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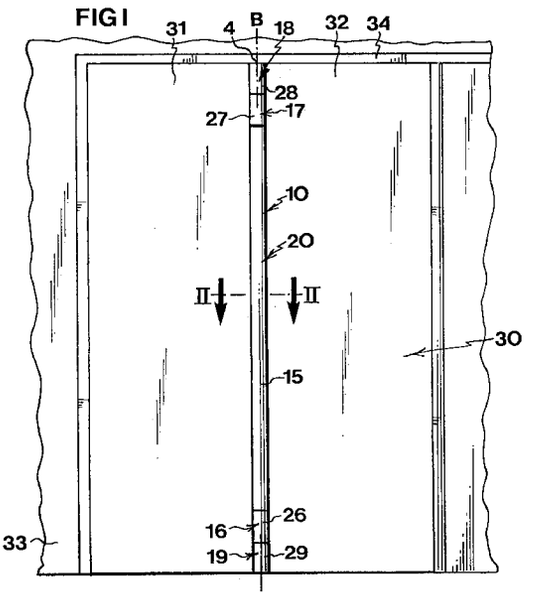
(54) Driving mechanism

(57) A folding screen arrangement comprises a first (31) and a second (32) screen member which are interconnected via a first hinge joint. The first screen member is also connected to a frame member (33) via a second hinge joint.

An operating mechanism (10) is with its transmission means (16,17) connected, in different axial positions, to the first screen member (31) and the second screen member (32) to perform, during operation of the motor, a mutual folding motion between the first screen member (31) and the second screen member (32).

The operating mechanism is arranged between the screen members (31, 32) in the rotational axis (B) of the joint.

FIG I



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Description

Field of the Invention

[0001] The present invention relates to screen arrangements, such as doors and folding walls, and concerns more specifically a folding screen arrangement according to the preamble to appended claim 1.

Background Art

[0002] Power-driven folding doors for industries and garages often have electric operating mechanisms, which are arranged beside the door and which via arms accomplish mutual folding of door segments for opening and closing of the folding door. The operating mechanisms are heavy and bulky and require additional work in mounting. A special problem is that in many cases such operating mechanisms cannot be used at all since the space round the door is too limited.

[0003] DE 3,122,872 discloses a folding door having a motor construction which is arranged adjacent to a hinge between two mutually folding door segments. Also this construction operates with arms and is bulky. Moreover a considerable extra weight in the form of the motor exerts a load on the door.

[0004] Also FR 1,396,088 discloses a folding door with an operating mechanism which is arranged adjacent to a hinge between two mutually folding door segments. This construction comprises a piston-and-cylinder assembly for hydraulic operation. This construction, too, is heavy and bulky. Besides a hydraulic source of power must be available.

[0005] SU 1,183,650 discloses an operating mechanism which is adapted to be mounted adjacent to a frame to operate folding doors of buses. The operating mechanism comprises two mutually rotatable tubes which are arranged concentrically in one another. One tube is non-rotatably connected to a frame and the other tube is non-rotatably connected to a door segment positioned adjacent to the frame. In the tubes there are two massive sectors of a circle, which, in a common axial position, are connected to one tube each. Between the two massive sectors there are two chambers, each comprising an inflatable member which is connected to an air source. By alternately filling and emptying the two inflatable members, a door segment can be made to perform a pivoting motion through 90° relative to the frame.

[0006] The construction according to SU 1,183,650 requires access to compressed air and can merely accomplish a pivoting motion through 90°.

Summary of the Invention

[0007] An object of the present invention is to provide, in view of the above-described drawbacks of prior-art constructions, an improved mechanism for operating screen arrangements, such as doors and folding walls, especially screen arrangements in buildings.

[0008] A special object is to provide an operating mechanism which only requires little space and which does not deteriorate or complicate the function of the screen arrangement in other respects.

[0009] A further object is to provide an improved motor-driven screen arrangement.

[0010] A specific object is to provide a motor-driven screen arrangement which can be mounted also in places where the space in the immediate surroundings of the screen member is limited.

