APPARATUS FOR INSTALLING PROTECTORS ON DRILL PIPE

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By manner of execution
This invention relates generally to devices for applying rubber protectors or collars to drill pipe and the like such as are shown in our Patent No. 2,252,692 issued August 19, 1942. This application is a division of our application on Apparatus for installing protectors on drill pipe, Serial No. 365,156 filed November 12, 1940, which was co-pending with the application for the above mentioned patent.

It is a primary object of this invention to provide a new and improved means for expanding a resilient rubber protector or collar so that the same may be applied to drill pipe or the like. It is a particular object to provide means for expanding such a collar which includes a resilient retractable follower or pusher collar positioned intermediate a fluid pressure force applying means and the collar to be expanded in conjunction with means for resiliently radially supporting the follower collar.

It is a further object of the invention to provide apparatus of the type indicated which is adaptable for use in expanding various sizes of collars on to members to which the collars are to be applied. In this respect it is a particular object to provide means adapted to accommodate and support a so-called transfer sleeve upon which it is desirable to expand a rubber protector for transport to a remote drill pipe upon which the protector is ultimately to be placed.

These and other objects will be apparent from the drawing and the following description thereof. Referring to the drawing which is for illustrative purposes only;

Fig. 1 is a sectional elevation of apparatus for expanding and applying a rubber protector or collar to a member of larger diameter than the bore of the collar embodying the invention;

Fig. 2 is a view similar to Fig. 1 showing the apparatus with the movable parts in the collar applying position;

Fig. 3 is a sectional plan view on line 3—3 of Fig. 1.

More particularly describing the invention, reference numeral 11 generally indicates a cylinder which is provided with a bottom closure 12 and an opening 13 by means of which fluid under pressure may be introduced and exhausted from the cylinder. The closure 12 is recessed with respect to the end of the cylinder so it will not be damaged when the cylinder is stood on end as shown.

The cylinder is provided with a centrally extending rod or post 14 mounted on the end closure 12. This rod extends for a considerable distance beyond the open end of the cylinder and is provided at its upper end with a plurality of grooves 15 adapted to accommodate a tool 16. The tool cooperates with an abutment means 17 adapted to bear against the upper end of what will be termed a transfer sleeve 18 which constitutes a member to which the expandable protector or collar is to be applied in the example of the invention shown. The sleeve is a transportable member for holding a rubber protector expanded until it can be applied to a drill pipe. This sleeve has threads 19 so that it may be attached to a means for removing a protector from the sleeve. Such means is disclosed in our co-pending application, Serial No. 365,156 referred to above.

The means 17 consists of an annular plate 20 and a tubular extension 21, the upper end of which is engaged by the aforementioned tool 16. Thus, the rod or post 14, tool 16 and means 17 provide a means of detachably connecting the cylinder and the sleeve 18 to prevent relative movement of the parts when the protector is forced on to the sleeve in the expanding operation as will hereinafter be described.

The cylinder contains a piston 24 which is comprised of an annular plate 25 provided with a suitable rubber or flexible seal ring 26 secured to the plate by means of a second plate 27 and suitable bolts 28. These bolts are provided with extensions 29 adapted to engage the plate 12 and prevent the piston dropping below opening 13.

The rod 14 is adapted to glidably accommodate a sleeve 30 which in the form of the apparatus shown where such apparatus is arranged vertically is adapted to have its lower end bear against the upper surface of the piston 24. The sleeve 30 forms what may be termed a guide means for accommodating a flexible collar or protector 32 and a pusher or follower collar 33 which may be formed of rubber or any other suitable material having the desired resiliency.

When the apparatus is assembled for the purpose of expanding the protector 32 on to the sleeve 18, the protector 32 is first slipped down over the post 14 and on to the sleeve 30 to the position in which it is shown in Fig. 1. A tapered annular member or mandrel 34 is next placed in position to engage the upper end of the protector. This tapered member is provided with a bore 35 of sufficient diameter to receive the sleeve 30. Externally the member 34 is provided with a tapered surface as shown providing a path of
gradual enlargement from the bore of the collar to the outer surface of the sleeve 10 which fits over the upper end of the tapered member, being accommodated in a groove 36 therein. The sleeve is secured in place as shown in Fig. 1 by means of the member 17 and tool 16 operating with member 36.

