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(71) Applicant: **Face S.r.l.**
31030 Casier (Treviso) (IT)

(72) Inventor: **Menuzzo, Angelo**
31030 Casier (Treviso) (IT)

(74) Representative: **Feltrinelli, Secondo Andrea**
APTA S.r.l.
Patent Department
Via Ca' di Cozzi, 41
37124 Verona (IT)

(54) MECHANICAL DEVICE FOR SYNCHRONIZING THE CLOSURE OF A DOUBLE LEAF SWING DOOR

(57) The present invention relates to a mechanical device for synchronizing the closure of a double leaf swing door, in particular for an automatic double leaf swing door as well as a double leaf swing door comprising such a device operatively associated therewith.

Furthermore, the present invention also relates to a method of synchronizing the closure of a double leaf swing door provided with the aforementioned mechanical synchronization device.

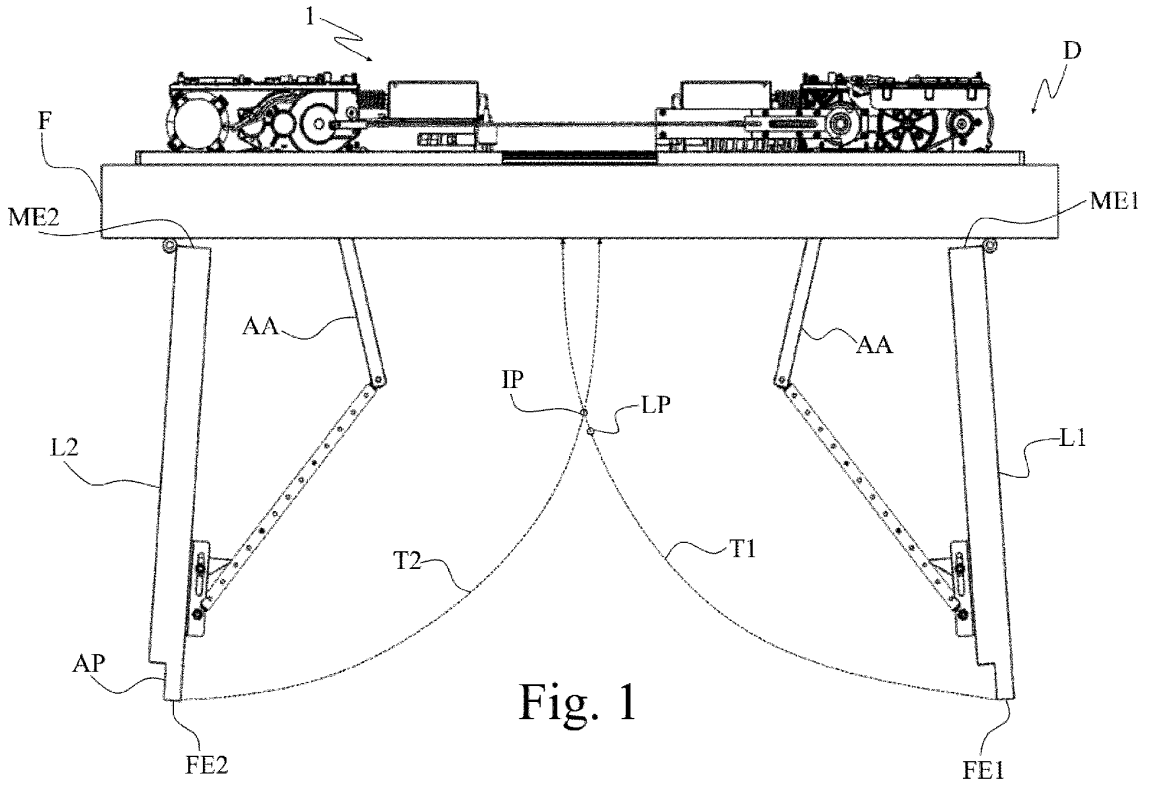

Fig. 1

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a mechanical device for synchronizing the closure of a double swing door, in particular for an automatic double leaf swing door as well as a double leaf swing door comprising such a device operatively associated therewith.

[0002] Furthermore, the present invention also relates to a method of synchronizing the closure of a double leaf swing door provided with the aforementioned mechanical synchronization device.

STATE OF THE PRIOR ART

[0003] As known, double leaf swing doors, in order to close correctly, need one leaf to close before the other since, generally, they comprise a male leaf and a female leaf, structurally configured in such a way that, in the closed position, the abutment or stop portion of the female leaf is operatively associated with the free end of the male leaf.

[0004] It can therefore be understood how, in the event that the male leaf closes before the female leaf, they could not guarantee the correct closure of the door.

[0005] With reference to an automatic double leaf swing door, typically, it includes an electronic synchronizer which controls and manages the closure, and naturally also the opening, of the leaves of this door.

[0006] However, if there were, for example, a power cut, and therefore a lack of electricity, the electronic synchronizer of such a door would no longer be able to guarantee its correct closure, and in particular the correct door closing sequence.

[0007] Moreover, a malfunction of the sensors, an improper manual push or even obstacles present in the closing trajectory or path of the leaves, could compromise correct closure of the door.

[0008] It should also be considered that if the door is an automatic fire door, its correct closure is essential to prevent the fire from spreading to other rooms.

[0009] To overcome the problems presented above, it is essential to use a mechanical synchronization device that allows to control and manage the correct closure of the door, and in particular the correct closing sequence of the leaves, even in the aforementioned emergency situations.

[0010] Furthermore, the mechanical synchronization devices provided by the state of the prior art are rather bulky, expensive, not very versatile and difficult to assemble.

[0011] It is therefore necessary to design and produce a mechanical synchronization device which allows to overcome the drawbacks of the prior art listed above.

OBJECTS OF THE INVENTION

[0012] An object of the present invention is to provide a new mechanical device for synchronizing the closure of a double leaf swing door which allows to improve the drawbacks of the state of the prior art presented above.

[0013] Another object of the present invention is to provide a mechanical device for synchronizing the closure of a double leaf swing door which is simple to assemble and easy to use.

[0014] Another object of the present invention is to provide a mechanical device for synchronizing the closure of a double leaf swing door which is simple to produce and economically advantageous.

[0015] A further object of the present invention is to provide a mechanical device for synchronizing the closure of a double leaf swing door which can also operate in emergency situations, such as a power failure, the presence of obstacles in the closing path of the doors, improper manual pushing of the doors, etc.

[0016] Yet another object of the present invention is to provide a mechanical device for synchronizing the closure of a double leaf swing door which is compact and structurally robust.

[0017] Another object of the present invention is to provide a new double leaf swing door, in particular a new automatic double leaf swing door equipped with a mechanical synchronization device as presented above.

[0018] According to one aspect of the invention, a device according to claim 1 is provided.

[0019] According to another aspect of the invention a door according to claim 9 is provided.

[0020] According to a further aspect of the invention a method according to claim 13 is provided.

[0021] The dependent claims refer to preferred and advantageous embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Other features and advantages of the invention will be more evident from the description of an example of embodiment of a mechanical synchronization device and of a door equipped with this device, illustrated by way of example in the attached drawings in which:

- figure 1 is a top view of a device according to an example of embodiment of the present invention, operatively associated with an example of embodiment of a door, in a fully open position;
- figure 2 is a simplified top view of the device according to the example of embodiment of the present invention shown in figure 1;
- figure 3 is a top view of the device according to the example of embodiment of the present invention shown in the previous figures in a locking or stop position;
- figure 4 is a simplified top view of the device according to the example of embodiment of the present

invention shown in the previous figures in the position of figure 3;

- figure 5 is a top view of the device according to the embodiment of the present invention shown in the previous figures in a partially closed position with correct closing sequence of the leaves;
- figure 6 is a simplified top view of the device according to the example of embodiment of the present invention shown in the previous figures in the position of figure 5;
- figure 7 is a top view of the device according to the example of embodiment of the present invention shown in the previous figures in a completely closed position;
- figure 8 is a simplified top view of the device according to the example of embodiment of the present invention shown in the previous figures in the position of figure 7;
- figure 9 is an enlarged top view of the device according to the example of embodiment of the present invention shown in the previous figures in a fully open position;
- figure 10 is an enlarged top view of the device according to the example of embodiment of the present invention shown in the previous figures in the position of figure 10;
- figure 11 is an enlarged perspective view of the device according to the example of embodiment of the present invention shown in the previous figures in a fully open position;
  figure 12 is an enlarged perspective view of the device according to the example of embodiment of the present invention shown in the previous figures in the position of figure 11;
- figure 13 shows an enlarged detail of some components of the device according to the example of embodiment of the present invention shown in the previous figures;
- figures 14 and 15 show a possible operating sequence of some components of the device according to the example of embodiment of the present invention shown in the previous figures;
- figures 16 and 17 are perspective views of a door according to the present invention in the open and closed configuration, respectively;
- figures 18 and 19 show sectional views of a door according to the present invention.

[0023] In the accompanying drawings, identical parts or components are identified by the same reference numbers.

EXAMPLES OF EMBODIMENT OF THE INVENTION

[0024] With reference to the attached figures, the reference number 1 shows a mechanical device for synchronizing the closure of a double leaf L1, L2 swing door D.

[0025] In general, the double leaf L1, L2 swing door D can be a mechanical door, or even an automatic door, if desired an automatic fire door.

[0026] Consider that, in the case of a mechanical door D, the device 1 is, in fact, what allows the synchronization of the leaves L1, L2 while in the case of an automatic door D, the device 1 constitutes a further additional control which operates together with, or in some situations even as a replacement to, the electronic synchronizer typically present in such automatic doors.

[0027] In this regard, in addition to operating together with the electronic synchronizer, the device 1 becomes essential in the event of a malfunction of the electronic synchronizer or in any case in all those emergency situations which cause a lack, a shortage or an interruption in the electrical power supply for the door D.

[0028] A device 1 according to the present invention comprises at least a first component 3 which is rotatable or displaceable (if desired, also displaceable along a straight or curved trajectory) between a first opening position and a second closing position arranged to be rendered integral in movement or rotation or kinematically connected to a first leaf or male leaf L1 of a door, at least one second component 4 which is rotatable or displaceable (if desired, also displaceable along a straight or curved trajectory) between a third opening position and a fourth closing position arranged to be rendered integral in movement or rotation or kinematically connected with a second leaf or female leaf L2 of a door D.

[0029] The device 1 also comprises locking or stop means 5, operatively associated with the second component 4, which are arranged to prevent rotation or displacement of the first component 3 until the second position if the second component 4 has not reached the fourth position or a certain intermediate position between the third and fourth position.

[0030] In particular, the device 1 according to the present invention is arranged to be operatively associated with a door D which comprises at least a first leaf or male leaf L1, whose end or vertical free edge FE1 can be moved along a first closing trajectory or path T1 and at least one second leaf or female leaf L2, whose end or vertical free edge FE2 can be moved along a second closing trajectory or path T2, comprising or defining at least one abutment or stop component or portion AP for the first leaf or male leaf L1.

[0031] More in detail, each leaf L1, L2 can be moved in a rotary manner by means of suitable movement members, for example by means of a suitable movement kinematic mechanism AA, if desired comprising an articulation arm AA and for this purpose can be pivoted at a frame or fixture F of the door D.

[0032] Preferably, the device 1 according to the present invention can be mounted or in any case operatively associated with the door D in an upper, in use, portion of the frame or fixture F of the same, so as to possibly carry out the assembly of the device 1 even after the assembly of the door D.

[0033] It should be noted that the two leaves L1, L2 follow respective closing trajectories or paths T1, T2 outlined or traced with reference to the respective ends or vertical free edges FE1, FE2, distal from the main ends ME1, ME2 of the two hinged leaves L1, L2 at the frame F, or with any components integral with them.

[0034] As can be understood, for correct closure of the door D, the second leaf or female leaf L2 must close before the first leaf or male leaf L1, since, otherwise, the configuration of the ends or vertical free edges FE1, FE2 of the two leaves L1, L2, or of any components integral with them, would not allow the second leaf or female leaf L2 to reach the final closing position.

[0035] It should also be noted that in the present discussion the closing trajectories or paths T1, T2 of the leaves L1, L2 or, more specifically, the ends or vertical free edges FE1, FE2, also define the travel direction of these closing trajectories or paths T1, T2, i.e., with the ends or vertical free edges FE1, FE2 of the leaves L1, L2 approaching the frame or fixture F of the door D.

[0036] Naturally, in the event of the door D opening, the leaves L1, L2 or, more specifically, the ends or vertical free edges FE1, FE2 will travel the respective trajectories or paths T1, T2 away from the frame or fixture F of the door D.

[0037] As regards the dimensions of the leaves L1, L2, they can be any depending on the needs, for example a first leaf or male leaf L1 longer than the second leaf or female leaf L2, or vice versa, with respect to a longitudinal direction parallel to the ground or, as shown in figure 1, a first leaf or male leaf L1 of similar dimensions to those of the second leaf or female leaf L2.

[0038] Moreover, the first and second closing trajectories or paths T1, T2 delimit an interception point or zone IP, common to the two closing trajectories or paths T1, T2, which defines the most open interception position of the first leaf or male leaf L1 or, more specifically, of its end or vertical free edge FE1, with the second leaf or female leaf L2 or, more specifically, with its end or vertical free edge FE2, along the respective closing trajectories or paths T1, T2.

[0039] It can therefore be understood that, if the first leaf or male leaf L1 reaches or surpasses the interception zone or point IP before the second leaf or female leaf L2, the door D will not close correctly.

[0040] For this purpose, as indicated above, the device 1 according to the present invention comprises locking or stop means 5 configured to prevent the rotation or displacement of the first component until the second position and therefore the closure of the first leaf or male leaf L1 until the second leaf or female leaf L2 is not closed or in any case until the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 has not exceeded or surpassed the interception point or zone IP.

[0041] More in detail, with reference to the relationship between the device 1 and the door D, is provided at least one first component 3 which can rotate or be displaced in function of the movement or rotation of the first leaf or male leaf L1 and vice versa, at least one second component 4 which can rotate or be displaced in function of the movement or rotation of the second leaf or female leaf L2 and vice versa, and locking or stop means 5, operatively associated with the second rotatable component 4, arranged to prevent the rotation or displacement of the first component 3, and consequently the closure or advancement of the first leaf or male leaf L1, in function of the position of the first leaf or male leaf L1 along the first closing trajectory or path T1 with respect to a limit point or zone LP and of the position of the second leaf or female leaf L1 along the second closing trajectory or path T2 with respect to the interception point or zone IP.