[0011] According to the invention, these and other objects that will appear from the following description are now achieved by a folding screen arrangement which is of the type described by way of introduction and which in addition has the features defined in the characterising clause of claim 1.

[0012] According to the invention, the screen arrangement thus has an operating mechanism comprising an electric motor and first and second transmission means which are connected to the motor and which are rotatably arranged in different axial positions along a common longitudinal axis to perform, during operation of the motor, a mutual rotary motion about the longitudinal axis. The fact that the transmission means are arranged in different axial positions gives, among other things, the possibility of making the operating mechanism compact and a good stability of the screen arrangement.

[0013] As a result, an operating mechanism is provided to be placed along a joint, in the rotational axis of the joint, of a screen arrangement. Such an operating mechanism, which is advantageously arranged concentrically with the rotational axis of the joint, can be made compact. Thanks to the placing along a joint between two mutually folding means, no external operating constructions are necessary in the immediate surroundings of the screen arrangement. Thus the space round the screen arrangement can be used more efficiently, and motor-driven screen arrangements, such as folding doors, can be mounted in positions where this has previously not been possible.

[0014] The operating unit can easily be mounted on existing screen arrangements since it can be placed adjacent to existing hinges in a joint.

[0015] By the fact that the electric motor accomplishes a mutual turning between the transmission means, the maximum angular displacement between the transmission means is thus only limited by the surroundings.

[0016] The operating mechanism is arranged between the two screen members in the rotational axis of the joint. This makes the operating mechanism effect a folding of the screen members via a turning operating motion through 180°. Since the folding motion is effected via an operating motion through 180° instead of 90°, which will be the case in an alternative placing between a screen member and a frame, the motor can operate at a lower torque and, thus, be given smaller

dimensions.

[0017] In a preferred embodiment of the invention, a disengaging device is arranged to permit manual operation of the screen arrangement.

[0018] In one more preferred embodiment, the operating mechanism of the screen arrangement comprises first and second hinge means for connection to a respective one of the two mutually folding means. The first hinge means is arranged at a distance from the first transmission means, and the second hinge means is arranged at a distance from the second transmission means. As a result, an operating mechanism is provided, which in a common unit constitutes a hinge in a joint of a screen arrangement and operating means for the screen arrangement. In this embodiment, the hinge means are advantageously freely rotatable about the longitudinal axis, which can be achieved by simple aids.

[0019] According to a further embodiment, the motor is arranged in a tubular casing extending concentrically with the longitudinal axis. In this embodiment, the transmission means are advantageously arranged on the casing.

[0020] In another preferred embodiment, the operating mechanism has a tubular casing which extends essentially along the entire length of the screen member. As a result, the tubular casing eliminates the risk of squeezing essentially along the entire length of the joint.

Brief Description of the Drawings

[0021] The invention will now be described in more detail with reference to the accompanying drawings, which illustrate preferred embodiments and in which

Fig. 1 is a side view of an operating mechanism mounted on a folding door in a closed position,
Fig. 2 is a sectional view along line II-II in Fig. 1,
Fig. 3 is a side view of the folding door shown in Fig. 1 in an open position from the opposite side,
Fig. 4 is a cross-sectional view along line IV-IV in Fig. 3,
Fig. 5 is an enlarged, part-sectional longitudinal view of an inventive operating mechanism,
Fig. 6 is a detailed view on a still larger scale of an upper part of the operating mechanism in the area VI in Fig. 5,
Fig. 7 is a detailed view on a still larger scale of a lower part of the operating mechanism in the area VII in Fig. 5, and
Fig. 8 is a side view, corresponding to Fig. 3, of a second embodiment of the operating mechanism.

Description of an Embodiment of the Invention

[0022] Figs 1-4 illustrate an operating mechanism 10 which is mounted on a screen arrangement in the form of a folding door 30 with mutually folding screen members in the form of vertical first and second door segments 31, 32, which are hingedly interconnected. The first door segment 31 is in turn hinged to a frame member in the form of a frame 33 surrounding the door 30. The door segments and the frame member are interconnected via hinge joints 4, i.e. joints about which a folding motion can be performed about an axis. At its upper end, the second door segment 32 is guided in a connecting link 34 in prior-art manner.

