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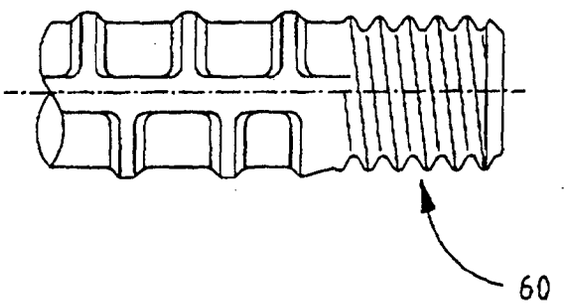
(54) Method of working connection end of deformed bar for reinforcing concrete, deformed bar worked by the method and structure of connecting deformed bar

(57) With an object of providing a method of working a connection end portion of deformed bar for reinforcing concrete considerably reducing working expense by enhancing easiness of working by promoting mechanical strength of a connection portion by being able to work the connection portion without destructing a steel skeleton structure of a connection portion between pieces of steel bar, deformed bar worked by the method and a connection structure of deformed bar, the invention provides a method of working a connection end portion of deformed bar for reinforcing concrete featured in comprising a swaging step in which in deformed bar for reinforcing concrete featured in swaging at least a connection end portion at normal temperature and forming a rolled thread portion at an outer peripheral face of the connection end portion of the deformed bar subjected to the swaging step in which at least one connection end portion is swaged at a 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

a rolling step of forming a thread portion having a diameter substantially equal to a swaging diameter at an outer peripheral face of the connection end portion of the deformed bar which has been subjected to the swaging step.

FIG.1E



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Description

BACKGROUND OF THE INVENTION

1. Field of The Invention

[0001] The present invention relates to a method of working a thread at a connection end of deformed bar for reinforcing concrete for forming a framework of a construction object at sites of construction and civil engineering works, deformed bar worked by the method and a connection structure of deformed bar.

2. Description of the Prior Art

[0002] Generally, at sites of construction and civil engineering works, after building a basic framework by using deformed bar for reinforcing concrete, in a procedure of applying and curing concrete, a construction object is erected. In this case, deformed bar refers to bar having projections on the surface, projection in the axial direction refers to "rib" and projection other than in the axial direction refers to "node".

[0003] Further, deformed bar for reinforcing concrete mentioned above is supplied by being cut in a predetermined length and accordingly, depending on a size of a construction object, deformed bar for reinforcing concrete is used by being cut or by being cut to a necessary length by mutually connecting pieces thereof.

[0004] Further, in mutually connecting pieces thereof, there is used a latching process in which connection end portions of respective pieces of deformed bar are made to overlap, thereafter, bound by steel wires.

[0005] However, loss of material is enormous since connection end portions of the respective pieces of deformed bar are used to overlap, pieces of deformed bar are connected by using steel wires and accordingly, there poses a problem in which connection portions are agingly weakened and considerable labor cost is required in respect of connecting operation.

[0006] Further, a steel skeleton connected by the latching process achieves a feature of the connected steel skeleton structure only after applying concrete mortar and completing curing operation by the force of adhering the steel skeleton with concrete and accordingly, when there causes trouble accidentally in concrete mortar or in the curing operation, the fragile structural feature of a structure may emerge.

[0007] As a method of resolving such a problem, there has been proposed a hot upsetting method of connection end portions which is a kind of a mechanical method of connection. This method is a method of upsetting the connection end portions by exerting force in the axial direction of deformed bar after heating the connection end portions.

[0008] However, there may also cause loss of material by shrinking the length of deformed bar.

[0009] Further, heat is locally applied to the connection end portions and accordingly, there poses a problem in which the elongation rate is decreased by a change in the material structure of the connection end portions between a portion affected by heat and a portion not affected by heat, the connection end portion becomes weak at impact and irregular structure distribution emerges by partial heating.

[0010] Further, in order to resolve the problem, there has been developed a cold process which is a method different from the above-described.

[0011] That is, according to the method, connection end portions are upset by exerting large pressure on the connection end portions along the axial direction of deformed bar at normal temperature (FIG. 5). In the process, there have been proposed a first method in which a cut thread portion is formed at the connection end portion and a second method in which a rolled thread portion is formed after finishing the cutting operation for skimming the upset connection end portion.

