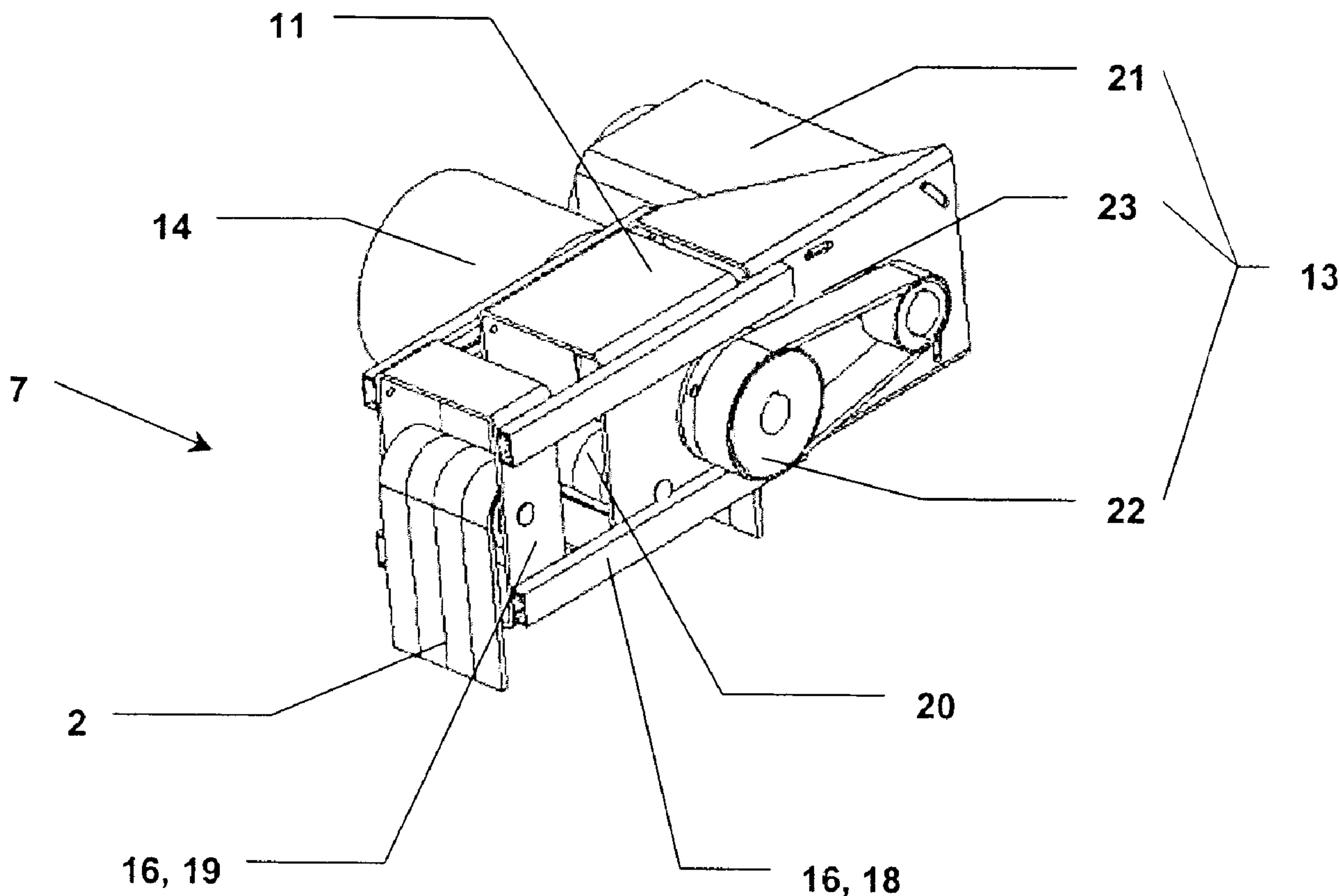




(22) Date de dépôt/Filing Date: 2005/01/05  
 (41) Mise à la disp. pub./Open to Public Insp.: 2005/07/07  
 (45) Date de délivrance/Issue Date: 2012/05/22  
 (62) Demande originale/Original Application: 2 491 551  
 (30) Priorité/Priority: 2004/01/07 (EP04 405 010.2)

(51) Cl.Int./Int.Cl. *B66B 11/08* (2006.01)  
 (72) Inventeurs/Inventors:  
 LIEBETRAU, CHRISTOPH, CH;  
 STOCKER, RUEDI, CH  
 (73) Propriétaire/Owner:  
 INVENTIO AG, CH  
 (74) Agent: RICHES, MCKENZIE & HERBERT LLP

(54) Titre : ENTRAINEMENT POUR ASCENSEUR ET METHODE DE DEMULTIPLICATION CONNEXE  
 (54) Title: DRIVE FOR A LIFT INSTALLATION



(57) **Abrégé/Abstract:**

The invention relates to a modular drive for a lift installation and to a method of converting and fastening a drive in a lift installation. According to the invention the main drive components such as drive device, brake device and drive pulley are combined into a drive module, at which connecting parts for fastening the drive within the shaft or in the engine space or for adjusting a support means spacing are mounted in correspondence with need.



## ABSTRACT

The invention relates to a modular drive for a lift installation and to a method of converting and fastening a drive in a lift installation. According to the invention the main drive components such as drive device, brake device and drive pulley are combined into a drive module, at which connecting parts for fastening the drive within the shaft or in the engine space or for adjusting a support means spacing are mounted in correspondence with need.

## DRIVE FOR A LIFT INSTALLATION

## Description

This application is filed as a division of Canadian patent application serial No. 2,491,551 filed January 5, 2005.

The invention relates to a lift installation with a modular drive and to a method for converting a lift installation, according to the introductory part of the independent patent claims.

A lift installation serves the purpose of transport of persons and goods within a building between storeys. A cage serves for reception of the persons and goods. A drive drives the cage by means of support means, the cage thereby being moved back and forth in a vertically extending shaft. The support means connects the cage with the counterweight. It is in that case guided by way of a drive pulley. The drive pulley transmits to the support means the force required for moving or stopping. The drive pulley is for that purpose driven or stopped by a drive device and/or a brake device.

Another type of drive drives the cage by means of hydraulic lifting apparatus. The driving and stopping force is in that case transmitted to the cage by a pump unit acting directly by way of a piston or acting indirectly by means of a cable or chain pull.

Both types of drive have specific use characteristics and in addition they are subject to wear. The use characteristics are, for example, the travel speed or the carry load for which the lift installation is designed. Wear arises due to, for example, long-term utilisation of the lift installation which leads to wear phenomena at components of the lift installation. If the use requirements change or if the wear is too great the drive or if need be the entire lift has to be replaced or renewed.

In order to cover a widest possible field of use in the case of replacement of existing lift drives or entire lift installations with few components, universally or modularly usable drive engines are required.

Drives which are small and compact or enable variable support means take-offs are known from existing specifications. Thus, EP 0763495 shows a drive engine which produces a change in the support means spacing (a) by changing the installation slope. The spacing between the support means run running up to the drive engine and the support means run

running down is termed support means spacing. The illustrated drive engine has the disadvantage that it is referred to an engine space with specially made support pedestals and accordingly is not suitable for installation in an existing engine space or in a shaft, a change in the support means spacing ( $a$ ) produces a change in the looping angle ( $\beta$ ) and the unit is large, which has a disadvantageous effect in the case of installation in an existing building. The looping angle ( $\beta$ ) denotes the angle by which the support means loop the drive pulley. The force transmissible from the drive pulley to the support means is usually dependent on the looping angle ( $\beta$ ).

A drive engine which is of compact construction and can be mounted within the shaft space is known from WO 01/28911. The drive engine has a fixed support means spacing. The disadvantage of this solution is the lack of flexibility of the drive, since it does not allow any adjustment of the support means spacing.

The object of the invention is now to provide a drive for a lift installation which is suitable for replacement of existing drives and which is adaptable in optimum manner to existing buildings, i.e. it shall be able to be arranged in an existing engine space or within the shaft space without further measures. The support means spacing shall be adjustable in simple manner and the drive shall have small dimensions. In addition, the drive shall be directly usable for lift installations which are slung around, such as for lift installations with direct 1:1 suspension. Obviously, general aspects such as a high safety standard, economic production and assembly as well as small dimensions are to be taken into consideration.

The solutions defined in the independent patent claims fulfil this object. Depending on the respective solution the optimum benefit for the lift constructor is achieved.

The lift installation comprises a drive, a cage held at support means and a counterweight. The cage and the counterweight are arranged in a vertically extending shaft to be movable up and down in opposite direction. The support means connects the cage with the counterweight and the support means is carried and driven by the drive by means of at least one drive pulley. The drive is provided with the drive pulley, with at least one motor required for driving the drive pulley and with a deflecting module. The motor and the drive pulley are combined to form a drive module. The core function of the drive is discernible through this drive module. As a rule the drive module similarly comprises a brake device.

According to the invention the drive module and the deflecting module are connected together by means of an extension, wherein the drive module and the deflecting module are provided with interfaces which together with the extension enable adaptation of the drive to a required support means spacing. At the same time the drive module and/or the deflecting module is or are provided with connecting parts which are used for fastening the drive within the shaft or in the engine space.

