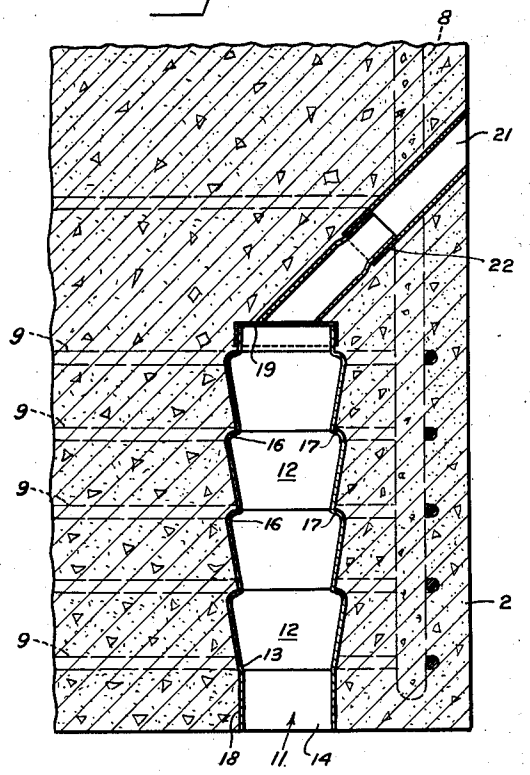
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PRECAST CONCRETE BLOCK JOINT

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Fig. 1.



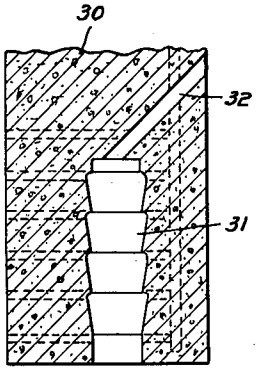


Fig. 3.

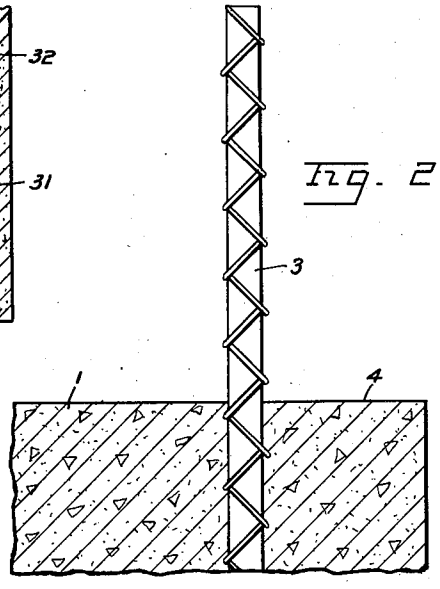


Fig. 2.

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Fig. 4.

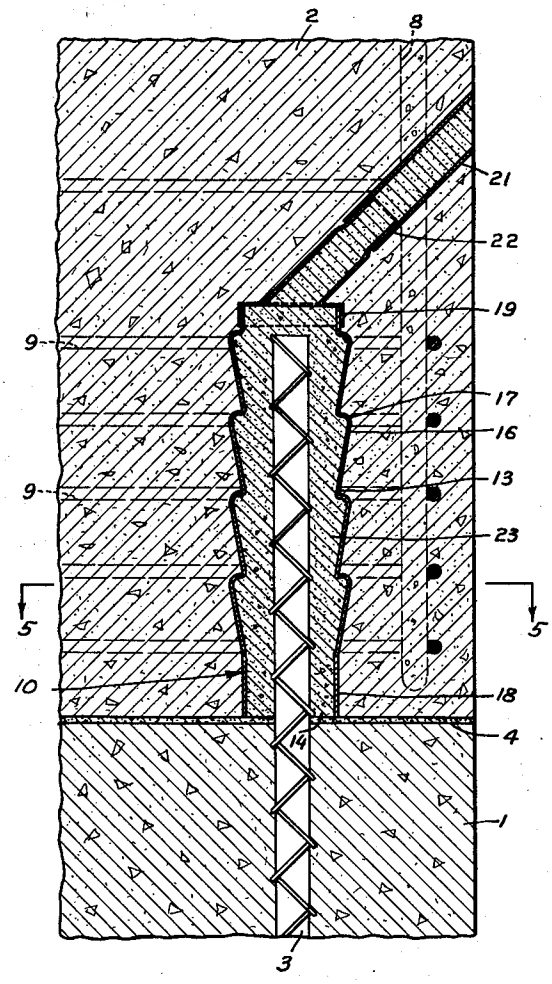


Fig. 5.