[0012] Incidentally, among them, the first method has been developed by Techniport S.A. and is disclosed in Korean Examined Patent Publication No. 94-8311 and corresponding U.S. Patent 5,158,527 and the second method has been developed by CCL of Great Britain and is disclosed in British Patent 2,286,782 A.

[0013] However, according to deformed bar worked by the upsetting method, there were problems that the tensile strength and the hardness become extremely high by work hardening and a value of impact absorption energy is rapidly decreased.

[0014] Meanwhile, when a metallographic structure (FIG. 6A and FIG. 6B) of an upset connection end portion of deformed bar is compared with a metallographic structure (FIG. 7A and FIG. 7B) of original material, FIG. 6A and FIG. 7A respectively show mctallographic structures along the axial direction of the upset material and the original material and it is known that in FIG. 7A, while ferrite and pearlite structures progress long and continuously in the axial direction, in FIG. 6A, the continuity of the metallographic structure in the axial direction is interrupted.

[0015] Further, FIG. 6B and FIG. 7B respectively show structures along a direction orthogonal to the axis of the upset and the original materials and it is known that while according to the original material of FIG. 7B, ferrite and pearlite structures are uniformly distributed, according to the upset portion of FIG. 6B, the metallographic structure is considerably coarsened. Thereby, it is known that the structure of the upset portion is nonuniformly formed.

SUMMARY OF THE INVENTION

[0016] In order to resolve the above-described problem, it is an object of the invention to provide a method of working a thread of a connection end portion of deformed bar for reinforcing concrete and a structure of connecting deformed bar worked in accordance with the

method.

[0017] Further, it is other object of the invention to provide a method of working a connection end portion of deformed bar for reinforcing concrete capable of maintaining a fibrous structure inherent to deformed bar by not carrying out cutting operation and a connection structure of deformed bar obtained by using the method.

[0018] Further, it is other object of the invention to provide a method of working a connection end portion of deformed bar for reinforcing concrete for making a structure remain unchanged by not applying heat and a connection structure of deformed bar obtained by using the method.

[0019] Further, it is other object of the invention to provide a method of working a connection end portion of deformed bar for reinforcing concrete for compensating for a weakness in a structure caused by work hardening by not upsetting the connection end portion and a connection structure of deformed bar worked by the method.

[0020] In order to realize such a problem, according to the invention, there is provided a method of working a connection end portion of deformed bar for reinforcing concrete characterized in comprising a swaging step in which in the deformed bar for reinforcing concrete, at least one connection end portion of the deformed bar for reinforcing concrete having ribs and a number of nodes is swaged at a 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

a rolling step of forming a thread portion having a diameter substantially equal to a swaging diameter at an outer peripheral face of the connection end portion of the deformed bar which has been subjected to the swaging step.

[0021] Further, according to the invention, there is provided a deformed bar for reinforcing concrete characterized in that at least one connection end portion is swaged at a normal temperature and a rolled thread portion is formed at the one connection end portion of the deformed bar subjected to the swaging step.

[0022] Further, the invention is featured in a connection structure of a deformed bar for reinforcing concrete in which at least one connection end portion is swaged at a normal temperature and pieces of the deformed bar each formed with a rolled thread portion at an outer peripheral face thereof which has been subjected to the swaging step are connected by a connector having a thread in a mode in correspondence with the rolled thread.

BRIEF ESCRIPTION OF THE DRAWINGS

[0023] FIG. 1A through FIG. 1E are stage views showing a method of working a connection end portion of deformed bar for reinforcing concrete according to the invention.

[0024] FIG. 2 is a view enlarging a thread portion of FIG. 1E.

[0025] FIG. 2A and FIG. 2B are views showing preferred embodiments of thread portions.

[0026] FIG. 3A is a metallographic structure diagram along an axial direction of a connection end portion according to the invention.

[0027] FIG. 3B is a metallographic structure view along a direction orthogonal to an axis of the connection end portion according to the invention.

[0028] FIG. 4 illustrates state views for connecting deformed bar according to the invention by couplers.

[0029] FIG. 5 is a state view in which a connection end portion of deformed bar for reinforcing concrete in line with a conventional technology is upset.

[0030] FIG. 6A is a metallographic structure diagram along an axial direction of the connection end portion of FIG. 5.

[0031] FIG. 6B is a metallographic structure diagram along a direction orthogonal to an axis of the connection end portion of FIG. 5.

[0032] FIG. 7A is a metallographic structure diagram along an axial direction of an original material used in the invention and the conventional technology.

