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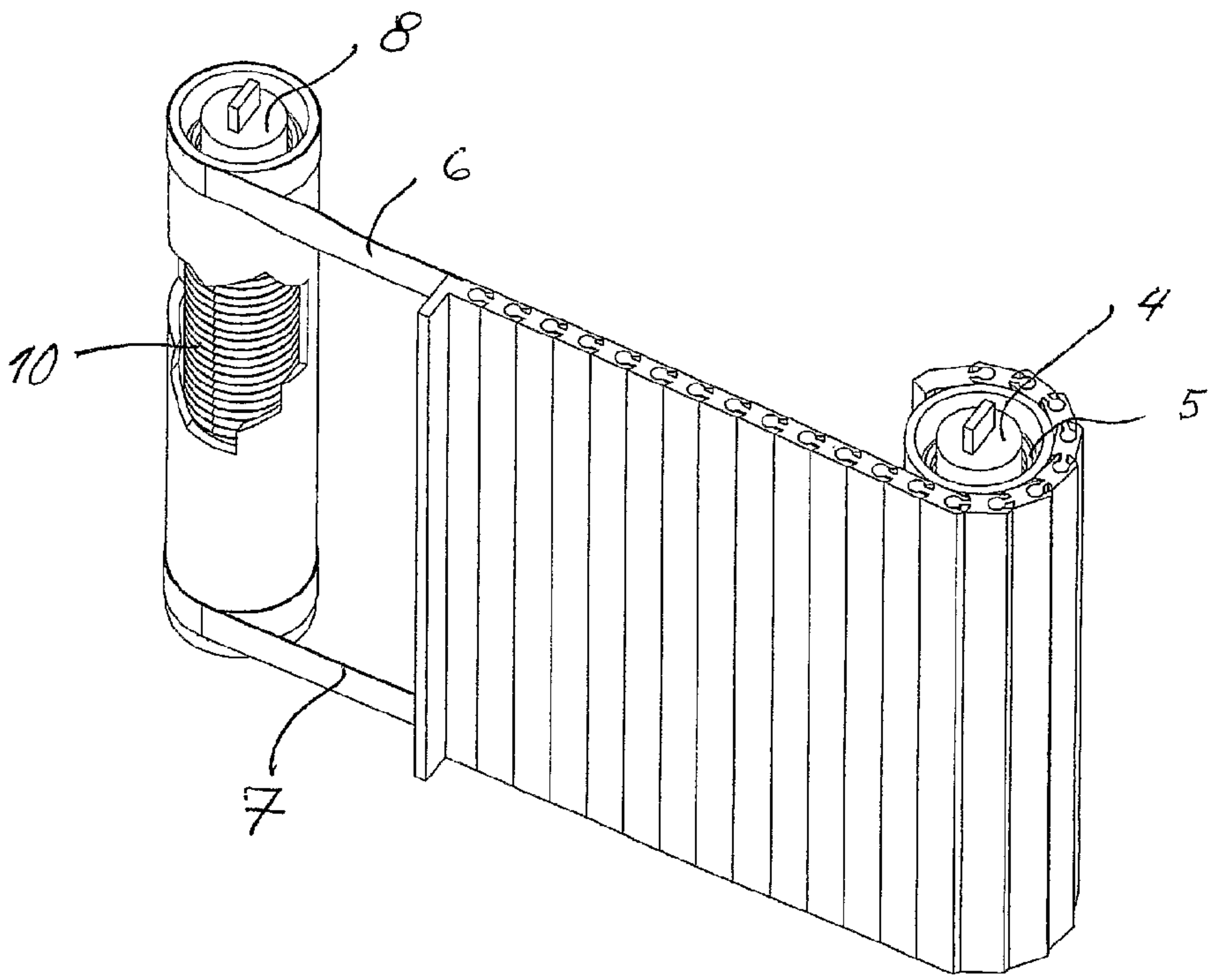

(57) Abrégé/Abstract:
The present invention concerns an elevator cabin door folding around a vertical axis during its closing movement and is based on the concept of making the door subject to a continuous tension exercised by a energy accumulator (preferably a spring) in order to keep the door opened, while, on the other door side, a traction action in opposite direction is exercised by means of two traction means (6, 7) that always pull the door and that wind around a second motorised vertical axis (8). The cabin door can then be mechanically coupled with a landing entrance door (11) so that the cabin door opening provokes the landing entrance door opening by means of dragging. The necessary torque on the different vertical axes of the construction are preferably exercised by cylindrical or helicoidal coil spring acting directly on the axes. The invention advantage mainly consists in the construction simplicity coupled with the reduced overall dimension and with the possibility of forming pre-assembled cabin doors and landing entrance doors and thus ready to be installed on the spot.

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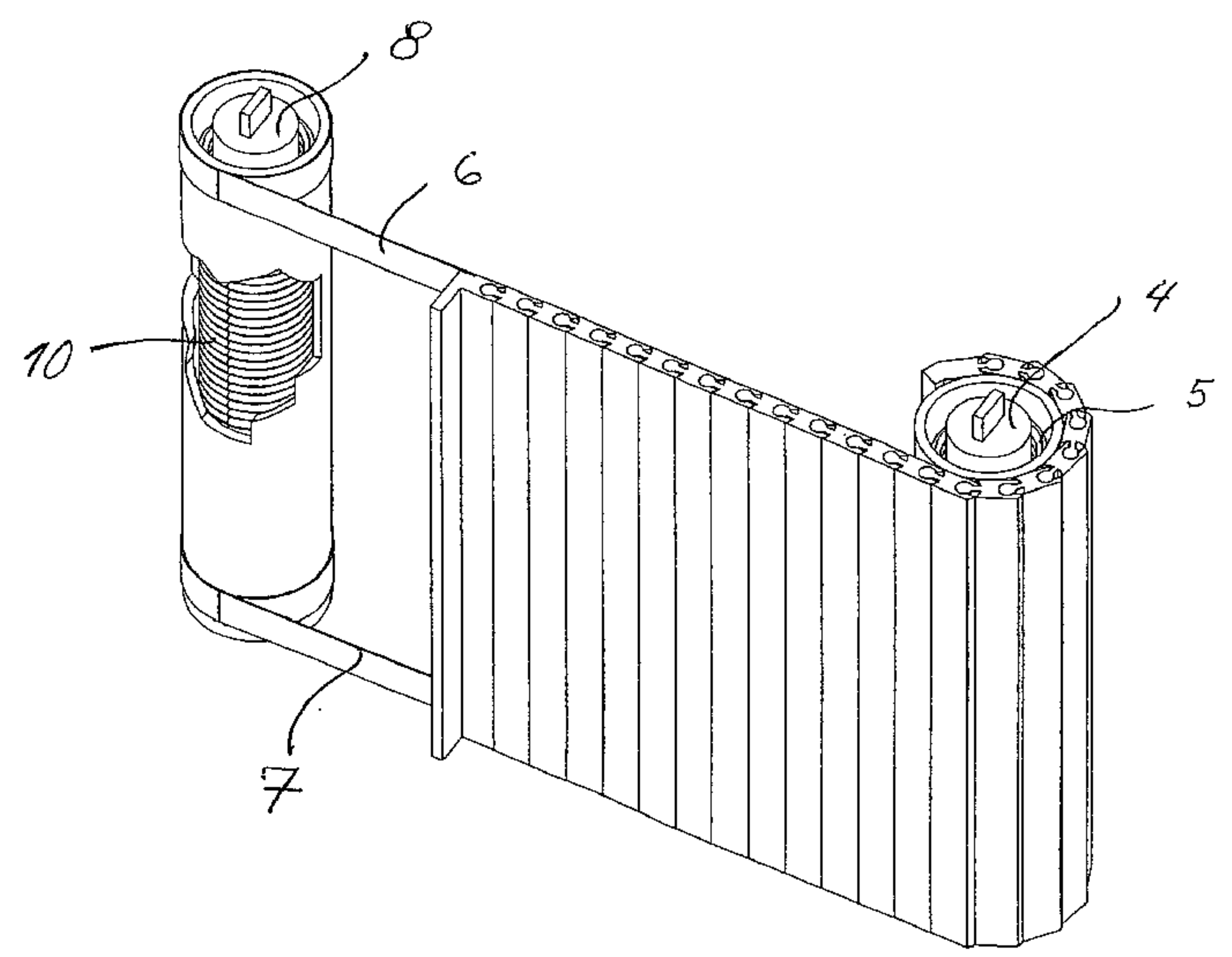

(57) Abstract: The present invention concerns an elevator cabin door folding around a vertical axis during its closing movement and is based on the concept of making the door subject to a continuous tension exercised by a energy accumulator (preferably a spring) in order to keep the door opened, while, on the other door side, a traction action in opposite direction is exercised by means of two traction means (6, 7) that always pull the door and that wind around a second motorised vertical axis (8). The cabin door can then be mechanically coupled with a landing entrance door (11) so that the cabin door opening provokes the landing entrance door opening by means of dragging. The necessary torque on the different vertical axes of the construction are preferably exercised by cylindrical or helicoidal coil spring acting directly on the axes. The invention advantage mainly consists in the construction simplicity coupled with the reduced overall dimension and with the possibility of forming pre-assembled cabin doors and landing entrance doors and thus ready to be installed on the spot.

