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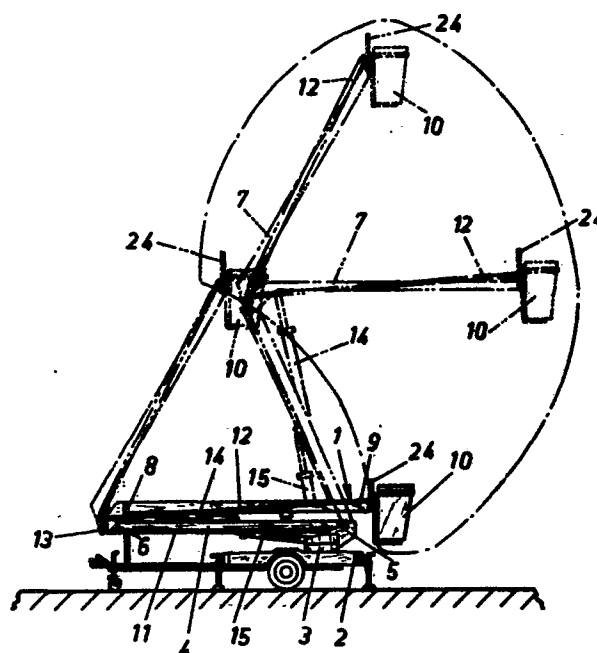
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⑤④ **A safety device in hydraulically operated working-platform elevators.**

⑤⑦ A safety device in working-platform elevators and the like. The elevator comprises two interconnected booms (4 and 7), the lower one (4) of which is mounted to a chassis-mounted stand (3). The working platform or personnel carrier (10) which is connected to the upper boom, is maintained in position by upper and lower parallel arms (11 and 12). These arms are interconnected by a link (13). The upper boom movements relative to the lower boom is controlled by a hydraulic piston-and-cylinder unit (15).

The device is automatically activated upon occurrence of a predetermined angle between the upper boom (7) of the elevator and ground level or is manually operated via controls from the platform. The device comprises a linkage system comprising four link arms (17, 18, 19, 20) interconnecting the hydraulic piston-and-cylinder unit valve with a segment (21). The latter is actuated either by an abutment member (22) on the upper boom or by an actuating means operated from the platform. Movement of the segment resulting from such actuation is transferred via the linkage system to the valve, and the lower boom is lowered. The safety device ensures that the elevator booms cannot assume positions beyond the intended operational range of the elevator and that electric faults and the like cannot prevent lowering of the platform.



A Safety Device in Hydraulically Operated Working-Platform
Elevators

The invention relates to a safety device to ensure that the operational range of working-platform
5 elevators is not exceeded beyond safe limits. The inventive object may be used also to lower the platform.

More precisely, the invention concerns a safety device intended to be used in working-platform elevators of the kind comprising an upper boom and a lower boom
10 which booms are pivotally interconnected at one of their ends by a common mounting shaft, the opposite lower end of the lower boom being pivotally mounted to a chassis-mounted stand and the opposite, upper free end of the upper boom is pivotally mounted to the working platform
15 or personnel carrier, which is maintained in its working position by means of two parallel arms, one upper and one lower. The lower parallel arm is secured at its lower end to the stand whereas the opposite end of this arm is secured to the lower part of a link. The link is mounted
20 on the same mounting shaft that interconnects the two booms for turning movement about said shaft. The upper parallel arm is mounted at its one end to the upper part of the link and at its opposite end to the working platform or personnel carrier. The movements of the upper boom relative to the lower boom are controlled by a hydraulic
25 piston-and-cylinder unit.

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Prior-art safety devices for use in working-platform elevators of this kind consist of so called limit switches, that is an electric position sensor which is positioned on the platform and which is arranged, 5 when the platform of the elevator assumes a predetermined position relative to the upper boom, to actuate the elevator controls via an electric wire to prevent the elevator from assuming a position beyond the intended operational range of the machine. Devices of this kind 10 suffer from certain drawbacks. Interruption of the power supply caused e.g. by breaks on the electric wires included in the system or faults in the battery supplying electric energy to the lifting mechanism renders the device inoperative. In addition, battery faults makes it impossible 15 to lower the lift to ground level.

