# United States Patent

[11] 3,552,258


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[45] Patented Jan. 5, 1971
Continuation-in-part of application Ser. No. 298,922, July 31, 1963, now abandoned.


[54] **BOLT ANCHORS**
**11 Claims, 20 Drawing Figs.**


[52] U.S. Cl. ..... 85/66, 85/79
[51] Int. Cl. ..... F16b 13/10
[50] Field of Search ..... 85/79, 3, 3K, 3S, 66, 63, 79; 285/104, 105



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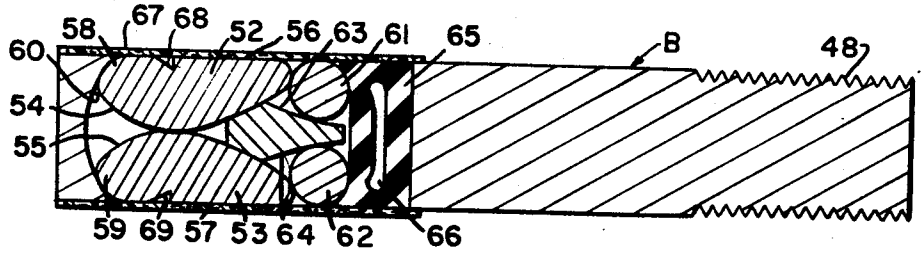
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**ABSTRACT:** An anchor device for attachment within a borehole in rock or the like comprising: a cylindrical member adapted to be received in said hole; at least one longitudinal slot in said cylindrical member and a cam surface associated with said slot; rock gripping means within said slot having a biting edge and a curved surface, generally opposite said biting edge, in engagement with said cam surface and both movable and rollable along said cam surface, and means within said slot for activating said rock gripping means, so that at least a portion of said rock gripping means, as it pivots, including said biting edge, is forced out of said slot and into the sides of said borehole in securing said device in said borehole, said activating means being resilient and compressible by said rock gripping means as said member is moved into said borehole and such compression tending to cause said biting edge to move into said rock to assist said rock gripping means to be moved into said rock by moving along and turning on said cam surface.

