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GB 1254490
GB 1106109
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Kings Patent Agency Limited

(54) **Aircraft cargo loading system**

(57) A cargo loading system for a wide bodied aircraft with an under floor cargo hold for containers or pallets includes a loading bay with run-over locking means 12 to prevent cargo running back, the bay having rolling ball mats with drive means 18*a*, 18*b* for transverse movement with sensors 14 to detect the position of cargo. Further drive means 18*c* to 18*h* providing longitudinal movement of cargo to the storage position in the hold. The cargo being guided and secured by latching devices 14′, 14″ and 14‴ with further holding systems 10 and 11 which may be electrically operated. Longitudinal movement of the containers may be effected by roller tracks A to F. The system is controlled automatically so that a container moves to the selected storage position and is locked after having been initially loaded into the bay.

Fig.3a

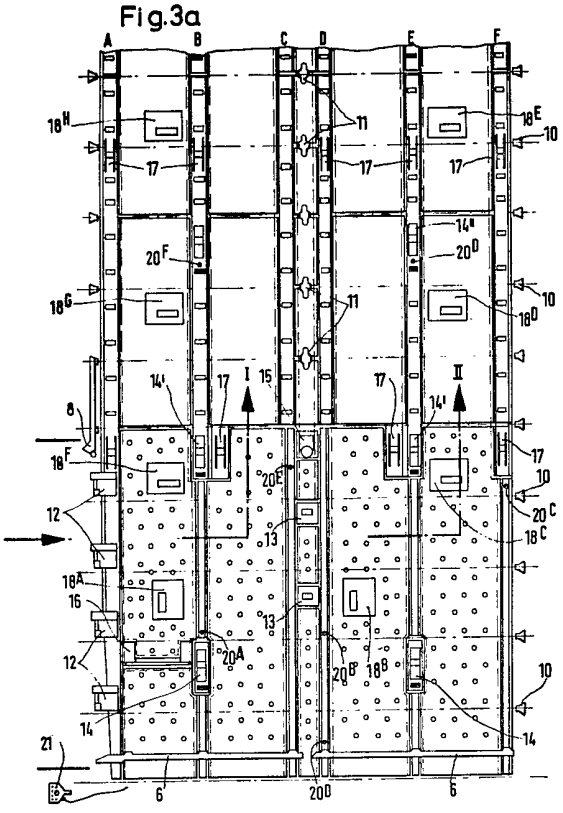

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Fig.1

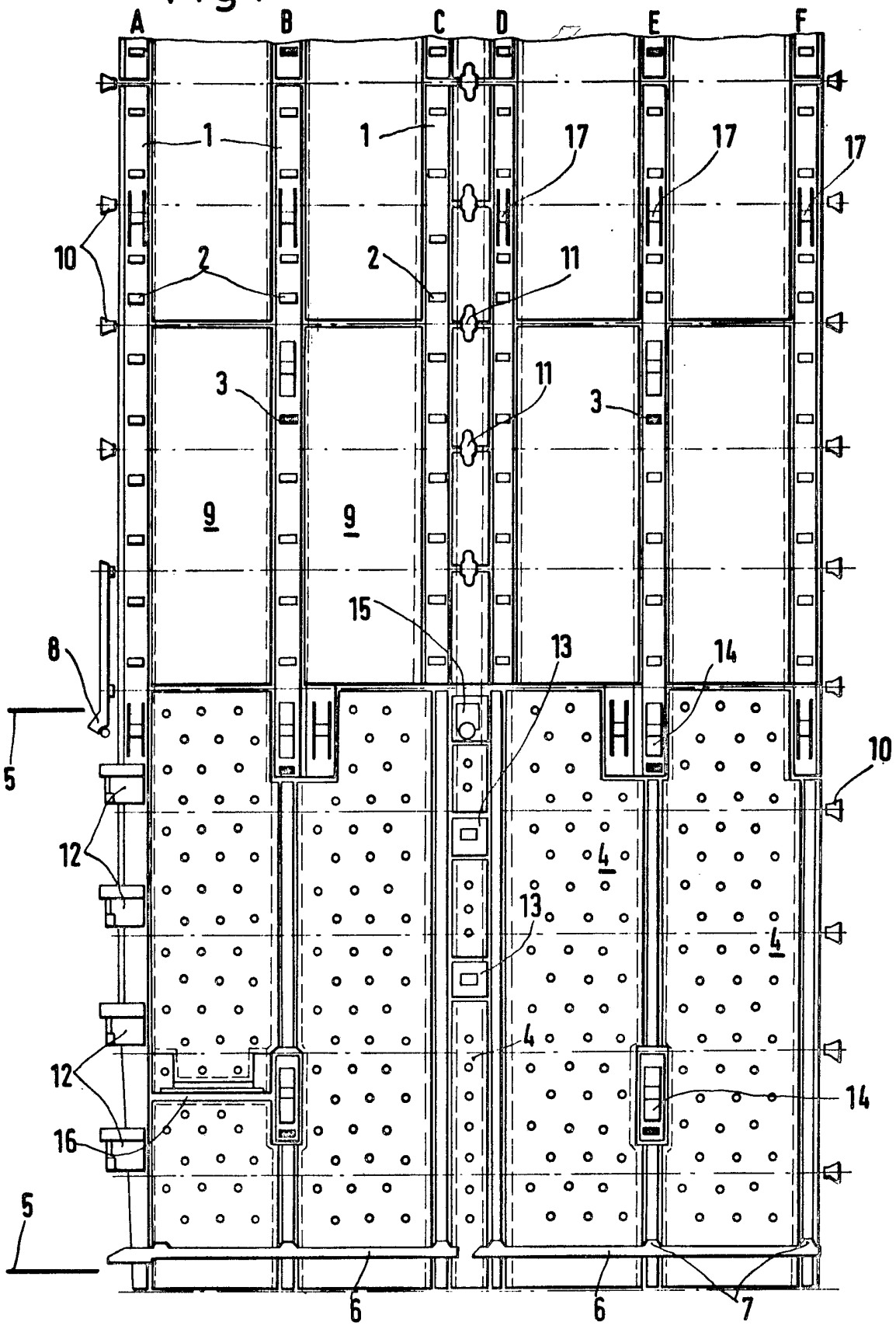
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Fig.1a