To solve the problems outlined above the device in accordance with the invention comprises a mechanic position sensing means capable of sensing the position of the working platform and positioned at the articulation 20 joint between the booms. The device operates independently of the controls operating the elevator, for which reason interruption or faults in the operation or function of the latter do not in any way render the device unserviceable. The device has no electric components and 25 consequently electrical faults have no affect on its operation. In addition, the device in accordance with the invention makes it possible for the workmen in the personnel carrier to lower the latter without having to use the electric system, which saves the battery of the 30 elevator. The safety device also functions while other controls are switched on and consequently the servicing personnel on the carrier is able to lower the carrier at all times. This is so also when the working platform is of

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the type which is controlled either from ground or from the carrier itself. Also when the latter is temporarily set to be controlled from ground it is still possible to lower the carrier. According to one characteristic
5 of the invention a spring-biased bolt is positioned adjacent the hydraulic valve so as to be accessible from below in the majority of positions of the working platform. Consequently, the personnel on ground may lower the platform through a simple operation, also when the
10 elevator is temporarily controlled from the platform.

More precisely, the invention is characterised by a linkage system which is connected to a valve in the hydraulic piston-and-cylinder unit controlling the movements of the upper boom relative to the lower boom, said
15 linkage system having one point of articulation on the lower boom and one point of articulation on the lower parallel arm, and by an abutment member on the upper boom, said abutment member arranged, upon upwards pivotal movement of the upper boom past an upper allowable limit
20 position, to abut against a first segment which forms a part of the link arm system, to urge the segment to open the valve in the hydraulic piston-and-cylinder unit via the linkage system to allow said unit to lower the upper boom.

25 The invention will be described in closer detail in the following with reference to the accompanying drawings, wherein

Fig. 1 is a lateral view of a working-platform elevator shown in four different operational positions,

30 Fig. 2 is a lateral view of a folded working-platform elevator incorporating a safety device in accordance with the invention,

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Fig. 3 is a lateral view of the same elevator but showing it in a different position,

Fig. 4 is a view on an enlarged scale of the main portion of the safety device in accordance with the
5 invention,

Fig. 5 is a view of the same part of the elevator as Fig. 4 but showing the situation upon lowering of the working platform or carrier,

Fig. 6 is a view on an enlarged scale of the construction of the articulation joint between the two
10 booms, and

Fig. 7 is a view as seen from the left in Fig. 6.

Fig. 1 shows a working-platform elevator 1 of a known type. It comprises a chassis 2 on which is mounted a rotary stand 3. On the stand is pivotally mounted the
15 lower end 5 of a lower boom 4. On the upper end 6 of the lower boom 4 is pivotally mounted the lower end 8 of an upper boom 7. A working platform or carrier 10 is pivotally mounted to the upper end 9 of boom 7.

Independently of the position of the booms, the
20 carrier or working platform 10 is maintained in the correct working position by means of two pairs of parallel arms, the lower pair 11 of which is pivotally mounted on the chassis-mounted stand and the upper pair 12 on the carrier or working platform. The two pairs of parallel arms are
25 interconnected by means of a link 13, the latter being pivotally mounted on the mounting shaft interconnecting the upper and lower booms. Owing to this arrangement, the platform 10 will always assume a horizontal position allowing the servicing personnel to be standing in an upright
30 position, irrespective of the positions of the booms.

The two booms are operated by means of two hydraulic piston-and-cylinder units, one upper 14 and one

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lower 15. The lower unit is secured both to the stand and to the lower boom while the upper unit is secured both to the lower boom and to the upper boom. Hydraulic flow to and from the hydraulic piston-and-cylinder units is controlled electrically. Sets of controls regulating the hydraulic flows are situated both on the platform and on the stand. In accordance with one alternative arrangement of the elevator only one of the sets of controls may be used at a time. In this case the elevator is equipped with a switching mechanism enabling choice of the set of controls that the operator wishes to be switched on. The operational range of the elevator appears from Fig. 1.

In elevator platforms it is necessary to prevent excess tilting, e.g. that the carrier or working platform is moved to a position beyond the operational range for which the elevator is constructed. The method hitherto used involves placing a so called limit switch between the platform and the upper boom in a position to ensure that the switch is switched on as soon as the working platform is elevated to a critical position. Via an electric system a signal is emitted to stop further elevation of the platform.

Fig. 2 illustrates the manner in which the safety device in accordance with the invention is mounted on a working-platform elevator. A spring-biased bolt 16 is mounted on a valve which when actuated by the bolt, opens the blocking valve regulating the flow to the hydraulic piston-and-cylinder unit 15 to lower the upper boom. The bolt 16 is secured to a first link arm 17 the opposite end of which is pivotally mounted on the lower boom 4. A second link arm 18 is secured at one of its ends to the first link arm 17 and extends along the lower boom 4. At its opposite end the second link arm 18 is secured

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to a third link arm 19, the latter being pivotally mounted on the lower parallel arm 11. To the link arm 19 is secured a fourth link arm 20, extending in parallel with the lower parallel arm and being secured 5 to a first segment 21 (see Fig. 6). This segment is pivotally mounted on the link 13 on the same mounting shaft as is the lower parallel arm 11. The construction of the linkage system and the mounting of the segment are such that movement of the segment corresponding to 10 a counter-clockwise turning movement about its articulation point results in the bolt 16 being pushed inwards with consequential lowering of the upper boom 7. This movement of the segment 21 can be achieved in two different ways. Either the segment may be actuated by an abutment 15 member 22 (see Fig. 6) or else by a second segment 23 which is connected to a control system which is operated from the working platform 10.