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SHEET 1 OF 4

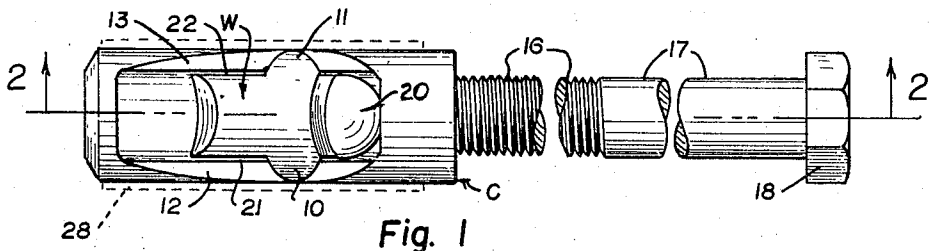



Fig. 1

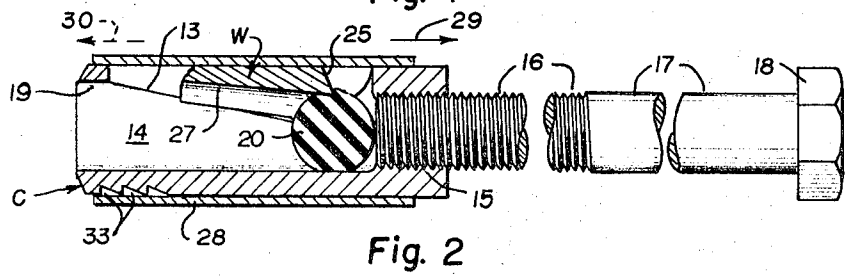



Fig. 2

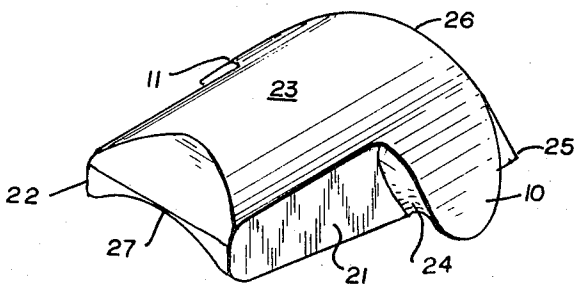



Fig. 3

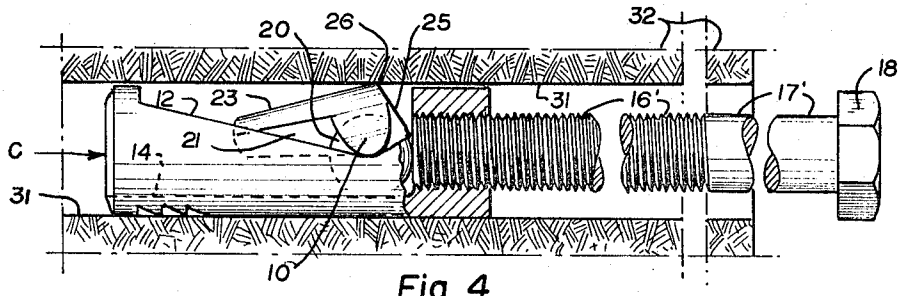



Fig. 4

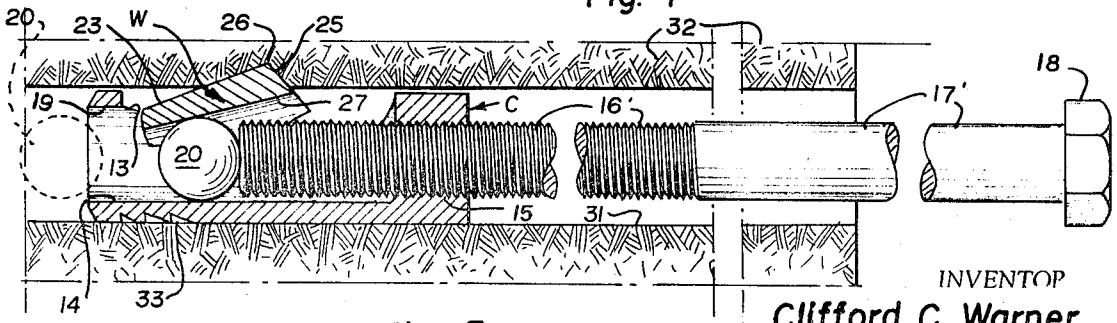



Fig. 5

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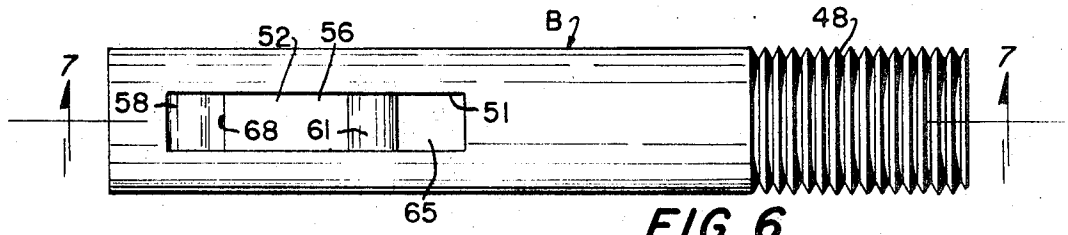



FIG. 6.

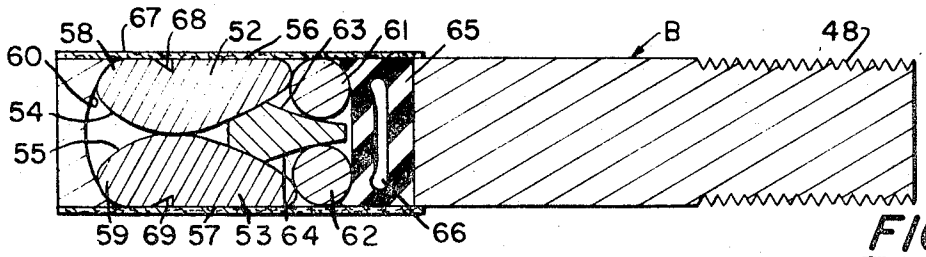



FIG. 7.

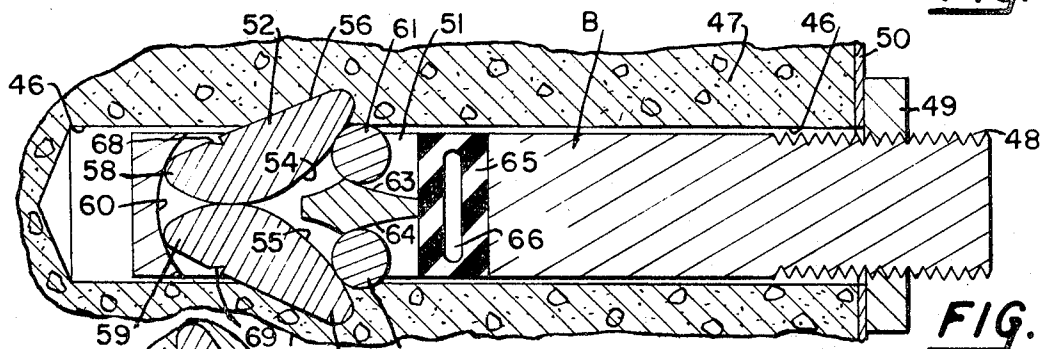



FIG. 8.

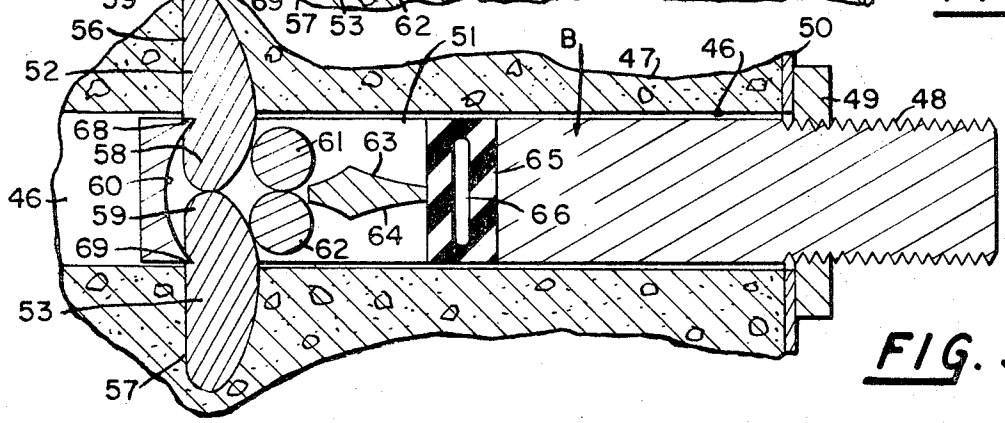



FIG. 9.

