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R. C. LISTER

2,468,503

METHOD OF MAKING TUBING CLEANERS

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Fig. 1.

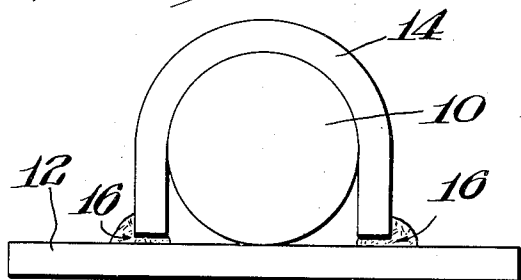


Fig. 2.

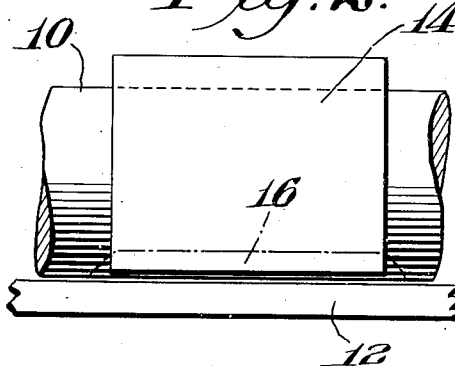


Fig. 3.

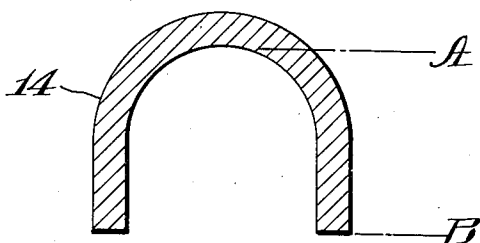


Fig. 4.

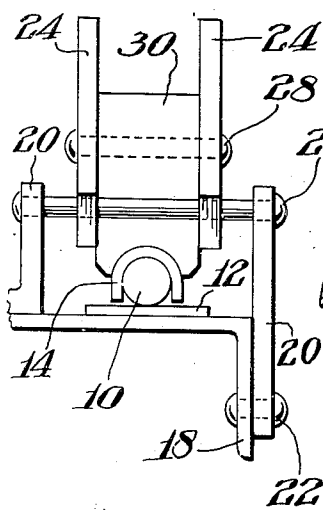
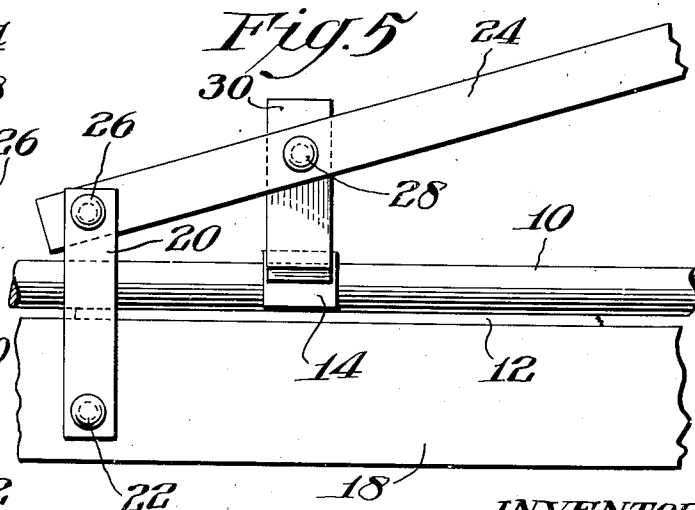


Fig. 5.



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METHOD OF MAKING TUBING CLEANERS

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1

This invention relates to a tubing cleaner and, particularly, to a novel assembly and method for constructing the same which is useful for preventing and removing accumulations of paraffin and other substances which tend to clog the tubing of an oil well and restrict the flow of oil therethrough.

An oil well generally comprises a casing, a string of smaller steel pipe inside the case and generally known as the tubing, a pump at the bottom of the well, and a string of steel rods, commonly referred to as sucker rods, within the tubing and extending down to the pump for operating the pump.