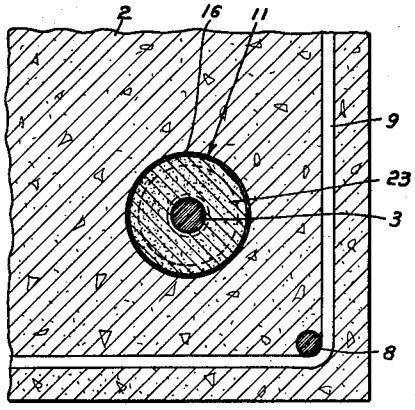
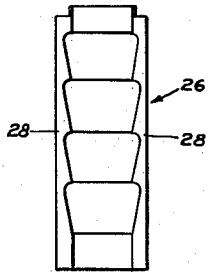


Fig. 6.



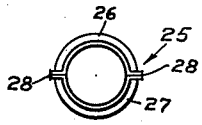


Fig. 7.

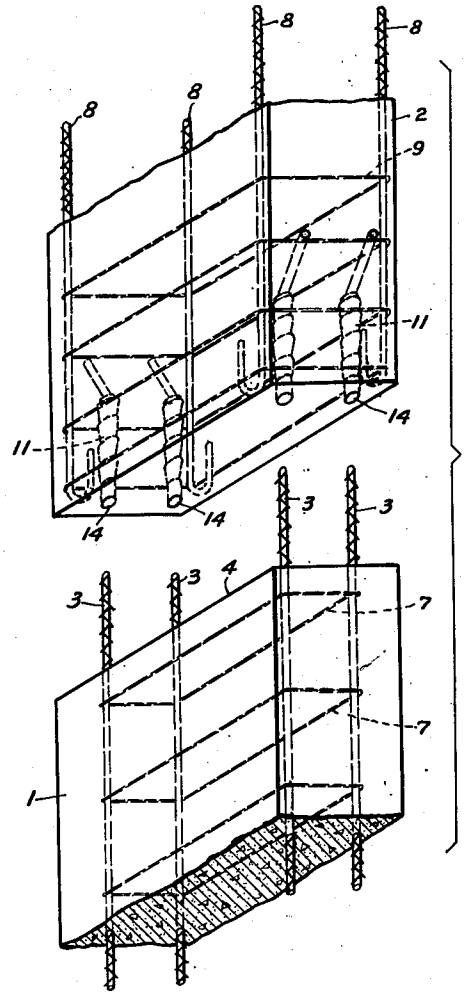
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Fig. 8.



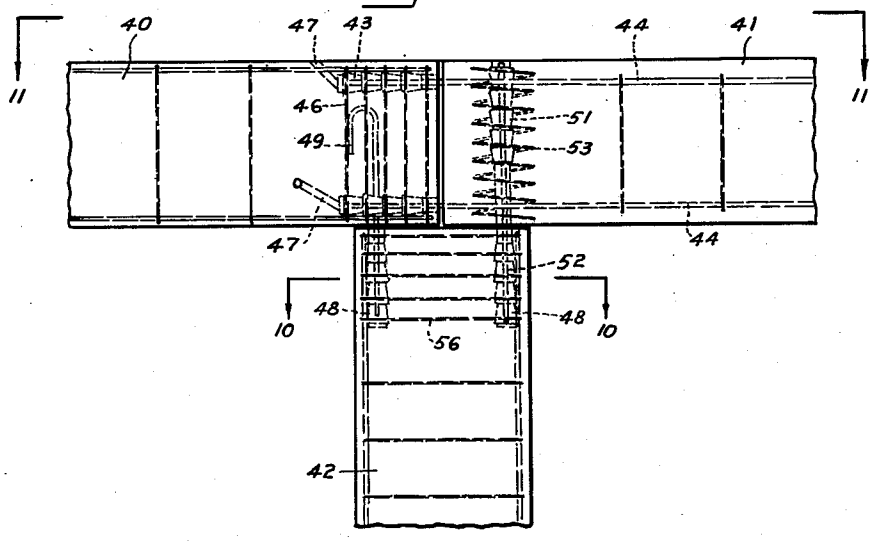
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PRECAST CONCRETE BLOCK JOINT

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Fig. 9.



