An engagement head for a rock bolt tensioning assembly is disclosed that is profiled to include at least one key surface to inhibit rotation of the engagement head relative to a rock surface, either by direct engagement with the rock surface or through abutment with a plate-like member that is engageable with the rock surface.
FIG. 18A

FIG. 18B
ENGAGEMENT HEAD FOR TENSIONING ASSEMBLY

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present disclosure relates to rock bolting and in particular to tension assemblies for rock bolts suitable for use in the mining and tunneling industry to provide rock and wall support. The invention is suitable for use in hard rock applications as well as in softer strata, such as that often found in coal mines, and it is to be appreciated that the term “rock” as used in the specification is to be given a broad meaning to cover both these applications.

[0003] 2. Description of Related Art

[0004] Roof and wall support is vital in mining and tunneling operations. Mine and tunnel walls and roofs consist of rock strata, which must be reinforced to prevent the possibility of collapse. Rock bolts, such as rigid shaft rock bolts and cable bolts are widely used for consolidating the rock strata.

[0005] In conventional strata support systems, a bore is drilled into the rock by a drill rod, which is then removed and a rock bolt is then installed in the drilled hole and secured in place typically using a resin or cement based grout. The rock bolt is tensioned which allows consolidation of the adjacent strata by placing that strata in compression.

[0006] To allow the rock bolt to be tensioned, the end of the bolt may be anchored mechanically to the rock formation by engagement of an expansion assembly on the end of bolt with the rock formation. Alternatively, the bolt may be adhesively bonded to the rock formation with a resin bonding material inserted into the bore hole. Alternatively, a combination of mechanical anchoring and resin bonding can be employed by using both an expansion assembly and resin bonding material.

[0007] When resin bonding material is used, it penetrates the surrounding rock formation to adhesively unite the rock strata and to hold firmly the rock bolt within the bore hole. Resin is typically inserted into the bore hole in the form of a two component plastic cartridge having one component containing a curable resin composition and another component containing a curing agent (catalyst). The two component resin cartridge is inserted into the blind end of the bore hole and the mine rock bolt is inserted into the bore hole such that the end of the mine rock bolt ruptures the two component resin cartridge. Upon rotation of the mine rock bolt about its longitudinal axis, the compartments within the resin cartridge are shredded and the components are mixed. The resin mixture fills the annular area between the bore hole wall and the shaft of the mine rock bolt. The mixed resin cures and binds the mine rock bolt to the surrounding rock.

[0008] Tension assemblies have been proposed to provide tension along rock bolts, for example cable bolts, which in turn provides a compressive force on the substrate, usually a mine shaft roof substrate, about the bolt.

SUMMARY OF THE INVENTION

[0009] Disclosed is a tensioning assembly for a rock bolt, the tensioning assembly comprising an engagement head that in use is forced into either direct or indirect engagement with a rock surface, wherein the engagement head is profiled to include at least one key surface to inhibit rotation of the engagement head relative to the rock surface.

[0010] In one form the engagement head is arranged to engage the rock surface through abutment with a plate-like member and rotation of the engagement head relative to the plate-like member is inhibited by the at least one key surface.

[0011] The positive engagement between the engagement head of the tensioning assembly and the rock surface, either directly or indirectly, acts to inhibit rotation of the engagement head and therefore may be used as a means to inhibit twisting of the rock bolt shaft which places tension on the shaft during tensioning. This is particularly useful in a cable bolt application where twisting of the cable induces unwinding of the cable strands. In some forms, the key surfaces are shaped to allow the shaft to be tilted with respect to the rock surface or plate-like member without disengaging the head thus maintaining the engagement to inhibit rotation.

[0012] In one form the key surface is part of a projection that is formed on the engagement head. In one form the key surface comprises radially projecting lateral surfaces. In one form the lateral surfaces project radially from a central zone to the circumference of the head. In one form the key surface is located on a projection extending outwardly from the circumference of the head. In one form the key surface is located in a slot extending into the head. In one form the key surface is formed as one or more flattened surfaces formed as the engagement head.

[0013] In one form, the engagement head forms part of a bearing member incorporating a passage through which the rock bolt extends. In a particular form, the bearing member includes an inner surface that defines the passage and which incorporates a surface that cooperates with an abutment mounted to, or formed in, the rock bolt to provide a positive engagement therebetween that inhibits rotation of the bearing member relative to the abutment about the bolt in at least one direction.