The crude oil generally contains paraffin and other substances which tend to congeal and precipitate out of the oil during the passage of the oil through the tubing. Such paraffin and other substances tend to deposit upon the walls of the tubing and to restrict the flow of oil therethrough. Such deposits are quite objectionable and various means and methods have been proposed for preventing the formation of such deposits and for removing deposits so formed. Such means and methods comprise the use of chemicals, electrical heating, and various mechanical scraping devices. Such means and methods are, in general, expensive and have other objectionable features.

A simple, inexpensive and efficient mechanical means for preventing and removing accumulations of paraffin and the like from oil well tubings has been devised by C. E. Blackburn and is disclosed and claimed in his Patent No. 2,321,275 patented June 8, 1943. Such device comprises briefly one or more flat scraping blades fastened on a sucker rod which is reciprocated and intermittently rotated in the oil well tubing. Such scraping blades are fastened to the sucker rod by U-bolts and the like. While such tubing cleaner of Blackburn has been commercially successful, it has been found difficult to fasten the blades to the sucker rod sufficiently firmly and there is a tendency for the blades to become loose in operation extending over a long period of time. My invention, disclosed and claimed hereinafter, is directed to an improvement over the structure of Blackburn and, particularly, to improved means and method for more securely fastening the scraper blades to the sucker rod.

It is an object of my invention to provide a simple, inexpensive and efficient tubing cleaner for oil wells. Another object is to provide new and improved means for more securely fastening the scraping blade of Patent 2,321,275 to the

2

sucker rod. A further object is to provide a new and improved method for fastening a scraping blade to a sucker rod. A still further object is to provide an improved tubing cleaner and method for constructing the same. Other objects are to advance the art. Still other objects will appear hereinafter.

The above and other objects may be accomplished in accordance with my invention which comprises fastening a substantially flat steel scraping blade to a cylindrical sucker rod by placing the blade in desired position against one side of the rod, placing one or more U-shaped steel bands about the sucker rod so that the inner semi-circular surface of the band conforms to a semi-circular arc of the surface of the rod and the ends of the band extend toward the blade but terminate about $\frac{1}{2}$ to about $\frac{3}{64}$ inch from the surface of the blade, forming a welding bead between one end of the band and the blade so as to attach the end of the band to the blade and, without permitting the aforesaid bead to cool, forming a second welding bead between the other end of the band and the blade so as to attach such other end of the band to the blade and then cooling the two welding beads substantially simultaneously. On cooling, the welding beads shrink or contract, drawing the band toward the blade and firmly clamping the sucker rod between the band and the blade under high pressures so as to substantially immovably fasten the blade to the sucker rod.

For a more complete understanding of my invention, the construction of the apparatus and the method of constructing the same, reference will be made to the following detailed description and claims taken in connection with the accompanying drawings wherein like reference characters designate like parts.

Fig. 1 is an end view of a tubing cleaner constructed in accordance with my invention;

Fig. 2 is a side view of the structure of Fig. 1 with parts broken off for ease of illustration;

Fig. 3 is a cross-sectional view of the fastening band employed in my invention;

Fig. 4 is an end view of the parts of the tubing cleaner in position for the formation of the welding beads and one form of suitable apparatus for assembling the tubing cleaner;

Fig. 5 is a side view of the structure of Fig. 4 with parts broken away for clearness of illustration.

Referring now in detail to the drawing, the numeral 10 designates the conventional cylindrical sucker rod of which only a portion is shown.

3

The scraping blade 12 corresponds to that shown in Patent 2,321,275 and may be in the form shown in Figs. 1 to 3 thereof, or in the form shown in Figs. 4 and 5 thereof, modified solely in that the apertures for the fastening bolts are omitted. This scraping blade is preferably made of steel and may be from about $\frac{1}{8}$ inch to about $\frac{1}{2}$ inch in thickness but will usually be about $\frac{1}{8}$ inch thick.

