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(54) ANCHOR SCREW AND EXTRACTOR THEREFOR

(71) I, ARTHUR SEDLEY CARTER, of South African Nationality, of 15 Glen Street, Kenmare, Krugersdorp, Transvaal Province, Republic of South Africa, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an anchor screw and to an extractor therefor. It relates in particular to anchor screws which are used in securing formwork for the pouring of concrete. Such screws are used for supporting formwork as used in dam construction, tunnels, high-rise buildings, panels, and similar work.

Anchor screws of this type are recoverable in that they are placed in position before a cementitious mix is poured around them, and are then screwed out of the concrete after the mix has set. In this way the anchor screws can be recovered for re-use.

It is an object of this invention to provide an anchor screw and an extractor spanner or tool therefor, which will have a longer effective life than anchor screws and tools known to the applicant.

According to the invention there is provided an anchor screw comprising a tapered shank having a male thread extending axially from the small end and having a screw-threaded socket extending axially from the large end, and having at least one groove extending axially into the socket and intersecting the thread in the socket, the shank being tapered along the full length of the male thread.

The groove is engageable by a tool or spanner so that the anchor screw may be recovered after use.

A plurality of grooves, conveniently about three or four, may be spaced circumferentially about the socket polar axis.

The anchor screws are made of a material of sufficient hardness, and the grooves are of sufficient depth and have sufficient bearing area to accommodate a tool or spanner so as to ensure that the threads adjacent the grooves do not become deformed by the spanner during the recovery of the anchor

screws when they are screwed out of the concrete. Likewise, the thickness and strength of metal remaining beyond the maximum depth of slot, are matched so that the metal around the periphery of the socket will safely carry the stress imposed upon the walls of the socket by the tool or spanner when the screw is being screwed out of the concrete. It will be realised that where a strong material is used, the thickness of the material may be less than when a weak material is used. Likewise, the depth of the grooves and their bearing area may be less, the higher the quality of the material used for the anchor screws.

In practice, it has been found with anchor screws of mild steel that the grooves have adequate bearing area for engagement with a tool or spanner when the groove radius, when measured from the socket polar axis, is at the most two-fifths greater than the major radius of the thread, also when measured from the said axis. Preferably, the groove radius when measured from the socket polar axis, is from one-twentyfifth to one-fifth greater than the major radius of the thread, also when measured from the said axis.

Preferably, the material used for the tool or spanner, will be of a better quality than that used for the anchor screw. This will then ensure that the tool or spanner is not damaged in the extraction of one screw, and cannot therefore damage subsequent anchor screws during extraction.

The groove length may be at least equal to three quarters the diameter of the socket, but may conveniently be from one and a half to two and a half times the diameter of the socket. The thread length in the socket may be from one-tenth to three-tenths longer than the groove length, and the axial length of the socket may be from two-fifths to four-fifths longer than the groove length.

The invention extends also to the combination of an anchor screw as described, with a tool or spanner for applying a torque to the anchor screw, the tool having a spigot formation adapted to enter the socket and to engage with the groove/s of the anchor screw. The tool may be an impact wrench

adaptor having a socket adapted to receive the working head of an impact wrench.

The invention will now be described by way of example, with reference to the accompanying drawings.

In the drawings:

Figure 1 shows a part-axial sectional elevation of one embodiment of the invention;

Figure 2 shows a rear end elevation of the embodiment of Figure 1, as seen in the direction II—II, but to a larger scale;

Figure 3 shows a three-dimensional view of a spanner adapted for use in extracting anchor screws according to the invention, from concrete which has set;

Figure 4 shows a part-sectional side elevation of an impact wrench adaptor adapted for use with an impact wrench in the extraction of anchor screws according to the invention;

Figure 5 shows a rear end elevation of an alternative embodiment of anchor screw according to the invention; and

Figure 6 shows a sectional side elevation of formwork utilising anchor screws according to the invention.

Referring to the drawings, reference numeral 10 indicates generally an anchor screw according to the invention. It has a tapered shank 12 having a coarse male thread 14 starting at the small end 12.1 of the shank, and extending along the length but stopping short of the other end 12.2 of the shank. This large diameter end has a screw-threaded axial socket, generally indicated by reference numeral 16, extending from the large end 12.2 of the shank. The socket has a screw thread 18 and a plurality of circumferentially spaced grooves 20 intersecting the screw thread 18 and extending axially along the length of the socket. In the drawing, the groove length is shown to have a length of about twice the diameter of the socket.

Referring to Figure 2 of the drawings, there are shown four grooves spaced symmetrically about the polar axis of the socket. They are arranged to define the corners of a square so as to accommodate the square spigot formation of a tool or spanner which will be described more fully hereafter.

Referring now to Figure 3 of the drawings, there is shown a tool or spanner, indicated generally by reference numeral 30, and having a square section spigot formation 32 adapted to enter the socket 16 of an anchor screw 10, and to engage with the grooves 20 of such socket. The spanner 30 has an arm 34 whereby a torque may be exerted in unscrewing the anchor screws from the concrete. The arm 34 is made robust so that it can be hammered, if desired.

