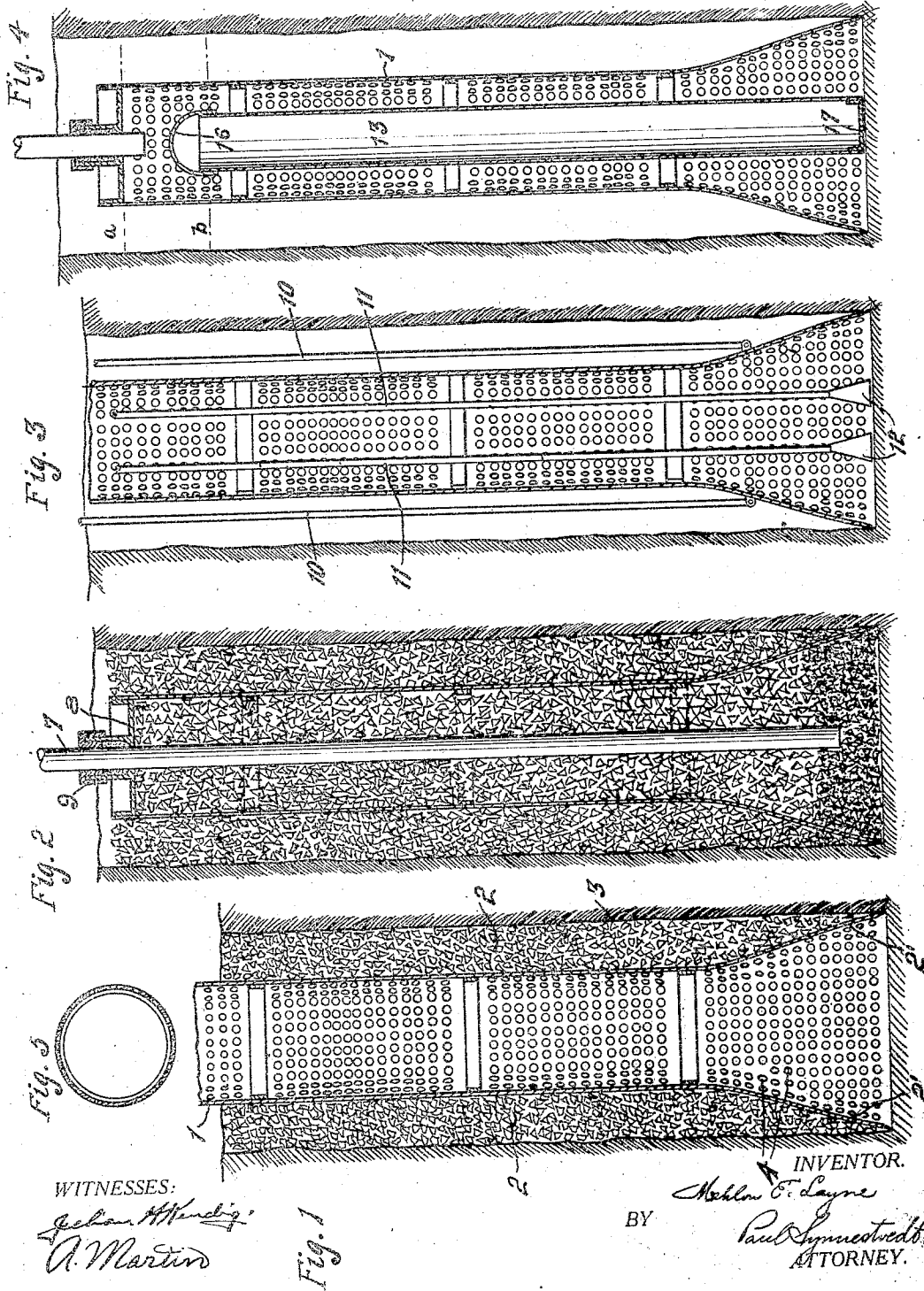


M. E. LAYNE.
METHOD OF FORMING CONCRETE FOUNDATIONS AND THE LIKE.
APPLICATION FILED MAY 22, 1912.

1,062,718.

Patented May 27, 1913.

