April 7, 1953 J. E. HALL, SR 2,633,632

APPLICATOR TOOL FOR DRILL PIPE PROTECTORS

Filed July 5, 1950

3 Sheets-Sheet 1

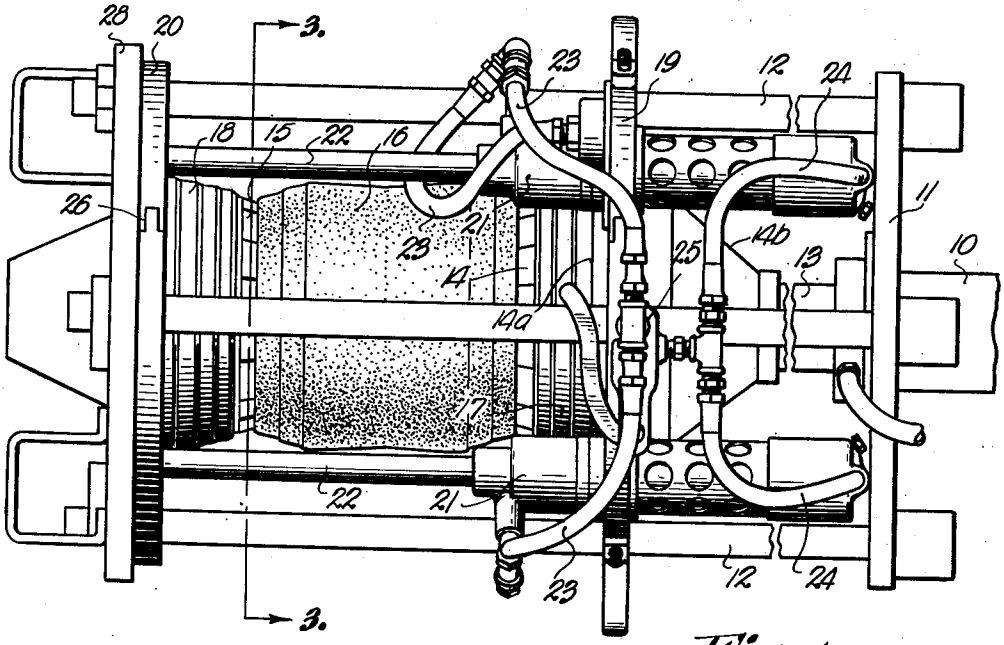


Fig. 1.

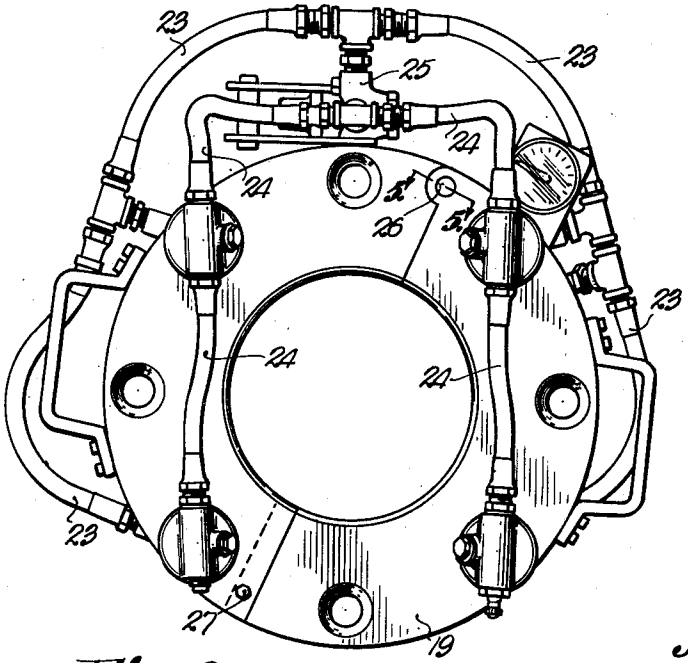


Fig. 2.



