Nov. 9, 1971 TAKEO NOJIMA 3,618,328

BEARING SUPPORT FOR PILING

Filed Jan. 5, 1970 2 Sheets-Sheet 1

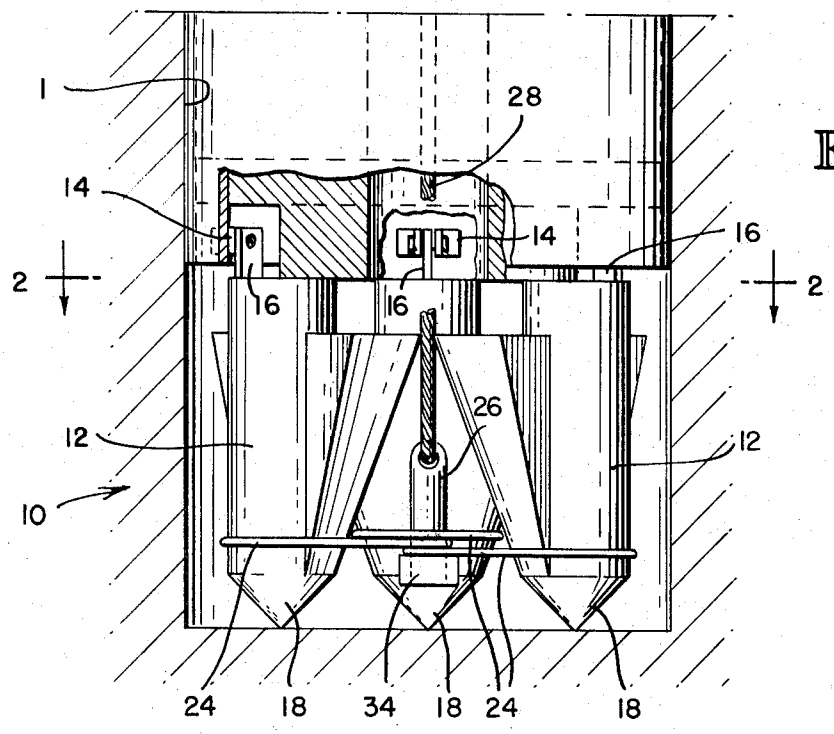


FIG. 1

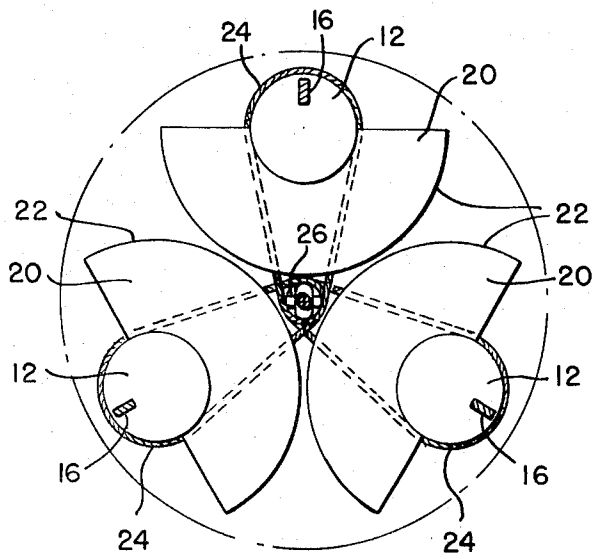


FIG. 2

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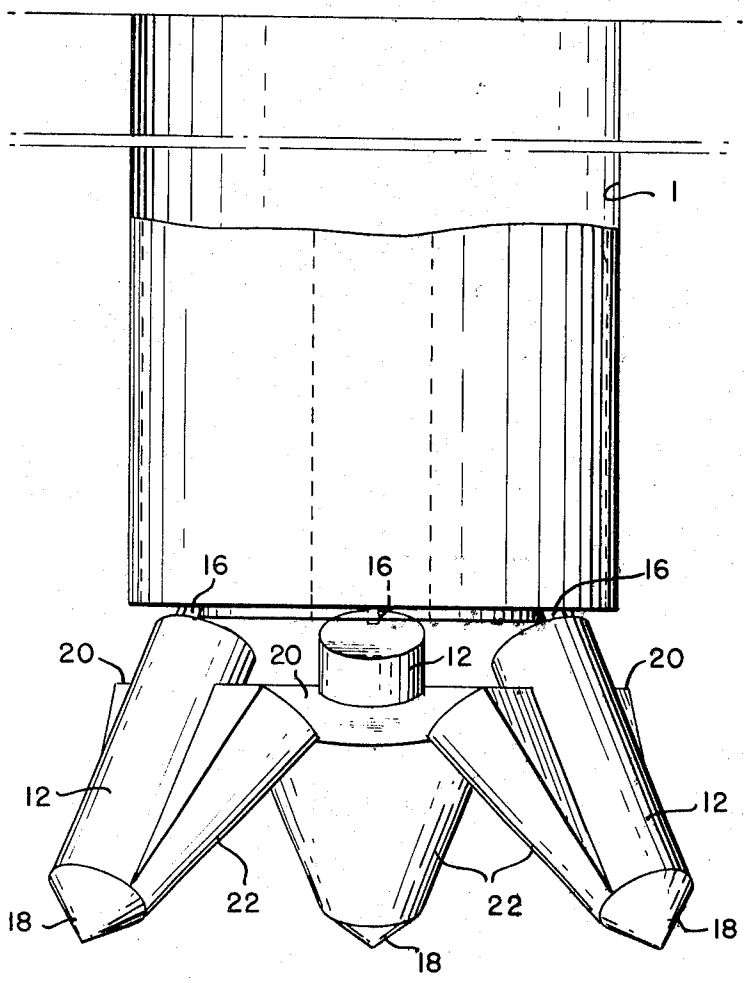


FIG. 3

FIG. 4

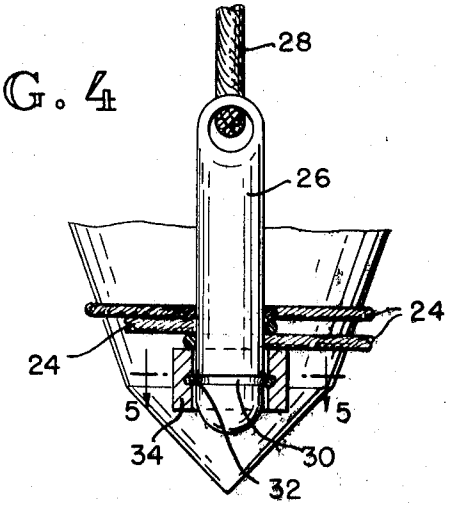
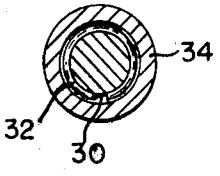


FIG. 5



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United States Patent Office 3,618,328 Patented Nov. 9, 1971

3,618,328

BEARING SUPPORT FOR PILING

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Filed Jan. 5, 1970, Ser. No. 559
Int. Cl. E02d 5/54
U.S. Cl. 61—53.68 9 Claims

ABSTRACT OF THE DISCLOSURE

A piling support for the lower end of pilings includes a plurality of tubular leg portions pivoted at their upper ends to the lower end of the piling and positioned equidistantly around the lower end of the piling, the legs having compacting means associated therewith, and means for (1) locking the legs together while the pile is being driven in the ground the desired distance and for (2) unlocking the legs, thereby allowing the legs to spread as the piling is further driven into the ground. The compacting means are half-conical sections attached to each of the legs and extending substantially the length thereof, the outer peripheral surfaces of the conical sections facing inwardly and sloping outwardly relative to the vertical axes of the legs moving from the lower ends of the legs upwardly.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a piling support for load bearing piles.

Prior art relating to the disclosure

Where satisfactory bearing soil cannot be found at a reasonable depth structures such as buildings, piers, transmission towers, etc. are rested on pilings which are driven into the ground to bedrock or to the "point of refusal." Not only is the cost of providing adequate support with deep driven pilings expensive but in many instances the bedrock may be too deep to provide adequate load bearing support. It has remained a problem to devise an economical way of supporting heavy loads where satisfactory bearing soil cannot be found.

