APPARATUS AND METHOD FOR DEVELOPING AND GRAVEL TREATING WELLS

Filed Oct. 29, 1932

3 Sheets-Sheet 1
APPARATUS AND METHOD FOR DEVELOPING AND GRAVEL TREATING WELLS

Filed Oct. 29, 1932

Inventor
Jasper Q. Peebles

By J.W. Evans
Attorney
UNITED STATES PATENT OFFICE

1,980,632

APPARATUS AND METHOD FOR DEVELOPING AND GRAVEL TREATING WELLS

Jasper Q. Peeples, Richmond, Va.

Application October 29, 1932, Serial No. 640,317

27 Claims. (Cl. 166—21)

My invention relates to improvements in an apparatus and method for developing footing and gravel treating wells.

One object of my invention is to provide a method and apparatus which can be attached to and used with any size or any make of strainer or drilled pipe or slotted pipe forming the strainer, under any method of installation in any size well which will permit the wash water to pass down through the well outwards around the strainer to wash the water, fine sand, clays and etc., back into the strainer and out at the surface and at the same time supplying gravel to the space around the strainer forming a footing or gravel bed which will prevent any sand from passing to the strainer after the proper amount of material or bed has been placed in position.

Another object of my invention is to provide a method and apparatus whereby a small well can be gravel treated the same as a large well.

Another object of my invention is to provide a method and apparatus of this character in which a greater amount of gravel or footing can be placed down through the well to the outside of the strainer entirely surrounding the strainer regardless of the length thereof and at the same time providing means whereby additional gravel or footing can be placed around the strainer at any time when conditions necessitate the same.

Another object of my invention is to provide a method and apparatus or attachment of this character whereby the strainer or strainers are installed in the well by any of the usual methods and the developing, gravel treating and forming the footing or gravel bed or wall, is accomplished without disturbing the strainer or strainers once they are set.

Another object of my invention is to provide an apparatus or attachment of this character which does not in any way interfere with the operation of the well and can be applied to any form or design of strainer, a well apparatus in which provision is made for feeding the water under pressure for washing the cavity around the strainer at the same time and at the same point that the gravel or crushed stone is fed, so that as fast as the sand is washed away, the gravel or crushed stone is placed in its place.

Another object of my invention is to provide a method and apparatus whereby sand and clay can be washed from around a very long strainer and a footing or wall of gravel formed around the entire length of the strainer.

Another object of my invention is to provide a method and apparatus of this character in which the gravel bed or footing can be placed in several strata of sand through which the well passes whereby the well is drawing from several supplies of water and in which the operation of one does not in any way affect the operation of the other.

A further object of my invention is to provide a method and apparatus whereby old wells, small and large, now in use can be developed and gravel treated merely by pulling the old strainer or strainers out and installing a new large slotted strainer or strainers with apparatus attached, washing and developing the same as a new well.

A still further object of my invention is to provide a simple, cheap and effective method and apparatus of this character having certain details of structure and combination of parts hereinafter more fully described.

In the accompanying drawings:—
Figure 1 is a side elevation of the well, showing the footing in position before the gravel and water wash line is removed.
Figure 2 is a vertical sectional view of the upper end of the well casing showing the gravel magazine or feeding tank and the water supply connections for washing the sand from around the strainer and replacing it with gravel.
Figure 3 is a vertical sectional view showing the apparatus in operation, removing the sand and replacing it with gravel or crushed stone.
Figure 4 is an enlarged sectional view of the insert attachment for feeding the washing water and gravel to the outside of the strainer.
Figure 5 is a transverse sectional view taken on the line 6—5 of Figure 4.
Figure 6 is a vertical sectional view of a modified form, showing the gravel and water supply pipe formed integral with the insert and controlled by a check valve.
Figure 7 is a further modified form of the insert, and gravel and water supply pipe.
Figure 8 is a detailed perspective view illustrating the gravel and water outlet valve.
Figure 9 is a vertical sectional view showing the gravel and water valve with a spring for normally holding the valve in an inwardly closed position.
Figure 10 is a diagrammatical view showing a well, passing through two strata of sand with the invention applied before the pocket is formed.
Figure 11 is a vertical sectional view of a long strainer formed of a series of sections showing my invention applied between the several sections for forming a bed of gravel and thoroughly washing along the entire length of the strainer.
Figure 12 is a transverse sectional view showing...
how the gravel and water supply pipe is lowered or raised from one level to another.

