

(51) Cl.Int./Int.Cl. *B65G 49/04* (2006.01)

(72) Inventeurs/Inventors:
MUELLER, HERBERT, DE;
WINKLER, JUERGEN, DE;
KROMBHOLZ, KLAUS, DE

(73) Propriétaire/Owner:
DURR SYSTEMS GMBH, DE

(74) Agent: KIRBY EADES GALE BAKER

(54) Titre : UNITE ET PROCEDE POUR TRANSPORTER DES PIECES SUR UN PARCOURS DE TRAITEMENT
(54) Title: UNIT AND METHOD FOR CONVEYING WORKPIECES ALONG A PROCESSING RUN



(57) **Abrégé(suite)/Abstract(continued):**

close to a first of the ends thereof, to rotate about the axis thereof at right angles to the conveying direction (FR) and on which a mounting (40) for the workpiece to be processed is provided. The rotating shaft (20) is only mounted close to the first end thereof on the transport car (10) and may thus be driven in the conveying direction (FR), whereupon the second free end thereof is passively transported along in the conveying direction (FR). It is thus possible to pivot the rotating shaft (20) in a plane running at right angles to the conveying direction, in particular, to permit a space saving return.

ABSTRACT

The invention relates to a unit and method for conveying workpieces along a processing run, comprising at least one transport car (10), moving along the processing run in a conveying direction (FR) and a rotating shaft (20), mounted on the transport car (10), close to a first of the ends thereof, to rotate about the axis thereof at right angles to the conveying direction (FR) and on which a mounting (40) for the workpiece to be processed is provided. The rotating shaft (20) is only mounted close to the first end thereof on the transport car (10) and may thus be driven in the conveying direction (FR), whereupon the second free end thereof is passively transported along in the conveying direction (FR). It is thus possible to pivot the rotating shaft (20) in a plane running at right angles to the conveying direction, in particular, to permit a space saving return.

WO 2005/115886

PCT/EP2005/004106

Unit and Method for Conveying Workpieces Along a Processing Run

Technical Field

The invention relates to a unit for conveying workpieces on a processing run.

Along such a processing run, there is located at least one, however, mostly several of successive processing stations into which said workpieces are introduced for surface treatment.

Such a processing station may, for example, be a dipping bath containing a processing liquid, the expression processing station may, however, also be understood to be any other kind of cabin or basin in which processing of the workpiece takes place. Such treatment may, for example, also encompass a washing process. Other examples of processing are dipping-phosphatizing, pre-treatment for immersion-painting, powder-coating, wet-painting or the like.

Prior Art

Units known so far for the surface treatment of workpieces, such as car bodies in dipping baths or processing cabins, are divided into continuously conveying units and non-continuously conveying units.

In continuously conveying units, the car bodies are conveyed in a conveying direction along the processing run using a chain drive and are at the same time lowered into the dipping baths, conveyed through said dipping baths and lifted out of

said dipping baths again. A continuously conveying unit for the surface treatment of car bodies is described in DE-A-196 41 048. In said unit the car bodies are held by mounts which are guided, at a fixed distance from each other, for example by means of a revolving chain, above the processing basins along a guiding way. The mounts are turned for introducing or removing the car bodies into and from the basins respectively. The corresponding rotating axes of the mounts are thereby oriented in parallel with the conveying direction. There is also the possibility to fold the mounts by 90° for return in order to save space.

There are also known in the art non-continuously conveying units which are referred to as cycle units. In cycle units, the car bodies are transported on carriers over the dipping basins, are stopped there and dipped into the processing bath using lifting devices, for example lifting units or rotating means, and are lifted or rotated thereout after lapse of the process time. Examples of such a unit are described in DE-C-43 04 145 and DE-U-200 22 634 as well as PCT/EP 2002/001782.

In some of the continuously and non-continuously conveying units known so far, the introduction of the car bodies into the dipping basins and the removal of the car bodies from the dipping bath is realized by means of rotation of the car bodies which are eccentrically arranged on the car body carrier around a rotating axis which is located transversely to the conveying direction. The movement carried out by the workpiece through the dipping bath is thereby completely different from the one in the unit of DE-A-196 41 048 described above, in which the rotating axis runs parallel to the conveying direction. The car body carriers are then supported, for example, on two guiding ways located on the left and the right of the dipping basins. The car body carriers can then be fixed for conveying on two revolving chains which are driven or diverted via chain wheels with a horizontal rotating axis and which are arranged at the start and the end of the processing run. At the end of the

processing run the unloaded car body carriers are diverted via the chain wheels and returned underneath the dipping bath.

The choice between a continuously conveying and a non-continuously conveying unit needs to be made in consideration of the specific advantages and disadvantages of both basic concepts. The continuously conveying units are more reliable since the units run using few driving motors, while the individually-cycled carriers of cycle units show an increased likelihood of breakdowns due to several individually controlled motors. The maximum capacity of workpieces per time unit is also greater in continuous units than is the case in cycle units. The advantage of cycle units, on the other hand, lies in the high degree of flexibility of workpiece processing due to the possibility to individually drive the individual carriers.

The present invention is mainly directed at continuously conveying units it, can, however, also easily be applied in non-continuously conveying units.

Illustration of the Invention

The present invention is based on the object to create a unit as well as a method for conveying a workpiece along a processing run by means of which return of the unloaded workpiece carriers can be effected in a space-saving manner.

This object is solved by means of a unit according to patent claim 1.

Accordingly, the unit according to the invention comprises at least one transport car for conveying a workpiece along a processing run, said transport car is movable along the processing run in a conveying direction. A rotating shaft is supported on the transport car close to a first of its ends and at right angles to the conveying direction to rotate around its axis. A mounting for the workpiece which is to be

processed is provided on the rotating shaft. According to the invention, the rotating shaft is only supported close to its first end on the transport car and is thus drivable in the conveying direction, whereas its second, free end is moved along passively in the conveying direction.

Accordingly, only one end of the rotating shaft is connected to the transport car. Thus, only one transport car is needed for conveying the workpiece at the rotating shaft in the conveying direction, said transport car can move along a single guiding way and may be driven by means of a single conveyer chain or a single conveying belt.

Driving and diverting wheels at the start and the end of the processing run can thus be implemented either with a horizontal or with a vertical axis.

The arrangement of the rotating shaft according to the invention, wherein the second end remains free also facilitates, in particular, pivoting the unloaded rotating shaft prior to or during diversion from the horizontal into the vertical position as well as a space-saving return adjacent to the processing run. These and other advantageous features of the unit according to the invention are described in dependent claims 2 to 17.

The rotating shaft is preferably arranged in such a manner that it is at least in part pivotable in a plane running at right angles to the conveying direction. In this regard, the transport car may be arranged to be pivotable in said plane together with the entire rotating shaft, and/or the rotating shaft may include a folding mechanism, by means of which the second end of the rotating shaft is pivotable in said plane. The latter-mentioned variant facilitates pivoting the shaft with comparably small constructional complexity.

The second end of the rotating shaft can be provided with a non-driven support member which may run on a supporting

surface, for example on an already provided rim of a dipping basin. In the case of such a support of the free end of the shaft, the loads acting on the workpiece carrier are reduced.

The rotating movement of the rotating shaft around its axis may be suitably coupled, using a rotation drive, with the movement of the transport car in the conveying direction; this brings about the advantage that no separate drive is required for the creation of this rotating movement and the energy required is reduced. The rotating drive may thereby for example be a roller lever. Variants are also possible with a gear which facilitates certain adaptation of the rotating movement of the rotating shaft.

There may, however, also be provided a separate rotating drive, for example, an electric drive, for creating the rotation of the rotating shaft around its axis. Said rotation may then occur completely independently of the movement of the transport car in the conveying direction.