[0042] In particular, the limit point or zone LP defines the position of the first leaf or male leaf L1 along the first closing trajectory or path T1 beyond which closure or advancement of the same is prevented until the second leaf or female leaf L2 is not closed or until the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 has not exceeded or surpassed the interception point or zone IP.

[0043] Advantageously, the at least one first component 3 rotates or moves in function of the movement or rotation of the first leaf or male leaf L1 and vice versa and the at least one second component 4 rotates or moves in function of the movement or rotation of the second leaf or female leaf L2 and vice versa because if these components 3, 4 do not rotate or move, or in any case their rotation or displacement is prevented, also the leaves L1, L2 will not be able to rotate or move.

[0044] Of course, the limit point or zone LP cannot coincide or overlap even only partially with the interception point or zone IP, since in this case if the first leaf or male leaf L1 reaches or surpasses this zone or point before the second leaf or female leaf L2, the latter would no longer be able to close.

[0045] For this reason, the limit point or zone LP is adjusted, as will be seen better hereinafter, so that its position along the first closing trajectory or path T1 is before the interception point or zone IP, preferably in the vicinity or in a neighborhood of the latter, for example about 1 centimeter before, possibly even 2, 3 or more centimeters before such interception point or zone IP.

[0046] As regards the interception point or zone IP, it can be determined empirically, through methods that will be detailed later, before the actual use of the door D.

[0047] Returning to focus attention on the device, advantageously and according to the non-limiting example of embodiment of the present invention shown in the figures, the locking or stop means 5 comprises at least one abutment or interference component 6 movable between at least one hindrance operative position BP of the advancement of the first component 3 towards the second closing position, in which the abutment or interference component 6 is arranged to interfere with the rotation or displacement towards the second position of the first component 3, and consequently the closure or advance-

ment of a respective first leaf or male leaf L1, and at least one enabling operative position CP, in which the abutment or interference component 6 does not interfere with or does not block or does not stop the rotation or displacement of the first component 3 towards the second position, and consequently, in use, the closing of a corresponding first leaf or male leaf L1.

[0048] With regard to a door D provided with a device 1, the hindrance operative position BP corresponds to a first operative configuration in which the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 has not yet passed or exceeded the interception point or zone IP and the position of the first leaf or male leaf L1 has already reached the limit point or zone LP, in which the abutment or interference component 6 interferes with or blocks or stops the rotation of the first rotatable component 3, and consequently the closure or advancement of the first leaf or male leaf L1, while the enabling operative position CP corresponds to a second operative configuration in which at least the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 has already passed or exceeded the IP Intercept point or zone.

[0049] However, a free operative position can also be provided for the device 1 corresponding to a third operative configuration for the door D, in which the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 has not yet exceeded or surpassed the interception point or zone IP and the position of the first leaf or male leaf L1 along the first closing trajectory or path T2 has not yet reached the limit point or zone LP.

[0050] Clearly, in the second and third operative configurations, the abutment or interference component 6 does not interfere with or does not block or does not stop the rotation or displacement of the first component 3, and consequently the closure or the advancement towards closure of the first leaf or male leaf L1.

[0051] Basically, when the first leaf or male leaf L1 has yet to reach the limit point or zone LP or when the second leaf or female leaf has already exceeded or surpassed the interception point or zone IP, the leaves L1, L2 can rotate freely while when the first leaf or male leaf L1 has already reached the limit point or zone LP but the second leaf or female leaf has yet to exceed or surpass the zone or intercept point IP, the rotation of the first leaf or male leaf L1 is blocked or stopped by the abutment or interference component 6 until the second leaf or female leaf L2 has not exceeded or surpassed the interception point or zone IP. Such exceeding or overtaking of the interception point or zone IP by the second leaf or female leaf L2 determines the movement or actuation of the locking or stop means 5, so that the first leaf or male leaf L1 is not hindered along its total closing path close to the frame or fixture F of the door D.

[0052] It should be noted that, as far as door D is concerned, if the rotation of the second leaf or female leaf L2 is accidentally blocked, for example by an obstacle or in any case by an external force, after exceeding or overtaking the interception point or zone IP, the first leaf or male leaf L2, thanks to the structural configuration of the leaves L1, L2, is able to continue the rotation of the second leaf or female leaf L2 bringing the end or vertical free edge FE1 of this first leaf or male leaf L1 in abutment against the abutment or stop portion or component AP, so as to force correct closure of the door D in this case as well.

[0053] It is understood that, in order to be able to force the closure of the door D, the rotation force of the first leaf or male leaf L1 must be able to overcome the external force which blocks the second leaf or female leaf L2.

[0054] Furthermore, the locking or stop means 5 preferably comprise support means 14 of the abutment or interference component 6, and handling means 7 of the abutment or interference component 6 which include a first end 7a operatively connected to the abutment or interference component 6 and a second end 7b operatively connected to the second component 4 and movable or rotatable with the latter.

[0055] According to the non-limiting example of embodiment of the present invention shown in the figures, the support means 14 are or comprise a plate 14a arranged to support the abutment or interference component 6 so that it can be moved or slid from the hindrance operative position BP to the enabling operative CP position and vice versa.

[0056] Preferably, the device 1 also comprises guide means 12 of the abutment or interference component 6.

[0057] Advantageously, the guide means 12 delimit with the support means 14 a sliding channel or seat SC for the abutment or interference component 6 configured to allow the sliding or displacement of the latter, if desired along a retraction or advancing-retracting direction X in its passage from the hindrance operative position BP to the enabling operative position CP and vice versa.

[0058] According to the non-limiting example of embodiment of the present invention shown in the figures, the guide means 12 are or comprise two parallel strip or bar components 12a, 12b mounted and/or fixed on the support means 14 or, more particularly, on the plate 14a by means of suitable connecting means, for example screws, rivets or the like.

[0059] Basically, the abutment or interference component 6 can advantageously be a slide which can translate along the retraction or advancing-retracting direction X defined by the sliding channel or seat SC to pass from the hindrance operative position BP to the enabling operative position CP and vice versa.

[0060] Consider in fact that, during the closing of the door D, the abutment or interference component 6 can pass from the enabling operative position CP to the hindrance operative position BP and again from the latter to the enabling operative position CP, always translating along the retraction or advancing-retracting direction X.

[0061] Naturally, during the opening of the door D, the same direction X will become, for the abutment or inter-

ference component 6, a direction away from the second component 4.

[0062] Clearly, there could be a circular or curved movement for the abutment or interference component 6.

[0063] From a constructive point of view, the abutment or interference component 6 is preferably made of a material designed to resist high impact forces, preferably in metal, for example in iron or in a ferrous alloy, for example in steel or other suitable material.

[0064] According to the non-limiting example of embodiment shown in the figures, the abutment or interference component 6 is a plate with a substantially rectangular plan shape which translates along the sliding channel or seat SC defined by the support means 14 and by the guide means 12.

[0065] Moreover, the abutment or interference component 6 preferably delimits at least one slot A or comprises a protruding end while the handling means 7 preferably comprise at least one tie-rod component 8, for example a rod, which includes a first connection end 8a, if desired configured as a hook or in any case substantially L-shaped, engaged, if desired slidingly engaged, in the slot A or with the protruding end, and a second connection end 8b.

[0066] Advantageously, the handling means 7 can also comprise a driving component 9 equipped with a first constraint end 9a connected to the second component 4, for example irremovably at or near or around an edge 4a of the second component 4 and a second connection end 9b operatively associated with the second connection end 8b of the tie-rod component 8.

[0067] According to the non-limiting example of embodiment of the present invention shown in the figures, the abutment or interference component 6 passes from the hindrance operative position BP to the enabling operative position CP by means of the rotation or displacement or translation of the second component 4 which moves the handling movement 7 so that the latter retract or move the abutment or interference component 6.

[0068] It should be noted that the abutment or interference component 6 could already be moved by the handling means 7 along the retraction or advancing-retracting direction X even before the actual passage from the hindrance operative position BP to the enabling operative position CP.

[0069] In this regard, the rotation or displacement of the second component 4 moves, if desired angularly, the driving component 9 integral with it, which in turn drive the tie-rod component 8 which can thus retract the abutment or interference component 6 along the direction X.

[0070] As far as the slot A is concerned, it can advantageously extend longitudinally to the abutment or interference component 6 or to the tie rod component 8 according to a substantially elliptical configuration, if desired rectangular or in any case elongated.

[0071] Basically, during the closing of the door D, the configuration of the slot A makes it possible to define for the tie-rod component 8 at least a rest operative arrangement RA, in which the first connection end 8a of the tie-rod component 8 is not pushing on a first end E1, proximal to the second component 4, of slot A and at least one movement operative arrangement PA in which the first connection end 8a of the tie-rod component 8 is pushing on the first end E1, proximal to the second component 4, of slot A.

[0072] As can be understood, since the displacement of the first connection end 8a, slidingly engaged in the slot A, is closely linked to the rotation or displacement of the second component 4, the possible elongated configuration of the slot A allows to obtain, during the closure of the door D, a first condition in which the second leaf or female leaf L2 can rotate, but the tie-rod component 8 is not pulling the abutment or interference component 6 along the retraction or advancing-retracting direction X, and a second condition in which the second leaf or female leaf L2 can still rotate but the tie-rod component 8 is pulling the abutment or interference component 6 along the direction X.

[0073] Similar considerations apply with reference to the case in which a slot is delimited in the tie-rod component 8 and not in the abutment or interference component 6.

[0074] In particular, the passage from the first to the second condition takes place with the exceeding of a given position of the second leaf or female leaf L2 along the second closing trajectory or path T2. Naturally, this also causes the second component 4 to exceed a certain angle or position, with respect to the starting position, which is the effective component that controls the handling means 7 or, more specifically, the tie-rod component 8.

[0075] It should be noted that the passage from the first to the second condition also depends on the length or operating dimensions of the tie-rod component 8, if provided, on the positioning point of the driving component 9, if provided, on the second component 4, as well as on the longitudinal length of the possible slot A.

[0076] Advantageously, the device 1 comprises adjustment means 13 designed to adjust the operating length of the handling means 7 in function of the interception point or zone IP.

[0077] In particular, said adjustment means 13 can advantageously comprise a block or body, if desired a hollow body 13a to which it is possible to connect or within which it is possible to engage or in any case house in a sliding manner the tie-rod component 8 or, more particularly, its second connection end 8b according to a certain desired operating length.

[0078] More in detail, the block or body 13a can delimit, preferably at a first portion thereof distal, in use, from the second component 4, at least one through opening TO, possibly two, three or more through openings TO, through which it is possible to set the operating length of the handling means 7 or, more particularly, of the tie-rod component 8, for example by engaging or inserting a respective fastening component 15, for example a fixing

screw, through the at least one through opening TO.

[0079] In practice, it is possible to engage or insert the second connection end 8b of the tie-rod component 8 in the block or body 13a, slide it inside this body 13a and set a specific operating length for such tie-rod component 8 by inserting through the at least one through opening TO the respective fastening component which blocks or stops the sliding of such second connection end 8b.

[0080] Basically, according to this procedure, the sliding of the second connection end 8b within the body 13a is blocked by the normal force exerted by the at least one fastening component on the tie rod component 8.

[0081] For greater fastening safety, it is also possible to use two, three or more fastening components, each one engaged or inserted into a respective through opening TO defined by the hollow body 13a of the adjustment means 13.

[0082] As can be understood, the operating length of the tie-rod component 8 can advantageously be chosen and adjusted according to the interception point or zone IP of the leaves L1, L2, for example by choosing an operating length of the tie-rod component 8 so that, when the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 exceeds or surpasses the interception point or zone IP, it has pulled or moved the abutment or interference component 6 along the retraction or advancing-retracting direction X up to a position such that the latter cannot interfere or in any case no longer interferes with the first component 3.

[0083] The interception zone or point IP of the leaves L1, L2 can be determined empirically before using the door D, for example by observing at which angle the second leaf or female leaf L2 intercepts the first leaf or male leaf L1 and, consequently, at which angle is the driving component 9, if desired with respect to a completely open position of the second leaf or female leaf L2, corresponding to a precise initial position of the driving component 9, at such interception point or zone.

[0084] More in detail, the rotation or displacement of the second component 4 moves the driving component 9 with respect to its initial position causing a precise displacement, for example angular, of the same, which translates into a precise displacement, for example of translation, along the retraction direction X of the tie-rod component 8, which in turn pulls the abutment or interference component 6.

[0085] From a mathematical point of view, the displacement of the abutment or interference component 6 along the retraction direction X can be calculated as the difference between the translational displacement along the same retraction direction X of the driving component 9 with respect to a completely open position of the second leaf or female leaf L2, corresponding to a precise position of the second component 4, and the distance of the first connection end 8a of the tie-rod component 8 from the first end E1 of slot A always with respect to the fully open position of the second leaf or female leaf L2, also corresponding to a precise position of the first connection end 8a of the tie-rod component 8 slidably engaged in the slot A, according to the non-limiting embodiment shown in the figures.

[0086] Preferably, the locking or stop means 5 comprises elastic loading means 10 designed to yieldably press the abutment or interference component 6 towards the enabling operative position CP or towards the hindrance operative position BP.

[0087] In this regard, at least one loading or limit switch component 11 may be provided, for example a loading or limit switch screw, and elastic loading means 10, for example a spring, equipped with a first end 10a connected to the abutment or interference component 6 and a second end 10b connected to the loading or limit switch component 11.

[0088] In particular, these elastic loading means 10 are designed to regulate the retraction force exerted on the abutment or interference component 6 during the passage of the latter from the hindrance operative position BP to the enabling operative position CP and vice versa.

[0089] The elastic loading means 10 as well as the loading or limit switch component 11 can advantageously be positioned within a suitable through light PL delimited by the abutment or interference component 6.

[0090] More in detail, the through light PL can advantageously extend longitudinally to the abutment or interference component 6, for example according to a substantially elliptical configuration, if desired rectangular or in any case elongated and can comprise an proximal end 6a to the first component 3 and a distal end 6b from it, while the loading or limit switch component 11 can comprise a connection portion 11a with the elastic loading means 10 and an abutment portion 11b with the abutment or interference component 6 or, more particularly, with the end 6b of the through light PL.

[0091] If desired, the loading or limit switch component 11 can be fixed on the support means 14 so as to protrude into the through light PL at a given distance from its end 6b so that when the abutment or interference component 6 is completely extracted along the retraction or advancing-retracting direction X, the end 6b of the through light PL is in contact or abutment with the abutment portion 11b of the loading or limit switch component 11.

