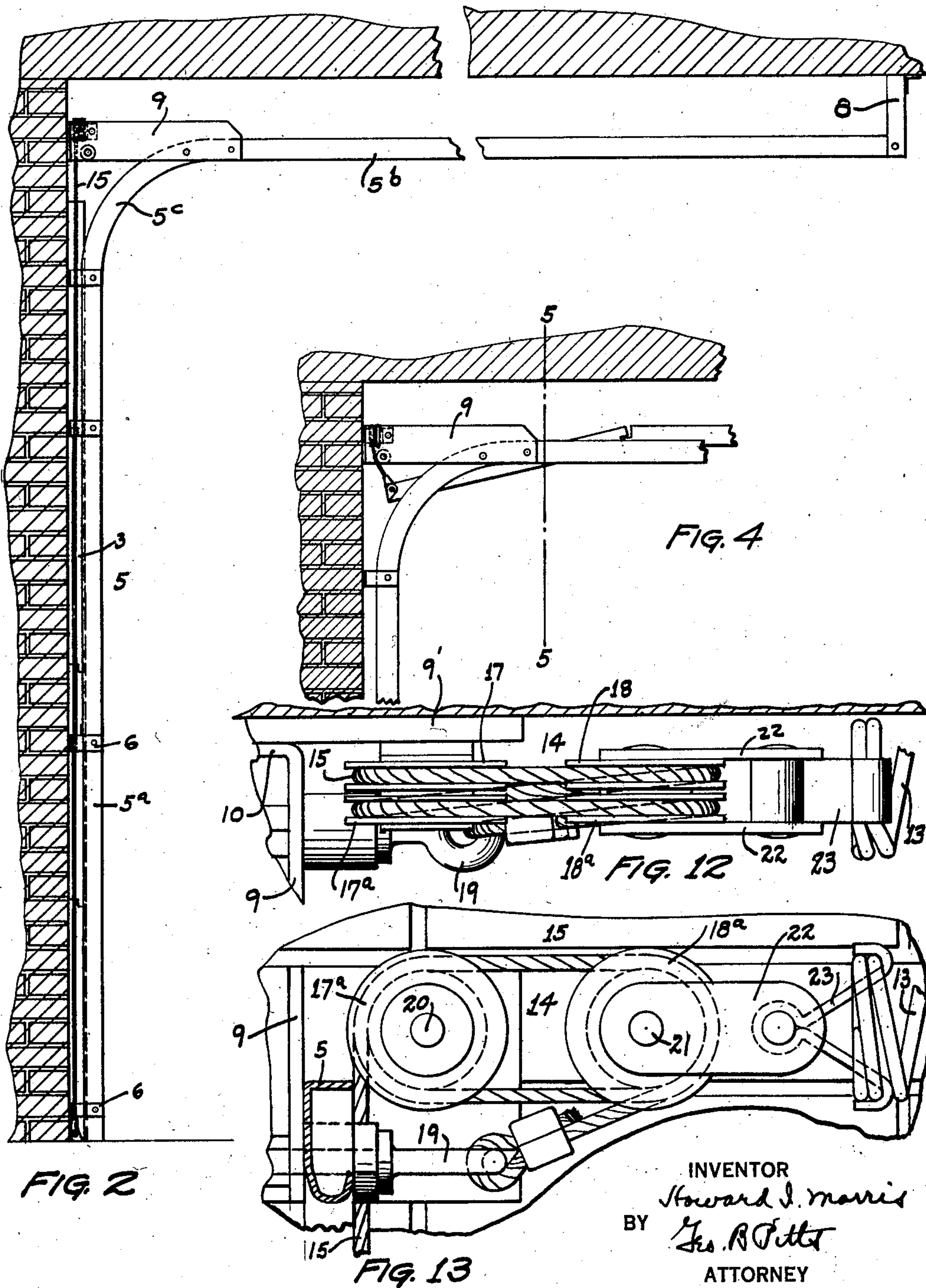
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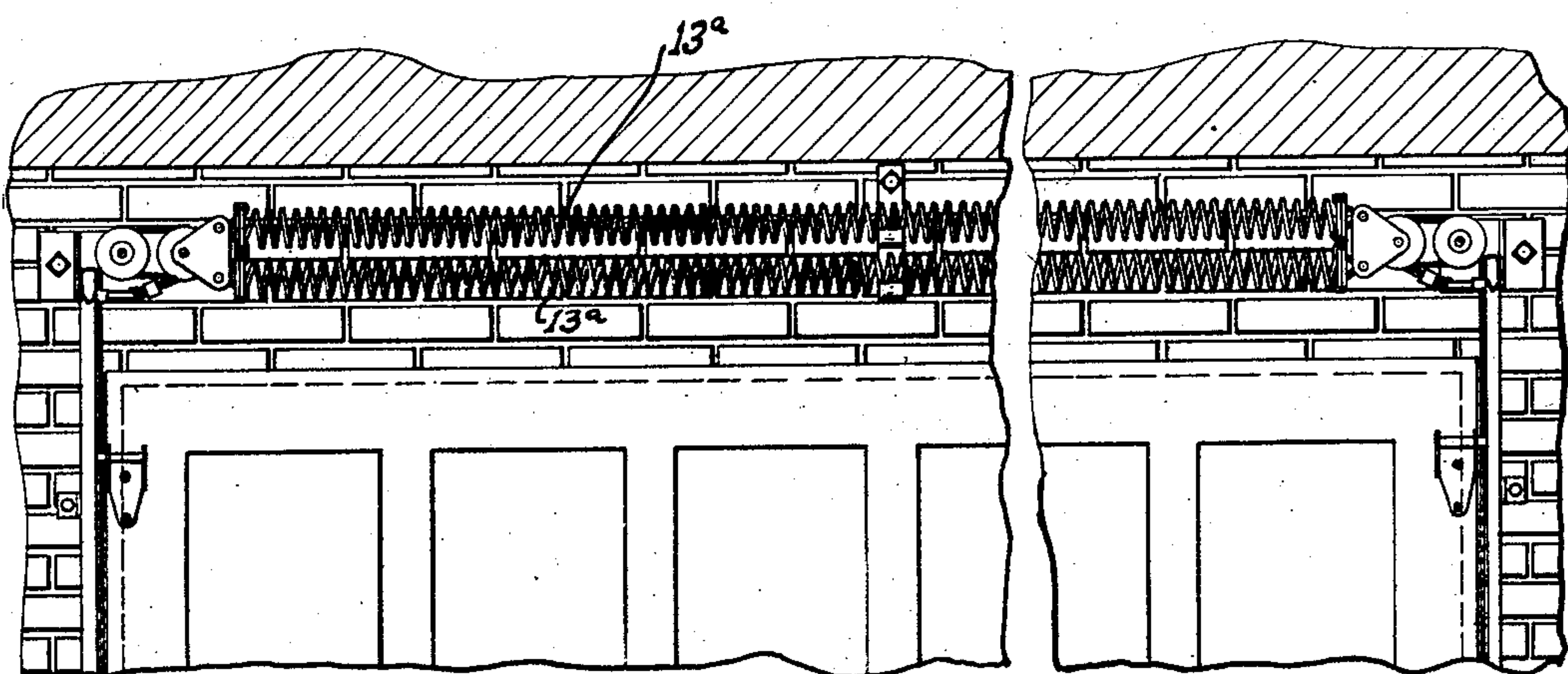


