

May 14, 1940.

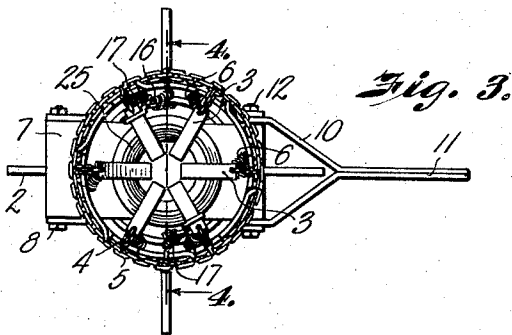
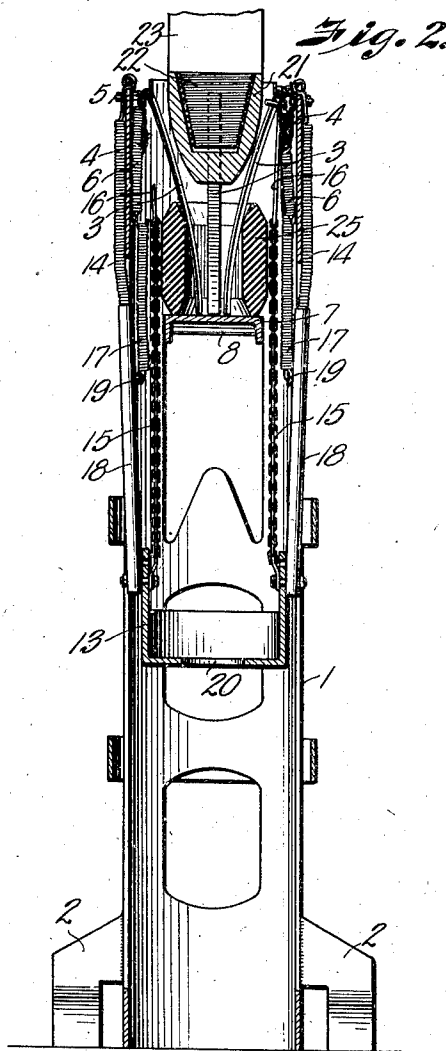
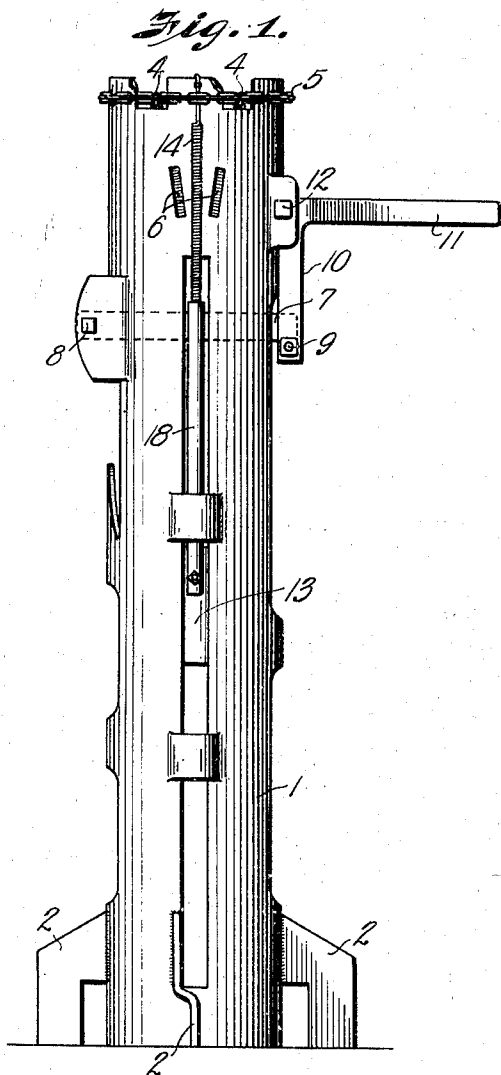
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2,200,716

