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The subject of the present invention is a device for joining or anchoring high-bond reinforcement bars for reinforced concrete, and a method for obtaining it.

When a reinforced concrete construction is to be built in phases, or when the lengths of reinforcement bar required are not available, because they are greater than those of standard bars, it is known how to arrange several bars end to end and join their ends together.

The most traditional solution consists in overlapping the ends of the two reinforcement bars, with a minimum overlap length which is greater than or equal to fifty times the diameter of the bars. Thus, bars of a diameter of 40 mm should be overlapped over a length of 2 m. The ends of the reinforcement bars therefore have to be left waiting, which is a hindrance to staff safety, and may pose a problem of size as regards the first part of construction achieved. Furthermore, with such overlapping, the two overlapping bar ends have to be bound to hold them together before the concrete is poured.

Next, it has been envisaged to join two ends of bars together by placing these two ends end to end, and connecting them using an adaptor sleeve which provides mechanical continuity. This joining operation is also known as butt-jointing.

A first solution consists in making tapered screw threads at the ends of the two bars to be assembled, and in connecting them using a coupling or adaptor sleeve in the form of a nut including two tapered screw threads, as described in Document US 3,415,552.

It is also known to produce such a joint by making cylindrical screw threads at the ends of the bars, and by assembling them using adaptor sleeves forming nuts. This assembly can be achieved with a reduction in the cross section of the bars in the threaded region, as described in Document GB 1,546,253. This reduction in cross section, in conjunction with the manufacturing method, results in a loss of strength of the components.

It is also possible to employ cylindrical screw threads without reducing cross section, by first of all



upsetting the ends of the bars in the cold state or in the hot state in order to increase their cross section, the machining employed to obtain the screw thread making it possible to return the ends of the bars to the cross
5 section which they have over the rest of their length, as described in Documents FR 2,626,600 and FR 2,639,054.

It is also known to produce the joint between two bars by forging a coupling in a female bar, and screw-threading the male end of the other bar, possibly after
10 forging, as described in Document US 4,619,096.

According to another technique, the ends of the reinforcement bars are not modified and they are joined together by a crimped adaptor sleeve, as described in the Document US 4,241,490. In such a case, the crimping
15 operation has to be carried out actually on site, requiring the use of a machine.

It is also known to assemble the ends of non-threaded bars, by employing an adaptor sleeve, the inside face of which is smooth, including tapped radial drillings designed for the passage of screws which press the
20 bars against notched surfaces, for example ones in the form of racks, rendered integral with the inside face of the adaptor sleeve. This technique, described in the Document GB 2,220,241, requires a coupling with transverse dimensions which are substantial by comparison with
25 those of the reinforcement bars to be assembled.

In the various cases spoken of above, the external cross section of the adaptor sleeve may be cylindrical, polygonal, oblong, or even square.

30 In reinforced concrete, it is appropriate to produce good bonding of the reinforcement bars relative to the concrete. This bonding is obtained via elements projecting from the outside face of the reinforcement bars, these elements consisting of striations also known
35 as ribs. In Europe, these are often oblique crescent-shaped ribs arranged along two edges each extending over approximately 180°, with or without reversal of the direction of inclination of the ribs from one edge to another. The two edges may be separated by longitudinal

ribs or flaps. The bonding of the reinforcement to the concrete may also be provided by virtue of ribs extending over a smaller portion of the circumference of the reinforcement, thus constituting more than two edges. It
5 may alternatively be provided by hollow markings in the reinforcement, grouped into two edges or more.

In a known fashion, the couplings or adaptor sleeves have a smooth surface. This results in discontinuity of the bonding between the butt-joined reinforcement bars and the concrete at the outside face of the
10 coupling.

In other cases, the parts of construction which are to be attached have different directions, most often orthogonal. This is the case, for example, of walls or
15 posts which are to be attached to the foundations on which they rest, or of floors relative to the bearing walls or to the posts. These elements to be attached are reinforced with bars which are specific to their function in the construction, and it is not possible to use the
20 fact of making their reinforcement continuous, in order to attach them. It is known to attach them by extending the reinforcements of one, generally the one made in the second instance, into the concrete of the other, so that they become anchored therein. Thus, the loadings from the
25 second construction element are transmitted through these extended reinforcements to the concrete of the first construction element. The anchoring parts and the reinforcements associated with these anchoring parts being situated in two construction parts made during different
30 phases of the construction, may be joined together in the same way as the reinforcements of the construction elements situated in the same direction, by overlapping, or butt-joining, as indicated before.

In the case where the reinforcements transmit the
35 maximum load that they can withstand to the concrete, the rules of calculation imply that the reinforcements have to be sealed either over a straight length equal to fifty times their nominal diameter or after shaping, that is to say bending, bearing in mind the radius of curvature



which is a function of the diameter of the reinforcement bar in question.

It is clear from the foregoing that the anchoring of reinforcements into concrete requires substantial reinforcement dimensions which, on the one hand, have an effect on the cost of the reinforcements and, on the other hand, sometimes entail overdimensioning part of the construction in order to accommodate the reinforcement anchorings.

This observation also holds true for the reinforcements situated inside one and the same part of the construction, the ends of which have to be anchored into the concrete of this constructional part, so that their central parts can correctly take the tensile forces which they are to resist.

The object of the invention is to provide an adaptor sleeve for joining together two reinforcement bars or a device for anchoring reinforcement bars, possessing excellent mechanical properties, having a modest cost price, and giving bonding of the concrete to its outside face.

To this end, the device to which the invention relates, in which the reinforcement bars include elements projecting from their outer surface, in the form of oblique elements or ribs or any other roughnesses, projecting or as hollows, giving the bars a strong bond in the concrete, optionally associated with longitudinal ribs, is characterized in that it comprises a mechanical component made from a length of high-bond reinforcement bar of greater diameter than the bars to be assembled or to be anchored, in which length an axial drilling of diameter substantially equal to that of the ends of these bars or to the largest transverse dimension of the ends thereof is made, and in which there are located means for fastening the ends of the bars, this mechanical component constituting, in the case of a joint between two bars, a coupling in which the ends of the two bars are engaged and immobilized and, in the case of the anchorage of one end of a reinforcement bar, itself forming the anchoring



device, being embedded in the concrete of part of the construction and used for the engagement and the immobilization of this end of the bar, the rest of the length of which extends either into a second part of the construction or into the same part of the construction as the anchoring device.

The mechanical component is produced from the same sort of material as that from which the bars are made. There is therefore homogeneity between the bars and the mechanical component. Since the mechanical component according to the invention is obtained by removing the central part of a reinforcement bar for reinforced concrete, it has better mechanical characteristics than the reinforcement bar itself. Indeed, the way in which reinforcement bars for reinforced concrete are manufactured, by hot-rolling or cold-rolling, gives the peripheral part of the steel greater strength properties than those obtained in the core of the steel. Furthermore, this is a product with a modest cost price because the reinforcement bars are not expensive products, so that in the case of joining two bars together, the price of the coupling, despite the machining to which it has to be subjected, particularly to form the central drilling, remains lower than or equal to that of a traditional coupling, with the additional advantage of having an outside surface exhibiting the same geometry as the outside surface of the bars assembled to each other. In the case where an anchoring device is being formed, it should be noted that it is the mechanical component itself which is all that is needed to produce the anchorage, its length and its cross section being determined so as to satisfy the required anchoring conditions. Bearing in mind the fact that the diameter of the mechanical component is substantially greater than that of the reinforcement bar, the surface area of the component in contact with the concrete is relatively great, and substantially greater than the contact surface area of a reinforcement bar of smaller cross section, for a given length. As the anchoring qualities result essentially



from the contact surface area between the anchorage device and the concrete, it is possible, by virtue of the invention, substantially to reduce the dimensions of the anchoring by comparison with current practice. This makes
5 it possible to avoid having to overdimension some parts of the construction to accommodate the anchorages for the reinforcements.

