H. M. GREEN.

PUMPING APPARATUS.

APPLICATION FILED JULY 20, 1918. RENEWED APR. 17, 1922.

1,437,939. Patented Dec. 5, 1922.

2 SHEETS—SHEET 1.

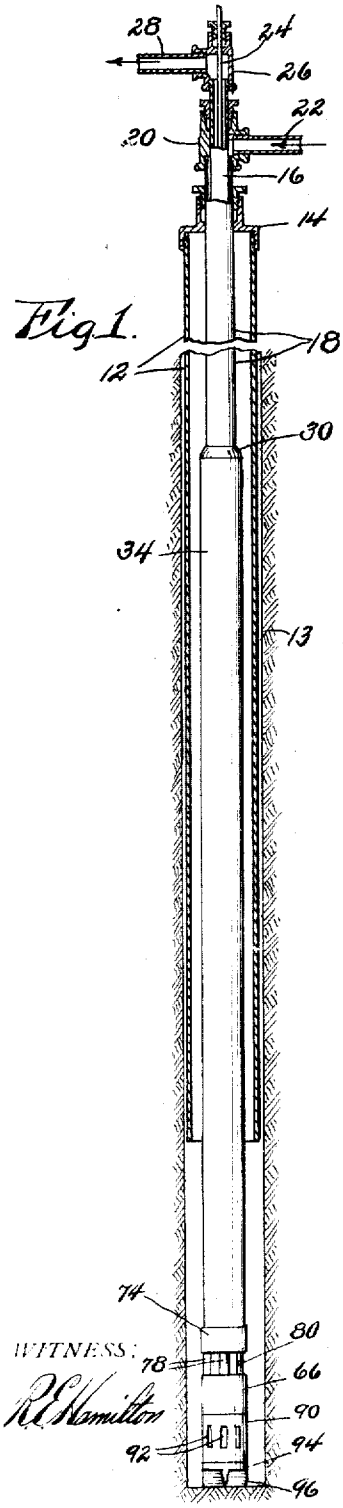


Fig. 1.

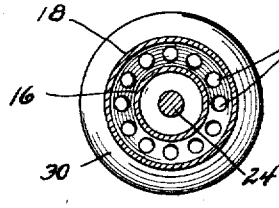


Fig. 5.

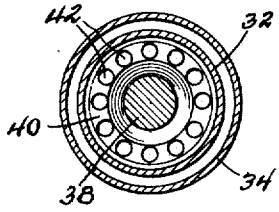


Fig. 6.

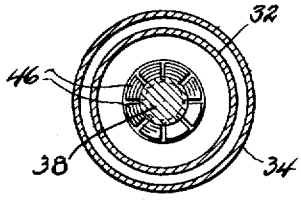


Fig. 7

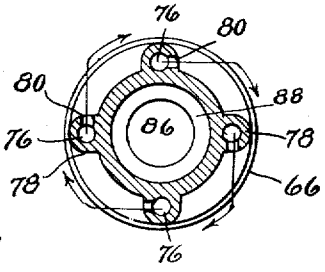


Fig. 8.

Fig. 10.

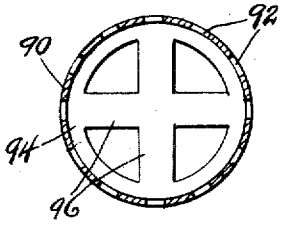
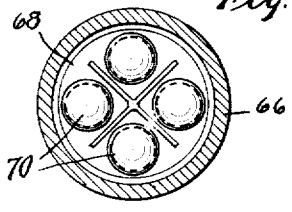


Fig. 9.



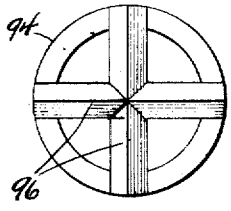


Fig. 11.

WITNESS:

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2 SHEETS—SHEET 2.