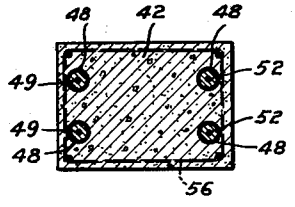


Fig. 10.

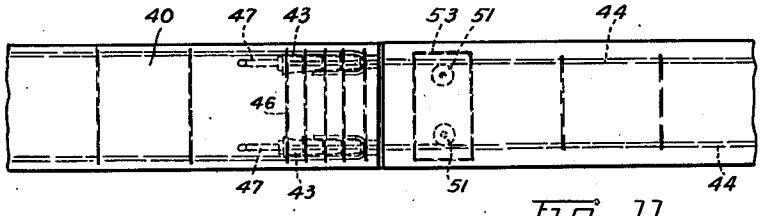


Fig. 11.

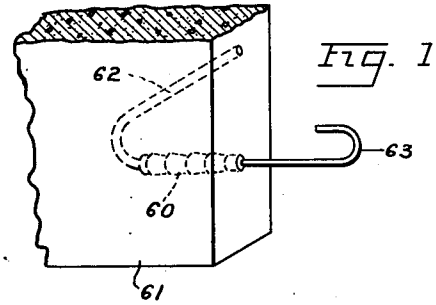


Fig. 12.

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2,616,284

UNITED STATES PATENT OFFICE

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PRECAST CONCRETE BLOCK JOINT

Valerian Leontovich, Palo Alto, Calif.

Application April 26, 1949, Serial No. 89,701

6 Claims. (Cl. 72—107)

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This invention relates to a means for connecting precast concrete building blocks having reinforcing rods embedded therein, so as to form out of the plurality of said blocks a monolithic unit of uniform strength.

The use of precast concrete blocks in building construction was proposed many years ago, but has not received general acceptance as yet. One of the main reasons for failure to gain the general recognition and acceptance was, and is, the lack of reliable and simple connecting means between the adjoining precast blocks which would provide proper tensile and flexure connection therebetween. It may be illustrated by the following example: a precast horizontal member is designed for resisting moment in accordance with the formula

$$M=\frac{WL^2}{8}$$

wherein W and L are unit load and the span of a beam, respectively. However, if the same member is spliced with another member, or its ends are affixed, the resisting moment of such member is calculated in accordance with the formula

$$M=\frac{WL^2}{12}$$

or less. Therefore, by providing the continuity of a given precast concrete beam, the same may be built only of two-thirds of the simple beam moment, thus effecting considerable economy in their construction.

This fact has been realized for a long time, and many attempts have been made to provide a simple and efficient joining means for two adjacent precast concrete members by connecting the same by special fittings, welding etc. But all such attempts did not succeed for the reason of being either impractical, or too costly.

Furthermore, the numerous inserts which were used for splicing said precast concrete members were incapable of transferring the full tensile strength of one member to another, which is of utmost importance, as the splicing member should not only be capable to withstand the load equal to the ultimate capacity of the reinforcing rod in said splicing member, but the bonding capacity of the connection at the initial slip preferably should be not less than the said ultimate capacity of the rod.

Another object of this invention is to provide a new means for connecting adjacent prefabricated concrete blocks by which the same are

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united to provide structural continuity of uniform tensile or flexural strength.

Another object of this invention is to provide a new means for connecting several adjacent prefabricated concrete blocks by which the full tensile or flexural strength of one block is transmitted to others.

Still another object of this invention is to provide a new connection between precast concrete blocks, in which free ends of reinforcing rods of one block are introduced into special jackets embedded in the other blocks or blocks, whereupon said jackets are filled with a binder, such as cement, or grout; said jackets being of such design as to create wedging action upon the end of the reinforcing rods embedded therein, when a force is applied to pull said rods out of said jackets.

Another object of this invention is to provide a new connection between adjacent prefabricated concrete blocks comprising a jacket in form of a plurality of superimposed frusto-conical sections embedded in one of the blocks, said sections tapering toward the open end. Said jacket is designed to admit a free end of a rod embedded in the other block, whereupon the jacket is filled in with cement, grout, or special grout and permitted to set.

Another object of this invention is to provide a special grout for filling said jacket.

Still another object of this invention is to provide a new anchoring means for connecting to a concrete block individual rods, stubs, dowels, bolts, swedge bolts and the like.

