

Dec. 1, 1959

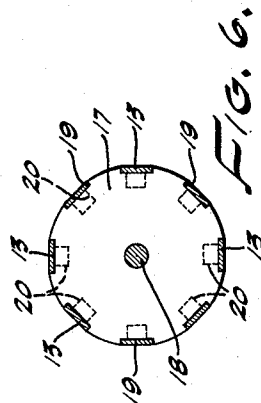
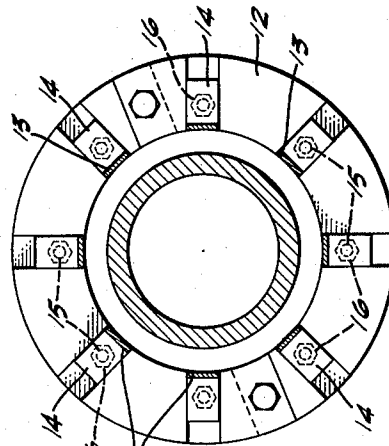
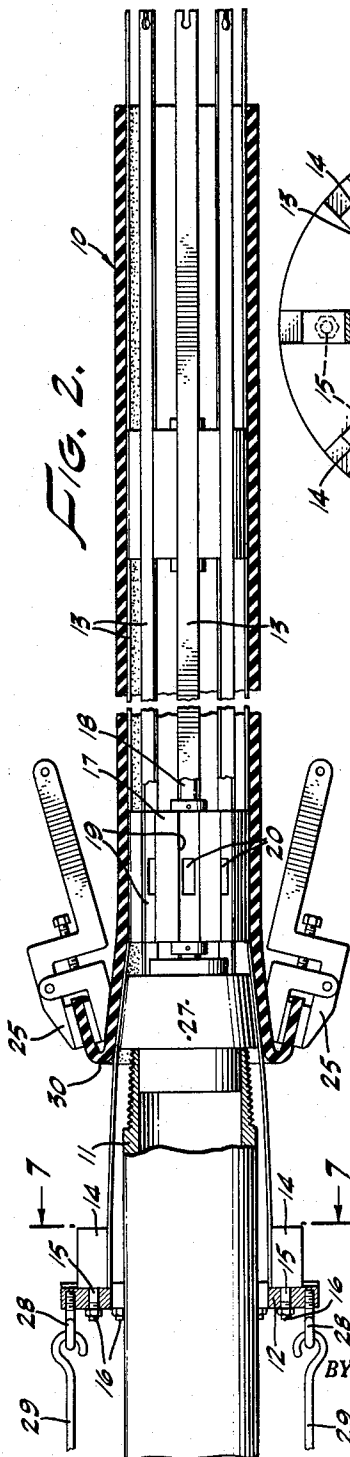
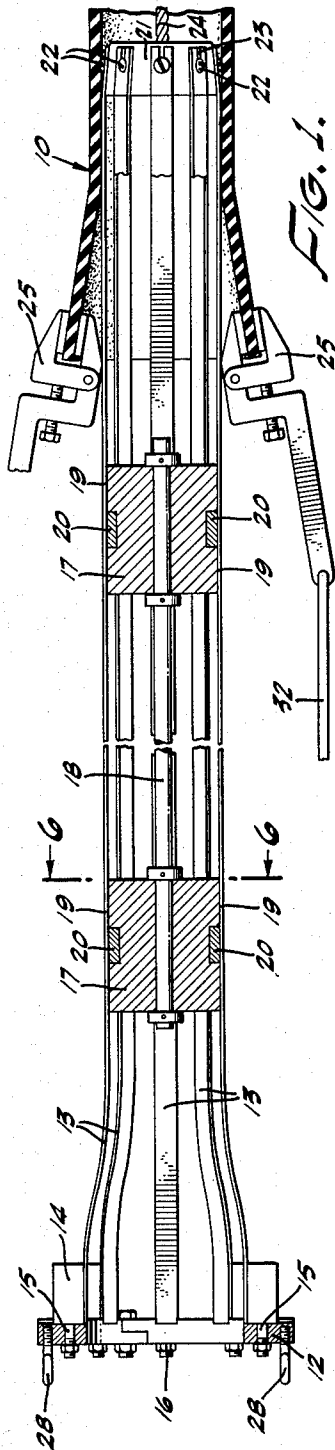
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2,914,845

