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(54) **AN ADJUSTMENT JOINT, FASTENING ELEMENTS AND A METHOD FOR INSTALLATION AND POSITION SETTING USING AN ADJUSTMENT JOINT**

EINSTELLBARES GELENK, BEFESTIGUNGSELEMENT UND VERFAHREN ZUR INSTALLATION UND POSITIONIERUNGMIT EINEM DERARTIGEN GELENK

JOINT DE REGLAGE POUR LE REGLAGE ET LE VERROUILLAGE D'UNE POSITION

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(56) References cited:
WO-A-98/10482
US-A- 4 235 556
US-A- 4 612 551
US-A- 5 103 236
US-A- 5 383 637

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Description

[0001] The present invention relates to an adjustment joint according to the preamble of claim 1 attached hereto for adjusting position. The invention also relates to fastening elements according to the preamble of claim 8 attached hereto for fastening objects and setting positions. In addition, the invention relates to a method according to the preamble of claim 10 attached hereto for installation and position setting using an adjustment joint.

[0002] It is known to use permanent and semipermanent radio links in order to facilitate a typically bi-directional radio connection. Radio links relay telephone and data traffic as well as radio and TV signals between stations. The radio link is realized by means of electromagnetic radiation, i.e. radio waves, and the frequency of radio waves in a radio link may range from the RF wave band to the microwave region. Links may be 40 to 50 km long, in which case the link masts are typically 40 to 60 meters tall. Link antennas attached to the masts may be parabolic antennas, for example. Typically, there is a line-of-sight path between the radio link antennas so that radio wave propagation is free.

[0003] A known wireless transmission system for telephone and data traffic is the cellular-based public land mobile network (PLMN), such as GSM network, which facilitates wireless communication between a mobile station (MS), such as a mobile phone, and fixed parts of the system while the user of the mobile station moves in the system's operating area. The radio links between the fixed parts of the system are typically a few kilometers or even shorter, whereby the types and sizes of the antennas used may vary. They may be e.g. antennas attached to masts or walls of buildings that are aimed at their targets, say at an antenna attached to another mast. As a general rule, cell sizes are becoming smaller, which will partly result in a growing number of radio links and, hence, more antenna installations and modifications.

[0004] Antennas are used to transmit and receive radio waves. An antenna does not radiate in the same way in all directions but its characteristics may be represented by a radiation pattern which describes the correlation between e.g. the field strength radiated by the antenna and the direction. Indeed many antennas radiate strongly in one direction only, whereby the radiation pattern of such an antenna usually has one main lobe and, in addition to that, weaker side lobes. The radiation pattern is an important factor in antenna design, and radio link antennas are normally very directional, i.e. the direction of the main lobe is both vertically and horizontally narrow. It is then obvious that such an antenna has to be aimed at another, receiving, antenna carefully and with adequate precision.

[0005] In the prior art, the aiming of a radio link antenna, for example, has been carried out in such a manner that the field strength of the antenna is measured with a so-called AGC voltmeter. Naturally the measurement has to take place at the target, say at the other end of the radio link, at which the antenna is aimed, and advantageously at the location in which the other antenna is to be, or has already been, mounted. Aiming is carried out in such a manner that first the antenna is pointed to the rough direction of its target, using e.g. a compass, after which the antenna is mechanically turned using its fastening or adjustment means, such as adjustment screws. At the same time the field strength is measured with the voltmeter, and by mechanically turning the antenna one attempts to find the field strength maximum both vertically and horizontally. Thus the main lobe of the antenna is aimed at its target and the antenna can be locked in its position.

[0006] Antenna fastening elements typically comprise several lockings, joints and lockable adjustment rods and similar elements for performing in addition to the actual fastening, coarse and fine adjustment in conjunction with the aiming. There are several work stages and typically several screws have to be removed and screwed back on in connection with the aiming. A joint used with the fastening elements typically comprises two joint portions that can be rotated with respect to each other and that are locked in their places by tightening a bolt functioning as an axle. Such a joint is suitable only for coarse adjustment. It may also be that there are no adjustment elements and joints as mentioned above, in which case the antenna must be aimed at its target simultaneously with the fastening, in conjunction with the installation. Typically, antennas are heavy, about 5 to 10 kg, so the fastening elements and adjustment elements tend to be large and difficult to handle.

[0007] With decreasing cell sizes also the radio link antenna sizes are becoming smaller and the antennas may typically weigh about 3 kg. Current fastening elements are rather unsuitable for small antennas e.g. because they do not have a sufficient adjustment range, they are very difficult to use for fine adjustment, and they are too large to be inconspicuously installed in urban surroundings. The adjustment range of known fastening elements is typically ±25-45° in the vertical plane and up to ±180° in the horizontal plane.

[0008] The prior art document WO 98/10482 introduces an integrated point-to-point microwave radio frequency unit/antenna system, which includes a microwave transceiver/antenna unit, a housing support element affixed to the microwave transceiver/antenna unit and a mounting structure support element engaged to the housing support element. The mounting structure support element comprises a fixedly adjustable ball-and-socket element, with either the ball or the socket affixed to the housing support element and the other affixed to an attachment structure. The mounting structure support element permits the microwave transceiver/antenna unit to be adjusted in three degrees of freedom.

[0009] An object of the present invention is to eliminate the aforementioned problems of the prior art and

to provide an adjustment joint with a wide adjustment range for the purpose of aiming, for example. In particular, it is an object of the invention to provide an adjustment joint such that the adjustment joint can be switched from a coarse adjustment mode, fine adjustment mode or locking mode to another one of these modes in a very simple manner just by tightening or loosening the locking means of the adjustment joint, which makes both the installation and the structure of the fastening elements considerably simpler.

[0010] The adjustment joint according to the invention is characterized by what is specified in the characterizing part of claim 1 attached hereto. The fastening elements according to the invention are characterized by what is specified in the characterizing part of claim 8 attached hereto. The method according to the invention is characterized by what is specified in the characterizing part of claim 10 attached hereto.

[0011] A considerable advantage of the invention is that when aiming an antenna one has to tighten or loosen only one locking mechanism fitted to the adjustment joint. Another advantage of the invention is that by means of two adjustment joints according to the invention the aiming can be carried out for a wide adjustment range in both the horizontal and vertical plane.

[0012] The invention is used to make the aiming of antennas significantly more accurate, quicker and simpler than in the prior art. A special advantage of the invention is the wide adjustment range, advantageously 180° in the vertical plane and 360° in the horizontal plane. Another special advantage of the invention is the adequate adjustment range for fine adjustment, advantageously about 10°, as well as the adequate aiming accuracy, advantageously about ±0.25°, facilitated by the structure. A further advantage of the invention is the small size, whereby a fastening element according to a preferred embodiment of the invention weighs about 2 kg.

[0013] The invention will now be described in more detail with reference to the accompanying drawings wherein

Fig. 1 is an overhead view of two adjustment joints according to a first preferred embodiment of the invention applied in connection with fastening elements,

Fig. 2 is a side view of the fastening elements of Fig. 1,

Fig. 3 is a partially cut out side view of an adjustment joint according to a second embodiment of the invention applied in connection with fastening elements in the coarse adjustment mode,

Fig. 4 shows the adjustment joint of Fig. 3 in the fine adjustment mode, and

Fig. 5 shows the adjustment joint of Fig. 3 locked.

[0014] Referring to Figs. 1 and 2, the fastening elements K, in connection with which the adjustment joints S 1 and S2 according to the invention are applied, comprise fastening parts K1 for attachment e.g. to a bar, mast, beam or the like 3. When attaching to a wall, there are no parts K1b, K1c and K1d. The fastening elements K depicted are adapted so as to attach an object (not shown), particularly an antenna, and to adjust its position. In the example described the bar 3 is vertical (arrow Y) but it is obvious that other positions, too, are possible. In addition, the fastening parts K1 may comprise lockable articulations by means of which it is possible to alter the position of the fastening elements K relative to the bar 3. A first fastening part K1a and a second fastening part K1b are interconnected by fastening bolts K1c and K1d by means of which the fastening parts K1a and K1b press between them the bar 3. The fastening elements K further comprise a first adjustment joint S 1 according to a first preferred embodiment of the invention and a first fine adjustment element F1, known as such, for the fine adjustment in the horizontal plane (arrow X). In addition, the fastening elements K comprise an adjustment joint S2 according to the first preferred embodiment of the invention and a first fine adjustment element F2, known as such, for the fine adjustment in the vertical plane (arrow Y). The detailed structure of the fine adjustment elements F1 and F2 may vary in different fastening elements K. The purpose of the fastening elements K is to provide a movable and lockable articulation for altering the position of the antenna attachment K2, such as mounting flange K2, in relation to the fastening parts K1. It is obvious that the fine adjustment element F 1 and adjustment joint S 1 may be left out, in which case the position of the mounting flange K2 is altered, when necessary, by altering the attachment position of the fastening parts K1 and by the adjustment joint S2. Both the fine adjustment elements F1 and F2 and adjustment joints S1 and S2 are advantageously used to change and lock the antenna position without opening the fastening parts K1. The aim line TL depicted in Fig. 2 corresponds to the direction of the main lobe of an antenna (not shown) attached to the mounting flange K2.