Other objects and advantages will appear as the specification proceeds and the particular features of the invention will be specifically pointed out in the appended claims.

This invention is illustrated in the accompanying drawing in which:

Fig. 1 is a vertical cross-section through a concrete block containing a jacket.

Fig. 2 is a vertical cross-section through a concrete block having a reinforcing rod protruding above the top surface thereof.

Fig. 3 is a cross-section through a concrete block showing a depression therein in form of a jacket shown in Fig. 1.

Fig. 4 is a vertical cross-section through two concrete blocks spliced in accordance with the teachings of this invention.

Fig. 5 is a horizontal section taken along the line 5—5 of Fig. 4.

Fig. 6 is a side view of one half of the modified jacket.

Fig. 7 is a plan view of the modified jacket.

Fig. 8 is a perspective view of two concrete blocks ready for splicing.

Fig. 9 is a side view of three spliced concrete blocks.

Fig. 10 is a horizontal cross-section taken along line 10—10 of Fig. 9.

Fig. 11 is a plan view of Fig. 9 looking along the line 11—11, and

Fig. 12 illustrates how a hook may be imbedded in a block.

In general, I provide a jacket comprising a plurality of frusto-conical sections superimposed upon each other and tapering toward the open end thereof. The jacket is embedded in a concrete block with the open end thereof flush with the side facing an adjoining block to which the first block is to be anchored. A passage is provided in the first mentioned block leading from a side thereof to the other end of said jacket, through which passage cement, grout or other cementitious material may be poured into the jacket.

The second mentioned block carries a reinforcing member which hereinafter shall be referred to through the specification and claims as a rod protruding beyond the surface of said block a certain predeterminate distance. The free end of said rod is located opposite to said jacket and is adapted to enter the same for the purpose of being anchored therein, when said blocks are placed in proper relation.

After the free end of said rod is introduced into the jacket and the blocks put in proper relation, cement, grout or other cementitious material is poured into the jacket through said passage and said material is allowed to set.

The jacket material is so chosen, that the cementitious material does not adhere thereto, but does adhere to the rod. Whenever a force is applied to the rod tending to pull said rod out of said jacket, said force is transmitted by said rod to the cementitious material around the same, as the latter is strongly bound to said rod. The said material, being free from adhesion to the jacket, has tendency to slip in relation to said jacket. The jacket being surrounded by monolithic reinforced concrete, cannot expand and reacts with passive compressive forces. Hence, the slightest slip of the cementitious material in the jacket results in wedging action upon said material due to the frusto-conical shape of the jacket's sections, which action is evenly distributed along the whole length of said jacket, and is evenly transmitted upon said rod by said material. The greater pulling force is exerted on said rod, the greater compression is produced on said rod by said material, due to said wedging action. Hence, the end of the rod is securely locked in said jacket, thus locking both blocks together.

The same principle of using a wedging force is employed in attaching a stub, dowel or bolt to a precast concrete block, or a wall.

By numerous experiments I have found out that copper, brass, aluminum and galvanized steel are suitable materials for the jacket, as they are comparatively cheap and ductile, and are repellant to cement, grout and other cementitious materials. The slope of the frustrums of the sections is preferably 3°–15°, the smaller the slope the greater wedging action is developed by its sections, subject to limitation by slippage between the grout and the jacket.

For illustration purposes, I have shown in

Figs. 1–4 and 8 two concrete prefabricated blocks 1 and 2, which are to be set one upon another and spliced. The lower block 1 has a plurality of rods 3 therein, the ends of which extend beyond the top surface 4 of said block a certain predeterminate distance. The rods 3 are of structural type and have a plurality of indentations and embossments thereon for the best possible connection and uniting with concrete. A number of horizontal reinforcing members 7 is also imbedded in said block.

The upper block 2 has also a plurality of reinforcing rods 8 located in close proximity to the corners of said block. The rods 8 are preferably tied by the horizontal members 9.

The blocks 1 and 2 are connected by a connector 10 which comprises a specially designed jacket 11 containing a free end of the rod 3 anchored in said jacket by means of grout or other cementitious material.