According to one possibility, the mechanical component has a threaded emerging axial drilling intended
10 to accommodate the threaded end of each bar associated with it. An adaptor sleeve or coupling is thus formed.

In a first embodiment, the axial drilling of the mechanical component has at least one tapered screw thread intended to receive the end with tapered screw
15 thread of a bar associated with it.

In a second embodiment, the axial drilling of the mechanical component has a cylindrical screw thread with parallel flights, intended to receive the end with cylindrical screw thread of each bar associated with it.

20 In these two embodiments, the shape of the flights may be chosen from various profiles known in screw threads, or created specifically for the particular use of butt-joining high-bond reinforcement bars for reinforced concrete, or anchoring high-bond reinforcement
25 bars for reinforced concrete.

According to another possibility, the inside of the axial drilling of the mechanical component is equipped with means for fastening each bar end by radially clamping the latter through radial drillings and
30 pressing it against raised surfaces formed inside the axial drilling.

According to yet another embodiment, the mechanical component has a smooth or rough axial drilling allowing each reinforcement bar to be assembled by
35 bonding.

In order to optimize the cost of butt-joining two bars, the adaptor sleeve may be equipped, on the one hand, with a fastening device and, on the other, with another fastening device described from among those



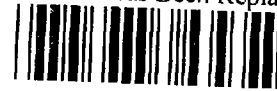
mentioned previously. It is thus possible to provide different screw threads at the two ends, or to provide one threaded end and the other end equipped with radial clamping means.

5 Advantageously, for mechanical bar/component pairings made of the same type of steel, and for a joining method using screw threads, with the nominal section of the bar being conserved in the screw thread, the device includes the following associations in which
10 the outside diameter of the elements is expressed in mm:
 - bar 14 - adaptor sleeve 25,
 - bar 16 or 20 - adaptor sleeve 32,
 - bar 25 - adaptor sleeve 40.

 A method for producing such a device consists
15 firstly in cutting a high-bond reinforcement bar into lengths, each one as long as a mechanical component and in making an axial drilling in each length, or in making a long central borehole in a reinforcement bar before cutting it into lengths, each one as long as an adaptor
20 sleeve, then in machining the inside of the drilling or in forming inside the latter means for fastening the ends of the bars to be assembled, and possibly in making radial drillings.

 In the case of an anchoring device, the axial
25 drilling may be emerging or non-emerging. All the characteristics described before, in the case of a mechanical component including an emerging drilling, are valid in the case of a mechanical component including a non-emerging drilling and intended for an anchoring device.
30 The length of such an anchoring device is deduced from the straight sealing length of reinforcement to be anchored and from the ratio between the diameter of the reinforcement to be anchored and that of the anchoring device.

35 The invention also relates to a reinforcement for reinforced concrete obtained by mechanically assembling at least two high-bond reinforcement bars using a joining device or at least one high-bond reinforcement bar and an anchoring device, characterized in that all the



constituent parts of the assembly have the same mechanical characteristics and the same characteristics of bonding to concrete.

5 In any case, the invention will be clearly understood with the aid of the description which follows with reference to the appended diagrammatic drawings which represents, by way of non-limiting examples, several embodiments of this device:

10 Figure 1 is a view of a reinforcement bar intended for the production of joining or anchoring adaptor sleeves;

Figures 2 and 3 are views of a length intended to form an adaptor sleeve during two phases in the production of an adaptor sleeve, these views being in longitudinal section and on an enlarged scale by comparison with Figure 1;

Figure 4 is a view of the coupling of Figure 3 after it has been assembled with one end of a bar;

20 Figure 5 is a view in longitudinal section of another coupling;

Figure 6 is a view in transverse section of the coupling of Figure 5 on VI-VI of Figure 5;

25 Figure 7 is an outside view of the joint between two reinforcement bars using the coupling of Figures 3 or 5;

30 Figures 8 to 10 are three diagrammatic views illustrating the use of the device according to the invention in applications to anchoring reinforcement bars respectively for attaching a post to a foundation sole, a floor to a bearing screen and an end of a girder reinforcement resting on a support;

35 Figures 11 and 12 are two views of a mechanical component intended to form an anchoring device, during two phases in the production of this device, these views being in longitudinal section and on an enlarged scale;

Figure 13 is a view of the device of Figure 12 after assembly of one end of a bar.

Figure 1 represents a high-bond steel reinforcement bar 2 for reinforced concrete comprising, projecting



from its outside surface, crescent-shaped ribs 3 arranged in an oblique fashion. Each series of ribs 3 extends over one edge arranged at approximately 180° of the periphery of the bar 2. Each edge is separated from the neighbouring edge by a longitudinal rib 4, also projecting relative to the surface of the bar.

In order to obtain elements for joining bars together, the bar 2 is cut transversely into lengths 5. The length 5 of Figure 1 is then pierced using a tool 6 in order to exhibit a central and longitudinal drilling 7. During another machining operation, a cylindrical screw thread 8 is produced in the drilling 7 so as to obtain a coupling 9 from the length 5. This coupling 9 is intended to assemble two high-bond reinforcement bars 10 together, these bars themselves also including ribs 3 and longitudinal ribs 4 on their outside faces. Each end of a bar 10 has a cylindrical screw thread 12 intended for screwing into the screw thread 8 of the coupling 9. As shown especially in Figure 4, the steel bar 2 from which the coupling 9 is produced has a greater cross section than the bar 10, the difference in cross section being such that after the drilling 7 and cylindrical screw thread 8 have been produced, the thickness of material of the coupling 9 is sufficient to provide the desired mechanical strength.

It is interesting to note that the outside surface of the coupling 9 has the same geometry as that of the bars 10 to be assembled, so that the bonding to the concrete also takes place over the coupling.

Figures 5 and 6 represent a coupling 19 produced like the coupling 9 from a length 5 of high-bond reinforcement bar, in which a drilling 7 has been made. In this case, two longitudinal rack-shaped elements 20 are welded inside the drilling 7, and at least two drillings 22 are made in the wall of the coupling, on the side opposite the racks 20. In practice, the ends of two high-bond reinforcement bars 23 are engaged in the coupling 19, and are held immobilized against the racks 20 via binding screws 24 passing through the holes 22



which are threaded.

Figure 7 shows clearly that in this case again, the outside surface of the coupling 19, the ends of which are chamfered, has the same geometry as the outside surface of the bars to be assembled.

Figure 8 represents very diagrammatically part of a construction including a foundation sole 25 made of concrete from which there extend two vertical posts 26. Each post 26 includes a concrete reinforcement consisting of bars 27, similar to those 10 described earlier. Each bar 27 is anchored into the foundation sole 25. To this end, embedded in the foundation sole 25 there is an adaptor sleeve 28 similar to the adaptor sleeve 9 of Figure 3, for example, embedded in the sole 25 and flush therewith, and into which the threaded lower end 29 of the bar 27 is screwed. In Figure 8, the adaptor sleeve 28 is represented in section in its left-hand part and as an external view in its right-hand part.

Figure 9 represents a construction including a bearing screen 30 for a floor 32. Attachment takes place using two lengths of reinforcement 33 and 34 respectively, the one 33 having a greater diameter than the one 34. The bars are anchored into the bearing screen 30 via adaptor sleeves 35, 36, respectively, which are similar to the adaptor sleeve 28.

It should be noted that this technique makes it possible to differentiate the diameter of the bars 33 and 34 as a function of their location, something which is not possible when anchorage is achieved by bending over the central part of one and the same bar, the two lengths of which are embedded in the floor.

Figure 10 represents a beam 37 associated with a support 38. Housed inside the beam 37 are reinforcement bars 40, each one of which is anchored at the support 38 using an adaptor sleeve 39 similar to the adaptor sleeve 28 of Figure 8.

It can be seen clearly from the foregoing three embodiments that the anchorage achieved is very compact, which possibly allows the dimensioning of the



constructional parts to be limited.