[0015] Still referring to Figs. 1 and 2, a first end F1a of the fine adjustment element F1 is fitted in an articulated manner to the fastening part K1a and a second end F1b is fitted in an articulated manner to the second adjustment part S 12 of the adjustment joint S1. Correspondingly, a first end F2a of the fine adjustment element F2 is fitted in an articulated manner to the mounting flange K2 and a second end F2b is fitted in an articulated manner to the second adjustment part S22 of the adjustment joint S2. In addition, the first adjustment part S11 of the adjustment joint S1 is attached in a fixed manner to the fastening part K1a and the first adjustment part S21 of the adjustment joint S2 is attached in a fixed

manner to the mounting flange K2. Thus it is possible by means of the fine adjustment element F1 (and, correspondingly, fine adjustment element F2) to rotate the first adjustment part S11 and second adjustment part S12 around (arrow R) the joint axis A1 (and, correspondingly, joint axis A2) traveling through the adjustment joint S1. The rotation is performed using the fine adjustment element F 1 in the fine adjustment mode of adjustment joint S 1 described later on. In this case the rotation is carried out by increasing or decreasing the length of the fine adjustment element F1 by screwing, whereby the distance between the ends F1a and F1b becomes either longer or shorter. This is arranged e.g. in the fine adjustment element F2 by means of adjustment rods F2c and F2d and locking bolts F2e and F2f, for example. A third adjustment part S 13 of the adjustment joint S 1 and a third adjustment part S23 of the adjustment joint S2 are attached to each other in a fixed manner, providing a so-called universal joint. Let it be mentioned that in Figs. 1 and 2 the adjustment joints S1 and S2 are shown locked and the joint axes A1 and A2 are adapted so as to be perpendicular in relation to each other. In the coarse adjustment mode the third adjustment part S13 (and, correspondingly, adjustment part S23) may be moved by hand, for example.

[0016] Figs. 3 to 5 show an adjustment joint S1 according to a second preferred embodiment of the invention in different modes and partly cut open for illustrative purposes. In Fig. 3 the adjustment joint S 1 is shown in the coarse adjustment mode, in which the third adjustment part S13 can be rotated in relation to the first adjustment part S11 around the joint axis A1, whereby the stepped adjustment range may be as wide as $\pm 180°$ in the horizontal plane. In Fig. 4 the adjustment joint S1 is shown in the fine adjustment mode in which the third adjustment part S 13 can be steplessly rotated in relation to the first adjustment part S11 around the joint axis A1, whereby the adjustment range depends on the adjustment range of the fine adjustment element F1 depicted in Figs. 1 and 2. Advantageously, the adjustment range is arranged in accordance with Fig. 3 so that in the coarse adjustment mode the mutual position of the adjustment parts S12 and S13 can be set in steps of 5° and in the fine adjustment mode the position can be additionally altered steplessly by $\pm 10°$. An angle in this description means the angle of rotation (arrow R in Fig. 3) of an adjustment part e.g. around the joint axis A1 in relation to another adjustment part. In Fig. 5 the adjustment parts S11, S12 and S 13 are locked, advantageously pressed against each other by a locking element S 15 so that rotary movement between them is prevented by means of friction, among other things.

[0017] Switching between modes is realized by tightening or loosening the adjustment joint S1 by means of a locking element S 15, advantageously a locking bolt S 15, whereby the movement of particularly the third adjustment part S 13 in the adjustment joint S1 is restricted in the direction of the joint axis A1 (arrow L). Said locking element S15 thus functions in the direction of the axis A1. In the coarse adjustment mode the directional movement of the third adjustment part S 13 in the direction of the joint axis A1 and rotary movement around the joint axis A1 are allowed, whereas in the fine adjustment mode the rotary movement and advantageously also the directional movement relative to the second adjustment part S12 are substantially prevented. The directional movement is prevented in such a manner that the third adjustment part S 13 is, in accordance with Fig. 4, in sliding contact with the first adjustment part S11, and the locking element S15 is tightened such that sliding is possible, but the rotation of the third adjustment part S13 to the next step of the cogging S16 is prevented as there is no room for the third adjustment element S 13 to move in the direction of the joint axis A1. In the coarse adjustment, the second adjustment part S12 and third adjustment part S13 can be stepwise brought into contact with each other, and in a suitable position the locking element S15 is tightened so as to keep the desired position. In the locked position, the adjustment elements S11 and S13 are tightened against each other so that friction prevents them from moving in relation to each other around the joint axis A1. The first cogging S16a of the gear S16 is located in the adjustment part S12 and the second cogging S16b is located in the adjustment part S13.

[0018] Referring to Figs. 1 to 5, the first adjustment part S 11 and third adjustment part S 13 are interconnected by a cone joint S 17, in which the male cone S 17a is fitted to the adjustment part S11 and the female cone S 17b is fitted to the adjustment part S 13 symmetrically with respect to the joint axis A1. In the second preferred embodiment of the adjustment joint S 1 the second and third adjustment parts S12 and S 13 are interconnected by a gear of conical cogs S16, as shown in Figs. 3 to 5. In the first preferred embodiment of the adjustment joint S 1 the second and third adjustment parts S12 and S 13 are interconnected by a gear of substantially rectangular cogs S 16, as shown in Figs. 1 to 2. It is obvious that the cogs S 16 may as well be curved, for instance. Advantageously the cogs S 16 are rectangular, as in Figs. 1 and 2, so that a short mutual movement of adjustment parts S12 and S 13 is allowed in the direction of the joint axis A1 but at the same time their mutual rotary movement around the joint axis A1 is prevented substantially completely, for their mutual rotary movement would degrade the accuracy of fine adjustment. The short movement allowed in the direction of the axis A1 is however arranged in such a manner that a movement of adjustment part S 13 over the cogs S16a is prevented by bringing the male cone S 17a sufficiently close to the female cone S17b. Said short movement is then preferably shorter than the height of the cogging S16a and S16b in the direction of the joint axis A1.

[0019] The locking element S 15 advantageously comprises simply a locking bolt S 15 which in the first preferred embodiment of the adjustment joint S 1 is arranged so as to lock the adjustment joint S 1 by means

of a nut S 15c, as shown in Figs. 1 and 2. In the second preferred embodiment of the adjustment joint S I the locking bolt S 15 is arranged so as to lock the adjustment joint S 1 by means of a thread S 18 in the first adjustment part S11 and a thread S15d in the locking bolt S15, as shown in Figs. 3 to 5. It is obvious that the thread S18 can be optionally located in the second adjustment element S12 so that the head S15b of the locking bolt S15 is located at the side of the first adjustment element S 11. The locking bolt S 15 advantageously serves simultaneously as an axle S14 traveling through the joint axis A1 and as a locking element S 15. Figs. 3 to 5 also show the cogs S26 of the second adjustment joint S2, its third adjustment part S23, arranged radially with respect to the joint axis A2 for stepwise adjustment. The second adjustment part S22 and adjustment joint S 1 have corresponding cogs. The circles of coggings S26 and S16 are divided into 72 cogs T so that for coarse adjustment the position can be set stepwise at 5° steps.

[0020] Referring to Figs. 3 to 5, it should be further noted that they show the lug S 19 of only the second adjustment part S12 and the lug K1e of the fastening part K1 for the attachment of the fine adjustment elements F1. In addition, the adjustment joint S1 has, around axle S14, a guide sleeve S15a for the mutual concentration and guiding of adjustment parts S 11, S 12 and S 13. In addition to this it should be noted that in the embodiment depicted, the rotary movement of the third adjustment element S 13 around the joint axis A 1 is restricted by the structure of the first adjustment part S11 attached to the fastening part K1, but the third adjustment part S13 may also be adapted such that it rotates freely around the joint axis A1, thus achieving a stepped adjustment range of ±180° for coarse adjustment.