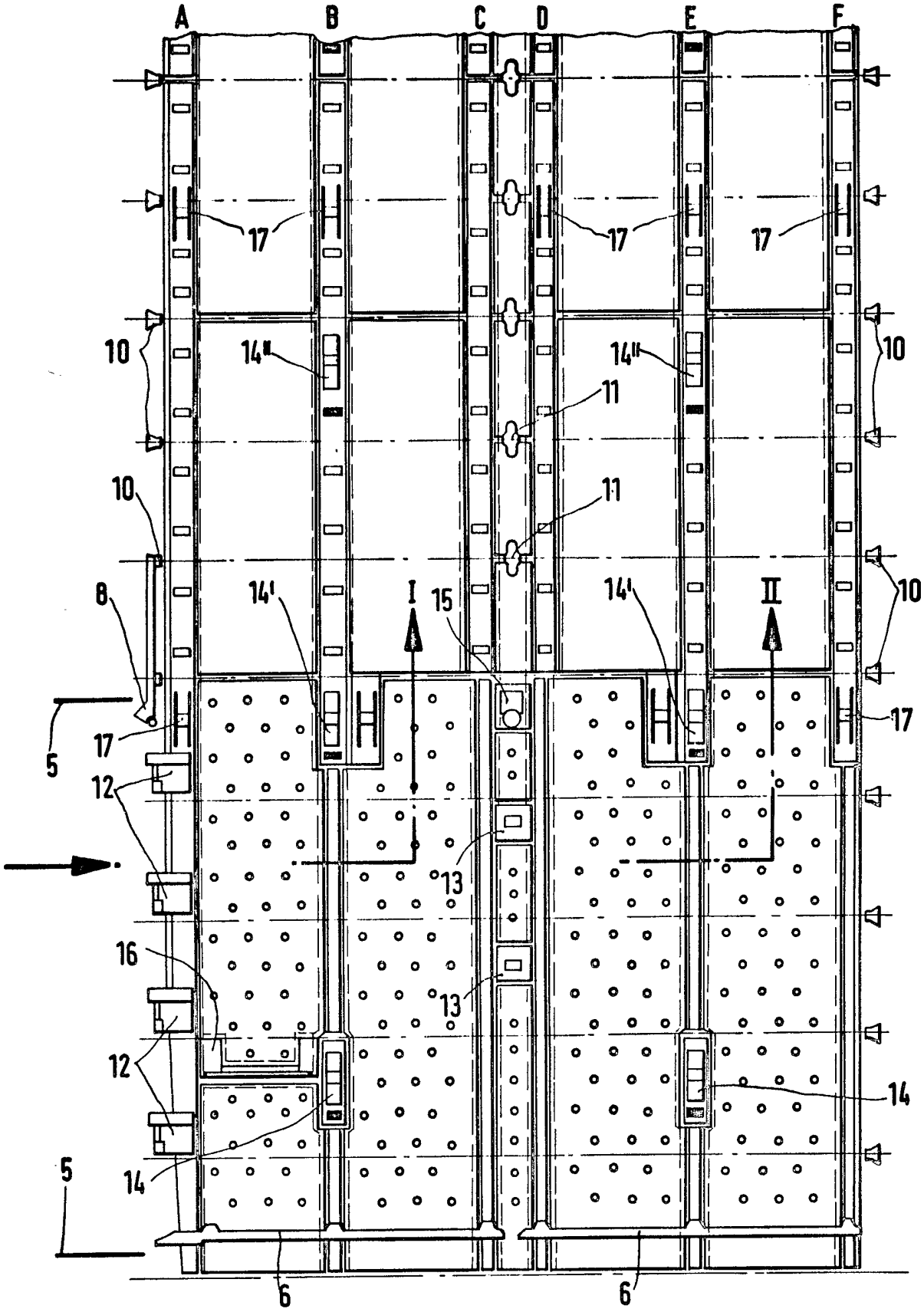

Fig.2

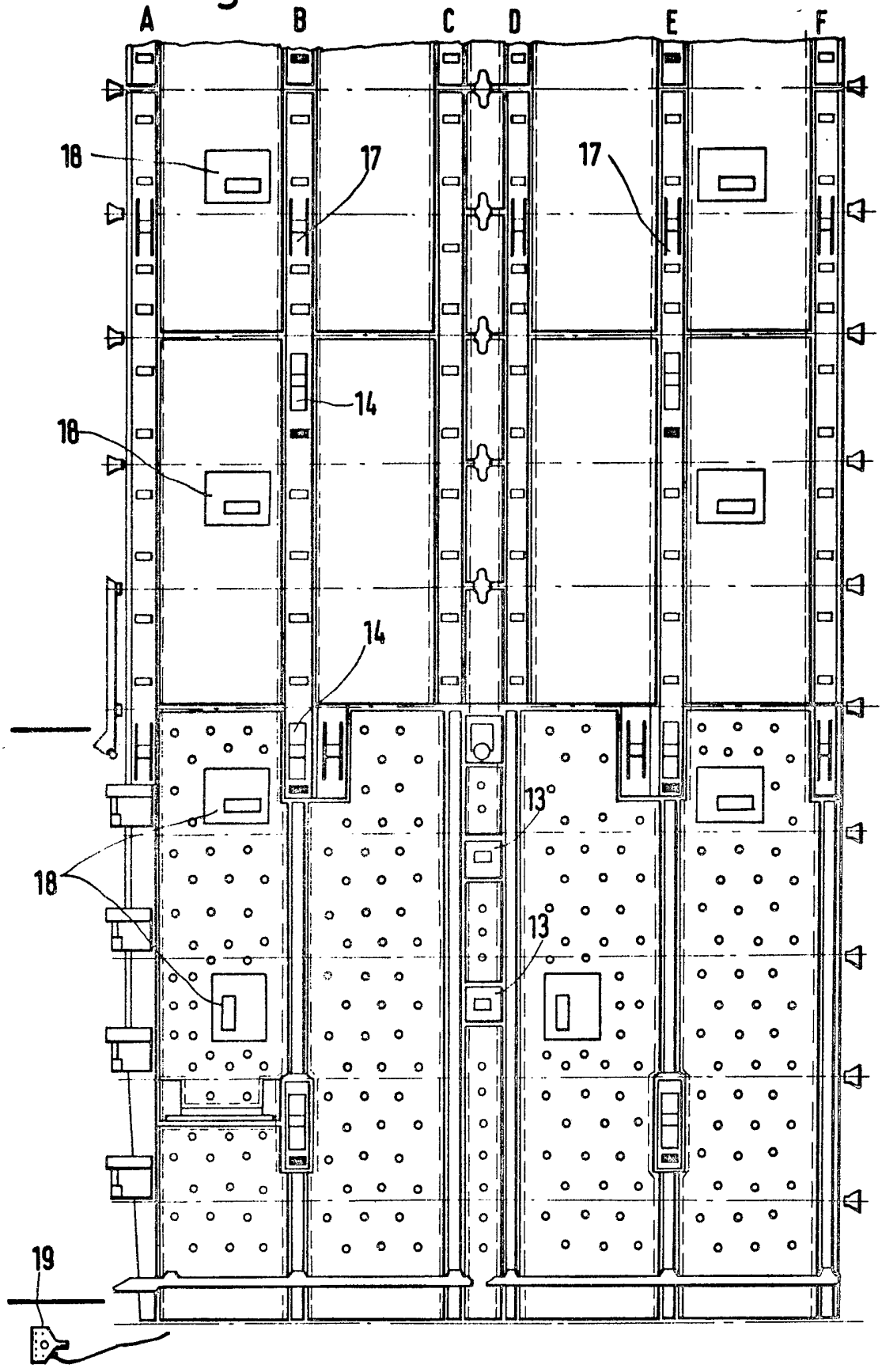

Fig. 2a

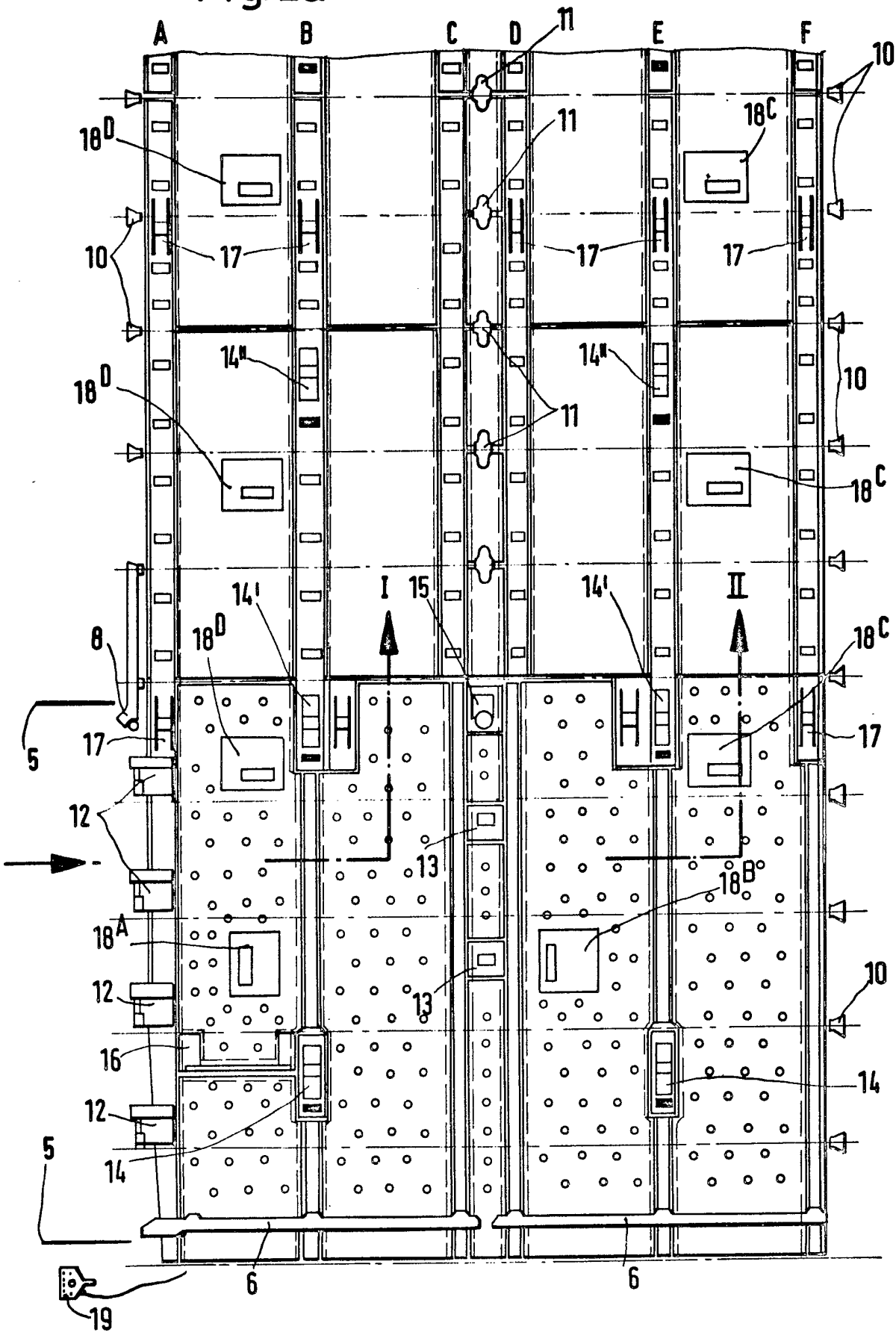

Fig. 3

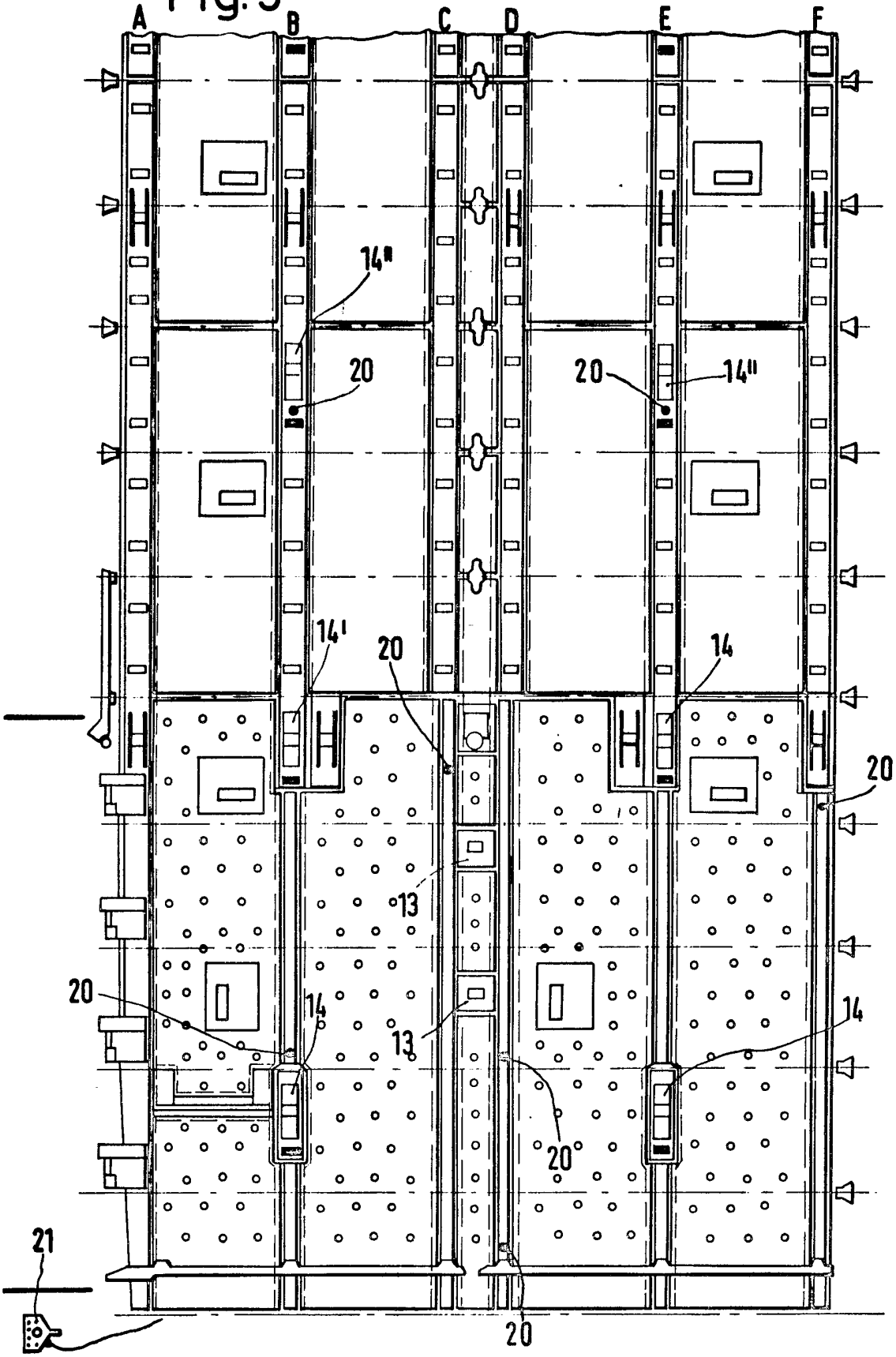

Fig.3a

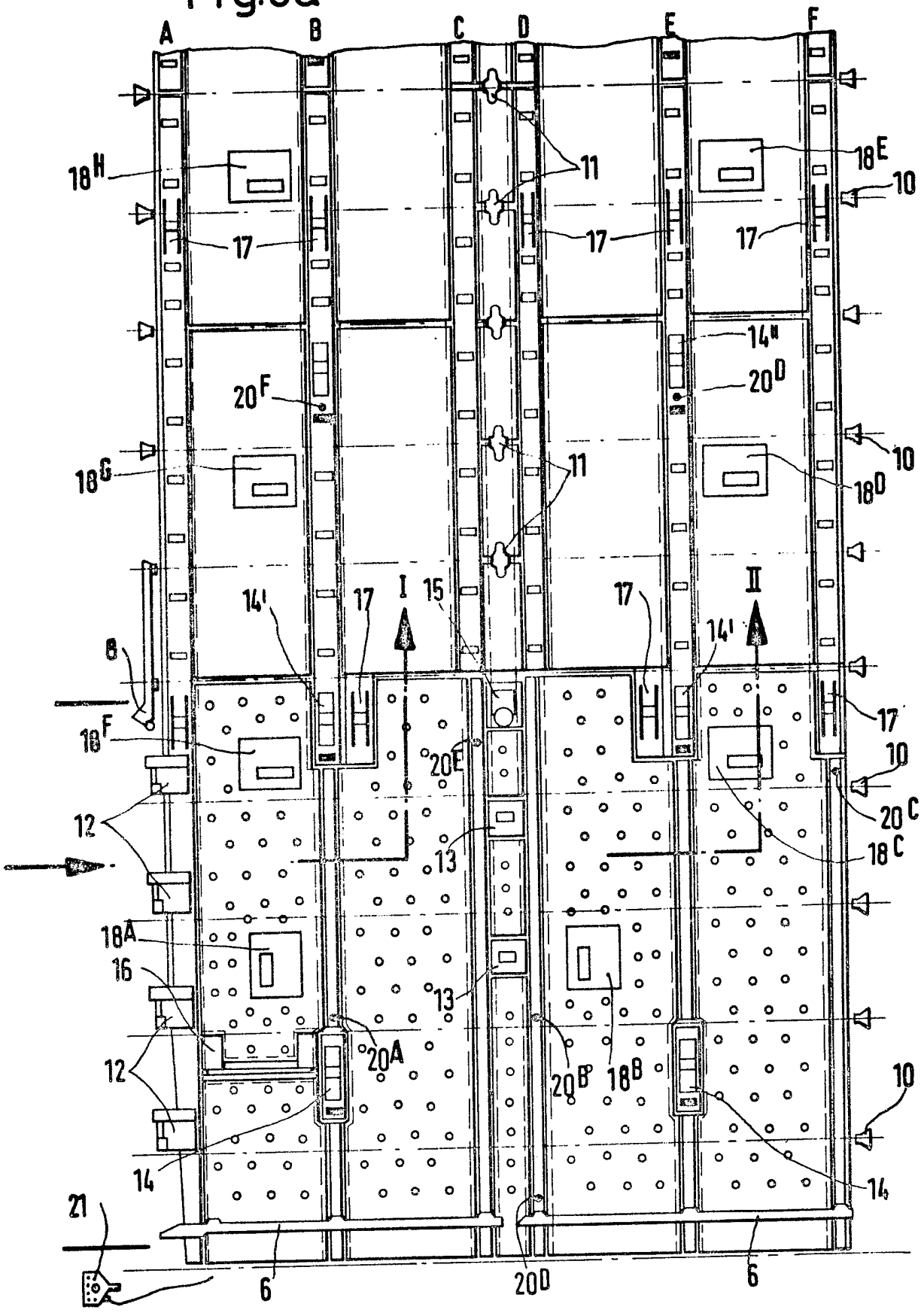
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Fig. 4

