May 17, 1938. C. C. BROWN 2,117,836

COMBINED BACK PRESSURE VALVE AND WALL SCRAPER

Original Filed Aug. 27, 1936 2 Sheets-Sheet 1

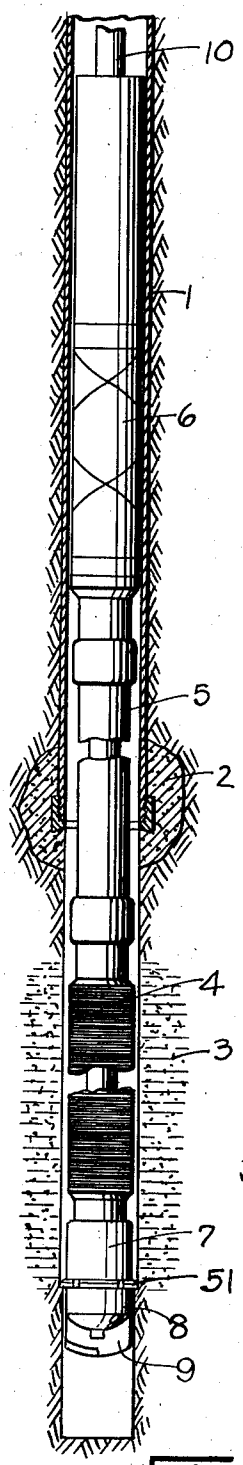


Fig. 1

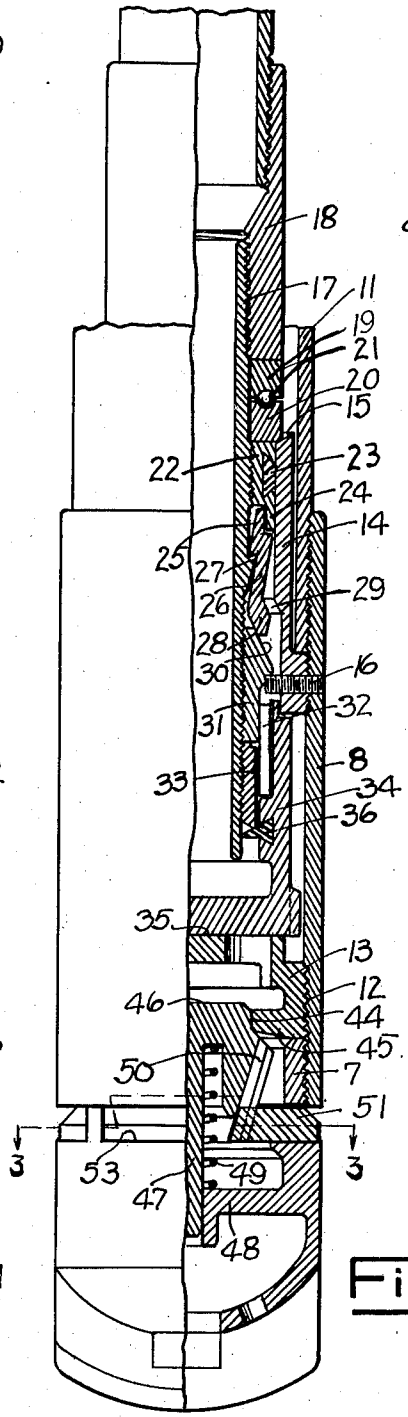


Fig. 2.

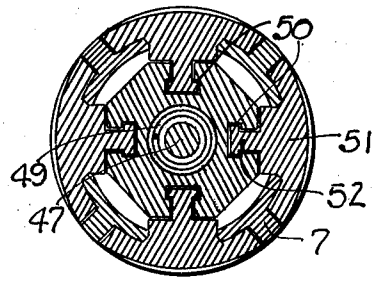


Fig. 3.