Fig. 5.

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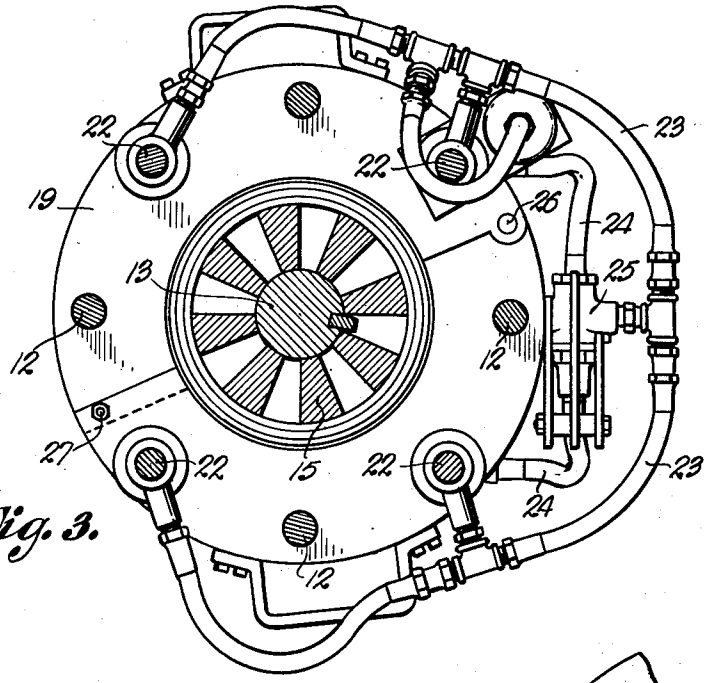


Fig. 3.

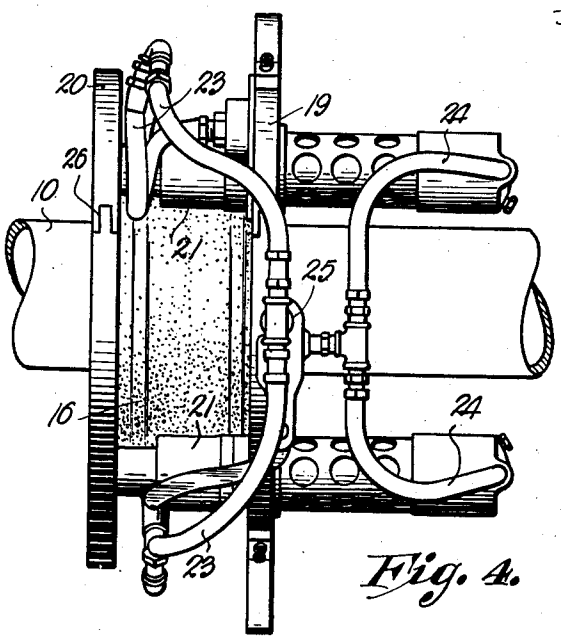


Fig. 4.

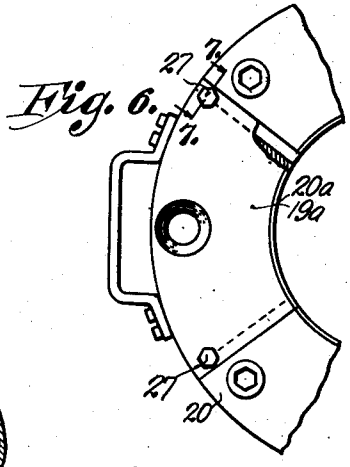


Fig. 6.

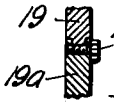


Fig. 7.

