Dec. 1, 1953 J. CAPBLANCH 2,660,862

APPARATUS FOR CONSTRUCTING POSTS IN THE GROUND

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Fig. 1

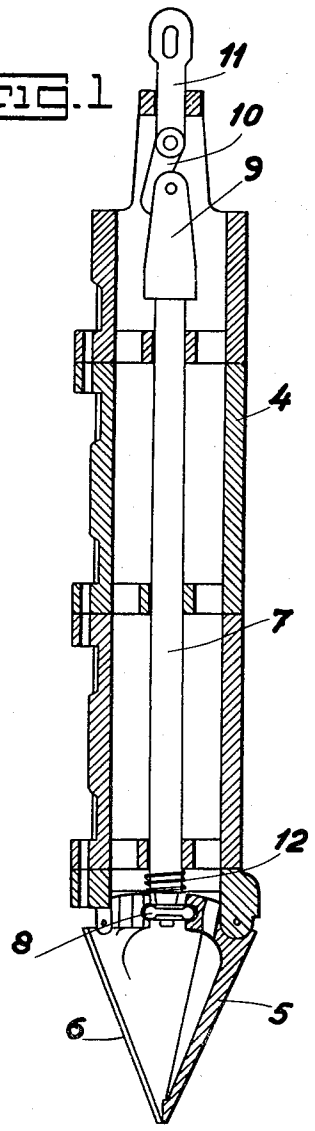
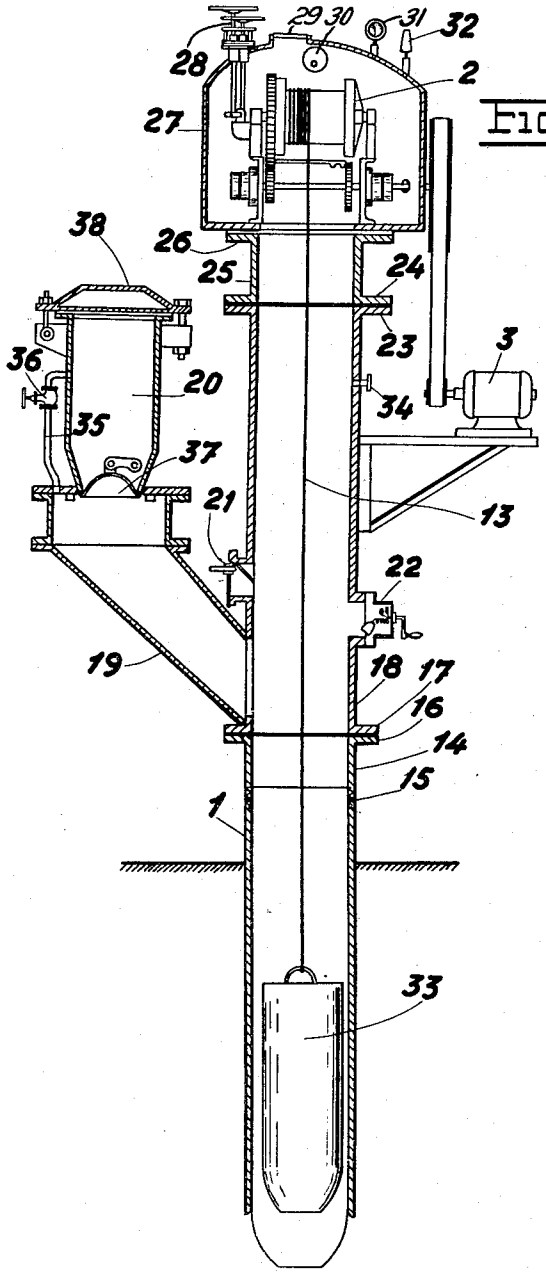


Fig. 2



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APPARATUS FOR CONSTRUCTING POSTS IN THE GROUND

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8 Claims. (Cl. 61—63)

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The present invention relates to a method and apparatus for the construction of posts in shafts bored into the ground.

It is an object of my invention to provide an improved method and apparatus of the kind described by which the posts can be rapidly and cheaply constructed.

It is another object of the present invention to provide an apparatus allowing to construct posts of any length.

A further object of my invention is to prevent water from assembling in the boring of the ground where the post is to be constructed.

Other objects of my invention will become apparent from the detailed description thereof given herebelow.