[0023] The operating mechanism 10 is placed in the joint between the door segments 31, 32 concentrically with the rotational axis of the joint.

[0024] The operating mechanism 10 has a tubular casing 20 comprising a central casing portion 15, first and second transmission means 16, 17 arranged below and above the central casing portion 15, and first and second hinge means 18, 19 arranged above the second transmission means 17 and below the first transmission means 16 respectively. The transmission means 16, 17 and the hinge means 18, 19 each have a tubular segment 26-29. The tubular segments 26-29 and the central casing portion 15 all have the same diameter and are successively arranged about a common longitudinal centre axis B with a view to forming the tubular casing 20. The tubular casing is advantageously made of aluminium.

[0025] Fig. 1 shows the door 30 in a closed position from a first side. Fig. 2 shows a part of the door 30 in cross-section along line II-II in Fig. 1, from which appear connecting portions 11, 14 belonging to the first transmission means 16 and the second hinge means 19 respectively, which connecting portions are connected to the respective door segments 31, 32 and will be described in more detail below. Arrow A in Fig. 2 indicates a reference direction.

[0026] Fig. 3 shows the door 30 in Figs 1 and 2 from the opposite side and in an open position. Fig. 4 is a cross-sectional view along IV-IV in Fig. 3, and the orientation relative to Figs 1 and 2 is evident from arrow A indicating the reference direction.

[0027] Fig. 3 illustrates connecting portions 11, 12 belonging to the first and the second transmission means 16, 17, and connecting portions 13, 14 belonging to the first and the second hinge means 18, 19. The connecting portions 11-14 serve to connect the operating mechanism 10 to the respective door segments 31, 32 and to transfer a turning force from a motor arranged in the central casing portion 15 to the door segments 31, 32. The connecting portions 11-14 are, like door hinge plates, non-turnably fixed directly to the respective door segments 31, 32, preferably as shown on the vertical short side of the door segments, by means of screws 9. Further the connecting portions 11-14 constitute an integrated part of the respective transmission or hinge means 16-19.

[0028] Figs 5, 6 and 7 show the operating mechanism 10 separately and in a part-sectional longitudinal view. A tubular motor 50 is arranged in the central casing portion 15 and is supplied with electricity via electric wires

(not shown). The tubular motor 50 has a motor housing 51 concentrically with the rotational axis of the joint, and a drive means 52 at its one end (in Fig. 5 the upper end), which is rotatably connected to the motor housing 51. The two motor components 51, 52, which are positioned one after the other in different axial positions along the longitudinal axis B, thus constitute actuating means, which during operation of the motor perform a mutual turning motion. The motor housing 51 is non-rotatably connected to the central casing portion 15, and the drive means 52 is non-rotatably connected to the second transmission means 17. The central casing portion 15 is on the other hand non-rotatably connected to the first transmission means 16. Thus the motor 50 effects, in operation, a mutual rotary motion between the two transmission means 16, 17.

[0029] Fig. 6 shows the upper end of the central casing portion 15, the second transmission means 17 and the first hinge means 18 in the area VI in Fig. 5. In the lower portion of the second transmission means 17, the drive means 52 of the motor 50 is non-rotatably connected, for instance by means of a screw. In the upper portion of the second transmission means 17, a tubular journal 41 of steel is non-rotatably mounted via an end sleeve 43 of steel. The journal 41 extends from there into the first hinge means 18, which is rotatably mounted on the journal 41 via a slide bearing sleeve 45 preferably of polyamide, which internally is rotatable about the journal 41 and externally is non-rotatably connected to the hinge means 18.

[0030] In the connecting portions 13, 12 respectively of the first hinge means 18 and the second transmission means 17 there are fixing apertures 8 for the screws 9 shown in Fig. 3. The same applies to the two connecting portions 11 and 14.

[0031] Fig. 7 shows the lower end of the central casing portion 15, the first transmission means 16 and the second hinge means 19 in the area VII in Fig. 5. The second hinge means 19 is rotatably connected to the first transmission means 16 via a slide bearing sleeve 46, a tubular journal 42 and an end sleeve 44 in the same manner as described in connection with Fig. 6.

