Nov. 21, 1933. O. A. MECHLIN 1,936,541

APPARATUS FOR FORMING CONCRETE PILES

Filed July 28, 1932 2 Sheets-Sheet 1

Fig. 1.

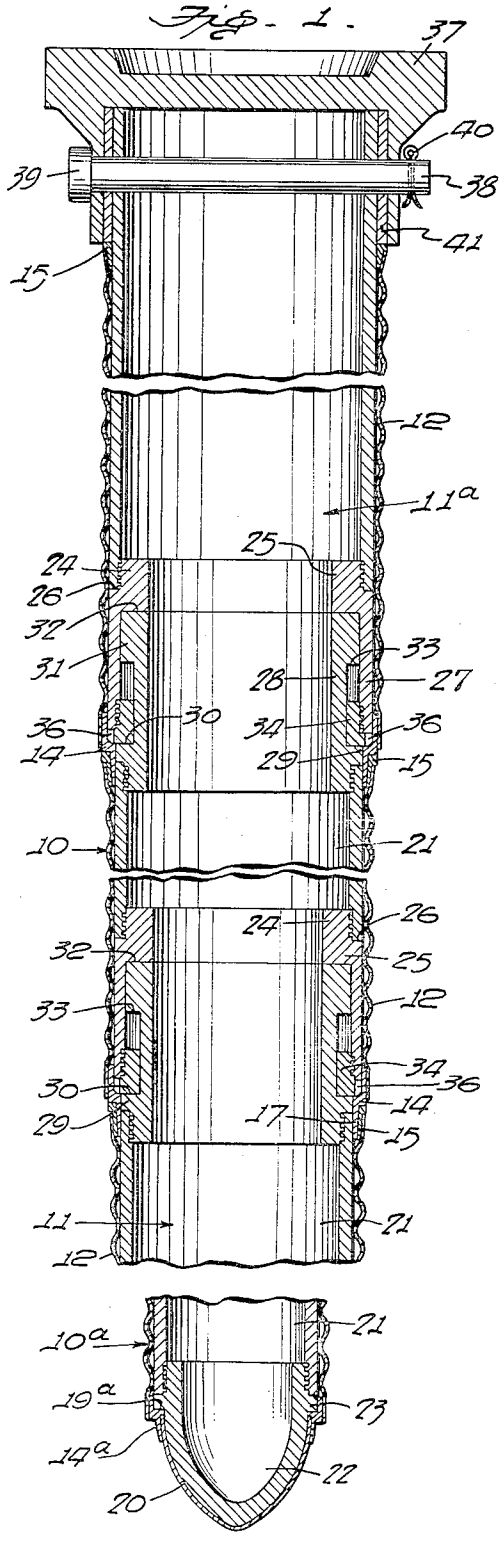
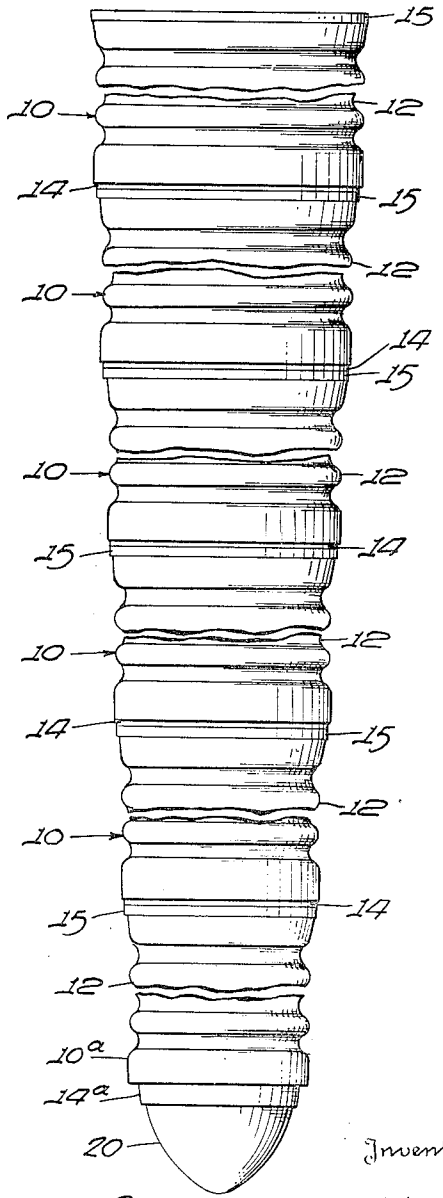