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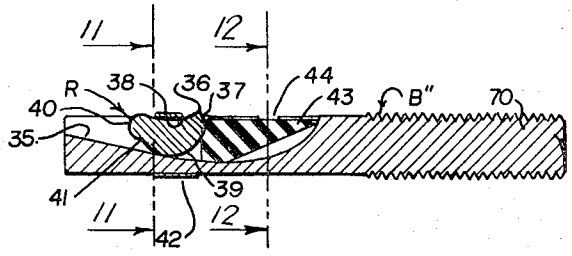



Fig. 10

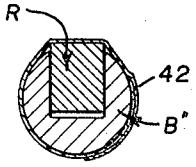



Fig. 11

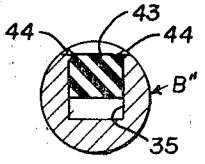



Fig. 12

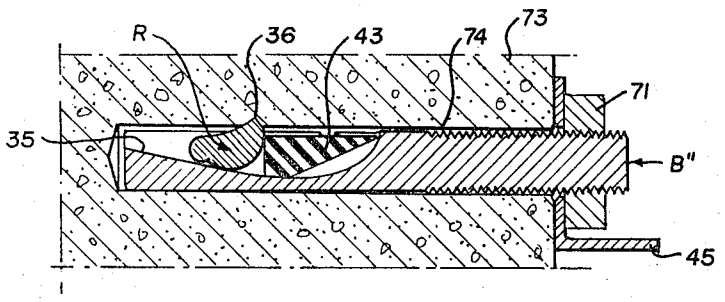



Fig. 13

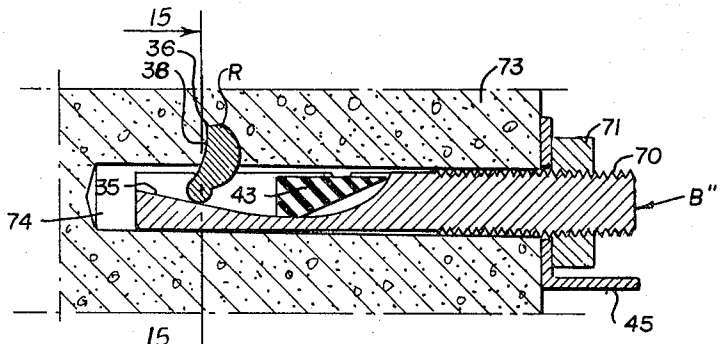



Fig. 14

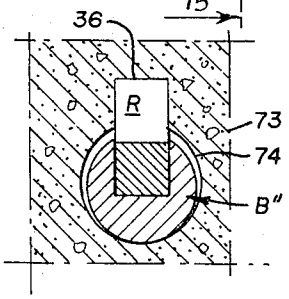



Fig. 15

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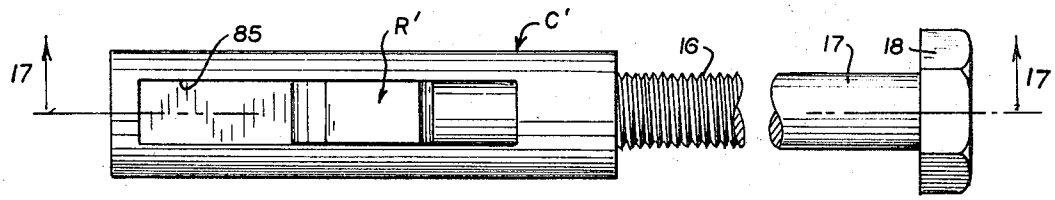