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COMBINED BACK PRESSURE VALVE AND WALL SCRAPER

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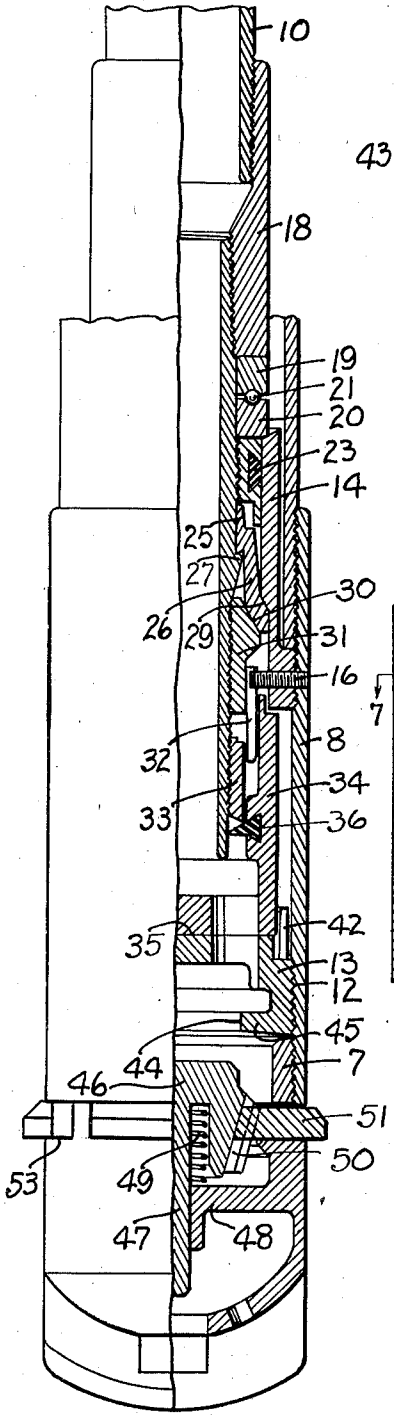


Fig. 4.

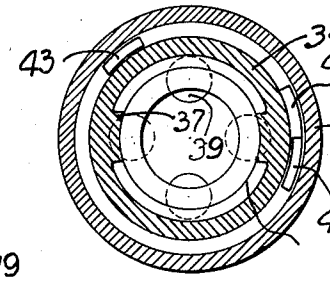


Fig. 7.

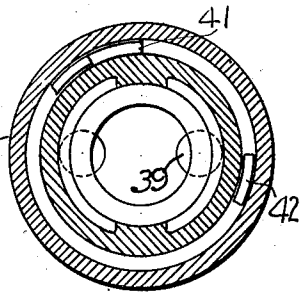


Fig. 8.

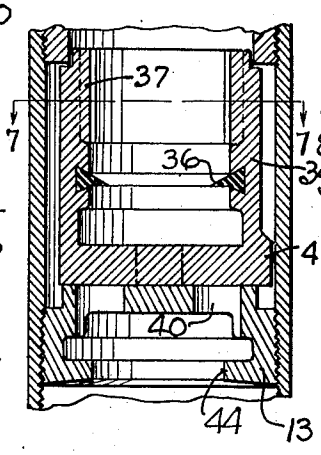


Fig. 5.

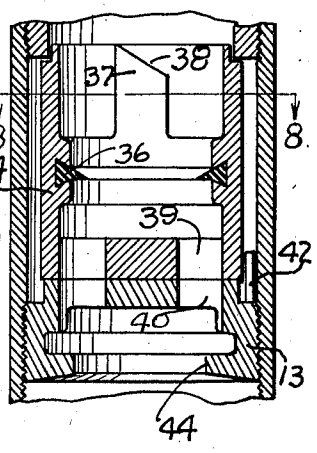


Fig. 6.

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Patented May 17, 1938 2,117,836

UNITED STATES PATENT OFFICE

2,117,836

COMBINED BACK PRESSURE VALVE AND WALL SCRAPER

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Application August 27, 1936, Serial No. 98,192
Renewed October 5, 1937

17 Claims. (Cl. 255—74)

My invention relates to devices for use in setting strainers and liners in wells.