The unit according to the invention is preferably provided with means for compensating for the torque created at the workpiece which is connected to the rotating shaft. There may, for example, be provided a counter-weight on the first end of the rotating shaft for compensating for the torque, preferably using a carrier, such that its distance from the rotating axis is variable. It is also possible to use a lever-spring mechanism for the compensation of the torque.

The above-mentioned object is, on the other hand, also solved by a method for conveying a workpiece along a processing run as according to claim 18.

Accordingly, a transport car is first driven into a starting position. There, a workpiece which is to be processed is fixed on a rotating shaft which is rotatably supported in the area of a first of its ends on the transport car. Said transport car is now moved along a processing run in a conveying

direction, with the rotating shaft being oriented at right angles to said conveying direction. In a disposal position the workpiece is detached from the rotating shaft following processing. Following thereafter, according to the invention, the rotating shaft is pivoted in a plane running at right angles to the conveying direction and the transport car is returned with the rotating shaft to the starting position.

The rotating shaft can thus be pivoted into a space-saving orientation for its return.

Preferred developments of the method according to the invention are described in the pertinent dependent claims.

The transport car can be diverted during pivoting or following pivoting on a return run, can be returned there and again diverted in order to reach the starting position and can be pivoted into its original position. This sequence facilitates returning the transport car with the rotating shaft in a particularly space-saving manner.

If a partial area of the rotating shaft which includes the second end of the rotating shaft is pivoted in said plane, said partial area of the rotating shaft may be diverted during pivoting or following pivoting to a return run, it may be oriented parallel with the conveying direction for return, and may be diverted again to reach the starting position and can be pivoted into its original position. The orientation of the shaft in parallel with the conveying direction during return results in by far less space being required perpendicular to the conveying direction.

Brief Description of the Drawings

Fig. 1 is a schematic overall view of a unit according to the invention for transporting workpieces,

- Fig. 2 is a perspective view of a first embodiment of a transport car which is part of the unit according to the invention,
- Fig. 3a shows the transport car of Fig. 2 in combination with a rotating shaft and a roller lever,
- Fig. 3b shows the transport car of Fig. 2 in combination with a rotating shaft and an electric drive,
- Fig. 4a shows a first possibility of creating the rotation of the rotating shaft in a front view,
- Fig. 4b is the pertinent side view,
- Fig. 5a shows a second possibility of creating the rotation of the rotating shaft in a front view,
- Fig. 5b is the pertinent side view,
- Figs. 6a to e are different views of a 45° diversion mechanism,
- Figs. 7a to d are different views of a 90° diversion mechanism,
- Fig. 8a is a side view of a unit according to the invention comprising a foldable rotating shaft,
- Fig. 8b is the pertinent top view,
- Fig. 8c is the same view as is shown in Fig. 8a, but shows the rotating shaft in the folded state, and

Fig. 9 shows different embodiments of a mechanism' for torque compensation.

Detailed Description of Preferred Embodiments

A schematic overall view of a unit according to the invention is shown in Fig. 1.

Using this unit, workpieces can be transported through a processing station. In particular, a unit of this type may serve to guide car body parts through a dipping bath in order to varnish the same. For this purpose, the unit comprises a plurality of workpiece carriers, two of which are shown in Fig. 1, and which are each formed by a transport car 10 and a rotating shaft 20 as essential parts.

Rotating shafts 20, in turn, each show mounts 40, on which the car body parts which are to be varnished can be fixed directly or using so-called skids. Rotating shafts 20 are rotatably supported on transport car 10 and move together with transport car 10 in a conveying direction characterized by "FR" along a guiding way 70. For this purpose, transport cars 10 are driven, for example using a conveying chain, a rope or a belt. A dipping bath (not shown), into which the car body parts which are fixed to mounts 40 are to be dipped for varnishing, is located adjacent to guiding way 70 and below the plane, in which rotating shafts 20 are moving; rotating shafts 20 are thus guided over the dipping bath using transport cars 10.

In order to now dip the car body parts into the dipping bath while rotating shafts 20 are moved over the dipping bath, there is provided a mechanism by means of which rotating shaft 20 can be put into rotating movement during the translational movement of transport car 10 and rotating shaft 20 along the guiding way 70. In the embodiment shown in Fig. 1, this mechanism is a roller lever 30. Said roller lever is connected or can temporarily be connected to rotating shaft 20 in a rotationally stiff manner and causes rotating shaft 20 to

rotate as soon as the same is in a suitable position above the dipping bath so as for the car body part on mounts 40 which is to be varnished to be rotated into the dipping bath while, at the same time, being drawn through the dipping bath since transport car 10 continuously moves further along the guiding way 70.

It is, as a matter of course, also possible to provide a discontinuous operation of this unit in which, for example, the movement of transport car 10 along guiding way 70 is interrupted for the car body part to be dipped into the dipping bath. This may be desirable in the case of certain geometries of the car body parts or certain ancillary conditions of the varnishing process. The choice between a continuous and a discontinuous working manner is made by the person skilled in the art taking into account all these circumstances.

Guiding way 70 may in any case form an endless loop. A certain position of this loop is a starting position where the car body part is fixed, with or without interposition of a skid, on mounts 40 of rotating shaft 20. Following thereafter, it is conveyed along a processing run of guiding way 70 through the dipping bath, and is detached from mounts 40 at a disposal position and removed for further processing. Transport car 10 with unloaded rotating shaft 20 is then returned along a return run of endless guiding way 70 into the starting position. The return run of guiding way 70 may thereby extend adjacent to the processing run and may be connected thereto via diversion areas.

It now also becomes particularly clear from Fig. 1 that the unit according to the invention requires only a single guiding way 70 and, according to the invention, rotating shaft 20 is supported on transport car 10 only on its first end and is driven in the conveying direction FR in this manner, whereas its second, free end is passively moved along. This is carried out in a manner contrary to conventional units, in which both

ends of the rotating shaft are guided along a guiding way respectively. In the illustrated embodiment, this second, free end of rotating shaft 20 is merely provided with a non-driven support roller 80 which rolls on a support surface 90.

Said support surface 90 may be formed for example by the anyway provided rim of the dipping bath. Support roller 80 or a corresponding support element is, however, not necessarily required; in a suitable design of the remaining constructive elements, the free end of rotating shaft 20 is also capable of free spatial movement.

During the rotation of the workpiece into and out of the dipping bath great torques are created on rotating shaft 20 which need to be supported via rotating shaft 20 and transport car 10 onto guiding way 70 and which create additional shear forces during inward rotation and outward rotation. The entire unit is thereby exposed to strong and continuously fluctuating loads.

Said torques can be compensated in various ways. In the embodiment of Fig. 1, a counter-weight 50 is provided for this purpose on a carrier 60 which, in turn, is supported on the end of rotating shaft 20 which faces away from mounts 40. Arranging counter-weight 50 at a certain distance from the rotating axis of rotating shaft 20 compensates at least in part for the torque of the workpiece.

In this regard, the distance of counter-weight 50 to said rotating axis may be variable. This can also be taken from Fig. 1. In the workpiece carrier shown on the right-hand side, the counter-weight is at a relatively large distance from the rotating axis of rotating shaft 20 and could thus balance the torque of a workpiece fixed to pertinent mounts 40. In the workpiece carrier shown on the left-hand side, counter-weight 50 is, on the other hand, shifted into the axis of rotating shaft 20 and thus does not exert a compensation torque.

The last-mentioned position is adopted in particular when the workpiece carrier is conveyed along guiding way 70. Counter-weight 50 should then be neutralized. This can alternatively also be effected by decoupling counter-weight 50 from the rotating axis or by decoupling roller lever 30 from the rotating axis.

The compensation of the torques significantly reduces the forces acting upon the conveying chain and the fluctuations in load are reduced. The solutions for the compensation of the torques thus support at the same time the restriction to a single chain, rope or belt line.

Fig. 2a shows a first embodiment of a transport car 10 which can be used in the unit according to the invention. It is also implied in Fig. 2a that conveying car 10 is movable along guiding way 17 using a conveying chain 15 or a rope 15'. Reception 25 serves to support rotating shaft 20.