METHOD OF PROTECTING LINERS AND CASINGS

Filed Nov. 19, 1953

3 Sheets-Sheet 1



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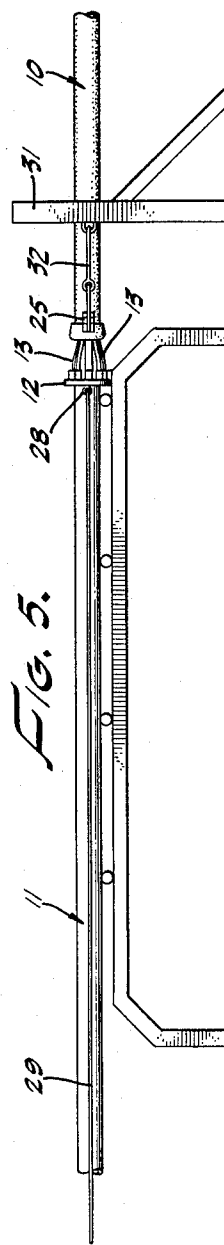
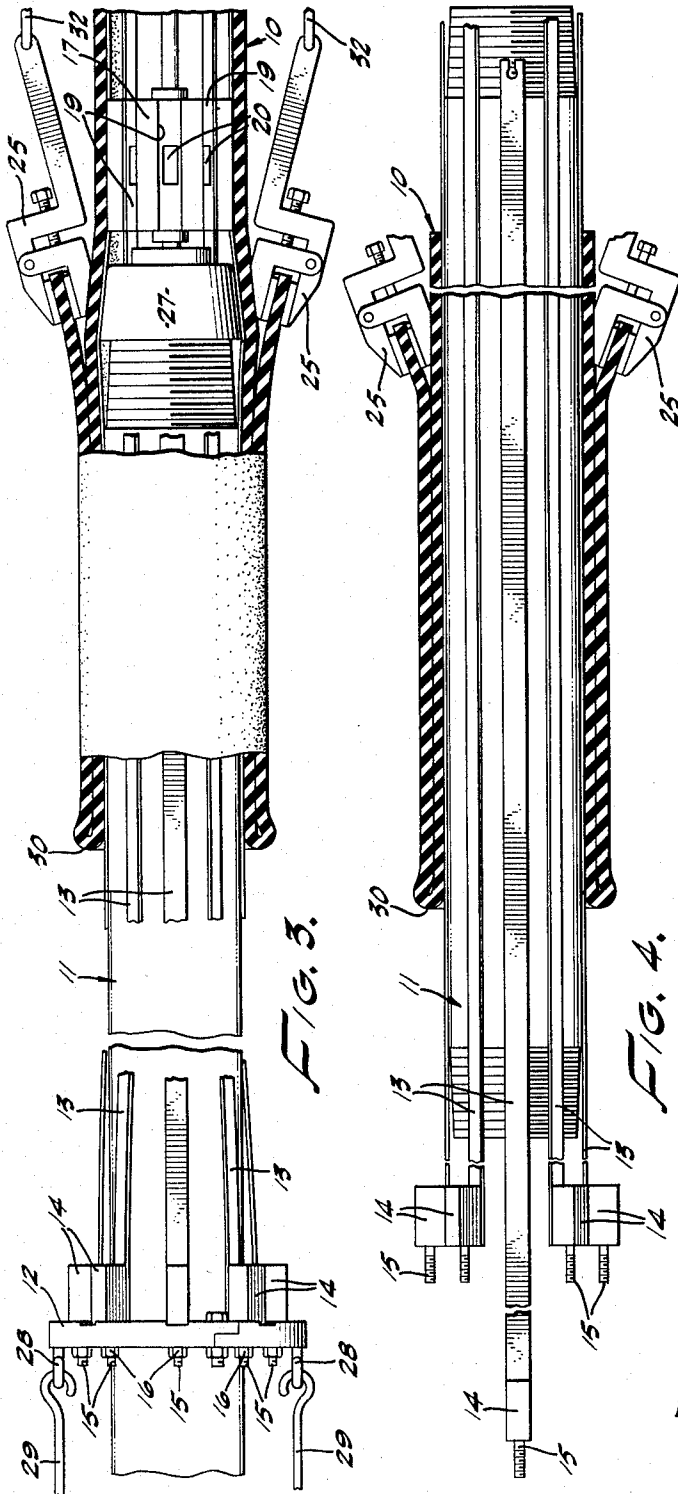
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METHOD OF PROTECTING LINERS AND CASINGS