By this solution the drive is adaptable in optimum manner to existing buildings and it can - with use of the connecting part - be arranged without further constructional measures in an existing engine space or within a shaft. The support means spacing can be adapted in simple manner to predetermined support cable spacings with use of the extension and the interfaces at drive module and deflecting module. The modular construction of drive module and deflecting module as well as the fastening possibility thereof by means of suitable connecting parts makes small dimensions possible, since support forces are directly introduced into the building. The connecting parts are designed in correspondence with the building requirements. The drive module and the deflecting module have the appropriate interfaces. The parts can thereby be produced in rational manner and in large batch numbers. This gives optimum conditions of manufacture in terms of economy. Due to the division into module and parts the drive is easily transportable; it can, for example, be transported within an existing building, by an existing lift installation, to the vicinity of the mounting location. It is thus particularly suitable for conversion of lift installations in existing buildings. An advantageous consequence is similarly that the installation height of the drive, independently of support means spacing, is not changed and thus there is no dependence of the height space requirement on the support means spacing.

Further advantageous solutions are described in the dependent claims.

In an advantageous embodiment the drive module is provided with a guide roller. The guide roller is disposed in the drive module in such a manner that independently of the support means spacing it enables a fixedly defined looping of the drive pulley. Costly installation-related verifications of sufficient drive capacity are thereby redundant, since a few, fixedly defined looping angles can be taken into consideration for proof calculation. The drive module can thereby be manufactured particularly economically.

A fastening for attachment of support means ends is integrated in the drive module and/or the deflecting module. This fastening is advantageously used in the case of lift installations with sling suspensions. All critical support points of the drive are thus placed in the drive itself. The entire suspension force of the lift installation is accepted by the support points predetermined by the drive. The drive engine is thus particularly suitable for use in existing buildings, since the introduction of forces into the building is reduced to a few points. Advantageously a monitoring device monitoring correct transmission of the drive forces to the drive means is arranged in the drive module. An inadequate transmission of drive forces is established, for example, by comparison of the rotational speed of the guide roller with the rotational speed of the drive pulley. In the case of critical deviation, pre-defined safety measures are initiated. The safety and serviceability of the lift installation is thereby increased, since the correct measures (maintenance request, shutdown, etc.) can be initiated specific to case.

Accordingly, in one aspect the present invention resides in a lift installation with a drive, a cage and a counterweight, which drive is provided with at least one drive pulley, with at least one motor required for driving the drive pulley and with a deflecting module with deflecting roller, wherein the motor and the drive pulley are combined into a drive module, and support means are guided over the drive pulley and the deflecting roller, wherein the drive module has an own drive module housing at which the motor, the drive pulley and interfaces for attachment of connection parts are arranged, wherein the drive module housing is carried by parts of a shaft or engine room and that the deflecting module has an own deflecting module housing at which the deflecting roller and interfaces for attachment of connecting parts are arranged, wherein the deflecting module housing is carried by parts of the shaft or the engine room separately from the drive module housing.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Advantageous embodiments of the invention are illustrated by way of example in the following figures Fig. 1 to Fig. 13.

4a

Fig. 1 is an example of a lift installation with a modular drive according to the invention, for possible use in the case of a conversion,

Fig. 2 is a three-dimensional view of a modular drive,

Fig. 3 is a further three-dimensional view of a modular drive,

Fig. 4 is a three-dimensional view of a drive module,

Figs. 4a to 4c are examples of slinging,

Figs. 4d to 4f are embodiments of support means by way of example,

Fig. 5 is a first example of installation of a modular drive mounted on a shaft roof,

Fig. 6 is a second example of installation of a modular drive mounted on a shaft roof,

- Fig. 7 is a third example of installation of a modular drive mounted below a shaft roof,
- Fig. 8 is a side view of a modular drive mounted below a shaft roof,
- Fig. 9 is an example of a deflecting module,
- Fig. 10 is an example of a deflecting module with extensions,
- Fig. 11 is a cross-sectional illustration of a drive module with belt connection,
- Fig. 12 is a cross-sectional illustration of a drive module with a directly connected drive device and
- Fig. 13 is an illustration of a method of mounting.

Fig. 1 shows a lift installation 1 with a cage 3 held at support means 2, and counterweight 4, which are movable back and forth in opposite direction in a vertically extending shaft 5. A drive 7 mounted below a shaft roof 6 carries and drives the support means 2 and the cage 3 and counterweight 4 held by means of the support means 2. In the illustrated example an existing lift installation 1 with engine space 8 is provided with a new drive 7. The original space required by the old drive engine 9 is no longer needed for the new drive 7. The old drive engine 9 can, as shown in the example, be left in mounted state and demounted at a later point in time or the space can be used for other tasks. A control 10 required for the new drive 7 can, as recognisable in the example, be arranged in the former engine space 8 or in the access region of a storey door or at another position, preferably in the vicinity of the drive 7.

The new drive 7 is, as illustrated in Figs. 2 and 3, of modular construction. A drive module 11 is provided with a drive pulley 12 for the support means 2 of the cage 3 and counterweight 4, with a motor 21 required for driving the drive pulley 12 and, in the illustrated example, with a brake device 14 required for braking the drive pulley 12. The drive device 13 and the drive pulley 12 are combined into a drive module 11 as illustrated in Fig. 4 by way of example. According to the invention the drive module 11 is provided with interfaces 15. These interfaces 15 enable the connection of connecting parts 16.

These connecting parts 16 selectably enable fastening of the drive module 11 within the shaft 5, for example to the shaft roof 6 as apparent in Figs. 1, 7 and 8, or on the floor of a conventional engine space 8 as is illustrated in Fig. 5 or on the pedestals 17 of a previously demounted old drive engine 9 as shown in Fig. 6.

The interfaces 15 moreover enable connection of an extension 18 to which a deflecting module 19 is connected as illustrated in Figs. 1, 2 and 3. The extension 18 together with the drive module 11 and the deflecting module 19 enables adjustment of the support means spacing in correspondence with the requirements of the lift installation 1. The deflecting module 19 in turn contains interfaces 15 which enables connection of fastenings such as are used in the drive module 11.

The interface 15 of the drive module 11 and the interface 15 of the deflecting module are preferably of identical construction. This enables simple mounting, since there is no possibility of mixing up when mounting of the extension 18.

The extension 18 and the deflecting module 19 are constructed in such a manner that the constructional height of the drive 7 is not changed by the combination of drive module 11, extension 18 and deflecting module 19. The interfaces 15 are designed appropriately to function. They enable a modular composition of the drive 7 according to the requirements of the building.

As an additional advantage the individual modules and parts can be separately transported to the mounting location. The transport units are thereby small and have a low individual weight. They can be transported, for example, by an old lift installation 9, which is intended for conversion, to the vicinity of the installation location in the building.

The advantage of this invention is to be recognised in the fact that this drive 7 is best suited for replacement of existing drives 9 in that it is adaptable in optimum manner to existing buildings, i.e. it can be arranged not only within the shaft 5, but also in an existing engine space 8. The support means spacing is, in addition, adjustable in simple manner. Adjustment of the support means spacing does not influence the constructional height of the drive.

As illustrated by way of example in Fig. 4, the drive module 11 is selectably provided with a guide roller 20 which ensures looping of the drive pulley 12 by the support means 2 independently of the support means spacing. If the support means 2 is deflected by use of the guide roller 20, the looping angle ( $\beta$ ) amounts to  $90^\circ$  to  $180^\circ$ . This looping can be changed by the arrangement of the guide roller 20. A looping angle ( $\beta$ ) in the vicinity of  $180^\circ$  is usually desired. The drive module 11 can also be used directly without employment of the guide roller 20. In that case a looping angle ( $\beta$ ) of  $90^\circ$  or  $180^\circ$  results depending on the respective arrangement, as is illustrated in the basic sketches Figs. 4a, 4b and 4c.

The advantage of this arrangement is to be recognised in that the looping angle ( $\beta$ ) can be defined independently of the support means spacing.

The drive module 11 is preferably provided with a monitoring device (not illustrated) which monitors the correct drive force transmission from the drive pulley 12 to the support means 2 and/or the correct tension of the support means 2. The arrangement of the drive roller 20 illustrated in Fig. 4 enables checking of the drive force transmission in that, for example, the rotational speed of the drive roller 20 is compared with the rotational speed of the drive pulley 12. If the two values noticeably differ from one another an incorrect transmission of the driving forces is present.

The advantage of this construction is to be seen in that the correct transmission of the drive force can be monitored directly at the drive 7. The safety and serviceability of the lift installation 1 is thereby increased, since the correct measures (maintenance request, shutdown, etc.) can be rapidly initialised specific to case.

The support means 2 has, as illustrated in Figs. 4d to 4f, a substantially round cross-section or it has a substantially flat cross-section, wherein the surface serving for transmission of the drive force is smooth, longitudinally structured, toothed, nubbed, apertured or of any other desired structure or the support means 2 has a desired cross-section. The drive pulley is constructed in such a manner that the transmission of the drive force from the drive pulley to the support means 2 is made possible appropriately to function.

The drive 7 is not limited to a specific support means 2. It is suitable for a plurality of support profile forms. It is advantageous if use is made of support means 2 which are suitable for small deflection radii. The drive 7 can thereby be of particularly small construction.

In an advantageous embodiment of the drive 7 according to the invention the motor 21 of the drive module 11 is, as illustrated in Fig. 11, arranged axially parallel to the drive pulley 12, wherein the motor 21 is connected by a drive belt 23 with a belt pulley 22 arranged coaxially with the drive pulley 12. This embodiment requires little constructional space in the width of the drive 7 and the transmission of the drive moment takes place with low vibration.

Alternatively, the motor 21 is arranged directly coaxially with the drive pulley 12. The advantage of this alternative is to be seen in that the constructional length of the drive 7 is reduced.

In a further alternative the motor 21 is connected with the drive pulley shaft 24 by a transmission. The advantage of this alternative lies in the use of commercially available translation equipment.