Fig. 3a shows the transport car 10 illustrated in Fig. 2 in combination with a rotating shaft 20. There is also shown the roller lever 30 already described with reference to Fig. 1, the movement of which causes rotating shaft 20 to rotate during the conveying movement of transport car 10 along a guiding way.

As an alternative, rotating shaft 20 may also be driven independently of the conveying movement, for example using an electric auxiliary power, and may also have corresponding mechanical and/or hydraulic or pneumatic transmission elements. Said rotating mechanism may be arbitrarily switched using a corresponding control and may be changed with regard to a rotating direction and rotating speed. This is illustrated in Fig. 3b: Instead of roller lever 30, in this case there is provided an electric drive 35 which creates the rotating movement of rotating shaft 20 independently of the conveying direction.

The rotating movement of rotating shaft 20 may also be facilitated, instead of using roller lever 30, in a flexible manner by means of the rotating mechanisms illustrated in Figs 4a, 4b and 5a, 5b and described below, namely using a spur gear unit (Figs. 4a, 4b) or a chain drive (5a, 5b) arranged on transport car 10 and using a rack and pinion gear pair (120, 130) via the conveying movement of transport car 10 initiated by the chain.

The rotating speed may thereby be modified by means of a gear box control or by changing the diameters of the pinion. The rotating direction may in particular also be changed using a gear box control or by changing the arrangement of the rack with regard to the pinion (above - below). Stopping positions of the rotating shaft can be realized by means of decoupling the drive or by interrupting rack 120. Reference number 100 in Figs. 4a and 5a designates a disc brake, 110 designates a ratch coupling.

The advantage of this gear lies in that the rotating speed is not necessarily connected in a 1:1 manner to the conveying speed of transport car 10.

All these possibilities for creating the rotation of rotating shaft 20 are known as such and are thus not described here in any more detail.

As has already been described, the unit according to the invention is characterized in that only one end of rotating shaft 20 is supported on transport car 10, the other end is free. This results in a number of advantages. It is in particular possible to pivot rotating shaft 20 due to its free end in the unloaded state also and in particular for its return in various manners and therefore the return can be carried out in a particularly space-saving manner.

For this purpose, on the one hand, the entire workpiece carrier which consists of transport car 10 and rotating

shaft 20 may be pivoted around a joint point arranged in the coupling area between the chain and the workpiece carrier, either using a separate pivoting mechanism or using rollers which run in guiding ways formed in a spiral manner and which are attached on the car body carrier. Fig. 6 shows such a separate pivoting mechanism: The entire transport car 10 is pivoted together with a pivoting mount 200 vis-à-vis stationary circular arc ways 210. In the embodiment of Fig. 6, pivoting is possible by 45° . In this regard, Fig. 6a is a side view, Fig. 6b is a rear view, Fig. 6c is a front view, Fig. 6d is a perspective view and Fig. 6e is a top view.

The pivoting mechanism of Fig. 7 is similar to the one shown in Fig. 6. Fig. 7a is a side view, Fig. 7b is a rear view, Fig. 7c is a perspective view and Fig. 7d is a top view. The pivoting mechanism of Fig. 7, however, facilitates pivoting by 90° . This is carried out in the following manner: After the workpiece has been conveyed on mounts 40 through the dipping bath and has been detached from said mounts 40 at the disposal station, transport car 10 is driven together with empty rotating shaft 20 into the pivoting station shown in Fig. 7 and is pivoted there by 90° together with pivoting mount 200 so as for rotating shaft 20 to face downwards. With this orientation of rotating shaft 20, transport car 10 can then be moved through a diversion area (not shown) of the guiding way to the return run of the guiding way. Rotating shaft 20 remains in this downwardly-directed position during the return of transport car 10 so that significantly less space is required than would be the case if the shaft was returned in its horizontal orientation - as is the case in conventional units in which the shaft is supported at both ends and is thus always transported in a horizontal manner. Before fixing a new car body part to mounts 40 in the starting position, transport car 10 is again pivoted with rotating shaft 20 in a further pivoting station so that rotating shaft 20 adopts its horizontal position again.

An alternative to the pivoting stations lies in designing rotating shaft 20 to be foldable itself. This is shown in Fig. 8. Figs. 8a and 8b show rotating shaft 20 in its horizontal position. Following unlocking of a locking mechanism 300, the shaft can be unfolded downwardly in a pivoting range 22. The position unfolded downwardly by 90° is shown in Fig. 8c. In contrast with the embodiment of Figs. 6 and 7, here not the entire transport car 10 as well as rotating shaft 20 are pivoted, but only the largest part of rotating shaft 20 which is arranged on the right-hand side in Fig. 8. Thus, rotating shaft 20 can also be brought in a vertical position which is directed downwardly for diversion and return thereof along the guiding way. Folding and unfolding of rotating shaft 20 at mount joint 22 is realized by forming a cam track, the position of the mount joint and the weight of the rotating shaft part itself without any external drive.

Moreover, this foldable design of rotating shaft 20 also facilitates pivoting rotating shaft 20 on the return run from the vertically downwardly directing orientation into an orientation in parallel with the return run which further reduces the space required for rotating shaft 20 on the return run. Here the pivoting step is also facilitated either by means of a separate pivoting mechanism' or by means of rollers which run in spirally formed guiding ways and which are fixed to the workpiece carrier or, however, by designing a corresponding rotating lever guiding way which realizes the pivoting step of the rotating shaft.

It will now be clarified, referring to Fig. 9, that the torque of the workpiece around the rotating axis of rotating shaft 20 can be compensated, at least in part, by means of a lever-spring mechanism instead of a counter-weight 50 in which springs are tensioned during the rotation of the workpiece into the dipping bath and thus counteract the torque of the workpiece. The torque required for rotating the workpiece

outwardly is then correspondingly reduced by the relaxing springs.

If the workpiece carrier is once conveyed through the processing run in an unloaded state, the effect of the lever-spring mechanism as well as the counter-weight described above need to be neutralized. This can be realized as follows:

- decoupling the lever-spring mechanism from the rotating shaft of the workpiece carrier,
- decoupling the elements of the rotating mechanism' (e.g. during rotation by means of roller levers running in guiding ways) vis-à-vis the rotating axis of the workpiece carrier, or
- switching off the rotating mechanism.

Figs. 9a) and b) show a lever-spring mechanism with a curve disc, Figs. 9 c) and d) with eccentrically designed springs, and Figs. 9 e) and f) with a batch crank or a crank loop. In this regard, M is the rotating axis of the rotating shaft and S is the point of application of the weight force of the workpiece at the rotating shaft.

CLAIMS

1. Unit for conveying a workpiece along a processing run, comprising:

at least one transport car, movable along the processing run in a conveying direction,

and a rotating shaft, mounted on the transport car, close to a first of the ends thereof, to rotate about the axis thereof at right angles to the conveying direction and on which a mounting for the workpiece to be processed is provided, wherein

the rotating shaft is only mounted close to the first end thereof on the transport car and may thus be driven in the conveying direction, whereas the second free end thereof is moved along passively in the conveying direction.

2. Unit according to claim 1, wherein the rotating shaft is arranged in such a manner that it may at least in part be pivoted in a plane running at right angles to the conveying direction.
3. Unit according to claim 2, wherein the transport car is arranged together with the entire rotating shaft to be pivotable in said plane.
4. Unit according to claim 2 or 3, wherein the rotating shaft comprises a folding mechanism, by means of which the second end of the rotating shaft is pivotable in said plane.