It has been found desirable in apparatus of the character disclosed herein utilizing what may be termed a follower or pusher rubber, as 33, for the purpose of pushing the protector over the tapered surface and on to the member of larger diameter to provide means of radially supporting such member to prevent the collapse or any undesirable migration of the pusher member during the expansion operation. In order to provide this radial support an annular resilient member 38 is positioned surrounding the follower rubber 33 and engaging the periphery thereof. This member in the form shown is provided with a plurality of longitudinally extending openings 39 to increase the flexibility of the member. In order to give the necessary support for the member 38 the piston is provided with a peripheral wall 40 which consists of a lower wall section 41 rigidly secured to the plate 25 and an upper wall section 42 threadably secured thereto. This upper wall section is provided with an inwardly extending flange or lip 43 engaging the end of the member 38. The purpose of the lip 43 is to prevent migration of the member 38 upwardly during the expanding operation and thereby prevent the migration of the pusher rubber 33 downwardly and outwardly in the region of the upper surface of the piston.

In the operation of the device, the various elements are assembled as above described so that the apparatus is in the position which it is shown in Fig. 1. A suitable lubricant is used in the bore of the collar and on parts 30, 34, and 18. A pressure fluid is then introduced into the cylinder to cause movement of the piston to the position in which it is shown in Fig. 2. During this operation, the follower or collar 35 transmits the motion of the piston to the expandable collar 32 and forces the same over the tapered member and on to the sleeve 18. Preferably, the upper end of the follower or pusher collar is provided with a tapered shoulder 33' so as to insure that such member have a tendency to enter the bore of the protector 32 and prevent the possibility of the follower expanding over the protector. The follower 33 and annular radial supporting member 38 for the follower are distorted to the approximate position shown in Fig. 2 as the follower moves up over the tapered member 34. When the fluid pressure is released from the cylinder the follower or pusher, due to the inherent resiliency of the parts 33 and 38, retracts off of the tapered member and the piston and associated apparatus may be returned to its original position for the application of another protector.

With the construction outlined, there is provided a device which functions efficiently for expanding and applying the rubber protectors which, although resilient and expandable, are in present day practice formed of harder rubber than was formerly the case, making them inherently difficult to expand. By changing the guide tube 30, tapet member 32 and, when necessary, the pusher means 38 and replacing these parts with similar parts of different size, the apparatus can conveniently be used for installing various size protectors.

For the apparatus to function properly it is important that the member 38 furnish sufficient support for the pusher rubber 33 to prevent the pusher rubber from collapsing under the force to which it is subjected. At the same time it is necessary that the radial support 38 permit of the expansion of the protector over the follower or tapered member 34 during the installation of the protector. If the member 38 is too soft it will not adequately support the pusher rubber and the rubber may then be forced out over the protector and be ineffective to move the protector over the tapered member 34 or member 38 will permit of the migration of the lower part of the pusher rubber so that the pusher rubber collapses and becomes ineffective. If the member 38 is too hard the pusher rubber cannot be expanded over the tapered member 34 to the position in which it is shown in Fig. 2.

Since the apparatus is designed for the installation of various size protectors by the utilization of different sizes of pusher rubbers, supporting members 38 and 33, it is apparent that the yieldability characteristics of the member 38 used in any particular case must be properly correlated to the particular pusher rubber used and to the type of protector to be expanded. In this connection it may be pointed out that different makes of protectors of the same size vary in hardness. As a result different size members 38 should not necessarily have the same yieldability and hardness since each must be correlated to the particular pusher rubber with which it is to be associated and to the particular protector to be applied. We have found that it is possible to vary the yieldability and resistance characteristics of the different members 38 by providing them with various sizes of longitudinally extending openings 39. It will be apparent from Fig. 2 of the drawing that by providing proper size openings 39 the member 38 permits the expansion of the pusher rubber over the cone 34 during installation of a protector and at the same time by making the member 38 sufficiently hard, the pusher rubber will be given the desired support.

