Jan. 7, 1941. J. E. HALL 2,228,229

CASING PROTECTOR APPLICATOR TOOL

Filed Sept. 23, 1938 2 Sheets-Sheet 1

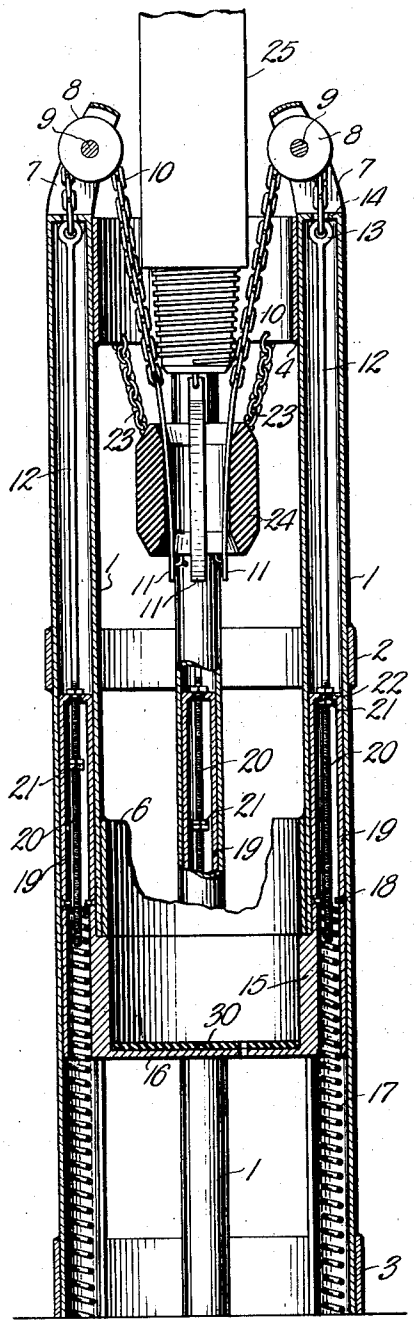


Fig. 1.

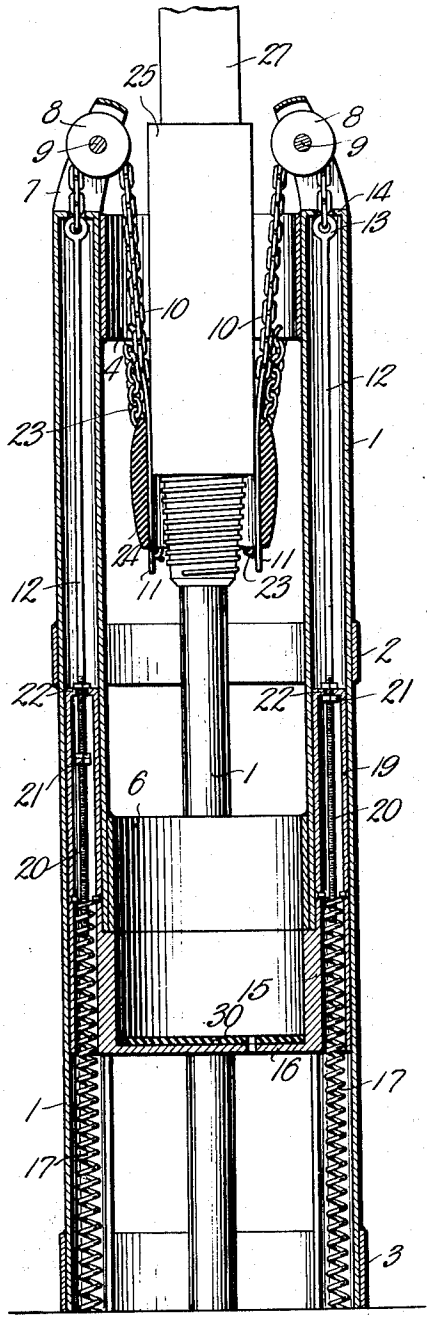


Fig. 2.