[0033] FIG. 7B is a metallographic structure diagram along a direction orthogonal to an axis of the original material used in the invention and the conventional technology.

[0034] FIG. 8A and FIG. 8B are a front view and a side view of dies showing a state of swaging a connection end portion of deformed bar for reinforcing concrete.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0035] A further detailed explanation will be given of preferred embodiments according to the invention in reference to the drawings as follows.

[0036] FIG. 1A shows deformed bar for reinforcing concrete before working and a deformed bar for reinforcing concrete 100 is constituted by a cylindrical body 10 and ribs 30 and nodes 20 formed on an outer peripheral face thereof at equal intervals.

[0037] Further, as shown by FIG. 1A, according to a long piece of deformed bar, a connection end portion 40 may normally be bent relative to an intermediary portion of deformed bar.

[0038] Further, FIG. 1B shows a swaging step in which deformed bar is inserted into swaging dies (FIG. 8A is a front view, FIG. 8B is a side view) constituted by 2 or more of pieces or rollers, thereafter, hydraulic or mechanical force is exerted and swaging is carried out at normal temperature.

[0039] Further, the projected ribs 30 and the nodes 20 of the connection end portion 40 shown by FIG. 1A are pressed such that diameters thereof become substan-

tially equal to a diameter 11 of the cylindrical body of the deformed bar 100.

[0040] In this way, an axis 19 of the cylindrical body 10 is aligned to be concentric with an axis 59 of a swaged portion 50. By being processed by the step, deformed projection portions of the ribs 30 or deformation of a steel skeleton bar member can be finished to be straight.

[0041] Thereafter, a section of the connection end portion 50 projected by the swaging step is machined similar to FIG. 1C, a section 53 is flattened by facing and chamfering and an edge 55 at an outer periphery of the section 53 is faced.

[0042] FIG. 1E is a state view showing a state of deformed bar finished with working operation.

[0043] In this way, by restraining destruction of a thread at a corner in handling deformed bar, fastening force of deformed bar is promoted.

[0044] Further, a thread portion 60 is formed by rolling an outer peripheral face of the swaged portion 50 similar to FIG. 1E.

[0045] Further, an outer diameter 61 of the rolled thread portion 60 is formed to be equal to or slightly larger than the diameter 11 ofthe cylindrical body 10.

[0046] In this way, the metallographic structure ofthe thread portion material according to the invention is not cut, according to the plastically worked thread portion, the mechanical strength is promoted, the metallographic structure becomes dense, at the same time, an inner portion of the connection portion maintains an inherent structure and accordingly, the connection portion withstands large load and impact.

[0047] FIG. 3A and FIG. 3B show photographs of a structure of a connection end portion of deformed bar according to the invention. FIG. 3A shows a metallographic structure along the axial direction of deformed bar and it is known that the continuity of ferrite and pearlite structures shown by FIG. 7A emerges further clearly and the structure also becomes dense.

[0048] Further, FIG. 3B shows a metallographic structure along a direction orthogonal to an axis of deformed bar and the structure emerges more densely than the ferrite and pearlite structures shown by FIG. 7B.

[0049] Meanwhile, in working the thread portion, although various kinds of threads such as a circular thread or a triangular thread and the like can be worked, the thread portion is worked by a circular thread more preferably.

[0050] For example, threads can be worked as shown by FIG. 2A and FIG. 2B.

[0051] The reason is that when the working is carried out by a circular thread, the section of a thread ridge is rounded and a tooth root portion is constituted thickly as in a trapezoidal thread and accordingly, the resistance force is intensified, as a result, not only a notch phenomenon does not occur but also a fastening force is intensified and the thread can be fastened easily at a construction site replete with dust or sand.

[0052] Further, when the pitch of the circular thread is narrowed more than that of a general thread, not only the fastening force and the strength are promoted but also there is no concern of relaxation even when considerable vibration is caused.

[0053] Further, a stress concentration phenomenon can be restrained by gradually increasing a groove diameter 63 of a thread ridge at a boundary 65 contiguous to the rib 30 and the node 20 from the rolled thread portion 60 as shown by FIG. 2.

[0054] Further, although there is illustrated the deformed bar 100 for reinforcing concrete formed with the ribs 30 and the nodes 20 in FIG. 1A, the invention is not limited thereto but is applicable to deformed bar for reinforcing concrete having ribs formed in slanted lines or X-like lines.

