March 7, 1933. R. TADA 1,900,622

APPARATUS FOR FORMING CONCRETE PILES

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Fig. 1.

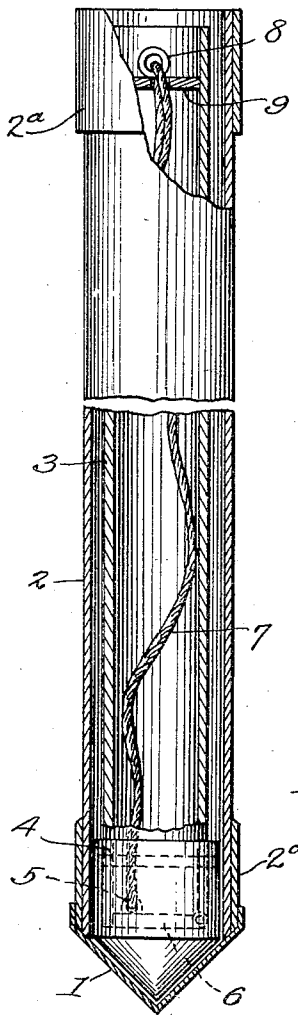


Fig. 2.

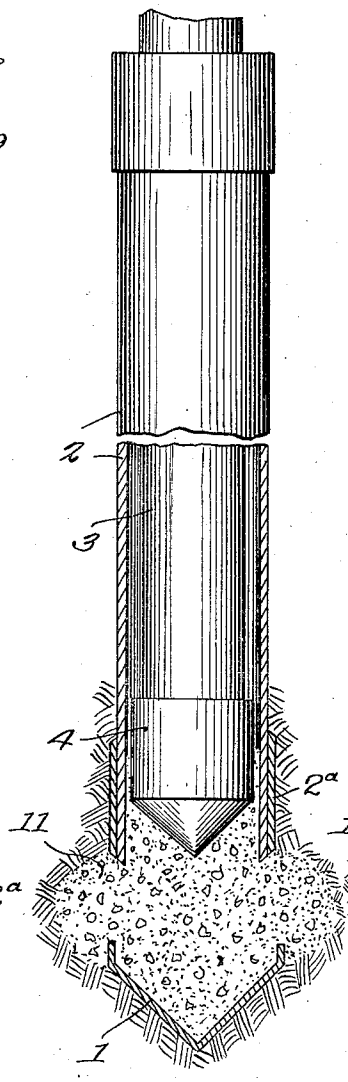
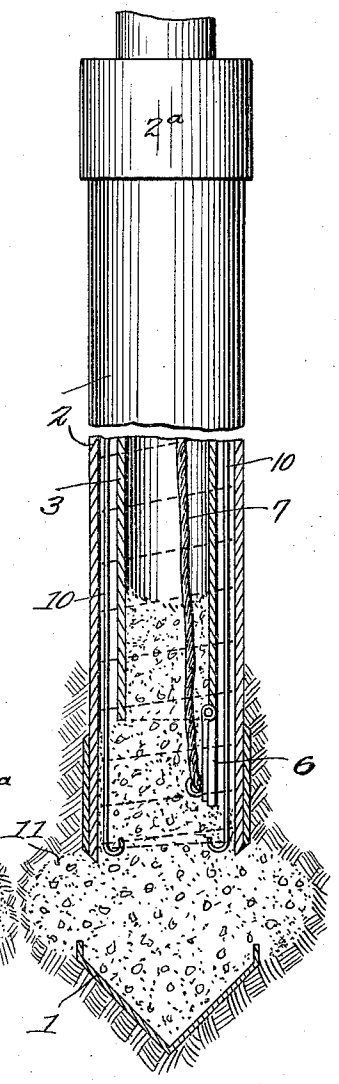


Fig. 3.



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Fig. 5.

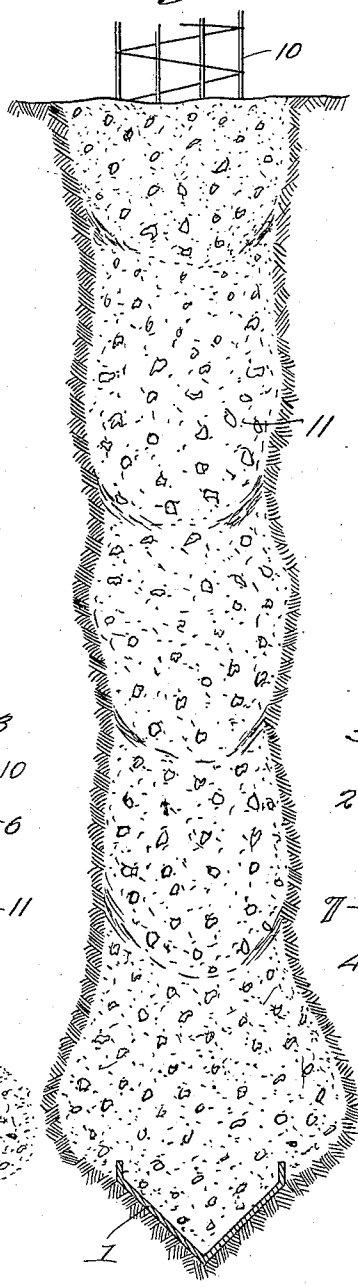


Fig. 4.

