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(54) Hardware set for coplanar sliding closet doors.

(57) According to the invention a hardware set for coplanar and sliding closet doors is obtained. Said hardware set comprises an upper element (6) attached to the upper part of a door (2) and sliding along horizontal tracks (7) attached to the ceiling (8) of the closet (3) and a lower element (9) attached to the lower part of the same door (2) and sliding along a horizontal track 10 attached to the bottom (11) of the closet (3). The connection between the upper and lower elements (6; 9) and the door (2) is obtained by means of articulated arms (61, 62; 91, 92) which, thanks to their pantograph-like movement, allow the displacement of the door (2) in relation to the sliding plane on the front of the closet when a force stresses the door orthogonally to the longitudinal sliding direction, while sliding elements (64; 84, 85) which are present on the upper element (6) and on the lower element (9) and which match the tracks (7; 10) allow the longitudinal displacement of the door (2) in the front of the closet when a force stresses it in that direction.

An elastic telescopic element (58) connected with the upper element (6) of the hardware set (1) and with the door (2), which is pre-loaded during the opening of the door (2) causes the return of the door to its coplanar position because of its elastic reaction. Means having the purpose of aligning the door, of locking it and of overcoming eventual dead centers during the opening and closing are also present.

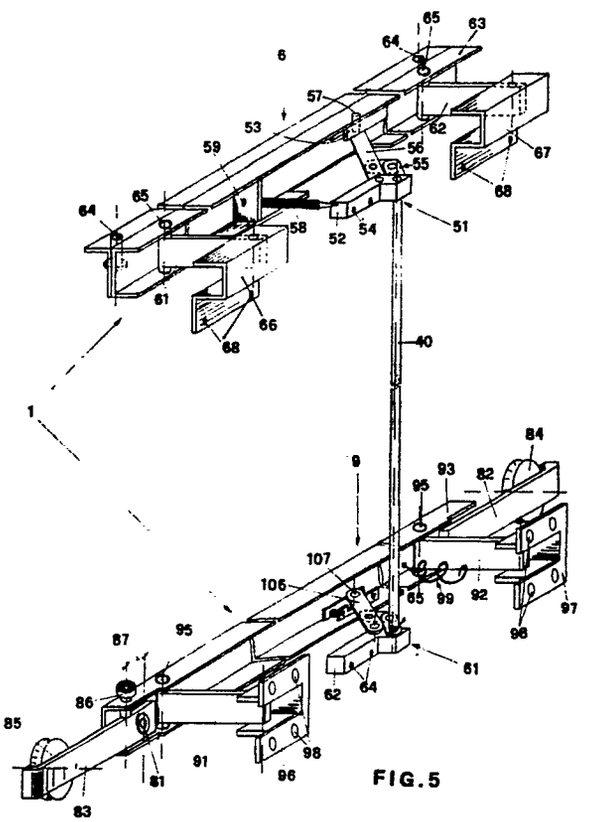

FIG.5

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HARDWARE SET FOR COPLANAR SLIDING CLOSET DOORS

The invention concerns a type of hardware for coplanar sliding doors of clothes closets.

The word "closet" will be used hereinafter to indicate all pieces of furniture acting in general as containers.

Closets with sliding doors are special types of closets wherein the doors are sliding horizontally on the front side of the closet, instead of being hinged on its lateral sides. Said doors, which in the known models move on two planes parallel with each other, are supported by suitable hardware which is attached on the bottom and top parts of the closet and allows the sliding motion and the guiding of the doors.

The use of said type of closets is convenient in all those cases where the space in front of the closet is insufficient to permit the opening of the traditionally hinged doors. They are also used when reasons of an aesthetic nature require it.

The closets of the known type made according such criterions present however the main inconvenience that, since the doors are not coplanar but, as has already been mentioned, they are arranged on two vertical sliding planes, which are parallel with each other, their aesthetical aspect does not always satisfy the user, who, in most cases prefers a closet presenting an outer flat frontal surface without recesses.

In order to eliminate the lamented inconvenience and to meet the requirements of the user, closets with coplanar sliding doors have been realized. When the closet is closed, said doors are arranged on a single vertical plane; the opening of the closet occurs by first pushing one of the doors inward in relation to the others, and then by causing it to slide horizontally behind one of the other doors, or by causing one of these to slide in front of the receded door.

Said closets present the inconvenience that the hardware supporting the doors can only be manufactured at extremely high costs and offers a much limited working reliability. In fact, all the solutions employed for the recession of the door use systems with an excentric or systems with motion transmission pulleys and cables which are elaborate to manufacture, difficult to assemble and very unreliable in their operation. The present invention proposes to eliminate the mentioned inconveniences.

The main purpose of the invention is to realize a hardware set for coplanar sliding closet doors which is easy to manufacture, to assemble and to adjust and which offers high operating reliability.

Another purpose of the invention is to realize a hardware set allowing the installation of coplanar sliding doors on closet structures with traditional sliding doors.

Yet another purpose of the invention is to realize a hardware set allowing the easy opening and closing of the door which it supports even when the weight of said door is considerable.

Not the least purpose of the invention is that of realizing a hardware set permitting to overcome possible dead centers when the door is being opened and closed.

All the above mentioned purposes and others, which will be better described hereafter, are obtained through a hardware set for coplanar sliding closet doors, which, in accordance with the patent claims, comprise a fixed upper element permanently attached to the upper part of a door and sliding along horizontal tracks attached to the closet ceiling and a lower element permanently attached to the bottom part of the same door and sliding along a horizontal track attached to the floor of the closet and it is characterized in that both the upper and the lower elements have the shape of frame members, preferably made of metal, each supporting at least two articulated arms, each of which presents one end which is hinged to the door, while the other end is hinged to the frame member, wherein said arms together with the door and the frame member constitute an articulated quadrilateral with a pantograph-like motion in order to obtain the displacement of the door in relation to the sliding plane, when a force stresses the door orthogonally in relation to the longitudinal sliding direction on the front side of the closet and wherein the frame members have sliding elements which match the rails and allow the longitudinal displacement of the door on the front side of the closet when a force stresses it in that direction, a mechanical junction being present between the articulated set of the upper element and the articulated set of the lower element, said mechanic junction granting the simultaneity of the rigid displacement of the articulated quadrilaterals. Moreovers, the articulated set of the upper element causes also the door to return to its coplanar position in relation to the other doors thanks to the elastic reaction of on elastic telescopic element which is connected with it. There are suitable means allowing the alignement of the door following the assembly, the overcoming of its dead centers during the opening and closing operation and the locking of the door in its closed position.

The advantages arising from the hardware set for coplanar sliding doors according to the invention are a door which can easily be assembled in the closet, a reliable operation, even when the

hardware set supports heavy doors, such as those sliding doors on the outer surface of which there are full-size mirrors.

Moreover, since the hardware set according to the invention consists of a few, easy-to-manufacture elements, it is particularly economic and unexpensive.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description, and from the drawings, wherein:

- Fig. 1 shows the hardware set according to the invention, assembled on the middle door of a closet with sliding doors, the middle door being in its closed position;
- Fig. 2 shows the same hardware set of Fig. 1, and the middle door in the receded position in relation to the sliding plane;
- Fig. 3 shows the same hardware set of Figs. 1 and 2, and the middle door during the opening phase;
- Fig. 4 shows in a vertical cross-section the relative position between two sliding doors, the inner door being the door on which the hardware set according to the invention is mounted, said door being in its open position;
- Fig. 5 shows in detail an axonometric representation of the hardware set according to the invention, wherein the upper and lower elements are joined together by means of a central junction rod;
- Fig. 6 shows a top view of the upper element of the hardware set with the door in the same position as in Fig. 1;
- Fig. 7 shows a top view of the upper element of the hardware set represented in Fig. 6, the door on which it is mounted being in the same position as represented in Fig. 2;
- Fig. 8 shows the detail of the elastic telescopic element of the upper element of the hardware set;
- Fig. 9 shows a top view of the upper element of the hardware set with the door on which it is mounted in the process of returning to its coplanar position thanks to the action of the elastic telescopic element;
- Figs. 10 to 14 show the possible relative positions of three doors of a closet, the middle door being complete with the hardware set according to the invention;
- Figs. 15 to 21 show the possible relative positions of four doors of a closet, two of said doors being complete with the hardware set according to the invention;
- Fig. 22 shows a side view of the closet lock in its unlocked position;
- Fig. 23 shows a front view of the closet lock in its unlocked position;
- Fig. 24 shows a side view of the closet lock in its locked position;
- Fig. 25 shows a front view of the closet lock in its locked position.

With reference to the mentioned drawings it will be observed in Fig. 1 that the hardware set according to the invention, which is indicated as a whole with 1, is mounted on the middle door 2 of a closet 3 with three sliding doors, the remaining two being indicated with 4 and 5 respectively.

It will be remarked that the choice of a three-door closet is purely indicative, since the following description applies to closets presenting any number of sliding doors, provided said number is in excess of two.

