

Feb. 9, 1943.

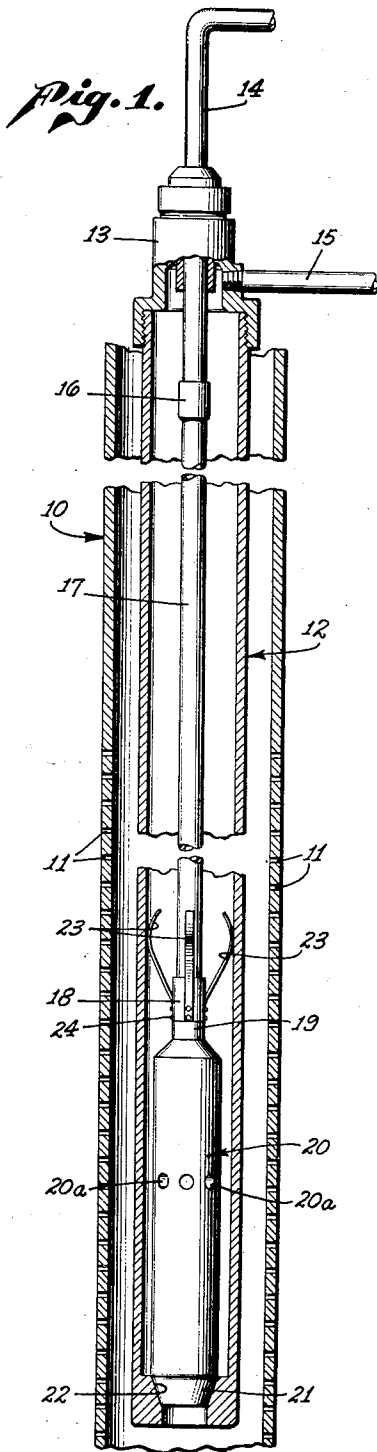
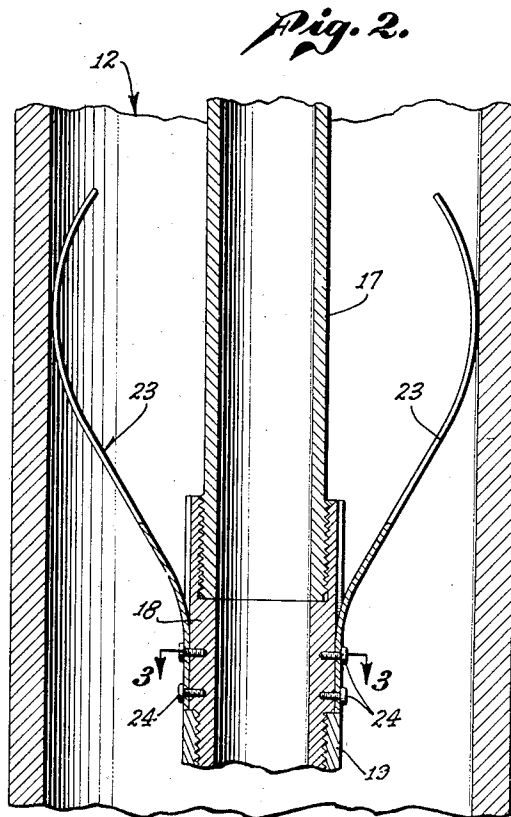
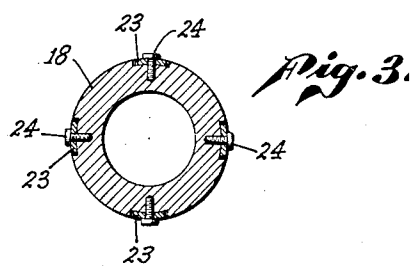
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2,310,757

