

F. J. M. M. DUCASTEL.  
 SYSTEM OF FOUNDATIONS FOR COMPRESSIBLE, SUBMERGED, OR MOIST GROUND.  
 APPLICATION FILED JUNE 25, 1907.

922,106.

Patented May 18, 1909.

Fig. 1.

Fig. 2.

Fig. 3.

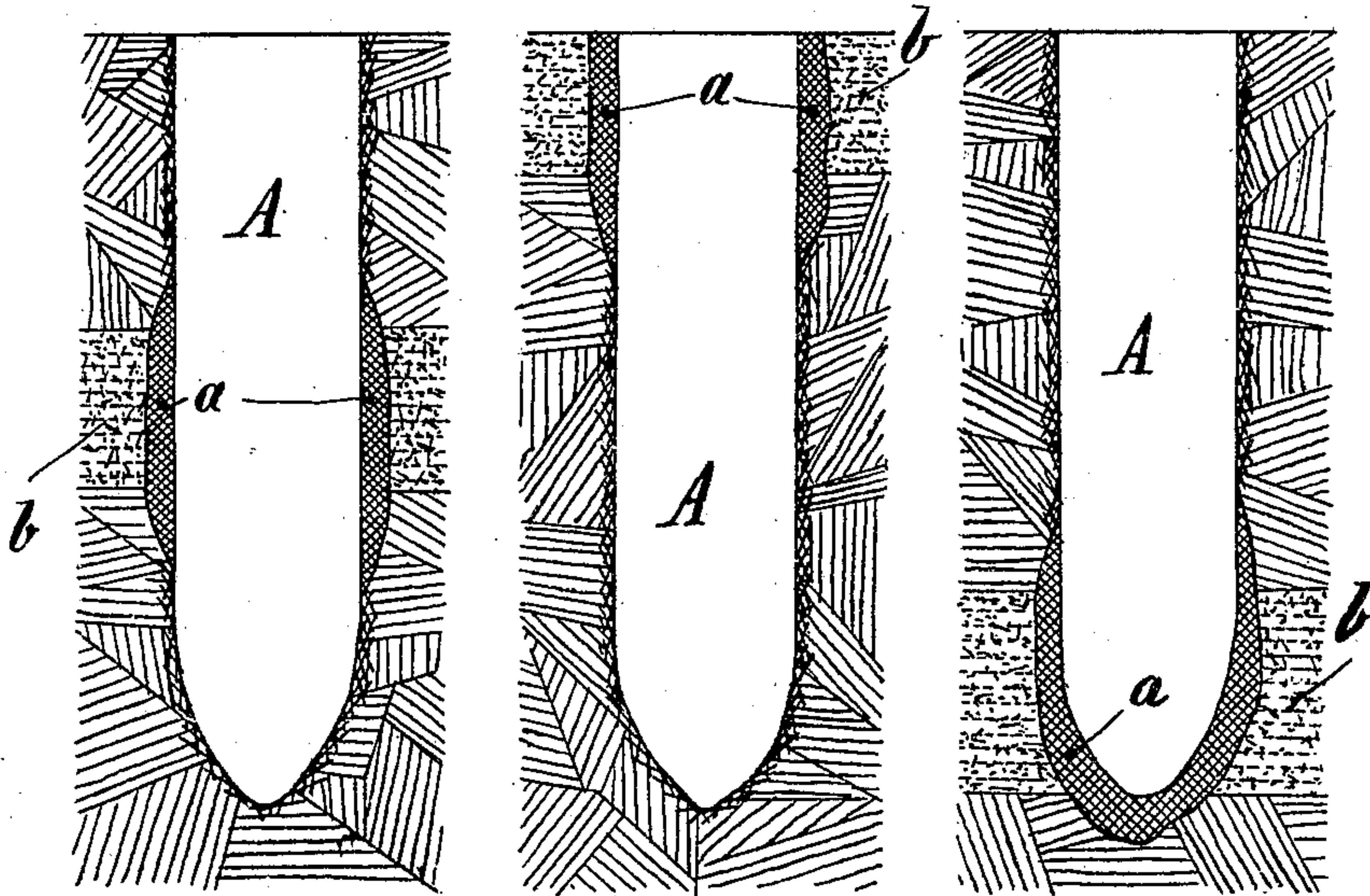
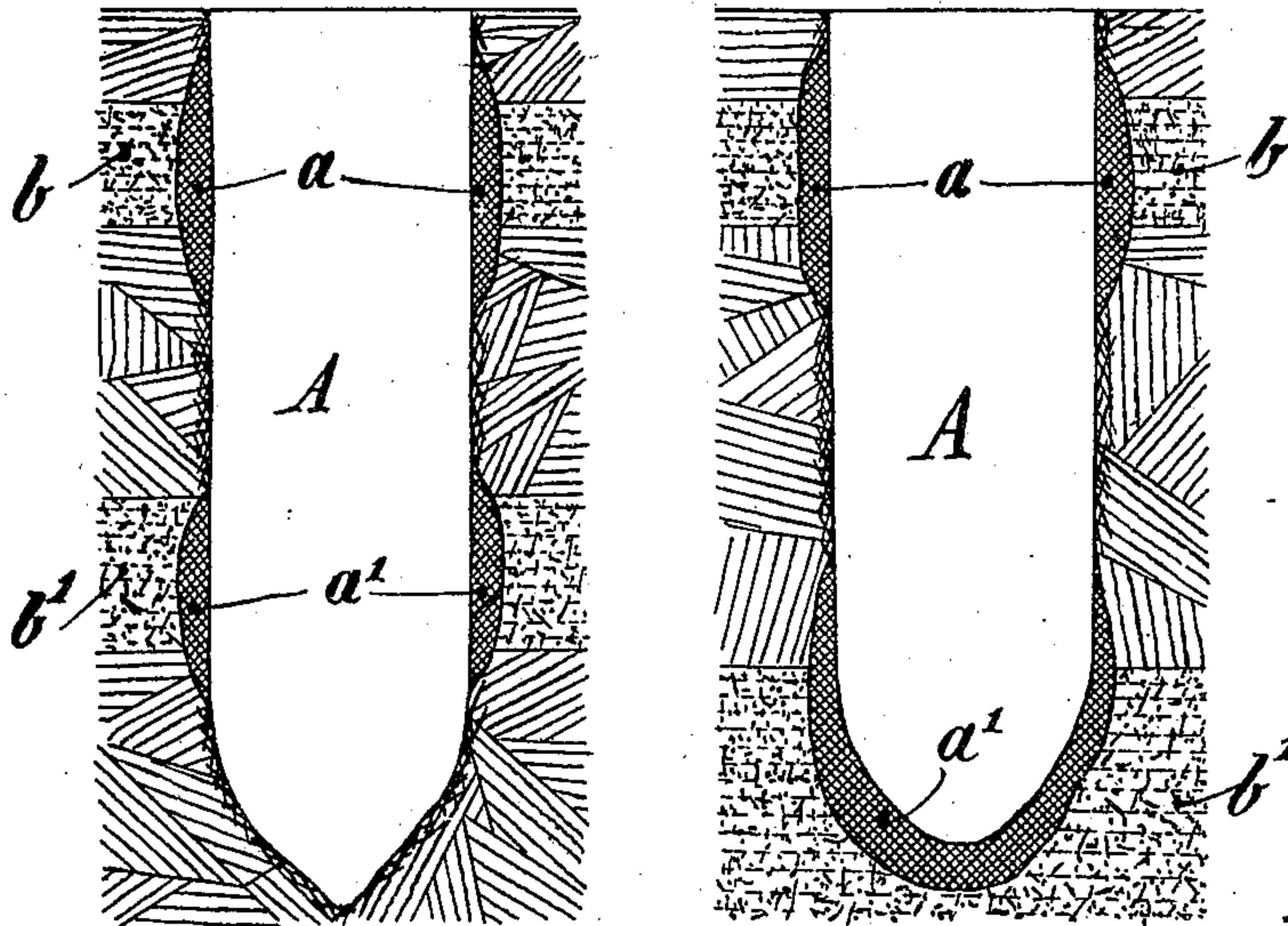