Hardware 1 according to the invention comprises an upper element 6, which is permanently attached to the top part of door 2 and slides along the horizontal tracks 7, which are attached to the ceiling 8 of closet 3, and a lower element 9, which is permanently attached to the bottom part of the same door 2 and slides within the horizontal guide 10, which is attached to the bottom 11 of closet 3.

When the closet is closed, the middle door 2 and the side doors 4 and 5 are arranged as represented in Fig. 1, i.e. they are coplanar to each other, so as to constitute a continuous surface of the closed closet 3.

In order to open the closet, it will be necessary first to force the middle door 2, complete with the hardware set 1 of the invention, in the direction 12 which is orthogonal to the sliding plane, as shown in Fig. 2. Thus the middle door 2 is caused to recede in relation to the horizontal sliding plane thanks to the pantograph-like movement of the articulated arms 61 and 62 of the upper element 6 and of the articulated arms 91 and 92 of the lower element 9.

The upper element 6 and the lower element 9, together with door 2, thus constitute each an articulated quadrilateral.

After the thrust in direction 12 has brought door 2 into the space comprised between the sliding tracks 7 and 10 and the lateral doors 4 and 5, door 2 can be opened by pushing it horizontally in the direction indicated by arrow 13, as can be observed in Fig. 3.

Thus door 2 slides horizontally behind door 5 until the former it completely disappears behind the latter.

By performing the same operation in reversed

order, i.e. by pulling door 2 in the direction opposed to arrow 13, door 2 slides back to the receded position shown in Fig. 2 and then to the closed position shown in Fig. 1, thanks to the action of the elastic elements which have been preloaded during the opening phase.

As can be observed in Fig. 5, the upper element 6 of the hardware set according to the invention comprises a frame member 63 which supports at its rear sliding rollers 64, which are also visible in the longitudinal cross-section of Fig. 4, while at its front it supports the articulated arms 61 and 62 by means of the pivots 65. Each of the articulated arms in turn supports at its free end the structural supports 66 and 67 which are attached to door 2 through the screws 68.

In the same way the lower element 9 comprises a frame member 93 at whose end there are the wheels 84 and 85 which slide along track 10 visible in Fig. 1, and which is attached to the bottom 11 of the closet. Moreover, to the frame member 93 are connected, through the bearings 95, the articulated arms 91 and 92, each of which presents at its free end the structural supports 96 and 97 for its attachment to door 2 by means of the screws 98.

From what has been described it is easy to understand how the upper element 6 and the lower element 9 together constitute a hardware set 1 which, when connected with door 2 allows it to slide horizontally by means of the rollers 64 and of the wheels 84 and 85, which are engaged within the tracks 7 and 10. Moreover, thanks to the presence of the articulated arms 61, 62 and 91, 92, each pair of which forms an articulated quadrilateral, door 2 can also move with a rigid vertical movement in the orthogonal direction in relation to its sliding direction.

In the middle of the upper element 6 there is an elastically articulated set 51 comprising a L-shaped square 52, which, as can be observed in the Figs. 6 and 7, is attached to door 2 by means of the screws 54.

On the shorter arm of the L-shaped square 52 is connected the articulated linkage 55 whose larger plate 56 is attached through a rotating pivot 57 to the frame member 63 through a slide 53. On the longer arm of the L-shaped square 52 is attached an elastic element 58, visible also in the detail in Fig. 8, whose free end is connected through pivot 59, which acts as its fulcrum, with the frame member 63 and has the function of granting elasticity to the opening and closing movements of door 2.

The elastic telescopic element 58, as can be observed in Fig. 8, consists of two springs 29 slipped over two cylinders 28 which are joined together telescopically and it is activated when the sliding door 2 is being opened.

When the sliding door 2 is closed, the situation is represented in Fig. 6, wherein it can be observed that door 2 is in the coplanar position with the lateral doors 4 and 5. Under these condition the elastic telescopic element 58 is completely unloaded, i.e. its two springs 29 are free. As has already been explained, in order to open door 2, it is necessary first to push it in the direction marked with 30, orthogonally in relation to the sliding direction.

When door 2 is pushed in the above-mentioned direction, it approaches the sliding tracks 7 but can not yet begin any horizontal sliding motion, since it is prevented from doing so by the presence of the guiding rollers 100, which are connected with the lower structure 101 supporting the lateral doors of the closet, as can be observed in Fig. 4. In fact, said rollers 100 by interfering with the lateral vertical edges of door 2 allow it only to move towards the tracks, i.e. orthogonally in relation to the opening direction. During this operating phase, because of the presence of the articulated quadrilateral, the frame member 63 moves horizontally along track 7 and compresses the springs 29 of the elastic telescopic element 58 which reaches its maximum stress when door 2 is positioned, as can be observed in Fig. 7, in the free space comprised between the sliding track 7 and door 5.

At this point door 2 can slide horizontally and threfore open, since, as can be observed in Fig. 4, the guiding roller 100 no longer constitutes a hindrance for the door, since said roller positions itself within the terminal rabbet 102, thereby freeing the door and even acting as a guiding element.

The elastic telescopic element 58 with its springs 29 which in this position are under their maximum stress and therefore exert their maximum force, does not perform however any action, since said force is discharged horizontally between the binding points of element 58, i.e. between the square 52 and it articulated point 59.

In order to proceed from this position to the return of door to its coplanar position, it would be sufficient to lightly pull it in the direction orthogonal to the sliding direction. Thus, the elastic telescopic element 58, which no longer arranges itself horizontally, as shown in Fig. 7, but in a slightly slanted position, would allow its springs to develop their elastic back stroke, whose direction orthogonal to the sliding direction of door 2 would cause the latter to go back automatically to its coplanar position to the other doors 4 and 5.

The stress force of the springs 29 is adjustable as a function of the compenetration of their windings in the common area 17.

In order to make the initial movement easier, thus avoiding to exert traction force on door 2, a spring 99 is connected with the frame member 93.

Said spring 99 is compressed between the frame member 93 and door 2, when the latter is in the position represented in Fig. 7. It is the presence of this spring 99 which by overcoming the resistence of the initial separation allows door 2 to go back immediately to the position coplanar with the other doors 4 and 5, as soon as the door itself, while sliding horizontally along the guiding tracks has passed the binding point constituted by the rollers 100.

In order the upper and lower articulated quadrilaterals to work simultaneously on door 2, the lower element 9 belonging to the hardware set 1 also presents in its middle an articulated set 61 comprising a L-shaped square 62. It is attached to the lower part of door 2 by means of the screws 64 and it presents at its shorter arm an articulated linkage 65 connected through a plate 106 with the frame member 93 by means of a rotating pivot 107. The upper articulated set 51 and the lower one 61 are connected with their respective articulated linkages 55 and 65 through a vertical rod 40 which guarantees their simultaneous rigid movement, thereby guaranteeing also the rigid movement of door 2 connected with them.

On the basis of what has been described so far it can be understood that the purpose of obtaining a hardware set for a coplanar sliding door, allowing an easy operation has been reached. In fact, it has been demonstrated that it is sufficient to operate even with a single hand in order to open and close the door, while exerting limited efforts.

In order to make easier the assembly of the hardware set on door 2 of closet 3 and in order to allow an easy adjustment permitting the recovery of possible clearances or differences in the alignment with the other doors 4 and 5, the lower frame member 93 presents the wheel 85 which is connected with the frame member 93 itself through bracket 83 and pivot 81, around which it can turn, while the wheel 84 is attached through bracket 82. Therefore, the vertical position of wheel 85 can vary in relation to the longitudinal axis of the frame member 93, thereby permitting the alignment of door 2 with the remaining doors 4 and 5.

This is done by adjusting an appropriate screw 86 which besides acting as an element for the adjustment of the height of wheel 85 in relation to the longitudinal axis of the frame member 93, also acts as a contrasting element preventing the complete revolution of bracket 83 around pivot 81, since its axis in relation to pivot 81 is out of alignment by a value 87.

It can therefore be understood that the hardware set according to the invention allows an easy assembly of the door in the closet and just as easy an adjustment of its alignment.

When the middle door 2, which is part of the three-door closet 3, has been assembled into position, its configuration is that shown in detail in Fig. 10, wherein the three doors, the middle one 2 and the lateral ones 4 and 5 are represented in a cross section seen from the top. In order to operate the opening of door 2 it is necessary to exert on it a force in the direction indicated by arrow 30, visible in Fig. 11, by means of which door 2 positions itself between the sliding tracks 7 and the lateral doors 5 and 4. Thereafter, by applying on door 2 a force in the direction of arrow 31, as can be observed in Fig. 12, it is moved to the right until it is completely hidden from sight behind the lateral door 4; thus the central part 32 of closet 3 is accessible, as can be observed in Fig.12. If, on the other hand, the left-hand space 33 is to be made accessible, as can be observed in Fig. 13, it will be necessary first to push inward the middle door 2 by applying a force 30, as represented in Fig. 11 and then, by applyng on door 5 a lateral force to the right 34, bring it into the position represented in Fig. 13, such as to completely hide door 2 and open the access to space 33, as can be observed in Fig. 13.

