

METHOD FOR WORKING A THREAD ON DEFORMED REINFORCING BAR

FIELD OF THE INVENTION

The present invention relates to a method for working a thread onto a deformed bar of the type used for reinforcing concrete.

BACKGROUND TO THE INVENTION

At construction sites and civil engineering works where concreting is required, the concrete structure is generally reinforced with reinforcing bars to provide added strength and stability. A reinforcing bar is typically a steel bar manufactured with surface deformations to provide a locking anchorage with the surrounding concrete, and is also known as a "deformed bar".

The deformed bars are supplied in pre-cut lengths and accordingly it may be necessary to connect several bars end to end for use depending upon the size of the construction work.

One known method of connecting the bars is by using a latching process wherein end portions of the two bars are overlapped and bound by steel wires. However, this connection method results in significant loss of material since the end portions are required to overlap. Additionally, this method requires considerable labour to connect the bars, and furthermore, the connections become weak with age which correspondingly weakens the overall structure.

Another method of connecting the bars has been proposed which includes heating the connection end portions and upsetting the connection end portions by exertion of force in the axial direction. However, loss of material is caused by shrinking the length of the deformed bar. In addition, as heat is locally applied to the connection end portions, the elongation rate may decrease by a change in the material structure between the heated portion and the non-heated portion. This will result in the connection end portion becoming weak on impact, and an irregular structure distribution may result.

In order to address these problems, a cold process for connecting the bar ends has been developed involving using a thread portion at the connection end portion of each connecting bar, and a connecting piece or coupler is threaded between the two bars around the corresponding threaded portions. In one method as disclosed in US Patent 5,158,527, a cut thread portion is formed at the

connection ends. In another method disclosed in GB Patent 2,286,782, a rolled thread portion is formed at the connection ends after finishing the cutting operation. However, the tensile strength and the hardness of the deformed bar becomes very high by work hardening and a value of impact absorption energy is rapidly decreased. This results in the structure of the upset portion becoming non-uniformly formed.

Accordingly, another method of working a thread of a connection end portion has been disclosed in CA 2,268,878. This method includes swaging the deformed bar at normal temperature such that a maximum diameter of the connection end portion is equal to or slightly larger than a diameter of a cylindrical body of the deformed bar or slightly smaller than a diameter of the deformed bar depending on a degree of working, and rolling a thread portion onto the outer peripheral face of the connection end portion.

However, this method takes considerable time to complete, since it is difficult to roll the thread onto the cold bar. Due to this difficulty, the threads are often not accurately aligned, and the process requires repeating, which causes strain on the rollers. This again results in significant construction time and cost of production.

It is an object of the present invention to provide a method for working a thread onto a deformed bar for reinforcing concrete that produces a high quality and consistent thread while also preferably reducing the construction costs.

SUMMARY OF THE INVENTION

Broadly, the present invention uses a pressing step to press thread marks onto a deformed bar before a rolling step to form the final thread on the bar.

In one aspect, the present invention provides a method for working a thread onto a deformed bar of the type used for reinforcing concrete, the method comprising the steps of: pressing the deformed bar to a predetermined diameter using a die having thread formations thereon to correspondingly form thread marks on the deformed bar; and rolling the pressed deformed bar to form the final thread.

In one form, the step of pressing the deformed bar to a predetermined diameter using a die having thread formations thereon comprises cold-pressing the deformed bar.

In another form, the step of rolling the pressed deformed bar to form the final thread comprises cold-rolling the pressed deformed bar.

In a second aspect of the present invention, a deformed bar for reinforcing concrete having at least one thread thereon, wherein the thread is worked by the method above is also provided.

The present invention and/or forms thereof increases the quality and consistency of the final thread on the deformed bar, as the thread marks are formed on the bar preferably at the same angle and pitch of the roller thread, which causes less resistance during the rolling step. This also enhances the life expectancy of the rollers, which reduces construction cost and accordingly achieves the object.