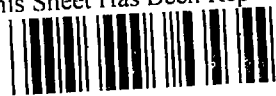
Figures 11 to 13 represent another possible embodiment of an anchoring device. As shown in Figure 11, an anchoring device may be produced from a component 5a consisting of a length of reinforcement bar in which a non-emerging axial drilling 7a is machined using a tool 6.

As shown in Figure 12, this drilling is machined making an internal screw thread 8a. This operation makes it possible to obtain an anchoring device denoted by the reference 28a.

Figure 13 represents this anchoring device 28a in which the threaded end 12 of a bar 10 is fastened.

As is clear from the foregoing, the invention provides a great improvement to the existing technique by providing a device for joining and anchoring high-bond reinforcement bars, obtained in a simple fashion, with quite a low cost, and having the geometry of the outside surface of the bars to be assembled.

It goes without saying that the invention is not limited merely to the embodiments of this device described hereinabove by way of examples, but in contrast encompasses all variations thereof. Thus in particular, the shape of the elements projecting from the reinforcement bars could be different, the means for immobilizing the ends of bars inside the coupling could be different, or the bar from which the couplings are obtained could have a long bore hole made in it in order to produce the central drilling, before being cut up into lengths, each as long as a coupling, without thereby departing from the scope of the invention.



CLAIMS

1. Device for joining or anchoring high-bond reinforcement bars for reinforced concrete, in which the reinforcement bars (10, 23) include elements projecting from their outer surface, in the form of oblique elements or ribs (3) or any other roughnesses, projecting or as hollows, giving the bars a strong bond in the concrete, optionally associated with longitudinal ribs (4), characterized in that it comprises a mechanical component (9, 19, 29, 35, 36, 39) made from a length (5) of high-bond reinforcement bar of greater diameter than the bars to be assembled or to be anchored, in which length an axial drilling (7) of diameter substantially equal to that of the ends of these bars or to the largest transverse dimension of the ends thereof is made, and in which there are located means (8, 20, 24, 29) for fastening the ends of the bars (10, 23, 27, 33, 34, 40), this mechanical component constituting, in the case of a joint between two bars, a coupling in which the ends of the two bars are engaged and immobilized and, in the case of the anchorage of one end of a reinforcement bar, itself forming the anchoring device, being embedded in the concrete of part of the construction and used for the engagement and the immobilization of this end of the bar, the rest of the length of which extends either into a second part of the construction or into the same part of the construction as the anchoring device.

2. Device according to Claim 1, characterized in that the mechanical component (9, 29) has a threaded axial drilling (7, 8) intended to accommodate the threaded end (12) of each bar (10) associated with it.

3. Device according to Claim 2, characterized in that the axial drilling of the mechanical component has at least one tapered screw thread intended to receive the end with tapered screw thread of a bar associated with it.

4. Device according to Claim 2, characterized in that the axial drilling (7) of the mechanical component has a cylindrical screw thread (8) with parallel flights,



intended to receive the end with cylindrical screw thread (12) of each bar (10) associated with it.

5. Device according to Claim 1, characterized in that the inside of the axial drilling (7) of the mechanical component (19) is equipped with means for fastening each bar end (23) by radially clamping the latter through radial drillings and pressing it against raised surfaces (20) formed inside the axial drilling.

6. Device according to any one of Claims 1 to 5, characterized in that in the case of a joint between two bars (10), the mechanical component (9) includes an emerging axial drilling.

7. Device according to any one of Claims 1 to 5, characterized in that in the case of the anchorage of a bar, the mechanical component (28a) has a non-emerging axial drilling (7a).

8. Device according to any one of Claims 1 to 7, characterized in that for mechanical bar/component pairings made of the same type of steel, and for a joining method using screw threads, with the nominal section of the bar being conserved in the screw thread, it includes the following associations in which the outside diameter of the elements is expressed in mm:

- bar 14 - adaptor sleeve 25,
- bar 16 or 20 - adaptor sleeve 32,
- bar 25 - adaptor sleeve 40.

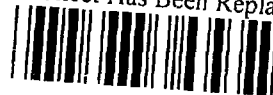
9. Method for producing a joining or anchoring device according to one of Claims 1 to 8, characterized in that it consists firstly in cutting a high-bond reinforcement bar (2) into lengths (5), each one as long as a mechanical component (9, 19) and in making an axial drilling in each length (5), or in making a long central borehole in a reinforcement bar before cutting it into lengths (5), each one as long as an adaptor sleeve (9, 19), then in machining the inside of the drilling (7) or in forming inside the latter means for fastening the ends of the bars to be assembled, and possibly in making radial drillings.

10. Reinforcement for reinforced concrete obtained by



mechanically assembling at least one high-bond reinforcement bar (10, 23) and a joining device or at least one high-bond reinforcement bar and an anchoring device according to one of Claims 1 to 8, characterized in that
5 all the constituent parts of the assembly have the same mechanical characteristics and the same characteristics of bonding to concrete.

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ABSTRACT

Device for joining or anchoring high-bond
reinforcement bars for reinforced concrete,
and method for obtaining it

5 Device in which the reinforcement bars (10)
include elements projecting from their external surface,
in the form of oblique elements or ribs (3), possibly
associated with longitudinal ribs (4), and in which the
end-to-end join between two bar ends is achieved using an
10 adaptor sleeve or coupling (9) in which the ends of the
two bars are immobilized, or in which one end of a
reinforcement bar is anchored into part of a reinforced
concrete construction.

 According to the invention, the adaptor sleeve
15 (9) or the anchoring piece is made from a length of high-
bond reinforcement bar of greater diameter than the bars,
in which an axial drilling of diameter at least equal to
that of these bars or to the greatest transverse dimen-
sion of the ends thereof is made, and in which means (8)
20 for fastening the ends of the bars (10) are located.