Fig. 2.



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Fig. 3.

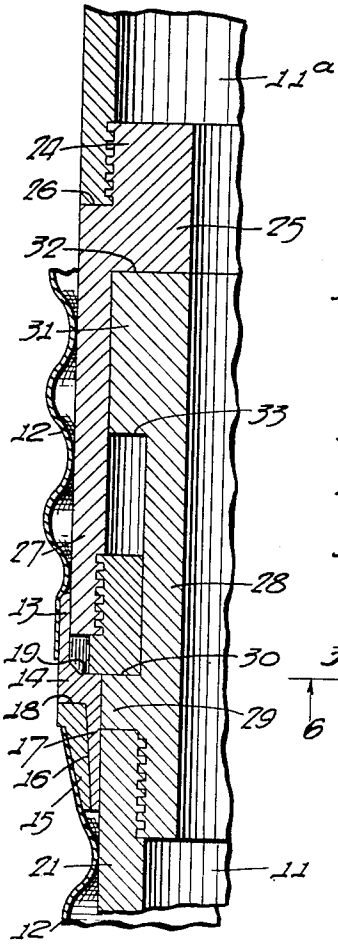


Fig. 4.

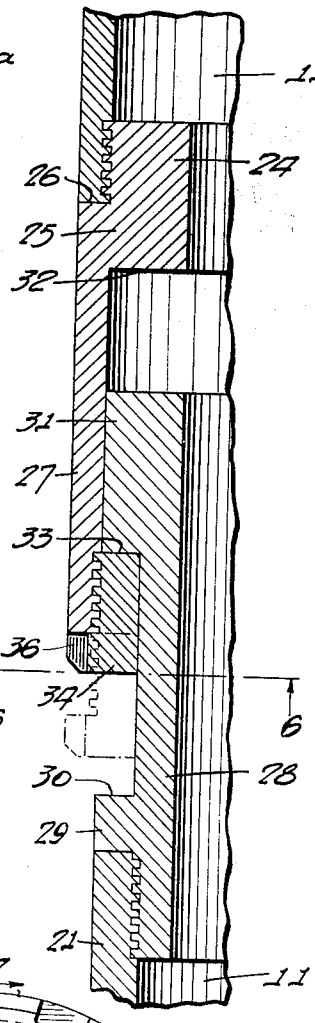


Fig. 5.

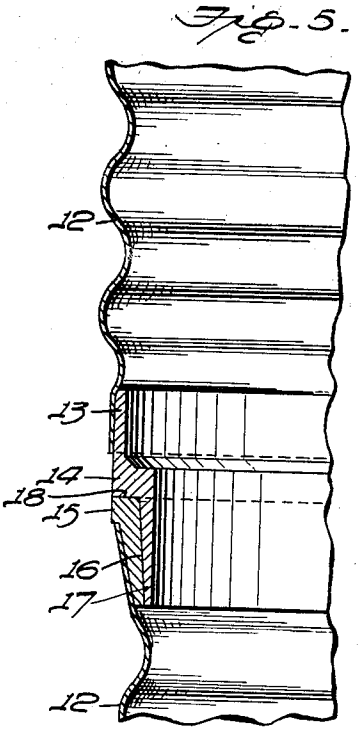


Fig. 6.