SUMMARY OF THE INVENTION

This invention is directed to a support assembly for load bearing piles, the assembly including a plurality of legs to which are secured compacting means, the legs depending from and pivotally secured to the lower ends of the piling. The legs are held within the peripheral area of the pile while it is being driven to the desired depth. When the desired depth is reached the legs are released and the pile driven further to spread the legs and compacting means secured thereto. The compacting means are designed to compact and form a hard core of soil beneath the pile to support structures resting thereon.

It is a primary object of this invention to provide a support assembly for piles, the assembly forming a solid core of soil beneath the pile as it is driven into place.

It is a further object of this invention to provide a support assembly for the lower end of a pile having compacting means associated therewith, wherein the pile and pile support are driven into the ground to a desired depth with the support in locked position, and the support unlocked to allow it to spread as the pile is further driven into the ground, the compacting means forming a solid core of soil beneath the pile to support it and structures resting thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical elevation of the pile support with the legs thereof in locked position;

FIG. 2 is a sectional view along section line 2—2 of FIG. 1 showing the relative positions of each of the legs of the pile support and the half-conical compacting means associated with each leg;

FIG. 3 is a vertical elevation of the pile support in unlocked position with the three legs spread;

FIG. 4 is an expanded cross-sectional view of the retaining means for locking the legs in place; and

FIG. 5 is a sectional view along section line 5—5 of FIG. 4.

DETAILED DESCRIPTION OF THE DISCLOSURE

Referring to the drawings reefrence numeral **1** denotes a conventional piling, on the lower end of which is secured the pile support **10** of this invention. The piling may be of wood, steel, concrete or other suitable material. The pile support includes a plurality of legs **12** which depend from and are pivotally attached to the lower end of the piling. The legs are positioned equidistantly around the lower end of the pile. Brackets **14** are secured to the lower end of the pile and extend inwardly from the edge of the pile. Corresponding brackets **16**, secured to the upper ends of the legs **12**, are hingedly secured to brackets **14** so that the legs are free to pivot outwardly as shown in FIG. 3. The legs may be elongated tubular members of steel or other suitable materials having pointed tips **18** which help guide the piling as it is driven into the ground.

Compacting means **20** are secured to and extend substantially the full length of each of the legs, the compacting means having sloping surfaces directed inwardly toward each other. Preferably the compacting means are half-cone sections secured around the inner surface of each of the legs, the vertical axis of the conical sections coinciding with the vertical axes of the legs. The half-cone sections are secured to the legs so that their outer peripheral surfaces **22** slope outwardly relative to the vertical axis of the cones from the lower ends of the legs upwardly. The radius of the conical sections at the lower ends of the legs is preferably equal to the radius of the tubular legs. The radius of the conical sections near the top of the legs should not be so great as to prevent the legs from being locked within the peripheral area of the pile as shown in FIG. 2. Neither should the radius of the cone sections at their upper ends be so small as to prevent compaction of the soil beneath the pile on spreading of the legs. The preferred angle of the peripheral surface of the half-cones relative to their axes is about 20 degrees. By experience this has been found to be the optimum angle for obtaining maximum compaction of soil beneath the piling on spreading of the legs.

The pile with the pile support attached to the lower end is initially driven by conventional means to a desired depth with the leg portions retained in a locked position as shown in FIG. 1. The upper ends of the legs rest against the lower end of the pile when the legs are in locked position. Retaining bands **24** of steel or other suitable material encircle each of the legs, the retaining bands held in place by a release pin **26** positioned between the legs and extending through the retaining bands. A cable or rope **28** is attached to the upper end of the release pin and extends upwardly through a hollowed out portion of the pile. The lower end of the pin has an annular groove **30** therein adapted to hold a retaining ring **32**. A retaining collar **34** with a similar interior annular groove slips over the release pin and retaining ring **32** to assist holding the release pin in place.