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3 Sheets-Sheet 2



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METHOD OF PROTECTING LINERS AND CASINGS

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3 Sheets-Sheet 3

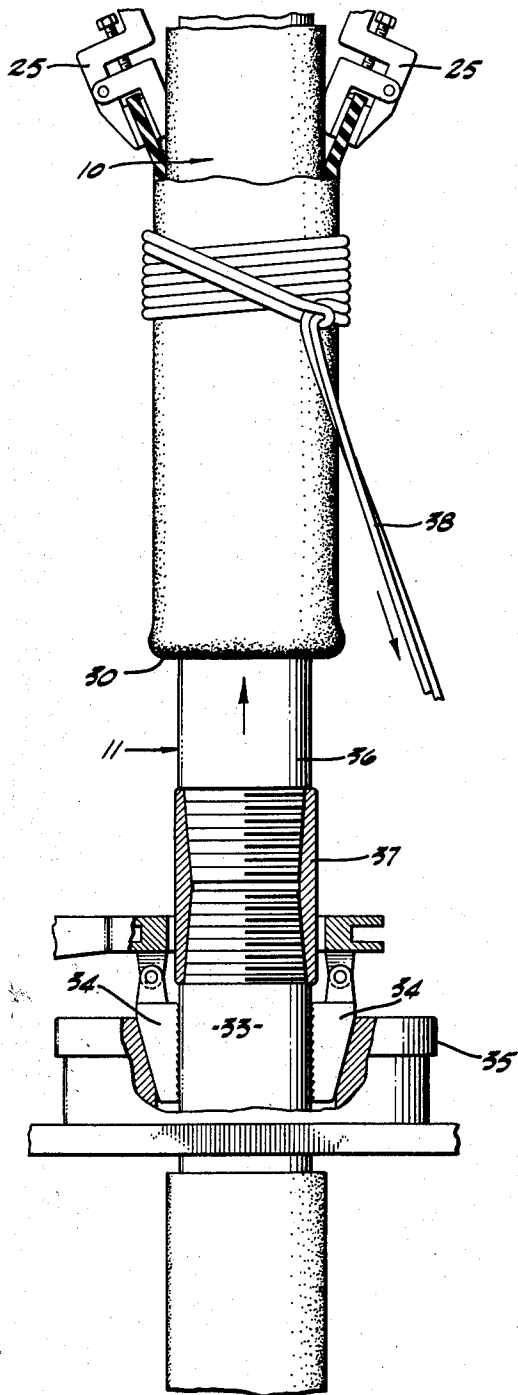


FIG. 8.

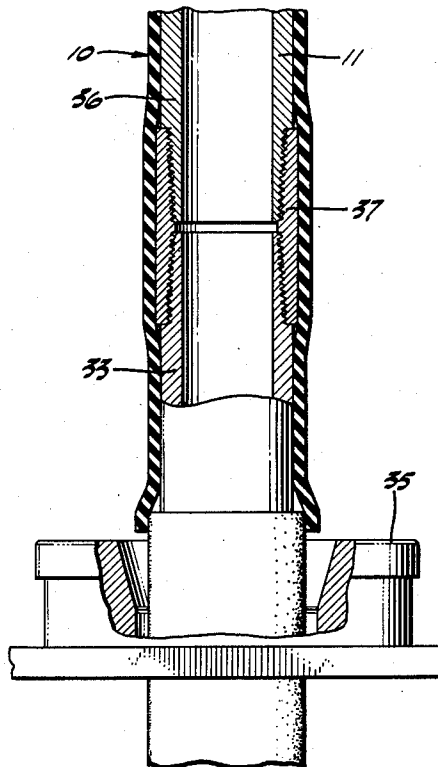


FIG. 9.

