

May 14, 1968

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3,382,680

PRESTRESSED CONCRETE PILE SECTIONS

Filed Sept. 21, 1965

3 Sheets-Sheet 1

Fig. 1.

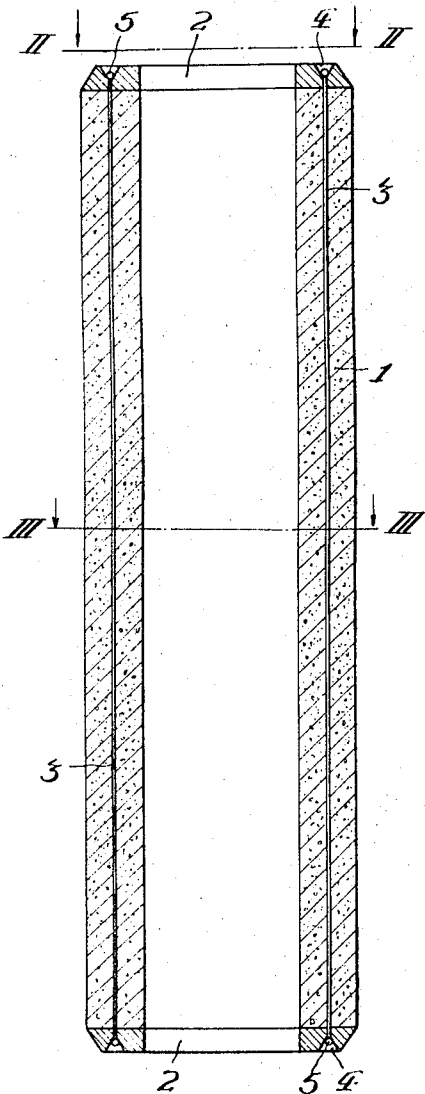


Fig. 2.

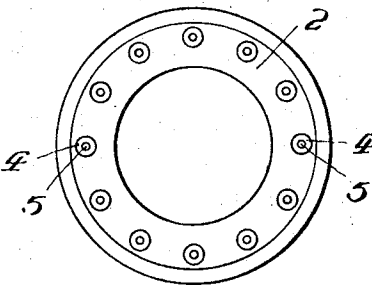
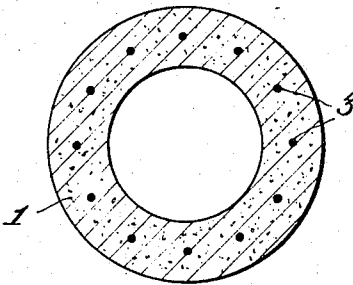


Fig. 3.



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Fig. 5.

Fig. 4.

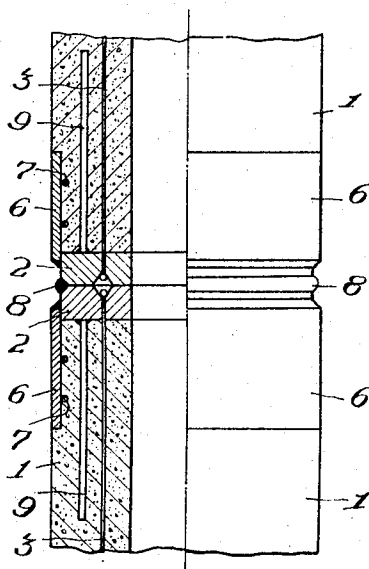
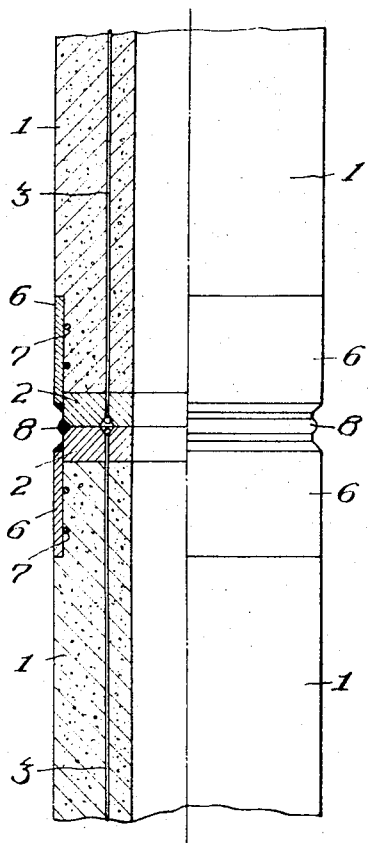
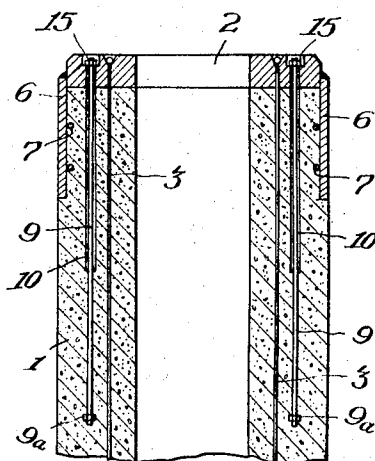


Fig. 6.



