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The invention relates to a method for the creation of a mechanical connection of round bars for concrete, to such a connection obtained by the method, to a round bar for concrete permitting the implementation of said method, and also to an installation for the preparation of round bars for concrete. It will be used in particular in the field of the construction of elements, of buildings or of edifices made of concrete.

In this field, it is customary to use mechanical connections to link round bars for concrete so as to be able to ensure the transmission of tensile stress in a continuous manner.

Nowadays, various solutions are proposed by builders and principally either a setting connection or a fillet connection is used.

In the case of connection by setting, a sleeve is used which is brought to be set on the two ends of the round bars which are to be connected. This technique avoids having to set one of the round bars in rotation, but nevertheless presents high risks of slipping, owing to the setting which is difficult to control. Furthermore, its implementation is often difficult on site because one must be able to intervene with setting tools at the place where the connection is to be carried out.

Increasingly, mechanical connection by filleting is preferred by users. In such a connection, two round bars for concrete are joined, substantially coaxially, by means of a tapped connection sleeve. This solution is likewise applicable when it is necessary to connect a round bar for concrete to an anchorage point.

In addition, to improve the quality of the mechanical connection of round bars for concrete by filleting, a method has been perfected for creating such a connection in which, prior to the filleting, the end of the round concrete bars

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which are to be connected is upset, cold, so as to create a reinforced zone having a diameter greater than the nominal section of the round bar, then the filleting is cut on the said reinforced zone such that the diameter at the base of the fillet is equal to or greater than the nominal section of the round bar for concrete.

Such a method is satisfactory in the majority of constructions and requires a very brief machining. In fact, the end of the round bar for concrete, with its grooves or ribs, is upset, cold, in a matrix then the filleting is carried out on this crude upsetting by cutting.

Although the upsetting is generally limited to a rate of increase in diameter in the order of 30 %, it is nevertheless necessary to use pressures, during upsetting, having a very high value, which are able to extend up to 400, even 500 bars.

In addition, it is to be noted that increasingly concrete edifices are subject to dynamic stresses, and under these conditions the mechanical connections of round bars for concrete are subject to alternate traction-compression effects. Also, the fragility of such connections is increased and it is necessary to anticipate these stresses so that they resist from the point of view of insecurity.

The aim of the present invention is to propose a method for the creation of mechanical connections of round bars for concrete which bring a total security to the connection and which, for the same dimensioning, bear dynamic stresses with an alternate traction-compression effect.

One of the aims of the present invention is to propose a method for the creation of a mechanical connection of round bars for concrete which permits the creation, at the end of the round bar for concrete, of a reinforced zone such that the diameter at the base of the fillet is equal to or greater than the nominal



section of the round bar for concrete, but which necessitates a cold upsetting of the lesser end, and consequently putting into operation smaller upsetting forces.

Another aim of the present invention is to propose a method for creating a mechanical connection of round bars for concrete which uses a very high quality filleting with good tolerances which does not reduce the resistance of the end.

In particular, the filleting is carried out by rolling, which avoids cutting the fibres of the bar and causing incipient fractures in the case of dynamic stresses.

Another aim of the present invention is to propose a mechanical connection of round bars for concrete and also a round bar for concrete permitting the implementation of the method of the present invention.

In addition, another aim of the present invention is to propose an installation for the preparation of such round bars for concrete which is economical, entails a reasonable investment and is of reduced dimensions, given the forces which are used.

Other aims and advantages of the present invention will become apparent in the course of the following description which is only given, however, by way of an indication and which does not aim to limit the invention.

According to the invention, the method for creating a mechanical connection of round bars for concrete, which will be used in particular in the field of construction in concrete, by which at least one round bar for concrete is connected to another round bar for concrete or to an anchorage point, by means of a tapped connection sleeve, said round bar for concrete having a nominal section Φ , at least one reinforced end, upset and filleted, such that the



diameter of the base of the fillet is equal to or greater than the nominal section Φ of the round bar, is characterised in that the reinforced end is effected by double upsetting, a first axial upsetting allowing the diameter of the round bar for concrete to increase, and a second radial upsetting when filleting is carried out by the rolling technique.

The method of the invention allows a mechanical connection of a round bar for concrete to an anchorage point to be produced, or a mechanical connection of two round bars for concrete end to end substantially coaxially.