MEANS OF PREVENTING PITTING OF WELL PUMPS

Filed May 12, 1941

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

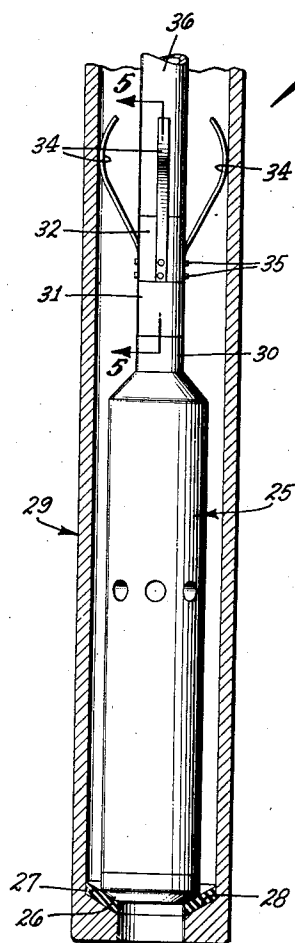


Fig. 4.

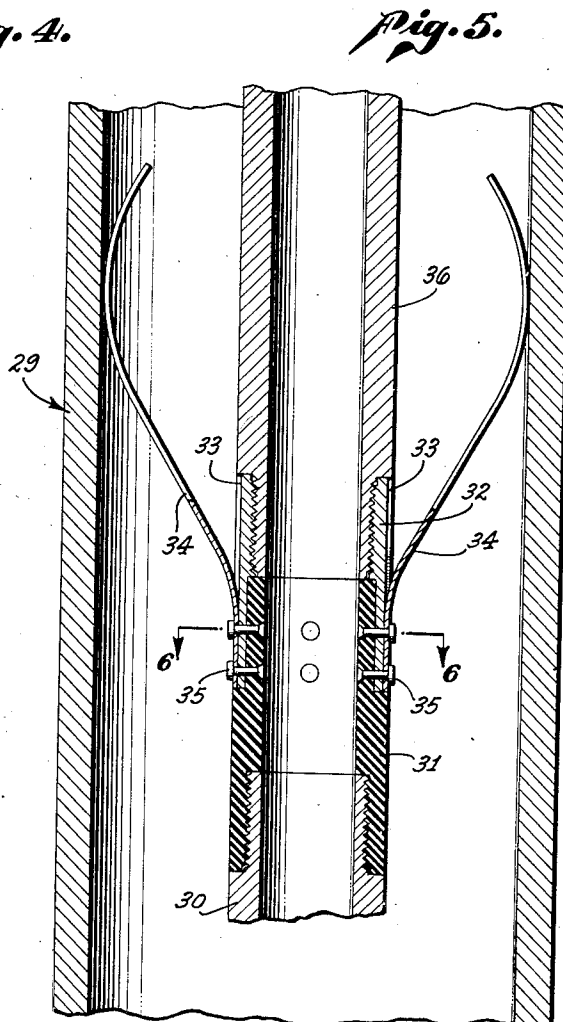


Fig. 5.

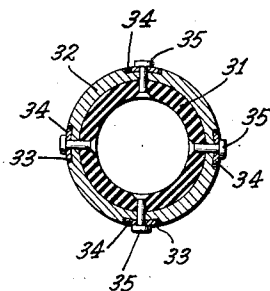
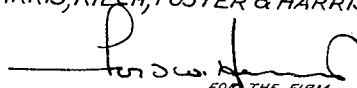


Fig. 6.

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2,310,757

MEANS OF PREVENTING PITTING OF
WELL PUMPSEdmond M. Wagner, Southgate, Calif., assignor to
Roko Corporation, Reno, Nev., a corporation of
Nevada

Application May 12, 1941, Serial No. 393,028

8 Claims. (Cl. 103—1)

My invention relates to the well pump art, and more particularly to a means for preventing pitting of well pumps. The invention is of particular utility with hydraulic deep well pumps and will be described in connection therewith, although it will be understood that I do not intend to be limited to such application, as the invention will operate equally well in connection with other types of well pumps.