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3 Sheets-Sheet 3

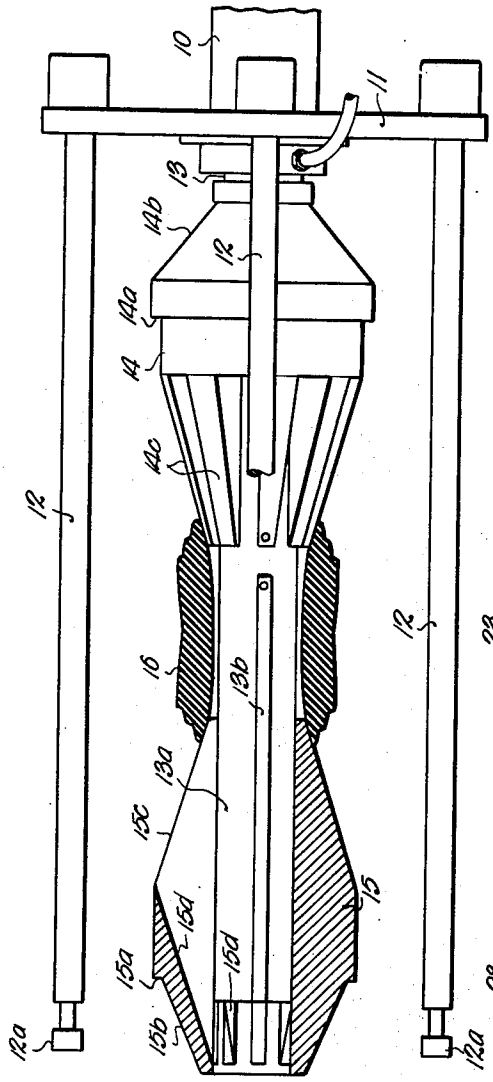


Fig. 8.

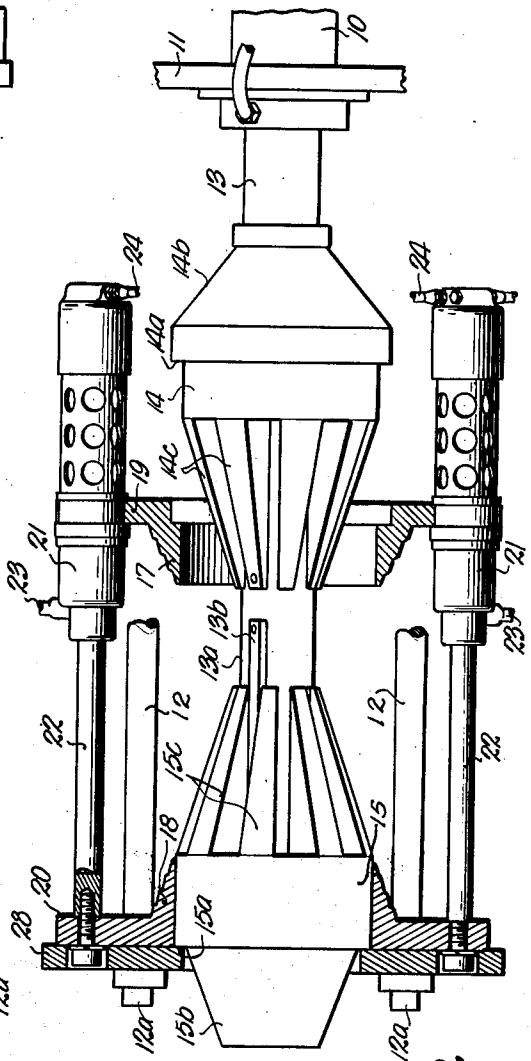


Fig. 9.

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APPLICATOR TOOL FOR DRILL PIPE PROTECTORS

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Application July 5, 1950, Serial No. 172,176

8 Claims. (Cl. 29—236)

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This invention relates to improvements in an applicator tool for drill pipe protectors used on drill pipe to protect the pipe and tool joints during drilling operations.

This application is a continuation-in-part of my application Serial No. 93,457 filed May 16, 1949.