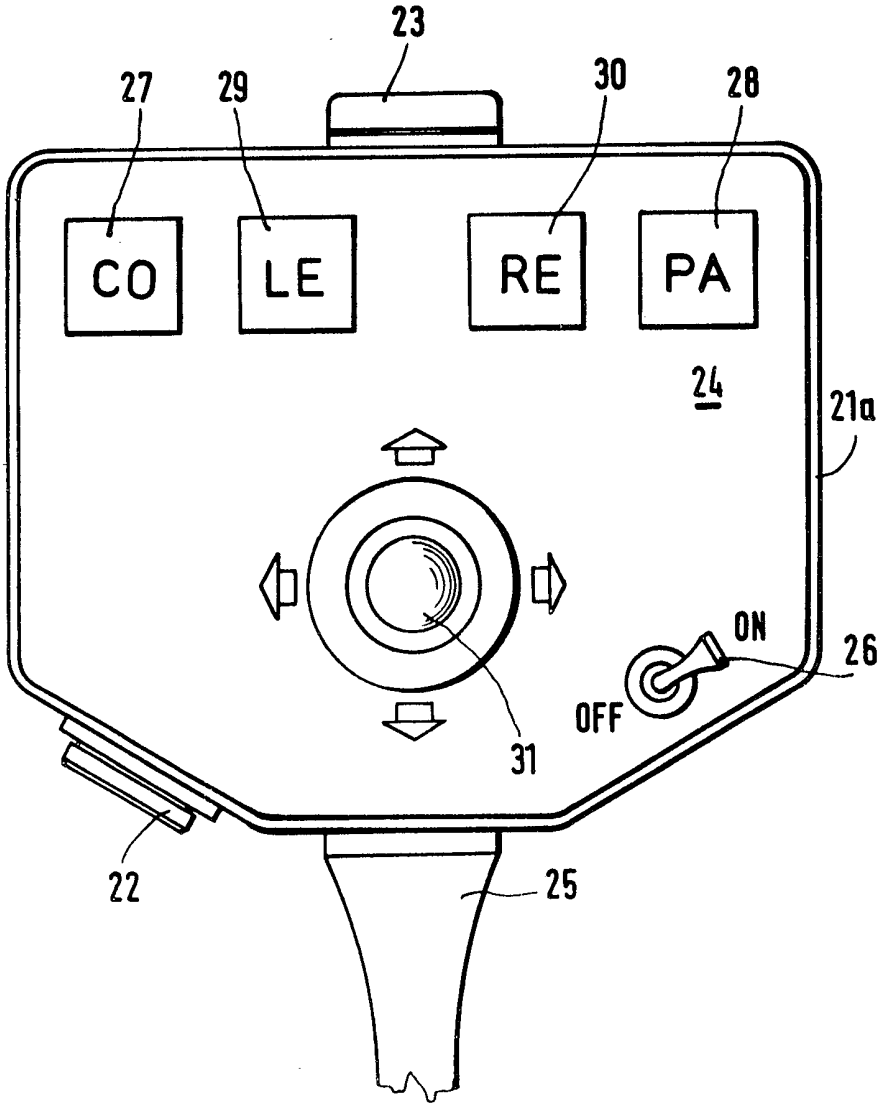
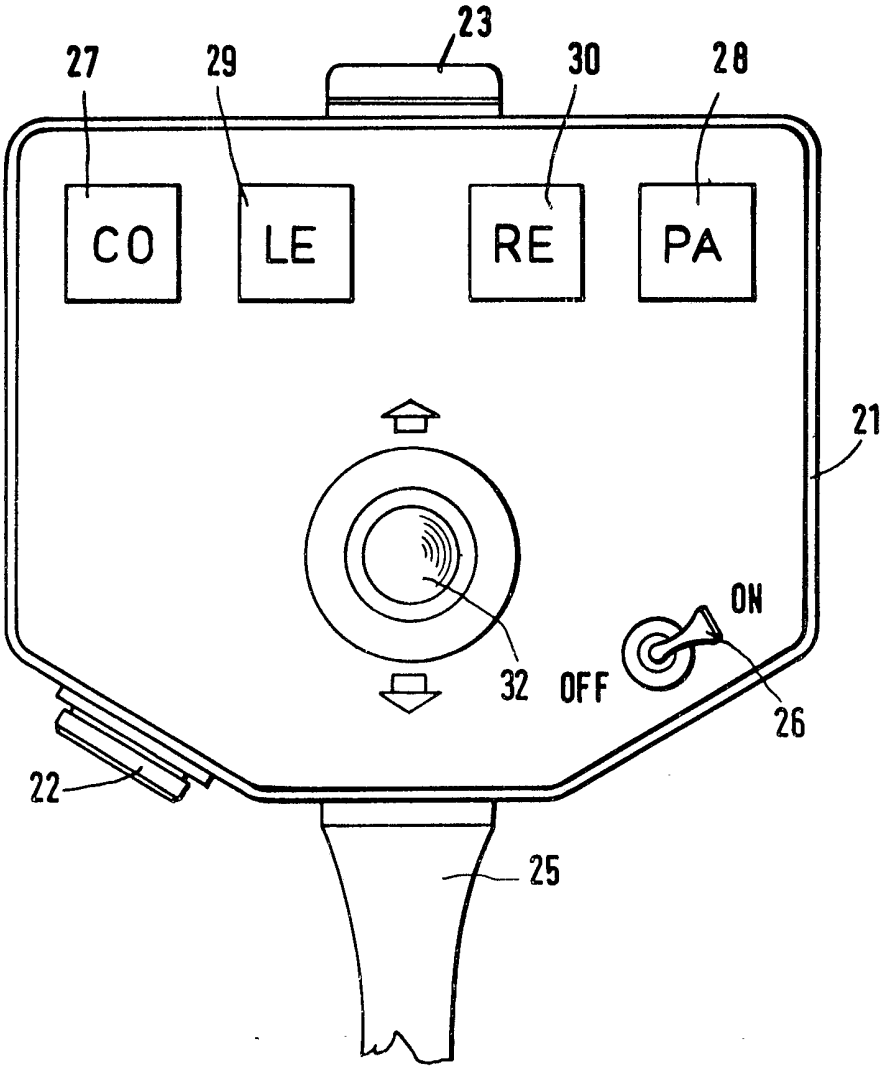


Fig. 5



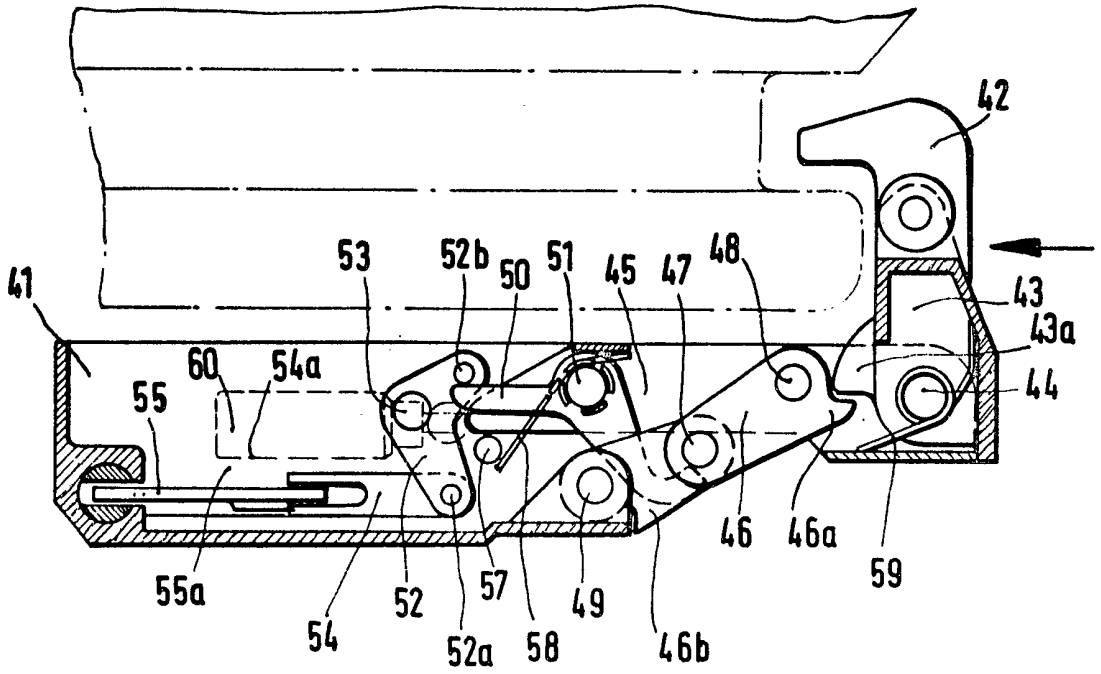

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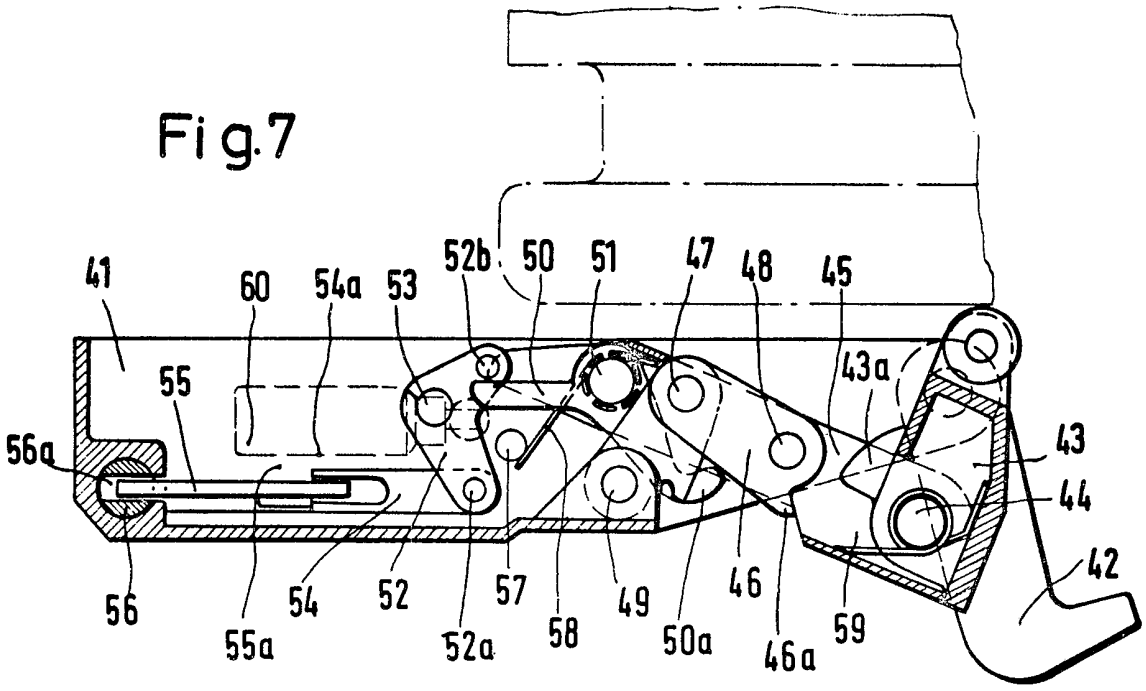
Fig.6