[0021] The joint according to the invention is applied in the mechanical aiming of an antenna e.g. as follows. The direction for the aiming is first selected coarsely and the antenna is pointed to the target, typically another antenna, or to the desired direction using coarse adjustment, say by hand, and the locking mechanism is tightened for fine adjustment. The antenna is then aimed using fine adjustment with the help of a voltmeter, for example, for which an adequate adjustment range is needed. The position of the adjustment elements is locked by sufficiently tightening the locking mechanism. The locking mechanism is tightened to the desired torque value using preferably a torque spanner so as to lock the cone joint S 17 to its position and to prevent the adjustment joint S1 from moving e.g. under the stress caused by wind or snow and ice. In the fine adjustment mode the locking force has to be such that the friction forces acting on the surfaces in question do not, however, prevent the sliding of the cone joint S 17. The adjustment joint S1 can be switched between the coarse and fine adjustment modes advantageously by hand.

[0022] The present invention is not limited solely to the explanatory preferred embodiments described above but it can be modified within the scope of the claims attached hereto. For example, more than two adjustment joints can be fitted to the fastening elements and the axes of the joints can also be parallel. In addition, it is obvious that the attachment of the adjustment joints to a mounting flange or fastening elements as well as the attachment of two adjustment joints to each other can be arranged in many ways which, as such, are obvious to a person skilled in the art. In particular it should be noted that in addition to the aiming of radio link antennas the invention can be applied elsewhere where the position of objects to be fastened needs to be adjusted in conjunction with the fastening.

Claims

1. An adjustment joint for adjusting position, which adjustment joint (S1, S2) comprises at least two adjustment parts (S11, S12, S13, S21, S22, S23) rotatable with respect to each other around (arrow R) a joint axis (A1, A2), and a locking element (S14, S15, S15a, S15b, S15c, S15d) functioning in the direction (arrow L) of said joint axis (A1, A2) for locking the adjustment parts (S11, S12, S13, S21, S22, S23) so that they become immobile with respect to each other, **characterised in that**:

   - the adjustment joint comprises a male cone (S17a) and female cone (S17b) that constitute a cone joint, a rotational axis of which coincides with said joint axis,

   - the adjustment joint comprises two matched coggings (S16a, S16b) that have a certain height of the cogging in the direction of said joint axis (A1),

   - the adjustment joint (S1, S2) is adapted so as to be switched from the locked state to a fine adjustment mode by opening the locking element (S14, S 15, S15a, S15b, S15c, S15d), which fine adjustment mode is arranged for stepless fine adjustment of position by sliding said cone joint around said rotational axis,

   - the adjustment joint (S1, S2) is adapted so as to be switched from the fine adjustment mode to a coarse adjustment mode by further opening the locking element (S14, S15, S15a, S15b, S15c, S15d), which coarse adjustment mode is arranged for stepped coarse adjustment of position by moving to a next step of said coggings, and

   - the adjustment joint (S1, S2) is adapted so as to be switched from the coarse adjustment mode back to the fine adjustment mode and fur-

ther from the fine adjustment mode to the locked state by tightening the locking element (S14, S15, S15a, S15b, S15c, S15d).

2. The adjustment joint (S1, S2) according to claim 1, **characterized in that**

- the adjustment joint (S1, S2) comprises a first adjustment part (S11, S21) and second adjustment part (S12, S22), whereby in the coarse adjustment mode said adjustment parts (S12, S22) are arranged so as to be movable (arrow L) with respect to each other in the direction of the joint axis (A1, A2) and rotatable (arrow R) with respect to each other around the joint axis (A1, A2), and whereby in the fine adjustment mode said adjustment parts (S12, S22) are arranged so as to be rotatable with respect to each other around the joint axis (A1, A2) and movement of said adjustment parts (S12, S22) with respect to each other in the direction of the joint axis (A1, A2) is prevented,
- a third adjustment part (S13, S23) is fitted between the first adjustment part (S11, S21) and second adjustment part (S12, S23), whereby in the coarse adjustment mode the third adjustment part (S13, S23) is arranged so as to be movable with respect to both the first (S11, S21) and the second (S12, S22) adjustment part in the direction of the joint axis (A1, A2) and rotatable around the joint axis (A1, A2), whereby in the fine adjustment mode the third adjustment part (S13, S23) is arranged so as to be rotatable with respect to the first adjustment part (S11, S21) around the joint axis (A1, A2) and movement of the third adjustment part (S13, S23) with respect to the second adjustment part (S12, S22) is prevented.

3. The adjustment joint (S1, S2) according to claim 2, **characterized in that** in the fine adjustment mode the movement of the second adjustment part (S12, S22) and third adjustment part (S13, S23) with respect to each other in the direction of the joint axis (A1, A2) is prevented at least in such a manner that the stepwise rotation to the next position of the third adjustment part (S13, S23) with respect to the second adjustment part (S12, S22) is prevented.

4. The adjustment joint (S1, S2) according to any one of claims 2 to 3, **characterized in that** the adjustment joint (S1, S2) is arranged so as to be switched from the coarse adjustment mode to the fine adjustment mode and further to the locked state by reducing the distance between the first adjustment part (S11, S21) and second adjustment part (S12, S22) by means of a locking element (S14, S15, S 15a, S15b, S15c, S15d).

5. The adjustment joint (S1, S2) according to any one of claims 1 to 4, **characterized in that** the adjustment joint (S1, S2) comprises an axle (S14), traveling through the joint axis (A1, A2) and functioning as locking element (S14, S 15, S15a, S15b, S15c, S15d), which axle (S14) is in the form of a bolt comprising a screw thread (S15d) and a head (S15b), said screw thread (S15d) being connected to a thread (S18) in the first adjustment part (S11, S21), a thread in the second adjustment part (S12, S22) or to a nut (S15c) fitted in the adjustment joint (S1, S2).

6. The adjustment joint (S1, S2) according to any one of claims 2 to 5, **characterized in that** the second adjustment part (S12, S22) is at least in the fine adjustment mode arranged so as to be rotatable with respect to the first adjustment part (S11, S21) around the joint axis (A1, A2) by means of a known fine adjustment element (F1, F1a, F1b, F2, F2a, F2b, F2c, F2d, F2e, F2f) such as a fine adjustment rod or fine adjustment screw.

7. The adjustment joint (S1, S2) according to any one of claims I to 6, **characterized in that** the adjustment joint (S1, S2) is fitted to fastening elements (K, K1, K2) which are arranged for attaching objects and setting their positions, and that the fastening elements (K, K1, K2) also comprise a second adjustment joint (S1, S2) the joint axis (A1, A2) of which is adapted so as to be transverse with respect to the joint axis (A1, A2) of said adjustment joint (S1, S2).

8. Fastening elements for attaching objects and setting their positions, to which fastening elements (K, K1, K2) it is fitted at least one adjustment joint (S1, S2) for adjusting position, which adjustment joint (S1, S2) comprises at least two adjustment parts (S11, S12, S13, S21, S22, S23) arranged so as to be rotatable with respect to each other around (arrow R) a joint axis (A1, A2) and a locking element (S14, S15, S15a, S15b, S15c, S15d) arranged so as to function in the direction (arrow L) of said joint axis (A1, A2) for locking the adjustment parts (S11, S12, S13, S21, S22, S23) so that they become immobile with respect to each other, **characterized in that**

- the adjustment joint comprises a male cone (S17a) and female cone (S17b) that constitute a cone joint, a rotational axis of which coincides with said joint axis,
- the adjustment joint comprises two matched coggings (S16a, S16b) that have a certain height of the cogging in the direction of said joint axis (A1),

- the adjustment joint (S1, S2) is adapted so as to be switched from the locked state to a fine adjustment mode by opening the locking element (S14, S15, S15a, S15b, S15c, S 15d), which fine adjustment mode is arranged for stepless fine adjustment of position by sliding said cone joint around said rotational axis,

- the adjustment joint (S1, S2) is adapted so as to be switched from the fine adjustment mode to a coarse adjustment mode by further opening the locking element (S14, S15, S15a, S15b, S15c, S15d), which coarse adjustment mode is arranged for stepped coarse adjustment of position by moving to a next step of said coggings, and

- the adjustment joint (S1, S2) is adapted so as to be switched from the coarse adjustment mode back to the fine adjustment mode and further from the fine adjustment mode to the locked state by tightening the locking element (S14, S15, S15a, S15b, S15c, S15d), and

- fitted in connection with at least one adjustment joint (S1, S2) there are provided fine adjustment elements (F1, F1a, F1b, F2, F2a, F2b, F2c, F2d, F2e, F2f) for the adjustment of position of the adjustment joint (S1, S2) in the fine adjustment mode.

9. Fastening elements (K, K1, K2) according to claim 8, **characterized in that** the fastening elements (K, K1, K2) comprise at least two adjustment joints (S1, S2) the joint axes (A1, A2) of which are adapted so as to be transverse with respect to each other.