Fig. 4.

Fig. 5.



Witnesses

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 By *[Signature]*  
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# UNITED STATES PATENT OFFICE.

FRANÇOIS JEAN MARIE MONNIER DUCASTEL, OF PARIS, FRANCE.

SYSTEM OF FOUNDATIONS FOR COMPRESSIBLE, SUBMERGED, OR MOIST GROUND.

No. 922,106.

Specification of Letters Patent.

Patented May 18, 1909.

Application filed June 25, 1907. Serial No. 330,790.

*To all whom it may concern:*

Be it known that I, FRANÇOIS JEAN MARIE MONNIER DUCASTEL, a citizen of the Republic of France, residing in Paris, in the Republic of France, have invented certain new and useful Improvements in Systems of Foundations for Compressible, Submerged, or Moist Ground, for which application has been made in Germany May 2, 1907, and in France June 1, 1907.

In my U. S. Patent No. 791,927, I have disclosed a process for forming foundations by perforating and compressing the ground which is applicable more particularly to submerged, marshy, or wet ground, said process consisting in the formation in the ground, by exclusively mechanical means, of a hollow, impermeable sheath of compressed clay, into the interior of which the materials utilized for the manufacture of the piles, which are to support the superstructure, are vigorously rammed. In the patent referred to, the application of the process to submerged or wet ground, such as muddy, peaty, or marshy ground traversed by subterranean streams and the like, and in general all water charged ground, was dealt with. Certain ground, however, in which foundations have to be made, has different layers of soil of divers natures and only one or more of these layers are very unstable or fluid. Thus a soil may be encountered which is comparatively firm and offers a certain resistance starting from the level of the ground, then a layer of peaty ground which is very unstable or a layer of quicksand may be encountered and then a quantity of water flowing over a bed of clay resting on similar ground to that situated at the surface. It is to this general character of ground that my present invention is applicable and my process will be described with reference to foundations made in such ground and as illustrated in the accompanying drawings, wherein:

Figures 1, 2 and 3 show, respectively, in vertical section, and merely as an example, the holes obtained in accordance with my invention; and Figs. 4 and 5 show, still as an example, two other forms of holes made according to my invention.

