Sept. 29, 1936. H. C. YARBROUGH 2,055,515

CLEANING APPARATUS FOR PERFORATED PIPE AND THE LIKE

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FIG. 1.

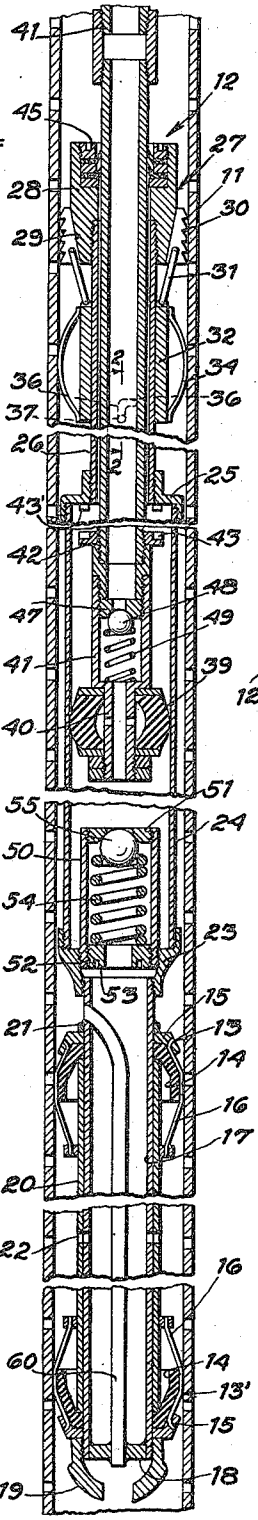


FIG. 2.

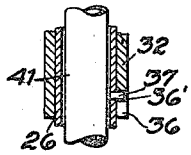


FIG. 3.

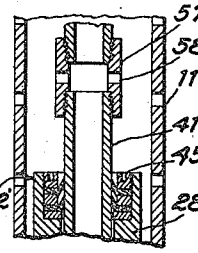
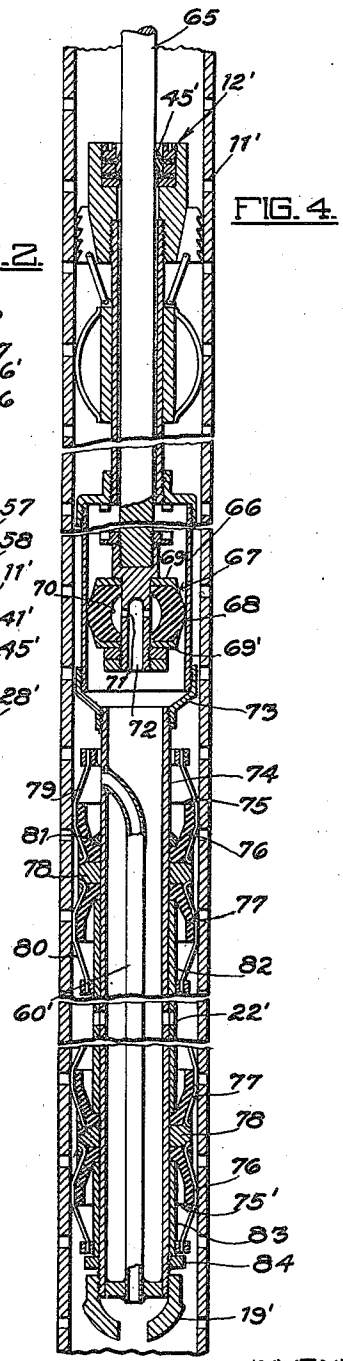


FIG. 4.



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FIG. 5.