5. Unit according to any one of claims 2 to 4, wherein the rotating shaft is pivotable by at least 45°.
6. Unit according to claim 5, wherein the rotating shaft is pivotable by 90°.
7. Unit according to any one of claims 1 to 6, with the second end of rotating shaft being provided with a non-driven support element which can run on a support surface.
8. Unit according to any one of claims 1 to 7, further including a guiding way, along which the transport car is movable in the conveying direction.
9. Unit according to any one of claims 1 to 8, wherein the transport car is driven in the conveying direction by means of a conveying chain, a belt or a rope drive.
10. Unit according to any one of claims 1 to 9, wherein the rotating movement of the rotating shaft around its axis is coupled to the movement of the transport car in the conveying direction via a rotating drive.
11. Unit according to claim 10, wherein the rotating drive is a roller lever.
12. Unit according to any one of claims 1 to 9, wherein the rotation of the rotating shaft around its axis is created by means of a separate rotating drive.

13. Unit according to claim 12, wherein the separate rotating drive is an electric drive.
14. Unit according to any one of claims 1 to 13, further including means for compensating the torque created by the workpiece which is mounted on the rotating shaft.
15. Unit according to claim 14, wherein a counter-weight is provided at the first end of rotating shaft for compensating the torque.
16. Unit according to claim 15, wherein the counter-weight is fixed to the first end of the rotating shaft via a carrier in such a manner that the distance thereof to the rotating axis of the rotating shaft is variable.
17. Unit according to claim 14, wherein a lever-spring mechanism is provided for compensating the torque.
18. Method for conveying a workpiece along a processing run, comprising:

moving a transport car in a starting position,

fixing a workpiece which is to be processed on a rotating shaft which is rotatably supported on said transport car in the area of a first of its ends,

conveying said transport car along a processing run in a conveying direction, with the rotating shaft being oriented at right angles to said conveying direction,

detaching the workpiece from the rotating shaft in a disposal position,

pivoting the rotating shaft in a plane running at right angles to the conveying direction, and

returning the transport car with the rotating shaft into the starting position.

19. Method according to claim 18, wherein the entire rotating shaft is pivoted in said plane together with the transport car.
20. Method according to claim 19, wherein during pivoting or following pivoting the transport car is diverted to a return run, is returned there and again diverted in order to reach the starting position and is pivoted into its original position.
21. Method according to claim 18, wherein only a partial area of the rotating shaft which includes the second end of the rotating shaft is pivoted in said plane.
22. Method according to claim 20, wherein the partial area of the rotating shaft is diverted during pivoting or following pivoting to a return run, is oriented in parallel with the conveying direction for return and is again diverted in order to reach the starting position and is pivoted into its original position.

