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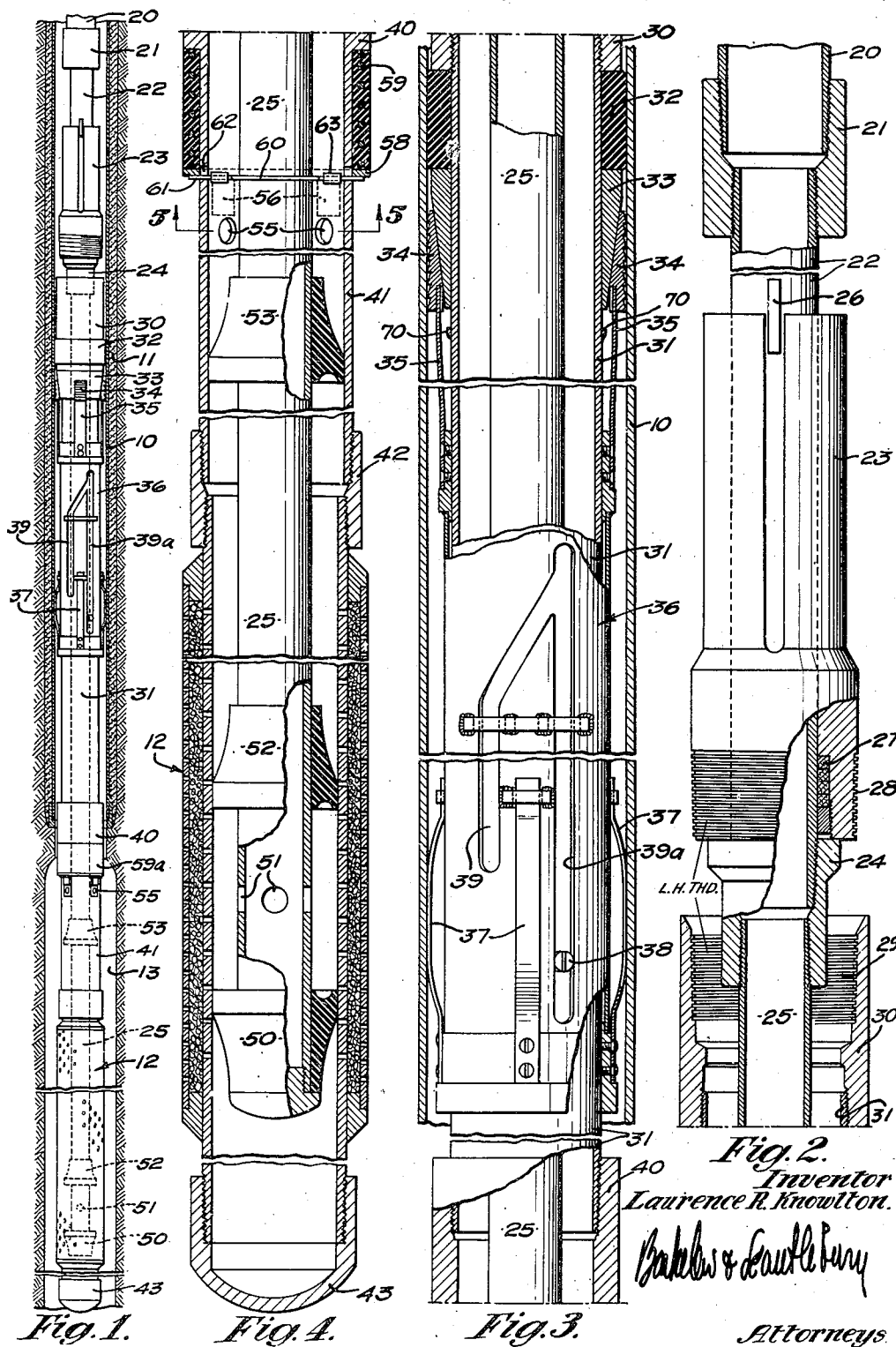
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2,318,167