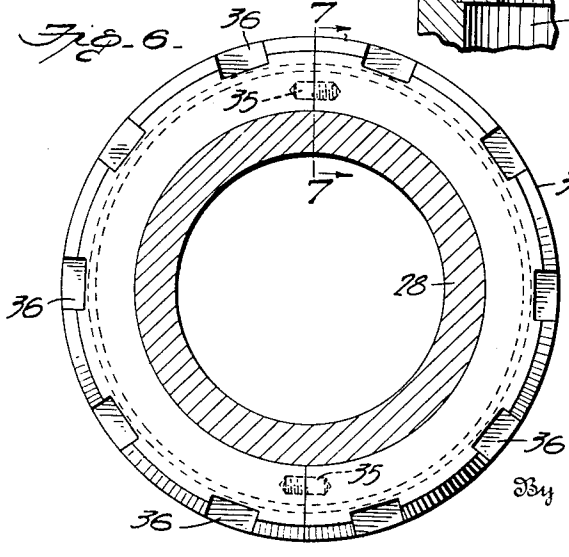
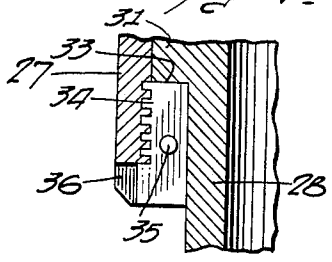


Fig. 7.



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UNITED STATES PATENT OFFICE

1,936,541

APPARATUS FOR FORMING CONCRETE PILES

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Application July 28, 1932. Serial No. 625,423

19 Claims. (Cl. 61—78)

The invention relates to piles to serve as the foundation for building structures and has for its general object the provision of a novel apparatus for forming concrete piles of that type embodying a metallic shell adapted to be driven into the ground and to be subsequently filled with concrete.

An important object of the invention is to provide a pile forming apparatus comprising a relatively thin metallic outer shell formed in sections and a driving core for the same similarly formed in sections, it being moreover a feature that the sections or units be preferably of a length such as to be readily stacked within a freight car for convenience and cheapness in transportation, the units being adapted to be connected to form a pile of any predetermined desired length.

Another important object of the invention is to provide a pile forming apparatus in which the sections or units of the outer shell are provided with novel means for effecting connection thereof, this connection being moreover of such character as to give stability when assembled so as to have sufficient strength to prevent lateral deflection during driving.

A further object is to provide an apparatus of this character in which the successive units are stepped, that is to say of different diameters increasing upwardly, the driving core being formed of corresponding sections and being so related to the outer metallic shell sections as to exert pressure upon both the upper and lower ends thereof during driving, the pressure at the lower end being tensional and that at the upper being compressional, this division or distribution of the forces operating to prevent distortion of the outer shell during driving.

Another object, and an important one, is to provide an apparatus of this character in which the sections of the driving core are relatively longitudinally movable and so arranged that after the outer shell has been driven to the desired depth and removal of the core is necessary the successive sections of the latter are successively released from driving engagement with the associated shell sections, thereby making it necessary to overcome the skin resistance of the frictional engagement between the core sections and shell sections one at a time, thus greatly facilitating and simplifying the work of withdrawing the core.

A further object of the invention is to provide a pile forming apparatus in which the predetermined number of shell sections and core sections necessary to form the entire pile are initially assembled and then driven all at once so as to obtain the benefits of continuous driving in contradistinction to apparatus and methods wherein sections are successively driven in superposed relation.

A more specific object is to provide a pile forming apparatus having novel means for connecting the core sections whereby great strength and rigidity will be obtained, particularly resistance to lateral deflection, this feature increasing in importance in proportion to the length of the pile.

An additional object is to provide a pile forming apparatus of this character which will be simple and inexpensive to make, easy to assemble and drive, positive in action, efficient and durable in service, and a general improvement in the art.