Figure 13 is a transverse sectional view showing a straight water and gravel supply pipe having two outlets.

Figure 14 is a vertical sectional view of the valve showing means for holding while the apparatus is being lowered into the well.

Applicant is aware that it is not new to place a footing of gravel around the strainer of a well and attention is called to United States Patent No. 1,291,915, dated January 21, 1919. Such means and apparatus have not been found practical as the amount of footing placed around the strainer is limited and is not under all conditions capable of placing enough gravel around the strainer to prevent the sand from working its way through the gravel into the strainer.

Applicant's method and apparatus is different from the prior art in that it feeds the water under pressure for washing the cavity around the strainer down through the same well and to the outside of the strainer at a point above the strainer and simultaneously feeds the gravel to this cavity also under pressure as the sand is washed out or in other words, fills the cavity as fast as it is made. The gravel being fed above the strainer, will by gravity and the flow of washing water, fill the cavity no matter how large it may become. As long as the pressure of the water being fed with the gravel together with the movement of the natural water flowing into the well and being pumped out is sufficient to wash up the sand, the gravel will continue to fill the cavity and this operation continues until a cavity sufficiently large is filled with gravel to prevent any sand being washed or carried to the strainer.

Applicant, by his invention, has also provided a method and apparatus whereby additional washing and the placing of additional gravel in the well can be accomplished no matter how long the well has been in operation. This adding of gravel to form the footing or filter bed does not require the pulling of the strainer and the gravel is driven or otherwise forced downwardly through the top soils, clays and rock, etc. to the top of the water bearing sand 3. The strainer 4, with apparatus inserted near the top of the strainer, is then put into the well being exposed to the sand strata for its entire length by any of the known methods. One is to drive or force the casing 1 down through the sand strata lower than the strainer which is equipped with a bail plug bottom and a lead seal 5 on the top, then jack the casing 1 back to expose and pull the strainer and stratum, the lead seal on top of the strainer is then swedged out making a tight joint with the casing. Some of the other methods are the balling in type, the telescoping type and where the strainer or strainers are spaced in a line of pipe, this operation for installing the strainer is the usual operation employed and is only described in order that applicant may more fully set forth his invention.

My invention consists of a short section of pipe 6 having its lower end screw-threaded internally as indicated at 7 and adapted to be screwed upon the upper externally threaded end 8 of the strainer. While I have shown a threaded connection between the strainer and the short section of pipe 6 any desired connection may be employed. The ordinary strainer now used is always provided with a suitable connection to allow of the attachment of pipe or the lead seal 5 thereto. The upper end of the pipe section 6 is internally sized and threaded as described and has been closed by means of springs 14, whereby during the ordinary operation of the well these valves are closed so that sand or water cannot pass through the openings 10 and 11 to the short pipe section 7. Connected to the pipe section 6 is an inverted Y shaped coupling 15 having the arms 16 and 17 permanently or temporarily connected to the pipe section around the openings 10 and 11 whereby water and gravel is forced out through the short pipe section 6 as will be hereinafter more fully described.

The upper end of the inverted Y shaped coupling 15 is provided with an internal left hand screw-threaded socket 18 into which is screwed a pipe 19 which leads to the top of the well casing as shown in Figures 1 and 2 of the drawings. As shown in Figure 7, this Y shaped coupling 5 is arranged at one side of the well casing 1 and does not interfere with the placing of the usual air lift or test pump pipe in the well. Connected to the upper end of the pipe 19 by the coupling 20 is a Y shaped pipe section 21, the branch 22 thereof is connected to a water inlet supply pipe 23 by means of which water is forced down through the pipe 19. The pipe 23 is provided with a gage 24 whereby the water pressure in the pipe 23 may be readily determined. Should the gravel passing down through the pipe 19 become jammed, it would cause a back pressure in the pipe 22 and be indicated by the gage.

The strainer 20 of the Y section 21 has a union 26 carried by its upper end, in which is arranged the gate valve 27 which has connected thereto below the valve the glass sight feed 28 and connected to the union 26 is the tank 29 in which the gravel is placed, and from which extends up through the section 26. The gravel is fed from the tank to the pipe connection 26 and in order to prevent the gravel from jamming in the lower end of the tank, a small pipe 30 which extends up through the tank and out through one side is connected to a water supply for causing the feed of gravel from the tank. A small water supply pipe 31 is connected to the upper end of the tank 29 for feeding water to the gravel tank and thus further aiding in the downward movement of the gravel in the tank.

