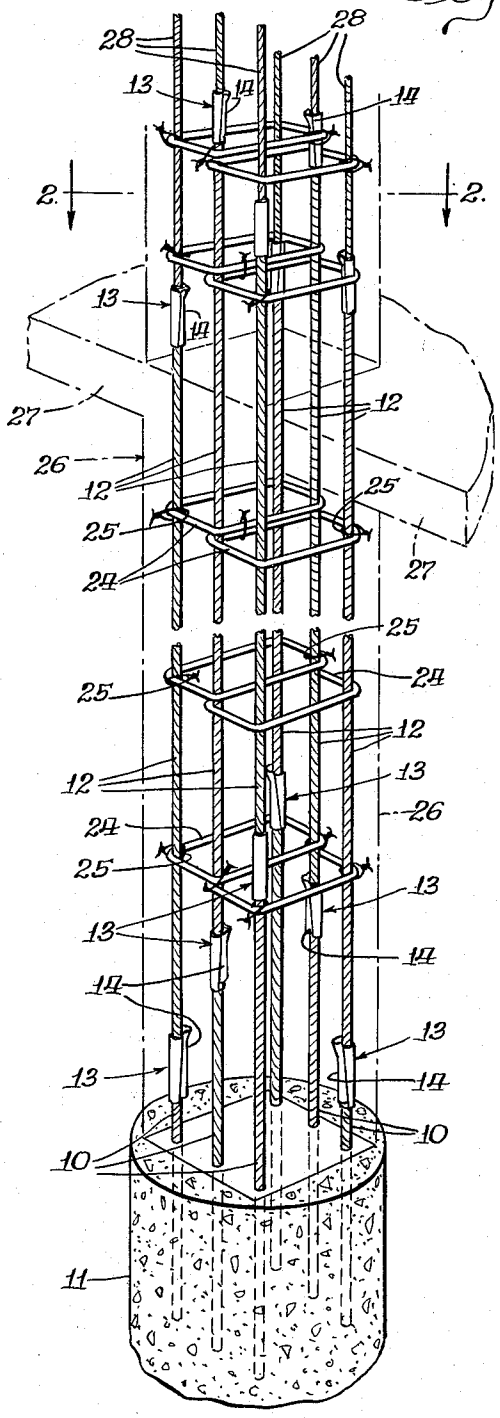
April 12, 1966 F. D. REILAND 3,245,189

REINFORCED VERTICAL CONCRETE STRUCTURES

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Fig. 1.



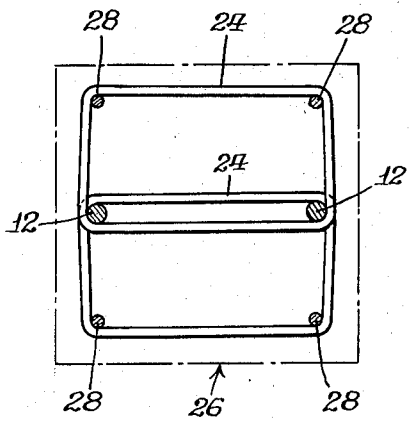


Fig. 2.

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REINFORCED VERTICAL CONCRETE STRUCTURES

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Fig. 3.

