March 13, 1945. C. J. HAYNES 2,371,391

SCREEN FOR WELLS

Filed Jan. 2, 1943

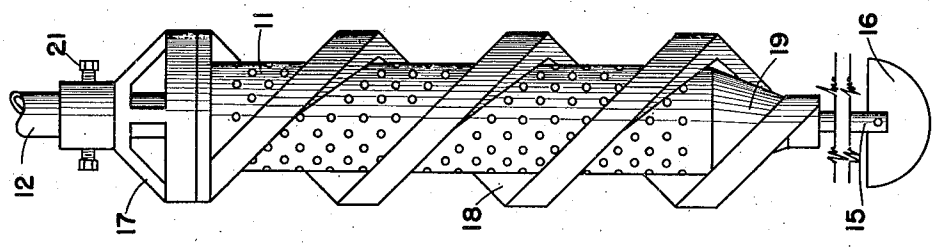


FIG. 5.

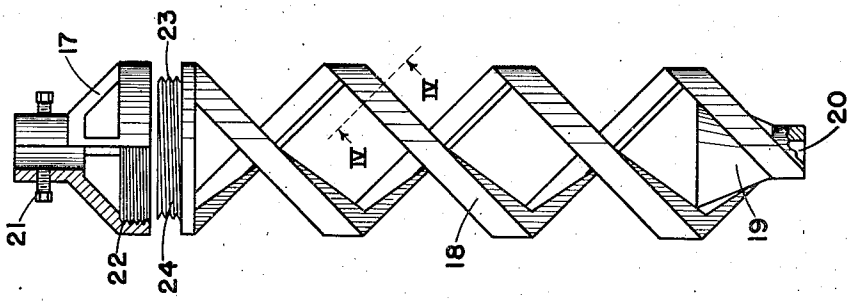


FIG. 3.

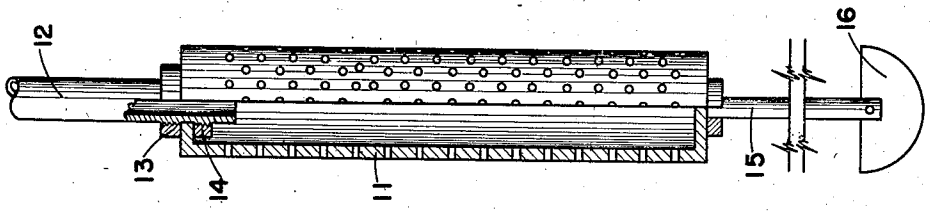


FIG. 2.

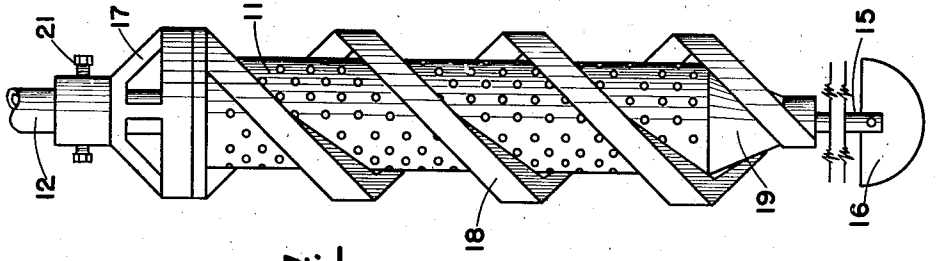


FIG. 1.



FIG. 4.

Cecil J. Haynes. INVENTOR.

BY J. O. McKean

ATTORNEY.

Patented Mar. 13, 1945

2,371,391

UNITED STATES PATENT OFFICE

2,371,391

SCREEN FOR WELLS

Cecil J. Haynes, Houston, Tex., assignor to Standard Oil Development Company, a corporation of Delaware

Application January 2, 1943, Serial No. 471,101

3 Claims. (Cl. 166—5)

The present invention is directed to a device suitable for application to gravel packed wells or for use in the gravel packing of wells.

The present invention may be described briefly as comprising a screen swivelly attached to the lower end of a string of tubing with a spiral conveyor arranged around the screen and secured to the tubing for rotation therewith.

This arrangement allows the screen to be forced into a pack of gravel after the gravel has been placed in the well. Another use of the device is for agitating the gravel pack to sift the gravel and open clogged portions of the screen by rotating the spiral without allowing longitudinal movement of the tubing. The device of the present invention is also suitable for use in placing gravel, as for example, when employing the device shown in Patent 2,224,538, issued Dec. 10, 1940, to John E. Eckel et al. and entitled "Method and apparatus for gravel-packing wells," in which case it is desirable for the screw conveyor to be used to force the discharged gravel downward and distribute it around the screen.