Usually, three U-shaped bands 14 about 1 inch wide are employed for fastening each scraping blade to the sucker rod, one band being placed about 1 inch from each end of the blade and one in the middle. A single U-shaped band having a width corresponding substantially to the length of the scraping blade may be employed, if desired. Also, only the two end bands or more than three small bands may be used. Each band may be from about $\frac{1}{8}$ inch to about $\frac{1}{2}$ inch thick but usually will be about $\frac{1}{8}$ inch thick. Also, preferably, the band will be made of steel. The inner curved surface of the band is substantially semi-circular and conforms substantially to a semi-circular arc of the surface of the sucker rod. Preferably, the arc of the inner curved surface of the band is formed with a radius equal to that of the sucker rod so that, when the band is placed over the sucker rod, a very snug fit is obtained. The legs of the U-shaped band will be substantially parallel and will be spaced apart by a distance substantially equal to the diameter of the sucker rod. Preferably the legs of the band are spaced apart by a distance equal to the diameter of the rod so that considerable force will be required to force the band down over the sucker rod and produce a forced fit.

The inner height of the band, that is the distance between the lines A and B of Fig. 3, will be about $\frac{1}{2}$ to about $\frac{3}{4}$ of an inch less than the diameter of the rod so that, when the band is placed over the rod with the ends extending toward the scraping blade, each end will terminate about $\frac{1}{2}$ to about $\frac{3}{4}$ inch from the surface of the blade. This provides a clearance for the formation of the welding bead 16 between the ends of the band 14 and the scraping blade 12 and the desired amount of contraction of the welding bead to produce the maximum pressure necessary to immovably hold the blade to the sucker rod. Substantially less clearance makes it difficult to produce a proper welding bead between the end of the band and the surface of the blade, and causes insufficient contraction of the bead, to produce the desired pressures. Substantially larger clearances tend to cause too great pressures so that the fastening is unstable and sufficiently large clearances may make it impossible to form a welding bead of a size to connect the band to the blade.

Referring more particularly to Figs. 4 and 5, suitable apparatus for assembling the tubing cleaner comprises a base plate 18 supporting bearing standards 20 secured to the base plate by suitable bolts 22. A lever 24 is pivoted on a rod 26 supported at the upper end of the bearing standards 20. A mallet 30 is pivotally supported on the lever 24 a short distance from the bearing standards 20. This mallet has an upper flat surface and an arcuate lower surface adapted to fit over the outer curved surface of a U-band 14. The assembling apparatus 18, 20, 22, 24, 26, 28 and 30 is provided so that substantial pressures can be placed on the band 14 to force it down over the rod and to maintain the entire tubing cleaner assembly under pressure during

4

the formation of the welding beads and the subsequent cooling thereof.

In the method of my invention, the blade 12 is placed upon the table 18, the sucker rod 10 is placed in position over the scraping blade, and the band 14 is placed in position above the sucker rod with its outer curved surface in the recess of the mallet 30 and with its open ends extending toward the blade in straddling position relative to the sucker rod. Pressure is then exerted on the end of the lever 24 to force the band 14 down over the sucker rod so that the inner curved surface of the band fits snugly over the upper curved surface of the sucker rod. By employing a lever having a 6 to 1 advantage a pressure of as much as 780 lbs. can be placed on the mallet by the exertion of about 130 lbs. on the end of the lever. If necessary, the top of the mallet may be given several sharp blows with a hammer in order to force the inner curved surface of the band into intimate contact with the outer curved surface of the rod.

With the parts now in assembled position as shown in Figs. 4 and 5, welding beads are formed connecting each end of the band to the blade. It will generally be impractical to form both beads simultaneously but it is generally desirable to form them as nearly simultaneously as possible. Usually the one bead will be formed and the other bead formed immediately thereafter and before the first bead has had an opportunity to cool. With good welding technique the beads can usually be formed within thirty seconds of each other, that is, substantially simultaneously. If it is necessary to delay for any substantial period of time before forming the second bead, provision should be made for maintaining the first bead hot until the second bead is formed so as to avoid unequal stresses and any displacement of the parts caused by contraction of the first bead. When both beads have been formed they are cooled substantially simultaneously. They may be permitted to cool by mere exposure to the atmosphere. Preferably, however, the beads are quickly cooled by directing one or more streams of cool fluid against them. A suitable cooling fluid which produces excellent results in practice is a mixture of compressed air and water.