When the casing has been set and the well drilled downwardly into the producing stratum it becomes necessary to lower the strainer into position to receive production from the formation. When this is done it is frequently found that the walls of the well below the casing are not fully open so as to allow the strainer to be introduced without injury thereto. This is ordinarily remedied either by continual washing of the well to get rid of material therein, or a wall scraper may be introduced to the lower end of the well and the hole carefully cleaned out to a larger diameter so that the strainer will not be injured when inserted into operative position.

It is an important object of my invention to provide, in connection with the back pressure valve below the strainer, a wall scraping device which may be used to clear off the interior of the well and expose the producing sand so that the oil and gas therefrom may easily enter the well.

I desire to provide a full open hole into which the strainer may be set without injury thereto.

It is a further object to provide a wall scraper of simple and cheap construction, which may serve the purpose of cleaning off the surface of the sand and opening up the hole, and after having served this purpose may be left in the well and form a part of the well equipment.

It is a further object to provide a back pressure valve which will normally be retained in closed position but which will open in response to fluid pressure and be moved downwardly to advance the wall scraping cutters into operative position.

It is a further object to arrange the cutters so that they will be automatically retracted when the back pressure valve is moved to closed position.

In the drawings herewith, Fig. 1 is a section of the lower end of the well with my improvement therein.

Fig. 2 is a side elevation of a back pressure valve and set shoe partly in elevation and partly in central vertical section.

Fig. 3 is a transverse section on the plane 3—3 of Fig. 1.

Fig. 4 is a view partly in elevation and partly in section showing the assembly illustrated in Fig. 2 with the parts in a different position.

Fig. 5 is a broken vertical section through a manually operated valve which is employed above the back pressure valve.

Fig. 6 is a similar view taken at right angles to the view shown in Fig. 5.

Fig. 7 is a transverse section on the plane 7—7 of Fig. 5.

Fig. 8 is a similar transverse section on the plane 8—8 of Fig. 6.

In Fig. 1 I have shown an assembly of parts in connection with which my invention may be employed.

It will be noted that the well has been reenforced by well casing 1 which has been cemented at the lower end as shown at 2. The well has then been drilled downwardly through the casing and into the producing stratum 3 so as to allow the strainer to be set therein. It will be understood that when the well is drilled in this manner mud is used as a circulating liquid to carry away the cuttings and this mud will plaster up the walls of the well and will in some cases materially close off the entrance of the producing fluid into the well. This inner surface of the producing stratum 3 is therefore sometimes scraped away as a separate operation after the well has been completed.

In setting my strainer, which is shown at 4, I have shown a liner 5 above the strainer at the upper end of which is a packer 6 of ordinary construction which, when the device is ready to be set at the lower end of the casing, may be expanded to seal off between the upper end of the liner 5 and the inner wall of the casing 1. Below the strainer I have shown a back pressure valve housing 7 having the usual set shoe 8 at the lower end upon which are forwardly extending blades 9.

When this assembly is introduced downwardly into the well a setting string 10 is employed. This setting string is of a substantial type of well tubing or flow pipe at the lower end of which is a setting tool. My particular setting tool is disclosed in Figs. 2 and 4 and is constructed so as to cooperate with the particular construction of the back pressure valve housing 7 and the setting barrel 8 thereon.

As will be seen from Figs. 2 and 4, the lower end of the pipe 11 below the strainer is screwed within the upper end of the setting barrel 8. Said setting barrel is an ordinary tubular member, the lower end of which is threaded at 12 to connect with the back pressure valve housing 7 and the valve seat 13. Within the upper end of the setting barrel 8 is a bushing 14 which extends upwardly within the liner 11 and is beveled at its upper end 15 to form a seat for the setting string. The bushing 14 is locked against

rotation by a set screw 16, the inner end of which projects through the bushing 14 and forms a stop member as will be later noted.