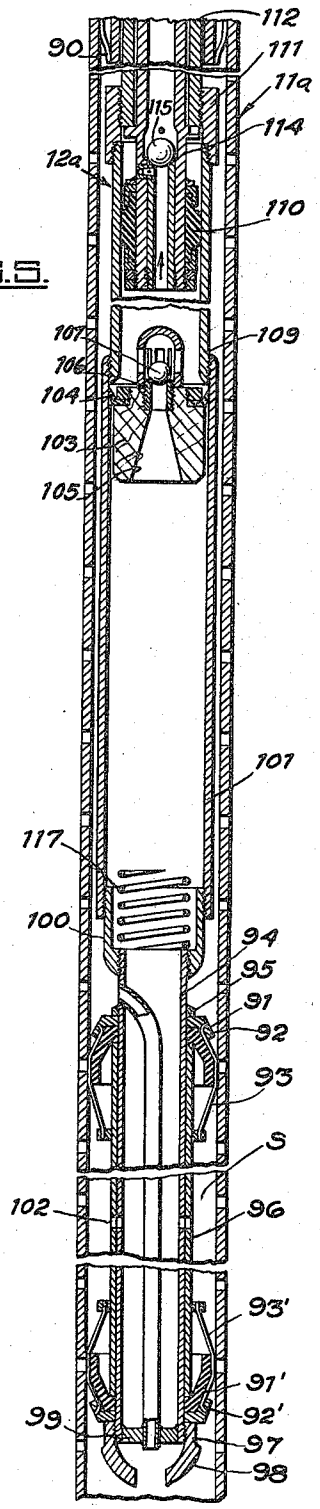
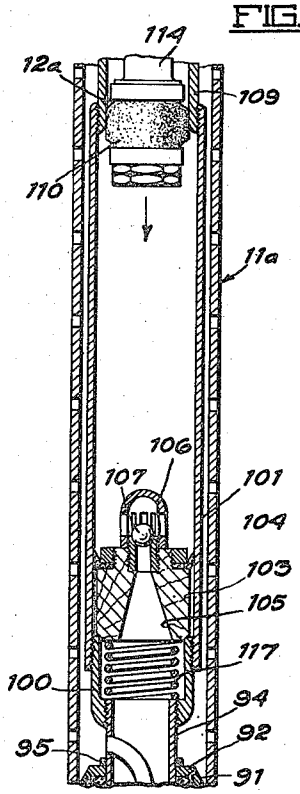


FIG. 6.



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Patented Sept. 29, 1936

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UNITED STATES PATENT OFFICE

2,055,515

CLEANING APPARATUS FOR PERFORATED PIPE AND THE LIKE

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Application July 3, 1933, Serial No. 678,875

18 Claims. (Cl. 166—20)

This invention has to do in a general way with devices for cleaning perforated pipe, and is more particularly related to a novel type of apparatus which can be used to wash the wall perforations in strainer casings such as are used in the oil producing zone or sand in an oil well.

As is well known to those familiar with the art, during the recession of the rock pressure in an oil well, the perforations in the strainer casings tend to become clogged either with sand and sediment, or, in the case of heavy asphaltic oil they become clogged and caked with asphalt and tar. Several devices have been developed for the purpose of cleaning these perforations. In my prior Patent No. 1,916,875 issued on July 4, 1933, I show a device whereby the perforations are cleaned through the application of sudden suction to a confined space in the perforated pipe. The present invention, however, relates to a tool operating upon an entirely different principle in that the perforations are washed by the application of a pressure fluid derived either from the well or supplied thereto from the surface of the ground.

The use of the tool contemplated by this invention is in itself sufficient to effect a complete cleaning of the perforated pipe under many conditions, but in some instances it may be found desirable to follow its use by that of the tool shown and described in my former application referred to above.

In one form of device contemplated by this invention, the pressure fluid is delivered to the tool from the surface of the ground either during or after its installation in the well, and may be of a character such as will react with or dissolve the material which has caked and lodged in the casing perforations and in the fissures of the formation adjacent the perforations. This type of tool may also be used in delivering cement to a confined region in the well casing with the idea of stopping water leaks, etc.

In another form of my invention, I provide a tool which merely sloshes the well fluid back and forth through the perforations in a confined region of the strainer casing, this tool being effective merely to wash the perforations and the fissures clean of deposited sediment, etc., the foreign material removed by the washing action being carried from the well after the tool is removed either by means of an ordinary pump by the flowing action of the well, or by means of a tool such as is shown in my former application referred to above.