In addition, the round bar for concrete permitting the method of the invention to be implemented is characterised in that at least one of its ends has a double upsetting such that the diameter of the base of the fillet is greater than or equal to the nominal section of the round bar for concrete.

The installation for preparing round bars for concrete according to the invention is as regards itself characterised in that it has:

- a) means for immobilising the round bar for concrete which is to be prepared,
 - b) means for the cold upsetting axially of the end of the round bar for concrete,
 - c) means for removing the surface from the extent which is to be upset and/or filleted,
 - d) means for carrying out a filleting by rolling of the said end,
- said means b), c), d) being movable so as to be placed coaxially in the axis of the round bar for concrete which is locked in the means a).

The present invention will be understood better on reading the following description accompanied by drawings which form an integral part thereof.



Figure 1 shows a mechanical connection of a round bar for concrete according to the method of the present invention.

Figures 2a to 2d show the different stages in the method for creating the mechanical connection of a round bar for concrete according to the invention, and more precisely the working of the end of the round bar for concrete carried out in the method.

Figure 3 shows a sectional view, on an enlarged scale, showing the dimensional characteristics of the end of the round bar for concrete of Figure 2d.

Figure 4 shows diagrammatically the arrangement of the various means constituting the installation for preparing the round bar for concrete according to the present invention.

The invention aims at a method for creating a mechanical connection of a round bar for concrete, a connection thus obtained and also a round bar for concrete permitting said method to be implemented, and an installation for preparing such round bars.

It will be used in particular in the field of construction in concrete.

Figure 1 shows an example embodiment of a mechanical connection permitting the connection to be ensured of two round bars for concrete 1 and 2, end to end, substantially coaxially. In addition, this connection uses a tapped connection sleeve 3, suited to receiving respectively on one side the filleted end 4 of the first round bar for concrete 1 and on the other side the end 5 of the second round bar for concrete 2.

Each of the round bars for concrete is determined by calculation then selected from a standardized or regulated range. The characteristic of a round bar for concrete lies essentially in an imposition of weight and section, these being rolled taking into account these requirements.

Generally, the round bar for concrete has on its external surface grooves or ribs 6 which create protuberances permitting the round bar to be immobilised in translation in the concrete when it is embedded in the latter.

Under these conditions, the round bar has on the one hand a nominal section characterised by Φ which is, as it were, the section of the core of the round bar, and a diameter on the grooves or ribs marked Φ_c , as illustrated in particular by Figure 2a.

According to the method of the present invention, each round bar for concrete 1, 2 which is to be connected has at least one reinforced end 4, 5, which is upset and filleted such that the diameter of the base of the fillet d_2 is equal to or greater than the nominal section Φ of the round bar. This is illustrated particularly in Figures 2d and 3.

More precisely, according to the method, the reinforced end 4, 5 is effected by double upsetting, a first axial upsetting 7 permitting the diameter of the round bar for concrete to be increased, and a second radial upsetting 8 during filleting by a rolling technique.

The first axial upsetting 7 is carried out prior to the filleting, and cold upsetting is carried out on the end of the round bar for concrete 1, 2 which is to be connected, so as to create a reinforced zone 7 corresponding at least substantially to the diameter d_4 of the fillet sides.

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Then the second radial upsetting 8 is carried out, creating a filleting 9 on the said reinforced zone 7 by rolling so that the diameter at the base of the fillet d_2 is equal to or greater than the nominal section Φ of the round bar.

This being so, in a general manner, the upsettings 7, 8 are carried out on the length of the filleting 9 of the said end 4, 5.

The different stages of the method are illustrated in Figures 2a to 2d.

In Figure 2a, a first removal of the surface of the end of the round bar to be reinforced is shown, to rid it of its grooves or ribs and to give this end an acceptable cylindrical form. This surface removal is marked by the diameter d_0 close to or very slightly less than the diameter Φ .

On this end 4 which has been prepared in this way, one proceeds with the first upsetting 7 at a rate of increase of the diameter of the end close to 15 to 20 %. This stage brings the diameter d_0 to a greater diameter d_3 , which is itself greater than diameter Φ of the round bar. This cold upsetting is realised by carrying out an axial pressure on the end in accordance with the arrow 10.

Then, as shown by Figure 2c, the upset extent 7 is adjusted, in particular to calibrate it, to the diameter d_4 which will allow the desired filleting to be carried out by rolling.