Referring now to Figure 4 of the drawings, there is shown in part-axial section, a

tool in the form of an impact wrench adaptor 40, adapted for use with an impact wrench where rapid extraction of anchor screws from concrete is desired. The adaptor has a square section spigot formation 42 adapted to enter the socket 16 of an anchor screw, and adapted to engage with the grooves 20. The adaptor has a socket 44 adapted to receive the working head of an impact wrench. The socket is provided with a hole 46, adapted to receive a locking pin for holding the adaptor 40 onto the working head of an impact wrench.

The tool or spanner 30 or 40 may conveniently be made of a material of strength superior to that of the anchor screws themselves.

Referring now to Figure 5 of the drawings, there is shown an alternative embodiment of the invention, having its grooves arranged to define the corners of an equilateral triangle. In certain circumstances such an anchor screw may be preferred. Here also, the groove radius is shown to be greater than the major radius of the thread. The tool or spanner will have a spigot formation to match the shape and size of the socket.

The applicant has found that a good balance between tool strength and resistance of groove to deformation is obtained if the groove radius 21, when measured from the socket polar axis, is at the most two-fifths greater than the major radius of the thread 19, also when measured from the said axis. Preferably, the dimension 21 (groove radius) is between one-twentyfifth and one-fifth greater than the dimension 19 (major radius of thread).

Referring now to Figure 6 of the drawings, there is shown the manner in which anchor screws according to the invention are used in practice in the moulding of concrete. The anchor screw 10.1 is shown embedded in concrete 48, after the concrete has set. Thereupon, formwork, generally indicated by reference numeral 50, is supported by a plurality of spaced anchor screws 10.1. To the formwork 50 there are secured a plurality of anchor screws 10.2 projecting into the cavity 52 which is to receive newly poured cementitious mix. Once the newly poured cementitious mix has set, the formwork 50 will be moved up again to be supported by the anchor screws 10.2, as they were supported by the anchor screws 10.1. Thereupon, or at a later stage, it will be possible to recover the anchor screws 10.1 by making use of the spanner 30 or adaptor 40 with an impact wrench by engaging the spigot formation 32 or 42 in the sockets 16, and by unscrewing the anchor screws from the concrete. The cavities from which the anchor screws have been removed, may be left or they may be grouted up afterwards.

The formwork 50 is supported by bolts 51.1 engaging with the threads 18 of the anchor screws 10.1. The anchor screws 10.2 engage via their threads 18 with the bolts 51.2 supported by the formwork 50 which is itself supported by the bolts 51.1 and the anchor screws 10.1. Ultimately, the anchor screws 10.2 may be removed in the same way as the anchor screws 10.1. Thus, the formwork may be raised progressively as the anchor screws 10.1 and 10.2, and so on, progress upwardly.

On building construction sites, conditions are not conducive to keeping screw threads clean. It is an advantage of this invention that the threads of the bolts 51.1 and 51.2, if they happen to be dirty, will be cleaned when being screwed into the socket, threads 18 because any foreign matter in the bolt threads will be cleared and will accumulate in the grooves 20 from where it may be cleared later, after the anchor screws have been removed from the concrete.

Furthermore, the spigot formations 32 and 42 have a good purchase on the anchor screw via the grooves 20 in the socket 16, and have little tendency to slip out of the socket 16 under adverse operating conditions.

WHAT I CLAIM IS:—

1. An anchor screw comprising a tapered shank having a male thread extending axially from the small end and having a screw-threaded socket extending axially from the large end, and having at least one groove extending axially into the socket and intersecting the thread in the socket, the shank being tapered along the full length of the male thread.

2. An anchor screw as claimed in Claim 1, in which a plurality of grooves are provided, spaced circumferentially about the socket polar axis.

3. An anchor screw as claimed in Claim 1 or Claim 2, in which the groove radius, when measured from the socket polar axis, is at the most two-fifths greater than the major radius of the thread, also when measured from the said axis.

4. An anchor screw as claimed in Claim 1 or Claim 2, in which the groove radius, when measured from the socket polar axis, is from one-twentyfifth to one-fifth greater than the major radius of the thread, also when measured from the said axis.

5. An anchor screw as claimed in Claim 3 or Claim 4, in which four grooves are provided such that they define the corners of a square.

6. An anchor screw as claimed in Claim 3 or Claim 4, in which three grooves are provided such that they define the three corners of an equilateral triangle.

7. An anchor screw as claimed in any one of the preceding claims, in which the groove has a length which is at least three quarters the diameter of the socket.

8. An anchor screw as claimed in any one of the preceding claims, in which the axial length of the groove is from one and a half to two and a half times the diameter of the socket.