LINER SETTING AND WASHING DEVICE FOR WELLS

Filed Oct. 4, 1940

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

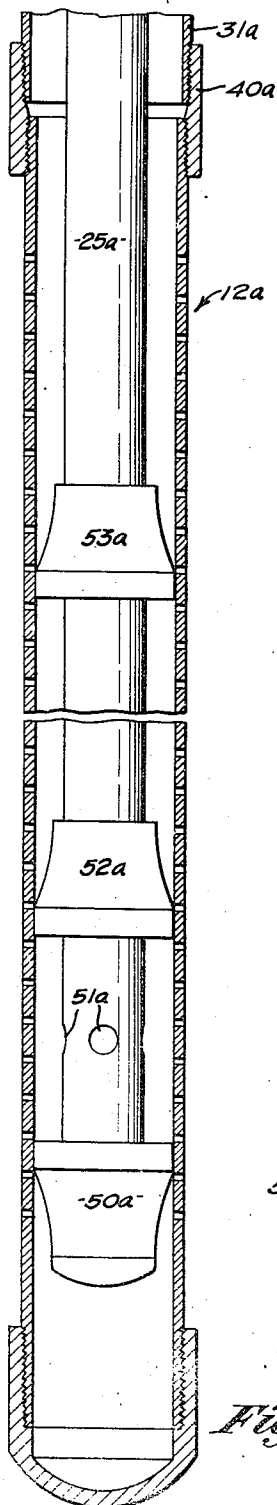
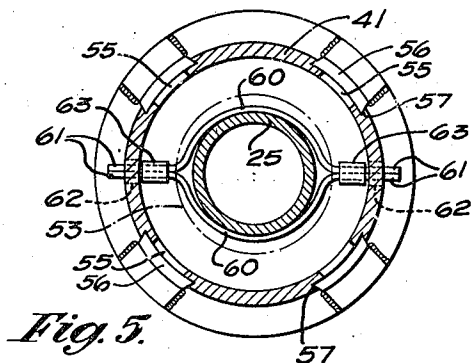
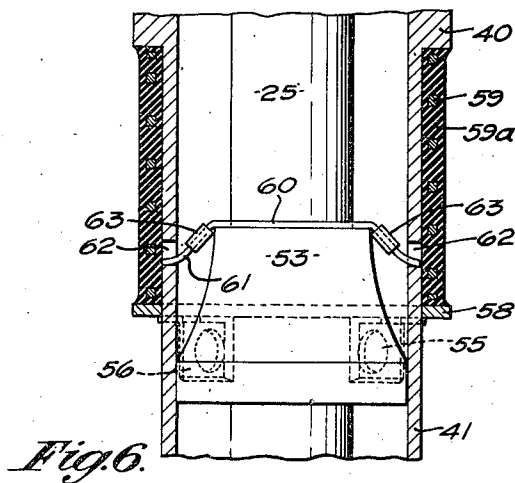
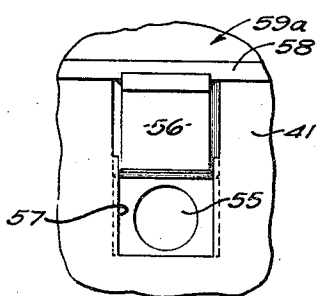
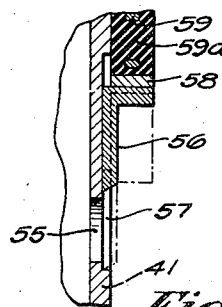


Fig. 7.

Fig. 8.

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Fig. 9.

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UNITED STATES PATENT OFFICE

2,318,167

LINER SETTING AND WASHING DEVICE FOR
WELLS

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Application October 4, 1940, Serial No. 359,676

11 Claims. (Cl. 166—20)

This invention has reference to devices for setting and washing the perforated screens such as are commonly used in well liners; and a general and main purpose of the invention is to provide an arrangement and a system of operation whereby a perforated screen liner may be set, and the liner and the wall of the hole washed, in one series of operations without the necessity of running into and out of the hole more than once.

With devices and operations which are in common use, it is commonly necessary to run into the hole with the liner and to then set the liner in position. The liner having been set, the pipe with which that operation of lowering and setting has been performed is withdrawn from the hole and the wash pipe and washing devices then lowered, the liner and hole wall washed, and the washing devices and pipe then removed. These operations require two runnings in and runnings out. My invention provides means and procedures by which both the setting operation and the washing operation may be performed with only a single run-in and run-out. There are also other purposes and accomplishments of the invention, all of which will be best understood from the following detailed description of preferred and illustrative devices and operations, reference for the purpose being had to the accompanying drawings in which

Fig. 1 is a view showing my complete devices in place in a well, with the parts of the devices in position for washing, after the liner has been set;