According to the rolling technique, this diameter d_4 corresponds to the diameter of the fillet sides shown in Figure 3. During rolling, the metal will then be pushed back to constitute the base of the fillet d_2 and will be upset to constitute the exterior part of the filleting d_1 .



Under these conditions, one arrives at the end as marked in Figure 2d in which the latter, after a double axial upsetting 7 and radial upsetting 8, shows a reinforced end such that the diameter at the base of the fillet d_2 is equal to or greater than the nominal section Φ of the round bar.

In addition, to resist the traction test which is imposed by certain safety standards, the end 4 and/or 5 of the round bar for concrete 1 and/or 2, reinforced by upsetting, is pre-stressed.

This pre-stressing allows all the displacements and elongations of the round bars for concrete to be cancelled and in particular of their ends when safety tests are carried out. It is carried out after the filleting, mechanically by compression of the said filleted end.

The method which has just been described permits the realisation of a mechanical connection of two round bars for concrete end to end, substantially coaxially. However, this method can be adapted to obtain a mechanical connection of a round bar for concrete to an anchorage point.

In this case, the sleeve will be adapted to receive a single round bar, but will have an exterior configuration in the form of an anchorage socket.

This being the case, by way of example, in a round bar for concrete HA20 of nominal section 20 mm, a filleting M24 of tolerance 6g is made on its end.

After a removal of the surface of the end of the round bar, the axial upsetting was carried out to obtain a diameter d_3 of 23 mm.

Then a rolling of the end thus upset was carried out to bring the diameter d_4 to be comprised between 21.803 and 22.003 mm.

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On this calibrated end, the filleting M24 was carried out at a pitch of 3 by rolling. The exterior diameter d_1 is therefore comprised between 23.577 and 23.952 mm and the diameter of the base of the fillet d_2 therefore corresponds to 20.704 mm, namely greater than the 20 mm of the nominal section of the round bar HA20.

Likewise, starting from a round bar for concrete HA of 20 mm, to obtain a diameter M24 at a pitch of two, taking into account the standardisation of the filletings, one must start from a basic diameter equal to the diameter at the sides of the fillet placed between 22.493 and 22.603 mm.

With respect to the previous solution in which a cold upsetting was carried out in a single stage on the end of the round bar for concrete and then the filleting was cut, a great gain is to be noted, because the upset mass which is necessary is much less.

Previously, an exterior upsetting had to be obtained in the order of 27 mm, namely a displacement of mass in the order to 50 g and a length of 20 mm.

According to the present invention, the necessary axial upsetting brings about a displacement of a mass of 18 g or a length of 8 mm. The axial upsetting is therefore reduced from 50 to 18 g, namely a reduced ratio of 2.8.

In addition, the quality of the filleting allows the 8g tolerance to be abandoned and allows 5 or 6 g tolerances to be used.

Figure 4 shows diagrammatically an installation for the preparation of round bars for concrete to allow the implementation of the method of the present invention.

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The installation firstly comprises a feeding zone of the round bar for concrete which is to be prepared. In this zone a vice 10 is provided, which will be able to grip the round bar for concrete 1 and move it towards the installation.

Following this zone, means 11 are provided for immobilising the round bar which is to be prepared. These means are, for example, constituted by a vice 11 having a great length, in particular provided with a covering of the natural rubber or polyurethane type to avoid damage to the round bars for concrete.

The advantage of offering a great length for the vice allows one to have a large area at one's disposal and a relative weakness of compression per square metre.

The vices 10 and 11 are of the hydraulic type, displaceable horizontally in relation to the longitudinal axis 22 for feeding the round bars for concrete.

The various arrows in Figure 4 simulate the functioning of the system and in particular the following functioning: the vice 10 grips the round bar for concrete, the immobilisation vice 11 opens, the vice 10 moves forward, the vice 11 grips around the round bar, the vice 10 releases itself and moves back to prepare a new cycle.

In front of the immobilisation vice 11 there will be provided in sliding arrangement: a cutter 12, means 13 for the cold upsetting axially of the end of the round bars, and also a unit for mechanical stress by compression of the filleted end of the round bar.

This will be possible in particular by providing slides 15 in front of the vice so as to permit a vertical displacement of the three tools 12-14 as suggested by the figures, to be placed coaxially in the axis 22 of the locked round bar at 11.



Under these conditions, the round bar for concrete will be able to be worked without having to alter its positionning, this being locked once and for all in the vice 11.