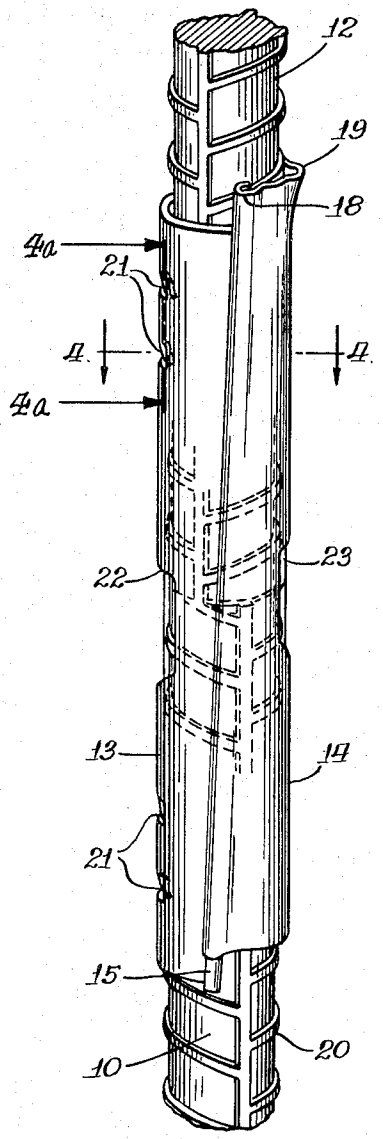
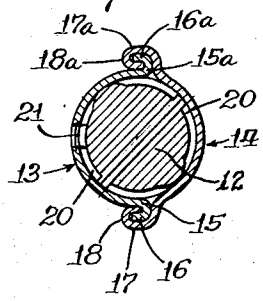


Fig. 4.



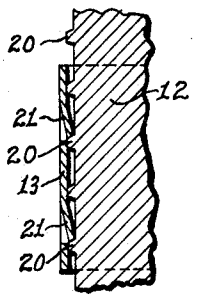
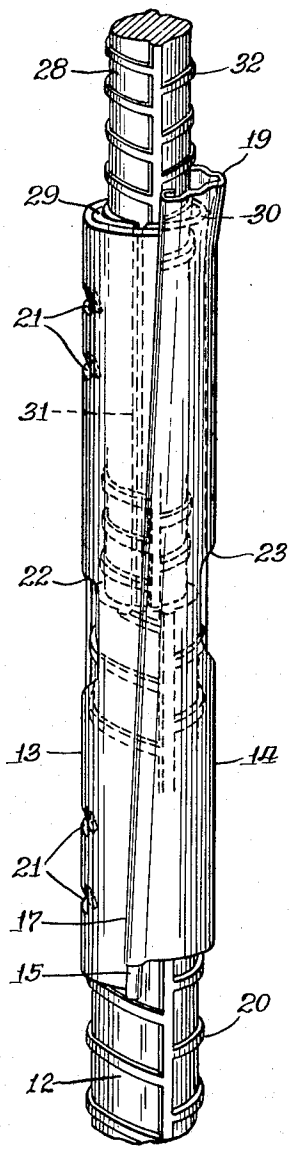


Fig. 4a

Fig. 5.



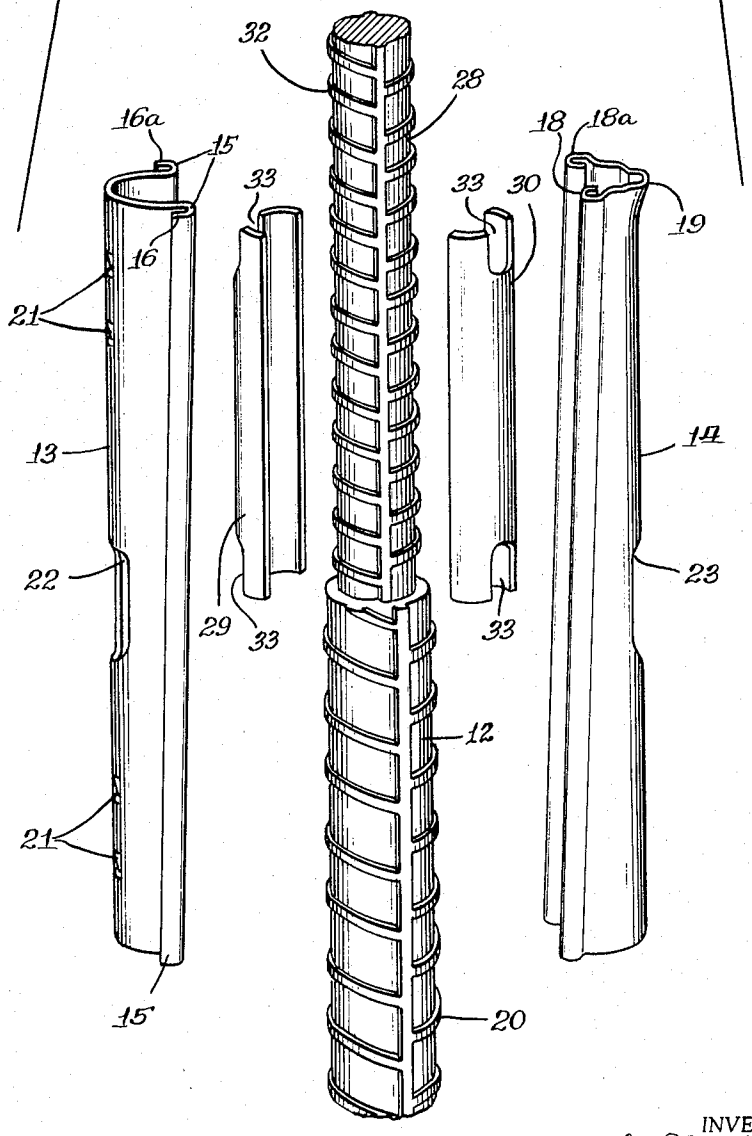
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REINFORCED VERTICAL CONCRETE STRUCTURES