Figs. 2, 3 and 4 are relatively enlarged fragmentary longitudinal sections (with certain parts in elevation for clarity of illustration) showing the parts of the devices in the same relative positions as shown in Fig. 1. Fig. 2 shows the upper parts of the devices, Fig. 3 the middle parts and Fig. 4 the lower parts;

Fig. 5 is a cross section on line 5—5 of Fig. 4;

Fig. 6 is a fragmentary longitudinal section, with parts in elevation, showing certain portions which are shown in Fig. 5, but showing those parts in the positions which they assume when the washing apparatus is finally withdrawn from the hole;

Fig. 7 is an elevation of one of the valvular members shown in Fig. 6;

Fig. 8 is a vertical section of the parts shown in Fig. 7; and

Fig. 9 is a view showing a modified construction of the lower parts of the washing devices.

In the drawings Fig. 1 shows at 10 the lower

end portions of a well casing set in cement 11 in the lower end of the well bore. The numeral 12 designates generally the perforated or screen liner, of any suitable type, which is set below the lower end of casing 10 in a prolongation of the well bore below the casing. Usually this well bore prolongation 13 is formed by drilling through the cement and into the formation below the lower end of the casing after the casing has been set; but the manner in which the open bore is provided below the lower end of the said casing is immaterial to my invention.

Referring now more particularly to the detailed showings of Figs. 2, 3 and 4, 20 designates the pipe on which the whole device is lowered in the well, and by means of which the liner is set and the washing fluid is introduced. A collar or coupling 21 at the lower end of pipe 20 couples pipe 20 with a nipple 22, both the threads in said coupling, as well as the threadings in all of the couplings in pipe 20 being normally right-handed threads. Nipple 22 extends downwardly through a sleeve 23 and is screw-threadedly connected with a coupling 24 which couples nipple 22 with a long tube 25 which extends downwardly through substantially the whole length of the device, and carries at or near its lower end the packers which will be hereinafter described. Sleeve 23 is preferably slidable on but locked against rotation by spline 26 to nipple 22, and carries packing 27 at its lower end engaging nipple 22, and also has left-hand threads 28 at its lower end engageable with internal left-hand threads 29 on the upper end of a collar 30 which, together with tube 31 and certain other parts affixed thereto forms in effect the body of the whole device. Nipple 22 is movable longitudinally a limited distance with reference to sleeve 23 when sleeve 23 is screw-threadedly connected to collar 30, the relative movement being limited by the two couplings 21 and 24.

Mounted immediately around the body tube 31 and immediately under collar 30 is a packer ring 32 of some material, such as rubber, which will expand radially when compressed longitudinally. Immediately below that a wedge ring 33 is slidably mounted around body tube 31, and casing engaging slips 34 are adapted to ride up and down on wedge ring 33, the slips being expanded by relative upward movement on the wedge ring, or by relative downward movement of the wedge ring. The slips are connected by flexible bars 35 with the upper end of a tubular shell 36 which surrounds body tube 31 and is longitudinally movable, and limitedly rotatably

movable, with relation to tube 31. Shell 36 carries the spring pressure members 37 which are adapted to ride the interior surface of the casing and retard movement of shell 36. Body tube 31 carries a pin 38 adapted to ride in a cam slot in shell 36. This cam slot has two vertical courses, a shorter one 39 and a longer one 39a, joined at their upper ends.

The anchoring and packing means which has been described in the immediately preceding paragraph is not, in and by itself, a part of my present invention. Any other suitable anchoring and packing means which will perform the functions necessary to my devices may be substituted for the one described.

The lower end of body tube 31 is screw-threaded into a collar 40 which is coupled to or formed on the upper end of a second and further downwardly extending body tube 41, whose lower end in turn is coupled by collar 42 with the upper end of the strainer section 12 of the liner. In the drawings I have shown the strainer section of the liner as of the double walled gravel packed type; but any other type of perforated or screen strainer may of course be used. My invention has no reference to the strainer in and of itself, but rather has reference to the setting and washing of any type of strainer section. Consequently the strainer section 12 will be looked upon as representing a strainer section of any type, forming a part of the tubular body of my device. The lower end of the strainer section is preferably closed by a cap 43.

The body of the liner is formed by the tubular parts 30, 31, 41 and strainer section 12, and the interconnected coupling members. It is this liner body, together with the packer and wedge slips and their operating means that is placed and secured in casing 10. All the other internal parts of the device are removed after the operation of placing and washing are complete.