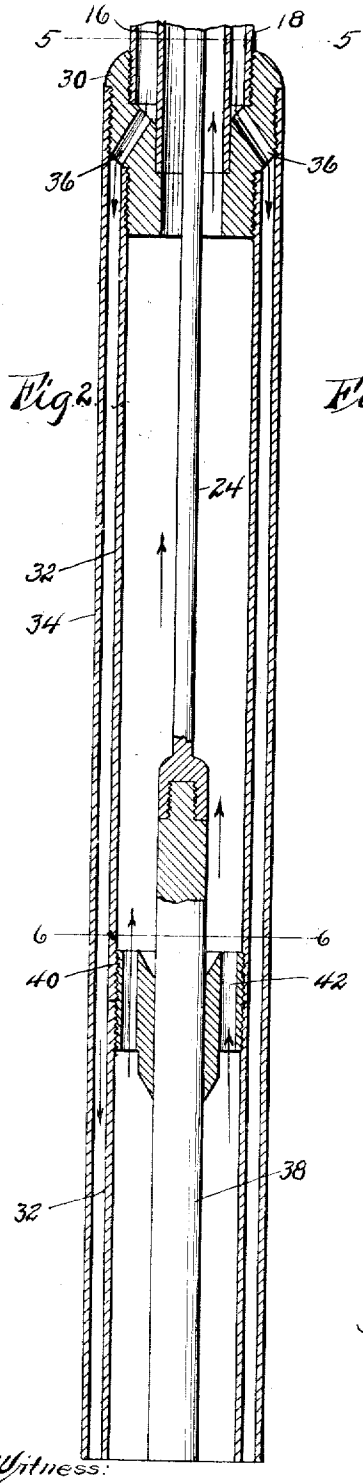


Fig. 2.

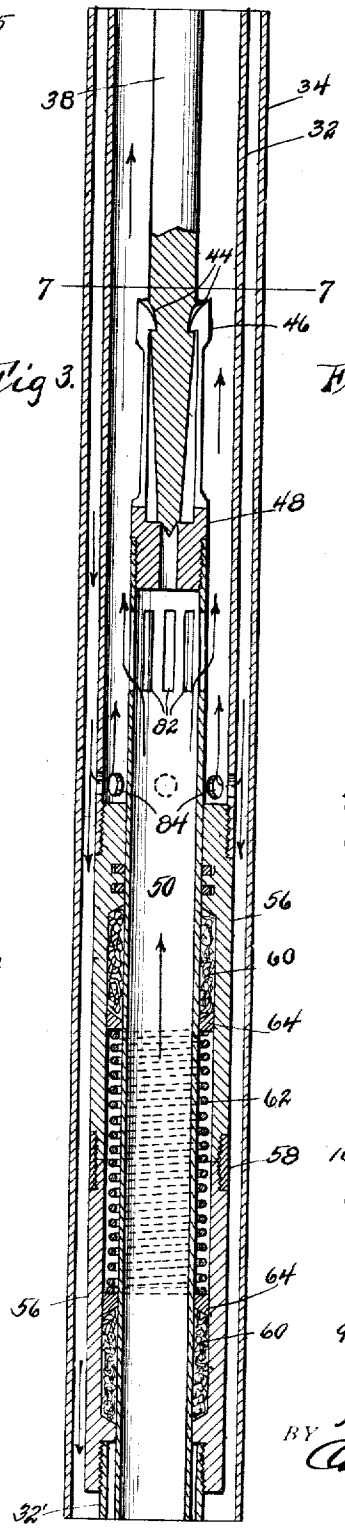


Fig. 3.