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ELEVATOR DOOR CABIN

Field of the Invention

The present invention concerns an elevator door folding around a vertical axis, during its opening or closing movement.

Background of the Invention

The elevator doors folding around a vertical axis are known from the State of the Art.

Summary of the Invention

The present invention wants to propose another alternative of elevator cabin door folding around an axis with incorporated driving motor that allows realising an elevator cabin door of an extremely simple construction, of small overall dimension, since all the driving mechanisms are in practice located within the door itself, which can be supplied as pre-assembled unit, ready to be incorporated in the door final landing entrance and ideal to be combined with the landing entrance door that, according to the provisions on safety in force in the sector, shall in any way be operated (opened and closed) via dragging by the cabin door. For a failsafe door drive in case of blackout it is necessary that the door remains closed, so that passengers do not fall into the elevator shaft.

These purposes are achieved with an elevator cabin door folding around a first vertical axis during its opening or closing movement, characterised in that the first vertical axis around which the door folds is subject to a sufficiently high torque in order to keep the door opened, the torque being exercised by a first energy accumulator overcoming an opposite force that tends to close the door, the door comprises an upper traction means and a lower traction means wound around a second vertical axis on which a second energy accumulator acts, the second energy accumulator providing the opposite force that tends to close the door, and a motor acts on the second vertical axis, whereby the second energy accumulator and the motor exert a stronger force than the first energy accumulator .

The main characteristic of the proposed inventive solution is employing for handling the door, a motorised axis and energy accumulators as springs incorporated into the one and/or the other vertical axis around which the door is folded or winded.

According to these features, the vertical axis, around which the door folds or winds, is subject to the action of an energy accumulator (a spring in a preferred embodiment) that exercises on the axis a sufficiently high torque in order to keep the door completely opened, overcoming an opposite force - to which the door itself is constantly subject to - that tends to close it, and that also in the maximal opened position of the door, whereby the opposite force is exercised on the door by means of an upper traction means and a lower traction means that wind around a second motorised vertical axis, assembled on the other side of the door. This motorised axis, which according to a preferred embodiment is made as an axis with electric motor with external rotor and internal stator is in a position of exercising on the traction means a force able to overcome the maximal torque exercised on the axis around which the door folds and in this way closing the door. The motor relieves the force applied on the motorized axis by the force accumulator when opening the door. During the door opening movement a torque, lower than the minimal one exercised on the vertical axis around which the door folds - or winds - when the door is fully opened, is exercised on the vertical axis around which the traction means wind. The basic concept of the invention is therefore that the axis around which the door folds (or wind) is always subject to a torque tending to keep the door opened by a energy accumulator, preferably made as cylindrical or helicoidal coil spring and from the other side of the door, being the one of the leaf, the door is always kept pulled with a balanced force (through two traction means, an upper one and a lower one).

The invention is then realised in its constructive advantages, which are entirely available if it is foreseen, that the cabin door is combined with the landing entrance door. We have to keep in mind that the coupling of the cabin door with the landing entrance door is currently requested by security reasons, because these imperatively foresee that the landing entrance door can only be opened by dragging by means of the cabin door. That is in order to prevent that the landing entrance door could inadvertently open without the cabin being present.

The present invention foresees therefore, in one of its particularly interesting embodiment forms, that also the landing entrance door is a door folding or winding around a vertical axis during its closing and opening movement and that moreover the door is constantly subject to a tractive force that tends to close it - as foreseen by the prescriptions on safety. Such tractive force must be overcome by the tractive force exercised on the door, in opposite direction, by the cabin door during its opening movement. The construction of the landing entrance door follows from the one of the cabin door, with the unique difference of not exhibiting a motorised vertical axis as the landing entrance door motorisation, as above-mentioned, takes place by dragging by means of the cabin door.

Another purpose of the present invention is to provide a door for elevators that regroups all the wanted requirements for an innovative and efficient door:

- small overall dimension laterally to the elevator cabin and therefore a flexible door able to be rolled up around a vertical axis,
- to be fire-resistant in order to satisfy the strict provisions regarding anti-fire protection currently in force,
- to have sufficient mechanical resistance, when stressed in its centre by a defined horizontal force, and not to exceed the permissible maximal elastic deformation ("bowing"),
- to be of pleasant appearance and therefore satisfying the requested aesthetic requirements defined by the trends of the current architecture.

The above-mentioned aims can be achieved by means of an elevator door folding around a vertical axis in conformity with the characteristics of the dependent claims. They contain the fundamental measures to realize a fire-resistant door, which is either airtight to fire or resisting to fire for the minimal time defined by the laws and regulations in force (that can vary and indeed vary from Country to Country). Such measures are the rigidity around any imaginary horizontal axis and the folding around any vertical axis in order to be able to realise the rolling up of the door around a vertical axis, with a minimal bending radius (r), that is smaller than the tenth part of the thickness (d) of the door.

Concerning the rigidity of the door around any horizontal axis in some Countries a rule exists that the door permissible maximal deformation (its "bowing"), if stressed, as above-mentioned with a force of 30 kg, is 15 millimetres. Such rigidity can be influenced, as it will be explained with the help of various preferred solutions, in different ways, but all available to the man skilled in the art, who is able to choose the most appropriate technical solution in relation to the specific conditions.

Brief Description of the Drawings

Other characteristics of the invention will be better described by some preferred embodiments with the attached relative Figures.

These show:

- Figure 1: cabin door according to the invention, in a section along a horizontal plan, in its opened state, in a schematic representation to show the basic elements that constitute it.

- Figure 2: the same schematic representation of Figure 1, but with the door closed,

- Figure 3: one schematic representation in a perspective of the essential elements of the inventive door,

- Figure 3a - 3f: various inventive forms of elevator door with different construction types, which are represented in a section and in a pure schematic way,

- Figures 4a and 4b: the door according to the invention shown in its frame as a constructive unit, in Figure 4a in a closed state and in Figure 4b in an opened state,

- Figure 5: constructive details of the door essential elements in an enlarged view,

- Figure 6: similar representation to the one of Figure 5, but where also the landing entrance door coupled with the cabin door is represented in a half-open position,

- Figure 7: a general view of the elevator standing on a floor with open doors.

Detailed Description of the Preferred Embodiments

Before describing more in detail the invention with the support of some embodiments, we want to emphasize two points of general nature.

The first one concerns the fact that the invention refers essentially only to the construction of the cabin door, even if we are aware that the security reasons impose that the cabin door is always being coupled, in the standing points, with the landing entrance door and that indeed it constitutes the mechanically coupled driving element of the landing entrance door that can only open by dragging by means of the cabin door.

However, the advantages offered by the invention concerning the possibility of adapting the cabin door as pre-assembled unit to be applied to the cabin, advantages essentially due to the possibility of rolling up the door around an axis and to its motorisation by means of a second motor axis incorporated in the axis itself, can generally be applied to whatever type of landing entrance door already known, for example also to a door with rigid shutter. It is true that if also the landing entrance door is made similarly to the one of the cabin - that is to say folding around an axis - other advantages can be obtained by the application of the present invention because it is possible to realise a total construction of the elevator, which is greatly simplified and that has a reduced overall dimension, since these characteristics are then applied also to the landing entrance door. This possibility, foreseen in claim 7, is surely a preferred embodiment of the invention, but it does not constitute in any way the only possible solution.

The second point we want to mention is the one related to the forces at play in the field. The invention, in its simple application as cabin door as well as in its combined version – according to claim 7 – as cabin door coupled with the landing entrance door, exhibits at least two energy accumulators (usually two springs) operating in opposition. In the preferred solution of claim 7, the energy accumulators are even four which must evidently be chosen appropriately, in order to satisfy in particular to the precise legal provisions relative to the minimal and maximal forces to operate the doors in case of a breakdown etc. Therefore this requires a specific study about the elastic characteristics of the single springs which are taken into account as energy accumulators (or of the single counterweights, respectively brakes, if the torques necessary for operating the door or doors are realised by means of weight or breaking, as described below).

The forces depend from many factors such as the size and the weight of the door, friction etc, which must be taken into account in addition to the mentioned legal provisions. It is not a task of the present description, neither could it be, to give some values of the torques that must act on the different vertical axes that constitute the driving elements of the single door or of the two doors. These forces are in fact calculated each time, taking into account the specific conditions of application of the invention, which is available to the man skilled in the art. From such computations result the characteristics of the springs to be employed, being of a cylindrical coil type or a helicoidal coil type or of some other types that will allow their most appropriated dimensioning in relation to the need.

These premises made, we may now get to the more detailed description of some embodiments of the present invention.

In Figures 1 and 2 are represented the essential elements of the inventive cabin door, the first with open door and the second with closed door in a section based on a horizontal plan. The door frame is systematically indicated with number 1 which is better seen in Figures 4a and 4b and that is made of a rectangular frame enclosing the full door. The door is guided by means of guides 3, 2 (see Figures 4a, 4b) along the upper and lower parts. The door itself is of the type folding around a vertical axis 4 (see Figures 1, 2 and 3). We want to specify already here that, in order to realise the present invention, it is only sufficient that the door is folding, respectively winding, around a vertical axis, which does not require the absolute fire-tight seal, so that also a door made of "parallel boards" can be taken into account in order to realise the present invention.