In the form shown in Figures 4 and 5, the short pipe section 6 has its four opposite walls thereof thickened as indicated at 32 and provided with dovetailed grooves 33 and opposite these dovetailed grooves are arranged openings 34. In this form the inverted Y shaped gravel feed connection 35 has enlarged tapering portion 36 adapted to enter the dovetailed grooves 33 and whereby the same is held in the grooves so that the gravel can pass therethrough and out through the openings 34. In Figure 3 I have shown a small pipe 35' connected to the inverted Y connection 15 which extends downwardly, as shown in Figure 1 of the drawings, adjacent the
lower end of the strainer 4 whereby water is supplied to the lower end of the strainer to agitate any sand that may have a tendency to settle therein. This small pipe 35' has a strainer 34' at the top to protect the gravel from entering. The female valves 12 are made in the form clearly shown in Figure 8 of the drawings andpivotally supported by the pin 36'. These valves are provided with fine slots 37 to allow the water from the sand and gravel supply pipe to pass there-through and wash the sand away from the outer face of the valve so that the pressure of the water and gravel against the valve will open it in the position shown in Figure 3 of the drawings.

In order to determine when the bed of gravel is completed and that the gravel is backing in the wash pipe 15, I provide a feeling rod 38 which is preferably made of a small pipe and extends down through the Y shaped connection 21 as clearly shown in Figure 2 of the drawings. This pipe has a packing 39 to form a tight connection to prevent leakage of water under pressure in the Y shaped connection. This pipe as shown in Figure 3 extends down below the pipe 19 and terminates a distance above the water supply pipe 35. This feeling rod is provided with any desired number of oblong shaped members 37 to keep in position thereof so as to prevent the gravel from jamming and causing a continuous flow thereof. Said feeling rod 38 can be connected to a water supply whereby an additional supply of water is supplied to the sand member. This pipe can also be used for blowing out the pipe 19 after the desired amount of gravel has been supplied to form the proper footing or well and the gravel cut off from the tank, the feeling rod will indicate whether or not the gravel is backed up in the pipe 15. If it is found to be backing up in the pipe 15 which would indicate valves 12 have not closed the washing water is again started working gravel out of the Y shaped pipe 15 through the valves so as they will close. The feeling rod 43 is then raised up a few feet and compressed air is forced through the same which will blow out any water or sand which may remain in the pipe acting as an air lift which will also pull valves shut.

Figure 14 shows a latch for holding valve 41 closed. In this view the valve is pivoted by the pivot 42 and the wall of the unit is provided with a vertical slot 43 in which is arranged the latch proper 44 having its outer end and turned at 45 upwardly into the notch 46 in the valve. The inner end of the latch is provided with a head 47 which extends beyond the inner end of the units so that when the inverted Y shaped member is lowered into the wedge shaped grooves 33 it engages the head 46 of the latch and forces it downwardly in the slot 43 moving the turned end 45 out of the notch 46 so that the valve is free to open outwardly.

In the form shown in Figure 6 of the drawings, the unit is placed on the strainer before it is lowered into the well and remains in the well at all times.