Figure 4

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FIG 1

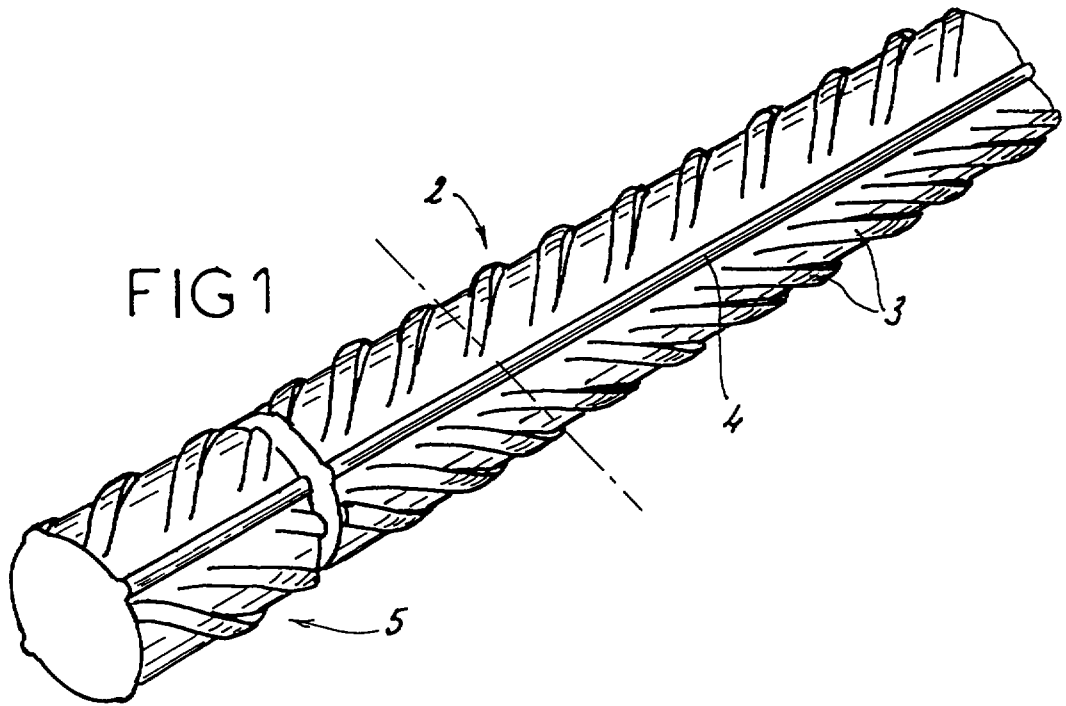


FIG 2

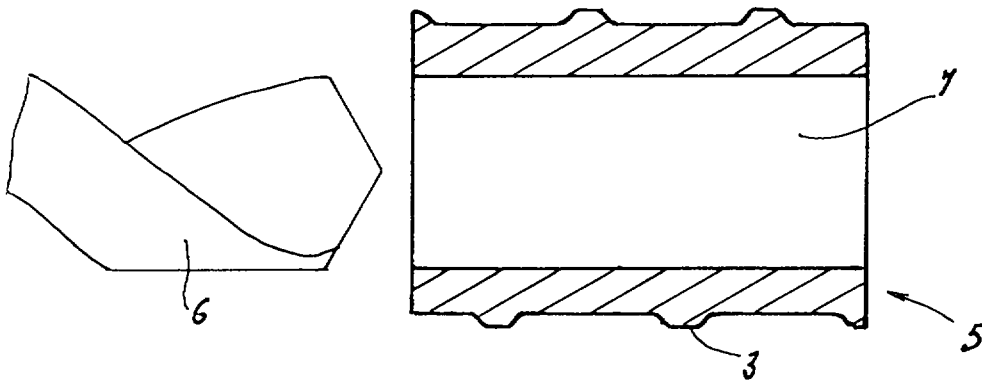
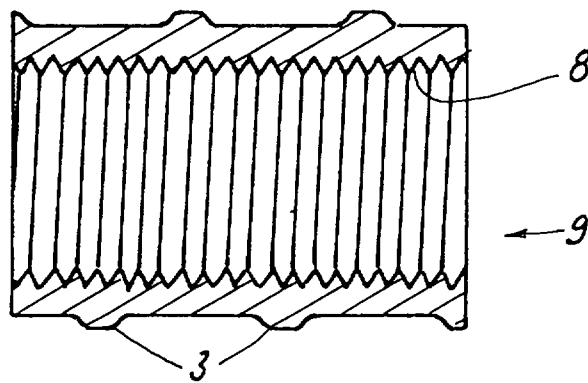
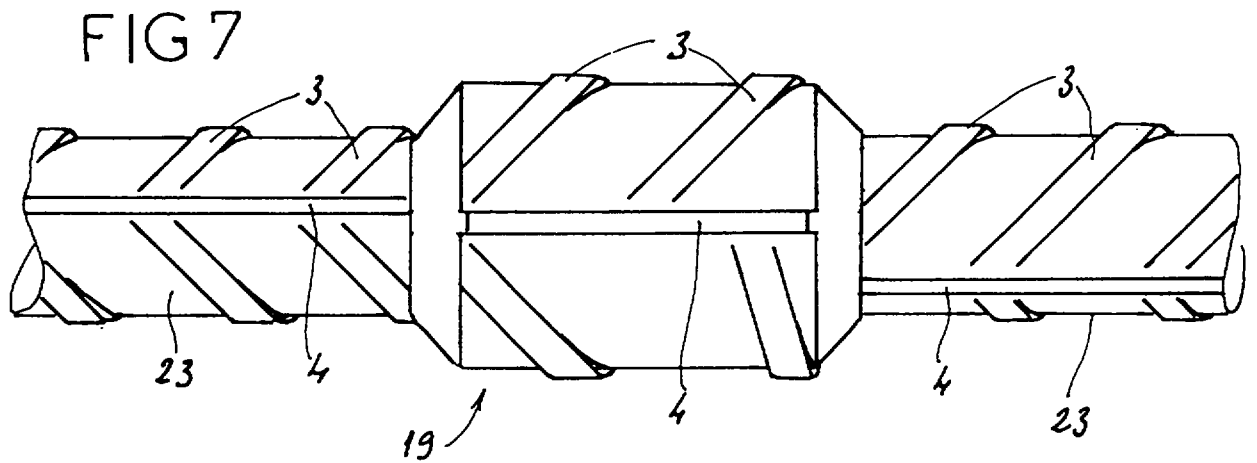