The setting string has at its lower end a connection with a mandrel 17, which extends downwardly within the liner and setting barrel, as will be clearly seen from the drawings. At the lower end of the coupling 18 which secures the mandrel to the setting string is an anti-friction bearing member including an upper ring 19, a lower ring 20, and an intermediate ball race 21. The upper ring 19 is held non-rotatably with the mandrel and the lower ring 20 is adapted to seat on the upper end of the bushing 14 in the seat 15 and form a support during the rotation of the setting string.

Below the ring 20 is a collar 22 which has on its outer face a sealing ring 23 which engages the inner face of the bushing 14 and forms a seal therewith. This collar has a downwardly extending flange 24 on its outer side, which engages over an upwardly extending arm 25 upon each of the latching dogs 26.

The latching dogs 26 are supported between their ends upon a shoulder 27 on the outer face of the mandrel. The lower end of each dog is formed with an outwardly extending finger 28 thereon, which is adapted to be clamped between an upper shoulder 29 upon the bushing 14 and a lower shoulder 30 on the upper end of a latching collar 31.

Said latching collar 31 is screwed upon the outer surface of the mandrel and may be moved thereon by the relative rotation of the mandrel. Adjacent the upper end of the latching collar the thickness of the same is increased outwardly to form a beveled seat 30 to engage with the latching dogs. At the lower end of the latching collar 31 is an outwardly extending key 32. This key extends downwardly below the lower end of the collar and is of assistance in the operation of the device, as will be later described.

Below the latching collar is a lock ring 33 screwed on the outer face of the mandrel and intended as a stop to limit the downward movement of the latching collar. Below the latching mechanism I have provided a valve which may be rotated by means of the setting string. This valve includes an upper valve operating sleeve 34, which rests at its lower end upon a valve seat 35 formed at the upper end of the seat ring 13. Said operating sleeve is spaced from the inner wall of the setting barrel and is of sufficient interior diameter to allow the movement downwardly therein of the key 32 on the latching collar. Spaced somewhat from the lower end the wall of the collar is somewhat thickened inwardly and a sealing gasket 36 is set therein, said gasket being approximately triangular in shape and having an inner lip extending into the valve operating sleeve so as to engage with the setting string. With reference particularly to Figs. 5 and 6, it will be noted that there are formed on the inner face of the valve-operating sleeve two opposed lugs 37 which, as will be seen particularly in Fig. 6, are beveled at 38. These lugs are adapted to cooperate with the key 32 upon the setting string to cause the rotation of the operating sleeve 34 in the movement of the valve. At the lower end of the valve operating sleeve is a partition closing said lower end except for two opposed openings 39 therein. Said openings are adapted by the rotation of the operating sleeve to be brought into or out of registration with openings 40 in the valve member below. On the outer face of the operating sleeve I have provided a projection 41 at the lower end thereof, which, as seen in Figs. 7 and 8, is adapted to contact with stop members 42 and 43 on the seat member 13 and limit the extent of movement of the operating sleeve.

The valve seat member 13 previously mentioned has two valve seats thereon, an upper valve seat 35, previously mentioned, and a lower valve seat 44, for the back pressure valve. Said seat 44 is formed on the inner margin of a flange or partition 45 which extends inwardly from the seat member 13. It cooperates with the back pressure valve 46 to close the passage upwardly from below as is common with back pressure valves.

The back pressure valve 46 is of special construction. It has a downwardly extending stem 47, which extends through a spider 48 in the set shoe which acts as a guide for the valve. A spring 49 bearing at its lower end on the spider 48 engages the lower face of the valve and tends to hold the valve resiliently upward into its seat. The outer face of the valve toward its lower end is tapered downwardly and a dovetailed groove 50 is formed therein for engagement with the scraping blades 51. This will be understood particularly from Fig. 3. There are four dovetailed or mortised grooves 50 which cooperate with the scraping blades 51.