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Fig. 7.

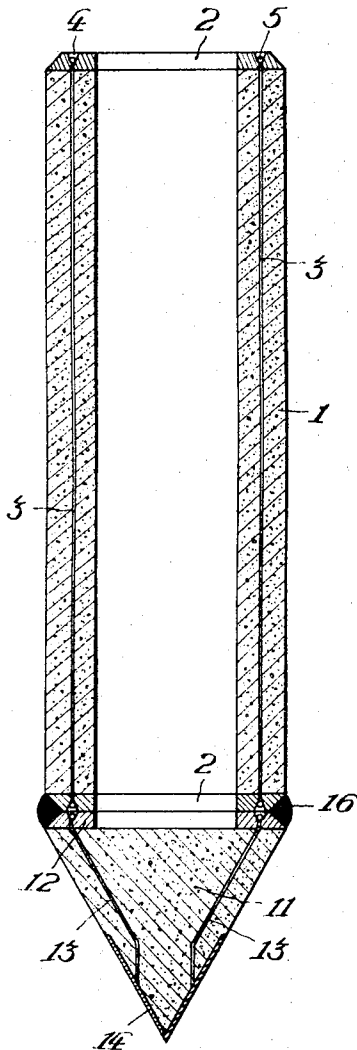
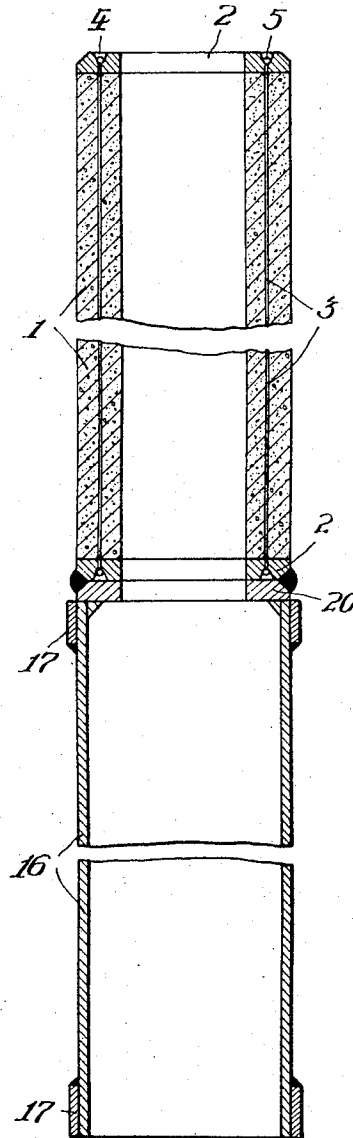


Fig. 8.



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PRESTRESSED CONCRETE PILE SECTIONS

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2 Claims. (Cl. 61—56)

ABSTRACT OF THE DISCLOSURE

A prestressed concrete pile section comprising a tubular body of concrete with a pair of annular metal discs at opposite ends thereof and reinforcing metal members extending between and secured to the metal discs in such a manner as to tension such reinforcing metal members and stress the concrete body is provided. Tubular metal plates are positioned on the periphery of the tubular concrete body and extend longitudinally thereof in partially axially overlapping relation with the metal discs to facilitate welding the tubular metal plates to the metal discs and strengthen end portions of the concrete body.

This invention relates to prestressed concrete piles and particularly to unit sections thereof. The concrete piles have reinforcing metal members extending under tensional forces longitudinally of a tubular body of concrete and tubular metal plates engage the periphery of the concrete body adjacent the ends thereof for reinforcing action.

The present invention has for its object to provide a prestressed concrete pile or pile section which has an improved structure particularly designed to enable effective pretensioning of the axial reinforcement, which takes the form of reinforcing steel wires, and is high in structural strength.

Another object of the present invention is to provide a prestressed concrete pile section of the character described which can be readily connected with another pile section of the same structure, forming therebetween a joint having a strength at least equal to that of the body portion of the pile sections.