Its principal novelty resides in the use of splined tapered cones mounted in opposed relationship upon a mandrel in a hydraulic jack so the splines of each cone register with the slotted portions of the opposed cones to expand the rubber protector placed between the cones. After expansion the protector is shifted to the sleeves of the collapsible hydraulically controlled transfer cage. This transfer cage has a hinged frame or a frame with removable sections permitting removal of the cage from the pipe after a protector has been applied to the drill pipe, as distinguished from the cage disclosed in my prior application which had to be slid on and off an end of the drill pipe in order to remove the cage from the pipe after the protector had been released.

An object, therefore, is to provide an applicator which is efficient, rapid in operation and one which reduces to a minimum the tearing or marring of the rubber edges or surfaces of the protector.

Another object is to provide a portable device which may be carried and transported from place to place in a light truck or in the rear of an automobile.

A further object is to provide an applicator which can be operated by an individual and the protectors expanded and transferred from the expanding mechanism to the drill pipe as rapidly as the operator can engage and disengage the transfer cage from the frame.

Other and further objects will appear from the description which follows:

In the accompanying drawings which form a part of the specification and are to be read in conjunction therewith, there is shown an embodiment of the invention and in these drawings like reference numerals indicate like parts in the various views.

Fig. 1 is a side elevational view of the hydraulic jack with the transfer cage extended and positioned within the frame, and showing the protector in a partially expanded condition.

Fig. 2 is an end view of the transfer cage removed from the jack to show the manner of hinging the end plates of the cage.

Fig. 3 is a view taken along the line 3—3 of Fig. 1 in the direction of the arrows.

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Fig. 4 is a side elevational view of the transfer cage on a drill pipe preparatory to releasing the protector.

Fig. 5 is a view taken along the line 5—5 in Fig. 2.

Fig. 6 is a modified type of construction utilizing removable sectors from the end plates of the cage in place of the hinged construction shown in the previous figure.

Fig. 7 is a view taken along the line 7—7 in Fig. 6 in the direction of the arrows.

Fig. 8 is a side elevational view of the splined tapered members and hydraulic jack or frame with a protector in position to be expanded.

Fig. 9 is a side view of the hydraulic jack and cage, rotated 45° from the view of Fig. 8, with parts broken away and in section to reveal the mounting of the splined tapered members and transfer sleeves.

The applicator is made up of four essential parts or units including a hydraulic jack, a transfer cage, a removable slidable splined tapered member or cone and removable end plate. The hydraulic jack, best shown in Fig. 1, comprises a hydraulic cylinder 10 to which is affixed base plate 11. The hydraulic system and controls for actuating the piston have been omitted for simplicity. Extending from the base plate 11 are a plurality of tie rods 12 rigidly attached at one of their ends to the base plate and at their opposite free ends are locking heads 12*a* formed by machining grooves circumferentially in the rods a short distance from their ends. Upon the hydraulic piston 13 operating in cylinder 10 is mounted a splined cone or tapered member 14, which is best seen in Fig. 8. The frusto-conical tapered portion of the member is slotted longitudinally to form splines 14*c*. Centrally of the cone is a shoulder 14*a* and that portion of the cone adjacent the piston is a plane surfaced taper designated by the numeral 14*b*. The cone is internally slotted to receive the splines of the opposed cone when the two are brought into registration as hereinafter explained. Piston 13 to which the cone is affixed extends through the splined cone 14 in the form of a cylindrical mandrel 13*a*.

Slidable tapered member

Mounted upon the piston extension or cylindrical mandrel 13*a* is a second splined cone 15, best seen in Figs. 8 and 9, corresponding in its general construction to cone 14 in that it has tapered splines 15*c* registering with the grooves in the opposed cone 14, a shoulder portion 15*a* and an unsplined tapered rear portion 15*b*. The shoul-

der portion of the cone, however, is at the opposite side of the cone from the shoulder on cone 14. Cone 15 is centrally drilled to slidably fit on mandrel 13a and a keyway is milled within the cone to register with key 13b on the mandrel. The key is located to position cone 15 so its splines are in alignment with and will register with the slots of cone 14, identical in construction with slots 15d of cone 15, when the two cones are moved together, as will be hereinafter described. In Figs. 1 and 8 a protector 16 is shown between the cones 14 and 15, being shown partially expanded in Fig. 1.

