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(54) DEVICE FOR JOINING REINFORCING BARS TOGETHER

(57) To avoid the rotation of a sleeve, providing an enhanced joint force. A reinforcing bar joint 1 according to the present invention includes an elliptic-sectioned sleeve 2, a load transfer rod 3 to be inserted through the sleeve, and wedging means 4. The sleeve 2 is configured so that end portions of reinforcing bars 5a, 5b can be inserted into openings 6a, 6b formed in respective ends of the sleeve 2 so that the reinforcing bars are arranged in series along an identical line. The load transfer rod 3 can also be inserted therethrough in parallel with the end portions of the reinforcing bars 5a, 5b which are inserted into the sleeve 2.

FIG. 1a

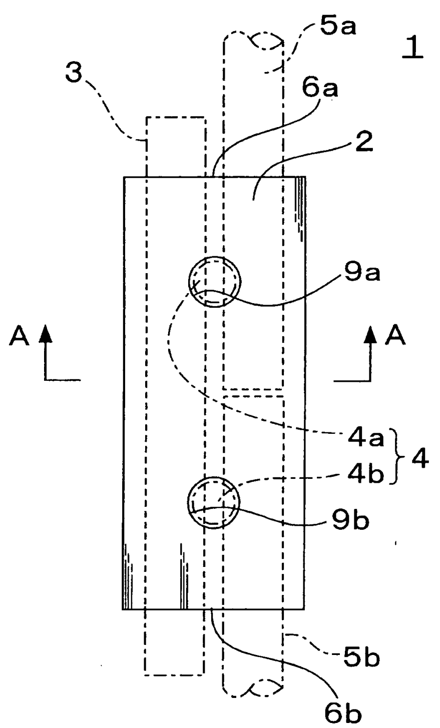

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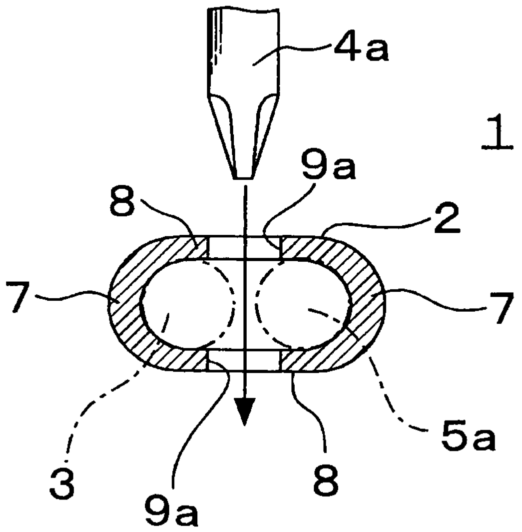
FIG. 1b



Description

TECHNICAL FIELD

[0001] The present invention relates to a reinforcing bar joint to be used for joining reinforcing bars.

BACKGROUND ART

[0002] Reinforcing bars are main components of reinforced concrete structures (RC structures) and steel-reinforced concrete structures (SRC structures), and are cut in predetermined lengths so as to be arranged easily during configuration on-site. The operation of joining reinforcing bars on-site is thus indispensable.

[0003] There are various types of methods for joining reinforcing bars, including a lap joint, a mechanical coupler, and a gas-pressure welding joint. These joints are selected and used as appropriate depending on the quality required of a structure, working conditions, the diameters of the reinforcing bars being used, and the like.

[0004] In this instance, the joining methods mentioned above have respective drawbacks and advantages. For example, a lap joint can join reinforcing bars easily by utilizing the bar's adhesion to concrete. Since two reinforcing bars must be overlapped, it becomes harder to perform various bar arrangements or secure overlapping lengths of such as the bar diameter increases. Furthermore, a mechanical coupler requires management on such details as the insert length of the reinforcing bars being inserted into the coupler and the fastening torque being applied. A gas-pressure welding joint requires the welder to hold a particular qualification for executing of the gas-pressure welding.

[0005] For this reason, bar joining methods that are capable of joining reinforcing bars easily, without requiring a lapping length, have also been developed.

[0006] Nevertheless, among those methods, one method for joining pairs of mutually parallel reinforcing bars is applicable only to reinforcing bars having fixed spacings, and thus is not sufficiently versatile in terms of bar pitch (see patent document 1). Moreover, joining methods that use a U-shaped sleeve cannot provide sufficient joint strength (see patent documents 2 and 3).

[0007] Under the circumstances, a joint has been developed that is composed of an elliptic-sectioned steel sleeve and a wedge member. According to such a joint, the end portions of two reinforcing bars are inserted into the sleeve from respective opposite directions, and then the wedge member can be driven into the space between the two reinforcing bars through a wedge insertion hole formed in the sleeve to join the reinforcing bars together (see patent document 4 and non-patent document 1).

[0008] In the case where the joint is composed of an elliptic-sectioned steel sleeve and a wedge member, however, two reinforcing bars with their end portions alternately inserted into the elliptic sleeve create a gap therebetween in the direction orthogonal to the axes of the reinforcing bars.

[0009] This precludes the two reinforcing bars from being joined along an identical line, and a problem exists in that it is difficult to provide sufficient clearances between reinforcing bars when a large number of reinforcing bars are required due to seismic standards or the like.

[0010] There has also been the problem that if a tensile force acts on the two reinforcing bars, the sleeve can be rotated due to the foregoing gap in the direction that is orthogonal to the axes, thereby loosening the engagement between the reinforcing bars and the wedge member. The rotation of the sleeve also produces a bending moment on the reinforcing bars so that the joined areas can be broken by a tensile load that is smaller than their tensile fracture load.

[0011] Furthermore, when reinforcing bars are inserted into the steel sleeve and the wedge member is pressed in, the reinforcing bars will be bent at the position where the wedge member is driven in, and extend obliquely from the sleeve even if the reinforcing bars have extended straight out from the sleeve before the wedge member was pressed in. There has thus been a problem that it is difficult to form the bar arrangement as intended, resulting in interference or insufficient spacing between the reinforcing bars.

[0012]

[Patent Document 1] Publication of Japanese Patent No. 3197079
[Patent Document 2] Japanese Patent Application Laid-Open No. Hei 5-156721
[Patent Document 3] Japanese Utility Model Publication No. Hei 3-047052
[Patent Document 4] Japanese Utility Model Publication No. Sho 58-32498
[Non-Patent Document 1]ERICO International Corporation, [searched on August 2, 2006], the Internet <URL: http://www.erico.com/products/QuickWedge.asp>

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0013] The present invention has been developed in view of the foregoing circumstances, and it is thus an object thereof to provide a reinforcing bar joint which is capable of avoiding the rotation of its sleeve, providing an enhanced joining force between reinforcing bars.

[0014] Another object of the present invention is to provide a reinforcing bar joint which is capable of suppressing bending of the reinforcing bars at the position where a wedge member is driven in.

[0015] In a reinforcing bar joint according to the present invention, the end portions of two reinforcing bars are inserted into openings in both ends of a sleeve, respectively, so that the reinforcing bars are arranged in series along an identical line. A load transfer rod is also inserted through the sleeve so as to be in parallel with the end portions of the respective reinforcing bars.

[0016] Then, a first wedge member is pressed into the space between either one of the two reinforcing bars and the load transfer rod. A second wedge member is pressed into the space between the other reinforcing bar and the load transfer rod.

[0017] As a result, when the two reinforcing bars are placed under a tensile load, the tensile load is transferred from one reinforcing bar to the load transfer rod through the first wedge member, and is further transferred from the load transfer rod to the other reinforcing bar through the second wedge member.