In its broadest aspect, the present invention comprises the steps of driving a hollow tube into the ground and at the same time removing the earth from the inside of the tube, sealing the inside of the tube hermetically and introducing concrete into the tube.

Preferably the concrete is pressed into the hollow of the tube and the introducing, as well as the pressing of the concrete may be done step by step in charges.

The apparatus according to the invention comprises in combination, a hollow tube to be placed vertically on the ground, a device for removing the earth from the inside of the tube so that the tube sinks gradually into the ground as the earth is removed from the inside of the tube, an extension to be connected to the upper end of the tube when it has almost entirely penetrated into the ground, and a concrete delivering device connected to the extension.

According to a preferred embodiment of the present invention, a device is used for boring the hole in the ground which is provided with jaws capable of boring all kinds of ground. Preferably compressed air is used for keeping the boring practically free of water.

According to the invention, an iron tube having a diameter corresponding to that of the bore to be made is brought into position at the place of boring. This tube serves as wall for the boring and penetrates into the ground as the earth is removed from its inside.

An excavator device for removing the earth acts inside the tube. This excavator device is suspended from a crane or the like, and provided with jaws forming collecting shovels which are articulated at the lowermost portion of the body of the excavator. They remain apart from each other with their free edge in a position in which

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the ground can be attacked when the excavator is allowed to fall. The jaws are then made to approach each other, and they come into a position in which they retain a certain amount of earth. The excavator is then lifted from the ground and the earth rests on the jaws while a pull is effected on the excavator to remove it from the surface of the ground. In this way a hollow can be made in the ground by successive motions of the excavator downwards and upwards. In this cavity the posts are constructed while the cavity is walled by the continuous driving in of the iron tube which has been described above.

The repeated attacks of the excavator on the ground and the consecutive removals of earth allow to recognize the conditions which prevail in the various layers traversed by the excavator. Therefore, it is possible to obtain a complete picture of the positions in the ground, particularly relating to the security obtainable by the construction of the posts.

Preferably, the excavator is suspended from a drum for free fall, a motor being provided for acting on the drum in order to lift the excavator. The suspension is preferably made by a steel cable which is wound on the drum.

Generally, recourse is had on posts in ground of very bad quality, when great depths have been penetrated or the layers of the traversed ground are soaked with water. All this gives rise to difficulties which are overcome by the present invention.

When the first tube has penetrated into the ground with all its length and if the boring is to be continued, a similar tube acting as a continuation is added. When the required depth is reached the excavator device is withdrawn, and an intermediate tube is connected to the uppermost tube in the ground which has a flange to which a flange of an extension is connected by means of a hermetically sealing joint. This extension communicates through a lateral branch with a container for concrete preferably closed in the manner of an autoclave. The concrete is alternatively delivered and pressed into the tube as described more fully hereinafter.

A chamber is provided above the interior in which a drum is provided which can freely move in one direction, whereas it is actuated by an electric motor in the other direction. From the drum a cable is suspended for suspending weights which are used for pressing the concrete delivered into the tube. A hermetically sealed space is formed which is constituted by the tubes, the ex-

tension and the chamber for the drum which is connected to the extension. This hermetically sealed space is filled with compressed air which not only prevents the infiltration of water into the hole, but also expels any water which has assembled therefrom for this reason or another.

The installation for reducing to practice the present invention is completed by accessories such as lamps and control devices, monometers, and etc.

The novel features which I consider as characteristic for my invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a longitudinal cross-section of the excavating device for removing the earth from the bore; and

Fig. 2 is a longitudinal section of the device used for constructing a post of concrete in a hole which has been emptied of water.

The process is begun by placing the tube 1 shown in Figure 2 on the ground. In the interior of this tube the excavator shown in Figure 1 is made to move. The excavator is suspended from a crane (not shown), by means of a steel cable (not shown), which is wound on a drum (not shown), allowing a free fall of the device, which however, is similar to the corresponding parts described hereinafter more fully in connection with Figure 2.

The drum (not shown) is actuated by an electric motor (not shown), or another device which produces alternatively the following actions:

Penetrating of the excavator into the earth when it falls from a certain height, and extraction of the earth gripped between the jaws when the excavator is lifted by means of the drum.

