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(71) Applicant: S.p.A. CASSEFORME METALLICHE E  
AFFINI S.A.C.M.A.  
Via XX Settembre, 24  
I-20123 Milano(IT)  
Applicant: SAEM SERVIZI AGRICOLI  
EDILMECCANICI S.p.A.  
Contrada Passo Martino o Valindeddu Strada  
Provinciale 69 KM 17,400  
I-95100 Catania(IT)

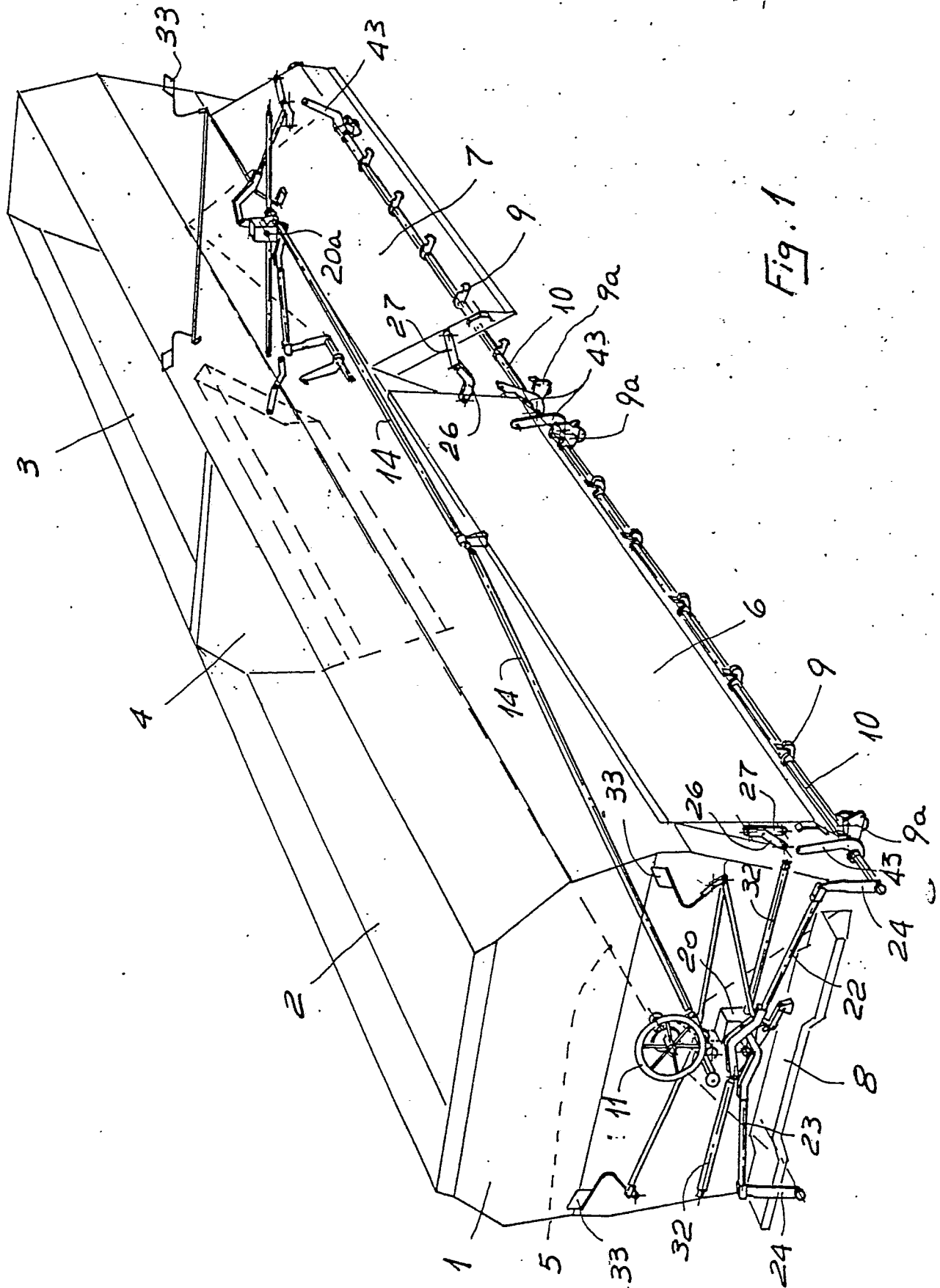
(72) Inventor: Miniotto, Pietro  
c/o S.A.C.M.A. Via XX Settembre, 24  
Milano(IT)  
Inventor: Rendo, Ugo  
c/o SAEM Via Guglielmo Saliceto, 8  
Roma(IT)

(74) Representative: Raimondi, Alfredo, Dott. Ing. Prof et  
al  
Studio Tecnico Consulenza Brevetti Piazzale  
Cadorna 15  
I-20123 Milano(IT)

(54) Hopper car with multiple bins having separate discharge drives.

(57) The present invention relates to a railway hopper car with multiple bins having independent, bilateral gravity discharge, wherein the drives for disengaging the opening may be given from the operation platform either for the hatches adjacent to it or for the hatches located at the opposite side of the car, wherein the driving and transmission means operate with low stress, wherein there are provided means for selecting the couple of hatches to be opened from the platform, means for preventing the hatches from non desired self-closing and means for a driven opening of same, wherein, moreover, the possibility is avoided of accidental opening of non selected hatches.

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## Hopper car with multiple bins having separate discharge drives

Bulk cargos such as coal, gravel, sand cargos and the like are normally transported by rail in hopper cars; such cars are usually fitted with two separate bins for loading, while the discharge of the materials contained therein is effected by gravity through two large side hatches for each bin, wherein the hatches are opened by drive means into dump pits.

Such dump pits, however, often do not present dimensions wide enough to collect the material discharged along the entire length of the car; therefore there is the need to effect separately the discharge of the bins of the car, separately opening the correspondent hatches.

For this purpose cars have been realized having separate release drives for each couple of hatches, but with these cars the operator must go round the car to reach the drive means from earth, because it is not possible to effect the complete operation from the control platform of the car.

A car has also been provided by the same owner of the present invention, having independent drive means for the hatches which may be actuated from the control platform, but the car, however, cannot be operated from earth at both ends and it is also fitted with a complex mechanism for operating the opening devices.

A further requirement relates to the necessity, in case of improper functioning of the drive and transmission means, of avoiding the unintentional opening of a pair of hatches which are out of the discharge area at the same time of, or instead of the hatches whose opening has been operated.

