Sept. 12, 1933. A. G. ROTINOFF 1,926,962

PILE AND PILE DRIVING

Filed Dec. 21, 1931

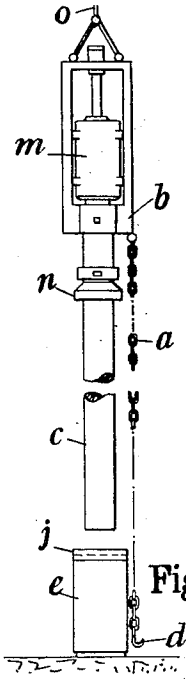


Fig.1

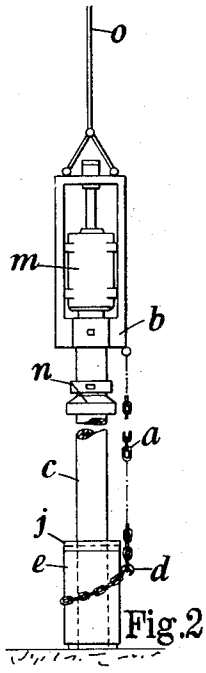


Fig.2

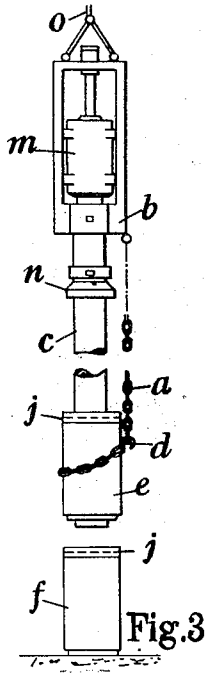


Fig.3

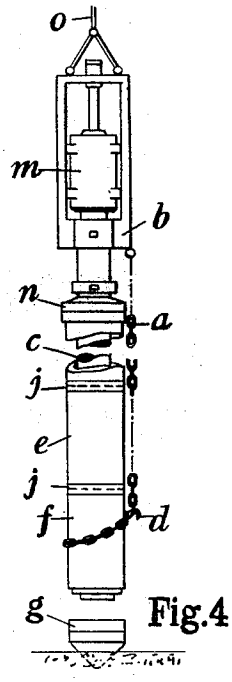


Fig.4

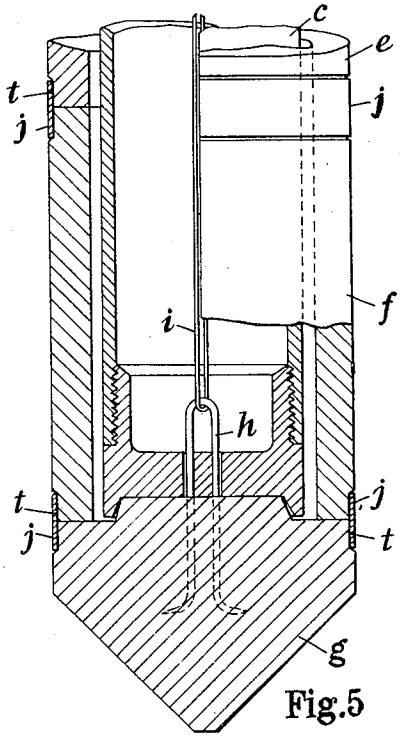


Fig.5

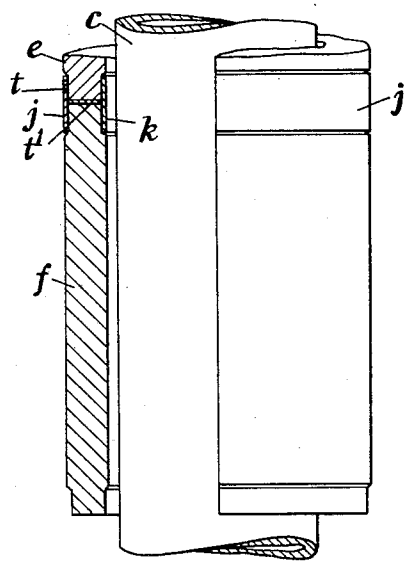


Fig.6

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PILE AND PILE DRIVING

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2 Claims. (Cl. 61—78)

This invention is an improvement in or modification of the invention described and claimed in my application for Patent No. 463,507. In the said prior application I have described a removable mandrel with an anvil axially adjustable along the mandrel by which the pile shoe is driven into the earth and which also applies cushioned blows to a hollow pile shaft (which is subsequently to be filled in with concrete) built in situ around the mandrel and resting at its lower end upon the shoe.