The vertical axis 4 is inventively subject to the action of a first energy accumulator 5, indicated in Figures 1 and 2 symbolically by the dotting of the axis itself. The energy accumulator 5 exercises a sufficiently high torque on the axis 4 in order to keep the door fully open, overcoming an opposite force that tends to close the door. The opposite force is necessary since is important that the door, in whatever situation (open, semi-open or closed), is always energised.

According to a preferred embodiment of the invention, the energy accumulator 5 acting on the axis 4 is a cylindrical coil spring or a helicoidal coil spring that can be preferably incorporated into the same axis, which must be, in such situation, hollow. A similar construction of a hollow axis with a cylindrical coil spring is shown, only as an example, in Figure 5. In any way, it is a constructive element known to the man skilled in the art.

According to an additional fundamental characteristic of the invention it is foreseen that the above-mentioned opposite force - that keeps the elevator cabin door constantly pulled – is applied to the door itself by means of an upper traction means 6 and a lower traction means 7. The traction means 6, 7 winds around a second motorised vertical axis 8. On the axis 8 acts a torque, exercised by a second energy accumulator 10, e.g. a coil spring. Within the axis 8 is placed an electric motor 18. The vertical axis 8, which lies on the opposite side of the cabin door in relation to the vertical axis 4, is therefore coupled with an electric motor 18 that is in a position of exercising on the traction means 6, 7 a force that can overcome the maximal torque exercised on the axis 4 around which the door folds and therefore close the door. The moment exercised by the energy accumulator 5 on the axis 4 will be in fact maximal when the door will be completely closed, since for example the spring that constitutes the energy accumulator 5 will be then pulled to the maximum. If the energy accumulator 5 has the form of a counterweight, the torque exercised on the axis 4 by the energy accumulator would be always constant. The motor that acts on the vertical axis 8 serves therefore only for opening or closing the door and its function will remain the same also in the event (represented in Figures 6, 7, 8 and object of the dependent claims 7 and 8) in which the cabin door is coupled with the landing entrance door and open this one by dragging.

When the cabin door is fully closed, it is mechanically blocked by means of an appropriate blocking mechanism 9, as for example a lock, indicated in Figure 2 only in a symbolic way. After that the driving motor can be deactivated and the door remains closed and pulled under the action of the energy accumulator that acts on the axis 4.

So that the described forces at play can properly work, a third condition that constitutes therefore the third fundamental characteristic of the present invention must then be fulfilled.

This foresees that during the opening movement of the door, a torque, lower than the minimal one exercised on the vertical axis 4 around which the door folds when the door is fully opened, is exercised by the respective energy accumulator on the vertical axis 8 around which the traction means 6 and 7 wind. Only in that way the door will remain fully opened and that in spite of the tension action exercised in every position on the door by the traction means 6 and 7. Here, we also want to specify that if instead of the spring we use counterweights as energy accumulators, the mentioned moments remain essentially constant, that is to say that the minimal moment and maximal moment have the same entity. This does not modify in any way the basic concepts on which lies the present invention.

According to an additional preferred embodiment alternative of the invention is foreseen that that the driving electric motor 18 of the second vertical axis 8 around which the traction means 6, 7 wind is incorporated into the vertical axis 8 itself, which is, in such circumstance, an hollow axis and it is made with internal stator and external rotor.

The advantage of this solution is obvious and is intrinsic in the characteristics of the built-in motor that allow the realisation of a compact and fully pre-assembled door.

We have already mentioned that, in order to exercise the torque on the vertical axis 8 around which the traction means 6, 7 wind during the door closing movement, this can be favourably generated by a cylindrical or helicoidal coil spring (indicated as an example with reference number 10 in Figure 5) acting directly on the axis 8.

This solution is mechanically elegant, allows the full incorporation of the energy accumulator into the axis 8 and has also the advantage of ensuring a considerable evenness of solution with the other energy accumulators foreseen for the other axes (this will better appear from the description of the most common application form of the invention, represented in Figure 6 and 7 and being the object of claim 7).

However, this embodiment is not the only one desirable. Indeed we must keep in mind that, during the door opening, the only veritable function of the energy accumulator that acts on the winding vertical axis 8 of the traction means 6, 7 is that one of braking the door, so as to always generate a tension in the door itself. This effect of braking the door can therefore, according to an additional preferred embodiment form of the invention, be generated through the action of a mechanical brake or electrical brake (not shown) acting on the axis 8, directly or by means of the driving electric motor of the axis 8, that is to say of the elevator cabin door. The man skilled in the art knows how to produce a similar mechanically or electrically driven brake, so that we do not need to spend more time getting into more details.

In Figure 5, which shows the constructive details of the door essential elements in an enlarged view - in which the proportion relations have been intentionally modified so as to improve the clarity of representation, we also see that the door can be made of single vertical sheets mutually connected "as hinge".

A feature sometimes necessary is the fact that the door must be "fireproofing", that is to say that they must have the necessary characteristics of airtight closing, that is to say that, in practice, they must be made of an unique continuous surface without holes, passages, fissures, etc. and to be made of a fire-resistant material (metal or fire-resistant plastic etc.), so as to satisfy to the relative norms present in every Country. Such norms vary from Country to Country, but they are known to the man skilled in the art, who does thus know what a fireproofing door means (concept related also to the resistance time of the door against fire and smoke attacks) and he is in a position of choosing the most appropriate materials, respectively materials mixtures in order to built a fireproofing door also folding around a vertical axis.

The present invention focus also on the mechanical properties that a similar door must possess for being used as elevator door and as a result realise the above-mentioned advantages as a similar door offers in the elevators field.

It is therefore foreseen that the door is sufficiently rigid around any horizontal axis so as to satisfy to the legal provisions - which have already been mentioned – on the maximal deformability for permissible bending if stressed in its centre, in the closed state, with the horizontal force required from the norm. The door must therefore be rigid in relation to its vertical plan in order not to exceed a permissible maximal "bowing". This legal provision is made in order to avoid that, in case of excessive filling of the cabin or if a person leans itself heavily against the inner door, this door can excessively bend outwards and jeopardise the elevator functionality. Moreover, it is foreseen that the door must be sufficiently folding around any vertical axis in order to be able to be folded with a bending radius r (see Figure 2) ten times lower than the thickness of the door indicated with d in Figures from 3a to 3f. Here, we specify that with d we indicate the overall thickness of the door, that is to say the maximal thickness measured over eventual ribs or reinforcement elements. This second provision gives therefore a precise indication about the radius of the rolling axis 4 and of the deviation of the door.

The characteristics of the inventive elevator door are therefore the maximal folding around any vertical axis and the maximal resistance to bending in respect to every horizontal axis, where then this last characteristic is tied to legal provisions while the first one constitutes a free choice of the inventor and is tied to the constructive conditions that must be guaranteed in order of being able to benefit from the advantage foreseen by the invention.

According to a first embodiment represented in Figures 3b and 3c, it is foreseen that the continuous surface of the door is made of an unique foil of fire-resistant material, reinforced in at least one of the sides (in Figures 3b and 3c for example reinforced only on the upper side of the Figure) by means of vertical bars arranged at a mutual distance from each other and solidly fixed to the foil 39 along all their length. It must be specified that when we here speak about "vertical bars" we mean that these bars 310 are to be found in this position when the corresponding door is placed in the elevator in a working position.

Clearly if the foil of fire-resistant material (simple or compound, made for example as a sandwich of multiple material layers) has in itself already a sufficient bending resistance in the sense that it does not have (as shown for example in Figure 3a) to be equipped with any reinforcement by means of vertical bars or other reinforcement elements, if it also maintains the necessary folding properties to satisfy the conditions requested by the claims. However, it is not easy to balance the rigidity concerning the horizontal axes and the folding regarding the vertical axes without providing some reinforcement measures, as foreseen by the solutions of Figures 3b -3f.

According to one alternative solution in Figure 3b it is foreseen that the bars 310 have a cylindrical section shape. This shape is ideal, since it allows the door folding in the winding or deviation point, in practice over all the surface dimension (that would not be the case if the bars 310 had, as an example, a rectangular section and were solidly fixed to the foil of fire-resistant material along one of their sides).

Another embodiment of the invention is represented in Figures 3f and 3e, based on which the continuous surface is made of an unique foil 39', respectively 39", exhibiting, at regular mutual distances, vertical ribs 311 obtained by means of press forming of the foil in a die (case of ribs 311 of Figures 31) or by means of local deformation of foil 39" (case of ribs 311 of Figure 3e).

According to another embodiment of the invention it is foreseen that the fireproofing continuous surface, that is to say the foil of fire-resistant material, is made of a metallic sheet, preferably of stainless steel with a thickness comprised between 0,2 and 1 millimetres, preferably 0.3 millimetres. This particular embodiment is particularly suitable in order to realise the solutions shown in Figures 3c and 3e. The advantages related to the use of a foil of metallic sheet and in particular of stainless steel, are more than obvious (fire-resistance, high elasticity coefficient, etc). Such solutions require in any event the use of appropriate vertical reinforcements as previously described.