To the attainment of the foregoing and other objects and advantages, the invention preferably consists in the details of construction and the arrangement and combination of parts to be hereinafter more fully described and claimed, and illustrated in the accompanying drawings in which:

Figure 1 is a vertical or longitudinal section through a pile forming apparatus constructed in accordance with my invention, intermediate portions being broken away,

Figure 2 is a side elevation of the outer shell,

Figure 3 is an enlarged detail sectional view showing the joint between the core sections and the shell sections with the parts in driving position,

Figure 4 is a similar view through the core section alone showing it in withdrawing position,

Figure 5 is a fragmentary detail sectional view through the shell alone, that is to say with the core removed, the joint being shown in detail,

Figure 6 is a cross sectional view taken on the line 6—6 of Figure 4 to illustrate the core section connecting nut,

Figure 7 is a detail section on the line 7—7 of Figure 6.

Referring more particularly to the drawings, it will be at once apparent that the shell and the core are formed of sections connected by certain means to be described, the number of sections used depending upon the desired length of the completed pile. The shell sections are designated as a whole by the numerals 10 and 10^a and the core sections by the numerals 11 and 11^a and it will be observed that they are similar in many respects except as regards their diameters, it

being clear that the lowermost sections of the shell and the core are of relatively small diameter and that the successive superposed sections are of increased diameter though each section is itself of uniform diameter throughout. By this arrangement the whole assembly will be stepped in contradistinction to tapered. The intention is that the shell sections, and of course the corresponding core sections, be preferably formed of the same length, for instance ten feet, this or a similar dimension being advantageous in that the sections may be easily handled and may moreover be conveniently shipped by stacking them in freight cars, it being also apparent that the sections of very small diameter may, additionally, be nested within those of materially larger diameter so as to reduce the space necessary.

Each shell section including the lower one 10^a is represented as comprising a relatively thin transversely corrugated sheet metal member 12 telescoped at its lower end upon the vertical upstanding flange 13 of what may be termed a Z-ring 14, that is to say a ring which is somewhat Z-shaped in cross section and telescoped at its upper end upon the inclined or tapered outer surface of a ring 15 having a tapered inner surface 16. The ring 14 has a depending vertical flange 17 offset inwardly with respect to the flange 13 and having a tapered outer surface adapted to fit within the ring 15 of the shell section next below, the flange 17 conformingly engaging against the tapered inner periphery 16 of the ring 15 as particularly well disclosed at the lower portions of Figures 3 and 5. The inward offsetting of the flange 17 with respect to the flange 13 defines an abutment shoulder 18 engaging the upper edge or end of the ring 15 of the section next below. Inwardly of the flange 13 the ring 14 has an abutment shoulder 19 designed to cooperate with the core to be described. It is intended that the upper end of each section be positively secured to the ring 15 and that the lower section be positively secured to the flange 13 and this may be conveniently accomplished by welding. A feature to be noted is when adjacent sections are assembled there is nothing projecting outwardly beyond the corrugated shell members.

The above detailed description applies to all of the shell sections except the lowermost which differs only in that the ring 14^a at its lower end and corresponding substantially to the rings 14 at the lower ends of the other sections naturally does not telescope into anything but on the contrary carries a point 20 which is closed and which is preferably of substantially semi-egg shape or shaped like a projectile so as to facilitate penetration within the ground. The ring member 14^a of this lowermost section has a shoulder 19^a thereon corresponding to the shoulders 19 on the other ring members 14.

Each core section 11 except the uppermost one which is indicated by the numeral 11^a comprises an appropriate length of pipe 21 internally threaded at both ends. Screwed into the lower end of the pipe of the lowermost section is an end member 22 of such shape as to fit conformingly within the shell point 20, and this member 22 is formed with an outstanding flange 23 which seats upon the shoulder 19^a and which is interposed between it and the lower end of the pipe of the lowermost section. The lower end of the pipe 21 of each of the other core sections has screwed thereinto the reduced upstanding flange 24 of a ring 25 which has an abutment shoulder 26 engaging against the lower end of the pipe and which is formed with a depending vertical flange 27 internally threaded at its lower end and of the same diameter as the pipe 21 to which it is secured.