The transfer cage

The transfer cage used for carrying the expanded protector from the frame to the drill pipe is shown in position on the jack in Figs. 1 and 9, removed from the jack in Fig. 2, and applied to the drill pipe in Fig. 4 with the protector in expanded position and ready to be released onto the pipe. The construction of the cage is probably best shown in Figs. 1, 2, 3, 4 and 9. In brief, it comprises tapered sleeves 17 and 18 which have stepped outer surfaces and enlarged end plates or flanges 19 and 20. Set into plate 19 and rigidly affixed thereto are hydraulic cylinders 21. The pistons 22 operating in these cylinders have their ends rigidly attached to plate 20 by means of bolts 22a. The sleeves 17 and 18 and plates 19 and 20 are centrally apertured to slide over the splined cones 14 and 15 so when the transfer cage is assembled upon the hydraulic jack, as shown in Fig. 1, sleeve 17 with its enlarged flange or end plate 19 surrounds the cylindrical portion of cone 14 while sleeve 18 with its flange 20 fits over the cylindrical portion of cone 15.

The hydraulic system of the transfer cage is a closed system, comprising the space within the cylinders 21 on opposite sides of the pistons connected through a series of pipes 23 at one end of the cylinders and by pipes 24 at the opposite ends of the cylinders. The two systems of pipes 23 and 24 are connected by a valve 25 to provide communication between the two systems so the hydraulic liquid can pass from one end of the cylinders to the opposite and back again, when the ends of the cage are drawn together by the jack in expanding the protector and when the cage is spread with the release of the protector onto the drill pipe.

In Figs. 2 and 3 the end plate construction of the cage is indicated. These end plates and the tapered sleeves 17 and 18 are in two pieces diametrically separated so they may be swung apart upon pivots 26. The joining edges of plates 19 and 20 are tongue and grooved, as shown in Fig. 5, and are held together by means of pins 27 which extend through the fitted portion of the plates. In Figs. 6 and 7 is shown a modified type of construction where, instead of hinging the annular plates or sleeve flanges, sectors 19a—20a are removable from each of the end plates 19 and 20. As in the hinged structure these sectors have a tongue and groove joint with the plate into which they fit and are held in place by pins or bolts 27 in a manner similar to that shown in the hinged construction in Fig. 2.

In operation the hydraulic jack is lowered to a horizontal position and, with the end holding plate 28 removed, a protector 16 is slid onto the mandrel 13a and against the splines of cone 14. The removable cone 15 is then slid onto the mandrel with its splines facing those of cone 14 as shown in Fig. 8. It will be noted that the tapered ends of the splines of the two cones are beneath the opposite end edges of the protector. The transfer cage, with sleeves 17 and 18 separated to a maximum degree, is slid onto the cones so sleeve 17 encircles the splines of cone 14 and sleeve 18 fits about the cylindrical portion of cone 15, as shown in Fig. 9. To separate the sleeves of the transfer cage, valve 25 is opened and the sleeves manually pulled apart causing the hydraulic fluid to flow into the ends of the hydraulic cylinders remote from holding plate 28. Plate 28 is then affixed to the ends of the tie rods 12 abutting the outer face of plate 20 of the cage. In this position the holding plate is locked. To expand the protector hydraulic fluid is introduced behind the piston in cylinder 10 by a fluid pump mechanism conventional to hydraulic apparatus and omitted from the drawings. Suitable controls are used in the introduction of the fluid to regulate the rapidity with which the piston is actuated and the length of the thrust. As piston 13, cone 14 and the cylindrical mandrel, upon which cone 15 slides, move as a unit longitudinally within the tie rods 12 of the hydraulic jack, the splines of the respective cones will advance toward each other within the protector. The splines of the cones are aligned to register with slots of the opposed cone and the depth of the slots is such that the cones can be drawn together to a position where the protector is expanded or stretched to a size that its inside diameter is that of the cylindrical portions of the cones. As cone 14 moves with the piston, its shoulder portion 14a abuts against the outer surface of sleeve 17 causing the sleeve to move with it as it advances toward the other cone. Holding plate 28 at the opposite end of the jack abuts against a shoulder portion on cone 18 holding it fixedly against longitudinal movement as cone 14 advances. As the cones move together protector 16 is expanded and the outer edges of the protector expand outwardly moving along the tapered surface of the splines and onto the transfer sleeves 17 and 18 where the protector finally rests in an expanded position as is shown in Fig. 4.

