O. WILHELMI.

PROCESS OF MAKING FIRM FOUNDATIONS IN THE GROUND FOR PILES, TUBED SHAFTS, AND THE LIKE.

APPLICATION FILED DEC. 30, 1912.

1,106,606. Patented Aug. 11, 1914.

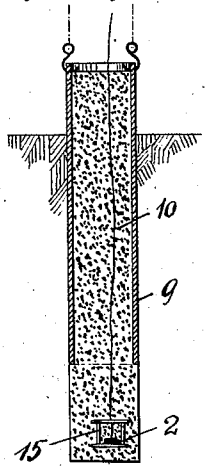


Fig. 1.

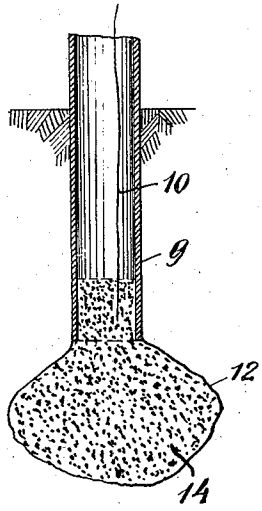


Fig. 2.

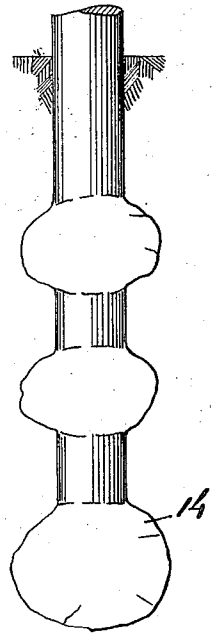


Fig. 3.

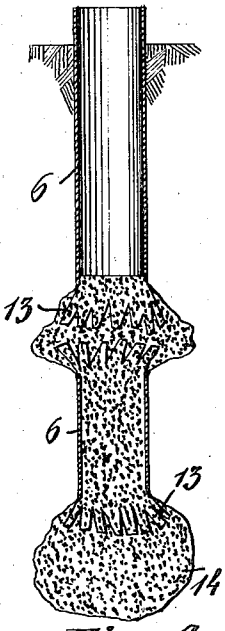


Fig. 4.

Fig. 5.

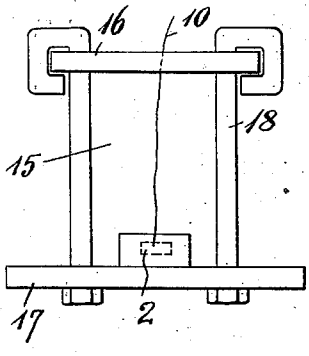


Fig. 6

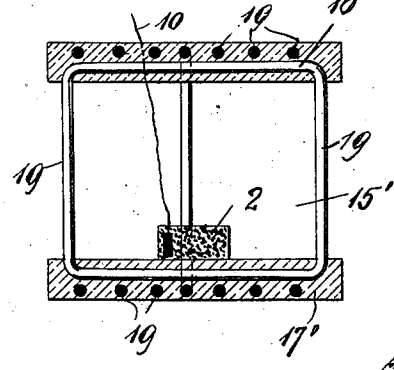
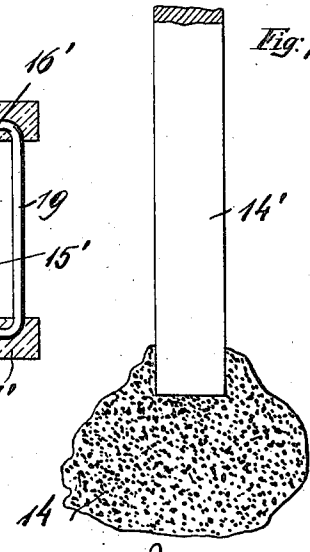


Fig. 7



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UNITED STATES PATENT OFFICE.

OTTO WILHELMI, OF LUCERNE, SWITZERLAND, ASSIGNOR OF ONE-HALF TO INTERNATIONALE SIEGWARTBALKENGESELLSCHAFT, A FIRM.

PROCESS OF MAKING FIRM FOUNDATIONS IN THE GROUND FOR PILES, TUBED SHAFTS, AND THE LIKE.

1,106,606. Specification of Letters Patent. Patented Aug. 11, 1914.

Application filed December 30, 1912. Serial No. 739,402.

To all whom it may concern:

Be it known that I, OTTO WILHELMI, a subject of the Emperor of Germany, and residing at Lucerne, Switzerland, have invented certain new and useful Improvements in Processes of Making Firm Foundations in the Ground for Piles, Tubed Shafts, and the like, of which the following is a specification.