The fourth link arm 20 is pivotally mounted on the third arm closer to the point of articulation of the 20 latter on the third link arm 19 than to its point of articulation to the lower parallel arm 11. When the lower boom 4 is raised, a relative movement occurs between the lower boom and the lower parallel arm. This movement causes a counter-clockwise turning movement of the third 25 link arm. Consequently, the fourth link arm will move in such a way that the segment 21 is displaced away from the abutment member 22. As a result, the position of the lower boom will affect the position of the segment 21 in relation to the abutment member 22.

30 An actuating lever 24 is provided on the working platform 10. Connected to the latter is a cable 25 extending through a holder 26 on the upper parallel arm 12. The cable is secured to the second segment 23, the latter being pivotally mounted on the shaft articulating

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the upper parallel arm 12 to the link 13. Pulling of the actuating lever 24 in a direction towards the platform 10 results in tightening of the cable 25 and in a clockwise turning movement of the segment 23 about its mounting shaft, whereby it will actuate the segment 21 and, consequently, in the manner described above, the latter will force the bolt 16 to bring about lowering of the upper boom 7. The actuating lever 24 is arranged in such a manner that irrespective of the position of the upper boom it will always assume the same position relative to the platform 10. The servicing personnel on the platform 10 will always be able to reach the actuating lever quickly and by operating the latter lower the platform to ground level, since irrespective of the position of the lower boom the platform 10 will always be at ground level when the upper boom has been lowered to its maximum. Consequently, the lower hydraulic cylinder unit 14 need not be actuated, when the platform is lowered to ground level.

The abutment member 22 is welded to the upper boom 7. Since the point of attachment of the abutment member is at a level above the pivot shaft of the two booms it will perform a movement relative to the segment 21 upon raising or lowering of the upper boom. Because of the mounting arrangement of the linkage system, according to which the first link arm 17 is secured to the lower boom and the third link arm 19 is secured to the lower parallel arm 11, the position of the segment 21 will change somewhat upon raising or lowering of the lower boom 4, as described in the afore-going. The combined result of these two measures is that the position of the abutment member 22 in relation to the segment 21 will be a direct function of the position of the upper boom relative to the plane

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of the chassis 2. When the upper boom assumes its maximum allowable angular position relative to the horizontal plane of the chassis, the abutment member abuts against the segment 21 and causes lowering of the upper boom 7.

5 Consequently, excess tilting cannot occur.

Fig. 3 illustrates manual lowering of the working platform of the elevator. Pulling of the actuating lever 24 results in a movement of the cable towards the platform 10, forcing the segment 23 to turn clockwise. In
10 doing so, the latter will abut against the segment 21, urging the latter to pivot counter-clockwise. In this movement, the segment 21 brings about the fourth link arm 20 which in turn causes the third link arm 19 to turn about its mounting shaft to the parallel arm 11. The
15 second link arm 18 which is mounted on the third link arm, is also brought along in the movement and is pulled in the direction towards the link 13. The movement of the link arm 18 urges the first link arm 17 to turn about its mounting shaft to the parallel arm 11, whereby the bolt
20 16 is pushed inwards, actuating a first valve which in turn opens a blocking valve controlling the flow to the hydraulic piston-and-cylinder unit 15 and consequently the upper boom 7 is lowered. Automatic lowering of the platform is effected in a corresponding manner, with the
25 exception that the abutment member 22 affects the segment 21.

When actuation on the bolt 16 ceases, either by interruption of the pulling force applied on the actuating lever 24 or by cease of the signal causing the upper boom
30 to assume a critical position close to excess tilting, the bolt 16 springs back to its outer position and the blocking valve 15 of the hydraulic piston-and-cylinder unit 15 closes. Immediately, the elevator can again be operated in the usual manner.

The valve that is actuated by the bolt 16 is inserted between the hydraulic piston-and-cylinder unit and the hydraulic lines to and from that unit, for which reason the safety device in accordance with the invention
5 still is serviceable, also in case of tube ruptures or leakage of hydraulic fluid for some other reason. Power failure interrupting the supply of electric energy or other disturbances cannot either prevent the device in accordance with the invention which is entirely mechanical,
10 from functioning in the intended manner.