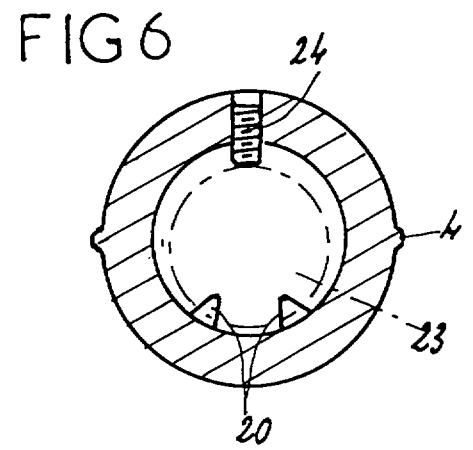
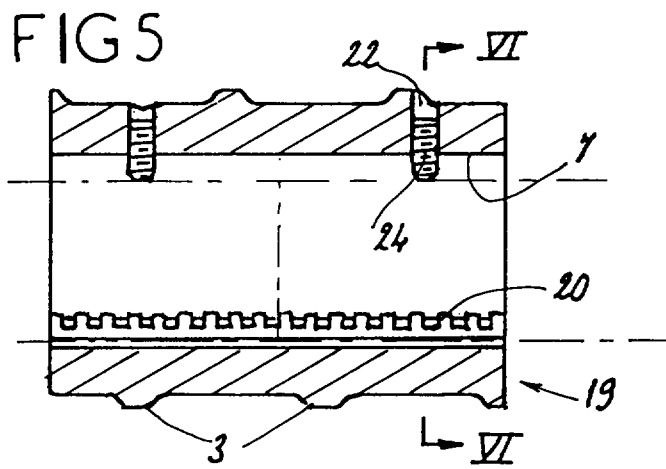
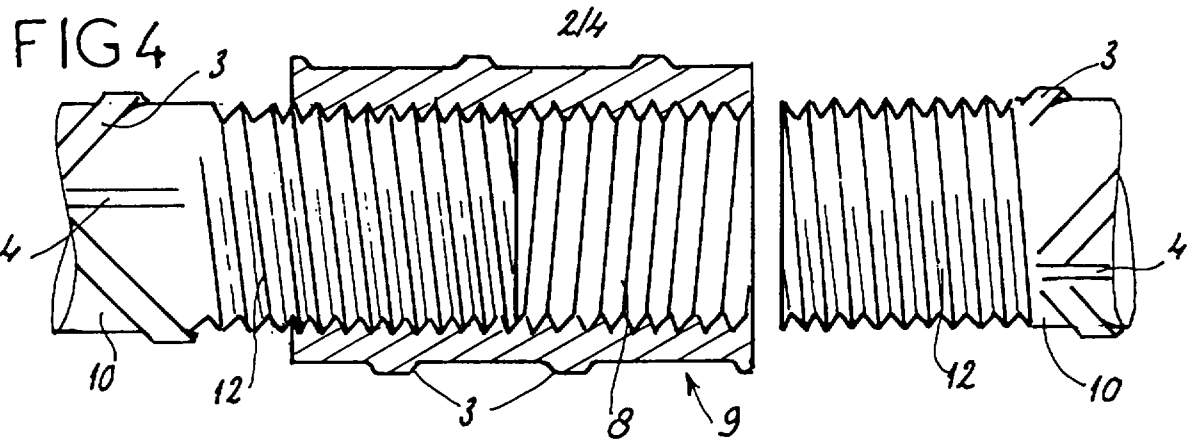
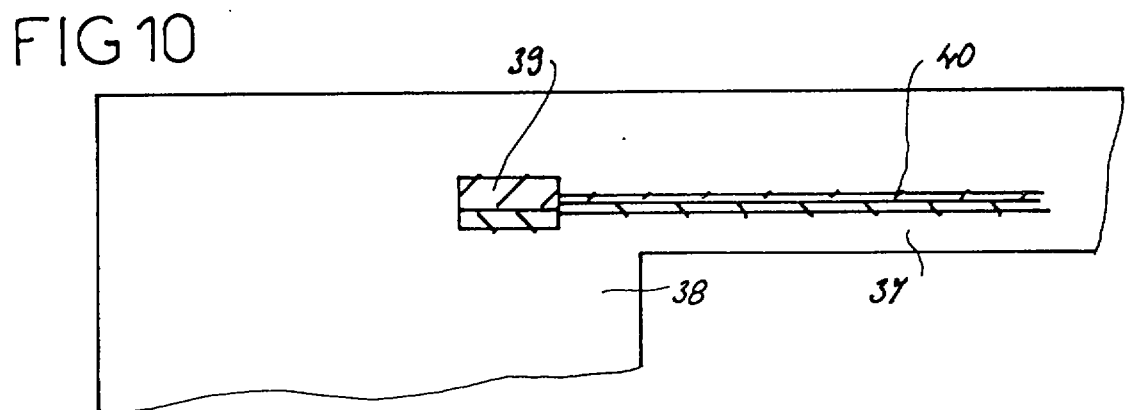
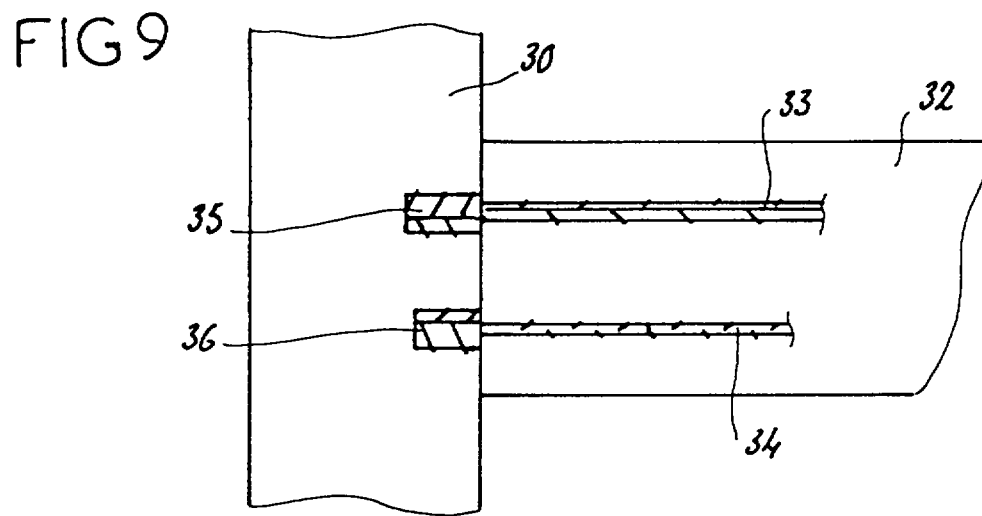
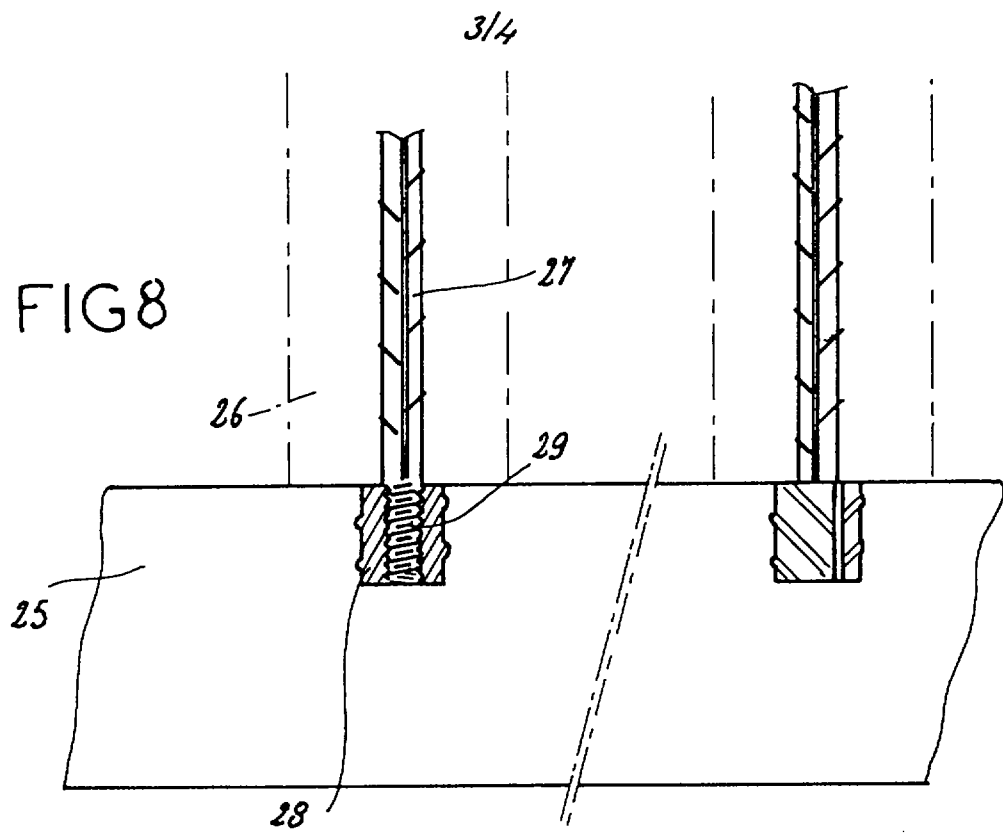


