



(86) Date de dépôt PCT/PCT Filing Date: 2011/07/20
 (87) Date publication PCT/PCT Publication Date: 2012/03/08
 (85) Entrée phase nationale/National Entry: 2013/02/21
 (86) N° demande PCT/PCT Application No.: EP 2011/003649
 (87) N° publication PCT/PCT Publication No.: 2012/028227
 (30) Priorité/Priority: 2010/08/31 (AT GM 538/2010)

(51) Cl.Int./Int.Cl. *B62M 6/55* (2010.01)
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(54) Titre : ADAPTATEUR DE MONTAGE POUR BICYCLETTE ELECTRIQUE
 (54) Title: MOUNTING ADAPTER FOR AN ELECTRIC CYCLE

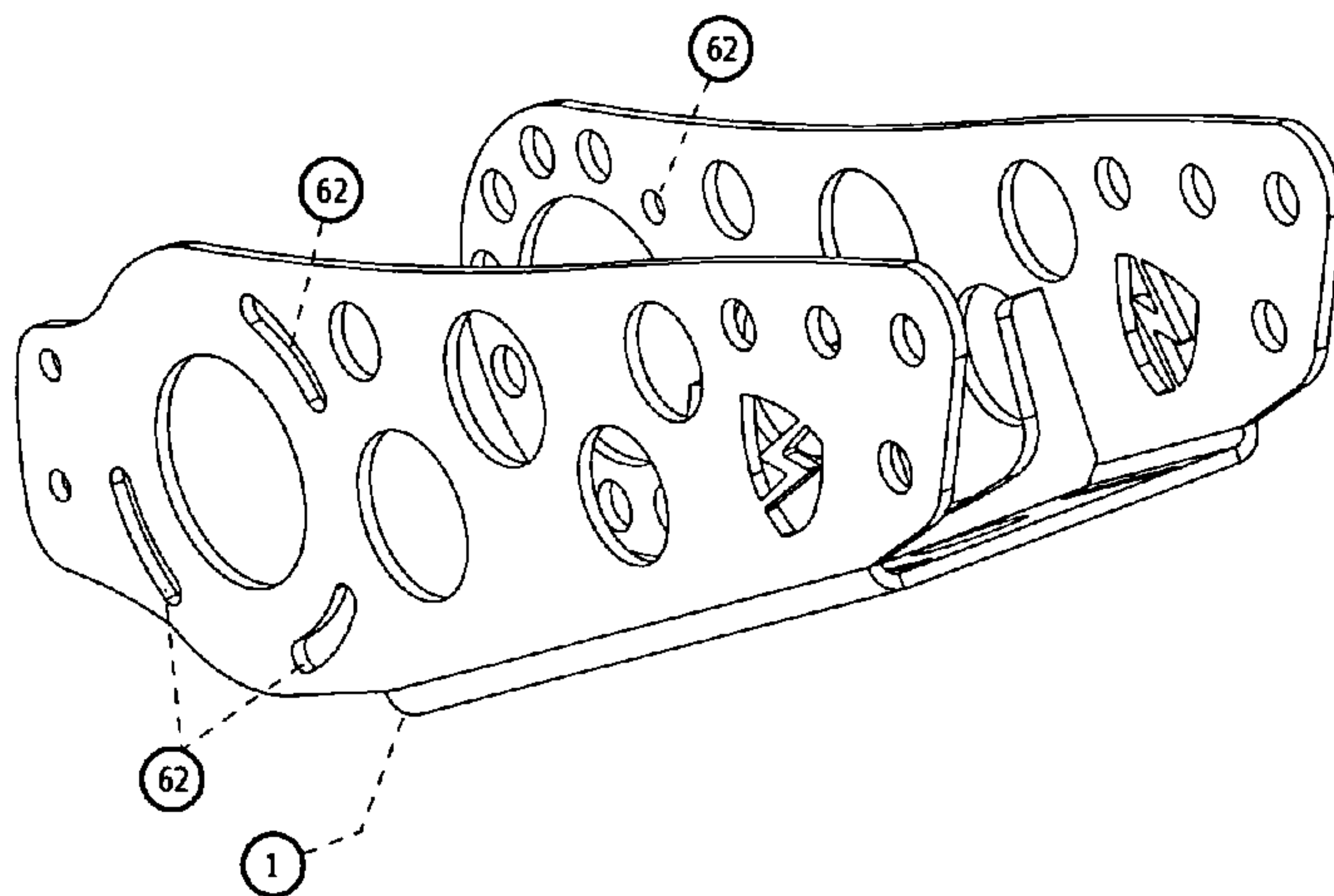


Fig.1

(57) **Abrégé/Abstract:**

The invention relates to a mounting set for mounting an electric motor on a single-track or multi-track cycle, comprising an adapter (1), which can be fastened on at least one side of a bottom bracket tube and at at least one point of a down tube, wherein the adapter (1) has fastening holes (62), by means of which the adapter (1) can be fastened to a receptacle (6) on at least one side of the bottom bracket tube using screws. The invention further relates to a cycle on which a mounting set according to the invention is mounted.



ABSTRACT

The invention concerns a mounting set for mounting an electric motor to a bicycle, tricycle, quadricycle, etc., featuring an adapter (1) which can be attached to at least one side of a bottom bracket and one point on a down tube, whereas the adapter (1) features attachment holes (62) by means of which adapter (1) can be attached to an attachment device (6) on at least one side of the bottom bracket tube by means of bolts. Furthermore, the invention concerns a bicycle, tricycle, quadricycle, etc. to which a mounting set in accordance with the invention has been mounted.

MOUNTING ADAPTER FOR AN ELECTRIC CYCLE

DESCRIPTION

The invention describes a mounting set with an adapter, as well as an adapter which makes mounting an electric motor to virtually any vehicle, especially bicycles, retroactively possible.

BACKGROUND OF THE INVENTION

Currently, there are a number of different models of electrically powered bicycles available on the market, which however only feature electric power units permanently attached at the factory. These power units support or provide 100% of forward propulsion. Furthermore, so-called retrofit kits for electric propulsion are available on the market for the conversion of a bicycle to a pedelec (“pedal electric cycle;” a hybrid electric bicycle where the electric motor merely supports the pedaling action of the rider.) These retrofit or conversion kits require a considerable installation effort. Uninstalling them is no less problematic.

The following documents are a few examples of electric, bicycle-mounted motorization units: US-A-4,871,042, GB-A-2.249.529, US-A-5,242,028, EP-A-0.755.854, EP-A-0728.663, as well as EP-A-0.776.818 and EP 1 462 355 A1.

The purpose of the following invention is to provide for the possibility of attaching an electric motor to a bicycle, as well as the possibility to nearly completely reverse the installation without much effort, as desired by the user (e.g. for a bicycle sporting event.)

The solution to the problem is provided by means of independent claims. Further advantageous developments are defined in subsequent claims.

DETAILED DESCRIPTION OF THE INVENTION

The problem is solved by a mounting set for mounting an electric motor to a chain driven bicycle, tricycle, quadricycle, etc., (henceforth “bicycle”) featuring an adapter (1) – which can be mounted

to at least one side of the bottom bracket and at least one point on a down tube - for the attachment of the electric motor. The adapter (1) shall feature attachment holes (62), which can be used to attach the adapter (1) to at least one side of the bottom bracket using bolts and an attachment device (6.)

The adapter preferably features three attachment holes which are spaced in accordance with the distances dictated by the International Standard Chainguard Mount (ISCG.) The attachment hole is preferably a drilled hole in a metal plate of the adapter. The attachment holes are preferably curved oblong holes.

The adapter preferably consists of three metal plates which are joined in a U-shaped manner; ideally of a single metal plate which has been curved upward on its left and right sides.

The down bracket tube is the tube containing the bottom bracket. It may also be called drivetrain bearing housing.

The attachment point is preferably an already existing attachment point on the frame, such as for a chain guard. It is preferably an ISCG attachment point. It preferably features three threads for the attachment of bolts.

The adapter can preferably be attached with bolts on the left or right side (from the rider's view), ideally on both sides of the bottom bracket with one, respectively two attachment devices. This way, the adapter can be easily attached or removed in the vicinity of the bottom bracket using common tools such as screwdrivers, wrenches, or hex-wrenches.

Using bolts and one of the already existing ISCG attachment points is a more stable attachment solution than using clamps on the bottom bracket tube. By attaching the adapter in the vicinity of the bottom bracket tube, the heavy electric motor can be attached there as well, where - to ensure optimum ride characteristics - the center of gravity should be located.

The adapter transmits the exerted forces preferably mostly by way of the bottom bracket area. It features at least one hole with at least the inside diameter of the down bracket tube. The adapter is preferably compatible with inner bearing sleeves for commonly marketed bottom bracket housing widths, such as 68 mm, 73 mm, or 83 mm.

In another mounting set designed according to the invention, the mounting set features at least one additional attachment device (6), with the attachment device (6) being either clampable to one side of the bottom bracket tube, or the attachment device being an integral part of an inner bearing sleeve.

This way, bicycles that do not feature an attachment point, such an ISCG attachment point, can be retrofitted with an attachment point. Most bicycles do not have any attachment devices on the left side of the bottom bracket (from the rider's point of view), which means that this location on the bicycle can be utilized for attaching the adapter to the bicycle using bolts and an attachment device connected to the bottom bracket; however, not without additional measures.

An attachment device which can be clamped to one side of the bottom bracket is preferably a metal plate with a hole of the same diameter as the inside diameter of the bottom bracket tube, as well as one or more, preferably three holes, preferably with cut threads, arranged around the hole of the same diameter as the inside diameter of the bottom bracket tube, preferably in accordance with the hole pattern of an ISCG attachment device. This metal plate is preferably round on the outside, possibly with recesses where the holes with the threads are located. This attachment device is preferably clamped to the bottom bracket with the bottom bracket bearing sleeve, which, in an installed state has an outside flange.

If the attachment device is an integral part of an inner bearing sleeve, the inner bearing sleeve will feature an even wider flange, in which the threaded holes are located.

The adapter can thus be bolted preferably on the right side to an existing ISCG attachment point, or, if no ISCG attachment points are available, with an attachment device included in the mounting set. This means an attachment device clamped together with the inside bearing (ISCG simulated adapter) or by means of a special inner bearing sleeve with molded attachment points.

The special inner bearing sleeve with attachment points and a bottom bracket are preferably part of the mounting set. The inner bearing and preferably the inner bearing axle of the bottom bracket feature preferably a sufficient length matched with the mounting set, to ensure proper chain paths for the motor drive chain as well as the chain rings and cogs, as well as providing room for the motor between the crankarms.

In another mounting set designed according to the invention, the adapter (1) features at least one

lateral mounting plate (60), which in the installed state of the adapter (1) reaches from the bottom bracket tube alongside the down tube (11), with one end featuring attachment holes (62) for attachment to the attachment device (6), and the other end featuring at least one possibility to attach the lateral mounting plate to the down tube.

The position of the mounting plate is preferably lateral, if in an installed state it is located perpendicular to the bottom bracket axle, and continues alongside the down tube, and runs parallel to the triangular plane created by the down and seat tubes. The mounting plate is preferably made of metal.

By means of the lateral mounting plate, the adapter can be mounted in at least two points on the bicycle. One point is the bottom bracket, the other being the down tube. The lateral position of the mounting plate preferably allows for the accommodation of different down tube designs, angles, and curvatures.

Attachment to the down tube is preferably achieved by means of a frame attachment device, preferably by means of a clamp which clamps the mounting plate to the down tube. This clamp is variable, in that it fits multiple down tube diameters and profiles.

One attachment possibility is for example an attachment hole or an attachment loop for a clamp. The adapter will preferably feature several attachment holes, so that attachment to the down tube at various points along the down tube can be achieved.

In another mounting set designed according to the invention, the adapter (1) features a second lateral mounting plate (60) located opposite the first lateral mounting plate (60), with the lateral mounting plates being arranged in such a manner that they will feature at least one opposing pair of holes consisting of one attachment hole on one lateral mounting plate (60) and one attachment hole on the other lateral mounting plate (60.)

The second lateral mounting plate in its installed state runs preferably on the side of the bottom bracket and down tube opposite from the first lateral mounting plate. Because of the attachment hole arrangement of the mounting plates, fastening devices for the down tube such as a frame clamps or bolts can be flexibly mounted to the adapter, allowing to compensate for different frame designs and down tube angles or curvatures. At least one mounting plate preferably features attachment holes in two parallel stacked rows.

In another mounting set designed in accordance with the invention, the adapter (1) can be attached to the down tube (11) by means of opposing bolts (17) running through the hole pair, and by means of at least one thread (18) located in the down tube (11), and preferably by means of spacers (19.)

The thread is preferably located inside a threaded sleeve which has been run through the down tube (along the diameter of the tube, parallel to the ground, with the bicycle in a perfectly upright position) and preferably has been welded into place. This way, a frame attachment component (such as a clamp) is unnecessary, and the adapter can be attached to the down tube simply by means of bolts and the attachment holes on the adapter, in which case the end of the main mounting plate located furthest away from the bottom bracket is preferably directly bolted to the down tube.

The adapter is preferably attachable to a shock absorber attachment point on the down tube, by means of two opposing bolts which are run through the pair of mounting holes. To accomplish this, the adapter features preferably at least one indentation on one of the mounting plates. This indentation in an installed state is preferably to be located in the triangular area made up of the down, seat, and top tubes, and preferably features at least one hole for attaching a bolt. The indentation is preferably bolted to the adapter subsequently as a piece of perforated sheet metal, while ideally the indentation is integrated into the design of at least one mounting plate. A shock absorber attachment point is for instance a flange on the top side of the down tube, which usually has one end of a shock absorber attached to it, as part of the rear wheel suspension.

As an alternative to attaching the adapter to at least one side of the bottom bracket, the adapter can preferably be attached with bolts to the right and left side of a shock absorber attachment point, while the mounting adapter can be mounted to the down tube near the bottom bracket using a clamp or a threaded sleeve integrated into the down tube at the attachment point. By using the already existing and easily reachable shock absorber attachment points, the adapter can be mounted to the frame just as securely.

In another mounting set designed according to the invention, the mounting set includes a battery holder (56) which can be attached to the adapter (1), while the battery holder (56) in its installed state together with the adapter will partially surround the down tube (1.)

The battery holder preferably consists of one or more clamps, which are on one side attached to the battery housing, while on the other side can be bolted to the adapter. The clamps are preferably U-

shaped, and preferably feature slots along their lengths, so that the battery can be positioned vertically. By way of a slot along the length of the battery holder, the battery can be moved up and down along the down tube.

This way the battery can be mounted to the bicycle without much effort. The battery holder uses existing attachment points on the adapter. Thus no additional attachment points on the bicycle frame have to be considered for the battery holder. Furthermore, this battery attachment design is very solid, as it builds on the stability of the adapter.

In another mounting set designed according to the invention, a motor mount (3) can be attached variably to the adapter (1) preferably movable and/or rotatable along at least two axes. The motor mount is preferably designed for attaching a motor. It is preferably attachable to and detachable from the adapter by means of four bolts. This ensures that the motor can be easily removed, so that it is possible for the mounting set to be removed wholly or partially, whichever is preferred.

Making the motor mount moveable and/or rotatable allows for the proper adjustment of the motor mount on the adapter to ensure an optimal chain path, as well as to position the motor in different ways in accordance with frame restrictions. The motor mount is preferably adjustable on all axes when attached to the adapter.

In another mounting set design in accordance with the invention, the adapter (1) is fitted with the motor mount (3), which can be installed and uninstalled quickly on the adapter (1) by means of bolts.

In another mounting set design in accordance with the invention, the motor mount (3) features an attachment point for a motor chain tensioner (37.)

The motor chain tensioner is preferably a small cog attached to a spring-loaded arm which is attached at the attachment point for the motor chain tensioner on the adapter. The motor chain tensioner's purpose is to put tension on the motor chain.

In another mounting set design according to the invention, the motor mount (3) features a chain guard (9.)

The chain guard, preferably a sheet metal chain cover, keeps foreign objects away from the moving chain or the moving drive belt.

In another mounting set design according to the invention, the motor mount (3) features a motor controller (43.)

