

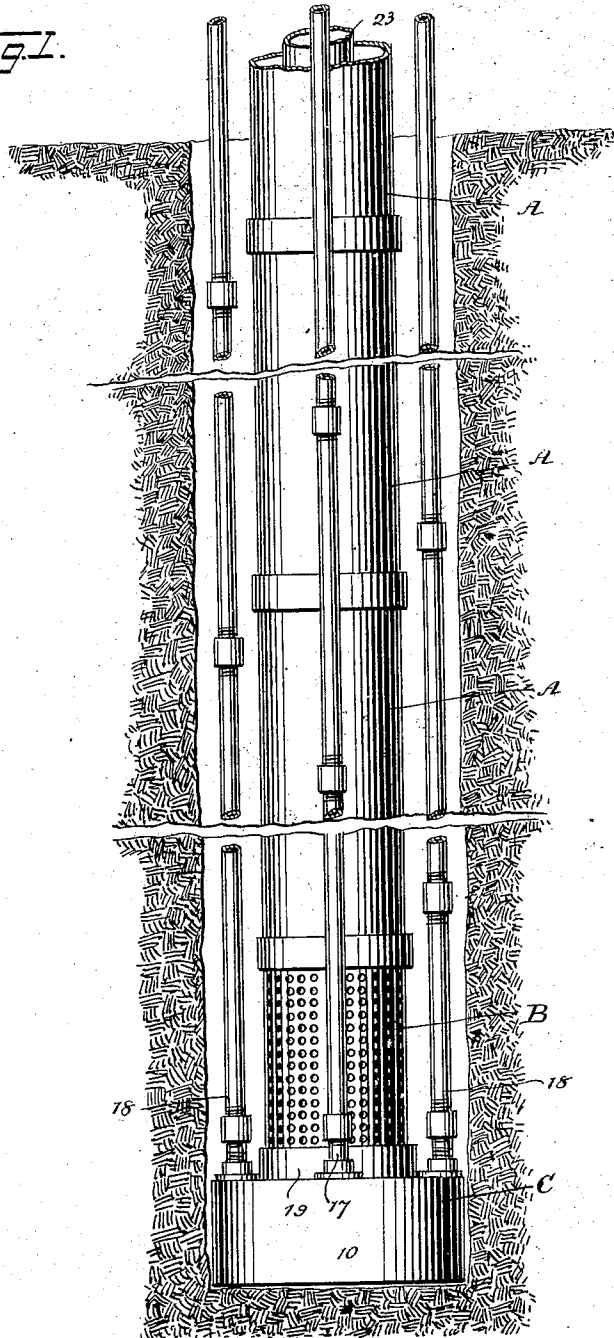
June 3, 1930.

E. D. EVERY
WELL CASING SHOE
Filed May 1, 1928

1,762,012

2 Sheets-Sheet 1

Fig. 1.



WITNESSES
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2 Sheets-Sheet 2

Fig. 2.

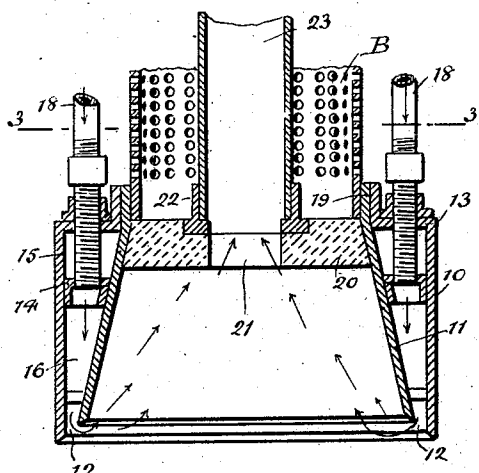


Fig. 3.