At its upper end the pipe 21 of each section, except the uppermost one, carries a ring 28 screwed thereinto and formed with an outstanding flange 29 abutting the upper end of the pipe and having its upper surface providing an abutment shoulder or ledge 30 flush, or adapted to be flush, with the shoulder 19 of the ring 14. The ring 28 extends the full height of the flange 27 of the ring 25 and has its upper end laterally enlarged or provided with an auxiliary ring secured thereto to define a head 31 which telescopes closely within the confines of the flange 27 and which is adapted to abut against a shoulder 32 on the underside of the ring 25 inwardly of the flange 27. As the head 31 is of considerably greater diameter than the ring 28 there is provided an abutment shoulder 33 which is for an important purpose to be described.

For effecting connection of the sections, I make use of a split or sectional nut member 34, the sections of which are held together by suitable dowel pins 35. This nut member has its periphery recessed at 36 for engagement of a suitable spanner or other tool therewith so that it may be turned. There is one of these nut members for each section and they are screwed into the lower ends of the flanges 27 on the rings 25. The lower edge or face of each sectional nut member engages upon the abutment shoulders 30 and 19, the lower portion of the nut member being of greater diameter than the interior of the flange 27 so as to be disposed between the lower edge of the flange and the shoulders referred to. By virtue of this arrangement the nut member constitutes an impact transmitter between the sections. It will be observed that the lateral widening or enlargement which forms the head 31 provides a recess or neck below the head and this recess is of greater height or length than the nut member so as to provide a slidable connection between the sections for a purpose to be explained.

The uppermost core section 11^a differs from the others in that it is not provided with the ring 28 but is simply formed as a pipe section which is, however, intended to be telescopically engaged within a driving head 37 to which it is attached as for example by means of a transverse bolt or pin 38 provided at one end with a head 39 and prevented from withdrawal by a cotter pin 40 passing through the other end. In the present instance there is disclosed a sleeve 41 located within the confines of the head 37, that is to say within the depending lower portion thereof, this sleeve closely embracing the pipe. At its lower end this sleeve abuts against the ring 15 provided at the upper end of the uppermost shell section so as to provide a driving engagement with the shell when impact is delivered to the driving head.

In the actual making of a pile, the desired number of shell sections and core sections are assembled in the manner indicated in the drawings and it will be noted that the successive sections are stepped in contradistinction to some varieties of piles which are of conical shape. The lowermost shell section of course carries the penetrating point and the top of the uppermost shell and core sections carry the driving head. The

question of interchangeability or selection of sections does not enter into the matter for the reason that the present invention contemplates a preassembling of the parts built up to the desired length so that when driving is carried out the driving may be continuous. In other words it is not the intention to drive one section, superpose another section, drive it and so on. The point is that the pile forming members to the predetermined length are initially assembled and then driven as a whole or complete assembly so as to derive the benefits of continuous driving as otherwise there would be the detrimental effects of the skin friction developed upon the driving of successive sections superposed at different points of time. Attention is directed to the fact that when the pile shell and core members are driven the latter will draw down the former by tension and also by compression. To explain this in greater detail is should be said that when a driving impact is delivered to the head 37 this force comes upon the upper end of the uppermost section 11a and by virtue of the fact that the lower end of this uppermost pipe section carries the ring 25 it is apparent that the blow delivered through the ring 25 will be imparted to the head 31 at the upper end of the section next below and by virtue of the fact that the ring 28 is provided with the outstanding flange 29 abutting against the upper end of the section next below the force is transmitted. This action continues throughout the length of the pile forming members. I am aware of the existence of patents covering the idea of forcing down shell sections by tension only but I am not particularly concerned with such a proposition for the reason that I contemplate forcing down the lower end of each section simultaneously with driving down the upper end.

