May 7, 1963 G. A. THOMPSON 3,088,534

WELL POINT

Filed May 18, 1962 3 Sheets-Sheet 1

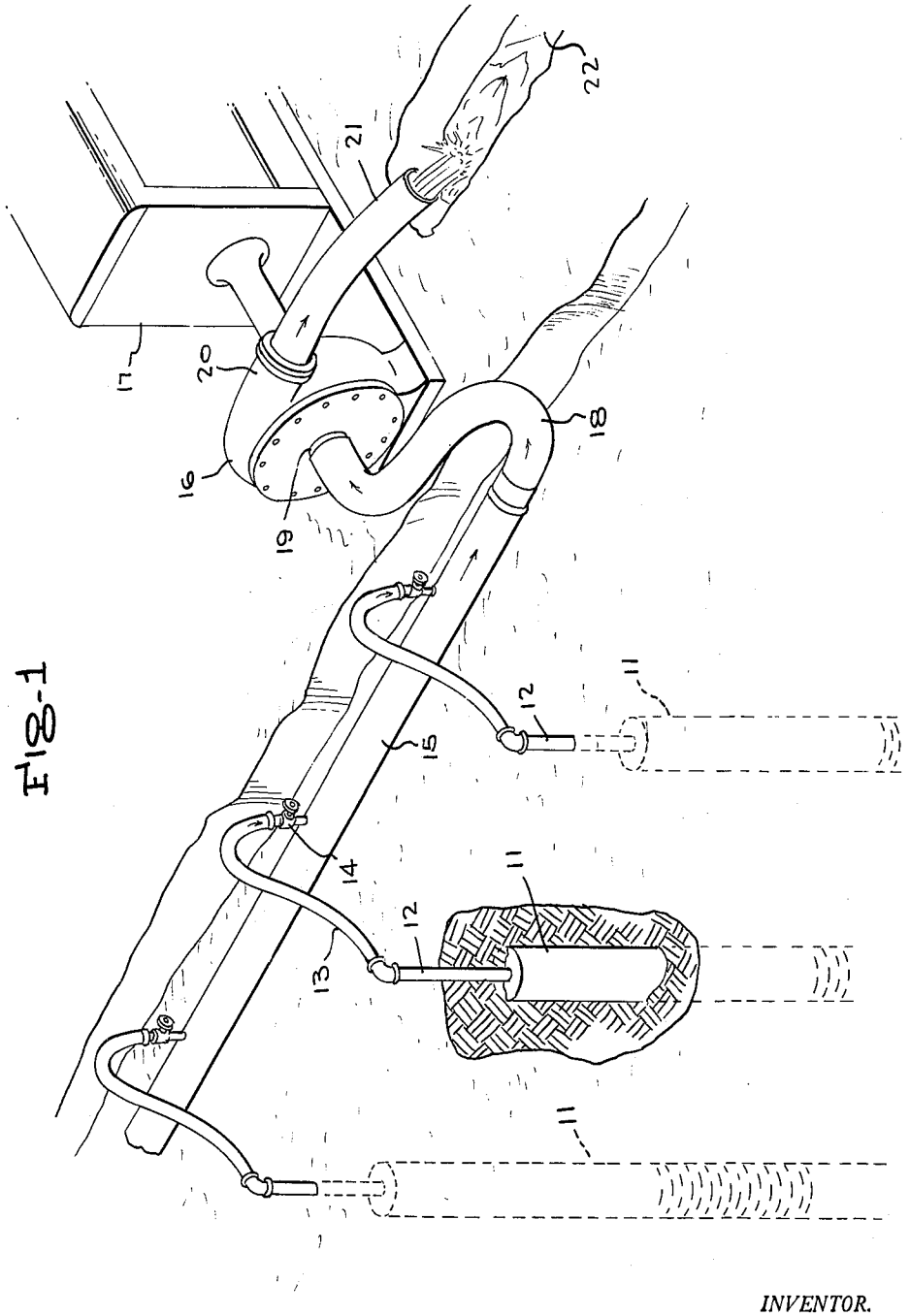


FIG-1

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Fig-2