9. An anchor screw as claimed in any one of the preceding claims, in which the axial length of the thread in the socket is from one-tenth to three-tenths longer than the groove length.

10. An anchor screw as claimed in any one of the preceding claims, in which the axial length of the socket is from two-fifths to four-fifths longer than the groove length.

11. An anchor screw as claimed in any one of the preceding claims, in which the threads of the socket are engageable by a concrete formwork supporting bolt, and the groove of the socket is engageable by the spigot formation of an extractor tool; and in which the groove is adapted to receive foreign matter cleared from the threads of the formwork supporting bolt.

12. The combination of an anchor screw as claimed in any one of Claims 1 to 11 inclusive, with a tool or spanner for applying a torque to the anchor screw, the tool having a spigot formation adapted to enter the socket and to engage with the groove/s of the anchor screw.

13. The combination as claimed in Claim 11, in which the tool is an impact wrench adaptor having a socket adapted to receive the working head of an impact wrench.

14. An anchor screw, substantially as described and as illustrated herein.

15. The combination of an anchor screw and a spanner, substantially as described and illustrated with reference to Figures 1, 2, 3 and 5 of the drawings.

16. The combination of an anchor screw and an impact wrench adaptor, substantially as described and illustrated with reference to Figures 1, 2, 4 and 5 of the drawings.

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The formwork 50 is supported by bolts 51.1 engaging with the threads 18 of the anchor screws 10.1. The anchor screws 10.2 engage via their threads 18 with the bolts 51.2 supported by the formwork 50 which is itself supported by the bolts 51.1 and the anchor screws 10.1. Ultimately, the anchor screws 10.2 may be removed in the same way as the anchor screws 10.1. Thus, the formwork may be raised progressively as the anchor screws 10.1 and 10.2, and so on, progress upwardly.

On building construction sites, conditions are not conducive to keeping screw threads clean. It is an advantage of this invention that the threads of the bolts 51.1 and 51.2, if they happen to be dirty, will be cleaned when being screwed into the socket threads 18 because any foreign matter in the bolt threads will be cleared and will accumulate in the grooves 20 from where it may be cleared later, after the anchor screws have been removed from the concrete.

Furthermore, the spigot formations 32 and 42 have a good purchase on the anchor screw via the grooves 20 in the socket 16, and have little tendency to slip out of the socket 16 under adverse operating conditions.

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WHAT I CLAIM IS:—

1. An anchor screw comprising a tapered shank having a male thread extending axially from the small end and having a screw-threaded socket extending axially from the large end, and having at least one groove extending axially into the socket and intersecting the thread in the socket, the shank being tapered along the full length of the male thread.

2. An anchor screw as claimed in Claim 1, in which a plurality of grooves are provided, spaced circumferentially about the socket polar axis.

3. An anchor screw as claimed in Claim 1 or Claim 2, in which the groove radius, when measured from the socket polar axis, is at the most two-fifths greater than the major radius of the thread, also when measured from the said axis.

4. An anchor screw as claimed in Claim 1 or Claim 2, in which the groove radius, when measured from the socket polar axis, is from one-twentyfifth to one-fifth greater than the major radius of the thread, also when measured from the said axis.

5. An anchor screw as claimed in Claim 3 or Claim 4, in which four grooves are provided such that they define the corners of a square.

6. An anchor screw as claimed in Claim 3 or Claim 4, in which three grooves are provided such that they define the three corners of an equilateral triangle.

7. An anchor screw as claimed in any one of the preceding claims, in which the groove has a length which is at least three quarters the diameter of the socket.

8. An anchor screw as claimed in any one of the preceding claims, in which the axial length of the groove is from one and a half to two and a half times the diameter of the socket.

9. An anchor screw as claimed in any one of the preceding claims, in which the axial length of the thread in the socket is from one-tenth to three-tenths longer than the groove length.

10. An anchor screw as claimed in any one of the preceding claims, in which the axial length of the socket is from two-fifths to four-fifths longer than the groove length.

11. An anchor screw as claimed in any one of the preceding claims, in which the threads of the socket are engageable by a concrete formwork supporting bolt, and the groove of the socket is engageable by the spigot formation of an extractor tool; and in which the groove is adapted to receive foreign matter cleared from the threads of the formwork supporting bolt.

12. The combination of an anchor screw as claimed in any one of Claims 1 to 11 inclusive, with a tool or spanner for applying a torque to the anchor screw, the tool having a spigot formation adapted to enter the socket and to engage with the groove/s of the anchor screw.

13. The combination as claimed in Claim 11, in which the tool is an impact wrench adaptor having a socket adapted to receive the working head of an impact wrench.

14. An anchor screw, substantially as described and as illustrated herein.

15. The combination of an anchor screw and a spanner, substantially as described and illustrated with reference to Figures 1, 2, 3 and 5 of the drawings.

16. The combination of an anchor screw and an impact wrench adaptor, substantially as described and illustrated with reference to Figures 1, 2, 4 and 5 of the drawings.

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