[0018] In addition to this, since the two reinforcing bars are arranged in series along an identical line, tensile loads from the respective reinforcing bars act on the sleeve along the same line of action. This eliminates the possibility of rotating the sleeve as heretofore discussed.

[0019] The sleeve is composed of a pair of semicylindrical wall portions which are arranged with their curved inner surfaces opposing each other, and a pair of flat wall portions which extend to corresponding-edges of the pair of semicylindrical wall portions. The internal space of the sleeve forms a bar insert space at the side of one of the semicylindrical wall portions, and the end portions of the two reinforcing bars are inserted thereto from both the openings of the sleeve, respectively. The side of the other semicylindrical wall portion forms a rod insert space, and the load transfer rod is inserted therethrough from one of the openings into the other opening of the sleeve. When the end portions of the two reinforcing bars are inserted into the sleeve and the load transfer rod is inserted through the sleeve, the end portions of the two reinforcing bars and the load transfer rod are placed in parallel in the sleeve.

[0020] Wedge insertion holes are formed in each of the flat wall portions so as to lie between one of the reinforcing bars and the load transfer rod and between the other reinforcing bar and the load transfer rod.

[0021] When the first wedge member is driven into the space between one of the reinforcing bars and the load transfer rod, it bites into and engages both the reinforcing bar and the load transfer rod by taking the reaction force from the semicylindrical wall portions of the sleeve. Similarly, when the second wedge member is driven into the space between the other reinforcing bar and the load transfer rod, it bites into and engages both the other reinforcing bar and the load transfer rod.

[0022] The first wedge member and the second wedge member have a tapered portion which bites into both the reinforcing bar and the load transfer rod as described above. Which of the two is bitten into to a greater degree depends primarily on the difference in hardness between the two. If the reinforcing bars are not sufficiently bitten into, the engaging forces between the reinforcing bars and the first wedge member and the second wedge member are then insufficient.

[0023] It is therefore desirable that the load transfer rod have a hardness that is equivalent to or higher than that of the reinforcing bars so that the first and second wedge members bite into the reinforcing bars sufficiently as much as allowable in design.

[0024] The load transfer rod may, for example, be made of a straight steel rod having a circular cross section.

[0025] In this instance, the load transfer rod has only to be arranged beside (on one side of) the two reinforcing bars, which are placed in series, whereas the load transfer rod may sometimes be arranged on both sides of the two reinforcing bars. In this case, a first wedge member and a second wedge member are additionally required. When pressing a pair of the first wedge members in, the first wedge members that are inserted on both sides of the two reinforcing bars are pressed in simultaneously as far as possible. In the case of a pair of the second wedge members, the same can be said.

[0026] Even given such a modification, there is still no possibility of rotating the sleeve or bending the reinforcing bars in any direction.

[0027] If the first and second wedge members are driven into the space between the reinforcing bars and the load transfer rod, the reinforcing bars can sometimes be bent at the positions where the first and second wedge members are driven in, and extend obliquely from the sleeve even if the reinforcing bars have extended straight out from the sleeve prior to the first and second wedge members being pressed in.

[0028] In such cases, protruding portions protruding toward the peripheries of the reinforcing bars are desirably formed on the load transfer rod. As a result of this, when the first and second wedge members are driven in and the reinforcing bars start to bend accordingly, the protruding portions formed on the load transfer rod come into contact with the peripheries of the reinforcing bars and suppress the bending of the reinforcing bars.

[0029] It should be appreciated that the protruding portions may have any configuration. For example, the load transfer rod may be made of a straight portion and bent portions formed on both ends of the straight portion so that the bent portions form the protruding portions. The load transfer rod may also be composed of a rod body and large diameter portions that are detachably attached to both ends of the rod body, the large diameter portions having an outer diameter that is greater than the rod body, so that the large diameter portions form the protruding portions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

Figs. 1(a) and 1(b) are diagrams showing a reinforcing bar joint 1 according to a first embodiment, Fig. 1(a) being a front view, Fig. 1(b) being a sectional view taken along line A-A.

Fig. 2 is a diagram showing a state where reinforcing bars 5a, 5b are joined by the joint 1 completely.

Figs. 3(a) and 3(b) are diagrams showing a reinforcing bar joint 41 according to a second embodiment, Fig. 3(a) being a front view, Fig. 3(b) being a sectional view taken along line B-B.

Fig. 4 is a diagram showing how large diameter portions 44a and 44b are attached to both ends of a rod body 45.

Fig. 5 is a diagram showing a state where the protruding portions are absent and the reinforcing bars 5a, 5b are bent.

Fig. 6 is a front view of a reinforcing bar joint according to a modification.

Figs. 7(a) and 7(b) are diagrams showing a reinforcing bar joint according to another modification, Fig. 7(a) being a front view, Fig. 7(b) being a sectional view taken along line C-C.

DESCRIPTION OF REFERENCE NUMERALS

[0031]

1, 41	reinforcing bar joint
2, 72	sleeve
3, 43, 53, 73	load transfer rod
4	wedging means
4a	first wedge member
4b	second wedge member
5a, 5b	reinforcing bar
9a, 9b	wedge insertion hole
44a, 44b	large diameter portion (protruding portion)
45	rod body
52	bent portion (protruding portion)
54	straight portion

BEST MODE FOR CARRYING OUT THE INVENTION

[0032] Hereinafter, a reinforcing bar joint according to the present invention will be described with reference to the accompanying drawings. It should be noted that components and the like substantially identical to those of conventional technology will be designated by the same reference numerals, and a description thereof will be omitted.

[0033] (First Embodiment)

[0034] Fig. 1 is a diagram showing a reinforcing bar joint according to the present embodiment. As shown in the diagram, the reinforcing bar joint 1 according to the present embodiment comprises an elliptic-sectioned sleeve 2, a load transfer rod 3 to be inserted through the sleeve, and wedging means 4.

[0035] The sleeve 2 is configured so that end portions of reinforcing bars 5a, 5b can be inserted into openings 6a, 6b formed in both ends of the sleeve 2 so that the reinforcing bars are arranged in series along an identical line. The load transfer rod 3 can also be inserted therethrough in parallel with the end portions of the reinforcing bars 5a, 5b which are inserted into the sleeve 2.

[0036] The sleeve 2 is composed of a pair of semicylindrical wall portions 7, 7 which are arranged with their curved inner surfaces opposing each other, and a pair of flat wall portions 8, 8 which extend to the corresponding edges of the pair of semicylindrical wall portions. Wedge insertion holes 9a, 9a are formed in the pair of flat wall portions 8, 8 so as to be opposed to each other. Similarly, wedge insertion holes 9b, 9b are formed in the flat wall portions 8, 8 so as to be opposed to each other.

[0037] The load transfer rod 3 is made of a straight steel rod having a circular cross section.

[0038] In this instance, the wedging means 4 include a wedge member 4a as a first wedge member to be driven into the space between the reinforcing bar 5a and the load transfer rod 3, and a wedge member 4b as a second wedge member to be driven into the space between the reinforcing bar 5b and the load transfer rod 3. The wedge member 4a is inserted through the wedge insertion holes 9a, 9a which are formed between the reinforcing bar 5a and the load transfer rod 3. The wedge member 4b is inserted through the wedge insertion holes 9b, 9b which are formed between the reinforcing bar 5b and the load transfer rod 3.

[0039] When the wedge member 4a is driven into the space between the reinforcing bar 5a and the load transfer rod 3, it bites into and engages both the reinforcing bar 5a and the load transfer rod 3 by taking the reaction force from the semicylindrical wall portions 7,7 of the sleeve 2 respectively. Similarly, when the wedge member 4b is driven into the space between the reinforcing bar 5b and the load transfer rod 3, it bites into and engages both the reinforcing bar 5b and the load transfer rod 3.