[0092] According to the non-limiting example of embodiment of the present invention shown in the figures, the elastic loading means 10 are positioned within the through light PL with the first end 10a connected to the abutment or interference component 6 or, more particularly, to the end 6a of the through light PL and with the second end 10b connected with the loading or limit switch component 11 or, more particularly, with its connection portion 11a.

[0093] The elastic loading means 10 regulate the retraction force exerted on the abutment or interference component 6 during the transition from the hindrance operative position BP to the enabling operative position CP and vice versa, accumulating in the form of elastic energy part of the mechanical energy deriving from the retraction

movement of the abutment or interference component 6.

[0094] It should be considered that, during the opening of the door D, the elastic loading means 10 release, in the form of mechanical energy, the previously accumulated elastic energy, allowing the extraction movement of the abutment or interference component 6 along the direction X, but in the opposite direction to the closing phase of the door D.

[0095] In this regard, the extraction movement of the abutment or interference component 6 is not instantaneous, since the elastic energy accumulated during closure by the elastic loading means 10 is gradually released, in the form of mechanical energy, thanks to the handling means 7 that hold back this release.

[0096] In practice, during the opening of the door D, the abutment or interference component 6 is pushed along the extraction direction thanks to the elastic energy released in the form of mechanical energy of the elastic loading means 10, but at the same time this displacement is controlled or in any case guided by the position of the second component 4, which causes the handling means 7 or, more specifically, the tie-rod component 8, to brake or in any case hold back the extraction of the abutment or interference component 6.

[0097] As regards the second component 4, it can be operatively associated, for example meshed, with a gear train or in any case with a component arranged to move the second leaf or female leaf L2.

[0098] In this regard, if the door D on which the mechanical synchronization device 1 is installed had articulation arms AA of the leaves L1, L2, as illustrated by way of example in the attached figures, the second component 4 could advantageously rotate or move integrally with the articulation arm AA of the second leaf or female leaf L2, and therefore in function of the same.

[0099] Therefore, if the rotation range of the second leaf or female leaf L2 or, more particularly, of its articulation arm AA, were for example between 0° and about 110°, preferably between 0° and about 100°, also if desired between 0° and about 90° or in any case between 0° and about 80°, also the second component 4, if rotatable, could have the same rotation range.

[0100] Thus, for example, if the second leaf or female leaf L2 made an angular displacement of approximately 20°, also the second component 4, if rotatable, could make the same angular displacement.

[0101] Naturally, the rotation range of the second component 4, if rotatable, is strictly dependent on the meshing and on the gear train to which it is associated and, therefore, the same could have a different rotation range with respect to the rotation range of the second leaf or female leaf L2 or in any case it could always rotate according to the same but with different angular displacements.

[0102] For example, a rotation of about 35° of the second leaf or female leaf L2 could correspond to a rotation of about 55° of the second rotatable component 4, and so on.

[0103] It should be noted that the rotation direction of the second component 4, if rotatable, is preferably defined by the rotation direction of the second leaf or female leaf L2.

[0104] Clearly, according to other non-limiting examples of embodiment of the present invention, the opposite could also be provided, i.e., a rotation direction of the second rotatable component 4 opposite to the rotation direction of the second leaf or female leaf L2.

[0105] Naturally, the second component 4 could also not be rotatable, but slidable or translatable along a specific direction, if desired by meshing with a pinion or the like integral in rotation, if desired by means of suitable meshing with the second leaf L2.

[0106] According to the non-limiting examples of embodiment of the present invention shown in the figures, the second rotatable component 4 has a circular plan configuration, however, according to other non-limiting examples, it could also have other configurations, for example elliptical, square, rectangular, etc.

[0107] As regards, however, the first component 3, if rotatable, also the latter can be operatively associated, for example meshed with a gear train or in any case with a component arranged to move the first leaf or male leaf L1.

[0108] In this regard, if the door D on which the mechanical synchronization device 1 is installed had articulation arms AA of the leaves L1, L2, as illustrated by way of example in the attached figures, the first component 3, if rotatable, could advantageously rotate integrally with the articulation arm AA of the first leaf or male leaf L1, and therefore in function of the same.

[0109] Therefore, if the rotation range of the first leaf or male leaf L2 or, more particularly, of its articulation arm AA, were for example between 0° and about 110°, preferably between 0° and about 100°, if desired also between 0° and about 90° or in any case between 0° and about 80°, also the first component 3, if rotatable, could have the same rotation range.

[0110] Thus, for example, if the first leaf or male leaf L1 made an angular displacement of approximately 20°, the first rotatable component 3 would also make the same angular displacement.

[0111] Naturally, the rotation range of the first component 3, if rotatable, is strictly dependent on the meshing and on the gear train with which it is associated and, therefore, the same could have a different rotation range with respect to the rotation range of the first leaf or male leaf L1 or in any case it could always rotate according to the same but with different angular displacements.

[0112] For example, a rotation of about 35° of the first leaf or male leaf L1 could correspond to a rotation of about 55° of the first rotatable component 3, and so on.

[0113] It should be noted that the rotation direction of the first component 3, if rotatable, is preferably defined by the rotation direction of the first leaf or male leaf L1.

[0114] Naturally, the first component 3 could also not be rotatable, but slidable or translatable along a specific direction, if desired by meshing with a pinion or the like

integral in rotation, if desired by means of suitable meshing with the first leaf L1.

[0115] Clearly, according to other non-limiting examples of embodiment of the present invention, the opposite could also be provided, i.e., a rotation direction of the first rotatable component 3 opposite to the rotation direction of the first leaf or male leaf L1.

[0116] More in detail the first component 3 comprises or preferably defines at least one abutment portion 3a configured to impact or engage the abutment or interference component 6, if the latter is in the hindrance operative position BP, so as to block the rotation or displacement of the first component 3, and consequently the closing or advancement of the first leaf or male leaf L1.

[0117] Advantageously, the abutment portion 3a can comprise at least one projecting section 3a1 and, preferably, at least one hollow section 3a2, which delimit an engagement seat ES for the abutment or interference component 6, when the latter is in the hindrance operative position BP.

[0118] According to the non-limiting example of embodiment of the present invention shown in the figures, the abutment portion 3a is substantially configured as an ax 3a and delimits a respective recess 3a2 at each tooth 3a1 of the ax 3a.

[0119] It can therefore be understood that by sizing the abutment portion 3a of the first component 3 it is possible to adjust or set the position of the limit point LP along the first closing trajectory or path T1 of the first leaf or male leaf L1.

[0120] In this regard, considering the non-limiting example of embodiment of the present invention shown in the figures, the length of the circumference arc joining the two teeth 3a1 or hollows 3a2 indirectly defines the angular displacement, with respect to the rotation range of the first component 3, necessary for locking or stopping the rotation of this first rotatable component 3 and, consequently, of the first leaf or male leaf L1, thus setting the position of the limit point or zone LP.

[0121] Clearly, for the adjustment of the limit point or zone LP, according to other non-limiting examples of embodiment of the present invention, abutment portions 3a of various dimensions could be provided which can be removably constrained to the first component 3 by means of any suitable engagement, for example bayonet, interlocking or similar, so as to be able to adjust the limit point or zone LP according to needs.

[0122] Furthermore, the mechanical synchronization device 1 can advantageously comprise at least one reinforcing component (not shown in the figures), for example a reinforcing plate, configured to reinforce the stability of the device 1 to the stresses generated by the possible collision of the first component 3 or, more specifically, of its abutment portion 3a with the abutment or interference component 6 or in any case generated by the possible maintenance of the locking or stop of the rotation or displacement of the first component 3 by means of the abutment or interference component 6.

[0123] A non-limiting operational example of the mechanical synchronization device 1 in a door D is described below according to the non-limiting example of embodiment shown in the figures, with reference to the closure of the door D.

[0124] Assume that the door D and consequently the leaves L1, L2 are completely open (see, for example, figure 1) and that, therefore, their position along the closing trajectories or paths T1, T2 is at the beginning of them.

[0125] Following the closure of the two leaves L1, L2, the first rotatable component 3 and the second rotatable component 4 can start to rotate integrally with the articulation arms AA of the same and therefore according to the rotation of the leaves L1, L2.

[0126] Consider a closing start position of the second rotatable component 4 which preferably provides that the driving component 9 of the handling means 7 is in the most proximal position to the first rotatable component 3, while consider a closing start position of the first rotatable component 3, which preferably provides that it is in a position such as to allow free rotation of the same up to the set limit point LP, for example on the basis of the dimensioning of the abutment portion 3a of the first rotatable component 3.

[0127] The abutment or interference component 6 is initially in the enabling operative position CP corresponding to the aforementioned third operative configuration in which the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 has not yet exceeded or surpassed the interception point or zone IP and the position of the first leaf or male leaf L1 along the first closing trajectory or path T2 has not yet reached the limit point or zone LP.

[0128] Assume that, at a certain point, a force, optionally external or in any case from the door movement device, pushes the first leaf or male leaf L1 so that the position of the latter along the first closing trajectory or path T1 surpasses the position of the second leaf or female leaf L2 along the second closing trajectory or path T2.

[0129] This push will cause the first leaf or male leaf L1 to reach the limit point or zone LP before the second leaf or female leaf L2 exceeds or surpass the interception point or zone IP (see, for example, figure 3).

[0130] However, the abutment or interference component 6 would in this case still be in a position such that it interferes with the first rotatable component 3, effectively blocking or stopping its rotation, i.e., in the hindrance operative position BP, corresponding to the first operative configuration in which the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 has not yet exceeded or surpassed the interception point or zone IP and the position of the first leaf or male leaf L1 has already reached the limit point or zone LP.

[0131] The second rotatable component 4 could instead continue its rotation or displacement or translation, which moves the driving component 9 which retracts the tie-rod component 8 which in turn pulls the abutment or interference component 6 along the retraction direction

X.

[0132] In particular, the operating length of the tie-rod component 8 is advantageously adjusted, by means of the adjustment means 13, so that as soon as the second leaf or female leaf L2, and consequently, the second rotatable component 4 has exceeded or surpassed the interception point or zone IP, the abutment or interference component 6 is in such a position that it does not interfere with the abutment portion 3a of the first rotatable component 3 or in any case unlocks the rotation or displacement of the same, i.e., it returns to an enabling operative position CP, corresponding to the second operative configuration in which at least the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 has already exceeded or surpassed the interception point or zone IP (see, for example, figure 5).

[0133] In other words, the operating length of the tie-rod component 8 is advantageously adjusted so that, once the second leaf or female leaf L2 has passed the interception point or zone IP, and therefore once the second rotatable component 4 has completed a certain displacement, possibly angular with respect to the starting position or beginning of closure, the tie-rod component 8 has retracted the abutment or interference component 6 along the retraction direction X by such a displacement that it cannot interfere or in any case no longer interferes with the rotation of the first rotatable component 3.

[0134] The two leaves L1, L2 and therefore the two rotatable components 3, 4 can continue their rotations until the door D closes (see, for example, figure 7), which will necessarily take place in the right order, i.e., first the second leaf or female leaf L2 and then the first leaf or male leaf L1.

[0135] An object of the present invention is clearly also a double leaf L1, L2 swing door D comprising a frame or fixture F and at least one first leaf or male leaf L1 articulated or pivoted to the frame or fixture F, whose end or vertical free edge FE1 distal from the articulation or pivoting area to the frame or fixture F can be moved along a first closing trajectory or path T1, and at least one second leaf or female leaf L2 articulated or pivoted to the frame or fixture F, whose end or vertical free edge FE2 distal from the articulation or pivoting area to the frame or fixture F can be moved along a second closing trajectory or path T2, such at least one second leaf or female leaf L2 comprising at least an abutment or stop portion or component AP for the first leaf or male leaf L1.

[0136] In particular, the first and second closing trajectories or paths T1, T2 delimit an interception point or zone IP, common to the two closing trajectories or paths T1, T2, which defines the most open interception position of the first leaf or leaf male L1 and of the second leaf or female leaf L2 along the respective closing trajectories or paths T1, T2.

[0137] The door D also comprises a mechanical synchronization device 1 according to the present invention or in any case according to non-limiting examples of embodiment of the present invention, operatively associated with such door D.

[0138] The door D can be a manually or automatically operated door, and in this case, it will be provided with suitable actuation means, comprising for example an electric motor 16, if desired a brushless motor, of the movement members of each leaf L1, L2, for example one or more kinematic mechanisms.

[0139] Moreover, in the case of an automatic door D, it will preferably comprise an electronic synchronizer designed to synchronize the leaves L1, L2 during normal use of the door D, i.e., when the door D is electrically powered.

[0140] Advantageously, again in the case of an automatic door D, the same will comprise emergency closing means, for example one or more accumulation springs 17.

[0141] In particular, these emergency closing means can be activated, in the event of a sudden power failure, in order to close the door D.

[0142] For example, if the emergency closing means were one or more accumulation springs 17, the latter could be charged during normal use of the door D by the electric motor 16, and then be able to discharge the accumulated energy in order to allow an emergency closure of the same in case of sudden power failure.

[0143] With reference to this aspect, one or both leaves L1, L2 could be provided with a belt or the like 18 driven in rotation by means of a respective transmission shaft 19 of the electric motor 16, which belt 18 is designed to operate the rotation of one or more pins, shafts, belts and/or gears designed to rotate or move the device 1, if desired one of the components 3, 4 thereof.

[0144] In this regard, for one or both leaves, a driving pin or shaft 20 can be provided which is integral in movement or in meshing engagement with the first 3 or second 4 component.

[0145] According to the non-limiting example of embodiment shown in the figures, for each leaf L1, L2 there is provided a respective driving shaft 20 driven by a respective motor 16, which shaft 20 is connected, fixed or in meshing engagement with the first 3 or second 4 component.

[0146] In this regard, registration means 4b, 20a of the engagement or fixing position of the first 3 and/or second 4 component with respect to the driving shaft 20 can be provided.

[0147] With reference to the non-limiting example of embodiment illustrated in the figures, the first 3 and/or second 4 component has a toothed lower or upper, in use, surface 4b while a respective shaft 20 has a toothed top or bottom, in use, surface 20a, so that the teeth of the surface 20 are in abutting and constraining engagement with respective teeth of the first 3 or second 4 component.

[0148] Moreover, fastening means may also be provided, such as a screw or bolt or a similar means 20b for fastening the first 3 and/or second 4 component to the respective shaft 20.