FIG. 7a

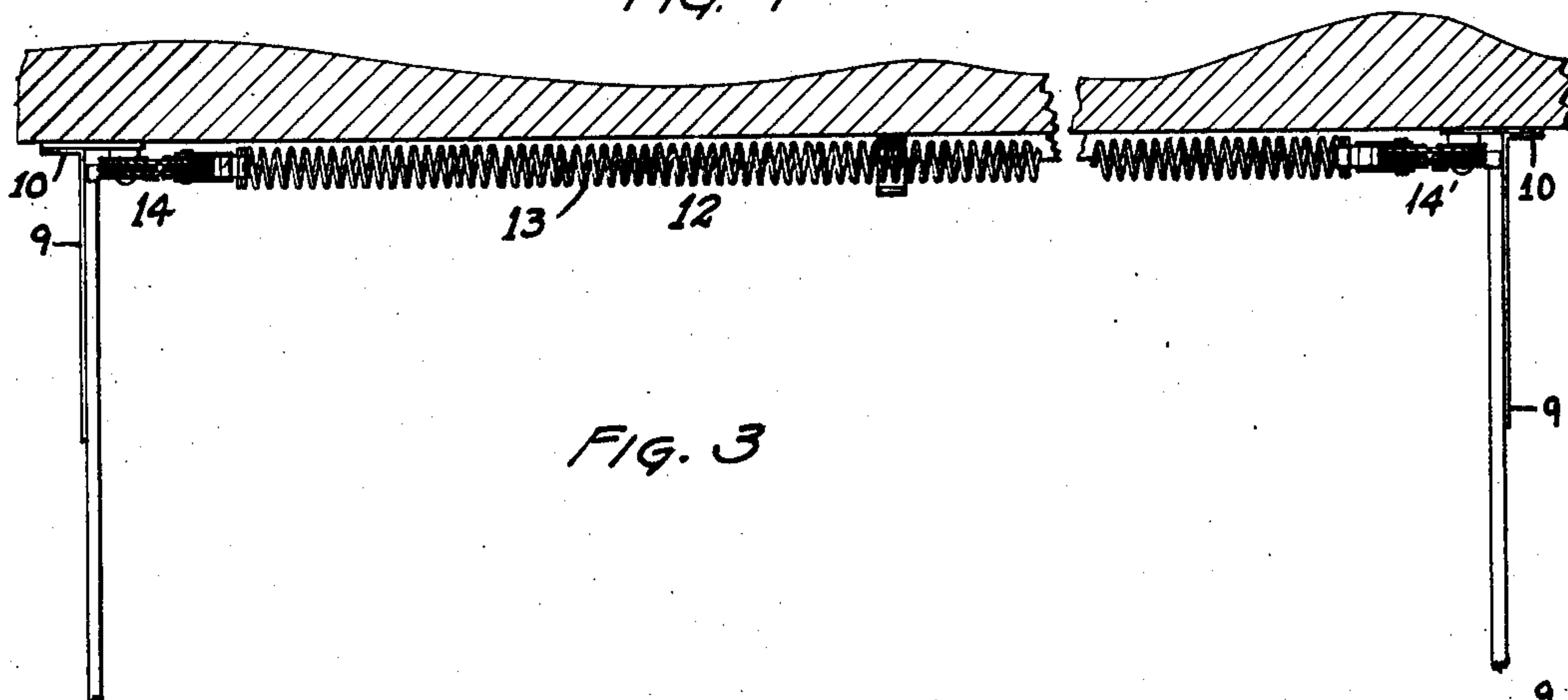


FIG. 3

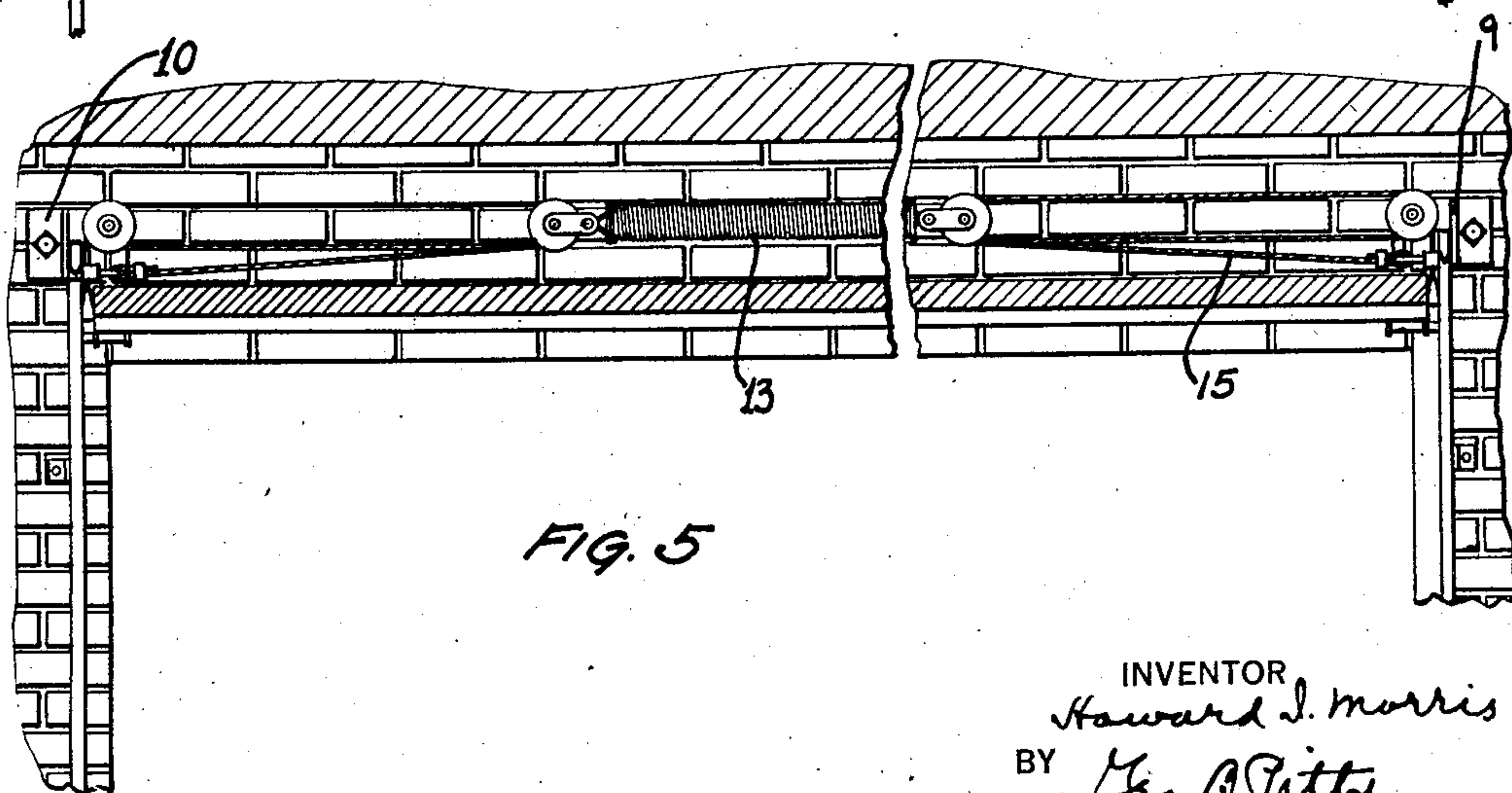


FIG. 5