According to another preferred embodiment, represented schematically in Figure 3a, it is foreseen that the fireproofing continuous surface is made of a foil of fire-resistant plastic material 39, with a thickness comprised between 2 and 10 millimetres, preferably 3 millimetres. The problem of such a foil of fire-resistant plastic material, of which today many types with different names and brands are marketed, is the one of the bending resistance that, as wanted by the present invention, must be high around the horizontal axes when the door is assembled into the elevator. In order to palliate to this possible disadvantage of the foil of fire-resistant plastic material, another embodiment of the invention, represented in Figure 3d, foresees that the same one is reinforced by means of embedment in its mass of reinforcement bars provided with a high elasticity coefficient, uniformly distanced from each other and that, after the assembly of the door in the elevator cabin, they will take a vertical position..

Another embodiment, which has the advantage of allowing obtaining the maximal reduction of the overall dimension laterally to the elevator cabin, foresees that the bending radius r is comprised between 3 and 20 centimetres.

The folding elevator door can favourably be made as rolling up door or winding door around a vertical axis 4 (Figures 1 and 2) placed on the door opening side or also that the door is folded of 90° from its opening side, as shown with the landing entrance door 11 of Figure 6 and is guided by means of upper and lower guides 2, 3, which are straight after such bending. In this second event, the handling of the external door will preferably take place via dragging by means of the corresponding cabin door, while in the event of rolling up door, the handling of the door will preferably take place individually, motorising the corresponding rolling axis 4 or 12. These motorisation problems are well known by the man skilled in the art and are today solved mainly by means of chain drive or toothed gearing.

Another preferred embodiment foresees then that the fireproofing continuous surface, respectively the foil of fire-resistant material, is textured on its external side so as to improve the aesthetical appearance, as mentioned also by the previous patent application JP-2000- 130051.

Another preferred embodiment foresees then that the fireproofing continuous surface, respectively the foil of fire-resistant material 39, is provided with an acoustic insulation layer. The sense of this alternative is obvious: to reduce the noise arising from the door opening and closing and possibly due to possible vibrations that could appear during the elevator stroke. This solution must be constructively seen, within the already mentioned sphere of the choice of multilayer foils of fire-resistant material and is therefore taken into account in this context.

The advantages are, beyond those of the reduction of the overall dimension and of the fulfilment of the legal provisions on anti-fire protection that have already been mentioned, related also to a relevant simplicity of construction of the door, thanks to the possibility of moving it directly through the manipulation of the rolling or winding axis and to its stillness.

As last we should not forget the aesthetical appearance, thanks to which the type of folding door for elevator is suitable for every type of traditional and innovative architecture.

According to another preferred embodiment form of the invention, mentioned here above and that is represented in Figures 6 and 7, the cabin door can be coupled, in the elevator halt points, with the landing entrance door according to the legal provisions. In Figure 6 the same elements of Figures 1 to 5 are indicated with the same reference numbers and are not mentioned any more.

The landing entrance door 11 is also a door folding or winding around a vertical axis 12 during its closing and opening movement. Moreover, (according to what the specific laws and regulations foresee), the landing entrance door 11 is mechanically dragged by the cabin door during its opening. The cabin door is equipped with a dragging element 13, which has the shape of a lock dragging a counter-hook 14 fixed at the extremity of the landing entrance door 11.

Moreover, the landing entrance door 11 shows the vertical axis 12 around which it folds - or it winds – on the same side in which the cabin door has the vertical axis 4 around which it folds or it winds (in the Figure a winding axis is always shown, but the invention can also be more or less suitably applied if the axes 4 and 12 are "only" bending axes of 90° of the door).

So that the invention can be used for cabin doors coupled with landing entrance doors is clearly necessary and indispensable that some general conditions are fulfilled:

- the landing entrance door 11 must be constantly subject to a tractive force that tends to close it and that must be overcome by the tractive force exercised on it, in opposite direction, by dragging, by means of the cabin door during its opening movement. The landing entrance door 11 is therefore subject to the tractive force exercised from the two traction means, an upper one 15 and a lower one 16, where then both traction means wind around a second vertical axis 17 of the landing entrance door 11 on which a torque is exercised by means of a energy accumulator (not shown, but fully similar in the construction, if not in the shape, to the one acting on the axis 8 of the cabin door).

According to a preferred embodiment for the execution of the invention, according to Figure 6, is foreseen that the energy accumulator, which exercises the torque on the vertical axis 17 around which the traction means 15, 16 of the landing entrance door 11 wind, is also made - as in the case of the energy accumulators for the other axes 4, 8, 12 - as cylindrical or helicoidal coil spring. As the vertical axis 17 is not motorised, it would not be possibile to foresee here a brake as an alternative to a spring, while a counterweight would be possible for the production of the torque.

In Figure 7 the elevator cabin is represented in a general view with opened doors so as to show the full carrying structure without the vertical guides and the necessary supporting elements.

As already mentioned here above, the characteristics of the different energy accumulators that can be taken into account for the realisation of the elevator cabin door, particularly in its combination with the landing entrance door, must be chosen so as to be able of satisfying to the legal requirements related to the minimal and maximal efforts for a person to open the doors from the inside or from the outside in case of a breakdown. These can be easily calculated by an expert constructor and can also be easily realised in the practice by means of adopting the available energy accumulator types adapted for each case.

PATENT CLAIMS

1. Elevator cabin door folding around a first vertical axis during its opening or closing movement,
   characterised in that
   - the first vertical axis around which the door folds is subject to a sufficiently high torque in order to keep the door opened, the torque being exercised by a first energy accumulator overcoming an opposite force that tends to close the door,
   - the door comprises an upper traction means and a lower traction means wound around a second vertical axis on which a second energy accumulator acts, the second energy accumulator providing the opposite force that tends to close the door, and
   - a motor acts on the second vertical axis, whereby the second energy accumulator and the motor exert a stronger force than the first energy accumulator .

2. Elevator cabin door according to claim 1,
   characterised in that
   the first and second energy accumulators that exercise on the first vertical axis and the second vertical axis the torque are formed by cylindrical or helicoidal coil springs.

3. Elevator cabin door according to claim 2,
   characterised in that
   at least one of the first vertical axis and the second vertical axis is hollow and the spring is incorporated into the at least one hollow vertical axis.

4. Elevator cabin door according to any one of claims 1 to 3,
   characterised in that
   the driving motor is placed within the second vertical axis.

5. Elevator cabin door according to claim 4, wherein the driving motor has an internal stator and an external rotor.

6. Elevator cabin door folding around the first vertical axis according to any one of claims 1 to 5,

   characterised in that

   - the cabin door is coupled, in the elevator halt points, with the landing entrance door,
   - the landing entrance door is also a door folding or winding around a third vertical axis during its closing or opening movement,
   - the landing entrance door is mechanically dragged by the cabin door during its opening,
   - the landing entrance door exhibits the third vertical axis around which it folds on the same side in which the cabin door has the first vertical axis around which it folds.

7. Elevator cabin door folding around the first vertical axis according to claim 6,

   characterised in that

   - the landing entrance door is constantly subject to a tractive force that tends to close it and that must be overcome by the tractive force exercised on it in opposite direction and by dragging by means of the cabin door during its opening movement,
   - and/or the force to which the landing entrance door is constantly subject to is exercised by means of an upper traction means and a lower traction means, where then the upper and lower traction means wind around a fourth vertical axis of the landing entrance door, on which a torque is exercised by means of a energy accumulator.

8. Elevator cabin door according to any one of claims 1 to 7,

   characterised in that

   the door folding around the first vertical axis during its opening or closing movement includes a fireproofing continuous surface made of fire-resistant material and/or

the door is guided along the upper part and the lower part by means of horizontal guides that determine its shifting trajectory at least along the door span

and/or

the door is sufficiently rigid around any horizontal axis and is sufficiently folding around any vertical axis in order to be able to be folded up with a bending radius r lower than 10 d, d being the thickness of the door.

9. Elevator cabin door according to claim 8,

characterised in that

the continuous surface is made of a single foil of fire-resistant material reinforced at least on one of the sides by means of vertical bars arranged at mutual distances from each other and solidly fixed to the foil along all their length.

10. Elevator cabin door according to claim 8 or 9,

characterised in that

the continuous surface is made of a single foil, exhibiting vertical ribs at regular mutual distances, obtained by means of press forming of the foil in a die or by means of local deformation of the foil.