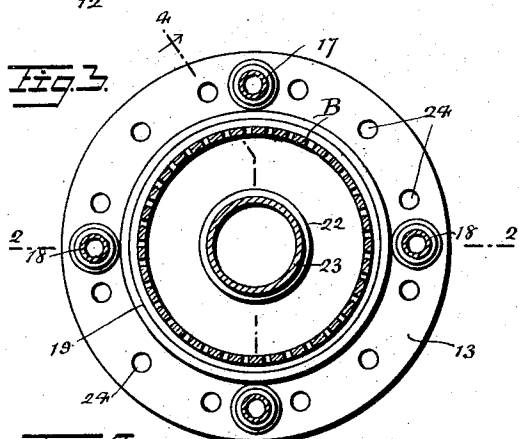
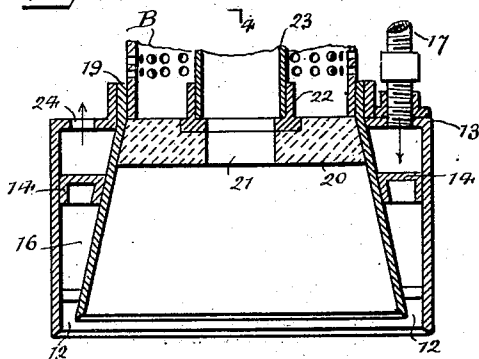


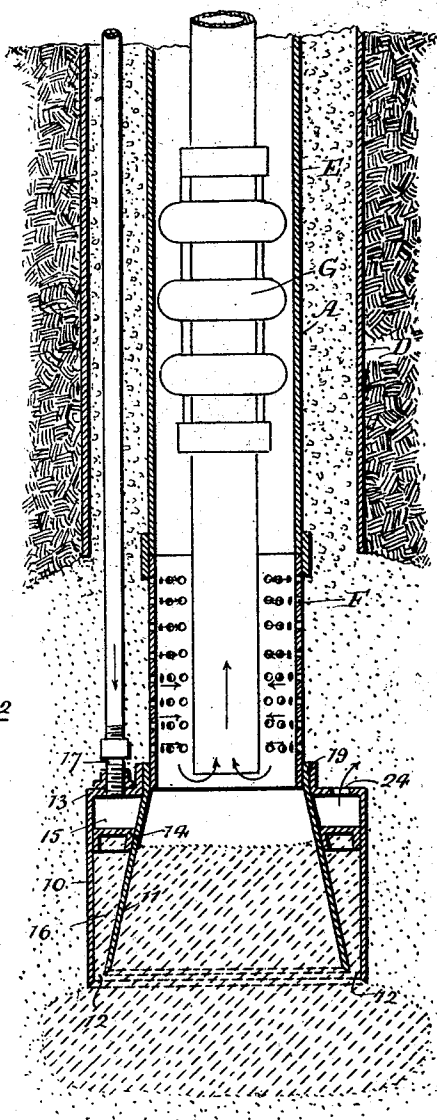
Fig. 4.



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Fig. 5.



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WELL-CASING SHOE

Application filed May 1, 1928. Serial No. 274,265.

This invention relates to apparatus for the sinking of wells, and has particular reference to an improved well casing shoe for use in connection with the sinking of outer or inner casings or screens.

Among its objects, the invention comprehends an improved shoe which primarily affords means, when connected with the lower end of a line of casing, for introducing water under pressure to the lower edge of the shoe for eroding the formation through which the casing is being sunk.

The invention further aims to provide an improved shoe by virtue of which a batter, such as a clay mixture, may be introduced around the casing above the shoe to function as a means for holding the sand from concaving in and exerting undue friction on the outer wall of the casing, to further serve as a lubricant through which the casing moves and to also act in the capacity of a means for excluding undesirable water from following down the casing to the permanent intake point of the casing.

As a still further object, the invention comprehends an improved shoe which, when used in connection with the sinking of a screen on an inner line of casing or in sinking a screen where only one line of casing is used, is provided with means at or adjacent the top of the shoe for seating and supporting a line of pipe of the proper size which is carried from the shoe to the surface to constitute a means for receiving and carrying off water pumped to the lower end of the shoe so as to prevent said water from flowing out through the openings in the screen and failing to return to the surface to carry off the excavated material with it; said inner line of pipe further functioning to provide a water tight conduit from the shoe to the surface which is sufficiently small so as to develop a high velocity of the flow of the water therethrough to carry the excavated material up for discharge at the surface.