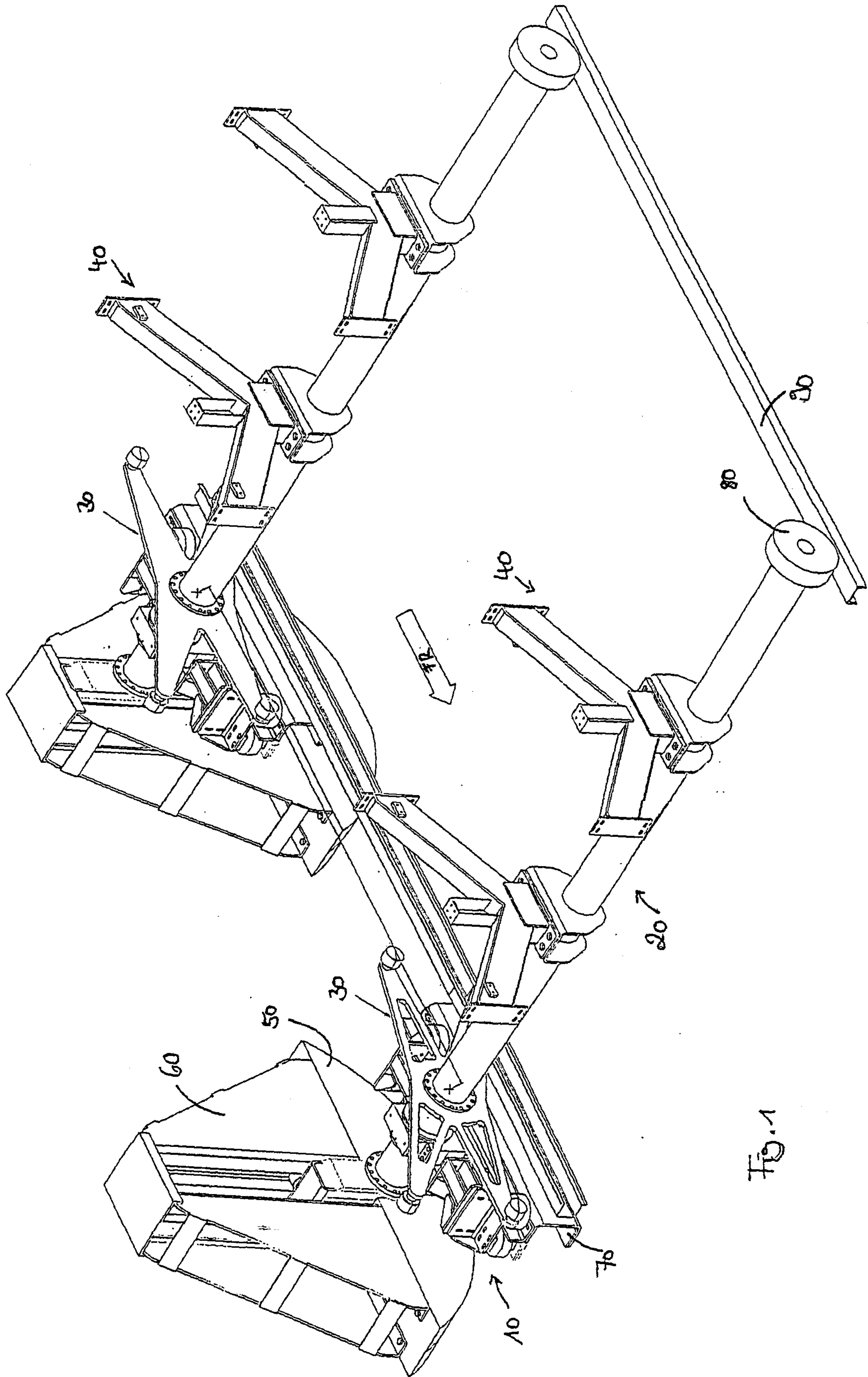
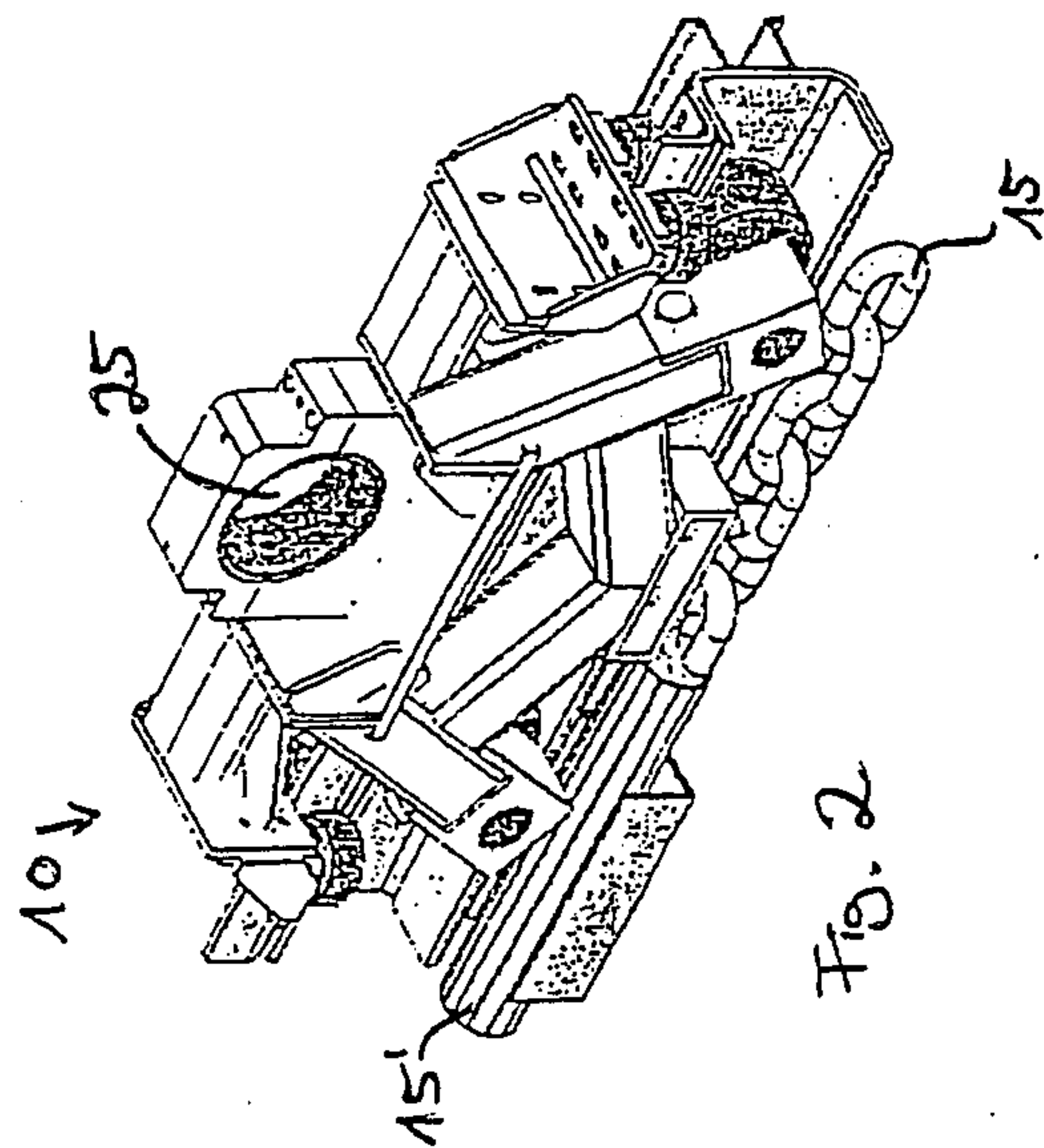
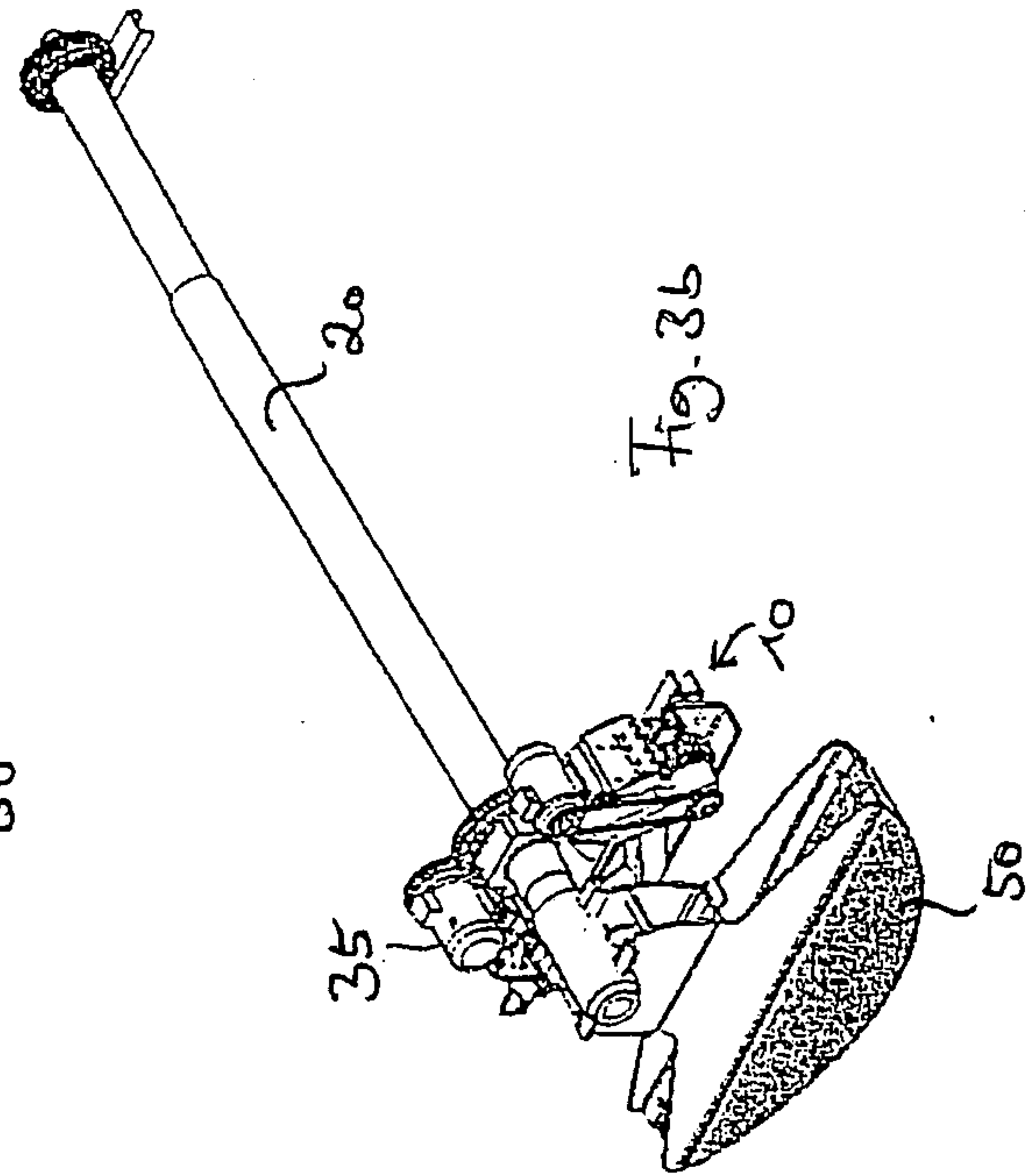