One of the objects of my present invention is to provide a simple and convenient method and means whereby the tubular sections constituting the hollow pile shaft can be assembled around the mandrel prior to driving so that the whole pile can be readily driven to any desired depth without the necessity for repeatedly inserting new sections of the pile shaft in position during driving.

Other objects of my present invention are to provide means for strengthening the abutting faces or edges of the sections of the hollow pile to withstand the force of the driving blows and also to resist penetration by water and soil through the joints and means for connecting the shoe to the hollow pile shaft, and the sections of the latter to one another to enable the pile to be passed through weak strata or water before meeting resistance requiring the application of driving blows.

In accordance with my present invention, I provide means for threading the tubular sections upon the mandrel before driving commences so as to accumulate thereon sufficient sections for the length of pile to be driven without the necessity of lifting the mandrel to a great height above the ground and obviating the necessity of withdrawing the mandrel after driving one section so as to place a further section in position for driving. By this means I am enabled to complete the driving of a pile of ordinary length in one uninterrupted driving operation. Further by using an outfit comprising a housing, a hammer in said housing and means for attaching the housing to the pile mandrel, I can effect the assembly of the pile sections upon the mandrel by the use of the rope by which the outfit is suspended from a crane or the like, the rope, chain or the like which lifts the pile sections being suspended from the housing or mandrel head.

I also provide a band to overlap the joint between each pair of superposed pile sections and between the shoe and the pile section above, such band lying in a peripheral recess in each of the adjacent parts, such bands strengthening the sections against bursting and against lateral and relative circular movements; they also prevent soil or water entering between the abutting faces of the section during driving.

Referring to the accompanying sheet of explanatory drawings:—

Figures 1–4 are views showing the method of threading the pile sections on to the mandrel.

Figures 5 and 6 are part elevations and part sectional elevations showing the bands at the abutting faces of sections and of the shoe, and a section Figure 5 showing a modified arrangement of the bands between two pile sections.

The same reference letters in the different views indicate the same or similar parts.

In Figures 1–4, the means for accomplishing the threading operation consists in a unitary outfit (comprising a housing *b*, a hammer *m* in said housing and means for connecting the top of the mandrel *c* to the housing) suspended by a single rope *o* from a crane. To the top of the mandrel or of the hammer housing *b* is secured a rope or chain *a* hanging freely alongside the mandrel *c* and being of sufficient length that a loop can be made thereof at the bottom of the mandrel to embrace a pile section, a hook *d* upon the rope or chain permitting the latter readily to be made into a loop or sling around the pile section. The mandrel *c* is first raised and a pile section *e* placed beneath it, as shown in Figure 1. The mandrel is then lowered into the pile section and a sling or loop formed around the latter, as shown in Figure 2. The mandrel is now lifted again, when it carries the pile section with it. A further pile section *f* is placed beneath the mandrel, as shown in Figure 3, and the mandrel lowered into it, when the section *e* upon the mandrel will be raised by the new section *f*. The sling or loop will free itself or slacken and is now placed around the new section *f*, when the mandrel is again raised with the two sections thereon, and a further section placed beneath. The operations are repeated until a sufficient number of sections are accumulated upon the mandrel for the complete length of pile to be driven with preferably an additional section or two. At the final lifting of the mandrel, all the pile sections under the adjustable anvil *n* are supported by the sling or loop around the lowest section, as shown in Figure 4. The pile and mandrel are now slewed by the crane to the point where driving is to be performed and may be lowered on to the shoe *g*, see Figure 4. When the soil is under water or soft, the shoe may be

fixed to the lowest pile section and the whole pile lowered until it meets resistance necessitating the operation of the hammer. The rope or chain is freed from the lowest pile section before driving proceeds. The shoe may, if desired, be detachably held up to the bottom of the mandrel as by the hoop *h* and chain or rope *i*, Figure 5, for manipulation purposes, instead of to the lowest pile section. If after driving is completed some sections of the pile remain above the ground, the sling or loop is placed around the lowest of the exposed sections and so all the exposed sections will be lifted with the mandrel when it is withdrawn from the pile. By the aforesaid arrangement, I am enabled to simplify the tackle requisite for pile formation, to economize in driving time and reduce the labour expended in driving the pile.