FIG 3







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FIG 11

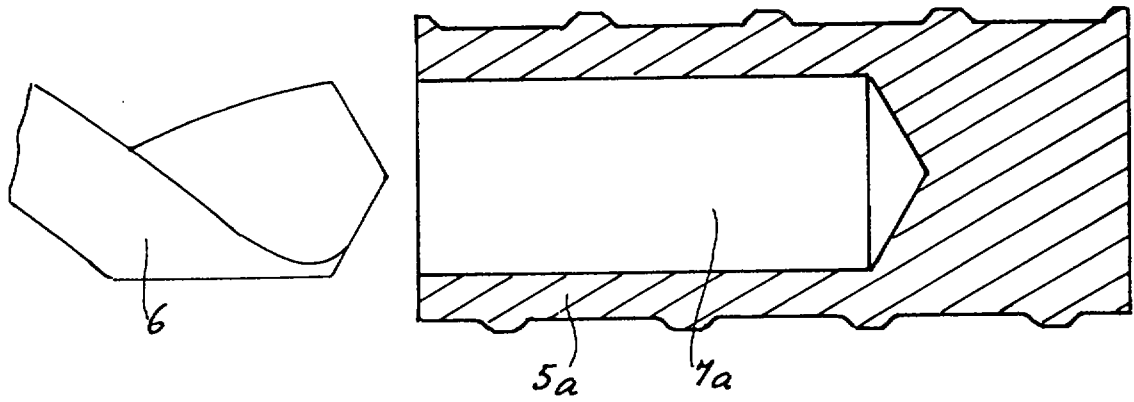


FIG 12

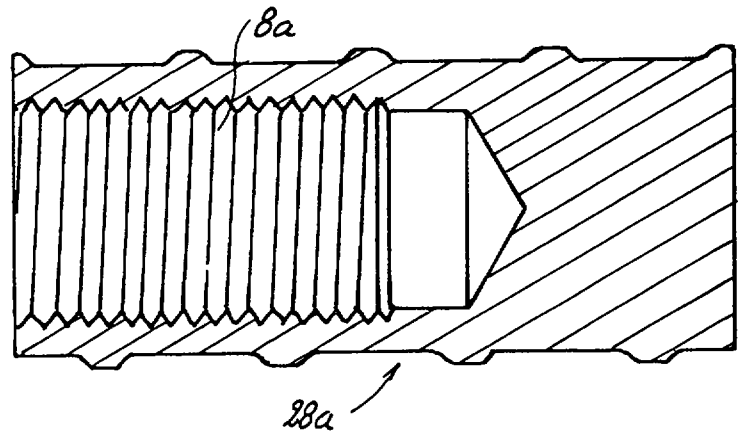
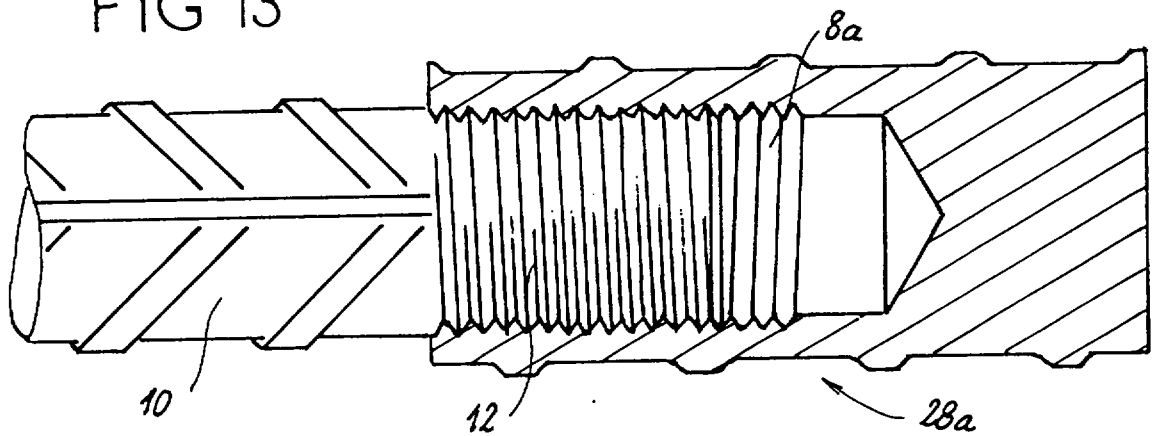


FIG 13



DEVICE FOR JOINING OR ANCHORING HIGH BOND REINFORCEMENT BARS
FOR REINFORCED CONCRETE, AND METHOD FOR OBTAINING IT

GB 2,415,552 4/10/74

The subject of the present invention is a device for joining or anchoring high-bond reinforcement bars for reinforced concrete, and a method for obtaining it.

When a reinforced concrete construction is to be built in phases, or when the lengths of reinforcement bar required are not available, because they are greater than those of standard bars, it is known how to arrange several bars end to end and join their ends together.

The most traditional solution consists in overlapping the ends of the two reinforcement bars, with a minimum overlap length which is greater than or equal to fifty times the diameter of the bars. Thus, bars of a diameter of 40 mm should be overlapped over a length of 2 m. The ends of the reinforcement bars therefore have to be left waiting, which is a hindrance to staff safety, and may pose a problem of size as regards the first part of construction achieved. Furthermore, with such overlapping, the two overlapping bar ends have to be bound to hold them together before the concrete is poured.

Next, it has been envisaged to join two ends of bars together by placing these two ends end to end, and connecting them using an adaptor sleeve which provides mechanical continuity. This joining operation is also known as butt-jointing.

A first solution consists in making tapered screw threads at the ends of the two bars to be assembled, and in connecting them using a coupling or adaptor sleeve in the form of a nut including two tapered screw threads, as described in Document US 3,415,552.

It is also known to produce such a joint by making cylindrical screw threads at the ends of the bars, and by assembling them using adaptor sleeves forming nuts. This assembly can be achieved with a reduction in the cross section of the bars in the threaded region, as described in Document GB 1,546,253. This reduction in cross section, in conjunction with the manufacturing method, results in a loss of strength of the components.

It is also possible to employ cylindrical screw threads without reducing cross section, by first of all

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upsetting the ends of the ² bars in the cold state or in the hot state in order to increase their cross section, the machining employed to obtain the screw thread making it possible to return the ends of the bars to the cross
5 section which they have over the rest of their length, as described in Documents FR 2,626,600 and FR 2,639,054.

It is also known to produce the joint between two bars by forging a coupling in a female bar, and screw-threading the male end of the other bar, possibly after
10 forging, as described in Document US 4,619,096.

According to another technique, the ends of the reinforcement bars are not modified and they are joined together by a crimped adaptor sleeve, as described in the Document US 4,241,490. In such a case, the crimping
15 operation has to be carried out actually on site, requiring the use of a machine.

It is also known to assemble the ends of non-threaded bars, by employing an adaptor sleeve, the inside face of which is smooth, including tapped radial drill-
20 lings designed for the passage of screws which press the bars against notched surfaces, for example ones in the form of racks, rendered integral with the inside face of the adaptor sleeve. This technique, described in the Document GB 2,220,241, requires a coupling with trans-
25 verse dimensions which are substantial by comparison with those of the reinforcement bars to be assembled.

In the various cases spoken of above, the external cross section of the adaptor sleeve may be cylindrical, polygonal, oblong, or even square.

30 In reinforced concrete, it is appropriate to produce good bonding of the reinforcement bars relative to the concrete. This bonding is obtained via elements projecting from the outside face of the reinforcement bars, these elements consisting of striations also known
35 as ribs. In Europe, these are often oblique crescent-shaped ribs arranged along two edges each extending over approximately 180°, with or without reversal of the direction of inclination of the ribs from one edge to another. The two edges may be separated by longitudinal

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ribs or flaps. The bonding of the reinforcement to the concrete may also be provided by virtue of ribs extending over a smaller portion of the circumference of the reinforcement, thus constituting more than two edges. It
5 may alternatively be provided by hollow markings in the reinforcement, grouped into two edges or more.

In a known fashion, the couplings or adaptor sleeves have a smooth surface. This results in discontinuity of the bonding between the butt-joined reinforcement bars and the concrete at the outside face of the
10 coupling.

In other cases, the parts of construction which are to be attached have different directions, most often orthogonal. This is the case, for example, of walls or
15 posts which are to be attached to the foundations on which they rest, or of floors relative to the bearing walls or to the posts. These elements to be attached are reinforced with bars which are specific to their function in the construction, and it is not possible to use the
20 fact of making their reinforcement continuous, in order to attach them. It is known to attach them by extending the reinforcements of one, generally the one made in the second instance, into the concrete of the other, so that they become anchored therein. Thus, the loadings from the
25 second construction element are transmitted through these extended reinforcements to the concrete of the first construction element. The anchoring parts and the reinforcements associated with these anchoring parts being situated in two construction parts made during different
30 phases of the construction, may be joined together in the same way as the reinforcements of the construction elements situated in the same direction, by overlapping, or butt-joining, as indicated before.

In the case where the reinforcements transmit the
35 maximum load that they can withstand to the concrete, the rules of calculation imply that the reinforcements have to be sealed either over a straight length equal to fifty times their nominal diameter or after shaping, that is to say bending, bearing in mind the radius of curvature

which is a function of the diameter of the reinforcement bar in question.

It is clear from the foregoing that the anchoring of reinforcements into concrete requires substantial reinforcement dimensions which, on the one hand, have an effect on the cost of the reinforcements and, on the other hand, sometimes entail overdimensioning part of the construction in order to accommodate the reinforcement anchorings.

This observation also holds true for the reinforcements situated inside one and the same part of the construction, the ends of which have to be anchored into the concrete of this constructional part, so that their central parts can correctly take the tensile forces which they are to resist.

The object of the invention is to provide an adaptor sleeve for joining together two reinforcement bars or a device for anchoring reinforcement bars, possessing excellent mechanical properties, having a modest cost price, and giving bonding of the concrete to its outside face.