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Fig. 6.



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REINFORCED VERTICAL CONCRETE STRUCTURES

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Fig. 7.

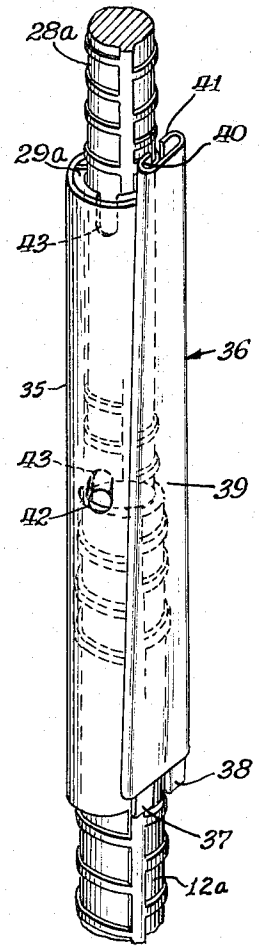
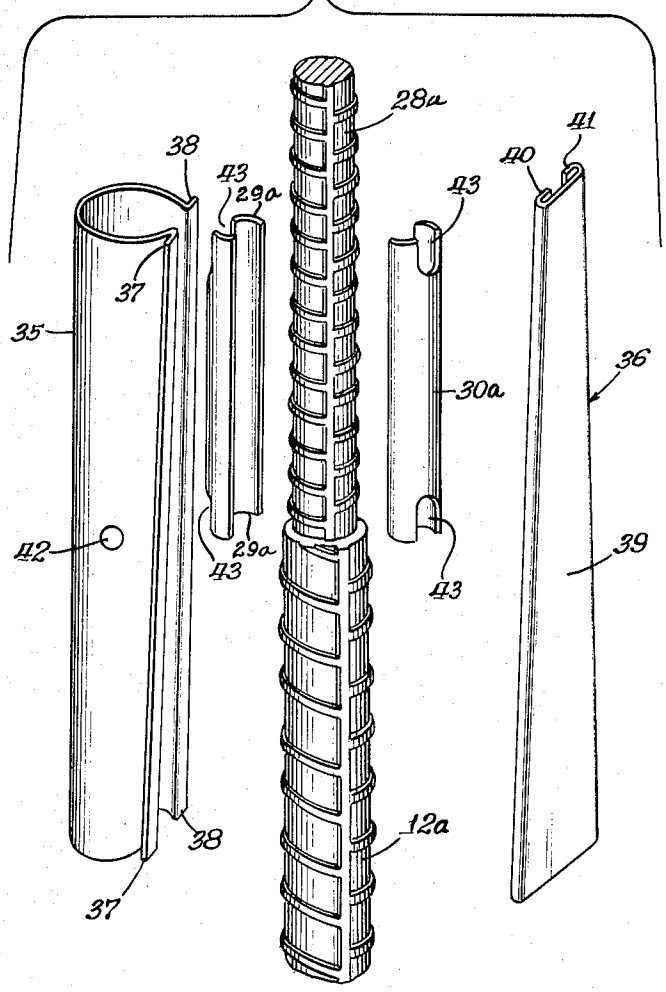


Fig. 8.