In the other form of device contemplated by this invention, I provide a tool which is similar to that just described in that the fluid in the well is sloshed back and forth in the perforations, but differs from the tool just described in that part of the liquid withdrawn from the restricted area in the perforated casing together with the substance removed from the perforations is carried from the well by the tool itself. All of these tools, however, have the common function of washing the perforations by the application of a pressure fluid within a restricted area or a confined space in the strainer casing, and in all of the tools contemplated by this invention such pressure fluid is applied to the restricted area by means of a plunger operating in a working barrel.

The details in the construction of certain preferred forms of my invention, together with other objects attending its production, will be best understood from the following description of the accompanying drawings which are chosen for illustrative purposes only, and in which—

Fig. 1 is a sectional elevation showing one preferred form of the invention;

Fig. 2 is a fragmentary section taken in a plane represented by the line 2—2 in Fig. 1;

Fig. 3 is a fragmentary section showing the upper end portion of a tool of the type shown in Fig. 1 and illustrating the same as having been provided with a special form of fitting whereby the well fluid is delivered into the tool at one point for injection into the strainer casing at another pont;

Fig. 4 is a sectional elevation showing another modified form of the invention;

Fig. 5 is a sectional elevation showing still another modified form of the invention; and

Fig. 6 is a fragmentary sectional elevation showing a portion of the device illustrated in Fig. 5 with the parts arranged in a different working position from that shown in Fig. 5.

More particularly describing the invention as herein illustrated, reference numeral 11 (Fig. 1) indicates a perforated pipe or a strainer casing, such as is ordinarily used in oil wells and the like, within which a cleaning device, generally indicated by reference numeral 12, is positioned. The cleaning device 12, in this form of my invention, constitutes the form referred to above wherein the pressure fluid is forced into the well, such fluid preferably being placed in the tool at the time it is installed and being of a nature such that it reacts with or dissolves the material deposited or caked in the perforations of the pipe and in the fissures of the formation.

It is, of course, necessary in a tool of this nature to apply the pressure fluid to a confined region

in the strainer pipe, and such confined space or region is obtained by means of a pair of packers 13 and 13' shown as comprising rubber cups 14 mounted in metal collars 15 and retained by wire ribs 16. The packers are mounted upon a hollow mandrel 17, provided with a closure 18 and a guide shoe 19 at its lower end, and are held in spaced relation thereon by means of a sleeve 20 interposed between the packers.

The collar 15 on the upper packer engages a stop member 21, welded or otherwise secured to the mandrel. The entire unit, including the packers and the sleeve, are pressed against the stop member 21 by means of the shoe 19 which is in threaded engagement with the lower end of the mandrel. The hollow mandrel and the sleeve are provided with openings 22 situated between the packers, such openings establishing communication between the interior of the mandrel and the confined space formed by the two packers.

The upper open end of the hollow mandrel 17 is mounted in a bushing 23 which forms the lower end portion of a working barrel 24. The upper end of the working barrel 24 is mounted in a bushing 25 carried by a sleeve 26 which in turn is releasably supported in the strainer casing by means of a slip mechanism generally indicated by reference numeral 27. The slip mechanism which may be of any conventional type is shown as comprising a collar 28 having a tapered lower surface 29 engaged by slips 30. The slips in turn are mounted on the upper ends of links 31 which in turn are supported by a sliding collar 32 having spring fingers 34 in frictional engagement with the interior of the strainer casing.

The lower end of the sliding collar 32 is provided with a bayonet slot 36 which receives a pin 37 mounted on the sleeve 26. This arrangement is such that when the pin 37 is in the notch 36' of the bayonet slot 36, the slips 30 are held inwardly against the inclined face 29 and the entire unit may have an uninterrupted movement into the pipe. When the unit has reached its predetermined position, the sleeve 26 is rotated by means which will be hereinafter more fully described so as to align the pin with the straight portion of the bayonet slot whereby further downward movement of the unit takes place relative to the slips which are held stationary by the frictional engagement of the springs 34 with the wall of the strainer pipe. The slips are, therefore, forced out into engagement with the interior of the pipe by the tapered surface of the collar 28 and the unit is locked into position.