As illustrated in Figs. 11 and 12, the brake device 14 is advantageously arranged to act directly on the drive pulley shaft 24 or the drive pulley 12. This arrangement significantly reduces the risk of brake failure, since the braking force is introduced directly into the drive pulley 12. The advantage of this arrangement is that a safety-compliant brake system for stopping and holding a cage 3 with intact support means 2 can be economically realised. Alternatively, the brake device 14 is arranged to act directly on the shaft of the drive motor 21. This arrangement is favourable in costs, since a brake device 14 with a low brake moment can be used. This arrangement usually requires further safety measures, which are known on the market, in order to cope with failure of the connection of drive motor 21 with drive pulley shaft 24. Alternatively, the brake device 14 or a further brake device can be arranged on the deflecting module 19.

Advantageously the drive pulley 12 and/or a drive pulley shaft 24 and/or the belt pulley 22 is or are of integral construction. This embodiment enables a production-optimised and economic construction of the drive module 11.

The drive module 11 is provided with interfaces 15 which enable attachment of several connecting parts 16. The advantage of this embodiment results from the universal usability of the drive module 11. The interfaces 15 enable attachment of the connecting parts 16 required for a specific lift installation 1. The interfaces 15 are, as apparent in Figs. 3, 4, 9 and 10, for example slots or hole arrangements or clamping jaws for reception of connecting means. The connecting parts 16 are, selectably, extension 18, deflecting module 19, suspension or support modules 25, 26, or there are support means end connections 27 or further auxiliary means. The construction of the drive module 11 with interfaces 15 appropriate to function enables utilisation of the drive module 11 for many kinds of lifts and this enables a rational and economic manufacture of the product.

A first advantageous connecting part 16 is an extension 18, which is arranged with one end region at the interface 15 of the drive module 11, and to the other end region of which a deflecting module 19 is fastened. The deflecting module 19 comprises an interface 15 identical to the drive module. By means of the extension 18 and the design of the interface 15 for the drive module and deflecting module there is made possible an adaptation of the drive 7 to the requisite support means spacing. Existing lift installations 1 have a specific form of suspension of the cage 3 or of the counterweight 4. Resulting from this form of suspension is a characterising spacing of the support means run, which usually extends from the centre of the cage 3 in vertical projection to the centre of the counterweight 4. The advantage of the extension 18 is that adjustment of the support means spacing is possible. Thus, universal drive and deflecting modules can be used, which in turn enables rational manufacture of the drive. The deflecting module 19 and the drive module 11 have the same interfaces 15. This is particularly advantageous, as design possibilities are thereby increased. Thus, for example, two drive modules 11 can be used instead of the arrangement of drive module 11 and deflecting module 19. The power of the drive system 7 can thereby be significantly increased.

The interface 15 of the drive module 11 and of the deflecting module 19 for the extension 18 enables a fine adjustability of the support means spacing. This advantageous embodiment allows adjustment to the actually present support means spacing. There is thus no skewed traction, whereby wear of the support means 2 is reduced.

A further advantageous connecting part 16 is a suspension module 24, which is arranged at the interface 15 of the drive module 11 and/or of the deflecting module 12 and which enables suspension of the drive at a shaft roof 6, or another connecting part 16 is a support module 26, which is arranged at the interface 15 of the drive module 11 and/or of the deflecting module 19 and which enables fastening of the drive 7 in an engine space 8 or to a shaft wall. The suspension or support modules 25, 26 are advantageously provided with noise-damping or vibration-damping materials. The advantage of this embodiment is to be seen in that a fastening appropriate to the type of building can be used.

The suspension module 25 uses, for example, existing openings in the shaft roof 6 or in the floor of the engine space 8 disposed above in order to suspend the drive 7 at the shaft roof 6, wherein the counter-plates required in the engine space 8 are constructed to be long and narrow and are arranged between the existing engine pedestals 17. Depending on the form of the engine space 8 the counter-plates can have other shapes, as appears rational for the arrangement. They can in case of need be constructed to be, for example, round.

It is particularly advantageous with this embodiment that any engine pedestals 17 which were used for fastening an old drive 9 can be left. This reduces conversion time and the costs connected therewith.

The drive module 11 and/or the deflecting module 19 is or are advantageously provided with support means end connections 27. It is of advantage in that case that the interfaces relative to the building are reduced, since all supporting forces from cage 3 and counterweight 4 are led to the drive unit and are introduced by way of the suspension points of the drive 7 into the building. The arrangement of the suspensions enables use of a 2:1 slung arrangement in the case of lift installations 1 which were suspended in the old construction directly, or 1:1. This arrangement is made possible by a particularly advantageous design of the support means end connections.

In a useful enhancement the drive module 11 and/or the deflecting module 19 is or are provided with an interface 15 for fastening an auxiliary hoist 28. The auxiliary hoist 28 serves for the movement, which is needed for mounting, of lift material and/or assembly

personnel. This enhancement allows a particularly efficient course of mounting of the drive 7 according to the invention, as illustrated in Fig. 13 by way of example.

The drive according to the invention is transported with the help of the old lift installation 1 to the vicinity of the installation location and completed there with the necessary connecting parts 16. The old cage 3 is now fixed and secured in the vicinity of the uppermost stop and the old support elements are demounted. The drive 7 according to the invention is now raised to the shaft roof 6, preferably with use of the already existing cable passages and traction equipment 29 mounted in the engine space 7, and fastened by means of suspension module 25. An auxiliary hoist 28 is now mounted at the interface 15 provided at the drive 7. With the help of this auxiliary hoist 28 the cage 3 can now be moved and any components of the old engine space equipment, such as drive engine, control boxes, etc., can be transported with the help of the auxiliary hoist 28. If the renewal of the rest of the shaft equipment is replaced in accordance with a respective conversion agreement, the new support means 2 can be put in, the auxiliary hoist 28 can be removed and the lift installation 1 is after a short conversion time again available for the customer. This outlined sequence of conversion is merely one possible example. It demonstrates the advantageous use of the drive 7 according to the invention.

A supplementary embodiment proposes that the fastening of the support means end connection 27 is provided with monitoring means for ascertaining the support means tension. The advantage of this embodiment is that in the case of deviation of the support means tension suitable measures can be initiated, such as, for example, a request for a service engineer or shutdown of the lift installation 1 before an unsafe operating state arises.

The control 10 belonging to the lift and/or drive regulation is or are advantageously arranged in the engine space 8. Alternatively, it can also be arranged entirely or partly in the shaft 5 or at a readily accessible location, preferably in the vicinity of the drive.

In the case of conversion of existing lift installations 1 an engine space 8 is often present. The engine space 8 cannot as a rule be used for other purposes. Thus, use of the engine space 8 is available for arrangement of the new control 10 and/or drive regulation. The electrical connection to the drive 7 is usually possible in simple manner via existing passages in the shaft roof 6. It is particularly advantageous in that case that an existing

engine space 8 is usefully re-employed. The best arrangement of the control 10 and/or the drive regulation can be selected in dependence on the existing arrangement or possibility of use of the engine space 8.

The illustrated forms of embodiment and methods are examples. Combinations are possible. Thus, for example, the illustrated drive and deflecting modules can also be used individually.

We claim:

1. Lift installation with a drive, a cage and a counterweight, which drive is provided with at least one drive pulley, with at least one motor required for driving the drive pulley and with a deflecting module with deflecting roller, wherein the motor and the drive pulley are combined into a drive module, and support means are guided over the drive pulley and the deflecting roller, wherein the drive module has an own drive module housing at which the motor, the drive pulley and interfaces for attachment of connection parts are arranged, wherein the drive module housing is carried by parts of a shaft or engine room and that the deflecting module has an own deflecting module housing at which the deflecting roller and interfaces for attachment of connecting parts are arranged, wherein the deflecting module housing is carried by parts of the shaft or the engine room separately from the drive module housing.
2. Lift installation according to claim 1, characterised in that the drive module housing or the deflecting module housing is of integral or self-supporting construction and the forces emanating from the housing are introducible into the roof or into the floor of the shaft or of the engine room.
3. Lift installation according to any one of claims 1 and 2, characterised in that the interfaces are hole arrangements arranged at the drive module housing or the deflecting module housing.
4. Lift installation according to any one of claims 1 to 3, characterised in that the connecting parts are extensions serving as spacers between the drive module and the deflecting module.
5. Lift installation according to any one of claims 1 to 3, characterised in that the connecting parts are suspension modules which serve as suspension of the drive module or the deflecting module at a roof of the shaft.
6. Lift installation according to any one of claims 1 to 3, characterised in that the connecting parts are support modules which serve as supports of the drive module or the deflecting module.

7. Lift installation according to any one of claims 1 to 3, characterised in that the connecting parts are support means end connections serving as holders for the ends of the support means.

8. Lift installation according to claim 7, characterised in that the support means end connections at the drive module are arranged below the drive pulley and at the deflecting module are arranged below the deflecting roller.

9. Lift installation according to claim 7 or claim 8, characterised in that a longitudinal axis of the drive module is parallel to a longitudinal axis of the deflecting module.

10. Lift installation according to claim 9, characterised in that the support means end connections form a straight line which is parallel to the longitudinal axis of the drive module or the longitudinal axis of the deflecting module.

11. Lift installation according to any one of claims 1 to 6, characterised in that a longitudinal axis of the drive module is parallel to a longitudinal axis of the deflecting module.

Application number/numéro de demande: 2546921

Figures: 3, 4, 9, 10

Pages: \_\_\_\_\_

DRW-IP.