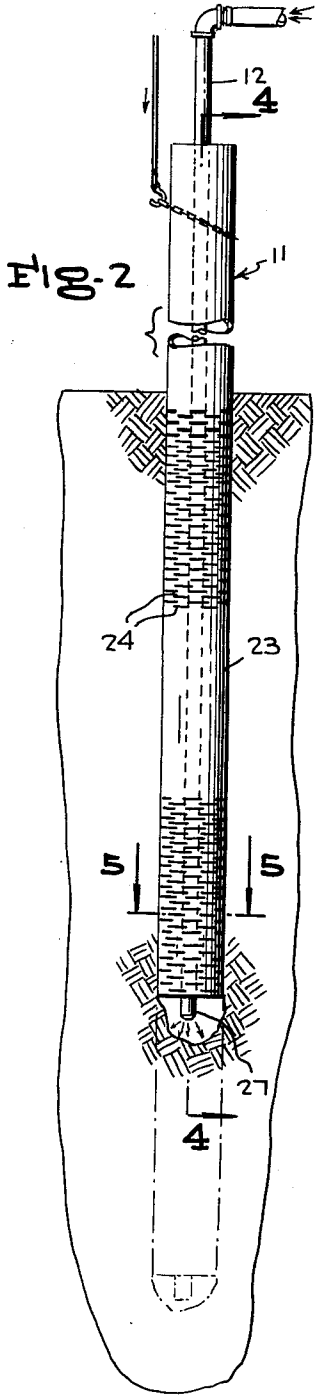


Fig-3

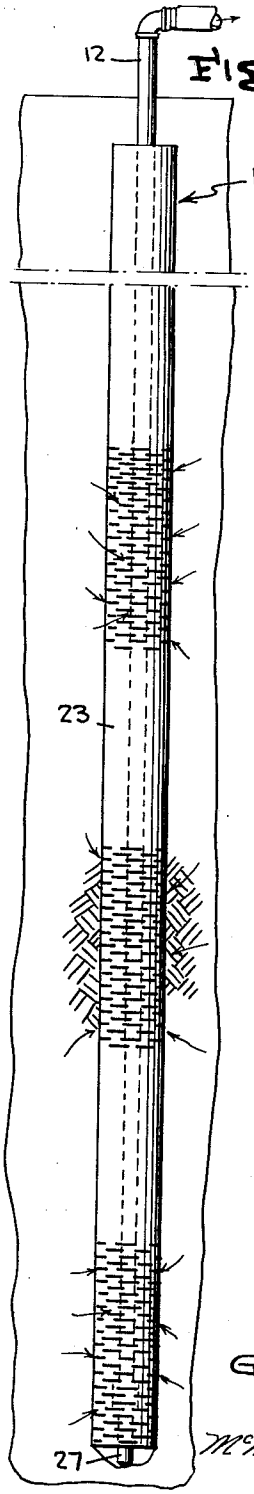
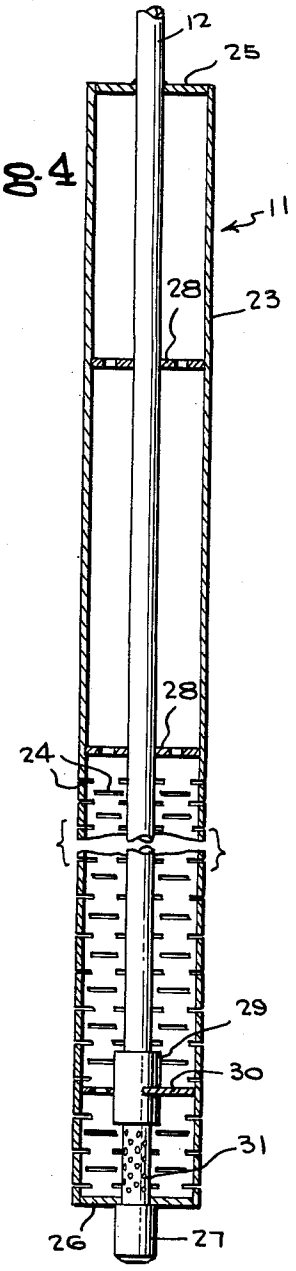


Fig-4



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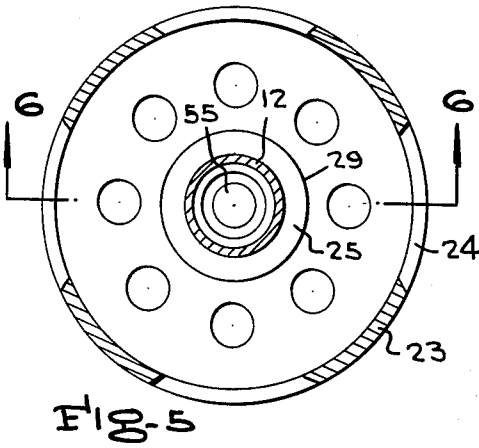