These and other technical problems are solved, as it will be apparent from the following description, by the present invention, which provides a railway hopper car with bilateral gravity discharge and separate bins, comprising a container body formed by two or more consecutive, separate loading bins, each of these bins being provided with two openings on the opposite sides of the car, which may be closed by means of hatches hinged at their upper side, each of the hatches being fitted with a plurality of locking hooks along the lower border; the hooks are fixedly carried by a shaft which is rotatively supported on the body of the car; the shafts carrying the locking hooks relative to the hatches of each of the loading bins being arranged to rotate, at choice, for unlocking the opening of the hatches by means of mechanical transmission lever mechanisms, through a reduction gear of the irreversible type which is hand-controlled by means of shanks accessible from earth which are directly connected to the reduction gear and, in addition, by means of a handwheel which may be connected to the reduction gear through a mechanical transmission comprising a selector capable of rotationally coupling to the handwheel the reduction gear corresponding to the couple of hatches whose opening has been selected; the locking hooks being provided with means apt to hinder the complete self-closing of the hatches by gravity; there being provided, moreover, means which may be actuated through the reduction gear, by means of the shanks or the handwheel, for the driven opening of the hatches and also means for signalling the opening of the selected couple of hatches, which are actuated by the mechanical transmission lever mechanisms.

In particular, the lever mechanisms comprise a rocker keyed to the output or slow shaft of the reduction gear, at the ends of which there are hinged the extremities of two connecting rods which are, at the opposited extremities, hinged to two arms joined to the shafts carrying the locking hooks, wherein the rotation in one direction of the rocking

lever is transmitted to the arms through the connecting rods, so as to cause rotation of the shafts in the sense suitable to disengage the locking hooks from the hatches, and in the opposite sense so as to cause the clamp of the hatches by means of the locking hooks.

For a greater closure safety, when the locking hooks are in position of clamping the hatches, the axis of the rocker intersects the action axis of both the connecting rods or is laying beyond the axis, in the closing direction.

The handwheel may be connected, through the selector and possible transmission shafts, to every reduction gear actuating the couple of hatches of each separate bin of the car; therefore, it is possible, by this way, to operate the opening of the selected couple of hatches by means of the handwheel itself.

At least one of the locking hooks of each hatch is provided with a hindering foot which projects upwards, beyond the edge of the hooks, and interferes with the opening path of the hatches when the hooks are in a first rotation position apt to free the hatches, the foot being free to rotate in the sense of the opening and rotationally blocked in the opposite sense, being capable in such rotation position of the hooks of non hindering the hatches from a free opening and at the same time, however, hindering them from a total closure movement, whereas a further rotation of the shafts carrying the locking hooks bears the hindering foot, or feet, out of the movement path of the hatches, thereby making their closing possible.

The means for driving the opening of the hatches consist of shaped arms fixedly joined to the shafts which carry the locking hooks, having at their ends rollers suitable to act against sliding blocks linked to the flanks of the hatches when the shafts are rotated in the opening sense beyond the unlocking point of the locking hooks and the hindering feet.

The means signalling the opening of the hatches consist of two flags for each couple of hatches, which can rotate between a position enclosed in the side shape of the car and a position projecting from same; the flags being rotationally driven by connecting rods and cranks actuated by a staff hinged to a swivelling block which by gravity maintains the flags projecting out of the car shape, there being provided an arm joined rotationally to the rocker, suitable to act on the swivelling block when the rocker is rotated into the closing position, beyond the intersection position of its rotational axis with the action axes of the connecting rods.

Conveniently, the selector is formed by a bilateral clutch which is rotationally joined, through a chain transmission or the like, to the handwheel and may be rotationally coupled, through a control lever, either with a corresponding clutch carried by a transmission shaft connected to a reduction gear relative to a couple of hatches located remote from the handwheel, or to a transmission shaft connected to a reduction gear relative to a couple of hatches located adjacent to the car head carrying the handwheel; the transmission shafts being independently supported by self-lubricating bushes carried by separate supporting elements and both being fixed to the car structure, so that the possible seizing of a bush may not bring the non selected shaft into rotation.

A more detailed description is following, with reference to the accompanying drawings in which:

Figure 1 is an assembly view of a car equipped with the discharge drives of the hatches according to the invention,

Figure 2 is a plan schematic representation of the hatches,

Figure 3 is a view of a car end, having the hatches in the closed position,

Figure 4 shows the view of figure 3 having the hatches in the opening phase,

Figure 5 shows the control levers of the flags signalling the opening of the hatches,

Figure 6 is the view of figure 3 with the hatches in driven opening condition,

Figure 7 is a side view of the opening selector, partially in section,

Figure 8 shows the selector of figure 7 in a view from the top.

As shown in fig. 1, a hopper car is usually formed by a body 1 subdivided into two bins 2, 3 separated by a wall 4. Inside of the loading bins there is provided a prismatic element 5, whose contour is dash-lined in the figure, having two oblique surfaces suitable to convey the contained material towards the couples of hatches 6, 7, relative to the front bin 2 and the back bin 3 respectively, with reference to the control platform 8 of the car.

The hatches 6, 7 are hinged, adjacent to their upper side, to the body 1 of the car, as shown in figure 1 and their center of gravity is so provided that they may rest in closure position by effect of their own weight.

The clamp of the hatches 6, 7 in the closure position capable of standing the thrust of the material contained in the car is assured by a plurality of locking hooks 9, 9a, supported by shafts 10, located below the lower border of the hatches, at the two opposite sides of the car.

The opening of the hatches, for enabling to discharge the material contained in one of the two bins 2, 3 of the car, is caused by the thrust of the material itself which flows along the oblique flanks of the inner prismatic element 5 when the shafts 10, carrying the locking hooks 9, 9a relative to the couple of hatches whose opening has been selected, are rotated of an angle sufficient to disengage the hooks 9, 9a from the border of the hatches (see fig. 3 and 4).

Rotation of the shafts 10 is achieved by means of a drive group, as illustrated in figure 2 in schematic form and partially visible in transparence in figure 1, wherein the drive group is represented by thick lines whereas the external shape of the car is represented by thin lines; it comprises a handwheel 11 connected through a chain 12 to a selector 13 suitable to select the pair of hatches, in the front or back side, which are to be opened.

The selector 13 may, in fact, connect the handwheel 11, through the gear wheels 15, 16 and a second transmission chain 17, to a shaft 18 that is in turn connected, through a bevel gears pair 19, to the input or quick shaft of a reduction gear 20 or to the cardanic transmission shaft 14, which is coupled, at the opposite end of the car, to a second bevel gears pair 19a and to a second reduction gear 20a.

The output shaft of the reduction gears 20 and 20a carries a rocker 21, at the ends of which are connected the shaped connecting rods 22, 23 which are pivoted at their end on the arms 24 joined to the shafts 10 carrying the hooks 9, 9a.

The rotation of the rocker 21 in the sense indicated by the arrow F of fig. 4, driven by the handwheel 11 via the selector 13 and the reduction gear 20 (or the reduction gear 20a relatively to the position of the selector) causes, therefore, through the connecting rods 22, 23, the rotation of the couple of shafts 10 selected and relative hooks 9, 9a until the lower border of the hatches 6 (or 7) disengages itself, the hatches becoming thus free to open under the thrust of the contained material, by rotating about their own axes, being restrained by opening limit rods 26, 27 which are hinged to each other.