As before mentioned, the internal tube 25 extends down through the body of the liner to a point near the bottom of the strainer section. At or near its lower end tube 25 carries a packing member 50 which may preferably be of the swab type as illustrated, facing upwardly. A short distance above packer 50 tube 25 has perforations 51 through which washing liquid may flow outwardly, and above those perforations there is located another swab type packer 52, preferably facing downwardly. The vertical distance between the packers 50 and 52 is preferably short as compared with the total vertical length of strainer section 12, so that the wash water which is introduced inside the strainer section between packers 50 and 52 may be confined within a relatively short and lowermost part of strainer section 12.

Above the packer 52, and in a position to always engage the inner surface of the liner body above the strainer, there is located a third swab packer 53, preferably facing downwardly. This third packer, like the others, is mounted on tube 25. Above the upper packer 53, in any position which that packer may take in the manipulation of the device, body tube 41 has openings or ports 55 through its wall. Outside each opening 55 there is a vertically sliding valve member 56 preferably guided vertically in dovetail recesses 57 in the wall of body tube 41. All of these vertically sliding valve members 56 are joined to ring 58 slidably surrounding tube 41, and a rubber encased spring 59, confined between coupling 40 and ring 58, tends to move the ring and valve members

downwardly to close openings 55. Downward movement of the valve members, until all the operations are completed and the internal parts of the device are withdrawn, is prevented by a pair of deformable locking bars, each of which has a semicircular portion 60 closely surrounding tube 25 and two projecting end parts 61 which project loosely out through openings 62 in body tube 41 and directly under the valve ring 58. Openings 62 are large enough so that locking bars 60 may be slipped into position from the outside, and the two clips 63 then slipped over the adjacent end portions 61 to hold them together with the portions 60 of the locking members fitting closely about tube 25.

For reasons that will be explained later it is desired to close openings 55 and openings 62 when the operations are completed and the internal parts are lifted out of the well. When the internal parts are lifted for final removal the upper swab packer 53 rises against the central portions 60 of the locking bars, and bends those bars upwardly, somewhat as indicated in Fig. 6; so that their ends 61 are eventually pulled out of openings 62 and the locking bars are then removed from the casing, together with the other parts. When the locking bars have been removed from under the valve ring 58, the valve ring and valve members 56 are pushed downwardly by the rubber encased spring 59 to close openings 55. And at the same time the rubber casing 59a of the spring moves downwardly over openings 62 to close them. Fig. 6 shows the positions of the parts just referred to when the locking bars have been removed from locking position.

The whole device is initially inserted in the casing and lowered to the bottom of the well with sleeve 23 screw-threadedly coupled by threads 28 and 29 to collar 30 which forms the upper end of the liner body. In this position of the parts the coupler 24, immediately under sleeve 23, and the long depending internal wash tube 25, and the parts mounted upon it, are all somewhat lower with relation to the liner body than is shown in the drawings. Otherwise, the positional relations of these parts are the same as shown in these drawings. Also when the device is being lowered through the casing to the bottom of the well, pin 38 on body tube 31 occupies a position at the lower end of the short arm 39 of the cam slot in shell 36; so that shell 36 and the coupled slips 34 are then lower on body tube 31 than is shown in Fig. 3, and wedge sleeve 33 is also somewhat lower and packing ring 32 is radially contracted. In this condition of the parts the whole device is easily lowered through the casing on the wash pipe or drill pipe 20, until the device reaches the position in which it is desired to set the liner. Upon reaching that position the operations are as follows:

First, the liner is set in position and the packer 32 is expanded to seal the liner to casing 10, by first raising the liner body to raise pin 38 to the upper end of short cam slot 39, and then lowering the whole liner body with pin 38 riding down in long cam slot 39a. Due to the frictional retardation of spring members 37, the shell 36 is retarded in downward movement, so that wedge ring 33 is moved down in slips 34 until they begin to grip the casing when further forcible downward movement forces the wedge ring 33 relatively upwardly on body tube 31 to expand packer 32 and also forces the wedge slips out to securely engage the casing. The liner body is then solidly set in position and sealed at its upper end to the

casing; in a position in which the strainer section 12 projects below the lower end of the casing into the uncased part of the hole.