At this time valve 25 is shut to isolate the hydraulic fluid in the ends of the cylinders closest to holding plate 28 thus holding the transfer cage in a collapsed condition as shown in Fig. 4.

Holding plate 28 is then rotated to an unlocked position and removed from the ends of the tie rods 12 at which time the transfer cage can be slid off the ends of the tie rods and placed on a section of pipe as shown in Fig. 4. By shifting the cage along the drill pipe, the protector can be located in any desired position and when so located valve 25 is opened releasing the expanded protector onto the surface of the pipe. The elastic force of the expanded protector snaps the sleeve apart and shifts the hydraulic fluid in cylinders 21 from one end to the opposite and through the hydraulic pipe system previously explained. Grease is used on the outer surface of the sleeves 17 and 18 to reduce friction during expansion of the protector and to facilitate release of the protector from the sleeves onto the drill pipe. When released onto the pipe the protector will grip tightly and evenly the surface of the pipe and will remain immovable thereon unless again expanded or cut

from the pipe. After the protector has been applied to the pipe pins **27** are removed from the end plates of the cage and the cage opened up by swinging open the ends on pivots **26**. The hinging of the end plates and sleeves permits easy removal of the cage from the drill pipe. When a cage employing the modified construction shown in Fig. 6 is used, pins **27** from the sectors in the two plates are taken out and the sectors removed when the cage is to be taken off of the pipe. After the pipe has been slid through the openings, the sectors are again inserted and the pins **27** replaced. The cage is then ready to be returned to the jack to expand another protector.

Thus it will be seen that there has been provided a device for expanding drill pipe protectors or other type of expansible rings whose inside diameter is to be enlarged to fit upon a larger object. There has been provided an applicator which requires a minimum of manual effort and one in which high expansive forces are obtained by the simple manipulation of a single hydraulic valve. The applicator not only provides a means for easily expanding a protector but furnishes a portable device for transferring the expanded annulus from the expanding mechanism to the drill pipe where it is released and applied to the pipe in a safe and simple operation.

From the foregoing it will be seen that the invention is well adapted to attain all of the ends and objects hereinbefore set forth together with other advantages which are obvious and which are inherent to the structure.

As many possible embodiments may be made without departing from the scope of the invention it is to be understood that all matter herein set forth or shown in the drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention I claim:

1. In a device for transferring protectors from a meshing splined cone expander to drill pipe, the combination comprising a pair of coaxial sleeves disposed in axially spaced relation, the facing ends of said sleeves adapted to fit inside the bore of an expanded protector and the opposite ends being provided with radial flanges, telescoping links connecting the respective flanges thereby to permit limited axial movement of said sleeves toward and from one another, said links being spaced circumferentially around said flanges, releasable means for holding said sleeves together with their adjacent ends in substantial abutment, each of said sleeves and its associated flange being divided longitudinally into separable complementary segments whereby sidewise removal of the device from the drill pipe is permitted on release of the protector to said pipe.