Fig. 4 illustrates the positions of the parts of the device that are arranged between the link 13 and the lower part 8 of the upper boom section 7. The abutment member 22 is placed above the mounting shaft of the booms
15 and the link, as mentioned above. The arm 20 is secured to the segment 21. The segment 21 is mounted on the mounting shaft interconnecting the lower parallel arm 11 and the link 13 and is positioned to ensure that it is actuated by the abutment member 22 or the segment 23.
20 The arm 20 is parallel with the parallel arm 11. The arm 17 is essentially parallel with the arm 19.

In accordance with a preferred embodiment of the invention the point of articulation of the arm 20 to the segment 21 is positioned on a straight line extending
25 between the point of articulation of the lower parallel arm 11 to the link and the point of articulation of the boom section 4 and 7 and the link 13. The link 19 extends in parallel with this line.

Fig. 5 illustrates the system when the platform
30 or carrier is elevated and a pulling force is applied on the cable 25 from the platform. The bolt 16 is pushed inwards in the manner described in the afore-going and the upper boom is lowered.

Fig. 6 gives a clearer picture of the positions of the various parts in the area of the mounting shaft of the booms.

Fig. 7 illustrates the relative positions of the various parts in a view from behind.

The safety device in accordance with the invention presents a number of advantages. It prevents operation of the platform or carrier (upper boom) beyond the intended operational range of the elevator and thus prevents excess tilting. The platform or carrier cannot assume an incorrect position in case of ruptures of the hydraulic lines or leakage in the lower hydraulic piston-and-cylinder unit, in other words, if the lower boom should start moving downwards, excess tilting cannot occur. Interruption of the supply of electric energy will not affect the position-limiting function of the device, nor will it prevent lowering of the platform manually. The system will function also in case of failure of a hydraulic valve or other component. Hydraulic lines or electric cables that are incorrectly connected cannot either affect the function of the safety device.

In addition, the safety device in accordance with the invention can be used to lower the carrier or platform manually, whereby the electric system need not be used and the battery of the working platform be relieved.

The embodiment described above is to be regarded as an example only and a variety of modifications are possible within the scope of the appended claims. The cable 25 could for instance be pulled into the upper boom 7 where it will be well protected. The parallel arms 11 and 12 may be single arms instead of arm pairs. Instead of a cable 25 a long stay or similar means could be used.

C l a i m s

1. A safety device in hydraulically operated working-platform elevators, comprising an upper boom and a lower boom, which booms are pivotally inter-
5 connected at one of their ends by a common mounting shaft, the opposite lower end of the lower boom being pivotally mounted to a chassis-mounted stand, whereas on the opposite, upper free end of the upper boom is pivotally mounted the working platform or personnel
10 carrier, said working platform or carrier being maintained in its working position by means of one lower and one upper parallel arm, the lower one of which is secured at its lower end to the stand whereas the opposite end of this arm is secured to the lower part
15 of a link, said link being mounted on said pivotal shaft common to the two booms for turning movement about said shaft, one end of the upper parallel arm mounted to the upper part of said link and at its opposite end to the working platform or carrier, the movements of the upper
20 boom relative to the lower boom being controlled by a hydraulic piston-and-cylinder unit, c h a r a c t e r - i s e d b y

a linkage system which is connected to a valve in said hydraulic piston-and-cylinder unit, said
25 linkage system having one point of articulation on the lower boom and one point of articulation on the lower parallel arm, and

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by an abutment member on the upper boom, said abutment member arranged, upon pivotal movement upwards of the upper boom past an upper allowable limit position, to abut against a first segment which forms a part of the linkage system, to urge the segment to open the valve in the hydraulic piston-and-cylinder unit via the linkage system to allow said unit to lower the upper boom.

2. A safety device as claimed in claim 1, characterised in that said linkage system comprises a first arm which is pivotally mounted on the lower boom, a second arm which is pivotally mounted on the first arm and to a third arm, said third arm in turn being pivotally mounted to the lower parallel arm, and a fourth arm which is pivotally mounted both on the third arm between the points of articulation of the latter to the second arm and the lower parallel arm, and on the first segment, the latter being pivotally mounted on the link.

3. A safety device as claimed in any one of the preceding claims, characterised in that the first arm of the linkage system is arranged to actuate the valve of the hydraulic piston-and-cylinder unit and is coupled to said valve via a spring-biased bolt.

4. A safety device as claimed in any one of the preceding claims, characterised in that an actuating lever is provided on or adjacent the working platform, a wire, cable or the like connecting said actuating lever with a second segment, said second segment being pivotally mounted adjacent the first segment and arranged, upon actuation of said actuating lever, to move into abutment against the first segment, bringing the latter to open said valve of the hydraulic piston-and-cylinder unit via the linkage system.