Fig. 16

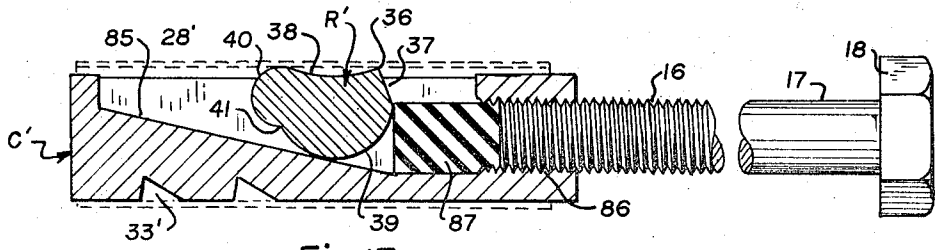



Fig. 17

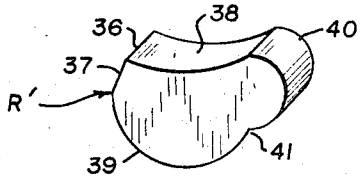



Fig. 18

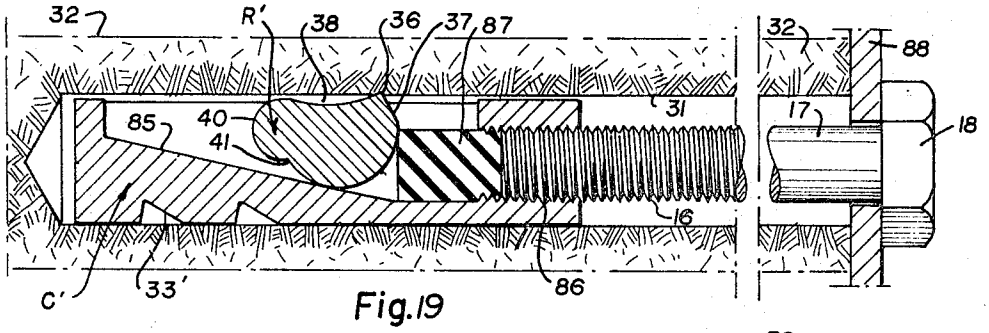



Fig. 19

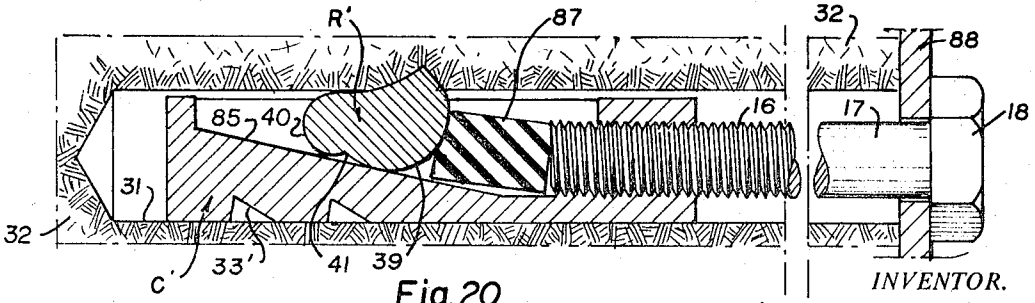



Fig. 20

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# BOLT ANCHORS

This application is a continuation-in-part of my prior application Ser. No. 298,922, filed Jul. 31, 1963, now abandoned.

This invention relates to bolt anchors, and more particularly to rock bolt anchors and integral bolt anchors for use in concrete, shale, hard rock or similar type of material.

In recent years, it has been the practice in the mining industry to attach steel plates to the walls and roofs of mine tunnels, stopes, drifts, etc., by means of anchor bolts to eliminate the necessity of timbering. This is done by drilling through the loose rock into solid rock so that one end of an anchor bolt may be imbedded in the solid rock and a steel plate held against the loose rock by the outer end of the bolt. Therefore, it is sometimes necessary to drill a hole many feet deep before solid rock is reached which is suitable for anchoring the bolt. These holes may be 15 feet or more in depth. Thus, the problem is encountered of inserting an anchor into a deep hole and then expanding it so that it is locked in the hole to securely fasten the end of the bolt in the rock. Also, a mat of rod or cable may be used to hold loose rock and it may be necessary to pull the mat toward the solid rock for several inches to a foot or more before the loose rock is sufficiently tight. This requires that the bolt be able to move through the anchor for the distance necessary to tighten the mat and that the anchor be placed solidly in an intermediate position in the hole, rather than at the end or bottom. The difficulty of providing such an anchor is increased because the bolt, in some installations, will be under a tension of several thousand pounds. Various types of bolt anchors and integral bolt anchors have been developed, but none have been entirely satisfactory. Some of these devices rely on springs to actuate wedges, but the springs do not always function properly and such anchors are not reliable. Other devices are so complicated as to make their price prohibitive.

For construction purposes, a short anchor which is readily installed in and will provide an effective anchor in somewhat softer material, such as concrete, is desirable. The extent of penetration of a wedge or the like into concrete is normally greater than into hard rock, which introduces the problem of adequate bearing area. Also, in certain operations, it is desired to install a bolt anchor in a hole in soft rock, such as shale, which requires that the area of the portion of the anchor extending into the soft rock be considerable.

Among the objects of this invention are to provide a novel rock bolt anchor; to provide such a rock bolt anchor which utilizes one or more outwardly rotatable wedges or cams for anchoring the bolt in rock or concrete; to provide such a rock bolt anchor, in one embodiment, wherein a single cam has wings, each adapted to slide up an inclined plane to engage the rock; to provide such a rock bolt anchor in which the bolt may be turned through the anchor for several inches to a foot or more, if desired; to provide such a rock bolt anchor, in other embodiments, wherein a plurality of cams are adapted to roll up an inclined plane to engage the rock; to provide such a rock bolt anchor wherein a pair of cams move outwardly in opposite directions into the rock or concrete; to provide such a rock bolt anchor wherein a pair of cams or wedges roll against each other as the move outwardly; to provide such a rock bolt anchor wherein the pair of wedges pivot within a slot in a sleeve; to provide such a rock bolt anchor having cam means for forcing the wedges apart as a bolt is tightened into the anchor; to provide such a bolt anchor which is capable of expansion up to double its size; to provide such a bolt anchor having a wrapper to hold the parts in place before use; to provide, in an alternative embodiment, an integral bolt anchor; to provide such an integral bolt anchor having wedges which are pivoted outwardly into the rock by rollers which move outwardly along cam surfaces; to provide such an integral bolt anchor in which the rollers are urged along the cam surfaces by a resilient block; to provide such an integral bolt anchor having a flexible wrapper to hold the parts in place before use; to provide, in a further alternative embodiment, an integral bolt anchor for use with concrete or the like; to provide such an integral bolt anchor having two or more rollers forced outwardly into the rock as they move along a cam surface; to provide such an integral bolt anchor in which the rollers are urged along the cam surfaces by a resilient block; to provide such an integral bolt anchor which may be provided with rollers of varying sizes; and to provide such integral bolt anchors provided with a flexible wrapper to hold the parts in place before use.