[0040] The wedge member 4a has a tapered portion which bites into both the reinforcing bar 5a and the load transfer rod 3 and wedge member 4b has a tapered portion which bites into both the reinforcing bar 5b and the load transfer rod 3, as described above. Which of the two is bitten into to a greater extent depends primarily on the difference in hardness between the two. If the reinforcing bar 5a is not sufficiently bitten into, the engaging force between the reinforcing bars 5a and the wedge member 4a is then insufficient and similarly if the reinforcing bar 5b is not sufficiently bitten into, the engaging force between the reinforcing bar 5b and the wedge member 4b is then insufficient.

[0041] It is therefore desirable that the load transfer rod 3 have a hardness that is equivalent to or higher than that of the reinforcing bars 5a, 5b so that the wedge members 4a, 4b sufficiently bite into the reinforcing bars 5a, 5b as much as allowable in design, respectively.

[0042] Specifically, taking an example where the reinforcing bars 5a, 5b are made of SD345 (steel rod for reinforced concrete, Japanese Industrial Standards (JIS)), the load transfer rod 3 may be made of S45C (carbon steel for machine structural use, JIS).

[0043] When joining the reinforcing bars 5a, 5b using the reinforcing bar joint 1 according to the present embodiment, one end portion of the reinforcing bar 5a is initially inserted into one opening 6a of the sleeve 2 and one end portion of the reinforcing bar 5b is inserted into the other opening 6b of the sleeve 2.

[0044] Simultaneously with or immediately before or after the operation of inserting the reinforcing bars, the load transfer rod 3 is inserted through the sleeve 2. During this inserting operation, the load transfer rod 3 is inserted into the sleeve 2 so as to be in parallel with the end portions of the reinforcing bars 5a, 5b.

[0045] Next, the wedge member 4a is inserted and pressed into the wedge insertion holes 9a, 9a, and the wedge member 4b is inserted and pressed into the wedge insertion holes 9b, 9b. To undertake the press-in, a conventionally known wedge driver may be selected and used as appropriate.

[0046] Fig. 2 is a diagram showing a state where the wedge driving operation is completed, resulting in the joining of the reinforcing bars 5a, 5b completely.

[0047] In the reinforcing bar joint 1 according to the present embodiment, the end portions of the two reinforcing bars 5a, 5b are inserted into the openings 6a, 6b in both ends of the sleeve 2, respectively, so that the reinforcing bars are arranged in series along an identical line. The load transfer rod 3 is also inserted through the sleeve 2 so as to be in parallel with the end portions of the reinforcing bars, and the two wedge members 4a, 4b are pressed in. The wedge member 4a is pressed into the space between the reinforcing bar 5a and the load transfer rod 3, and the wedge member 4b is pressed into the space between the reinforcing bar 5b and the load transfer rod 3.

[0048] Consequently, when the two reinforcing bars 5a, 5b are placed under a tensile load, the tensile load is transferred from the reinforcing bar 5a to the load transfer rod 3 through the wedge member 4a, and is further transferred from the load transfer rod 3 to the reinforcing bar 5b through the wedge member 4b.

[0049] In addition to this, since the two reinforcing bars 5a, 5b are arranged in series along an identical line, tensile loads from the respective reinforcing bars 5a, 5b act on the sleeve 2 along the same line of action.

[0050] As has already been described, according to the reinforcing bar joint 1 of the present embodiment, the introduction of the load transfer rod 3 makes it possible to transfer tensile loads in the situation where the two reinforcing bars 5a, 5b are arranged in series along an identical line.

[0051] Consequently, the tensile loads from the respective reinforcing bars 5a, 5b act on the sleeve 2 along the same line of action, thereby preventing the sleeve 2 from being rotated. Moreover, since the reinforcing bars 5a, 5b are free from bending ascribable to the rotation of the sleeve 2, the reinforcing bars 5a, 5b are precluded from being broken by tension or by bending without the reinforcing bars exercising their tensile strengths. This makes it possible to fully exercise the tensile strengths of the reinforcing bars 5a, 5b.

[0052] It should be appreciated that when the two reinforcing bars 5a, 5b are placed under a tensile load, the tensile load is transferred from the reinforcing bar 5a to the load transfer rod 3 through the wedge member 4a, and is further transferred from the load transfer rod 3 to the reinforcing bar 5b through the wedge member 4b.

[0053] This makes it possible to provide sufficient joining strength between the reinforcing bars 5a, 5b.

[Embodiment 1]

[0054] The following tensile tests were undertaken in order to examine what effects the relative difference in hardness between the reinforcing bars and the load transfer rod has on the tensile characteristics of the reinforcing bar joint according to the present invention.

[0055] The tensile tests undertaken used wedge members having a wedge length of 48 mm, a wedge diameter of 16 mm, and a tip length of 10 mm. Table 1 shows specifications of the sleeves.

[0056] [Table 1]

[0057] As can be seen from Table 1, the sleeves tested were of three steel types: STKM13A (carbon steel for machine structural use, JIS), S45C (non-heat treated), and S45C (annealed). The wedge members were made of one steel type S45C (refined and hardened).

[0058] Next, Table 2 shows the results of the respective tensile tests.

[0059] [Table 2]

[0060] Cases 1 and 2 were intended to examine the influence of shape variations, before examining what effects the relative difference in hardness between the reinforcing bars and the load transfer rod has on the tensile characteristics. In both cases, the load transfer rod was made of a deformed bar of steel type (SD345) having the same hardness as that of the reinforcing bars (SD345) to be joined, but was sourced from different steel bar producers.

[0061] Case 3 was intended to examine the case of using a load transfer rod of a steel type having the same specification (lower limit) of tensile strength as that of the reinforcing bars to be joined. The load transfer rod was made of steel type SNR490B (rolled steel bar (round bar) for building construction use, JIS).

[0062] Cases 4 and 5 were intended to examine the cases of using load transfer rods of steel type harder than the reinforcing bars to be joined. Because a round bar is insusceptible to shape-based variations in tensile characteristic, the load transfer rods of round shape were used. The load transfer rods were made of steel type S45C (refined) or SCM435.

[0063] Cases 7 and 9 were generally the same as cases 4 and 5, and were intended to examine the cases of using load transfer rods of steel type harder than the reinforcing bars to be joined. Because a round bar is insusceptible to shape-based variations in tensile characteristic, the load transfer rods of round shape were used. The load transfer rods were made of steel type S45C (refined and hardened).

[0064] As a result of the tensile test in case 1, the reinforcing bars to be joined caused base-material fracture. This result shows that deformed bars can be used as the load transfer rod of the joint according to the present invention if the load transfer rod has a hardness that is equivalent to that of the reinforcing bars to be joined.

[0065] In case 2, the reinforcing bars to be joined caused a shear fracture. This result shows that deformed bars have different tensile characteristics because such configurations as a rib diameter, a node diameter and mechanical characteristics of the actual materials themselves vary from one steel bar producer to another.

[0066] In case 3, the reinforcing bars to be joined caused a shear fracture before base-material fracture. This result shows that when the load transfer rod in use has the same specification (lower limit) of tensile strength as that of the reinforcing bars to be joined (SD345), the SD345 may sometimes become harder since actual SD345 materials have greater variations in tensile strength than those of SNR490B.

[0067] In cases 4, 5, 7, and 9, the reinforcing bars to be joined caused base-material fracture.

[0068] From these results, it has been found that the reinforcing bars to be joined will cause base-material fracture without exception if the load transfer rod is made of steel type (S45C (refined), SCM435, S45C (refined and hardened)) that is harder than the reinforcing bars to be joined (SD345).