Fig.1

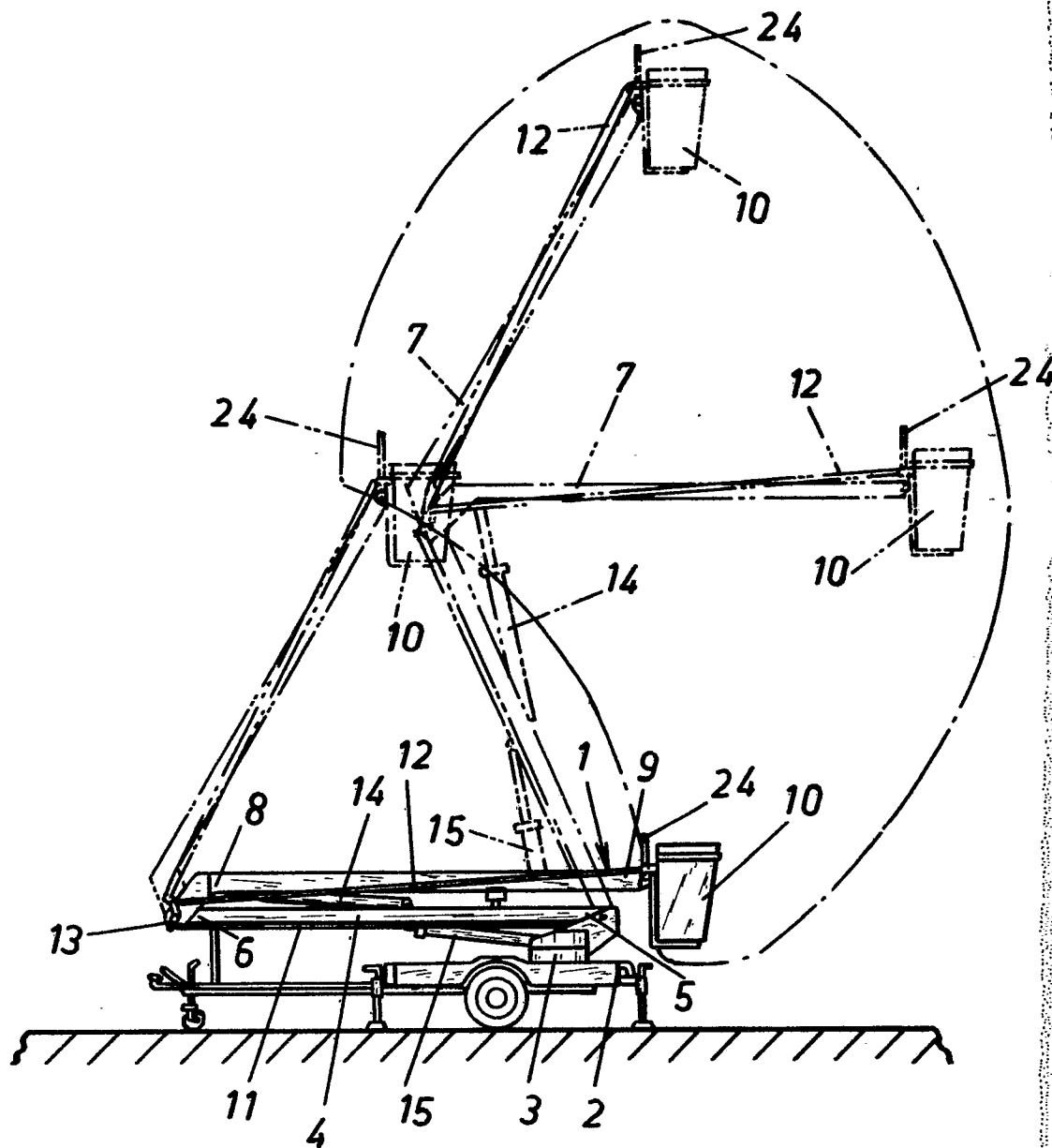


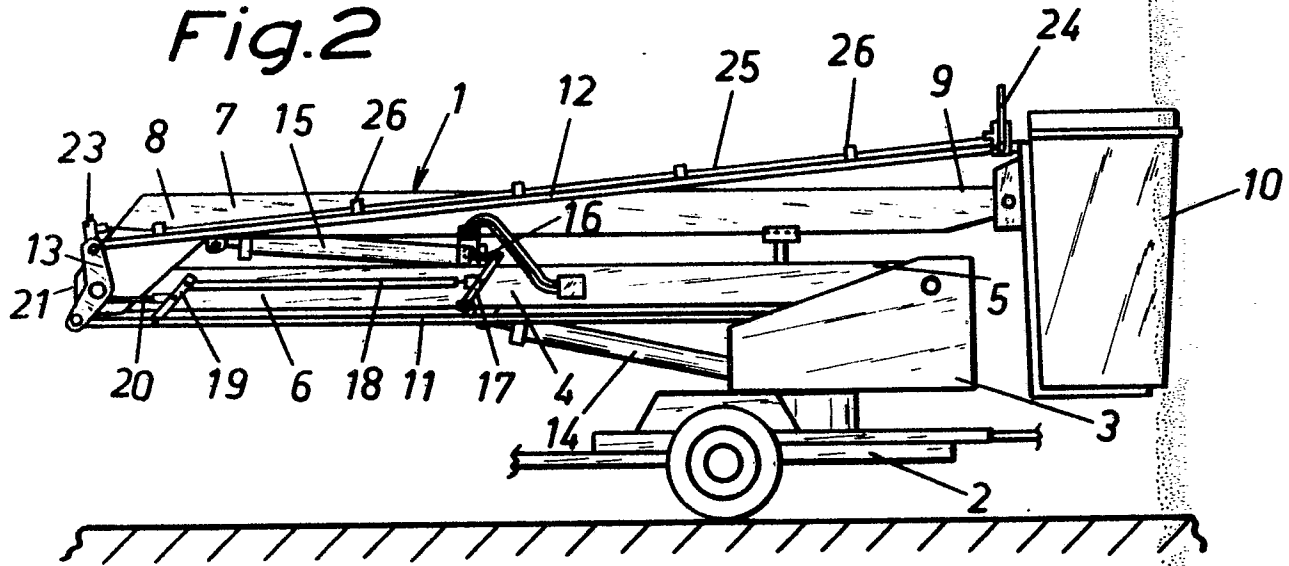