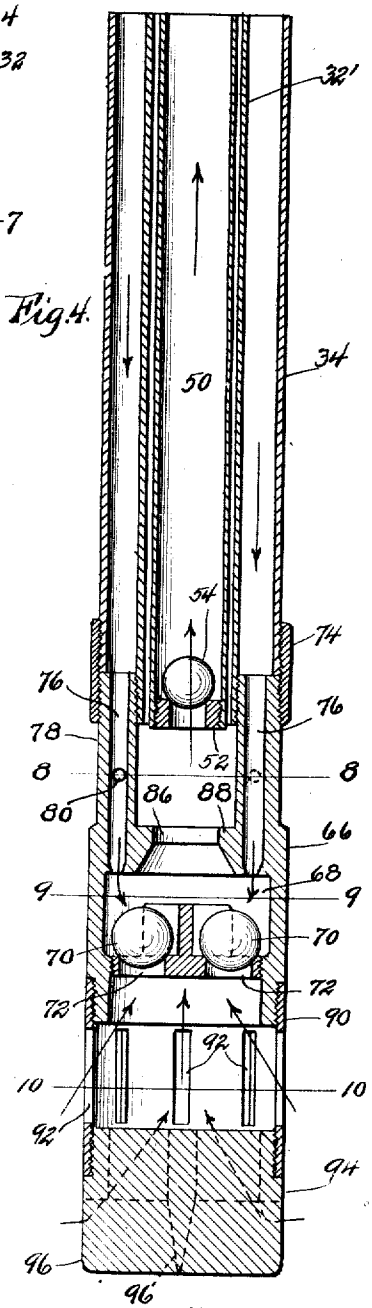


Fig. 4.

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Patented Dec. 5, 1922. 1,437,939

UNITED STATES PATENT OEFICE.

HENRY M. GREEN, OF LOS ANGELES, CALIFORNIA.

PUMPING APPARATUS.

Application filed July 20, 1918, Serial No. 245,945. Renewed April 17, 1922. Serial No. 553,931.

To all whom it may concern:

Be it known that I, HENRY M. GREEN, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles, State of California, have invented certain new and useful Improvements in Pumping Apparatus, of which the following is a full and exact specification.

The present invention relates to apparatus for use in pumping wells, such as oil wells and the like, and one of the objects in view is to devise an improved pumping construction in which means is provided for utilizing a fluid pressure flow in cooperation with mechanical pumping means for producing a continuous and more effective pumping action by the joint operation of said fluid pressure and mechanical means.

Another object of the invention is to provide an apparatus of the character described in which provision is made for utilizing said fluid pressure flow for exerting a well cleaning action around the outside of the pumping structure at the bottom of the well.

A further object is to provide an improved pumping apparatus whereby a chopping action may be effected around the base of the apparatus for loosening up the material at the bottom of the well so that said material may be freed and removed by the pumping action and said apparatus allowed to settle further within the well.

It is also sought to devise a simple and compact arrangement and construction for the purpose stated, and which will be both efficient and economical in its operation.

With these general objects in view, as well as minor objects which will appear in the course of the following specification, the invention will now be described in detail with reference to the accompanying drawings illustrating one form of construction which has been devised for embodying the proposed improvements, after which the novel features therein will be set forth and defined in the appended claims.

In the drawings—

Figure 1 is a vertical sectional elevation illustrating a pumping apparatus constructed in accordance with the present invention;

Figures 2, 3 and 4 are vertical sectional views, on a larger scale, illustrating the upper, intermediate and lower portions, respectively, of the enlarged working portion of the pump tubing structure;

Figures 5 and 6 are transverse sections taken on the lines 5—5 and 6—6, respectively, of Figure 2;

Figure 7 is a similar transverse section taken on the line 7—7 of Figure 3;

Figures 8, 9 and 10 are similar transverse sections taken on the lines 8—8, 9—9 and 10—10, respectively, of Figure 4; and

Figure 11 is an inverted plan view of the foot-piece member of said tubing structure.

Referring to the said drawings in detail, these show (see Figure 1) a well casing 12 adapted to be positioned in the well bore 13 and extending in practice more or less nearly to the bottom of the well. Through a packing collar 14 at the top of said casing extends the upper end of a tubing structure comprising the inner and outer tubing 16 and 18, respectively, the latter carrying a packing casting 20 provided with an inlet pipe 22 adapted to be connected with any suitable source of fluid pressure supply (not shown) for a purpose hereinafter explained. A plunger rod 24 is operated within the tubing 16 by any suitable mechanical means (not shown), said rod extending out through a packing casting 26 at the upper end of said tubing, which is also provided with an outlet pipe 28 for the discharge of the material pumped up through said tubing 16.