Additional objects and the novel features will become apparent from the description which follows, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a top plan view of a hard rock bolt anchor of this invention, particularly adapted to be tightened over a considerable distance;

FIG. 2 is a longitudinal section, taken along line 2–2 of FIG. 1, showing the position of a cam wedge and a paper wrapper holding the wedge in place, prior to use, the wrapper being shown in dotted lines in FIG. 1;

FIG. 3 is a perspective view of the cam of the rock bolt anchor of FIG. 1;

FIG. 4 is a side elevation, partly in longitudinal section similar to FIG. 2, but showing the bolt in position in a borehole in rock, with the cam wedge initially biting into the rock, the wrapper being slipped off the anchor as the anchor is slipped into the hole;

FIG. 5 is a longitudinal section, similar to FIG. 4, but showing the bolt position in the borehole in rock, and the cam wedge forced into the rock, with a resilient plug, as in the form of a ball, shown in dotted lines after passage out of the anchor;

FIG. 6 is a top plan view of an integral rock bolt anchor of this invention, particularly adapted for use in softer rock;

FIG. 7 is a longitudinal section, taken along line 7–7 of FIG. 6, showing wedges in closed position with a rubber block compressed, the parts being held in place by a wrapper;

FIG. 8 is a longitudinal section, similar to FIG. 7, but showing the bolt in a hole in a softer rock or concrete wall, with the wedges partially open, the wrapper being removed when the anchor is inserted in the hole;

FIG. 9 is a longitudinal section, similar to FIG. 8, but showing the wedges fully extended.

FIG. 10. is a longitudinal section of an alternative, integral blot anchor which is of smaller size and utilizes a rolling cam, being particularly adapted for use in concrete;

FIG. 11 is a transverse section, on an enlarged scale and taken along line 11–11 of FIG. 10;

FIG. 12. is a transverse section, on an enlarged scale and taken along line 12–12 of FIG. 10;

FIG. 13 is a longitudinal section, similar to FIG. 10, but showing the integral bolt anchor in position in a hole in a concrete wall, with the cam biting into the concrete;

FIG. 14 is a longitudinal section, similar to FIG. 13, but showing the cam forced further into the concrete;

FIG. 15 is a transverse section, taken along line 15–15 of FIG. 14;

FIG. 16 is a top plan view of a further alternative bolt anchor, particularly adapted for use in hard rock;

FIG. 17 is a longitudinal section, taken along line 17–17 of FIG. 16, showing also a paper wrapper which holds the parts in place prior to use;

FIG. 18 is a perspective view, on an enlarged scale, of the cam of the bolt anchor of FIG. 16;

FIG. 19 is a longitudinal section, similar to FIG. 17, but showing the rock bolt anchor in position in a hole in rock, with the cam biting into the rock; and

FIG. 20 is a longitudinal section similar to FIG. 19, but showing the cam forced outwardly further into the rock.

In accordance with this invention, a rock bolt anchor is provided, as in FIGS. 1—5, which includes a cylinder C adapted to receive a cam wedge W having wings 10 and 11 for sliding movement along laterally rounded, longitudinal cam edges 12 and 13 of an opening into a bore 14 of cylinder C. The outer end 15 of bore 14 is provided with threads, as shown, which engage threads 16 of a bolt 17 having a head 18, such as hexagonal, while the outer end 19 of the bore need not be

threaded but has a larger diameter than the inner end, such that a resilient ball **20**, as of rubber, will pass through. When the bolt **17** need not be tightened for an appreciable distance, threads **16** may extend for a short distance, as in the case of bolt **17** of FIGS. **1** and **2**, which, of course, may otherwise be several feet in length, as on the order of up to 15 feet, but when the bolt is to be tightened for a considerable distance, in order to draw a mat against loose rock, for instance, the threads may extend for several feet, as in the case of threads **16'** of bolt **17'** of FIGS. **4** AND **5**.

Cam wedge W is also provided with flat sides **21** and **22**, extending from the inner end of wings **10** and **11**, respectively, and spaced apart a distance slightly less than the distance between cam edges **12** and **13**, so that the inner end of cam wedge W may be deflected into the bore. Top **23** of cam wedge W and the outer surfaces of wings **10** and **11** are laterally arcuate to correspond to the outer diameter of sleeve S, while the underside **24** of each wing **10** and **11** as in FIG. **3**, is laterally concave to correspond to the lateral convexity of cam edges **12** and **13**, to prevent cam wedge W from twisting as it rides up onto cam edges **12** and **13**. The front face **25** thereof is inclined downwardly and forwardly, so that a dihedral angle will be formed at the biting edge **26**, since a square corner may tend to break off under extreme pressure, The depth of wings **10** and **11** is such that the outer surface of the cam wedge will form a circle with the outer surface of sleeve S, when the wings rest in the lowest point of cam edges **12** and **13**, as in FIGS. **1** and **2**, while ball **20** is preferably slightly greater in diameter than the bolt and will be compressed by the cam wedge W. The underside **27** of the latter is transversely concave and slopes upwardly from front to rear, for a purpose described later.