Washing the strainer section and the surface of the well bore may then be proceeded with. The next operation is that of unscrewing sleeve 23 from coupling 30 which forms the upper end of the liner body. This is done by first pulling up on wash pipe 20 until the weight of the wash pipe, or any pressure of coupling 21 on sleeve 23, is removed, and then rotating the wash pipe and sleeve 23 in right-handed direction. After unscrewing sleeve 23 the wash pipe 20 is then pulled upwardly far enough to move the lower end of sleeve 23 up to provide a clearance for wash flow between the lower end of sleeve 23 and the upper end of collar 30. This operation of moving sleeve 23 up of course also moves the depending tube 25 and its inter-connected parts upwardly a slight distance. The parts are then all in the relative positions shown in Figs. 1, 2, 3 and 4, and with the packers 50 and 52 located at or near the lowermost portion of strainer section 12, and with the upper packer 53 located above the upper end of strainer section 12 but below openings 55.

Washing is then accomplished by forcing the washing fluid down through wash pipe 20. The washing fluid passes down through the wash pipe, through the interconnecting nipple 22 which in effect forms a continuation part of the wash pipe, and down through wash tube 25 which also in full effect is a continuation part of the wash pipe. The washing fluid can only escape from the wash pipe at openings 51 between the two spaced packers 50 and 52. Hence the washing fluid passes out into the well bore through only a limited lower part of the openings in strainer section 12, and consequently the washing fluid enters the well bore very close to the bottom of the uncased bore. Hence the washing fluid flows upwardly in contact with the outside surface of strainer section 12 and the wall surface of the uncased bore. The washing fluid cannot flow inwardly through the perforations or openings in the major portion of the strainer section which is above packer 52, because the internal passage upwardly through the liner body above the strainer section is stopped off by the upper packer 53. Hence the washing fluid must pass upwardly in washing contact with the whole length of the outer face of the strainer section, and also in contact with the whole vertical length of the wall surface of the uncased bore, because the lengths of the parts of the liner have been so chosen, and the liner has been so set in position, that the openings 55 are located not much, if any below the bottom of casing 10. They may be located above the bottom of the casing. Consequently the whole outer surface of the strainer section, and the whole wall surface of the uncased bore, are washed and cleaned by washing liquid. And any detritus washed off and picked up by the washing liquid cannot flow radially inwardly through the upper parts of the strainer section but must flow upwardly with the washing liquid and through openings 55 and thence up through the upper parts of the liner body and thence through the clearance under sleeve 23 into casing 10 and thence upwardly out of the well. A complete and thorough washing of both the hole wall and strainer section is accomplished.

After washing is completed the internal parts of the device, including the wash tube 25 and packers 50, 52 and 53 are merely pulled upwardly and raised out of the well. In so doing, the lock-

ing bars 60, 61 are removed from under spring 59, closing openings 55 and openings 62 as I have described before. The liner is thus left with no openings for oil or other fluid entry except through the strainer section.

If at any time it is desired to rewash the liner and the hole bore, it is only necessary to reenter with the internal parts which have been removed except that the upper packer 53 will not then be used. Or the arrangement shown in Fig. 9, hereinafter described, may be used for washing after ports 55 are closed. If at any time it is desired to remove the whole liner, it is only necessary to enter the well with any suitable fishing or coupling device which will take hold of collar 30 at the upper end of the liner body, and to pull the whole liner body upwardly. Upon such upward movement the liner body moves upwardly with relation to slips 34 and upwardly with relation to wedge ring 33 until lugs 70 engage wedge ring 33. Wedge ring 33 then moves upwardly with relation to slips 34, which are held against upward movement first by their engagement with the casing and then by the downward drag of springs 37. The slips and packer 32 are thus contracted, and the whole liner may then be removed from the well.

Fig. 9 shows a modification of the portions which are shown in Fig. 4. Other than these modifications to the lower parts of the device, the modified device is the same as that before described. Or, in other words, Fig. 9 may be considered as a modified downward continuation of the parts which are shown in Figs. 2 and 3. In Fig. 9 the liner body collar 40a corresponds to the collar or coupling 40 shown in Figs. 3 and 4. The strainer section 12a may here be directly coupled at its upper end to collar 40a. And the strainer section is here shown as being simply a length or lengths of perforated pipe. Wash tube 25a, which corresponds to wash tube 25 of the other figures, extends downwardly in the strainer section and carries the two spaced packers 50a and 52a near its lower end and located at or near the lower end of the strainer section. Openings 51a are the same as openings 51 in Fig. 4.