The motor controller is preferably installed to regulate the motor and provide electricity from the battery to the motor. Since the motor controller is attached to the motor mount, motor controller and motor are close together, meaning that the necessary wiring can be kept to a minimum.

In another mounting set design according to the invention, the adapter (1) features a connecting plate, on which a chain guide cog (22) can be mounted. The connecting plate (21) features at least one oblong hole (23), which is used to mount the chain guide cog (22) to the adapter using a bolt (24.) It is adjustable in at least one direction.

The chain guide cog is preferably mounted to the connecting plate using a rubber pulley, and is adjustable depending on the chain ring size.

This way an additional, preferably lower chain guide cog can be attached to the adapter, so that the chain can be adjusted for optimum tension and guidance. The likelihood of the chain leading to the cassette to derail is thus reduced.

In another mounting set design according to the invention, the mounting set features a chain ring adapter (25) which is attachable to an integrated free-wheel assembly (26) which separates the chain ring adapter (25) from the drivetrain (30) when being turned in one particular direction. At least one chain ring (27, 28) for a chain leading to the rear wheel of a bicycle, as well as a motorized chain ring (5) for a drive chain leading to a motor (2) can be attached to the chain ring adapter (25.)

The chain ring adapter is preferably a circular disk with a primary ring of at least three, preferably four or more holes, which are intended for mounting the free-wheel assembly; and a secondary ring of at least three, preferably four or more holes, which are intended for mounting cogs. The holes of the secondary ring are preferably located in recesses on the chain ring adapter. The drivetrain can preferably be bolted to a threaded hole in the free-wheel assembly. The free-wheel assembly preferably features a circular flange with three, preferably four or more holes for mounting the chain ring adapter. Chain rings with a diameter of 104 mm (e.g. 32 to 46 teeth) as well as chain rings with 20 to 24 (e.g. 22) teeth and a smaller diameter (58 mm, 64 mm) are preferably mountable to the chain ring adapter. The free-wheel assembly, drivetrain, and/or at least one chain ring are

preferably part of the mounting set.

The chain ring adapter allows for different chain rings to be mounted, which the free-wheel assembly separates from the drivetrain. This way different types of chain rings can be mounted or e.g. the existing chain rings of the bicycle can be used. The free-wheel assembly supports a mode of operation which allows the rider to run the bicycle on electric power only, without pedaling. The chain ring adapter furthermore allows for low production costs. Because of the great forces exerted on the free-wheel assembly, it is preferably made of stainless steel. The adapter allows for the adapter itself as well as the chain rings to be made of cheaper and lighter materials, such as aluminum. Manufacturing a free-wheel assembly with an integrated chain ring adapter results in larger amounts of more expensive material having to be used, which is multiplied especially because of waste material. Thus, this solution provides a greater amount of flexibility, lower weight, and lower production costs.

Alternatively, despite its disadvantages, a chain ring adapter with integrated free-wheel assembly is part of the mounting set, if this option is chosen for example for reasons of simpler procurement for the production.

In another mounting set design according to the invention, the mounting set additionally features a chain guide plate (59), which in its installed state is located between at least one chain ring (27, 28) and the motor chain ring (5), its purpose being to safely keep the the chain to the rear wheel and the chain to the motor (2) at a distance from each other.

The chain guide plate preferably features a larger diameter than the present chain rings. This plate prevents the chain to the rear wheel from jumping to the motor chain ring, and the chain to the motor from jumping to a chain ring intended for the chain to the rear wheel. It prevents derailment of the two chains or drive belts.

In another mounting set design according to the invention, the mounting set features a motor (2) with a drive cog (36) which is separated from the motor (2) when being turned in one particular direction by means of a free-wheel assembly.

The separation by means of the free-wheel assembly, which is preferably mounted to the motor axis, allows for a mode of operation in which the bicycle can be used as a regular bicycle without any motorization. The second mode of operation allows for the bicycle to be pedaled without any

motor support whatsoever (like any regular bicycle.) This arrangement makes a third mode of operation possible, which allows for the bicycle to be pedaled with motor support. The amount of motor support is individually adjustable by means of a lever. A lever, which preferably is part of the mounting set, features a display showing the amount of power currently used (for example in three levels.)

The motor drive shaft preferably features an adapter with a safety bolt and outside thread to accommodate the drive cog and free-wheel assembly.

In another mounting set design according to the invention, the mounting set features a controller holder (44), which is attachable to the handlebar stem (46) by means of bolts (45) and the threads present in the handlebar stem (46) for the attachment of a handlebar (47) by means of a clamp (48.)

The holder utilizes the existing threads of the handlebar stem, resulting in the controller being able to be attached more solidly to the handlebar stem. Thus, no plastic clamps or strap systems are necessary, which typically are less solid and twist. The controller can thus be attached to the handlebar stem, by means of a special holder, which is attached by means of e.g two or e.g. four handlebar stem bolts.

In another mounting set design according to the invention, the mounting set features a battery (54) which can be connected by means of a plug (52) and a wire (53), whereas the wire's (53) length and/or the battery's (54) size and shape are designed in such a manner, that the battery (54) can be carried in a backpack (55) during a bicycle ride.

The plug connecting battery and motor is preferably polarized, waterproof, and preferably severs the connection in all directions immediately, for example by means of a predetermined breaking point. The wire and plug are preferably rated for currents of up to 50 A or more.

The battery is preferably equipped with a battery management system which governs charging and discharging of the battery and adjusts the processes according to demand. The cells of the battery are preferably balanced. The battery management system will preferably shut off the battery before it is completely discharged. Likewise, it will preferably shut off the charging process as soon as the battery is fully charged. The battery, motor, and controller are preferably adaptively interlinked to provide maximum service without relinquishing control of the individual components. The controller is preferably programmable.

Transporting the battery in a backpack results in freer or more agile ride characteristics of the bicycle, since the weight is carried by the rider. The rider can keep the center of gravity within the bicycle frame triangle near the bottom bracket just as with any non-motorized bicycle. Furthermore, it ensures a higher rate of protection from theft of the battery, since the rider, when parking, can quickly disconnect the battery from the bicycle by means of the plug, and carry it with him/her.

The problem is also solved by a bicycle, to which a mounting set in accordance with one of the preceding claims has been mounted. The mounting set is preferably retrofitted to the bicycle. Ideally, it is mounted to the bicycle at the factory or dealership.

The invention shall now be exemplarily illustrated using the following figures:

- Fig. 1: A mounting set according to the invention with an adapter featuring mounting holes, which serve to attach the adapter to at least one side of the bottom bracket tube using bolts.
- Fig. 2: Exploded view of a mounting set according to the invention, showing how the adapter is attached to an attachment device.
- Fig. 3a: Exploded view of a mounting set according to the invention, featuring an adapter which is attachable to the down tube by means of a clamp.
- Fig. 3b: Exploded view of a mounting set according to the invention, featuring an adapter attachable to the down tube by means of at least one threaded sleeve located inside the down tube and spacers.
- Fig. 4: Parts used in Fig. 2.
- Fig. 5: A mounting set according to the invention with an adapter featuring a connecting plate with an attachable chain guide cog.
- Fig. 6a, 6b: Part of a mounting set according to the invention, featuring a chain ring adapter
- Fig. 7: Part of a mounting set according to the invention, featuring a motor mount including an attachment possibility for the controller (exploded view)
- Fig. 8: Part of a mounting set according to the invention, featuring a motor mount
- Fig. 9: Part of a mounting set according to the invention, featuring a controller holder for the handlebar stem
- Fig. 10: A mounting set according to the invention, featuring a plug and wire for a flexibly positionable battery
- Fig. 11: Part of a mounting set according to the invention, featuring a battery which can be

carried in backpack

Fig. 12: A mounting set according to the invention, featuring a battery holder which can be attached to the adapter

Fig. 13a, 13b: Part of a mounting set according to the invention, featuring an attachment device which can be retrofitted to a bicycle

Fig. 14: Bottom bracket sleeves for additional housing widths

Fig. 15: Adapter 1 attached to a shock absorber attachment point

Fig. 16: Adapter 1 attached to the bicycle frame, using an attachment point near the bottom bracket by means of a clamp (56) instead of attaching one end of adapter 1 to the bottom bracket

Fig 17: Attachment of adapter 1 according to Fig. 16, using the shock absorber attachment point (72) as the upper attachment point

Fig. 18: Attachment of motor 3 by means of a mounting plate 68

SHORT DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a mounting set according to the invention with an adapter 1 featuring mounting holes 62, by means of which adapter 1 can be attached to at least one side of the bottom bracket using bolts and an attachment device.

Mounting holes 62 are oblong holes on at least one side of the adapter. This way adapter 1 can be attached to the bottom bracket tube of a bicycle, and fixed in place using bolts, only slightly snug at first. The adapter is then adjusted to fit the down tube angle, and the bolts are tightened. As long as the bolts have not been tightened too much, adapter 1 can be turned around the inner bearings.

This way, adapter 1 can be installed and uninstalled effortlessly and without the use of many tools.

Fig. 2 shows an exploded view of a mounting set according to the invention, showing the attachment of adapter 1 to an attachment device 6. Shown is a bicycle frame section consisting of seat tube 10, bottom bracket 13, top tube 12, down tube 11, and head tube 14, to which adapter 1, including motor 2 and motor mount 3, as well as the drivetrain unit consisting of motor chain 4 and motor chain ring 5, have been attached.

In order to attach adapter 1, the attachment device 6 is mounted on both sides of the bottom bracket. If an ISCG attachment point is available on the right side of the frame, adapter 1 shall be attached to said attachment point as well as attachment device 6 on the left side of the bottom bracket.

A third (and flexible) attachment point option is attaching adapter 1 by means of a clamp (7, 8) to the down tube of the frame.

Chain guard 9, which is attached to the motor mount, serves to protect the drive cog and motor chain from foreign objects and outside influences. Adapter 1 features oblong holes 62 in the vicinity of the bottom bracket, as well as mounting holes 16 on the end of the adapter opposite the bottom bracket attachment point. Adapter 1 features two opposing mounting plates 60, which are joined by a connecting plate.

Fig. 3a shows an exploded view of a mounting set according to the invention, featuring an adapter 1 which is attachable to the down tube by means of a clamp 7. Clamp 7 is U-shaped, and its limbs each have an oblong hole to accept bolts 63 and grommets 64. These are simultaneously run through the holes in adapter 1. This drawing shows holes 16 as an example.

Fig. 3b shows the exploded view of a mounting set according to the invention, featuring an adapter 1, which can be attached to the down tube by means of at least one thread (18) existing in the down tube as well as preferably spacers (19) and bolts (17.)

The thread was integrated into the down tube at the time of manufacture of the frame. This ensures an even simpler mounting process with less parts, but resulting in possibly greater stability of the adapter on the bicycle. The construction allows for greater forces to be transferred to the frame.

Fig. 4 shows the parts used in Fig. 2. Shown is a two-piece clamp 7, 8, which can be substituted for a one-piece clamp 7, as shown in Fig. 3a. Attachment device 6 in this case is an attachment device 6 which can be clamped to the bottom bracket tube, in order to simulate an ISCG attachment point. This allows for adapter 1 to be bolted and unbolted if no ISCG attachment point or other attachment points are available on the bicycle. When uninstalling the adapter, it can be completely removed, and the weight of the bicycle is reduced to its original state. Only the clamped-on attachment device

would have to be removed with a greater amount of effort. However, due to the minimal weight of the device, removing it is unnecessary.

Fig. 5 shows a mounting set according to the invention with an adapter 1, featuring a connecting plate 21, to which a chain guide cog can be attached. The connecting plate 21 features two oblong holes 23. Using these oblong holes 23 and bolts 24, it can be bolted to adapter 1. One of the oblong holes 23 is used by chain guide cog 22, which preferably can be fixed in one position within oblong hole 23. Connecting plate 21 can be rotated around one axis and because of oblong hole 23, it is adjustable.

Connecting plate 21 provides for a simple but effective and adjustable carrier for a chain guide cog 22. Chain guide cog 22 provides for optimal guidance of the present chains. This guidance prevents the chains from easily coming in contact or interfering with each other.

Fig. 6a and 6b show part of a mounting set according to the invention, featuring a chain ring adapter 25. Chain ring adapter 25 features an inner circular bolt hole pattern with four (preferably three to five) holes and a diameter of 58 mm or 64 mm, to which can be attached in accordance with Fig. 6a a free-wheel assembly 26 with its four (preferably three to five) holes by means of bolts 35. Fig. 6b shows chain ring adapter 25 integrated with free-wheel assembly 26, forming a free-wheel assembly 29 with integrated chain ring adapter. Using the chain ring adapter's (25) outer four (preferably three to five) holes arranged in a circular pattern (diameter 104 mm), at least one primary chain ring 27 with 36 (preferably 30 to 48) teeth and corresponding bolt hole pattern can be attached using threaded sleeves 33 and bolts 32. Furthermore, a second chain ring 28 with 22 (preferably 20 to 28) teeth and a corresponding but smaller bolt hole pattern diameter than chain ring 27, can be attached by means of the inner circular bolt hole pattern. Motor chain ring 5 with chain guide plate 59 for chain separation purposes can be attached to chain ring adapter 25 by means of bolts 31 and spacers 34. Crankarm 30 is to be bolted into the free-wheel assembly 26. The drivetrain is preferably a part of the mounting set. The chain ring adapter allows for the continued use of existing chain rings as well as the expansion by motor chain ring 5 and chain guide plate 59 in between. The integration of a free-wheel assembly by means of chain ring adapter 25 allows for the different modes of operation of an electric bicycle. The existing gears of the bicycle can continue to be used as designed. Every gear can be supported individually by the electric motor through the control lever, allowing for both steep inclines as well as high speeds to be attained. The motor provides a lot of

torque thanks to the planetary gear box (gear reduction) integrated into the motor.

Fig. 7 shows part of the mounting set according to the invention, featuring a motor mount (3) in an exploded view. The motor features longitudinal cooling fins in the direction of travel to ensure good airflow to facilitate heat dissipation. Drive cog 36 features an integrated free-wheel assembly, and is attached to the motor axle by means of a drive cog adapter sleeve 38, which has been fitted with an outside thread to affix drive cog 36, which is secured by a cotter pin. A motor chain tensioner 37 is mounted to the motor by means of a spacer 42 and a pin. A chain cover 9 is located at a distance from motor mount 3 by means of spacing pins, and is fixed in place by means of bolts 40. A free-wheel assembly fixing mechanism 41 completes the motor axle and fixes the drive cog adapter sleeve 38 including the attached drive cog 36 into place. Furthermore, a motor controller 43 is situated on the motor mount 3.

This provides for a compact drive unit consisting of motor, motor mount, controller (on the motor mount) and drive cog, which can be mounted to adapter 1. Chain guard 9 reduces the possibility of dirt and mechanical outside influence in the vicinity of the drive cog. The motor chain tensioner provides for optimal tension of the motor drive chain or belt.

Fig. 8 shows part of the mounting set according to the invention, featuring the motor mount (3.) The elements from Fig. 7 are shown here in their assembled state. Controller 43 can be mounted to the handlebar stem as well as the motor mount.

Fig. 9 shows part of the mounting set according to the invention, featuring a controller holder 44 for the handlebar stem. Controller holder 44 is attached to clamp 48 by means of spacers 65 and bolts 45. Controller holder 44 as well as handlebar 47 are clamped to handlebar stem 46 by means of bolts 45 and clamp 48. Controller 43 is attached to controller holder by means of a protective plate 49. Protective plate 49 features integrated or attachable cooling fins for cooling controller 43. Protective plate 49 is bolted to controller holder 44 by means of bolts 51.

This allows for existing threads in the handlebar stem to be utilized to ensure a solid and safe connection of motor controller 43 in the vicinity of handlebar 47.

Fig. 10 shows a mounting set according to the invention, featuring a plug 52 and wire 53 to flexibly position a battery 54. Wire 53 leads from the motor, or, if controller 43 is attached to the motor mount, from the motor mount, ending in plug 52.

This allows for the battery to be flexibly positioned as desired (e.g. in a basket, on a luggage rack, or in backpack 55.)

Fig. 11 shows part of a mounting set according to the invention, featuring a battery 54 which can be transported in backpack 55. Battery 54 features a wire 53, which leads from battery 54 to a plug 52, which fits plug 52 leading to the motor or motor controller.