The locking hooks 9, arranged in middle position along the border of the hatches 6, 7 are shaped as shown in the left side of figure 3; the end locking hooks 9a are shaped as illustrated in the right portion of figure 3 and also in figures 4 and 5, and exhibit a projecting part which carries a pivot 28 about which the hindering foot 29 may swivel, being fitted with a counterweight 30 and resting against the stop pin 31.

In the opening phase the hindering foot 29 does not represent an obstacle to the hatches movement as it is free to swivel about the pivot 28 under the thrust of the hatches themselves, as shown by dot-and-dash line in the right part of fig. 4; in the closing phase of the hatches, under the action of their own weight, when the thrust produced by the flowing material is lowering, the hindering feet 29 blocks the hatches themselves in partial opening position, as shown by a dot-and-dash line in the left part of fig. 4, because their rotation in the sense given by the thrust of the hatches in closing phase is blocked by the stop pins 31, so as to enable the total discharge of the car; the complete closing is therefore made possible by a further rotation of the rocker 21 only, in the sense indicated by the arrow F of fig. 4, so as to bring the hindering foot 29 below the lower border of the hatches 6 (or 7).

The input shafts to the reduction gears 20, 20a are besides connected with the shanks 32 for operation from earth,

by which it is possible to carry out the operation of opening the hatches from earth; this operation is only possible when the selector 13 is in idle position, as the reduction gears 20, 20a are of the irreversible type, for example an endless screw, in order to prevent the handwheel 11 from being unvoluntarily brought into rotation by actuating the shanks 32, thus with danger of accident for a person casually staying on the platform in same moment.

The opening of the hatches is associated with a signal constituted by flags 33 which are projecting from the car shape, as shown in fig. 1 and 3, when the lever mechanisms for driving the hatches have been removed from their safety block position.

The closing position, in fact, wherein the hooks 9, 9a lock the hatches, as shown in fig. 3, presents the rotation axis of the rocker 21 placed on the action axis of the connecting rods 22, 23 coupling the corresponding linking axes of the connecting rod itself with the rocker 21 and the arms 24.

Such position, representing a dead point, is not stable and the complete closure is therefore achieved through a further rotation of the rocker 21, according to the arrows G, shown in fig. 5, bringing it beyond the dead point, thanks to the resilience of connecting rods 22, 23, into a firmly closed position.

The signalling flags 33 are carried by the supports 34 swivelling about the pivots 35; the supports 34 are also fitted with levers 36, one of which is connected with a staff 37, hinged to a heavy block 38, which is swivelling about the pivot 39. A connecting rod 40, curved for space reasons, joins the ends of the levers 36, thus enabling a joined movement of the two flags 33 at both sides of the car.

On the output shaft of reduction gears 20, 20a, besides the rocker 21, there is linked an arm 40 which carries a pin 41 suitable to come into contact with the pivot 42 of the block 38 when the rocker 21 is rotated into the position of fig. 3, i.e. corresponding to the dead point; in this phase, therefore, the flags 33 are still in opening position, as shown in figure.

Only a conclusive rotation of the rocker 21 together with the arm 40 rotationally joined to it, causes the pin 41 to act against the pivot 42, producing rotation of block 38 in the sense of the arrow H and, through the staff 37 and the connecting rod 40, rotation of the flags 33 into the closure position, as shown in figure 5.

In order to enable the opening of the hatches, also when there is no material to discharge, i.e. for maintenance servicing and the like, or when the thrust of the material contained in the car is not sufficient, the shafts 10 carry, in correspondence to the extremities of the hatches 6, 7, the shaped arms 43, having an end roller 44 suitable to act against the sliding blocks 45 linked to the flanks of the hatches 6, 7.

The, going on with the opening movement, by rotating the rocker 21 in the sense indicated by the arrow F, the hatches are pushed into the opening position, as shown in figure 6, and firmly kept in this position.

In fig. 7 and 8 the selector 13 is illustrated in a preferred embodiment.

It comprises the gear wheel 15, joined to the front clutch 46, rotatively supported through the self-lubricating bushes 47 on the hollow support housing 48 linked to the car structure; inside of the hollow housing 48 the shaft 51 may rotate on the self-lubricating bushes 49, 50, the shaft 51 carrying at one end the keyed gear wheel 52 for coupling with handwheel 11, and at the other end the rotatively joined and axially moveable bilateral coupling element 53, on the front of which, at the opposite side with regard to the frontal clutch 46, there is located the frontal clutch 54 linked with the shaft 55.

The shaft 55 is carried by the bush support 56 and is connected at its end with the cardanic shaft 14.

The bilateral coupling element 53 may be brought into the position of engagement with the frontal coupling 46 or with the frontal coupling 54, or maintained in a middle position, or "idle" position, through the lever 57 having three fixed stop positions which may be disengaged through the knob 58, as shown by dash-and-dot line in figure 7.

The selector 13 keeps the shaft 55 and the gear wheel 15 separated and independent; in this way, it is not possible that, in case of seizing of the self-lubricating bushes supporting the rotary elements, a non selected couple of hatches is also brought into rotation, as it would occur if the gear 15 were supported by bushes placed directly on the shaft 51, in case of seizing and blocking of the bushes.

The opening limiting rods 26, hinged at one end of the car structure, present a curvilinear shape; such a shape serves to establish a free space between the car wall and the surface of the rod 26 which is substantially larger than the maximum size of the transported material; this to the

aim of assuring that possible material deposited on the surface of the rods may not remain closed, during unloading, between the same and the car, thus hindering a complete closing movement of the hatches.

A curvilinear conformation, for the same above mentioned purpose, is provided for the arms 24 too, which, as they are also located in the area subject to material flowing, have not to be in condition of holding back some material against the car wall, what would hinder the hooks 9, 9a from their complete closing movement causing the clamp of the hatches.

Therefore, the opening mechanism according to the present invention proves to be especially safe and reliable, besides economically convenient, since the transmissions and selection of the hatches to be opened are carried out at high speed, upstream to the reduction gears and consequently with low driving torques.

The car structure may be built according to the known art; it has, therefore, not to be described here in detail.

Many variations may be introduced without, however, moving away from the general context of the present invention and its global characteristics.

