Sept. 1, 1925.

1,551,863

L. G. BERRY

CONCRETE REENFORCING BAR

Filed Jan. 25, 1919

Fig. 1.

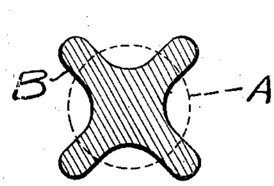


Fig. 2.

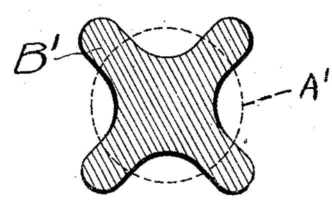


Fig. 3.

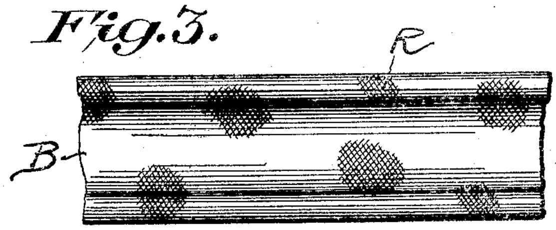
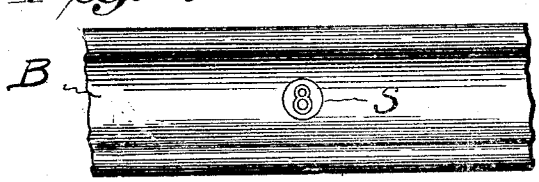


Fig. 4.



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Patented Sept. 1, 1925. **1,551,863**

UNITED STATES PATENT OFFICE.

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CONCRETE REENFORCING BAR.

Application filed January 25, 1919. Serial No. 273,087.

To all whom it may concern:

Be it known that I, LESLIE G. BERRY, citizen of the United States, residing at 403 Louise Ave., Charlotte, in the county of Mecklenburg and State of North Carolina, have invented certain new and useful Improvements in Concrete Reenforcing Bars, of which the following is a specification.

This invention relates to reenforcing bars, and has particular reference to a novel improvement in the type usually employed in reenforcing concrete structures.

The type of concrete reenforcing bar generally employed usually consists of a body having a plurality of lugs, projections or indentations for the purpose of providing the so-called mechanical bond between the concrete and the rod. While bars of this type have been widely utilized, experiments have shown that the bond frictional resistance of bars thus deformed, seldom exceeds, and in many instances fails to even reach, that provided by plain bars under similar conditions. Tests have shown that bond frictional resistance per unit of surface area is the same regardless of the size of the bar, and also that round bars which have been slightly rusted or pitted, and afterwards cleansed and tested, show the greatest adhesion to the concrete while flat surfaces show the least.

Furthermore, reenforcing bars having means of the character above referred to for giving a mechanical bond, obviously cannot be as efficient either from the standpoint of economy of metal or relative strength, for the reason that in such bars the fibres are not all continuous or parallel to the axis of the bar, and all of the metal is not available for direct tension. Such bars either weigh more than plain round or square bars of an equivalent sectional area, or else sacrifice some of this area to make deformations which break up the continuity of the fibres of the metal, and thus render the bar somewhat less effective for direct tension, as far as utilizing all of the metal in the bar for this purpose is concerned. Experiments have shown that such deformations, as a media for increasing bond strength are of doubtful value, and also that practical bond between concrete in flexure and the surface of the steel is not lasting but that the real bond is broken at about one-third of the ultimate load. After the breaking of this bond there is a creeping of the rod accompanied by a frictional resistance between the particles adhering to them and the surface of the concrete encasing them. This frictional resistance is termed as heretofore indicated bond frictional resistance.

Since experiments have proven that the bond frictional resistance per unit of area is the same regardless of the size of the bar, and have also proven the fact that a plain round bar which has been slightly rusted or pitted and afterwards cleaned off and tested gives the highest unit value of bond frictional resistance, it is desirable to provide a bar wherein the surface area is materially increased with relatively the same amount of metal, and at the same time preserving the continuity of the fibres of the metal in the bar wherein all of the same are fully in tension.

Accordingly, the present invention has primarily in view the provision of a deformed concrete reenforcing bar wherein the surface area of the bar is substantially increased for a given section. In other words it is proposed to provide a bar of uniform cross-section throughout, wherein the metal is so distributed that all of the fibres thereof are parallel to the axis of the bar, and continuous throughout its length, whereby all of the advantages of a plain bar will be preserved, but, in addition, a much larger percentage of surface area will be provided as compared with a plain bar of the same cross-sectional area. Thus, it will be apparent that the present invention clearly distinguishes from reenforcing bars having lugs, projections or other deformations which break up the fibres of the bar and impair its tensile strength.

A further object of the invention is to provide a bar having an identification symbol impressed thereon, whereby various sizes of bars may be readily identified when stacked together without the aid of any special instrument or the like for gauging. Reenforcing bars are generally made in sizes which increase in diameter from ⅜″ upward, each bar being approximately ⅛″ greater in diameter than the other. While the selection of different sizes of bar is relatively simple in the case of plain round or flat bars, it is more difficult in deformed bars, although they have the same cross-sectional area as plain bars. Hence an identification impressed on the bar during the rolling operation greatly facilitates the identification of the bars for after use.

With the above and other objects in view which will more readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated and claimed.

A practical illustration of the invention is disclosed in the accompanying drawings, in which:—

Figure 1 shows a deformed reenforcing bar, the dotted line therein representing the diameter of an equivalent circular area.

Figure 2 is a view similar to Figure 1 showing a bar of larger diameter.

Figure 3 is a fragmentary elevation showing how the surface of the bar may be superficially roughened over its entire surface to prevent relative slipping of the bars when secured together after being placed in the forms.