This allows for transporting battery 54 in a backpack 55. This is advantageous for very athletic bicyclists who do not want to alter the ride characteristics of their bicycle and thus may preferably carry the weight of battery 54 on their back.

Fig. 12 shows a mounting set according to the invention, featuring a battery holder (56) which can be attached to adapter (1.) The battery holder features two upper and two lower clamps. In their installed state, the lower clamps attach to the down tube from below, and the upper clamps from above. The clamps are connected to adapter 1 by means of bolts 58, and threaded sleeves 57. Alternatively, the battery holder consists of only upper clamps.

This allows for providing a battery holder within the bicycle frame triangle using few additional parts. Attaching the adapter to down tube 11 is thus combined with an attachment device for a battery holder on down tube 11. Attaching battery holder 56 to adapter 1 provides for a very solid connection for the battery to the bicycle, as it now cannot fall sideways out of the frame triangle.

Fig. 13a shows a mounting set according to the invention, including an attachment device 6, which can be clamped to the bottom bracket tube by means of a bottom bracket sleeve 61. In this example, the bottom bracket assembly is shown for a bottom bracket tube width of 83 mm. Alternatives include bottom bracket sleeves 61 for bottom bracket tube widths of 73 mm or 68 mm. Bottom bracket sleeve 61 features a flange, which in its bolted-on state protrudes from bottom bracket tube 50. Attachment device 6 is to be clamped between this flange and bottom bracket tube 50.

This allows for a bicycle, which does not have an attachment device for adapter 1 to be bolted to the frame, to be retrofitted with such an attachment device.

Fig. 13b shows an attachment device 6, which is an integral part of bottom bracket sleeve 61, forming a bottom bracket sleeve 20 with integrated attachment device 6. The adapter can be bolted to the bottom bracket sleeve 20 with integrated attachment device 6.

This also allows for a bicycle, which does not have an attachment device for adapter 1, to be retrofitted by means of attachment device 6, which is part of bottom bracket sleeve 20.

Fig. 14 shows bottom bracket sleeves for additional housing widths, such are 73 mm (bottom bracket sleeve 66) and 68 mm (bottom bracket sleeve 67), as well as a bottom bracket 13. Bottom bracket sleeves 61, 66, and 67 each feature different lengths L1 and L2. L1 is the total length of the inner bearing sleeve, while L2 is the length of part of the inner bearing sleeve with a primary diameter, which borders the part of the inner bearing sleeve with a secondary diameter. The primary diameter is greater than the secondary diameter. The part with the secondary diameter prevents sideways movement of an inner bearing within the inner bearing sleeve.

The current state of technology dictated so far that different inner bearings had to be utilized for bottom bracket housing widths of 68 mm, 73 mm, and 83 mm. Because of the differing lengths L1 and L2 of the inner bearing sleeves or inner bearing assembly sleeves, respectively, it is possible to utilize a single inner bearing body for all three housing widths. The right side inner bearing sleeve preferably stays the same, while the left side will feature three bottom bracket sleeves for adjusting to the different housing widths of 68 mm, 73 mm, and 83 mm.

Fig. 15 shows how adapter 1 can be attached to a shock absorber attachment point. The connection of adapter 1 to the shock absorber attachment point 72 is realized by two pieces of perforated sheet metal 69, which are bolted to the adapter. One piece of perforated sheet metal 69 features at least one vertical oblong hole 75 and at least one horizontal oblong hole 74. As an alternative (not shown), one end of adapter 1 is designed with an indentation, which features at least one hole to bolt adapter 1 directly to shock absorber attachment point 72 using shock absorber bolt 71, as

opposed to utilizing perforated sheet metal 69. The forward shock absorber attachment point on e.g. downhill oriented fully suspended bicycles is located on the down tube and accommodates shock absorber 73.

Shock absorber attachment point 72 is designed to withstand great forces, and thus is able to transfer the forces exerted by the motor to the frame without compromising the long-term durability of the frame. This is a very solid mounting point. Four vertical oblong holes make mounting of a piece of perforated sheet metal 69 to adapter 1 possible. Horizontal oblong hole 74 allows for a solid connection to shock absorber attachment point 72. Spacers 70 are utilized to bridge shock absorber attachment point width differences on the frame.

This allows for a possibly already existing, very solid attachment point on the bicycle to be utilized.

Fig. 16 shows adapter 1 attached to the bicycle frame near the bottom bracket by means of a clamp 56, instead of attaching one end of adapter 1 to the bottom bracket. The clamp can be mounted to one end of the adapter by means of bolts 58 and attachment holes. The other end of adapter 1 can be attached by means of a second clamp 56 (shown here), a thread 18 located in the down tube, or, as shown in Fig. 17, by attaching the end to an existing shock absorber attachment point 72 (by means of an indentation on adapter 1 or a piece of perforated sheet metal 69.)

Ideally, adapter 1 should be attached to shock absorber attachment point 72, since this attachment point is very solid. Attaching adapter 1 to a shock absorber attachment point prevents adapter 1 from moving laterally, which in turn means that attaching adapter 1 by means of one or more clamps 56 will be sufficient, resulting in a very high level of flexibility concerning installation and uninstallation.

Fig. 18 shows attachment of motor 3 by means of mounting plate 68. In this case, adapter 1 corresponds to mounting plate 68, which is bolted or welded directly to down tube 11. It preferably features a thread. The frame preferably features mounting plate 68 as a factory mounted option.

Motor mount 2 together with motor 3 are alternatively bolted directly to the frame, for which the frame features at least two, preferably three or more attachment points.

Alternatively, motor mount 2 is directly integrated on or welded to the frame, preferably on down tube 11, and motor 3 can be attached to the bicycle by bolting it to motor mount 2.

The technical innovation of this invention is the simple, flexible, and retroactive attachment of electric motors to virtually any bicycle frame. It allows for the utilization of already existing attachment points for easily mounting an electric motor, which can be accomplished by technically versed laymen, allowing for positive-mode propulsion.

The flexible motor mount allows for the possibility to adjust chain tension and run.

The propulsion generated by the motor is transferred directly to the chain ring, which is disconnected from the manually powered part of the drivetrain by means of a free-wheel assembly.

ISCG stands for International Standard Chainguard Mount, an international norm defining attachment points for a special chain guard within the bicycle industry.

This invention for the first time provides the possibility to convert a bicycle into an electric bicycle using simple tools to bolt an adapter with an attachable motor mount and motor to the bicycle. The bicycle can still be reverted back to a regular bicycle without much effort and special tools. On one hand, existing attachment points such as an ISCG chain guard attachment point are utilized. On the other hand, attachment points can be retrofitted by means of special attachment devices which are included in the mounting set. These are either clamped to the bottom bracket tube by means of the bottom bracket sleeve, or they already serve the function of a bottom bracket sleeve. This step is only necessary one time, if no ISCG attachment point is present on the bicycle. However, the adapter can then be flexibly installed or uninstalled, with just the use of a screwdriver.

LIST OF REFERENCE SIGNS

- 1 Adapter
- 2 Motor

- 3 Motor Mount
- 4 Propulsion Force Conversion Unit Motor Chain
- 5 Motor Chain Ring
- 6 Attachment Device
- 7 Clamp (for attachment to Down Tube)
- 8 Clamp (for attachment to Down Tube)
- 9 Chain Guard
- 10 Seat Tube
- 11 Down Tube
- 12 Top Tube
- 13 Bottom Bracket
- 14 Head Tube
- 15 Bolt
- 16 Holes
- 17 Bolt
- 18 Thread
- 19 Spacers
- 20 Bottom Bracket Sleeve with Integrated Attachment Device 6
- 21 Connecting Plate for a Chain Guide Cog
- 22 Chain Guide Cog
- 23 Oblong Hole
- 24 Bolt
- 25 Chain Ring Adapter
- 26 Free-Wheel Assembly
- 27 Chain Ring
- 28 Chain Ring
- 29 Free-Wheel Assembly with Integrated Chain Ring Adapter
- 30 Drivetrain
- 31 Bolt
- 32 Bolt
- 33 Threaded Sleeve
- 34 Spacer
- 35 Bolt
- 36 Drive Cog
- 37 Chain Tensioner

38	Drive Cog Adapter Sleeve
39	Pins
40	Bolts
41	Free-Wheel Assembly Fixing Mechanism
42	Spacer
43	Motor Controller
44	Controller Holder
45	Bolts
46	Handlebar Stem
47	Handlebar
48	Clamp
49	Protective Plate
50	Bottom Bracket Tube
51	Bolt
52	Plug
53	Wire
54	Battery
55	Backpack
56	Battery Holder
57	Threaded Sleeves
58	Bolts
59	Chain Guide Plate
60	Mounting Plate
61	Bottom Bracket Sleeve
62	Attachment Hole
63	Bolt
64	Sleeve
65	Spacers
66	Bottom Bracket Sleeve for 73 mm Bottom Bracket Housing Width
67	Bottom Bracket Sleeve for 68 mm Bottom Bracket Housing Width
68	Mounting Plate
69	Piece of Perforated Sheet Metal
70	Spacer
71	Shock Absorber Bolt
72	Shock Absorber Attachment Point

- 73 Shock Absorber
- 74 Oblong Hole for Shock Absorber Attachment Point
- 75 Oblong Hole for Adapter

The invention concerns an adapter (1) which can be attached to virtually any vehicle frame, but predominantly bicycle frames, by means of three flexible attachment points (6, 7, 8), and which can accommodate a propulsion device (motor), whereas one attachment device (6) is attached to the right side of the bottom bracket (13) either by clamping it between the bottom bracket sleeve and the bottom bracket tube, or by bolting it to the ISCG attachment point (Fig. 1.)

The invention further concerns a style of adapter (1) intended to be mounted to bicycles, tricycles, quadricycles, etc., which can accommodate a propulsion unit (motor, or motor mount with motor.) This style of adapter is identified by the fact that mounting it on a frame is possible in three or more attachment points by means of a number of different holes in the adapter.

The invention further concerns a style of adapter, identified by the fact that it can be attached to the right side of the bottom bracket (13) either by clamping it by means of the bottom bracket sleeve to the bottom bracket tube, or by bolting it directly to an ISCG or similar attachment point.

The invention further concerns a style of adapter, identified by the fact that the attachment device (6) is attached to the left side of the bottom bracket (13) by means of the bottom bracket sleeve clamping it to the bottom bracket tube.

The invention further concerns a style of adapter, identified by the fact that it is attached to the down tube of the frame by means of a clamp, as a third flexible attachment point.

The invention further concerns a style of adapter, identified by the fact that the motor mount (3) can be flexibly attached to the main adapter.

CLAIMS

1. Mounting set for mounting an electric motor to a bicycle, tricycle, quadricycle, etc., featuring an adapter (1) for attaching the electric motor, which can be attached to at least one side of the bottom bracket tube and at least one point on the down tube, and which is

- identified by the fact that the adapter (1) features mounting holes (62), by means of which the adapter (1) can be attached to at least one side of the bottom bracket tube by means of an attachment device (6) and bolts.
2. Mounting set according to claim 1, whereas the mounting set additionally features at least one attachment device (6), whereas the attachment device (6) can be clamped to one side of the bottom bracket tube, or the attachment device (6) is an integrated part of a inner bearing sleeve.
 3. Mounting set according to one of the preceding claims, whereas adapter (1) features at least one lateral mounting plate (60), which in the installed state of the adapter (1) reaches from the bottom bracket tube alongside the down tube (11), and which features attachment holes (62) on one end for attaching it to the attachment device (6), and which features at least one attachment possibility on the opposing end for attachment to the down tube.
 4. Mounting set according to claim 3, whereas adapter (1) features a second lateral mounting plate (60), which is located opposite of the first lateral mounting plate (60), whereas the mounting plates (60) create a bolt hole pattern which has at least one opposing pair of holes, consisting of an attachment hole (16) of one mounting plate (60) and an attachment hole (16) of the other mounting plate (60.)
 5. Mounting set according to claim 4, whereas adapter (1) can be attached to down tube (11) by means of opposing bolts (17) run through the bolt hole pair, as well as by means of at least one thread (18) located in the down tube (11) preferably using spacers (19.)
 6. Mounting set according to one of the preceding claims, whereas the mounting set additionally features a battery holder (56) which can be attached to adapter (1), whereas the battery holder (56) in its installed state will partially surround the down tube (11) together with the adapter (1.)
 7. Mounting set according to one of the preceding claims, whereas the adapter (1) can be fitted with a motor mount (3) in a flexible manner, preferably movable and/or rotatable along at least two axes.
 8. Mounting set according to one of the preceding claims, whereas the adapter (1) features a motor mount (3) which can be quickly installed on or uninstalled from the adapter (1) by means of bolts.
 9. Mounting set according to claim 8, whereas motor mount (3) features an attachment point for motor chain tensioner (37.)
 10. Mounting set according to claims 8 through 9, whereas motor mount (3) features a chain guard (9.)
 11. Mounting set according to claims 8 through 10, whereas motor mount (3) features a motor

- controller (43.)
12. Mounting set according to one of the preceding claims, whereas adapter (1) features a connecting plate (21), to which a chain guide cog (22) can be attached, whereas the connecting plate (21) features at least one oblong hole (23), by means of which the chain guide cog (22) can be attached to adapter (1), by means of a bolt (24). The chain guide cog should furthermore be adjustable in at least one direction.
 13. Mounting set according to one of the preceding claims, whereas the mounting set features a chain ring adapter (25), which can be attached to an integrated free-wheel assembly (26), which in turn disconnects the chain ring adapter (25) from crankarm (30) in one particular direction, while at least one chain ring (27, 28) for a chain to a rear wheel of the cycle and one motor chain ring (5) for a chain to the motor (2) can be attached to said chain ring adapter (25.) (Does this claim cover the solution of a free-wheel assembly with integrated chain ring adapter (one piece design?))
 14. Mounting set according to claim 13, whereas the mounting set additionally features a chain guide plate (59), which in its installed state shall be located between at least one chain ring (27, 28) and the motor chain ring (5), its purpose to keep the chain leading to the rear wheel and the chain leading to the motor (2) physically securely separated.
 15. Mounting set according to one of the preceding claims, whereas the mounting set features a motor (2) with a drive cog (36), which disconnects from the motor (2) when turning in one particular direction by means of a free-wheel assembly.
 16. Mounting set according to one of the preceding claims, whereas the mounting set features a controller holder (44), which can be attached to the handlebar stem (46) of a cycle by means of bolts (45) and the threads already existing in the handlebar stem (46) for the attachment of a handlebar (47) by means of a clamp (48.)
 17. Mounting set according to one of the preceding claims, whereas the mounting set features a battery (54), which can be connected by means of a plug (52) and wire (53), whereas the wire (53) and/or the battery (54) are designed in their length and/or form and size, respectively, to allow for the battery (54) to be transported by the rider in a backpack (55) during a ride.
 18. A bicycle (tricycle, quadricycle, etc.) identified by the fact that it has been fitted with a mounting set according to one of the preceding claims.