## Claims

1) A railway hopper car with separate bins having bilateral gravity discharge, characterized in that it comprises a container body formed by two or more consecutive, separate loading bins, each of these bins being provided with two openings on the opposite sides of the car, which may be closed by means of hatches hinged at their upper side, each of the hatches being fitted with a plurality of locking hooks along the lower border; the hooks are fixedly carried by a shaft which is rotatively supported on the body of the car; the shafts carrying the locking hooks relative to the hatches of each of the loading bins being arranged to rotate, at choice, for unlocking the opening of the hatches by means of mechanical transmission lever mechanisms, through a reduction gear of the irreversible type which is hand-controlled by means of shanks accessible from earth which are directly connected to the reduction gear and, in addition, by means of a handwheel which may be connected to the reduction gear through a mechanical transmission comprising a selector capable of rotationally coupling to the handwheel the reduction gear corresponding to the couple of hatches whose opening has been selected; the locking hooks being provided with means apt to hinder the complete self-closing of the hatches by gravity; there being provided, moreover, means which may be actuated through the reduction gear, by means of the shanks or the handwheel, for the driven opening of the hatches and also means for signalling the opening of the selected couple of hatches, which are actuated by the mechanical transmission lever mechanisms.

2) A railways hopper car with separate bins having bilateral gravity discharge according to the preceding claim, characterized in that the lever mechanisms comprise a rocker keyed to the output or slow shaft of the reduction gear, at the ends of which there are hinged the extremities of two connecting rods which are, at the opposite extremities, hinged to two arms joined to the shafts carrying the locking hooks, wherein the rotation in one direction of the rocking lever is transmitted to the arms through the connecting rods, so as to cause rotation of the shafts in the sense suitable to disengage the locking hooks from the hatches, and in the opposite sense so as to cause the clamp of the hatches by

means of the locking hooks.

3) A railways hopper car with separate bins having bilateral gravity discharge according to the preceding claims, characterized in that the axis of the rocker intersects the action axis of both the connecting rods or is laying beyond the axis, in the closing direction.

4) A railways hopper car with separate bins having bilateral gravity discharge according to the preceding claims, characterized in that the handwheel may be connected, through the selector and possible transmission shafts, to each reduction gear actuating the couple of hatches of each separate bin of the car.

5) A railways hopper car with separate bins having bilateral gravity discharge according to the preceding claims, characterized in that at least one of the locking hooks of each hatch is provided with a hindering foot which projects upwards, beyond the edge of the hooks, and interferes with the opening path of the hatches when the hooks are in a first rotation position apt to free the hatches, the foot being free to rotate in the sense of the opening and rotationally blocked in the opposite sense, being capable in such rotation position of the hooks of non hindering the hatches from a free opening and at the same time, however, hindering them from a total closure movement, whereas a further rotation of the shafts carrying the locking hooks bears the hindering foot, or feet, out of the movement path of the hatches, thereby making their closure possible.

6) A railways hopper car with separate bins having bilateral gravity discharge according to the preceding claims, characterized in that the means for driving the opening of the hatches consist of shaped arms fixedly joined to the shafts which carry the locking hooks, having at their ends rollers suitable to act against sliding blocks linked to the flanks of

the hatches when the shafts are rotated in the opening sense beyond the unlocking point of the locking hooks and the hindering feet.

5 7) A railways hopper car with separate bins having bilateral gravity discharge according to the preceding claims, characterized in that the means signalling the opening of the hatches consist of two flags for each couple of hatches, which can rotate between a position enclosed in the side shape of the car and a position projecting from same; the flags being rotationally driven by connecting rods and cranks actuated by a staff hinged to a swivelling block which by gravity maintains the flags projecting out of the car shape, there being provided an arm joined rotationally to the rocker, suitable to act on the swivelling block when the rocker is rotated into the closing position, beyond the intersection position of its rotational axis with the action axes of the connecting rods.

10 7) A railways hopper car with separate bins having bilateral gravity discharge according to the preceding claims, characterized in that the means signalling the opening of the hatches consist of two flags for each couple of hatches, which can rotate between a position enclosed in the side shape of the car and a position projecting from same; the flags being rotationally driven by connecting rods and cranks actuated by a staff hinged to a swivelling block which by gravity maintains the flags projecting out of the car shape, there being provided an arm joined rotationally to the rocker, suitable to act on the swivelling block when the rocker is rotated into the closing position, beyond the intersection position of its rotational axis with the action axes of the connecting rods.

15 8) A railways hopper car with separate bins having bilateral gravity discharge according to the preceding claims, characterized in that the selector is formed by a bilateral clutch which is rotationally joined, through a chain transmission or the like, to the handwheel and may be rotationally coupled, through a control lever, either with a corresponding clutch carried by a transmission shaft connected to a reduction gear relative to a couple of hatches located remote from the handwheel, or to a transmission shaft connected to a reduction gear relative to a couple of hatches located adjacent to the car head carrying the handwheel; the transmission shafts being independently supported by self-lubricating bushes carried by separate supporting elements and both being fixed to the car structure, so that the possible seizing of a bush may not bring the non selected shaft into rotation.