Prior to installation, the cylinder C is enclosed by a cylindrical wrapper sleeve **28**, conveniently formed of cardboard, which holds the parts in the position of FIG. **2** and is slipped onto or removed from the cylinder C in the direction of arrow **29**, since the inside of wrapper sleeve **28** will slip along the outer surface of cam wedge W and past biting edge **26**, causing the cam wedge to compress ball **20**. Thus, wrapper **28** can slip over the biting edge **26** if moved in the direction of arrow **29**, but if moved in the reverse direction, i.e. in the direction of dotted arrow **30**, the biting edge **26** will bite into the inside of the wrapper, through the pressure of ball **20** and will cause the inner edge of cam wedge W to tip into the bore **14**, preventing further movement of the wrapper. This action of the wrapper illustrates what happens when the bolt anchor is installed. Thus, when the bolt anchor is installed, the wrapper **28** is slipped off sleeve S and onto the bolt as the anchor is inserted in a borehole **31** in rock **32**, which borehole has a diameter slightly in excess of cylinder C. The bolt **17** or **17'** is sufficiently long that cylinder C may be pushed into the hole until head **18** of the bolt engages the hole collar or the plate, mat or other part to be held in position. As in the case of wrapper sleeve **28**, the anchor may be pushed inwardly in the hole as far as desired, since although ball **20** will push cam wedge W against the inside of the hole, the cam wedge will readily slide along the inside of the hole, in a position corresponding to FIG. **2**. When the desired position is reached, tightening of the bolt is begun, as by turning head **18** with an appropriate wrench, but as soon as a slight return movement is imparted to cylinder C, biting edge **26** will engage the rock and the inner end of cam wedge W will deflect into bore **14**, as in FIG. **4**. Continued tightening of the bolt will move the cylinder C outwardly in the hole, with ball **20** being pushed inwardly in the cylinder and being compressed by the cam wedge W. As long as cylinder C is moved in the hole, cam edges **12** and **13** will slide under wings **10** and **11**, respectively, forcing cam wedge W outwardly into the rock, with increasing resistance to movement of cylinder C, as to the position of FIG. **5**. Of course, if a mat or the like is being pulled against loose rock, the anchor bolt will usually reach a point of equilibrium where the force necessary to draw the mat toward the solid rock will be less than the force necessary to force cam wedge W further into the rock, so that further tightening of the bolt will draw the mat toward the solid rock, rather than tighten the anchor. Normally, a relatively short movement of cylinder C will suffice to lock the anchor so that a mat or the like will begin to be tightened, with further tightening of the bolt causing movement of the mat or plate, or movement of the cylinder C, or both, with the final result that the cam wedge W will be pushed laterally until a greater force is necessary to move cylinder C in the hole than to tighten the mat. When a mat or the like is moved several inches, the bolt **17'** of FIG. **5** will push the ball **20** through the inner end **19** of the bore, as to the dotted position of FIG. **5** and beyond, the ball being followed by the inner end of the bolt. As the ball is pushed past the cam wedge W, the outer surface of the cam edge cannot become parallel to the bore, since the taper between top **23** and underside **24** accommodates movement of the ball, while as cam edges **12** and **13** slide under wings **10** and **11**, respectively, the cam wedge W is pushed further out into the rock. Thus, the cam wedge will always be tipped into the rock.

Since as cam wedge W is moved into the rock, the reaction is on the opposite side of cylinder C, the latter may, on the underside and at the inner end, be provided with transverse serrations or teeth **33** for gripping the rock in that area, particularly as the cam wedge approaches a position further to the rear of the cylinder.

An alternative embodiment is shown in FIGS. **6—9**, wherein an integral bolt anchor B is provided for use in a hole of the same size as the bolt, such as hole **46** in a rock wall **47** of FIGS. **8** and **9**. Bolt B has threads **48** at one end for receiving a nut **49** for attaching a metal plate, such as plate **50** of FIGS. **8** and **9**, to wall **47**, as is more fully described below, and a slot **51** adjacent the other end which is adapted to receive cam wedges **52** and **53**. Cam wedges **52** and **53** are provided with curved inner surfaces **54** and **55**, respectively, which engage and roll against each other during extension of the wedges. The wedges also have flat outer surfaces **56** and **57**, respectively, and rounded rear ends **58** and **59** which are adapted to slide against the curved surface **60** at the end of slot **51** during expansion. The opposite ends of cams **52** and **53** are forced into the rock by rollers **61** and **62** which may have smooth surfaces or be knurled and are urged outwardly along cam surfaces **63** and **64**, respectively, by a resilient block **65**, as of latex rubber, at the inner end of slot **51**. Conveniently, block **65** has a central transverse slot **66** to facilitate displacement thereof, although this slot is not absolutely necessary. It will be evident that other resilient material, such as plastic or spring metal may be used, but rubber has been found to be the most satisfactory.

Prior to use, the parts are held in place, as shown in FIG. **7**, by a paper or cellophane wrapper **67**. Thus, integral bolt anchor B, together with wrapper **67** may be inserted in hole **46** drilled in rock **47** and nut **49** tightened against plate **50**. While wrapper **67** is tight enough to hold the parts in place, it is loose enough to allow rubber block **65** to push rollers **61** and **62** against the sides of the hole. Also, when the bolt is driven in the hole, most of the wrapper will be torn off by the sides of the hole. Of course, the sides of the hole will contain the rollers after the bolt is inserted therein. Thus, the integral bolt anchor can be inserted in the hole without difficulty, because the sides of the hole will merely force rollers **61** and **62** into rubber block **65**. However, as nut **49** continues to be tightened and bolt B tends to be pulled back out of the hole, rollers **61** and **62** will be forced outwardly along cam surfaces **63** and **64** by rubber block **65**, so that they engage the sides of the hole, as in FIG. **8**, forcing the ends of wedges **52** and **53** out into the rock also. The only purpose of the rollers is to activate the wedges. Therefore, once the ends of the wedges move outwardly beyond the rollers, the rollers become inactive and no longer perform any function. Initially, however, they serve as a fulcrum for the wedges as rounded ends **58** and **59** move along curved surface **60**. Thus, curved surface **60** provides the very useful function of allowing a slight longitudinal movement of

the wedges to prevent jamming. It will be understood that, if bolt B is to be used in rock having a wide variance in compressive strength, wedges **52** and **53** may be provided with interengaging gear teeth, so that simultaneous movement of the wedges will be assured.