The working barrel 24 is provided with a plunger member 39 which may be of any preferred construction but is shown as being a rubber type of plunger which is mounted on the lower reduced end portion 40 of a hollow plunger rod 41. The plunger rod or tubing 41 is provided with a collar 42 having recesses 43 adapted to receive lugs 43' in the top of the plunger barrel whereby the plunger barrel and the sleeve 26 may be rotated at will from the surface of the ground for the purpose hereinabove described. The plunger rod 41 extends upwardly through the sleeve 26 and through a packing unit 45 in the collar member 28 and from there on in sections to the surface of the ground where it may be operated in any conventional manner such as by means of a walking beam or by blocks in the derrick.

The lower end portion of the hollow plunger rod is provided with a valve seat indicated at 47 against the lower side of which a ball valve 48 is supported by means of a light compression spring 49.

As was pointed out above, this device is designed primarily for use in delivering a foreign liquid into the well for the purpose of cleaning the perforations in the strainer pipe, and in operating the device the liquid is most satisfactorily placed in the device as it is lowered into the well. In other words, after a predetermined number of sections of the hollow plunger tubing have been assembled, the desired quantity of liquid is poured therein and it is necessary, therefore, to provide valve means in the plunger barrel which will support the weight of this column of liquid but which will at the same time be released under the pressure action of the plunger to deliver such liquid through the hollow mandrel and the openings into the confined space defined by the packers 13 and 13'. Such a valve is shown in Fig. 1 as comprising what is in effect an enclosed cage 50 having a seat 51 in its top, such cage being mounted in the bottom of the plunger barrel through the threaded connection 52 and containing a bottom apertured plug 53 which engages a heavy compression spring 54 that presses a ball valve 55 against the seat 51.

The compression spring 54 is of sufficient strength to support the weight of a column of liquid in the plunger barrel and the plunger tubing of such quantity as may be desired for cleaning the perforations in the pipe.

In the operation of this device, as pointed out above, the desired quantity of liquid is poured into the tubing 41 after it has been lowered into the well to a predetermined depth. The installation of the tool is then continued in the usual manner by lowering the same and adding additional sections to the plunger rod or tubing.

When the unit has reached the desired point at the lower end portion of the perforated section, as indicated by the length of the rod which has been lowered into the well, the tubing or plunger rod is rotated thereby releasing the slips to lock the unit at the desired point. The plunger barrel having been locked in this manner, the tubing is permitted to move downwardly of its own weight, thereby forcing the contents of the plunger barrel through the spring-pressed check valve 55 and the hollow mandrel 17 into the confined space and through the perforations of the strainer casing.

The operation of the plunger may be repeated once or twice for each setting if desired, the upward movement of the plunger being effective to admit additional liquid from the tubing through the check valve 48 into the plunger barrel, such liquid being forced out into the confined space by the downward movement of the plunger. After one setting has been cleaned, the unit may be raised a distance corresponding to the length of the space confined by the packers at which time the slips are automatically reset by permitting the tubing to settle. The unit is then reoperated in the manner just described. This operation may be repeated until the entire length of strainer casing has been cleaned.

In the event it is not desired to deliver a foreign material, such as a cleaning solvent or an acid into the well, or in the event the well contains liquid which can be used to clean the perforations in the pipe, I may provide a device of the class just described with an apertured collar 57 (Fig. 3) which is mounted in the tubing 41' at a point above the packing 45' in the slip

collar 28'. In the use of this device, liquid in the well above the top packer is admitted through ports 58 in the collar 57, flowing downwardly through the hollow tubing and being forced into the well in the manner just described above.

In order that the packing unit, comprising the two packing members 13 and 13', may be lowered downwardly through the casing, I provide such unit with a by-pass pipe 60 which has its lower end extending through the plug 18 opening into the region of the casing below the packing unit and has its upper end extending through the wall of the hollow mandrel and opening into the casing above the packing unit. In this manner the device may be lowered downwardly through the liquid in the well, such liquid passing through the by-pass pipe as the unit travels on its downward course.