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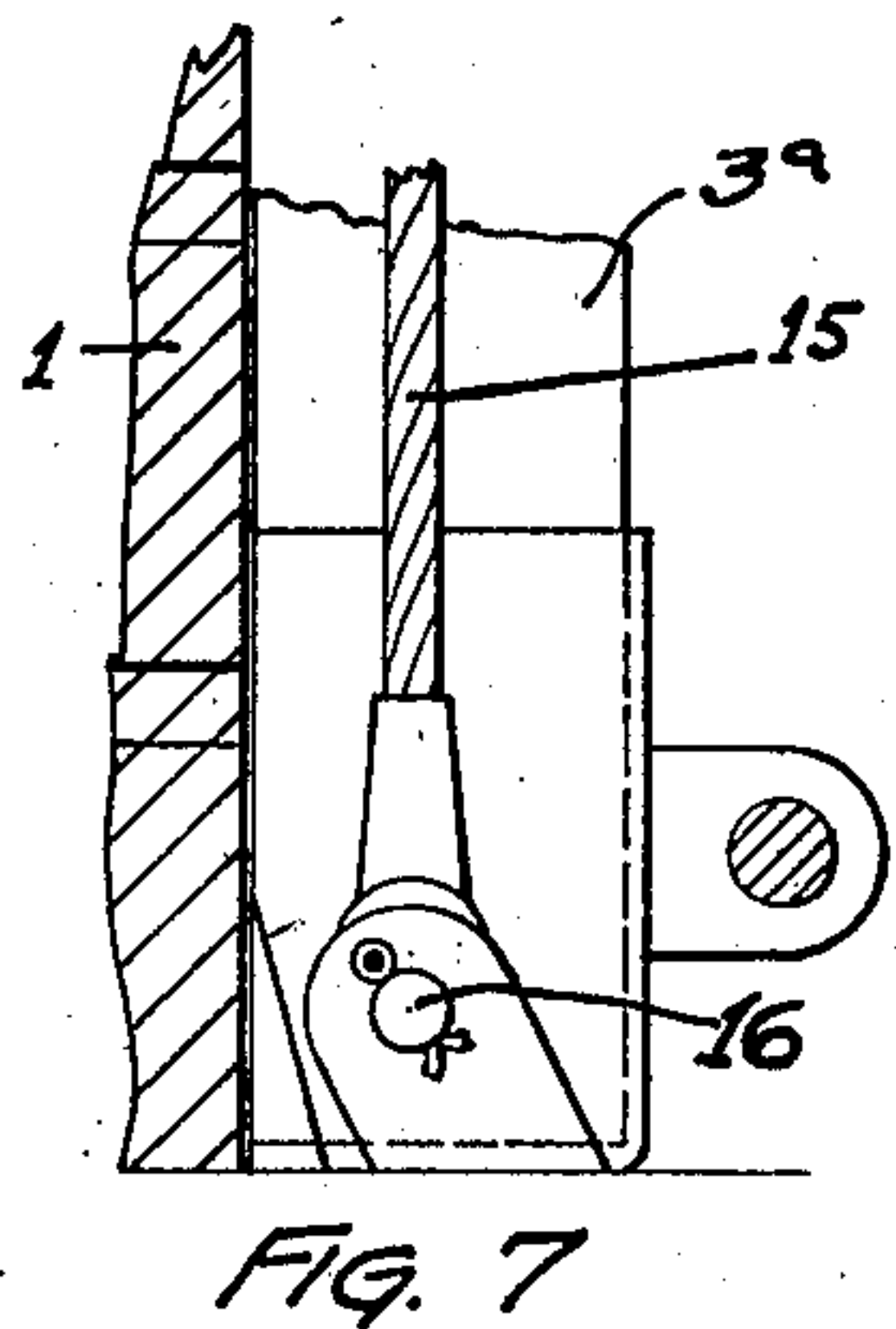
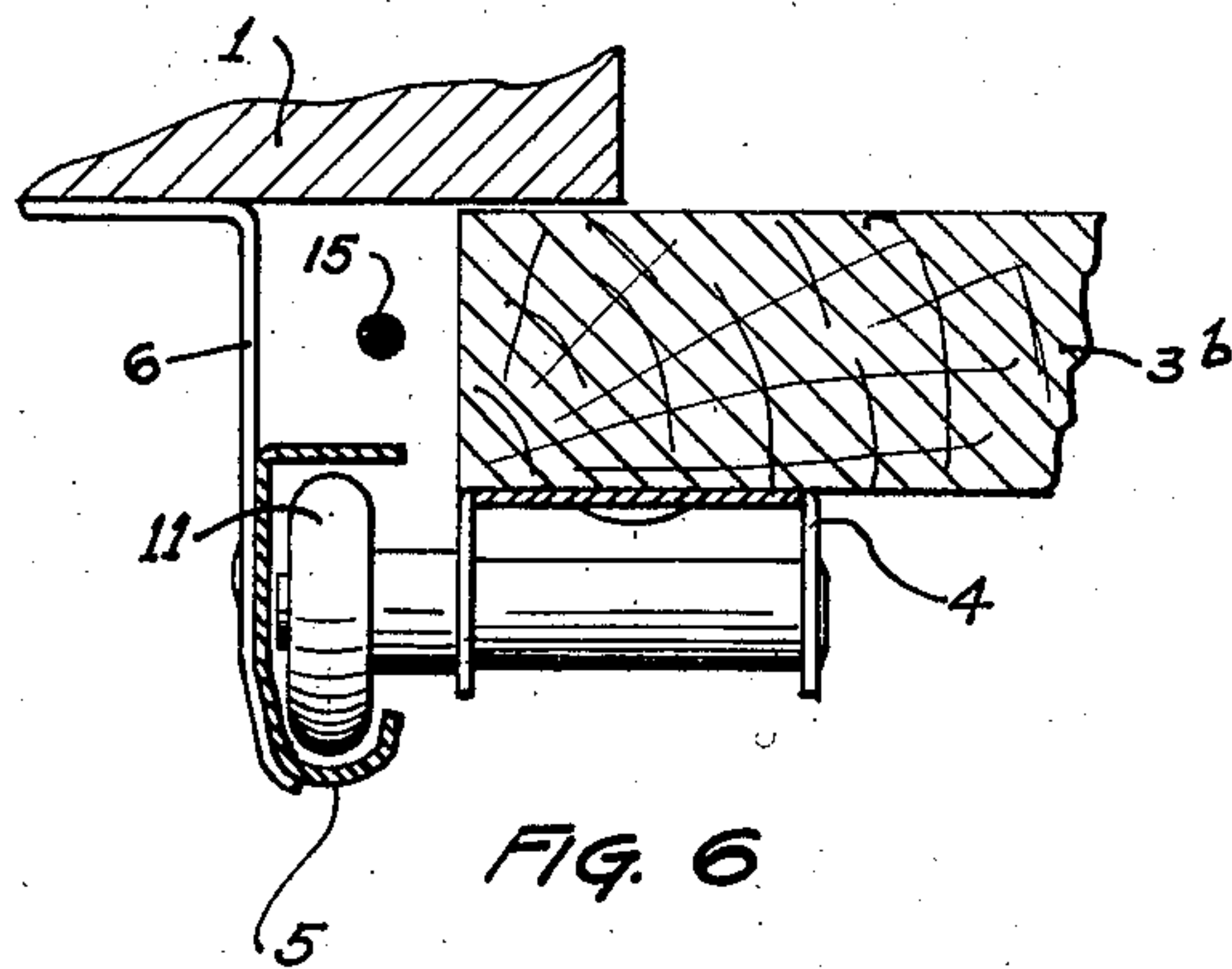