FIG-5

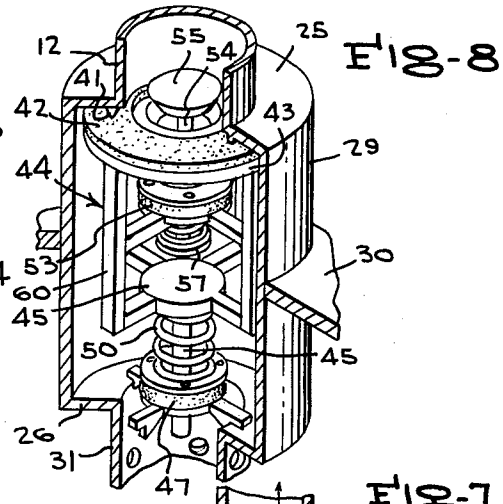


FIG-8

FIG-6

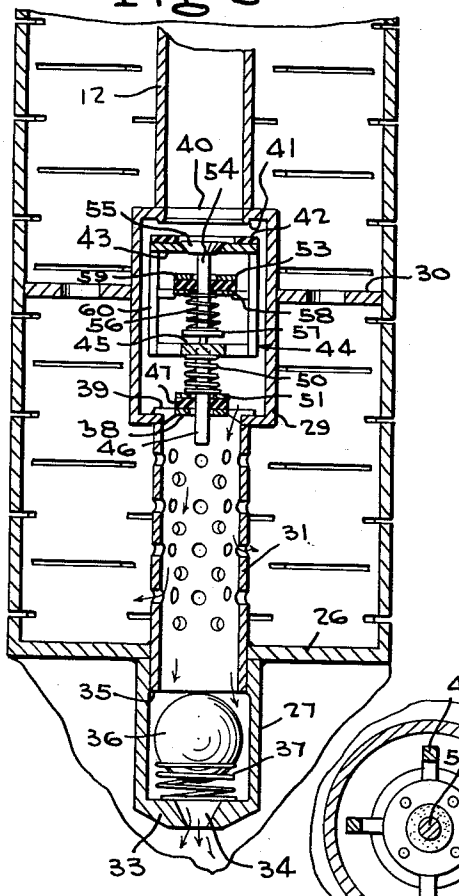
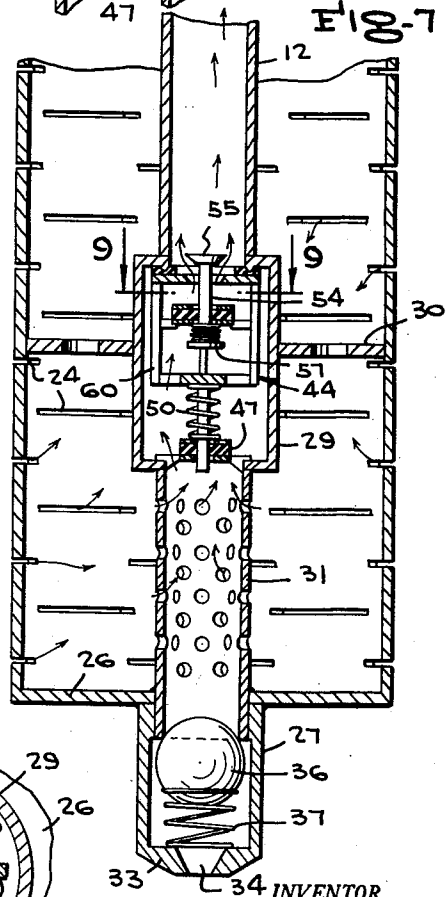


FIG-7



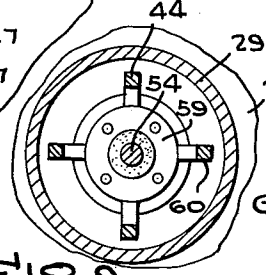


FIG-9

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3,088,534

WELL POINT

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7 Claims. (Cl. 175—314)

This invention relates to apparatus for draining land and more particularly to an improved well point for use in draining water from soil to allow excavation work.