Referring to the drawings, according to my invention, by the use of a boring pile-driver, a hole is made in the ground by compressing it laterally, and from top to bottom, or downwardly, without utilizing any sheath or lining, until a layer of unstable or soft

earth is reached. From this moment, and before each blow of the pile-driver, there is thrown to the bottom of the hole a quantity of clay which, by continual ramming, is caused to consolidate and form the walls or impermeable sheath *a*, which clay will also combine and consolidate with the said unstable or soft earth *b* surrounding said sheath; and this addition of clay is continued until a more resistant layer of soil is again encountered. When such is the case, the deepening of the hole is continued without any sheathing or lining material being added. When good ground is reached, on which the weight of the construction may be supported, or a depth which is recognized to be sufficient for the establishment of the pile intended to carry this weight, the bottom is formed and the hole is filled up exactly in the manner set forth in my former patent.

Obviously, ground formed of layers of soil of different natures may be frequently encountered, and mention has just been made, but only as an example, of a case in which a layer of unstable ground is interposed between layers of more resistant or stable ground, as in Fig. 1; but, this layer of unstable ground may be either at the mouth of the hole, as in Fig. 2, or above the firm ground on which the foundations are to be based, as in Fig. 3. In these figures, *A* indicates the hole formed as described. If, in the course of the boring of a hole, two or more isolated layers of ground, which are more unstable or liable to slip, alternating with more resistant layers, are encountered, recourse is had to sheathing as many times as are necessary, as in Figs. 4 and 5, wherein the additional sheathing is indicated by *a'* and the surrounding unstable ground by *b'*.

Although the process described in the foregoing is particularly effective for the formation of foundations in unstable ground of the nature mentioned, it will be understood that it can be equally well employed in dry unstable ground, as, for instance, ground composed of rubble or spoil unsuitable to be used for forming a hole, unless recourse be had to the use of tubbing, or a total or partial sheathing. Moreover, I have mentioned clay as preferable for forming the sheath; but, it is evident that the invention will not be changed if there be substituted for this material, for the formation of the sheath, either totally or partially, any argillaceous earth, or any other materials



adapted to yield the same result. For instance, marl, cement, beton, mortar and the like, or even ordinary earth, may be used.

My invention also includes, as a part of the process, when found necessary or desirable on account of the character of the ground, the use of coarse material such, for instance, as rubble, or ashlar, energetically rammed into the hole in order to force said material out laterally, and then adding the material intended to form the sheath, wholly or partially. This material will be used when foundations have to be made in peaty ground, quicksand and other like ground, or in the ground traversed by unstable layers of this kind.

The sinking of the hole is carried on gradually by ramming in succession hard materials, and material intended to be incorporated with the latter and to form the watertight wall of the hole. Owing to this way of proceeding, there is formed in unstable or slipping ground, in addition to the impermeable sheath, a sort of consolidation of the ground, rendering the application of the process more practical.

I declare that what I claim is:

1. The method of forming foundations in ground having strata of stable and unstable material, comprising sinking a shaft therein by compressing laterally the stable material; mixing with the unstable material when reached a substance which will consolidate the same and form therewith an impermeable sheath; compressing laterally the consolidated material so as to form thereof an

impermeable sheath; and filling in the shaft with foundation material.

2. The method of forming foundations in ground having strata of stable and unstable material, comprising sinking a shaft therein by compressing the material, forming the stable strata, downwardly and laterally; inserting in the shaft, when unstable material is encountered, material capable when compressed of forming an impermeable sheath; compressing said inserted material downwardly and laterally; and filling in the shaft with foundation material, substantially as described.

3. The method of forming foundations in ground having strata of stable and unstable material, comprising sinking a shaft therein by compressing the material, forming the stable strata, downwardly and laterally; inserting in the shaft, when unstable material is encountered, coarse filling material; then forcing said filling material out laterally; then inserting in the shaft material capable of forming an impervious sheath; then compressing this inserted material so as to displace it downwardly and laterally; and then filling the shaft with foundation material, substantially as described.

In witness whereof, I have hereunto signed my name this 28th day of May 1907, in the presence of two subscribing witnesses.

FRANÇOIS JEAN MARIE MONNIER DUCASTEL.

Witnesses:

ALPHONS MEJEAU,  
H. C. COXE.