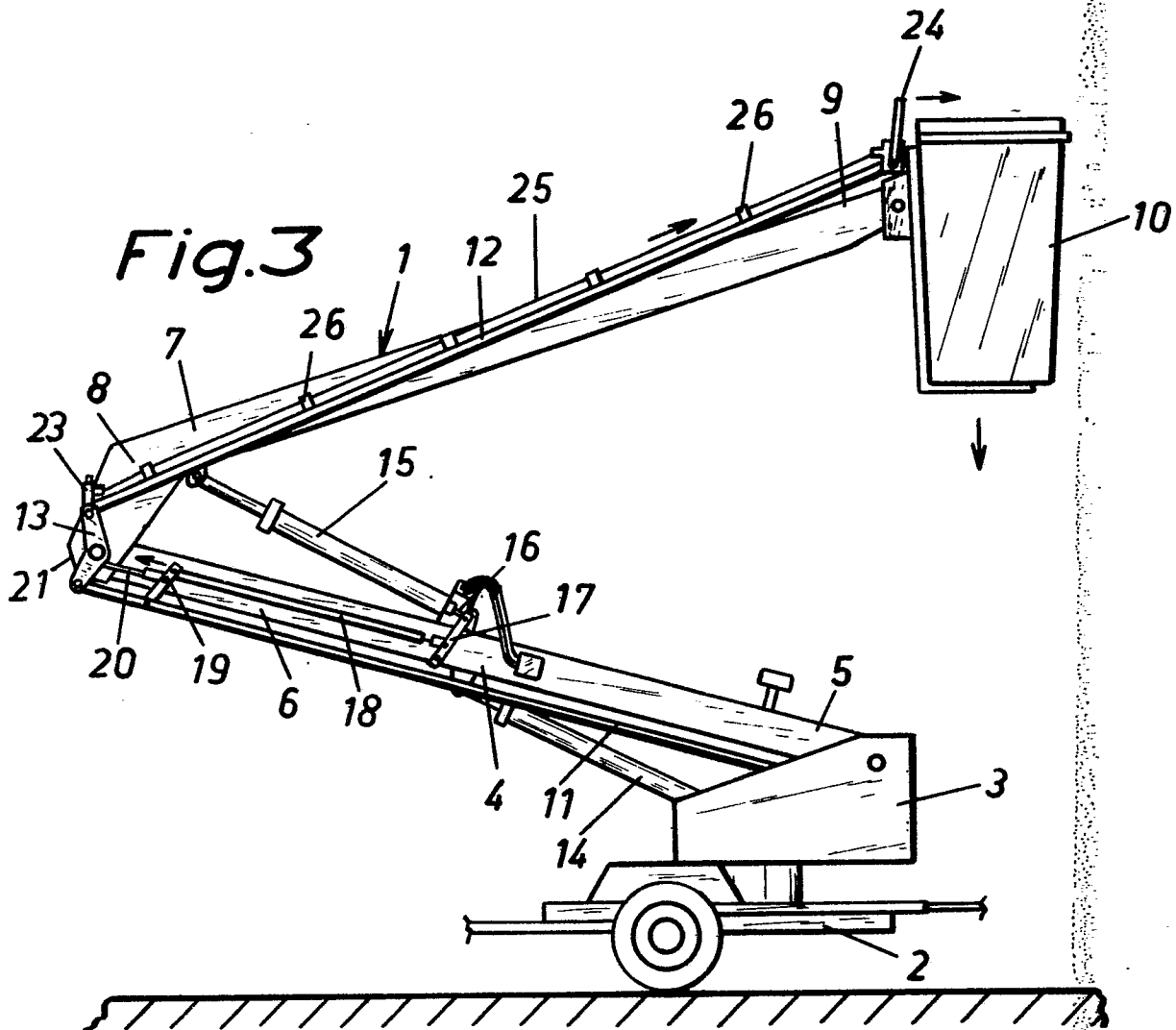
Fig.2*Fig.3*