A main object of the invention is to provide a novel and improved well point apparatus for use in draining water from soil, said apparatus being relatively simple in construction, being easy to install, and facilitating the rapid extraction of water from the subsurface formations into which it is driven.

A further object of the invention is to provide an improved well point for use in apparatus for draining water from soil, for example, to permit excavation work adjacent to the soil, the well point apparatus being relatively inexpensive in construction, being durable, involving relatively few moving parts, and being arranged so that it extracts water rapidly from subsurface formations while blocking the entry of sand or other loose foreign material into the well point.

A still further object of the invention is to provide an improved well point for use in removing water from subsurface formations so as to allow excavation work to be carried on adjacent thereto, the well point being provided with improved means for allowing a rapid down flow of water therethrough while the well point is being driven into its working position, but being arranged so that the well point seals itself automatically with respect to downward flow and reverses the permissible direction of flow of liquid therethrough responsive to suction exerted thereon.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIGURE 1 is a perspective view of a typical installation for draining water from subsoil adjacent to an excavation, employing a plurality of improved well point units according to the present invention.

FIGURE 2 is an enlarged vertical cross sectional view taken through the subsoil adjacent to one of the well point units of FIGURE 1 during the process of driving the well point unit towards its working position in the soil.

FIGURE 3 is a vertical cross sectional view, similar to FIGURE 2, but showing the well point unit driven to its working position.

FIGURE 4 is a fragmentary enlarged vertical cross sectional view, taken substantially on the line 4—4 of FIGURE 2.

FIGURE 5 is an enlarged horizontal cross sectional view taken substantially on the line 5—5 of FIGURE 2.

FIGURE 6 is a vertical cross sectional view taken substantially on the line 6—6 of FIGURE 5.

FIGURE 7 is a vertical cross sectional view, similar to FIGURE 6, but showing the positions of the parts when the well point unit is in working position and suction is applied to its inner tube.

FIGURE 8 is a perspective view, partly broken away, of the pressure-responsive reversing valve assembly employed in the well point unit of FIGURES 2 to 7, to a substantially enlarged scale.

FIGURE 9 is an enlarged horizontal cross sectional view taken substantially on the line 9—9 of FIGURE 7.

Referring to the drawings, and more particularly to FIGURE 1, a typical installation is illustrated, wherein a plurality of well point units 11 are driven vertically into the soil adjacent an area in which excavation work is

to be carried out, for the purpose of draining water from the area, so as to permit the excavation work to be freely carried on. Thus, each of the units 11 includes a central tube 12 which projects upwardly through the top end of the main body of the unit and which is connected by a flexible conduit 13 through a manually operated valve 14 to an elongated header conduit 15. Associated with the installation is a pump 16 of conventional construction which is driven by suitable prime mover means, for example, an internal combustion engine 17. Connected to the end of the header conduit 15 is a flexible conduit 18 which may be at times connected to a suitable source of water under pressure, namely, when the well point units 11 are being installed in the ground, in the manner presently to be described, and which may be subsequently connected to the intake conduit 19 of the pump 16 for applying suction to the well point units 11 after said well point units have been driven to their working positions.

As will be readily understood the pump 16 may be employed as the water injection means by connecting the conduit 18 to the outlet conduit 20 of the pump and by connecting the pump inlet 19 to a suitable water reservoir. With the arrangement illustrated in FIGURE 1, the pump 16 is connected in its working position relative to the well point units 11, namely, is connected in a manner to exert suction on the well point units so as to drain water from the ground, ultimately discharging the water through its outlet conduit 21 into a drainage ditch 22.

Each well point assembly 11 comprises the generally cylindrical elongated outer casing 23 which is formed over the major portion of its length, starting from its lower end, with staggered peripheral rows of horizontal slots 24, said slots being relatively narrow, and being sufficiently narrow to substantially prevent sand or other loose solid material from moving into the casing after the unit has been installed in working position and placed in operation. The casing 23 is provided with the top and bottom walls 25 and 26, the bottom wall 26 being provided with the depending central generally cylindrical tip member 27.

The elongated central tube 12 extends axially through the casing 23, extending through spaced apertured horizontal partition discs 28 provided in the casing, being rigidly secured to the central portions of the apertured partition discs 28, said discs being in turn rigidly secured to the cylindrical casing 23. The lower portion of the tube 12 is connected to the top end of a cylindrical housing 29 which is in turn rigidly secured in the lowermost apertured supporting disc 30. The bottom end of the cylindrical housing 29 is connected by an apertured tube 31 to the tip member 27.