The lower ends of the tubing 16 and 18 are connected by means of a suitable coupling 30 to the upper ends of the inner and outer enlarged tubing 32 and 34, respectively, adapted to be let down into the bottom portion of the well. Ports 36 (see Figures 2 and 5) provide communication between the annular space between the inner and outer tubing 16 and 18 and the annular space between the inner and outer tubing 32 and 34. The rod 24 extends through and below the coupling 30 and is connected to a rod 38 of larger diameter operating through an internal bearing coupling 40 joining sections of the tubing 32 and provided with ports 42 (Figure 6) to permit passage of the fluid past said coupling 40. The lower end portion of the rod 38 is formed with recesses 44 adapted to be detachably engaged by a plurality of spring clutch fingers 46 (see Figures 3 and 7) provided on the head 48 of a plunger tube 50,

the lower end of which is fitted with an internal collar 52 supporting a ball inlet valve 54. The rod 38 is adapted to be disconnected from the plunger tube by the raising of said rod so as to engage the fingers 46 with the tapered lower end portion 54 of the bearing coupling 40, thereby spreading said fingers out of the recesses 44 and releasing the rod 38.

The plunger tube 50 operates through a packing structure comprising a sectional packing cylinder 56 (see Figure 3), the sections of which are connected by a coupling 58, said sections inclosing packing 60 which is automatically compressed in opposite directions by means of a coil spring 62 and followers 64. The upper section of the cylinder 56 is threaded into the lower end of the inner tubing 32, while the lower section of said cylinder has threaded thereinto an inner tubing section 32′ of smaller diameter than the tubing 32. The lower end of this section 32′ is threaded into the top of a casting 66 (see Figures 4 and 9) which provides a valve chamber 68 having a plurality of ball inlet valves 70 controlling the inlet ports 72. The upper end of the casting 66 is also secured by a coupling 74 to the lower end of the outer tubing 34, and passages 76 are provided, leading from the valve chamber 68 to the annular space between said outer tubing 34 and the tubing section 32′. These passages 76 extend through vertical rib formations 78 so that jet outlet ports 80 may be provided, communicating with the passages 76 and leading out in directions approximately tangential to the well bore (see Figures 1, 4 and 8). The upper end of the plunger tube is provided with outlet openings 82, and the lower end of the tubing 32 is provided with ports 84 adjacent the top of the packing cylinder 56 and below the lowermost working position of the outlet openings 82 of the plunger tube. The valve chamber 68 communicates with the plunger tube 50 by way of a passage 86 around which is formed a ledge 88 adapted to support said plunger tube when disconnected from the rod 38 for any reason, as in the knocking down or assembling of the apparatus.

To the bottom of the casting 66 is secured a cylindrical section 90 provided with the side inlet openings 92, and to the lower end of this section 90 is attached a footpiece 94 of skeleton form having its bottom face provided with a plurality of radial wedge-shaped elements 96 (see Figure 11) for engagement with the bottom of the well.

In the operation of the apparatus, the plunger 50 is reciprocated by any suitable mechanical means applied to the rod 24, and a fluid under powerful pressure is admitted through the pipe 22 into the outer chamber which is formed between the inner and outer tubing 16 and 18 as well as between the inner and outer tubing 32 and 34. With the tubing structure arranged as described, the fluid pressure is obviously confined by the outer tubing and the flow of said fluid restricted to the path indicated by the arrows in Figures 2 to 4; a part of said flow being admitted through the ports 84 into the inner or pumping chamber occupied by the plunger, while the remainder of the flow proceeds down to the passages 76, the outlet ends of which are constricted in order to force some of the fluid out in jets through the ports 80, the rest of the fluid passing through the valve chamber and up into the plunger tube. By this means a fluid pressure flow is produced which cooperates with the mechanical action of the plunger in effecting a more efficient and continuous pumping operation in the inner chamber; and at the same time this fluid flow is so confined as not to waste the fluid or its pressure in flooding the oil sands (as would result from throwing the pressure upon the walls of the well), and by being so confined the action of the fluid pressure is rendered that much more direct, economical and effective. Again, the fluid flow, on leaving the outer chamber and entering through the ports 84 into the inner or pumping chamber (which is of smaller cross-sectional area), is accelerated in velocity and the force of its movement within said inner chamber thereby increased. In the working strokes of the plunger the openings 82 do not descend to the level of the inlet ports 84, and consequently the fluid pressure flow entering through said ports is at all times behind that issuing from the plunger and drives this on in front of it. The combined flow which thus results and is delivered from the pipe 28 at the top of the well comprises the fluid admitted under pressure through the pipe 22 and mingled with the liquid, such as oil, which is lifted up by the plunger, together with such sand and other material as is mixed therewith.