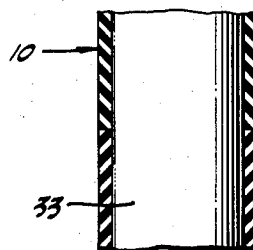


FIG. 10.

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## METHOD OF PROTECTING LINERS AND CASINGS

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2 Claims. (Cl. 29—450)

This invention relates to a method of covering pipe with a tubular rubber-like coating.

The invention has been primarily designed for applying rubber-like coatings to liners used in wells, but is equally applicable to casing and even line pipe.

In wells, two important causes of liner failure are

(1) the erosion or abrasion caused by the bombardment of the metal of the liner by sand and gravel particles under considerable gas pressure; and

(2) electrolytic corrosion which occurs particularly in water drive fields after water has introduced the producing sands.

As a means for protecting the liner against these two causes of failure, I propose to cover the liner with a tubular envelope of rubber or rubber-like material. The elasticity or resiliency of the covering is such that it will effectively resist the abrasion occasioned by the driving of the sand particles against the metal of the liner. Also, the covering forms a good dielectric casing surrounding the liner which will, to a large extent, isolate and thus protect the liner from electrolytic corrosion. After the liner with its surrounding covering of rubber-like material has been positioned in the well, perforations may be formed in the liner and in the covering by means of any conventional gun perforator or the equivalent. In some instances, such as in casing or in line pipe, the pipe may not be severely subjected to abrasion but may, nevertheless be subject to electrolytic corrosion. In these latter instances, the surrounding protector of rubber-like material effectively protects the metal of the pipe from the electrolytic corrosion.

It is an object of the present invention to provide a method for applying a tubular rubber-like coating to pipe sections in such a manner that the covering is effectively telescoped onto the pipe section in an expanded condition so that the covering when released will contract on the pipe and remain thereon in a stretched or taut condition.

In applying the invention to pipe to be used in wells, such as in the case of liner or casing, it is necessary to support a suspended length of the liner or casing in the well while an additional section is being connected thereto. In supporting a long suspended length it is desirable to support or suspend the pipe in the well by means of the conventional slips which must engage and bite into the metal of the pipe. It is therefore another object of the invention to provide a method and apparatus for applying rubber-like coverings to pipes which will enable portions of the pipe to be left exposed during assembly so that these exposed portions may be engaged by the slips as occasion may require. After the added section or stand of pipe has been assembled with the pipe in the hole the rubber covering may be so manipulated as to completely cover the joint with the result that the completed length of pipe, although made up of sections or stands, can be completely covered with the rubber-like covering throughout its entire length.

With the foregoing and other objects in view which

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will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Figure 1 is a vertical section of apparatus employed to slip a rubber-like covering onto a section of pipe;

Fig. 2 is a sectional view illustrating the apparatus in the process of applying the rubber-like covering to a section of pipe;

Fig. 3 is a view similar to Fig. 2, but illustrating the application of the rubber-like covering as having been substantially completed;

Fig. 4 is a sectional view illustrating the application of the covering as having been completed;

Fig. 5 is a partial view illustrating apparatus which may be employed to apply the covering to the pipe in the manner illustrated in Figs. 2, 3, and 4;

Fig. 6 is a vertical section taken substantially upon the line 6—6 upon Fig. 1;

Fig. 7 is a vertical section taken substantially upon the line 7—7 upon Fig. 2;

Fig. 8 is a partial view illustrating the manner in which a section of pipe covered in accordance with the present invention may be assembled with a length of pipe suspended within a well;

Fig. 9 is a view similar to Fig. 8, but illustrating the manner in which the joint is covered by the rubber covering; and

Fig. 10 is a partial view in vertical section illustrating the completed joint between rubber coverings on two adjacent sections of pipe.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, 10 indicates a tubular rubber-like covering which it is desired to apply to a section of pipe 11. This pipe 11 may be a section of liner, a section of casing or a section of line pipe. The rubber-like covering 10 may be in the form of vulcanized, natural rubber, but preferably is formed of cured synthetic rubber, possessing suitable properties of elasticity and insulation.