As shown in FIGURE 6, the tip member 27 has a bottom wall 33 provided with the central, downwardly convergent frusto-conical discharge orifice 34. The apertured tube member 31 extends into the top portion of the tip member 27 and defines an annular seat 35 adapted to at times sealingly receive a hollow float ball 36 in the manner illustrated in FIGURE 7, said float ball 36 being biased upwardly by a coil spring 37 which bears between the bottom wall 33 and the hollow float member 36, as is clearly illustrated in FIGURES 6 and 7, urging the ball 36 upwardly against the annular seat 35 in the absence of downward liquid pressure exerted thereon.

The float ball 36 is quite buoyant, so that it will be urged upwardly into sealing engagement with the annular seat 35 by its buoyancy, as well as by the biasing effect of the coil spring 37.

Mounted centrally in the bottom portion of the housing member 29 is a centrally apertured annular plate member 38 which is rigidly supported over the top end of tube 31 by a plurality of radial supporting arms 39 rigidly con-

necting the plate 38 to the bottom wall of housing 29. The top wall of housing 29 is formed around its top aperture 40 with a depending annular sealing rib 41 which is at times sealingly engageable by an annular sealing gasket 42 carried on the top wall member 43 of a frame 44 which is resiliently supported for axial vertical movement in the housing 29. Thus, the frame 44 includes the circular central bottom plate member 45 to which is rigidly secured a depending axial shaft 46 which extends slidably through a resilient cushioning pad 47 secured on the plate 38, the shaft 46 extending through the central aperture of plate 38. A coil spring 50 surrounds the shaft 46, bearing between the circular bottom plate 45 of frame 44 and an annular washer 51 supported on the cushion member 47. The cushion member 47 is of substantial thickness and slidably supports the shaft 46 so as to guide said shaft for vertical movement, cooperating with the spring 50 to maintain the frame 44 in an axial position inside the housing 29. Horizontally secured in the intermediate portion of the frame 44 is a centrally apertured resilient guide member 53 of rubber or other suitable resilient material through which slidably extends the depending vertical stem 54 of a frusto conical valve 55 sealingly engageable in a correspondingly shaped central valve seat provided in the annular top plate 43. The stem 54 is biased downwardly by a coil spring 56 which surrounds the lower portion of the stem and bears between an enlarged flange 57 rigidly secured to the bottom end of the stem 54 and an annular washer 58 to which the bottom surface of the rubber guide member 53 is secured. A similar annular washer 59 is secured to the top surface of the rubber guide member 53. The washer 58 is rigidly connected to the vertical rods 60 of frame 44.

As will be readily apparent, when a downward pressure is exerted by forcing liquid downwardly in tube 12, the annular sealing element 42 will be forced downwardly below the sealing rib 41, allowing the liquid to flow freely downwardly through the housing 29 and into the apertured bottom tube member 31, and to flow downwardly therefrom past the float ball 36 into the tip member 27 and to be ejected from the bottom orifice 34. However, when suction is applied to the tube 12, with the well point in working position and with liquid in its bottom portion, the suction forces the liquid upwardly through the housing 29, causing the conical valve 55 to be elevated, as shown in FIGURE 7, allowing the liquid to move upwardly through the tube 12. Thus, FIGURE 6 illustrates the positions of the parts when liquid is pumped downwardly through the tube 12, forcing the frame 44 downwardly and allowing the liquid to flow to the bottom nozzle member 27. FIGURE 7 illustrates the reverse condition, namely, where suction is applied to the tube 12, causing the float ball 36 to be urged upwardly into sealing position against the annular seat 35, whereby water in the lower portion of the casing 23 will be urged upwardly through the apertures of the tube member 31 through the housing 29, exerting a sufficient upward force on the plate member 43 to cause member 42 to sealingly engage with the annular rib 41, whereby the upward force is applied to the valve member 55, causing it to be elevated and allowing the water to flow upwardly through the tube 12 under the applied suction.