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United States Patent Office 3,245,189 Patented Apr. 12, 1966

3,245,189

REINFORCED VERTICAL CONCRETE STRUCTURES

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Filed July 10, 1962, Ser. No. 208,714
7 Claims. (Cl. 52—648)

The present invention is a continuation-in-part of my copending application Serial No. 125,538, filed July 20, 1961, and relates to improvements in reinforced vertical concrete structures such as columns and other verticals in which one or more pairs of conventional reinforcement bars are spliced together and embedded in the concrete.

The principal object of the invention is to provide, in a structure of the above character, a reinforcement which may be composed of one or more axially aligned pairs of reinforcement bars of the same or of different diameter classifications arranged in end to end abutting engagement and clamped together by a novel sleeve clamp structure adapted to accommodate bars of the same diameter or of different diameters to be imbedded in the same concrete structure.

Heretofore, it has been customary practice to splice vertically extending reinforcing bars together for embedment in concrete by overlapping the adjacent ends of the bars to an extent equal to twenty or more times the diameter of the larger bar and thereafter secure the bars together by means of heavy wire wrapped around the overlapped ends of the bars. Making a splice of this character requires considerable time and therefore involves high labor costs. Also the overlapped ends of the bars displace objectional amounts of concrete at the splices in the region of the perimeter of the concrete structure. Furthermore, the compression forces in the column are not transmitted directly from one reinforcement bar to another. On the contrary, such compression forces are transmitted through the splice solely by virtue of the surface bond of the concrete with the deformations of the bars—that is to say with the angular ribs formed on the bars.

Another type of splice is formed by butt welding aligned bars together. The butt ends are usually formed with interfitting V-shaped end faces for receiving the welding metal. This practice is more expensive and therefore less desirable, from the standpoint of economy, than the "lap splice" since each weld requires the services of a highly skilled technician from ½ to 1½ hours. Also it is necessary to X-ray each weld to make certain that the weld is acceptable. Therefore, in spite of the drawbacks of the "lap splice" it is used more extensively than the welded type of splice.

According to the present invention the reinforcement bars of the same or of different diameters having their adjacent end faces formed flat and perpendicular to the longitudinal axes of the bars, are arranged in longitudinal axial alignment with each other and with their adjacent end faces in flat coplanar contact so that compression forces are transmitted directly from one bar to an adjacent bar. The said ends of the connecting bars are clamped together by means of a sleeve-type clamp having some circumferential flexibility and adapted, when the bars are of like diameters, to exert a circumferential constricting grip on the peripheries of both bars being spliced. If the bars are of different diameter classifications, a sectional reducer sleeve is applied as an auxiliary fitting to the end portion of the bar of smaller diameter. The reducer sleeve sections are of sufficient thickness to compensate for the difference in the diameters of the bars and are clampingly embraced by the sleeve clamp. The reducer sleeve sections have some circumferential flexibility and also have some clearance along their longitudinal edges. Consequently they are adapted to be flexed into tight contact with their associated bar by virtue of their direct contact with the sleeve clamp and by the constrictive pressure exerted by the latter.

In order to facilitate final inspection of the abutting contact of the bars after the clamp is applied, the medial portion of the sleeve clamp is formed with inspection openings located at the abutting faces of the bars. The end portions of the reducer sleeve sections are formed with slots adapted to cooperate with the openings in the sleeve clamp to facilitate inspection of the face to face contact of the connected bars.