Referring now to Fig. 4 in which the strainer casing 11' and the slip mechanism 12' are the same as those shown in Fig. 1, I show a cleaner of modified construction which is adapted to merely slosh the liquid of the well back and forth through the perforations in a restricted area of the strainer pipe. In this form of my invention I may employ a substantially solid plunger rod 65 which extends downwardly through the packing gland 45' into a plunger barrel 66 where it is provided with a substantially solid piston 67. This piston is similar to that shown in Fig. 1 in that it comprises a rubber or other flexible central portion 68 interposed between metal supporting collars or rings 69 and 69'. The interior of the rubber portion 68 is hollowed out to form a chamber 70 and this chamber communicates through ports 71 and a bore hole 72 with the interior of the working barrel so that the piston receives a pressure fluid forcing the same into expanded position during its down stroke.

The lower end portion of the working barrel 66 is secured in a bushing 73 which in turn supports a hollow mandrel 74 similar in all of its essential respects with the mandrel 17 in Fig. 1.

In view of the dual action, that is, pressure and suction which is applied to the restricted area, in this form of my invention the packing members generally indicated by reference numerals 75 and 75' are formed so as to withstand both pressure and suction in that each comprises a pair of oppositely disposed cups 76 and 77, such cups being mounted on opposite sides of a ring 78 which is shown as supporting the reinforcing wires 79 and 80. The uppermost cup 76 engages a stop member 81 on the mandrel. The two sets of cups are held in spaced relation by means of a sleeve 82 like the construction shown in Fig. 1, and the lowermost set of cups is pressed upwardly against the sleeve by means of a secondary sleeve 83 which is in turn engaged by a nut 84 mounted on the lower end of the mandrel above the guide shoe 19'.

The packing assembly in this form of my invention, like that shown in Fig. 1, is provided with a bypass pipe indicated at 60', and the mandrel and spacing sleeve are provided with ports indicated at 22' for establishing communication between the interior of the hollow mandrel and the space confined by the packers. In the operation of this device, the tool is merely lowered into the well in the conventional manner by extending the plunger rod until it reaches the desired point at which time the plunger is rotated to release the slip mechanism as described in Fig. 1 and the plunger rod is reciprocated much as an ordinary pump to apply suction and pressure alternately to the confined space, thereby sloshing the liquid out of the well back and forth through the perforations to thoroughly wash them of sediment, etc.

Referring now to Fig. 5, reference numeral 11a indicates a strainer casing or a perforated pipe which is shown as containing a modified form of cleaning unit generally indicated by reference numeral 12a. This cleaning unit is supported in the casing by means of a slip mechanism generally indicated by reference numeral 90 which is the same in construction and operation as the slip mechanism described in connection with Fig. 1.

Reference numerals 91 and 91' indicate a pair of packers, the peripheries of which engage the interior of the casing, such packers being spaced apart to form a confined space S within the perforated pipe. The packers 91 and 91' are shown as being of the rubber cup type having metal supporting collars 92 and 92' and reinforcing cages 93 and 93'. The packers are mounted upon a hollow mandrel 94 and are retained thereon by means of a shoulder 95 formed on the mandrel, a sleeve 96 which holds the packers in spaced relation with each other, and a nut 97 which is in threaded engagement with the lower end of the mandrel and is shown as being provided with a guide shoe 98.

The lower end portion of the mandrel is provided with a closure plug 99, and the upper end portion of the mandrel is open, being in open communication with a bushing 100 which in turn communicates with and is supported by a plunger barrel or working barrel 101. The hollow mandrel is provided with ports 102 opening into the confined space S.

Reference numeral 103 indicates, what I may term, a float-plunger which is shown as being formed of wood or other suitable material of low specific gravity having a packing cup 104 on its upper edge engaging the interior of the working barrel. The float-plunger 103 is provided with an upwardly tapered opening 105 which is provided with a valve seat and cage 106 in its upper end portion, the seat and cage containing a ball-check valve 107.

The top of the plunger barrel 101 is supported by, what I may term, an operating cylinder 109 which is of substantially smaller diameter than the working barrel and which contains, what I may term, a power piston or power plunger 110. The power cylinder is supported through the medium of a collar 111 and a sleeve 112 from the slip mechanism, generally indicated at 90. The power piston 110 is mounted on the lower end portion of a plunger tubing or tubular plunger rod 114 which is provided with a check valve indicated at 115.