[0014] In a second aspect, there is disclosed a combination comprising a tensioning assembly according to any form described above and a plate-like member arranged to directly engage the rock surface, the plate like member including at least one plate key surface that cooperates with the at least one key surface of the engagement head to inhibit rotation therebetween.

[0015] In a third aspect, disclosed is an engagement head for a tensioning assembly for a rock bolt, the engagement head being for direct or indirect engagement with a rock surface, the engagement head being profiled to include at least one key surface to inhibit rotation of the engagement head relative to the rock surface.

[0016] In one form the key surface of the engagement head is otherwise as described above with respect to the tension assembly.

[0017] In a fourth aspect, disclosed is an engagement assembly for engagement between a rock surface and a tensioning assembly, the engagement assembly comprising a plate-like member arranged to directly engage the rock surface, the plate like member including at least one plate key surface and, a bearing member arranged to engage the tensioning assembly, the bearing member having a head including at least one head key surface, wherein the head key surface and the plate key surface are adapted to engage such that rotation of the head relative to the rock surface is inhibited.

[0018] In a fifth aspect, the invention is directed to a plate-like member for use with the tension assembly or forming part of the engagement assembly as described above.
In a sixth aspect, disclosed is a rock bolt assembly comprising a rock bolt having an axis, a bearer member for facing and urging against rock strata, the rock bolt being arranged to extend through the bearer member, and an abutment mounted to, or formed in the rock bolt, the abutment and the bearer member incorporating cooperating surfaces that provide positive engagement therebetween that inhibits rotation of the bearer member relative to the abutment about the bolt axis in a least one direction.

In yet a further aspect, disclosed is a method of inhibiting rotation of a tensioning assembly with respect to a rock surface, the tensioning assembly including a bearer member, the method comprising positioning a plate-like member in contact with the rock surface; positioning a bearer member in contact with the plate like member; and causing a key surface in the bearer member to abut a corresponding key surface in the plate-like member.

BRIEF DESCRIPTION OF THE DRAWING(S)

Embodiments will now be described by way of example only, with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of one embodiment of the tensioning device disposed on a cable bolt;

FIG. 2 is an exploded view of the tensioning device of FIG. 1;

FIG. 3 is a perspective view of the base member of a tensioning device of FIG. 1;

FIG. 4 is a cross-sectional view of the base member of FIG. 3;

FIG. 5 is a top view of the base member of FIG. 3;

FIG. 6 is a perspective view of the bearer member of a tensioning device of FIG. 1;

FIG. 7 is a cross-sectional view of the member of FIG. 6;

FIG. 8 is a top view of the member of FIG. 6;

FIG. 9 is a side elevation of the tensioning device of FIG. 1 connected to a bearing plate and cable bolt;

FIG. 10 is a cross-sectional view of the device of the assembly of FIG. 9;

FIGS. 11A to C show a perspective view from above, a plan view and a cross-sectional elevation of an alternative bearer member;

FIGS. 12A and B show a plan view and a cross-sectional side view of a bearing plate for use with the bearer member of FIG. 11;

FIGS. 13A to C show a perspective view from below, a view from below and a side view of a bearing plate of a cable bolt tensioning assembly in accordance with a further embodiment;

FIGS. 14A, B and C show a perspective view from below, a view from below and a sectional view of a bearer member of a cable bolt tensioning assembly for use with the bearing plate of FIG. 13;

FIGS. 15A and B illustrate operation of the bearer member of FIG. 13 with the bearing plate of FIG. 14;

FIGS. 16A, B and C show a perspective view from below, a view from below and a side view of a bearing plate for a cable bolt tensioning assembly in accordance with a further embodiment;

FIGS. 17A, B and C show a perspective view from below, a view from below, and a sectional view of a bearer member head for a cable bolt tensioning assembly in accordance with a further embodiment for use with the bearing plate of FIG. 16;

FIGS. 18A and B illustrate operation of the bearer member of FIG. 17 with the bearing plate of FIG. 16;

FIGS. 19A and B show a view from above and a side view of a bearer member head for a cable bolt tensioning assembly in accordance with yet a further embodiment;

FIGS. 20A and B show a view from the side and a view from below of a bearing plate for use with the bearer member of FIGS. 19A and B;