CASING PROTECTOR APPLICATOR TOOL

Filed June 27, 1938

3 Sheets-Sheet 1



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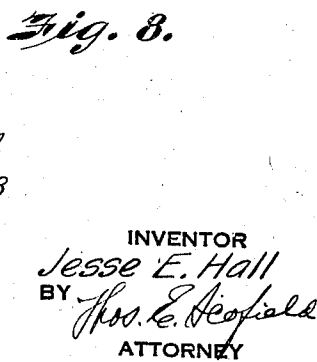
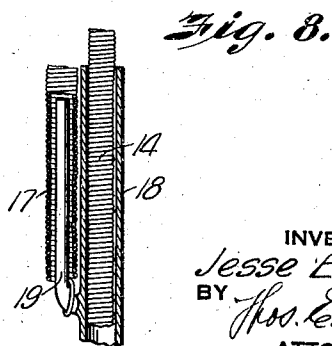
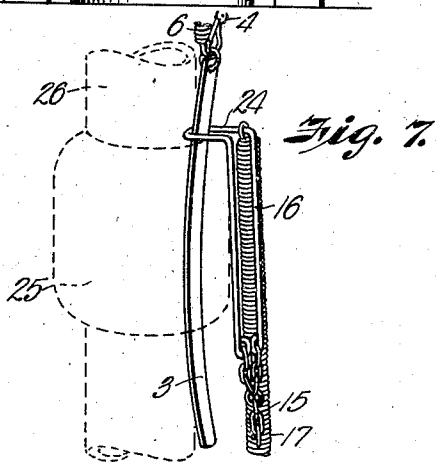
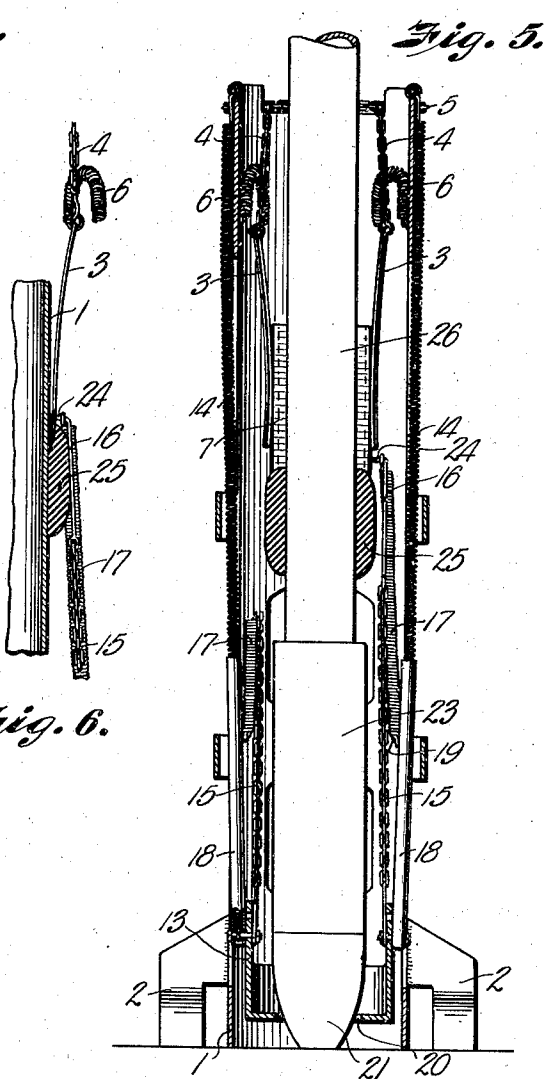
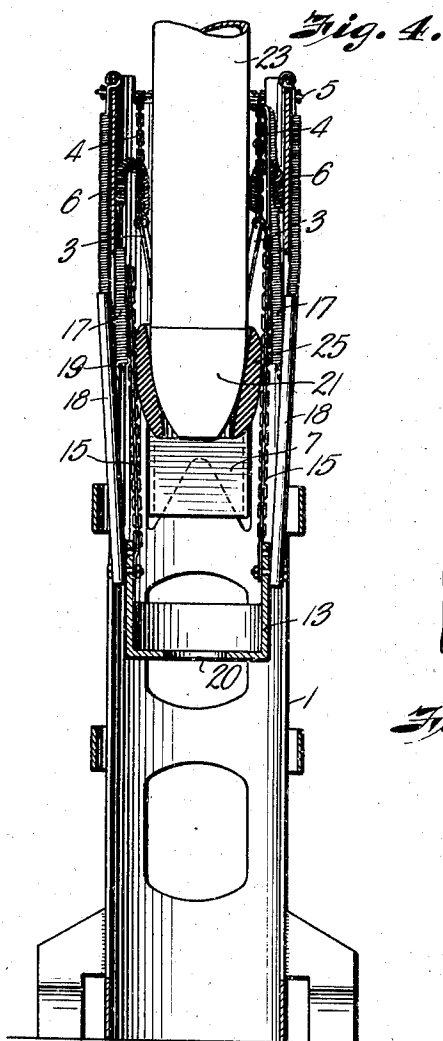
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CASING PROTECTOR APPLICATOR TOOL