A preferred embodiment of the invention is shown in the accompanying drawings wherein:

FIG. 1 is a fragmentary view of a concrete structure reinforced by means of steel bars of different diameters and showing also special clamp structures for splicing said bars;

FIG. 2 is a cross-section on line **2—2** of FIG. 1, showing bars of different diameters;

FIG. 3 is a perspective view in side elevation of a pair of reinforcement bars of like diameter clamped together by means of a special sleeve clamp;

FIG. 4 is a cross-section on line **4—4** of FIG. 3;

FIG. 4*a* is a fragmentary cross section taken on line *4a—4a* of FIG. 3;

FIG. 5 shows the sleeve clamp of FIG. 3 used in connection with a sectional reducer sleeve for splicing bars of different diameters;

FIG. 6 is an exploded view showing the parts of FIG. 5;

FIG. 7 is a view in perspective showing, on a smaller scale, the reducer sleeve sections of FIG. 5 used in connection with a modified form of clamping sleeve; and

FIG. 8 is an exploded view of the assembly shown in FIG. 7.

Referring first to FIGS. 1 and 2 wherein six metallic reinforcements extend vertically of a concrete column and are embedded therein, each of the six reinforcements includes a bar partially embedded in a base or pier **11** and having a dowel section **10**. The several dowels **10** extend different distances upwardly from the base **11** and each supports on its upper end a bar section **12** of the same diameter as its associated dowel **10**. The contiguous end faces of the dowels **10** and the bars **12** are formed to provide flat faces extending perpendicular to the longitudinal axis of the respective bars so that the contiguous end faces will have perfectly horizontal coplanar contact and thereby insure direct transmission of compressive forces from one bar to another without danger of lateral slippage.

Each pair of aligned bars **10** and **12** are arranged in end-to-end axial alignment and are clamped together by means of a sleeve clamp (see FIGS. 3 and 4) comprising in each case a pair of substantially semi-cylindrical wedge members **13–14** which together embrace and wedgingly interlock about the abutted ends of said bars **10** and **12**. The semi-cylindrical wedge member **13** has inclined longitudinal edges **15–15***a* which are turned outwardly and then laterally to form hooks **16–16***a* as shown best in FIG. 4. The longitudinal edges **17–17***a* of the clamp element **14** are inclined and turned outwardly and then inwardly as indicated at **18–18***a* to form wedge-like hooks for interlocking with the wedge hooks **16–16***a*. One end of the wedge member **14**, for example, the upper end in FIG. 3 is preferably pressed outwardly to provide a fluted end portion as indicated at **19** to provide a striking face for receiving the impact force of a hammer (not shown) to drive the element **14** lengthwise of element **13** to effect clamping engagement with perimeters of the abutting bars **10**, **12**. The said wedge members have

frictional contact with the outer surfaces of deformation ribs **20** which define the perimeters of the bars **10**, **12**. However, in order to avoid displacement of the wedge member **13** during the driving of the member **14** to its operative clamping position, the upper and lower ends of member **13** are provided with inwardly displaced tongues **21** adapted to abut against certain of the deformation ribs **20** of the bars **10** and **12** as shown best in FIGS. 3, 4 and 4*a*. The medial portions of both wedge members **13** and **14** are provided with elongated inspection openings **22**, **23**, whereby the condition of the abutting contact of the end faces of the reinforcement bars may be observed.

The bars **10** and **12** may vary slightly in diameters and in their respective perimeter contours as an incident to the wear of the rolls used in forming the bars. However, the wedge members **13**, **14**, while they are rigid lengthwise, being of a length equal to approximately seven times the diameter of the larger bar, are sufficiently thin to yield circumferentially, and therefore will conform to said slight variations in diameters and perimeter contours.

The fact that the wedge members **13** and **14** are substantially semi-cylindrical they may be moved laterally of the bars into embracing engagement therewith after the bars have been positioned in endwise engagement. The tightening of the wedge members will move the abutting bars into perfect axial alignment and maintain them in proper position during the pouring of the concrete.