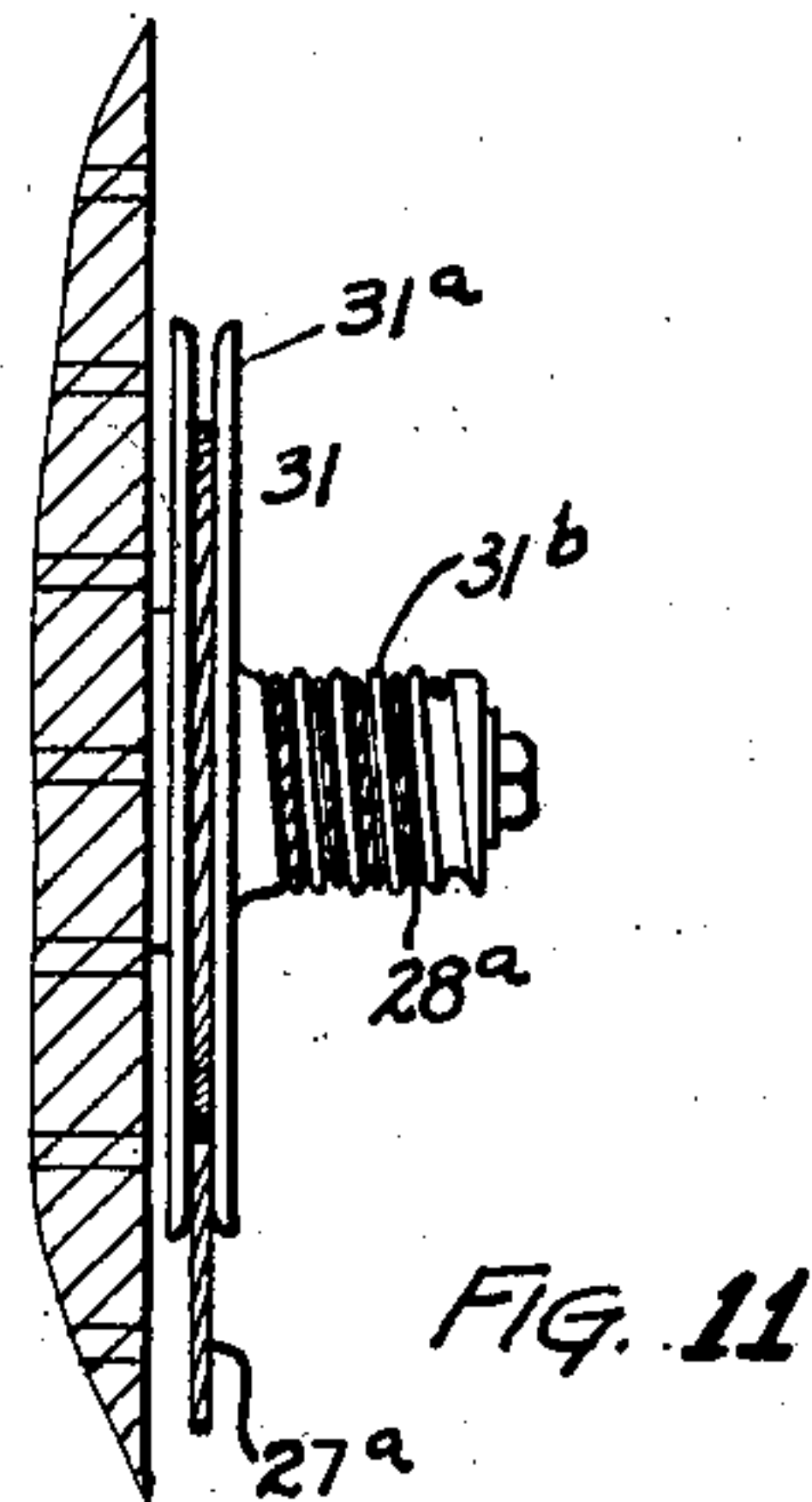
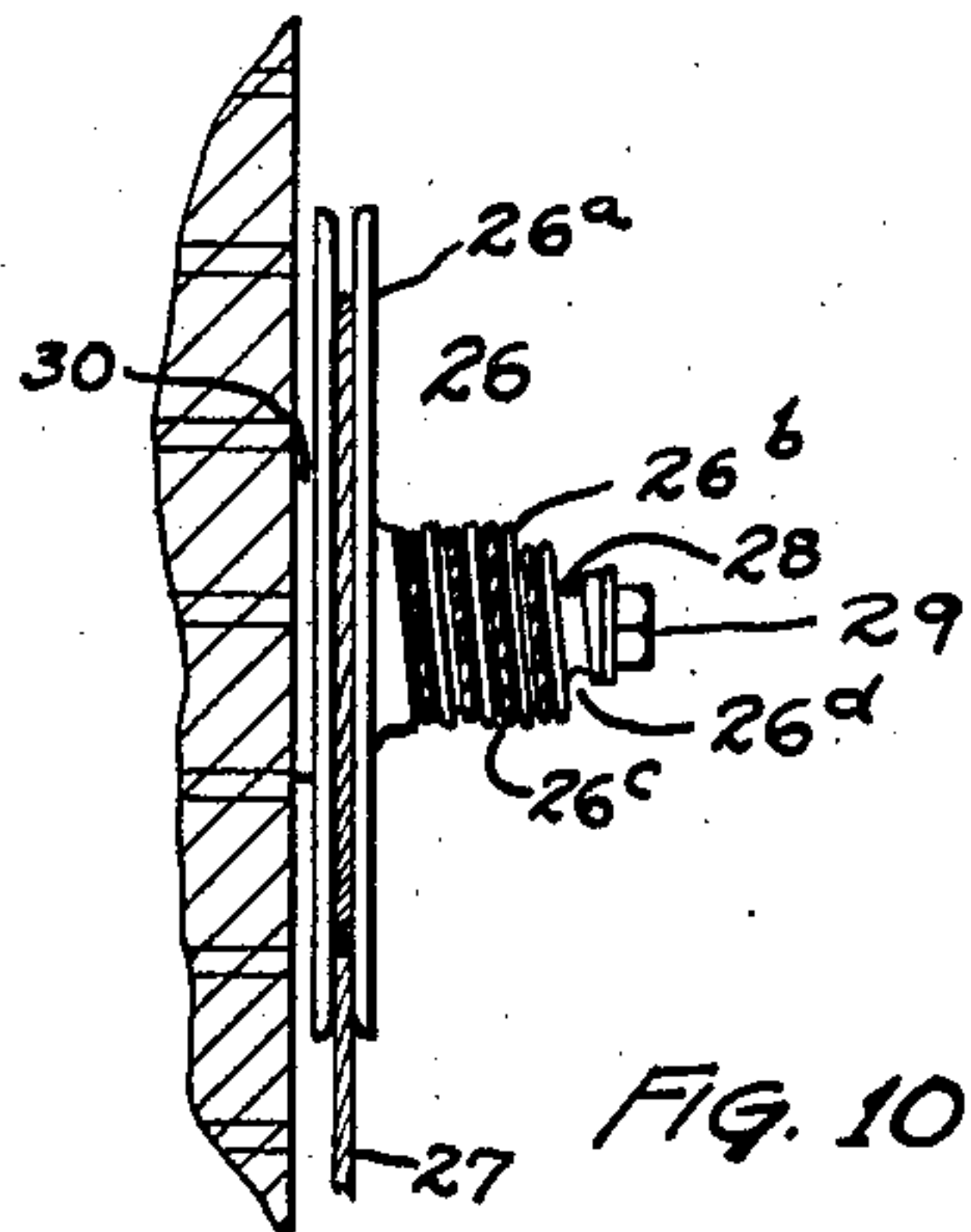
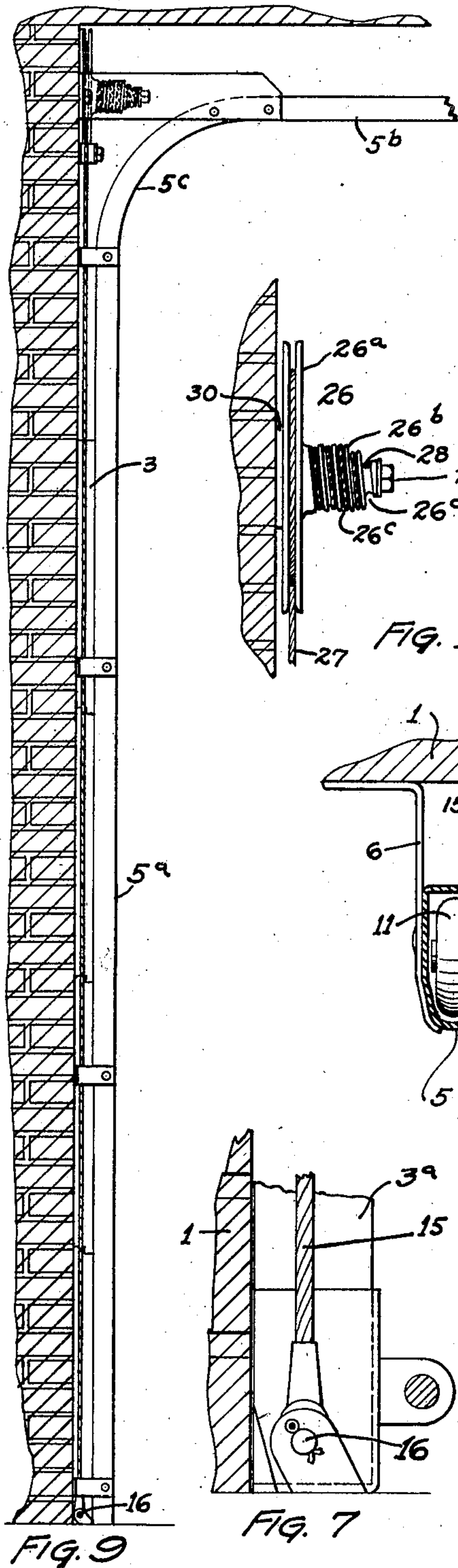