FIGS. 21A and B show a view from above and a side view of a bearer member head for a cable bolt tensioning assembly in accordance with yet a further embodiment;

FIGS. 22A and B show a side view and a view from below of a bearing plate for use with the bearing member of FIGS. 21A and 21B;

FIG. 23 shows a cross-sectional elevation of a tensioning assembly according to yet a further form;

FIG. 24 is a perspective view from below of the actuator of a tensioning device of FIG. 1;

FIG. 25 is a cross-sectional elevation of the actuator of FIG. 24;

FIG. 26 is a detailed view to an enlarged scale of the end engagement profile of the actuator of FIG. 24;

FIGS. 27 to 36 are installation sequences (showing assembly side elevations and cross-sectional views) for installing the tensioning device of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

The following description relates to engagement heads for tensioning assemblies as best shown in FIGS. 11 to 22 for tensioning rock bolt shafts that have been installed in a bore in rock strata and anchored to the rock strata typically by a chemical and/or mechanical anchoring process. The description further relates to assemblies (best seen in FIGS. 1 to 10 and 23 to 26) for tensioning cable bolts and to installation procedures (shown in FIGS. 27 to 36) which utilize the described engagement heads.

Tensioning Assembly

Referring firstly to the FIGS. 1 to 10, a first embodiment of a tensioning assembly 1 is shown. The tensioning assembly 1 is for use with a rock bolt 2 having a shaft 3 typically formed from wire strands that are bundled together. In use, the rock bolt is installed in a bore 501 (see FIG. 27) formed in the rock strata 500 with a distal end (not shown) of the bolt 2 being disposed adjacent the blind end of the bore 501 and a proximal end portion 3b arranged to project from the bore 501. The tensioning assembly 1 is arranged to be fitted onto that proximal end portion 3b so that it is disposed at an exterior surface 502 of the rock strata.

The tensioning assembly comprises three primary components; a base member 5 which is fixed to the shaft 3, a bearer member 10 which is moveable relative to the base member along the shaft and which is arranged to abut either directly or indirectly the rock strata 500, and an actuator 16 that is engageable with both the bearer member and the base member and operative to transmit a biasing force to move the bearer member away from the base member which in use provides tensioning to the cable as will be described in more detail below.
In the illustrated form, the base member 5 comprises a first part that forms a barrel 7, a second part that forms a stem 8, and tension wedges 6 which are located within the barrel 7 which in use secure the base member 5 with respect to the shaft 3. The tension wedges 6 have an inner wedge face 6a for defining a cable receiving passage for receiving the cable 2 and an outer wedge face 6b, opposite the inner wedge face. The outer wedge face has a profile complementary to the interior of the barrel 7. The tension wedges 6 are forced into engagement with the cable under loading of the barrel in the direction of the cable proximal end 3. Further the barrel 7 and wedges 6 have sufficient strength to prevent shear stress failure to ensure that the cable 2 is held in place by the tension wedges 6 within the barrel 7 under this loading.

The stem 8 of the base member 5 extends from the barrel 7 and along the cable 3. The stem 8 is cylindrical and merges with the barrel to form an annular shoulder 31 that in use faces towards the distal end of the rock bolt 2. An interior passage 32 is provided to allow the cable shaft 3 to be inserted through the stem and the stem has a non-circular exterior surface 33 that includes key surfaces 9 which as shown are formed as flats on the exterior 33 of the stem 8.

The bearer member 10 is mounted on, and moveable with respect to, the stem portion 8. As best seen in FIGS. 6 to 8, the bearer member 10 comprises an externally threaded body 11 and a dome head 13 at one end of the body. The body 11 has an internal cavity 34, the walls 35 of which are complementary to the exterior 33 of the stem 8 and include internal keyed sections 12. The internal keyed sections 12 are located within the cavity such that when the bearer member 10 locates over the base member 5 (such that stem 8 extends into the cavity in bearer member 10), the external keyed sections 9 on the stem 8 engage with the internal keyed sections 12 on the bearer member 10 thereby inhibiting the rotation of the bearer member 10 with respect to the base member 12 about the longitudinal axis of the shaft 3. However, the bearer member 10 is movable along the stem 8 in the direction of the axis of the cable.