Filed June 27, 1938

3 Sheets-Sheet 2



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CASING PROTECTOR APPLICATOR TOOL

Filed June 27, 1938

3 Sheets-Sheet 3

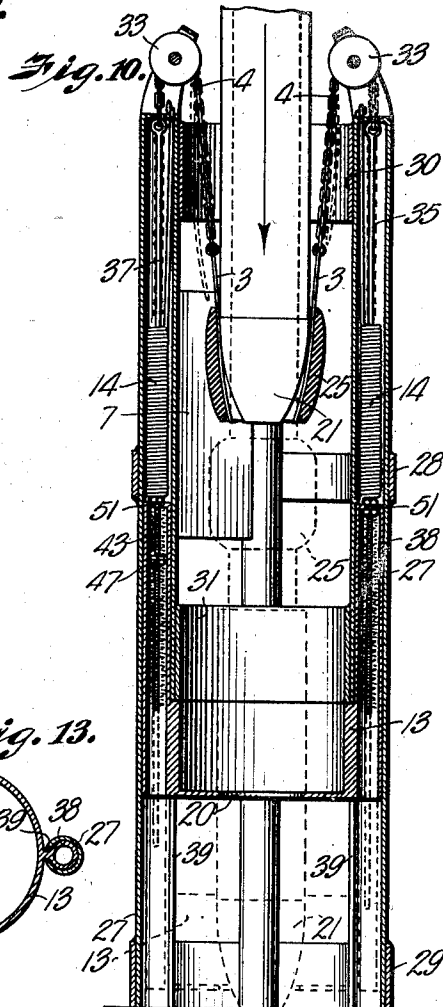
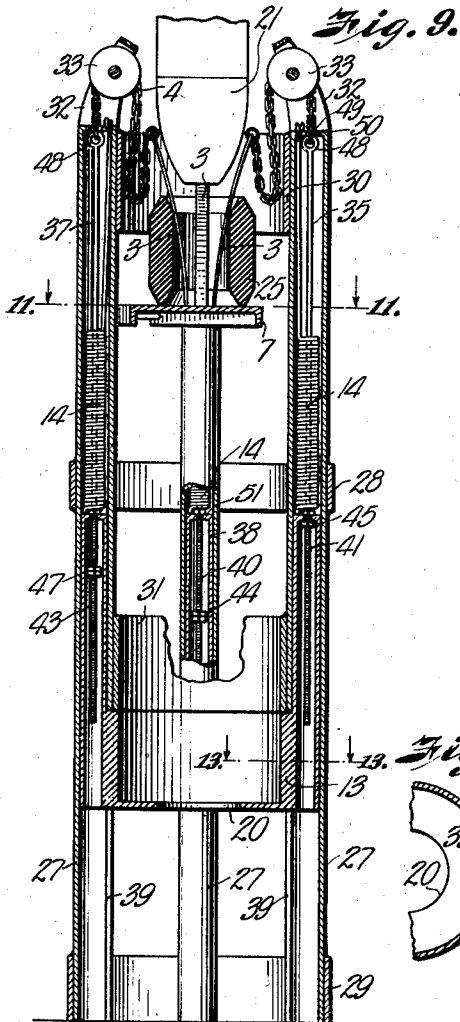
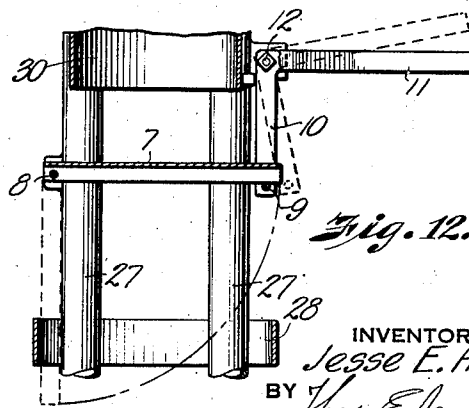
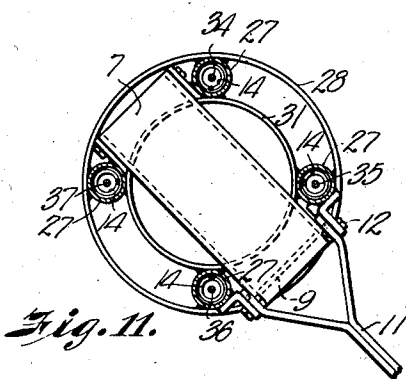
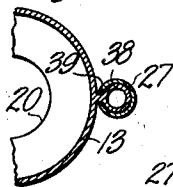