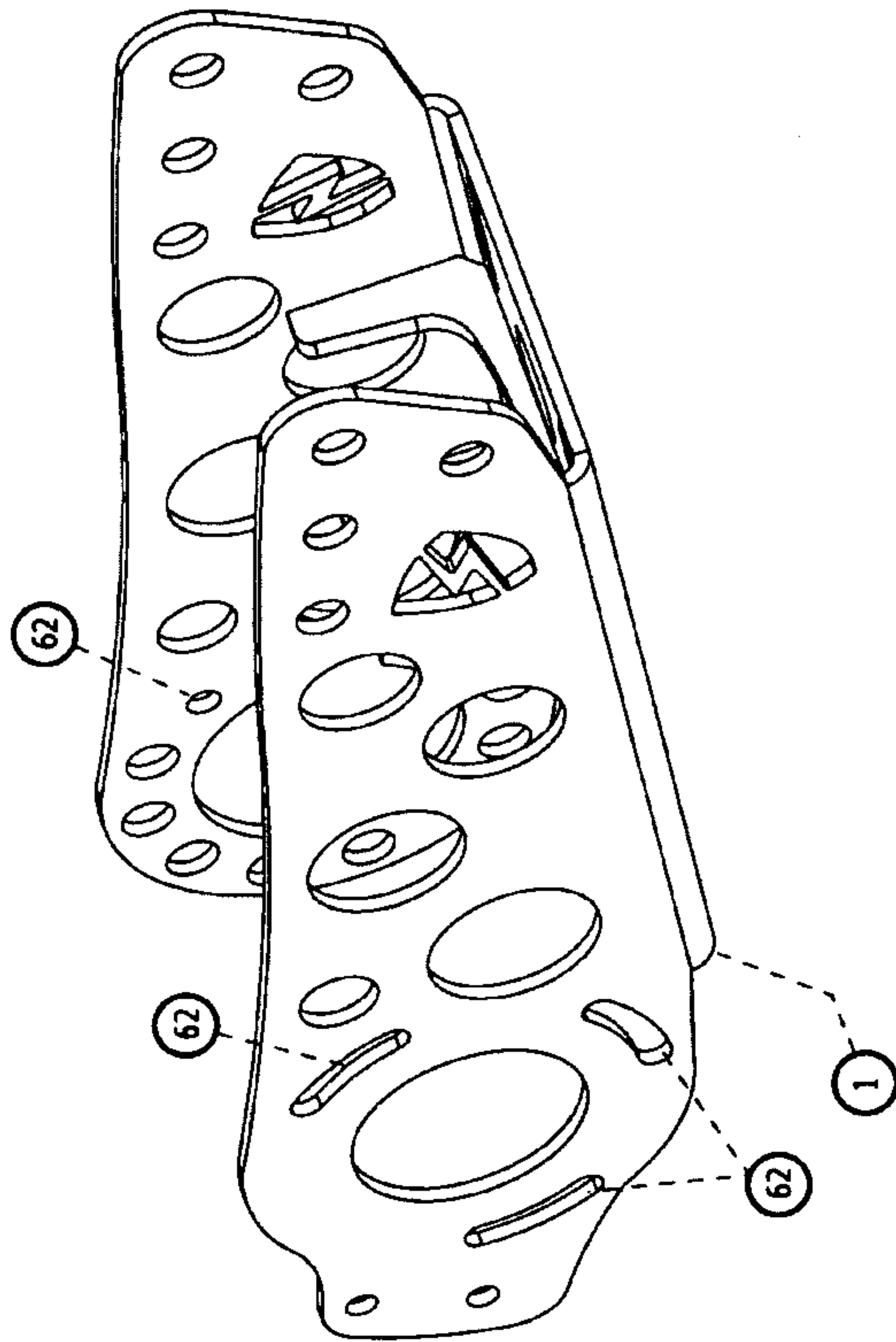


Fig.1

Fig. 2

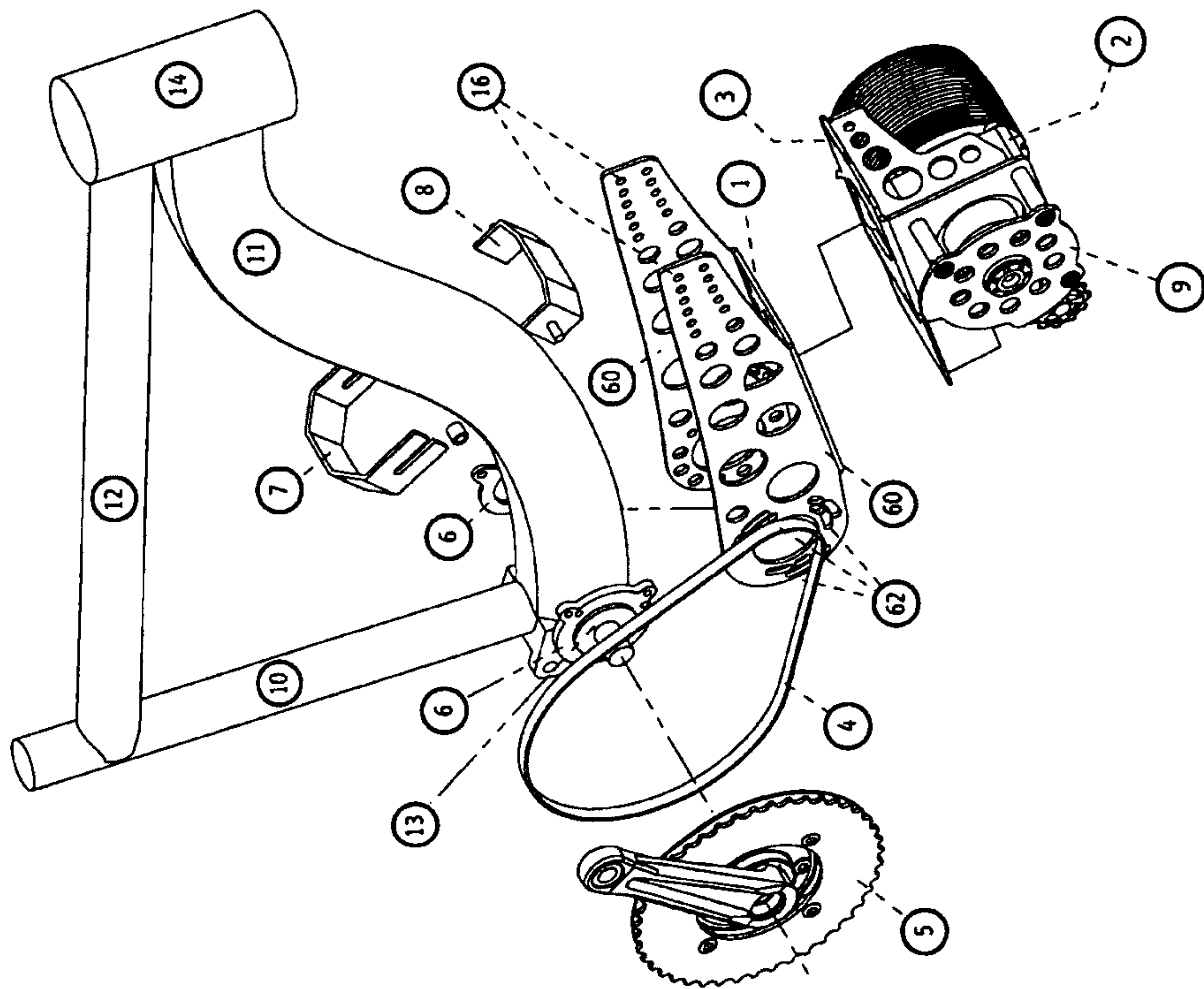


Fig.3a

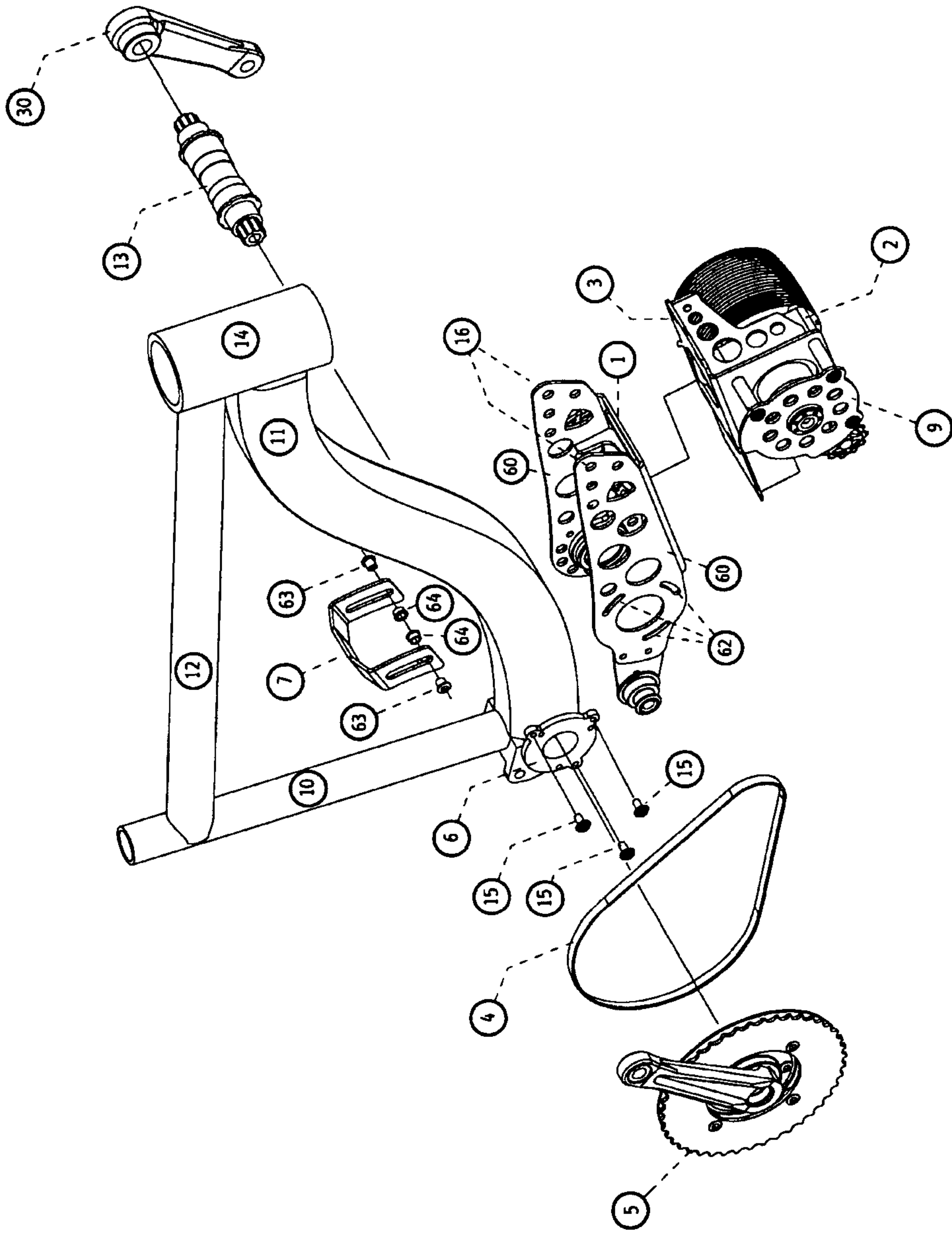
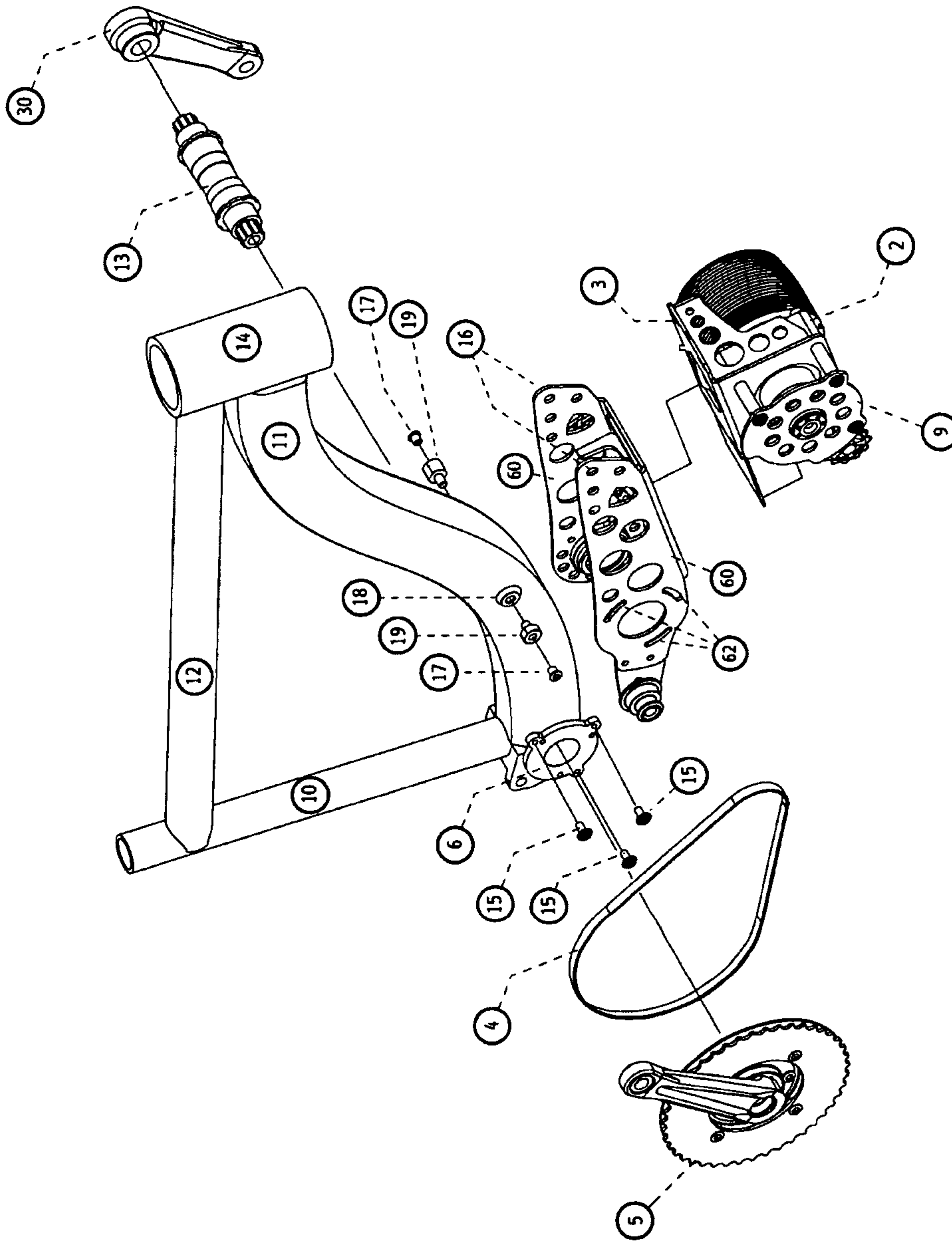