The bearer member 10 is arranged so that the dome head 13 engages directly or indirectly with the rock surface into which the rock bolt extends. The head 13 which incorporates an opening 35 to allow passage of the cable shaft 3 through the bearer member, may be shaped other than as a dome (for example being flattened to form a plate like appearance) so that it is engageable directly with the rock surface. However, in the illustrated forms, the dome head 13 is arranged to engage a separate rock bolt bearer plate 30 (see FIGS. 9 and 10) which in use is positioned between the rock surface and the bearer member 10.

The dome head 13 shown in FIGS. 1 to 10 is hemispherical and engages with an inner edge 36 of the plate 30 (as best shown in FIG. 10) formed on a boss 42 of the plate 30. This direct contact is arranged to provide frictional resistance so that in tensioning of the device 1 the engagement between the plate 30 and the head 13 inhibits rotation of the head relative to the plate 30. Further the use of a generally hemispherical head 30 allows the head to remain engaged (and thereby provide the rotational resistance) with the plate 30 when the bearer member 10 is tilted at an angle with respect to the bearing plate 30, allowing for the axis of the rock bolt to be tilted with respect to the bearing plate 30, which may occur in use. As will be explained in more detail below, the inhibiting of the rotation of the bearer member assists in preventing twisting of the cable during tensioning.

FIGS. 11 to 22 disclose embodiments of the tensioning device where, rather than relying on frictional resistance between the head and the plate 30, a positive engagement arrangement is provided to inhibit rotation of the head 13 relative to the plate 30. In the illustrated form the head and plate have cooperating key surfaces to form this positive engagement.

In the arrangement of FIGS. 11 and 12, the head 13a is profiled to include key surfaces in the form of offset lateral surfaces 91. The lateral surfaces 91 are angularly spaced apart, and project radially from, the head 13a. The lateral surfaces are adapted to engage with corresponding surfaces 92 in the bearing plate 30a shown in FIGS. 12A and 12B. In this way under clockwise rotation (looking from the lower end of the bearer 10) the surfaces 91, 92 are arranged to engage so as to provide positive engagement to inhibit rotation of the bearer member 10 with respect to the plate 30a. Furthermore, the curved surfaces 91a of the head 13a behind the lateral surfaces 91 provide a lead in surface for engagement of the head with the plate 30a so that the head 13a may be presented to the plate 30a in any angular orientation about the axis of the bolt. The head can then engage the plate 30a and on rotation of the head 13a, the head 13a will move across the plate 30a until the complementary lateral surfaces 91 and 92 engage. In the illustrated embodiment, the lateral surfaces 91 extend from the top of the “dome” of the head. This allows for the surfaces 91, 92 to remain engaged when the bearer member 10 is tilted at an angle with respect to the bearing plate 30a, again allowing for the axis of the rock bolt to be tilted with respect to the bearing plate 30a.

FIGS. 13 through 15 illustrate an embodiment where the head 13b is provided with a key projection 100 which forms a key surface which is arranged to interact with a corresponding slot 101 in the boss 42 of the bearing plate 30b. In operation the key projection 100 fits within the slot 101 and relative rotation between the bearing plate 30b and bearer member 10 is prevented.

In the illustrated embodiment, the key projection 100 extends from the top of the dome of the head 13b to the lower end of the head. This allows for the key projection 100 to still engage with the slot 101 when the bearer member 10 is tilted at an angle with respect to the bearing plate 30a.

FIGS. 15A and B illustrate how the bearer member head 13b interacts with the bearing plate 30b in operation, with the key 100 fitting into the slot 101.

Note that in the drawings, only the dome head 13b of the bearer member 10 is shown. In FIG. 14C the presence of the rest of the bearer member 10 is indicated by ghost lines 110.

FIGS. 16 through 18 show an alternative embodiment, in which a slot 120 is provided in the dome head 13c of the bearer 10 and a complementary key projection 121 is mounted in the boss 42c of the bearing plate 30c. Operation of the embodiment of FIGS. 16 through 18 is similar to the operation of the embodiment of FIGS. 13 through 15, except the key 121 is provided in the bearing plate 30c and the slot 120 is provided in the head 13c.

FIGS. 19 and 20 illustrate yet further in which the bearer member 10 may engage with the bearing plate. In this embodiment, the domed head 13d of the bearer member 10 is provided with a plurality of key surfaces 150. The key surfaces 150 have edges 151 that define boundaries between
each key surface 150. Complementary receiving key surfaces 152 with edges 153 are provided in the receiving boss 42d of the bearing plate 30d.