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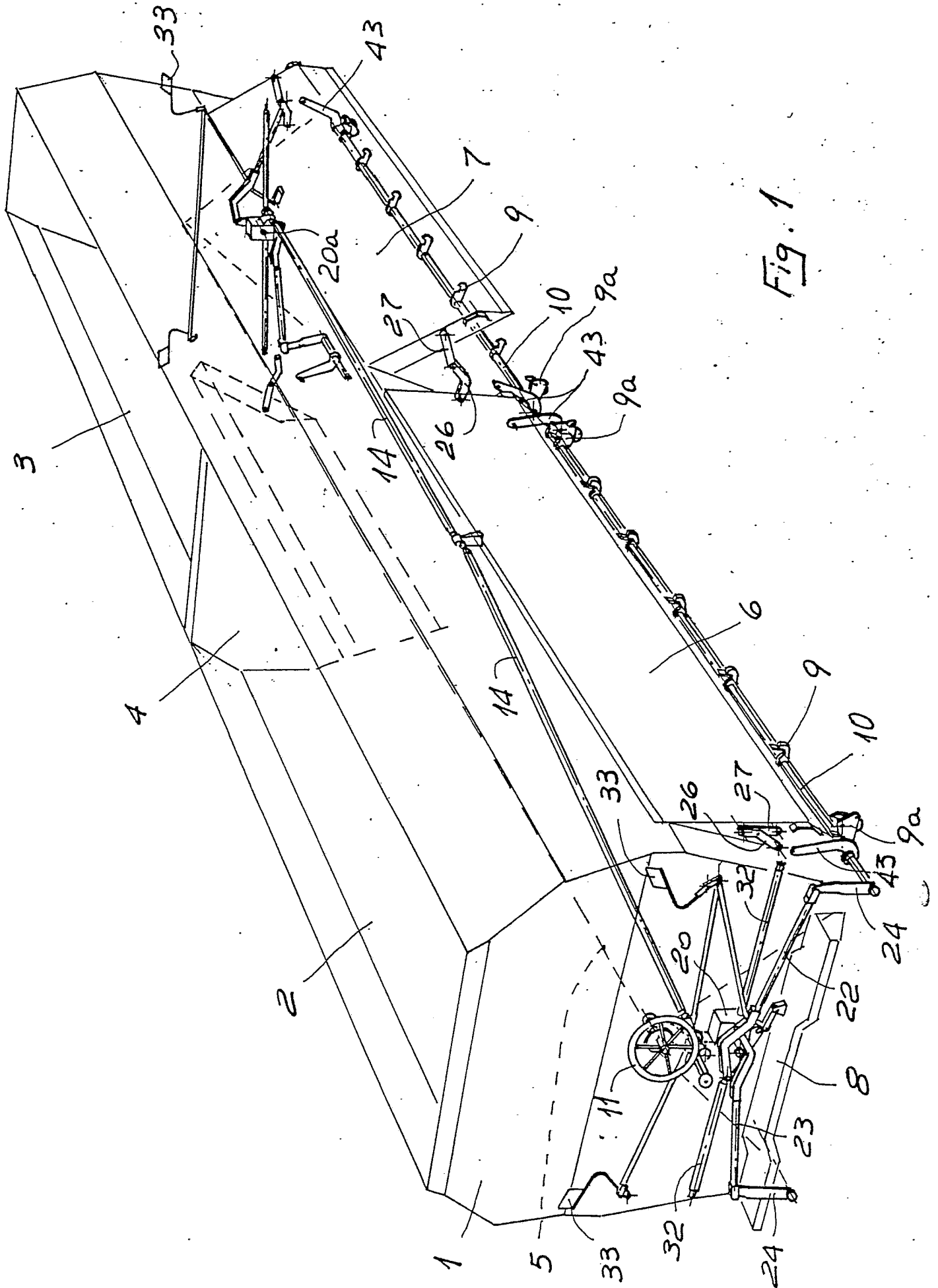
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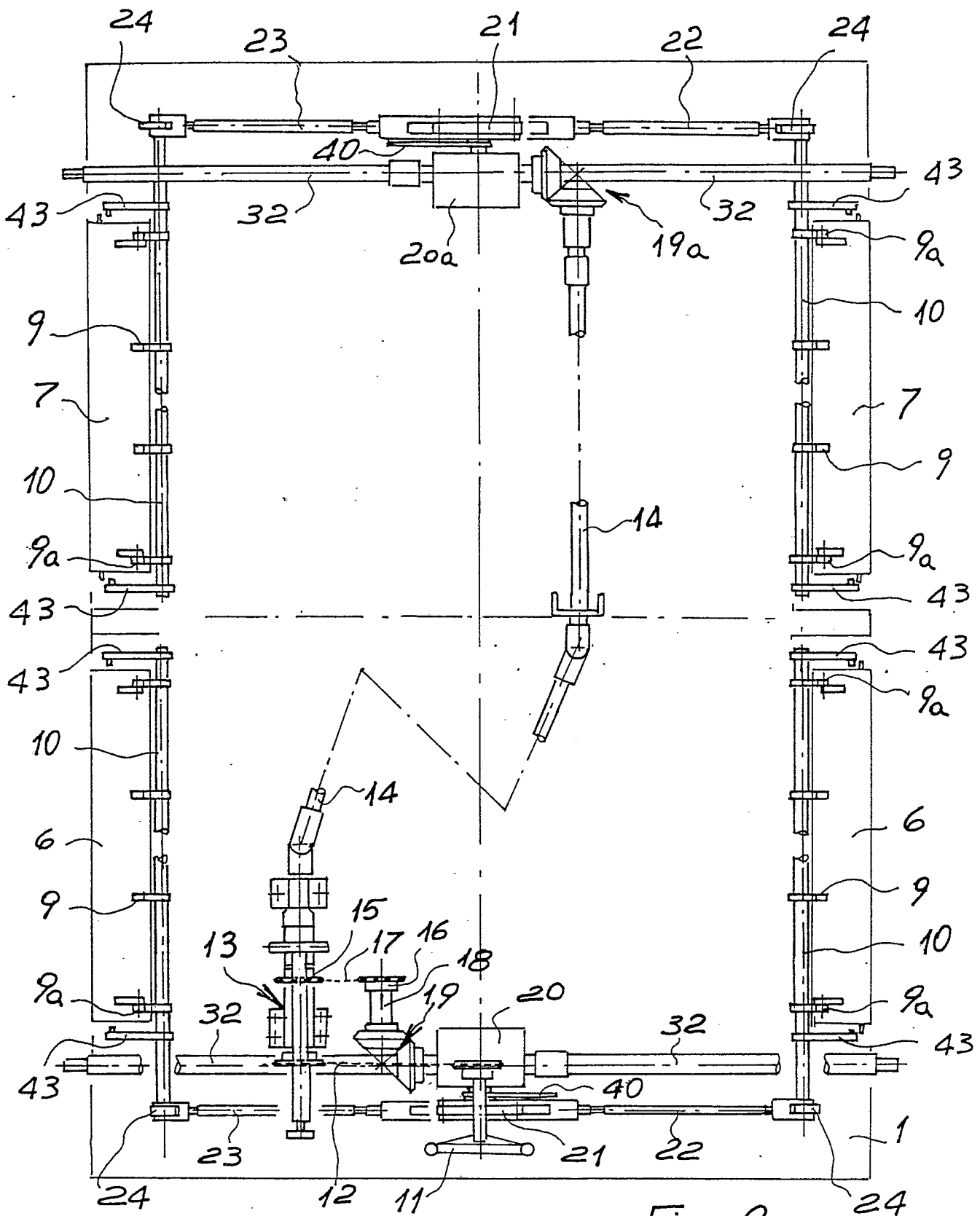