Reference numeral 117 indicates a compression or recoil spring mounted in the bottom of the plunger barrel or in the bushing 100 and extending up into the plunger barrel so as to be engaged by the plunger float when it reaches the bottom of its stroke in the manner which will now be described.

In the operation of this device, the tool is lowered into the well to the desired point at which time the slips are released in the manner described above to lock the same in place, thereby holding the packing unit so as to provide a confined space in the strainer casing. Meanwhile any liquid which may have entered the confined space during the downward movement of the unit or after it is positioned will rise through the mandrel into the plunger barrel and lift the plunger float into the upper end portion of the plunger barrel. As the power plunger is moved downwardly by the

weight of the tubing after the unit has been locked in place, it creates a substantial vacuum in the operating cylinder which is released when the power plunger enters the working barrel. Such release of pressure is effective to draw additional liquid through the strainer casing, or, in the event none has seeped through, to draw liquid through the perforations in the strainer casing and into the working barrel. It will be seen that through this operation the plunger float will follow the operating plunger to the top of the working barrel as the plunger travels upwardly in the operating cylinder. In the down stroke of the power plunger 110, however, the weight of the liquid in the hollow plunger rod will hold the check valve 115 closed so that the compression of liquid below the power plunger will force the plunger float downwardly in the working barrel, thereby expelling liquid from the working barrel through the ports 102 and forcing such liquid under pressure through the perforations in the confined space S. In this manner it will be seen that the operation of this device is to force liquid under pressure through the perforations in the confined space and then apply sudden suction to the confined space so that liquid is redrawn back through the perforations, thus giving a washing effect similar to but possibly more violent than the washing effect obtained by the washing device shown in Fig. 4.

The spring 117 is provided for the purpose of giving the plunger-float an initial impelling movement when the pressure thereabove is released or, more specifically, when the sudden suction is applied thereto, thus preventing the possibility of this plunger becoming stuck and permitting all of the liquid to pass up through the check valve without lifting the plunger-float.

It is also possible to extend the spring 117 a substantial distance up into the working barrel and employ a plunger which does not have the low specific gravity of the plunger-float. In such instance, the operation of the plunger in the working barrel would be covered entirely by the spring, the plunger being forced downwardly, compressing the spring while the power plunger was traveling in the operating cylinder and being forced upwardly by the action of the spring when the power plunger entered the working barrel from the operating cylinder. Fig. 5 shows the plunger-float in the position which it would occupy under normal operation when the power plunger is in the top of the operating cylinder, and Fig. 6 shows the position of the plunger-float just prior to the time at which the power plunger enters the working barrel from the operating cylinder.

It will be apparent from the foregoing description that my invention in its three modified forms is capable of applying a pressure fluid to a confined region within a strainer casing, and it is to be understood that, while I have herein described and illustrated certain preferred forms of my invention, the invention is not limited to the precise construction described above, but includes within its scope whatever changes fairly come within the spirit of the appended claims.

I claim as my invention:

1. An apparatus for cleaning perforated pipe and the like embodying: a pair of packers adapted to engage the interior of said pipe and spaced apart to form a confined space therein; a hollow mandrel supporting said packers and having an opening communicating with said confined space; a working barrel supporting said hollow mandrel and communicating therewith; a plunger in said working barrel adapted, during downward movement, to force a pressure fluid from said working barrel into said confined space; and means for actuating said plunger.

2. An apparatus for cleaning perforated pipe and the like embodying: a pair of packers adapted to engage the interior of said pipe and spaced apart to form a confined space therein; a hollow mandrel supporting said packers and having an opening communicating with said confined space; a working barrel supporting said hollow mandrel and communicating therewith; a plunger in said working barrel adapted, during downward movement, to force a pressure fluid from said working barrel into said confined space; a hollow plunger rod for actuating said plunger; and a check valve between said plunger and said plunger rod for admitting fluid from said plunger rod to said working barrel during upward movement of said plunger.

3. An apparatus for cleaning perforated pipe and the like embodying: a pair of packers adapted to engage the interior of said pipe and spaced apart to form a confined space therein; a hollow mandrel supporting said packers and having an opening communicating with said confined space; a working barrel supporting said hollow mandrel and communicating therewith, a plunger in said working barrel adapted, during downward movement, to force a pressure fluid from said working barrel into said confined space; and means for actuating said plunger, said plunger being substantially solid so as to apply suction to said confined space during its upward movement.