2 SHEETS-SHEET 1.



WITNESSES:

John H. Hendig
A. Martin

Fig. 1

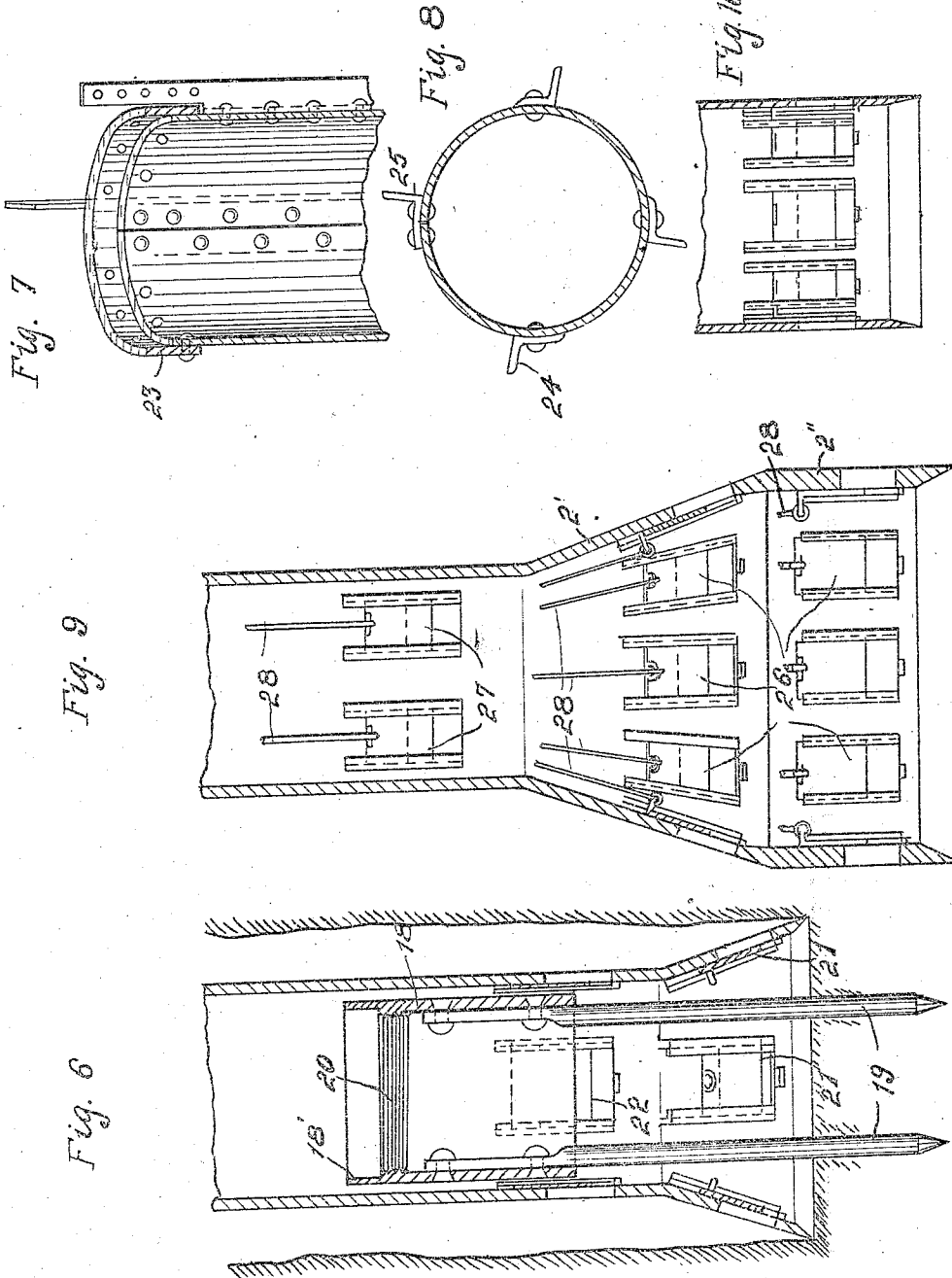
BY

INVENTOR.
Mehlan E. Layne
BY *Paul Lynnebrook*
ATTORNEY.

M. E. LAYNE.
METHOD OF FORMING CONCRETE FOUNDATIONS AND THE LIKE.
APPLICATION FILED MAY 22, 1912.

1,062,718.

Patented May 27, 1913.
2 SHEETS-SHEET 2.



WITNESSES:
Julian B. Kendrick
James C. Bradley

INVENTOR.
M. E. Layne
BY *Paul Symmesworth*
ATTORNEY.

UNITED STATES PATENT OFFICE.

MAHLON E. LAYNE, OF HOUSTON, TEXAS.

METHOD OF FORMING CONCRETE FOUNDATIONS AND THE LIKE.

1,062,718.

Specification of Letters Patent.

Patented May 27, 1913.

Application filed May 22, 1912. Serial No. 688,937.