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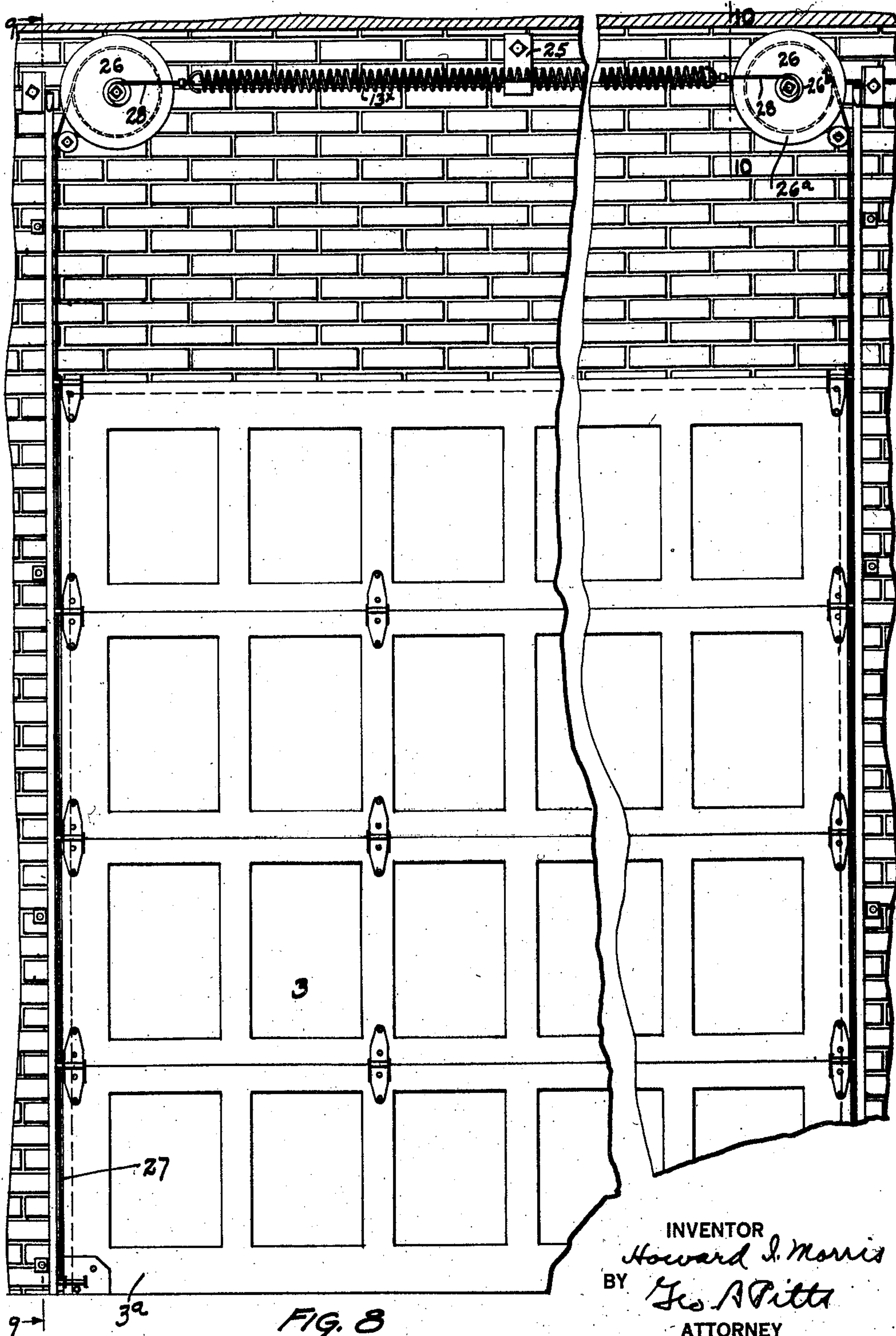
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DOOR