[0032] The lower end of the central casing portion 15 is non-rotatably connected to the first transmission means 16 via a disengaging device 60 which comprises a first engaging means 61, a second engaging means 62 and a transmission element 63. The first engaging means is formed of a lower end sleeve 61 of steel, which is non-rotatably connected to the central casing portion 15 and which internally has a first engaging portion in the form of a central spline bore 64. The second engaging means 62 is formed of an upper end sleeve 62 of steel, which is non-rotatably connected to the first transmission means 16 and which internally has a second engaging portion in the form of a central spline bore 65. The transmission element 63 comprises an external upper spline portion 66 and a narrower lower portion 67 of circular cross-section. In the lower end of the transmission element 63 there is besides arranged a guide pin 68, which extends in the axial direction into a corresponding duct 69 in the lower end sleeve 44. In the upper end of the transmission element 63 an actuating means 70 is arranged in the form of a radially projecting (away from the plane of the drawing sheet in Figs 5 and 7) actuating pin. The actuating pin 70 extends out of the central casing portion 15 and runs in an axial groove 71 (indicated by dash-dot lines in Fig. 7) in the casing wall. The axial groove 71 has at its upper end a laterally extending area for locking the actuating pin. Fig. 7 shows the disengaging device 60 in an engaging position for operation. For disengagement, the actuating pin 70 in the axial groove 71 is raised. As a result, the upper spline portion 66 of the transmission element 63 is raised out of engagement with the two engaging means 61, 62, and simultaneously the guide pin 68 is lifted out of the duct 69. By the actuating pin 70 then being moved sideways, the transmission element 63 is locked in the disengaged position, whereby the two transmission means 16, 17 are freely rotatable relative to each other. This position is used when one wants to operate the folding door 30 manually, for instance in case of power failure. When the disengaging device is again to be moved into an engaging position, first the central casing portion 15 and the first transmission means 16 must be moved to the mutual initial rotary position that existed before disengagement since otherwise the guide pin 68 cannot be moved into the guide duct 69 and the transmission element 63 cannot be moved axially downwards to engage the second engaging means 62. A correct mutual rotary position between the central casing portion 15 and the first transmission means 16 can also be secured in some other way, for instance, with the aid of an asymmetric design of the splines.

[0033] Fig. 8 shows an alternative embodiment of the invention. In this case a folding door 130 has an operating mechanism 110 which is connected to two door segments 131, 132. In this embodiment, the casing 120 of the operating mechanism 110 comprises a first and a second transmission means 116, 117, which are arranged side by side along a common longitudinal axis B. Each of the transmission means 116, 117 further comprises a tubular casing portion 121, 122 facing away from the opposite transmission means. The tubular motor is here arranged in the lower casing portion 121, the drive means of the motor being arranged in the second transmission means 117. In this construction, at least one additional hinge or an additional drive unit is required along the folding hinge B of the door 130 to hold the two door segments 131, 132 together.

[0034] In folding doors provided with an operating mechanism according to the invention, it has been found extremely advantageous that the connecting link controlling the folding motion of the door is designed as an arcuate bar (not shown), such that the side of the door which is positioned at a distance from the frame is controlled to perform an arcuate motion during opening

and closing. Between two end positions, the bar is slightly displaced from the major plane of the door in the direction in which the door segments extend in the open position of the door. Particularly the initial motion during closing from an open position occurs smoothly if the bar is somewhat angled adjacent to the frame.

[0035] The invention is in no way restricted to the above embodiments, and further developments are feasible within the scope of the appended claims. For instance, the inventive operating mechanism is usable not only for vertical folding doors. Also folding doors with horizontal door segments and horizontal joints, as well as folding walls with a plurality of successively arranged vertical wall segments and vertical joints can be provided with one or more operating mechanisms according to the invention.