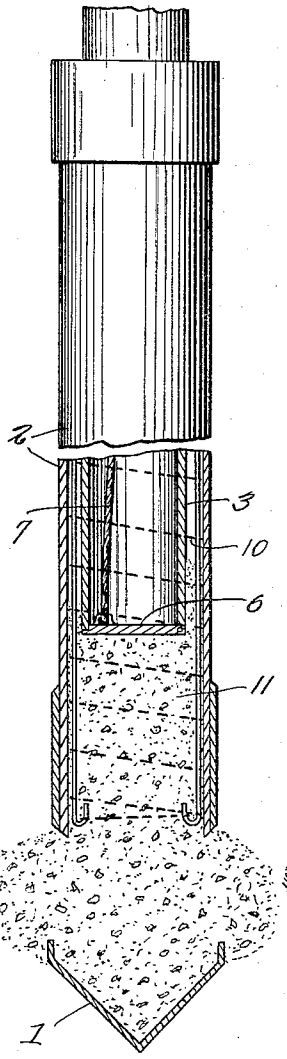


Fig. 7.

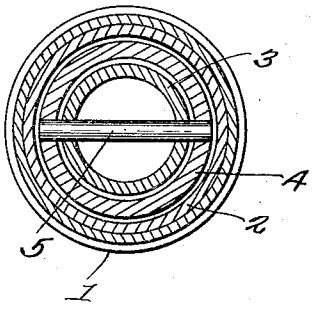
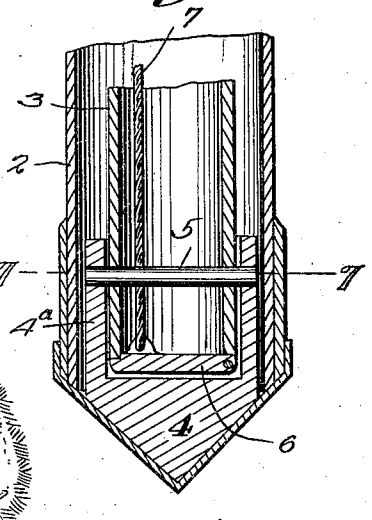


Fig. 6.



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UNITED STATES PATENT OFFICE

RENZO TADA, OF TOKYO-FU, JAPAN

APPARATUS FOR FORMING CONCRETE PILES

Application filed February 3, 1931, Serial No. 513,173, and in Japan October 18, 1930.

This invention relates to an improvement of apparatus for forming concrete piles having enlarged parts, one above the other, along the whole length thereof. The main object of the invention is to provide an apparatus for forming concrete piles of the kind above-mentioned, simple in construction and effective in operation for stamping concrete charge.

In apparatus of this type devised hitherto, an outer and an inner tube are provided, and after both tubes have been driven into the ground by a steam hammer, the inner tube is utilized to stamp a charge of concrete supplied through the bore of the inner tube. In the said apparatus, it has been found that the lower or stamping end of the inner tube is easily liable to damage or rendered ineffective in operation, owing to the heavy stamping force and a relatively complicated construction of the lower end. The main object is to remove these difficulties.

With this in view, this invention consists of an apparatus for forming a concrete pile having enlarged parts, one above the other, along its entire length, comprising in combination an outer tube; a plate shoe for the same; an inner tube adapted to be concentrically arranged within the outer tube; a valve plate pivoted on the lower end of the inner tube; and means for operating the valve plate and opening or closing the lower end of the inner tube to discharge concrete material through the bore of the inner tube, or cut off the discharge; and means detachably connected to the lower end of the inner tube for protecting the valve plate.

Another object of this invention is to provide an apparatus of the kind above-mentioned wherein a rope or the like attached at one end to the pivoted valve plate and extended to the top of the inner tube is provided for operating the valve plate.

A further object of this invention is to provide an apparatus of the kind, comprising a strong solid conical shoe detachably attached to the lower end of the inner tube for protecting the valve plate and inner tube end.

In the drawings:—

Fig. 1 is a front view, partly in section, of an apparatus constructed according to this invention.

Fig. 2 is a view similar to Fig. 1 and shows an operation of the apparatus wherein a charge of concrete is supplied below the lower end of the inner tube and tamped by the inner tube with the conical shoe.

Fig. 3 is a view similar to Fig. 2 and shows an operation of the apparatus wherein, after the lowest concrete enlargement has been formed below the lower end of the outer tube and an assembled reinforcement and inner tube have been inserted into the outer tube, the valve plate is opened to discharge a part of the concrete from the interior of the inner tube.