This invention relates to a process of making firm foundation for piles in the ground, and for shafts with sunken tubing and the like, and substantially consists in making a cavity or hole in the ground by ignition of an explosive charge buried therein and in filling up the cavity or hole by a mass which constitutes the pile. The explosion enables a wide base for the pile to be made, which increases the carrying capacity of the pile, and in the case of concrete pile foundations the explosive action may be successively utilized for forming the space for the shaft of the pile itself having one or more enlarged portions.

The mode of carrying my process into practice will now be described by way of example with reference to the accompanying drawings, wherein:—

Figures 1 and 2 are vertical sections showing the formation of a concrete pile before and after employing the process according to this invention; Fig. 3 is an elevation showing a finished concrete pile having several enlarged portions; Fig. 4 is an elevation partly in section, illustrating a mode of making a concrete pile in which the preliminary tube first driven into the ground is left there as a permanent mold; Figs. 5 and 6 are elevation and longitudinal vertical section, respectively, showing devices by means of which the action of the explosive can be regulated; Fig. 7 shows a concrete base on which a ready-made short pile has been subsequently placed.

In making the foundations of concrete piles according to this invention, a hole for the explosive is first formed, said hole being suited to the dimensions of the pile-shaft. For this purpose, as shown in Fig. 1, the mold for the hole for the explosive, the pipe 9 is driven into the ground, and if it is to be used again, it is loosened and drawn so far out that it cannot be injured by the explosion. The explosive charge 2 is covered by a quantity of soft or liquid concrete and is then ignited by means of the fuse 10 and, in consequence of its explosive action, the surrounding ground is forced apart and a hole or cavity 12 is formed, (Fig. 2) into which the liquid concrete above it at once rushes or flows. If necessary, the concrete may then be consolidated in the hole 12 by its being rammed. The pile foundation may then be completed by further filling up the hole with concrete, reinforced or not. In very unstable ground the explosion is preferably repeated several times by arranging an explosive charge at different levels, so as to produce enlargements at different points as shown in Figs. 3 and 4, whereby concrete piles are formed, as shown in Fig. 4, with the pipe 6 left in the ground as a permanent mold, where the pipe 6 forms a good reinforcement, and is firmly embedded in the concrete of the broad base 14 by its ends which are torn into lugs or strips 13 by the explosion. The explosive charge must be protected from premature ignition owing to the concrete mass, which is subsequently filled into the bore hole, or falling stones or the like, and the column of concrete above the charge must be protected from being severely pressed upward by the explosion and possibly driven out of the pipe. To this end, the explosive charge 2 may be placed in a cage 15 (Figs. 1 and 5) which is preferably formed of two plates 16, 17 located one above the other at certain distances apart and having intermediate side pieces 18. A cage 15′, as shown in Fig. 6, of ferro-concrete may also be employed, in which the plates 16′, 17′ are formed of concrete and the intermediate pieces are constituted by coiled iron reinforcement 19. The upper plate 16 or 16′ restrains the upward pressure. As the explosive charge rests on the lower plate 17 or 17′ and the sides are wholly or partially open, the force of the explosion is mainly directed downward and laterally. The downward pressure compresses the ground below the cage and renders it more stable, and the increased lateral pressure makes a wider hole 12 and a larger base 14 is formed than is the case when the ex-

plosion is unrestricted. As shown in Fig. 7, a previously prepared short pile 14′ is subsequently placed upon the concrete base 14.

What I claim is:—

1. A process of making firm pile foundations in the ground, consisting in making a hole in the ground, placing the explosive charge upon the bottom of this hole, filling the latter with grout, exploding the charge and forming thereby an enlarged recess into which the grout automatically descends and fills it.

2. A process of making firm pile foundations in the ground, consisting in making a hole in the ground, lining the hole with metal tubes, placing an explosive charge upon the bottom of said hole, connecting a protected fuse with said charge, filling the hole with grout, exploding said charge and forming thereby an enlarged recess into which the grout automatically descends and fills it.

3. A process of making a firm pile foundation in the ground, consisting in making a hole in the ground, placing the explosive charge upon the bottom of this hole, filling the same with grout, restraining the charge from exploding in an upward direction, and securing the same against premature explosion during the initial filling in of the concrete, and finally exploding said charge and forming thereby an enlarged recess into which the grout automatically descends and fills it.

In testimony whereof I affix my signature in presence of two witnesses.

OTTO WILHELMI.

Witnesses:

CHARLOTTE METZNER,

ALFRED MEYER.