[0069] The test results of cases 1 to 3, 4, 5, 7, and 9 show that deformed bars as well as round bars of steel types having the same hardness as that of the reinforcing bars to be joined can be employed as the load transfer rod, however, the load transfer rod might become softer than the reinforcing bars to be joined due to variations in shape or manufacturing variations in quality. It can thus be said that the load transfer rod is desirably selected from among steel types sufficiently harder than the reinforcing bars to be joined.

[0070] However, if the load transfer rod is too hard, the degree to which the wedge members bite into the reinforcing bars increases to increase the degree of flex of the reinforcing bars accordingly, and the wedge members may even be deformed as well. The load transfer rod must therefore have a hardness such that the degree of biting into the reinforcing bars does not become excessive and also cause deformation of the wedge members.

[0071] Moreover, in cases 6 and 8 where the sleeve was made of a hard material, the reinforcing bars to be joined caused a shear fracture before base-material fracture. The reason for this seems to be that the press-in of the wedge members does not press the reinforcing bars against the inner wall surfaces of the sleeve sufficiently since the sleeve is harder than the reinforcing bars to be joined. In case 8, a fracture occurred at the position where a wedge member bit in. This seems to be ascribable to the occurrence of a stress concentration at the biting position of the reinforcing bar. This also shows that even if the load transfer rod is harder than the reinforcing bars to be joined, the degree to which the wedge members bite into the reinforcing bars can possibly be excessive if the sleeve is harder than the reinforcing bars.

[0072] From the foregoing test results, it is desirable for the reinforcing bar joint of the present invention that the wedging means be the hardest, and that the load transfer rod, the reinforcing bars to be joined, and the sleeve be made progressively softer in this order.

[0073] It should be noted that, in the foregoing tests, hardness was expressed in terms of tensile strength in order to avoid difficulties in comparison ascribable to different hardness-indicating specifications.

[0074] (Second Embodiment)

[0075] A description will now be given of a second embodiment. It should be appreciated that components and the like substantially identical to those of the foregoing embodiment will be designated by the same reference numerals, and a description thereof will be omitted here.

[0076] Fig. 3 is a diagram showing a reinforcing bar joint according to the second embodiment. As shown in the diagram, the reinforcing bar joint 41 according to the present embodiment comprises an elliptic-sectioned sleeve 2, a load transfer rod 43 to be inserted through the sleeve, and wedging means 4.

[0077] The load transfer rod 43 is composed of a rod body 45 and large diameter portions 44a, 44b which are protruding portions to be attached to respective ends of the rod body. The large diameter portions 44a, 44b are formed to have an outer diameter that is greater than the rod body 45, and internal threads are cut in their internal cavities.

[0078] Conversely, the rod body 45 is made of a straight steel rod having a circular cross section with external threads in both ends. These external threads are engaged with the internal threads of the large diameter portions 44a, 44b respectively so that the large diameter portions 44a, 44b can be detachably attached to the respective ends of the rod body 45.

[0079] In this instance, the large diameter portions 44a, 44b have an outer diameter determined so that their peripheries come into contact with the reinforcing bars 5a, 5b respectively when they are engaged with the respective ends of the rod body 45 which is inserted through the sleeve 2. It should be appreciated that the radius of the large diameter portions 44a, 44b is made smaller, if necessary, than the distance from the axis of the rod body 45 to the peripheries of the reinforcing bars 5a, 5b so as not to hinder the operation of screwing the large diameter portions 44a, 44b onto the rod body 45.

[0080] The wedge members 4a, 4b have a tapered portion which bites into both the reinforcing bar 5a or 5b and the load transfer rod 43. Which of the two is bitten into to a greater degree depends primarily on the difference in hardness between the two. If the reinforcing bars 5a, 5b are not sufficiently bitten into, the engaging forces between the reinforcing bars 5a, 5b and the wedge members 4a, 4b are then insufficient.

[0081] It is therefore desirable that the load transfer rod 43 have a hardness that is equivalent to or higher than that of the reinforcing bars 5a, 5b so that the wedge members 4a, 4b bite into the reinforcing bars 5a, 5b as much as allowable in design.

[0082] Specifically, taking an example where the reinforcing bars 5a, 5b are made of SD345 (steel rod for reinforced concrete, JIS), the load transfer rod 43 may be made of S45C (carbon steel for machine structural use, JIS).

[0083] The sleeve 2 and the wedging means 4 are the same as used in the first embodiment, and a description thereof will thus be omitted here.

[0084] When joining the reinforcing bars 5a, 5b using the reinforcing bar joint 41 according to the present embodiment, one end portion of the reinforcing bar 5a is initially inserted into one opening 6a of the sleeve 2 and one end portion of the reinforcing bar 5b is inserted into the other opening 6b of the sleeve 2.

[0085] Simultaneously with or immediately before or after the operation of inserting the reinforcing bars, the rod body 45 of the load transfer rod 43 is inserted through the sleeve 2. During this inserting operation, the rod body 45 is inserted into the sleeve 2 so as to be in parallel with the end portions of the reinforcing bars 5a, 5b.

[0086] Next, the internal threads of the large diameter portions 44a, 44b are engaged with the external threads that are cut in both ends of the rod body 45, as shown in Fig. 4, so that the peripheries of the large diameter portions 44a, 44b make contact with the reinforcing bars 5a, 5b. It should be appreciated that if the large diameter portions 44a, 44b are made smaller in radius than the distance from the axis of the rod body 45 to the peripheries of the reinforcing bars 5a, 5b for the convenience of the screwing operation, a clearance occurs accordingly and both members will not be in contact in the strictest sense.

[0087] Next, the wedge member 4a is inserted and pressed into the wedge insertion holes 9a, 9a, and the wedge member 4b is inserted and pressed into the wedge insertion holes 9b, 9b. To undertake the press-in, a conventionally known wedge driver may be selected and used as appropriate.

[0088] In the reinforcing bar joint 41 according to the present embodiment, the end portions of the two reinforcing bars 5a, 5b are inserted into the openings 6a, 6b in both ends of the sleeve 2, respectively, so that the reinforcing bars are arranged in series along an identical line. Meanwhile, the load transfer rod 43 is inserted through the sleeve 2 so as to be in parallel with the end portions of the reinforcing bars, and the two wedge members 4a, 4b are pressed in. The wedge member 4a is pressed into the space between the reinforcing bar 5a and the load transfer rod 43, and the wedge member 4b is pressed into the space between the reinforcing bar 5b and the load transfer rod 43.

[0089] Consequently, when the two reinforcing bars 5a, 5b are placed under a tensile load, the tensile load is transferred from the reinforcing bar 5a to the load transfer rod 43 through the wedge member 4a, and is further transferred from the load transfer rod 43 to the reinforcing bar 5b through the wedge member 4b.

[0090] In addition to this, since the two reinforcing bars 5a, 5b are arranged in series along an identical line, tensile loads from the respective reinforcing bars 5a, 5b act on the sleeve 2 along the same line of action.

[0091] In this instance, when the wedge members 4a, 4b are driven in and the reinforcing bars 5a, 5b start to bend, the large diameter portions 44a, 44b formed on the load transfer rod 43 come into contact with the peripheries of the reinforcing bars 5a, 5b and thus suppress the bending of the reinforcing bars.

[0092] As has been described, according to the reinforcing bar joint 41 of the present embodiment, the new introduction of the load transfer rod 43 makes it possible to transfer tensile loads in the situation where the two reinforcing bars 5a, 5b are arranged in series along an identical line.