The upper packer 53a, instead of being located above the uppermost end of strainer section 12 as in Fig. 4, is here located in strainer section 12a a short distance below its top. It will be understood that the major portion of the length of strainer section 12a lies between 52a and 53a, just as the major portion of the length of strainer section 12 in Fig. 4 lies above packer 52.

As mentioned before, in this modified form of device there is no necessity of having the body tube 41 of Fig. 4, because in this modified form of device there is no necessity of having the openings 55 or 62 and their valvular closures. Consequently in Fig. 9 the body tube 31a corresponds to body tube 31 in Fig. 3.

In the operation of this modified device the wash water flows outwardly through openings 51a and outwardly through a limited vertical zone near the bottom of the strainer section. Thence the wash water flows upwardly in contact with the outer surface of most the length of the strainer section and in contact with most the vertical length of the hole wall. The wash water then enters the strainer section through the limited vertical zone of perforations at its upper end, and thence flows upwardly through the inside of the liner body and up and out through the casing. Inward flow of the wash water, with its detritus, may partially clog the limited upper

zone of the strainer section; but the large majority of the strainer section length is washed, and substantially the whole vertical length of the bore wall may be washed if this modified form of liner is set in the casing so that upper portion of the strainer section is within the lower end of the casing.

The modified form of wash tube 25a with its appurtenant packers may also be used for repeated washings of the form of liner that is shown in Fig. 4, after the original wash pipe has been withdrawn and openings 55 and 62 have been closed.

The specific descriptions foregoing are intended to be but illustrative of the invention and not necessarily limitative except as expressly stated in the following claims. Variations and changes may be made within the scope of the invention. For instance, the three packers 50, 52 and 53, or 50a, 52a and 53a, need not necessarily be mounted on the wash pipe although that of course is convenient for the desirable removal of the packers from the well. They can however, be mounted in the liner in the relative positions described, with the wash pipe vertically movable within them. And also in the broader aspects of my invention it may not be necessary, although desirable, to have sleeve 23 vertically slidable with relation to the wash pipe. The coupling at 28 could be relatively fixed on the wash pipe.

I claim:

1. A screen-liner and washer for wells, comprising in combination, a tubular liner open at its upper end and having vertically spaced openings through its tubular wall, at least some of which are located in a lower zone of the liner to act as strainer openings, means carried by the upper portion of the tubular liner whereby the upper portion may be locked and sealed in the lower end portion of a well casing with the zone of lower strainer openings below the casing, a wash pipe extending downwardly within the tubular liner to a point near its lower end, means for detachably securing the wash pipe to the liner, two vertically spaced packers surrounding the wash pipe near the lower end thereof sealingly engaging the inner surface of the liner and defining within a limited lower portion of the strainer zone a vertically sealed off zone within the liner, an exit opening for washing fluid in the wash pipe between the two packers, and a third packer surrounding the wash pipe and sealing the annular space between it and the tubular liner at a level below the uppermost of the openings through the liner wall.

2. A screen liner and washer for wells, comprising in combination a tubular liner open at its upper end and which includes a vertically extended screen section in its lower portion, means carried by the upper portion of the tubular liner whereby the upper portion may be locked and sealed in the lower end portion of a well casing with the lower screen section extending below the casing, a wash pipe extending downwardly within the tubular liner to a point near the lower end of the screen section, means for detachably securing the wash pipe to the liner, two vertically spaced packers surrounding the wash pipe near its lower end sealingly engaging the inner surface of the screen section and defining a vertically sealed off zone within a limited lower portion of the screen section, an exit opening for washing fluid in the wash pipe between the two packers, a port through the liner wall at a level spaced above the screen section and below

the sealing means carried by the liner, a third packer surrounding the wash pipe sealing the annular space between it and the liner at a level between said port and the upper end of the screen section, and valvular means associated with said port adapted to occupy an initial position opening said port and operable by said third packer to close said port after washing is completed.

3. A screen liner and washer for wells, comprising in combination a tubular liner open at its upper end and which includes a vertically extended screen section in its lower portion, means carried by the upper portion of the tubular liner whereby the upper portion may be locked and sealed in the lower end portion of a well casing with the lower screen section extending below the casing, a wash pipe extending downwardly within the tubular liner to a point near the lower end of the screen section, means for detachably securing the wash pipe to the liner, two vertically spaced packers surrounding the wash pipe near its lower end sealingly engaging the inner surface of the screen section and defining a vertically sealed off zone within a limited lower portion of the screen section, an exit opening for washing fluid in the wash pipe between the two packers, a port through the liner wall at a level spaced above the screen section and below the sealing means carried by the liner, a third packer surrounding the wash pipe sealing the annular space between it and the liner at a level between said port and the upper end of the screen section, and valvular means associated with said port adapted to occupy an initial position opening said port and actuated by the wash pipe upon withdrawal thereof from the liner to close said port.