Unscannable items  
received with this application  
(Request original documents in File Prep. Section on the 10th Floor)

Documents reçus avec cette demande ne pouvant être balayés  
(Commander les documents originaux dans la section de préparation des dossiers au  
10ième étage)

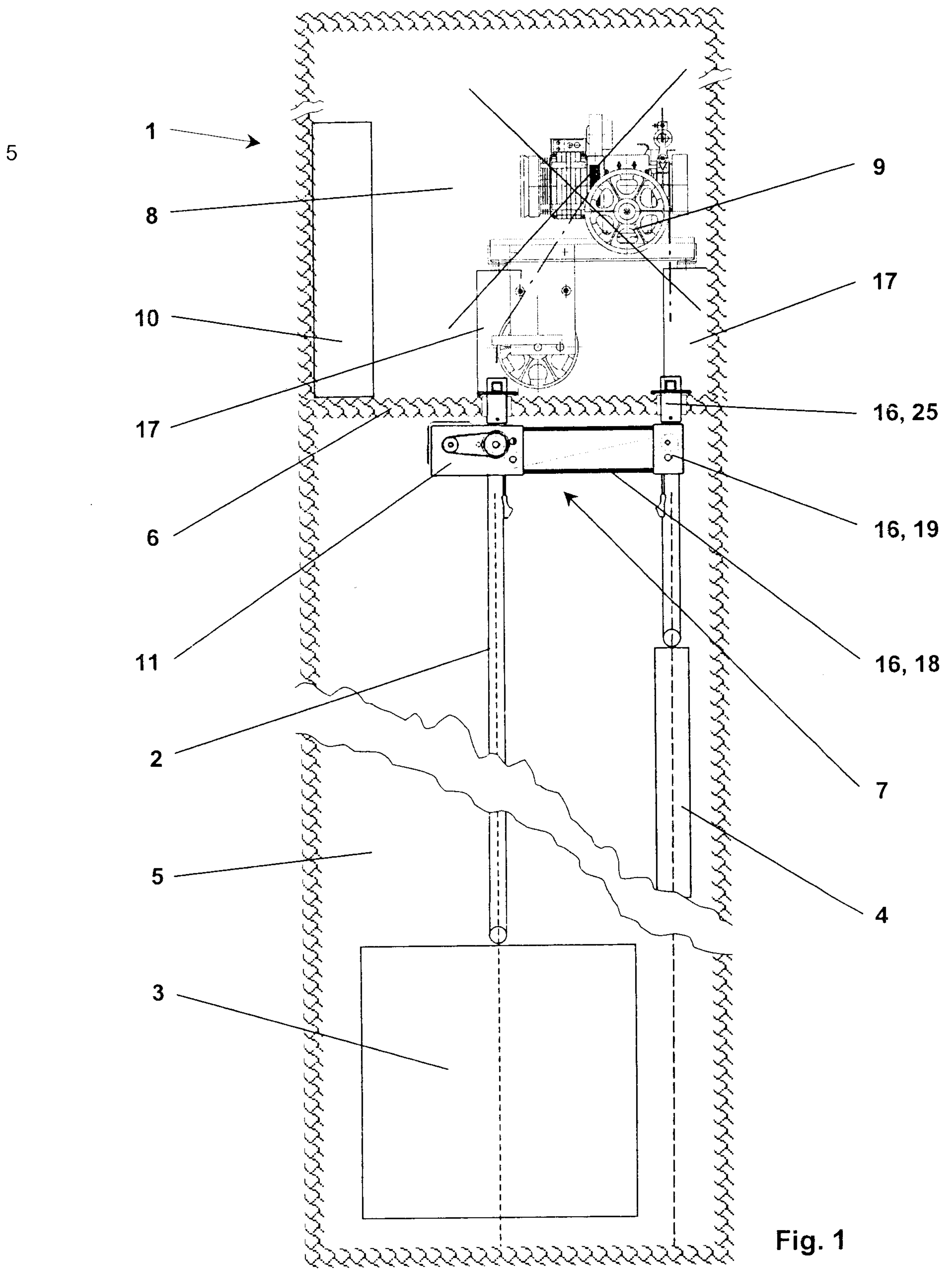


Fig. 1

2

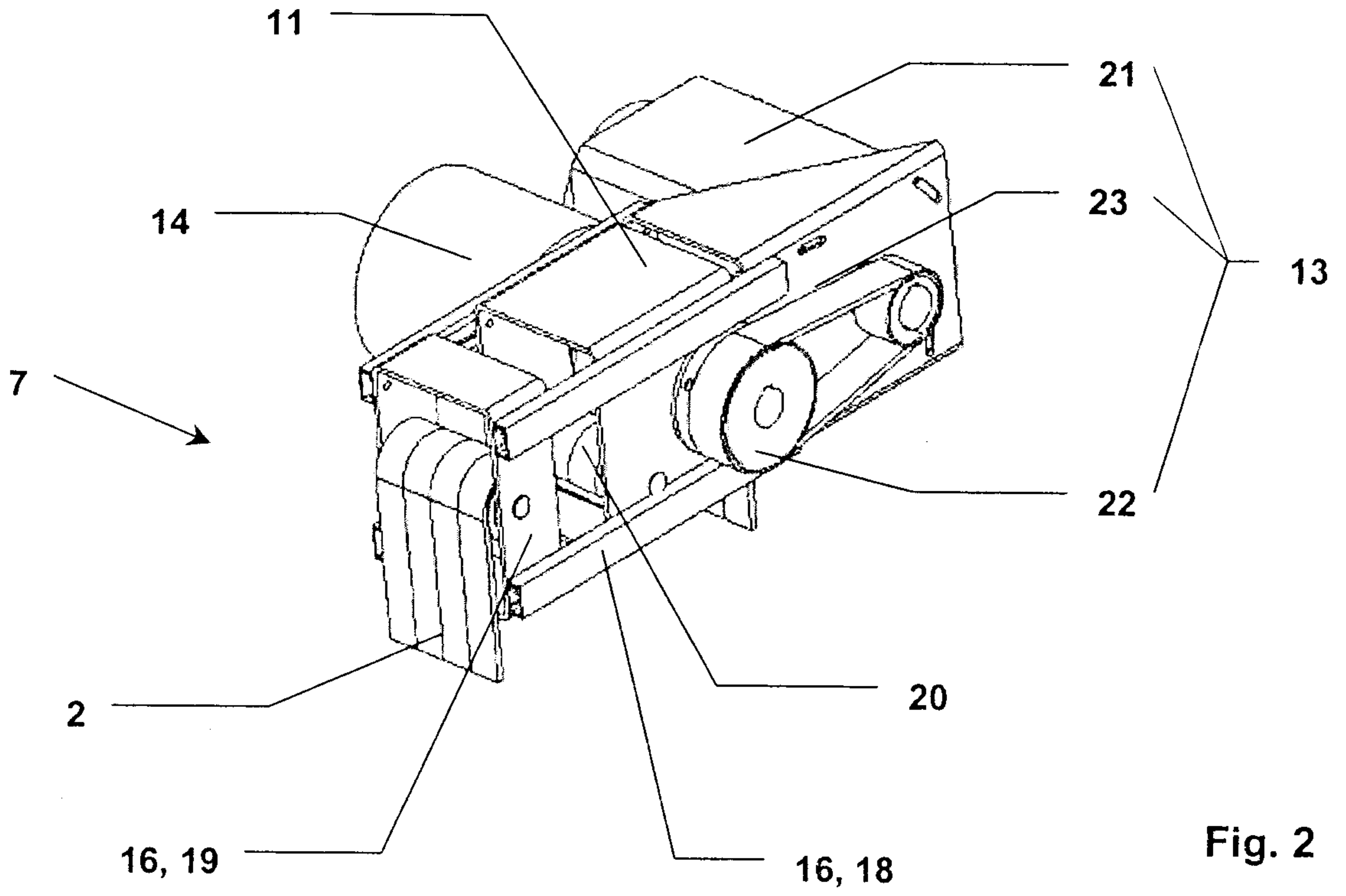


Fig. 2

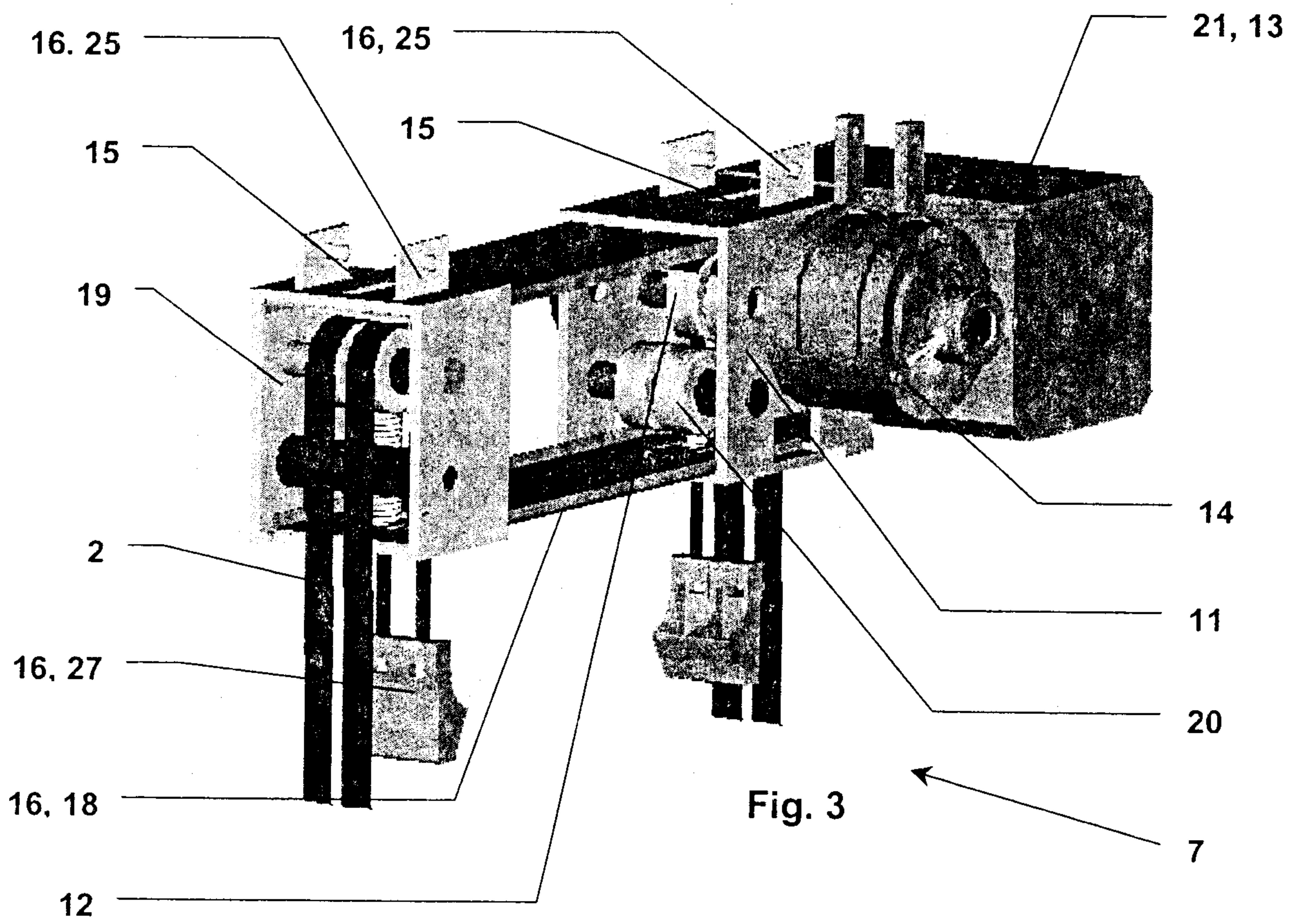