[0093] Consequently, tensile loads from the respective reinforcing bars 5a, 5b act on the sleeve 2 along the same line of action, thereby preventing the sleeve 2 from being rotated. Moreover, since the reinforcing bars 5a, 5b are free from bending ascribable to the rotation of the sleeve 2, the reinforcing bars 5a, 5b are precluded from being broken by bending and tension without the reinforcing bars exercising their tensile strengths. This makes it possible to fully exercise the tensile strengths of the reinforcing bars 5a, 5b.

[0094] It should be appreciated that when the two reinforcing bars 5a, 5b are placed under a tensile load, the tensile load is transferred from the reinforcing bar 5a to the load transfer rod 43 through the wedge member 4a, and is further transferred from the load transfer rod 43 to the reinforcing bar 5b through the wedge member 4b.

[0095] This makes it possible to provide sufficient joining strength between the reinforcing bars 5a, 5b.

[0096] Moreover, according to the reinforcing bar joint 41 of the present embodiment, the ends of the load transfer rod 43 are provided with the detachable large diameter portions 44a, 44b, respectively, and the large diameter portions 44a, 44b are formed so that the large diameter portions protrude toward the peripheries of the reinforcing bars 5a, 5b when attached to the respective ends of the load transfer rod 43. Then, when the wedge members 4a, 4b are driven in and the reinforcing bars 5a, 5b start to bend, the large diameter portions 44a, 44b formed on the load transfer rod 43 make contact with the peripheries of the reinforcing bars 5a, 5b and can thus suppress the bending of the reinforcing bars 5a, 5b.

[0097] This eliminates the possibility that it may become difficult to form a bar arrangement as intended, which would have resulted in interference or insufficient spacing between reinforcing bars, as heretofore described.

[0098] Fig. 5 schematically shows how the reinforcing bars 5a, 5b might be bent. In the absence of the large diameter portions 44a, 44b, the press-in of the wedge members 4a, 4b can sometimes bend the reinforcing bars 5a, 5b at the driving positions as shown in the diagram. If the large diameter portions 44a, 44b are provided, however, the reinforcing bars 5a, 5b being bent come into contact with and are restrained by the large diameter portions 44a, 44b. As a result, the bending of the reinforcing bars 5a, 5b is suppressed.

[0099] In the present embodiment, the protruding portions of the present invention, protruding toward the peripheries of the reinforcing bars, are formed as the large diameter portions 44a, 44b. Nevertheless, the protruding portions according to the present invention are not limited to such a configuration.

[0100] For example, as shown in Fig. 6, a load transfer rod 53 composed of a straight portion 54 and bent portions 52, 52 formed on respective ends of the straight portion may be employed so that the bent portions 52,-52 form the protruding portions.

[0101] Even in such a configuration, when the reinforcing bars 5a, 5b start to bend at the driving positions of the wedge members 4a, 4b, the extremities of the bent portions 52, 52 come into contact with the peripheries of the reinforcing bars 5a, 5b and thus suppress the bending of the reinforcing bars 5a, 5b.

[0102] In the foregoing embodiments, only a single load transfer rod 3 is inserted through the sleeve 2 so that it is in parallel with the end portions of the reinforcing bars 5a, 5b which are inserted into the sleeve 2. Alternatively, as shown in Fig. 7, two load transfer rods 73, 73 may both be inserted through a sleeve 72 so that they lie on both sides of the reinforcing bars 5a, 5b in parallel when the end portions of the reinforcing bars 5a, 5b are inserted into the sleeve 2.

[0103] In this configuration, the wedging means 4 includes wedge members 4a, 4a, or first wedge member respectively to be driven into the spaces between the reinforcing bar 5a and the load transfer rods 73, 73, and wedge members 4b, 4b, or second wedge member respectively to be driven into the space between the reinforcing bar 5b and the load transfer rods 73, 73. The wedge members 4a, 4a are inserted through wedge insertion holes 9a, 9a respectively which are formed in flat wall portions of the sleeve 72 between the reinforcing bar 5a and the load transfer rods 73, 73. The wedge members 4b, 4b are inserted through wedge insertion holes 9b, 9b. respectively which are formed in the flat wall portions of the sleeve 72 between the reinforcing bar 5b and the load transfer rods 73, 73.

[0104] The wedge members 4a, 4a and the wedge member 4b, 4b are the same as those detailed in the first embodiment, and a description thereof will thus be omitted here.

[0105] Here, while the load transfer rods 3, 53, and 73 and the rod body 45 in the foregoing embodiments and various modifications thereof are attached on-site, they may instead be attached to the sleeve 2 or the sleeve 72 at a factory or the like in advance.

[0106] In the foregoing embodiments and various modifications thereof, the number of wedge member 4a to be pressed into the space between the reinforcing bar 5a and the load transfer rod 3, and the number of wedge member 4b to be pressed into the space between the reinforcing bar 5b and the load transfer rod 3 is one each. In the case of the load transfer rod 53 and the load transfer rod 73, the same thing can be said also. However, it should be appreciated that more than one of each may actually be used, and wedge members 4a may be pressed in along the axes of the reinforcing bars 5a. In the case of the wedge member 4b, the same thing can be said also.

[0107] In this regard, the minimum number of wedge members to be pressed in is one for each of the two reinforcing bars. Remaining wedge insertion holes may be left unused.

[0108] In such a configuration, unused wedge insertion holes make concrete filling holes during concrete casting, so that concrete flows into the sleeve.

[0109] This enhances the strength of the joining reinforcing bars.

Claims

1. A reinforcing bar joint comprising:

    an elliptic-sectioned sleeve having openings in both ends, end portions of two reinforcing bars being insertable into said openings, respectively, so that the reinforcing bars are arranged in series along an identical line;
    a load transfer rod to be inserted through said sleeve so as to be in parallel with the end portions of said reinforcing bars which are inserted into said sleeve; and
    a wedging means inserted through wedge insertion holes formed at opposite positions in a pair of flat wall portions constituting said sleeve,
    said wedging means comprising a first wedge member to be driven into a space between either one of said two reinforcing bars and said load transfer rod, and a second wedge member to be driven into a space between the other reinforcing bar and said load transfer rod.

2. The reinforcing bar joint according to claim 1 wherein said load transfer rod are arranged on both sides of said two reinforcing bars.

3. The reinforcing bar joint according to claim 1 or 2 wherein protruding portions protruding toward peripheries of said reinforcing bars are formed on said load transfer rod.

4. The reinforcing bar joint according to claim 3 wherein

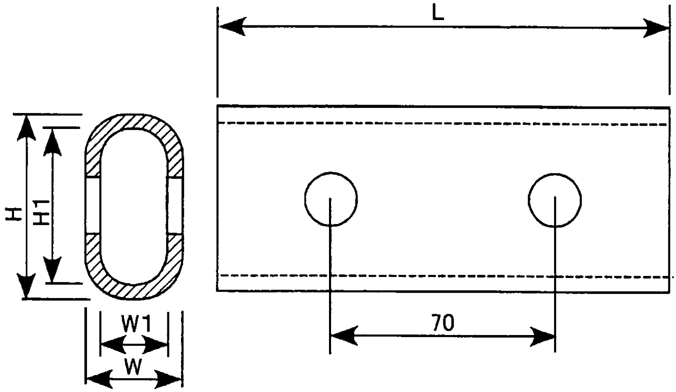
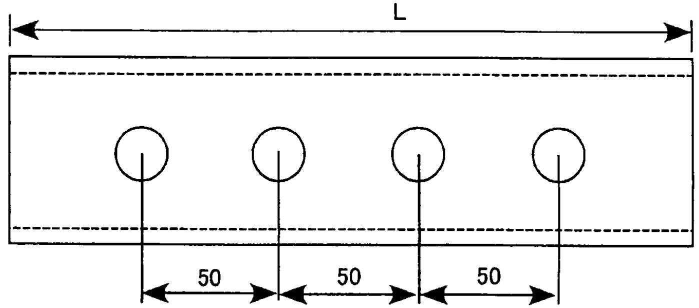
said load transfer rod is composed of a straight portion and bent portions formed on respective ends of said straight portion so that said bent portions form said protruding portions.