After the shell sections and the core have been forced down to the desired depth it is of course necessary to remove the core prior to filling of the shell sections with concrete. To effect this it is merely necessary to apply a pull upon the driving head 37 which by virtue of the pin 38 will apply an upward pull upon the uppermost core section 11a. When this is done the nut member 34 at the lower end of the uppermost core section will strike against the abutment shoulder 33 at the underside of the head 31 and this impact will be sufficient to overcome the frictional engagement between the uppermost shell section and the core section therewithin. As the uppermost section is thus moved the nut member 34 of the section next below will strike against the abutment shoulder 33 and loosen that section. In this way it is apparent that the successive sections are pulled in succession instead of all at once and manifestly this will be simpler as involving less power. After removal of the core the shell is filled to the desired level with concrete and the pile is then complete.

Attention is called to the fact that the shell sections overlap and that a comparatively long overlap of the core sections will give the whole assembly sufficient stability and rigidity to prevent any lateral deflection during driving.

From the foregoing description and a study of the drawings it is believed that the construction, operation and advantages will be readily apparent to one skilled in the art without further explanation.

While I have shown and described the preferred embodiment of the invention, it should be understood that the disclosure is merely an exemplification of the principles involved as the right is reserved to make all such changes in the details of construction as will widen the field of utility and increase the adaptability of the device provided such changes constitute no departure from the spirit of the invention or the scope of the claims hereunto appended.

Having thus described the invention, I claim:

1. A concrete pile forming apparatus comprising a plurality of shell sections, rigid ring members secured to the adjacent ends of the sections and telescopically engaged therewith for connecting the sections in series, one of said members providing an abutment shoulder, a core member formed of tubular sections located within the respective shell sections, a ring member within each core section providing a driving connection between each core section and the abutment shoulder on the associated shell section, and means connected with the last named ring members for enabling the core sections to have relative longitudinal movement while restraining them against disconnection.

2. A concrete pile forming apparatus comprising a plurality of shell sections each of substantially uniform diameter and all varying in diameter, ring members telescoped within and secured to the adjacent ends of the shell sections, a series of core sections located within the shell sections, ring members connecting the adjacent ends of the core members and having slidably interfitting relation, and abutment shoulders on said last named ring members reacting through the first named ring members for transmitting to the shell sections the force of impacts delivered to the core members.

3. A concrete pile forming apparatus comprising a plurality of shell sections each of substantially uniform diameter and all varying in diameter, ring members telescoped within and secured to the adjacent ends of the shell sections, a series of core sections located within the shell sections, ring members connecting the adjacent ends of the core members and having slidably interfitting relation, abutment shoulders on said last named ring members reacting through the first named ring members for transmitting to the shell sections the force of impacts delivered to the core members, and other abutment means on one of the last named ring members and coacting with the other to enable the core sections to have relative longitudinal movement and to transmit to the successive core members in series a force applied upwardly to the uppermost core member.

4. A concrete pile forming apparatus comprising, in combination, a metallic shell formed of a series of sections, interfitting members telescopically engaged within the adjacent ends of the sections for connecting them and providing abutment shoulders, a driving core removably engaged within said shell and formed of sections, and means connecting the adjacent ends of the core sections and providing abutment shoulders engageable with said first named shoulders.

5. A concrete pile forming apparatus comprising, in combination, a metallic shell formed of a series of sections, interfitting members telescopically engaged within the adjacent ends of the sections for connecting them and providing abutment shoulders, a driving core removably engaged within said shell and formed of sections slidably telescopically engaged at their ends,

means on the adjacent ends of the core sections for limiting their relative sliding movement and cooperating to apply impact to the upper ends of the core sections upon the exertion of an upward pull upon the topmost core section whereby the frictional engagement between the core sections and the shell sections may be broken successively, said means at the lower end of each core section cooperating with said abutment shoulders for imparting driving force to all of the shell sections when force is applied to the uppermost core section.