The invention furthermore embodies a shoe having a frangible means for seating and supporting the lower end of the inner line of pipe or velocity tube so that said

means may, if desired, be subsequently broken out from the surface to allow an inner casing the outside diameter of which is slightly less than the inner diameter of the outer casing, to be passed through the shoe for sinking the well to a greater depth where the original outer casing has been sunk to the maximum depth possible.

The invention contemplates as a still further object an improved shoe which is subdivided into upper and lower chambers, the uppermost chamber of which is provided with outlets and the lower of which chambers is provided with an annular outlet and to which chambers a plurality of pipes are respectively led to afford means for clearing the chambers should they become clogged by the disconnection of one of the pipes so as to permit the forcing of compressed air or water under pressure into the chambers to wash out the clogging material.

Another important object of the invention resides in the provision of a shoe constructed in accordance with the invention which functions as a means for discharging compressed air to disturb and loosen sand around the screen of an inner casing which has been driven beyond the outer casing so that said sand may be removed by a developing pump and selected gravel may be introduced between the inner and outer casings to form a gravel screen around the casing screen in place of the sand removed. This is especially useful where the screen is set in place in a water bearing formation which may consist of fine sand or fine sand and gravel which tends to clog up the well casing screen and which without a shoe constructed in accordance with the invention, would be impossible to develop with the apparatus now in use.

As a still further object, the invention resides in an improved shoe of the character set forth which affords means, when the screen has been sunk to the desired location, for placing a cement plug in the bottom of the screen by forcing the cement mixture down through the lower chamber and out of the lower orifice where it will form a permanent plug for the bottom of

the screen while the upper chamber of the shoe may be used to place a cement mixture in the formation at any point where it may be desired or needed.

5 Other objects of the invention reside in the comparative simplicity of construction and mode of use of the shoe, the economy with which it may be produced and employed and the general efficiency derived
10 therefrom.

With the above recited and other objects in view, reference is had to the following description and accompanying drawings, in which there is exhibited one ex-
15 ample or embodiment of the invention, while the claims define the actual scope of the same.

In the drawings:

20 Figure 1 is a vertical sectional view through a well illustrating the well casing equipped with a shoe constructed in accordance with the invention.

Figure 2 is a vertical sectional view through a shoe equipped and functioning in
25 connection with a velocity tube.

Figure 3 is a horizontal sectional view taken approximately on the line indicated
30 at 3—3 in Figure 2.

Figure 4 is a vertical sectional view taken
30 approximately on the line 4—4 of Figure 3.

Figure 5 is a vertical sectional view illustrating the manner in which the well is developed after reaching the water bearing
35 formation.

Referring to the drawings by characters of reference, A designates the casing sections, B the screen carried by the lower casing section and to the lower end of which screen the shoe designated generally at C
40 is attached. The shoe C is formed or constructed in any suitable manner but as shown for the purpose of illustration, the same consists of an outer cylindrical wall
45 10 and an inner frusto-conical wall 11 disposed within the outer wall and having its lower larger end of slightly less diameter than and spaced radially inward from the lower end of the outer wall to provide a restricted substantially annular outlet 12. An
50 annular top wall or deck 13 extends between the upper edge of the outer wall 10 and the upper edge of the restricted upper end of the inner wall. An annular intermediate
55 partition wall 14 spaced from and below the top wall or deck 13 subdivides the shoe into upper and lower chambers 15 and 16. The upper wall or deck 13 has extending therethrough and communicating with the
60 upper chamber 15 two or more pipes 17. Two or more pipes 18, preferably arranged at diametrically opposite points with respect to the pipes 17, extend completely
65 through the upper wall or deck 13 and through the intermediate wall 14 and communicate with the lower chamber 16. The

shoe is provided at its upper end extending above the upper deck 13 with an attaching boss 19 which is riveted, welded or otherwise connected with the lower end of the screen B or the lower casing section A, as
70 the case may be, depending upon the formations through which the well is to be sunk.