I have found that in operating a hydraulic pump in a relatively deep well, stray electric currents are set up in the pump. These currents may be transmitted to the pump from the pumping equipment on the surface of the ground, they may be picked up by the pump from the well formation as sometimes a difference in structure in the formation of a well will produce a battery effect, they may be set up in the pump as a direct result of the pumping operation, or otherwise. While the source of these currents is not always clearly discoverable, they nevertheless exist and pass from the pump through the liquid around the pump to the tubing or casing surrounding the pump, where the well liquid is a good conductor of electricity, as is commonly the case. At the point where the electrons of the current leave the pump, a severe pitting of the pump parts frequently occurs, which is always undesirable, and, where the pitting continues for any length of time, frequently requires repairs or replacement of parts of the pump, which requires shutting down of production during such repairs or replacement. Any such stopping of production causes serious economic loss. It is therefore a primary object of my invention to prevent such pitting of a pump by providing separate means for conducting any stray currents in the pump directly to a suitable ground through a conductor provided for this purpose on the pump itself. I prefer to accomplish this by providing on a well pump spring fingers adapted to engage the wall of a surrounding tubing so as to ground the pump through the fingers.

Other objects and advantages will appear from the following description and the drawings, in which:

Fig. 1 is a diagrammatic assembly view, partly in section, showing the invention installed in a well.

Fig. 2 is an enlarged vertical sectional view showing the detailed construction of my invention.

Fig. 3 is a cross-sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is an assembly view, partly in section, of an alternative embodiment of the invention.

Fig. 5 is an enlarged vertical sectional view taken substantially on the line 5—5 of Fig. 4.

Fig. 6 is a cross-sectional view taken on the line 6—6 of Fig. 5.

Referring to the drawings, Fig. 1 shows a casing 10 set in a well, the lower end of the casing being perforated at 11 so as to permit well fluid to flow into the casing from the producing formation. As will be understood, the perforations 11 may be provided, if desired, in a separate liner attached to the lower end of the casing 10, as is well known in the art. Extending downwardly through the casing 10 is a production tubing 12, the upper end of which is suitably secured to a tubing head 13 having an inlet pipe 14 and a discharge pipe 15 projecting therefrom. The discharge pipe 15 is in open communication with the interior of the production tubing 12, and the inlet pipe 14 is secured, as by a collar 16, to a supply tubing 17 which extends downwardly through the production tubing 12, the supply tubing normally being made of steel or other electrical conductive material. The lower end of the supply tubing 17 is threaded into the upper end of a finger collar 18, the lower end of which is threaded into the upper end 19 of a fluid operated pump 20. The fluid operated pump 20 may be of any type well known in the art, such, for example, as shown in the patent to Coberly, No. 2,081,220, issued May 25, 1937, and is provided with discharge openings 20a, which are diagrammatically indicated. The lower end of the fluid operated pump 20 is provided with a seating face 21 which is received in a pump seat 22 formed in the lower end of the production tubing 12. The finger collar 18 has secured to its outer surface a plurality of vertically extending spring fingers 23, the lower ends of which are suitably secured to the finger collar as by screws 24. Although the spring fingers 23 are fixed to the finger collar 18 at their lower ends, as shown in Fig. 2, it will be understood that they may be reversed in position so as to extend downwardly without departing from the spirit of my invention. Similarly, although I have shown four spring fingers 23 secured to the finger collar 18, it will be appreciated that this number may be increased or decreased without departing from the invention. As will be noted, each of the spring fingers 23 firmly engages the inner wall of the production tubing 12, although the spring fingers are so designed that they do not operate to center

the fluid operated pump 20 in the production tubing 12 either during installation or use, the spring fingers being made of relatively thin spring material. It is important, however, that the spring fingers 23 be made of a metal having good electrical conductivity properties, as they form a means for electrically grounding the lower end of the supply tubing 17 to the production tubing 12.