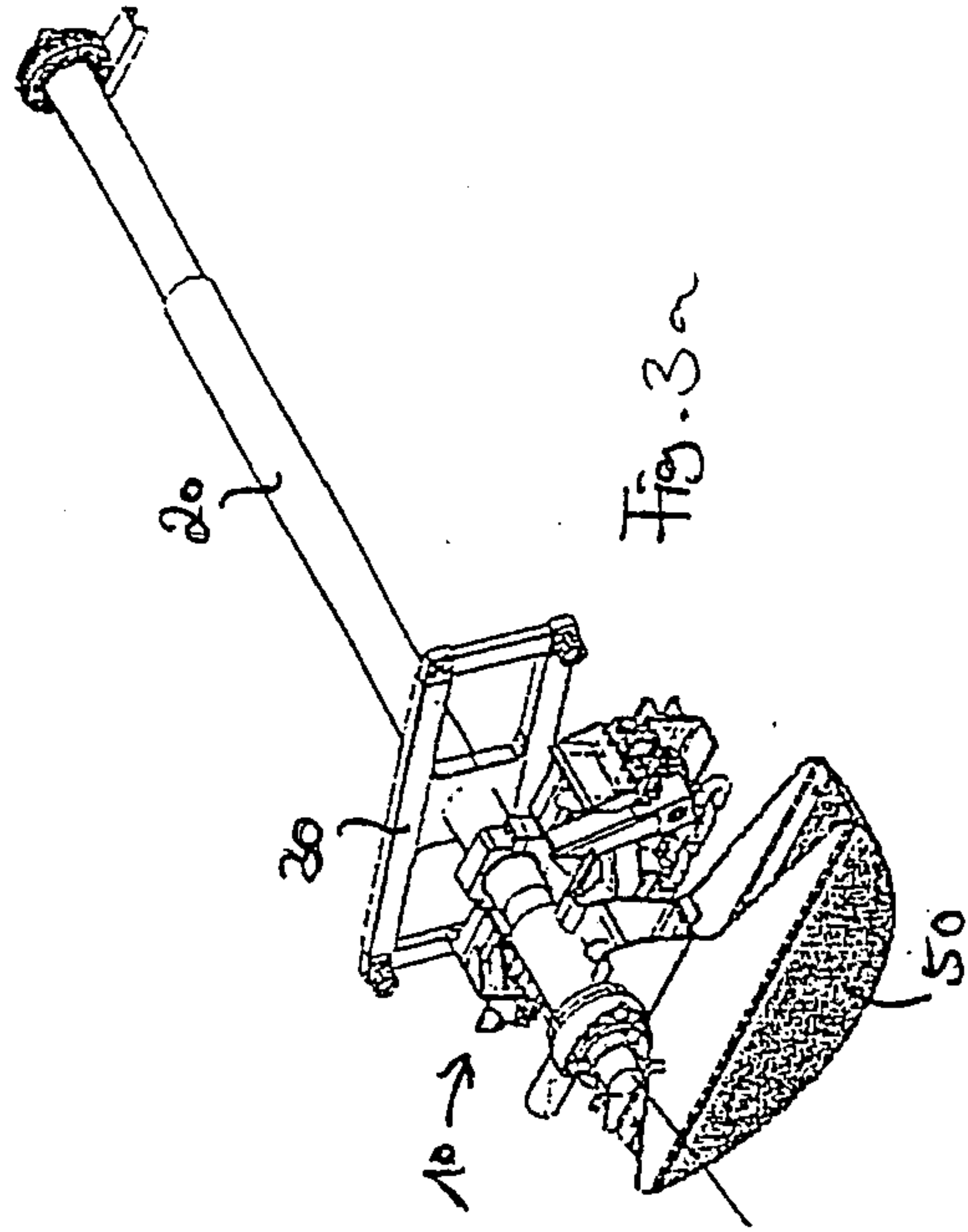
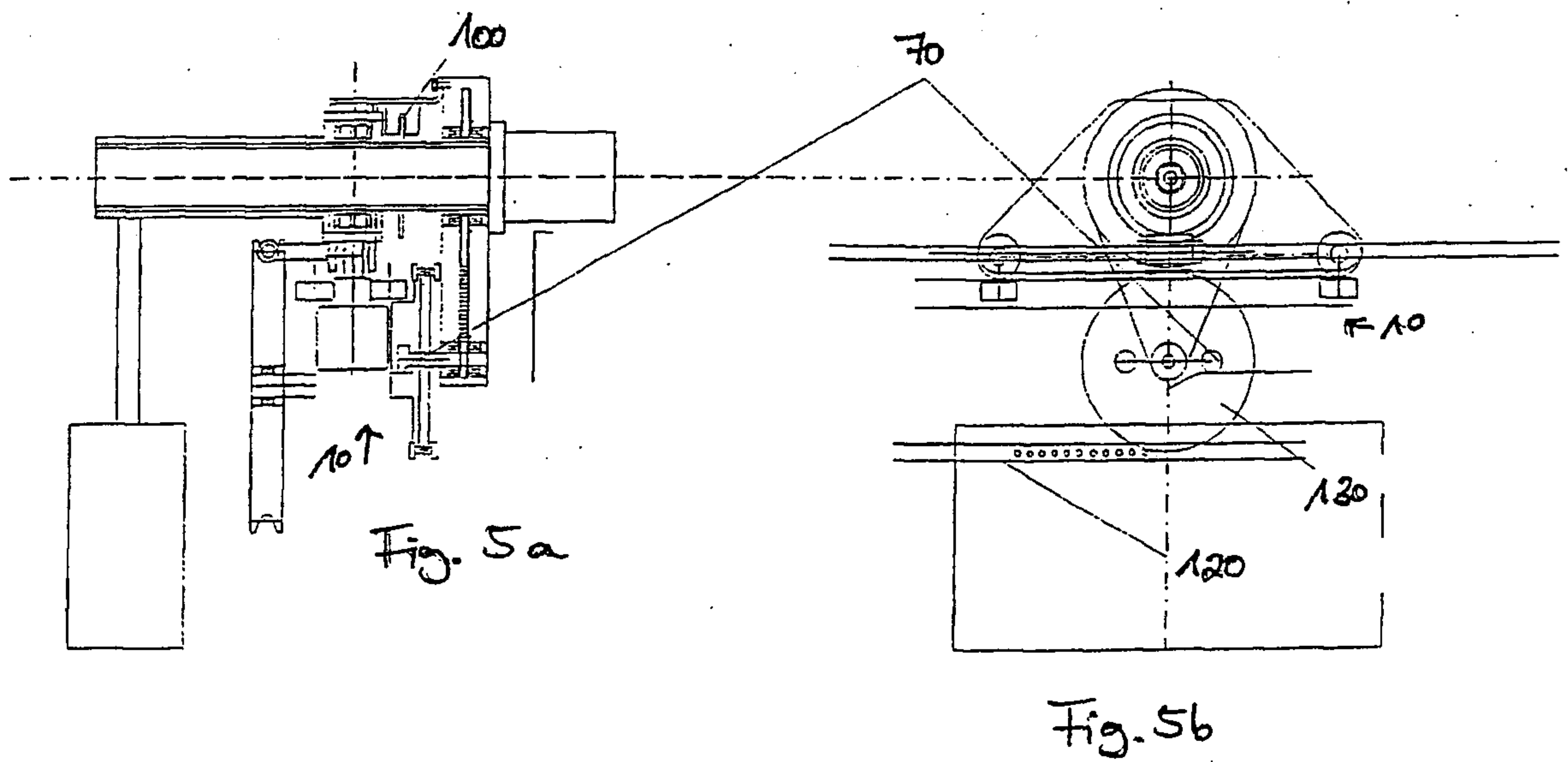