As the depth of the excavation increases, said excavation having the form and dimension of the tube 1, which is driven into the ground and sinks into the earth and forms a solid wall of the boring. Each tube has a length of 1 to 2 meters, or even more, and when the tube is nearly buried in the ground it is connected to another tube which forms a prolongation thereof.

The excavating device comprises, as shown in Figure 1, a substantially cylindrical hollow body 4 consisting of metal and having thick and solid walls. In the lower part of the walls two jaws 5 and 6 are articulated. The jaws 5 and 6 can be closed by means of a rod 7 which is connected to the jaws at its lower ends by means of a disk 8. On the other end the rod 7 is provided with a stirrup 9 hanging on a hook 10 articulated to a suspension piece 11 which is connected to the cable wound on the drum.

The operation of this device is as follows:

When the excavator is allowed to fall, the rod 7 is disengaged from the hook 10, and its weight acts on the jaws 5 and 6 and keeps the latter, by means of a helical spring 12 in a vertical open position which facilitates the penetration of the device into the ground. The weight of the jaws contributes to hold them in this position.

When the drum is released the excavator descends without the least obstruction by the cable. Under the action of the weight of the cylinder 4, the rod 7, and the jaws 5 and 6, which in this case are vertical, the excavator buries itself in the ground. At this moment the hook 10 which

still further descends under inertia engages the stirrup 9 at the upper end of the rod 7. If now, by means of the drum, a pull is exerted on the cable which is connected to the suspension piece 11, the rod 7 opposes the action of the spring 12 and the jaws 5 and 6 are turned about their pivots so that they hold between them the earth which has been separated from the ground by the penetration of the jaws.

When the excavator returns to the surface of the earth it is emptied by the following operations:

The hook 10 is detached from the stirrup 9 and the jaws 5 and 6 open and allow the earth and the material which have been retained between them to fall down. The jaws may have different forms according to the quality of the ground which they are supposed to excavate. According to the diameter of the excavation to be produced the number of jaws is varied, for instance between 2 and 6. The weight of the whole device may vary according to the conditions of the ground to be excavated. If necessary, additional elements can be provided, the weight of which adds to that of the excavator. Of course, the harder the ground is the more weight must act on the jaws in order to obtain an efficient action.

When the boring walled by the tube 1 has attained the desired depth, the apparatus shown in Figure 2 is assembled at the end of the uppermost tube introduced into the ground. An intermediate tube 14 is screwed at 15 to the tube 1. The intermediate tube has a flange 16 on which abuts a similar flange 17 which belongs to an extension 18 which is denoted hereinafter as "siphon tube." Between the flanges is interposed a hermetic joint (not shown) and the flanges are connected with each other by means of screw bolts (not shown).

The siphon tube 18 is provided laterally with an inclined conduit 19 which communicates with a reservoir or autoclave 20 which serves for introducing concrete. A periscope 21 and a lamp 22 are disposed laterally along the siphon tube 18. In its upper part the siphon tube 18 ends in another flange 23 on which abuts a flange 24 forming part of an intermediate tube 25 which is connected by means of a flange 26 to a chamber or bell 27 in which a drum 2 is located, which is actuated by an electric motor 3, and controlled by hand wheels 28 or the like. In the chamber 27 is provided a looking window 29, a lamp 30, a manometer 31, and a safety valve 32. On the drum 2 is wound a steel cable 13 from which is suspended a heavy ram 33 having a cylindrical shape and a tapered head as shown in the drawing.

An inlet 34 is provided for letting in compressed air into the interior of the closed space formed by the siphon tube 18, the parts connected to it, and the hollow shaft in the ground. The introduction of compressed air into this enclosed space exerts a pressure on it which prevents the infiltration of water which is likely to happen at such depth and would be injurious to the formation of the concrete posts and damage their solidity.

The operation of this device is as follows:

In order to construct a post with the described device, compressed air is injected through the inlet 34. The air has a pressure necessary to urge back any water which might have assembled at the bottom of the wall, so that the space limited by the tube 1 remains completely dry which can

be verified by means of the periscope 21. Now the filling in of concrete is started by allowing the compressed air to pass through a pipe 35 and a valve 33 into the upper part of the autoclave 20 in which the concrete has been placed. When the pressure prevailing in the autoclave 20 is in equilibrium with that of the siphon tube 18, the sluice 37 is opened and the concrete allowed to fall to the bottom of the well where the concrete expands and at least partly penetrates into the ground thereby imparting to the post to be built up a large resistance and stability by friction with, and adhesion to, the particles of the ground. The concrete which is deposited slowly in the well is pressed by repeated action of the ram 33. When the autoclave 20 is completely discharged, the sluice 37 and the valve 36 are again shut and the lid 38 is opened so that the autoclave can be filled once more. By means of the electric motor 3 the drum 2 is driven in a direction to lift the ram 33 to the necessary height for letting it drop on the concrete.