In order to apply the covering 10 lengthwise of the pipe section 11, I provide an annular yoke or ring 12, the inside diameter of which is such that it may readily pass over the pipe section 11. To this yoke is detachably secured a plurality of flexible steel expanders or skids 13. These expanders or skids are in the form of long flexible steel strips having blocks 14 welded or otherwise secured thereto at one end. The blocks 14 are provided with studs 15 which may be extended through holes in the yoke 12 and secured thereto by nuts 16. The expanders or skids 13 are attached to the yoke 12 at equally spaced intervals about its circumference and are of such a length that they may extend completely through the tubular covering 10. Intermediate their ends these strips may be held in proper spaced relation to each other by means of wooden cores 17 that are connected to each other by means of a spacing rod 18. These cores have recesses 19 on their outer surfaces in which the strips 13 are receivable. Beneath these recesses there may be embedded in the cores permanent magnets 20 which attract the strips 13 and hold them in their respective recesses 19. At the opposite ends of the strips there is a plug 21 on which radial studs or headed bolts 22 are arranged. These studs extend through keyhole slots or tapered slots 23 in the ends of the strips so that the strips may readily be attached to and detached from the plug. When the studs are extended through the keyhole slots the widths of the studs prevent their being longitudinally withdrawn through the narrow ends of the slots 23.

A cable 24 or similar tension element is secured to the plug 21. This cable is adapted to be dropped through

the covering 10 so as to extend out of its remote end. The covering 10 has an internal diameter when in its unstretched condition somewhat smaller than the external diameter than the pipe 11 so that it is necessary to stretch the covering circumferentially in applying it to the pipe. The external diameter of the cores 17 and the skids or expanders 13 thereon may be equal to or slightly less than the internal diameter of the covering.

In preparing to apply the covering 10 to the pipe 11 clamps 25 are applied to one end of the covering and are caused to grip the covering 10. These clamps may be anchored to any stationary support by means of connectors 26. With the apparatus and covering mutually assembled together, as shown in Fig. 1, the cover 24 may be caused to pull the plug 21 and the expanders 13 together with their contained cores 17 into the covering. When the expanders have been thus drawn through the covering to assume a position as depicted in Fig. 2, the flexible ends of the expanders 13 will spring outwardly to cause the keyhole slots 23 to disengage the studs 22 and the plug 21 is thereafter removed.

A plug 27 preferably having a frusto-conical exterior is then applied to the end of the pipe section 11 and the yoke 12 together with the attached expanders 13 is then slipped over the plug 27 and onto the pipe section 11. On the yoke 12 there are eyes 28 to which cables or the equivalent indicated at 29 may be attached. The cables 29 are, in turn, connected to any pulling instrumentality which can forcibly draw the yoke onto the pipe section. Before drawing the yoke onto the pipe section the clamps 25 are swung from the position shown in Fig. 1 into the position shown in Fig. 2 to start a reverse fold 30 in the covering 10. These clamps are, in turn, anchored to a stationary structure 31 such as by tension elements 32. When the cables 29 draw the yoke 12 onto the pipe section 11, the expanders or strips 13 merely slide upon the plug 27 and are expanded thereby to a diameter at least as great, if not greater, than the exterior of the pipe section 11. As the expanders are thus forcibly expanded by the plug 27 they forcibly expand or radially stretch the covering 11. The expanders slide on the plug and on the exterior of the pipe 11 with a minimum amount of friction, thus carrying the covering 10 with them onto the pipe 11. As this action proceeds, the end of the connecting rod 18 engages the plug 27, causing the cores 17 to slide out from between the expanders. Also, as the clamps 25 are held stationary these clamps cause the covering to be reversely folded for a substantial distance on the covering as it is applied to the pipe section 11, see Fig. 3. Preferably grease or a similar lubricant is applied to the exterior of the covering adjacent the clamps 25 to facilitate this reversely folded portion sliding on the portion of the covering 10 that is disposed therewithin.

When the covering 10 is in its completely applied position, as depicted in Fig. 4, both ends of the pipe section 11 are left exposed thereby for a purpose hereinafter to be described.