In operation, the parts of the device are assembled in the positions shown in Fig. 1 in a well, in which the spring fingers 23 engage the inner wall of the production tubing 12. Operating fluid under pressure is delivered through the inlet pipe 14 from a suitable source thereof (not shown) and through the supply tubing 17 to the fluid operated pump 20 to operate the same. Operation of the fluid operated pump 20 pumps fluid from the casing 10 and discharges it into the interior of the production tubing 12 through the discharge openings 20a, and the pump fluid then flows upwardly through the production tubing and is conveyed through the discharge pipe 15 to a suitable point of storage or use (not shown). Well fluid, particularly crude oil in an oil well, ordinarily contains foreign materials in large quantities and has a fair degree of electrical conductivity and through which an electrical current may readily pass from the pump 20 to the production tubing 12 in the space therebetween. Since both the fluid operated pump 20 and the spring fingers 23 are made of an electrically conductive metal, and since the electrical resistance of the path formed by the spring fingers between the pump and the production tubing 12 is low relative to the electrical resistance of the path through the well fluid between the pump and the production tubing, any electric current set up in the upper part of the pump will pass through the spring fingers 23 directly into the production tubing 12. It will thus be appreciated that the spring fingers 23 provide a simple and economical means for grounding the lower end of the supply tubing 17 and the upper end of the fluid operated pump 20. This construction is very desirable in that if the spring fingers 23 are omitted, stray electric currents in the upper end of the pump 20, which may pass downwardly through the supply tubing 17, will pass directly therefrom to the production tubing 12 through the well fluid therebetween, with an attendant pitting of the fluid operated pump and the parts thereof. It is also to be noted that, as the production tubing 12 is normally made of steel or other electrically conductive material, the lower end of the fluid operated pump 20 is also electrically grounded to the production tubing through the engagement of the seating face 21 with the pump seat 22, thus electrically grounding both the upper and lower ends of the pump. Although it will be appreciated that with the assembly shown in Fig. 1 a path of electric conduction remains directly through the fluid between the pump 20 and the production tubing 12, the conductivity characteristics of this path remain low relative to the high electrical conductivity of the path set up through the spring fingers 23, and, consequently, the current flows through the spring fingers instead of the fluid path. It will thus be understood that my invention entirely prevents or materially decreases the pitting effect mentioned above, which is a matter of serious concern in the operation of many pumps in wells, particularly in the oil industry.

Referring to Figs. 4, 5, and 6, an alternative embodiment is shown in which the fluid operated pump is insulated at both ends so as to prevent stray electric currents from passing thereinto. A fluid operated pump 25 is provided at its lower end with a conical seating face 26 which seats on a seat member 27 which is formed of a material having good electrical insulation characteristics, such as, for example, Bakelite. The seat member 27 rests on a seat 28 formed on the lower end of a production tubing 29 which is adapted to be installed in a well similar to the production tubing 12 shown in Fig. 1, and which is formed of steel or other electrically conductive material.

The upper end of the fluid operated pump 25 is provided with a collar 30, the upper end of which is threaded, as shown in Fig. 5, into the lower end of an insulating collar 31 which is also formed of a material having good electrical insulation characteristics, such as, for example, Bakelite. To the upper end of the insulating collar 31 is fitted a metallic collar 32 having longitudinal grooves 33 formed in the exterior surface thereof which receive the lower flat ends of metallic spring fingers 34, the upper ends of which are bowed outwardly to resiliently engage the inner wall of the production tubing 29, similar to the spring fingers 23 shown in Fig. 1. The metallic collar 32 and the spring fingers 34 are rigidly secured to the insulating collar 31, as by rivets 35 passing therethrough. The upper end of the metallic collar 32 is threaded to the lower end of a supply tubing 36, similar to the supply tubing 17, which is also normally formed of steel or other electrically conductive material.

The operation of the embodiment shown in Figs. 4, 5, and 6 is generally similar to that shown in Figs. 1, 2, and 3 and described hereinabove. It is to be noted, however, that due to the insulating characteristics of the insulating collar 31, stray electrical currents cannot pass downwardly from the supply tubing 36 to the fluid operated pump 25 but instead pass through the metallic collar 32 and the spring fingers 34 directly to the production tubing 29. Similarly, due to the insulating characteristics of the seat member 27, stray electrical currents cannot pass upwardly into the fluid operated pump from the lower end of the production tubing 29. The seat member 27 and the insulating collar 31 thus constitute insulating means of the invention. Consequently, the fluid operated pump 25 is electrically insulated at both ends, which in some installations is desirable in reducing the pitting referred to due to the passage of stray electrical currents from the pump to the production tubing 29 through the well fluid therebetween.