In operation the key surfaces 150 of the head 13d engage with complementary key surfaces 152 of the boss 42d, preventing relative rotation between the bearer member 10 and the bearing plate 30d.

FIGS. 21 and 22 show yet another embodiment which utilizes key surfaces 160 and edges 161 on the head 13c. These key surfaces 160 are similar in operation to the key surfaces of FIG. 19, but there are less of them. Complementary key surfaces are provided on the boss 42c of the bearing plate 30c. They comprise complementary surfaces 163 and edges 164.

As well as the above embodiments, there may be other arrangements which facilitate engagement of the domed head of the bearer member 10 with the bearing plate so that the bearing member does not rotate, and the cable is not twisted. For example, the embodiments of FIGS. 13 through 18 show only one key in slot arrangement. There may be two key in slot arrangements on opposite sides of the domed surface/bearing plate boss, or more than two.

Arrangements causing interference between the head and bearing plate could even be used in rock bolt tensioning assemblies that vary from the embodiments described with reference to FIGS. 1 to 10. In fact, any rock bolt tensioning assembly which requires interaction between a head of a tensioning component and a bearing plate may utilize any of these arrangements.

A further embodiment of the tensioning device 1 is disclosed in FIG. 23 where the base member 5 does not include a stem portion but merely includes the barrel 7 and wedges 6 which clamp that member to the cable 3 as described above. To restrict rotational movement of the bearer member 10 relative to the cable, but still allow longitudinal movement (in a manner akin to that provided by keying of the bearer member 10 to stem 8 in the earlier embodiments), a “flower” insert 40 is provided in the cavity 35 which is contoured to receive the individual stands of the rock bolt shaft 3. In this way the bearer member 10 engages directly with the cable shaft rather than engages the base member 5 as in the earlier embodiment. The arrangement of FIG. 23 is not as preferred as the earlier arrangements, as the bearer member 10 is not able to move solely in the longitudinal direction of the shaft as it must follow the line of the individual strands which are helically wound along the length of the strand. Moreover, the bearer member is not isolated from the cable as occurs in the earlier arrangements by the presence of the stem 7 and as such there is some chance that the cable will twist under tensioning. Nonetheless the engagement of the bearer member with the cable does provide some resistance to inhibit twisting of the cable under tensioning.

In any of the forms described above, the actuator 16 is arranged to receive the body 11 of the bearer member 10 and extend partially over the base member 5. The actuator 16 is internally threaded so as to engage with the externally threaded body 11 of the bearer member 10 and includes a shoulder 17 which is adapted to engage with the shoulder 31 formed on the base member 5 at the junction between the barrel part 7 and the stem 8 (if present). In this way, the actuator engages both the base member (through abutment of the shoulders 17 and 31) and the bearer member 10 (through engagement of the cooperating threads on those members).

Rotation of the actuator in one direction (in the illustrated form being right hand or clockwise looking along the rock bolt from the proximal end 3b) allows for tensioning of the rock bolt. The actuator 16 is adapted to engage with a drive to impart this rotation with the actuator being shaped so as to engage a drive coupling (dolly) to transmit that rotational force.

The actuator is provided with an end profile 20 on the actuator end 19 that engages in end to end relation with a specially shaped end drive on dolly 200 (see FIGS. 27 to 32), which is described in more detail below. That end profile is best shown in FIGS. 24 to 26.

The end profile 20 on the actuator 16 is shaped generally as a wave or toothed profile having alternating peaks 43 and troughs 44. The profile includes a base portion 45 that is of generally constant radius and opposing side walls 46 and 47. One wall 46 is sloped relative to the longitudinal axis of the actuator 16 and provides a lead in surface for the complementary teeth 231 of the dolly 200 to locate in the profile troughs 44, whereas the other wall 47 is disposed in the direction of the actuator axis and forms the abutment surface for the actuator profile that engages with the dolly drive to impart rotation.

Installation Procedure

In a first stage as disclosed in FIGS. 27 and 28 a rock bolt 2 is inserted into a bore 501 formed in rock strata 500. Fitted to the rock bolt 2 is a bearing plate 30 and a rock bolt tensioning device 1 which is disposed adjacent a proximal end 3b of the rock bolt which projects beyond the bore 502. At this stage the rock bolt 2 is not point anchored in the bore 502 but resin cartridges and/or a mechanical anchor are installed in conjunction with the rock bolt adjacent the blind end (not shown) of the bore. To activate point anchoring (by shredding and mixing of the resin cartridges and/or activation of a mechanical anchor) the rock bolt 2 needs to be spun typically under right hand rotation.