In operation, the well casing is driven or forced down in any desired manner through the sub-soils and clay or rock strata to the top of the sand stratum 40. The strainer 4 carrying the pipe section 6 is then inserted and exposed to the sand stratum 40 by any of the known methods for installing strainers. If the lead seal type is used, as shown in Figure 3, the lead seal 5 is then swaged to the casing making a tight seal between the top of the strainer and the inside of the casing but above the bottom end of the casing. The pipe 19 with Y shaped gravel and water supply member 15 attached, is then lowered into the well until the position 36 of the Y member 15 slips into and rests in the dovetailed grooves 33. The Y connection 21 as shown in Figure 2 of the drawings is then connected to the top of feeder pipe 19. The glass sight feed 26 and gravel control valve 27 and gravel supply 22 is then connected to one side of the Y connection 21. The pressure gauge 24 and wash water supply 23 (either from force pumps or pressure system) is then connected to the other opening of Y connection 21. The sounding pipe 36 is then lowered inside of pipe 19 to just above the top of water pipe 32' which screws into the bottom of supply member 15. The packing box 39 is then put on to make a tight joint. The usual developing pump, air lift, turbine pump or reciprocating type plunger pump, petrol lift, (and for small diameter wells it must be air lift) is then installed down along beside feeder pipe 19, inside the well casing as indicated at 40 as shown in Figure 1 to the usual depth for testing purposes. The gravel tank 29 is then filled with a gravel gravel with valve 37 closed. The air lift or test pump is then started which will pump water from the well. The wash water is then started down feeder pipe 19. The pressure on pressure gauge 24 will build up until outlet valves 12 have opened. When the pressure drops on gauge 24 it will indicate valves 12 have opened. Valve 27 at bottom of gravel magazine 29 is then opened to permit a small stream of gravel to start down pipe 19 with the water. The amount of gravel is determined through sight feed 26. The sounding pipe or rod 38 is then started to moving up and down slowly which will indicate any stoppage of the gravel in pipe 19. The wash water and gravel is forced down pipe 19 through Y fitting 15 and to the outside of the strainer 4 through valves 12. The clay and fine sand is washed into the strainer and kept from settling and washed up by water pipe 35 and is pumped or blown out on the surface by the test pump or air lift. This process is kept up until all the fine sand around the strainer has been replaced with gravel and the strata has taken all the gravel possible. The test pump also indicates that no more sand is being pumped out. The test pump is then removed, sounding pipe 38 is then raised a few feet. Air is then connected to sounding pipe 38 and used as air lift to see that valves 12 are closed. Gravel tank 29 and other fittings are then removed. Sounding pipe 38 is then removed. Wash water and gravel pipe 19 with Y shaped member 15 is then raised out of dovetailed groove 33 and removed leaving the well thoroughly developed and clear.

In the event it is necessary to use a long strainer as shown in Figure 11 of the drawings, I have shown three strainers 41', 42' and 43' having the same sections 44, 45 and 46 and so placed as shown in the Figure 11 of the drawings would be the same as described in respect to the form shown in Figure 3. After the operation described in respect to Figure 3 is completed, the inverted Y shaped connection 15 is moved upwardly by lifting the pipe 19 upwardly...
to bring the outer ends thereof out of the \textit{V} shaped slots 33. The pipe 19 is then turned to bring the outer ends of the member 15 between the \textit{V} shaped slots 33 and the pipe 19 is lowered into the strainer 41 below. It is understood that the water pressure is maintained in the pipe 19 which continues to wash the sand out of the strainer 41. The discharge of the water from the pipe 35 also washes the sand out of the strainer 41 and the \textit{V} shaped section 15 can be locked in the wedge shaped slots 33 in the section 45. The washing operation is then repeated, the same as for the upper strainer and the same operation can be repeated for each strainer whereby a very long or deep bed of sand or gravel can be developed.

It will also be understood that this apparatus is designed to form a footing or bed of gravel in any number of strata of sand and in Figure 10 I have shown two strainers 47 and 48 arranged in two strata of sand and and one considerable distance above the other and the upper strainer is connected by a long pipe 51. The operation of forming these footings around the two strainers 47 and 48 would be the same as that employed in forming the beds or footings around the different sections of strainers shown in Figure 11 of the drawings. This apparatus is also designed to form a bed or footing of gravel around the strainer where the natural sand stratum contains gravel. Where the sand stratum contains gravel only water is supplied to the pipe 19 and this water washes the sand and gravel inwardly around the strainer, the sand passing into the strainer is pumped out the same as where the gravel is supplied and a foot or bed is formed around the strainer.

Having thus fully described my invention, what

I claim is:

1. An attachment for wells comprising a short pipe section adapted to be secured to the upper end of a strainer, a small pipe therein having its lower end communicating with an opening in the pipe section and its upper end adapted to be connected to a combined water and gravel supply pipe and means for closing the lower end of the pipe when water and gravel are not being fed through it.

2. An attachment for wells comprising a short pipe section having a small pipe arranged at one side and communicating with an opening in the pipe section at its lower end, means for connecting a combined gravel and water supply pipe to the upper end of the small pipe, whereby water and gravel may be forced outwardly and downwardly around the strainer and a valve closing the opening when the supply of gravel and water is cut off from said small pipe.

3. A combination with a strainer, of a short pipe section secured to the upper end of the strainer, a small pipe arranged in the short pipe section and having its lower end communicating with an opening in the short pipe section, a valve closing said opening and means for connecting a combined gravel and water supply pipe to the upper end of the small pipe whereby gravel and water is forced downwardly around the upper end of the strainer as the sand is washed out and whereby the short pipe section can be taken out at any time it is found necessary.