2. In a device for transferring protectors from a meshing splined cone expander to drill pipe, the combination comprising a pair of coaxial sleeves disposed in axially spaced relation, the facing ends of said sleeves adapted to fit inside the bore of the expanded protector and the opposite ends being provided with radial flanges, telescoping links connecting the respective flanges thereby to permit limited axial movement of said sleeves toward and from one another, said links being spaced circumferentially around said flanges, releasable means for holding said sleeves together with their adjacent ends in substantial abutment, and each of said sleeves and its associated flange being split longitudinally to provide opposing complementary sections, the sections of each sleeve and flange being hingedly

connected at one juncture about a common axis parallel to and spaced from the sleeve axis and releasably secured at the other juncture to permit pivotal separation of the sections whereby lateral removal of the device from the drill pipe is permitted on the release of the expanded protector to said pipe.

3. In a device for transferring protectors from a meshing splined cone expander to drill pipe, the combination comprising a pair of coaxial sleeves disposed in axially spaced relation, the facing ends of said sleeves adapted to fit inside the bore of the expanded protector and the opposite ends being provided with radial flanges, telescoping links connecting the respective flanges thereby to permit limited axial movement of said sleeves toward and from one another, said links being spaced circumferentially around said flanges, releasable means for holding said sleeves together with their adjacent ends in substantial abutment, and each of said sleeves and its associated flange being provided with a removable sector between two adjacent links whereby sidewise removal of the device from the drill pipe is permitted on release of the protector to said pipe.

4. In a device for transferring protectors from a meshing splined cone expander to drill pipe, the combination comprising a pair of coaxial sleeves disposed in axially spaced relation, the facing ends of said sleeves adapted to fit inside the bore of an expanded protector and the opposite ends being provided with radial flanges, a plurality of telescoping links positioned between and connected to said flanges, said links being spaced circumferentially around said flanges, each of said sleeves and its associated flange being separated longitudinally to form opposed complementary sections hingedly connected at one juncture about a common axis spaced from and substantially parallel to the axis of said sleeves and releasably secured at the other juncture to permit pivotal separation of said sections and the telescoping links carried thereby thus to permit lateral removal of the device from the drill pipe on the release of the expanded protector to said pipe.

5. In a device for transferring protectors from a meshing splined cone expander to drill pipe, the combination comprising a pair of coaxial sleeves disposed in axially spaced relation and having radial annular flanges at their outer ends, a plurality of enclosed tubes secured to one of said flanges at circumferentially spaced intervals, said tubes paralleling the axis of said sleeves and each containing a piston having a piston rod connected to the other of said flanges, each of said sleeves and its associated flange being longitudinally split to form opposed complementary sections hingedly connected at one juncture about a common axis parallel to and spaced from said sleeve axis and releasably secured at the other juncture to permit pivotal separation of the sections and their associated tubes and pistons about the hinge axis, hydraulic fluid in each tube on both sides of the piston, passageways through which fluid can flow from one side of the respective pistons to the other side upon axial movement of the sleeves, and valve means associated with said passageways operable to prevent said flow and thus cause said tubes and pistons to resist movement of said sleeves relative to one another.

6. A device as in claim 5 wherein said passage-

ways comprise flexible hoses joined to a common duct having a single valve.

7. In a device for transferring protectors from a meshing splined cone expander to drill pipe, the combination comprising a pair of coaxial sleeves disposed in axially spaced relation and having radial annular flanges at the other ends, a plurality of enclosed tubes secured to one of said flanges at circumferentially spaced intervals, said tubes paralleling the axis of said sleeves and each containing a piston having a piston rod connected to the other of said flanges, hydraulic fluid in each tube on both sides of the piston, passageways through which fluid can flow from one side of the respective pistons to the other side upon axial movement of the sleeves, valve means associated with said passageways operable to prevent said flow and thus cause said tubes and pistons to resist movement of said sleeves relative to one another, and each of said sleeves and its associated flanges being provided with a removable sector between two adjacent tubes whereby sidewise removal of the device from the drill pipe is permitted on release of the protector to the pipe.

8. A device as in claim 7 wherein said passageways comprise flexible hoses joined to a common duct having a single valve.

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REFERENCES CITED

The following references are of record in the file of this patent:

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