4. A screen-liner and washer for wells, comprising in combination, a tubular liner open at its upper end and having vertically spaced openings through its tubular wall, at least some of which are located in a lower zone of the liner to act as strainer openings, means carried by the upper portion of the tubular liner whereby the upper portion may be locked and sealed in the lower end portion of a well casing with the zone of lower strainer openings below the casing, a wash pipe extending downwardly within the tubular liner to a point near its lower end, means for detachably securing the wash pipe to the liner, two vertically spaced packers mounted on the wash pipe near the lower end thereof sealingly engaging the inner surface of the liner and defining within a limited lower portion of the strainer zone a vertically sealed off zone within the liner, an exit opening for washing fluid in the wash pipe between the two packers, and a third packer mounted on the wash pipe and sealing the annular space between it and the tubular liner at a level below the uppermost of the openings through the liner wall.

5. A screen liner and washer for wells, comprising in combination a tubular liner open at its upper end and which includes a vertically extended screen section in its lower portion, means carried by the upper portion of the tubular liner whereby the upper portion may be locked and sealed in the lower end portion of a well casing with the lower screen section extending below the casing, a wash pipe extending downwardly within the tubular liner to a point near the lower end of the screen section, means for detachably securing the wash pipe to the liner, two vertically spaced packers mounted on the wash pipe near its lower end sealingly engaging the inner surface of the screen section and defining a vertically sealed

off zone within a limited lower portion of the screen section, an exit opening for washing fluid in the wash pipe between the two packers, a port through the liner wall at a level spaced above the screen section and below the sealing means carried by the liner, a third packer mounted on the wash pipe sealing the annular space between it and the liner at a level between said port and the upper end of the screen section, and valvular means associated with said port adapted to occupy an initial position opening said port and operable by said wash pipe to close said port after washing is completed.

6. A screen liner and washer for wells, comprising in combination a tubular liner open at its upper end and which includes a vertically extended screen section in its lower portion, means whereby the upper portion of the tubular liner is sealed in the lower end portion of a well casing with the lower screen section extending below the casing, a wash pipe extending downwardly within the tubular liner to a point near the lower end of the screen section, means for detachably securing the wash pipe to the liner, two vertically spaced packers mounted on the wash pipe near its lower end sealingly engaging the inner surface of the screen section and defining a vertically sealed off zone within a limited lower portion of the screen section, an exit opening for washing fluid in the wash pipe between the two packers, a port through the liner wall at a level spaced above the screen section and below the sealing means carried by the liner, a third packer mounted on the wash pipe sealing the annular space between it and the liner at a level between said port and the upper end of the screen section, and valvular means associated with said port adapted to occupy an initial position opening said port and actuated by the wash pipe upon withdrawal thereof from the liner to close said port.

7. A screen liner and washer for wells, comprising in combination a tubular liner open at its upper end and which includes a vertically extended screen section in its lower portion, means whereby the upper portion of the tubular liner is sealed in the lower end portion of a well casing with the lower screen section extending below the casing, a wash pipe extending downwardly within the tubular liner to a point near the lower end of the screen section, means for detachably securing the wash pipe to the liner, two vertically spaced packers surrounding the wash pipe near its lower end sealingly engaging the inner surface of the screen section and defining a vertically sealed off zone within a limited lower portion of the screen section, an exit opening for washing fluid in the wash pipe between the two packers, a port through the liner wall at a level spaced above the screen section and below the sealing means carried by the liner, a third packer surrounding the wash pipe and engaging the liner at a level between said port and the upper end of the strainer section, valvular means mounted for vertical movement on the liner between positions covering and uncovering said port and yieldingly urged to move to cover the port, and a lock adapted to support the valvular means in the position uncovering the port and releasable by the wash pipe upon upward removal thereof from the liner to permit movement of the valvular means to cover said port.