The fluid jets which are forced out through the ports 80 exert a washing action around these points near the bottom of the well so as to loosen the sand and other solid material in this vicinity; but such liquid as is thus used for washing purposes is at once sucked back into the pumping apparatus, with the oil and sand, through the openings 92, and on passing the valves 70 mixes with any of the fluid which has entered the valve chamber directly from the passages 76. The proper sizes of passages 76 and ports 80 and 84 will be maintained for obtaining the most effective results as regards the action of the fluid pressure flow. The described packing structure serves to seal the inner or pumping chamber while at the same time preserving the packing itself free

from any contact with the sands. It will be understood also that by manipulating the apparatus so as to raise and lower the foot-piece 94, and also slightly turning the same, a chopping action may be exerted upon the bottom of the well through the medium of the wedge-shaped ribs 96, whereby the sands and other material forming the bottom of the well may be loosened and broken up and the pump tubing thus allowed to settle further on down into such material,—this material being finally pulverized and sucked into the apparatus with the liquid flow.

Having described the invention, what I claim as new and desire to secure by Letters Patent is:

1. A well pumping apparatus comprising a pumping cylinder, mechanical pumping means operating within said cylinder, means for conducting a confined flow of fluid under pressure and admitting the same to said cylinder near its lower end for cooperating with said pumping means in effecting a pumping action upward through said cylinder, and means associated with said fluid pressure means for producing an outward and approximately congential jet flow at the bottom of said apparatus for washing the bottom of the well.

2. A well pumping apparatus comprising a tubing structure forming an inner chamber and an outer chamber both extending substantially entirely from the top to the bottom of the well, said outer chamber having valved inlet ports at its lower end and also a series of outlet ports above said inlet ports permitting a continuous restricted outflow from said outer chamber, mechanical pumping means operating within said inner chamber, said chambers being provided with communicating ports near the bottom of the well, and means for admitting fluid under pressure at the top of said outer chamber, whereby a fluid pressure may be exerted in cooperation with said mechanical pumping means for effecting a pumping action upward through said inner chamber and also producing a jet flow out through said outlet ports for washing the bottom of the well.

3. A well pumping apparatus comprising a tubing structure forming an inner chamber and an outer chamber both extending substantially entirely from the top to the bottom of the well, said inner chamber being provided with packing near its lower end and a valved plunger operating thruogh said packing, said chambers being provided with communicating ports above said packing and said outlet chamber being also provided with valved inlet ports at its lower end and with a series of approximately tangentially arranged outlet ports adjacent said inlet ports for permitting a continuous restricted outflow from said outer chamber, and means for admitting fluid under pressure at the top of said outer chamber whereby a fluid pressure may be exerted in cooperation with said plunger for effecting a pumping action upward through said inner chamber and also producing a jet flow out through said outlet ports for washing the bottom of the well.

In witness whereof I hereto affix my signature.

HENRY M. GREEN.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,437,939, granted December 5, 1922, upon the application of Henry M. Green, of Los Angeles, California, for an improvement in "Pumping Apparatus," an error appears in the printed specification requiring correction as follows: Page 3, line 27, claim 1, for the word "congential" read *tangential;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of January, A. D., 1923.

[SEAL.]

KARL FENNING,

Acting Commissioner of Patents.