In place of the lever 24 of Figs. 4 and 5, the mallet may be forced down by other means such as an air or hydraulic ram. An air ram exerting a pressure of 2,000 pounds on the ring has been found to be particularly satisfactory in practice.

The blades cannot very well be welded to the sucker rods as the heat thus produced in the sucker rod would tend to cause crystallization or internal stresses to be set up therein which would render the sucker rod more fragile. Also, if the formation of the welding beads in accordance with my invention is long delayed, and if the beads are allowed to cool slowly, there is a tendency for the heat to transfer to the sucker rods to similarly cause crystallization or internal stresses. For this latter reason it is preferable to form the beads and cool them as promptly and quickly as possible to a temperature below that which would tend to cause crystallization or internal stresses in the sucker rod.

Preferably throughout the formation and cooling of the welding beads it will be desirable to maintain substantial pressures on the band to force the band and rod tightly together and the rod tightly against the blade. Such pressures may be any pressure which is practicable and preferably will be from about 780 to about 2,000

5

6

pounds per inch of band. Much greater and far less pressures may be employed but without substantial advantages as it is only essential to employ such pressures as will insure close contact between the parts during the formation and cooling of the welding beads.

It will be seen that by my invention I have provided a novel method and means for securing the scraping blade to the sucker rod which has many advantages over the method and means disclosed by Blackburn in Patent 2,321,275. By my invention a tubing cleaner is produced in which the scraping blade is more firmly and securely fastened to the sucker rod. It has been found difficult to move a scraping blade, so secured, on the rod with a two pound ball pein hammer.

I claim:

1. The method of fastening a substantially flat steel scraping blade to a cylindrical sucker rod which comprises placing the blade in desired position against one side of the rod, placing a U-shaped steel band about the sucker rod so that the inner semi-circular surface of the band conforms to a semi-circular arc of the surface of the rod and the ends of the band extend toward the blade but terminate about $\frac{1}{32}$ to about $\frac{3}{64}$ inch from the surface of the blade, forming a welding bead between one end of the band and the blade so as to attach the end of the band to the blade and, without permitting the aforesaid bead to cool, forming a second welding bead between the other end of the band and the blade so as to attach such other end of the band to the blade and then cooling the two welding beads substantially simultaneously.

2. The method of fastening a substantially flat steel scraping blade to a cylindrical sucker rod which comprises placing the blade in desired position against one side of the rod, placing a U-shaped steel band about the sucker rod so that the inner semi-circular surface of the band conforms to a semi-circular arc of the surface of the rod and the ends of the band extend toward the blade but terminate about $\frac{1}{32}$ to about $\frac{3}{64}$ inch from the surface of the blade, forming a welding bead between one end of the band and the blade so as to attach the end of the band to the blade and, before the aforesaid bead has cooled substantially, promptly forming a second welding bead between the other end of the band and the blade so as to attach such other end of the band to the blade and then quickly cooling the two welding beads substantially simultaneously.

3. The method of fastening a substantially flat steel scraping blade to a cylindrical sucker rod which comprises placing the blade in desired position against one side of the rod, placing a U-shaped steel band about the sucker rod so that the inner semi-circular surface of the band conforms to a semi-circular arc of the surface of the rod and the ends of the band extend toward the blade but terminate about $\frac{1}{32}$ to about $\frac{3}{64}$ inch from the surface of the blade, forming a welding bead between one end of the band and the blade so as to attach the end of the band to the blade and, before the aforesaid bead has cooled substantially, promptly forming a second welding bead between the other end of the band and the blade so as to attach such other end of the band to the blade and then quickly cooling the two welding beads substantially simultaneously by directing a stream of cool fluid against the beads.