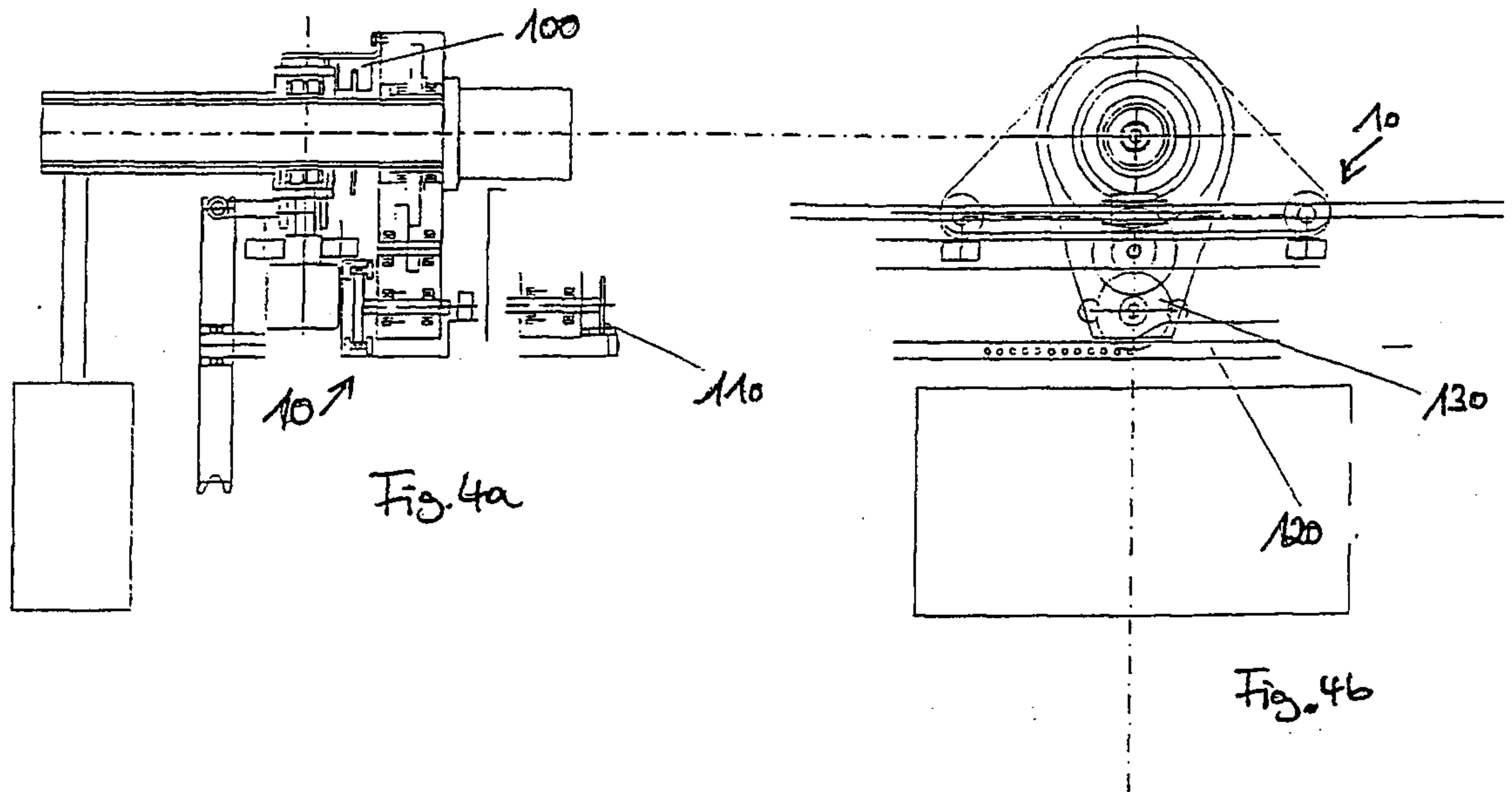
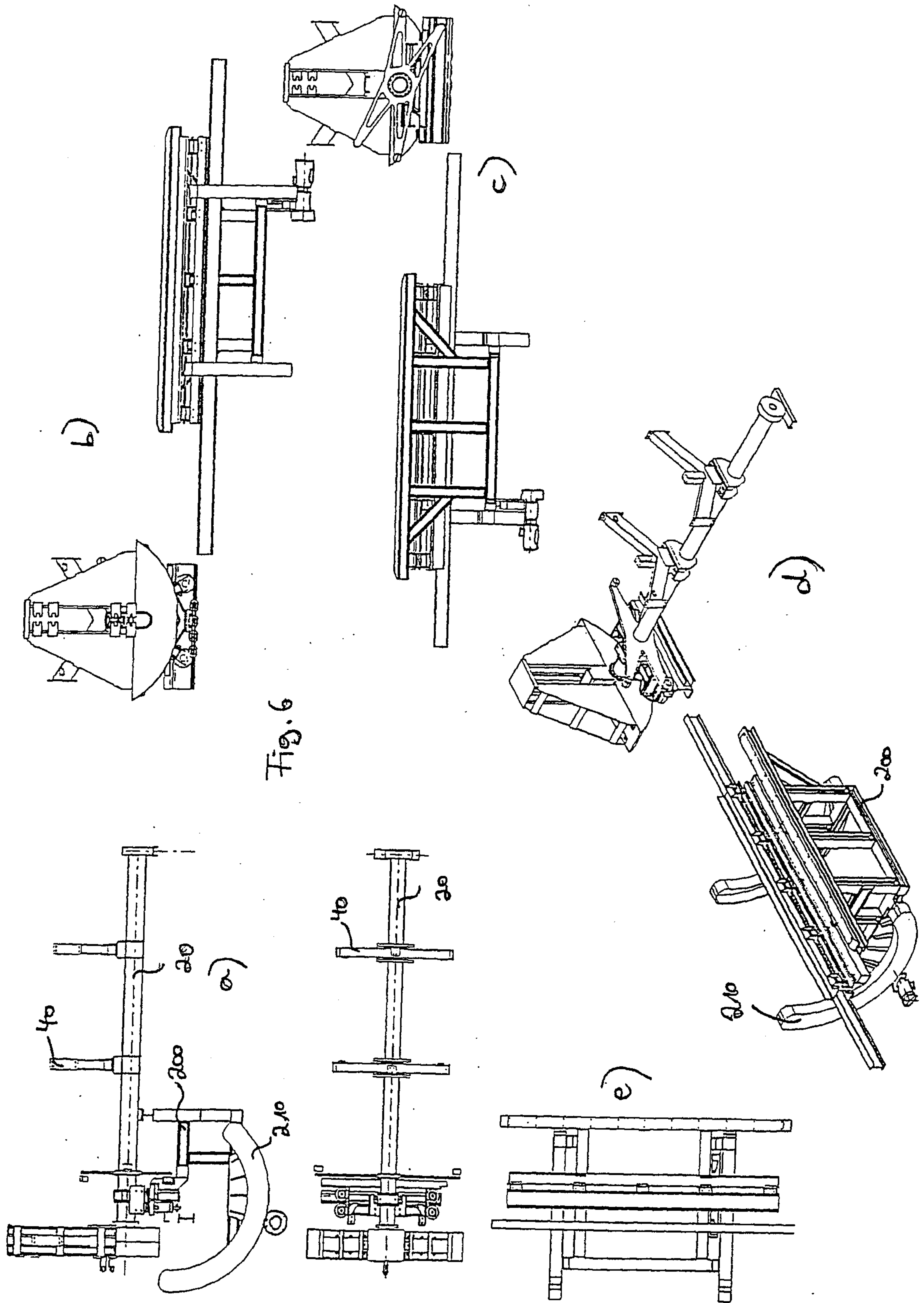
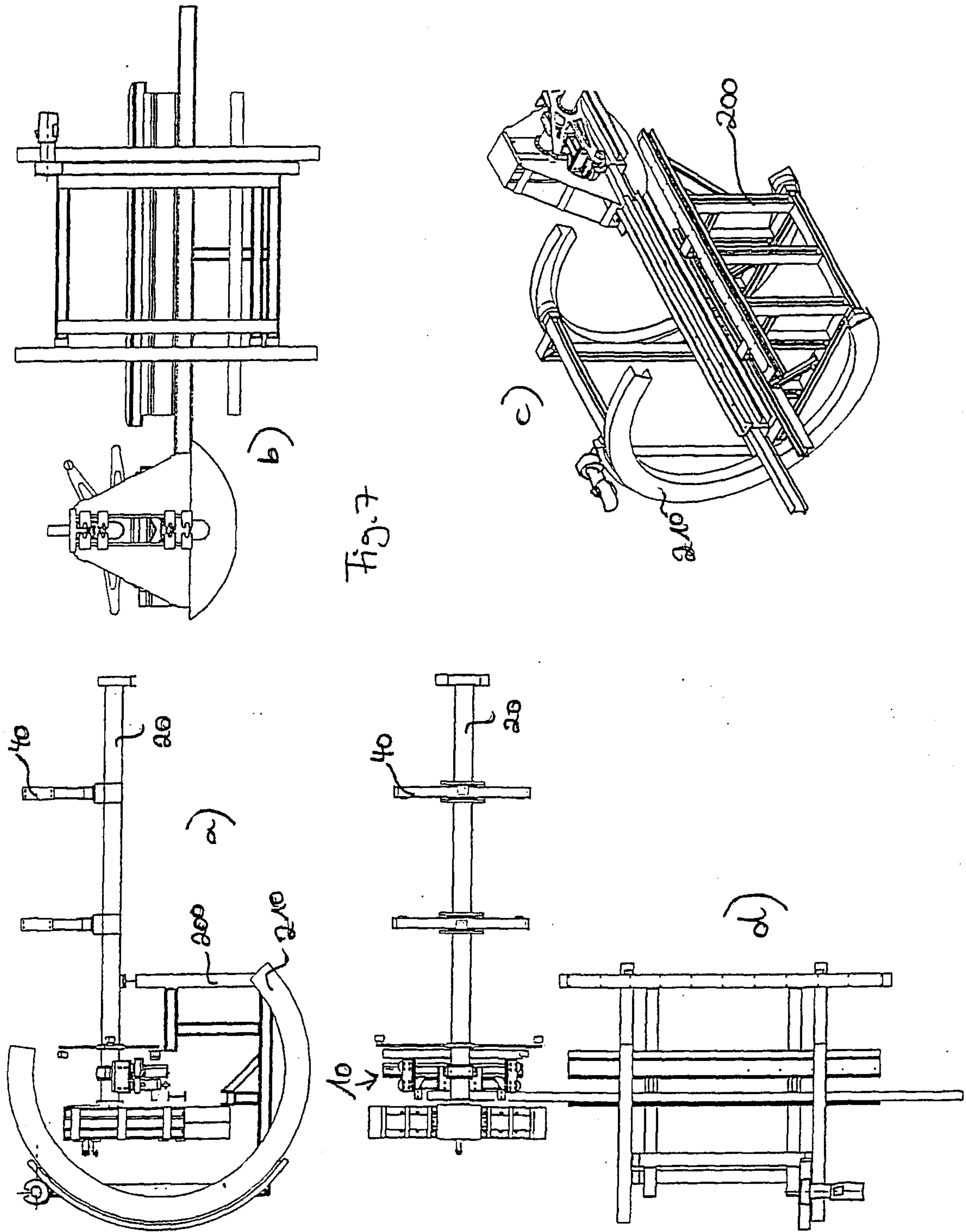