Fig. 2

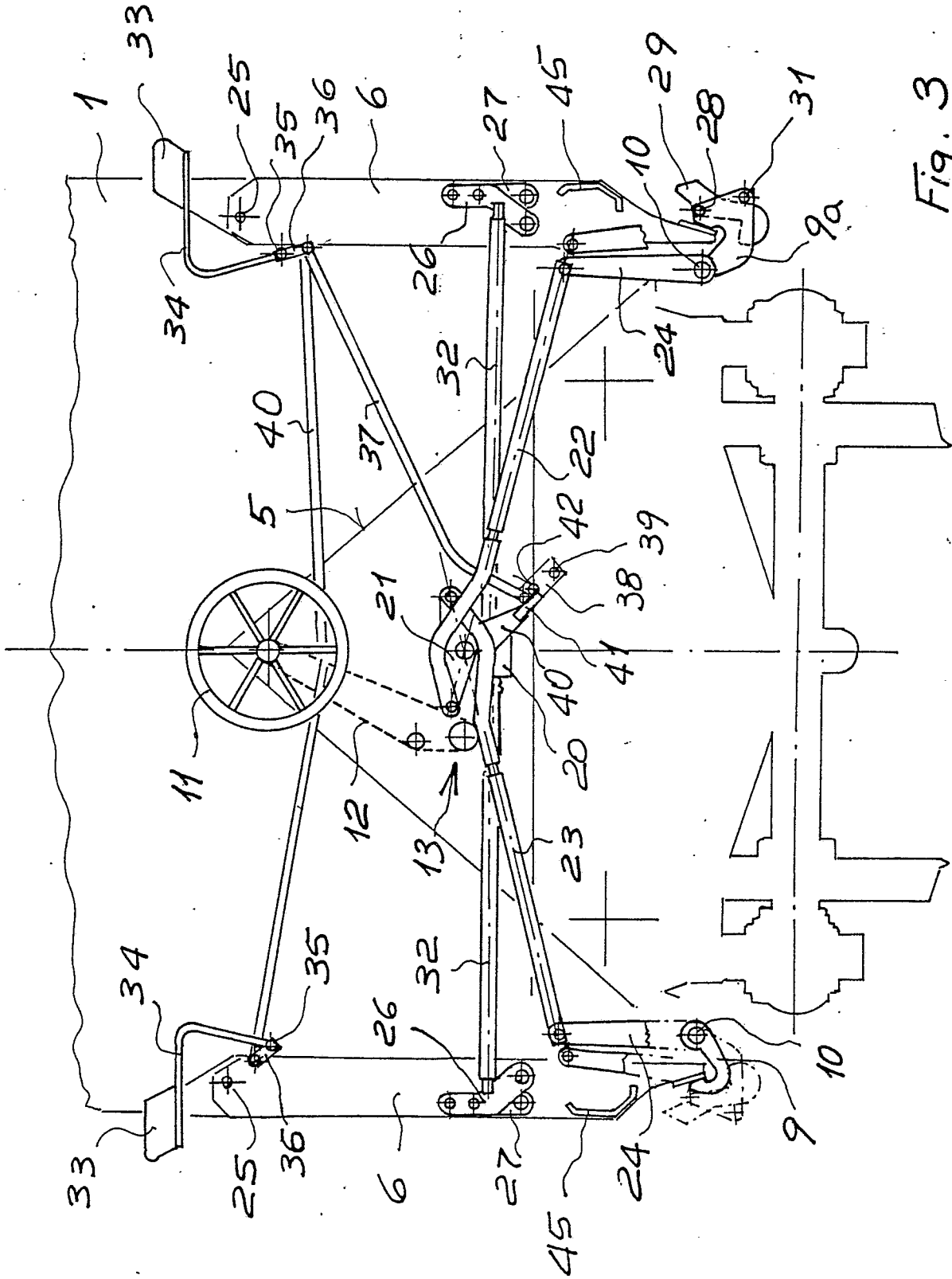
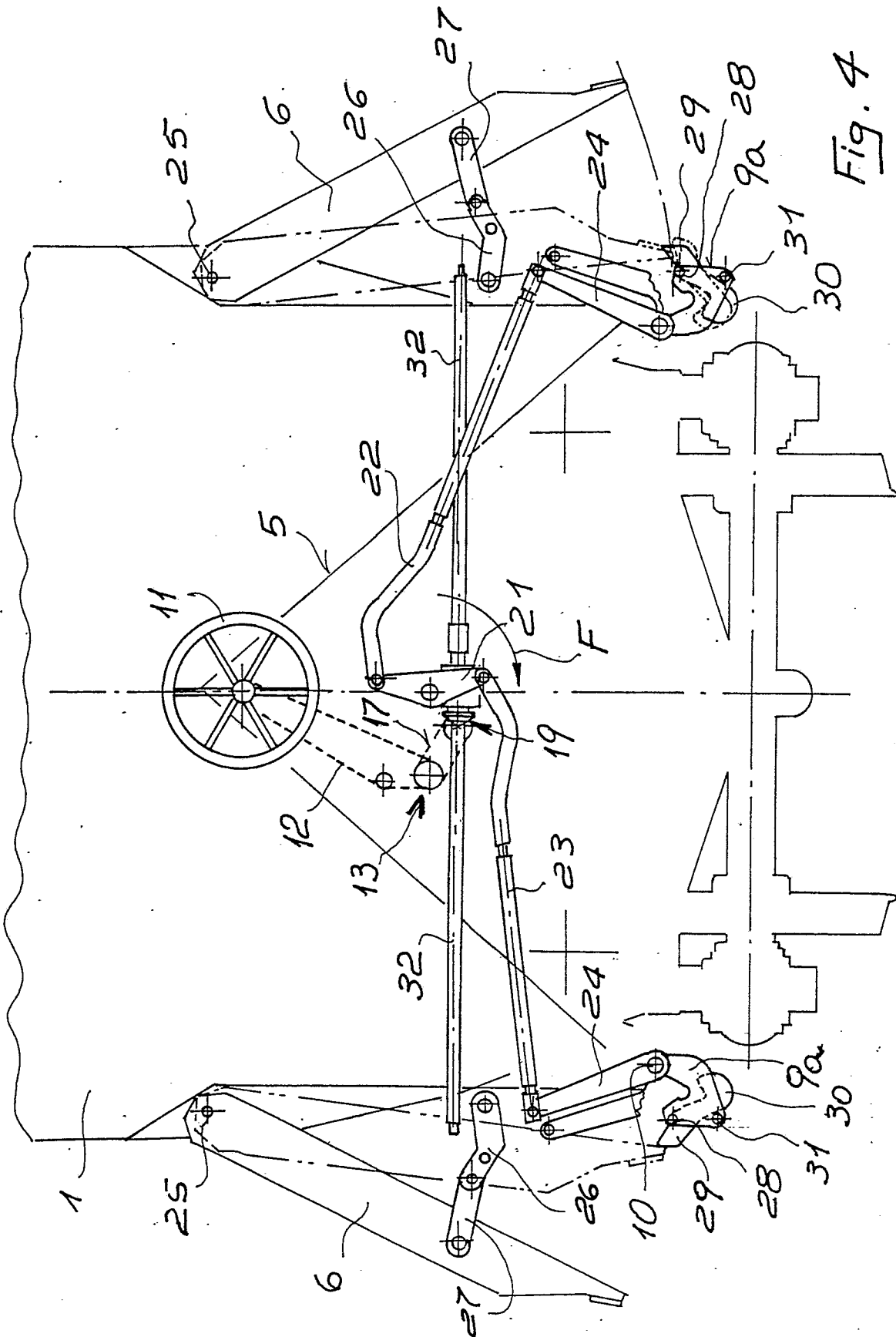