The scraping blades are arcuate on their outer faces as will be understood from Fig. 3. They fit within recesses through the wall of the housing 7 and have an inwardly extending tenon 52 fitting within the mortised groove 50 and are thus slidable vertically in the grooves 50 and are constrained to move outwardly or inwardly in response to the downward or upward movement of the back pressure valve. On their lower sides the scraping plates are supported upon a shoulder 53 on the upper end of the valve housing and set shoe. It will be understood, therefore, that when the fluid is circulated downwardly through the setting string the valve 46 will be unseated and moved downwardly so as to advance the scraping blades 51 into the position shown in Fig. 4 and the vertical reciprocation of the string thereafter will scrape the walls of the hole in the manner shown in Fig. 1, so as to open up the producing stratum and to provide full clearance for the screen. Also the tool may be rotated in scraping the hole. This is accomplished in rotating the string in a direction the reverse of that necessary to release the setting tool from the screen.

In introducing the assembled liner and screen into the well the parts are locked together as shown in Fig. 4. The latching collar 31 is screwed upwardly upon the latching dogs so that they will clamp against the shoulder 29 and the parts will thus be held firmly together. A seal will be formed above the latching dogs by the ring 23 and below the latching dogs the sealing ring 36 will cut off circulation around the latching mechanism.

When the device has been lowered so as to clear the lower end of the casing and the cement, fluid may be circulated downwardly through the string against the back pressure valve so as to move the scraping blades 51 outwardly, as shown in Fig. 4, in position to scrape the wall of the well. The blades are spaced apart sufficiently to provide a passage upwardly between the blades for material scraped off the inner wall of the well and this material will thus be washed upwardly to the surface. When the wall has been scraped

sufficiently to allow the string to rest upon the bottom of the well the circulation may be cut off so as to permit the valves to close and the scraping blades to be withdrawn by the upward thrust of the spring 49 on the back pressure valve. The setting string will then be unlatched and released and the upper valve closed. In doing this, the setting string which will be supported at the upper end of the bushing 14, will be rotated so as to screw the latching collar 33 downwardly. The keys 32 upon the latching collar will be in contact with the screw 16, as will be seen in Fig. 4. This will form a positive stop for the latching collar so that when the mandrel is rotated it will move the latching collar downwardly to bring the lower end of the key 32 into engagement with the lug 37 at the upper end of the operating sleeve 34 of the valve. The key will move away from the screw 16 and when the latching collar engages the upper end of the lock ring 33 the latching collar will be compelled to rotate with the mandrel and will move the operating sleeve 34 around so as to engage the lug 41 thereon with the stop member 43 and close the valve by bringing the openings 39 in the operating sleeve out of registration with the opening 40 in the seat. The screwing of the latching collar downwardly will release the latching dogs as shown in Fig. 2, and when the valve has been closed the setting string may be moved upwardly from the well. It will be obvious therefore that the setting string may be employed as a tube to flow the liquid from the well and, in case this is desired, the same string may be moved upwardly to the desired level and may remain in the well to act as tubing in the flowing of the liquid.

It will be seen that I have provided an efficient means for scraping the wall of the well during the time the well is being washed and before the strainer is set. This scraper is operated through connection with the ordinary back pressure valve and a simple and economical construction is provided which will allow the operator to abandon the scraper at the lower end of the well during the production thereof. The features of the setting tool are not a part of the present invention, the invention residing in the combination between the back pressure valve and its parts with the wall scraper and the connection therewith.

What is claimed as new is:

1. A combination back pressure valve and wall scraper including a housing having a passage therethrough, a valve seat in said passage, a downwardly opening valve therein, means to hold said valve resiliently in said seat, laterally slidable scraping blades mounted in said housing, and means on said valve engaging said blades to control their lateral movement.

2. A combination back pressure valve and wall scraper including a housing having a passage therethrough, a valve seat in said passage, a downwardly opening valve therein, means to hold said valve resiliently in said seat, laterally slidable scraping blades mounted in said housing, and means on said blades responsive to the movement of said valve to advance or retract said blades.