These and other objects, features and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings, which illustrate a few embodiments of the invention and in which:

FIG. 1 is a longitudinal cross-sectional view of a prestressed concrete pile section embodying the present invention;

FIG. 2 is a top plan view of the pile section taken along the line II—II in FIG. 1;

FIG. 3 is a transverse cross-sectional view of the pile section taken along the line III—III in FIG. 1;

FIG. 4 is a fragmentary longitudinal cross-sectional view of two prestressed concrete pile sections each embodying the present invention and connected with each other in end-to-end relations;

FIG. 5 is a view similar to FIG. 4, illustrating the connection between two prestressed concrete pile sections also embodying the present invention;

FIG. 6 is a fragmentary longitudinal cross-sectional view illustrating one end portion of a further embodiment of the present invention;

FIG. 7 is a longitudinal cross section of a modification of the pile section shown in FIG. 1 and including a conical shoe connected to the bottom end thereof; and

FIG. 8 is a view similar to FIG. 7, illustrating a cylindrical steel pile connected with the pile section shown in FIG. 1.

Referring to the drawings and particularly to FIGS. 1 to 3, there is shown a prestressed concrete pile section which includes a tubular body 1 of concrete and a pair

of annular steel discs or rings 2 arranged at the opposite ends of the body of concrete 1 to form opposite end faces of the pile section. The pile section has an axial steel reinforcement in the form of circumferentially equally spaced parallel steel wires 3 secured at opposite ends to the respective steel rings 2 to extend therebetween. For the pretensioning of the steel wires 3, forces are applied prior to the placing of concrete to the opposite steel rings 2 to pull the latter away from each other and, with all the wires tensioned substantially uniformly, concrete is placed or cast into a tubular form in such a manner that the wires are embedded in the body of concrete. Subsequently, after the concrete has set, the forces acting upon the steel rings 2 are removed, transferring the prestress to the concrete through its bond to the steel wires.

The tubular concrete pile section thus obtained includes at its opposite ends steel rings 2 exteriorly exposed with the stretched axial reinforcing wires 3 embedded in the wall of the tubular body of concrete 1 and is longitudinally prestressed owing to the bond between the concrete and the axial reinforcing steel wires 3 and also to the restraining effect of the annular steel rings 2 to which the wires 3 are secured at their opposite ends.

When it is desired to connect this pile section with another unit of the same structure in end-to-end relation, the steel rings 2 forming the adjacent end faces of the two pile sections are brought into abutment against each other and welded together along their peripheral edges, as shown in FIG. 4. It is to be noted that the welded connection forms a joint having a strength at least equal to that of the tubular body portion 1 of the pile sections since the steel rings 3 welded together are each connected with the pretensioned steel wires 3 in the associated pile section and that there occurs no opening between the body of concrete and the adjacent steel ring even if the jointed pile portion is subjected to bending stress. Also, the top steel ring 2 of the upper pile section serves as a protection against blows applied when the pile is driven.

As shown, the steel rings 2 are formed with apertures 4 each having an enlarged end portion for securing the reinforcing steel wire 3 therein. To this end, the steel wire 3 is formed at each end with an enlarged head, which is received in the enlarged portion of the associated aperture 4 in the steel ring. For pretensioning the steel wires, the heads of each of the wires may be welded to the respective steel rings 2, if desired. It is to be noted that the wire heads are entirely in the enlarged portions of the apertures 4 not projecting beyond the end surface of the associated steel ring 2 and thus form no obstacle to the driving of the pile or to the face-to-face connection of the steel discs 2 of the adjoining pile sections.

Referring next to FIG. 4, which illustrates another embodiment of the present invention, a tubular steel plate 6 is welded to the periphery of each of the annular steel discs 2 and extends therefrom longitudinally of the pile section along the periphery of the tubular body of concrete 1. To interconnect two pile sections formed in this manner, the annular steel discs 2 forming the adjacent end faces of the two sections are brought together in face-to-face relation and welded together along the peripheral edges, as indicated at 8 in FIG. 4. In this figure, reference numeral 7 indicates rings of steel wire welded to the inner peripheral surface of the tubular steel plate 6 for the purpose of increasing its bond to the tubular body of concrete 1. The annular steel disc 2 and tubular steel plate 6 together form an integral steel structure bonded to the body of concrete 1 along its end and peripheral surfaces, effectively preventing any opening between the annular steel disc 2 and the body of concrete 1. Also, the joint, connecting the two pile sections with each other, has a strength at least equal to that of the tubular bodies of concrete.

Referring to FIG. 5, which illustrates a modification of the embodiment shown in FIG. 4, reference numeral 9 indicates an appropriate number of deformed steel bars each having an appropriate length and welded at one end to the inside face of the adjacent annular steel disc 2. Apparently, the steel bars 9 are embedded in the body of concrete 1 thus increasing the bond of the annular steel disc 2 to the latter.