To this end, the device to which the invention relates, in which the reinforcement bars include elements projecting from their outer surface, in the form of oblique elements or ribs or any other roughnesses, projecting or as hollows, giving the bars a strong bond in the concrete, optionally associated with longitudinal ribs, is characterized in that it comprises a mechanical component made from a length of high-bond reinforcement bar of greater diameter than the bars to be assembled or to be anchored, in which length an axial drilling of diameter substantially equal to that of the ends of these bars or to the largest transverse dimension of the ends thereof is made, and in which there are located means for fastening the ends of the bars, this mechanical component constituting, in the case of a joint between two bars, a coupling in which the ends of the two bars are engaged and immobilized and, in the case of the anchorage of one end of a reinforcement bar, itself forming the anchoring

device, being embedded in the concrete of part of the construction and used for the engagement and the immobilization of this end of the bar, the rest of the length of which extends either into a second part of the construction or into the same part of the construction as the anchoring device.

The mechanical component is produced from the same sort of material as that from which the bars are made. There is therefore homogeneity between the bars and the mechanical component. Since the mechanical component according to the invention is obtained by removing the central part of a reinforcement bar for reinforced concrete, it has better mechanical characteristics than the reinforcement bar itself. Indeed, the way in which reinforcement bars for reinforced concrete are manufactured, by hot-rolling or cold-rolling, gives the peripheral part of the steel greater strength properties than those obtained in the core of the steel. Furthermore, this is a product with a modest cost price because the reinforcement bars are not expensive products, so that in the case of joining two bars together, the price of the coupling, despite the machining to which it has to be subjected, particularly to form the central drilling, remains lower than or equal to that of a traditional coupling, with the additional advantage of having an outside surface exhibiting the same geometry as the outside surface of the bars assembled to each other. In the case where an anchoring device is being formed, it should be noted that it is the mechanical component itself which is all that is needed to produce the anchorage, its length and its cross section being determined so as to satisfy the required anchoring conditions. Bearing in mind the fact that the diameter of the mechanical component is substantially greater than that of the reinforcement bar, the surface area of the component in contact with the concrete is relatively great, and substantially greater than the contact surface area of a reinforcement bar of smaller cross section, for a given length. As the anchoring qualities result essentially

from the contact surface area between the anchorage device and the concrete, it is possible, by virtue of the invention, substantially to reduce the dimensions of the anchoring by comparison with current practice. This makes
 5 it possible to avoid having to overdimension some parts of the construction to accommodate the anchorages for the reinforcements.

According to one possibility, the mechanical component has a threaded emerging axial drilling intended
 10 to accommodate the threaded end of each bar associated with it. An adaptor sleeve or coupling is thus formed.

In a first embodiment, the axial drilling of the mechanical component has at least one tapered screw thread intended to receive the end with tapered screw
 15 thread of a bar associated with it.

In a second embodiment, the axial drilling of the mechanical component has a cylindrical screw thread with parallel flights, intended to receive the end with cylindrical screw thread of each bar associated with it.

20 In these two embodiments, the shape of the flights may be chosen from various profiles known in screw threads, or created specifically for the particular use of butt-joining high-bond reinforcement bars for reinforced concrete, or anchoring high-bond reinforcement
 25 bars for reinforced concrete.

According to another possibility, the inside of the axial drilling of the mechanical component is equipped with means for fastening each bar end by radially clamping the latter through radial drillings and
 30 pressing it against raised surfaces formed inside the axial drilling.

According to yet another embodiment, the mechanical component has a smooth or rough axial drilling allowing each reinforcement bar to be assembled by
 35 bonding.

In order to optimize the cost of butt-joining two bars, the adaptor sleeve may be equipped, on the one hand, with a fastening device and, on the other, with another fastening device described from among those

mentioned previously. It is thus possible to provide different screw threads at the two ends, or to provide one threaded end and the other end equipped with radial clamping means.

5 Advantageously, for mechanical bar/component pairings made of the same type of steel, and for a joining method using screw threads, with the nominal section of the bar being conserved in the screw thread, the device includes the following associations in which
10 the outside diameter of the elements is expressed in mm:

- bar 14 - adaptor sleeve 25,
- bar 16 or 20 - adaptor sleeve 32,
- bar 25 - adaptor sleeve 40.

A method for producing such a device consists
15 firstly in cutting a high-bond reinforcement bar into lengths, each one as long as a mechanical component and in making an axial drilling in each length, or in making a long central borehole in a reinforcement bar before cutting it into lengths, each one as long as an adaptor
20 sleeve, then in machining the inside of the drilling or in forming inside the latter means for fastening the ends of the bars to be assembled, and possibly in making radial drillings.

In the case of an anchoring device, the axial
25 drilling may be emerging or non-emerging. All the characteristics described before, in the case of a mechanical component including an emerging drilling, are valid in the case of a mechanical component including a non-emerging drilling and intended for an anchoring device.
30 The length of such an anchoring device is deduced from the straight sealing length of reinforcement to be anchored and from the ratio between the diameter of the reinforcement to be anchored and that of the anchoring device.

35 The invention also relates to a reinforcement for reinforced concrete obtained by mechanically assembling at least two high-bond reinforcement bars using a joining device or at least one high-bond reinforcement bar and an anchoring device, characterized in that all the

constituent parts of the assembly have the same mechanical characteristics and the same characteristics of bonding to concrete.

5 In any case, the invention will be clearly understood with the aid of the description which follows with reference to the appended diagrammatic drawings which represents, by way of non-limiting examples, several embodiments of this device:

10 Figure 1 is a view of a reinforcement bar intended for the production of joining or anchoring adaptor sleeves;

Figures 2 and 3 are views of a length intended to form an adaptor sleeve during two phases in the production of an adaptor sleeve, these views being in longitudinal section and on an enlarged scale by comparison with Figure 1;

Figure 4 is a view of the coupling of Figure 3 after it has been assembled with one end of a bar;

20 Figure 5 is a view in longitudinal section of another coupling;

Figure 6 is a view in transverse section of the coupling of Figure 5 on VI-VI of Figure 5;

25 Figure 7 is an outside view of the joint between two reinforcement bars using the coupling of Figures 3 or 5;

30 Figures 8 to 10 are three diagrammatic views illustrating the use of the device according to the invention in applications to anchoring reinforcement bars respectively for attaching a post to a foundation sole, a floor to a bearing screen and an end of a girder reinforcement resting on a support;

Figures 11 and 12 are two views of a mechanical component intended to form an anchoring device, during two phases in the production of this device, these views being in longitudinal section and on an enlarged scale;

Figure 13 is a view of the device of Figure 12 after assembly of one end of a bar.

Figure 1 represents a high-bond steel reinforcement bar 2 for reinforced concrete comprising, projecting

from its outside surface, crescent-shaped ribs 3 arranged in an oblique fashion. Each series of ribs 3 extends over one edge arranged at approximately 180° of the periphery of the bar 2. Each edge is separated from the neighbouring edge by a longitudinal rib 4, also projecting relative to the surface of the bar.

In order to obtain elements for joining bars together, the bar 2 is cut transversely into lengths 5. The length 5 of Figure 1 is then pierced using a tool 6 in order to exhibit a central and longitudinal drilling 7. During another machining operation, a cylindrical screw thread 8 is produced in the drilling 7 so as to obtain a coupling 9 from the length 5. This coupling 9 is intended to assemble two high-bond reinforcement bars 10 together, these bars themselves also including ribs 3 and longitudinal ribs 4 on their outside faces. Each end of a bar 10 has a cylindrical screw thread 12 intended for screwing into the screw thread 8 of the coupling 9. As shown especially in Figure 4, the steel bar 2 from which the coupling 9 is produced has a greater cross section than the bar 10, the difference in cross section being such that after the drilling 7 and cylindrical screw thread 8 have been produced, the thickness of material of the coupling 9 is sufficient to provide the desired mechanical strength.

It is interesting to note that the outside surface of the coupling 9 has the same geometry as that of the bars 10 to be assembled, so that the bonding to the concrete also takes place over the coupling.

Figures 5 and 6 represent a coupling 19 produced like the coupling 9 from a length 5 of high-bond reinforcement bar, in which a drilling 7 has been made. In this case, two longitudinal rack-shaped elements 20 are welded inside the drilling 7, and at least two drillings 22 are made in the wall of the coupling, on the side opposite the racks 20. In practice, the ends of two high-bond reinforcement bars 23 are engaged in the coupling 19, and are held immobilized against the racks 20 via binding screws 24 passing through the holes 22

which are threaded.