Fig.7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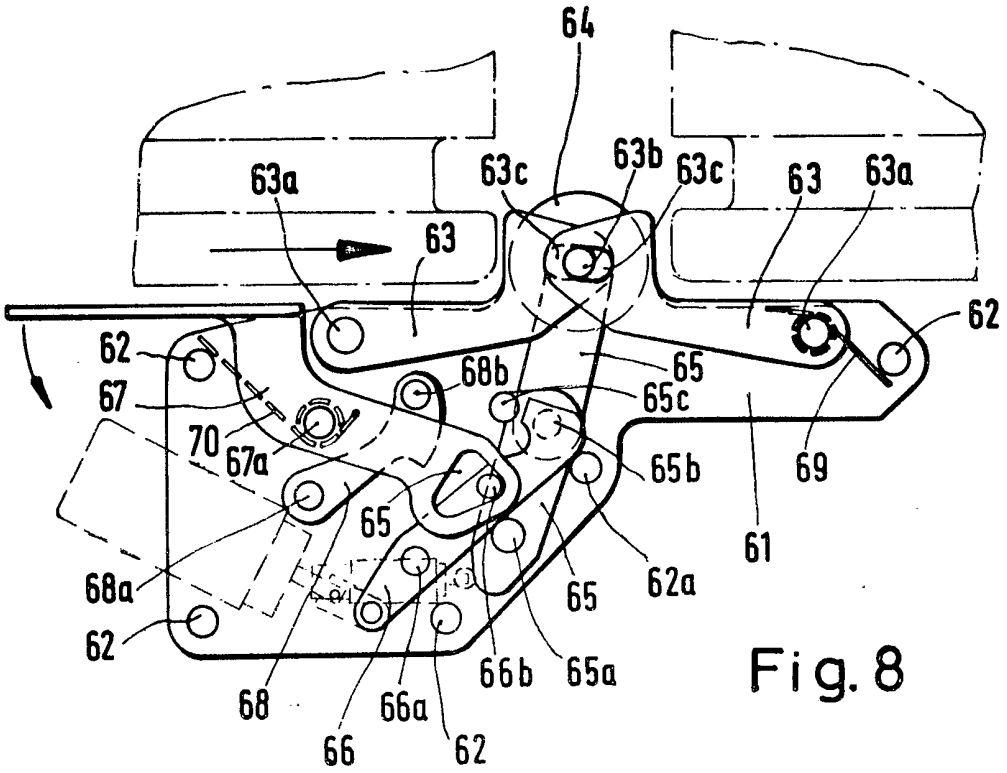
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Fig. 8

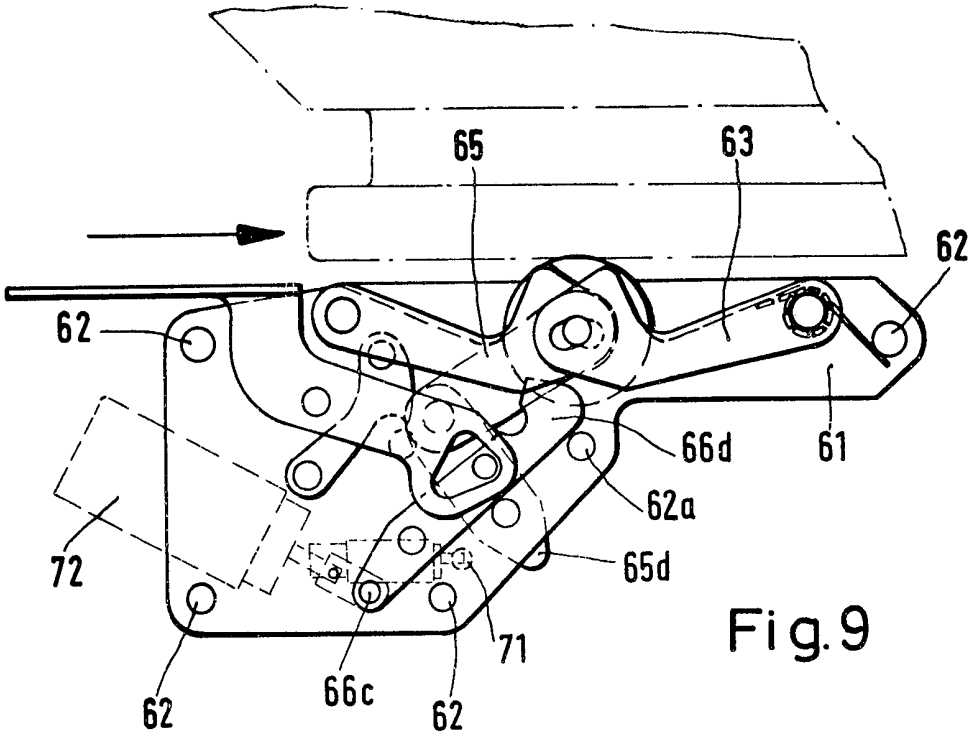
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Fig. 9

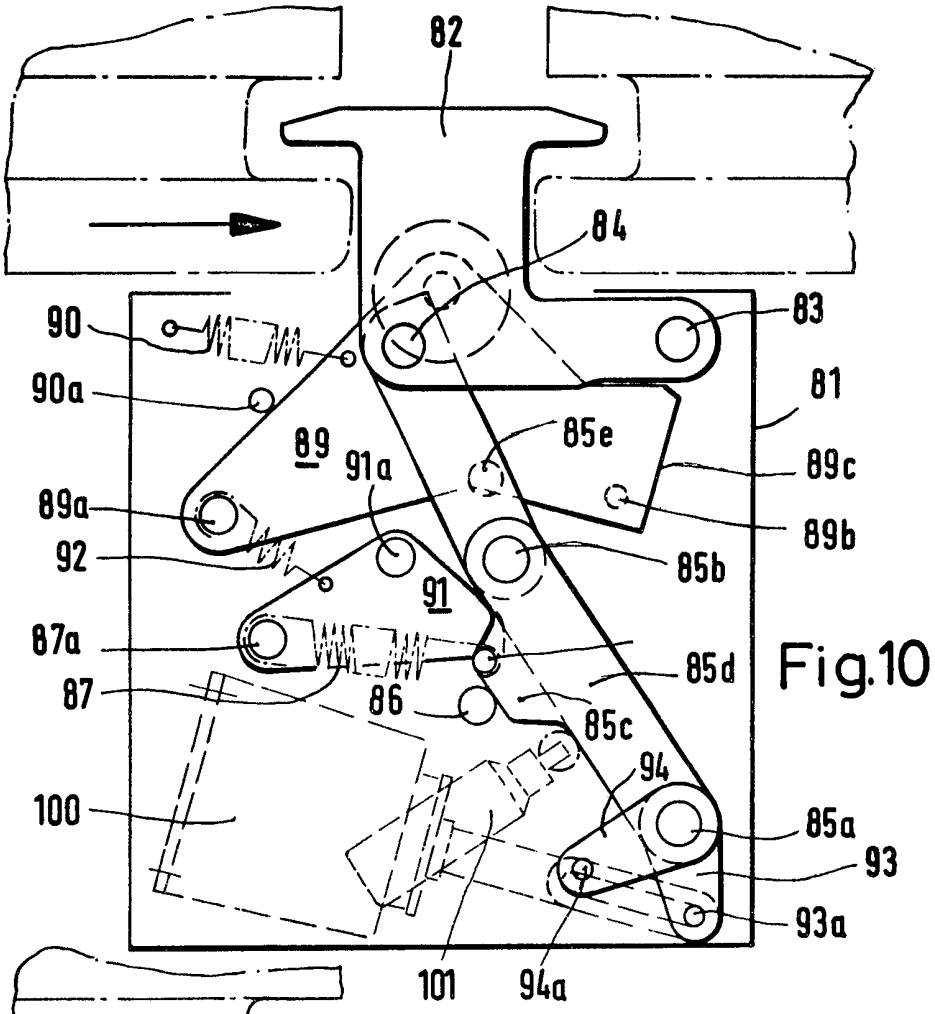
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Fig.10

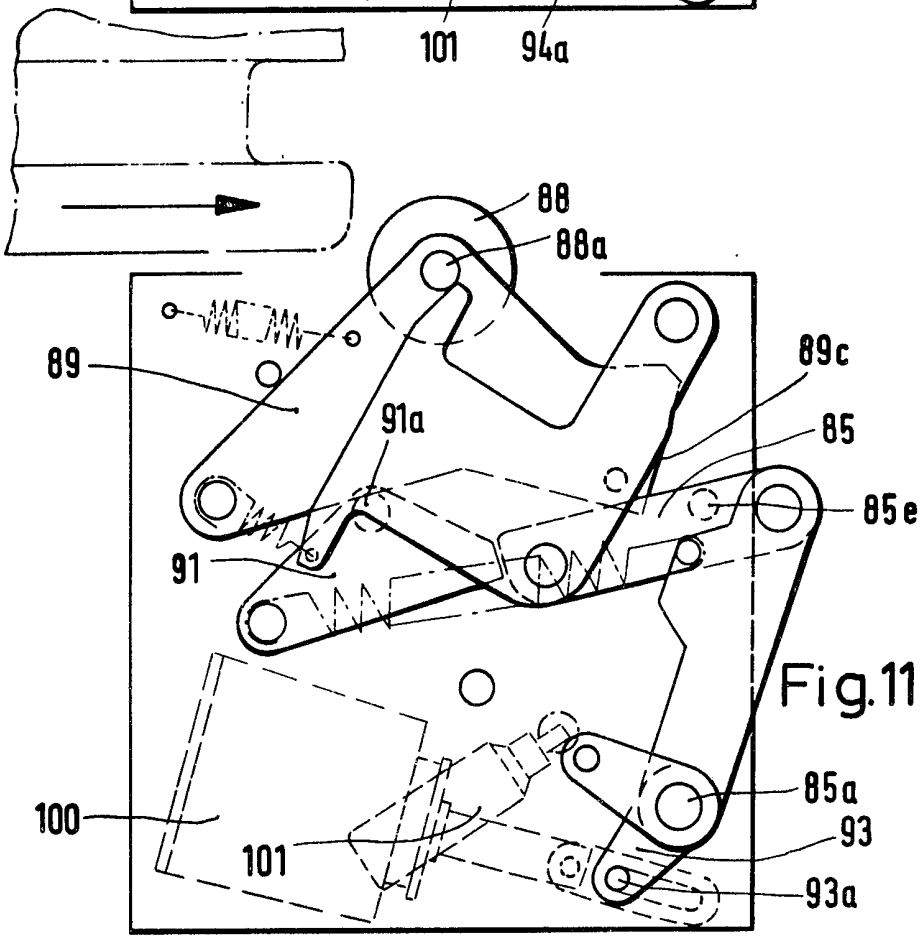
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Fig.11