Fig.3b



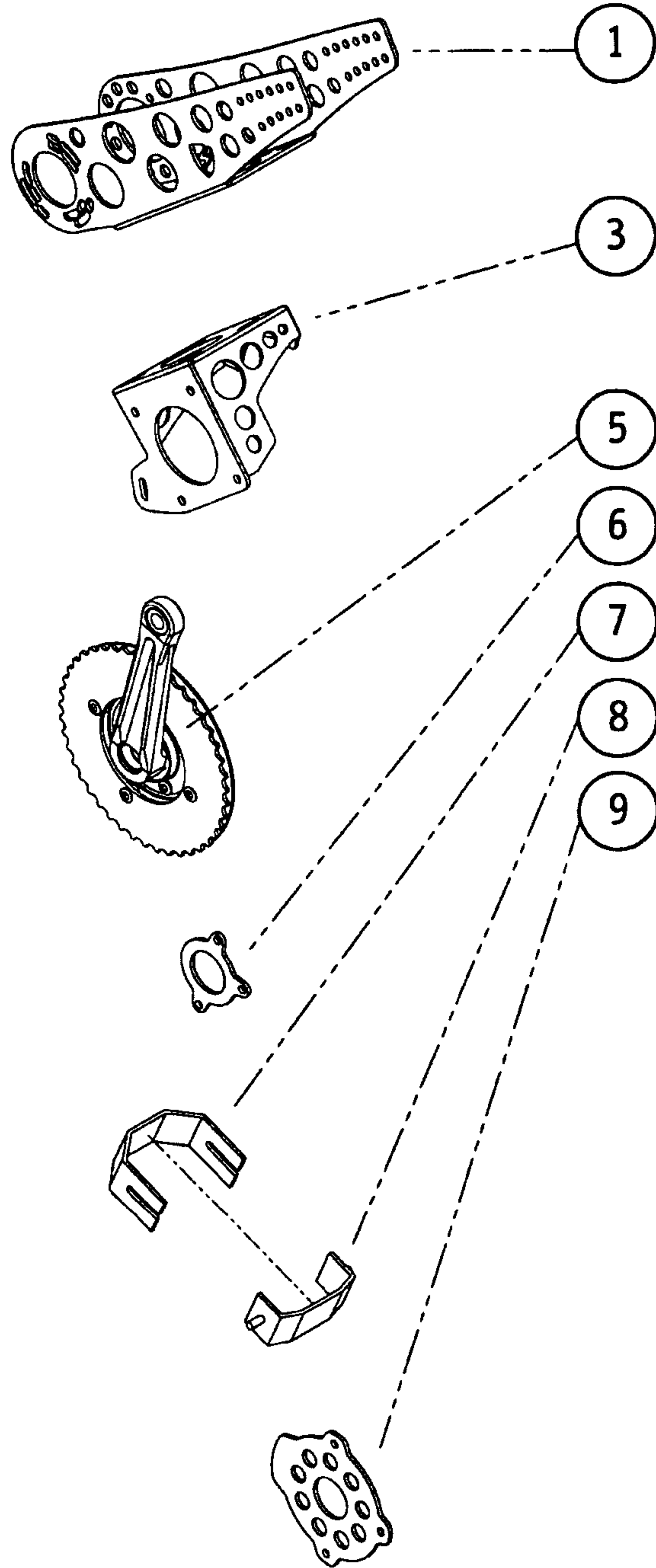


Fig.4

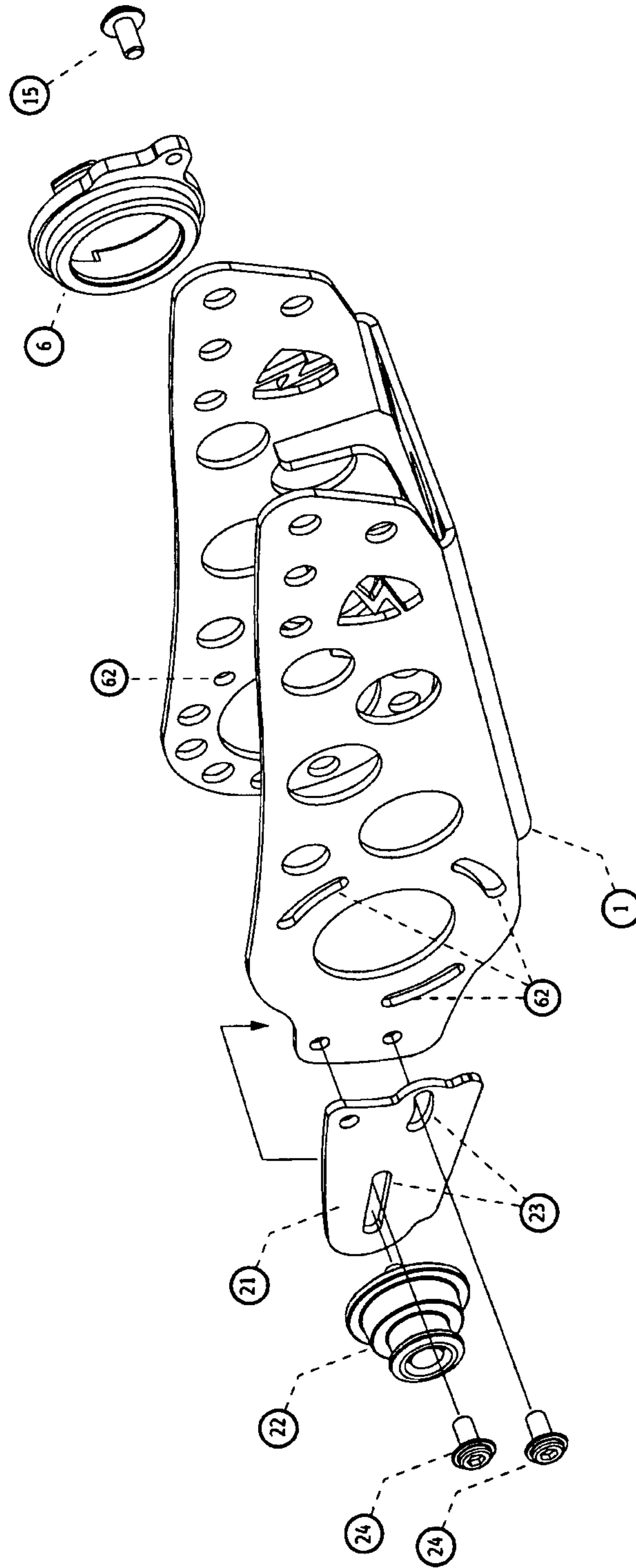


Fig. 5

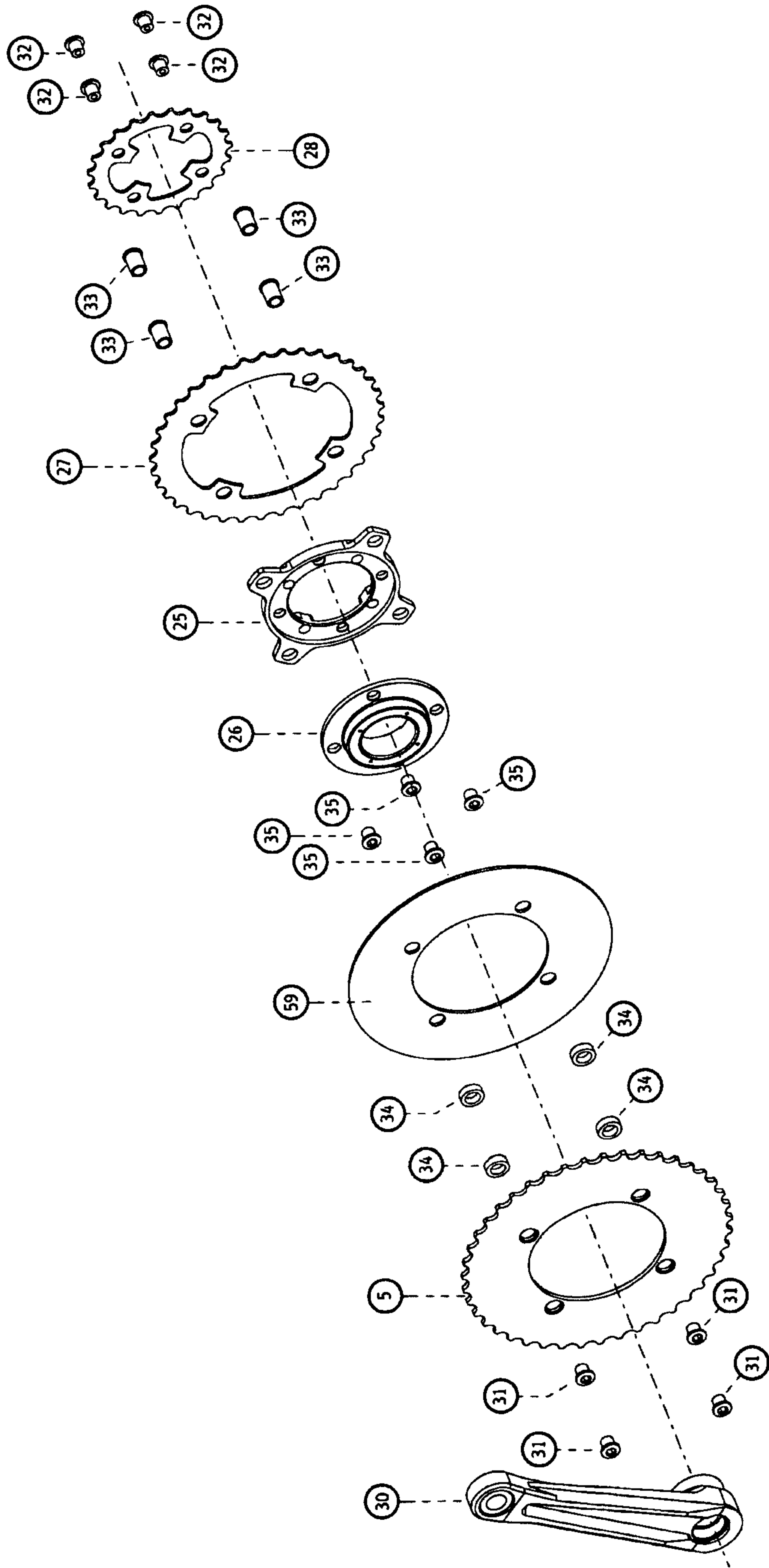


Fig. 6a

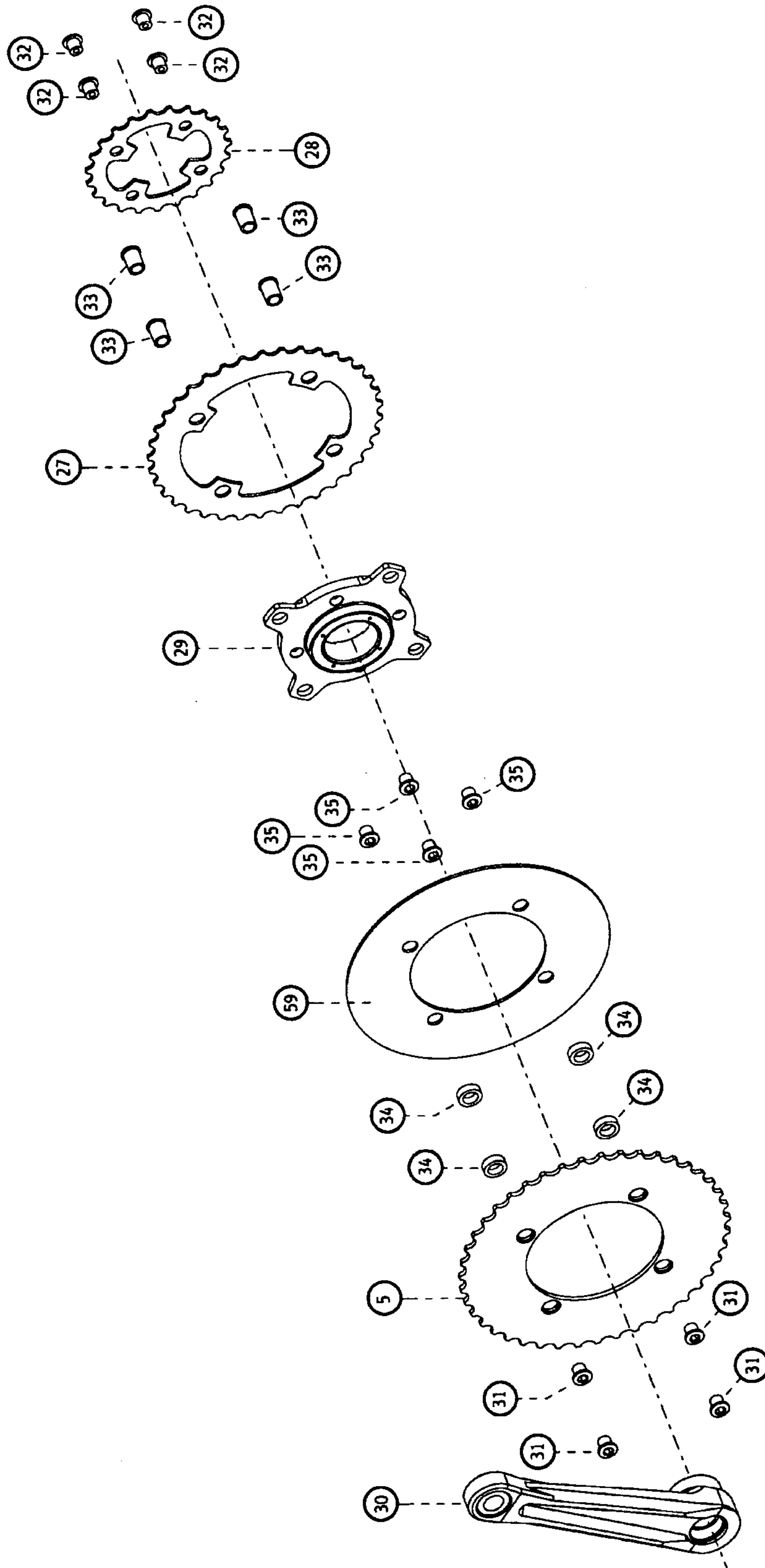


Fig.6b