An illustrative embodiment of the present invention will now be described with reference to the accompanying figures. Further features and advantages of the invention will also become apparent from the accompanying description.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1a through Figure 10 are stage views showing a method for working a thread onto a deformed bar for reinforcing concrete in accordance with one embodiment of the present invention, in particular:

Figure 1a shows a front elevational view of a pressing die for use with the embodiment of the present invention;

Figure 1b shows a side elevational view of the pressing die of Figure 1a;

Figure 1c shows a perspective view of the pressing die of Figure 1a;

Figure 2a shows a front elevational view of the pressing die of Figure 1a with a deformed bar located between the parts of the die;

Figure 2b shows a side elevational view of Figure 2a;

Figure 3a shows a front elevational view of the pressing die and bar of Figure 2a with arrows indicating the pressing step;

Figure 3b shows a side elevational view of Figure 3a;

Figure 4a shows a front elevational view of the pressing die and bar of Figure 3a with the die in the pressed position;

Figure 4b shows a side elevational view of Figure 4a;

Figure 5a shows a front elevational view of the pressing die and bar of Figure 3a after the pressing step with the die in the open position;

Figure 5b shows a side elevational view of Figure 5a, showing the thread marks formed on the bar;

Figure 6a shows a front elevational view of the pressing die and bar of Figure 5a, showing the bar being rotated;

5 Figure 6b shows a side elevational view of Figure 6a;

Figure 7a shows a front elevational view of the pressing die and rotated bar of Figure 6a with the die again in the pressed position;

Figure 7b shows a side elevational view of Figure 7a;

10 Figure 8a shows a front elevational view of the pressing die and bar of Figure 7a after the pressing step with the die in the open position;

Figure 8b shows a side elevational view of Figure 8a, showing the further thread marks formed on the bar;

Figure 9 shows a cold-rolling step for forming the final thread, with the pressed bar located between two rollers;

15 Figure 10 shows the deformed bar with final thread formed thereon.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to Figure 1a, there is shown a die 10 for working thread marks onto a deformed bar. The die 10 is formed of two parts 10a and 10b, although other shapes and configurations of dies may be used, for example the die may
20 only include one part. The die 10 is formed of DF-2 material, which exhibits a hardness of between 52 to 58 on the Rockwell scale.

The die 10 comprises a substantially semi-circular channel 12 in each part 10a and 10b thereof. As shown in Figure 1b, a first portion of the channel 12 comprises thread formations 14 including a plurality of ribs and nodes for
25 pressing into the deformed bar. The second portion of the channel 12 comprises a depth greater than the first portion, with a third portion of varying depth connecting the first and second portions. The length of the thread formations portion of the channel 12 may vary depending upon the length of thread required on the deformed bar and the length of the die 10. For example, the thread
30 formations 14 may extend along the entire length of the channel 12.

As shown in Figures 2a and 2b, a deformed bar 16 for reinforcing concrete is inserted into the die 10, as indicated by the arrow 17, with the location where

the thread to be formed is positioned at the portion of the die 10 having the thread formations 14.

The deformed bar 16 comprises a cylindrical body with ribs 20 and nodes 22 formed on an outer peripheral face. The deformed bar 16 is in the range of 380 yield strength to 600 yield strength. The preferred diameter of the deformed bar 16 is 10 mm to 50 mm, although other sizes could be used as desired.

Once the deformed bar 16 is in the desired location within the die 10, the two die portions 10a and 10b are pressed together, as indicated by the arrows 23 in Figures 3a and 3b, and Figures 4a and 4b. The pressing together causes the diameter of the deformed bar 16 within the first portion of the die 10 to be reduced to the predetermined diameter while also causing thread marks to form on the bar 16 corresponding to the thread formations 14 on the die 10. The pressing step may also straighten the bar 16 should the connection end portion be slightly bent relative to an intermediary portion of the deformed bar.