Fig. 3

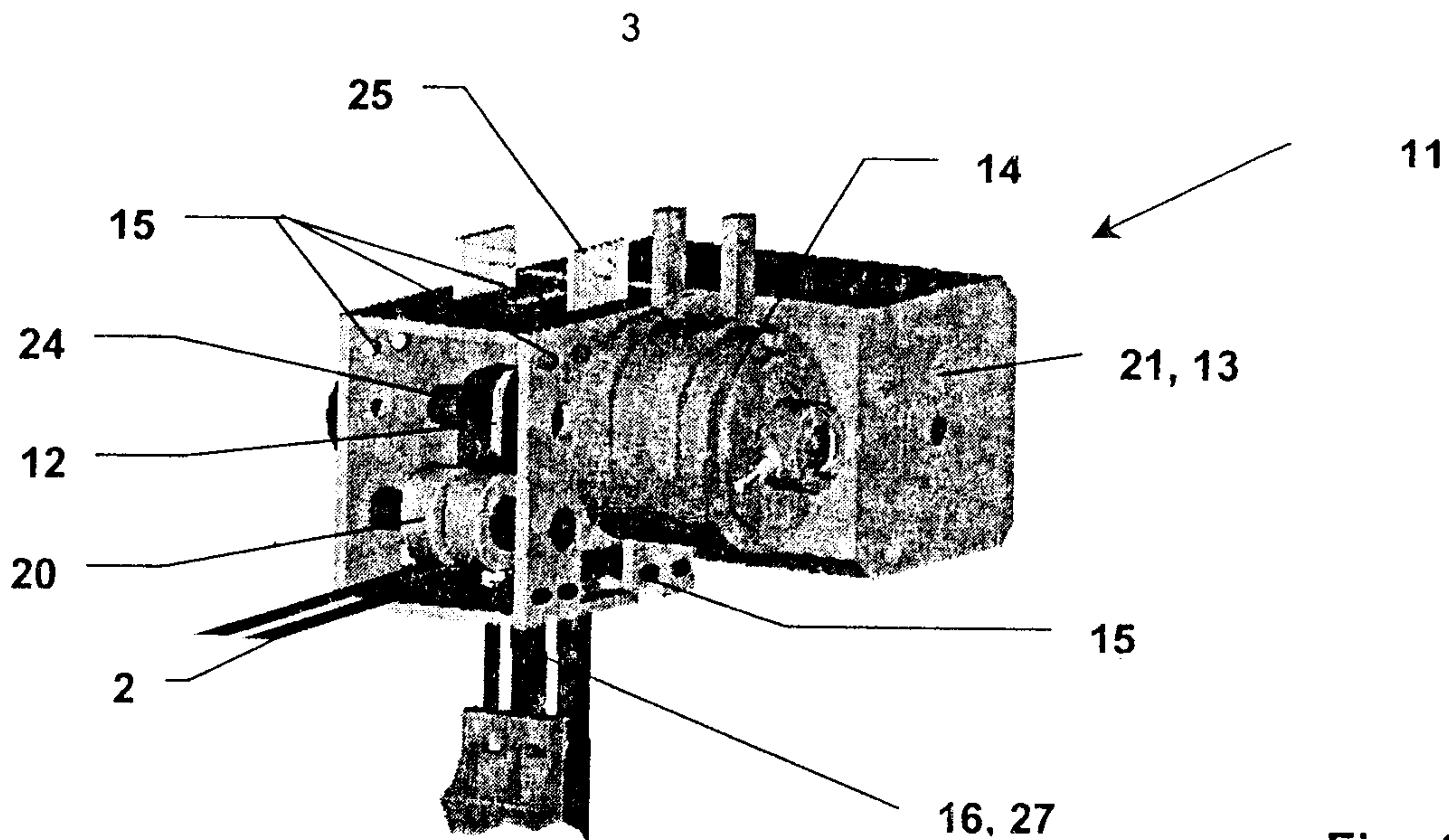


Fig. 4

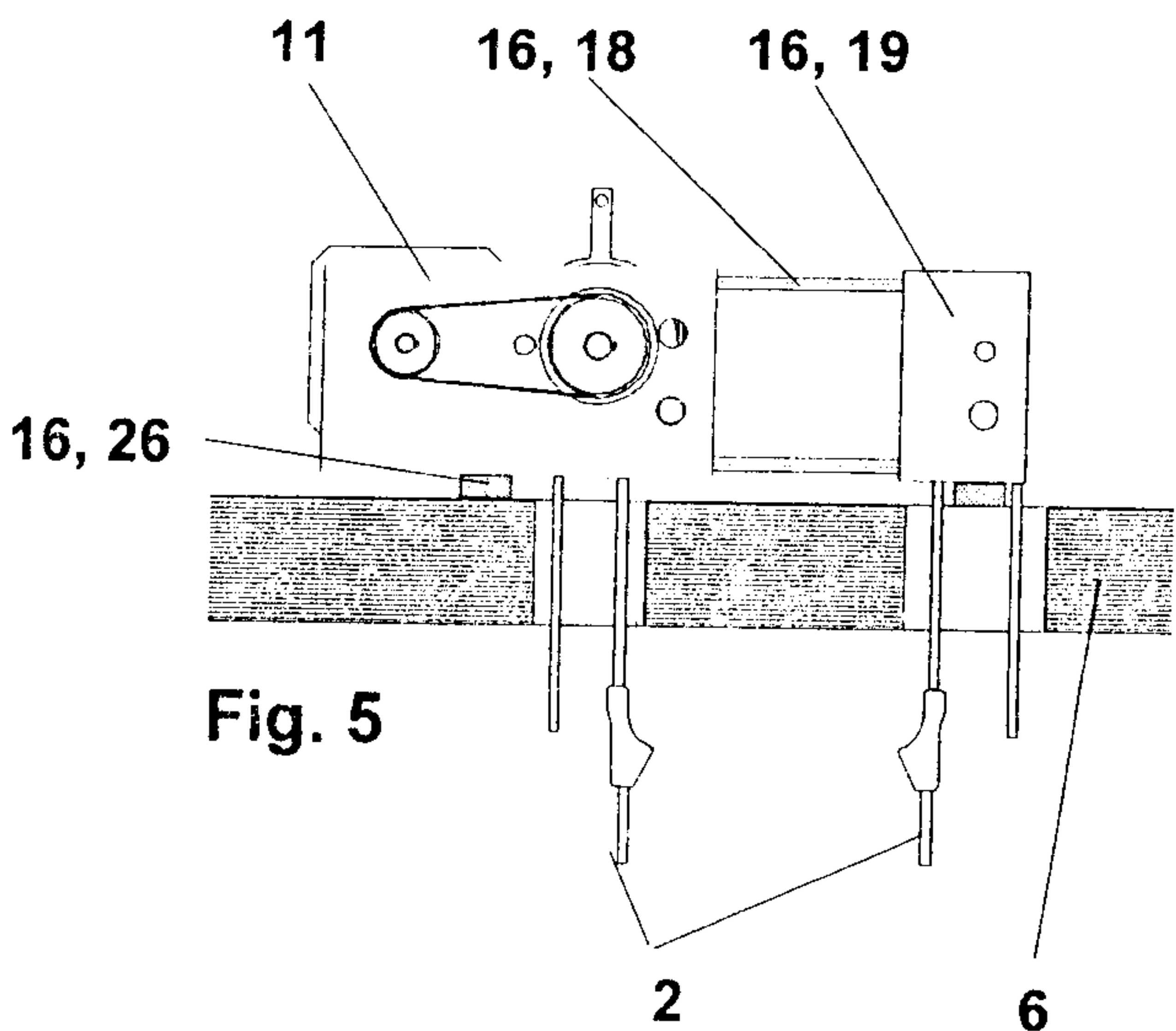
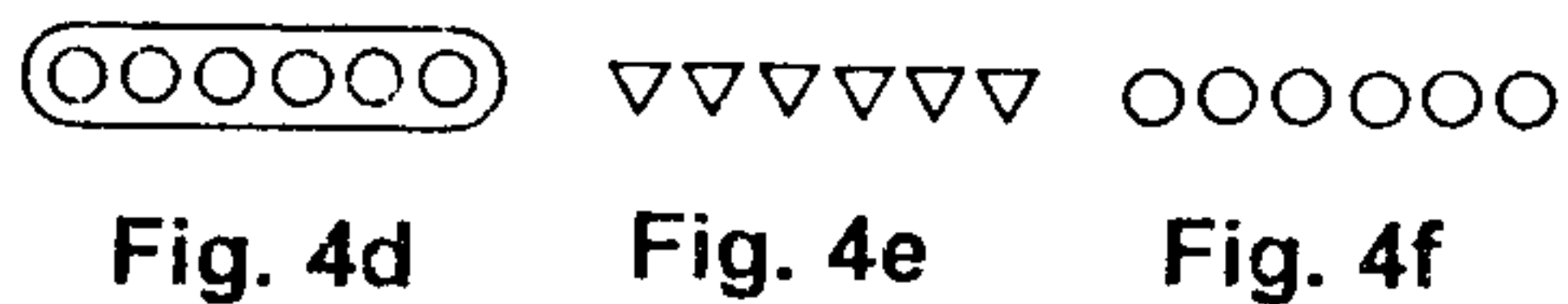
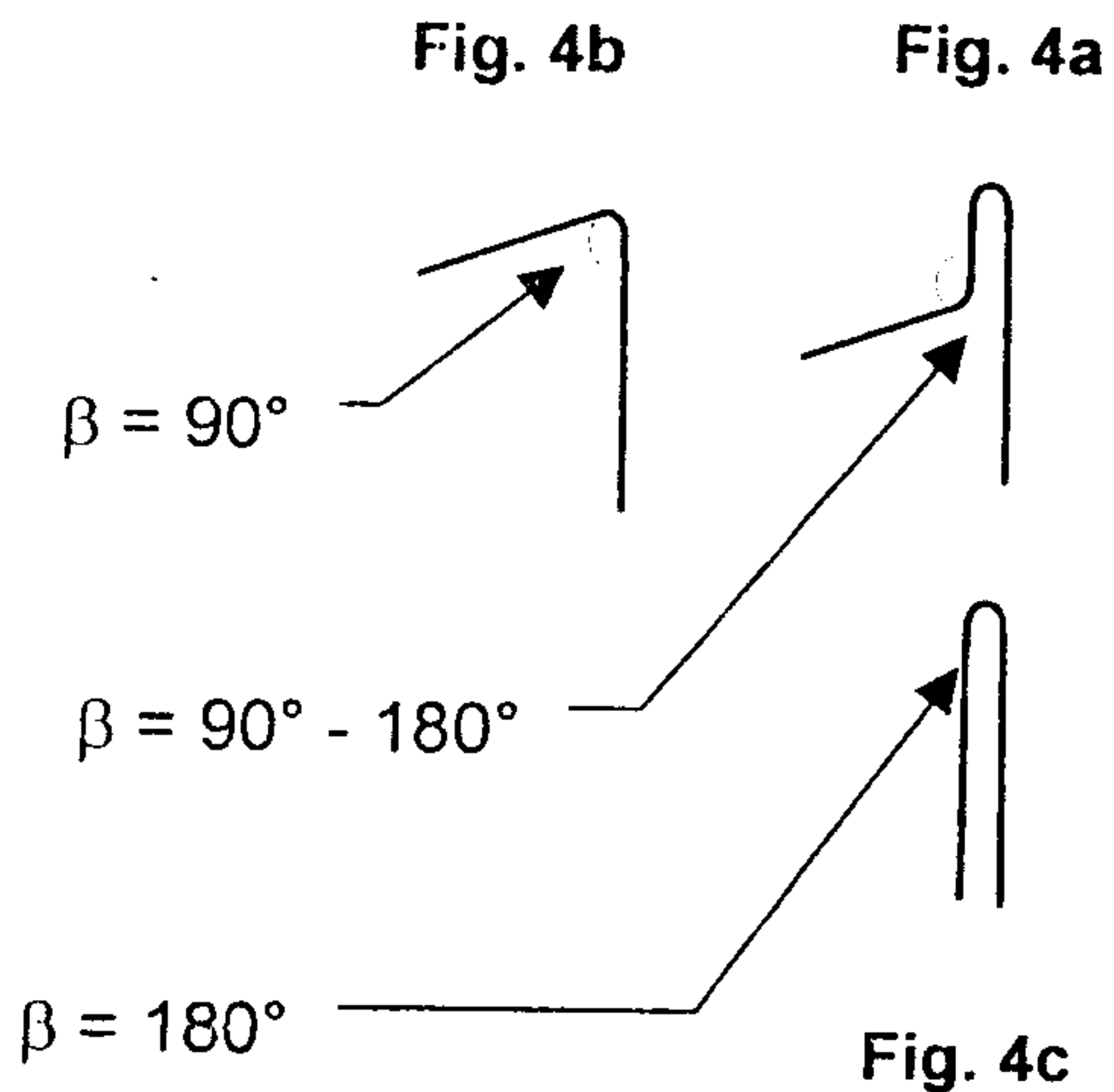