Claims

1. A folding screen arrangement (30), such as a folding door or a folding wall, comprising

   a first and a second screen member (31, 32; 131, 132) which are foldingly interconnected via a hinge, the first screen member (31) being connected to a frame member (33) via a second hinge, and
   an operating mechanism which comprises an electric motor (50) and first and second transmission means (16, 17) which are connected to the motor (50) and which on both sides of the hinge joint are each connected to one of said first and second screen members (31, 32; 131, 132), to make, during operation of the motor (50), the screen members (31, 32; 131, 132) perform a folding motion about the joint, **characterised** in
   that the two transmission means (16, 17) are rotatably arranged in different axial positions along a common longitudinal axis (B) to perform, during operation of the motor (50), a mutual rotary motion about the longitudinal axis (B), and
   that the operating mechanism is arranged between the first and the second screen member (31, 32; 131, 132) in the rotational axis (B) of the joint.

2. A screen arrangement as claimed in claim 1, wherein a disengaging device (60) is arranged between the motor (50) and the first transmission means (16).

3. A screen arrangement as claimed in claim 2, wherein the disengaging device (60) comprises

   a first engaging means (61) non-rotatably connected to the motor (50),
   a second engaging means (62) non-rotatably connected to the first transmission means (16), and
   a transmission element (63) which is movable between an engaging position, in which the transmission element (63) engages in a form-fit manner with the two engaging means (61, 62), and a disengaging position, in which the transmission element (63) is moved out of engagement with one of said two engagement means (61, 62).

4. A screen arrangement as claimed in any one of the preceding claims, which along the longitudinal axis (B) has first and second hinge means (18, 19) for connection to a respective one of said two mutually folding means (31, 32), wherein the first hinge means (18) is arranged at a distance from the first transmission means (16) and the second hinge means (19) is arranged at a distance from the second transmission means, the hinge means (18, 19) preferably being freely rotatable about the longitudinal axis (B).

5. A screen arrangement as claimed in any one of the preceding claims, wherein the motor is arranged in a tubular casing (20) extending concentrically with the longitudinal axis (B), the transmission means (16, 17) being arranged on the casing (20).

6. A screen arrangement as claimed in claim 5, wherein the casing (20) has a central casing portion (15) which at its axial ends along the longitudinal axis (B) is surrounded by a first tubular segment (26) belonging to the first transmission means (16), and a second tubular segment (27) belonging to the second transmission means (17).

7. A screen arrangement as claimed in claim 5 or 6, wherein the tubular casing (20) extends essentially along the entire length of the screen arrangement (30).