10. A method of installation and setting of position by means of an adjustment joint, which adjustment joint (S1, S2) comprises at least two adjustment parts (S11, S12, S13, S21, S22, S23) rotatable with respect to each other around (arrow R) a joint axis (A1, A2), and a locking element (S14, S15, S15a, S15b, S15c, S15d) functioning in the direction (arrow L) of said joint axis (A1, A2) for locking the adjustment parts (S11, S12, S13, S21, S22, S23) so that they become immobile with respect to each other, **characterized in that**

- the adjustment joint comprises a male cone (S17a) and female cone (S17b) that constitute a cone joint, a rotational axis of which coincides with said joint axis,

- the adjustment joint comprises two matched coggings (S16a, S16b) that have a certain height of the cogging in the direction of said joint axis (A1),

- the adjustment joint (S1, S2) is switched from the locked state to a fine adjustment mode by opening the locking element (S14, S15, S15a, S15b, S15c, S15d), which fine adjustment mode is arranged for stepless fine adjustment of position by sliding said cone joint around said rotational axis,

- the adjustment joint (S1, S2) switched from the fine adjustment mode to a coarse adjustment mode by further opening the locking element (S14, S15, S15a, S15b, S15c, S15d), which coarse adjustment mode is arranged for stepped coarse adjustment of position by moving to a next step of said coggings, and

- the adjustment joint (S1, S2) is switched from the coarse adjustment mode back to the fine adjustment mode and further from the fine adjustment mode to the locked state by tightening the locking element (S14, S15, S15a, S15b, S15c, S15d).

11. The method according to claim 10, **characterized in that** the position is adjusted in the fine adjustment mode of the adjustment joint (S1, S2) by means of fine adjustment elements (F1, F1a, F1b, F2, F2a, F2b, F2c, F2d, F2e, F2f), such as a fine adjustment rod or fine adjustment bolt, which are fitted in connection with said adjustment joint (S1, S2).

Patentansprüche

1. Einstellgelenk für eine Einstellposition, wobei das Einstellgelenk (S1, S2) zumindest zwei mit Bezug aufeinander um (Pfeil R) eine Gelenkachse (A1, A2) drehbare Einstellteile (S11, S12, S13, S21, S22, S23) und ein Sperrelement (S14, S15, S15a, S15b, S15c, S15d) hat, das in der Richtung (Pfeil L) der Gelenkachse (A1, A2) funktioniert, um die Einstellteile (S11, S12, S13, S21, S22, S23) zu sperren, so dass sie mit Bezug aufeinander unbeweglich werden,
dadurch gekennzeichnet, dass
das Einstellgelenk einen Innenkonus (S17a) und einen Außenkonus (S17b) aufweist, die ein Konusgelenk bilden, dessen Drehachse mit der Gelenkachse zusammenfällt,
das Einstellgelenk zwei passende Verzahnungen (S16a, S16b) hat, die eine gewisse Höhe der Verzahnung in der Richtung der Gelenkachse (A1) haben,
das Einstellgelenk (S1, S2) dazu angepasst ist, dass es von dem gesperrten Zustand auf einen Feineinstellmodus umgeschaltet werden kann, indem das Sperrelement (S14, S15, S15a, S15b, S15c, S15d) geöffnet wird, wobei der Feineinstell-

modus zur stufenlosen Feineinstellung der Position angeordnet ist, indem das Konusgelenk um die Drehachse gleitet,

das Einstellgelenk (S1, S2) so angepasst ist, dass es von dem Feineinstellmodus auf einen Grobeinstellmodus umgeschaltet wird, indem das Sperrelement (S14, S15, S15a, S15b, S15c, S15d) weiter geöffnet wird, wobei der Grobeinstellmodus zur abgestuften Positionsgrobeinstellung angeordnet ist, indem er auf eine nächste Stufe der Verzahnungen bewegt wird, und

das Einstellgelenk (S1, S2) angepasst ist, dass es von dem Grobeinstellmodus zurück zu dem Feineinstellmodus umgeschaltet werden kann und weiter von dem Feineinstellmodus zu dem gesperrten Zustand umgeschaltet werden kann, indem das Sperrelement (S14, S15, S15a, S15b, S15c, S15d) festgezogen wird.

2. Einstellgelenk (S1, S2) gemäß Anspruch 1, **dadurch gekennzeichnet, dass**

das Einstellgelenk (S1, S2) ein erstes Einstellteil (S11, S21) und ein zweites Einstellteil (S12, S22) hat, wobei in dem Grobeinstellmodus die Einstellteile (S12, S22) so angeordnet sind, dass sie mit Bezug zueinander in der Richtung der Gelenkachse (A1, A2) bewegbar sind (Pfeil L) und mit Bezug aufeinander um die Gelenkachse (A1, A2) drehbar sind (Pfeil R), und wobei in dem Feineinstellmodus die Einstellteile (S12, S22) so angeordnet sind, dass sie mit Bezug aufeinander um die Gelenkachse (A1, A2) drehbar sind und die Bewegung der Einstellteile (S12, S22) mit Bezug aufeinander in der Richtung der Gelenkachse (A1, A2) verhindert ist,

ein drittes Einstellteil (S13, S23) zwischen dem ersten Einstellteil (S11, S21) und dem zweiten Einstellteil (S12, S22) gepasst ist, wobei in dem Grobeinstellmodus das dritte Einstellteil (S13, S23) so angeordnet ist, dass es mit Bezug sowohl auf das erste (S11, S21) als auch das zweite (S12, S22) Einstellteil in der Richtung der Gelenkachse (A1, A2) beweglich ist, und um die Gelenkachse (A1, A2) drehbar ist, wobei in dem Feineinstellmodus das dritte Einstellteil (S13, S23) so angeordnet ist, dass es mit Bezug auf das erste Einstellteil (S11, S21) um die Gelenkachse (A1, A2) drehbar ist und eine Bewegung des dritten Einstellteils (S13, S23) mit Bezug auf das zweite Einstellteil (S12, S22) verhindert ist.

3. Einstellgelenk (S1, S2) gemäß Anspruch 2, **dadurch gekennzeichnet, dass** in dem Feineinstellmodus die Bewegung des zweiten Einstellteils (S12, S22) und des dritten Einstellteils (S13, S23) mit Bezug aufeinander in der Richtung der Gelenkachse (A1, A2) zumindest in so einer Weise verhindert ist, dass die stufenweise Drehung auf die nächste Position des dritten Einstellteils (S13, S23) mit Bezug auf das zweite Einstellteil (S12, S22) verhindert ist.

4. Einstellgelenk (S1, S2) gemäß einem der Ansprüche 2 oder 3, **dadurch gekennzeichnet, dass** das Einstellgelenk (S1, S2) so angeordnet ist, dass es von dem Grobeinstellmodus auf den Feineinstellmodus und ferner auf den gesperrten Zustand umgeschaltet wird, indem der Abstand zwischen dem Feineinstellteil (S11, S21) und dem zweiten Einstellteil (S12, S22) mittels eines Sperrelements (S14, S15, S15a, S15b, S15c, S15d) verringert wird.

5. Einstellgelenk (S1, S2) gemäß einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** das Einstellgelenk (S1, S2) eine Welle (S14) hat, die durch die Gelenkachse (A1, A2) wandert und als Sperrelement (S14, S15, S15a, S15b, S15c, S15d) funktioniert, wobei die Welle (S14) in Form eines Bolzens besteht, der ein Schraubgewinde (S15d) und einen Kopf (S15b) aufweist, wobei das Schraubgewinde (S15d) mit einem Gewinde (S18) in dem ersten Einstellteil (S11, S21), einem Gewinde in dem zweiten Einstellteil (S12, S22) oder einer in das Einstellgelenk (S1, S2) gepassten Mutter (S15) verbunden ist.

6. Einstellgelenk (S1, S2) gemäß einem der Ansprüche 2 bis 5, **dadurch gekennzeichnet, dass** das zweite Einstellteil (S12, S22) zumindest in dem Feineinstellmodus so angeordnet ist, dass es mit Bezug auf das erste Einstellteil (S11, S21) um die Gelenkachse (A1, A2) mittels eines bekannten Feineinstellelements (F1, F1a, F1b, F2, F2a, F2b, F2c, F2d, F2e, F2f), wie bspw. einer Feineinstellstange oder einer Feineinstellschraube, drehbar ist.