Fig. 12

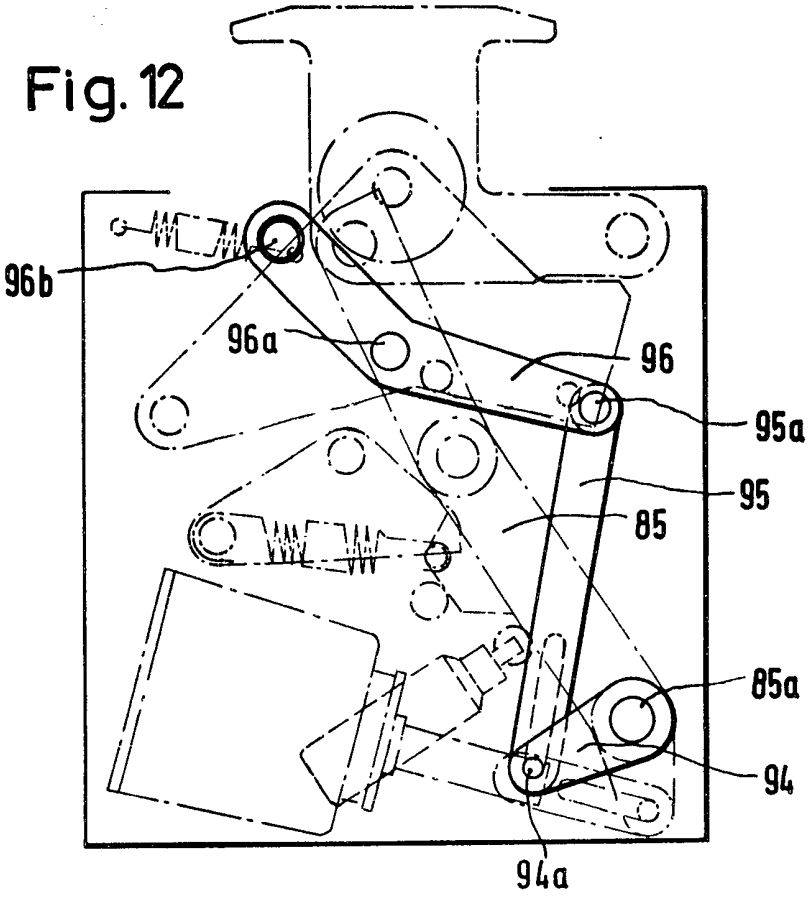
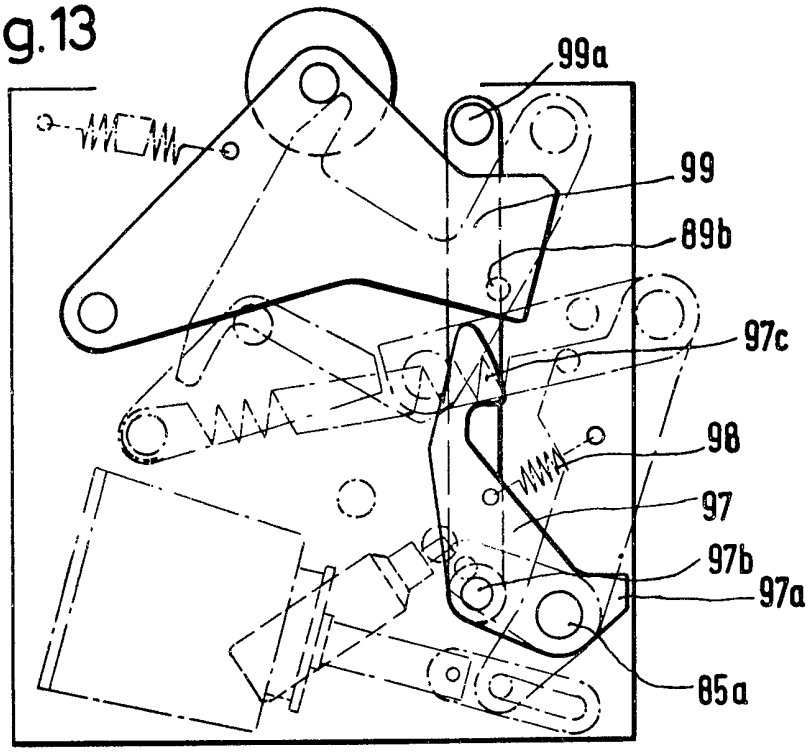


Fig. 13



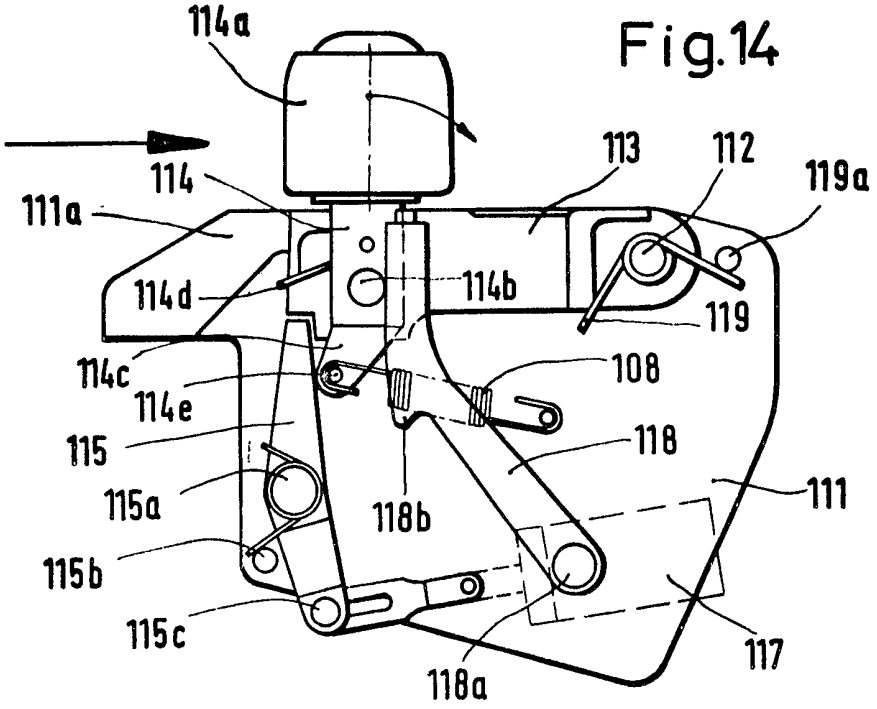

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Fig.14

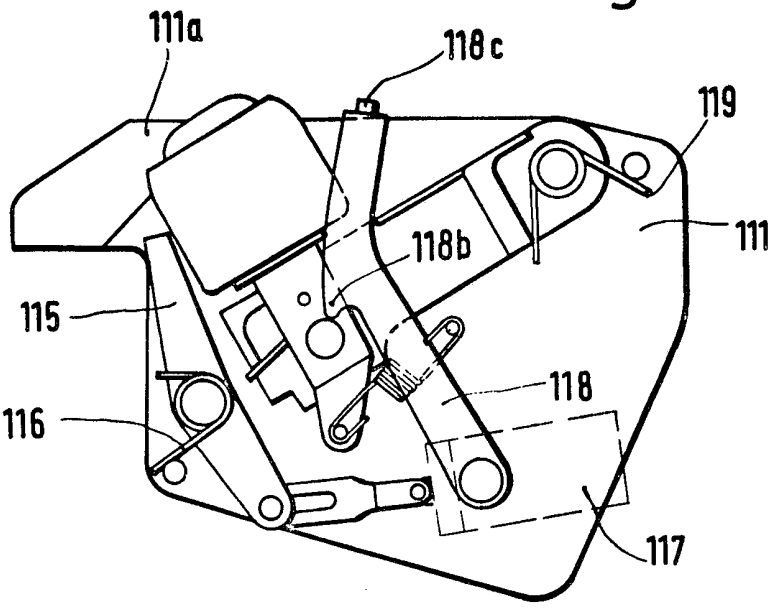
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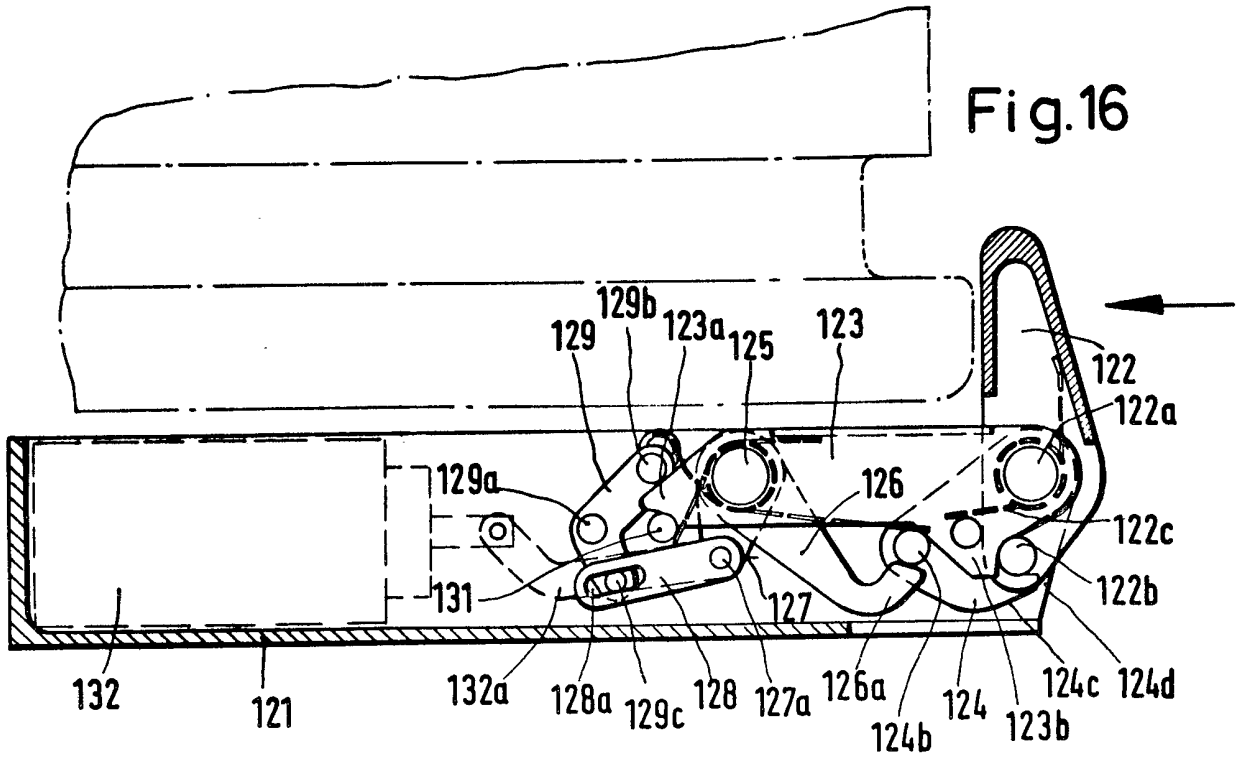
Fig.15