The jacket 11 is located in said block 2 opposite each rod 3 of the block 1, said jacket being opened at its bottoms. Each jacket 11 consists of a plurality of frusto-conical sections 12 superimposed upon each other, the narrow end 13 of each section being closer to the opening 14 of the jacket, than its wider end 16. The wide end 16 of each succeeding section is connected to the narrow end 13 of each preceding section by a round shoulder 17. The last section 12 is formed at its bottom into a long cylindrical part 18. The top of the jacket 11 is closed by a cap 19, which carries a tube 21. The jacket 11 is preferably made of cheap ductile metal which is repellant to cement and cement grout, such as copper, brass, aluminum and galvanized steel, which while inexpensive, possess said qualities. The slope of the frustrums of the sections 12 is preferably between 3° to 15°, however greater slopes may be used.

The jacket 11 may be integral, or consist of two or more parts, which may be connected together by welding, soldering, or bolts, or otherwise. In Figs. 6 and 7 I show a jacket 25 made of two symmetrical halves 26 and 27 having flanges 28. The latter may be welded, spot-welded, bolted or otherwise secured to each other for the purpose of making a complete jacket.

The cylindrical part 18 is specially provided for the purpose of avoiding high concentration of stresses near the block's surface.

The purpose of the cap 19 is to close and keep the jacket 11 closed while the block is being made. The tube 21 serves as a passage for grout into the jacket 11. Said tube 21 is preferably made with a slip extension 22 which permits increasing or decreasing the length of the tube so that the end of the tube may be positioned flush with the side wall of the block.

The rod 3 is introduced into the jacket 11 and is placed concentrically thereto. The block 2 is placed on the block 1, whereupon grout is poured into the jacket 11 through the tube 21 and is allowed to set, to form a grout mold 23 which adheres to the rod 3 but does not adhere to the walls of said jacket.

When a force is applied to separate said blocks 1 and 2, the pull exerted on the rod 3 and transmitted to the grout, will produce wedging effect upon the latter due to the shape of said jacket, which effect will be evenly distributed along the length of the jacket and evenly transmitted upon the rod 3, thus wedging the rod 3 in said grout. It is desirable to have the horizontal members 9

closely spaced around the jacket 11 in order to counteract radial pressure exerted by the jacket, or the jackets, on surrounding concrete.

Fig. 3 shows a concrete block 30 having a depression 31 made in form of a jacket by some form which, after the concrete block sets, may be taken apart and out of said depression. A passage 32 is provided in said block for the purpose of pouring grout into said depression after a rod, or some other member, is introduced thereinto.

By eliminating a metallic jacket a considerable saving may be achieved, and the depression 31, having the same form as the jacket, will react on the grout therein exactly the same as the jacket. The wall of the depression 31 should be covered with some grout repellent composition to prevent the adherence of the grout to the concrete block.

Figs. 9–11 illustrate the application of the connectors for connecting two beams 40 and 41 with a column 42 wherein the ends of the beams rest on said column. For the purpose of connecting the two beams together, the beam 40 is provided with four jackets 43 embedded in the end thereof facing the beam 41. The latter beam has four reinforcing rods 44 located opposite said jackets, so that said rods enter said jackets. A plurality of reinforcing members 46 arranged around said jackets is provided in the beam 40 to take care of the stresses which may develop therein. The rods 44 are anchored in said jackets by grout poured through the passages 47.

For the purpose of attaching the beams 40 and 41 to the column 42, the latter is provided with four jackets 48 adapted to receive the rods anchored in said beams. The beam 40 has two reinforcing rods 49 embedded therein, the free ends of which enter the jackets 48 after the same are filled with grout. The beam 41 preferably has a pair of vertically arranged jackets 51 extending practically the whole thickness of said beam. Upon splicing the beam 40 with the column 42, the beam 41 is moved in so that its reinforcing rods 44 enter the horizontal jackets 43, and the jackets 51 are aligned with the jackets 48, whereupon short reinforcing bars 52 are dropped into said jackets and grout poured in. The jackets 51 are surrounded with a reinforcing member 53 in the form of a spiral.

The jackets 48 are reinforced by a plurality of reinforcing members 56. Grout is also poured and fills in the spaces between said concrete members, which is preferably about one half inch, for the purpose of providing flexibility between the same.

Fig. 12 illustrates how a bolt, a hook, or the like, may be secured to a concrete block, or a wall. A jacket 60 is provided in a block 61. Said jacket may have a passage 62 leading from the inner end of said jacket to the outside surface of the block for the purpose of introducing grout into said jacket, if for some reason grout cannot be introduced through the open end of said jacket. A hook 63, or bolt, or the like, is inserted in the jacket and grout is forced in. Upon setting of grout said hook 63 is securely anchored in the block.