11. Elevator with a cabin door according to any one of claims 1 to 10.

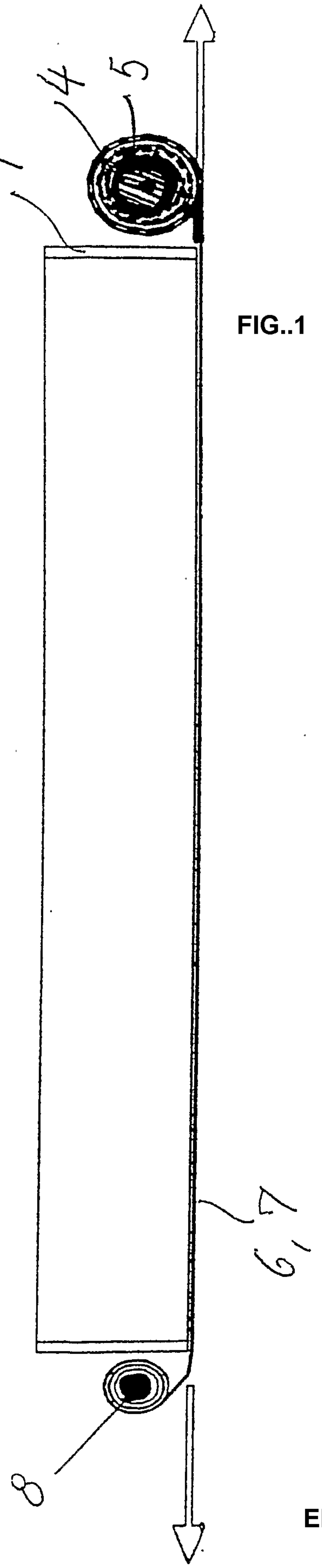

FIG..1

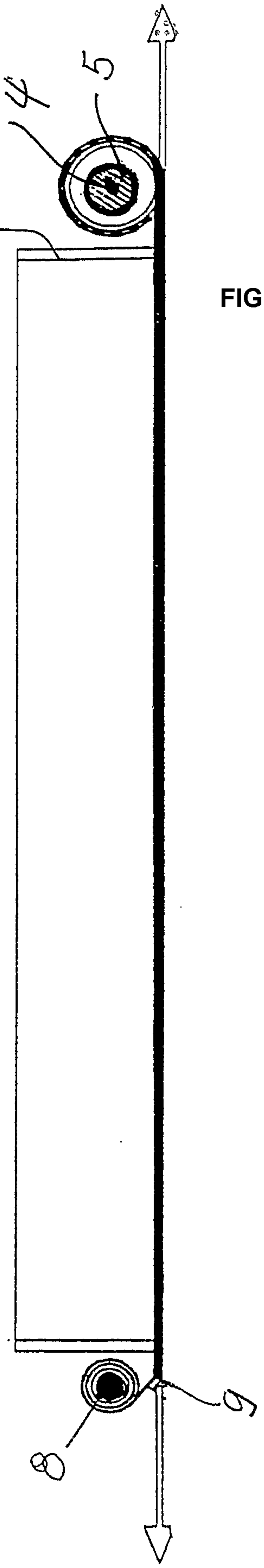

FIG..2

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FIG..4a

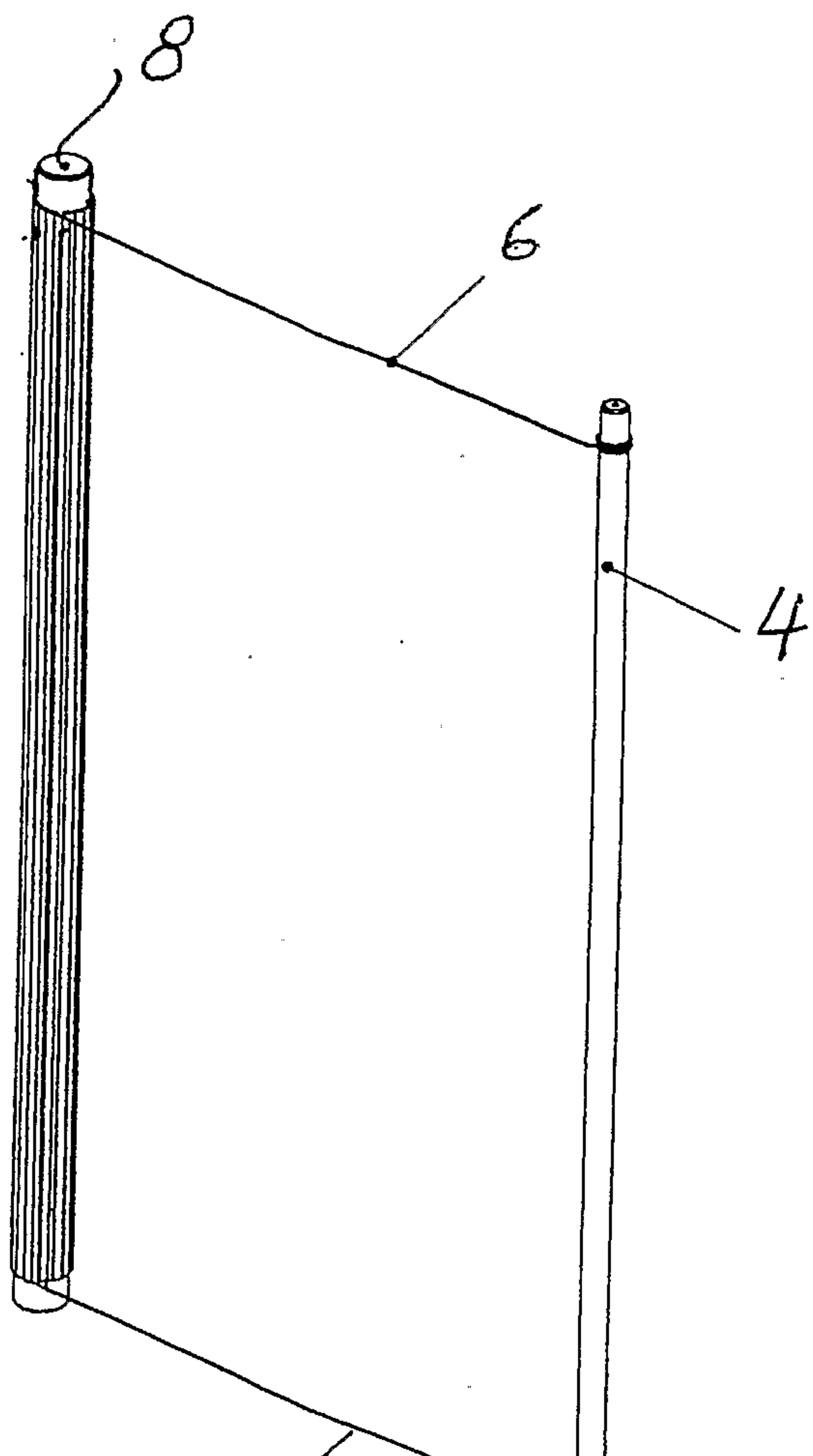

FIG..3

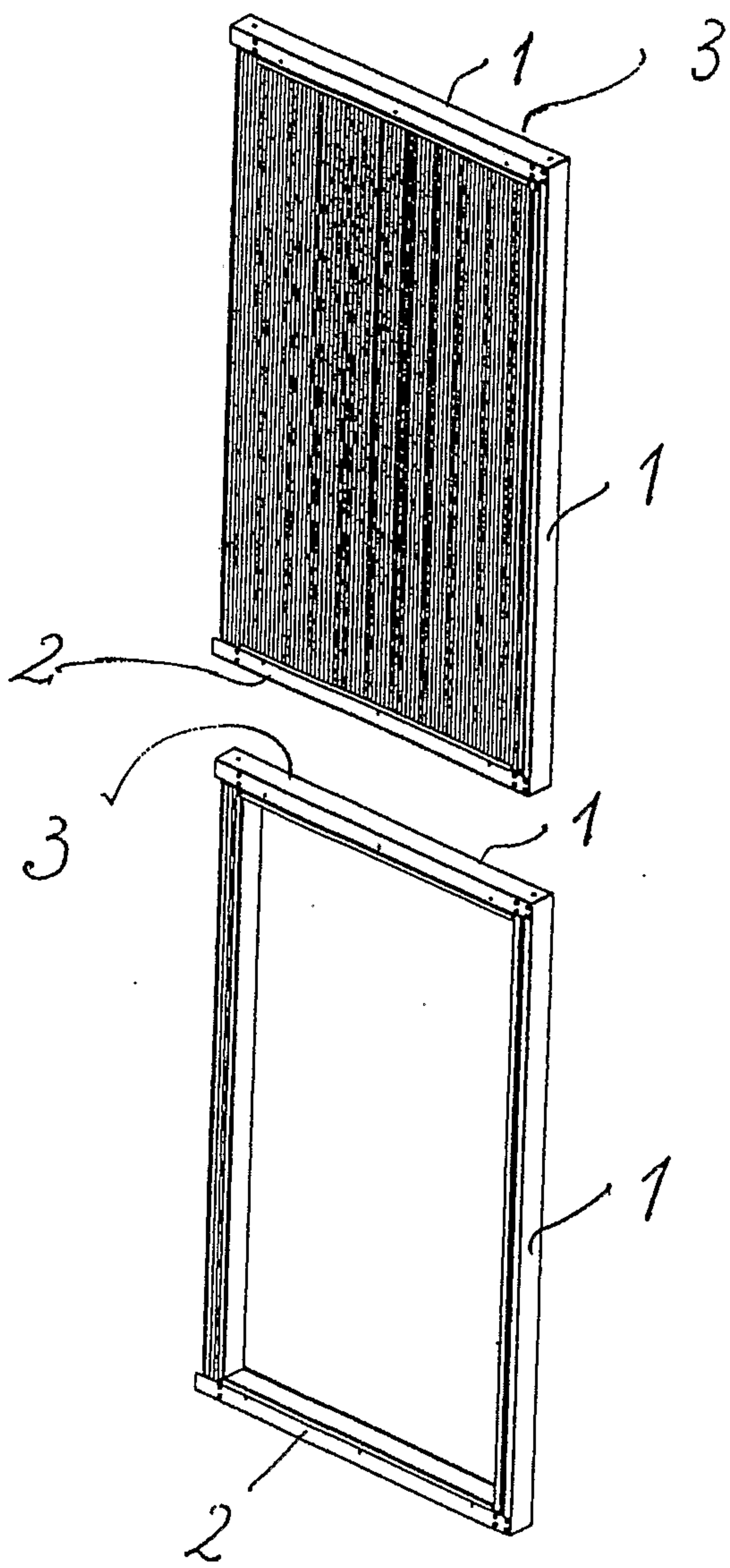

FIG..4b

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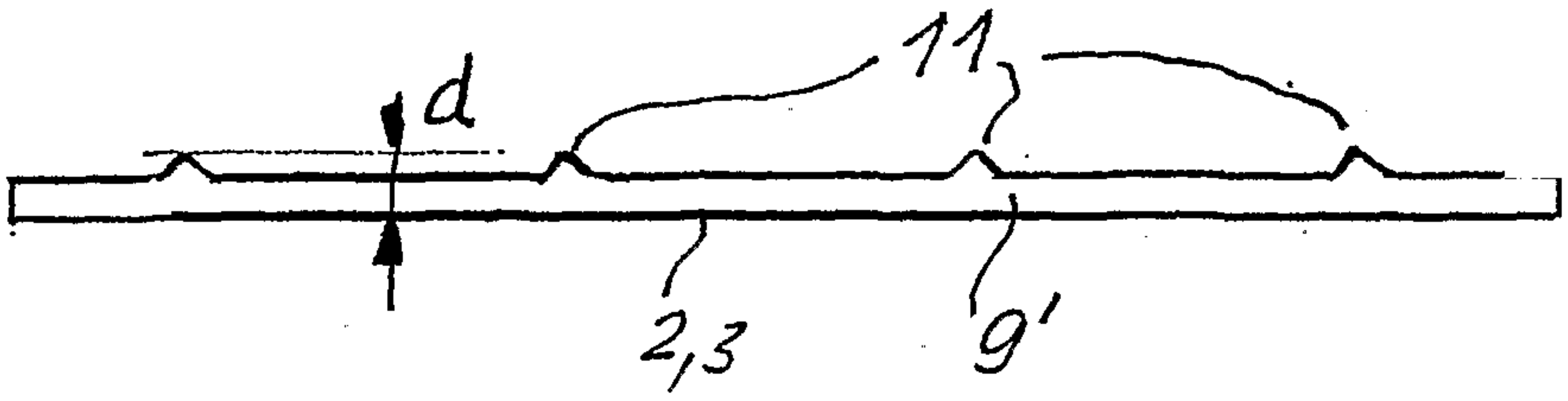