4. An apparatus for cleaning perforated pipe and the like embodying: a pair of packers adapted to engage the interior of said pipe and spaced apart to form a confined space therein; a hollow mandrel supporting said packers and having an opening communicating with said confined space; a working barrel supporting said hollow mandrel and communicating therewith; a plunger in said working barrel adapted, during downward movement, to force a pressure fluid into said confined space; and means for actuating said plunger, said plunger comprising a float, packing means on said float engaging the interior of said working barrel, and a check valve in said float adapted to close under the application of pressure from the top portion of said working barrel.

5. An apparatus for cleaning perforated pipe and the like embodying: a pair of packers adapted to engage the interior of said pipe and spaced apart to form a confined space therein; a hollow mandrel supporting said packers and having an opening communicating with said confined space; a working barrel supporting said hollow mandrel and communicating therewith; a plunger in said working barrel adapted, during downward movement, to force a pressure fluid from said working barrel into said confined space; means for actuating said plunger; and a by-pass conduit communicating between the regions of said pipe on either side of said confined space.

6. An apparatus for cleaning perforated pipe and the like embodying: a working barrel; means for releasably supporting said working barrel in said pipe; a valve seat in the bottom of said working barrel; a check valve engaging the underside of said valve seat; a compression spring normally holding said check valve against its seat; a plunger member in said working barrel; a downwardly opening check valve in said plunger; a hollow plunger rod for actuating said plunger; a hollow mandrel mounted on the bottom of said working

barrel; and a pair of packers mounted on said mandrel and engaging said pipe to form a confined space therein, said hollow mandrel being provided with an opening communicating with said confined space.

7. An apparatus for cleaning perforated pipe and the like embodying: a working barrel; means for releasably supporting said working barrel in said pipe; a downwardly opening check valve in the bottom of said working barrel; a hollow mandrel communicating with said working barrel through said check valve; a pair of packers mounted on said mandrel to form a confined space in said pipe, the wall of said mandrel being provided with an opening communicating with said confined space; a plunger member in said working barrel; a tubular plunger rod for actuating said plunger; and a downwardly opening spring-pressed check valve in said tubular plunger rod.

8. An apparatus for cleaning perforated pipe and the like embodying: a working barrel; means for releasably supporting said working barrel in said pipe; a valve seat in the bottom of said working barrel; a check valve engaging the underside of said valve seat; a compression spring normally holding said check valve against its seat; a plunger member in said working barrel; a downwardly opening check valve in said plunger; a hollow plunger rod for actuating said plunger; a hollow mandrel mounted on the bottom of said working barrel; and a pair of packers mounted on said mandrel and engaging said pipe to form a confined space therein, said hollow mandrel being provided with an opening communicating with said confined space, said compression spring being of sufficient strength to maintain said working barrel check valve closed against the pressure of a substantial column of fluid in said working barrel and said hollow plunger rod.

9. An apparatus for cleaning perforated pipe and the like embodying: a working barrel; means for supporting said working barrel in said pipe; a substantially solid plunger in said working barrel; a plunger rod for actuating said plunger; a hollow mandrel secured to the bottom of said working barrel in open communication therewith; and a pair of packing members mounted on said mandrel and adapted to engage said pipe to form a confined space therein, the wall of said hollow mandrel being provided with an opening communicating with said confined space.

10. An apparatus for cleaning perforated pipe and the like embodying: a working barrel; means for supporting said working barrel in said pipe; a substantially solid plunger in said working barrel; a plunger rod for actuating said plunger; a hollow mandrel secured to the bottom of said working barrel in open communication therewith; and a pair of packing members mounted on said mandrel and adapted to engage said pipe to form a confined space therein, each of said packing members comprising a pair of oppositely disposed cups, the wall of said hollow mandrel being provided with an opening communicating with said confined space.