Fig. 4

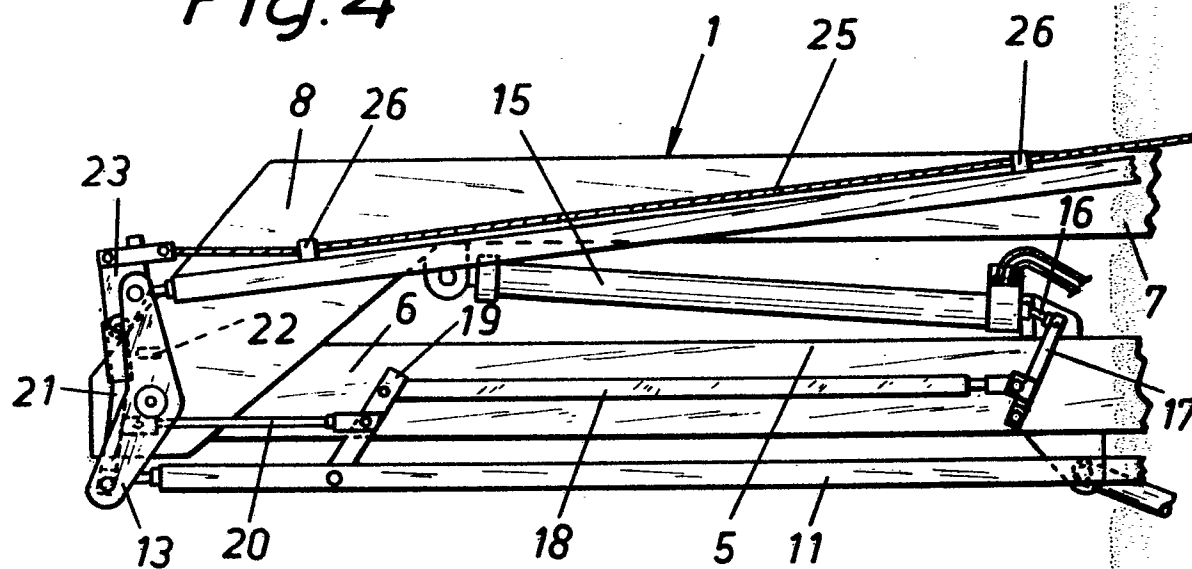


Fig.5