FIG..3f

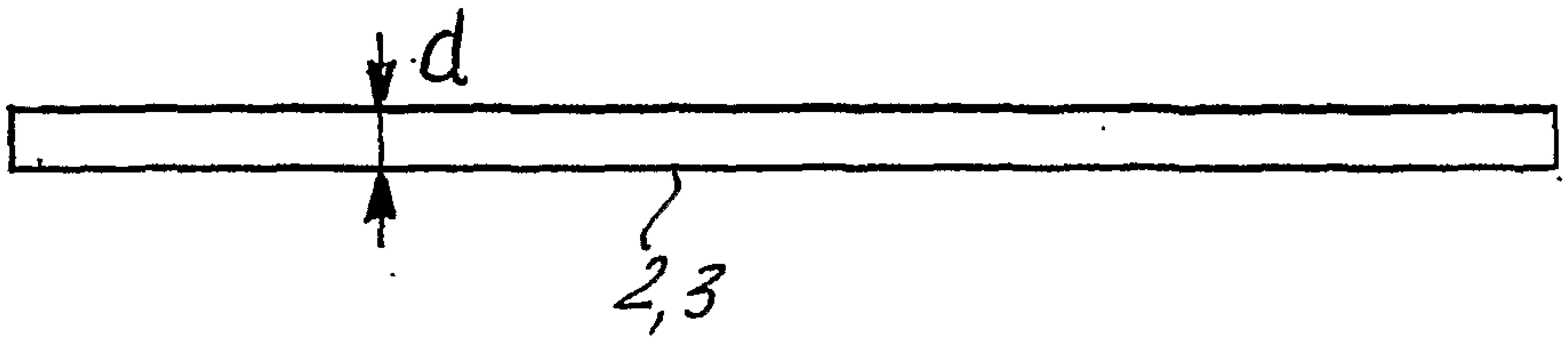


FIG..3a

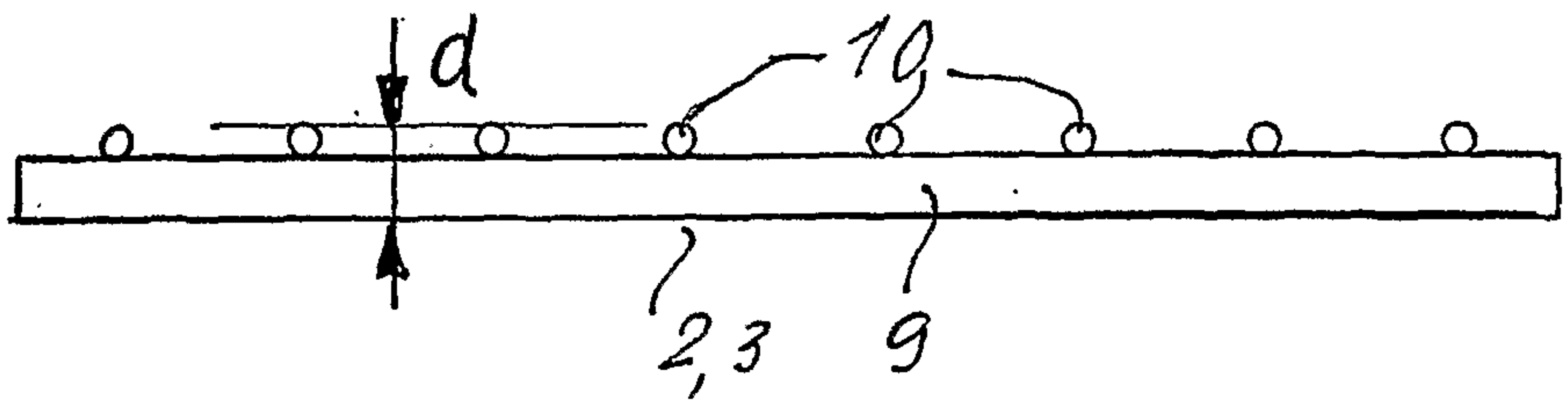


FIG..3b

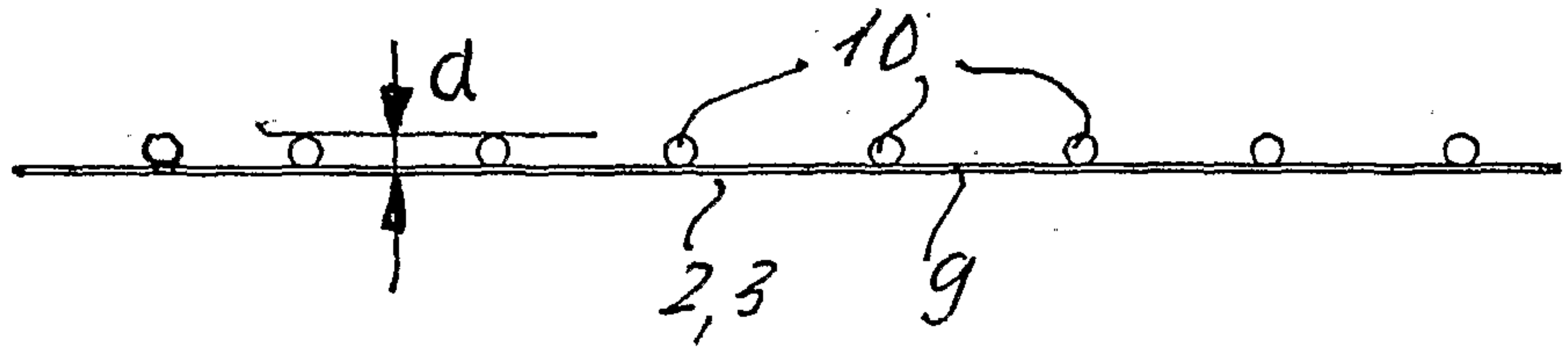


FIG..3c