[0149] As will be understood, in this case it would be possible to mount or adjust the first 3 and/or the second 4 component to a respective shaft 20 in different, for example angular, positions and to do this it would be sufficient to vary the position, for example angular, of the component 3, 4 with respect to the shaft 20 thus engaging their teeth in a different and adjustable manner.

[0150] Advantageously, for one or both leaves L1, L2 both the actuation means (if desired an electric motor 16) and any emergency closing means (for example one or more accumulation springs 17) are kinematically or operatively connected with a respective first 3 or second 4 component, so that the angular displacement or translation of one of the latter takes place when the actuation means 16 or the emergency closing means 17 operate or control the angular displacement of the leaves L1, L2.

[0151] In this regard, according to the example of embodiment illustrated in the figures, the emergency closing means 17 are integral in displacement or kinematically connected, if desired with meshing engagement, with a respective shaft 20.

[0152] In this regard, the shaft 20 could have a portion with a substantially annular or cylindrical outer surface 20c configured as a toothed wheel for the meshing engagement of a rack portion 23a defined in whole or in part by a rod 23 integral in translation or kinematically connected to a respective emergency closing means 17, if desired a spring.

[0153] In this regard, during normal operation, the motor or motors 16 for driving one or both leaves L1, L2 drive the respective shaft 20 (if desired by means of the respective belt 18) and therefore the first 3 and second 4 component, and at the same time they move and progressively alternately load (when they open the leaves L1, L2) and unload (when they close the leaves L1, L2) the emergency closing means 17.

[0154] Should the current fail with the leaves L1, L2 in the open or partially open condition, the emergency closing means 17 would be sufficiently charged to cause closure of the leaves L1, L2 by commanding at the same time the first 3 and second 4 component to ensure that the synchronization device works even in emergency situations in the absence or lack of electricity. This could be achieved by rotation, for example of the emergency closing means 17 of the shaft or of each shaft 20.

[0155] As will be understood, other intermediate components 24 could also be provided, such as gears, pulleys, pinions or the like, arranged to transfer the motion from the actuation means or motor 16 to the shaft 20, the latter being able to have suitable connection portions, if desired gear wheel 20d.

[0156] With reference therefore to the kinematic movement of each leaf L1, L2, it can comprise one or more articulation arms AA designed to be articulated or pivoted at a first main or terminal end to a frame or fixture F of the door D or to angular movement means of the leaves L1, L2 operated by the actuation means 16 as well as, if provided, by the emergency closing means 17.

[0157] The movement kinematic mechanism AA can clearly be moved, for example angularly or inclinable between a first closing arrangement and a second opening arrangement, so as to vary the angle or inclination between components of the kinematic mechanism itself or between the kinematic mechanism and the frame or fixture F when switching between these positions.

[0158] According to the example of embodiment illustrated in the figures, for one or both leaves L1, L2 an articulation arm of the movement kinematic mechanism AA is mounted or fixed to the driving shaft 20, optionally on the bottom of the same, for example by interposing a suitable sleeve 25. Clearly, another type of connection could be provided for the movement kinematic mechanism AA to the actuation means and, if provided, to the emergency closing means 17.

[0159] As regards the position of the actuation means 16 and also of the possible emergency closing means 17 as well as the gears or mechanical transmission means between the actuation means 17, the possible emergency closing means 17 and the leaves L1, L2, the same may or may not be housed in one or more casing or containment box 26 mounted or fixed, with any suitable method, such as screws, bolts, rivets, interlocking or hooking, to the frame or fixture F of a door D, for example at the top of the same, clearly in a higher position than the leaves L1, L2.

[0160] In practice, during normal use of the automatic door D, the mechanical synchronization device 1 constitutes an additional control of the synchronization of the leaves L1, L2 which can intervene, for example, in the event of malfunctions of the electronic synchronizer while, in the event of emergency, such as for example the lack of electrical power supply, it constitutes the only control able to guarantee the synchronization of the leaves L1, L2 and therefore the correct closure of the door D.

[0161] The present invention also relates to a method of synchronizing the closure of a door D according to the present invention or in any case according to non-limiting examples of embodiment of the present invention.

[0162] Such method initially comprises the step of closing or in any case starting the closing of the door D and, consequently, of the at least two leaves L1, L2 which control the rotation or displacement of the first and second component 3, 4 respectively. This step can for example be carried out by means of actuation means 16 or determined by the lack of electrical power supply and therefore, if desired, controlled by the emergency closing means 17.

[0163] In particular, the locking or stop means 5 or, more specifically, the abutment or interference component 6 of the device 1 prevent the rotation or displacement of the first component 3, and consequently the closure or the advance until closing of the first leaf or male leaf L1, until the second leaf or female leaf L2 is closed or until the position of the second leaf or female leaf L2 along the second closing trajectory or path T2 has ex-

ceeded or surpassed the interception point or zone IP.

[0164] Preferably, the method provides, for example before using the door D, if the latter comprises a mechanical synchronization device 1 which includes adjustment means 13, the step of regulating, by means of said adjustment means 13, the operating length of the tie-rod component 8 so that, once the second leaf or female leaf L2 has passed the interception point or zone IP, and therefore once the second component 4 has made a specific displacement, if desired an angular displacement, with respect to the starting position, the tie-rod component 8 has retracted the abutment or interference component 6 along the retraction or advancing-retracting direction X by a displacement such that it cannot interfere or in any case no longer interferes with the rotation or displacement of the first component 3.

[0165] The mechanical synchronization device 1 according to the present invention, as well as the door D comprising this device 1 and the method of synchronizing the closure of the door D, always guarantee the correct closure of the door D, i.e., with the second leaf or female leaf L2 which it necessarily closes before the first leaf or male leaf L1.

[0166] Moreover, the device 1 according to the present invention can be assembled and used in a very simple way.

[0167] Furthermore, this device 1, in addition to being economically advantageous and simple to make, is also not bulky and at the same time very strong against the stresses generated by any blockages or stops of the first door or male door L1.

[0168] Consider that the device 1, if mounted on an automatic door D, guarantees synchronization of leaves L1, L2 even in the event of emergency situations, such as, for example, an electrical power cut to the door D.

[0169] It has thus been seen how the invention has fully achieved the proposed objects.

[0170] Modifications and variations of the invention are possible within the scope of protection defined by the claims.

Claims

1. Mechanical device (1) for synchronizing the closure of a double leaf (L1, L2) swing door (D) comprising at least one first component (3), which can be rotated or moved between a first opening position and a second closing position, arranged to be rendered integral in movement or rotation or kinematically connected with a first leaf or male leaf (L1) of a door, at least one second component (4), which can be rotated or moved between a third opening position and a fourth closing position arranged to be rendered integral in movement or rotation or kinematically connected with a second leaf or female leaf (L2) of a door, said device further comprises locking or stop means (5), operatively associated with said second component (4), arranged to prevent rotation or displacement of said first component (3) until said second position if said at least one second component has not reached said fourth position or a determined intermediate position between said third and said fourth position, wherein said locking or stop means (5) comprises at least one abutment or interference component (6) movable between at least one hindrance operative position (BP) hindering the advancement of said first component (3) towards said second closing position, wherein said abutment or interference component (6) is arranged to interfere with the rotation or displacement towards said second position of said first component (3), and consequently with the closing or advancement of a respective first leaf or male leaf (L1), and at least one enabling operative position (CP), wherein said abutment or interference component (6) does not interfere with or does not block or does not stop the rotation or displacement of said first component (3) towards said second position, and consequently, in use, the closure of a first leaf or male leaf (L1), wherein said first component (3) comprises or defines at least one abutment portion (3a) configured to impact said abutment or interference component (6), if the latter is in said hindrance operative position (BP), thereby blocking the rotation or displacement of said first component (3), and consequently the closing or advancement of a corresponding first leaf or male leaf (L1).

2. Device (1) according to claim 1, wherein said locking or stop means (5) comprise support means (14) for said abutment or interference component (6), and handling means (7) of said abutment or interference component (6) which include a first end (7a) operatively connected to said abutment or interference component (6) and a second end (7b) operatively connected to said second component (4) and movable or rotatable with the latter.

3. Device (1) according to the preceding claim, wherein said abutment or interference component (6) defines at least one slot (S) or has a protruding end and said handling means (7) comprise at least one tie-rod component (8) , which includes a first connection end (8a), slidingly engaged in said slot (A) or delimits a slot for sliding engagement of said protruding end, said at least one tie-rod component (8) further including a second connection end (8b), said handling means (7) further comprising a driving component (9) equipped with a first constraining end (9a) connected to said second component (4) and a second constraining end (9b) operatively associated to said second connection end (8a) of said tie-rod component (8).

4. Device (1) according to the preceding claim, wherein

said at least one tie-rod component (8) is displaceable following the displacement or rotation of said second component (4) between at least one rest operating arrangement (RA), in which it does not push or pulls said abutment or interference component (6) away from said at least one hindrance operative position (BP) and at least one movement operating arrangement (PA) in which said tie-rod component (8) pushes or pulls said abutment or interference component (6) in said at least one enabling operative position (CP).

5. Device (1) according to any one of the preceding claims, wherein said locking or stop means (5) comprise elastic loading means (10) designed to yieldably press said abutment or interference component (6) towards said enabling operative position (CP) or towards said hindrance operative position (BP).

6. Device (1) according to any one of claims 2 to 5, comprising guide means (12) for said abutment or interference component (6), said guide means (12) delimiting, with said support means (14), a sliding channel or seat (SC) for said abutment or interference component (6) configured to allow the sliding or displacement of the latter in the passage from said hindrance operative position (BP) to said enabling operative position (CP) and vice versa.

7. Device (1) according to any one of the preceding claims, wherein said abutment portion (3a) comprises at least one projecting section (3a1) and at least one hollow section (3a2), which delimit an engagement seat (ES) for said abutment or interference component (6), when the latter is in said hindrance operative position (BP).

8. Device (1) according to any one of claims from 2 to 7 when dependent on claim 2, comprising adjustment means (13) designed to adjust the operating length of said handling means (7).

9. Double-leaf (L1, L2) swing door (D) comprising a frame or fixture (F) and at least one first leaf or male leaf (L1) articulated or hinged to the frame or fixture (F), whose end or vertical free edge (FE1), distal from the articulation or pivoting area to the frame or fixture (F), can be moved along a first closing trajectory or path (T1), and at least a second leaf or female leaf (L2) articulated or hinged to the frame or fixture (F), whose end or vertical free edge (FE2), distal from the articulation or pivoting area to the frame or fixture (F), can be moved along a second closing trajectory or path (T2), the end or vertical free edge (FE2) of said second leaf or female leaf (L2) comprising at least an abutment portion or component (AP) for the first leaf or male leaf (L1), the first and second closing trajectory or path (T1, T2) intersecting with one another at an interception zone or point (IP), common to the two closing trajectories or paths (T1, T2), which defines the most open interception position of the first leaf or male leaf (L1) with the second leaf or female leaf (L2) along the respective closing trajectories or paths (T1, T2), said door (D) further comprising a device (1) according to any one of the preceding claims, operatively associated to said door (D), with said at least one first component (3) rotatable or movable according to the movement or rotation of the first leaf or male leaf (L1), while said at least one second component (4) is rotatable or movable according to the movement or rotation of the second leaf or female leaf (L2), said device (1) being arranged to prevent the closing of the first leaf or male leaf (L1) until the second leaf or female leaf (L2) is closed or until the position of the end or vertical free edge (FE2) of the second leaf or female leaf (L2) along the second closing trajectory or path (T2) has not passed or overtake the interception zone or point (IP) in the closing direction.

10. Door (D) according to claim 9, wherein said locking or stop means (5) are designed to prevent the rotation or displacement of said first component (3) up to said second position, and consequently the closing of the first leaf or male leaf (L1), depending on the position of the first leaf or male leaf (L1) along the first closing trajectory or path (T1) with respect to a limit zone or point (LP) and the position of the second leaf or female leaf (L1) along the second closing trajectory or path (T2) with respect to the interception zone or point (IP), said limit zone or point (LP) defining the position of the first leaf or male leaf (L1) along the first closing trajectory or path (T1) beyond which it is prevented from closing or advancing until the second leaf or female leaf (L2) is closed or until the position of the second leaf or female leaf (L2) along the second closing trajectory or path (T2) has not passed or overtake the interception zone or point (IP).

11. Door according to claim 9 or 10, comprising moving members for each leaf (L1, L2), said moving members including at least one kinematic mechanism (AA) for moving each leaf (L1, L2) as well as actuation means (16) of said moving members, in which for one or both leaves (L1, L2) said actuation means (16) are kinematically or operationally connected with said respective first (3) or second (4) component, so that the angular displacement or translation of one of the latter takes place when said actuation means (16) actuate or command the angular displacement of the leaves (L1, L2).

12. Door according to claim 11, wherein said door comprises emergency closing means (17) of the leaves (L1, L2) designed to close the leaves following the

interruption of the electrical power supply of said actuation means (16), in which for one or both leaves (L1, L2) both said actuation means (16) and said emergency closing means (17) are kinematically or operatively connected with said respective first (3) or second (4) component, so that the angular displacement or translation of one of the latter takes place when said actuation means (16) or said emergency closing means (17) actuate or command the angular displacement of the leaves (L1, L2).

13. Door according to the preceding claim, comprising at least one driving shaft (20), said at least one driving shaft (20) being connected, fixed or in meshing engagement with said first (3) and/or second (4) component, said actuation means (16) and said emergency closing means (17) being integral in movement with said respective driving shaft (20).

14. Door according to the preceding claim, comprising registration means (4b, 20a) of the engagement or fixing position of said first (3) and/or said second (4) component with respect to said at least one driving shaft (20).

15. Method of synchronizing the closure of a door (D) according to any one of claims 9 to 15, comprising the steps of:

- close or in any case start the closing of the door (D) and, consequently, of the at least two leaves (L1, L2) which control the rotation or displacement of the first and second component (3, 4) respectively,
- the locking or stop means (5) preventing the rotation or displacement of the first component (3), and consequently the closing or advancement of the first leaf or male leaf (L1), until the second leaf or female leaf (L2) it is not closed or until the position of the second leaf or female leaf (L2) along the second closing trajectory or path (T2) has not passed or overtake the interception zone or point (IP).