Fig. 5

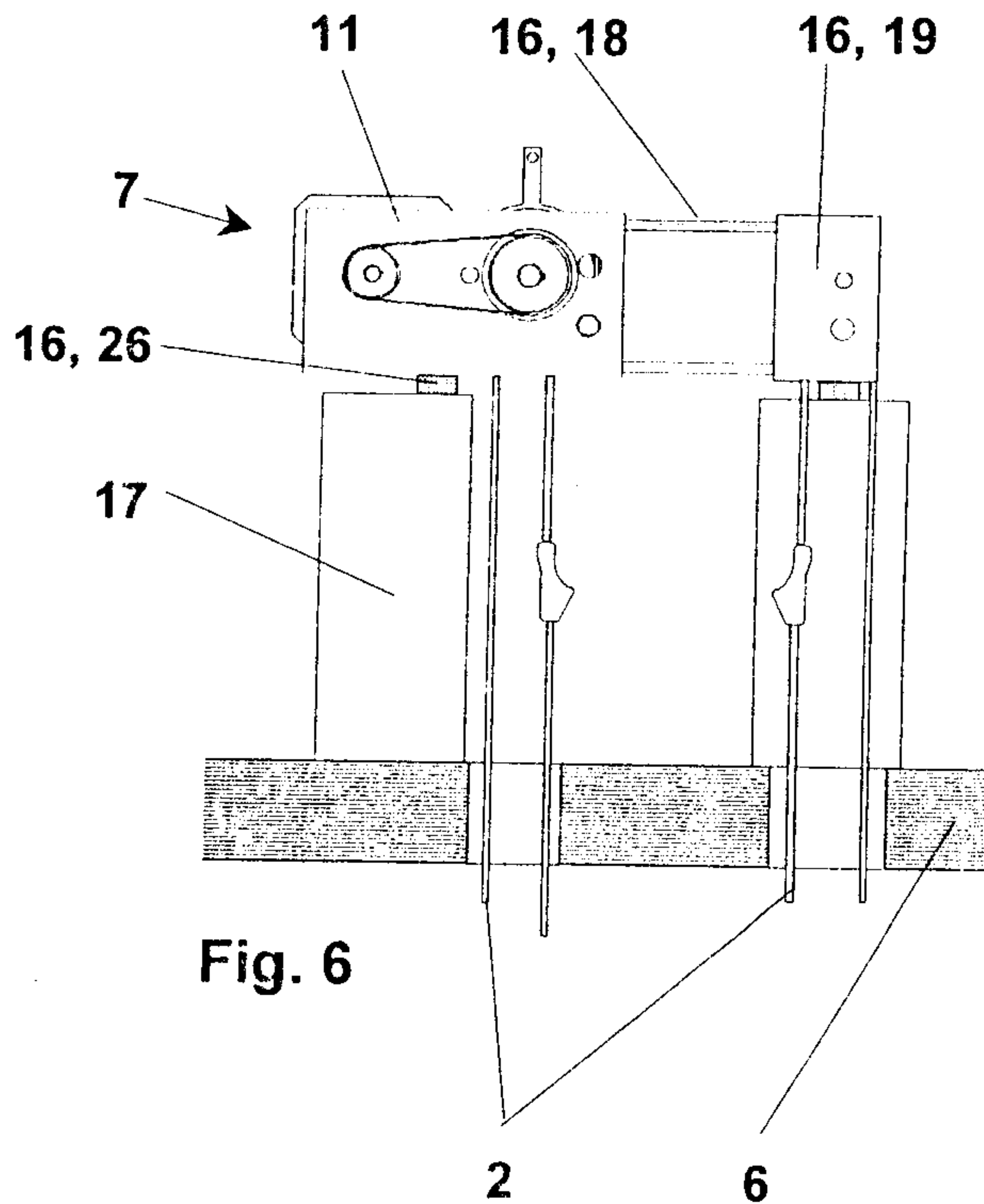


Fig. 6

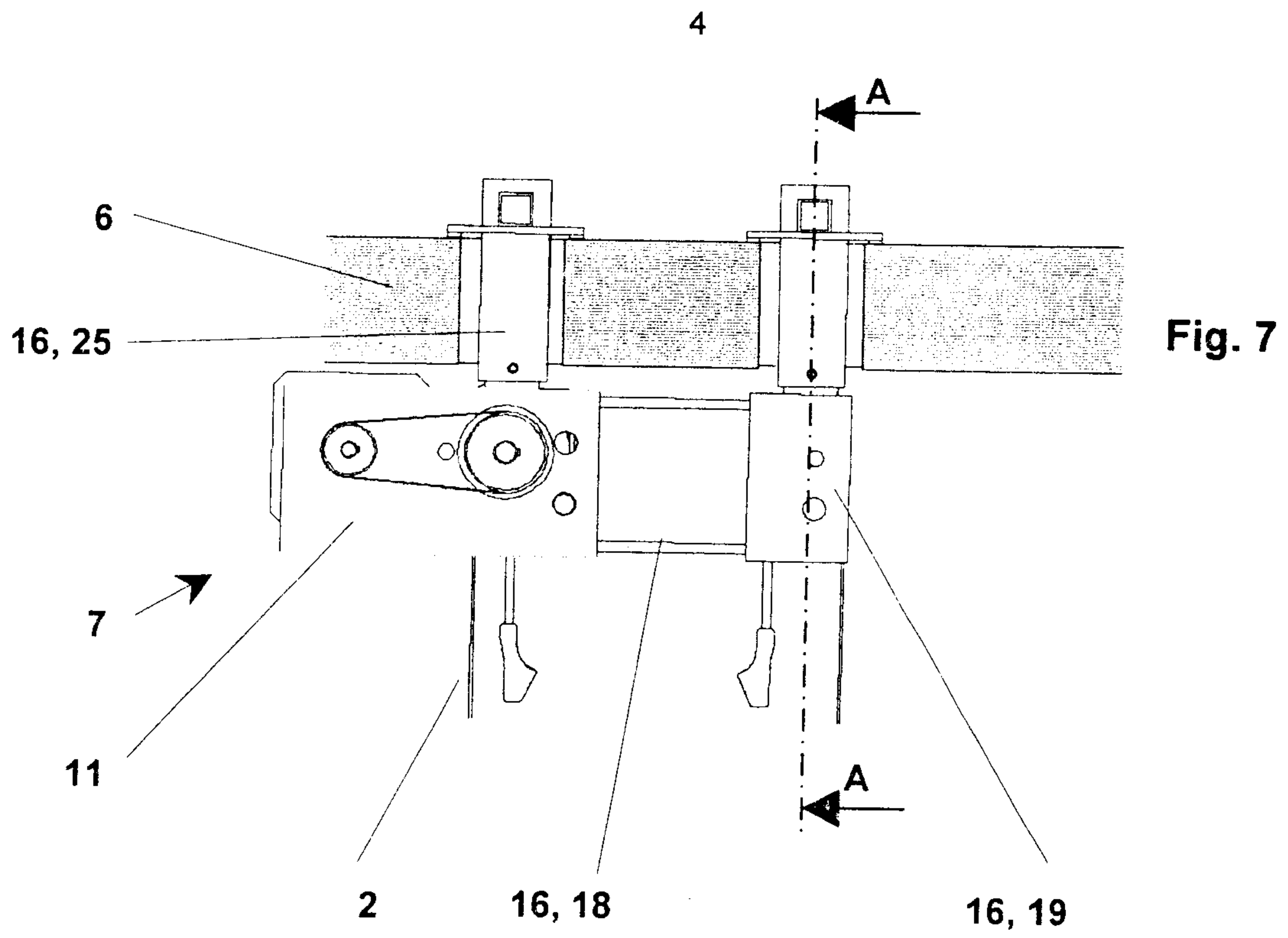
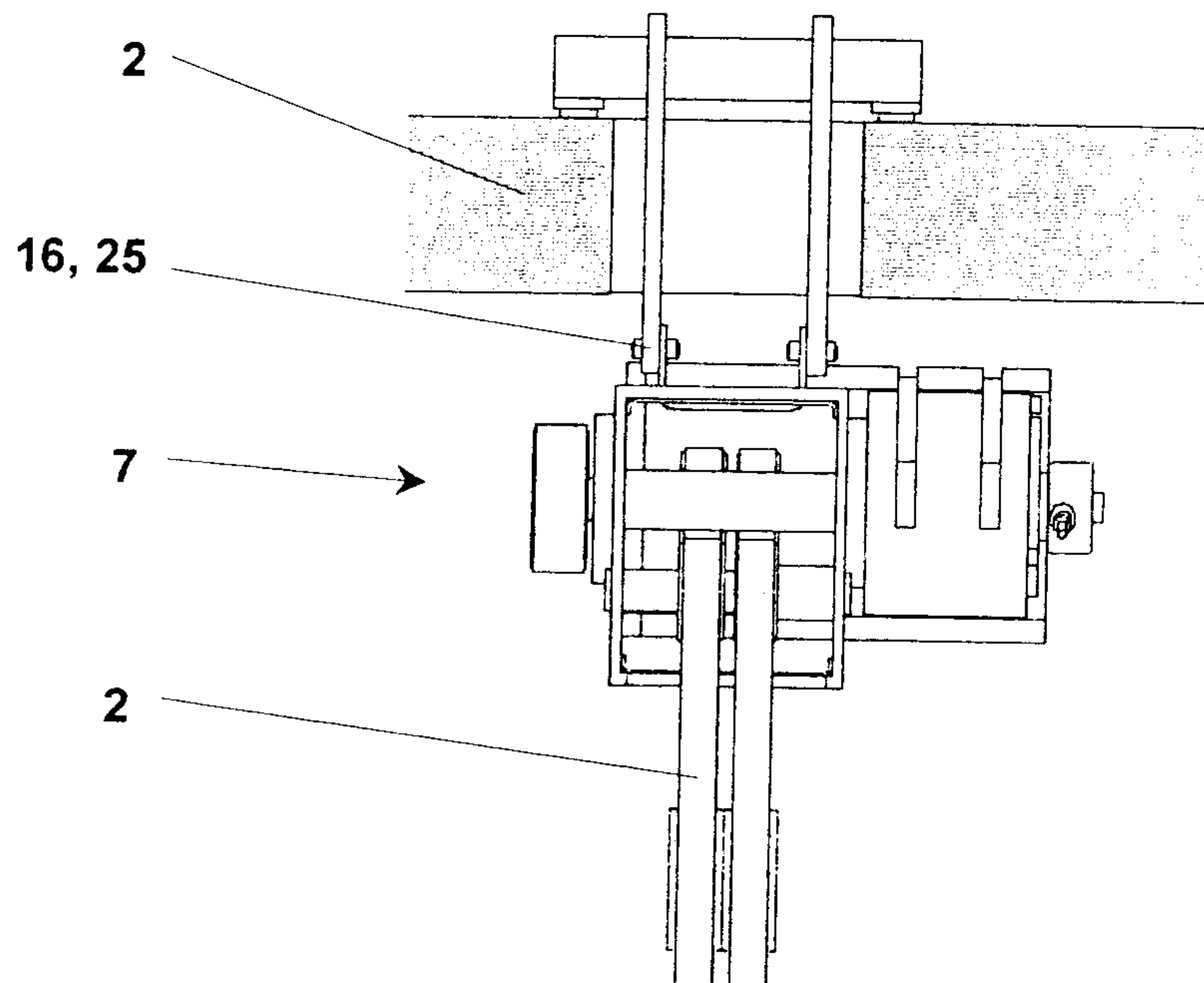