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CASING PROTECTOR APPLICATOR TOOL

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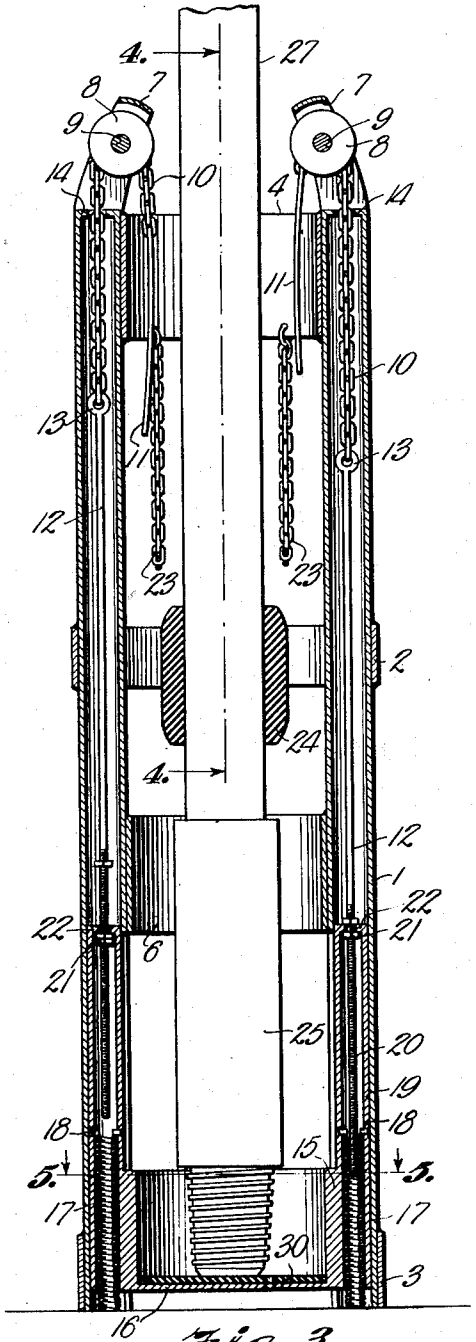


Fig. 3.

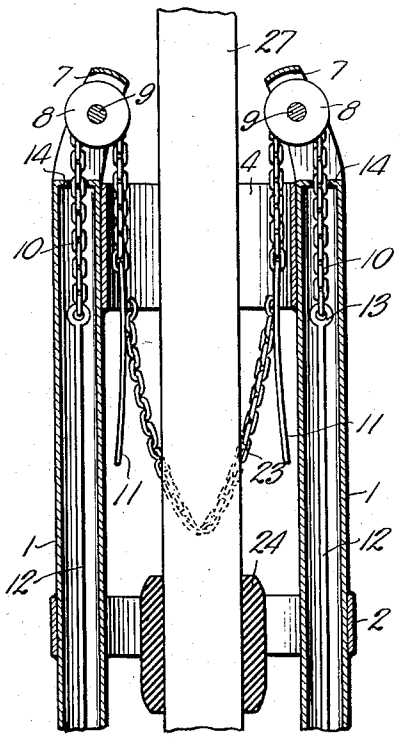


Fig. 4.

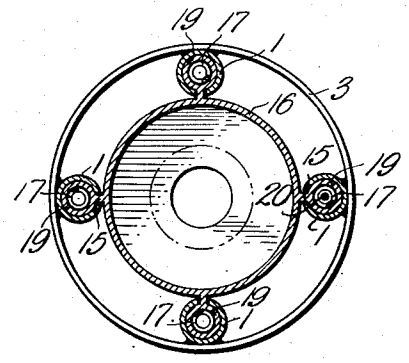


Fig. 5.

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2,228,229

UNITED STATES PATENT OFFICE

2,228,229

CASING PROTECTOR APPLICATOR TOOL

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Application September 23, 1938, Serial No. 231,379

4 Claims. (Cl. 29—88.2)

My invention relates to a casing protector applicator tool for applying casing protectors to tubular members such as sections of an oil well drilling string.

This application is an improvement over my copending application, Serial No. 216,055, filed June 27, 1938.

In the rotary method of drilling oil wells, the drilling string comprises a plurality of sections made up of lengths of drill pipe connected by couplings and tool joints. As the hole progresses in depth, casings are set and drilling proceeds through a casing which has been cemented in place. When the drilling string is rotated the tool joints will engage the well casing with the result that the couplings and joints in the string become worn and the well casing frequently damaged even to the extent of being punctured. After a casing has been set and cemented, damage to the casing may result in the loss of a well.