Once rounded ends **58** and **59** come together, they become the fulcrum for the wedges, so that a large mechanical advantage is obtained as nut **49** continues to be tightened against plate **50**, forcing the ends of the wedges into the rock. If the rock is relatively soft, theoretically the nut may be tightened until the wedges are perpendicular to the axis of bolt B, as in FIG. **9**, so that notches **68** and **69** engage the ends of curved surface **60**, as shown. When the wedges **52** and **53** reach the position of FIG. **9**, the front surfaces thereof will provide a maximum bearing area against the anchor pulling out of the softer rock, while the area of flat surfaces **56** and **57** will also bear against the rock to prevent the wedges from rotating from the perpendicular position shown.

An alternative embodiment, particularly adapted for use in concrete, is shown in FIGS. **10—15**, wherein a smaller integral bolt anchor B'' is provided at its inner end with a slot **35** having a curved base, as shown, the outer end being provided with threads **70**. A cam roller R has a biting edge **36**, with a planar surface **37** extending therefrom at one side and a concave surface **38** at the opposite side, a generally arcuate surface **39** adjoining planar surface **37** and a convex knob **40**, such as generally semicircular, merging with concave surface **38**, with a notch **41** between knob **40** and surface **39**, which may be filled, if desired, to provide a flat area. Cam roller R is located in slot **35**, with biting edge **36** and the adjacent portion of cam roller R initially extending above bolt B'' and held in place, prior to installation, by a breakable wrapper **42**, as in FIG. **11** conveniently formed of tape provided with an adhesive on one side. An elongated, generally triangular, resilient block **43**, as of rubber, is placed at the outer end of slot **35** and may be held in place by crimps **44** on opposite sides and at the edges of slot **35**, as in FIG. **12**. Upon insertion of bolt B'' in a hole **74** in concrete **73**, as by tapping, the exposed surface of cam roller R will cause the cam roller to be tipped into slot, breaking the tape and providing sufficient pressure to force it downwardly and forwardly into slot **35** and against block **43** to compress the block, but without edge **36** biting into the concrete Upon tightening nut **71** on threads **70**, as against an angle **45** or other part to be attached to the concrete wall, thereby reversing the direction of movement of the bolt, the biting edge **36** of cam roller R will be urged into the concrete by the pressure of block **43**, as in FIG. **13**. Further tightening of nut **71** will cause cam roller R to rock onto the base of the slot, with the surfaces on opposite sides of notch **41** engaging the slot base. The cam roller R may then slide upwardly along the base of the slot, in such position, or may roll further up the incline of slot **35**, as to the position of FIG. **14** depending upon the ease with which the cam roller is forced into the concrete. Thus, if biting edge **36** encounters a harder and larger piece of aggregate in the concrete, requiring a greater force to push the cam roller into it, a sliding action is more likely, while if biting edge **36** engages smaller pieces of aggregate or a space between two harder and larger pieces of aggregate, the rolling action is more likely, the latter being more likely during normal use. Further rotation of cam roller R, from the position of FIG. **14**, will be hindered by the concave surface **38**. Thus, an integral anchor bolt is provided which is of simple construction but can expand to about twice its original diameter, as in FIG. **15**.

The embodiment of FIGS. **16—20** is particularly adapted to be used as a roof bolt anchor in softer rock and is similar in many respects to the concrete bolt anchor of FIGS. **10—15** but is larger in size and includes a cylinder C' having a slot **85** provided with a base which is inclined downwardly from the rear toward the front and communicating with a threaded bore **86** adapted to receive the threads **16** of a bolt **17** having a head **18**, similar to the bolt of FIG. **1**. The cam roller R' is similar to the cam roller R of FIG. **10**, except for size, being shown in FIG. **18** in a position reversed from that of FIGS. **21**, **23** and **24** for clarity of illustration. Thus, as in FIG. **18**, cam roller R' is provided with a biting edge **36**, a planar surface **37**, a concave surface **38**, an arcuate surface **39**, a knob **40** and a notch **41**. In this instance, the resilient block is a cylindrical plug **87** adapted to be compressed into bore **86** to retain it in place initially. Cylinder C' may also be provided with transverse serrations **33'** at the inner end on the side opposite slot **85**, for the same purpose as serrations **33** of FIG. **2**. Cam roller R' may also be held in place, for transportation and handling, by a sleeve **28'** of cardboard or the like, which may be slipped onto cylinder C' from the inner end and off at the outer end, onto bolt **17**, in the same manner as sleeve **28** of FIG. **2**. Plug **87** has a length such that cam roller R' will extend beyond the periphery of cylinder C', unless forced down into slot **85** to compress the plug, while sleeve **28'** is conveniently slipped off onto bolt **17** as cylinder C' is slipped into a borehole **31'** in rock **32'**. When cylinder C' reaches the desired position, and bolt **17** is initially turned, the pressure of plug **87** will cause biting edge **36** to bite into the rock, as in FIG. **19**. Tightening of bolt **17**, as against a plate **88** to be held against the rock, as of the roof of a tunnel, will compress plug **87** against cam roller R' and withdraw cylinder C' , causing cam roller R' to roll about arcuate surface **39** until knob **40** engages the base of slot **85**, as in FIG. **20**. In slightly harder rock, the device will be anchored securely in this position, but if the resistance to turning of bolt **17** indicates that cam roller R' should be forced further into the rock, such as softer rock, the bolt **17** may be further tightened. Depending upon the resistance of the rock to penetration by the cam roller R', the cam roller will, from the position of FIG. **20**, either slide up the inclined base of slot **85**, retaining the relative position of FIG. **24**, or will rock about knob **40** and rotate further into the rock, as to a position corresponding to the position of cam roller R in FIG. **14**. As will be evident, this embodiment provides a rock bolt anchor which will accommodate various degrees of hardness of the rock and can be expanded to correspond thereto.