4. A well footing or gravel treating apparatus of the character described, comprising a well casing a strainer a short pipe section secured to the upper end of the strainer and having a lead seal connection with the lower end of the well casing, means arranged within the short pipe section whereby gravel and water may be allowed to pass outwardly around the upper end of the strainer, a pipe connected thereto and extending upwardly to the upper end of the casing whereby gravel and water supply for the upper end of the said pipe and a gravel supply for the upper end of said pipe means for withdrawing the sand and water from the strainer whereby gravel and water are forced outwardly around the upper end of the strainer as the sand is washed inwardly through the strainer and withdrawn from the well.

5. A well footing or gravel treating apparatus comprising a well casing an attachment for the upper end of a strainer whereby gravel and water are forced downwardly through the single well casing and outwardly around the upper end of the strainer, a pipe lead therefrom to the upper end of the well casing, a \textit{V} shaped connection carried by the upper end of the pipe, means for supporting the upper end of the \textit{V} shaped connection and means for supplying gravel through the other branch of the \textit{V} shaped connection.

6. A well footing or gravel treating apparatus of the character described comprising a well casing an attachment for the upper end of the strainer, a pipe lead therefrom to the upper end of the well casing, a \textit{Y} shaped connection and means arranged within the short pipe section whereby gravel and water may be allowed to pass outwardly around the upper end of the strainer, a pipe connected thereto and extending upwardly to the upper end of the casing, a water supply for the upper end of the said pipe and gravel supply for the upper end of said pipe means for withdrawing the sand and water from the strainer whereby gravel and water are forced outwardly around the upper end of the strainer as the sand is washed inwardly through the strainer and withdrawn from the well.

7. A well footing or gravel treating apparatus of the character described, comprising a short pipe section adapted to be secured to the upper end of a strainer and having a pipe connection therein and adapted to communicate with the outside thereof, a flap valve closing said communication, a pipe removably connected to the pipe connection and extending to the upper end of the well casing and a separate water and gravel supply means for said pipe whereby gravel and water are forced outwardly around the upper end of the strainer as the sand is washed away completely filling the cavity and whereby gravel can be at any time added to the footing when the necessity arises.

8. A well footing or gravel treating apparatus of the character described, comprising a short pipe section secured to the upper end of the strainer, a pipe leading downwardly through the well casing and having a \textit{Y} shaped coupling connected to the water supply extending upwardly through the casing, a gravel tank communicating with said pipe and means for supplying water into the tank at the point of discharge from whereby gravel is continuously and even feed of the gravel is obtained.

9. A well footing or gravel treating apparatus of the character described comprising a pipe extending from the upper end of the well casing and adapted to be found necessary, a combined gravel and water supply pipe connected to said pipe, a gauge carried by the water supply pipe for indicating any back pressure therein, a tank connected to the upper end of the pipe leading into...
the well casing, a sight gauge below the tank for determining the feed of gravel to the pipe, a water supply pipe extending into the tank and discharging at the point of discharge of the tank and water supply pipe for the upper end of the tank, whereby gravel and water are supplied and forced outwardly above the strainer.

10. A well footing or gravel treating apparatus of the character described, comprising a well casing, a strainer, a short pipe section secured to the upper end of the strainer, means carried by said short pipe section for forcing water and gravel outwardly around the upper end of the strainer, a lead seal carried by the upper end of the short pipe section and a removable supply pipe extending downwardly through the casing and removably connected to the means for supplying water and gravel outwardly around the strainer.

11. A well footing or gravel treating apparatus of the character described comprising a strainer, a short pipe section secured to the upper end of the strainer, means carried by the short pipe section for supplying gravel and water outwardly through opposite walls of the short pipe sections at the upper end of the strainer, means whereby said discharge may be closed and a lead seal connected to the upper end of the feed pipe, a water supply connected to one branch of said couplings, a tank connected to the other branch, a valve interposed between said branch and tank for controlling the flow of gravel from the tank, a glass sight feed above the valve, a water supply pipe extending downwardly through the tank and disked and a charging at the point of discharge of the tank, and a water supply for the upper end of the tank.

12. An attachment for wells comprising a short pipe section adapted to be secured to the upper end of the strainer and having means at its upper end for attaching a lead seal, an inverted Y shaped member permanently carried within the short pipe section and adapted to discharge gravel and sand outwardly through opposite walls of the short pipe section, means for closing said discharge openings and means for connecting a supply pipe thereto.