In order to protect the casing and the couplings of a string of drill pipe, protector rings of rubber have been placed upon the drill pipe in proximity to the tool joints. These protector rings are of larger external diameter than the tool joints and prevent metal to metal contact of the tool joint and the casing wall from taking place, thus preventing wear and protecting both the casing and the tool joints.

There are two general types of protectors in use—namely, the split type, which is formed of sections adapted to be secured in place by various securing means, and the elastic type. The split type has proven unsatisfactory due to the fact that it is impossible to secure them to the drill pipe sufficiently tightly to prevent them from becoming dislodged. This is especially true when drilling deep wells. In such case the weight of the drilling string is such that protectors adjacent the upper end of the string carry a very heavy load, so that when the drilling string is raised or lowered, the friction between the protectors and the casing is so great as to slide the protector rings along the drill pipe. In practice it is not uncommon to find a number of protector rings stripped from their proper places and assembled upon a single section of drill pipe permitting an extended length of the drilling string to be without protection.

The elastic type has proven to be more satisfactory in that it may be placed upon the drill pipe under heavy tension tightly gripping the pipe and remaining in place. The difficulty has been in placing a heavy annular elastic band or protector ring upon drill pipes, due to the fact that it must be expanded over the tool joints, which are always larger in diameter than the drill pipe proper and frequently are of considerable length.

One method of applying protector rings is disclosed in Bettis Patent No. 1,965,876. The weight of the section of drilling string is insufficient to force the protector ring over the tool joint when heavy protector rings are used, as they must be for deep drilling. This necessitates the jarring of the drill pipe in order to force the protector ring over the tool joint. This jarring is accomplished by dropping the traveling block, the hook and the elevator of the drilling rig upon the top of the section of drill pipe on the lower end of which the protector ring is being placed. This practice requires the moving of the tool to a central point of the derrick. The jar damages the upper tool joint. When the elevator is disconnected the upper end of the drill pipe section is unsupported and the entire weight of the section is borne by the tool. This practice is dangerous and men have been killed and maimed during the operation of placing protector rings upon drill pipe. The forcing of the rubber protector ring by sliding it over the tool joint in accordance with the method shown in the Bettis patent, frequently damages the rubber. The load is chiefly compressional, and the rubber protector ring becomes distorted and mashed. Lubrication has been resorted to to assist in sliding the rubber protector ring over the tool joint. When the rubber is lubricated it reduces its adherent properties, enabling it to become displaced more readily. The lubrication which may be employed is limited and due to the limitations in weight tending to force the protector ring onto the drilling string, the size of the protector which may be employed with the Bettis method is limited.

In my copending application, the friction between the shoes and the protector ring is relied upon to hold the protector ring against the shoes. As long as the friction between the protector ring and the shoes is greater than the friction between such portions of the drill pipe as contact the protector ring, the protector ring will not move relative to the shoes, while the drill pipe is passing through the shoes. In certain cases, where the drill pipe is of small diameter and only a few shoes can be used, or where the drill pipe is covered with mud laden fluid, as is the case when protector rings are being placed on

sections of the drill pipe being withdrawn from a well, the friction between the shoes and the protector ring is insufficient to prevent relative movement between the shoes and the protector ring.

One object of my invention is to provide an improved construction in which means are provided to prevent relative motion between the shoes and the protector ring to positively insure that no relative motion between the shoes and the protector ring will take place, while the protector ring is being placed in position on the drill pipe.

Another object of my invention is to provide a novel tool for applying casing protector rings to drill pipe.

Other and further objects of my invention will appear from the following description.

In the accompanying drawings which form part of the instant specification and are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views;

Figure 1 is a sectional elevation of a protector ring applicator assembly, embodying one form of my invention, showing the protector ring in place with the drill pipe about to move through the shoes.

Figure 2 is a view similar to Figure 1, showing the drill pipe in position partially through the shoes.

Figure 3 is a view similar to Figure 1, showing the parts in position with the protector ring in place upon the drill pipe.

Figure 4 is a sectional view, taken on a line 4—4 of Figure 3.

Figure 5 is a sectional view, taken on a line 5—5 of Figure 3.