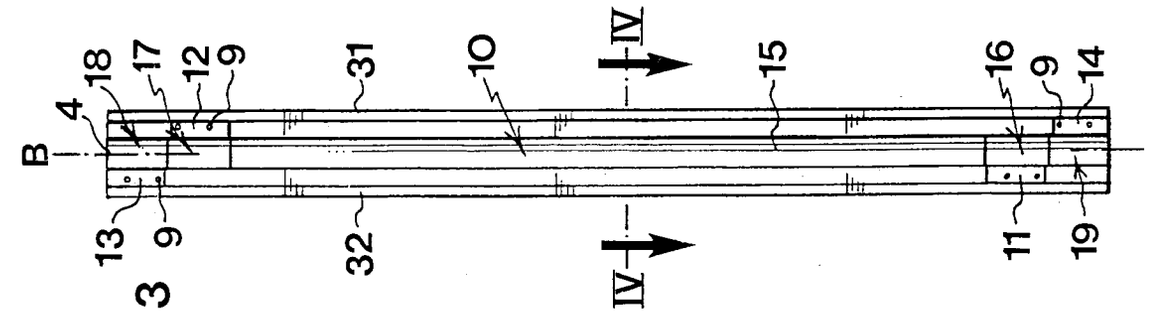

FIG 3

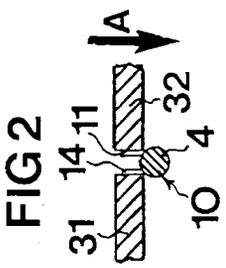

FIG 2

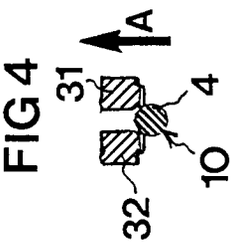

FIG 4

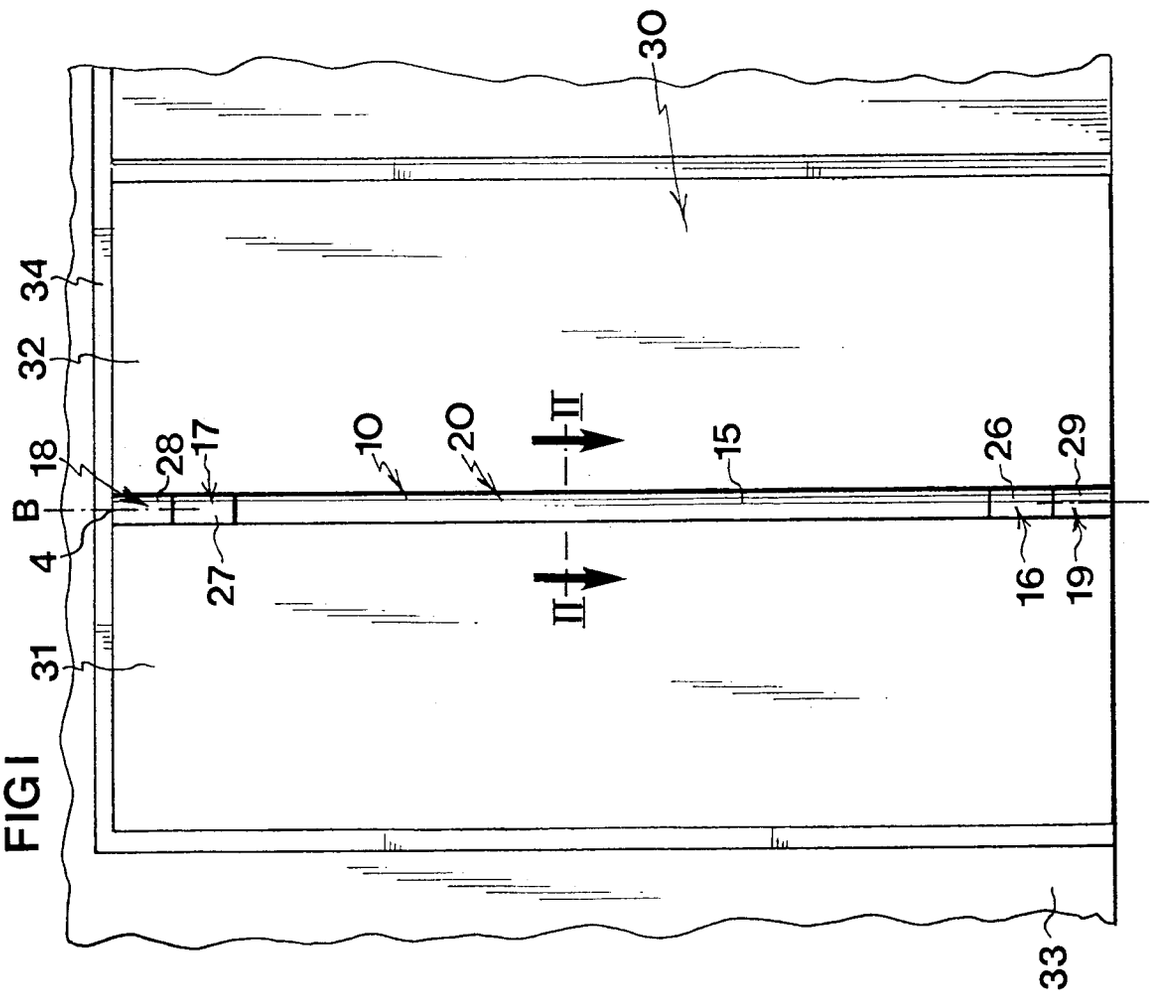