Fig. 13.



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2,200,716

CASING PROTECTOR APPLICATOR TOOL

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Application June 27, 1938, Serial No. 216,055

8 Claims. (Cl. 29—88.2)

My invention relates to a casing protector applicator tool and a novel method of applying casing protectors to sections of an oil well drilling string.

5 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.

15 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.

20 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.

25 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 operating 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.

30 One object of my invention is to provide a novel method of expanding elastic, annular protector rings for positioning them upon drill pipe to protect the same and the casing through which drilling is taking place.

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

40 Still another object of my invention is to provide a method of applying protector rings to drill pipe which will avoid the disadvantages of the methods known to the prior art.

45 A further object of my invention is to provide a novel method and applicator tool for applying protector rings to drill pipe, which will enable stronger and larger protectors to be used and which may be applied without resorting to the use of lubricants.

A still further object of my invention is to provide a novel applicator tool for safely, expeditiously and quickly applying large and strong protector rings upon drill pipes, which when in place will remain securely.

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 which are to be read in conjunction therewith, and in which like reference numerals are used to indicate like parts in the various views,

Fig. 1 is an elevation of an applicator assembly for applying protector rings upon drill pipe embodying one form of my invention and capable of carrying out the method of my invention.

Fig. 2 is a sectional elevation of the protector ring applicator shown in Fig. 1.

Fig. 3 is a top plan view of the tool shown in Fig. 1.

Fig. 4 is a sectional view taken on the line 4—4, Fig. 3, showing the parts in position in an initial stage in the operation of my method.

Fig. 5 is a sectional view similar to Fig. 4 showing the parts in position with the protector ring in position upon the drilling pipe.

Fig. 6 is an enlarged view of a detail showing the parts in position for stripping the protector ring from the stretching means to position upon the drill pipe.

Fig. 7 is a perspective view of a portion of the stripping means shown in Fig. 6.

Fig. 8 is an enlarged sectional view of a detail.

Fig. 9 is a sectional elevation of an applicator tool capable of carrying out the method of my invention showing another form of the tool.

Fig. 10 is a sectional view similar to Fig. 9 in which the full lines indicate the positions of parts in an initial position of the operation, while the dotted lines indicate the position of parts with the applicator rings in position upon the drill pipe.

Fig. 11 is a sectional view taken on the line 11—11, Fig. 9.

Fig. 12 is an enlarged fragmentary view of a tripping means forming part of the apparatus of and used in carrying out the method of my invention.

Fig. 13 is a sectional view taken along the line 13—13, Fig. 9.

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.

More particularly, referring now to the drawings, a standard 1 is provided with a plurality

of feet 2, enabling the tool to rest in the position shown. A plurality of shoes 3 are suspended from the upper portion of the standard by chains 4. The upper ends of chains 4 are secured to an annular chain 5, as can readily be seen by reference to Figs. 1 and 2.

Normally the shoes 3 are supported adjacent the upper end of the standard 1 by springs 6, which support the shoes 3 with their lower ends above a pivoted door 7. The door 7 is hinged around a pivot 8 and has its free end normally supported on a bolt 9 extending between bell crank arms 10. The bell crank arms 10 are brought together to form a handle 11 and are pivoted around bolts 12. The arrangement is such that when the handle 11 is raised, the lower bell crank arms 10 are swung away from the standard, moving the supporting bolt from under the free end of the door 7, permitting the door to swing around its pivot pin 8. Below the door and above the bottom of the tool I suspend a platform 13 by means of springs 14, as can readily be seen by reference to Figs. 1 and 2.