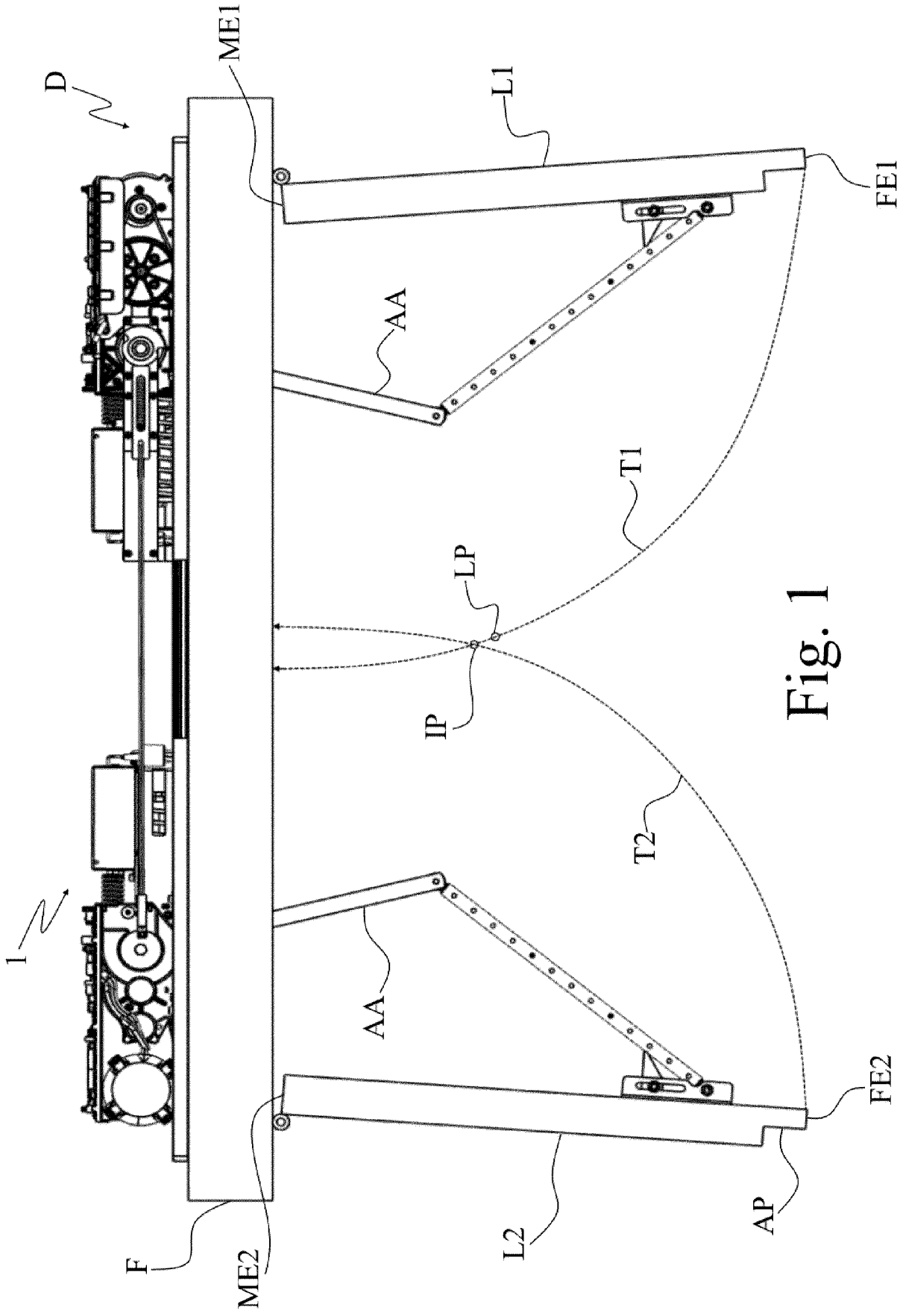


Fig. 1

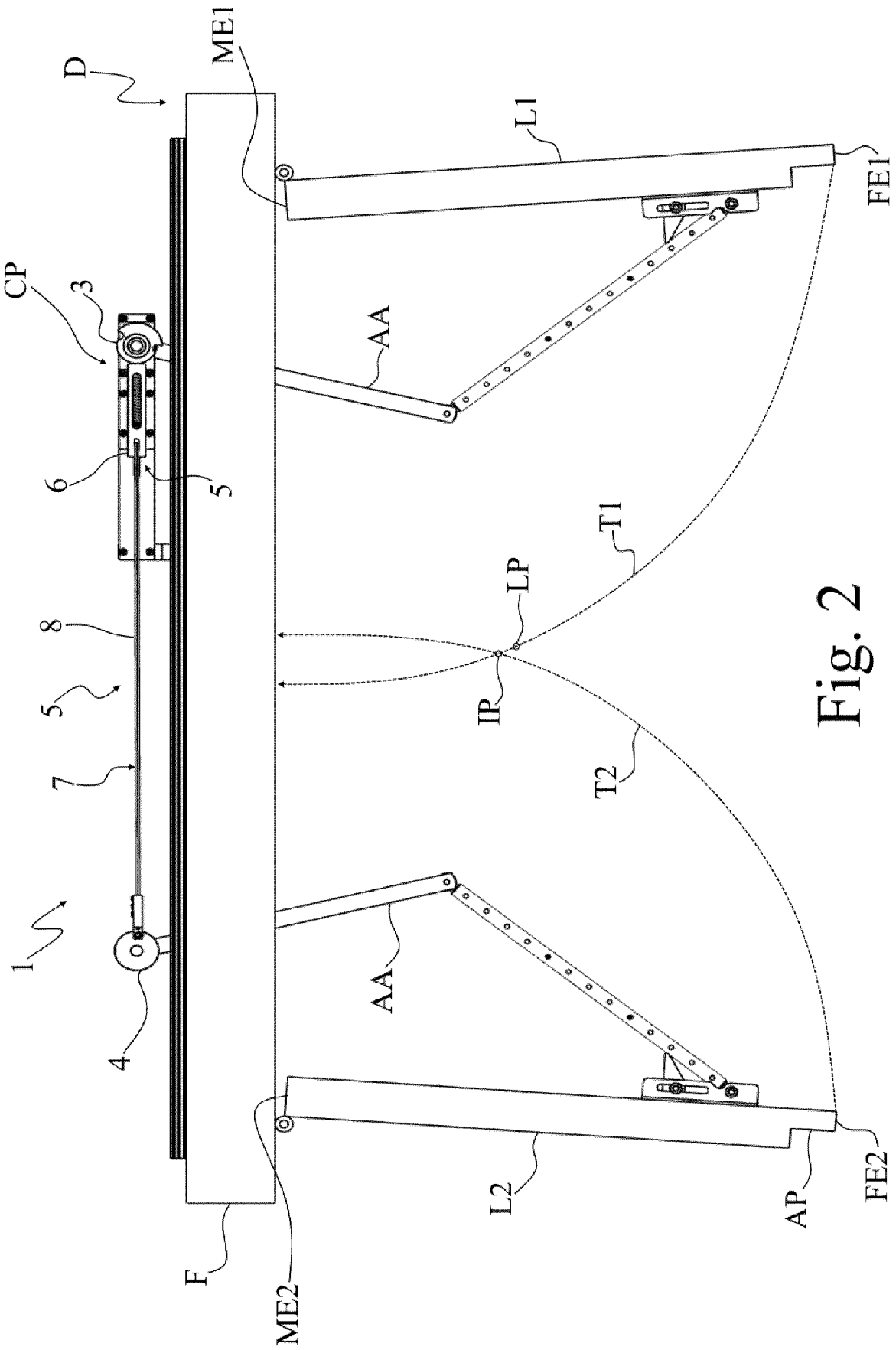


Fig. 2

Fig. 3

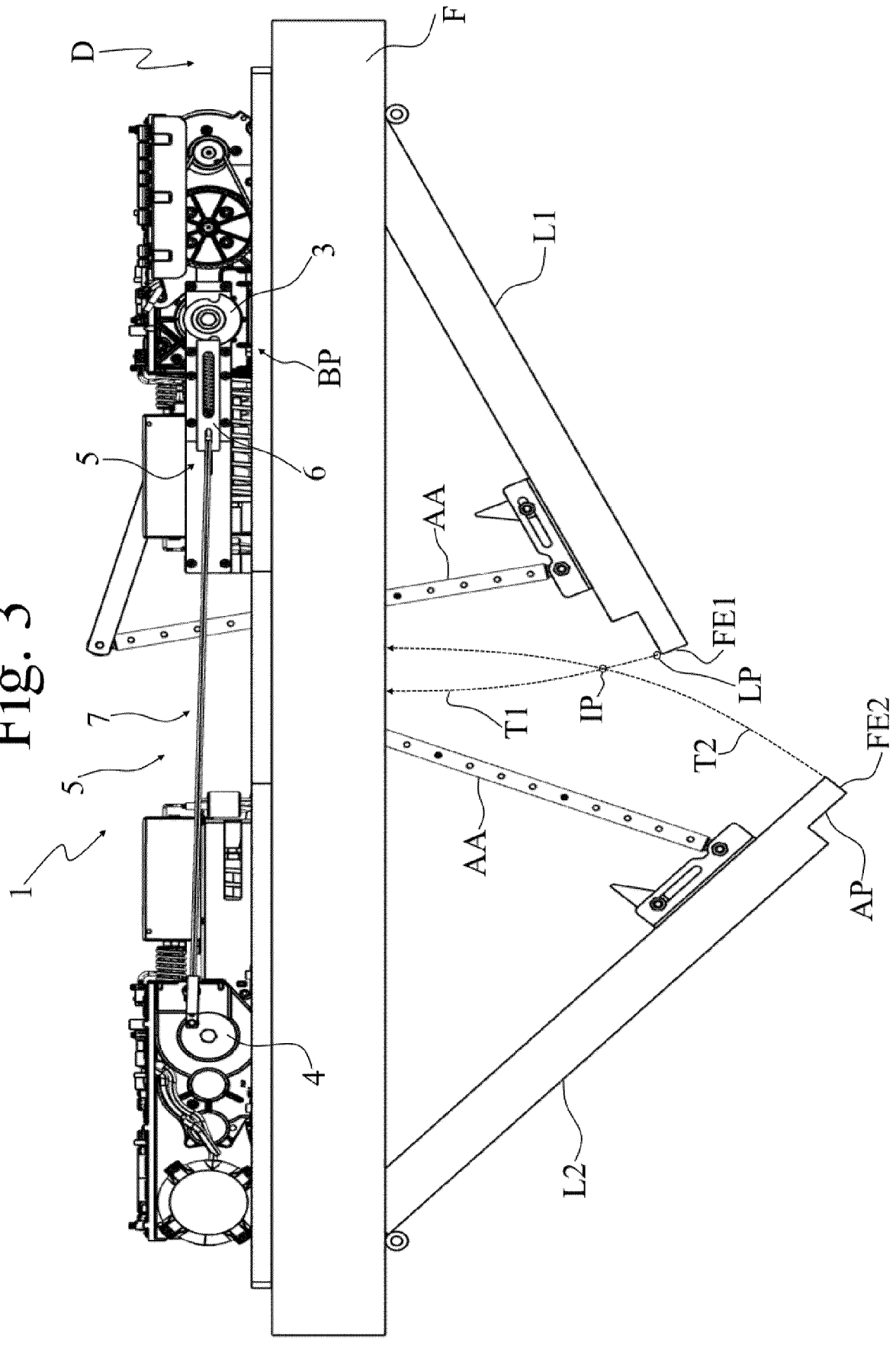


Fig. 4

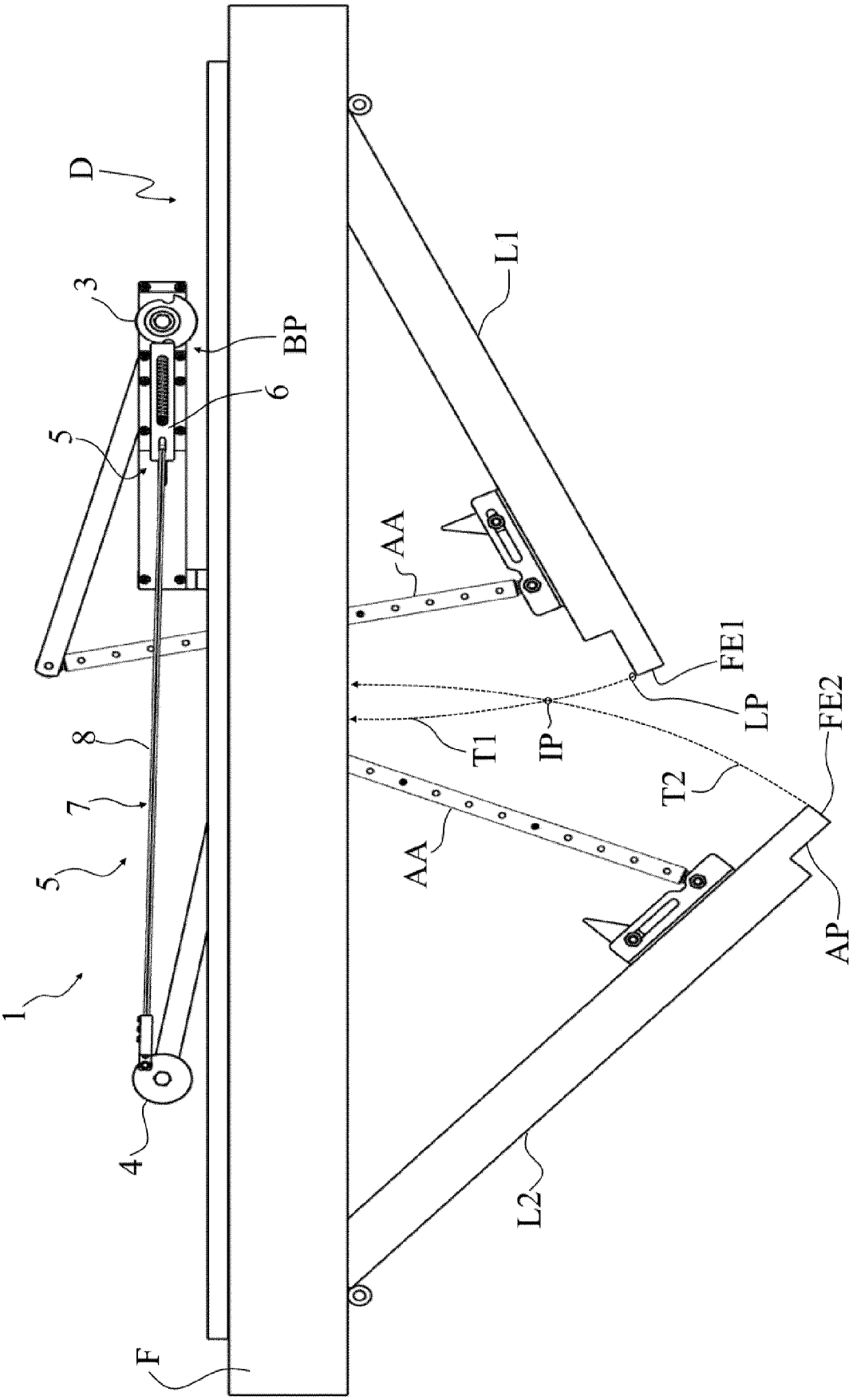


Fig. 5