6. A concrete pile forming apparatus comprising, in combination, a metallic shell formed of a series of sections, interfitting members telescopically engaged within the adjacent ends of the sections for connecting them and providing abutment shoulders, a driving core removably engaged within said shell and formed of sections, members connected with the adjacent ends of the core sections and arranged in telescopic slidable engagement, one of said last named members having spaced abutment shoulders, and an abutment ring carried by the other of said last named members and cooperating with said first named abutment shoulder for imparting driving force to all of the shell sections.

7. A concrete pile forming apparatus comprising the combination of a metallic shell formed of sections having means at their ends adapted to be slidably telescopically engaged, a driving core formed of sections and having a driving head, and means on the core sections engageable with the means at the lower ends of the shell sections for forcing the same into telescoped and abutting engagement with the means at the upper ends of the sections when movement of the lower section is resisted, the means on the core sections then cooperating with the interengaged means on the shell sections for simultaneously applying a compressive force to the upper ends of all the shell sections and tension to the lower ends thereof when the shell is driven.

8. A concrete pile apparatus comprising in combination, a metallic shell formed of sections each having connected thereto at adjacent ends separate metallic members which are adapted to telescopically interfit, and a driving core detachably engaged within said connected shell sections and formed of relatively movable parts telescopically engaged, portions of said relatively movable parts cooperating with said metallic members for transmitting driving force to the connected shell sections.

9. A concrete pile forming apparatus comprising a plurality of shell sections adapted to be superposed in coaxial relation and having telescopic joints formed by rigid metallic members one of which is formed with a shoulder, and a driving core detachably mounted within the assembled shell sections and comprising a plurality of sections having their adjacent ends telescopically engaged for limited relative sliding movement, and a shoulder formed on each of said core sections to engage the shoulder on said metallic member.

10. A concrete pile forming apparatus comprising in combination a sheet metal shell formed of a plurality of sections, means connected with the adjacent ends of the sections whereby the same are adapted to slidingly telescope, shoulders formed on said means, said shoulders occupying corresponding positions with reference to each of said sections, a sectional core having a driving head, and a plurality of spaced means on the core each adapted to engage one of said shoulders whereby force applied to said driving head is distributed to said sections at spaced points.

11. In a concrete pile forming apparatus, the combination of an outer metallic shell formed of sections, rigid members secured to the adjacent ends of said sections and having abutting and telescopic interfitting relation, one of said members providing an abutment for taking vertical thrust, and a driving core disposable within said shell and formed of sections corresponding in number to the number of sections of the shell, the sections of the core being slidably telescopically connected, and means on the adjacent core sections for limiting relative sliding movement thereof, a portion of said means being respectively engageable with each of said abutments for imparting driving force to the shell sections when impact is delivered upon the top of the core.

12. A concrete pile forming apparatus comprising, in combination, a metallic shell formed of a plurality of sections, members secured to the adjacent ends of said sections and having telescopic engagement for connecting the sections, one of said members providing an abutment for receiving vertical thrusts, and a driving core disposable within the shell and likewise formed of a plurality of sections, the upper portion of each core section having a constricted neck defining an abutment shoulder and an overhanging head, the lower end of each core section having a member carried thereby slidably embracingly engaging the constricted neck at the upper end of the core section next below and of less length than the neck to enable the core sections to have relative sliding movement, said last named member being engageable with the underside of the head and said abutment shoulder for limiting the relative sliding movement of the core sections, and said last named member being engageable with said first named abutment for imparting driving force thereto when impact is delivered at the upper end of the core.