8. A screen liner and washer for wells, com-

prising in combination a tubular liner open at its upper end and which includes a vertically extended screen section in its lower portion, means carried by the upper portion of the tubular liner whereby the upper portion may be locked and sealed in the lower end portion of a well casing with the lower screen section extending below the casing, a wash pipe extending downwardly within the tubular liner to a point near the lower end of the screen section, means for detachably securing the wash pipe to the liner, two vertically spaced packers mounted on the wash pipe near its lower end sealingly engaging the inner surface of the screen section and defining a vertically sealed off zone within a limited lower portion of the screen section, an exit opening for washing fluid in the wash pipe between the two packers, a port through the liner wall at a level spaced above the strainer section and below the sealing means carried by the liner, a third packer mounted on the wash pipe and engaging the liner at a level between said port and the upper end of the screen section, valvular means mounted for vertical movement on the liner between positions covering and uncovering said port and yieldingly urged to move to cover the port, and a locking bar adapted to support the valvular means in the position uncovering the port and engageable and removable by the said third packer as the wash pipe and packer are removed from the liner to permit movement of the valvular means to cover said port.

9. A screen liner and washer for wells, comprising in combination a tubular liner open at its upper end and which includes a vertically extended screen section in its lower portion, means carried by the upper portion of the tubular liner whereby the upper portion may be locked and sealed in the lower end portion of a well casing with the lower screen section extending below the casing, a wash pipe extending downwardly within the tubular liner to a point near the lower end of the screen section, means for detachably securing the wash pipe to the liner, two vertically spaced packers surrounding the wash pipe near its lower end sealingly engaging the inner surface of the screen section and defining a vertically sealed off zone within a limited lower portion of the screen section, an exit opening for washing fluid in the wash pipe between the two packers, a port through the liner wall at a level spaced above the screen section and below the sealing means carried by the liner, a third packer surrounding the wash pipe and engaging the liner at a level between said port and the upper end of the screen section, a valvular means for said port including a coiled spring encased in an annular rubber casing surrounding the liner near said port and having endwise abutment against a shoulder on the liner, said casing being adapted normally to cover said port, and to uncover the port when the spring is compressed, and locking means adapted normally to hold the spring in compression in a position with the casing uncovering said port and releasable by the wash pipe upon upward withdrawal thereof from the liner to permit the spring and casing to expand and cover the port.

10. A screen liner and washer for wells, comprising in combination a tubular liner open at its upper end and which includes a vertically extended screen section in its lower portion, means carried by the upper portion of the tubular liner whereby the upper portion may be locked and sealed in the lower end portion of a well

casing with the lower screen section extending below the casing, a wash pipe extending downwardly within the tubular liner to a point near the lower end of the screen section, means for detachably securing the wash pipe to the liner, two vertically spaced packers surrounding the wash pipe near its lower end sealingly engaging the inner section of the screen section and defining a vertically sealed off zone within a limited lower portion of the screen section, an exit opening for washing fluid in the wash pipe between the two packers, a port through the liner wall at a level spaced above the screen section and below the sealing means carried by the liner, a third packer surrounding the wash pipe and engaging the liner at a level between said port and the upper end of the screen section, valvular means for said port including a vertically expansive annular element surrounding the liner near said port and having endwise abutment against a shoulder on the liner, said annular element being adapted to cover said port when expanded, and to uncover said port when compressed, and locking means adapted normally to hold the annular element compressed and releasable by the wash pipe upon upward withdrawal thereof from the liner to permit expansion of the annular member.

11. A screen liner and washer for wells, comprising in combination a tubular liner open at its upper end and which includes a vertically extended screen section in its lower portion,

means carried by the upper portion of the tubular liner whereby the upper portion may be locked and sealed in the lower end portion of a well casing with the lower screen section extending below the casing, a wash pipe extending downwardly within the tubular liner to a point near the lower end of the screen section, means for detachably securing the wash pipe to the liner, two vertically spaced packers surrounding the wash pipe near its lower end sealingly engaging the inner surface of the screen section and defining a vertically sealed off zone within a limited lower portion of the screen section, an exit opening for washing fluid in the wash pipe between the two packers, a port through the liner wall at a level spaced above the screen section and below the sealing means carried by the liner, a third packer surrounding the wash pipe and engaging the liner at a level between said port and the upper end of the screen section, valvular means including a vertically expansive annular element surrounding the liner near said port and having endwise abutment against a shoulder on the liner, said annular element being adapted to cover said port when expanded, and to uncover said port when compressed, and a locking bar adapted normally to hold the annular element compressed and engageable and removable by the third packer upon upward movement thereof when the wash pipe is withdrawn from the liner to permit expansion of the annular member.

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