After a group of bars are clamp spliced to their respective dowels, for example the group of bars **12** shown in FIG. 1, transverse ties such as shown at **24** or other conventional reinforcements are slipped over the upper end of the group of bars and moved longitudinally thereof to selected positions to hold the bars in parallel relation and thereby form a cage-like assembly. The lateral reinforcements **24** are anchored in position by means of wire fasteners **25**.

Referring now to the concrete column **26** or other structure in which the metallic reinforcements are embedded: The concrete verticals of a building are poured for one floor at a time. The column **26** is therefore shown herein as extending from the pier or base **11** to an upper floor **27**; the column and the upper floor being both shown in dot and dash outline for the purpose of clearness.

The bars **12** are preferably of uniform length and their upper ends project different distances above the upper floor **27**. These projecting ends, therefore, serve as dowels for receiving additional bar sections **28**. The bar sections **28**, of the present structure, have standard diameters less than the diameters of the bars **12** (see FIGS. 5 and 6). Therefore, in order to utilize the wedge members **13**, **14** to effect a butt splice connection of each pair of bars **12–28**, reducer sleeve comprising sections **29**, **30** are applied to the lower end of the bar **28** of smaller diameter. The reducer sleeve sections seat on the flat upper end of the bar **12** and their thickness compensates for the difference in the diameters of the abutted bars **12** and **28**. The sleeve clamp wedge members **13** and **14** are then applied in the usual manner to embrace and clamp the bar **28** by constricting pressure exerted through the reducer sleeve sections **29**, **30** and by like constricting pressure exerted directly on the upper end portion of the bar **12** as shown in FIG. 5. The said reducer sleeve sections are sufficiently thin and their longitudinal edges are spaced apart as shown at **31** in FIG. 5. Consequently, the reducer sleeve as a whole is flexed circumferentially into tight gripping engagement with the perimeter surfaces of the deformation ribs **32** on the clamped bar **28**.

The opposite ends of each reducer sleeve section are recessed to provide inspection openings **33**, **33** adapted to register with portions of the inspection openings **22**, **23** of the wedge members **13**, **14** when the latter are

in their interlocked applied positions. When the reducer sleeve sections are used, the upper pair of tongues **21** engage the adjacent reducer sleeve while the lower pair of tongues **21** abut against a side wall of a deformation rib **20** on the associated lower bar **12**.

FIGS. 7 and 8 illustrate a modified splice assembly comprising a pair of reinforcement bars of different diameters, a circumferentially flexible reducer sleeve including a pair of reducer sleeve sections fitted to the lower end portion of the smaller bar, and a pair of sleeve clamp wedge members enclosing the adjacent end portions of the bars. The bars may be the same as the bars **12** and **28** shown in FIGS. 5 and 6, and are designated by the same reference numerals **12***a* and **28***a*. This is also true of the reducer sleeve sections designated as **29***a* and **30***a* which are constructed and applied to the bar **28***a* of smaller diameter in the same manner as described in connection with FIGS. 5 and 6.

The clamping means of the above modified assembly comprise sleeve clamp wedge members **35**, **36** which embrace and grip an end portion of the bar **12** of larger diameter and also embraces and grips the reducer sleeve sections **29***a*, **30***a* so as to press them into gripping contact with an end of the smaller bar **28**. The member **35** of the modified sleeve clamp in a split sleeve which embraces the major portion of the circumference of the end of bar **12** and the said reducer sleeve sections **29***a*, **30***a*. Its longitudinal edges are bent outwardly to provide wedge flanges **37**, **38**. A flat wedge member **39** is formed with marginal inturned flanges **40**, **41** which have interlocking wedging engagement with the flanges **37**, **38** and thereby flexes the sleeve **35** into tight gripping contact with the bar **12** and reducer sleeve sections **29***a*, **30***a*. The sleeve **35** and likewise reducer sleeve sections **29***a*, **30***a* have sufficient circumferential flexibility to permit them to conform substantially to slight variations of the diameters and contours of the bars.