By successive repetition of these operations, high posts are formed in successive layers.

The materials used in the design of the various parts of the device may vary according to the quality of the concrete used for the construction of the posts without going beyond the scope of the present invention.

While I have illustrated and described the invention as embodied in a method and apparatus for constructing posts of concrete in the ground, I do not intend to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of my invention.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of method and apparatus for constructing posts, differing from the types described above.

Without further analysis, the foregoing will so fully reveal the gist of my invention that others can, by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic, or specific aspects of the invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What I claim as new and desire to secure by Letters Patent is:

1. An apparatus for constructing posts of concrete in a well in water-containing ground, comprising in combination, a hollow tube placed vertically in the ground; an extension connected to the upper end of said tube; a concrete delivering device connected to said extension; a motor-driven drum arranged at the upper end of the extension; a device suspended from said drum for pressing the concrete into said tube; a chamber arranged at the upper end of said extension and containing said drum; said chamber, said extension, said tube and said concrete-delivering device; and means for maintaining under air pressure said chamber, said extension and said tube, while the concrete is dryly pressed into said tube by said device suspended from said drum, the concrete passing through the lowest portion of said tube being allowed to fall to the bottom of the well so that the concrete expands and penetrates at least partly into the ground.

2. An apparatus for constructing posts of concrete in a well in water-containing ground, comprising in combination, a hollow metal tube placed vertically in the ground; a first intermediate tube connected to the upper end of said tube; a flange arranged on the upper end of said intermediate tube; an extension having a flange hermetically connected to said flange of said intermediate tube; a lateral branch opening into said extension; an autoclave adapted to receive a charge of concrete and arranged at the upper end of said lateral branch; a flange arranged at the upper end of said extension; a second intermediate tube having a lower flange hermetically jointed to said flange arranged at the upper end of said extension; a chamber arranged at the upper end of said second intermediate tube; a rotatable drum in said chamber; and a device suspended from said drum for pressing the concrete into said tube whereby a first charge of concrete is delivered by said autoclave and firmly and dryly pressed into said tube by said device suspended from said drum and allowed to fall to the bottom of the well and to expand and at least partly to penetrate into the ground, whereas further charges of concrete are successively delivered by said autoclave and united to the preceding charge, respectively, by pressing the same by said device suspended from said drum.

3. An apparatus for constructing posts of concrete in a well in water-containing ground, comprising in combination, a hollow metal tube placed vertically in the ground; a first intermediate tube connected to the upper end of said tube; a flange arranged on the upper end of said intermediate tube; an extension having a flange hermetically connected to said flange of said intermediate tube; a lateral branch opening into said extension; an autoclave adapted to receive a charge of concrete and arranged at the upper end of said lateral branch; a flange arranged at the upper end of said extension; a second intermediate tube having a lower flange hermetically jointed to said flange arranged at the upper end of said extension; a chamber arranged at the upper end of said second intermediate tube; a rotatable drum in said chamber; a device suspended from said drum for pressing the concrete into said tube; and a connection arranged in said extension for admitting compressed air in order to expel any water from said tube whereby a first charge of concrete is delivered by said autoclave and firmly and dryly pressed into said tube by said device suspended from said drum and allowed to fall to the bottom of the well and to expand and at least partly to penetrate into the ground, whereas further charges of concrete are successively delivered by said autoclave and united to the preceding charge, respectively, by pressing the same by said device suspended from said drum.

4. An apparatus for constructing posts of concrete in a well in water-containing ground, comprising in combination, a hollow metal tube placed vertically in the ground; a first intermediate tube connected to the upper end of said tube; a flange arranged on the upper end of said intermediate tube; an extension having a flange hermetically connected to said flange of said intermediate tube; a lateral branch opening into said extension; an autoclave adapted to receive a charge of concrete and arranged at the upper end of said lateral branch; a flange arranged at the upper end of said extension; a second intermediate tube having a lower flange hermetically jointed to said flange arranged at the upper end of said extension; a chamber arranged at the

upper end of said second intermediate tube; a rotatable drum in said chamber; and a heavy device arranged for reciprocation in said tube and extension and suspended from said drum for dryly pressing the concrete into said tube by consecutive layers, the first of the layers being allowed to fall to the bottom of the well so that the same expands and at least partly penetrates into the ground.