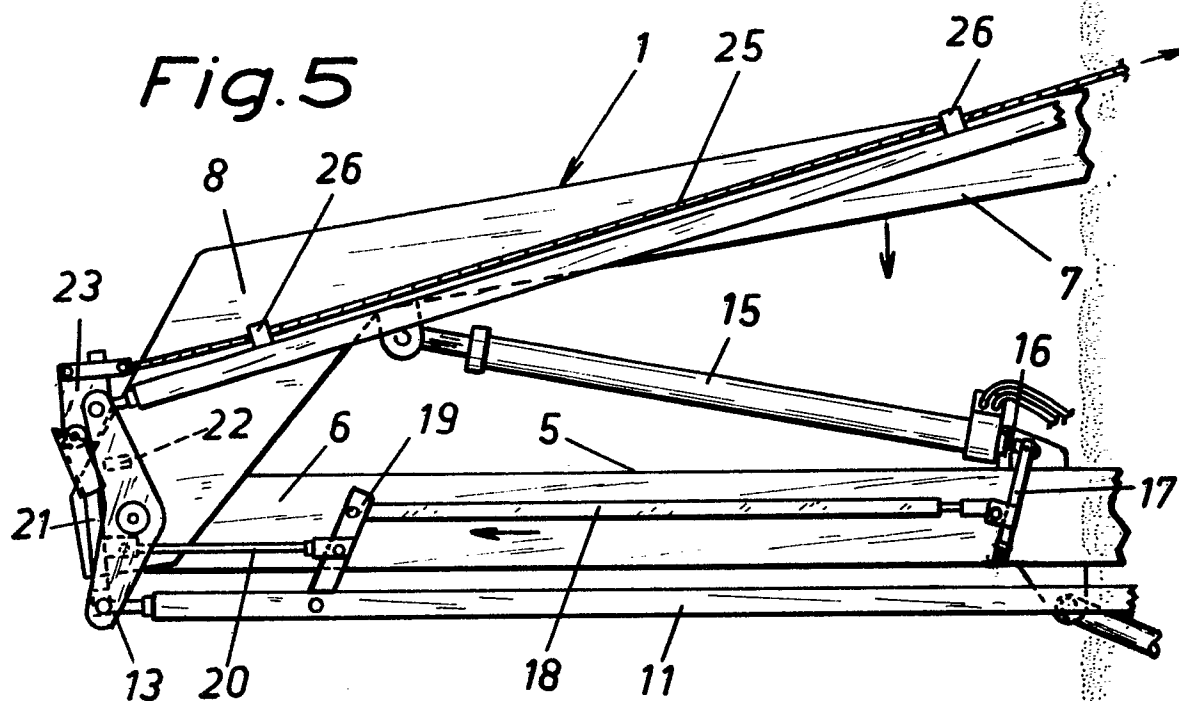
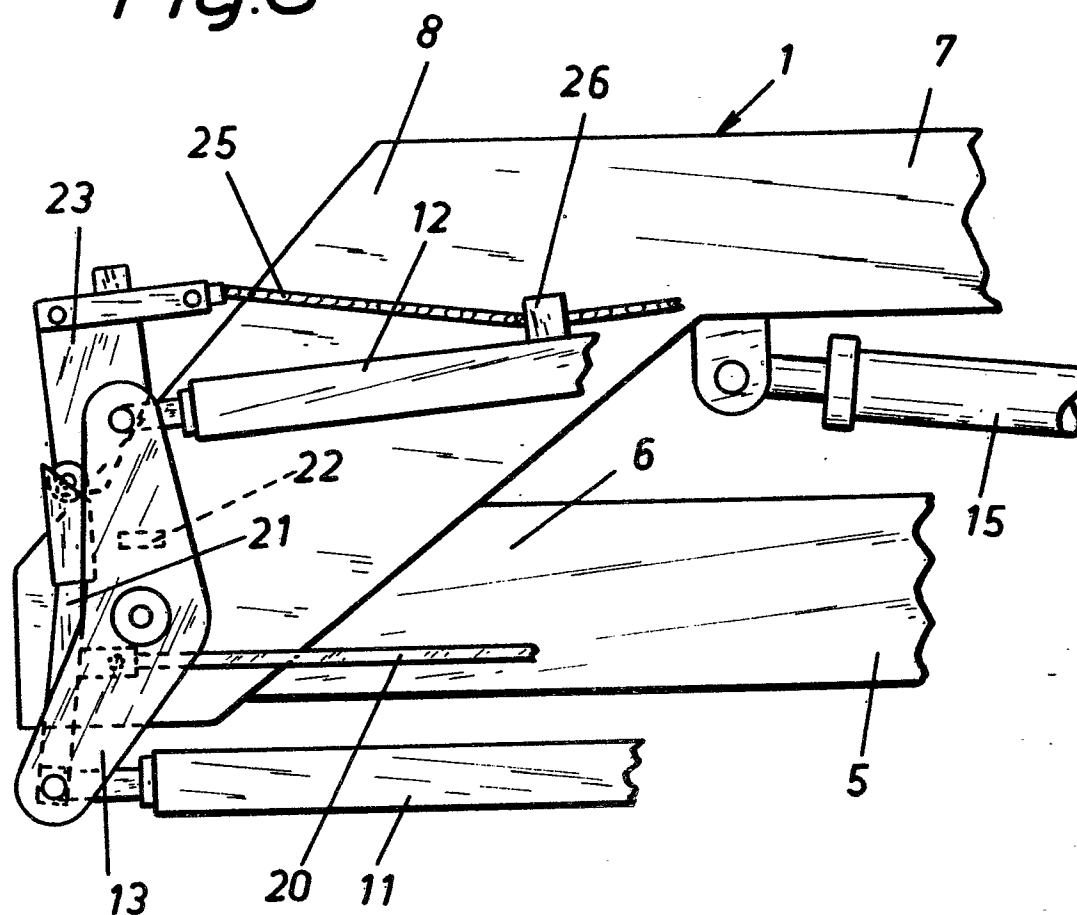


Fig.6*Fig.7*