The openings or passages 39 are not essential however as it is possible to vary the yieldability characteristics of the different members 38 by other means such, for example, as by varying the hardness of the rubber. In this respect it may also be pointed out that the rubber in a given member 38 may be made harder in certain portions of the member than in other portions in order that the member 38 may give the desired support and yet be sufficiently yieldable in regions where yieldability is required.

Where the support 38 is provided with passages it has been found advisable to make this member of somewhat harder rubber than the followed or pusher member 33. It is also contemplated that the parts 33 and 38 can be made in one piece without departing from the invention and when this is done, it would be desirable to make the inner portion, that is, the part of the element which would correspond with the pusher member 33, of somewhat softer rubber and have the hardness of the rubber increase from the inside outwardly. It is also contemplated that various other modifications and changes can be made without departing from the scope of the claims. We claim as our invention:

1. In apparatus for expanding and applying
an expansible collar to a member of larger diameter than the bore of the collar; a piston and cylinder mechanism; a collar guide member associated with the movable element of said piston and cylinder mechanism and movable therewith, said guide member being adapted to accommodate a collar to be applied and a piston collar interposed between the collar to be applied and the movable element of said piston and cylinder mechanism; a tapered member providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied, said tapered member having a bore of such size as to slidably receive said guide; and means cooperating with said piston and cylinder mechanism and said member to which the collar is to be applied to prevent said member from moving away from the stationary element of said piston and cylinder mechanism.

2. In apparatus for expanding and applying an expansible collar to a member of larger diameter than the bore of the collar; a stationary cylinder; a piston in said cylinder; a collar guide member mounted on said piston and adapted to accommodate a collar to be applied and a pusher collar interposed between the collar to be applied and the piston; a tapered member providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied, said tapered member having a bore of such size as to slidably receive said guide; a rod mounted on said cylinder extending through said collar guide and the member to which the collar is to be applied and means cooperating with said rod and said member to which the collar is to be applied to prevent said member from moving away from said cylinder.

3. In apparatus for expanding and applying an expansible collar to a member of larger diameter than the bore of the collar; a stationary cylinder; a piston in said cylinder; a resilient pusher collar with an end engaging said piston; means for supporting a collar to be applied on said pusher collar; annular resilient confining means around said pusher collar; annular non-resilient confining means about said resilient confining means; a tapered member providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied; and means cooperating with said cylinder and the member to which the collar is to be applied to prevent said member from moving away from said cylinder.

4. In apparatus for expanding and applying an expansible collar to a member of larger diameter than the bore of the collar; a stationary cylinder; a piston in said cylinder; a resilient pusher collar with an end engaging said piston; means for supporting a collar to be applied and said pusher collar; an annular resilient member surrounding said pusher collar and mounted on said piston; a tapered member providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied; and means cooperating with said cylinder and the member to which the collar is to be applied to prevent said member from moving away from said cylinder.

5. In apparatus for expanding and applying an expansible collar to a member of larger diameter than the bore of the collar; a cylinder; a piston in said cylinder; a resilient pusher collar with an end engaging said piston; guide means on said piston for receiving a collar to be applied and said pusher collar interposed between the collar to be applied and said piston; a resilient annular member surrounding said pusher collar and resting on said piston; means for engaging the periphery of said annular member and extending partly over the end thereof; an annular tapered member adapted to receive said guide means providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied; and means cooperating with said cylinder and the member to which the collar is to be applied to prevent said member from moving away from said cylinder.