4. The method of fastening a substantially flat steel scraping blade to a cylindrical sucker

rod which comprises placing the blade in desired position against one side of the rod, pressing a U-shaped steel band about the sucker rod so that the inner semi-circular surface of the band conforms to a semi-circular arc of the surface of the rod and the ends of the band extend toward the blade but terminate about $\frac{1}{32}$ to about $\frac{3}{64}$ inch from the surface of the blade, the band being preformed so that the legs thereof are spaced apart by a distance equal to the diameter of the rod and the inner semi-circular surface has a radius equal to the radius of the rod so as to produce a forced fit of the band over the rod, forming a welding bead between one end of the band and the blade so as to attach the end of the band to the blade and, without permitting the aforesaid bead to cool, forming a second welding bead between the other end of the band and the blade so as to attach such other end of the band to the blade and then cooling the two welding beads substantially simultaneously.

5. The method of fastening a substantially flat steel scraping blade to a cylindrical sucker rod which comprises placing the blade in desired position against one side of the rod, pressing a U-shaped steel band about the sucker rod so that the inner semi-circular surface of the band conforms to a semi-circular arc of the surface of the rod and the ends of the band extend toward the blade but terminate about $\frac{1}{32}$ to about $\frac{3}{64}$ inch from the surface of the blade, the band being preformed so that the legs thereof are spaced apart by a distance equal to the diameter of the rod and the inner semi-circular surface has a radius equal to the radius of the rod so as to produce a forced fit of the band over the rod, forming a welding bead between one end of the band and the blade so as to attach the end of the band to the blade and, before the aforesaid bead has cooled substantially, promptly forming a second welding bead between the other end of the band and the blade so as to attach such other end of the band to the blade and then quickly cooling the two welding beads substantially simultaneously.

6. The method of fastening a substantially flat steel scraping blade to a cylindrical sucker rod which comprises placing the blade in desired position against one side of the rod, pressing a U-shaped steel band about the sucker rod so that the inner semi-circular surface of the band conforms to a semi-circular arc of the surface of the rod and the ends of the band extend toward the blade but terminate about $\frac{1}{32}$ to about $\frac{3}{64}$ inch from the surface of the blade, the band being preformed so that the legs thereof are spaced apart by a distance equal to the diameter of the rod and the inner semi-circular surface has a radius equal to the radius of the rod so as to produce a forced fit of the band over the rod, forming a welding bead between one end of the band and the blade so as to attach the end of the band to the blade and, before the aforesaid bead has cooled substantially, promptly forming a second welding bead between the other end of the band and the blade so as to attach such other end of the band to the blade and then quickly cooling the two welding beads substantially simultaneously by directing a stream of cool fluid against the beads.

7. The method of fastening a substantially flat steel scraping blade to a cylindrical sucker rod which comprises placing the blade in desired position against one side of the rod, placing a U-shaped steel band about the sucker rod so that

7

the inner semi-circular surface of the band conforms to a semi-circular arc of the surface of the rod and the ends of the band extend toward the blade but terminate about $\frac{1}{32}$ to about $\frac{3}{64}$ inch from the surface of the blade, forming a welding bead between one end of the band and the blade so as to attach the end of the band to the blade and, without permitting the aforesaid bead to cool, forming a second welding bead between the other end of the band and the blade so as to attach such other end of the band to the blade and then cooling the two welding beads substantially simultaneously, maintaining substantial pressure on the band to force the band and rod toward the blade throughout the forming and cooling of the welding beads.

8. The method of fastening a substantially flat steel scraping blade to a cylindrical sucker rod which comprises placing the blade in desired position against one side of the rod, placing a U-shaped steel band about the sucker rod so that the inner semi-circular surface of the band conforms to a semi-circular arc of the surface of the rod and the ends of the band extend toward the blade but terminate about $\frac{1}{32}$ to about $\frac{3}{64}$ inch from the surface of the blade, forming a welding bead between one end of the band and

8

the blade so as to attach the end of the band to the blade end, before the aforesaid bead has cooled substantially, promptly forming a second welding bead between the other end of the band and the blade so as to attach such other end of the band to the blade and then quickly cooling the two welding beads substantially simultaneously, maintaining substantial pressure on the band to force the band and rod toward the blade throughout the forming and cooling of the welding beads.

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