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UNITED STATES PATENT OFFICE

2,022,142

DOOR

Howard I. Morris, Lakewood, Ohio, assignor, by
mesne assignments, to Overhead Door Corpo-
ration, Hartford City, Ind., a corporation of
Indiana

Application July 28, 1932, Serial No. 625,367

4 Claims. (Cl. 20—20)

This invention relates to a door, more partic-
ularly an overhead type of door, the mounting
for the door, whereby it may be raised and low-
ered, and the counterbalancing means which en-
ables the door to be readily operated in either

One object of the invention is to provide for
an overhead door having articulating panels, an
improved counterbalancing means which is of rel-
atively simple construction and which is readily
mounted and installed with the door, whereby
the cost of the door and its counterbalancing
means and the expense of installation is mate-
rially reduced.

Another object of the invention is to provide
a vertically sliding door, a mounting therefor
and a counterbalancing means of simplified con-
struction and arrangement permitting ready in-
stallations under a wide range of conditions and
providing for the mounting of the counterbal-
ancing means directly above the door.

Another object of the invention is to provide
for a vertically slidable, articulatable door, an
improved counterbalancing means utilizing a sin-
gle length of spring operatively connected to the
opposite side edges of the door, whereby a spring
of minimum length may be used and equal ten-
sion on the side edges of the door is maintained
at all times.

A further object of the invention is to provide
for a vertically slidable, articulatable door, a
counterbalancing means of relatively simple con-
struction arranged to counterbalance the door
during its bodily vertical movement and move-
ment as the upper panels move into and out of
a horizontal position.