With my improved method of driving in which all the pile sections may be assembled upon the mandrel before driving commences, it is important that the pile sections shall be able to stand the hammer blows, the lateral vibrations and movements of the mandrel during driving, and also shall not be damaged during the rebounds which follow the blows. The difficulties in this connection are increased because the pile sections above ground level have not the earth to support and grip them. I have found that piles having concrete male and female spigots at the end of the tube sections cannot withstand satisfactorily the lateral vibrations due to the blows. Also that the concrete is weakened by the shaping of the engaging faces. To meet the aforesaid difficulties, I provide a steel or like metal band *j* (Figure 5) which overlaps the joint between each pair of superposed pile sections as *e* and *f* and lies in a recess formed in the peripheral surface of each pile adjacent to its end face. The band is preferably flush with the pile surface, as shown. It strengthens the sections against bursting and against lateral movement, and prevents relative movements in a circular direction which would cause different parts of the adjacent faces to be in contact during successive blows, which I find to be a frequent cause of fracture of pile sections. The bands also prevent soil entering between the abutting faces of the pile sections which would make the pressure between adjacent surfaces during driving uneven and so tend to produce fractures. A further advantage of the bands is that they can be used to prevent the penetration of water or silt into the pile. I may coat the inside of the band or the recessed parts of the pile sections with tar, pitch, or like substances *t* to make the joints between the bands and pile sections water tight. If desired, bands may be placed both on the inside and on the outside of the pile sections and grouted, as indicated at t^1. This arrangement is shown in Figure 6 in which the inner band is lettered *k*. The lowest pile section may be connected to the shoe *g* in the same way by a band or bands, as *j* and *k*, with a coating of tar to make a watertight joint. The bands are preferably a good fit upon the pile sections and shoe. In Figure 5, a single band *j* is shown between the pile section *f* and shoe *g*, the tar being indicated at *t*.

If a pile of very considerable length is to be driven, the mandrel may be made in sections, and after one with its pile sections thereon has been driven, a second mandrel (with its pile sections thereon) may be secured to the first mandrel and driving be continued. When driving is completed, the second mandrel is disconnected from the first and raised with any pile sections still above ground level. The first mandrel section is then withdrawn, leaving the complete length of pile clear, dry and ready for inspection and concreting.

It will be understood that the anvil *m* which is above the top pile section *e* during driving will be adjusted axially along the mandrel as in my prior application for Patent No. 463,507, after driving commences to suit any diminution in the over-all length of the pile due to the driving blows and consequent tightening of the joints. This will ensure that contact is maintained between the lowermost section and the shoe *g* and that the joints will not open during rebound and allow water to enter the pile or soil to get in between the abutting surfaces.

What I claim is:

1. The process of assembling the parts of a sectional pile casing and sinking said casing which comprises assembling one section of the pile casing around a mandrel that is to be driven to sink the casing, raising the mandrel and said section while said section is around the mandrel high enough to place under it a second section set on end, lowering the mandrel and first section on to the end of the second section, suspending the second section from a point above the mandrel, raising the mandrel with both the sections around the mandrel to repeat the operation until the desired number of sections have been accumulated upon the mandrel, then sinking the mandrel and the sections.

2. A pile driving equipment comprising a hammer, a frame therefor, a mandrel and a plurality of sections of pile casing surrounding the mandrel and adapted to be placed end to end one above another, and a chain suspended from said housing and adapted to be attached at its lower end to the lowest section of said casing, and an adjustable anvil around the mandrel above the topmost section.

ALEXANDER GEORGE ROTINOFF.