It is understood that in every connector, the jacket may be dispensed with, and a depression may be provided in the concrete block instead of said jacket, providing said depression has a form adapted to wedge grout and the rod contained therein, thereby greatly increasing the anchoring power of the connector.

In some cases for some special classes of concrete where extreme durability and strength is required, I prefer to use a special grout which is comprised of cement, water and small particles of quenched steel, for instance nail whiskers, all mixed in any desired proportion. The preferred composition of this grout consists as follows: one part of cement by weight, to one to five parts of said steel particles. Amount of water and sand depends upon the desired degree of plasticity of grout.

I found experimentally that to bear the tensile capacity of anchored rod, the grout in the jacket should not only withstand compression and shear, but mainly bear the extreme pressure exerted on the grout by the projections and deformations of the rod. I also found that the quenched steel particles, such as nail whiskers, when added to the grout in the above proportion, make the grout extremely strong in bearing and consequently permit to develop high tensile capacity in the connector.

I claim:

1. In a joint between two precast blocks, a rod anchored in one of said blocks and having a free end extending therefrom, the other of said blocks having an opening on the side opposite said one block, a jacket in said opening comprising a plurality of frustrums superimposed upon one another and tapering toward the side opposite said one block, said free rod end extending into said jacket, a binder filling the chamber and surrounding said rod end in said jacket, said jacket having a straight cylindrical section near said open block side, a cover closing the opposite end of said jacket, said cover having an opening therein to admit said binder to said jacket, a pipe embedded in said other block and leading from said opening in said cover to a side of said other block, said pipe constituting a passage for the delivery of said binder into said jacket, said jacket having a binder repelling inner surface allowing slippage between said surface and said binder.

2. A connection between precast blocks, said connection including a reinforcing rod embedded in one of said blocks and having a free end extending beyond said one block, a jacket embedded in another of said blocks, said jacket having an open end at that of the block sides which faces the one of said blocks, said jacket comprising a plurality of frusto-conical sections superimposed upon one another and having the smaller ends of their frustrums disposed toward the open end of said jacket, said free rod end extending through said open end into said jacket, a binder around said free rod end filling said jacket, said jacket having an inner wall surface repelling said binder to allow slippage between said binder and said jacket under a pulling force, whereby wedging action is effected by said binder upon said free rod end.

3. A joint between two precast concrete blocks, said joint comprising a rod embedded in one of said blocks and having a free end extending beyond said one block, the other of said blocks having a depression of larger cross section than that of said rod end and having an open end, said free rod end extending through said open end into said depression, said depression being in form of a plurality of superimposed frustrums tapering toward the open end of said depression, a binder filling the space between said free rod end and the walls of said depression and a means on the walls of said depression allowing slippage between said binder and said walls, whereby said

free rod end extending into said depression is subjected to a wedging action by said binder, when a pulling force is exerted on said free rod end.

4. A joint connecting two precast blocks, said joint comprising a rod, one end of which is embedded in one of said blocks and the other end of which extends beyond said one block, the other of said blocks having a cavity open at the block side facing the one block, said cavity being of larger cross section than that of the other rod end and receiving said other rod end, a binder around said other rod end in said cavity filling the latter, said binder having the form of a plurality of superimposed frustrums tapering toward the opening of said cavity and means on the wall of said cavity preventing adhesion of said binder to said wall and thereby permitting slippage between said other block and said binder under a pulling force, whereby a wedging action takes place on said other rod end within said binder.

5. In a concrete block, a rod anchoring means, said block having a cavity formed in one side of said block, a rod having a free rod end, said cavity receiving said free rod end, a binder embedding said free rod end in said cavity and filling the latter, said binder being in the shape of a wedge tapering toward said one side of said block, means on the walls of said cavity preventing adhesion of said binder to said cavity walls and thereby permitting slippage of said binder in relation to said block under a pulling force, whereby a wedging action is effected on said rod end within and by said binder.

6. In a joint between two precast blocks, a rod anchored in one of said blocks and having a free end extending therefrom, the other of said blocks having an opening on the side opposite said one block, a jacket in said opening comprising a plurality of frustrums superimposed upon one another and tapering toward the open block side, said free rod end extending into said jacket, a binder filling the chamber surrounding said rod end in said jacket, said jacket being of thin ductile material having a binder repelling inner surface allowing slippage between said surface and said binder.

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