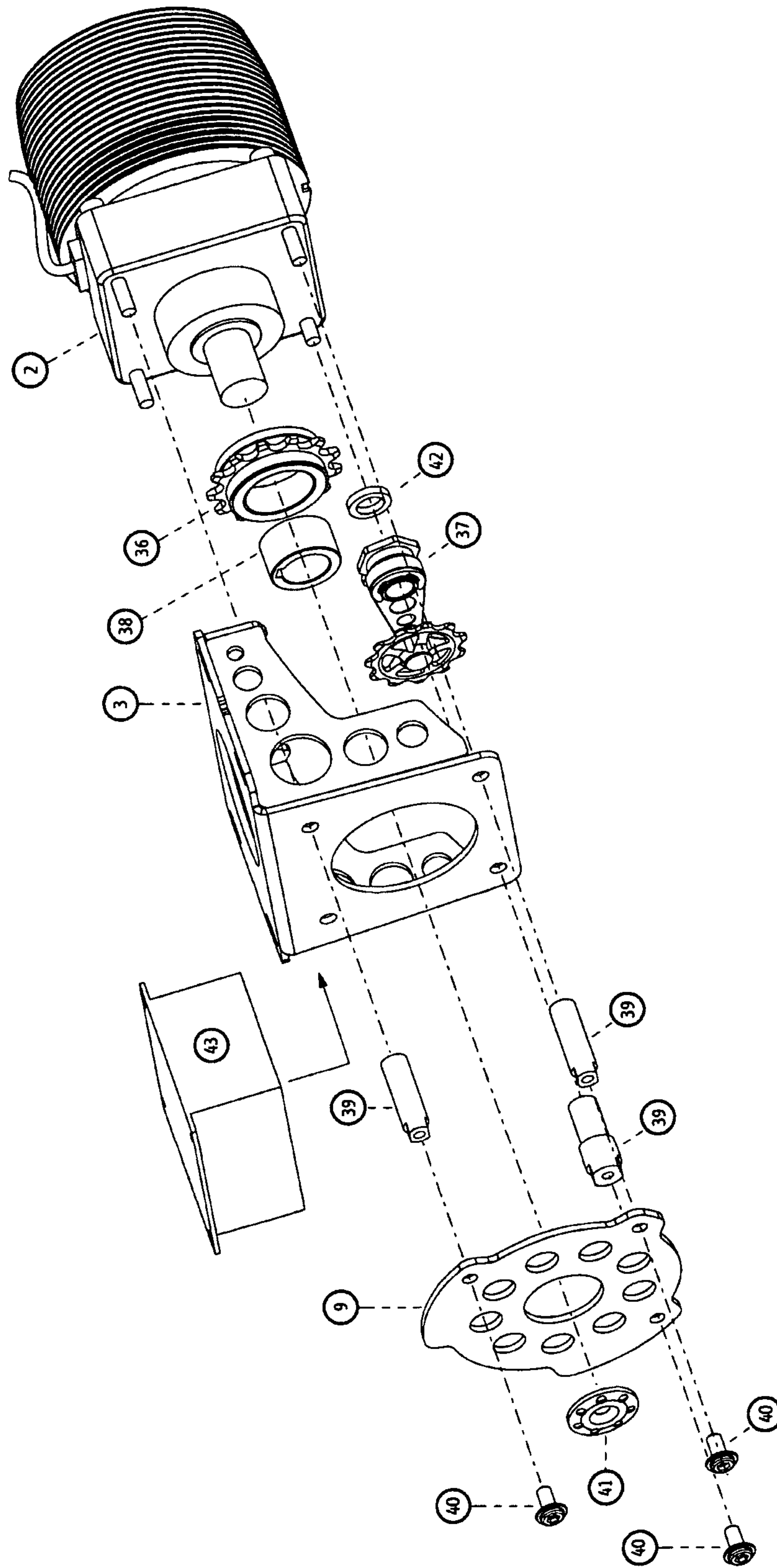


Fig.7

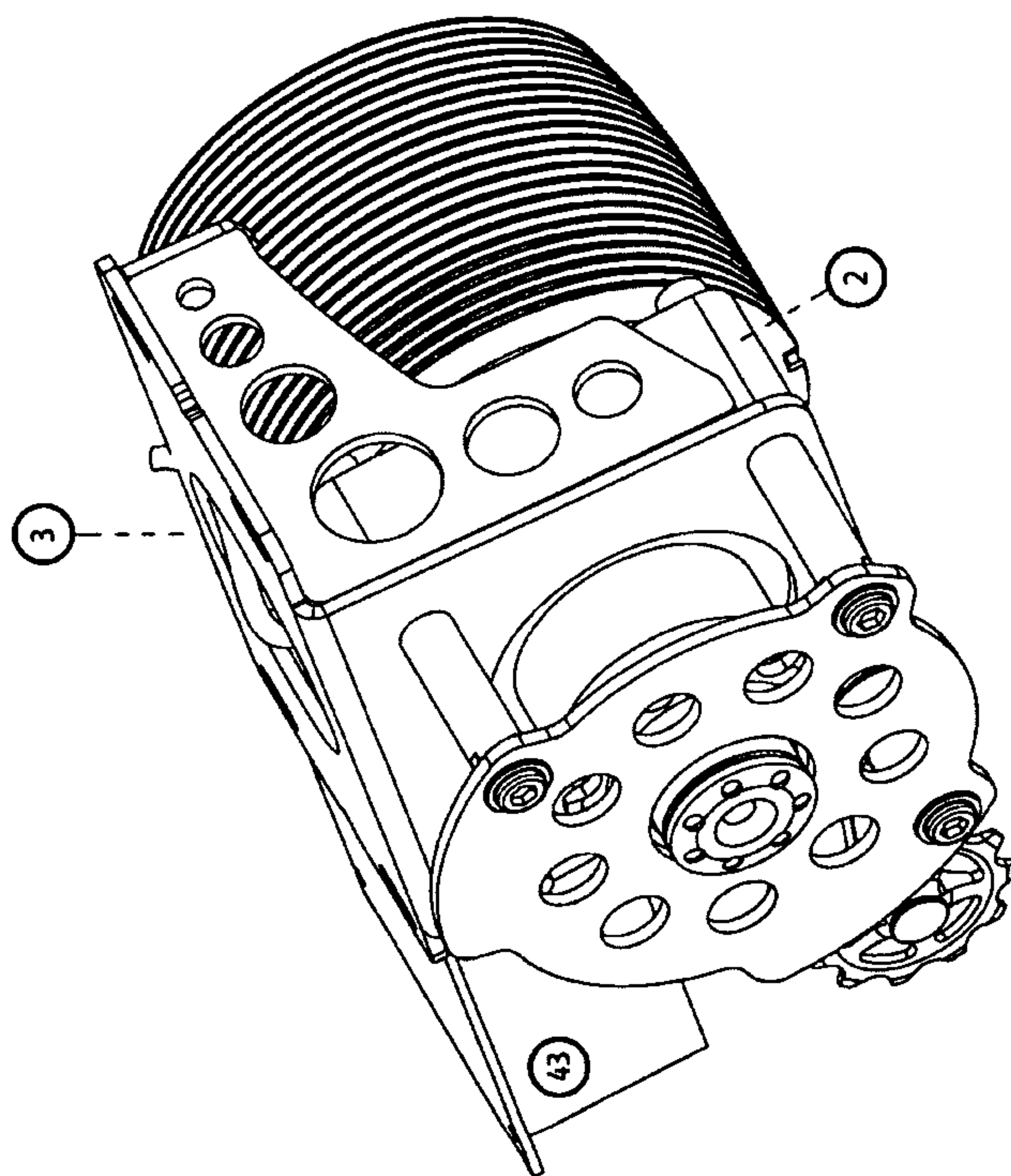


Fig. 8

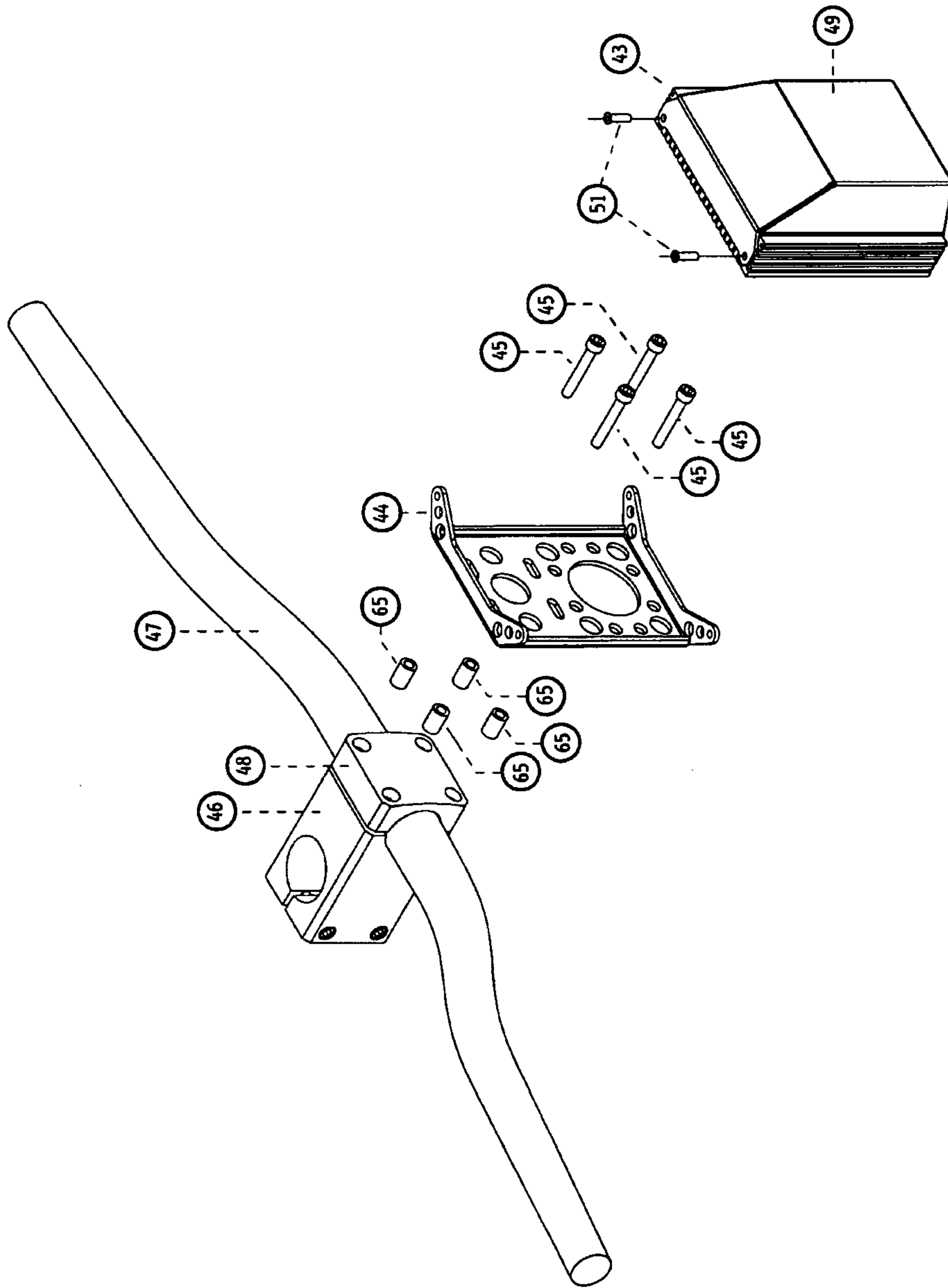


Fig.9

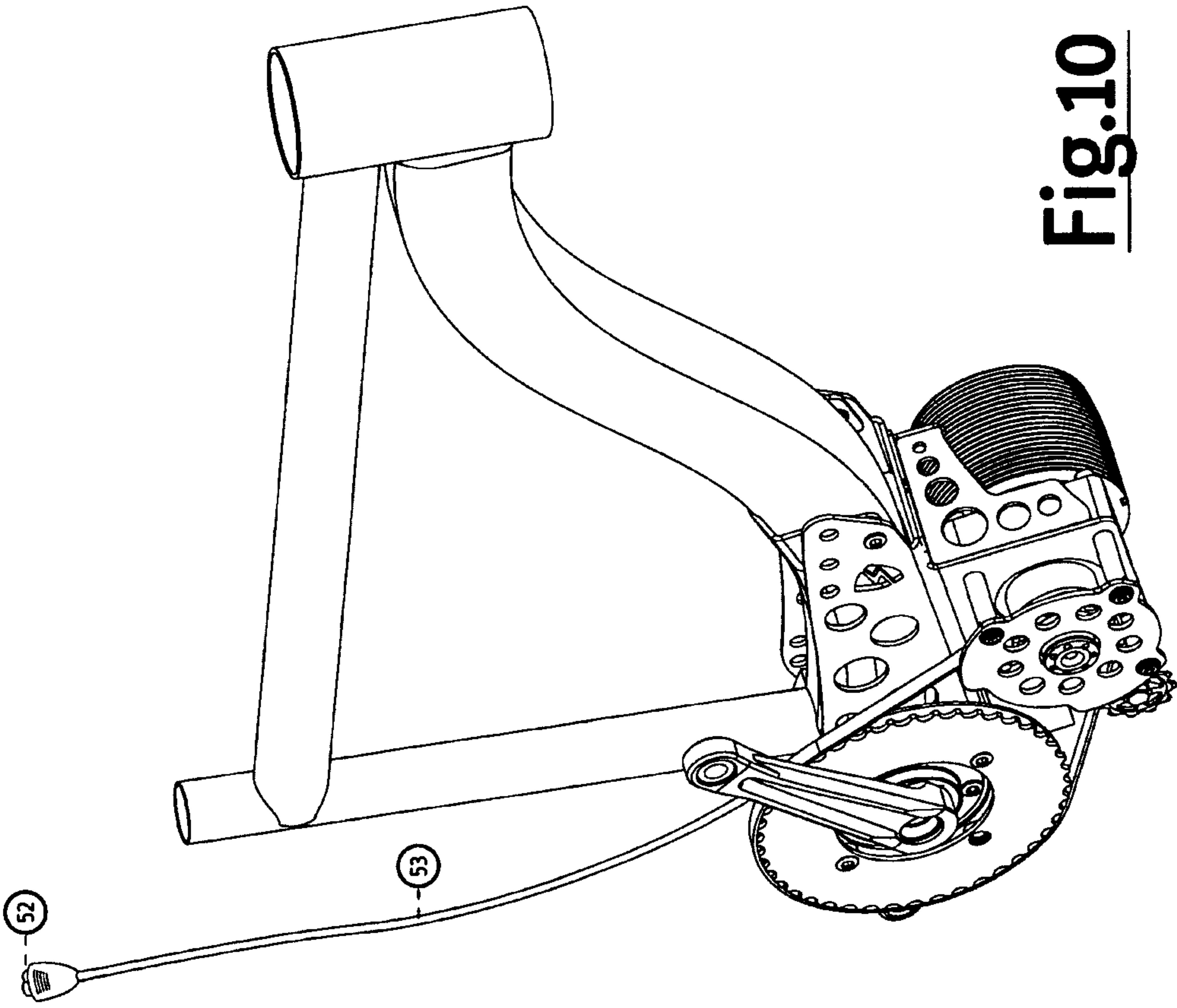


Fig.10

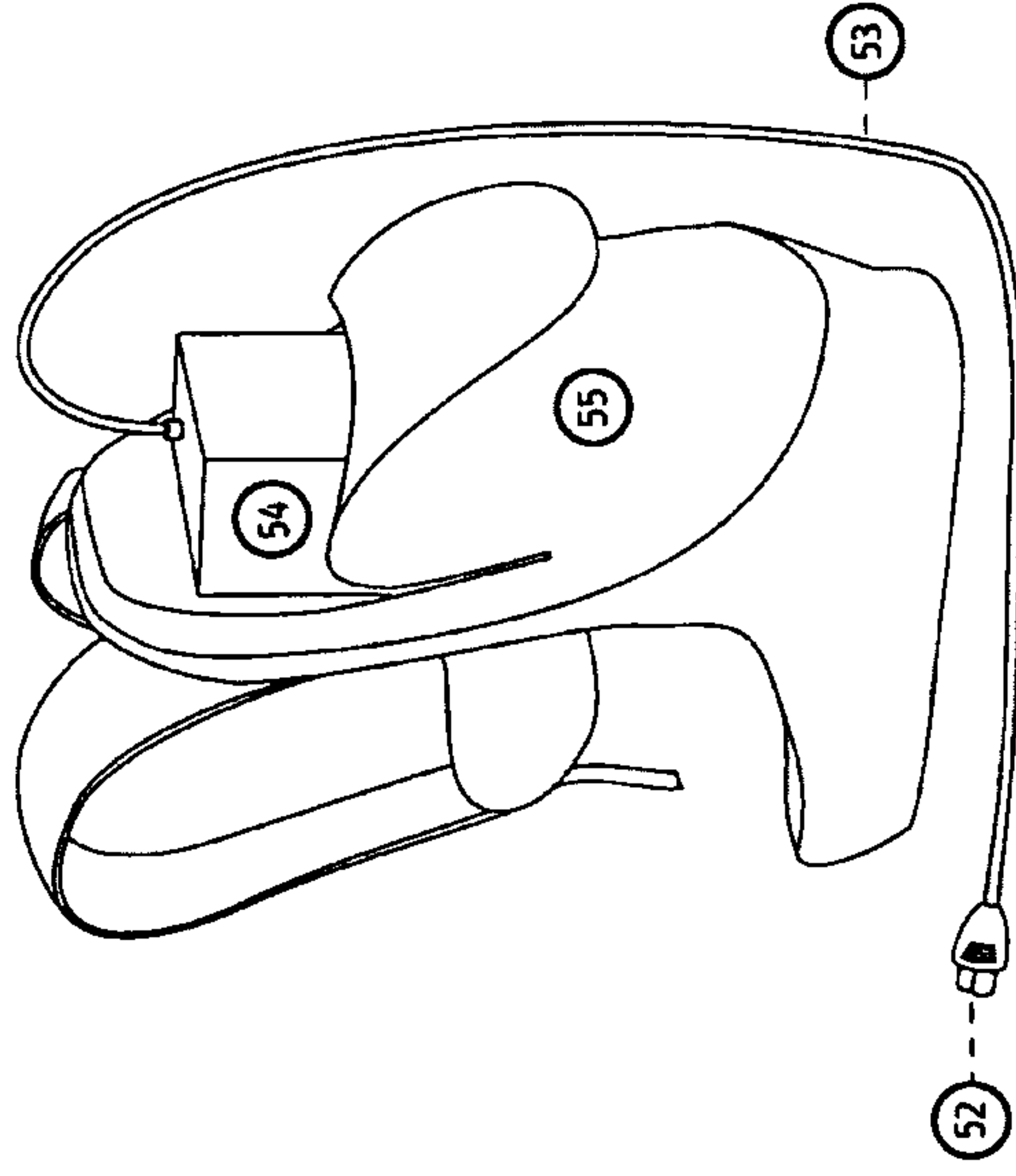