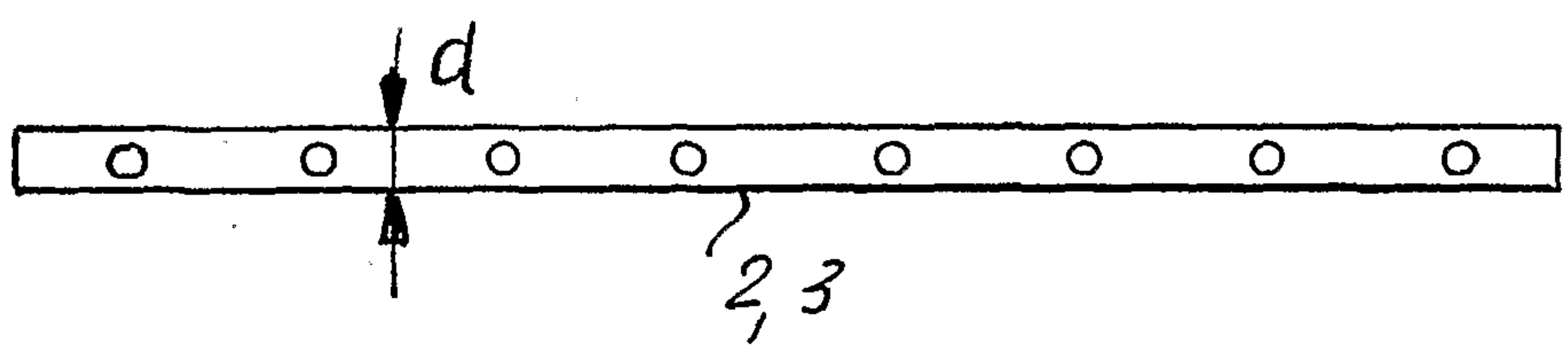


FIG..3d

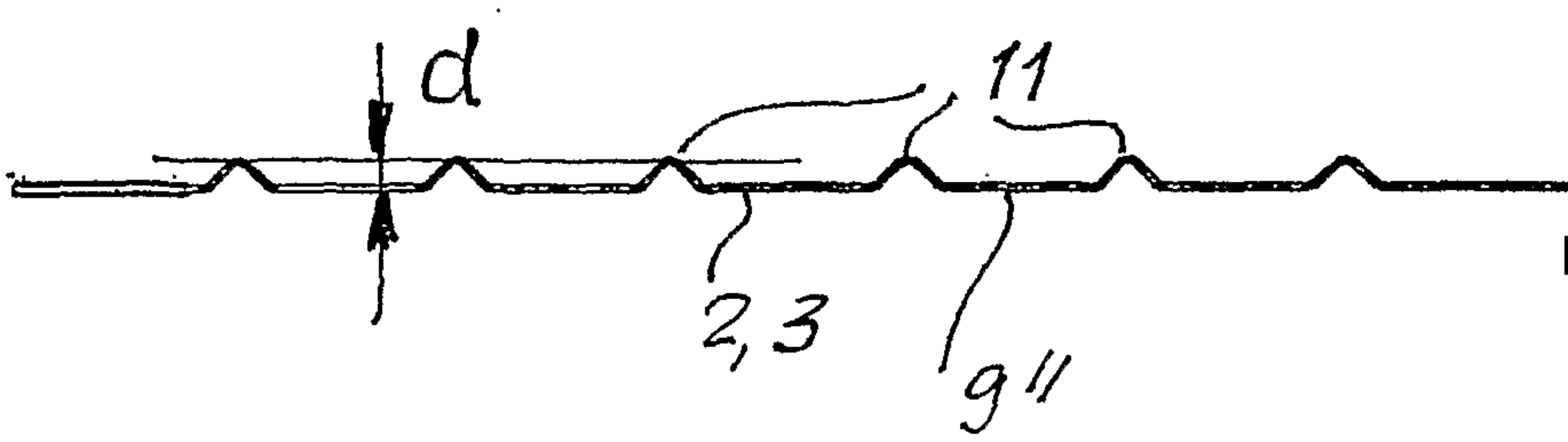


FIG..3e

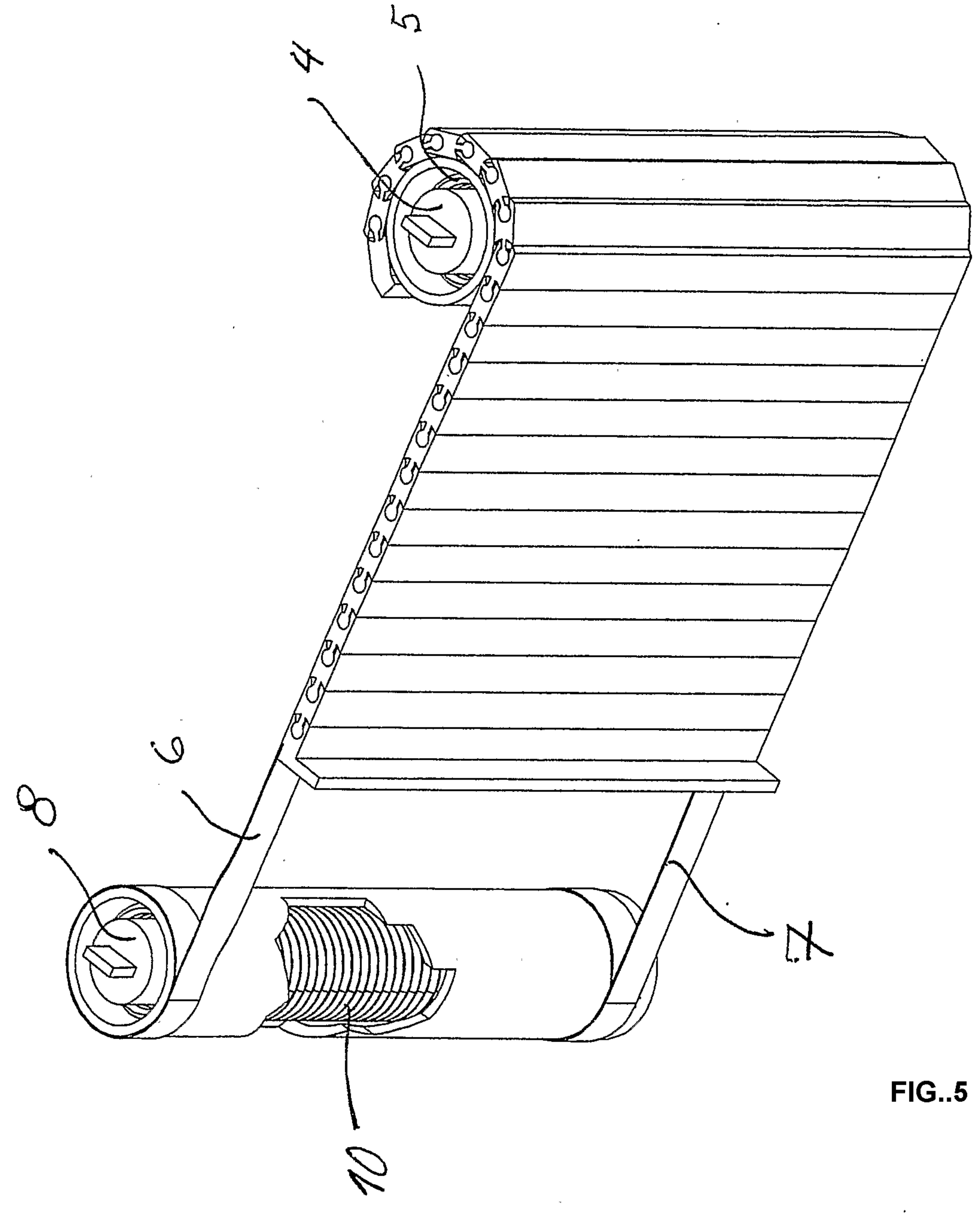


FIG..5

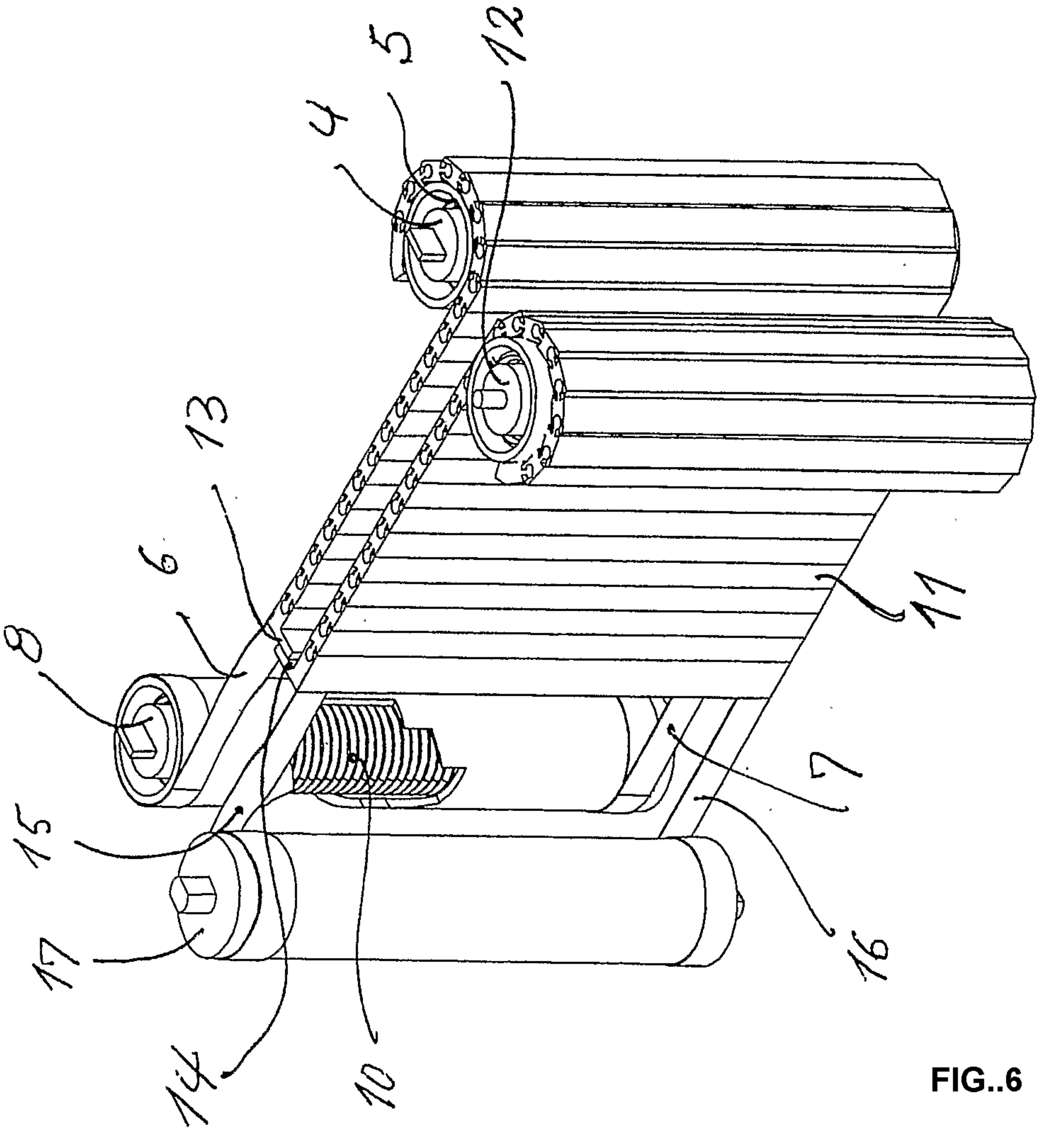