In practice and in its general use, the shoe is provided adjacent its upper end with an internal seat 20, preferably constructed
75 of cement or other frangible material which may be broken out from the surface by the use of suitable tools. This seat is provided with a central aperture 21 and may be further provided with an upstanding collar or
80 flange 22 to receive the lower end of a pipe line 23.

In the sinking operation, water under pressure or water and compressed air are introduced or fed through the pipes 18 to
85 the lower chamber where it will be discharged through the orifice or annular outlet 12 at the lower edge of the shoe for disturbing, eroding or washing away the formation which will be carried with the water
90 and discharged over the top of the casing, or the loosened material may be removed with a sand bucket through the casing. Where the shoe is attached to a screen, the inner pipe line 23 or velocity tube is used for preventing the water which is pumped through
95 the shoe for the purpose of settling the same, from passing out through the openings in the screen and for further increasing the velocity of the return flow of the water and excavated material. As the shoe
100 and casing begin to sink, a batter, such as a heavy mixture of clay and water, is pumped or forced by means of compressed air through the pipe 17 leading to the upper chamber where it will be discharged
105 through circumferentially spaced openings 24 in the upper deck or wall to define a continuous ring of said batter or mixture around the casing for holding the sand back and preventing possible caving in which
110 causes friction on the casing sufficient to retard its sinking. This clay ring formed by the casing as the work progresses will also act as a seal to prevent any of the upper undesirable water which may be encountered,
115 from following down the outside of the casing to the final intake point. This batter or clay ring also acts as a lubricant to facilitate the gravitational sinking of the well. In addition to impinging an effective weight
120 on the upper wall or deck to assist in the sinking operation. The outlet openings 24 in the upper wall or deck 13 also serve as a means for releasing the compressed air or water or steam or a combination of same
125 around the casing to loosen it in event of binding by a caving in of the material. By employing two or more pipes attached to each chamber of the shoe, the following

ends are obtained, first, allowing for an extension of pipes at the surface by means of valves interposed in each line at the surface without shutting off the water, air or clay mixture from the shoe, thereby maintaining a pressure in the same at all times which will prevent sand or other material from backing up into the chambers and resulting in possible clogging. Second, by employing two or more pipes opening into each chamber, means is also afforded for clearing the chambers should they become clogged by disconnecting one of the pipes at the surface and introducing compressed air or water or both to permit of forcing the same into the shoe and washing out of the clogging material through the pipe which has been disconnected at the surface. The disconnection of the pipes 17 and 18 at the shoe may be readily accomplished by providing a left-hand thread at the point of connection of the pipes with the shoe and by employing right-hand threads on all the other connections between the pipe sections.

Assuming that an outer casing has been sunk by means of the shoe to the maximum depth possible and it is desired to sink the well to a greater depth. Where a shoe having the velocity tube seat 20 has been used, it is possible to remove the velocity tube and break out the frangible seat 20 by suitable tools introduced through the upper end of the casing and to remove the particles thereof. It is then obvious that an inner casing, the outside diameter of which is slightly less than the inner diameter of the outer casing, may be passed through the shoe. In instances where an outer casing D, as illustrated in Figure 5, has been sunk to a certain point and an inner casing E carrying a screen F equipped with a shoe constructed in accordance with the invention has been sunk to a point below the outer casing to expose the screen, it is found that the water bearing formation consists of fine sand or fine sand and gravel, the shoe may be used in the following manner to thoroughly develop the well or area about the screen. Compressed air is forced through the pipes 17 to the upper chamber 15 and suddenly released into the sand for loosening and disturbing the same around the screen in such a manner that it will be caused to flow through the orifices in the screen. A sand pump diagrammatically illustrated at G will be introduced for the purpose of carrying off the sand and discharging the same at the top while at the same time selected gravel will be fed downwardly between the inner and outer casings E and D to surround the screen and hold back the fine sand and gravel. Prior to the development of the well in this manner or otherwise, a cement mixture may be forced down through the pipes 18 to the lower chamber and thence outwardly

through the lower outlet or orifice 12 to form a permanent plug for the bottom of the screen. It is, of course, understood that the pipe 17 leading to the upper chamber may have cement forced therethrough into the upper chamber 15 and thence outwardly through the outlet openings 24 for placing a cement mixture in the formation at any point where the same may be needed.