Fig. 3



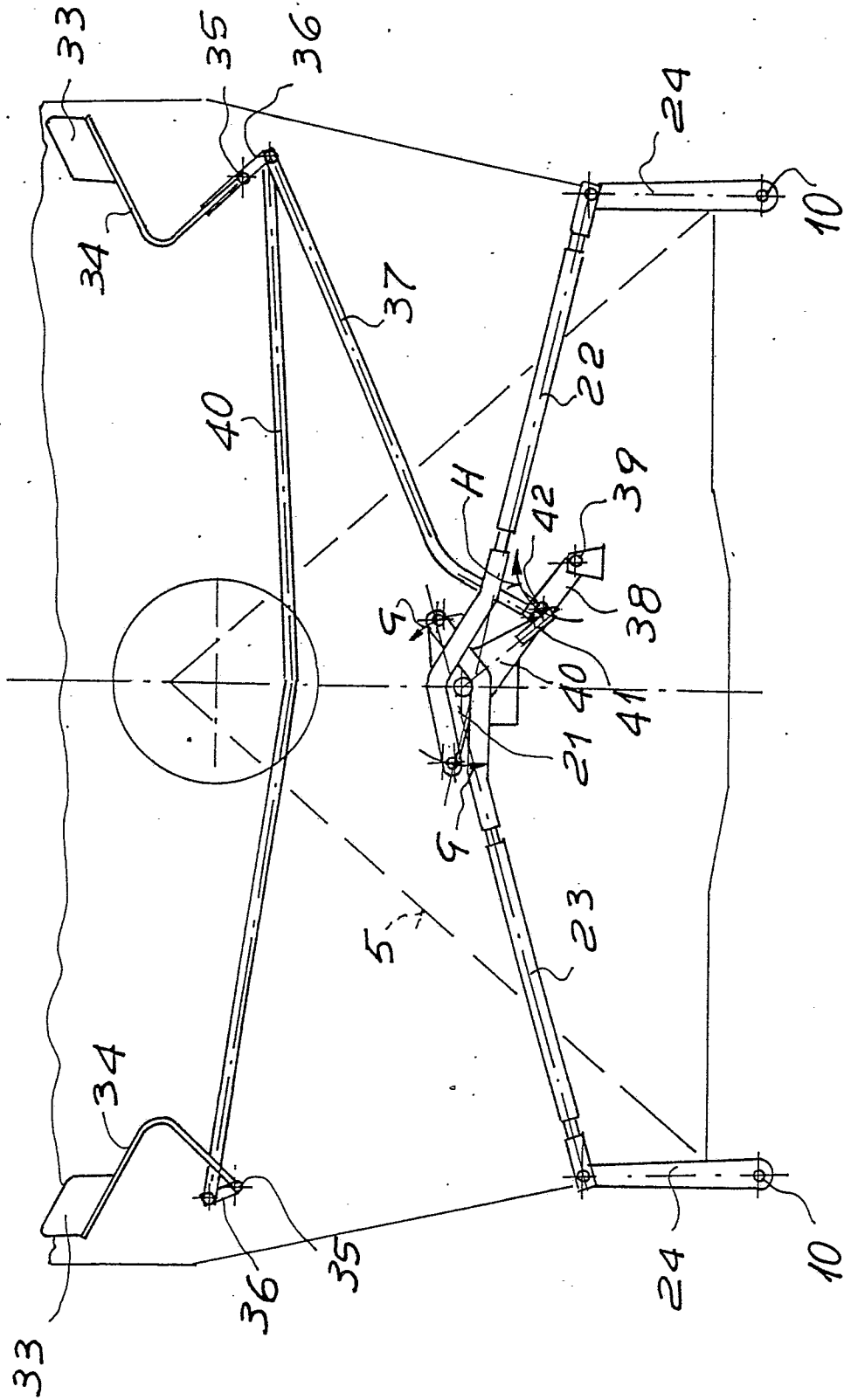


Fig. 5

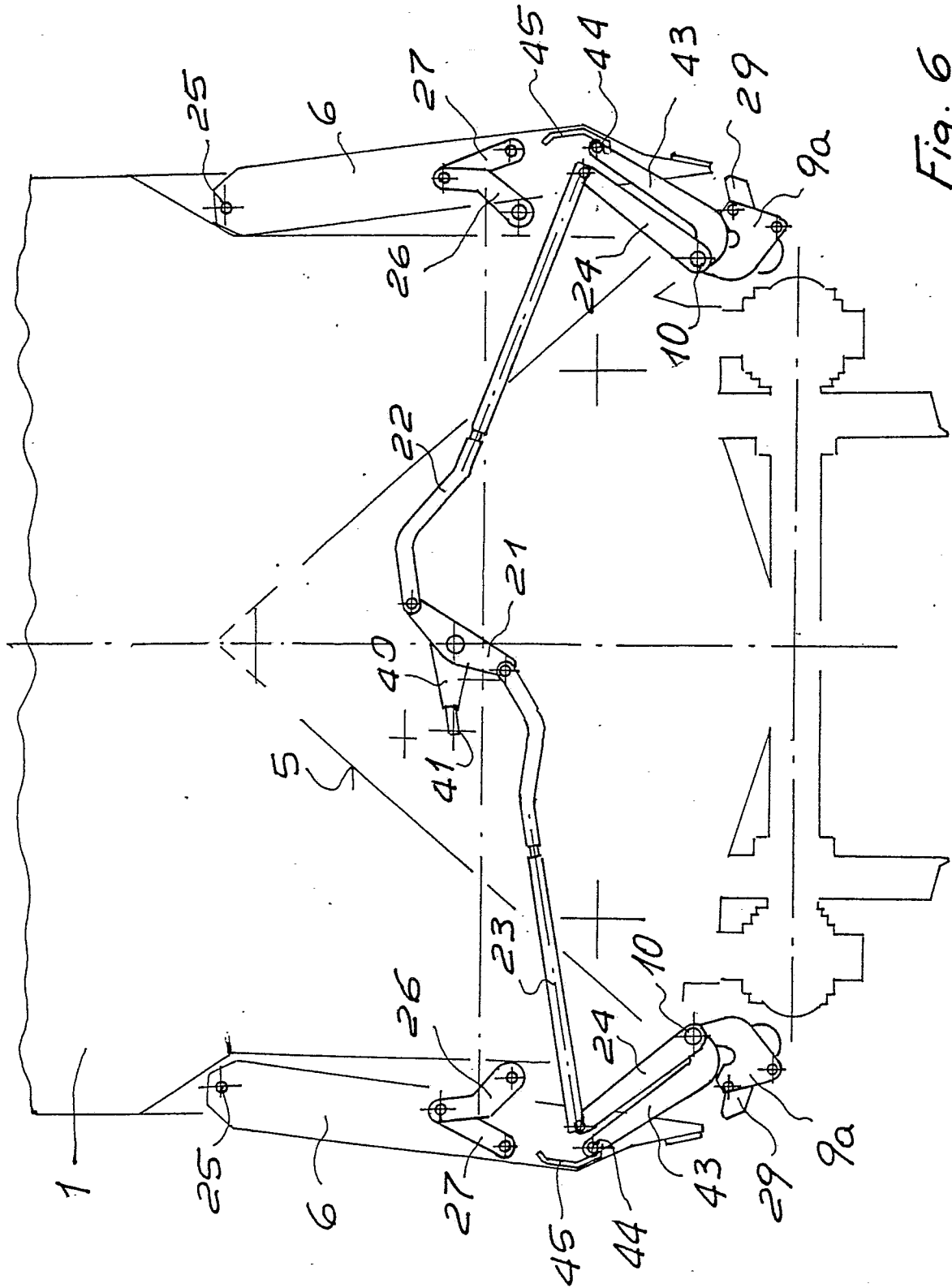