Likewise, the installation will offer means 16, 17 for removing the surface from the extent which is to be upset and/or filleted. These means will be provided with vertical and horizontal displacement so as to be able to bring the surface removal tool in the longitudinal axis 22 of the round bar for concrete which is to be worked.

In addition, the installation will comprise, in the same sense, means 18 to create a filleting by rolling, i.e. the unit 18 will be suited to being displaced so as to be placed coaxially in the axis 22 locked in the means 11.

Finally, the installation will likewise offer a unit 19 for screwing and unscrewing a sleeve, permitting the utilisation of the said stress in the tool 14.

The main advantage of the installation of the present invention lies in that all the operations are carried out without having to move the round bar for concrete or having to reposition it and thus avoid all the positioning and centering operations which would be obligatory in order to carry out the various machining stages.

Thus, on the round bar for concrete and more precisely on the ends thereof, a reinforcement will be able to be carried out by double upsetting, a first axial upsetting by the means 13 for cold upsetting, and a second radial upsetting during filleting by the rolling tool 18. This manner of procedure allows the cold upsetting pressures to be reduced, allows the cold upsetting to be facilitated by working on a machined diameter, allows the hardened surface to be eliminated,



i.e. the skin of the round bar for concrete, and its ribs, due to the surface removal.

Of course, other forms of embodiment of the present invention, within the scope of the specialist in the art, could have been envisaged without, however, departing from the framework of the present application.

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Claims

1. A method for the creation of a mechanical connection of round bars for concrete, which will be used in particular in the field of construction in concrete, by which at least one round bar for concrete (1) is connected to another round bar for concrete (2), or to an anchorage point, by means of a tapped connection sleeve (3), said round bar for concrete (1) having a nominal section Φ , and at least one reinforced end (4), upset and filleted, such that the diameter at the base of the fillet d_2 is equal to or greater than the nominal section Φ of the round bar, characterised in that the reinforced end (4) is effected by double upsetting, a first axial upsetting (7) allowing the diameter of the round bar for concrete to increase, and a second radial upsetting (8) when filleting is carried out by a rolling technique.
2. A method according to Claim 1, characterised in that:
 - prior to filleting, the end (4) of the round bar for concrete which is to be connected undergoes a cold upsetting so as to create a reinforced zone having a diameter corresponding at least substantially to the fillet sides diameter d_4 ,
 - a filleting (9) is carried out on said reinforced zone (7) by rolling so that the diameter at the base of the thread d_2 is equal to or greater than said nominal section Φ .
3. A method according to Claim 1, characterised in that the upsettings (7, 8) are carried out over the length of the filleting of the said end (4).
4. A method according to Claim 1, characterised in that the first upsetting (7) is carried out at a rate of increase of the diameter of the end which is close to 15 %.
5. A method according to Claim 1, characterised in that after the filleting of



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the said upset end, the said filleted end is stressed mechanically by compression.

6. A method according to Claim 2, characterised in that:

- the end of the crude round bar has its surface removed to take off the exterior ribs,
- a cold upsetting is carried out, creating an axial thrust on the end so as to obtain a diameter close to the fillet sides diameter d_4 ,
- the upset extent is adjusted to calibrate it and to carry out the desired filleting by rolling.

7. A mechanical connection of a round bar for concrete to an anchorage point, obtained by implementing the method according to any one of Claims 1 to 6.

8. A mechanical connection of round bars for concrete end to end substantially coaxially obtained by implementing the method according to any one of Claims 1 to 6.

9. A round bar for concrete permitting the implementation of the method according to any one of Claims 1 to 6, characterised in that at least one of its ends (4) carries a double upsetting (7, 8) such that the fillet base diameter d_2 is greater than or equal to the nominal section of the round bar for concrete Φ .

10. An installation for the preparation of round bars for concrete to permit the implementation of the method according to any one of Claims 1 to 6, characterised in that it has:

- a) means (11) for immobilising the round bar (1) which is to be prepared,
- b) means (13) for the cold upsetting axially of the end (4) of the round bar for concrete,
- c) means (16, 17) for removing the surface from the extent which is to be



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upset and/or filleted,

d) means (18) for carrying out a filleting by rolling of the said end,
said means b), c), d) being movable so as to be placed coaxially in the axis (22)
of the round bar for concrete which is locked in the immobilisation means (11).



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