If, on the other hand the space 35 is to be made accessible, as can be seen in Fig. 14, it will be necessary to apply on door 2 a force 30, as represented in Fig. 11 and then push door 4 to the left by applying a force 36, as shown in Fig. 14.

By following what has been described, it will be possible to obtain closets having more than three doors, and in that case it will be necessary to provide more than one sliding door with the hardware set according to the invention.

Thus, for instance, the Figs from 15 to 21 show a closet 120 comprising four doors 121, 122, 123, 124, wherein the doors 122 and 123 are equipped with the hardware set according to the invention.

By operating in the manner described before, i.e. by appropriately acting on the middle doors 122 and 123 and on the lateral doors 121 and 124 it will be possible to have access to the space 130 represented in Fig. 16, or to space 131 represented in Fig. 17, or to space 132 of Fig. 18, or yet to space 133 represented in Fig. 19. It is also possible to have simultaneously access to the two central spaces 130 and 132, as represented in Fig. 20, or to the two lateral spaces 131 and 133, as represented in Fig. 21.

On the basis of what has been described, it can be understood that the hardware set according to the invention permits to obtain closets with a plurality of doors and with the possibility of combined openings of the doors.

In order to make easier the operations of opening and closing door 2 by overcoming the dead centers, the hardware set according to the invention presents a shock-absorbing set 20, which is

visible in the Figs. 6, 7 and 9 and which is mounted on the sliding track 7 of the upper element 6 in the position opposite to the sliding and opening direction of door 2. The presence of said shock-absorbing set facilitates the overcoming of the dead centers while door 2 is being moved.

More specifically, it facilitates the beginning of the lateral sliding motion of door 2 and, therefore, of its opening operation, after door 2 has been brought into its receded position in relation to the lateral doors 4 and 5. In fact, it has been said that, in order to open door 2, it is necessary to push it back in relation to the plane of the lateral doors 4 and 5, by applying on its outer surface a pressure 30, as shown in Fig. 6. It has also been said that during this displacement motion door 2 is bound by the rollers 100, so that its displacement occurs exactly orthogonally to the direction of the lateral sliding. The articulated arms 62 and 61 vary their angle of inclination during this movement, so that the entire frame member 63 with which they are connected is displaced to the right in the direction of arrow 21, as shown in Fig. 6. This causes the compression of clamp 22 which will load spring 23 of the shock- absorbing set 20, which pushes against clamp 24, which is fixed within the sliding track 7. When the door has reached the end of its backward movement in relation to the plane of the doors 4 and 5, it is no longer bound by the rollers 100, in relation to which it can even slide more easily thanks to the presence of rabbet 102 obtained in its lower edge and visible in Fig. 4. The situation is now represented in Fig. 7, wherein spring 23 is free to expand and unloads the force accumulated during the compression, thereby displacing the frame member 63 and, as a consequence, door 2, which is attached to it, in the opening direction indicated by arrow 25.

The shock-absorbing set 20 also performs the action of overcoming the dead center of door 2 during its return movement to its coplanar position during the closing phase. If, in fact, because of the application of an excessive closing force, door 2 were horizontally displaced too far the right in the direction shown by arrow 26 of Fig. 9, it would enter into the area of interference of guiding roller 100 and would not go back to its coplanar position with the door 4 and 5 and, therefore would not close properly. The presence of the shock-absorbing set 20 prevents this from happening. In fact, in this case, an excessive opening force in direction 26 would compress spring 23, which would then, by unloading itself after this compression force has ceased, cause door 2 to move to the left in the direction of arrow 27, through the interference of the mobile clamp 22 against the upper frame member 63. As soon as door 2 arranges itself in the space comprised between the guiding rollers 100, it goes back to its coplanar position thanks first to the action of spring 99 and then to the action of the telescopic element 58.

The hardware set according to the invention also presents a lock 70 represented in the Figs 22 to 25. By preventing the rotation of the vertical rod 40, said lock 70 blocks door 2 in its coplanar position in relation to the lateral doors 4 and 5, thereby preventing the opening of door 2 and, therefore, the access to closet 3.

As can be observed in Fig. 22, lock 70 comprises a cylindrical block 71, which is inserted through the thickness of door 2 and presents at the exterior of the door an escutcheon 72 through which it is operated by inserting the removable key 74. The cylindrical block 71 presents a crescent-shaped area 73 which is obtained by cutting off part of the surface of the cylindrical block 71, thus obtaining a right-angle flat undercut 75. When the cylindrical block 71 is arranged with the crescent-shaped area 73 in the position shown in the Figs. 22 and 23, the vertical rod 40 can perform a 360 degrees rotation in any direction, since the screw 41, which is attached to it does not interfere with the cylindrical block 71 of the lock. Under these conditions door 2 can be opened. When, on the other hand, by turning key 74 block 71 is rotated by 90 degrees, as represented in the Figs. 24 and 25, screw 41 is prevented from rotating by crescent 73, so that the vertical rod 40, which can not rotate, prevents any movement of door 2. Thus the closet can not be opened. On the basis of the foregoing description it can be understood that the invention reaches all the proposed purposes. First of all the main purpose of the invention has been reached, i.e. a hardware set for coplanar sliding doors of closets, which is easy to manufacture, easy to assemble and adjust and which offers a high working reliability. In fact, on the basis of what has been described, it has been possible to observe that the hardware set according to the invention consists of structural or tubular elements, preferably made of metal and joined together by means of joining elements, such as, for instance, pivots. Such a construction is easy to manufacture and also offers a high working reliability, particularly when one considers that rotating elements, such as pulleys or excentrics are completely eliminated, as are transmission means or ropes which jeopardize the working reliability, as is the case of hardware sets manufactured according to the known technique.

On the contrary, it has been observed that the operation of the hardware set according to the invention is based solely on the relative movement of elements which are rigidly joined together by pivots.

It has also been observed how easy the as-

sembly of the hardware set on the doors as well as the assembly of the doors in the closet are and how easy it is to adjust the coplanar position of the door through a simple screw adjustment.

Moreover, it has been observed that advantagesously according to the invention a hardware set has been obtained which also reaches the the purpose of improving the overcoming of dead centers which the door encounters while it is being opened and closed, without requiring any effort on the part of the operator. This fact is extremely important when doors supporting full-size mirrors extending to the their entire height and width are mounted on the closet.

During the manufacturing phase the hardware set according to the invention may undergo various changes and modifications both on an aesthetic and a functional nature with a purpose to improve its functionality or reliability or even to make its manufacture easier; said changes and modifications will however not exceed the scope of the present invention.

Claims

1) A hardware set for coplanar and sliding closet doors comprising an upper element (6) permanently attached to the upper part of the door (2) and sliding along horizontal tracks (7) attached to the ceiling (8) of a closet (3) and a lower element (9) permanently attached to the lower part of the same door (2) and sliding along a horizontal track (10) attached to the bottom (11) of the closet (3), characterized in that the upper element (6) and the lower element (9) comprise each a frame member (63; 93) preferably made of metal, supporting at least two articulated arms (61, 62; 91, 92) each of which presents an end which is hinged to the door (2) and the opposite end which is hinged to the frame member (63; 93), said articulated arms together with the door and theire respective frame member constituting an articulated quadrilateral with a pantograph-like movement in order to obtain the displacement of the door (2) in relation to the sliding plane, when a force pushes the door (2) orthogonally to the longitudinal sliding direction on the front of the closet, and the frame members (63; 93) have sliding elements (64; 84, 85) matching the tracks (7; 10) suited to allow the longitudinal displacement of the door (2) on the front of the closet, when a force stresses it in that direction, a mechanical connection being present between the articulated set (51) of the upper element (6) and the articulated set (61) of the lower element (9), having the purpose of achieving the simultaneity of the rigid displacement of both articulated quadrilaterals, further characterized in that the articulated set (51) of the upper element (6) causes the door (2) to go back to its coplanar position to the other doors (4, 5) because of the elastic reaction of an elastic telescopic element (58) attached to it, suitable means being also present allowing the alignment of the door after its assembly, the overcoming of its dead centers during the opening and closing operations and finally the locking of the door in its closed position.

2) A hardware set for coplanar and sliding closet doors according to claim 1, characterized in that each upper articulated set (51) and lower articulated set (61) comprises a square (52; 62) preferably shaped as a L, attached to the door (2) by means of screws and connected through a plate with a pivot (56; 66) and an articulated linkage (55; 65) to the frame member (63; 93) of each element (6; 9) of the hardware set (1).

3) A hardware set for coplanar and sliding closet doors according to claim 1, characterized in that the mechanical junction between the articulated sets (51; 61) of the upper element (6) and of the lower element (9) of the hardware set (1) is obtained through a vertical metal rod (40) positioned inside the door (2) and passing through its entire height.

4) A hardware set for coplanar and sliding closet doors according to claim 1, characterized in that the articulated set (51) of the upper element (6) of the hardware set (1) is made elastic by an elastic telescopic element (58) one end of which is pivoted in the square (52) of the articulated set (51), while its other end is pivoted in the frame member (63) of the upper element (6) of the hardware set.