Secured to the platform by chains 15 are a pair of stripper members 16, shown in greater detail in Figs. 6 and 7. The stripper members 16 and chains 15 are normally held in their upper position by supporting springs 17, which are in turn supported by pins 19. The lower ends of springs 14 pass through pipes 18. The platform 13 is provided with a central opening 20 in which a tool joint thread protector 21 is adapted to seat, as shown in Fig. 5.

In operation of the form of the tool shown in Figs. 1, 2, 3, 4, 5, 6, 7, and 8, and in carrying out my method, a protector ring 25 is placed upon the door 7, the door being latched in the position shown in Figs. 1 and 2. The shoes 3 are placed within the protector ring with their lower ends resting upon the door 7. Since the springs 16 support the upper ends of the shoes and the lower ends are gathered and placed within the protector rings, the shoes will form a cradle. A protector 21 for the threads 22 of the tool joint 23 is placed over the threads of the tool joint. If desired, one or two threads may be formed adjacent the top of the thread protector 21 to secure it in place. It need not be of any particular size and it may be smaller or larger than the tool joint 23. The stand of drill pipe upon which it is desired to place a protector ring is then lowered. As it is lowered the weight of the stand of drill pipe will force the shoes outwardly stretching the protector ring 25, causing it to frictionally engage the outside surfaces of the shoes 3. The weight of the stand is usually sufficiently great to push the thread protector some distance into the protector ring.

Where heavy protector rings are being used, the weight of the stand of drill pipe is not sufficient to ride through the shoes. The lowering is continued without disconnecting the elevator hook or traveling block, permitting some slack to occur at the upper end of the drill stand, the stand being supported by the shoes 3 and the weight being supported by the trap door 7. If sufficient slack is obtained, the operating handle 11 is lifted freeing the trap door 7, permitting the stand of drill pipe, the shoes 3 and the protector ring to fall together until the slack in the chains 4 to which the shoes 3 are secured, is taken up. When this occurs the shoes will stop with a jerk and since the protector ring 22 is expanded around the outside of the shoes 3, the drill pipe and tool joint will start through the

protector ring riding on the inside surface of the shoes 3. The position of parts at this instant is shown in Fig. 4, where the chains 4 are taut and the tool joint 23 is starting to ride on the shoes 3 through the protector ring expanding it. The tool joint and drill pipe will continue to ride through the protector ring, which is held in expanded position by the shoes 3. It will be observed that there is substantially no rubber to metal contact between the tool joint and the protector ring, the movement being between the metal shoes and the tool joint.

After the tool joint passes the protector ring, the tool joint thread protector 21 will seat in the opening 20 in the platform 13, carrying it downward against the action of its supporting springs 14. As the platform 13 moves downwardly, it will pull chains 15, which are secured to stripper members 16. The stripper members 16 are formed with projections 24 adapted to engage the upper end of the protector ring on opposite sides thereof. The momentum of the falling stand acting through the platform 13 and the chains 15, pulls the stripper members 16 downwardly, as will readily be seen by reference to Figs. 6 and 7. The stripper members will strip the rubber ring from the shoes 3. It will be observed that the ring is carried frictionally by the outside surfaces of the shoes 3, and does not engage the drill pipe. Continued movement of the stand with the resultant continued movement of the stripper members, pulls the rubber ring in expanded condition from the shoes 3 and onto the drill pipe. Fig. 5 illustrates the position of parts at the end of the fall of the drill pipe, that is, when the tool joint thread protector 21 strikes the floor of the derrick. The stripper members 16 have just pulled the protector ring 25 from the shoes 3 and it is lodged upon the drill pipe 26 above the tool joint 23.

From the foregoing the operation of my method will be understood. I place a plurality of shoes within a protector ring and then force the shoes outwardly to stretch the protector ring, and pass the tool joint through the expanded protector ring and then remove the shoes from between the drill pipe and the protector ring to permit the protector ring to contract upon the drill pipe in the desired position.

A convenient method of stretching the protector ring is to utilize the camming action of the drill pipe against the interior of the shoes, so that I obtain metal to metal friction at a plurality of spaced points, instead of rubber to metal friction, which obviously will be very much greater. By this method I am enabled to use very heavy and strong protector rings, such that when contracted in the desired position they will not be readily dislodged even though protecting a portion of a very heavy and long drilling string.