7. Einstellgelenk (S1, S2) gemäß einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** das Einstellgelenk (S1, S2) an Befestigungselemente (K, K1, K2) gepasst ist, die zum Anbringen von Gegenständen und zum Einstellen ihrer Position angeordnet sind, und dass die Befestigungselemente (K, K1, K2) zudem ein zweites Einstellgelenk (S1, S2) haben, dessen Gelenkachse (A1, A2) so angepasst ist, dass sie mit Bezug auf die Gelenkachse (A1, A2) des Einstellgelenks (S1, S2) quer verläuft.

8. Befestigungselemente zum Anbringen von Gegenständen und zum Einstellen ihrer Positionen, wobei an diese Befestigungselemente (K, K1, K2) zumindest ein Einstellgelenk (S1, S2) zum Einstellen der Position gepasst ist, wobei das Einstellgelenk (S1, S2) zumindest zwei Einstellteile (S11, S12, S13, S21, S22, S23), die so angeordnet sind, dass sie mit Bezug aufeinander um eine Gelenkachse (A1,

A2) drehbar sind (Pfeil R) und ein Sperrelement (S14, S15, S15a, S15b, S15c, S15d) aufweist, das so angeordnet ist, dass es in der Richtung (Pfeil L) der Gelenkachse (A1, A2) funktioniert, um die Einstellteile (S11, S12, S13, S21, S22, S23) zu sperren, so dass sie mit Bezug aufeinander unbeweglich werden,

dadurch gekennzeichnet, dass

das Einstellgelenk einen Innenkonus (S17a) und einen Außenkonus (S17b) aufweist, die ein Konusgelenk bilden, dessen Drehachse mit der Gelenkachse zusammenfällt,

das Einstellgelenk zwei passende Verzahnungen ((S16a, S16b) aufweist, die eine gewisse Verzahnungshöhe in der Richtung der Gelenkachse (A1) haben,

das Einstellgelenk (S1, S2) so angepasst ist, dass es von dem gesperrten Zustand auf einen Feineinstellmodus umgeschaltet werden kann, indem das Sperrelement (S14, S15, S15a, S15b, S15c, S15d) geöffnet wird, wobei der Feineinstellmodus zur stufenlosen Feineinstellung der Position durch Gleiten des Konusgelenks um die Drehachse angeordnet ist,

das Einstellgelenk (S1, S2) so angepasst ist, dass es von dem Feineinstellmodus auf einen Grobeinstellmodus durch weiteres Öffnen des Sperrelements (S14, S15, S15a, S15b, S15c, S15d) umgeschaltet werden kann, wobei der Grobeinstellmodus zur abgestuften Positionsgrobeinstellung angeordnet ist, indem er auf eine nächste Stufe der Verzahnungen bewegt wird, und

das Einstellgelenk (S1, S2) so angepasst ist, dass es von dem Grobeinstellmodus zurück zu dem Feineinstellmodus und weiter von dem Feineinstellmodus zu dem gesperrten Zustand umgeschaltet werden kann, indem das Sperrelement (S14, S15, S15a, S15b, S15c, S15d) angezogen wird, und

Feineinstellelemente (F1, F1a, F1b, F2, F2a, F2b, F2c, F2d, F2e, F2f) für die Einstellposition des Einstellgelenks (S1, S2) in dem Feineinstellmodus vorgesehen sind, die in Verbindung mit zumindest einem Einstellgelenk (S1, S2) eingepasst sind.

9. Befestigungselemente (K, K1, K2) gemäß Anspruch 8, **dadurch gekennzeichnet, dass** die Befestigungselemente (K, K1, K2) zumindest zwei Einstellgelenke (S1, S2) aufweisen, deren Gelenkachsen (A1, A2) so angepasst sind, dass sie mit Bezug aufeinander quer verlaufen.

10. Installations- und Positionseinstellverfahren mittels eines Einstellgelenks, wobei das Einstellgelenk (S1, S2) zumindest zwei Einstellteile (S11, S12, S13, S21, S22, S23), die mit Bezug aufeinander um (Pfeil R) eine Gelenkachse (A1, A2) drehbar sind, und ein Sperrelement (S14, S15, S15a, S15b, S15c, S15d) aufweist, das in der Richtung (Pfeil L) der Gelenkachse (A1, A2) funktioniert, um die Einstellteile (S11, S12, S13, S21, S22, S23) zu sperren, so dass sie mit Bezug aufeinander unbeweglich werden,

dadurch gekennzeichnet, dass

das Einstellgelenk einen Innenkonus (S17a) und einen Außenkonus (S17b) aufweist, die ein Konusgelenk bilden, dessen Drehachse mit der Gelenkachse zusammenfällt,

das Einstellgelenk zwei passende Verzahnungen (S16a, S16b) aufweist, die eine gewisse Verzahnungshöhe in der Richtung der Gelenkachse (A1) haben,

das Einstellgelenk (S1, S2) von dem gesperrten Zustand auf einen Feineinstellmodus umgeschaltet wird, indem das Sperrelement (S14, S15, S15a, S15b, S15c, S15d) geöffnet wird, wobei der Feineinstellmodus zur stufenlosen Positionsfeineinstellung angeordnet ist, indem das Konusgelenk um die Drehachse gleitet,

das Einstellgelenk (S1, S2) von dem Feineinstellmodus auf einen Grobeinstellmodus umgeschaltet wird, indem das Sperrelement (S14, S15, S15a, S15b, S15c, S15d) weiter geöffnet wird, wobei der Grobeinstellmodus zur abgestuften Positionsgrobeinstellung angepasst ist, indem er auf eine nächste Stufe der Verzahnungen bewegt wird, und

das Einstellgelenk (S1, S2) von dem Grobeinstellmodus zurück zu dem Feineinstellmodus und weiter von dem Feineinstellmodus zu dem gesperrten Zustand umgeschaltet wird, indem das Sperrelement (S14, S15, S15a, S15b, S15c, S15d) festgezogen wird.

11. Verfahren gemäß Anspruch 10, **dadurch gekennzeichnet, dass** die Position in dem Feineinstellmodus des Einstellgelenks (S1, S2) mittels Feineinstellelementen (F1, F1a, F1b, F2, F2a, F2b, F2c, F2d, F2e, F2f), wie bspw. einer Feineinstellstange oder eines Feineinstellbolzen, eingestellt wird, die in Verbindung mit dem Einstellgelenk (S1, S2) eingepasst sind.

Revendications

1. Raccord d'ajustement pour ajuster une position, lequel raccord d'ajustement (S1, S2) comprend au moins deux parties d'ajustement (S11, S 12, S 13, S21, S22, S23) capables de tourner les unes par rapport aux autres autour (flèche R) d'un axe de raccord (A1, A2), et un élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d) fonctionnant dans la direction (flèche L) dudit axe de raccord (A1, A2) pour verrouiller les parties d'ajustement (S11, S12, S13, S21, S22, S23) de sorte qu'elles deviennent immobiles les unes par rapport aux autres, **caractérisé en ce que** :

- le raccord d'ajustement comprend un cône mâle (S17a) et un cône femelle (S17b) qui constituent un raccord conique, dont un axe de rotation coïncide avec ledit axe de raccord,
- le raccord d'ajustement comprend deux dentures appariées (S16a, S16b) dont les dentures présentent une certaine hauteur dans la direction dudit axe de raccord (A1),
- le raccord d'ajustement (S1, S2) est adapté pour être commuté de l'état verrouillé vers un mode d'ajustement fin en ouvrant l'élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d), lequel mode d'ajustement fin est agencé pour effectuer un ajustement de position fin en continu en faisant coulisser ledit raccord conique autour dudit axe de rotation,
- le raccord d'ajustement (S1, S2) est adapté pour être commuté du mode d'ajustement fin vers un mode d'ajustement grossier en ouvrant davantage l'élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d), lequel mode d'ajustement grossier est agencé pour effectuer un ajustement de position grossier par pas en déplaçant lesdites dentures vers un cran suivant, et
- le raccord d'ajustement (S1, S2) est adapté pour être commuté du mode d'ajustement grossier de retour vers le mode d'ajustement fin et, en outre, du mode d'ajustement fin vers l'état verrouillé en serrant l'élément de verrouillage (S14, S 15, S15a, S15b, S15c, S15d).