[0055] There is shown in FIG. 4 a method of connecting pieces of deformed bar for reinforcing concrete formed as described above, there is adopted a coupler 200 provided with nut portions (Figs. 4B, 4C) in correspondence with a shape of the rolled thread portion 60 for connecting the rolled thread portions 60 formed at the connection end portions 40 of respective pieces of the deformed bar 100.

[0056] As described above, according to the invention, by enabling to work a connection portion of deformed bar for reinforcing concrete used at sites of construction and civil engineering works without destructing a steel skeleton structure of the connection portion, the mechanical strength of the connection portion can be promoted.

[0057] Further, the connection portion can be formed by swaging dies and rolling and accordingly, fabrication thereof is extremely facilitated, further, reduction in fabrication expense accompanied thereby is made possible. Particuiady, when the connection portion is fabricated by a circular thread, there is achieved an advantage in which fastening is facilitated, connecting operation is much facilitated, shortening of a construction time period as well as a reduction in expense are achieved, compared with a connection structure of deformed bar fabricated by a conventional upsetting system, the length of deformed bar can be maintained as it is and accordingly, about 1 through 2 % of material can be saved.

Claims

1. A method of working a connection end portion of deformed bar for reinforcing concrete characterized in comprising a swaging step in which in a cylindrical body of the deformed bar for reinforcing concrete, at least one connection end portion of the deformed bar in the deformed bar for reinforcing concrete having ribs and a number of nodes is swaged at a normal temperature such that a maximum diameter of the connection end portion is equal to or slightly larger than a diameter of the cylindrical body

or slightly smaller than a diameter of the deformed bar depending on a degree of working; and

a rolling step of forming a thread portion having a diameter substantially equal to a swaging diameter at an outer peripheral face of the at least one connection end portion of the deformed bar which has been subjected to the swaging step.

2. The method of working a connection end portion of deformed bar for reinforcing concrete according to Claim 1, characterized in that an axis of the connection end portion of the deformed bar which has been subjected to the swaging step is aligned concentrically with an axis of a cylindrical body of the deformed bar formed with the ribs and the nodes.

3. The method of working a connection end portion of deformed bar for reinforcing concrete according to Claim 1, characterized in adding a step of cutting for facing and chamfering a side end face of the connection end portion of the deformed bar subjected to the swaging step.

4. The method of working a connection end portion of deformed bar for reinforcing concrete according to Claim 1, characterized in that in the rolling step, a groove diameter of a thread ridge at a boundary contiguous to the rib and the node is gradually increased at the thread portion of rolling.

5. A deformed bar for reinforcing concrete characterized in that in a cylindrical body of a deformed bar for reinforcing concrete, in respect of the deformed bar for reinforcing concrete having ribs and a number of nodes, at least one connection end portion is swaged at a normal temperature and a rolled thread portion is formed at the one connection end portion of the deformed bar subjected to the swaging step.

6. The deformed bar for reinforcing concrete according to Claim 5, characterized in that a maximum diameter of the swaged connection end portion becomes substantially equal to a diameter of the cylindrical body.

7. The deformed bar for reinforcing concrete according to Claim 5, characterized in that an outer diameter of the rolled thread portion is formed to be equal to or slightly larger than a diameter of the cylindrical body of the deformed bar.

8. The deformed bar for reinforcing concrete according to Claim 5, characterized in that a groove diameter of a thread ridge at a boundary contiguous to the rib and the node in the rolled thread portion is gradually increased.