To all whom it may concern:

Be it known that I, MAHLON E. LAYNE, a citizen of the United States, residing at Houston, in the county of Harris and State of Texas, have invented certain new and useful Improvements in the Method of Forming Concrete Foundations and the Like, of which the following is a specification.

The invention relates to the art of making concrete piers, foundations and the like and to the art of positioning a metal tube or similar member with a surrounding envelop of gravel or the like for use in the foundation or any other desired purpose. Certain forms of the invention are illustrated in the accompanying drawing, wherein:—

Figure 1 is a sectional diagrammatic view showing the first step in the method, which consists in positioning the metal shell; Fig. 2 is a similar section illustrating a later step in the method; Fig. 3 is a diagrammatic sectional view showing the complete pier or foundation structure without the concrete material; Fig. 4 is a sectional view illustrating a modified arrangement for practising the method; Fig. 5 is a transverse section through the tube shown in Fig. 1; Fig. 6 is an enlarged sectional view taken through the bottom of the tube and showing details of construction not illustrated in the diagrammatic views; Figs. 7 and 8 are enlarged longitudinal and sectional views through the upper portion of the tube; Fig. 9 is a section showing a slightly modified construction at the lower end of the tube, and Fig. 10 is a section through the lower part of a tube of modified construction:

In the construction as shown in Fig. 1 which shows the first step of the operation; 1 is a metal shell or tube provided in its sides with a large number of perforations and having an enlarged or expanded bottom portion 2'; 2 is an envelop surrounding the tube and comprising a mass of gravel, crushed stone or similar material; and 3 is the dirt wall surrounding the envelop 2. The tube 1 may be sunk to the position shown in any desired way, such for instance as by using an excavator, auger or sand bucket upon the interior of the tube, and gradually forcing the tube downward as the excavating progresses. The opening thus formed in the dirt is of a diameter equal to or greater than the diameter of the lower

enlarged portion 2', the purpose being to provide a space between the dirt wall 3 and the wall of the tube 1 for the gravel envelop 2. This gravel constituting an envelop is preferably supplied as the tube 1 is forced downward, the weight of the gravel upon the enlarged portion 2' materially assisting in the work of carrying the tube downward, any suitable means being employed to support the tube from above and prevent its too rapid downward movement under the weight of the gravel when the excavating beneath the tube progresses more rapidly than the desired downward movement of the tube. The tube is more readily guided in a true vertical direction when held back and not allowed to descend too rapidly. The perforations 4 in the wall of the tube 1 are shown as round but may be of any desired character. The perforating of the tube is preferably done prior to sinking of it to position, but if desired perforations of a different character might be made from the inside of the tube after it was positioned in the ground.

After the tube has been positioned as indicated in Fig. 1, its interior is filled with a mass of gravel, crushed rock or the like, which material surrounds a second tube 7 whose lower end terminates adjacent the bottom of the tube 1. A removable header 8 is secured removably in the upper end of the tube 1, and is provided with the stuffing box 9 in which the tube 7 is mounted for vertical movement. The next step in the operation is the forcing through the tube 7 of a liquid hydraulic cement, which not only permeates the gravel inside of the tube, but is also forced through the perforations 4 and into the mass of gravel 3 surrounding the tube. As the cement is supplied, the tube 7 is gradually drawn upward until the entire mass of material inside and outside of the tube is permeated with a sufficient quantity of cement to form a binder and, which when it hardens, constitutes with the masses of gravel 2 and 6 a concrete solid mass with the tube 1 as a reinforcing means therefor.

Fig. 3 illustrates the manner in which additional reinforcing means may be supplied if desired. As illustrated, the outside reinforcing rods 10 are secured at their lower ends to the tube 1 by riveting or any other desired means, while the inside rods 11 are provided at their lower end with anchors 12.

Various other means might obviously be employed for securing additional reinforcement.

In Fig. 4 the method is shown as applied to the formation of a shaft for mine or other work. In this arrangement a closed tube 13 is fitted inside of the tube 1, and the space intermediate this tube 13 and the tube 1 is filled first with the gravel and subsequently supplied with cement through the tube 15, such cement being forced into the gravel, and then through the perforations in the tube 1 and into the gravel envelop. In order to form a plug for the gravel envelop outside the tube 1 at the top thereof, cement is preferably added for a short distance down, as between the lines marked *a* and *b* and the concrete thus formed at the top of the envelop allowed to harden before applying the cement through the tube 15. This plug serves to prevent the cement as applied through the tube 15 from being forced out at the top of the gravel instead of thoroughly permeating the gravel beneath such plug. After the filling operation the heads 16 and 17 are removed from the tube 13, thus leaving an open passage-way or shaft.