Fig.11

Fig.12

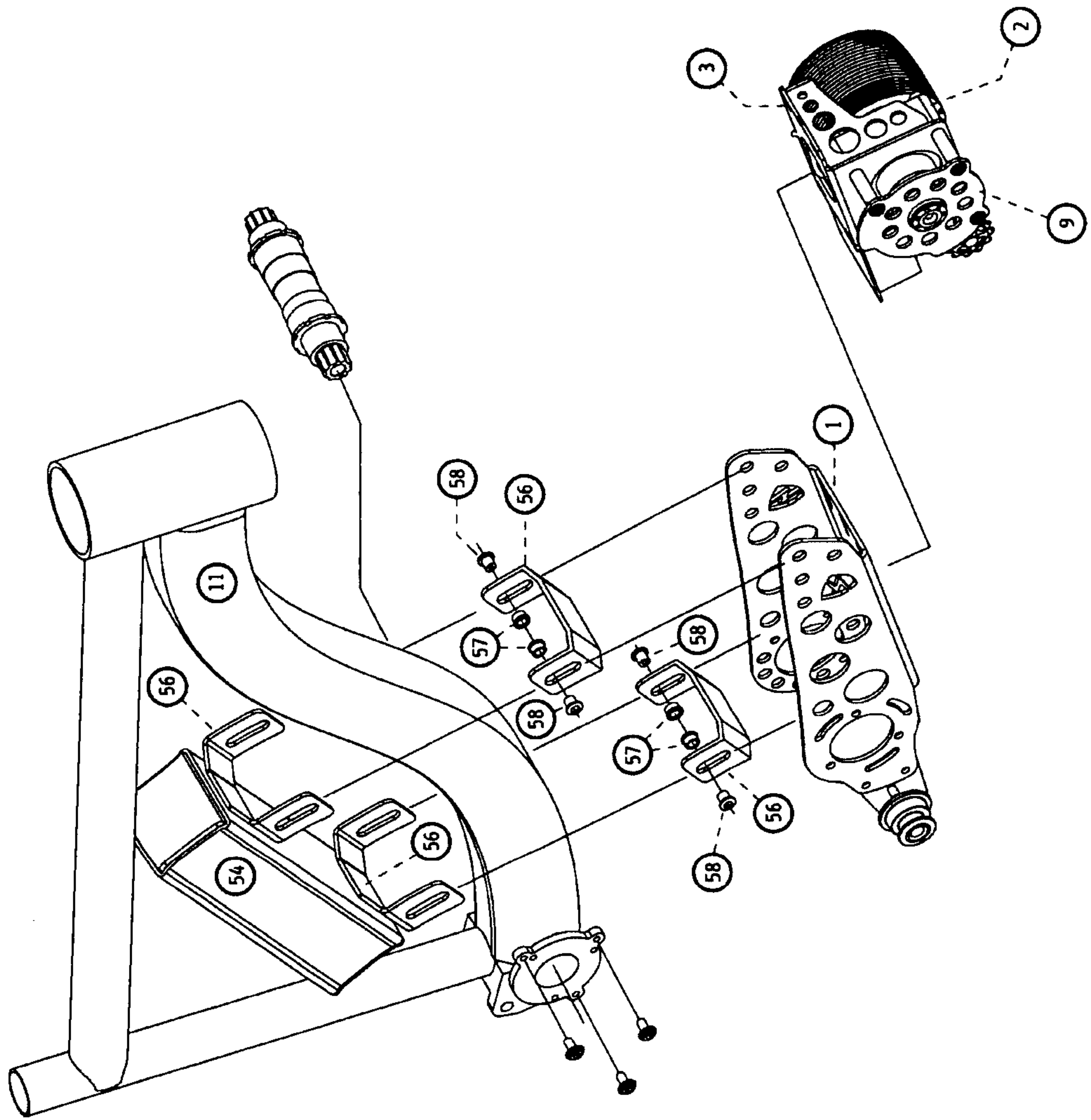


Fig.13a

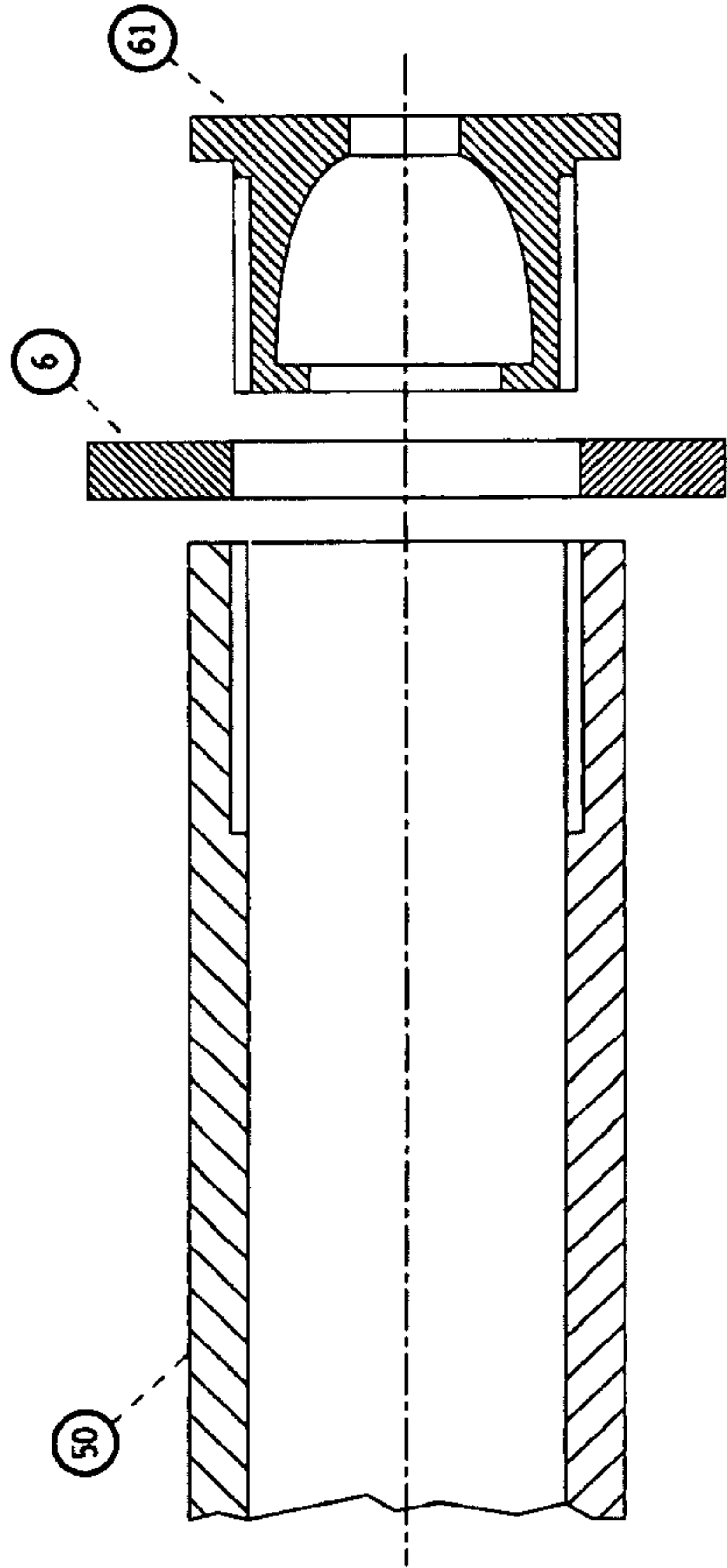


Fig.13b

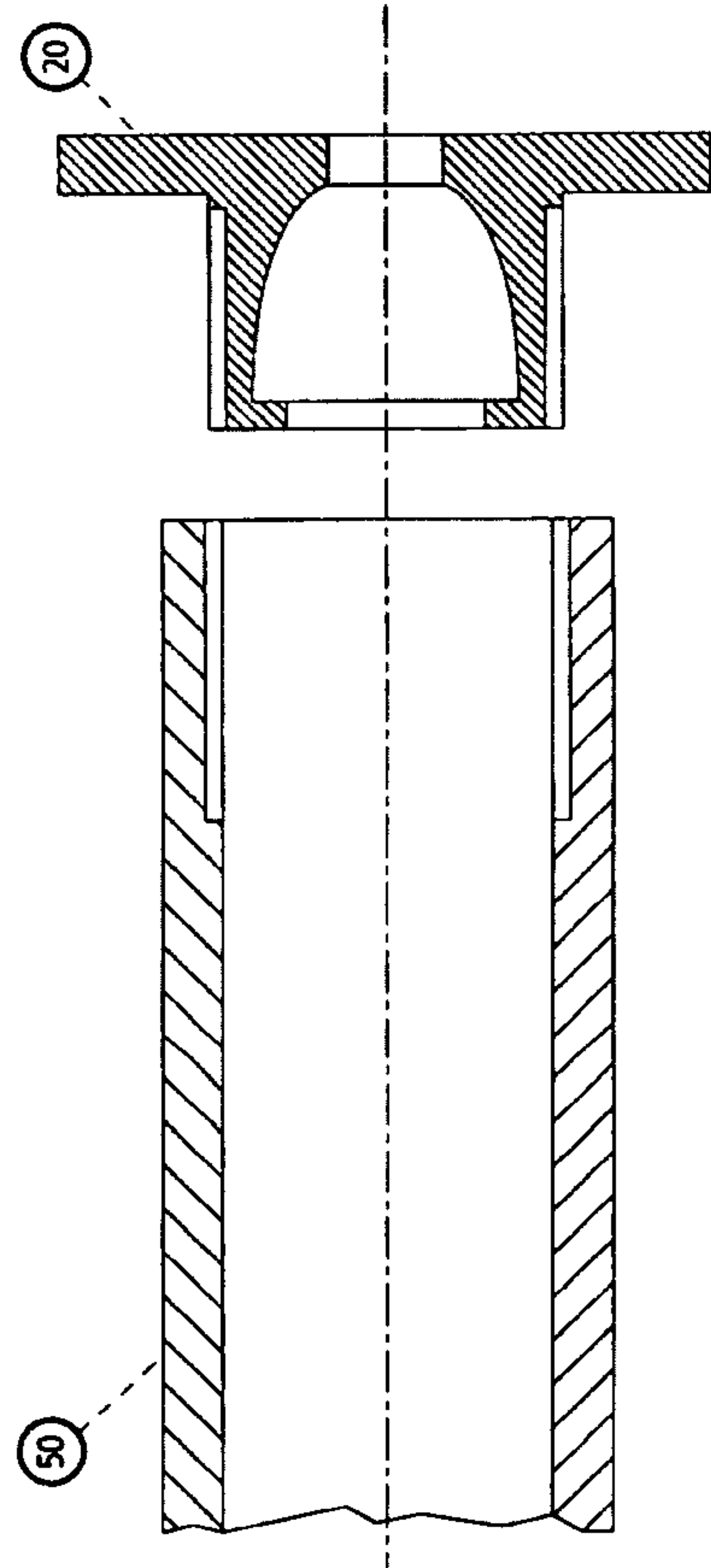


Fig.14

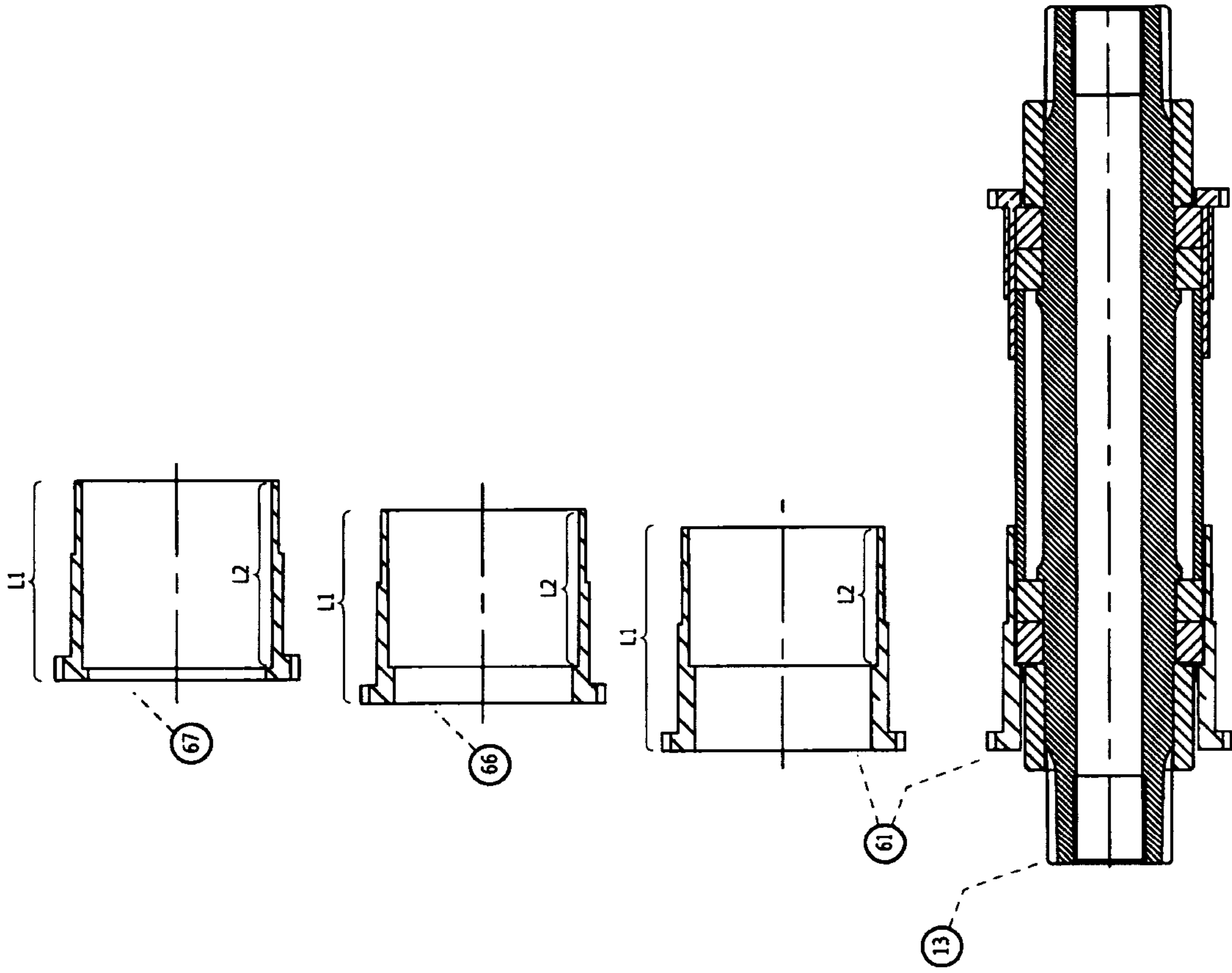


Fig.15