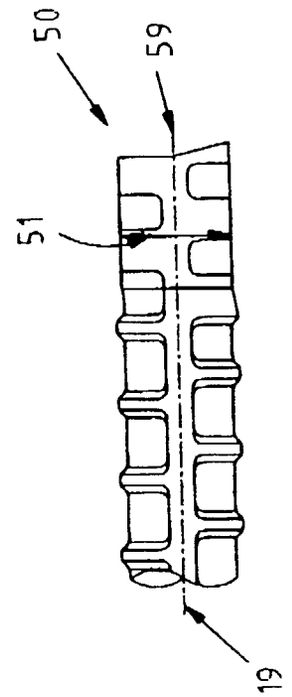


FIG.1B

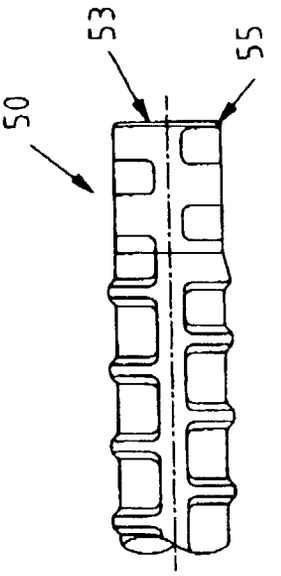


FIG.1D

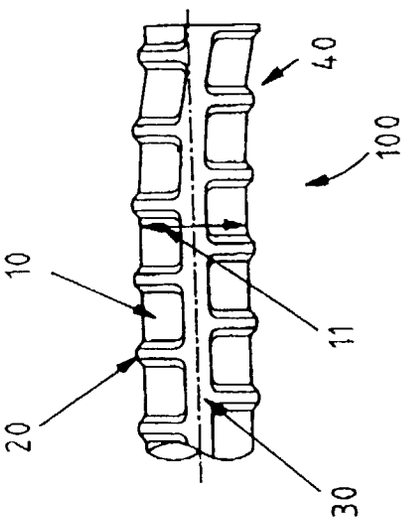


FIG.1A

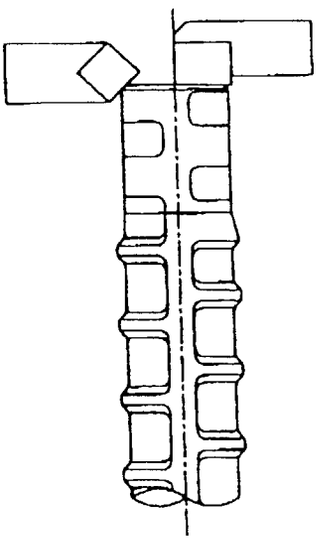


FIG.1C

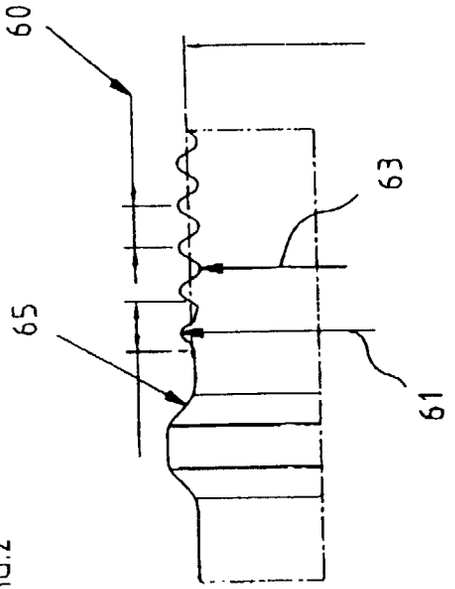