Fig.16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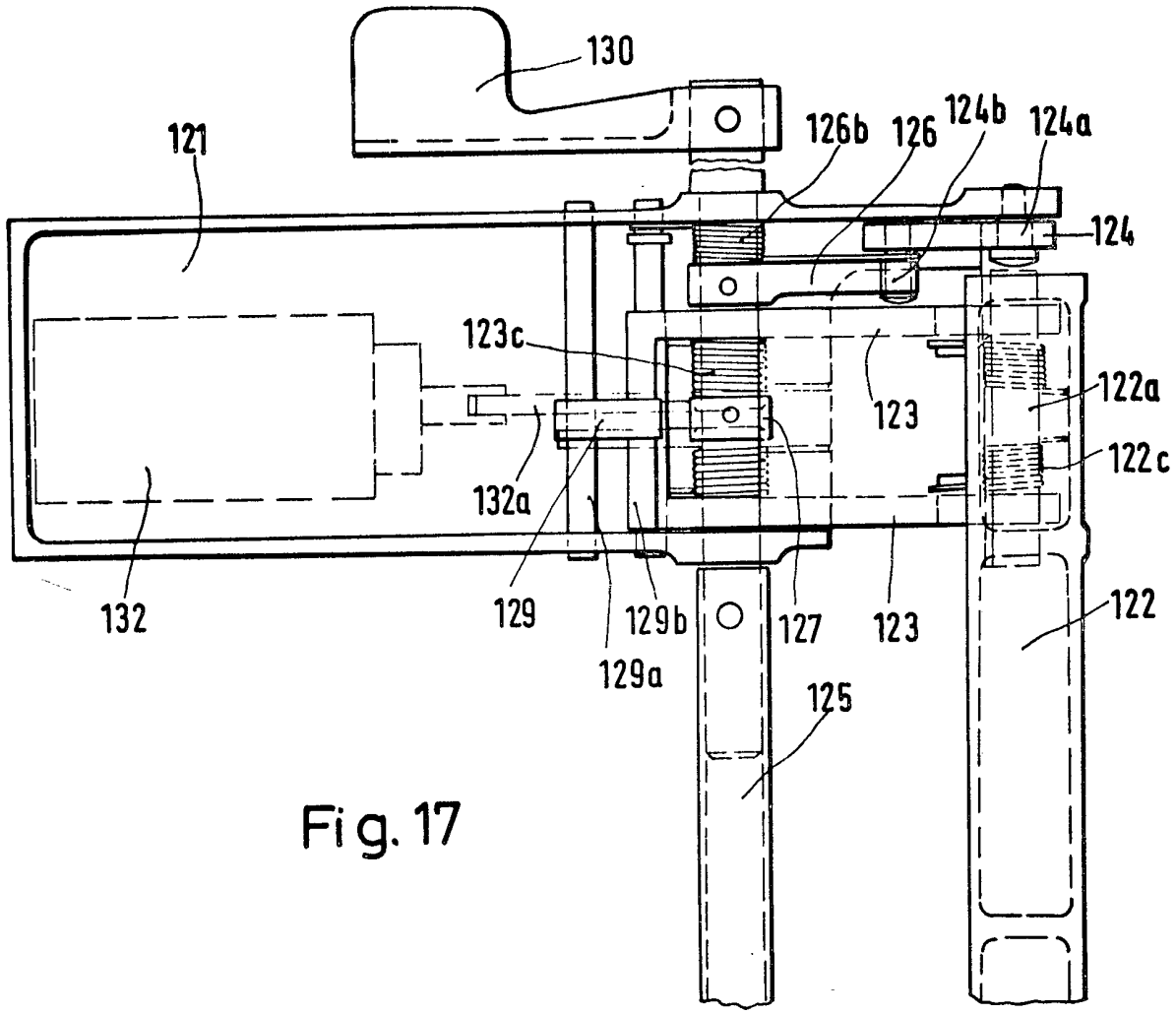
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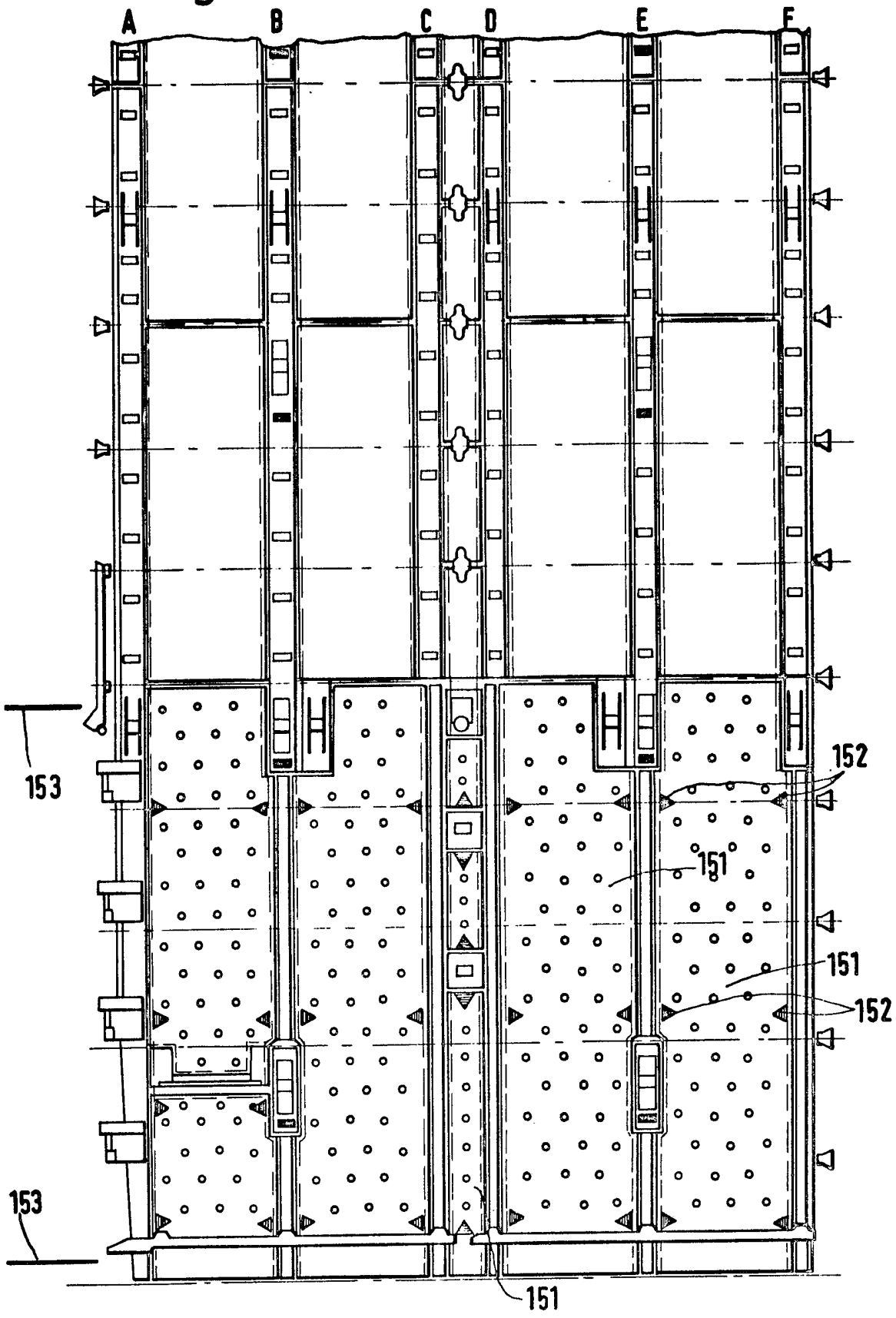
Fig. 17

Fig.18



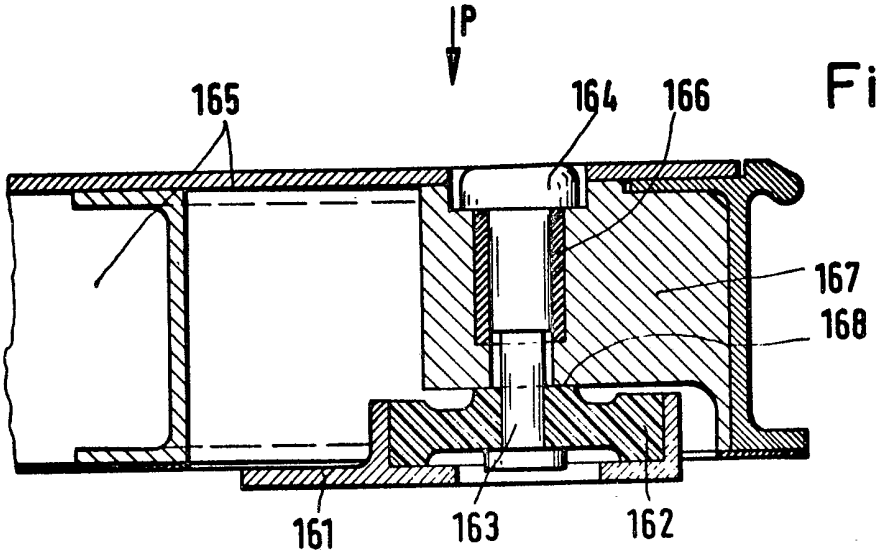


Fig.19

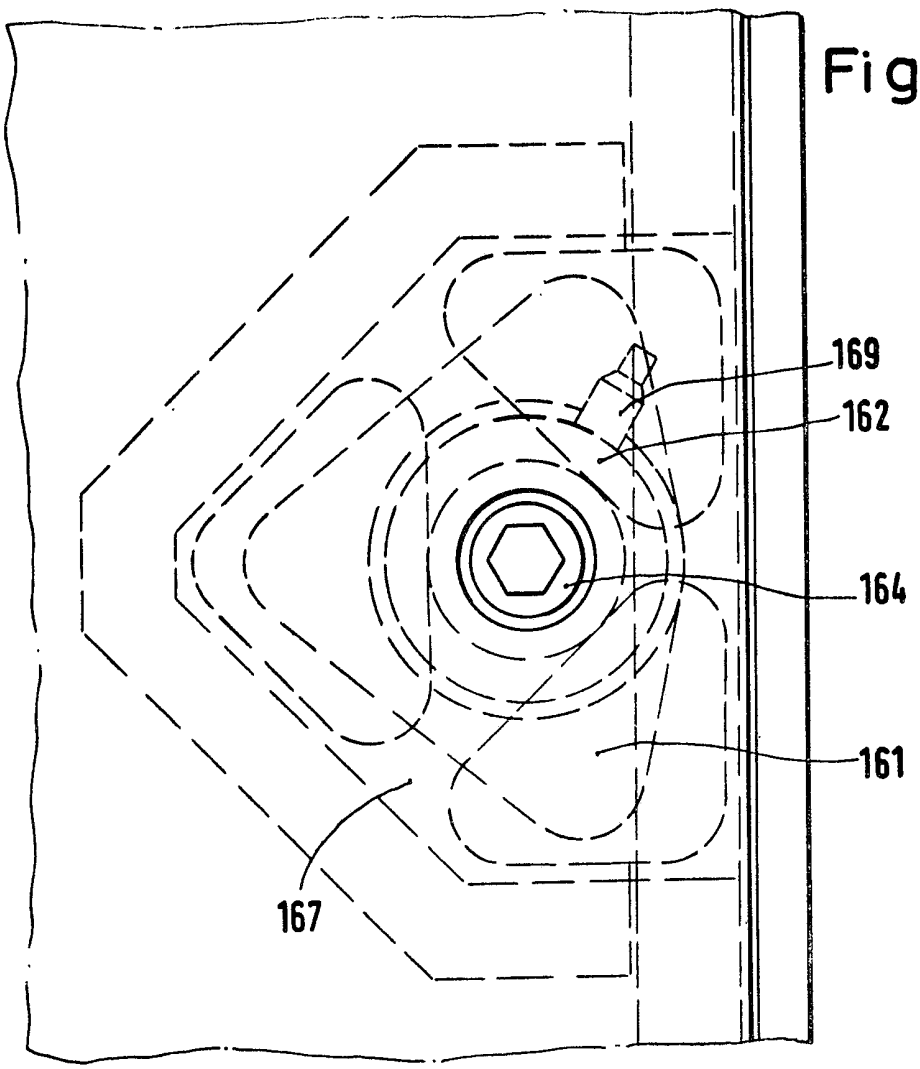


Fig.20

SPECIFICATION

Cargo loading system for aircraft

This invention relates to a cargo loading system for the under-floor freight compartments in wide body aircraft for carriage of containers and pallets. The system being of the kind constructed from roller bearing tracks, ball bearing mats, bearing rollers, braking rollers and drive means for same.

Loading systems of this kind which are automatic are known for the under-floor compartments of large aircraft but have a single loading and locking arrangement which does not enable the system to be adapted to other requirements or constructed for special purposes without appreciable outlay.