FIG 1

FIG.5

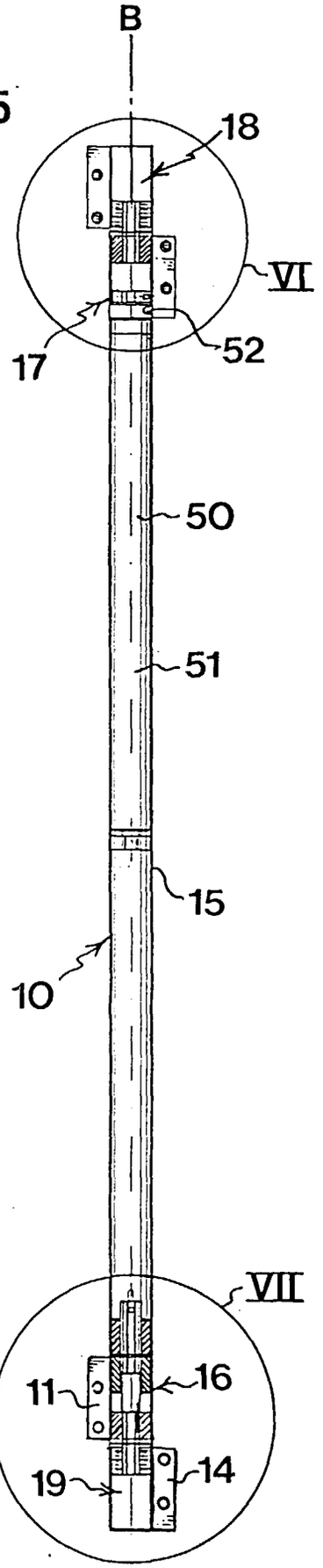

FIG6

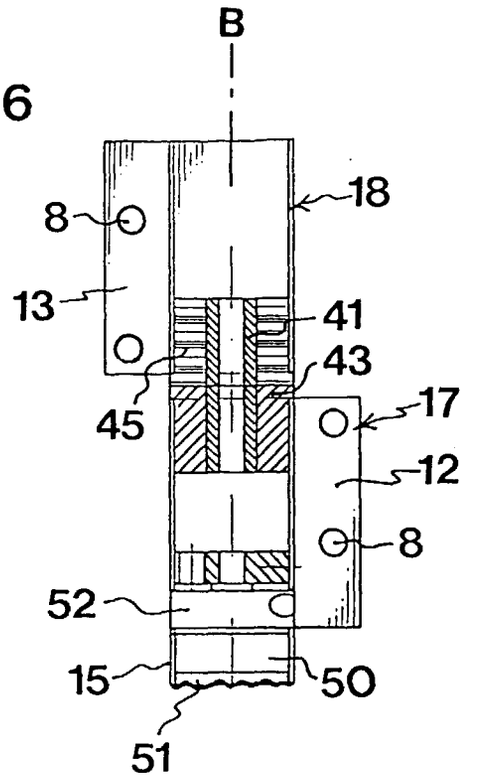

FIG7

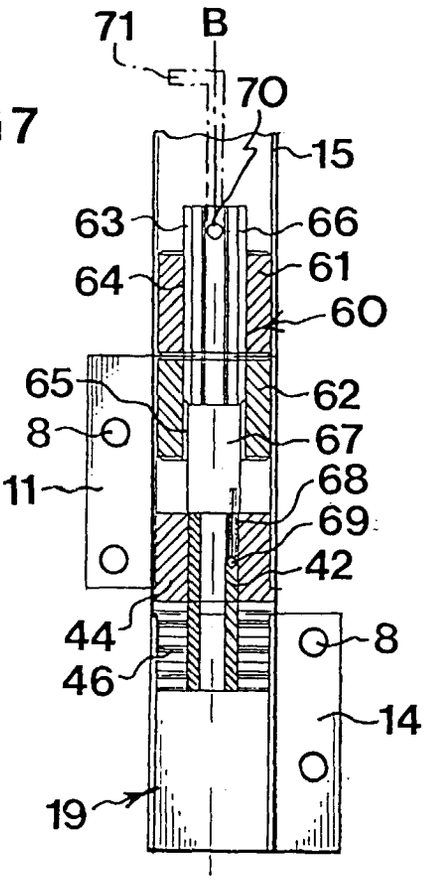

FIG8