FIG.2

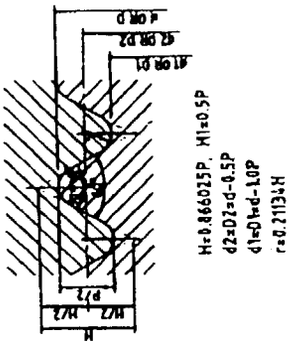


FIG.2b

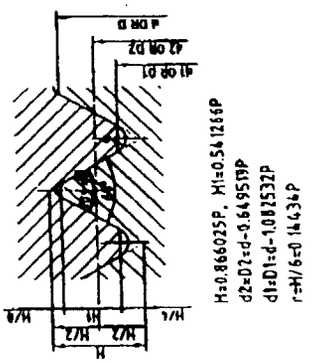


FIG.2a

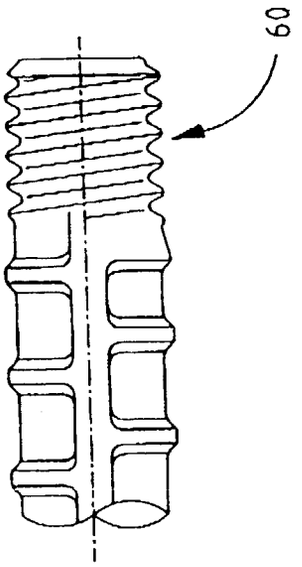


FIG.1E

FIG 3A

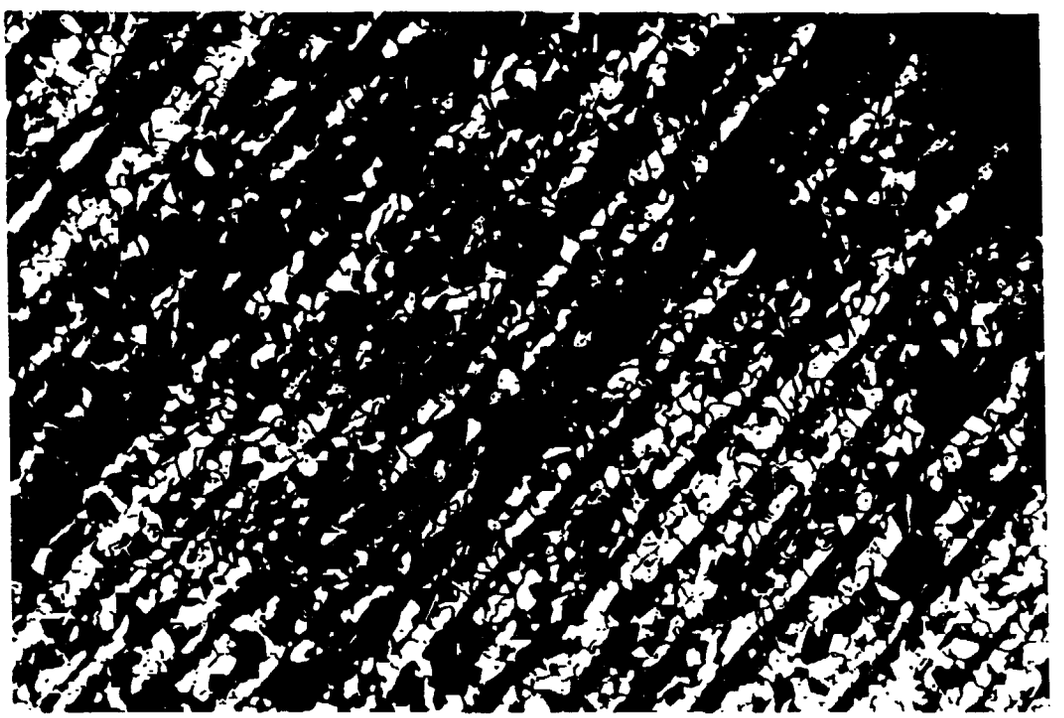
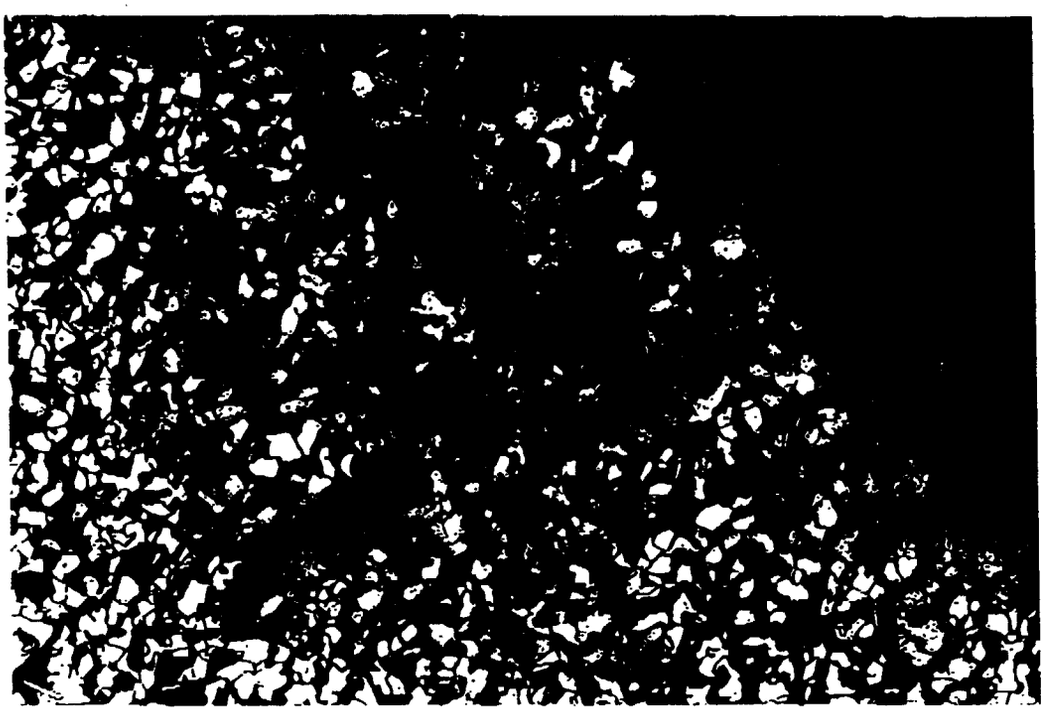