In sinking the tube or shell as shown in Figs. 1 and 2, it has been found difficult to prevent the lower end of the tube from deflecting laterally in its progress downward, due to the fact that strata through which the end of the tube passes differ greatly in composition and offer at various points more resistance on one side of the tube than on the other. In order to obviate this difficulty I have provided two means, both of which are illustrated in Fig. 6. The first of these means consists in providing in the tube a guide member or sleeve 18 to which is secured a plurality of rods 19 which are adapted to project in front of the lower edge of the tube. The sleeve 18 is pushed or driven downward from above by means of a tool of any suitable character which is adapted to take against the upper portion 18', and during the sinking of the tube the rods 19 are always kept in advance of the lower edge of the tube, thus serving as a means to penetrate the strata in advance of the edge of the tube and hold such tube against lateral deflection. The interior of the casing 18 is threaded at 20 to receive a threaded tool whereby the casing may be raised or lowered as the case may be. Another means which also contributes in securing an undeflected downward movement of the end of the tube is the provision of a plurality of doorways adjacent the lower end of the tube, which doorways are covered by the sliding doors 21 and 22. When these doors are open, the material at the sides of the tube passes inwardly therethrough as the tube descends, and the tendency of the end of the tube to wobble is materially reduced. This arrange-

ment is also advantageous in that it tends to prevent the choking up of the tube, as the upward pressure at the bottom of the tube is relieved by reason of the escape into the tube at the sides of the water from material through which the tube is passing. The doors may be operated by rods from above (not shown) or in any other desired way.

The lower end of the tube may also be guided by the reinforcing rods 10 (Fig. 3). By pulling on one of these rods the end of the tube is directed laterally in the direction of the pull.

Figs. 7 and 8 illustrate the means preferably employed for stiffening the perforated tube and connecting the various sections thereof together. The various sections are preferably connected by butt straps 23, so that the interior of the tubing is unobstructed, and these connections are further reinforced by the stiffening ribs 24 and 25 secured to the exterior of the tube. These stiffening ribs are preferably commercial angles, although other sections might be used, and extend substantially the full length of the tubing, so that they bridge the joints and reinforce the tube at such points. These ribs are also very useful in keeping the gravel envelop in its proper position, as they prevent the body of gravel from shifting circumferentially and thus accumulating more at one portion of the tube than at another. The rib 25 at the vertical joint has a flange of sufficient length to constitute a connecting strap between the two edges of the tube, as indicated in Figs. 7 and 8. As the tubes are often of large diameter it is necessary to form them out of sheet metal bent to the desired form.

Still another modification is illustrated in Fig. 9, which figure indicates a somewhat different proportioning of the lower end of the tube, and also shows the tube without the guide sleeve and the rods as illustrated in Fig. 6. In this construction the tube has a cone or expanded portion 2' from the bottom of which there is an extension 2'' the sides of which are substantially parallel to the walls of the tube, but a greater distance apart, as will be readily seen. Both the cone 2' and extension 2'' may be provided with sets of doorways covered by the doors 26 and 27, such doors being operable by means of the upwardly extending rods 28.

The invention is illustrated throughout as applied to the formation of piers or foundation members which are circular in horizontal cross section, but it will be obvious that the process is applicable to the formation of piers or foundations of any other desired cross section, which cross section will depend upon the cross section of the metal shell employed and may be square or oblong or of any desired shape. Gravel or crushed stone is preferably used inside and outside

the tube or shell, but it will be understood that my invention comprehends the use of any similar material capable of receiving the cement. It will also be understood that the term "concrete" as employed is used in its generic sense and comprehends all materials formed of cement, crushed stone, gravel or the like, which may be applied in the manner set forth heretofore, and which subsequently sets or hardens into a solid mass.

The method of positioning the tube 1 with its surrounding envelop of gravel or the like constitutes in itself a feature of invention applicable to other uses than the one heretofore described, and is intended to be covered when so applied. For instance, the tube 1, when positioned as heretofore described and provided with its envelop of gravel 2, constitutes a well screen having very decided merits, the gravel 2 in such case constituting the screening medium and the relatively large openings 4 permitting the water to pass freely but preventing the gravel from working into the tube.