5. The reinforcing bar joint according to claim 3 wherein said load transfer rod is composed of a rod body and large diameter portions that are detachably attached to respective ends of said rod body, said large diameter portions having an outer diameter that is greater than said rod body, so that said large diameter portions form said protruding portions.

6. The reinforcing bar joint according-to any one of claims 1 to 5 wherein said load transfer rod has a hardness that is relatively higher than that of said reinforcing bars.

7. The reinforcing bar joint according to any one of claims 1 to 5 wherein said sleeve has a hardness that is relatively lower than that of said reinforcing bars.

〔TABLE 1〕

CASE No.	Steel type	L (mm)	W (mm)	W1 (mm)	H (mm)	H1 (mm)	thickness of sleeve (mm)	wedge insertion hole (mm)	
1～5	STKM 13A	140	34	22	56.5	44.5	6.0	16.5	
6	S45C	220	34.4	24.9	62.7	53.3	4.7	16.5	
7	S45C (annealed)	220	34.3	24.6	63.1	53.2	4.9		
			34.3	24.6	63.0	53.5	4.8		
8	S45C	230	40.0	28.0	69.4	58.1	5.8		
9	S45C (annealed)	230	39.3	28.5	69.9	58.6	5.5		
			40.7	29.8	69.6	58.0	5.6		

[TABLE 2]

case No.	reinforcing bar				load transfer rod				sleeve		results	tensile strength (experiment) [N/mm²]
	diameter	steel type	tensile strength (Standard value) [N/mm²]	tensile strength (material) [N/mm²]	diameter	steel type	tensile strength (Standard value) [N/mm²]	tensile strength (material) [N/mm²]	steel type	tensile strength (material) [N/mm²]		
1	D19	SD345	490	569	D19	SD345	490	569	STKM13A	500.8	base-material fracture	572.4
											base-material fracture	569.8
2	D19	SD345	490	575	D19	SD345	490	575	STKM13A	500.8	shear fracture	568.2
3	D19	SD345	490	566	φ19	SNR490B	490	521	STKM13A	500.8	shear fracture	550.1
4	D19	SD345	490	566	φ20	S45C (refined)	-	812	STKM13A	500.8	base-material fracture	582.2
											base-material fracture	586.4
											base-material fracture	586.4
5	D19	SD345	490	566	φ20	SCM435	-	990	STKM13A	500.8	base-material fracture	582.2
											base-material fracture	587.1
											base-material fracture	568.2
6	D22	SD345	490	567	φ24	S45C (refined)	-	812	S45C	679.4	shear fracture	525.4
											shear fracture	565.2
7	D22	SD390	560	626	φ23	S45C (refined and hardened)	-	930	S45C (annealed)	561.7	base-material fracture	641.2
											base-material fracture	640.7
8	D25	SD345	490	548	φ27	S45C (refined)	-	812	S45C	679.4	fracture in wedge potion	515.5
9	D25	SD390	560	611	φ26	S45C(refined and hardened)	-	908	S45C (annealed)	578.3	base-material fracture	614.2
											base-material fracture	614.2