Although several embodiments of this invention have been illustrated and described, it will be understood that other embodiments may exist, that various features of one embodiment may be incorporated in other embodiments and that various changes may be made in each embodiment, without departing from the spirit and scope of this invention.

I claim:

**1.** An anchor device for attachment within a borehole in rock or the like comprising:

a cylindrical member adapted to be received in said hole.

at least one longitudinal slot in said cylindrical member and a cam surface associated with said slot;

rock gripping means within said slot, having a biting edge and a curved surface, generally opposite said biting edge, in engagement with said cam surface and both movable and rollable along said cam surface;

means within said slot for activating said rock gripping means, so that at least a portion of said rock gripping means, as it pivots, including said biting edge, is forced out of said slot and into the sides of said borehole in securing said device in said borehole, said activating means being resilient and compressible by said rock gripping means as said member is moved into said borehole; and such compression tending to cause said biting edge to move into said rock to assist said rock gripping means to be moved into said rock by moving along and turning on said cam surface.

**2.** An anchor device, as set forth in claim **1**, wherein said rock gripping means is provided with a wing at each side having a curved surface and a cam surface is located at each side of said slot in position for engagement with said curved surface of the corresponding wing said slot.

**3.** An anchor device, as set forth in claim **1**, wherein said slot is covered with a wrapper for holding said rock gripping means within said slot before insertion of said device into said hole.

**4.** An anchor device, as set forth in claim **1**, wherein:

said rock gripping means comprises a pair of wedges mounted within said slot, said slot extending through said member and said wedges having engaging longitudinally curved inner edges and longitudinally straight outer edges normally aligned with the outer surface of said member; and

said cam surface is formed at the inner end of said slot for engagement by a curved end of each said wedge opposite said biting edge.

5. An anchor device, as set forth in claim 1, wherein:

said cam surface associated with said slot comprises an inclined edge at each side of said slot; and

said rock gripping means comprises a can wedge disposed in said slot and having a wing at each side engaging the respective inclined edge.

6. An anchor device as set forth in claim 5, wherein said resilient means is a ball formed of rubber-like material.

7. A anchor device, as set forth in claim 5, wherein the inside of said cam wedge is softer arcuate.

8. An anchor device, as set forth in claim 5, wherein the inside and outside of said cam wedge are inclined toward each other in a longitudinal direction away from the initial position of said resilient means.

9. An anchor device, as set forth in claim 5, wherein said cam wedge includes:

a cylindrical top having a lateral curvature corresponding to that of said member, the outer surface of said wings being a continuation of said top;

a transverse front face inclined at an angle away from a perpendicular to said top;

a transversely arcuate underside longitudinally inclined towards said top in a direction away from said front face; and

the underside of each wing is transversely concave to fit against transversely convex surfaces of said inclined edges.

10. A bolt anchor adapted for use within a borehole in a rock or concrete wall, comprising:

a cylindrical member having a longitudinal slot extending from a point at least adjacent the inner end toward the opposite end, said slot having a base inclined from said inner end to a greater depth at a point spaced therefrom;

a cam roller within said slot having a transverse biting edge and a generally arcuate convex surface opposite said biting edge adapted to roll along said inclined base of said slot;

said cam roller having a concave surface on one side of said biting edge and a planar surface on the opposite side of said biting edge, said generally arcuate surface adjoining said planar surface;

said cam roller also having a generally semicircular knob having a radius less than said generally arcuate surface, said knob merging at one side with said concave surface and at the other side forming a notch adjoining said generally arcuate surface;

resilient means in the deeper portion of said slot which is compressed by said cam roller upon movement of said member into said borehole and which causes said biting edge to engage said rock whenever said member is moved outwardly said borehole; and

means for moving said member outwardly in said borehole.

11. An integral bolt anchor adapted for use within a hole in a concrete wall, comprising:

a bolt threaded at its outer end for receiving a nut and having a longitudinal slot adjacent the inner end thereof, said slot having a concave base;

a cam roller adapted to roll along said base and having a generally arcuate convex surface resting at one point on said inclined base, a planar surface at the front and above said generally arcuate surface, a concave surface on the top and a generally semicircular knob at the upper rear having a lesser radius than said generally arcuate surface, said planar surface and said concave surface intersecting at a front upper biting edge and said knob forming a notch on the underside at the rear edge of said generally arcuate surface; and

a resilient block having a generally triangular shape with the larger end abutting said cam roller in said slot and being compressed by said cam roller as said bolt is moved into said hole and causing said biting edge to bite into the concrete when said bolt is moved outwardly in said hole, said generally arcuate surface rolling along said slot base as said bolt is moved further outwardly in said hole until said knob also engages said base.

# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,552,258 Dated January 5, 1971

Inventor(s) Clifford C. Warner

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 42, "blot" should read -- bolt --. Column 7, line 13, "can" should read -- cam --; line 19, "softer" should read -- transversely --.

Signed and sealed this 25th day of May 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, J
Commissioner of Patent