The nuts 16 are then removed and the yoke 12 is detached from the expanders or skids 13. The expanders are thereafter individually and consecutively removed by pulling each expander lengthwise from between the covering and the pipe. The removal of one such expander is illustrated in Fig. 4. All of the expanders can thus be consecutively removed from between the covering and the pipe without disturbing the position of the covering inasmuch as the friction between a single expander and the covering is less than the friction between the covering and the remaining expanders or between the covering and the pipe.

When all of the expanders have been withdrawn from between the covering and the pipe the covering will then have contracted into a snug fit about the pipe, it being preferable to have the covering under circumferential tension when in its fully applied position. The pipe sec-

tion with its covering 10 in applied position thereon is then ready to be connected to adjacent pipe sections and lowered into a well in the case of liner and casing. In the case of line pipe, the pipe sections may be mutually assembled together to form the complete conduit.

As illustrated in Fig. 8, when the covered pipe sections are to be used in the well the exposed end of the metal of the pipe at one end of the pipe section indicated at 33 may be engaged by the conventional pipe slips 34 on the rotary table 35 of a rotary well drilling apparatus. These slips will adequately suspend the pipe section that is within the well and subjacent pipe sections connected thereto.

The added stand of pipe indicated at 36 may be elevated by the travelling block in the derrick and positioned over the pipe that is within the hole and the collar 37 applied to the adjacent ends to connect the adjoining pipe sections together. A rope or the equivalent indicated at 38 may be given several wraps about the reversely folded portion of the covering and its lower end may be anchored to any suitable anchor on the derrick floor.

After the pipe section 36 has been applied the entire length of pipe may be elevated by the travelling block on the derrick to free the slips 34. In the course of elevating the pipe the rope 38 causes the reversely folded portion of the covering to be unfolded downwardly over the pipe. In the preferred form the clamps 25 are left attached to the end of the covering while this occurs as it is found that these clamps are advantageously employed in bringing about an unfolding of the extreme end of the covering 10. This unfolding or sliding downwardly of the reversely folded portion of the covering causes the covering to cover the collar 37 or the joint between adjacent pipe sections as illustrated in Fig. 9. The extreme end of the unfolded covering may even overlap slightly the upper end of the covering on the subjacent pipe section as illustrated in Fig. 9. The excess or overlapping portion of the covering 10 may then be trimmed off so that the coverings on the two adjacent pipe sections mutually abut each other as shown in Fig. 10.

It will be appreciated that the procedure as above outlined may be repeated with each added section of pipe until the entire liner or casing is completed. Upon completion of the liner coatings in this manner the liner may be properly positioned in the well and perforations subsequently formed therein by a gun perforator or the equivalent, in the above described manner. It will be appreciated that a relatively heavy rubber-like covering may be applied to pipe sections, and when in applied position, it will contract upon the pipe section so as to remain under tension thereon. Not only are the individual pipe sections covered by the covering but the covering extends across the joint between adjacent pipe sections and abuts the covering of the subjacent pipe section. In this manner joints between sections of the covering 10 may be regarded as staggered with relation to the joints between the pipe sections. In utilizing the invention it is not necessary to alter or modify any of the conventional apparatus employed in rotary well drilling and in fact, such apparatus is used to advantage in assembling the pipe sections and in unfolding the reversely folded portion of the covering.

Various changes may be made in the details of construction without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. The method of covering pipe comprising introducing into a tubular rubber-like covering having a smaller internal diameter than the external diameter of the pipe a plurality of flexible expanders, drawing the covering and the expanders endwise onto the pipe and in so doing expanding the covering, reversely folding one end of the covering as the expanders and covering are drawn onto the pipe to leave one end of the pipe exposed, and in-

dividually withdrawing the expanders from between the covering and the pipe leaving the covering in position thereon in an expanded condition.

2. The method of covering pipe comprising introducing into a tubular rubber-like covering having a smaller internal diameter than the external diameter of the pipe a plurality of flexible expanders, drawing the covering and the expanders endwise onto the pipe and in so doing expanding the covering, reversely folding one end of the covering as the expanders and covering are drawn onto the pipe to leave one end of the pipe exposed, and individually withdrawing the expanders from between the covering and the pipe leaving the covering in position thereon in an expanded condition, connecting the exposed end of the pipe to another section of pipe and unfolding the reversely folded portion of the covering to cover the joint between the pipe and said other section of pipe.

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