3. A housing having a fluid passage therethrough, an upwardly closing back pressure valve therein, downwardly tapered mortised grooves in said valve, laterally movable scraping blades in said housing engaging in said grooves, so that vertical movement of said valve will move said blades to or from said housing.

4. A housing having a fluid passage therethrough, an upwardly closing back pressure valve therein, downwardly tapered mortised grooves in said valve, laterally movable scraping blades in said housing engaging in said grooves, said valve being movable downwardly to advance said blades outwardly in response to fluid pressure thereon.

5. A back pressure valve housing for deep wells, said housing having a fluid passage, a valve therein, a spring to hold said valve normally closed, laterally movable wall scraping blades in said housing, means on said valve engaging with said blades to move said blades outwardly to wall scraping position in response to fluid pressure on said valve, and means to seal off the entrance of fluid from above to said valve.

6. A back pressure valve housing for deep wells, said housing having a fluid passage, a valve therein, a spring to hold said valve normally closed, laterally movable wall scraping blades in said housing, means on said valve engaging with said blades to move said blades outwardly to wall-scraping position in response to fluid pressure on said valve, and means operated from the upper end of the well to seal off the entrance of fluid from above to said valve.

7. A well strainer, a back pressure valve housing at the lower end thereof, an upwardly closing back pressure valve in said housing, means in said valve housing to scrape the wall of the well as said strainer is being moved downwardly to set position, said scraping means being moved to operative position in response to the downward movement of said valve under fluid pressure.

8. A well strainer, a back pressure valve housing at the lower end thereof, an upwardly closing back pressure valve in said housing, means in said valve housing to scrape the wall of the well as said strainer is being moved downwardly to set position, said scraping means being moved to retracted position when said strainer is set by the closing of said valve.

9. A well strainer, a back pressure valve housing at the lower end thereof, an upwardly closing back pressure valve in said housing, means in said valve housing to scrape the wall of the well as said strainer is being moved downwardly to set position, said scraping means being moved to operative position in response to the downward movement of said valve under fluid pressure, and means operative through the rotation of said strainer to close off the flow of fluid downwardly to said valve.

10. A well strainer, a back pressure valve housing at the lower end thereof, an upwardly closing back pressure valve in said housing, means in said valve housing to scrape the wall of the well as said strainer is being moved downwardly to set position, said scraping means being moved to operative or inoperative position in response to vertical movement of said valve under fluid pressure, and a valve above said back pressure valve operated to close off said fluid pressure through rotation of said strainer.

11. A well strainer, means associated therewith to scrape the walls of the well when said strainer is being lowered to set position, means to normally retract said scraping means, and fluid operated means to advance the same to scraping position.

12. A well strainer, a wall scraper connected with the lower end thereof, means responsive to fluid pressure from above to move said scraper to scraping position, and means normally acting

to move said scraper to retracted, inoperative position.

13. A well strainer, a back pressure valve housing at the lower end thereof, an upwardly closing back pressure valve in said housing, means below said strainer to scrape the wall of the well as said strainer is being moved longitudinally in the well, said scraping means being moved to operative position in response to the downward movement of said valve under fluid pressure.

14. A well strainer, a back pressure valve housing at the lower end thereof, an upwardly closing back pressure valve in said housing, and means associated with said strainer to scrape the wall of the well as said strainer is being moved longitudinally therein, said scraping means being moved to retracted position by the closing of said valve when said strainer is set.

15. A well strainer, scraping blades associated with the lower end thereof to scrape the wall of the well while said strainer is introduced therein, and means to retract said blades to inoperative position when said strainer is set.

16. A well strainer, scraping blades associated with the lower end thereof to scrape the wall of the well while said strainer is introduced therein, said blades being normally held in retracted inoperative position, and means under the control of the operator to advance said blades to cutting position when desired.

17. A well strainer, scraping blades associated with the lower end thereof to scrape the wall of the well while said strainer is being introduced therein, said blades being extended beyond the diameter of the well to enlarge the well hole ahead of said strainer.

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