11. An apparatus for cleaning perforated pipe and the like embodying: a working barrel; an operating cylinder of smaller diameter than said working barrel mounted on the top of said working barrel in open communication therewith; a plunger-float in said working barrel, said plunger-float having a passage therethrough; a downwardly closing check valve in said plunger-float passage; a power plunger in said operating cylinder; a working valve in said power plunger; means for operating said power plunger; a hollow mandrel mounted on the bottom of said working barrel in open communication therewith; and a pair of packers mounted on said mandrel adapted to engage the interior of said pipe and spaced apart to form a confined space therein, said hollow mandrel having an opening in its wall communicating with said confined space.

12. An apparatus for cleaning perforated pipe and the like embodying: a working barrel; an operating cylinder of smaller diameter than said working barrel mounted on the top of said working barrel in open communication therewith; a plunger-float in said working barrel, said plunger-float having a passage therethrough; a downwardly closing check valve in said plunger-float passage; a recoil spring mounted in the bottom of said working barrel and adapted to be engaged by said plunger-float; a power plunger in said operating cylinder; a working valve in said power plunger; means for operating said power plunger; a hollow mandrel mounted on the bottom of said working barrel in communication therewith; and a pair of packers mounted on said mandrel adapted to engage the interior of said pipe and spaced apart to form a confined space therein, said hollow mandrel having an opening in its wall communicating with said confined space.

13. An apparatus for cleaning the perforations in perforated pipe embodying: a pair of packers adapted to engage the interior of said pipe and spaced apart to form a confined space therein; means for intermittently applying pressure to said confined space comprising a hollow mandrel supporting said packers and having one open end and another opening communicating with said confined space; a working barrel communicating with the open end of said mandrel; a plunger in said plunger barrel; means for operating said plunger; and a check valve at the open end of said mandrel adapted to be opened under pressure from said plunger.

14. An apparatus for cleaning the perforations in perforated pipe embodying: a pair of packers adapted to engage the interior of said pipe and spaced apart to form a confined space therein; and means for alternately applying pressure and suction to said confined space comprising a hollow mandrel supporting said packers, said mandrel having one open end and having an opening in its wall communicating with said confined space, a working barrel communicating with the open end of said mandrel, a substantially solid plunger in said working barrel, and means for actuating said plunger.

15. An apparatus for cleaning the perforations in perforated pipe embodying: a pair of packers adapted to engage the interior of said pipe and spaced apart to form a confined space therein; and means for alternately applying pressure and suction to said confined space comprising a hollow mandrel supporting said packers, said mandrel having one open end and having an opening in its wall communicating with said confined space, a working barrel communicating with the open end of said mandrel, a plunger-float in said working barrel, a power cylinder of smaller diameter than said working barrel mounted on the top of said working barrel, a piston in said power cylinder, means for moving said piston through said power cylinder into said working barrel, said plunger-float having a passage therethrough, and a check valve in said passage adapted to close under the action of pressure from said

power piston and adapted to open when the suction created in said power cylinder behind said piston is released as said piston enters said working barrel.

16. An apparatus for cleaning the perforations in perforated pipe embodying: packing means; a hollow mandrel supporting said packing means in said pipe, thereby forming a confined space therein, said mandrel having an opening in its wall communicating with said confined space; and means including a working barrel communicating with said hollow mandrel and a plunger in said working barrel for intermittently applying pressure to said confined space.

17. An apparatus for cleaning perforated pipe and the like embodying: packing means adapted to engage the interior of said pipe and form a confined space therein; a hollow mandrel supporting said packing means and having open communication with said confined space; a working barrel communicating with said hollow mandrel; a plunger in said working barrel adapted to force pressure fluid from said working barrel through said mandrel into said confined space during relative movement between said plunger and said working barrel in one direction; and means for effecting relative movement between said plunger and said working barrel.

18. An apparatus for cleaning perforated pipe and the like embodying: packing means adapted to engage the interior of said pipe and form a confined space therein; a hollow mandrel supporting said packing means and having open communication with said confined space; a working barrel communicating with said hollow mandrel; a plunger in said working barrel adapted to alternately apply pressure and suction in said confined space during relative movement between said plunger and said working barrel in opposite directions; and means for effecting relative movement between said plunger and said working barrel.

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