5) A hardware set for coplanar and sliding closet doors according to claim 4, characterized in that the elastic telescopic element (58) comprises two pressure springs (29) which are slipped on two tubes which are connected with each other telescopically, wherein the stroke of the telescopic tubes (28) is adjustable according to the length of the central area (17) wherein the windings of the springs (29) compenetrate each other.

6) A hardware set for coplanar and sliding closet doors according to claim 1, characterized in that on the frame member (93) of the lower element (9) of the hardware set (1) is attached a spring (99) which is supplies the initial separation force to the door (2) during the initial phase of the return to the position coplanar with the other doors (4, 5) of the closet (3).

7) A hardware set for coplanar and sliding closet doors according to claim 1, characterized in that a wheel (85) supported by a bracket (83) connected through a pivot (81) with one end of the frame member (93) of the lower element (9) of the hardware set (1) permits the alignment of the door

(2) after it has been assembled on the closet through the adjustment of the vertical position of the wheel (85) by means of an adjusting screw (86).

8) A hardware set for coplanar and sliding closet doors according to claim 1, characterized in that a shock-absorbing set (20) arranged on upper track (7) in a suitable position, so that it can contrast against the frame member (63) of the upper element (6) of the hardware set (1), causes the door (2) to overcome its dead centers during its horizontal displacement.

9) A hardware set for coplanar and sliding closet doors according to claim 8, characterized in that the shock-absorbing set (20) comprises a clamp (24) fixed on the upper track (7) and a mobile clamp (22) contrasting against the frame member (63) of the upper element (6) of the hardware set, an elastic mechanical junction being obtained between the fixed clamp (24) and the mobile clamp (22) by means of a spring (23).

10) A hardware set for coplanar and sliding closet doors according to claim 1, characterized in that a cylindrical structural block (71) is attached to the door (2) and passing through it, which, when caused to rotate by a removable key (74), locks the door (2) because of the interference of an external appendix of its in the shape of a crescent (73) against a lag screw (41) which is radially screwed in the vertical cylindrical rod (40) connecting together the articulated sets (51, 61) of the upper element (6) and of the lower element (9) of the hardware set.

11) A hardware set for sliding closet doors according to claim 1, characterized in that the rollers (100) arranged on the lower structure (101) supporting the lateral doors (4, 5) act as guides for the door (2) during its displacement in the direction orthogonal to the longitudinal opening direction.