2. Raccord d'ajustement (S1, S2) selon la revendication 1, **caractérisé en ce que** :

- le raccord d'ajustement (S1, S2) comprend une première partie d'ajustement (S11, S21) et une deuxième partie d'ajustement (S12, S22), moyennant quoi, dans le mode d'ajustement grossier, lesdites parties d'ajustement (S12, S22) sont agencées pour pouvoir être déplacées (flèche L) l'une par rapport à l'autre dans la direction de l'axe de raccord (A1, A2) et pour pouvoir tourner (flèche R) l'une par rapport à l'autre autour de l'axe de raccord (A1, A2), et moyennant quoi, dans le mode d'ajustement fin, lesdites parties d'ajustement (S12, S22) sont agencées pour pouvoir tourner l'une par rapport à l'autre autour de l'axe de raccord (A1, A2) et un mouvement desdites parties d'ajustement (S12, S22) l'une par rapport à l'autre dans la direction de l'axe de raccord (A1, A2) est empêché,
- une troisième partie d'ajustement (S13, S23) est montée entre la première partie d'ajustement (S11, S21) et la deuxième partie d'ajustement (S12, S23), moyennant quoi, dans le mode d'ajustement grossier, la troisième partie d'ajustement (S13, S23) est agencée pour pouvoir être déplacée par rapport à la fois à la première (S11, S21) et à la deuxième (S12, S22) partie d'ajustement dans la direction de l'axe de raccord (A1, A2) et pour pouvoir tourner autour de l'axe de raccord (A1, A2), moyennant quoi, dans le mode d'ajustement fin, la troisième partie d'ajustement (S13, S23) est agencée pour pourvoir tourner par rapport à la première partie d'ajustement (S11, S21) autour de l'axe de raccord (A1, A2) et un mouvement de la troisième partie d'ajustement (S13, S23) par rapport à la deuxième partie d'ajustement (S12, S22) est empêché.

3. Raccord d'ajustement (S1, S2) selon la revendication 2, **caractérisé en ce que**, dans le mode d'ajustement fin, le mouvement de la deuxième partie d'ajustement (S12, S22) et de la troisième partie d'ajustement (S13, S23) l'une par rapport à l'autre dans la direction de l'axe de raccord (A1, A2) est empêché au moins de manière à ce que la rotation par pas vers la position suivante de la troisième partie d'ajustement (S13, S23) par rapport à la deuxième partie d'ajustement (S12, S22) soit empêchée.

4. Raccord d'ajustement (S1, S2) selon l'une quelconque des revendications 2 à 3, **caractérisé en ce que** le raccord d'ajustement (S1, S2) est agencé pour être commuté du mode d'ajustement grossier vers le mode d'ajustement fin et, en outre, vers l'état verrouillé en réduisant la distance entre la première partie d'ajustement (S11, S21) et la deuxième partie d'ajustement (S12, S22) au moyen d'un élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d).

5. Raccord d'ajustement (S1, S2) selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** le raccord d'ajustement (S1, S2) comprend un axe (S14) passant par l'axe de raccord (A1, A2) et fonctionnant en tant qu'élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d), lequel axe (S14) a la forme d'un boulon comprenant un filetage (S15d) et une tête (S15b), ledit filetage (S15d) étant relié à un filetage (S18) dans la première partie d'ajustement (S11, S21), à un filetage dans la deuxième partie d'ajustement (S12, S22) ou à un écrou (S15c) inséré dans le raccord d'ajustement (S1, S2).

6. Raccord d'ajustement (S1, S2) selon l'une quelconque des revendications 2 à 5, **caractérisé en ce que** la deuxième partie d'ajustement (S12, S22) est, au moins dans le mode d'ajustement fin, agencée pour pouvoir tourner par rapport à la première partie d'ajustement (S11, S21) autour de l'axe de raccord (A1, A2) au moyen d'un élément d'ajustement fin (F1, F1a, F1b, F2, F2a, F2b, F2c, F2d, F2e,

F2f) connu tel qu'une tige d'ajustement fin ou une vis d'ajustement fin.

7. Raccord d'ajustement (S1, S2) selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** le raccord d'ajustement (S1, S2) est monté sur des éléments de fixation (K, K1, K2) qui sont agencés pour fixer des objets et définir leurs positions, et **en ce que** les éléments de fixation (K, K1, K2) comprennent également un deuxième raccord d'ajustement (S1, S2) dont l'axe de raccord (A1, A2) est adapté pour être transversal à l'axe de raccord (A1, A2) dudit raccord d'ajustement (S1, S2).

8. Eléments de fixation pour fixer des objets et définir leurs positions, sur lesquels éléments de fixation (K, K1, K2) au moins un raccord d'ajustement (S1, S2) est monté pour l'ajustement de position, lequel raccord d'ajustement (S1, S2) comprend au moins deux parties d'ajustement (S11, S12, S 13, S21, S22, S23), agencées pour pouvoir tourner les unes par rapport aux autres autour (flèche R) d'un axe de raccord (A1, A2), et un élément de verrouillage (S14, S 15, S15a, S15b, S15c, S15d) agencé de manière à fonctionner dans la direction (flèche L) dudit axe de raccord (A1, A2) pour verrouiller les parties d'ajustement (S11, S12, S13, S21, S22, S23) de sorte qu'elles deviennent immobiles les unes par rapport aux autres, **caractérisé en ce que** :

- le raccord d'ajustement comprend un cône mâle (S17a) et un cône femelle (S17b) qui constituent un raccord conique, dont un axe de rotation coïncide avec ledit axe de raccord,
- le raccord d'ajustement comprend deux dentures appariées (S16a, S16b) dont les dentures présentent une certaine hauteur dans la direction dudit axe de raccord (A1),
- le raccord d'ajustement (S1, S2) est adapté pour être commuté de l'état verrouillé vers un mode d'ajustement fin en ouvrant l'élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d), lequel mode d'ajustement fin est agencé pour effectuer un ajustement de position fin en continu en faisant coulisser ledit raccord conique autour dudit axe de rotation,
- le raccord d'ajustement (S1, S2) est adapté pour être commuté du mode d'ajustement fin vers un mode d'ajustement grossier en ouvrant davantage l'élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d), lequel mode d'ajustement grossier est agencé pour effectuer un ajustement de position grossier par pas en déplaçant lesdites dentures vers un cran suivant, et
- le raccord d'ajustement (S1, S2) est adapté pour être commuté, du mode d'ajustement grossier de retour vers le mode d'ajustement fin et, en outre, du mode d'ajustement fin vers l'état verrouillé en serrant l'élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d), et
- des éléments d'ajustement fin (F1, F1a, F1b, F2, F2a, F2b, F2c, F2d, F2e, F2f) pour l'ajustement de position du raccord d'ajustement (S1, S2) dans le mode d'ajustement fin sont prévus montés en relation avec au moins un raccord d'ajustement (S1, S2).

9. Eléments de fixation (K, K1, K2) selon la revendication 8, **caractérisés en ce que** les éléments de fixation (K, K1, K2) comprennent au moins deux raccords d'ajustement (S1, S2) dont les axes de raccord (A1, A2) sont adaptés pour être transversaux l'un à l'autre.

10. Procédé d'installation et de définition de position au moyen d'un raccord d'ajustement, lequel raccord d'ajustement (S1, S2) comprend au moins deux parties d'ajustement (S11, S 12, S 13, S21, S22, S23) pouvant tourner les unes par rapport aux autres autour (flèche R) d'un axe de raccord (A1, A2), et un élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d) fonctionnant dans la direction (flèche L) dudit axe de raccord (A1, A2) pour verrouiller les parties d'ajustement (S11, S12, S13, S21, S22, S23) de sorte qu'elles deviennent immobiles les unes par rapport aux autres, **caractérisé en ce que**:

- le raccord d'ajustement comprend un cône mâle (S17a) et un cône femelle (S17b) qui constituent un raccord conique, dont un axe de rotation coïncide avec ledit axe de raccord,
- le raccord d'ajustement comprend deux dentures appariées (S16a, S16b) dont les dentures présentent une certaine hauteur dans la direction dudit axe de raccord (A1),
- le raccord d'ajustement (S1, S2) est commuté de l'état verrouillé vers un mode d'ajustement fin en ouvrant l'élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d), lequel mode d'ajustement fin est agencé pour effectuer un ajustement de position fin en continu en faisant coulisser ledit raccord conique autour dudit axe de rotation,
- le raccord d'ajustement (S1, S2) est commuté du mode d'ajustement fin vers un mode d'ajustement grossier en ouvrant davantage l'élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d), lequel mode d'ajustement grossier est agencé pour effectuer un ajustement de position grossier par pas en déplaçant lesdites dentures vers un cran suivant, et
- le raccord d'ajustement (S1, S2) est commuté

du mode d'ajustement grossier de retour vers le mode d'ajustement fin et, en outre, du mode d'ajustement fin vers l'état verrouillé en serrant l'élément de verrouillage (S14, S15, S15a, S15b, S15c, S15d).