Fig. 6

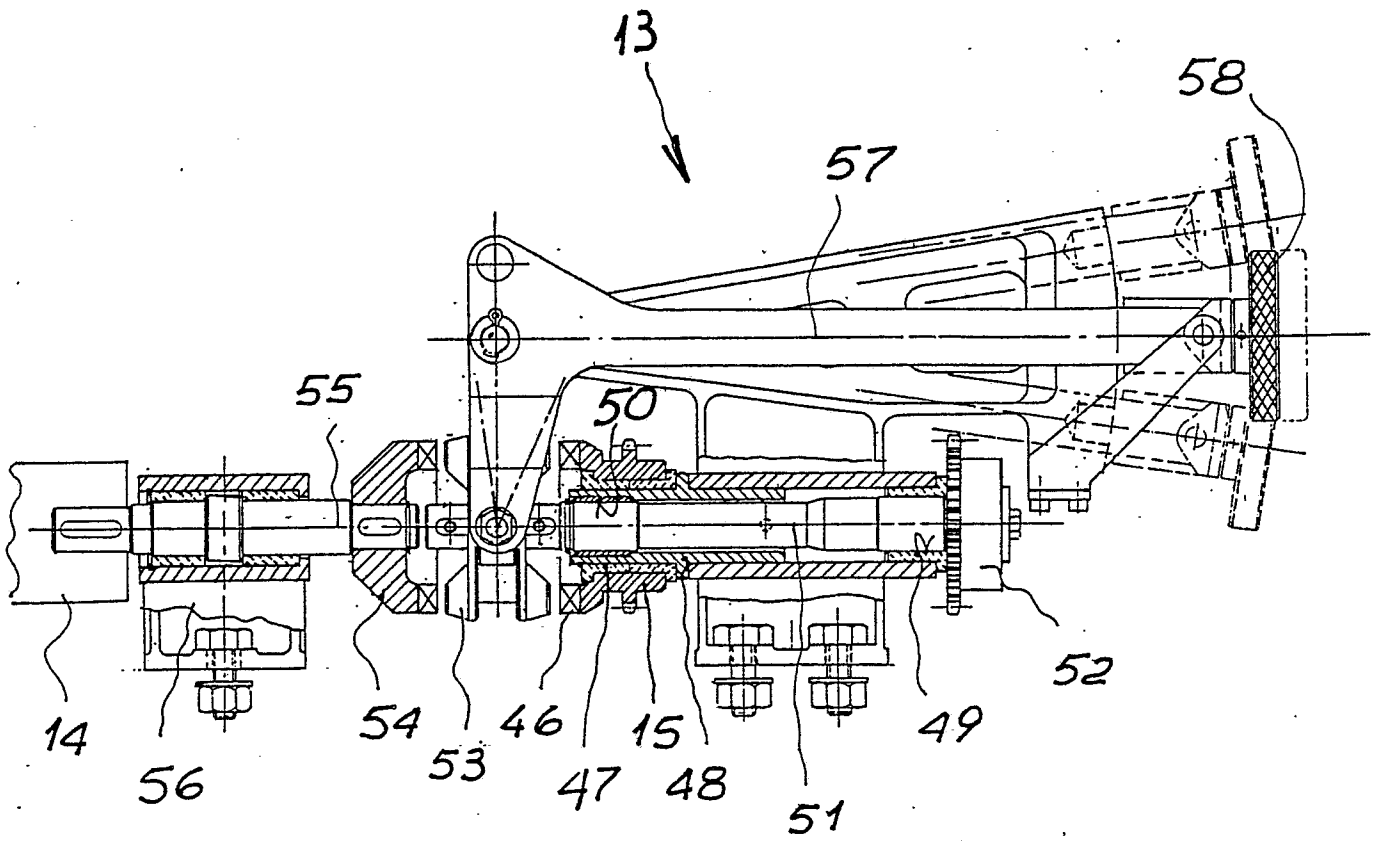


Fig. 7

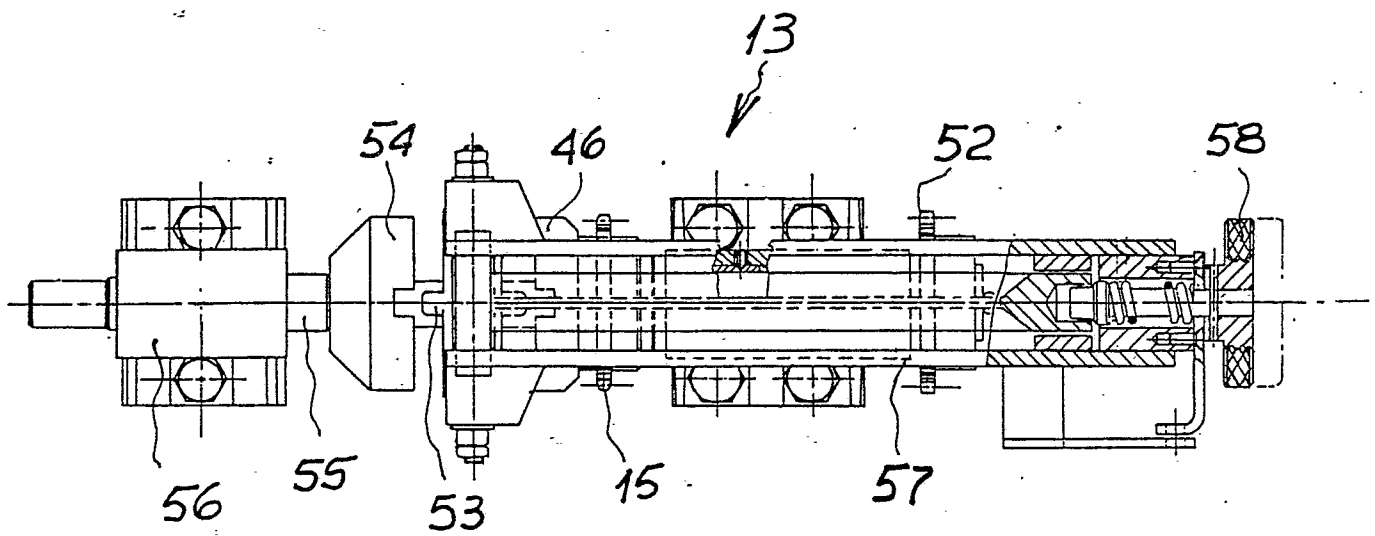


Fig. 8