Fig. 8  
A - A



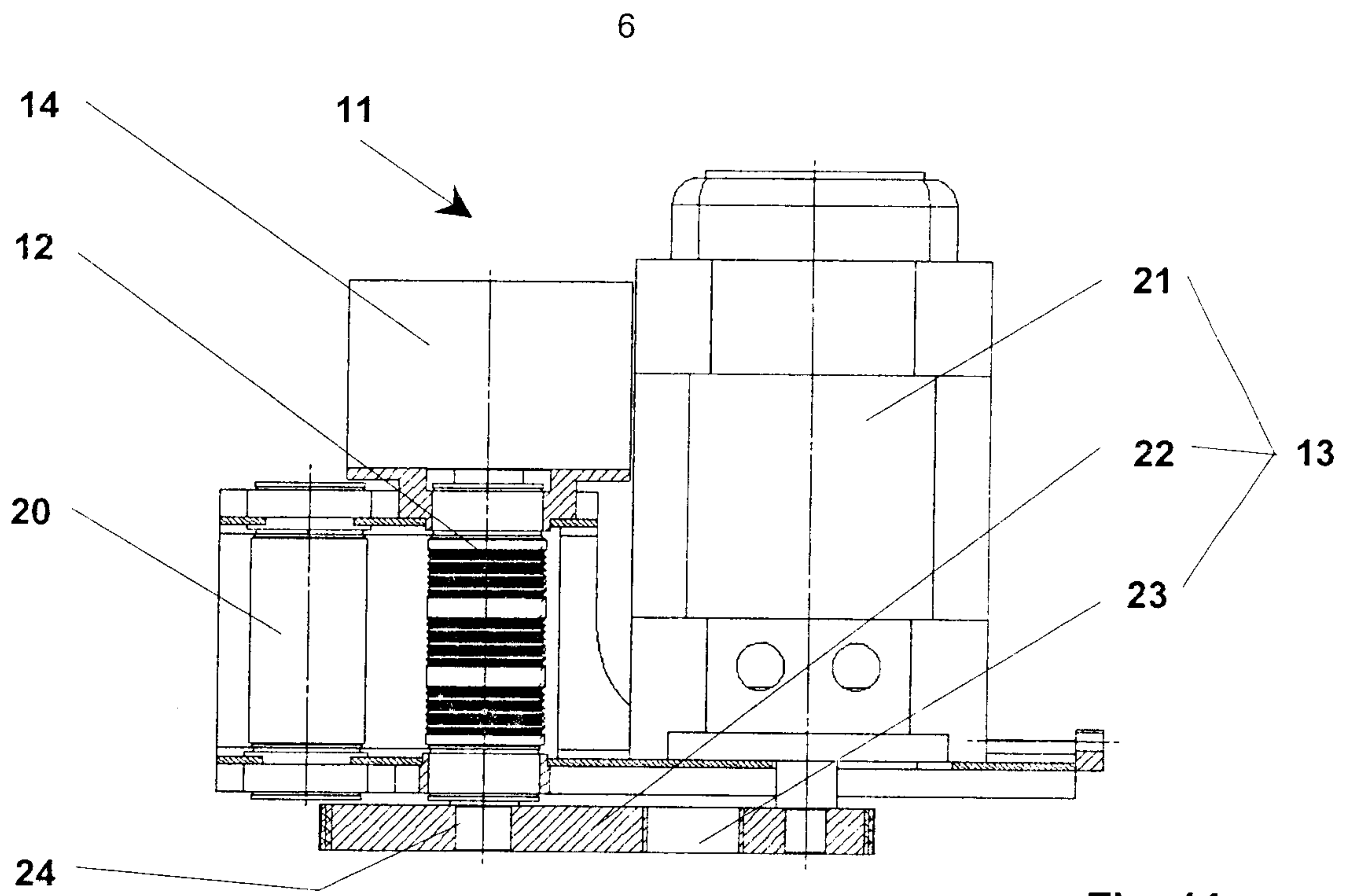


Fig. 11

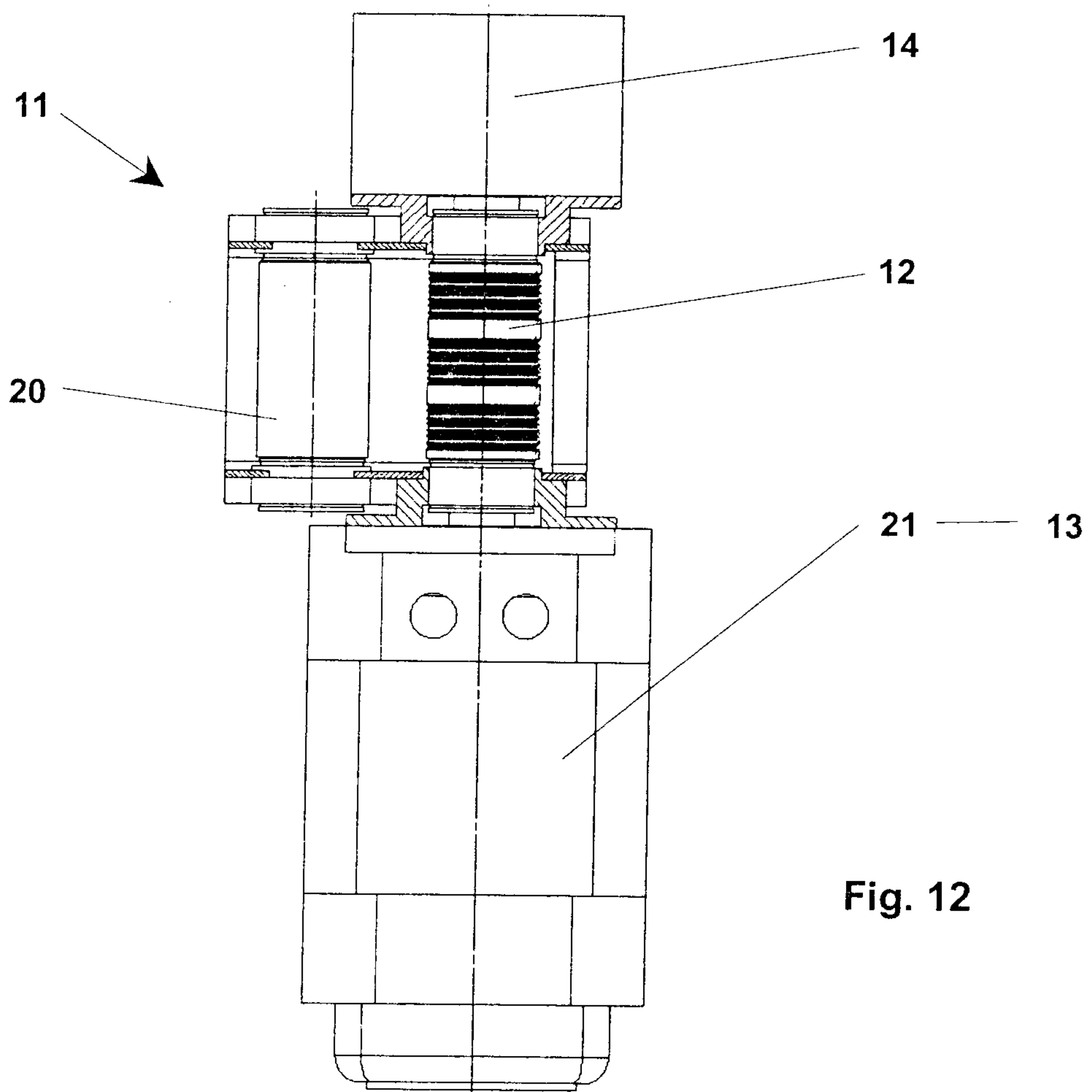


Fig. 12

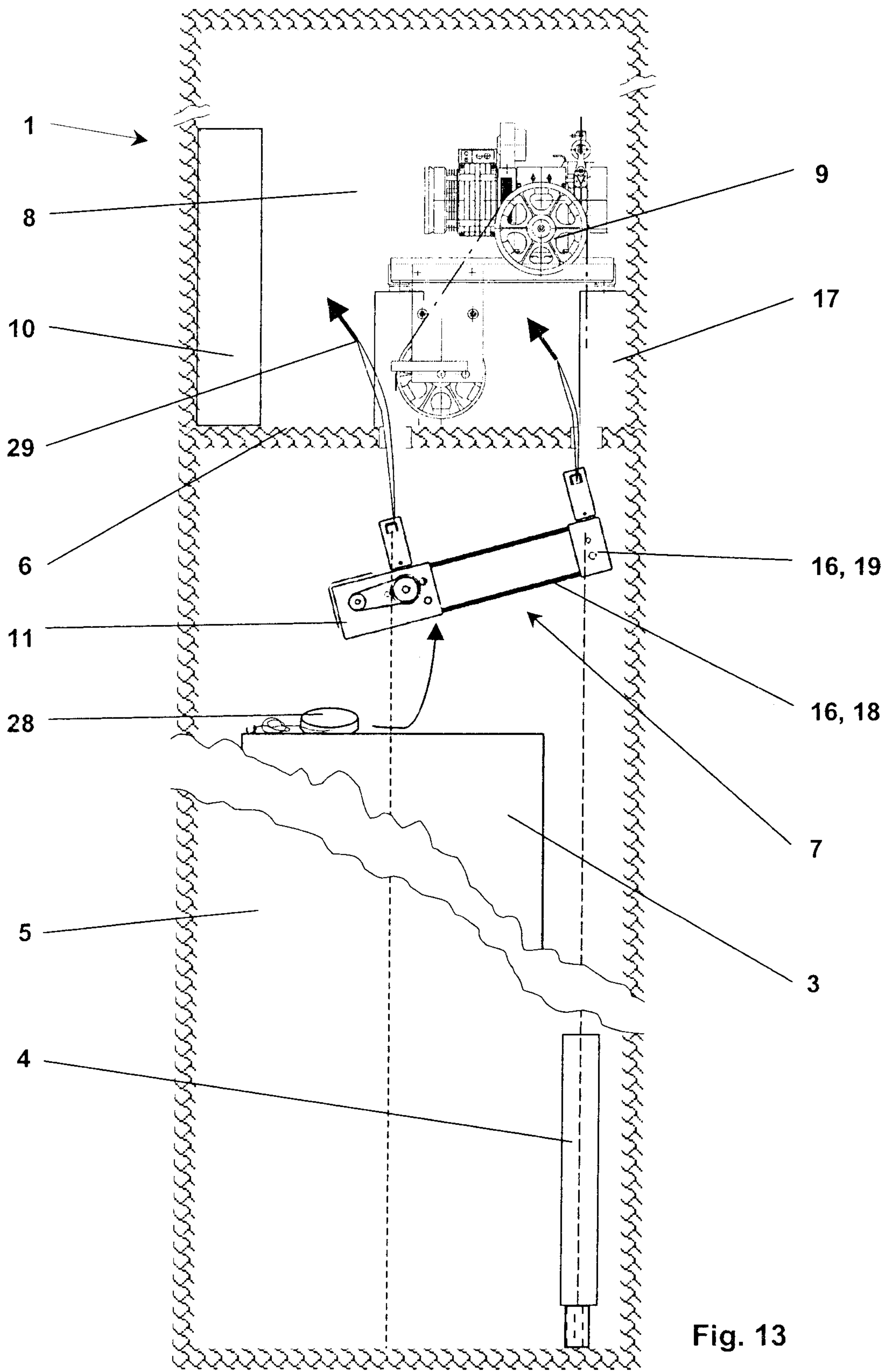


Fig. 13