FIG 3B



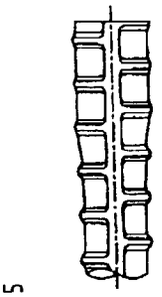


FIG.5

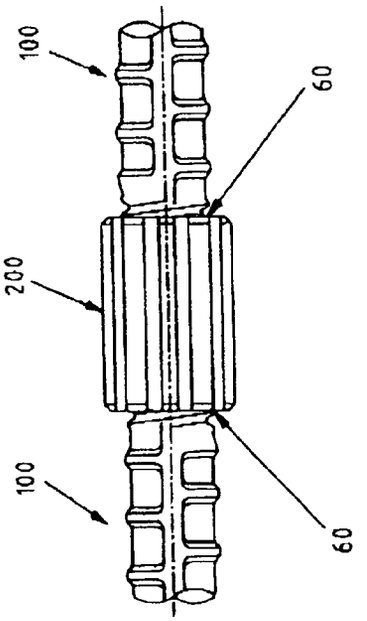


FIG.4A

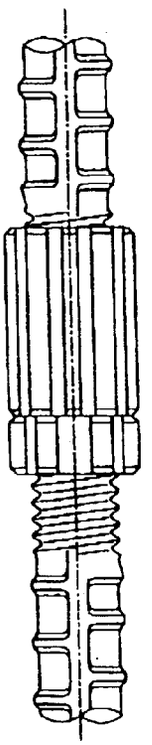


FIG.4B

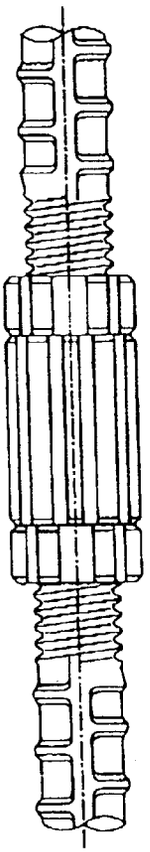