The construction and method heretofore described involving the use of the flared tube with the gravel envelop has certain important advantages as applied to screening or filtering devices. In sinking a tube of this character the sand, and fine material through which the tube penetrates is permitted to enter the tube through the sides thereof as it descends, and because of this fact the water level in the tube retains substantially its normal head during the sinking operation, thus eliminating the rapid inflow of water at the bottom such as occurs from time to time where an unperforated tube is employed. Such a sudden inflow of water at the bottom of the tube is detrimental, inasmuch as it carries with it a large body of sand and other material, tending to choke up the tube and prevent its free movement downward. By the sinking process heretofore described the formation is moved in advance of the tube, permitting the tube to work down, and the gravel wall or envelop rolls down and out, such wall being entirely loose from top to bottom and serving because of its great weight to assist in forcing the tube downward. A tube of this kind with a relatively loose wall is much less liable to stick than a tube of uniform diameter which fits the solid walls of the material, and is liable to stick or bind because of quicksand settling around the tube, or by reason of small rocks dropping in between the tube and the opening. A gravel wall of any desired thickness may be employed, and this gravel wall not only assists in screening the water which passes therethrough, but also serves as a retainer for the sand which lodges therein and as a filter for purifying the water passing therethrough. The screening capacity of a device of this kind

is obviously very much greater than it is possible to secure in any kind of a perforated tube used without the gravel envelop.

It will be apparent from the foregoing that the formation of piers and foundations by means of the use of my method may be rapidly and cheaply accomplished, and that the resulting formation is of a superior character. The material inside and outside the tube is formed into one concrete mass, the perforations in the tube permitting of the connection of the material inside and outside the tube and giving the tube 1 when considered as a reinforcing means, a very secure grip upon the concrete. The tube 1 may be sunk to any desired depth or through any formations which may be encountered, such as quicksand or water, and without difficulty, and by applying sufficient pressure to the cement supplied to the interior of the tube, this cement may be made to permeate to a greater or less degree even the earth surrounding the outer envelop of gravel, thus giving the pier or foundation a very firm grip upon the formations in which it may be located. The enlargement 2' at the lower end of the tube may be made in a variety of ways, the only requirement being that the lower end of the tube be of larger diameter than those portions of the tube lying thereabove, and the limitation as to the diameter of the lower end of the tube, refers obviously only to the exterior diameter, the interior diameter being an immaterial factor.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is the following:—

1. The method of forming piers, foundations, and the like which consists in sinking into the ground a metal shell having side walls with such walls spaced away from the ground, supplying the space between the walls and ground with a material capable of receiving cement to form concrete, supplying the interior of the shell with a material also capable of receiving cement to form concrete, and then forcing into the said shell and through perforations provided in the side walls of the shell and the said material surrounding the shell a cement which subsequently hardens forming with the said material a concrete mass inside and outside the said shell.

2. The method of forming piers, foundations, and the like which consists in sinking into the ground a metal shell having side walls and having an enlarged base whereby a space is provided between the walls of the shell and the dirt side walls of the excavation, supplying the said space with a material capable of receiving cement to form concrete, supplying the interior of the shell with a material also capable of receiving cement to form concrete, and then forcing

into the said shell and through perforations provided in the side walls of the shell and the said material surrounding the shell a cement which subsequently hardens forming with the said material a concrete mass inside and outside the said shell.

3. The method of forming piers, foundations, and the like which consists in sinking into the ground a metal shell having side walls and an enlarged lower end whereby a space is provided around the shell above the said lower end as the shell is sunk, providing the said space as the shell moves down with a material capable of receiving cement to form concrete, and then forcing cement through perforations provided in the side walls of the shell and into the said material.

4. The method of positioning a tube in the ground and providing a surrounding envelop of gravel or the like, which consists in sinking a tube having its lower portion larger than the portions thereabove whereby a space is provided around the tube above the said lower portion between the exterior surface of the tube and the ground as the tube is sunk, and supplying the said space

between the tube and the ground with the said gravel or the like as the tube moves down, the body of gravel or the like bearing at its outer surface against the ground and at its inner surface against the tube.

5. The method of positioning a perforated tube in the ground, and providing a surrounding envelop of gravel or the like, which consists in sinking a tube having its lower end larger than the portions thereabove, whereby a space is provided around the tube above the lower end as the tube is sunk, guiding the said lower end of the tube during its downward movement, and supplying the said space with the said gravel or the like as the tube moves down, the body of gravel or the like bearing at its outer surface against the ground and at its inner surface against the tube.

In testimony whereof I have hereunto signed my name in the presence of the two subscribed witnesses.

MAHLON E. LAYNE.

Witnesses:

F. W. CARRUTH,
GEO. B. RIKER.