In the present embodiment, the pressing is performed while the deformed bar 16 is at a normal room or cold temperature. The pressure is applied using a hydraulic machine, typically applying pressure in the range of 800 PSI to 3,000 PSI depending upon the deformed bar size and the yield strength. The time for which the pressure is applied is dependent upon the materials and the diameter of the bar 16.

Once the pressing step has been completed, the die portions 10a and 10b are separated, as indicated by the arrows 25 in Figures 5a and 5b, and the deformed bar 16 is released. At this stage, the deformed bar 16 will have thread marks 24 worked on part of the circumference of the bar. The pitch and depth of the thread marks 24 formed will be dependent on the diameter of the deformed bar 16. Various kinds and shapes of thread marks may be worked, such as a circular thread or a triangular thread, however preferably the thread is a circular thread.

As illustrated in Figures 6a and 6b, the bar 16 is then rotated by approximately 90 degrees to position the part of the bar without the thread marks within the die. The die 10 is then pressed together as shown in Figures 7a and 7b, to form thread marks around the remaining (unthreaded) portion of the bar. Once the die is released as shown in Figures 8a and 8b, the entire circumference

of the bar has thread marks formed thereon. In other forms and configurations of the die, it may not be necessary to rotate the deformed bar as one press may enable the thread marks to be formed around the entire circumference.

In order to provide a deeper thread in the bar 16 for securely connecting
5 the bar 16 to a coupler (based on customers requirement, and not shown in the drawings), the bar 16 with the thread marks 24 then undergoes a rolling step as indicated in Figure 9. The bar 16 is placed between two rollers 26 which cold-roll into the thread marks 24 on the bar 16, forming the deeper, final, thread. The thread pitch of the rollers 26 will vary depending upon the size of the deformed
10 bar 16. Typically, a deformed bar with a diameter of 10 mm will result in having a pitch of about 1.5 mm and a depth of about 0.8 mm, whereas a deformed bar with a diameter of 50 mm will typically have a pitch of about 4.0 mm and a depth of about 2.0 mm.

Preferably the rolling step is performed while the bar 16 is at a normal
15 room or cold temperature to ensure there is no alteration of the inherent properties of the bar 16 to cause weakness. The rolling step comprises using a conventional rolling machine that is known to a person skilled in the art. The working pressure during the rolling of the final thread ranges from 800 PSI to 2,000 PSI. The revolutions of the roller machine are standard with the particular
20 machine, and do not impact on the quality of the final thread on the deformed bar. Typically, the final thread is formed within 2 to 25 seconds depending upon the size of the bar 16 and the length of the thread.

Once the rolling step has been completed, the final thread 28 has been worked on the bar 16, as shown in Figure 10, and the bar 16 is ready for use.
25 Each threaded end of the bar 16 may be connected to another bar 16 by use of a coupler. The coupler comprises corresponding thread formations on an inner surface thereof, which accordingly mate with the thread formed on the outer surface of the ends of the bar 16.

The present embodiment increases the quality and consistency of the final
30 thread on the deformed bar, as the thread marks are formed on the bar preferably at the same angle and pitch of the roller thread, which causes less resistance during the rolling step. This also enhances the life expectancy of the rollers, which reduces construction cost.

It will be appreciated that persons skilled in the art could implement the present invention in different ways to the one described above, and variations may be produced without departing from its spirit and scope.

CLAIMS:

1. A method for working a thread onto a deformed bar of the type used for reinforcing concrete, the method comprising the steps of:
pressing the deformed bar to a predetermined diameter using a die having
5 thread formations thereon to correspondingly form thread marks on the deformed bar; and
rolling the pressed deformed bar to form the final thread.
2. A method according to claim 1, wherein the step of pressing the deformed bar to a predetermined diameter using a die having thread formations thereon
10 comprises cold-pressing the deformed bar.
3. A method according to any one of the preceding claims, wherein the step of rolling the pressed deformed bar to form the final thread comprises cold-rolling the pressed deformed bar.
4. A deformed bar of the type used for reinforcing concrete having at least
15 one thread thereon, wherein the thread is worked by the method of any one of claims 1 to 3.