In installing the well point units 11, the units are first supported in vertical positions and allowed to descend into engagement with the ground, with water under pressure applied to the tubes 12, the water emerging from the bottom orifice 34 of each tube, providing an emergent jet of considerable force which acts as a digging means to wash away the soil adjacent the bottom of the associated casing 23. Thus, as the soil is washed away, the casing is allowed to descend, and is forced downwardly into the excavation thus dug by the jet of water emerging from the bottom nozzle member 27 of the unit. Eventually, the casing will be driven into its intended working position, for example, the position thereof illustrated in FIGURE 3, after which the header 15 is connected to the intake conduit 19 of the pump 16, as above described, whereby suction may be applied to the tubes 12 of the various well points 11. It will be understood, that a plurality of well points 11 may be installed in the ground, the manner above described, adjacent to an area where excavation work is to be carried out, so as to maintain said area drained of water.

When the suction is applied to the tube 12 of the well point units 11, the water or other liquid from the adjacent formations around the respective casings 23 flows into the casings and enters the perforated tubes 31 at their bottom ends, being then drawn upwardly through the housing 29 by suction, in the manner above described, being drawn upwardly through the tubes 12 and finally discharged from the outlet conduit 21 of the pump 16.

As will be readily apparent, the float balls 36 are urged against the annular bottom rims 35 of the perforated tubes 31 not only by the biasing springs 37 but also by the buoyancy of the float balls.

While a specific embodiment of an improved well point assembly has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. In a well point, an elongated main vertical casing formed with spaced horizontal relatively narrow slots, said casing having top and bottom walls, an imperforate tube mounted axially in said casing and extending through said top wall, a perforated tube mounted axially in the lower portion of said casing, a depending nozzle secured centrally to said bottom wall and receiving the bottom end of said perforated tube, a float ball movably disposed in said nozzle and being sealingly engageable with the bottom rim of said perforated tube, a valve housing connecting the top end of said perforated tube and the bottom end of said imperforate tube, a vertical frame reciprocably mounted in said valve housing, means on the frame sealingly engageable with the top wall of the housing to seal the housing relative to said imperforate tube, means biasing said frame upwardly towards sealing position, the frame being movable downwardly responsive to liquid pressure in said imperforate tube, and upwardly movable normally closed valve means on said frame opening responsive to suction in said imperforate tube.

2. In a well point, an elongated main vertical casing formed with spaced horizontal relatively narrow slots, said casing having top and bottom walls, an imperforate tube mounted axially in said casing and extending through said top wall, a perforated tube mounted axially in the lower portion of said casing, a depending nozzle secured centrally to said bottom wall and receiving the bottom end of said perforated tube, a float ball movably disposed in said nozzle and being sealingly engageable with the bottom rim of said perforated tube, a valve housing connecting the top end of said perforated tube and the bottom end of said imperforate tube, a vertical frame reciprocably mounted in said valve housing, said frame having a top wall, means on said last-named top wall sealingly engageable with the top wall of the housing to seal the housing relative to said imperforate tube, means biasing said frame upwardly toward sealing position, the frame being movable downwardly responsive to liquid pressure in said imperforate tube, and upwardly movable normally closed valve means in said last-named top wall opening responsive to suction in said imperforate tube.

3. In a well point, an elongated main vertical casing formed with spaced horizontal relatively narrow slots, said casing having top and bottom walls, an imperforate tube mounted axially in said casing and extending through said top wall, a perforated tube mounted axially in the lower portion of said casing, a depending nozzle secured

centrally to said bottom wall and receiving the bottom end of said perforated tube, a float ball movably disposed in said nozzle and being sealingly engageable with the bottom rim of said perforated tube, a valve housing connecting the top end of said perforated tube and the bottom end of said imperforate tube, a vertical frame reciprocably mounted in said valve housing, said frame having a top wall, means on said last-named top wall sealingly engageable with the top wall of the housing to seal the housing relative to said imperforate tube, means biasing said frame upwardly towards sealing position, the frame being movable downwardly responsive to liquid pressure in said imperforate tube, vertically reciprocable valve means in said last-named top wall, and spring means biasing said valve means downwardly into sealing engagement with said last-named top wall, said valve means being movable upwardly toward open position responsive to suction in said imperforate tube.