Figure 7 shows clearly that in this case again, the outside surface of the coupling 19, the ends of which are chamfered, has the same geometry as the outside surface of the bars to be assembled.

Figure 8 represents very diagrammatically part of a construction including a foundation sole 25 made of concrete from which there extend two vertical posts 26. Each post 26 includes a concrete reinforcement consisting of bars 27, similar to those 10 described earlier. Each bar 27 is anchored into the foundation sole 25. To this end, embedded in the foundation sole 25 there is an adaptor sleeve 28 similar to the adaptor sleeve 9 of Figure 3, for example, embedded in the sole 25 and flush therewith, and into which the threaded lower end 29 of the bar 27 is screwed. In Figure 8, the adaptor sleeve 28 is represented in section in its left-hand part and as an external view in its right-hand part.

Figure 9 represents a construction including a bearing screen 30 for a floor 32. Attachment takes place using two lengths of reinforcement 33 and 34 respectively, the one 33 having a greater diameter than the one 34. The bars are anchored into the bearing screen 30 via adaptor sleeves 35, 36, respectively, which are similar to the adaptor sleeve 28.

It should be noted that this technique makes it possible to differentiate the diameter of the bars 33 and 34 as a function of their location, something which is not possible when anchorage is achieved by bending over the central part of one and the same bar, the two lengths of which are embedded in the floor.

Figure 10 represents a beam 37 associated with a support 38. Housed inside the beam 37 are reinforcement bars 40, each one of which is anchored at the support 38 using an adaptor sleeve 39 similar to the adaptor sleeve 28 of Figure 8.

It can be seen clearly from the foregoing three embodiments that the anchorage achieved is very compact, which possibly allows the dimensioning of the

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constructional parts to be limited.

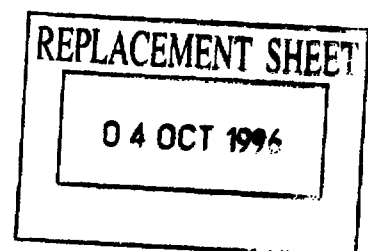
Figures 11 to 13 represent another possible embodiment of an anchoring device. As shown in Figure 11, an anchoring device may be produced from a component 5a consisting of a length of reinforcement bar in which a non-emerging axial drilling 7a is machined using a tool 6.

As shown in Figure 12, this drilling is machined making an internal screw thread 8a. This operation makes it possible to obtain an anchoring device denoted by the reference 28a.

Figure 13 represents this anchoring device 28a in which the threaded end 12 of a bar 10 is fastened.

As is clear from the foregoing, the invention provides a great improvement to the existing technique by providing a device for joining and anchoring high-bond reinforcement bars, obtained in a simple fashion, with quite a low cost, and having the geometry of the outside surface of the bars to be assembled.

It goes without saying that the invention is not limited merely to the embodiments of this device described hereinabove by way of examples, but in contrast encompasses all variations thereof. Thus in particular, the shape of the elements projecting from the reinforcement bars could be different, the means for immobilizing the ends of bars inside the coupling could be different, or the bar from which the couplings are obtained could have a long bore hole made in it in order to produce the central drilling, before being cut up into lengths, each as long as a coupling, without thereby departing from the scope of the invention.



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1. Device for joining or anchoring high-bond reinforcement bars for reinforced concrete, in which the reinforcement bars (10, 23) include elements projecting from their outer surface, in the form of oblique elements or ribs (3) or any other roughnesses, projecting or as hollows, giving the bars a strong bond in the concrete, optionally associated with longitudinal ribs (4), characterized in that it comprises a mechanical component (9, 19, 29, 35, 36, 39) made from a length (5) of high-bond reinforcement bar of greater diameter than the bars to be assembled or to be anchored, in which length an axial drilling (7) of diameter substantially equal to that of the ends of these bars or to the largest transverse dimension of the ends thereof is made, and in which there are located means (8, 20, 24, 29) for fastening the ends of the bars (10, 23, 27, 33, 34, 40), this mechanical component constituting, in the case of a joint between two bars, a coupling in which the ends of the two bars are engaged and immobilized and, in the case of the anchorage of one end of a reinforcement bar, itself forming the anchoring device, being embedded in the concrete of part of the construction and used for the engagement and the immobilization of this end of the bar, the rest of the length of which extends either into a second part of the construction or into the same part of the construction as the anchoring device.

2. Device according to Claim 1, characterized in that the mechanical component (9, 29) has a threaded axial drilling (7, 8) intended to accommodate the threaded end (12) of each bar (10) associated with it.

3. Device according to Claim 2, characterized in that the axial drilling of the mechanical component has at least one tapered screw thread intended to receive the end with tapered screw thread of a bar associated with it.

4. Device according to Claim 2, characterized in that the axial drilling (7) of the mechanical component has a cylindrical screw thread (8) with parallel flights,

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intended to receive the end with cylindrical screw thread (12) of each bar (10) associated with it.

5. Device according to Claim 1, characterized in that the inside of the axial drilling (7) of the mechanical component (19) is equipped with means for fastening each bar end (23) by radially clamping the latter through radial drillings and pressing it against raised surfaces (20) formed inside the axial drilling.

6. Device according to any one of Claims 1 to 5, characterized in that in the case of a joint between two bars (10), the mechanical component (9) includes an emerging axial drilling.

7. Device according to any one of Claims 1 to 5, characterized in that in the case of the anchorage of a bar, the mechanical component (28a) has a non-emerging axial drilling (7a).

8. Device according to any one of Claims 1 to 7, characterized in that for mechanical bar/component pairings made of the same type of steel, and for a joining method using screw threads, with the nominal section of the bar being conserved in the screw thread, it includes the following associations in which the outside diameter of the elements is expressed in mm:

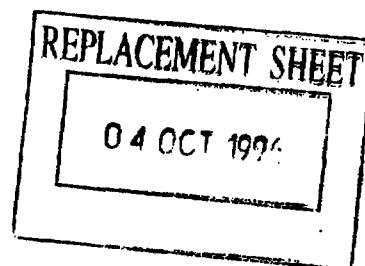
- bar 14 - adaptor sleeve 25,
- bar 16 or 20 - adaptor sleeve 32,
- bar 25 - adaptor sleeve 40.

9. Method for producing a joining or anchoring device according to one of Claims 1 to 8, characterized in that it consists firstly in cutting a high-bond reinforcement bar (2) into lengths (5), each one as long as a mechanical component (9, 19) and in making an axial drilling in each length (5), or in making a long central borehole in a reinforcement bar before cutting it into lengths (5), each one as long as an adaptor sleeve (9, 19), then in machining the inside of the drilling (7) or in forming inside the latter means for fastening the ends of the bars to be assembled, and possibly in making radial drillings.

10. Reinforcement for reinforced concrete obtained by



mechanically assembling at least one high-bond reinforcement bar (10, 23) and a joining device or at least one high-bond reinforcement bar and an anchoring device according to one of Claims 1 to 8, characterized in that
5 all the constituent parts of the assembly have the same mechanical characteristics and the same characteristics of bonding to concrete.



ABSTRACT

Device for joining or anchoring high-bond reinforcement bars for reinforced concrete, and method for obtaining it

5 Device in which the reinforcement bars (10) include elements projecting from their external surface, in the form of oblique elements or ribs (3), possibly associated with longitudinal ribs (4), and in which the end-to-end join between two bar ends is achieved using an
10 adaptor sleeve or coupling (9) in which the ends of the two bars are immobilized, or in which one end of a reinforcement bar is anchored into part of a reinforced concrete construction.

 According to the invention, the adaptor sleeve
15 (9) or the anchoring piece is made from a length of high-bond reinforcement bar of greater diameter than the bars, in which an axial drilling of diameter at least equal to that of these bars or to the greatest transverse dimension of the ends thereof is made, and in which means (8)
20 for fastening the ends of the bars (10) are located.

Figure 4