Fig. 4 is a front view, partly in section, of the apparatus showing its operation in stamping the top surface of the charged concrete by the inner tube after a charge of concrete through the inner tube, has been completed and the valve plate closed.

Fig. 5 shows a concrete pile formed by the apparatus according to this invention, the said pile being provided on the lower end with a greater enlarged part, and the stem part of the pile being formed by a succession of smaller enlarged parts.

Fig. 6 shows a longitudinal section of the lower part of the apparatus.

Fig. 7 shows a cross section thereof.

In the drawings, (1) is the plate shoe for protecting the end of the outer tube while the tube is driven into the ground. (2) is the outer tube made of a metal such as steel. (3) is the inner metallic tube. (4) is the conical solid metallic shoe detachably connected to the lower end of the inner tube. (5) is a transverse pin for connecting the shoe (4) to the inner tube. (6) is the valve plate pivoted on the lower end of the inner tube so as to be opened or closed. (7) is a rope connected at one end to the plate (6) and extended to the top of the inner tube. (8) is a ring attached to the top end of the rope (7) for operating the same. (9) is a bridge piece for supporting the said ring. (10) is an assembled reinforcement comprising a plurality of vertically arranged parallel reinforcing rods surrounded by a spiral wire as shown in

dotted lines in Figs. 3 and 4. (11) is a mass of concrete forming the greater enlarged part.

The outer tube (2) is provided at the top and bottom respectively with a reinforcing ring 2*a*, and the bottom is frictionally fitted with the conical plate shoe (1). The shoe (1) is left in the ground when the outer tube (2) with the plate shoe and inner tube (3) has been driven into the ground and then lifted for a distance. The inner tube (3) has a diameter so that a space is left between the outer and inner tubes when the latter tube is inserted into the former tube. The solid conical shoe (4) is formed at its upper end with a cylindrical flange 4*a* which is removably connected to the lower end of the inner tube (3) by means of the transverse pin (5) passing through the flange and inner tube.

In operation of this apparatus for forming a concrete pile in the ground, the plate shoe (1) is frictionally fitted to the outer tube (2), while the solid shoe (4) is connected to the inner tube (3) by means of the transverse pin (5). Then both tubes are assembled as shown in Fig. 1, and driven into the ground by means of a steam hammer not shown. When the assembled tubes have been driven to a desired depth, the inner tube (3) is withdrawn from the outer tube and a suitable quantity of concrete material (11) is charged into the outer tube (2). Then the inner tube (3) with the conical shoe (4) is inserted again and the mass (11) of the concrete material is stamped repeatedly by the hammering action of the steam hammer given to the top of the inner tube (3), whereby the lowest enlarged concrete part is formed on the plate shoe (1) which has been further driven by the mass of concrete during its stamping. Then the inner tube (3) is withdrawn again from the outer tube (2), and the assembled reinforcement (10) having a shape of a cylindrical cage opened on both ends is inserted into the outer tube. The solid conical shoe (4) is removed from the inner tube (3) which is then inserted into the outer tube (2) as before, the reinforcement being left in a space between the outer and inner tube. By loosening the rope (7), the valve plate (6) may be opened so as to charge a suitable quantity of concrete on the lowest enlarged part of the concrete pile. After the material has been charged, the valve plate (6) is closed by means of the rope (7) and the material is repeatedly stamped by the inner tube end while the outer tube is withdrawn, whereby a relatively smaller enlarged part is integrally formed on the lowermost enlarged part. The operation is repeatedly carried out, whereby there is formed a concrete pile of a desired length having a relatively larger lowest enlarged part and stem part composed of a succession of relatively smaller enlarged parts.

For driving the assembled tube into the ground and forming the lowest enlarged part of the pile, a succession of powerful hammering operations of the assembled tube and then of the inner tube is necessary. By this powerful hammering operation, however, the lower end of the inner tube and its shoe are easily liable to damage. In this invention, a solid conical strong shoe is used, whereby the said defect is removed. If necessary, the shoe can be easily removed and renewed. Also by the use of the pivoted valve plate, the construction of the lower end of the inner tube is considerably simplified and made stronger, whereby the effective stamping operation can be carried out.

I claim:

Apparatus for forming a concrete pile having superimposed radial enlargements and an enlarged footing, comprising an outer tube adapted to be raised alternatively through fractions of the height of the pile under construction, said outer tube having a detachable shoe at its lower end, an inner tube of less diameter than the outer tube and adapted to be rammed, a valve plate pivotally mounted at the lower end of the inner tube, an operating cord passing into the inner tube and attached to the said valve plate, and a conical tamping shoe detachably connected to the lower end of the inner tube, said tamping shoe being removed after the formation of the enlarged footing so that the pile is formed continuously afterwards without withdrawing the inner tube out of the outer tube.

In testimony whereof, I have signed my name to this specification at Tokyo, Japan, this 26th day of December, 1930.

RENZO TADA.