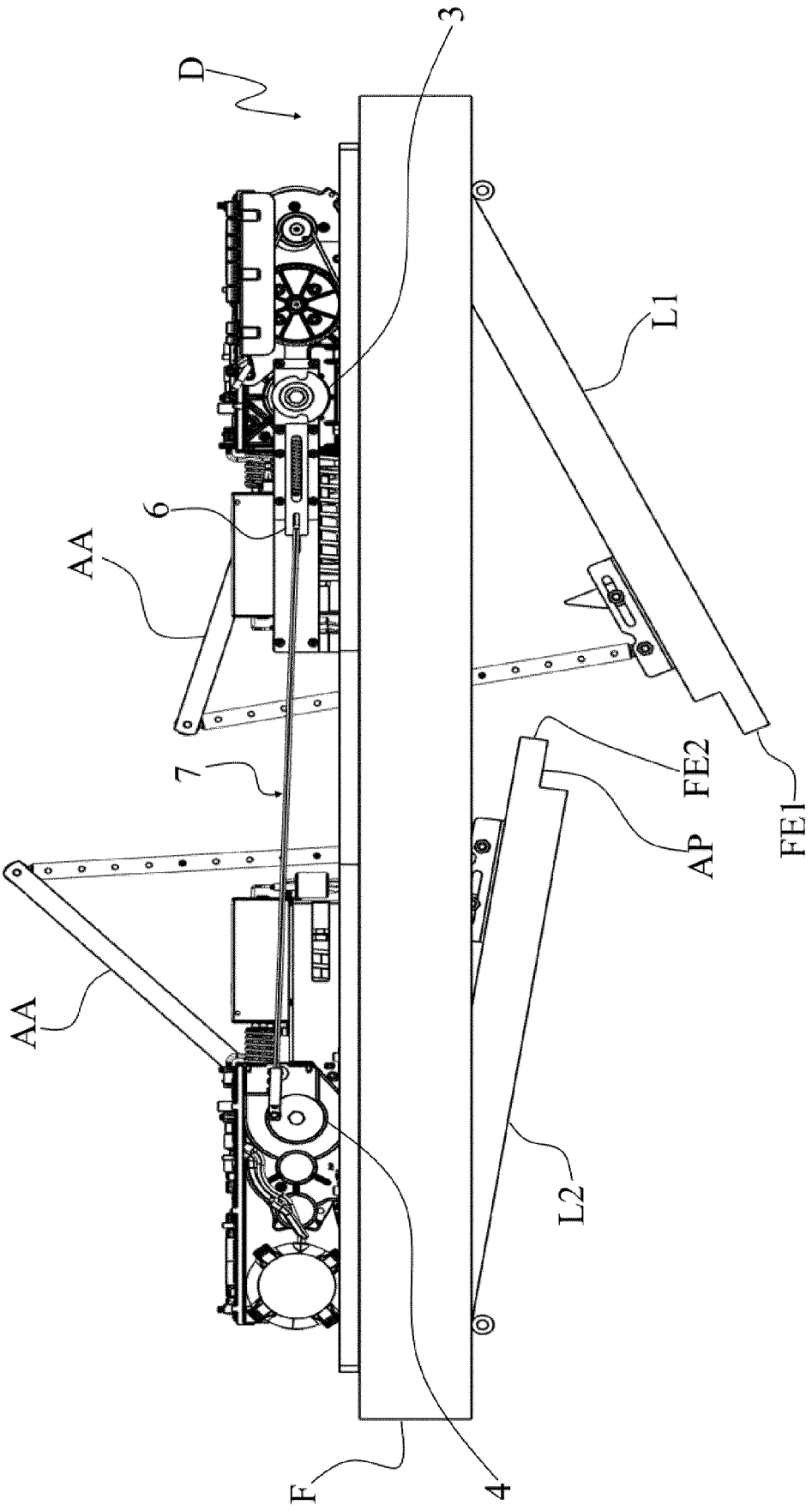


Fig. 6

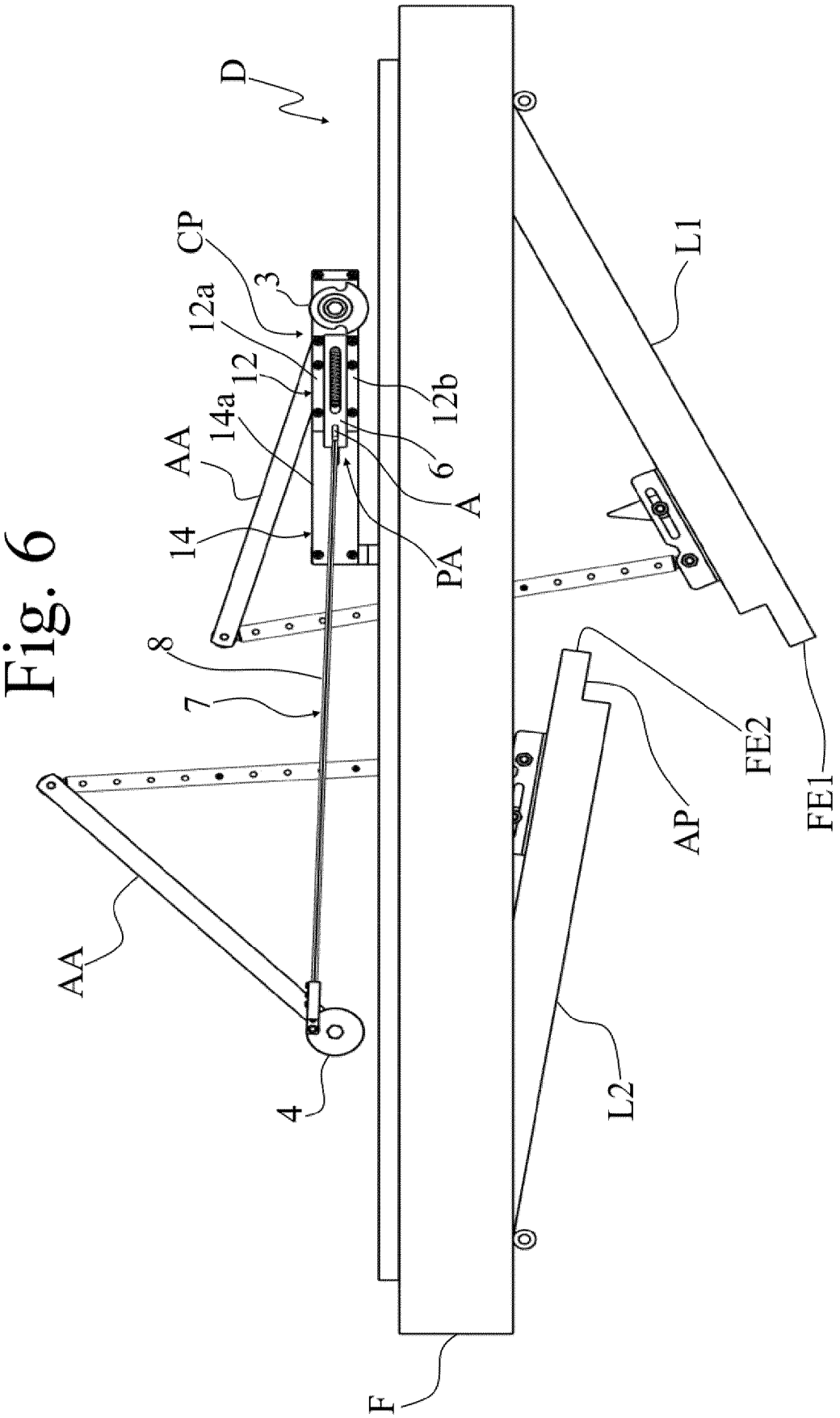


Fig. 7

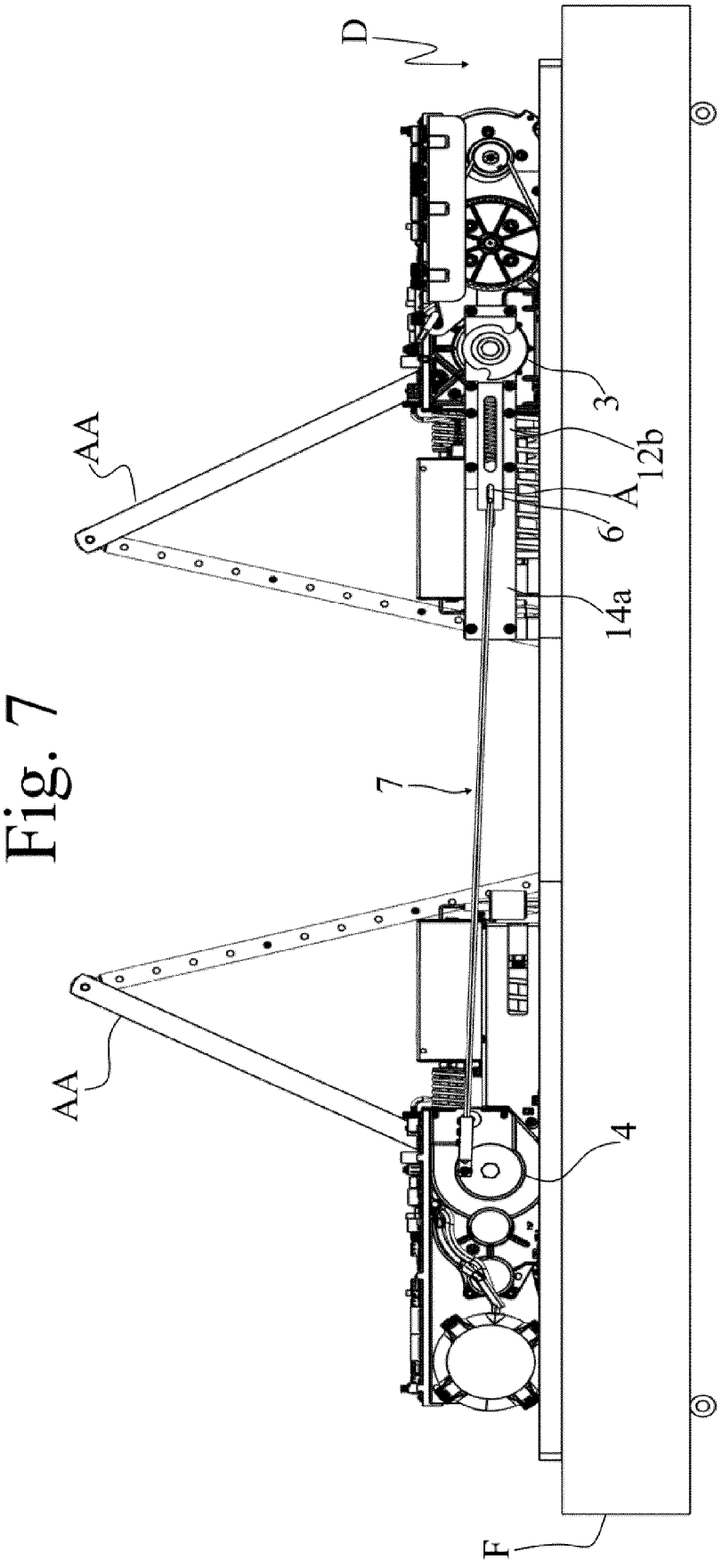
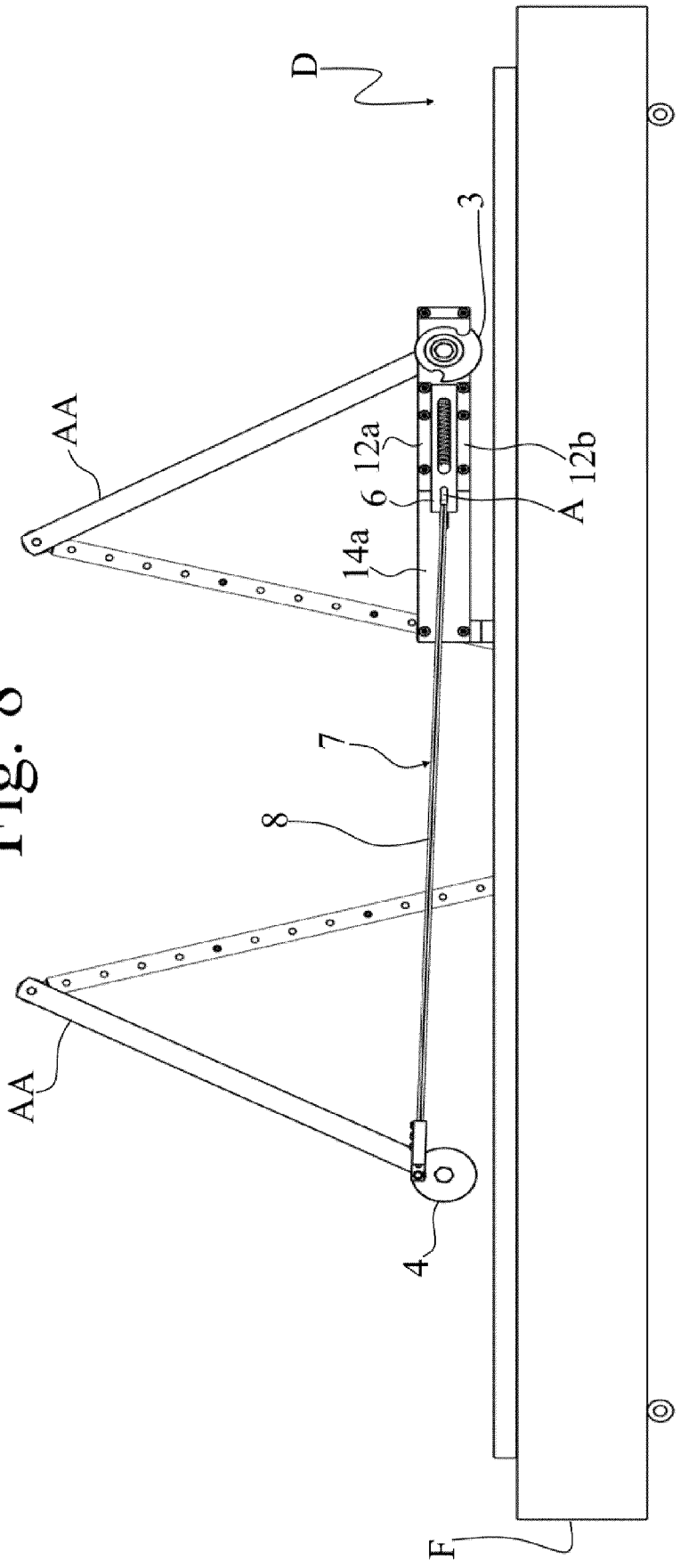
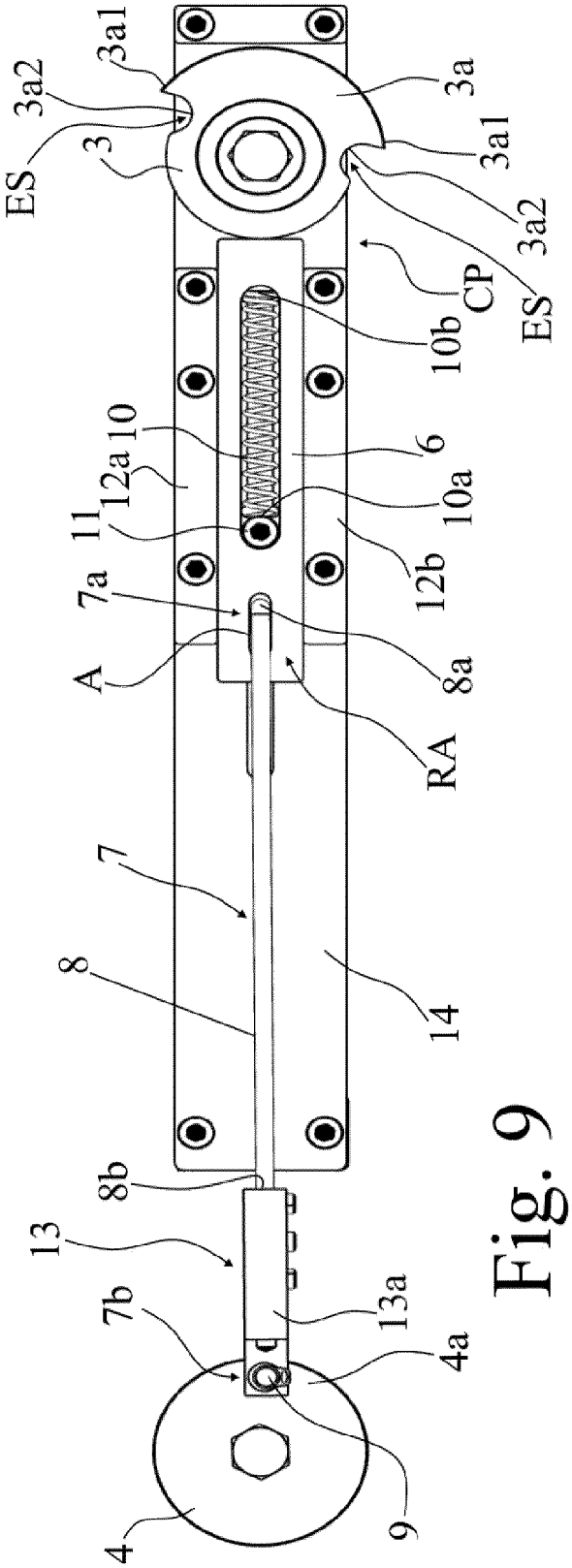