It will be noted that the chains 4 are supported from a chain 5. If desired, a separate hoist may be hooked at any convenient place upon the chain 5 so that when chain 5 is pulled, it will pull the shoes from between the drill pipe and the protector ring out in succession, it being further understood that if desired the chain 5 may be uncoupled at any suitable point so that the successive shoe removing operation may readily take place.

Referring now to Figs. 9, 10, 11, 12 and 13. I have shown another improvement of my invention. A plurality of tubes 27 are welded in spaced relation to the inside of rings 28 and 29. Rings 30 and 31 are welded to the inside of tubes 27,

thus forming the framework for my device. Welded to the upper ends of tubes 27 are extensions 32, in which are pivoted sheaves 33. The trap door 7 pivoted upon pin 8 and held in latched position by pin 9 supported by the arms 10 of the bell crank lever, as described above, is provided as in the form shown in Figs. 1 and 2.

The shoes 3 have their upper ends connected to chains 4 as in the previous modification. The chains 4, however, instead of being secured to a stationary point, or to a chain 5, as in the form shown in Figs. 1 and 2, pass over sheaves 33 and are secured to a plurality of rods 34, 35, 36 and 37. The platform 13 is provided with a plurality of tubular guide members 38 adapted to ride within tubular members 27, the tubular members being slotted at 39, as can readily be seen by reference to Fig. 13.

The rods 34, 35, 36 and 37 are formed with threaded lower ends 40, 41, 42 and 43, which are adapted to enter corresponding guide members 38, as can readily be seen by reference to Fig. 9. Each threaded end 40, 41, 42 and 43, carries its respective nut 44, 45, 46 and 47. The upper ends of rods 34, 35, 36 and 37 are provided with respective eyes 48, which are larger than the openings 49 formed in the closures 50 of the tubular members 27. The platform 13 is held in its uppermost position by springs 14.

In operation, the trap door 7 is latched in its closed position and a protector ring 25 is placed upon the door, as shown in Fig. 9. The shoes 3 are placed within the protector ring, as in the previous operation. The stand of drill pipe upon which the protector ring is to be placed is lowered and slack is given in the hoisting equipment, permitting the drill pipe to rest upon the cradle formed by the shoes 3 and supported by the trap door 7. The weight of the stand is sufficient to stretch the protector ring so that it will be frictionally carried on the outside of shoes 3. The door is then tripped and the shoes and protector ring will fall together with the drill pipe until the chains 4 become taut, the strain being taken by the eyes 48 against the partition members 50 across the upper ends of tubular members 27. When the chains become taut, further movement of the shoes will stop. Since the protector ring is supported by the shoes, it will stop and the position of parts will be that shown in full lines in Fig. 10. The stand of drill pipe will continue falling through the protector ring due to its inertia, and the tool joint thread protector 21 will engage the platform 13, moving it downwardly. It will be observed that nut 45 on threaded portion 41 of rod 35 is in engagement with partition 51 across the upper end of guide member 38, so that when the platform 13 moves downwardly, it will pull rod 35 downwardly, pulling the shoe 3 attached to this rod through its chain 4 upwardly from between the drill pipe and the protector ring 25, permitting the protector ring to engage the drill pipe, and tending to cause the ring 25 to move downwardly with the drill pipe off of the remaining shoes 3.

After the platform 13 travels a short distance further, the partition 51 surrounding threaded end 43 of the rod 37, will engage the nut 47, causing it to move the rod 37 downwardly and pull the shoe 3 secured to this rod through its chain 4 from between the drill pipe and the protector ring, allowing the protector ring to engage the drill pipe at still another point and again tending to urge the protector ring 25 downwardly with the drill pipe and off of the remaining shoe 3. Con-

tinued downward motion of the platform 13 and the downward motion of the guides 38 secured thereto will result in the engagement of the partition 51 surrounding the threaded end 40 with the nut 44, pulling the shoe 3 secured to rod 34 out from between the drill pipe and the protector ring 25. If desired, the nut threaded upon the lower end of rod 36 may be placed at the same position as nut 44, so that both final shoes may be pulled out simultaneously.