To effect this rotation the dolly 200 is fitted onto the proximal end 3b of the rock bolt shaft 3 as shown in FIGS. 27 and 28. The dolly 200 is disposed in a cable drive mode so as to allow the end of the rock bolt shaft to be fitted within the holder 220 disposed in the cable drive portion of the dolly 200. As best shown in FIG. 27 the sheath 207 is sufficiently retracted so that the drive end 204 of the sheath does not engage the actuator 6 of the tensioning device 1.

The dolly is fitted to a drive apparatus (not shown) such as a mining drill rig through the shaft 202. The drill rig imparts drive to the shaft 202 which in turn is transferred through to the cable drive portion 207 by virtue of the splines 217, 218 interengaging thereby allowing spinning of the rock bolt 3 to provide point anchoring of the rock bolt 2. Typically, thrust is also applied to the rock bolt along the axis of the bolt so as to push the rock bolt further into the bore 501 moving the plate 30 towards the surface 502 of the rock strata 500. This then places the rock bolt into a position as shown in FIGS. 29 and 30 where the cable is point anchored by setting of the resin and/or by activation of the mechanical anchor.

The second stage commences after point anchoring. In this stage the dolly is moved into a tensioning mode by movement of the sheath forward relative to the central drive 205 into the position as illustrated in FIGS. 31 and 32. In that position the sheath 208 moves forward so that the teeth of the sheath engage with the actuator whilst the end of the cable remains engaged with the cable drive portion 207. By having
the dolly 200 adopt the tensioning mode the cable drive portion 207 becomes disengaged with the sheath 208 and is therefore not driven by the drive shaft 202 and moreover is able to rotate independently of that drive shaft and the sheath 208. This then allows rotation of the actuator by the dolly relative to the cable 3.

[0078] As best illustrated in FIG. 31, a feature of the engagement between the dolly and the actuator is that the diameter of the dolly is no greater than the diameter of the actuator. This has significant advantage in many mining applications as it allows the dolly to be located in more confined situations than would otherwise occur if a conventional dolly which mounted over the actuator (typically in the form of a nut) was used. This can be particularly advantageous if a “timber jack” is used as a stabilizing and guiding mechanism for drilling and installing cables. The timber jack usually incorporates a confined opening through the centre section of the jack top head frame. Due to the reduced diameter of the dolly (as compared to more conventional dollies) it has been found in practice possible to tension the bolt using the dolly 200 without requiring removal of the timber jack. This improves both speed of operation and safety in the installation procedure.

[0079] Once the dolly 200 is installed in engagement both with the cable shaft and the actuator of the tensioning device, drive is imparted to the actuator whilst holding the cable shaft stationary (by virtue of engagement of the cable shaft with the cable drive portion). Rotation of the actuator causes that actuator 6 to unwind from the bearer member 11, this in turn causes the bearing member to move apart from the base member 5. Under an initial movement the bearer member movement forces the plate 30 into engagement with the rock surface 502. Engagement of the rock plate 30 hard against the rock surface 502 prevents further travel of the bearer member 6 towards the rock surface and also prevents any twisting of the bearer member by virtue of engagement of the bearer member head 13 with the plate 30.

[0080] Continued rotation of the actuator 6 under drive imparted from the dolly 200 forces the bearer head to continue to move away from the base member which causes increased loading to be induced on the base member 5 by the actuator which has the effect of pulling the cable 2 from the bore. This tensioning force applied to the base member is offset by a reaction force applied by engagement of the plate 30 against the rock surface and causes the cable to be placed in tension.

[0081] Once sufficient tension has been applied to the cable, the dolly 200 is removed thereby leaving the tensioned cable with the tensioning device still affixed in place as best illustrated in FIGS. 35 and 36.