FIG.4C

FIG 6A

FIG 6B

FIG 7A

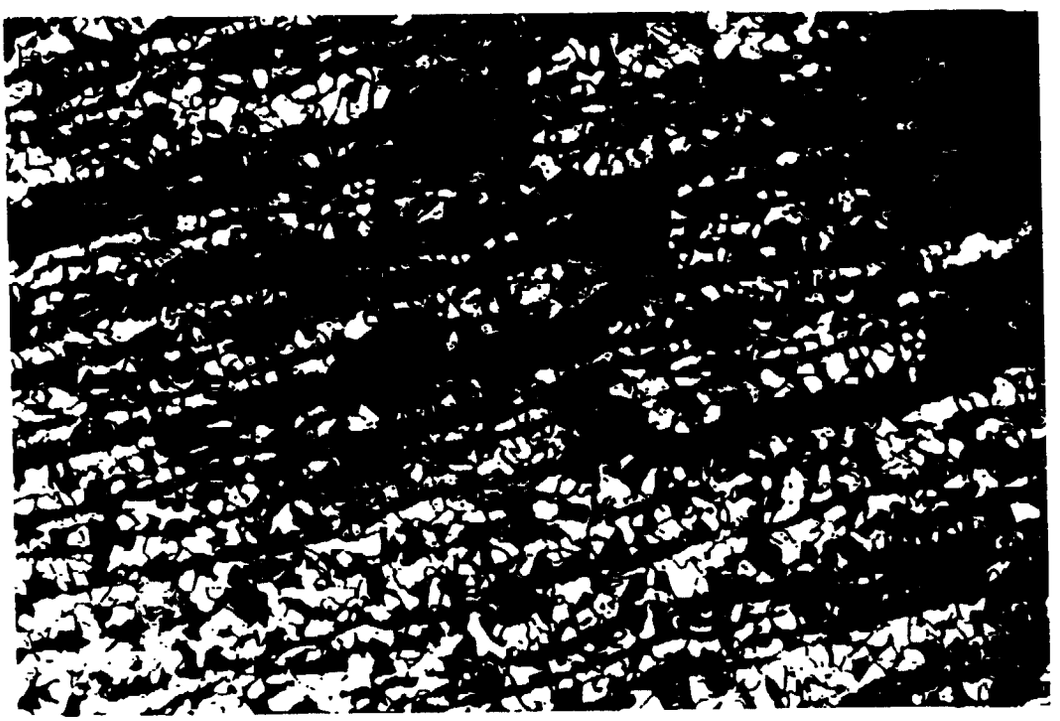


FIG 7B

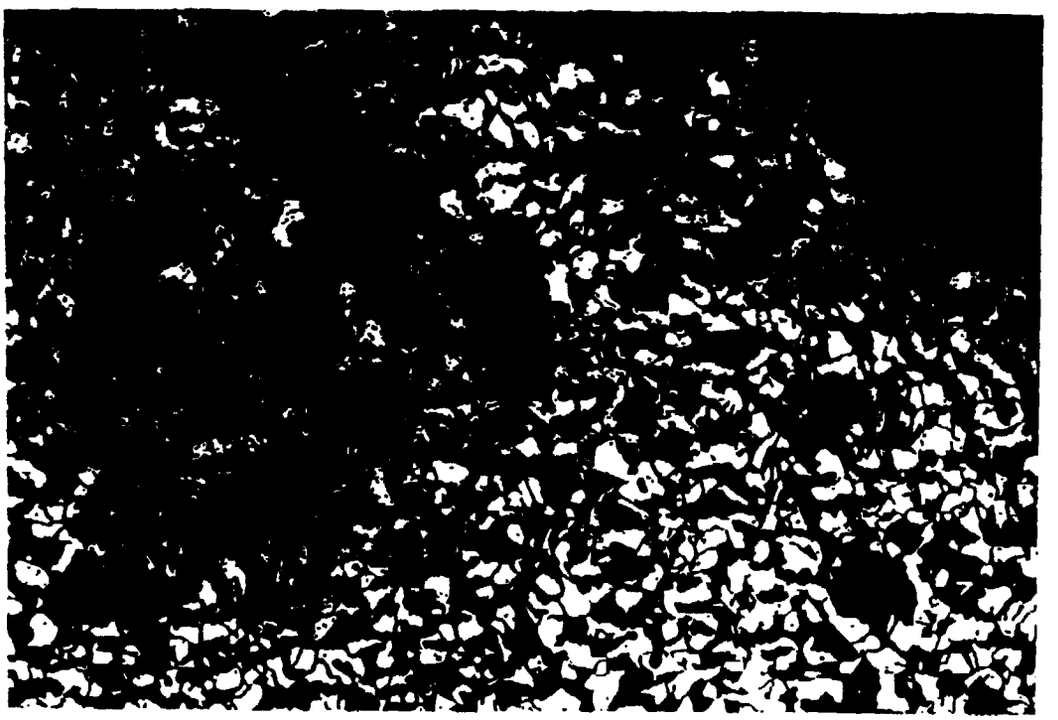


FIG 8A

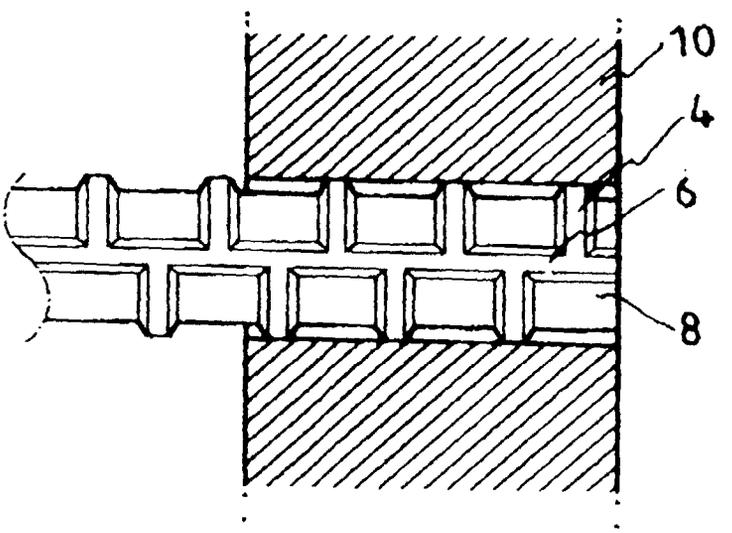


FIG 8B