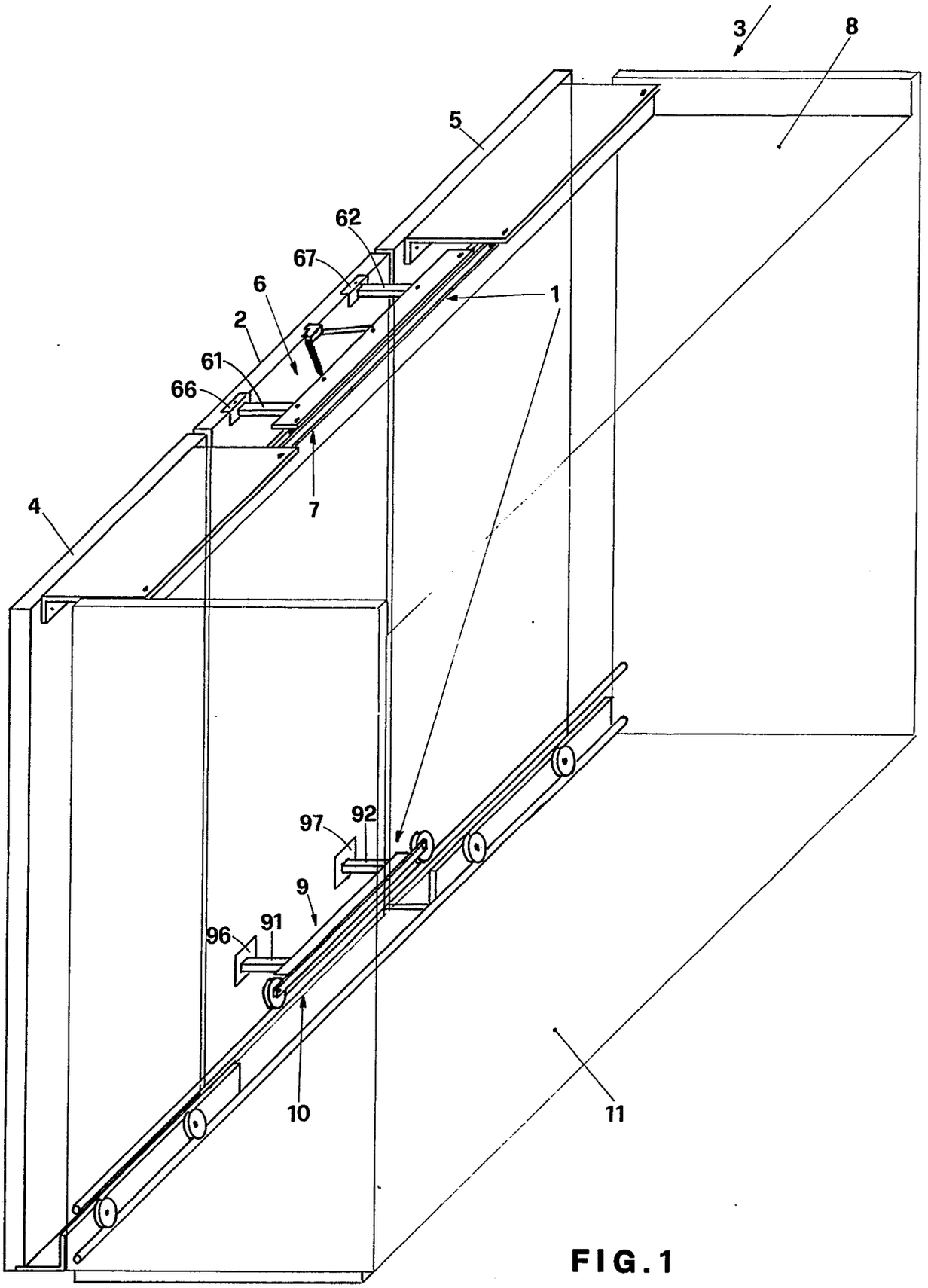

FIG. 1

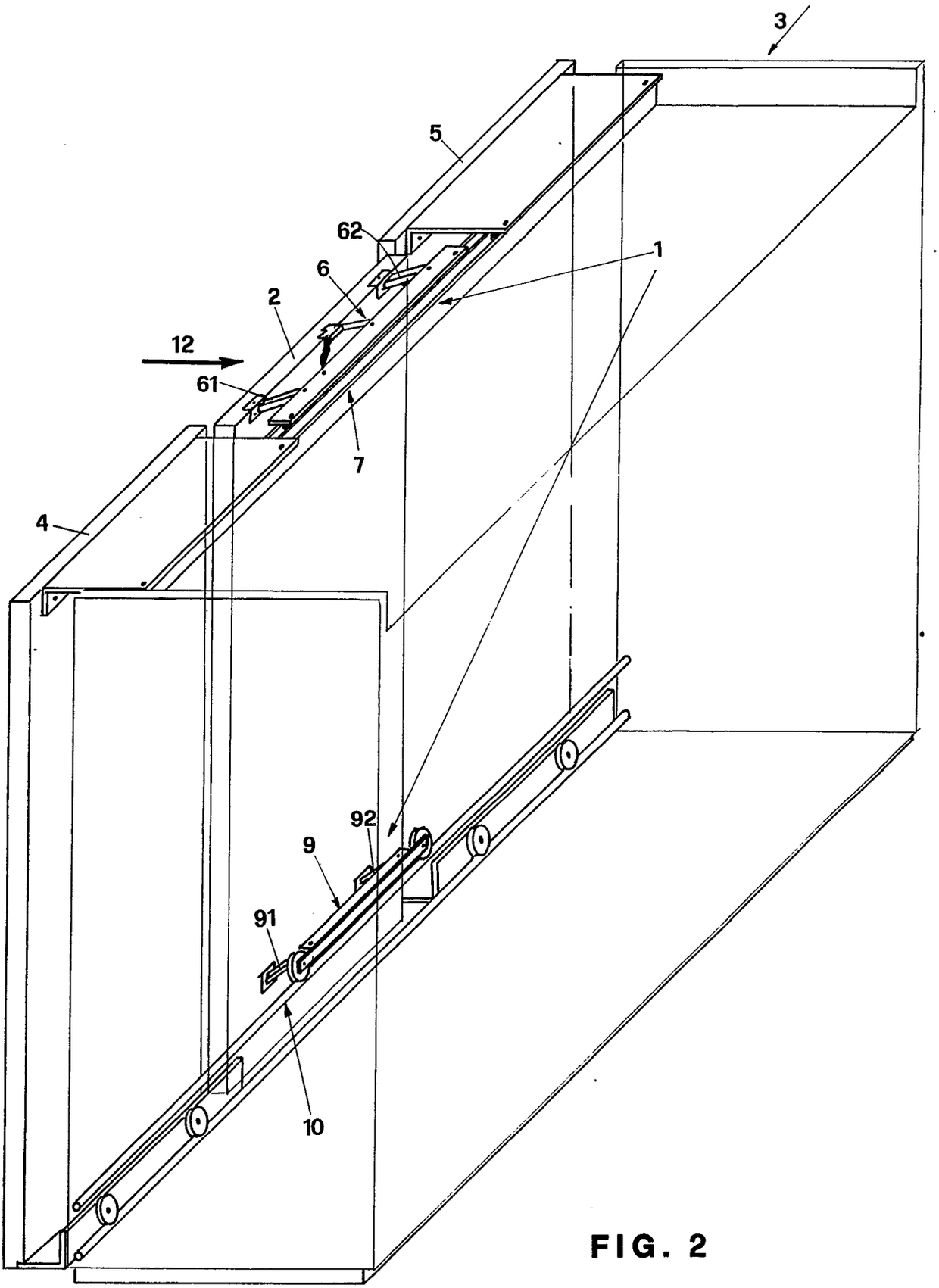

FIG. 2

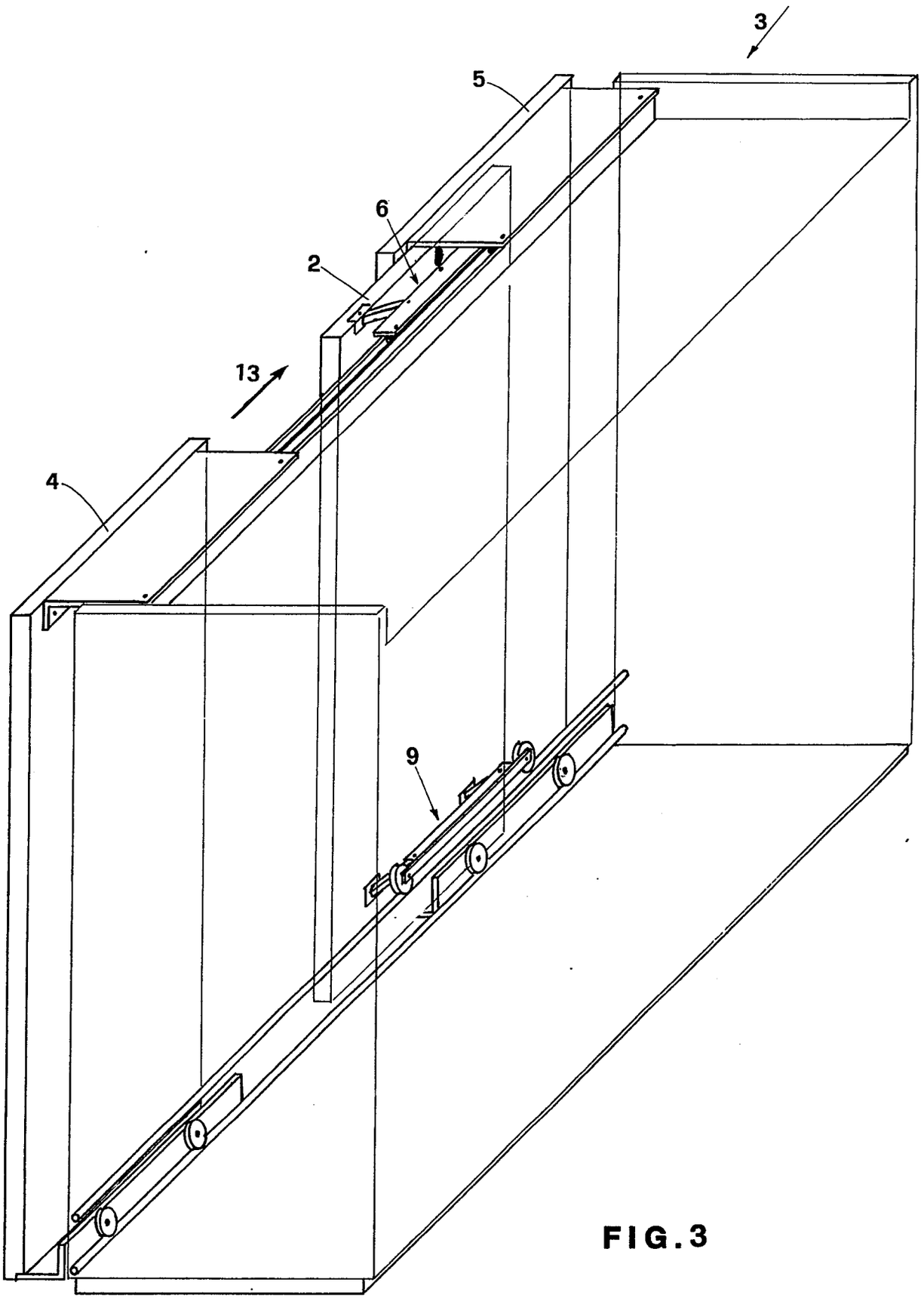

FIG.3