Fig. 8

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4a
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9

Fig. 9

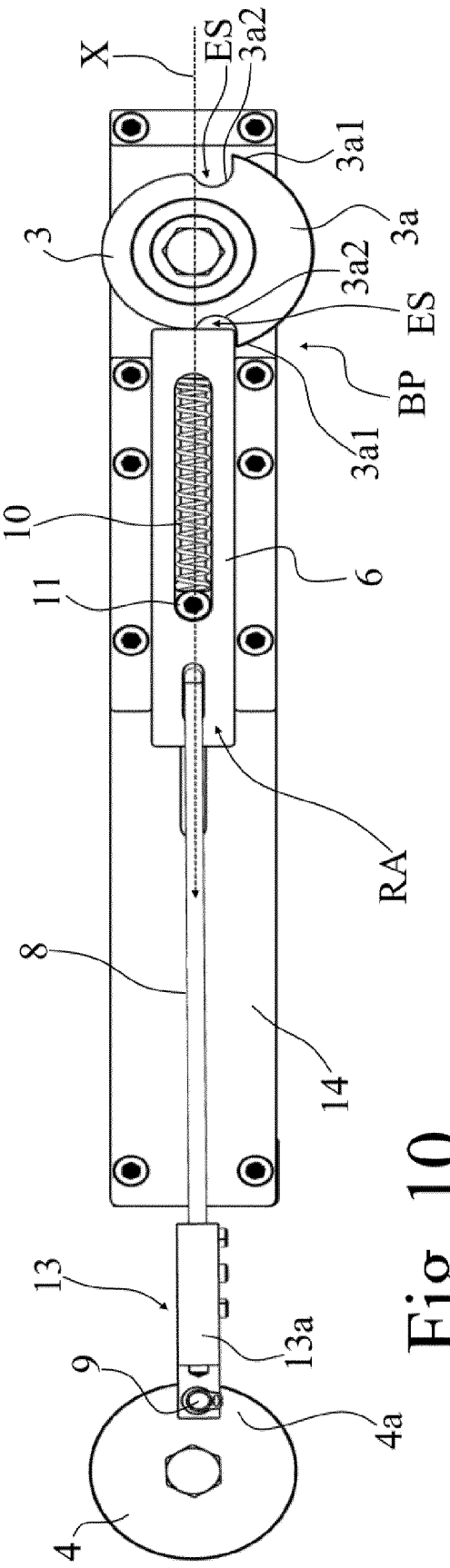
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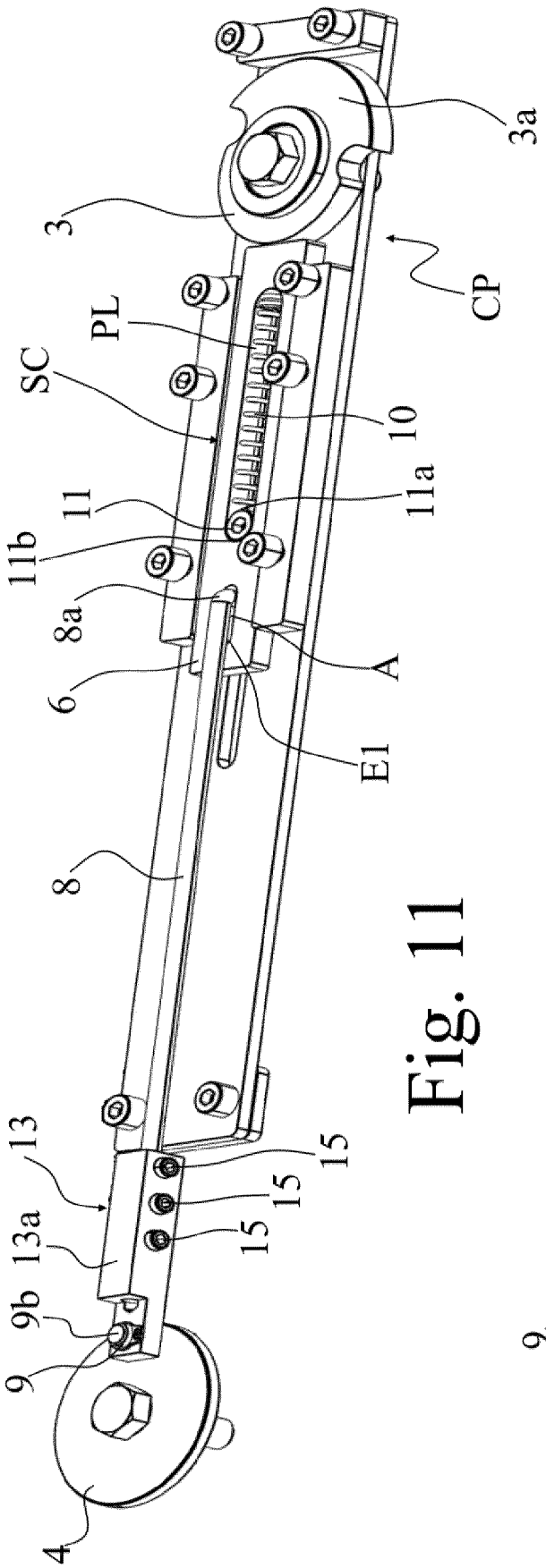
Fig. 10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9b
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Fig. 11

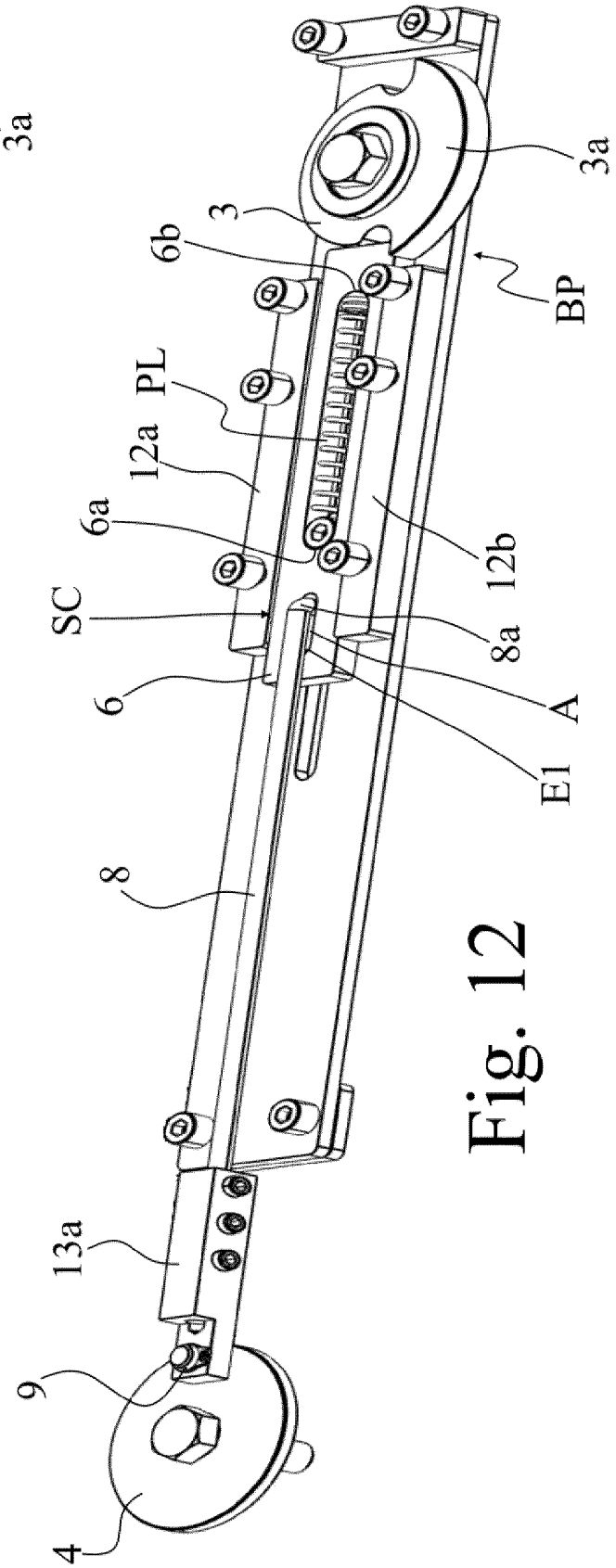
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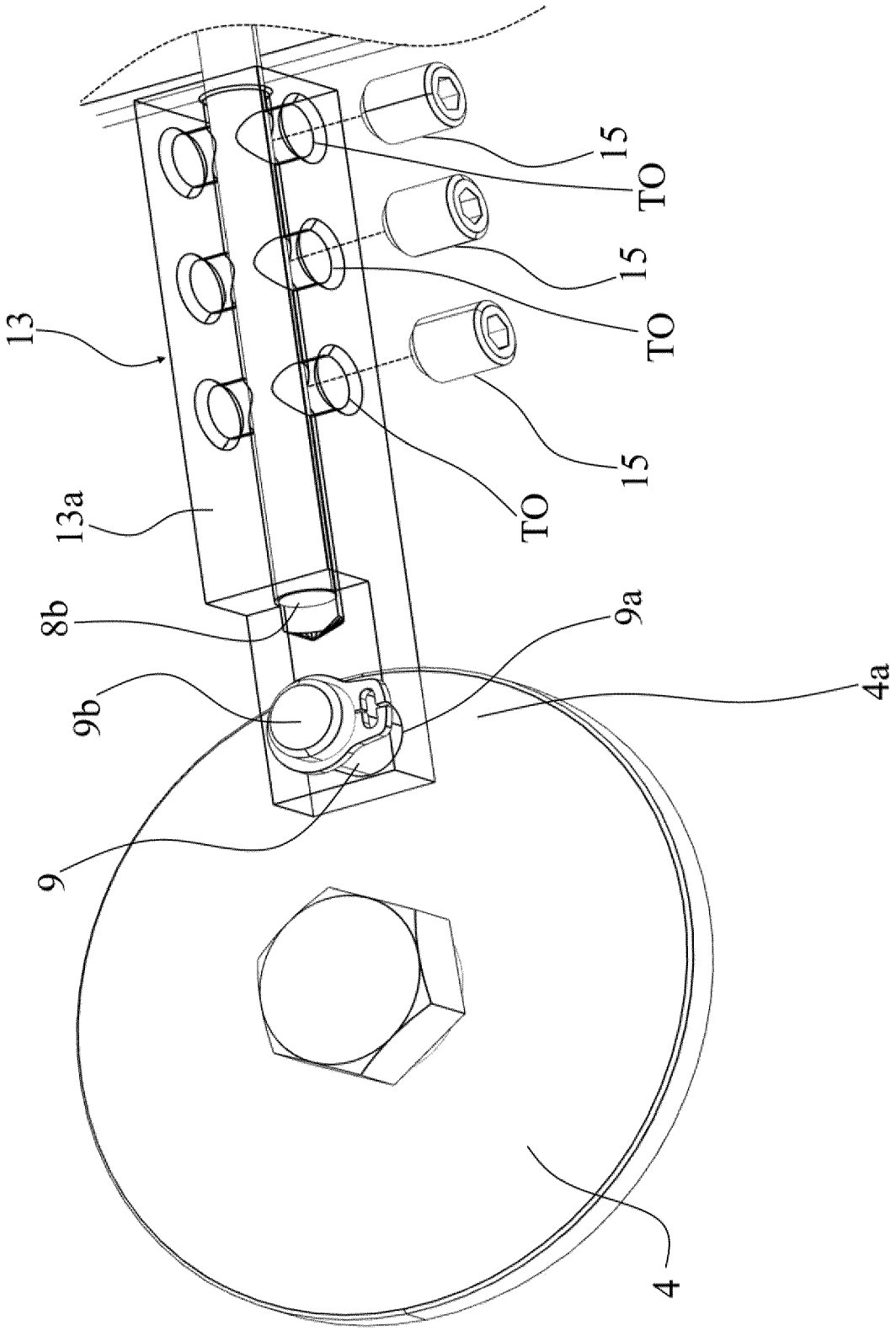
Fig. 12