Known systems have the disadvantage that they are comparatively bulky to handle and the complicated design and construction make them liable to breakdowns. In addition, the systems are not associated with any weighing devices carried on board the aircraft itself, so that the centre of gravity for the larger-capacity aircraft cannot be readily determined.

According to this invention there is provided a cargo container or pallet loading system for the under-floor compartment of an aircraft, the system comprising roller tracks for moving cargo longitudinally of the aircraft, and ball mats for transverse movement at the loading bay door, the system including bearing rollers, braking rollers and drive means, wherein a manually operable loading system is adaptable by inclusion of electrical drive means and electronic sensing devices for automatic or semi-automatic cargo loading, the mechanical cargo locking and retaining components remaining unchanged constructionally and functionally.

Embodiments of a cargo loading system are shown by way of example in the accompanying drawings wherein:-

Figure 1 shows a schematic plan diagram of an installation of a manual cargo system in an aircraft under-floor compartment,

Figure 1a shows a schematic plan of the loading process,

Figure 2 shows a schematic plan of a semi-automatic installation,

Figure 2a shows the loading process of the system of Figure 2,.

Figure 3 shows a schematic plan view of a fully automatic system,

Figure 3a shows the loading process of the system of Figure 3,

Figure 4 shows a control panel for a semi-automatic freight loading system,

Figure 5 shows a control panel for a fully automatic system,

Figure 6 shows a section through a run-over latching gate in the locked position,

Figure 7 shows a section through the run-over latching gate in the free or running-over position,

Figure 8 shows a section through a run-over container lock in the locked position,

Figure 9 shows a section through the container lock in the run-over position,

Figure 10 shows a section through a container lock located in a ball mat zone and in a locked position,

Figure 11 shows a section through the container lock located in the ball mat zone in the run-over position,

Figure 12 shows a section through a container lock located in the ball mat zone having a foot operated means,

Figure 13 shows a section through a container lock located in the ball mat zone with a releasable locking device,

Figure 14 shows a section through a central guide and separating roller for double loading using a half container and in the locked position,

Figure 15 shows a section through the central guide and separating roller in the run-over position,

Figure 16 shows a section through a run-over entry guiding system in a locked position,

Figure 17 shows a plan view of the system of Figure 16,

Figure 18 shows a plan view of a loading system with a weighing device located in the ball mat zone,

Figure 19 shows a section through the weighing sensor in the ball mat, and

Figure 20 shows a plan view of the weighing sensor of Figure 19.

Figures 1 and 2 shows the structure of a manually operable cargo loading system in which the roller tracks A to F with load bearing rollrs 2 for freight containers or pallets extending longitudinally of the aircraft. The slowing-up or braking rollers 3 positioned in the roller tracks B and E prevent the freight containers from rolling rapidly back. The ball mats 4 in the loading bay zone 5 enable the freight to be moved in any direction. This enables freight carriers to be introduced into the loading compartent sideways and moved so that they are then aligned longitudinally. Guide rails 6 and 8 facilitate the introduction of the containers into the compartment. The noses 7 on the rails 6 are at the same time locking devices when the cargo uses pallets. Between each of the roller tracks A, B, C and D, E, F floor plates 9 are provided with fixed locking devices 10 along the longitudinal sides of the compartment. The rollers 2 and locks 10 serve for longitudinal guiding and lock of the containers.

When the compartment is loaded with half containers centre bolts 11 are located between the two tracks C and D these form guide and locking devices for the freight carriers.

The loading bay bolts 12 provided on the sill of the bay gate form guides and prevent roll-out from the bay. In conjunction with manually operable latching hooks they form also a locking system (Figures 6 and 7).

For the locking of half containers in the loading bay zone at the centre of the aircraft two container locks 13 are provided (see Figures 10 to 13) which can be over-run by the containers. For the locking of the containers in a longitudinal direction of the aircraft over-run locks 14 (see Figures 6 and 7)) are located in the roller tracks B and E.

For loading the cargo compartment with containers and pallets a central guide roller 15 is provided in the loading bay zone at the centre of the aircraft. In

the case of loading with two half containers which are moved into the cargo compartment in succession, the guide roller 15 separates the two containers when they are moved longitudinally so that they move along a line I or II (Figures 1*a*), into the cargo hold (see also Figures 14 and 15).

A guide 16 which is provided in the loading gate zone 5 (Figures 16 and 17) can be over-run and enables the compartment to be loaded with containers without difficulty.

If the hold is loaded with pallets then these are locked by means of the latches locks 17 provided in the roller tracks A to F. The loading method in accordance with Figures 1 and 1*a*, when using manual loading is carried out as follows:-

The freight gate of a wide bodied aircraft is opened and the latches in the loading gate locks are depressed manually. The loading apparatus for the half containers is located on the loading gate sill and aligned in the required direction. The locks 14 in the loading bay 5 are now moved into the locked position by a foot control. The container locks 14' (Figure 1*a*) are lowered by a foot control and locked in this position. The remaining locks 14'' are unlocked by a foot control. The locks 13 are all lowered by a foot lever. All the pallet locks 17 are likewise lowered. The centre guide roller 15 is erected. A container is now pushed into the freight compartment by a loading apparatus in the transverse direction shown by the arrow (Figure 1*a*). When the container base reaches the loading gate lock 12 the longitudinal guides are unlocked by the container and lowered. The container moves between the guides 8 and 16 into the loading bay. When the container base has passed-over the loading gate lock 12 the guides automatically lock and the container continues to run-over the locks 13 which are released, these automatically locking after the container base as passed thereover. The container is now positioned in row II.

By the further movement of the container in a longitudinal direction it is moved towards the rear, between the fixed locking abutment 10 and the centre locking abutments 11, into the hold. After over-run of the locks 14'' these are released and automatically rise to lock behind the container after same has passed over them. This measure serves to prevent a container from running back in the hold. When the carrier has reached the storage location it is thus automatically locked. The locks 14'' in unoccupied storage locations are again unlocked by a foot control and the next container is loaded. The loading bay latches 12 are again over-run and the container moved as far as the locks 13 which have been moved into a locking position by the preceeding container. The container is now positioned in row I. The aforementioned operations proceed for row I until the container is locked in the storage location. Once again the container locks 14'' are unlocked by a foot control and the locks 13 lowered so that the loading can again proceed.

For the last three and last two containers the lock 14'' must be engaged by the foot control, after the containers have been located and when the last two containers are positioned the latches of the loading bay locks are closed manually and this completes the loading process using LS_3 containers.

The unloading operation requires the reverse sequence of operation.

When loading with pallets the container locks 14, 14' and 14'' are lowered fully using the foot control and locked in such position. The same applies to the container lock 13. The run-in guide 16 is lowered and manually locked as are the pallet locks 17. The pallet locks 17 farthest from the loading bay zone 5 and positioned in the tracks A to F are moved to the locked position by foot control while the preceeding pallet locks 17 are operational to effect the locking process. The loading is carried out generally as described before. The pallet moves, between the guide rails 6, 8 and 15, to the opposite side of the loading bay. When the fixed locking abutments 10 are reached, the pallet base releases longitudinal guides in the loading gate locks 12 and automatically locks them. The freight moves to the selected storage location, where it is then automatically locked by the operative pallet locks 17. The centre locks 11 are automatically over-run when pallets are loaded and are automatically erected again by the spring force. For protection all pallet locks in the roller tracks B and E are made operative before the loading operation so that after they have been over-run they are automatically erected for locking purposes and thus prevent the cargo from rolling back. With pallet loading also, the rest of the method is carried out as described before. The last pallet is loaded in a transverse direction, between guides 6, 8 and 15, into the loading bay in which process the locking is effected by the noses 7 of the guide rails 6. The front end of the pallet is secured by the four pallet locks 17, while the locks 10 and the loading bay locks 12 secure the sides of the pallet.

In a semi-automatic embodiment of the system according to the invention (Figure 2) electrical drive means 18 are provided with a control panel 19. In addition, the locks 13 and 14 and the pallet locks 17 in the tracks B and E are provided with electrical limit switches which control the drive means. The centre roller 15 is controlled by a lift magnet. The system otherwise is the same as in the previously described manual system. The method of operation is the same as far as the principal features are concerned. The container locks 13 are lowered by a foot control and the locks 14 and guide rail 16 are erected. All the locks 14' and 14'' and the pallet locks 17 are lowered and secured in such a position while the last container locks 14'' in the rows I and II are only unlocked.

The operation of the system is started by pressing the loading button on the control panel 19 (Figure 4). When the direction control is moved to the "transverse load" position the transverse drives 18*a* and 18*b* start to operate automatically. When the button "longitudinal load" is pressed then, after the cargo has reached or over-run the container lock 13, the built-in limit switch is automatically switched off and after the lock is over-run the two transverse drives 18*a* and 18*b* are switched-off and the longitudinal drives 18*c* of the selected row II is set in operation. The further operation is the same as that already

described. In the further loading the commands are given in accordance with the loading positions, the longitudinal drives 18*d* being set in operation last.

The loading process with half containers is essentially the same and reference can be made to Figure 2*a*. The loading with four containers takes place in an equivalent- manner as the method of operation described before and only the essential points are described. The container locks 13 and the pallet locks 17 are lowered by a foot control before the loading commences and are secured in position. The container locks 14 and the guide 16 are erected. The container locks 14′ and 14″ in the loading rows I and II are fully lowered and locked in position. Only the last container locks 14″ are unlocked by a foot control, and this operation is carried out each time the storage space is occupied by means of the next container lock 14″.

In the pallet loading operation both the container locks 13, 14, 14′ and 14″ and the pallet locks 17 are lowered by foot control before the loading commences and secured in this position and only the last pallet locks 17 in the tracks A to F, are unlocked by foot control. The loading process is similar to that previously described. After entering the cargo hold the pallet over-runs the longitudinal guides of the loading bay locks 12, and the limit switches in these start the transverse drives 18*a* and 18*b*. After the guides have been over-run the loading gate locks 12 automatically lock and at the same time switch off the transverse guides 18*a* and 18*b* by the limit switches. The command "longitudinal load" is given as a result of which the longitudinal drives 18*c* and 18*d* are switched on. The lift magnet in the centre guide roller 15 receives a switch pulse which unlocks the roller. The pallet is conveyed to the rear cargo compartment. When the pallet has reached its storage position the pallet locks 17 once again automatically lock behind the pallet by spring action and switch off the drives 18*c* and 18*d* situated below the pallet. That the rest of the loading operation is effected accordingly. Unloading is carried out in the converse order.

Figures 3 and 3*a* show a fully automatic loading and unloading system in accordance with the invention, this having been supplemented by the installation of light beam sensors 20 and a control panel 21 (Figure 5) as well as appropriate electronic control systems, so that the semi-automatic equipment now becomes fully automatic. At the beginning of the loading operation the guides 16 are erected and the container locks 14 are in the unlocked position. All the pallet locks 17 occupy the lowered position and the centre guide 15 is erect. By operating the control the first transverse drive 18*a* is started up which conveys the first container to the sensor 20*a*. When the latter responds a switch pulse is fed to the lift magnet and the two container locks 13 and lowers same. At the same time the sensor switches on the transverse drive 18*b*, which conveys the container to the opposite side of the loading bay. When the sensor 20*a* is uncovered by the container 4 the drive 18*a* automatically switches off. The container locks 13 automatically lock after they have been over-run. The sensor 20*c* after detecting the container is row II supplies a control pulse to the lift magnet of the container lock 14′ which initiates the unlocking. At the same time the sensor 20*c* switches on the longitudinal drives 18*c* and 18*d*. The container is conveyed between the fixed locks 10 and the centre locks 11 in the longitudinal direction of the hold and on reaching the sensor 20*d* the container lock 14″ is unlocked, the drive 18*c* switched off and the longitudinal drive 18*e* switched on. This process is repeated until the storage position is reached and the last sensor is covered when the last container lock 14″ by a spring automatically prevents the cargo from running back by spring means or latches same in position. The last drive is at the same time switched off. The electronic control system signals the end of the loading process for the first container on the panel 21. The second container is introduced into the hold and the operation repeat accordingly. This sequence applies to the loading and unloading of pallets and full containers in the manner previously described.