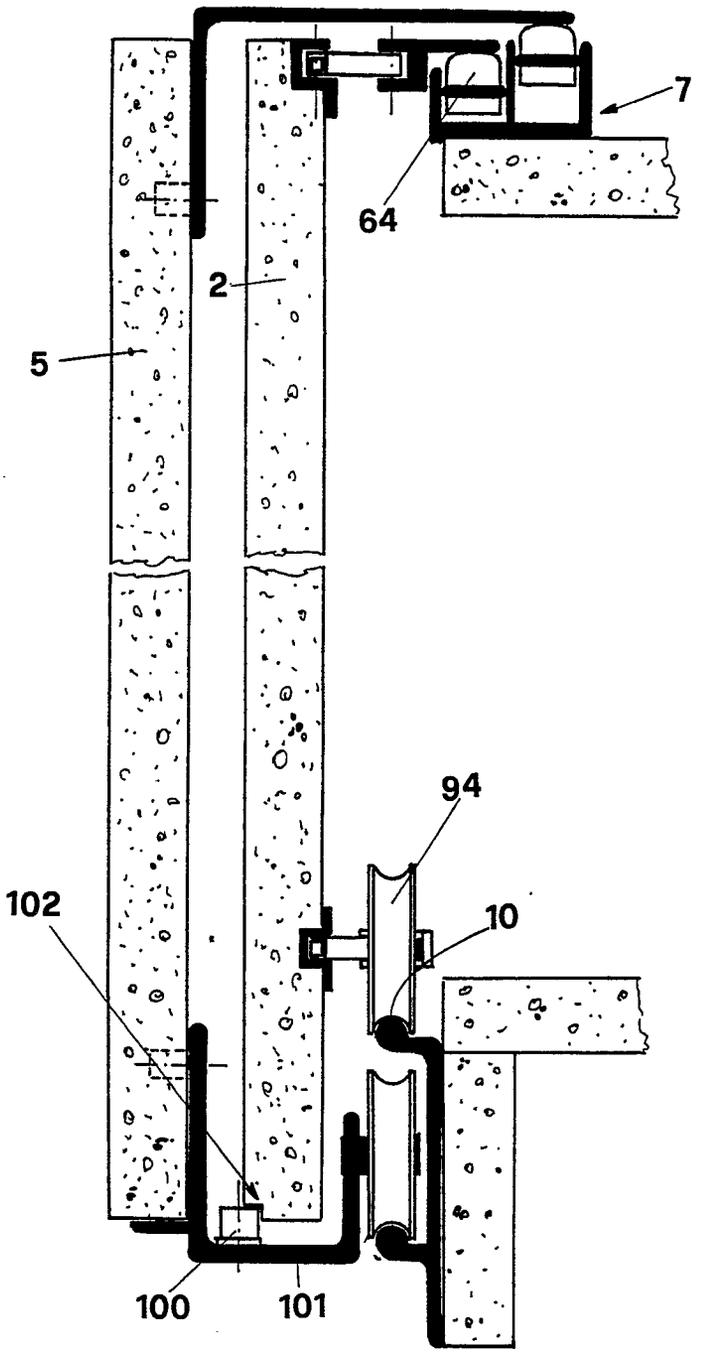

FIG. 4

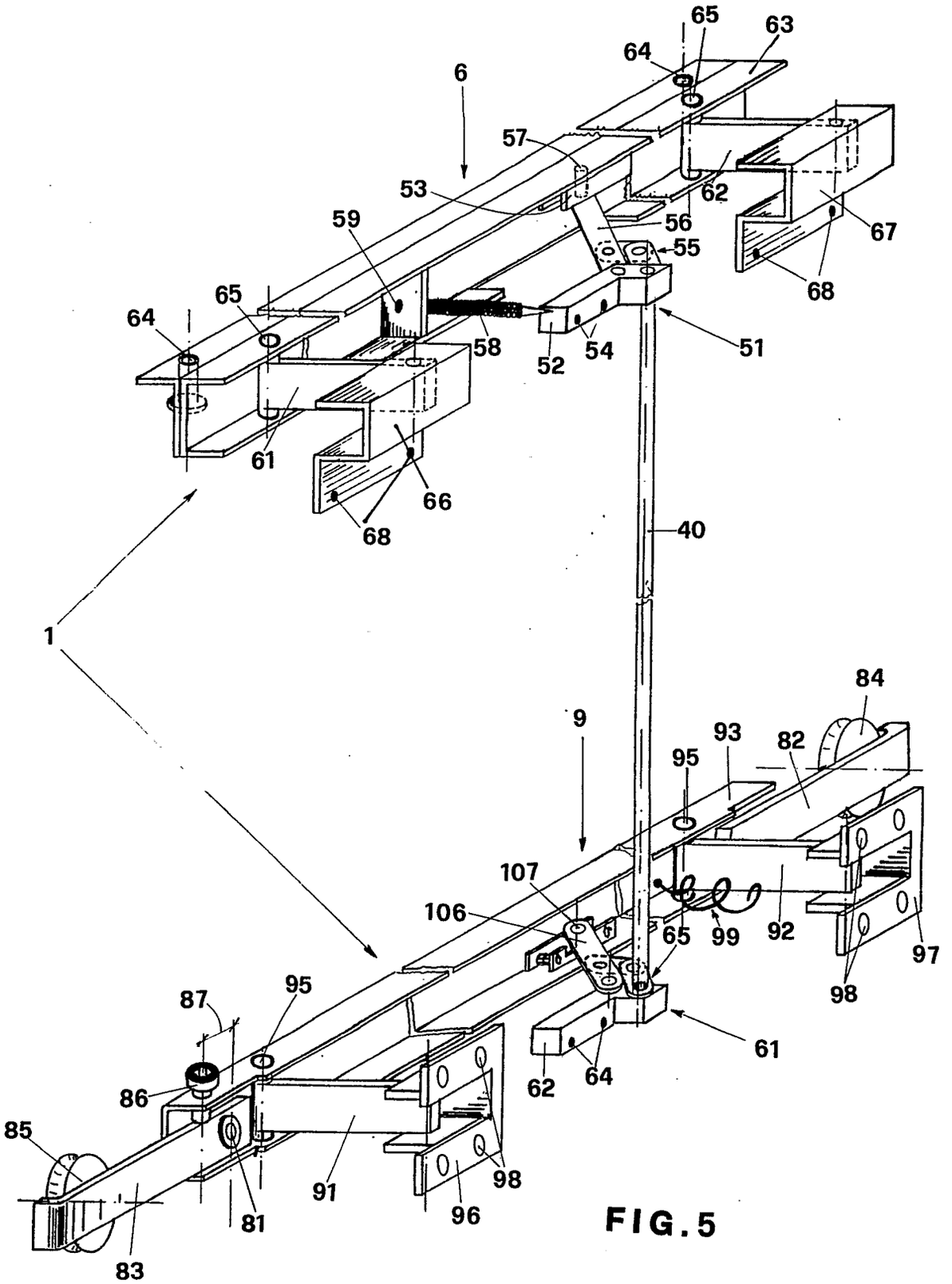
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FIG. 5