Other objects of the invention will be apparent
to those skilled in the art to which my inven-
tion relates from the following description taken
in connection with the accompanying drawings
wherein

Fig. 1 is an elevational view of a door, the
mounting and counterbalancing means therefor,
embodying my invention, the door, mounting
and counterbalancing means being shown in-
stalled in a building in operative relation to an
opening therein.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a plan view.

Fig. 4 is a fragmentary view of parts shown
in Fig. 2, but showing the door opened.

Fig. 5 is a section on the line 5—5 of Fig. 4.

Fig. 6 is a section on the line 6—6 of Fig. 1.

Fig. 7 is a fragmentary section on the line 7—7
of Fig. 1.

Fig. 7a is a fragmentary view similar to Fig. 1,
but showing a slightly different form of con-
struction.

Fig. 8 is a view similar to Fig. 1, but showing
a different embodiment of the invention.

Fig. 9 is a section on the line 9—9 of Fig. 8.

Fig. 10 is a fragmentary section on the line
10—10 of Fig. 8.

Fig. 11 is a view similar to Fig. 10, but showing
a slight modification of the differential element.

Fig. 12 is a fragmentary plan view of one of
the operating connections, enlarged.

Fig. 13 is a side view of the parts shown in
Fig. 12.

In the drawings, 1 indicates a building, the
walls of which form an opening or door way 2.
3 indicates a door comprising panels or sections
3a, 3b, 3c, 3d, pivotally or hingedly connected
by suitable devices 4. The number of door pan-
els may be increased or decreased depending upon
the size thereof and the height of the opening
2. The door is slidably mounted on a pair of
spaced aligned guides 5, 5, each having a verti-
cal portion 5a, a portion 5b disposed at an angle
(preferably a right angle) to the portion 5a and
an intermediate curved portion 5c, said portions
being related end to end to permit the door to
move from its closed position (Fig. 1) to a full
open position (Fig. 4). These guide portions
may be formed from a single section of material.
The vertical portion 5a of each guide is secured
by brackets 6 to the walls 1, in spaced relation
thereto, the angle portion 5b is supported, pref-
erably in a plane below the ceiling or other over-
head structure by a hanger 8 depending there-
from, and the intermediate portion 5c is braced
by a plate 9 having a base portion 10 secured
to the wall 1 above the opening 2.

The guides 5 form tracks for rollers 11. The
rollers are slidably and rotatably mounted on ex-
tended ends of the pivot pins for those hinge de-
vices 4 which are disposed adjacent the side edges
of the door; and a roller 11 is mounted on a pin
suitably supported at the lower side edge of the
lower panel 3a. The construction of the guides
and mountings for the rollers 11 are preferably
similar to corresponding parts shown and claimed
in my co-pending application Ser. No. 448,377, for
which reason no claim thereto is made in this
application.

12 indicates as an entirety a counterbalancing
means for the door. In Figs. 1, 2, 3, 4, and 5 I
have shown an arrangement in which the upper-
most panel 3d of the door 3, substantially immedi-
ately upon the raising of the door, is guided rear-

wardly, so that there is a substantially uniform reduction in the weight of the door as it moves to the position shown in Figs. 4 and 5; whereas in Figs. 8 and 9 I have shown an arrangement in which the door 3, when raised, has an initial vertical movement preceding the rearward movement of the uppermost panel and in such arrangement I provide for the counterbalancing of the door during both its initial movement and subsequent movement and corresponding movements in the reverse directions.

Of the counterbalancing means 12 shown in Figs. 1, 2, 3 and 4, 13 indicates a coiled spring, having its opposite ends operatively connected by connections to be later described, to the lower outer side edges or ends of the door 3, that is, the lower outer side edges of the panel 3a, whereby a single spring effecting equal tension or counterbalancing effort on the door at or in line with its side edges, results. This arrangement also permits the (1) use of a relatively short spring while permitting the door to travel the necessary distance to completely open the opening 2 and (2) mounting of the spring in a convenient location as well as a location that avoids the use of cables of undue lengths. The operating connections between the spring ends and the door side edges are shown at 14, 14', respectively, and are similarly constructed and mounted, so that the following description of the connections 14 between one spring end and the adjacent door side edge will answer for both. Of the connections 14, 15 indicates a flexible member, such as a wire cable pivotally connected at its outer end to a suitable device 16, such as a pin, preferably projecting laterally from the side edge of the panel 3a, adjacent its lower end. From the pin 16, the cable 15 extends upwardly, preferably in the plane of the door when in closed position and parallel to its adjacent side edge and reeves around a stationary guide sheave 17, then around a sheave 18, connected to the adjacent end of the spring 13, then around a second stationary guide sheave 17a, and then around a second sheave 18a, connected to the adjacent end of the spring, the inner free end of the cable being suitably anchored to an eye or hook 19, which is preferably supported by the plate 9. The sheaves 17, 17a, loosely rotate on a stud shaft 20, suitably mounted on plate 9', also secured to the wall 1, whereas the sheaves 18, 18a, loosely rotate on a shaft 21, the latter being supported by a pair of spaced plates 22, pivoted to the outer end of a yoke-device 23. The yoke-device is provided with a pair of diverging members the free ends of which are clamped around or hooked to one or more convolutions at the adjacent end of the spring 13 (see Figs. 12 and 13). The arrangements of the reeving sheaves for the flexible members 15 shown and described above constitute differential or compensating connections between the opposite ends of the spring and the lower side edges of the door to permit the necessary travel of the latter, but with limited expansion and contraction of the spring 13, whereby its ends move one relative to the other, but a short distance. As shown, the spring is connected to the door side edges in such manner that one end serves as an anchor for the other end; accordingly, the closing of the door puts the spring under the same tension from end to end, so that equal counterbalancing effects on both side edges of the door result and are maintained at all times. The construction permits the use of a relatively short spring, which when expanded has a length less than the width of the door (Figs. 1 and 3).

I am therefore enabled to locate the spring and the reeving sheaves carried by its ends between and in the plane of the guide sheaves for the flexible members as they extend upwardly from their connections 16; and this arrangement permits the counterbalancing means to be positioned on the wall 1 of the building immediately above the opening 2. It will be noted that the spring 13 is connected to the flexible members 15 (that is, indirectly through the reeving elements 18, 18a), and supported entirely by them; also that the counterbalancing means is supported and operatively related to the door by means of two elements, namely, the shafts 20 for the guide sheaves 17, 17a. As these sheaves are so disposed that the cables 15 extend upwardly along and parallel to the side edges of the door, the tension of the spring is exerted substantially in the plane of the door. In this arrangement, the sheaves 17, 17a, serve to both support and guide the operating connections 14, 14'. As none of the elements of the counterbalancing means extend along or above the guide portions 5b, installation of the door and the counterbalancing means therefore may be readily and economically made.