Although I have shown and described two preferred embodiments of my invention, it will be appreciated that substitutions of parts may be made therein without departing from the invention, and, consequently, I do not intend to be limited to the specific constructions illustrated, but intend to be afforded the full scope of the following claims.

I claim as my invention:

1. In a well pumping device, the combination of: an outer tubing extending downwardly in a well; a fluid operated pump in said outer tubing near the lower end thereof and having a substantial area thereof spaced from the inner wall of said tubing so that an electric current in said pump would normally pass from said pump across said space to said outer tubing so as to

cause pitting of said pump; an inner tubing extending downwardly through said outer tubing and connected to said pump so as to supply operating fluid thereto, said inner tubing being adapted to carry an electric current to said pump; and means for grounding the upper end of said pump to said outer tubing so as to prevent said electric current from passing across said space, said means including a plurality of metallic fingers associated with said pump and adapted to engage the inner wall of said outer tubing.

2. In a well pumping device, the combination of: an outer tubing extending downwardly in a well; a fluid operated pump in said outer tubing near the lower end thereof and having a substantial area thereof spaced from the inner wall of said tubing so that an electric current in said pump would normally pass from said pump across said space to said outer tubing so as to cause pitting of said pump; an inner tubing extending downwardly through said outer tubing and connected to said pump so as to supply operating fluid thereto, said inner tubing being adapted to carry an electric current to said pump; and means for grounding the upper end of said pump to said outer tubing so as to prevent said electric current from passing across said space, said means including a plurality of metallic spring fingers formed of electrical conductive material associated with the upper end of said pump and adapted to engage the inner wall of said outer tubing.

3. In a well pumping device, the combination of: a well pump adapted to be set in a well; a tubing connected to the upper end of said pump and adapted to conduct an electric current to said pump; and means associated with the upper end of said pump for electrically grounding the upper end of said pump and the lower end of said tubing, said means including a plurality of outwardly extending resilient spring fingers formed of electrically conductive material.

4. In a well pumping device, the combination of: a tubing extending downwardly in a well; a well pump in said tubing having a substantial area thereof spaced from the inner wall of said tubing so that an electric current would normally pass from said pump across said space to said tubing so as to cause pitting of said pump; electrically conductive means extending downwardly through said tubing and adapted to be secured relative to said pump; and means for securing said electrical conductive means relative to said pump but adapted to provide electric insulation between said pump and said electrically conductive means.

5. In a well pumping device, the combination of: a tubing extending downwardly in a well; a well pump in said tubing having a substantial area thereof spaced from the inner wall of said tubing so that an electric current would normally pass from said pump across said space to said tubing so as to cause pitting of said pump; electrically conductive means extending downwardly through said tubing and adapted to be secured relative to said pump; means for securing said electrically conductive means relative to said pump but adapted to provide electric insulation between said pump and said electrically conductive means; and means for electrically grounding the lower end of said electrically conductive means to said tubing.

6. In a well pumping device, the combination of: a tubing extending downwardly in a well; a well pump in said tubing having a substantial area thereof spaced from the inner wall of said tubing so that an electric current would normally pass from said pump across said space to said tubing so as to cause pitting of said pump; electrically conductive means extending downwardly through said tubing and adapted to be secured relative to said pump; means for securing said electrically conductive means relative to said pump but adapted to provide electric insulation between said pump and said electrically conductive means; means for electrically grounding the lower end of said electrically conductive means to said tubing; and means for electrically insulating the lower end of said pump from said tubing.

7. In a well pumping device, the combination of: an outer tubing extending downwardly in a well; a well pump adapted to be supported by said outer tubing adjacent the lower end thereof; an inner tubing extending downwardly through said outer tubing and adapted to be secured relative to said pump; and insulating means for electrically insulating said pump from both said outer and inner tubings.

8. In a well pumping device, the combination of: an outer tubing extending downwardly in a well; a well pump adapted to be supported by said outer tubing adjacent the lower end thereof; an inner tubing extending downwardly through said outer tubing and adapted to be secured relative to said pump; insulating means for electrically insulating said pump from both said outer and inner tubings; and means for electrically grounding the lower end of said inner tubing to said outer tubing.

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