11. Procédé selon la revendication 10, **caractérisé en ce que** la position est ajustée dans le mode d'ajustement fin du raccord d'ajustement (S1, S2) au moyen d'éléments d'ajustement fin (F1, F1a, F1b, F2, F2a, F2b, F2c, F2d, F2e, F2f), tels qu'une tige d'ajustement fin ou un boulon d'ajustement fin, qui sont montés en relation avec ledit raccord d'ajustement (S1, S2).

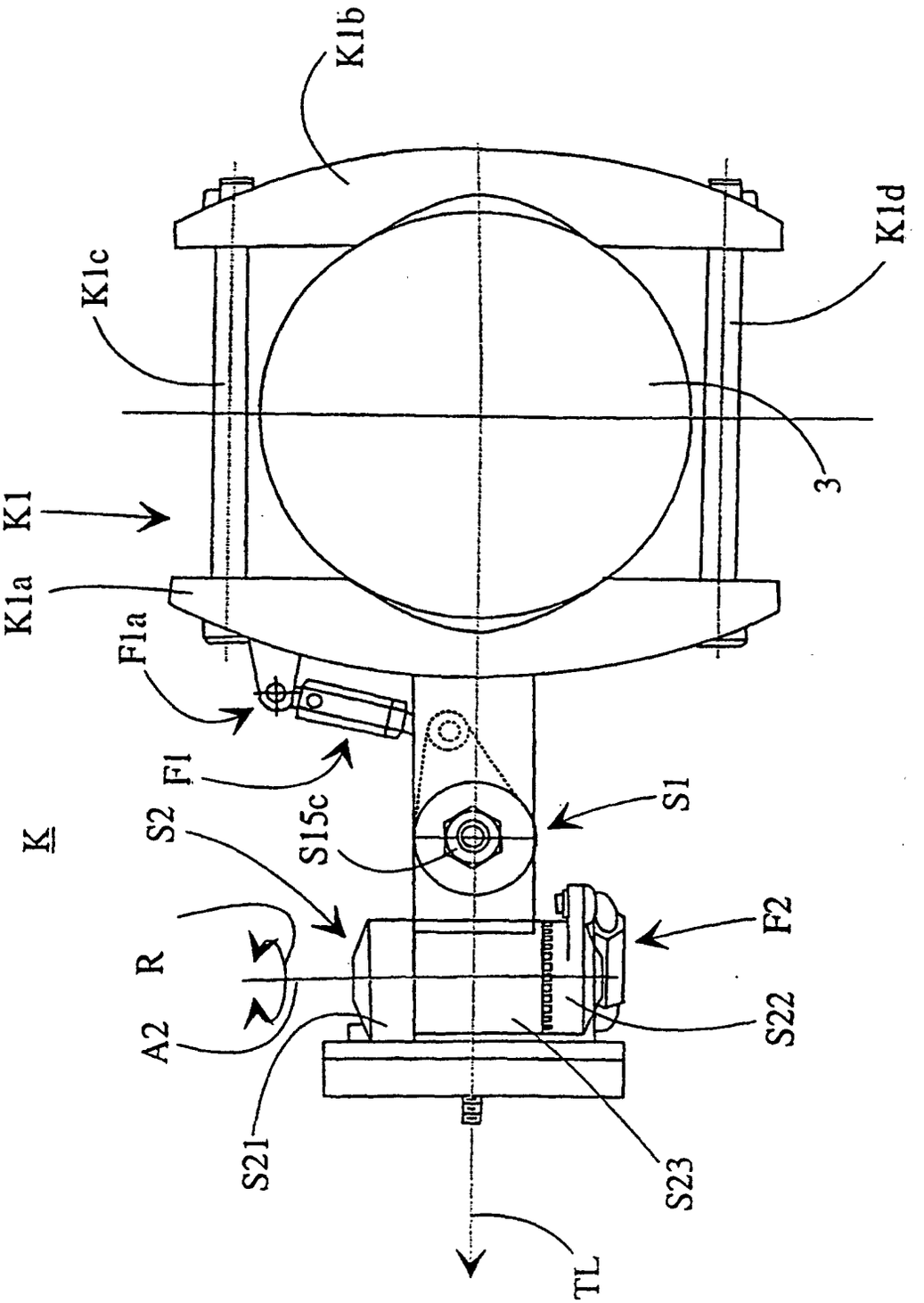

Fig. 1

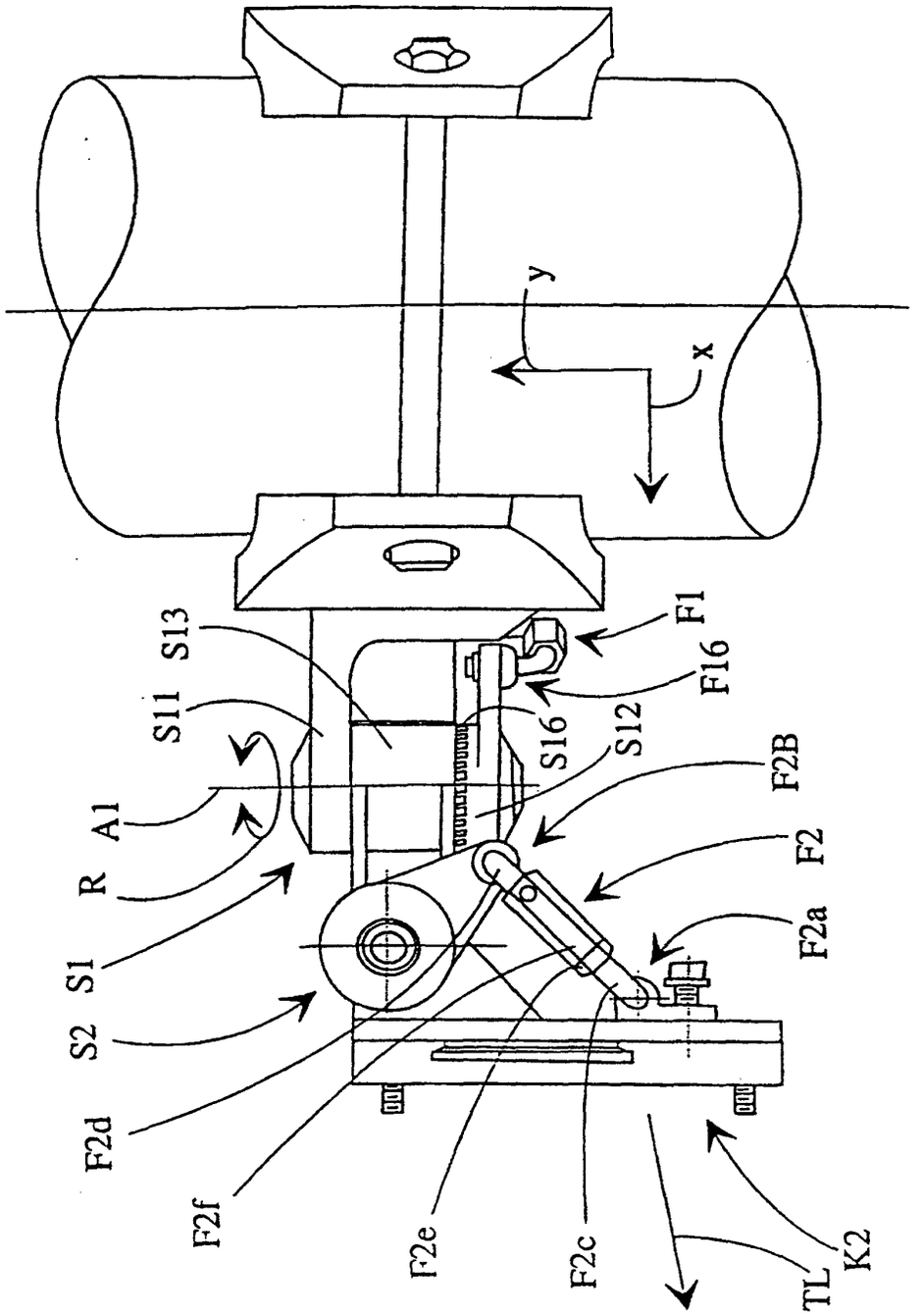
K
y
x
S13
S11
A1
R
S1
S2
F2d
F2f
F2e
F2c
TL
K2
F1
F16
S16
S12
F2B
F2
F2a