13. A concrete pile forming apparatus comprising, in combination, a metallic shell formed of a plurality of sections, members secured to the adjacent ends of said sections and having telescopic engagement for connecting the sections, one of said members providing an abutment for receiving vertical thrusts, and a driving core disposable within the shell and likewise formed of a plurality of sections, the upper portion of each core section having a constricted neck defining an abutment shoulder and an overhanging head, the lower end of each core section having a member carried thereby slidably embracingly engaging the constricted neck at the upper end of the core section next below and of less length than the neck to enable the core sections to have relative sliding movement, said last named member being engageable with the underside of the head and said abutment shoulder for limiting the relative sliding movement of the core sections, and said last named member being engageable with said first named abutment for imparting driving force thereto when impact is delivered at the upper end of the core, said last named member being removable to enable the core sections to be assembled or disassembled.

14. A concrete pile forming apparatus comprising, in combination, a metallic shell formed of a plurality of sections, members secured to

the adjacent ends of said sections and having telescopic engagement for connecting the sections, one of said members providing an abutment for receiving vertical thrusts, and a driving core disposable within the shell and likewise formed of a plurality of sections, the upper portion of each core section having a constricted neck defining an abutment shoulder and an overhanging head, the lower end of each core section having a member carried thereby slidably embracingly engaging the constricted neck at the upper end of the core section next below and of less length than the neck to enable the core sections to have relative sliding movement, said last named member being engageable with the underside of the head and said abutment shoulder for limiting the relative sliding movement of the core sections, and said last named member being engageable with said first named abutment for imparting driving force thereto when impact is delivered at the upper end of the core, said last named member being formed as a ring screwed into the lower end of each core section and having an outstanding portion underlying the lower edge thereof.

15. A concrete pile forming apparatus comprising, in combination, a metallic shell formed of a plurality of sections, members secured to the adjacent ends of said sections and having telescopic engagement for connecting the sections, one of said members providing an abutment for receiving vertical thrusts, and a driving core disposable within the shell and likewise formed of a plurality of sections, the upper portion of each core section having a constricted neck defining an abutment shoulder and an overhanging head, the lower end of each core section having a member carried thereby slidably embracingly engaging the constricted neck at the upper end of the core section next below and of less length than the neck to enable the core sections to have relative sliding movement, said last named member being engageable with the underside of the head and said abutment shoulder for limiting the relative sliding movement of the core sections, and said last named member being engageable with said first named abutment for imparting driving force thereto when impact is delivered at the upper end of the core, said last named member being formed as a ring detachably connected with the lower end of each core section and underlying the lower edge thereof and abuttingly engageable with the abutment shoulder at the lower end of the constricted neck portion as well as abuttingly engaging the first named abutment.

16. A core for driving a shell formed of a plurality of metallic sections having their adjacent ends connected by means providing abutment shoulders, said core comprising a plurality of sections having their adjacent ends slidably telescopically connected, and means carried by one end of each core section and abuttingly engageable with means on the adjacent end of the next core section for limiting the relative sliding movement of the core sections, and engageable with said abutment shoulders for imparting driving force to the shell sections when impact is delivered to the upper end of the core.

17. A core for driving a shell for forming a concrete pile, comprising a plurality of core sections having their adjacent ends slidably telescopically engaged, one end of each core section having a constricted neck portion defining spaced outstanding abutment shoulders, and means carried by the adjacent end of the adjoining core section closely embracing said constricted neck portion and adapted to engage said abutment shoulders for limiting the relative sliding movement of the core sections.

18. A core for driving a shell for forming a concrete pile, comprising a plurality of core sections having their adjacent ends slidably telescopically engaged, one end of each core section having a constricted neck portion defining spaced outstanding abutment shoulders, and means carried by the adjacent end of the adjoining core section closely embracing said constricted neck portion and adapted to engage said abutment shoulders for limiting the relative sliding movement of the core sections, said means being formed as a removable member enabling the core sections to be assembled or disassembled.

19. In a concrete pile forming apparatus, a shell formed of a plurality of metallic sections, rigid ring members secured to the adjacent ends of said sections and telescoped in interfitting relation for connecting the sections in series, said ring members having coacting and contacting thrust transmitting surfaces and one of said ring members providing an abutment shoulder adapted to receive impact from a sectional driving core to which impact is applied at its upper end.

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