In the method of the prior art an elastic protector ring has been supported upon an expandible support, and the protector ring and the expandible support expanded by pushing a tapered mandrel through the assembly, the protector ring riding along the tapered mandrel to be forced by the cam action to expanded position equal to the diameter of the tool joint. After being expanded to the diameter of the tool joint, the expandible support pushes the protector ring over the tool joint and onto the drill pipe. It will be noted in the method of the prior art there is rubber to metal contact during the movement of the rubber protector ring to expanded position and during its movement over the tool joint.

In general, my invention contemplates the positioning of a plurality of shoes within the elastic protector ring, the expanding of said shoes to stretch the protector ring supported upon them to such extent that the tool joint and drill pipe may be passed through the expanded ring to the desired position, and then the removal of the shoes from between the drill pipe and the ring. I provide additional means which coact with the shoes and prevent the relative motion of the protector ring with respect to the shoes, while the drill pipe is being moved through the shoes.

More particularly referring now to the drawings, a plurality of tubes 1 are welded in spaced relation to the inside of rings 2 and 3. Rings 4 and 6 are welded to the inside of tubes 1. The tubes and the rings form a framework. Each of the tubes 1 supports a U-shaped frame 7 at its upper portion. Each of the U-frames 7 forms the cheeks of a block supporting respective sheaves 8 upon pins 9. A flexible supporting member such as a chain 10 passes over each sheave 8. One end of the chain 10 carries a shoe 11. The other end of the chain 10 is secured to a rod 12 housed in tubular member 1. The upper end of the rod 12 is formed with an eye 13 to which the chain is secured. The eye is adapted to engage an apertured partition 14, extending across tube 1, limiting the upward movement of the rod 12 and hence the downward movement of the shoe 11 secured to the chain 10. The partition 14 of course may be placed in any suitable position within the tube 1. The lower ends of the tubes 1 are slotted to act as guides for extensions 15 secured to a platform member 16. The platform member 16 is normally held in the position shown in Figure 1, by springs 17, housed within tubes 1, acting against pins 18 secured to tubular guide members 19 housed within tubes 1. The lower ends of the rods 12 are provided with threaded portions 20. The threaded portions carry nuts 21, positioned at different places on the threaded portions 20 of respective rods 12. Downward motion of the platform 16 will impart a downward motion to the guide tubes 20. The upper ends of each of the guide tubes is formed with a partition 22 adapted to engage the stop nuts 21 on respective threaded portions 20.

A pair of flexible members such as chains 23 are hung from the ring 4 as can readily be seen by reference to Figures 3 and 4. The lower end of the chain forms a bight or loop which is adapted to be hooked over the lower portion of a shoe 11. If desired, more than two flexible members may be employed and provided with a ring or link which may be hooked over the lower portion of the shoe.

In operation, the parts will be in the position shown in Figure 1. The shoes 11 are inserted within a rubber protector ring 24, which is to be moved over the tool joint 25 of a drilling string and placed upon the drill pipe 26. In order to hold the protector ring 24 in the position shown in Figure 1, the bights of the chains 23 are hooked over the projecting portions of a pair of shoes 11 as can readily be seen by reference to Figure 1. In the position shown in the figure, the protector ring is supported by the chains 23 which are prevented from hanging vertically because their lower ends are hooked over the lower portions of a pair of shoes 11.

If desired, the shoes 11 may be made out of brass or other softer material than that used in the tool joint. The drilling string is then lowered between the shoes, as can readily be seen by reference to Figure 2. Inasmuch as the tool joint rides over the shoes with metal to metal contact, the weight of the drilling string is sufficient to pass through the shoes. As the tool joint passes through the shoes, the shoes are moved outwardly, camming them apart and strengthing the protector ring 24. As soon as the tool joint 25 passes through the shoes, the drilling string gathers speed, falling downwardly, moving relative to the protector ring supported on the shoes. The end of the tool joint will then strike the rubber cushion 30 carried by platform 16, moving the platform downwardly against the action of the springs 17. As the platform moves downwardly, the tubular guide members 19 will move downwardly engaging in succession the stop nuts 21 secured to the threaded portions 20 of the rods 12. When the partition 22 of a guide member engages a stop nut, the rod 12 to which that stop nut is secured will move downwardly with the platform. Downward motion of a rod 12 will pull