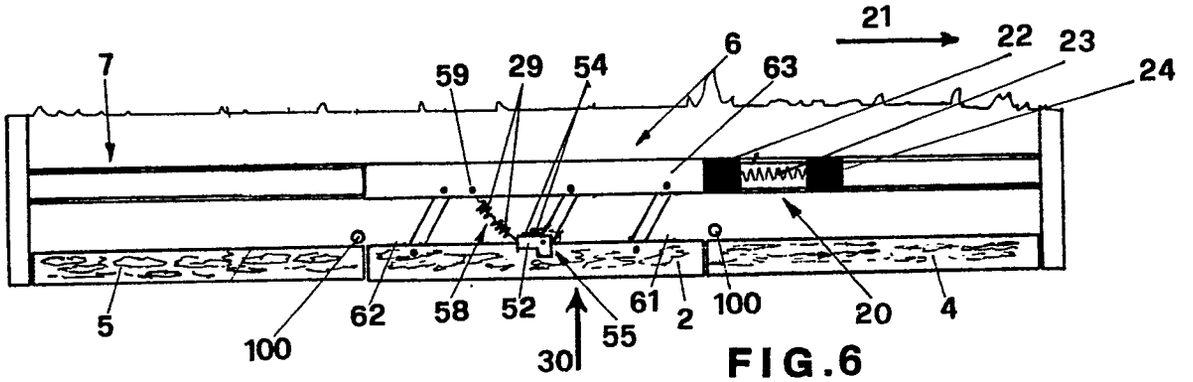

FIG.6

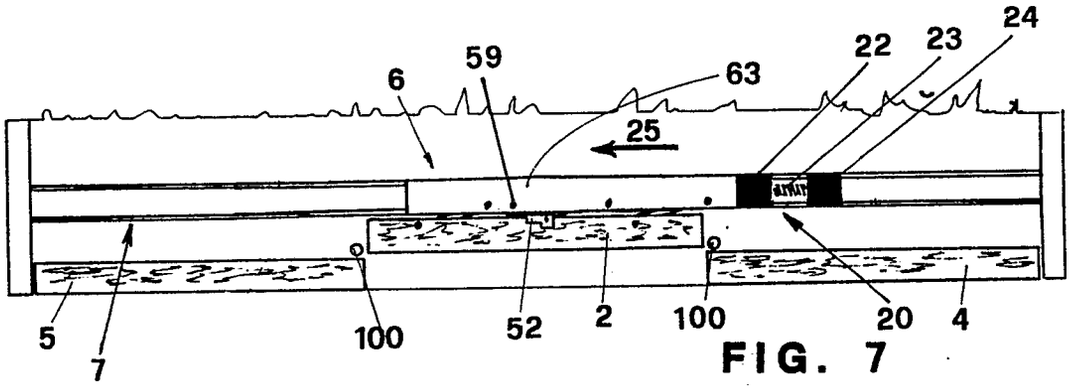

FIG. 7

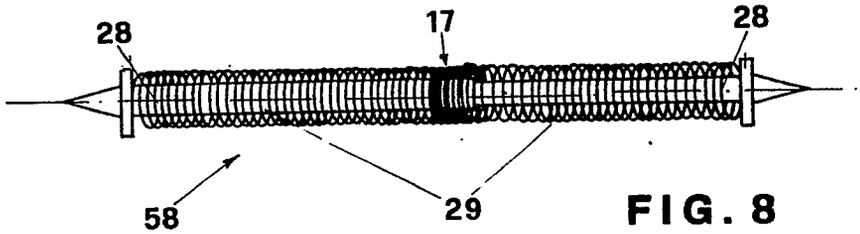

FIG. 8

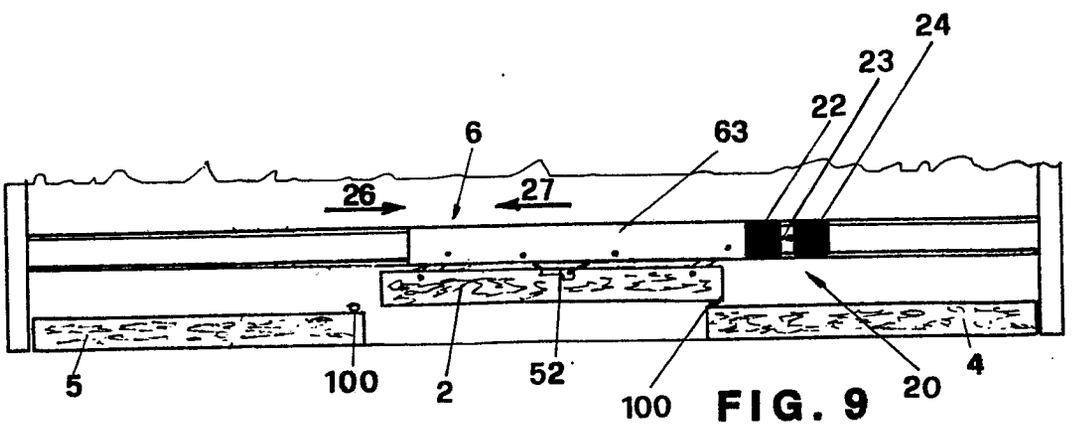

FIG. 9

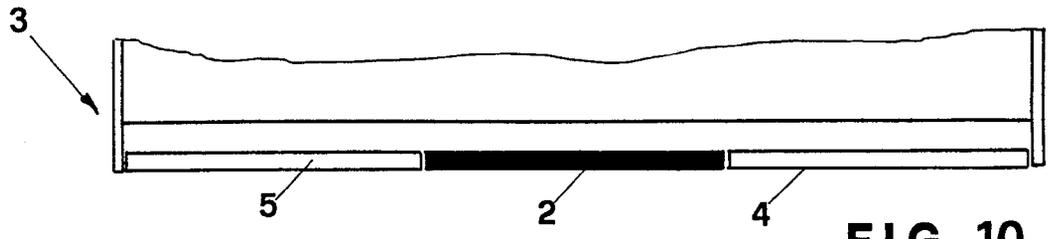

FIG. 10

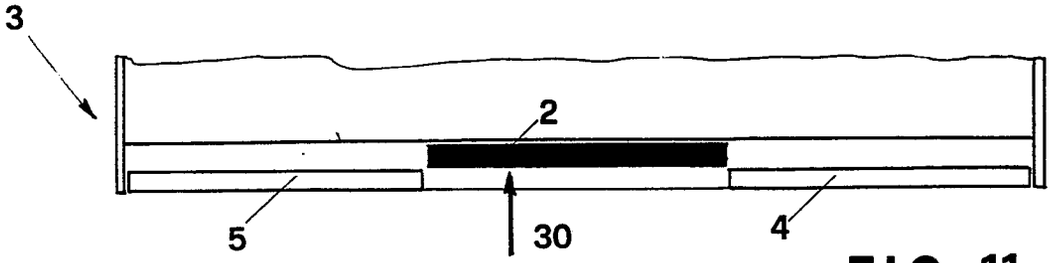

FIG. 11

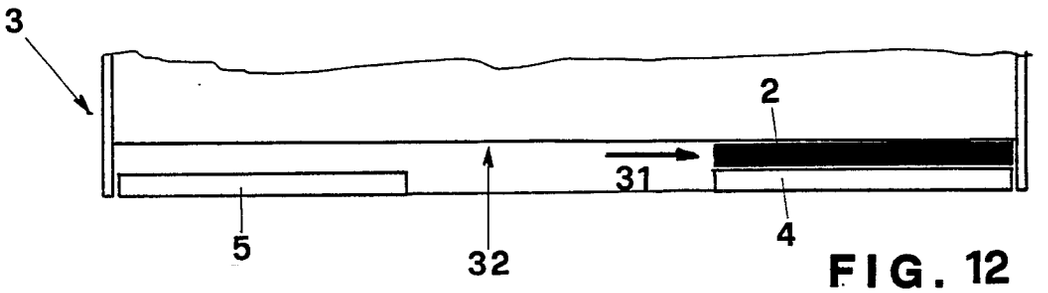

FIG. 12

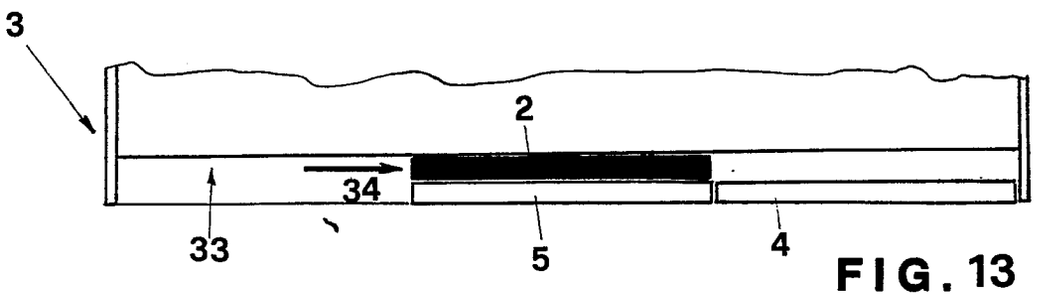

FIG. 13

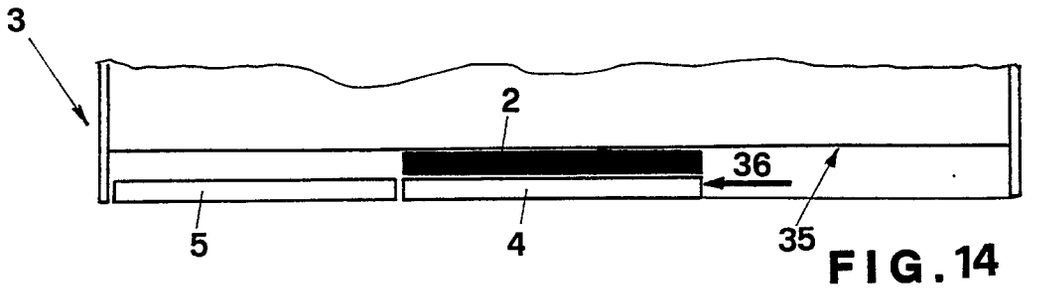

FIG. 14

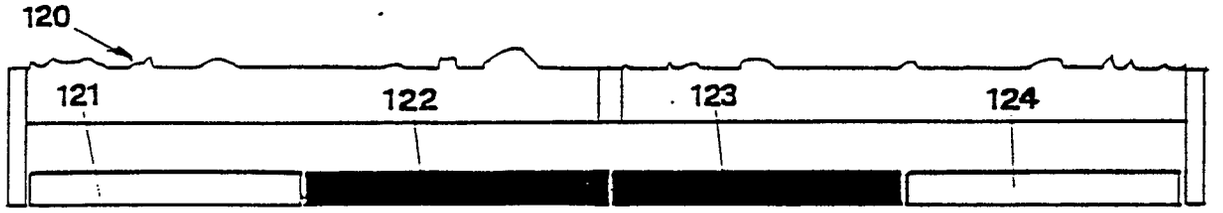

FIG.15

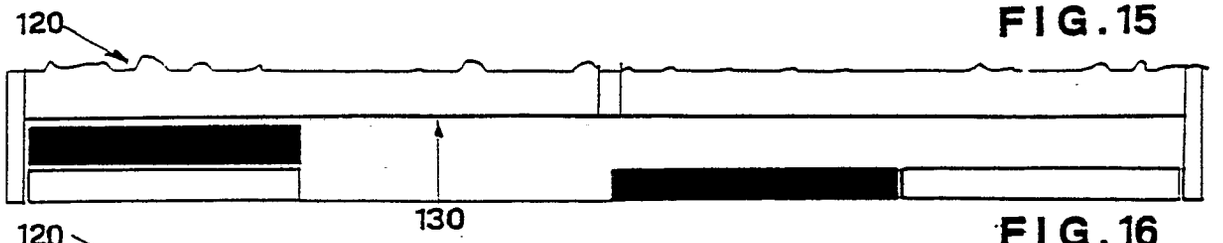

FIG.16

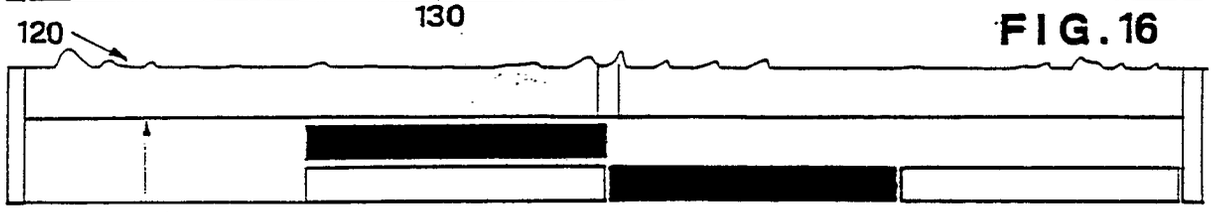

FIG.17

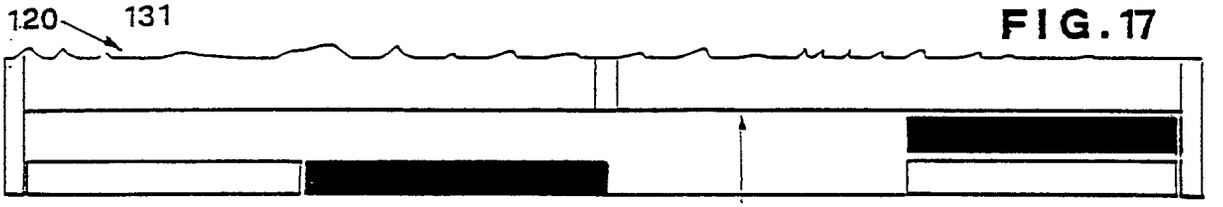

FIG.18

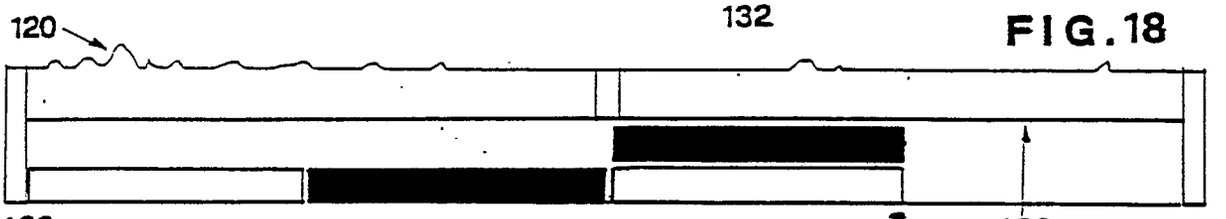

FIG.19

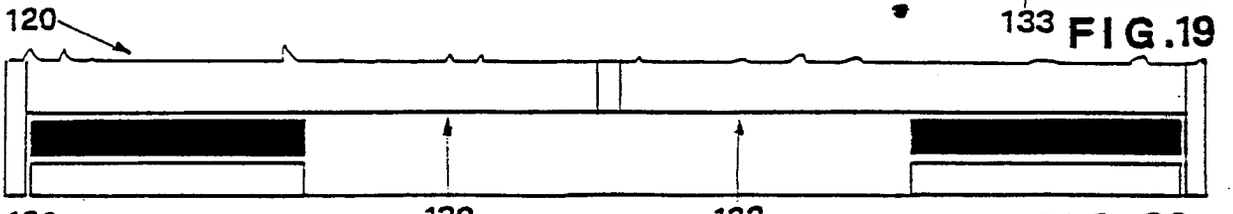

FIG.20

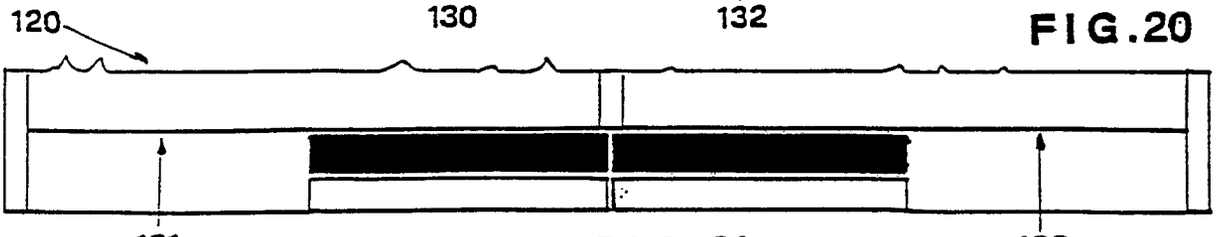

FIG.21

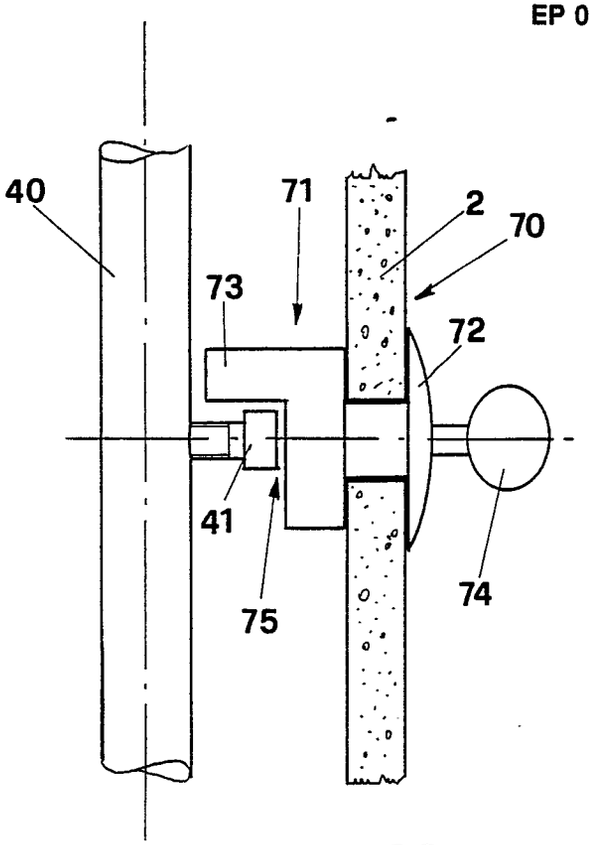

FIG.22

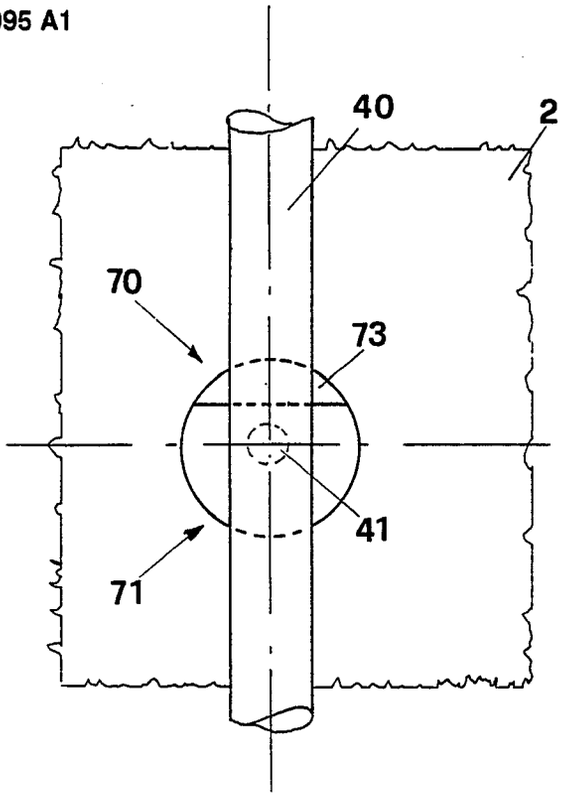