5. An apparatus for constructing posts of concrete in a well in water-containing ground, comprising in combination, a hollow metal tube placed vertically in the ground; a first intermediate tube connected to the upper end of said tube; a flange arranged on the upper end of said intermediate tube; an extension having a flange hermetically connected to said flange of said intermediate tube; a lateral branch opening into said extension; an autoclave adapted to receive a charge of concrete and arranged at the upper end of said lateral branch; a flange arranged at the upper end of said extension; a second intermediate tube having a lower flange hermetically jointed to said flange arranged at the upper end of said extension; a chamber arranged at the upper end of said second intermediate tube; a rotatable drum in said chamber; a cable wound on said drum; and a heavy device arranged for reciprocation in said tube and extension and suspended from said cable for dryly pressing the concrete into said tube by consecutive layers, the first of the layers being allowed to fall to the bottom of the well so that the same expands and at least partly penetrates into the ground, said heavy device having a cylindrical shape and a tapered head.

6. An apparatus for constructing posts of concrete in a well in water-containing ground, comprising in combination, a hollow metal tube placed vertically in the ground; a first intermediate tube connected to the upper end of said tube; a flange arranged on the upper end of said intermediate tube; an extension having a flange hermetically connected to said flange of said intermediate tube; a lateral branch opening into said extension; an autoclave adapted to receive a charge of concrete and arranged at the upper end of said lateral branch; a flange arranged at the upper end of said extension; a second intermediate tube having a lower flange hermetically jointed to said flange arranged at the upper end of said extension; a chamber arranged at the upper end of said second intermediate tube; a rotatable drum in said chamber; and a motor arranged outside said extension for driving said drum whereby a first charge of concrete is delivered by said autoclave and firmly and dryly pressed into said tube by said device suspended from said drum and allowed to fall to the bottom of the well and to expand and at least partly to penetrate into the ground, whereas further charges of concrete are successively delivered by said autoclave and united to the preceding charge, respectively, by pressing the same by said device suspended from said drum.

7. An apparatus for constructing posts of concrete in a well in water-containing ground, comprising in combination, a hollow metal tube

placed vertically in the ground; a first intermediate tube connected to the upper end of said tube; a flange arranged on the upper end of said intermediate tube; an extension having a flange hermetically connected to said flange of said intermediate tube; a lateral branch opening into said extension; an autoclave adapted to receive a charge of concrete and arranged at the upper end of said lateral branch; a flange arranged at the upper end of said extension; a second intermediate tube having a lower flange hermetically jointed to said flange arranged at the upper end of said extension; a chamber arranged at the upper end of said second intermediate tube; a rotatable drum in said chamber; hand-operated means for controlling said drum; and a motor arranged outside said extension for driving said drum whereby a first charge of concrete is delivered by said autoclave and firmly and dryly pressed into said tube by said device suspended from said drum and allowed to fall to the bottom of the well and to expand and at least partly to penetrate into the ground, whereas further charges of concrete are successively delivered by said autoclave and united to the preceding charge, respectively, by pressing the same by said device suspended from said drum.

8. An apparatus for constructing posts of concrete in a well in water-containing ground, comprising in combination, a hollow metal tube placed vertically in the ground; a first intermediate tube connected to the upper end of said tube; a flange arranged on the upper end of said intermediate tube; an extension having a flange hermetically connected to said flange of said intermediate tube; a lateral branch opening into said extension; an autoclave adapted to receive a charge of concrete and arranged at the upper end of said lateral branch; a flange arranged at the upper end of said extension; a second intermediate tube having a lower flange hermetically jointed to said flange arranged at the upper end of said extension; a chamber arranged at the upper end of said second intermediate tube; a rotatable drum in said chamber; hand-operated means for controlling said drum; a motor arranged outside said extension for driving said drum; and a heavy device arranged for reciprocation in said tube and extension and suspended from said drum for pressing the concrete into said tube.

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