The pile with the legs locked in the position shown in FIG. 1 is driven to a suitable depth with a pile hammer of other conventional means. Cable **28** is then tensioned to pull release pin **26** free of the retaining bands **24**, thereby allowing them to fall free of the legs. The piling is then driven into the ground further. The soil entering between the legs and cone sections, as the piling is further driven into the ground, acts to force the legs and conical sections outwardly. At the same time the soil surrounding the legs resists the outward movement of the legs. The coaction of these two forces compacts the soil between the half-cone sections to a hard, rock-like consistency. The half-cones serve to compact the soil without allowing any substantial amount of it to pass between them and along the side wall of the pile.

The depth to which the piling must be driven before the release pin is pulled to allow the legs to spread is dependent on the soil conditions and the load which is to be rested on the pilings.

Transmission towers weighing as much as six tons have been supported on pilings using the pile support of this invention, the pilings driven to depths of less than 30 feet. Conventional pilings driven more than 100 feet into the ground in the same area proved inadequate to adequately support the weight of the towers.

The embodiment of the invention in which an exclusive property or privilege is claimed are defined as follows.

1. A pile support for load bearing piles comprising:

a plurality of depending legs pivotally connected to the lower end of the pile and adapted to swing outwardly from a downwardly projecting retracted driving position wherein the legs are beneath the pile and are substantially within a downward projection of the outer surface of the pile to an outwardly sloped compacting position wherein the legs extend radially beyond the projection, the legs having opposed downwardly tapering compacting surfaces extending over a major portion of their length and surrounding an upwardly tapered zone in which soil is trapped beneath the pile and is compacted to form a load bearing support for the pile while the pile is being further driven after the legs have been released from their driving position and are caused by such further driving to swing to their compacting position, and

means for initially locking the legs in the retracted driving position during driving of the pile into the ground a predetermined depth and for unlocking the legs when the predetermined depth is reached to allow the legs to swing to their compacting position as the pile is further driven into the ground.

2. The pile support of claim **1** wherein the downwardly tapered compacting surfaces are frustoconical sections having their peripheral conical surfaces directed inwardly toward each other with the vertical axis of each of the frustoconical sections being coincident with the vertical axes of the depending legs.

3. The pile support of claim **2** wherein the peripheral conical surfaces of the frustoconical sections are downwardly tapered at an angle of about 20° with reference to the vertical axes of the frustoconical sections.

4. The pile support of claim **1** wherein the means for locking and unlocking the legs includes (1) retaining bands encircling each of the legs, (2) a releasable pin

positioned between the legs and extending through the retaining bands to hold them in place, and (3) means to remove the pin for release of the retaining bands.

5. The support of claim **3** wherein each of the legs are elongated tubular members having the frustoconical sections secured thereto, the radius of the frustoconical sections at their lower ends being substantially equal to the radius of the legs, and the radius of the conical sections at their upper ends sufficient to cause compaction and entrapment of the soil between the conical sections as they pivot outwardly.

6. The support of claim **2** wherein there are three legs spaced equidistantly from one another around the lower end of the pile.

7. A pile support assembly adapted to be secured to the lower end of a pile comprising a plurality of legs adapted to be pivotally connected and dependent from the lower end of a pile to swing outwardly from a downwardly projecting retracted driving position wherein the legs are beneath the pile and are substantially within a downward projection of the outer surface of the pile to an outwardly sloped compacting position wherein the legs extend radially beyond the projection, the legs having opposed downwardly tapering compacting surfaces in the form of frustoconical sections having their peripheral conical surfaces directed inwardly toward each other with the vertical axis thereof substantially coincident with the vertical axis of the legs, the frustoconical sections extending over a major part of the length of the legs and surrounding an upwardly tapered soil zone in which soil is trapped beneath the pile and compacted to form a load bearing support for the pile while the pile is being further driven into the ground after the legs have been released from the retracted driving position and are caused by such further driving to swing to their compacting position.

8. The support of claim **7** including means for initially locking the leg members and conical sections within the peripheral area of the pile during driving of the pile into the ground a predetermined depth, and for unlocking the leg members when the pile and pile support have reached the predetermined depth to allow the leg members and conical sections to spread outwardly as the pile is driven further into the ground.

9. The support of claim **7** wherein the taper of the outer peripheral surfaces of the frustoconical sections is about 20 degrees with reference to the vertical axes of the frustoconical sections.

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U.S. Cl. X.R.

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