To prevent undue vibration of the spring where the door is slid rapidly from one position to another, I provide on the wall 1, a guard 25. If the door is moved upwardly and rearwardly to a position which permits the spring 13 to sag, the guard will support it in substantially its normal position.

Where the weight of the door requires a greater spring tension, I may provide a plurality of springs in side by side relation for conjoint operation to counterbalance the door. One example of this form of construction, employing two springs 13a, 13a, is shown in Fig. 7a.

Where the building construction and arrangement make it desirable or necessary for the curved guide portions 5c to be positioned some distance above the opening 2 (Figs. 8 and 9), it will be noted that the door 3, in its raising movement slides vertically a predetermined distance without losing weight or until its uppermost panel is guided inwardly by the guide portions 5c, and that loss of weight of the door does not take place until the door panels enter and traverse the guide portions 5c and 5b. In the closing movement of the door, its weight increases as the panels traverse the guide portions 5b, 5c, until the uppermost panel enters the guide portion 5a and thereafter the weight remains the same throughout the remaining movement of the door. To provide for these conditions or manner of operation of the door, I use connections of a different form or arrangement between the ends of the spring 13x and the side edges of the door, as shown in Figs. 8, 9 and 10, whereby the door is counterbalanced while bodily moving vertically and while it is traversing the guide portions 5b, 5c. Referring to one of these connections in these views, 26 indicates a differential sheave comprising a drum 26a and a drum 26b, preferably formed integrally, the latter drum having a smaller diameter than the drum 26a; also the drum 26b has a straight winding portion 26c and a tapered winding portion 26d at its outer end. The portions 26c, 26d, are grooved to guide the flexible member, to be later referred to, from one portion to the other. 27 indicates a flexible member, preferably a wire cable, connected at its outer end to the adjacent side edge of the door panel 3a and connected at its inner end to the drum 26a and arranged to wind there-

on in convolute arrangement when the door 3 is opened. 28 indicates a flexible member, preferably a wire cable, connected at its inner end to the adjacent end of the spring 13x and connected at its outer end to the inner end of the straight drum portion 26c of the drum 26a. When the door is closed, the flexible member 28 is wound on the drum portions 26c, 26d, and unwinds therefrom when the door is raised, the flexible member unwinding from the tapered portion 26d and winding thereon during the bodily vertical travel of the door, during which travel the weight of the door remains the same. In the upward movement of the door the tension of the spring 13x is decreasing and in its downward movement the tension of the spring is increasing, but by causing the cable to wind on and off a tapered surface during such vertical movement of the door, the decrease and increase of tension of the spring is compensated for.

The differential sheave 26 is loosely mounted on a shaft 29 suitably supported on a plate 30, which is fixed to the wall 1.

When the mounting of the door 3 is similar to that shown in Fig. 1, that is, where the door does not have a bodily vertical movement, I may employ a differential sheave as shown at 31, in Fig. 11. The sheave 31 is similar in construction to the sheave 26, except that the relatively small diameter drum 31b thereof has the same diameter from end to end. The sheave 31 has connected to it the cables 27a, 28a, which wind on and off the drums 31a, 31b, similarly to the cables 27, 28, respectively.

To those skilled in the art to which my invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. My disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

What I claim is:

1. In a door construction, the combination with a wall formed with an opening, of spaced guides related to said opening and having vertical portions and portions extending at an angle thereto, a door consisting of articulatable sections slidably mounted in said guides, and a counterbalancing means for said door, said means consisting of a coiled spring disposed in an elevated position above the lower door section when the door is open and having connections between its opposite ends and the opposite sides of the lower door section and serving to counterbalance the door during raising and lowering thereof, each said connection including a differential means arranged to reduce the relative movement of the spring ends due to expansion and contraction of the spring as the door is raised and lowered.

2. In a door construction, the combination with a wall formed with an opening, of spaced guides related to said opening and having vertical portions and portions extending at an angle thereto, a door consisting of articulatable sections slid-

ably mounted in said guides, and a counterbalancing means for said door, said means consisting of a coiled spring and a differential operating connection between each end of said spring and the adjacent lower side edge of said door, each of said operating connections including a flexible member anchored at its inner end and connected at its outer end to the adjacent lower side portion of the door and a set of reeving elements around which said flexible member reeves, certain of said elements being stationarily mounted on said wall and the remaining elements being carried by the adjacent end portion of said spring.

3. In a door construction, the combination with a wall formed with an opening, of a pair of spaced guides related to said opening and having vertical portions and portions disposed at an angle thereto, a door consisting of articulatable sections slidably mounted on said guides, differential sheaves mounted on said wall above and at opposite sides of said opening and each having separate winding portions of different diameters, a coiled spring arranged to expand and contract endwise during lowering and raising of said door, a pair of flexible members each connected at its outer end to the lower edge portion of said door and arranged to wind on and off the large winding portion of the adjacent sheave at its inner end, and a pair of flexible members connected at their inner ends to the opposite ends of said spring and each arranged to wind on and off the small winding portion of the adjacent sheave at its outer end to reduce the relative movement of the spring ends due to expansion and contraction thereof.

4. In a door construction, the combination with a wall formed with an opening, of a pair of spaced guides related to said opening and having vertical portions and portions disposed at an angle thereto, a door consisting of articulatable sections slidably mounted on said guides, differential sheaves mounted on said wall above and at opposite sides of said opening and each having separate winding portions of different diameters, a coiled spring arranged to expand and contract endwise during lowering and raising of said door, a pair of flexible members each connected at its outer end to the lower edge portion of said door and arranged to wind on and off the large winding portion of the adjacent sheave at its inner end, and a pair of flexible members connected at their inner ends to the opposite ends of said spring and each arranged to wind on and off the small winding portion of the adjacent sheave at its outer end to reduce the relative movement of the spring ends due to expansion and contraction thereof, each said small winding portion having a conical section and a straight section, said last mentioned flexible members being arranged to wind on the conical sections of said winding portions as the door traverses the vertical portions of said guides and to wind on the straight sections of said winding portions as one or more door sections traverse the other portions of said guides.

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