13. A method for placing footing in wells consisting in driving the well casing through two or more strata of water bearing sand, lowering two or more strainers into the casing connected by a blank pipe section whereby the strainers are opposite their respective sand strata, jacking up or cutting the casing slightly above the lower strainer, forcing the water and gravel outwardly above and around the lower strainer, jacking up the casing outwardly above the strainer and forcing water and gravel outwardly around the upper strainer whereby water is being supplied to the well from the two strata.

15. An apparatus for placing footing in one, two or more strata or water bearing sand, the upper or the ones comprising a strainer, a short pipe section secured to the upper end of the strainer, means carried by said short pipe section for forming water and gravel outwardly around the upper end of the strainer, a blank pipe section secured to the short pipe section and extending upwardly to the first stratum of water bearing sand, a strainer secured to the blank pipe, a short pipe section secured to the last mentioned strainer, means carried by the short pipe section for supplying gravel and water around the upper end of the strainer and a lead seal secured to the short pipe section and adapted to form a tight joint with the well casing.

16. An attachment for wells comprising a short pipe section adapted to be secured to the upper end of a strainer, an inverted Y shaped coupling within the pipe section having its lower end communicating with openings in opposite walls of the pipe section, valves closing said openings, a combined gravel and water supply for said inverted Y shaped coupling and a pipe connected to the inverted Y shaped coupling and adapted to extend to the lower end of the strainer for supplying water thereto.

17. A footing or gravel treating apparatus comprising a well casing, a strainer formed of a series of sections connected together by short pipe sections having openings, means carried by said short pipe sections for connecting a water supply thereto and a gravel and water supply adapted to be connected to any of the short pipe sections opposite said openings.

18. A footing or gravel treating apparatus comprising a well casing, a strainer spaced in the line connected to the upper end of the well casing and connected by a pipe whereby the strainers are arranged opposite the sand strata at different levels and means for connecting a water and gravel supply to either of the strainers for forming a footing or bedding of gravel around the strainers.

19. A footing or gravel treating apparatus for wells comprising a well casing, a strainer, a short pipe section secured to the upper end of the strainer, outwardly swinging valves carried by the short pipe section, a latch for holding said gravel supply pipe adapted to be connected to the short pipe sections and adapted to release the latches when being inserted in operative position.

20. A footing or well treating apparatus comprising a well casing, a strainer, a short pipe section secured to the strainer, a pipe leading through the casing and connected to the short pipe section for supplying water and gravel outwardly around the upper end of the strainer and a sounding rod passing downwardly through the water and gravel supply pipe to indicate when the feeding of the gravel has stopped.

21. A footing or well treating apparatus comprising a well casing, a strainer, a short pipe section secured to the strainer, a pipe leading through the casing and connected to the short pipe section for supplying gravel and water outwardly around the upper end of the strainer and a sounding rod passing downwardly through the water and gravel supply pipe to indicate when the feeding of the gravel has stopped, a casing supply pipe extending through the casing and connected to the short pipe section and adapted to force the water outwardly around the strainer.
6 and wash the sand inwardly to allow the gravel in the sand to form a bed around the strainer.

23. A footing or gravel treating apparatus comprising a well casing, a strainer, a short pipe section secured to the upper end of the strainer, a pipe extending downwardly through the casing and connected to the short pipe section for supplying the water and gravel outwardly through the short pipe section above the strainer, a sounding rod vertically reciprocating within the pipe for agitating and causing the downward feed of the gravel and of a hollow form to supply water to the gravel adjacent the discharge of the gravel from the short pipe section.

24. A well footing or gravel treating apparatus, comprising a well casing, a strainer carried by the lower end of the casing, a conduit in said casing and having means for feeding water and gravel around the strainer and said means adapted to remain in the casing so that the operation can be repeated at any time.

25. A well footing or gravel treating apparatus, comprising a well casing, a strainer carried by the lower end of the casing, a conduit in said casing, means connected to the conduit for feeding water and gravel from the conduit around the outside of the strainer, and means for agitating the sand in the strainer.

26. A well footing or gravel treating apparatus comprising a well casing, a strainer carried by the lower end of the casing, a conduit in said casing, said casing having openings above the strainer and means connected to the conduit for conveying gravel and water therefrom through said openings.

27. A well footing or gravel treating apparatus, comprising a well casing, a strainer carried by the lower end thereof, said casing having openings above the strainer, a conduit in said casing, means connected to the conduit for conveying gravel and water from the conduit through said openings and automatic means for closing said openings when the footing operation is completed.

JASPER Q. PEEPLES.