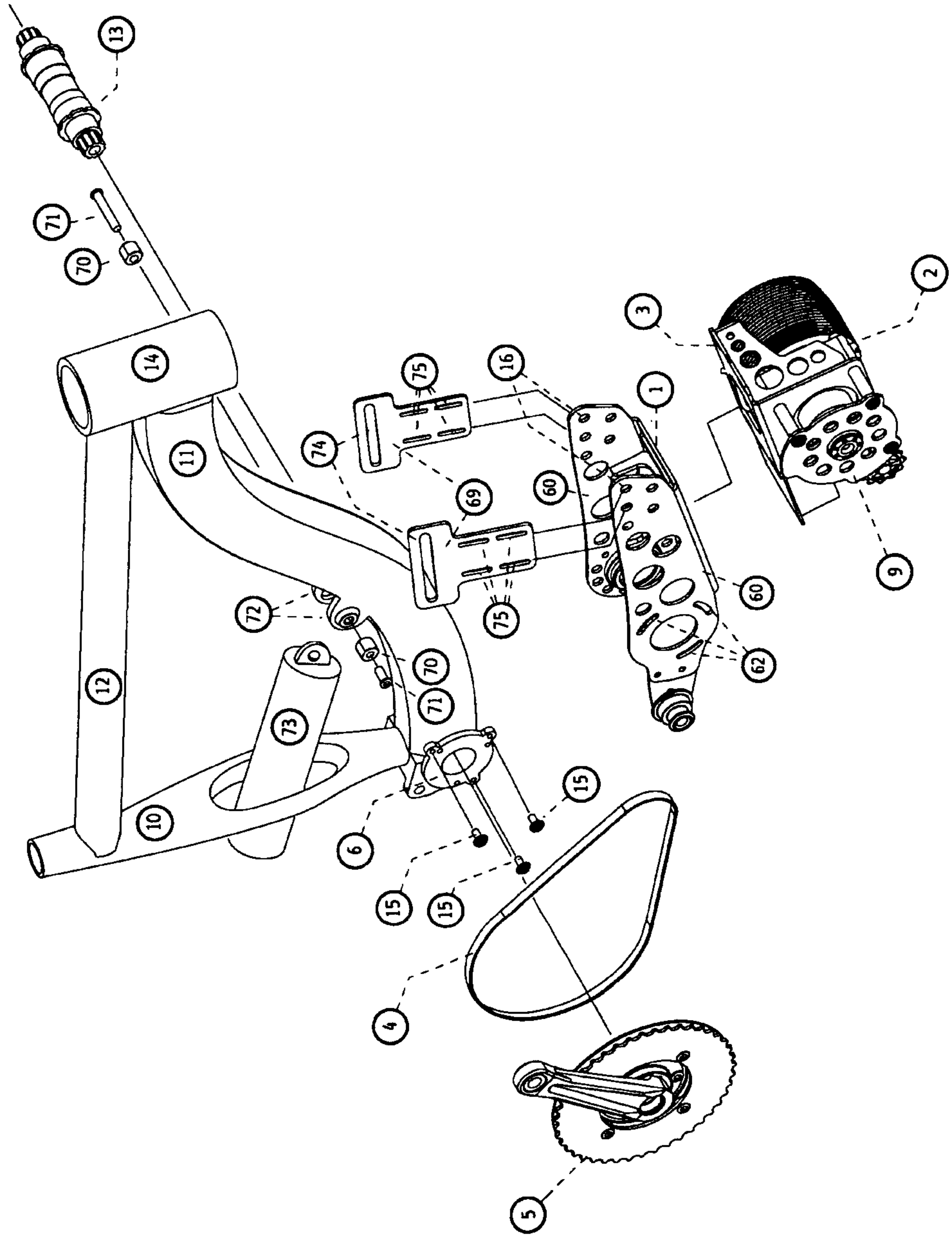


Fig.16

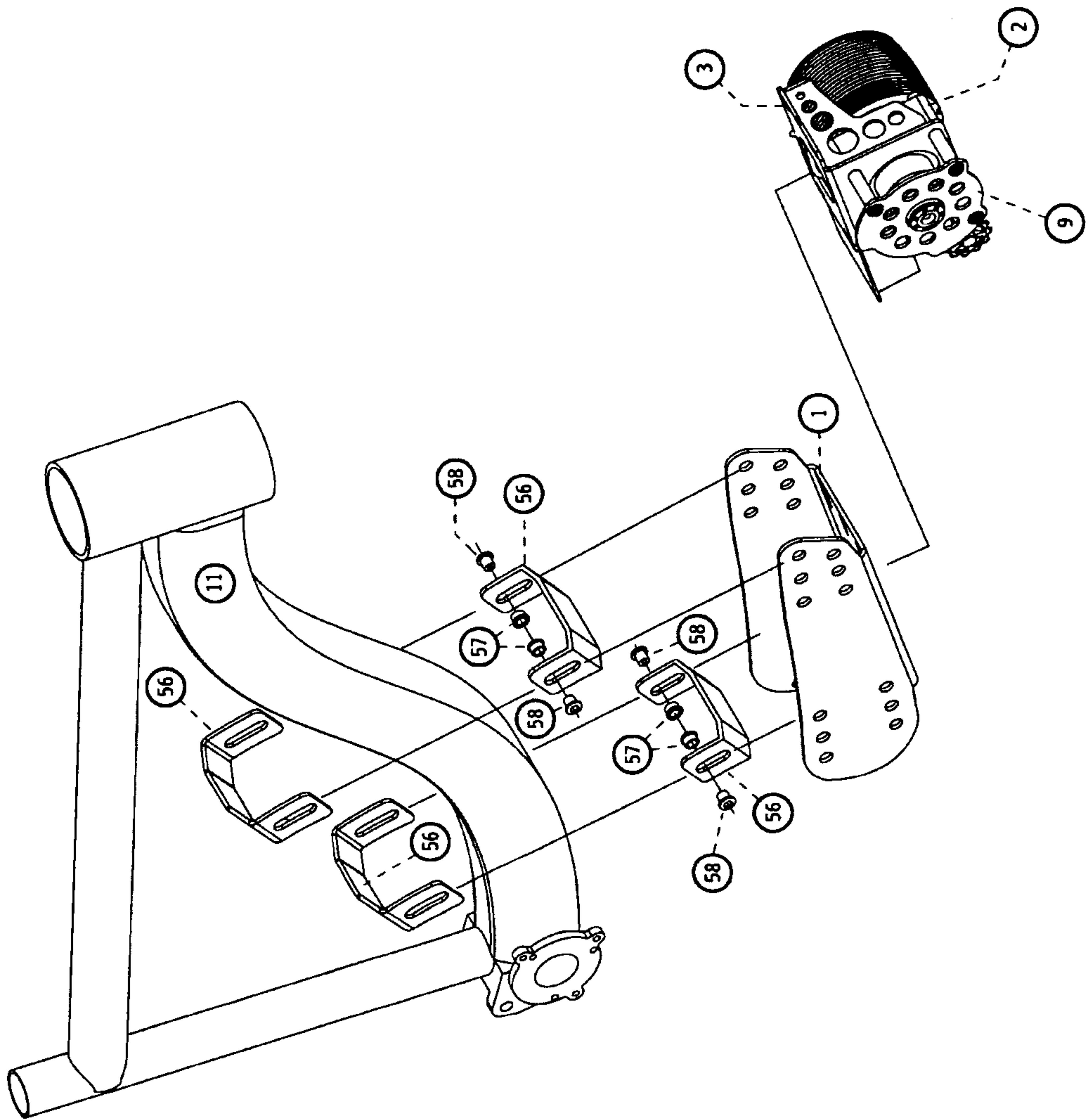
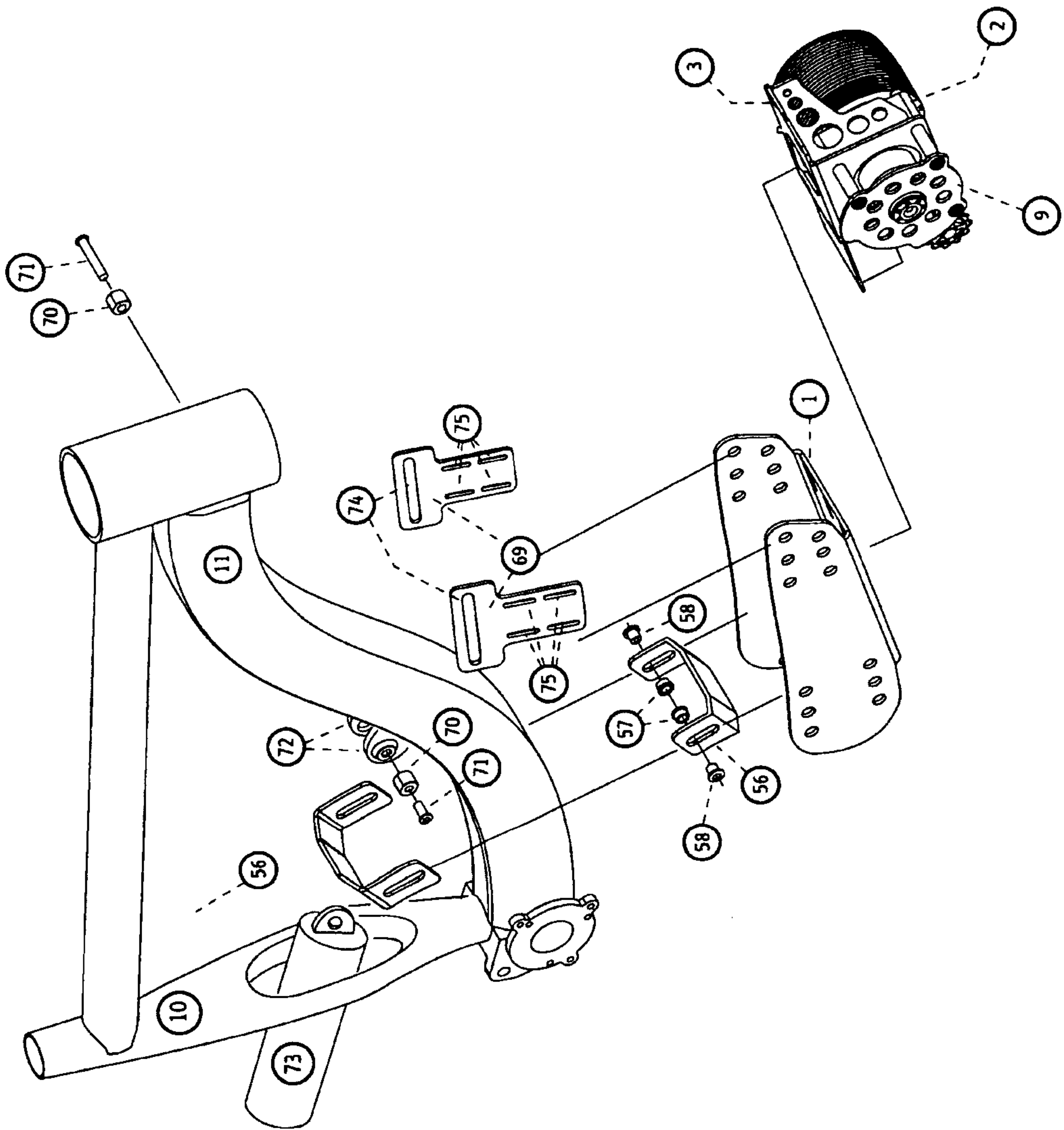


Fig.17



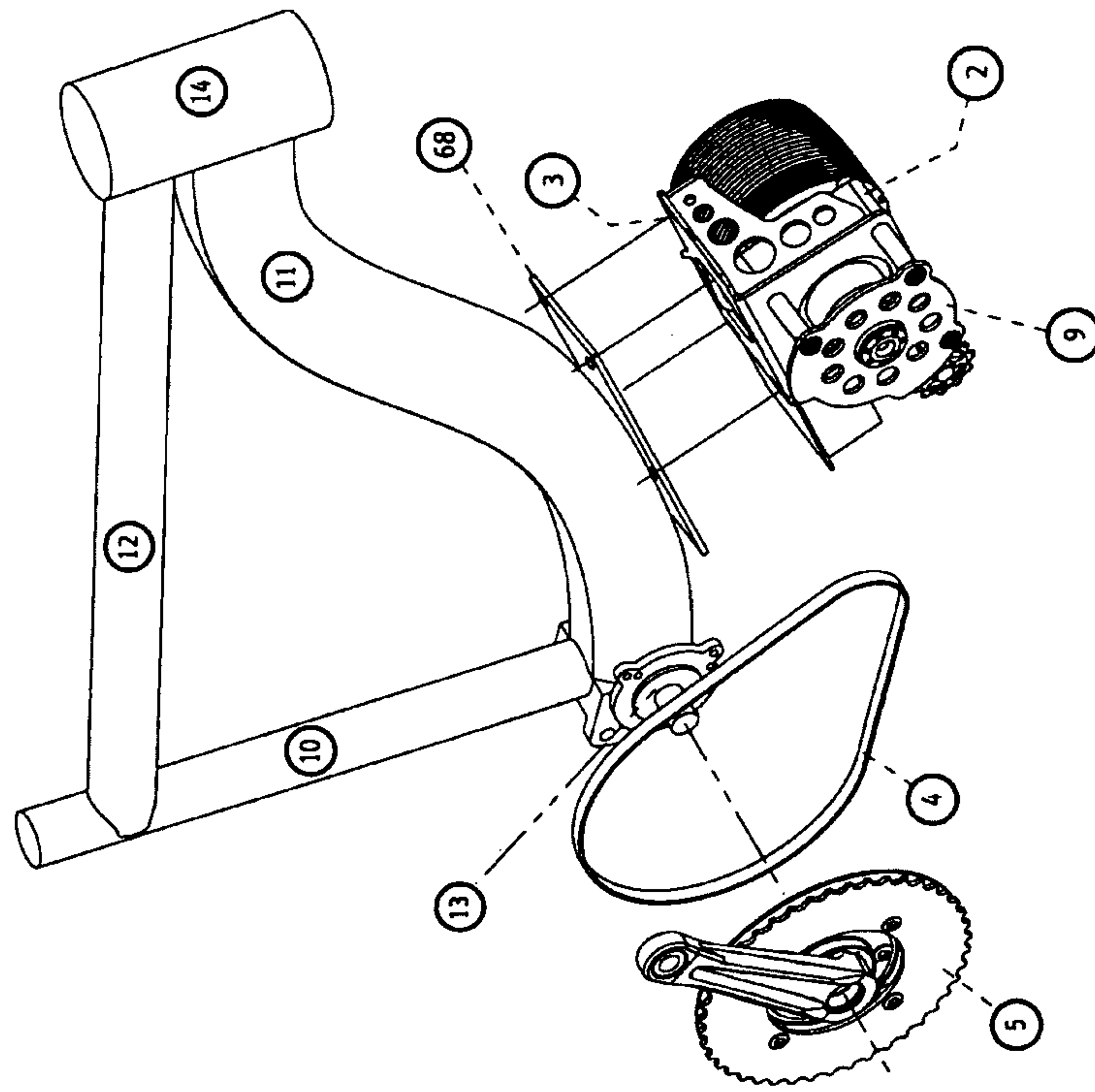


Fig.18

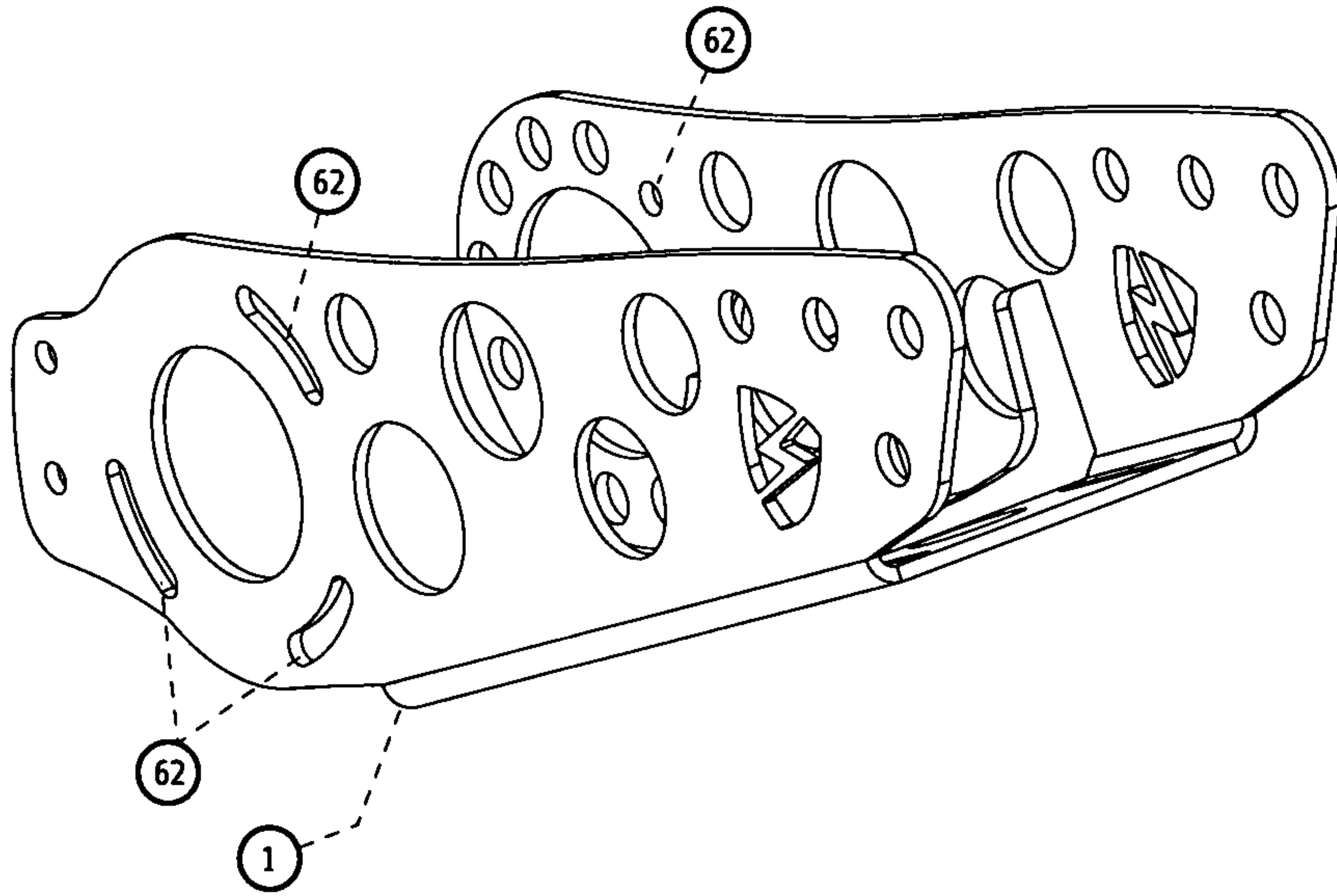


Fig.1