6. In apparatus for expanding and applying an expansible collar to a member of larger diameter than the bore of the collar; a cylinder; a piston in said cylinder surrounding said rod; a sleeve slideable on said rod and having one end engaging said piston; said sleeve being adapted to receive an expansible collar to be applied; an expansible pusher collar on said sleeve between the collar to be applied and the piston; a resilient annular member surrounding said pusher collar and resting on said piston; means for engaging the periphery of said annular member and extending partly over the end thereof; an annular tapered member adapted to receive said guide means providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied; and means cooperating with said cylinder and the member to which the collar is to be applied to prevent said member from moving away from said cylinder.

7. In apparatus for expanding and applying an expansible collar to a member of larger diameter than the bore of the collar; a cylinder; a piston in said cylinder; a resilient pusher collar with an end engaging said piston; means for supporting a collar to be applied and said pusher collar; said collar being adapted to receive said guide means; a collar to be applied; an annular member surrounding said pusher collar and resting on said piston; said annular member being formed of harder material than said pusher collar; means for cooperating with said annular member and extending partly over the end thereof; an annular tapered member adapted to receive said guide means providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied; and means cooperating with said cylinder and the member to which the collar is to be applied to prevent said member from moving away from said cylinder.

8. In apparatus for expanding and applying an expansible collar to a member of larger diameter than the bore of the collar; a cylinder; a piston in said cylinder; a resilient pusher collar with an end engaging said piston; means for supporting a collar to be applied and said pusher collar; said collar being adapted to receive said guide means; a collar to be applied; means for engaging the periphery of said annular member and extending partly over the end thereof; an annular tapered member adapted to receive said guide means providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied; and means cooperating with said cylinder and the member to which the collar is to be applied to prevent said member from moving away from said cylinder.
with said cylinder and the member to which the collar is to be applied to prevent said member from moving away from said cylinder.

9. In apparatus as defined in claim 8 in which the passages are of sufficient size with relation to the hardness of the member to impart adequate yieldability to the member to permit of the expansion of the pusher collar on to said tapered member and being insufficient in size to reduce the yieldability of the member below a point where it will adequately support the pusher collar.

10. In apparatus for expanding and applying an expansible collar to a member of larger diameter than the bore of the collar; a piston and cylinder mechanism; a collar guide member associated with the movable element of said piston and cylinder mechanism and movable therewith, said guide member being adapted to accommodate a collar to be applied; a tapered member providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied, said tapered member having a bore of sufficient size to slidable receive said guide; a resilient annular means in abutment relation with the movable element of said piston and cylinder mechanism surrounding said guide member; said resilient annular means including an inner annular extended portion adapted for engagement with an end of a collar to be applied, said resilient annular means extending radially beyond the radial extension of an unexpanded collar to be applied; and detachable means cooperating with said piston and cylinder mechanism and with said member to which the collar is to be applied to prevent the stationary element of said piston and cylinder mechanism from moving away from said member to which the collar is to be applied.

11. In apparatus for expanding and applying an expansible collar to a member of larger diameter than the bore of the collar; a piston and cylinder mechanism; a collar guide member associated with the movable element of said piston and cylinder mechanism and movable therewith, said guide member being adapted to accommodate a collar to be applied; a tapered member providing a path of enlargement from the bore of the collar to the outer surface of the member to which the collar is to be applied, said tapered member having a bore of sufficient size to slidable receive said guide; a resilient pusher collar on said guide interposed between a collar on said guide and the movable element of said piston and cylinder mechanism; a resilient annular member surrounding said pusher collar engaging the movable element on said piston and cylinder mechanism; means on the movable element of said piston and cylinder mechanism engaging the periphery of said resilient annular member; and detachable means cooperating with said piston and cylinder mechanism and with said member to which the collar is to be applied to prevent the stationary element of said piston and cylinder mechanism from moving away from said member to which the collar is to be applied; said resilient annular member being sufficiently yieldable to permit of the expansion of said pusher collar on to said tapered member and being sufficiently firm to prevent the collapse or undesirable migration of said pusher collar.

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