Other objects and advantages of the present invention may be seen from a reading of the following description taken with the drawing, in which—

Fig. 1 is a front elevation of a preferred embodiment of the present invention;

Fig. 2 is a view, partly in section, of a portion of the device shown in Fig. 1 with the spiral conveyor removed therefrom;

Fig. 3 is a view of the parts not shown in Fig. 2 used to make up the complete unit illustrated in Fig. 1;

Fig. 4 is a view along IV—IV of Fig. 3; and

Fig. 5 is an elevation of an embodiment similar to that shown in Fig. 1, but with the spiral conveyor reversed for use in distributing gravel in gravel packing wells.

A wire screen or perforated pipe 11 is secured to the lower end of tubing or drill pipe 12 by means which allows the drill pipe to swivel with respect to the screen. A suitable means for attaching the screen and tubing is illustrated in the drawing involving bushings 13 and 14 secured by suitable screw threads to the lower end of the string of tubing with the top of the screen retained between them.

A rod 15 extending from the lower portion of the screen has secured thereto an anchor 16. The anchor may be described briefly as formed of a sheet of metal with a downwardly extending knife edge which moves ahead of the screen while it is being forced down through a gravel pack and which prevents the rotation of the screen 11 when tubing 12 is being rotated without longitudinal movement.

The remainder of the assembly as shown in Fig. 3 consists of a spider 17, helical flanges 18, and tip 19. The helical flanges are secured to the tip by suitable means, such as by welding. A central passage 20 extends through the tip to allow the tip to be journaled on rod 15. The upper end of spider 17 forms a collar closely embracing tubing 12 and arranged to be secured thereto by suitable means, such as set screw 21. The lower portion of spider 17 is of substantially the same diameter as the helical flanges and is provided with suitable screw threads 22 to cooperate with screw threads 23 formed on an annulus 24, to which the upper ends of the helical flanges are attached.

It will be understood that there is appreciable clearance between members 18 and screen 11. It also will be seen from the drawing that below the screen the members 18 taper inwardly. The tapering of the lower ends of the flanges causes the tool readily to enter a sand or gravel pack. The flanges rotate with tubing 12, while the inner screen 11 may be held stationary by anchor 16.

If a pack of gravel has been placed in the lower end of a borehole and it is desired to insert the tool of the present invention into the pack, the tubing with the tool secured to the lower end thereof may be lowered into the borehole until it engages the upper portion of the pack. The weight of the tubing may then be allowed to rest on the tool, whereupon rotation of the tubing will cause a corresponding rotation of flanges 18 and the tapering lower portion of the flanges will serve to lift the gravel or sand up and along the outside of the screen.

The flanges will remove the gravel or sand from immediately below the screen and transport it to the top of this screen, thereby allowing the screen to move downward into the gravel pack.

After the tool is placed as above described production may be obtained through the screen in the usual manner. If at any later date the pack has become contaminated and openings in the pack and screen clogged by paraffin or similar material, the gravel pack may be agitated to renovate the gravel pack. This may be done by rotating tubing 12 without allowing longitudinal movement of the tubing. This rotation lifts gravel from adjacent the lower portion of the screen and forces it upwardly, at the same time

cleaning the screen by the relative rotation between members 18 and the outer surface of this screen.

Another use of the device of the present invention is in placing gravel in the borehole by use of normal circulation, as described in U. S. Patent No. 2,224,538. In the above mentioned patent, the gravel is deposited in the well by releasing it through a valve at the top of the liner and allowing it to settle downwardly under the influence of gravity. When employing the tool for placing gravel, the spiral flanges should be arranged so that rotation of the drill pipe will force the flanges to carry the gravel downwardly. Since it is the usual practice to have right-hand threads on the drill pipe, it is desirable to arrange the flanges as illustrated in Fig. 5 of the drawing. By attaching the tool illustrated in Fig. 5 to the lower end of the tubing and releasing the gravel from the tubing above the screen, the rotation of the tubing causes the conveyor to carry the gravel downwardly and positively form a uniform gravel pack. The advantage of using the tool described in the present application for depositing gravel is that it prevents bridging of the gravel and insures the formation of a gravel pack without cavities.

Having fully described and illustrated preferred embodiments of the present invention, what I desire to claim is:

1. A borehole tool comprising, in combination, a screen adapted to be secured to the lower end of a string of tubing, means arranged to connect swivelly the screen to said tubing, an anchor secured to said screen, and a spiral conveyor arranged over said screen and attached to said tubing for rotation therewith.

2. A borehole device comprising, in combination, a well screen, means swivelly securing the upper end of said screen to the lower end of a string of tubing, an anchor secured to the lower end of said screen, and a member secured to the lower end of the tubing concentric with said screen and extending the length of the screen, whereby said member may be given annular movement with respect to said screen.

3. A borehole tool adapted to be secured to the lower end of a string of tubing comprising, in combination, an elongated screen, means swivelly connecting the upper end of said screen to the lower end of said string of tubing, a flat sharp-edged anchor, a rod extending along the longitudinal axis of said screen having its upper end secured to the lower end of said screen and its lower end secured to said anchor, a conveyor arranged over said screen with the portion adjacent the screen helical and its lower end extending below said screen and tapering inwardly, and means securing said conveyor to the lower end of said tubing for rotation therewith.

CECIL J. HAYNES.