FIG.23

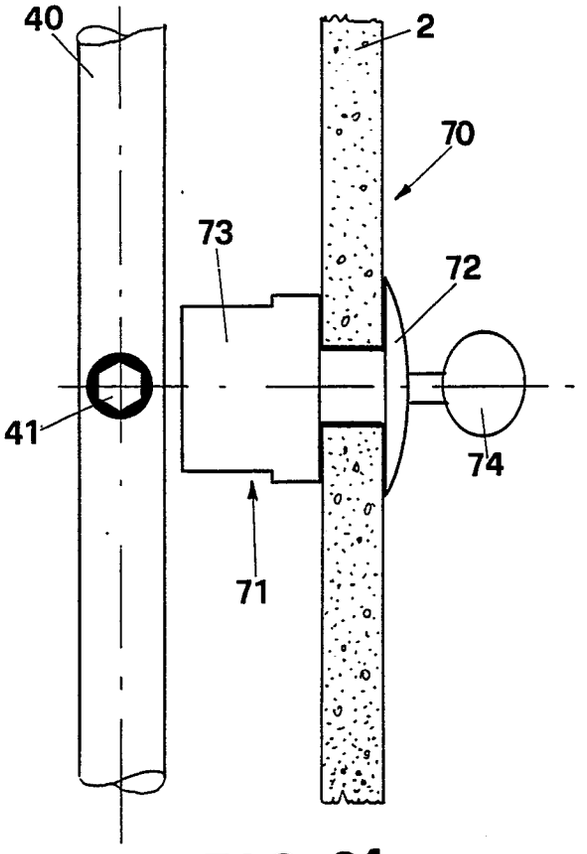

FIG.24

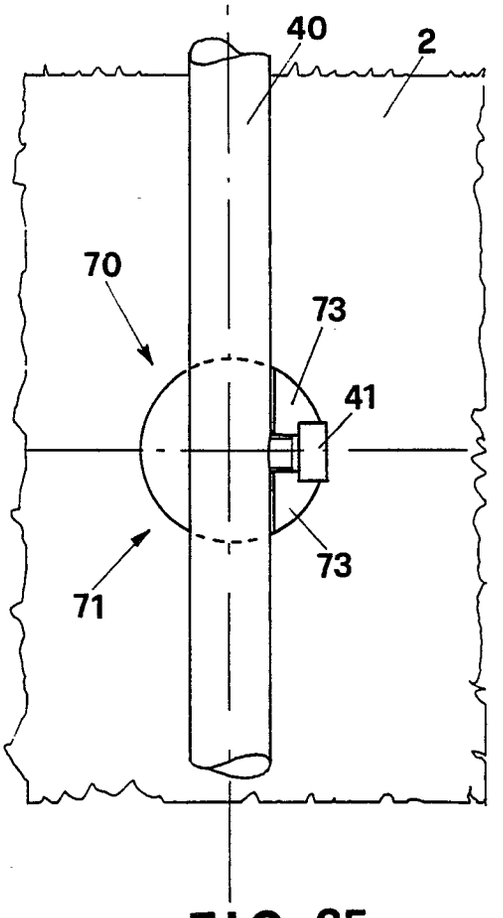

FIG.25

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 11 3106

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	CH-A- 182 913 (FORSCHUNG) * Whole document *	1,2	E 05 D 15/10
A	EP-A-0 139 046 (B.A.W.K. HOLDING N.V.) * Figure 1; page 3, line 23 - page 5, line 16 *	1	
A	CH-A- 462 226 (WAGGONFABRIK TALBOT) * Figure 1; column 2, lines 27-35 *	1,3,7, 10	
A	DE-A-2 218 678 (GRÖZINGER KG) * Figure 1; page 3, lines 8-19 *	1,4,6	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E 05 D
E 06 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16-11-1989	KISING A.J.

CATEGORY OF CITED DOCUMENTS

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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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