Fig. 13



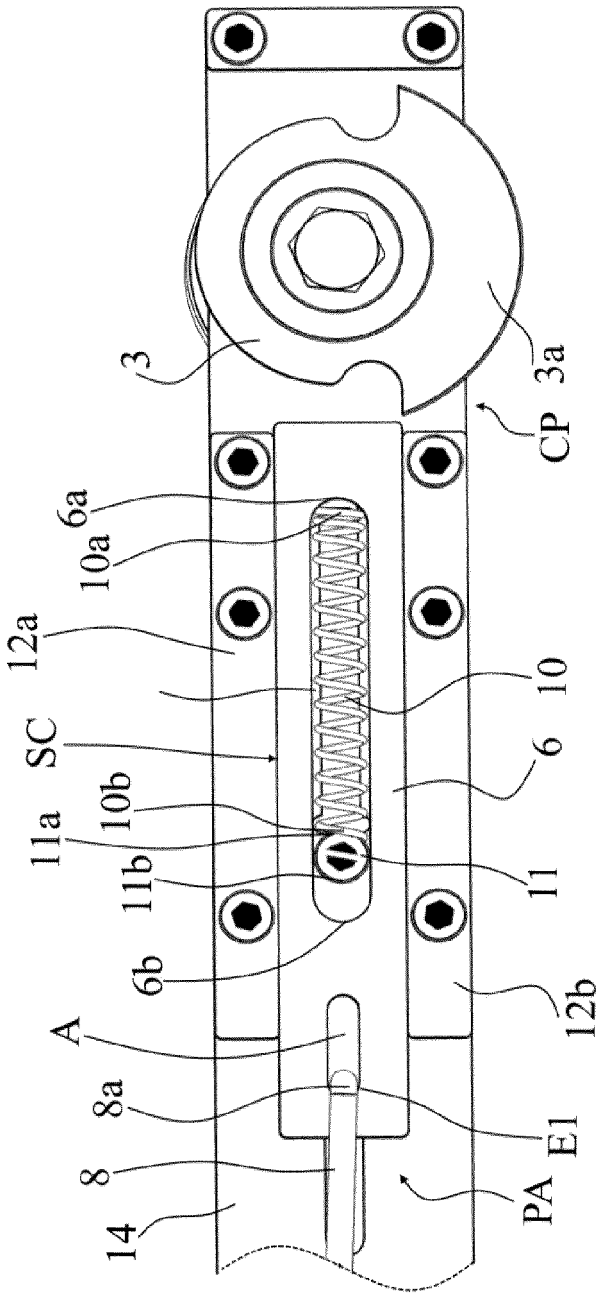

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Fig. 15

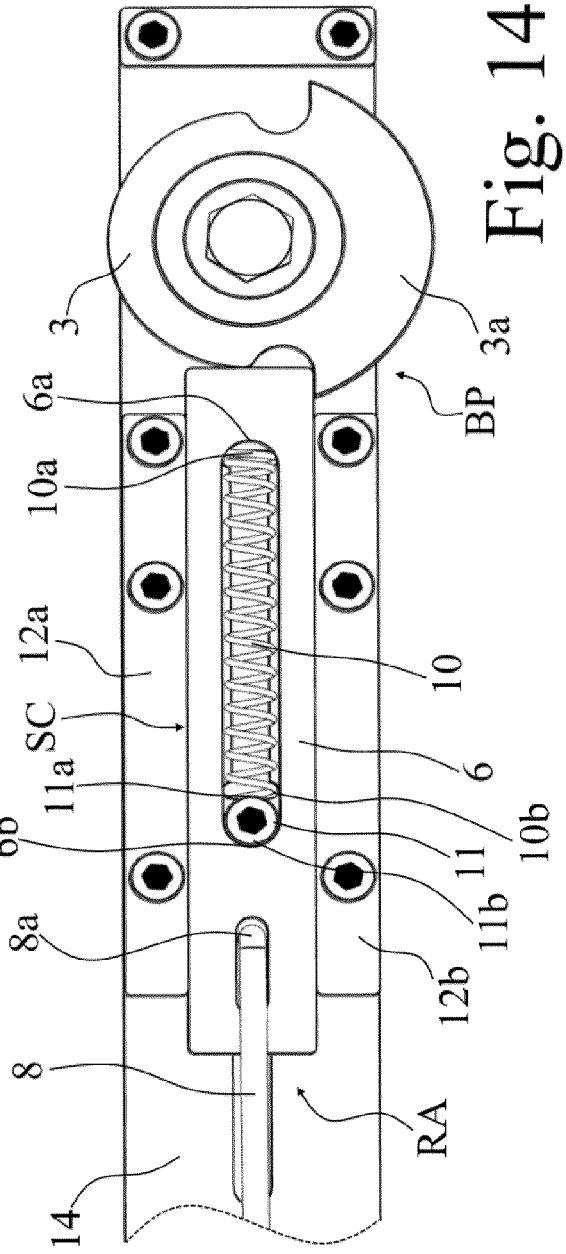
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Fig. 14

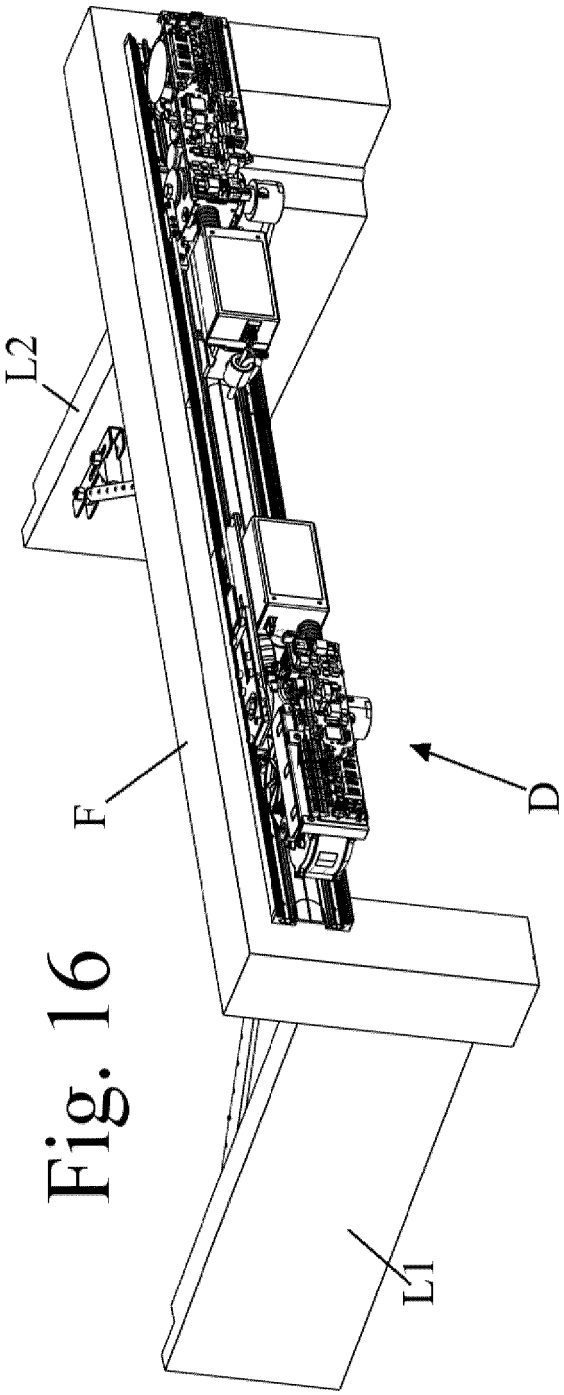

Fig. 16

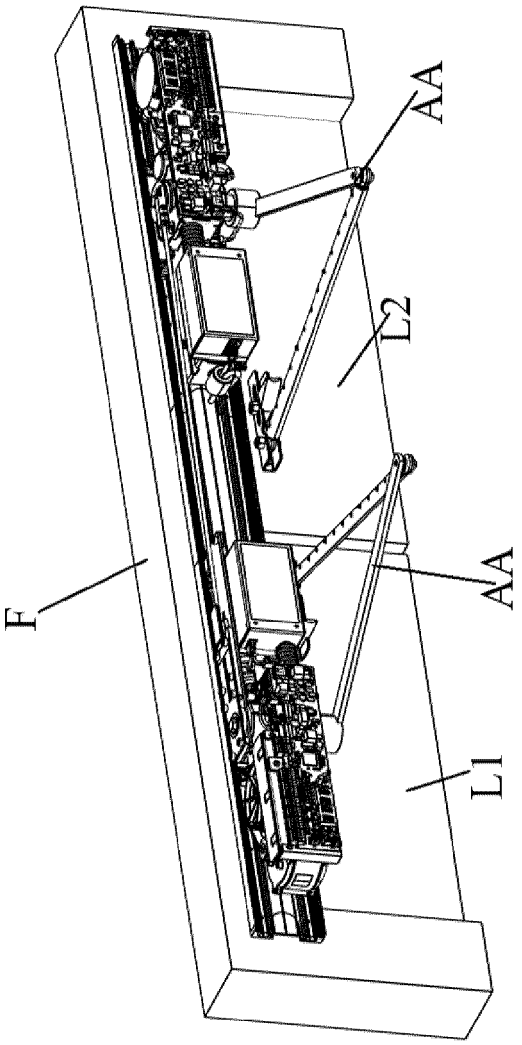

Fig. 17

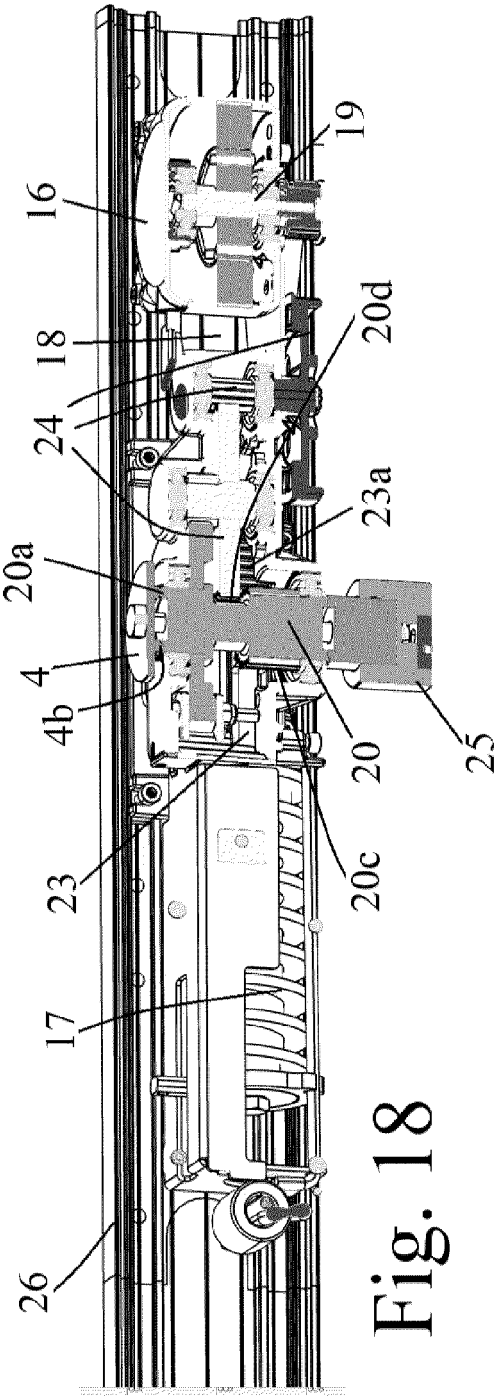

Fig. 18

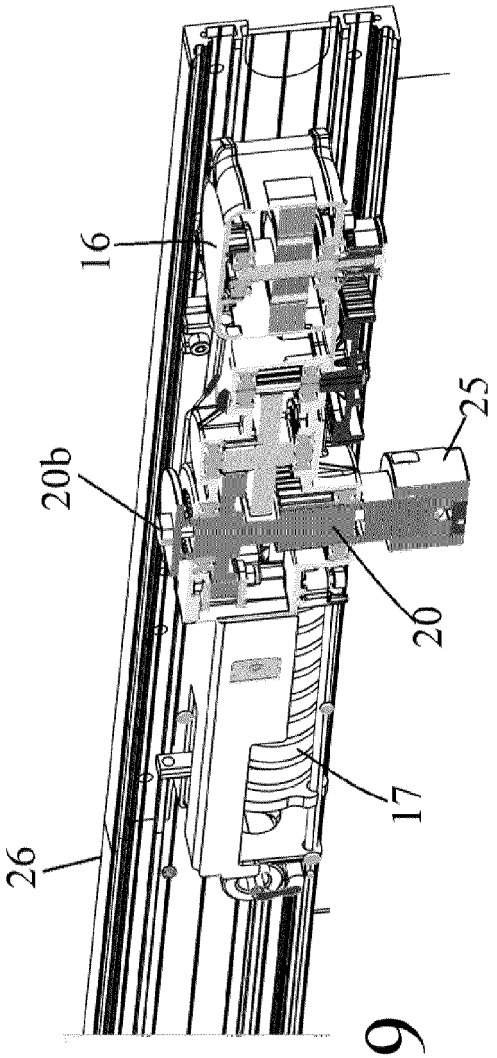

Fig. 19

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EUROPEAN SEARCH REPORT

Application Number
EP 22 21 4445

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X	EP 2 963 218 A1 (GEZE GMBH) 6 January 2016 (2016-01-06) * the whole document *	1-15	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 March 2023	Van Beurden, Jason

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