Figure 4 is a fragmentary elevation illustrating the application of a symbol to the bar to indicate its relative size.

Similar reference characters designate corresponding parts throughout the several figures of the drawings.

In carrying the present invention into effect, it is to be noted that the primary feature thereof is to increase the surface area of the bar for a given section, to provide the highest unit value of bond frictional resistance. As previously indicated the surface of a plain round bar gives the highest unit value of bond frictional resistance and at the same time all of the metal of the round bar is effective in calculating the tensile strength thereof. The present invention has in view preserving these desirable characteristics of the round bar and proposes to so distribute the metal in a deformed bar with this end in view, but at the same time providing a materially greater surface area.

By way of illustration reference may be made to Figure 1 which shows a round bar A, in dotted lines, of one inch diameter for instance, while in full lines is shown a geometrical shape B, resulting from such a distribution of the metal of a blank as to provide considerably greater perimeter for the same cross-sectional area without added metal, than found in the plain round bar A. That is to say, the same amount of metal and the same cross-sectional area is present in the bars A and B of the illustration, and the bar B has the increased surface due to the special distribution of metal referred to.

Further illustrating the example given, it is well known that the perimeter of a plain round bar one inch in diameter is approximately 3.14″, as A of the drawings, and by suitable calculation it is found that the perimeter of the fluted geometrical shape B has an augmented perimeter of 5.45″. Thus, by the distribution of metal into a fluted shape shown according to the present invention, the perimeter of the bar is increased approximately 2.31″. As compared with the perimeter of a one inch round bar this 2.31″ increase amounts to a 73% greater bond frictional resistance surface.

This percentage of increase in perimeter and consequent increase in surface area will hold good for all sizes of round bars. That is, in a comparison of larger sized bars, as given by the example of Figure 2, if the corresponding "round" A is an inch and a quarter in diameter, and the bar deformed according to the present invention into the shape B′, it will have its perimeter increased 73% with the consequent augmented surface area.

In the case of a plain square bar the perimeter may be increased 54%. For example a bar one inch square will normally have a periphery of four inches, but when deformed into a bar of fluted cross section as shown in the drawings it will have a total perimeter of 6.16 inches. This calculation is obtained upon the same basis as for a round bar.

For the purpose of aiding to prevent a relative slipping of bars when wired or otherwise fastened together before the concreting operation, it may be desirable to superficially and quite finely roughen the surface as indicated at R in Figure 3.

A further novel feature of the invention, and one of much practical importance is that of providing the various bars as they are rolled with suitable identification marks or symbols S to facilitate selection of sizes without the aid of any skilled knowledge or special instruments.

Figure 4 of the drawings illustrates a bar having thereon the figure "8" for instance, which would indicate that this bar is a 8/8″ bar or would be equivalent to a 1″ "round". In other words, the numeral appearing on the bar bears a relative significance to the size of the bar, it being the numerator of a common fraction indicating the size of the bar. Bars are usually made in ⅛″ sizes from ⅜″ upward, and hence the numerals or symbols 3, 4, 5, 6, 7, 8, 9 and 10 would readily indicate the numerator of the fraction whose denominator is always 8 to give the size of the bar. It is preferred to use the plain numerals without any exponent to indicate the diameters of round bars, and when the numerals are used with the exponent "x" for instance, 3^x, 4^x, 5^x, etc., it would indicate that the deformed bar has the equivalent cross-sectional area of a square bar, the length of whose sides correspond to the indication represented by the symbol. It will be observed that this feature of the invention therefore provides the surface of the bar with deformations affording a mechanical bond, and of a character indicative of a physical property of the bar.

From the foregoing it will be apparent that the present invention aims to provide a reinforcing bar of uniform cross-section throughout wherein the surface of the bar is materially increased for a given section to thereby also increase the total bond frictional resistance, this feature being accomplished by distributing the metal of the bar into a suitable geometrical figure, such for instance as shown in the drawings, while at the same time preserving the continuity of all of the fibres in the bar and maintaining its full cross-sectional area for tensile strength. Furthermore, the provision of suitable identification symbols readily facilitates the handling of the bars in trade and generally increases their facile identification by laborers or workmen who put them to place.

I claim:

1. A reenforcing bar for concrete structures including four radially disposed ribs extending uniformly parallel throughout the bar and connected by intervening sigmoidal faces, the perimeter of said bar being fifty-four percent greater than the perimeter of a square bar having the same cross-sectional area.

2. A reenforcing bar for concrete structures including four radially disposed ribs extending uniformly parallel throughout the bar and connected by intervening sigmoidal faces, the perimeter of said bar being seventy-three percent greater than the perimeter of a plain round bar having the same cross-sectional area.

3. A reenforcing bar having an index symbol impressed thereon, said symbol being the numerator of a common fraction indicating the relative size of the bar as compared with the unit of a bar of undeformed cross-section having the same cross-sectional area.

4. A bar for structural purposes provided with deformations affording a mechanical bond and of a character indicative of a physical property of the bar.

5. A bar for structural purposes provided on the surface thereof with deformations affording a mechanical bond and of a character indicative of the diameter of said bar, such deformations being visibly displayed at intervals on the surface of the bar.

6. A bar for structural purposes provided with deformations of a character indicative of a physical property of the bar and other deformations so positioned as to attain an area of cross section of the bar substantially uniform, certain of the deformations affording a mechanical bond.

7. A bar for structural purposes provided with means unitary therewith indicative of a physical property, such as the diameter, of said bar and with deformations affording a mechanical bond.

In testimony whereof I hereunto affix my signature.

LESLIE G. BERRY.