the end of the chain supporting a shoe 11 upwardly. Inasmuch as the protector ring is stretched around a plurality of shoes, the friction between a single shoe and the protector ring will be much less than that existing between the protector ring and the remaining shoes. The result is that the shoe supported by a chain, the supporting rod of which has had its stop nut engaged by the platform guide 2, will move upwardly and out from between the drill pipe and the protector ring. As soon as the lower end of a shoe around which the ring stop chain 23 is looped has moved upwardly sufficiently to clear the bight of the stop chain, the stop chain will swing outwardly to a position shown in Figure 3. The arrangement is such that the shoes, the lower ends of which act as latches for the stop chains, are pulled out from between the protector ring and the drill pipe during the early portion of the movement of the platform. As soon as two shoes are removed from between the protector ring and the drill pipe, the friction existing between the protector ring and the drill pipe is such as to cause the protector ring to tend to move downwardly with the drill pipe. This assists in removing the protector ring from the shoes which are held against downward motion by the engagement of the eyes 13 with the stop members 14. The timing of the removal of the shoes from between the protector ring and the drill pipe can be regulated by the adjustment of the stop nuts 21 upon the threaded portions 20 of the rods 12. When the platform 16 has moved downwardly toward the bottom of the assembly, the parts are in the position shown in Figure 3, that is, all of the stop nuts 21 have engaged the stop partitions 22 in the guide members 19 and the shoes are pulled upwardly to various heights depending upon the position of the stop nuts upon the threaded portions 20. The protector ring stop chains 23 hang in the position shown in Figure 3 and the protector ring 24 is in the desired position upon the drill pipe 27 above the tool joint 25.

It will be observed that I have accomplished the objects of my invention. I have provided novel apparatus for applying elastic protector rings to a drill string in a simple and expeditious manner. The protector ring rides upon shoes when the drill pipe is moving through the shoes, thus avoiding relative motion between the rubber and the metal of the drill pipe. In this manner, damage to the rubber occasioned by pushing it over the tool joint in a stretched condition is eliminated. It is not necessary to lubricate the rubber since metal to metal friction is considerably less than rubber to metal friction. By means of my apparatus, I am enabled to employ a single applicator tool to apply rubber protector rings of varying sizes. The operation of applying the protector rings requires a very short period of time. After the parts are in the position shown in Figure 1, all that is necessary is to lower the drill pipe and the protector ring is automatically placed in the desired position by the operation of the apparatus.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, I claim:

1. A tool for applying elastic rings to tubular members including in combination a standard, a plurality of shoes, means for supporting the upper ends of the shoes from said standard, the lower ends of said shoes being free and adapted to be placed within an elastic protector ring which is to be applied to the tubular member, means secured to said standard and adapted to be passed around the outside of said ring and operatively secured to the lower end of a shoe for preventing relative motion between the protector ring and the shoes, said supporting means being such that the tubular member upon which the protector ring is to be placed may be moved between the shoes and through the protector ring, and means for imparting a relative motion between the shoes and the protector ring when it has moved to the desired position axially of the tubular member to release said means and the ring.

2. A tool as in claim 1 in which stop means for preventing relative motion between the shoes and the protector ring comprises a flexible member supported from said standard in the form of a loop, said loop being of such length that when the end of a shoe is passed through the loop, it will project beyond the loop whereby the shoes engage the inside of the ring and the flexible member passes around the outside of the ring and is operatively secured to the lower end of a shoe to support the protector ring.

3. A tool as in claim 1 in which said means for imparting relative motion between the shoes and the protector ring comprises a platform adapted to be engaged by the tubular member, means connecting said platform and said shoes, the construction of said means being such that downward motion of said platform under the influence of downward movement of the tubular member will pull the shoes from between the tubular member and the protector ring.

4. A tool for applying casing protectors to drill pipe including in combination a standard, a plurality of shoes, means for supporting the upper ends of said shoes from said standard, the lower ends of said shoes being free and adapted to be placed within an elastic protector ring which is to be applied to drill pipe, means secured to said standard and adapted to be passed around the outside of said ring and operatively secured to the lower end of a shoe for preventing relative motion between said shoes and said protector ring, said shoe supporting means comprising sheaves, extension members, flexible members passing over said sheaves, respective ends of said flexible members being secured to said shoes and said extension members respectively, a platform, means for selectively connecting said extension members to said platform, said extension members being provided with stops to limit their upward movement, the construction being such that downward movement of said platform will impart a downward movement to said extension members and an upward movement to said shoes.

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