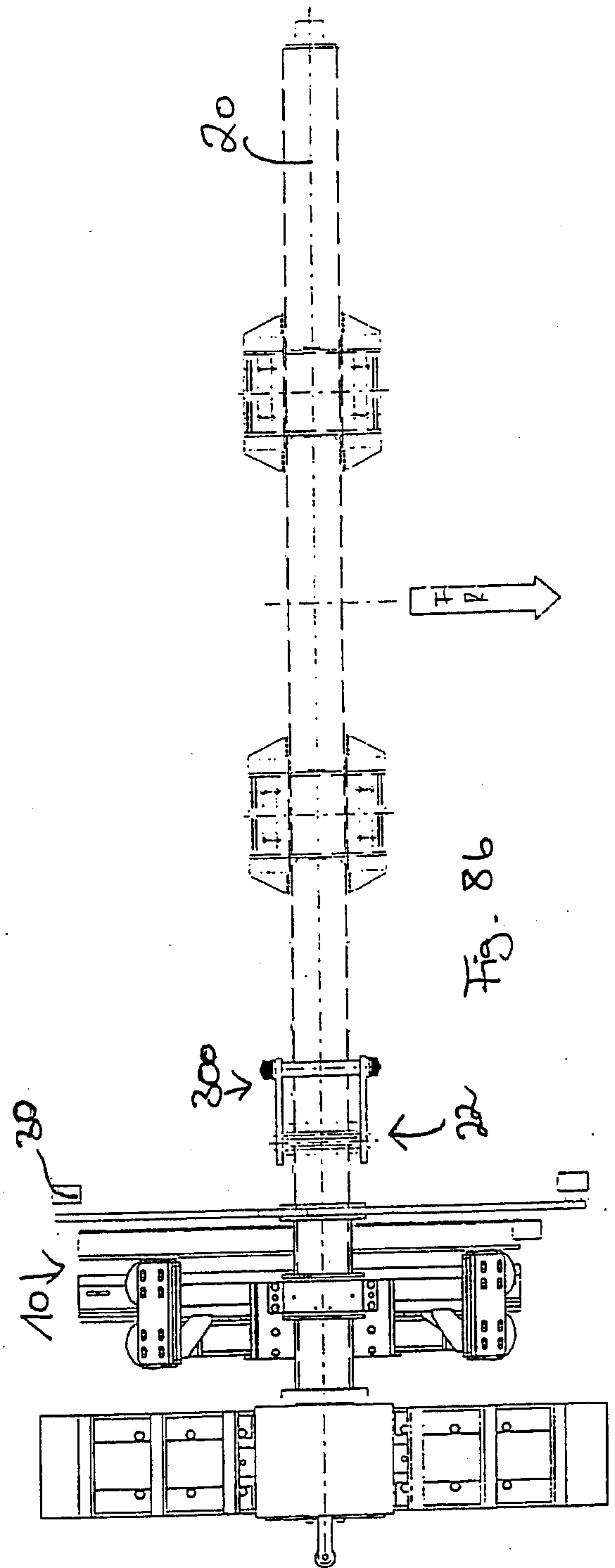
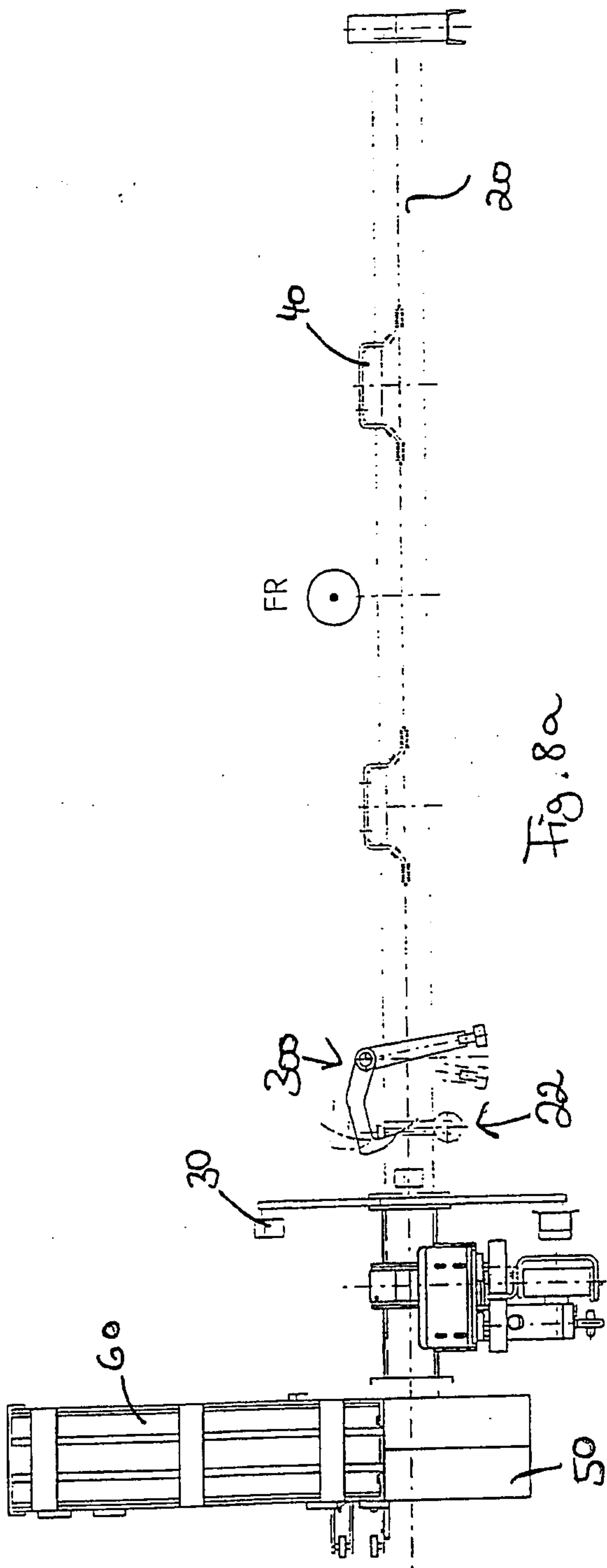
FIG. 1











7/8