What is claimed is:

1. A well casing shoe including a body defining an upper closed chamber adapted to receive a fluid and having a portion thereof extending radially beyond the casing periphery and provided with an upwardly directed restricted outlet for discharging the fluid therethrough.

2. A well casing shoe including a body defining an upper closed chamber having a portion thereof extending radially beyond the casing periphery and provided with an upwardly directed outlet, said body defining a lower chamber having a downwardly and inwardly directed substantially annular outlet.

3. A well casing shoe including a body defining an upper chamber having a portion thereof extending radially beyond the casing periphery and provided with an upwardly directed outlet, said body defining a lower chamber having a downwardly and inwardly directed substantially annular outlet disposed in approximately alignment with the major periphery of the shoe.

4. A well casing shoe including a body defining an upper closed chamber having a portion thereof extending radially beyond the casing periphery and provided with an upwardly directed restricted outlet and a conduit extending from the surface to and communicating with the upper chamber to supply fluid to the chamber for discharge upwardly through said restricted outlet.

5. A well casing shoe including a body defining an upper closed chamber having a portion thereof extending radially beyond the casing periphery and provided with an upwardly directed restricted outlet, said body defining a lower chamber having a downwardly and inwardly directed substantially annular outlet and a plurality of independent conduits extending from the upper surface respectively to each of said chambers to selectively supply fluids thereto for discharge therefrom through their respective outlets.

6. A well casing shoe including a closed annular hollow body, a horizontal partition subdividing the body into upper and lower chambers, the latter having a restricted inwardly directed annular outlet at its lower end, the former having circumferentially spaced restricted outlets in its upper wall and conduits respectively communicating with said chambers to independently sup-

ply the same with fluids of different characters for discharge therefrom through said outlets.

5 7. A well casing shoe including an annular hollow body subdivided vertically into upper and lower chambers, the latter having a restricted annular outlet at its lower end, the former having circumferentially spaced outlets in its upper wall and a plurality of conduits respectively communicating with each of said chambers.

10 8. A well casing shoe including a cylindrical outer wall, a frusto-conical inner wall disposed within the outer wall having its lower larger end of slightly less diameter than and spaced radially inward from and slightly above the lower end of the outer wall to provide a restricted substantially annular inwardly directed outlet, an annular top wall having circumferentially spaced upwardly directed restricted outlet openings, an annular intermediate partition wall below and spaced from the top wall, defining upper and lower chambers and independent conduits pipes leading to and communicating respectively with the chambers to selectively introduce fluids of different characters to said chambers for discharge therefrom through their respective outlets.

20 9. A well casing shoe including a cylindrical outer wall, a frusto-conical inner wall disposed within the outer wall having its lower larger end of slightly less diameter than and spaced radially inward from and above the lower end of the outer wall to provide a restricted substantially annular inwardly directed outlet, an annular top wall having circumferentially spaced upwardly directed restricted outlet openings, an annular intermediate partition wall below and spaced from the top wall, defining upper and lower chambers and conduit pipes respectively leading to and communicating with the upper chamber and leading through the upper chamber and communicating with the lower chamber to admit independent fluid supplies to the chambers for discharge therefrom through their respective outlets.

30 10. A well casing shoe including a cylindrical outer wall, a frusto-conical inner wall disposed within the outer wall having its lower larger end of slightly less diameter than and spaced radially inward from the lower end of the outer wall to provide a restricted substantially annular outlet, an annular top wall having circumferentially spaced upwardly directed outlet openings, an annular intermediate partition wall below and spaced from the top wall, defining upper and lower chambers, conduit pipes respectively leading to and communicating with the upper chamber and leading through the upper chamber and

communicating with the lower chamber and a frangible annular flange carried inside of the shoe adjacent its upper end constituting a seat for a velocity tube.

Signed at New York, in the county of New York and State of New York this 21st day of April, A. D. 1929.

ELMER D. EVERY.

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