[0082] The tensioning device, dolly and installation as described in the above forms has the advantage that a rotatable actuator can apply an axial force to the cable (through the base member) without inducing twisting of the cable. In the particular form illustrated the moving component (the bearer member) is isolated from the cable and moreover the entire tensioning device is inhibited from twisting by virtue of engagement of the bearer head against the plate 30. In addition the tensioning device is of relatively compact form thereby allowing easy handling on site by use of the drive dolly installation and tensioning of the rock bolt can be achieved using a standard drill rig thereby obviating the need for specialist tensioning drives as has occurred in the prior art. In addition the drive dolly is of compact form allowing the dolly to be used in confined spaces often found in mining applications.

[0083] In the claims which follow and in the preceding summary, except where the context requires otherwise due to express language or necessary implication, the word “comprising” is used in the sense of “including”, that is the features specified may be associated with further features in various embodiments.

[0084] Variations and modifications may be made to the parts previously described without departing from the spirit or ambit of the disclosure.

The invention claimed is:

1. A tensioning assembly for a rock bolt, the tensioning assembly comprising an engagement head that in use is forced into either direct or indirect engagement with a rock surface, wherein the engagement head is profiled to include at least one key surface to inhibit rotation of the engagement head relative to the rock surface.

2. A tensioning assembly according to claim 1, wherein the engagement head is arranged to engage the rock surface through abutment with a plate-like member and wherein rotation of the engagement head relative to the plate-like member is inhibited by the at least one key surface.

3. A tensioning assembly according to claim 2, wherein the at least one key surface is formed as one or more flattened surfaces formed on the engagement head.

4. A tensioning assembly according to claim 2, wherein the at least one key surface comprises one or more lateral surfaces that project radially from an axis of the engagement head.

5. A tensioning assembly according to claim 4, wherein the one or more lateral surfaces project radially from a central zone towards the circumference of the engagement head.

6. A tensioning assembly according to claim 2, wherein the at least one key surface is located on a projection extending outwardly from the circumference of the head.

7. A tensioning assembly according to claim 2, wherein the at least one key surface is located in a slot extending into the head.

8. A tensioning assembly according to claim 2, wherein the engagement head forms part of a bearer member incorporating a passage through which the rock bolt extends.

9. A tensioning assembly according to claim 8, wherein the bearer member includes an inner surface that defines said passage and which incorporates a surface that cooperates with an abutment mounted to, or formed in, the rock bolt to provide a positive engagement therebetween that inhibits rotation of the bearer member relative to the abutment about the bolt in at least one direction.

10. A combination comprising a tensioning assembly according to claim 2 and a plate-like member arranged to directly engage the rock surface, the plate like member including at least one plate key surface that cooperates with the at least one key surface of the engagement head to inhibit rotation therebetween.

11. An engagement assembly for engagement between a rock surface and a tensioning assembly, the engagement assembly comprising:

- a plate-like member arranged to directly engage the rock surface, the plate like member including at least one plate key surface; and
- a bearer member arranged to engage with, or form part of, the tensioning assembly, the bearer member having a head including at least one head key surface, wherein the
12. An engagement assembly according to claim 11, wherein the at least one head key surface is formed as one or more flattened surfaces formed on the bearer member head.

13. An engagement assembly according to claim 11, wherein the at least one head key surface comprises one or more lateral surfaces that project radially from an axis of the bearer member head.

14. An engagement assembly according to claim 13, wherein the one or more lateral surfaces project radially from a central zone towards the circumference of the bearer member.

15. An engagement assembly according to claim 13, wherein the at least one head key surface is located on a projection extending outwardly from the circumference of the head.

16. An engagement assembly according to claim 13, wherein the at least one head key surface is located in a slot extending into the head.

17. A rock bolt assembly comprising a rock bolt having an axis, a bearer member for facing and urging against rock strata, the rock bolt being arranged to extend through the bearer member, and an abutment mounted to, or formed in the rock bolt, wherein the abutment and the bearer member incorporate cooperating surfaces that provide positive engagement therebetween that inhibit rotation of the abutment relative to the bearer member about the bolt axis in at least one direction.

18. A rock bolt assembly according to claim 17, further comprising an engagement assembly according to claim 11, wherein the bearer member forms part of the engagement assembly.

19. A method of inhibiting rotation of a tensioning assembly with respect to a rock surface, the tensioning assembly including a bearer member, the method comprising:
   positioning a plate-like member in contact with the rock surface;
   positioning a bearer member in contact with the plate like member; and
   causing a key surface in the bearer member to abut a corresponding key surface in the plate-like member.