During the installation of the modified clamp assembly shown in FIGS. 7 and 8 the split sleeve **35** is slipped over the upper end of the bar **12***a*. The reducer sleeve sections **29***a*, **30***a* are then applied to the lower end of the bar **28***a* to be spliced to the bar **12***a*. The sleeve element **35** is then moved upwardly until its transverse center aligns with the abutting end faces of the bars **12***a* and **28***a*. While the sleeve element **35** is retained in its operative position, the wedge member **36** is engaged with the wedge flanges **37**, **38** and forced lengthwise thereof in a direction to draw the flexible sleeve **35** tightly about the bar **12** and the reducer sleeve section members. The clamping pressure exerted in addition to clamping the bars moves them into axial alignment.

An inspection opening **42** in the sleeve **35** cooperates with an end slot **43** formed in a reducer sleeve section **29***a* or **30***a* to facilitate visual inspection of the relative positions of the end faces of the abutting bars **12***a*, **28***a*.

The sleeve clamp members **35**, **36** conform substantially to one form of clamp shown in my copending application, Serial No. 200,204, filed June 5, 1962. However, the specific form of clamp sleeve **35**, **36** is claimed in my said copending application, and is not claimed herein apart from the reinforcing bars of different diameters and the associated reducer sleeve elements **29***a*, **30***a*.

It will be observed by inspection of the improved reinforcing structure shown herein that each of the several verticals thereof includes at least one pair of reinforcement bars of like diameters butt spliced together by means of interlocked wedge clamp elements and at least one pair of connected bars of different diameters butt spliced together, by means of a suitable clamp assembly.

While the invention is illustrated in connection with certain preferred embodiments, it will be understood that the invention contemplates all variations in construction coming within the scope of the appended claims.

I claim:

1. A reinforced vertical concrete structure comprising

at least one pair of reinforcement bars of different diameter classifications embedded therein to extend lengthwise thereof and arranged in end-to-end axial alignment, and a sleeve clamp for splicing the bars together comprising a circumferentially flexible reducer sleeve embracing the butted end of the bar of smaller diameter and a pair of wedge members which together embrace the adjacent end portions of said bars and the said reducer sleeve; the said wedge members being formed along their opposite longitudinal edges with interlocking flanges having co-engaging wedging surfaces extending lengthwise of the wedge members and adapted upon relative movement of the wedge members in one direction to exert circumferential constrictive clamping pressure directly on the perimeter of the bar of larger diameter and on the bar of smaller diameter through said reducer sleeve.

2. A reinforced vertical concrete structure as defined in claim 1, wherein the bars are provided with conventional angular deformations thereon and one of the semi-cylindrical wedge members is provided with at least one flexible tongue extending inwardly in abutting engagement with a side wall of an angular deformation to hold the tongued wedge member fixed relative to the bars, while the other wedge member is driven lengthwise of the bars to exert said constrictive clamping pressure.

3. A reinforced vertical concrete structure as defined in claim 2, wherein there is a pair of said inwardly projecting tongues at either side of the medial region of the fixed wedge member.

4. In a reinforced vertical concrete structure of the character defined in claim 1, wherein the said wedge members of the sleeve clamp are semi-cylindrical and one wedge member is formed with a fluted end portion to provide an outwardly projecting striking surface for receiving impact applying force.

5. In a reinforced vertical concrete structure as defined in claim 1, wherein one of the sleeve clamp wedge members is circumferentially flexible, whereby the said wedge member and the reducer sleeve will conform to variations in the perimeter contours of the butted bars.

6. A reinforced vertical concrete structure as defined in claim 1, wherein the reducer sleeve includes two semi-cylindrical sections, both of which and one sleeve member of the sleeve clamp are provided with cooperating inspection openings for revealing the character of the end-wise contact of the reinforcement bars and the reducer sleeve sections.

7. A reinforced vertical concrete structure according to claim 6, wherein the reducer sleeve sections seat on the end face of the larger bar and the inspection openings in the sections of the reducer sleeve are elongated slots opening through the opposite ends of each reducer sleeve section, whereby either end of a reducer sleeve section may be seated on the end face of the larger bar.

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