4. In a well point, an elongated main vertical casing formed with spaced horizontal relatively narrow slots, said casing having top and bottom walls, an imperforate tube mounted axially in said casing and extending through said top wall, a perforated tube mounted axially in the lower portion of said casing, a depending nozzle secured centrally to said bottom wall and receiving the bottom end of said perforated tube, a float ball movably disposed in said nozzle and being sealingly engageable with the bottom rim of said perforated tube, a valve housing connecting the top end of said perforated tube and the bottom end of said imperforate tube, a vertical frame reciprocably mounted in said valve housing, said frame having atop wall, means on said last-named top wall sealingly engageable with the top wall of the housing to seal the housing relative to said imperforate tube, a centrally apertured guide member secured to the bottom wall of the housing, a depending guide rod in the frame extending slidably through the central aperture of said guide member, means biasing said frame upwardly towards sealing position, the frame being movable downwardly responsive to liquid pressure in said imperforate tube, vertically reciprocable valve means in said last-named top wall, and spring means biasing said valve means downwardly into sealing engagement with said last-named top wall, said valve means being movable upwardly toward open position responsive to suction in said imperforate tube.

5. In a well point, an elongated main vertical casing formed with spaced horizontal relatively narrow slots, said casing having top and bottom walls, an imperforate tube mounted axially in said casing and extending through said top wall, a perforated tube mounted axially in the lower portion of said casing, a depending nozzle secured centrally to said bottom wall and receiving the bottom end of said perforated tube, a float ball movably disposed in said nozzle and being sealingly engageable with the bottom rim of said perforated tube, a valve housing connecting the top end of said perforated tube and the bottom end of said imperforate tube, a vertical frame reciprocably mounted in said valve housing, said frame having a top wall, means on said last-named top wall sealingly engageable with the top wall of the housing to seal the housing relative to said imperforate tube, a centrally apertured guide member secured to the bottom wall of the housing, a depending guide rod on the frame extending slidably through the central aperture of said guide member, spring means surrounding said guide rod and bearing between the frame and said guide member and biasing said frame upwardly toward sealing position, the frame being movable downwardly responsive to liquid pressure in said imperforate tube, vertically reciprocable valve means in said last-named top wall, and spring means biasing said valve means downwardly into sealing engagement with said last-named top wall, said valve means being movable upwardly toward open position responsive to suction in said imperforate tube.

6. In a well point, an elongated main vertical casing formed with spaced horizontal relatively narrow slots, said casing having top and bottom walls, an imperforate tube mounted axially in said casing and extending through said top wall, a perforated tube mounted axially in the lower portion of said casing, a depending nozzle secured centrally to said bottom wall and receiving the bottom end of said perforated tube, a float ball movably disposed in said nozzle and being sealingly engageable with the bottom rim of said perforated tube, a valve housing connecting the top end of said perforated tube and the bottom end of said imperforate tube, a vertical frame reciprocably mounted in said valve housing, said frame having a top wall, means on said last-named top wall sealingly engageable with the top wall of the housing to seal the housing relative to said imperforate tube, a centrally apertured guide member secured to the bottom wall of the housing, a depending guide rod on the frame extending slidably through the central aperture of the guide member, spring means surrounding said guide rod and bearing between the frame and said guide member and biasing said frame upwardly toward sealing position, the frame being movable downwardly responsive to liquid pressure in said imperforate tube, vertically reciprocable valve means in said last-named top wall, a centrally apertured horizontal guide plate in the intermediate portion of said frame, a depending stem on said valve means extending slidably through the central aperture of said guide plate, abutment means on the bottom end of said stem, and a coiled spring on the stem bearing between said abutment means and said guide plate and biasing said valve means downwardly into sealing engagement with said last-named top wall, said valve means being movable upwardly toward open position responsive to suction in said imperforate tube.

7. In a well point, an elongated perforated vertical main casing, said casing having top and bottom walls, an imperforate tube mounted axially in said casing and extending through said top wall, a perforated tube mounted axially in the lower portion of said casing, a depending nozzle secured centrally to said bottom wall and communicating with said perforated tube, annular valve seat means between the perforated tube and said nozzle, a float ball movably disposed in said nozzle and being sealingly engageable with said valve seat means, a valve housing connecting the top end of said perforated tube and the bottom end of said imperforate tube, a vertical frame reciprocably mounted in said valve housing, means on the frame sealingly engageable with the top wall of the housing to seal the housing relative to said imperforate tube, means biasing said frame upwardly toward sealing position, the frame being movable downwardly responsive to liquid pressure in said imperforate tube, and upwardly movable normally closed valve means on said frame opening responsive to suction in said imperforate tube.

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