FIG. 6 illustrates a further modification of the embodiment shown in FIG. 4. In this modification, the steel bars 9, embedded in the tubular body of concrete 1 and preferably deformed, are insulated from the concrete by an appropriate bituminous material along the major part of their length adjacent their outer threaded end. A nut 15 is threaded on the outer end of each of the steel bars 9 to clamp the latter against the annular steel disc 2. By tightening the nuts 15, it will be noted that the engaging pressure between the annular steel disc 2 and the tubular body of concrete 1 can be effectively increased. As shown, the inner ends of the steel bars 9 are also threaded to carry respective nuts 9a.

FIG. 7 illustrates a combination of a prestressed concrete pile section of the form shown in FIG. 1 and a conical shoe secured to the bottom of the pile section. The conical shoe includes an inverted cone of concrete 11 and an annular steel disc 12 of the same configuration as the one forming the bottom end face of the pile section 1. The steel disc 12 is secured to the top face of the inverted cone of concrete 11 and welded to the bottom steel disc 2 of the pile section 1, as shown. The bottom end or apex portion of the inverted cone of concrete 11 is capped with a conically formed steel sheet 14, which is connected with the steel discs 12 by a number of reinforcing steel wires 13 embedded in the inverted cone of concrete 11. The annular steel disc 12 of the conical shoe is brought into face-to-face contact with the bottom steel disc 2 of the pile section 1 and welded thereto along their peripheral edges as indicated at 16. The conical shoe 11 forming the bottom point of the pile unit apparently serves to facilitate driving the latter into earth.

FIG. 8 illustrates another form of pile unit which includes a prestressed concrete pile section of the form shown in FIG. 1 and a cylindrical steel pile 16 connected therewith in end-to-end relation. The steel pile 16 has an annular steel disc 20 welded to its one end and the disc is placed in face-to-face contact with the bottom disc 2 of the pile section 1. As shown, the two annular steel discs 2 and 20 are welded together along their peripheral edges. Annular steel bands 17 are fitted over the opposite end portions of the cylindrical steel pile 16 for the purpose of reinforcing the latter.

As will be readily understood from the foregoing description, prestressed concrete pile sections according to the present invention can be easily connected with each other and with pile attachments such as conical shoes for example shown in FIG. 7 or cylindrical steel piles such as shown in FIG. 8, and experiments conducted by the inventor has revealed that the simple connecting structure according to the present invention gives a joint strength at least equal to that of the pile body.

While the principles of the invention have been described above in connection with specific embodiments, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of the invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. A prestressed concrete pile section comprising:
 - a tubular body of concrete,
 - a pair of annular metal discs arranged at opposite ends of said tubular concrete body,

reinforcing metal members extending between said annular metal discs longitudinally through said tubular concrete body, said reinforcing members being pretensioned by applying forces to said annular metal discs to pull the latter away from each other,

tubular metal plates positioned so that they extend longitudinally of the pile section along the periphery of said tubular concrete body at each end thereof, said tubular metal plates partially axially overlapping and contacting exposed peripheral portions of the said metal discs and being made from plate material thinner than said metal disc to facilitate welding an end of each of said tubular metal plates to one of said metal discs,

metal rods extending axially into said concrete body from at least one end thereof through a said metal disc, said metal rods extending only a fraction of the length of said pile section, the inner ends of said rods being fixedly embedded in said concrete body and the axially outer ends of said metal rods being movably associated with said concrete body by bituminous layers between such body and said rods, and means to adjust the positions of the axially outer ends of said rods relative to said metal disc to increase the stresses on said concrete body.

2. A prestressed concrete pile section comprising:
 - a tubular body of concrete,
 - a pair of annular steel discs arranged at opposite ends of said tubular concrete body,
 - reinforcing steel wires extending between said annular steel discs longitudinally through said tubular concrete body, said reinforcing steel wires being pretensioned by applying forces to said annular steel discs to pull the latter away from each other,
 - a tubular steel plate being welded so that it extends longitudinally of the pile section along the periphery of said tubular concrete body,
 - steel wire rings welded to the inner peripheral surface of said tubular steel plate to increase the bond of said steel plate with said tubular concrete body,
 - metal rods extending axially into said concrete body from at least one end thereof through a said steel disc, said metal rods extending only a fraction of the length of said pile section, the inner ends of said rods being fixedly embedded in said concrete body and the axially outer ends of said metal rods being movably associated with said concrete body by bituminous layers between such body and said rods, and means to adjust the positions of the axially outer ends of said rods relative to the said steel disc to increase the stresses on said concrete body.

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JACOB SHAPIRO, *Primary Examiner*.