It will be obvious that after the first shoe is pulled from between the drill pipe and the protector ring that there will be a tendency for the ring to travel with the drill pipe, tending to pull the ring from the shoes. When the platform 13 reaches the bottom of its stroke, as shown in the dotted lines in Fig. 10, all of the shoes 3 will have been pulled out from between the drill pipe and the protector ring, and the protector ring will be in contracted position upon the drill pipe above the tool joint.

It will be observed that I have accomplished the objects of my invention. I have provided a novel method and apparatus for applying elastic protector rings to a drill string in a simple and expeditious manner. In practicing my method and using my apparatus it is not necessary to disconnect the stand of drill pipe, upon which the protector ring is to be applied, from the elevator. It is not necessary to move the applicator tool to a position directly underneath the top of the derrick, and my tool may be stationed to one side of the derrick floor and the rings applied while the tool is in that position.

No rubber to metal movement is necessary in practicing my method or using my tool, except when removing the shoes after the protector ring is in the desired position, and then the only movement which takes place is between the protector ring and the shoes and not circumferentially around the drill pipe. In this manner damage to the rubber occasioned by pushing it over the tool joint in 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, and the friction takes place between the shoes at predetermined spaced points, rather than circumferentially around the tool joint.

By means of my method and apparatus I am enabled to use heavier and stronger rubber protector rings which will remain more tightly in place and will not be displaced even though a long drilling string is being protected. The operation of placing a protector ring upon a stand of drill pipe occupies a very short period of time. After the parts are in position and slack is given, the trap door may be sprung and the protector ring may be placed in literally a fraction of a second. Since the elevator is not disconnected, after the ring is in place the stand may be hoisted and swung to position over the center of the derrick and the tool joint coupled to the drilling string. Every moment that the drilling string is supported by the slips a dangerous condition exists, since the drilling string may drop into the hole with the resultant danger of losing a well, since fishing operations are not always successful. The time of operation is further reduced by the fact that my tool may be employed while positioned to one side of the derrick floor and need not be brought to a central position, as is the practice with tools of the prior art.

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, what I claim is:

1. In a tool for applying casing protectors to drill pipe, a vertical standard, means carried by said standard for supporting a protector ring, 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 the elastic protector ring which is to be applied to drill pipe, said shoe supporting means being such that a drill pipe upon which a protector ring is to be mounted may be lowered between the shoes and through the protector, 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 drill pipe.

2. A tool as in claim 1 in which said means for imparting relative motion between the shoes and said protector ring comprises a platform adapted to be engaged by the drill pipe, a stripper member adapted to engage the protector ring, means connecting said stripper member and said platform, the construction being such that said stripper member in moving downwardly will pull the protector ring from said shoes.

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

4. In a device for applying elastic protector rings upon drill pipe, a frame, a plurality of shoes, flexible means for supporting said shoes within said frame, a trap door adapted to be swung across said frame therewithin to support a protector ring and said shoes within said protector ring, said frame being such that the drill pipe upon which the protector ring is to be positioned may be lowered between said shoes with its weight supported by said trap door, said flexible means being of predetermined length whereby when said trap door is sprung, the protector ring, the shoes and the drill pipe will fall together until said flexible means become taut whereupon the drill pipe will ride through the protector ring upon said shoes under the influence of its inertia.

5. A device as in claim 4 including a platform movably positioned within said frame below said trap door and adapted to be engaged by said drill pipe during its downward movement within said frame, and means operated by movement of said platform for imparting a relative movement between said shoes and said protector ring.

6. A device as in claim 4 including in combination a platform movably mounted within said frame below said trap door, stripper members adapted to engage said protector ring, means connecting said platform and said stripper members, said platform being adapted to be engaged

by said drill pipe during its downward movement within said frame, the construction being such that downward movement of the said platform will move said stripper members downwardly to pull said protector ring from said shoes and onto the drill pipe.

7. A device as in claim 4 including in combination a platform movably positioned within said frame below said trap door, means connecting said platform and said shoes, the construction being such that downward movement of said platform under the influence of said drill pipe will pull said shoes from between the drill pipe and said protector ring.

8. A device as in claim 4 including in combination a platform movably positioned within said frame beneath said trap door, said shoes being connected to said platform by members of different length, said drill pipe being adapted to engage said platform during its downward movement within the frame, the construction being such that downward movement of the platform under the influence of said drill pipe will pull said shoes from between said protector ring and the drill pipe in succession.

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