FIG. 1a

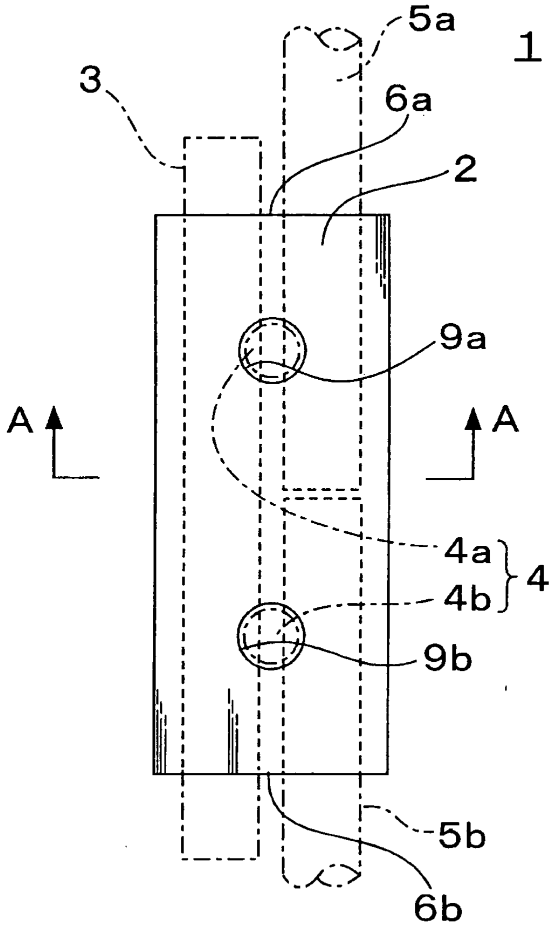


FIG. 1b

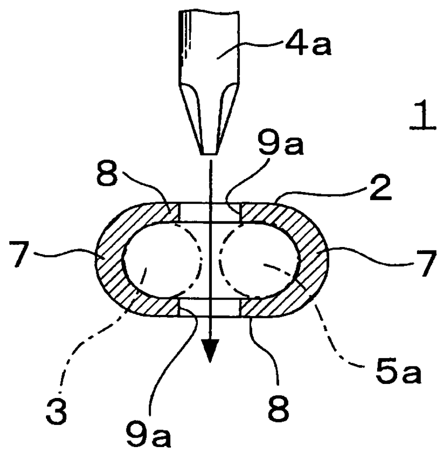


FIG. 2

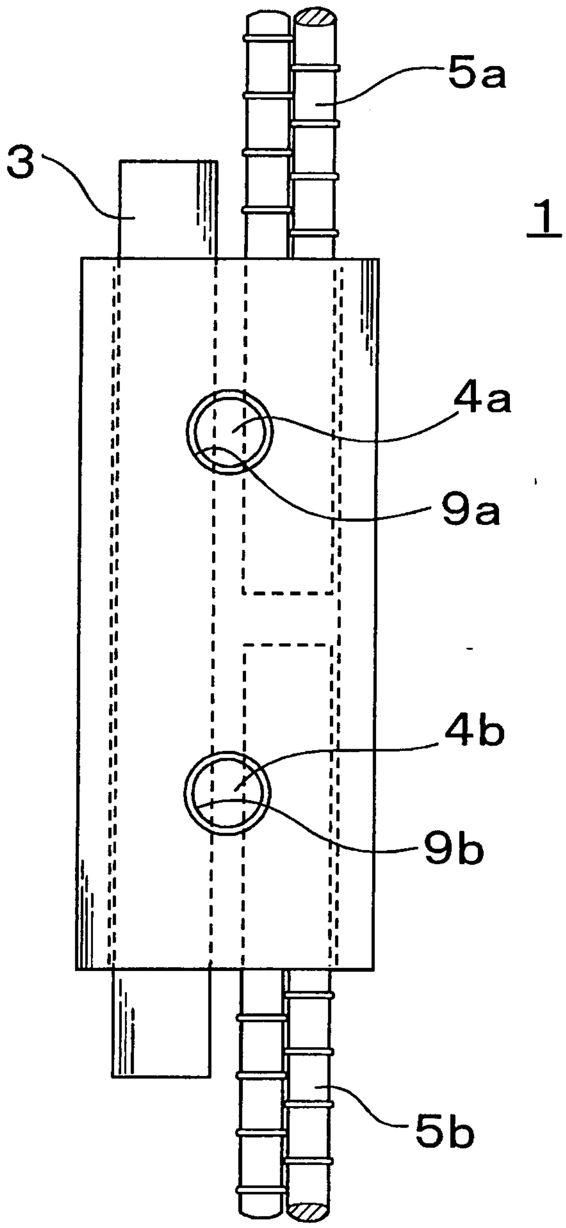


FIG. 3a

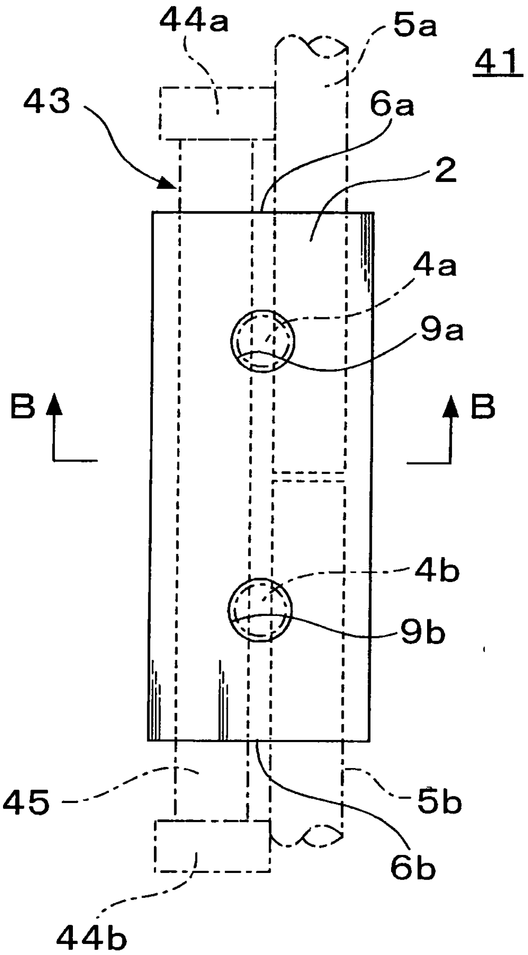


FIG. 3b

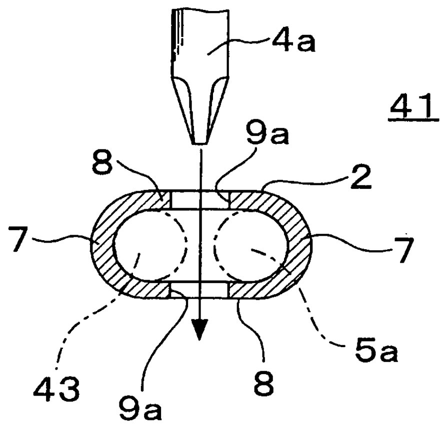


FIG. 4

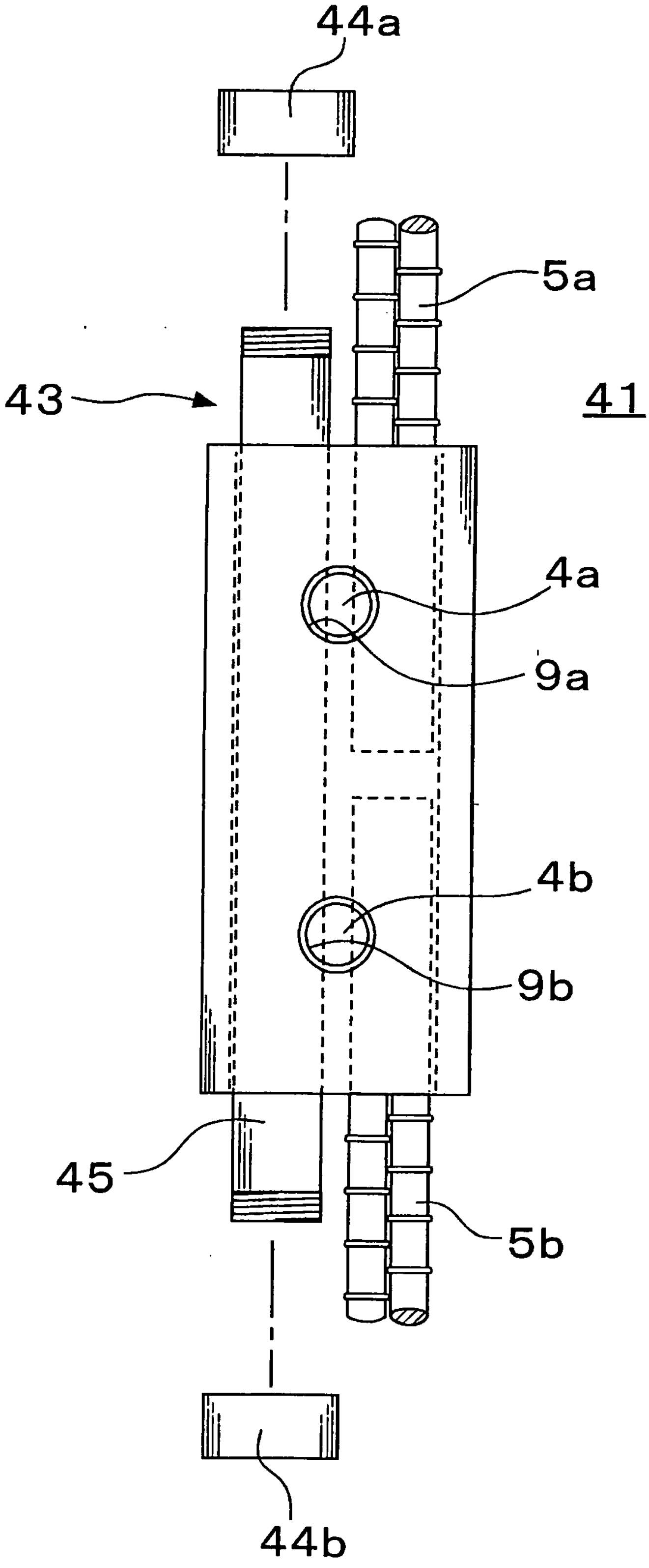


FIG. 5

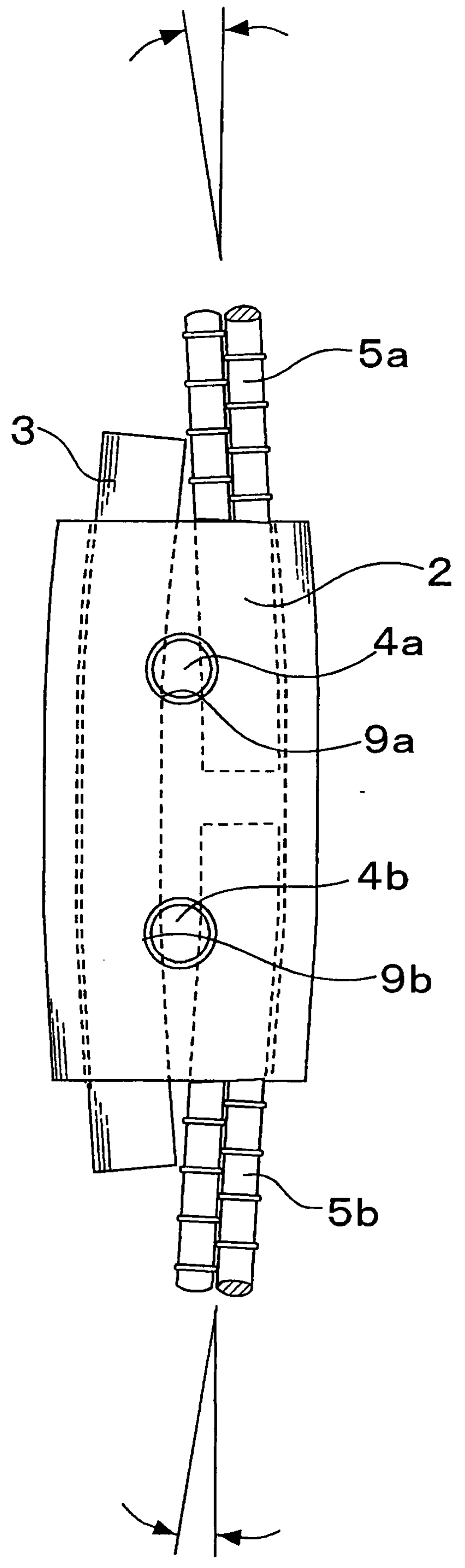


FIG. 6

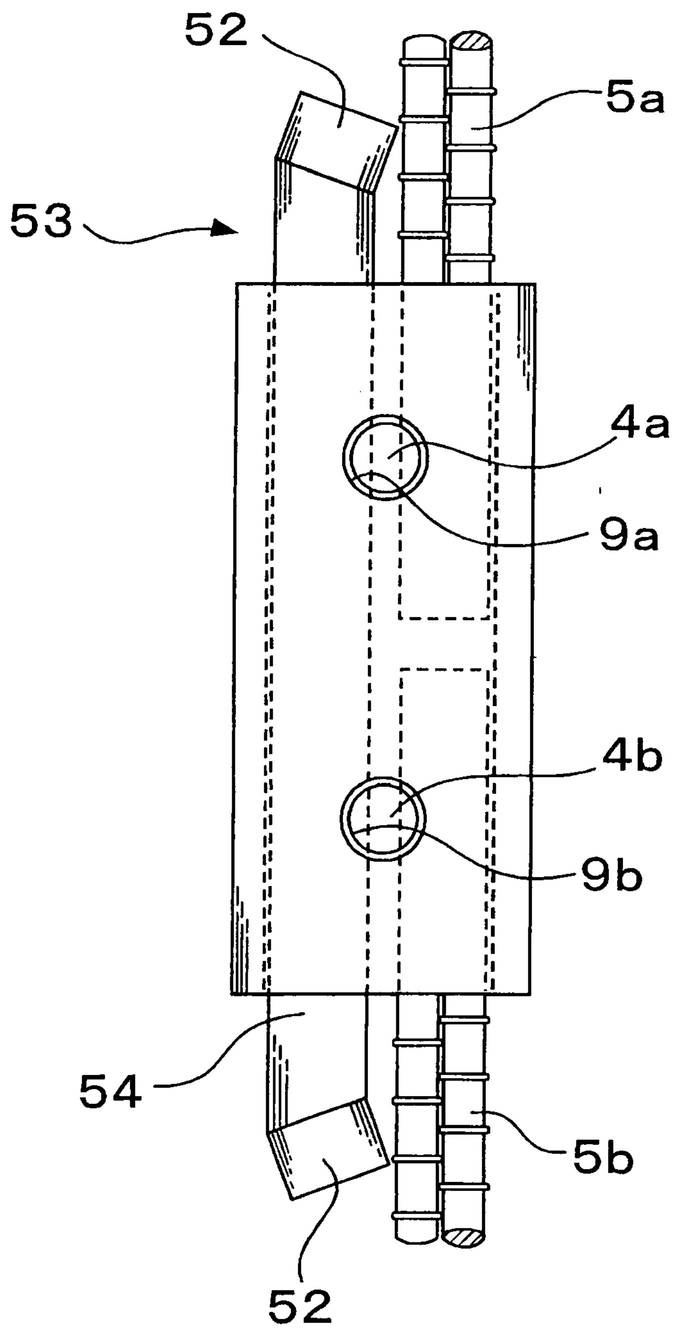


FIG. 7a

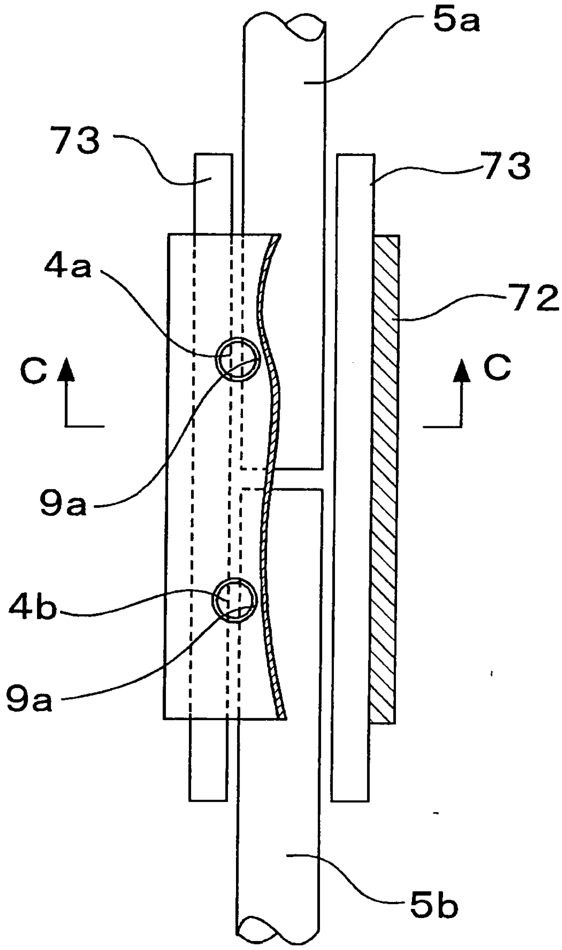
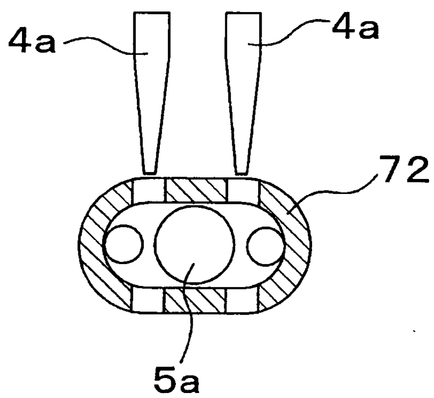


FIG. 7b



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/000564

A. CLASSIFICATION OF SUBJECT MATTER
E04C5/18(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04C5/18

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2007
Kokai Jitsuyo Shinan Koho	1971-2007	Toroku Jitsuyo Shinan Koho	1994-2007

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 11-100947 A (Yasuo SHIRAKURA), 13 April, 1999 (13.04.99), Par. Nos. [0009] to [0019]; Figs. 1 to 5 (Family: none)	1-7
A	JP 2-132248 A (Haseko Corp.), 21 May, 1990 (21.05.90), Page 2, lower left column, line 6 to page 3, upper right column, line 5; Figs. 1 to 8 (Family: none)	1-7

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
26 July, 2007 (26.07.07)	07 August, 2007 (07.08.07)

Name and mailing address of the ISA/	Authorized officer
Japanese Patent Office	
Facsimile No.	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/000564

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 120472/1974(Laid-open No. 46417/1976) (Kobe Steel, Ltd.), 06 April, 1976 (06.04.76), Page 4, lines 2 to 6; Fig. 11 (Family: none)	1-7

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REFERENCES CITED IN THE DESCRIPTION

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- JP 3197079 B **[0012]**
- JP HEI5156721 B **[0012]**
- JP HEI3047052 B **[0012]**
- JP SHO5832498 B **[0012]**