FIG..6

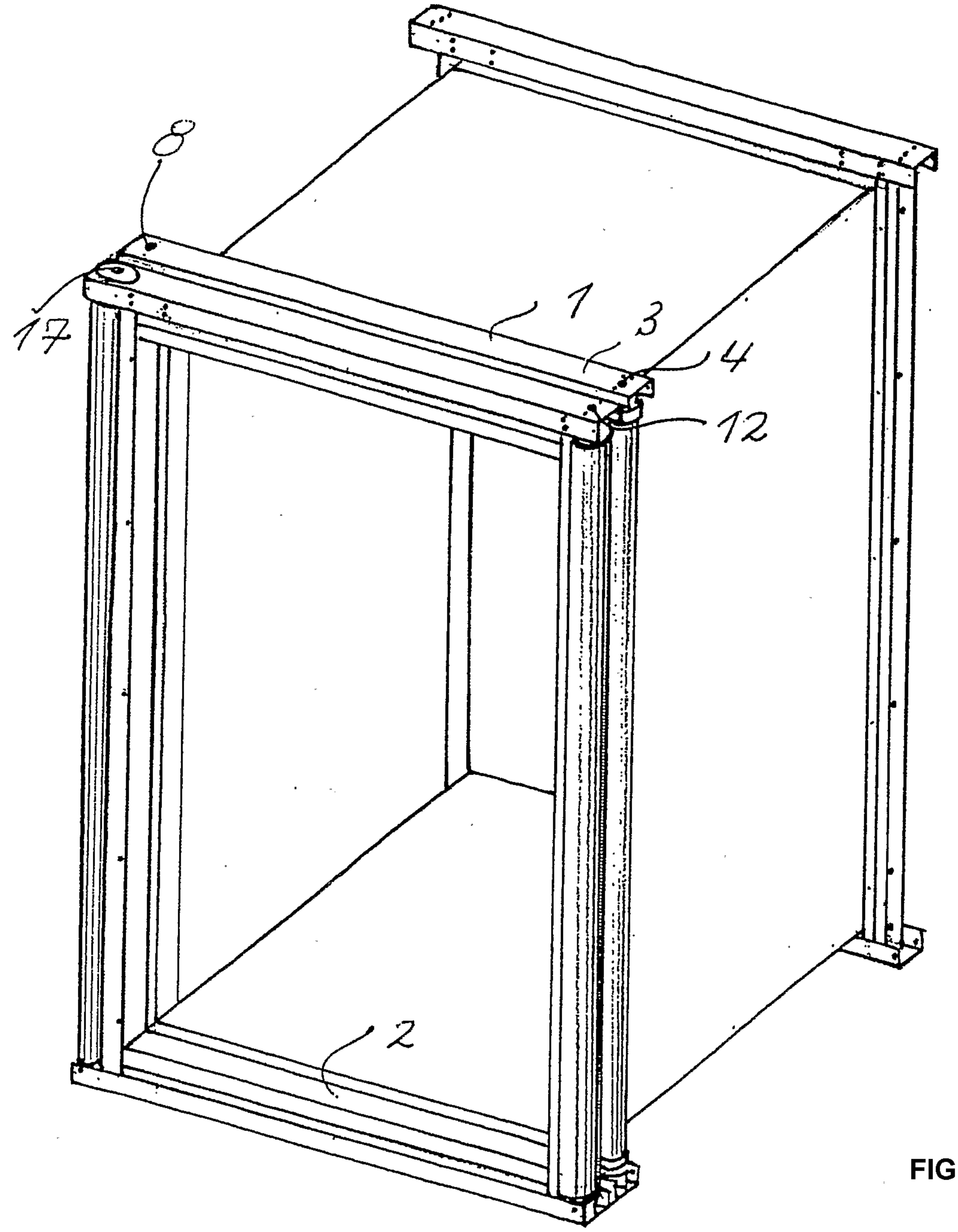
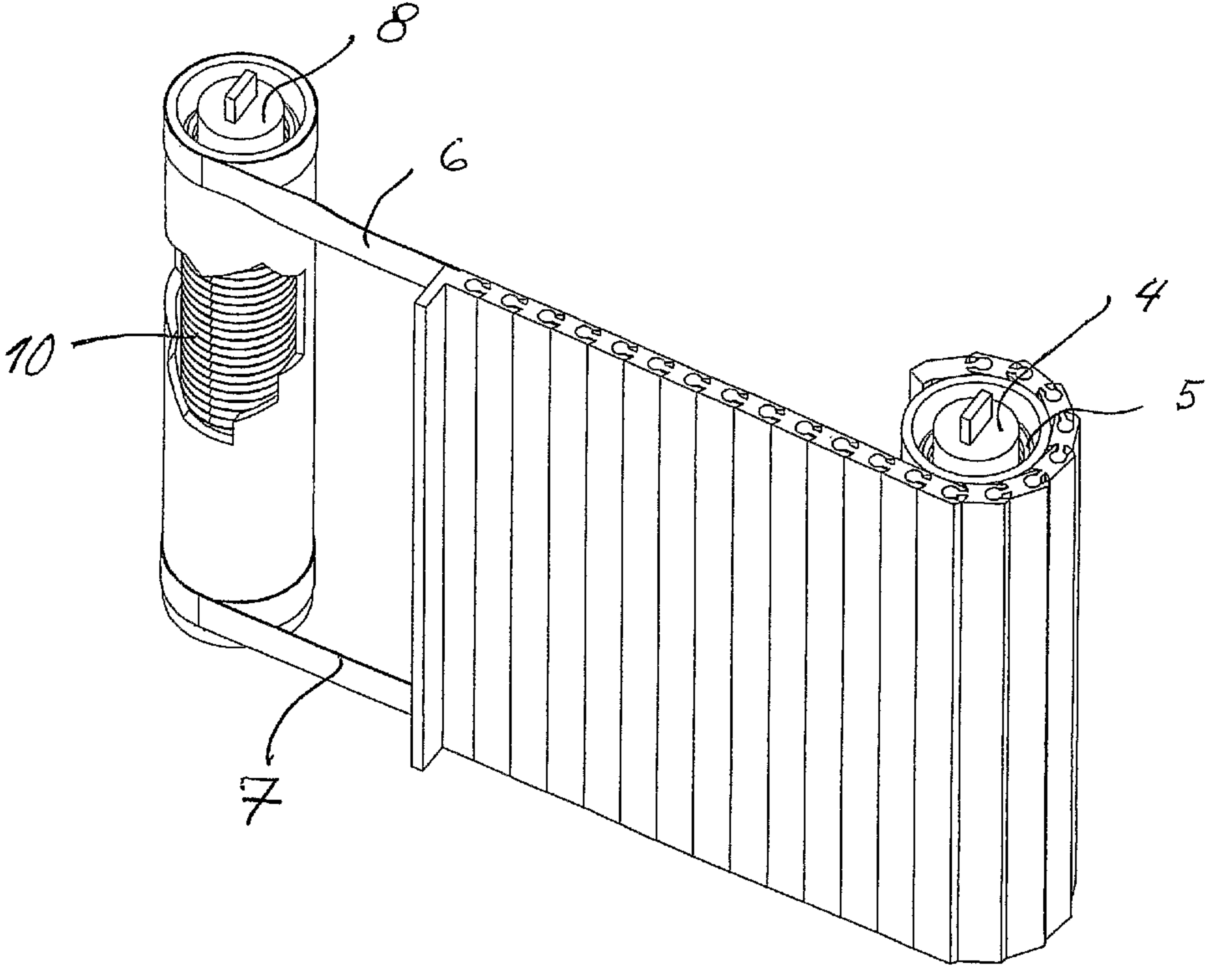


FIG..7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