Figure 4 shows the operating panel 21 with housing 21*a* provided with a socket connector 22 and a computer coupling 23 and which carries a front panel 24. The housing 21*a* can be provided with a handle 25. The front panel 24 contains a switch 26 for the power supply to the loading system. The control button 27 is intended for the loading and unloading of full containers, while the control button 28 is intended for pallet loading. In the case of loading with semi-containers the two control buttons 29, 30, are intended for the selection of the desired loading row. The four-way lever switch 31 determines the direction of rotation of the drives for the loading and unloading and the switching over from transverse to longitudinal drive.

When the freight loading system is switched on by the switch 26 the four control buttons 27 to 30 light up. The type of freight, such as pallets is selected by pressing the appropriate button which then remains lit. The connection 23 on the housing 21*a* is required when a weighing device is associated with the aircraft for feeding data.

Figure 5 shows the panel for a fully automatic loading system, which mainly corresponds with the previous example described before. The only difference is that the two way switch lever 32 is provided for loading and unloading. The lever 31 and 32 in both control units is so designed that it can be moved to the required position and then automatically returns, when released, to the neutral position thus stopping the operation and shutting off the system. This makes the system more safe. The control button may be arranged to flash to indicate which loading process has just been terminated.

Figures 6 and 7 show a latching gate forming the locking device for the loading bay which can be over-run. This latch has a housing 41 with a side wall and a rear wall and a hook lock 42 movably mounted therein and which can be moved aside about a hinge by means of a foot pedal (not shown in the drawing). A longitudinal guide 43 has a nose 43*a* which is rotatably mounted by the bolt 44 in the rocker 45. Two toggle levers 46 with noses 46*a* and 46*b* are rotatably connected to bolt 47. The toggle lever 46 is

movably connected by bolt 48 to the rocker 45 and via the bolt 49 to the housing 41. The release lever 50 and the rocker 45 are rotatably mounted in the housing 41 by means of the bolt 51. A toggle lever 52 is likewise mounted with the bolt 53 and the housing 41. The control roller 52*b* serves to operate the release lever 50. With the bolt 52*a* the toggle lever 52 is coupled to the lever 55 via the thrust rod 54. The fulcrums of the latter are marked 54*a* and 55*a*. The free end of lever 55 engages the slit 56*a* in the thrust rod 56, which in its turn is connected to the foot lever or to the lift magnet. The bolt 57 serves as a thrust bearing for the rocker 45 and the restoring spring 58. The rotary spring 59 moves the longitudinal guide into the erected position. The system is supplemented by the limit switch 60 for the semi-automatic and fully automatic loading system shown in Figures 2 and 3, the entire mechanical locking part remaining unaltered. The method of operation can be seen from the drawings and from the preceding description. In the unloading process the thrust rod 56 is operated either by the foot lever or by the lifting magnet.

Figures 8 and 9 show a container lock which can be over-run in both positions occurring during operation. The housing 61 and the two connecting bolts 62 and 62*a* are the supporting elements for this locking device. The lock parts 63 are rotatably mounted with the bolt 63*a* in the housing 61. The lock parts 63 are movably connected to the shaft 63*b* by the slots 63*c*, the roller 64 and the toggle lever 65. The toggle lever 65 is also rotatably mounted, with the shaft 65*a*, in the housing 61. The bolt 65*b* interconnects the two toggle levers 65 so that they can rotate in relation to each other. The roller 65*c* is actuated by the release lever 66, which is mounted with the bolt 66*a* in the housing 61. The roller 66*b* is connected to the housing 61 via the link 67*b* of the foot lever 67. The locking lever 68 is likewise situated on the housing 61, in the fulcrum 68*a*, and is operated by the foot lever 67 via the roller 68*b*. The rotary spring 69 moves the lock parts 63 into the erected position, and the rotary spring 70 re-erects the foot pedal. The semi-automatic system is supplemented by the limit switch 71 installed as a means of controlling the drives via the nose 65*d* of the toggle lever. The lifting magnets 72, in the case of the fully automatic system, is installed as a means of operating the release lever 66 via the fulcrum 66*c*.

The locking system shown in Figures 10 to 13 comprises a housing 81 with the lock hook 82, which is rotatably mounted with the bolt 83 in the housing 81. The lock hook 82 is connected to the shaft 84 with the toggle lever 85, which in its turn is mounted with the shaft 85*a* in the housing 81 and can bend aside about the fulcrum 85*b*. The support 85*c*, when in the dead centre position, rests against the bolt 86 and is drawn by the traction spring 87 into the dead centre position via the spring bearing point 85*d* and the bolt 87*a*. The roller 88 is mounted with the shaft 88*a* in the release bridge 89, which is connected to the housing 81 via the shaft 89*a*. The traction spring 90 holds the release bridge 89 in the erected position, against the stop 90*a*. The pawl 91 is rotatably mounted on the bolt 87*a* and is pressed against the toggle 85 by the traction spring 92. The roller 91*a* is operated via the release bridge 98. The holding pins 85*a* and 89*b* serve to start up the operation. The angle lever 93 is provided, in the fully automatic system shown in Figure 3, for the connection of the lifting magnet 100. The angle lever 94 with the boring 94*a* is provided for the connection of the foot operation device as shown in Figure 12. For this case the draw bar with the slot 95 is connected to the toggle lever 95*a* via the bolt 94*a* of the angle lever 94. The foot lever 96 is articulated to the housing 81 via the shaft 96*a* and to the draw rod 95 via the bolt 95*a*, the foot pedal being marked 96*b*. For the lowering locking action shown in Figure 13 the locking pawl 97 is rotatably mounted on a shaft 95*a*, which is secured in its position, on the housing 81, by the support 97*a*, via the traction spring 98. The locking pawl 97 is connected to the operating bar 99 and the foot pedal 99*a*- via the bolt 97*b*. In the semi-automatic and fully automatic system the limit switch 101 is installed for switching the drives.

In Figures 14 and 15 the guide roller is shown with its housing 111 and with the lowering rocker 113 mounted via the shaft 112 and with the roller shaft 114 mounted therein and fitted with the guide and separating roller 114*a* and also the rotary shaft 114*b*, the release cams 114*c* of the rotary spring 114*d* and of the spring bolt 114*e*. The locking pawl 115 is mounted by the shaft 115*a* in the housing 111 and is held by the rotary spring 116 against the stop bolt 115*b* in the vertical position. By the connecting bolt 115*c* the locking pawl 115 is connected to the magnet 117 in the semi-automatic and fully automatic version. For the manual loading of the freight compartment with full containers the lowering locking lever 116 is provided, this being connected to the housing 111 via the fulcrum 118*a*. The rotary spring 119 holds the lowering rocker 112 against the stop 111*a* via the spring bearing 119*a*. The traction spring 120 reinforces the lowering movement of the rocker via the roller shaft 114.

Figures 16 and 17 show a version of a guide consisting of the housing 121, the guide 122, which is rotatably mounted via the shaft 122*a*, in the lowering rocker 123. This lowering rocker 123 is rotatably mounted on the control shaft 125. The supporting bolt 122*b* rests against the nose 123*b* of the rocker in the vertical position. In addition the supporting bolt 122, in the locked position, engages the hook pawl 124, which is rotatably mounted, with the bolt 124*a*, on the housing. The roller 124*b* of the hook pawl 124 is operated by the release lever 126, which is affixed to the control shaft 125. The control lever 127 with the connecting bolt 127*a* is rigidly connected to the control shaft 125 and is connected via the draw bar 128 and the slot 128*a* to the lowering device 129, the latter being rotatably mounted on the shaft 129*a*. The foot lever 130 is likewise rigidly connected to the rotary shaft 125. The stop 123*a* of the lowering rocker 123 rests against the stop bolt 131. The rotary spring 122*c* holds the guide 122 in the vertical position. The rotary spring 126*c* presses the hook pawl 124 with the roller 124*b* against the release lever 126. The lifting magnet 132, which is installed in the semi-

automatic and fully automatic loading system, actuates the rotary shaft 125 via the thrust bar 132*a*, by means of the conncting bolt 127*a* of the control lever 127.

Figure 18 shows a version having an associated weighing system, with a mechanical and an electronic part. The mechanical weighing device consists of ball mats 151, which serve as a weighing platform, and the weighing sensors 152, which are connected to the computer and enable the weight to be determined. The weighing system functions as follows: the cargo such as a container or pallet is manually or automatically moved into the ball mat zone 153, transverse to the direction of flight. When the freight has reached its appropriate loading row I or II, the weighing operation takes place prior to the longitudinal transport operation. The individual weights of the loaded weighing sensors are added up by the computer to form an over-all weight and are indicated or recorded in the computer.

Figures 19 and 20 show an example of weighing sensors. A sensor of this kind consists of a housing 161 with a force receiving device 162 which is rigidly connected thereto and which is connected by the bolt 163 and the connecting screw 164 to the ball mat 151. The elastic supporting device 166 in the thrust bearing 167 of the ball mat 165 is installed for the purpose of avoiding compulsive forces in the weighing process. At the point 168 the thrust bearing 167 rests on the force-locking principle on the force receiving device 162. The connection 169 is provided for the electrical measuring leads.

If cargo is placed on the corresponding ball mat zone this load P passes through the ball mat 165 in the appropriate proportions via the thrust bearing 167 and the poing 168 to the force receiving device 162 and is received by the computer in the form of an overall weight. In addition, the ball mat 165 is connected to the structure of the aircraft via the housing 161, the bolt 163 and the connecting screw 164.

The resulting loading system of the type mentioned in the beginning enables the same components to be used for manual, semi-automatic and fully automatic loading and unloading devices and also enables the system to be adapted without any appreciable expense or labour to the particular needs arising, without the necessity of alterning the system in itself. As the weight of the freight is determined at the same time the position of the centre of gravity can be identified very accurately.

CLAIMS

1. A cargo container or pallet loading system for the under-floor compartment of an aircraft, the system comprising roller tracks for moving cargo longitudinally of the aircraft, and ball mats for transverse movement at the loading bay door, the system including bearing rollers, braking rollers and drive means, wherein a manually operable loading system is adaptable by inclusion of electrical drive means and electronic sensing devices for automatic or semi-automatic cargo loading, the mechanical cargo locking and retaining components remaining unchanged constructionally and functionally.

2. A loading system in accordance with Claim 1, wherein electrical components are associated with the mechanical devices and positioned therein.

3. A loading system in accordance with Claim 1 or 2, wherein the locking devices are operable by foot control.

4. A loading system in accordance with any one of claims 1 to 3, wherein a weighing means forming a part of the aircraft is operatively associated with the loading system.

5. A loading system in accordance with any one of Claims 1 to 4, wherein the locking devices are each actuated by a lift magnet, the locking system being released by the cargo carrier and locked by sensors or limit switches or an operating device.

6. A loading system in accordance with any preceding Claim 1 to 5, wherein a weighing means comprises sensors associated with the ball mats and operatively connected to same.

7. A loading system in accordance with any one of the preceding Claims 1 to 6, wherein a control unit includes operating controls for effecting semi-automatic or fully automatic loading.

8. A loading system in accordance with any one of Claims 1 to 7, wherein a computer is associated with the control unit and thereon the computer effecting control of the loading system.

9. A loading system in accordance with any one of Claims 1 to 8, wherein the loading bay includes guide rails and reverse movement prevention system.

10. A loading system in accordance with Claim 6, wherein the sensors comprise visible or infra-red light beams.

11. A loading system constructed and arranged substantially as herein described with reference to and as shown in any one of the Figures of the accompanying drawings.

12. An aircraft including a loading system in accordance with any preceding claim.

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