Fig. 2

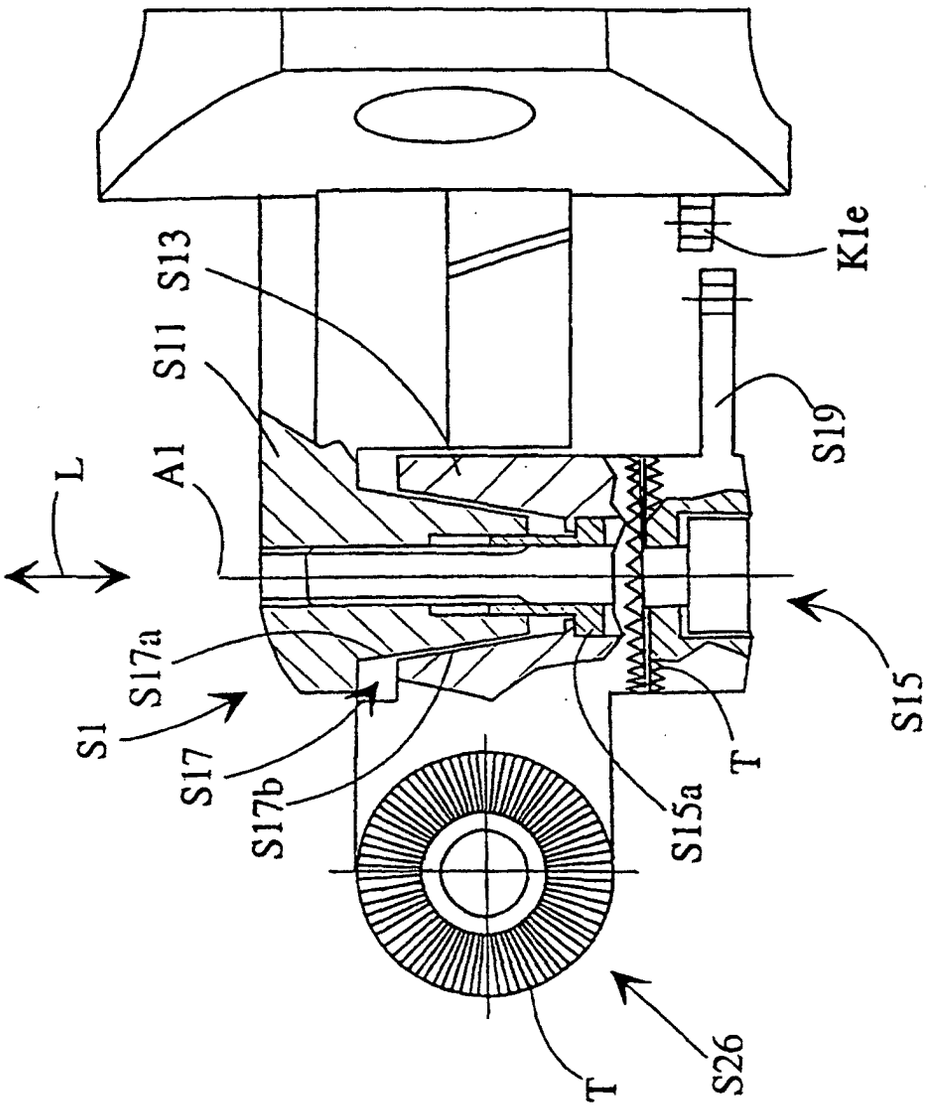

Fig. 3

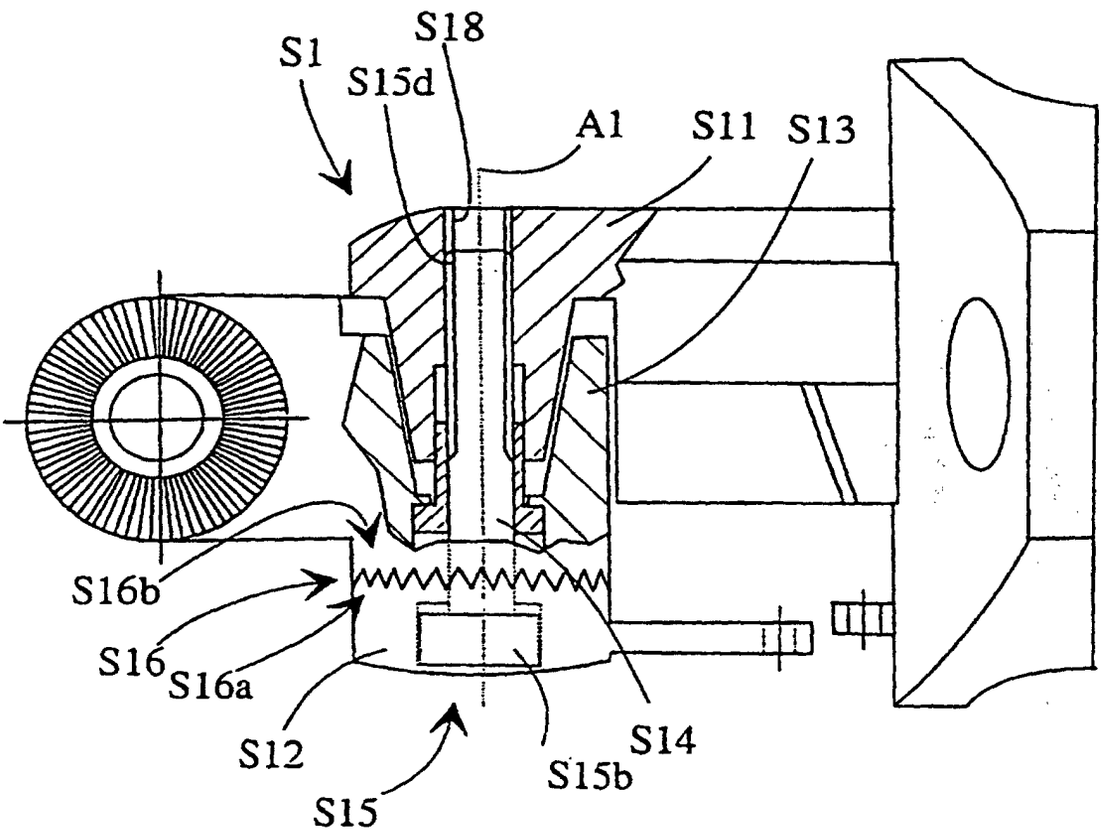

Fig.4

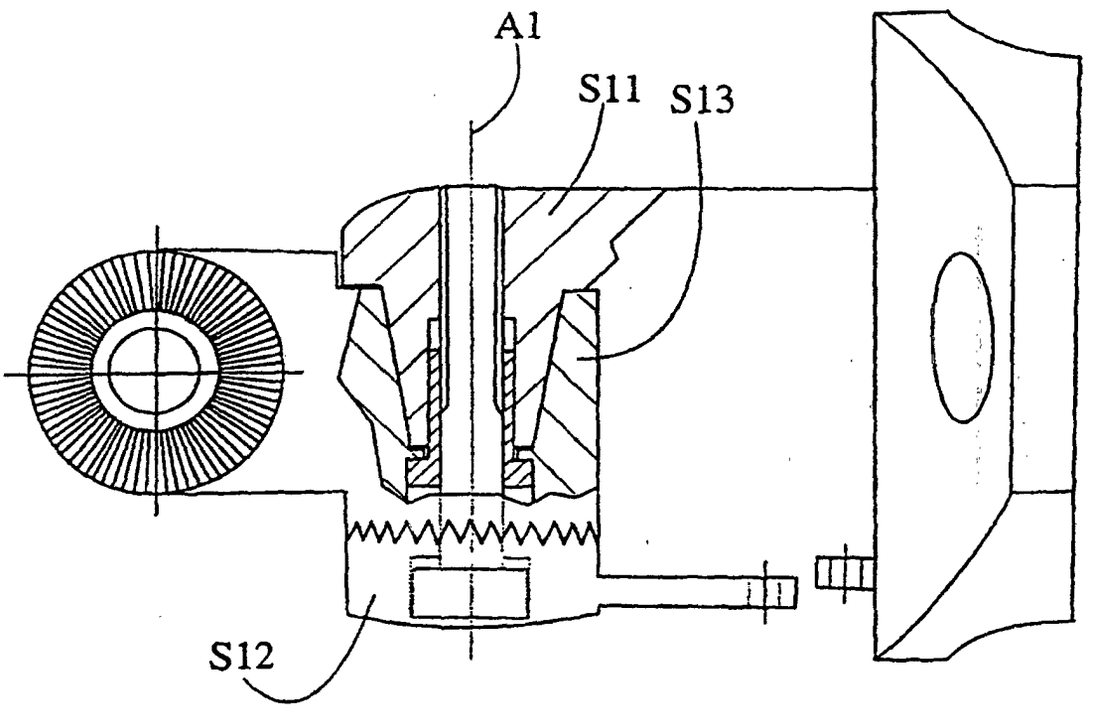

Fig. 5