

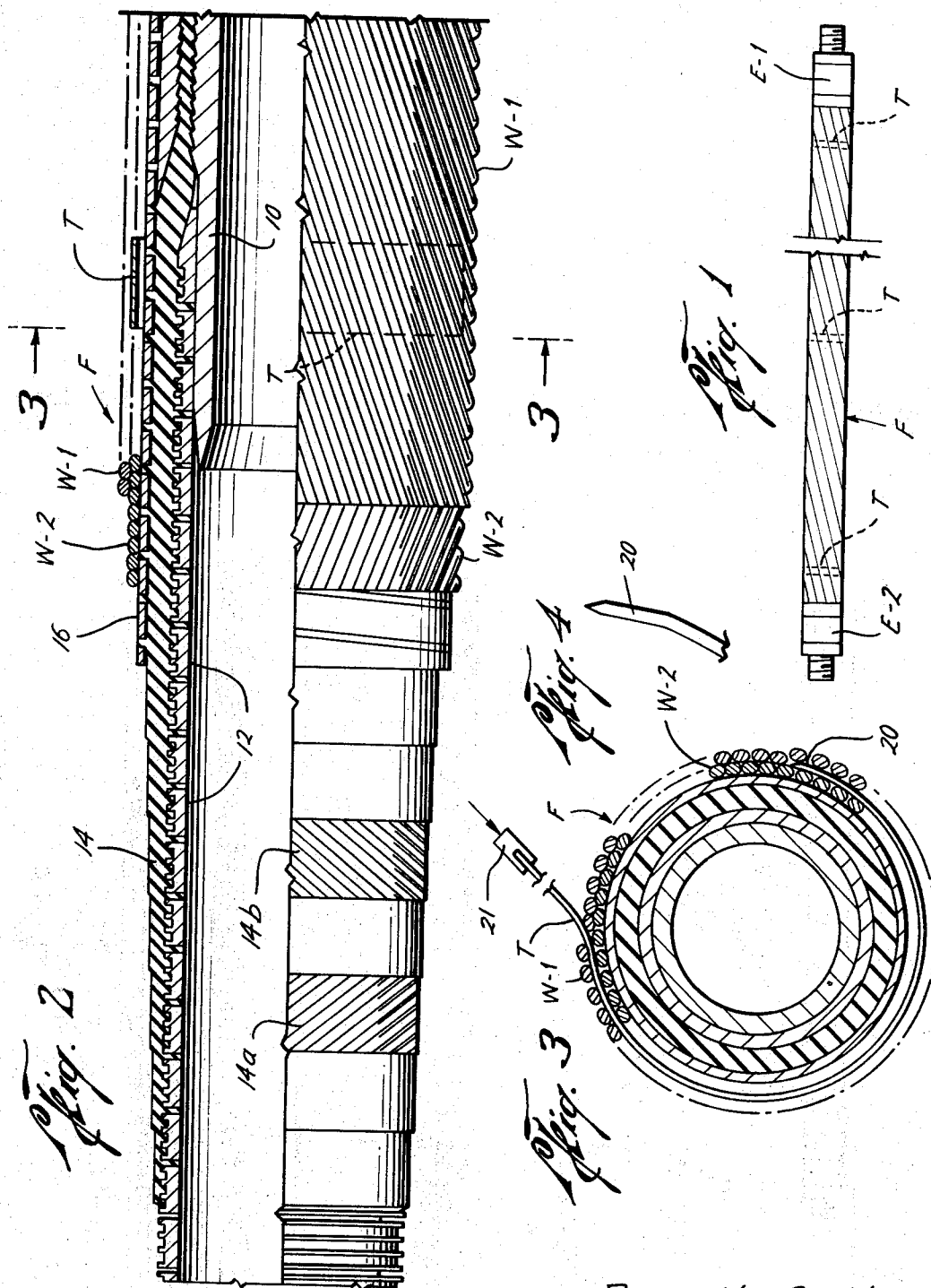
Sept. 29, 1970

R. H. CULLEN

3,530,564

METHOD OF REMOVING LOOSENESS IN WIRES OF FLEXIBLE PIPE

Filed Feb. 23, 1968



Roy H. Cullen
INVENTOR

Vincent Martin
BY Joe E. Edwards
ATTORNEYS

1

2

3,530,564

METHOD OF REMOVING LOOSENESS IN WIRES OF FLEXIBLE PIPE

Roy H. Cullen, Houston, Tex., assignor to The Youngstown Sheet and Tube Company, Boardman, Ohio
Continuation-in-part of application Ser. No. 648,039, June 22, 1967. This application Feb. 23, 1968, Ser. No. 707,812

Int. Cl. B21d 19/10; B23p 7/00

U.S. Cl. 29—401

9 Claims

ABSTRACT OF THE DISCLOSURE

A method of moving looseness in wire wrapping of flexible pipe wherein one or more tapes of metal or the like is forced substantially circumferentially below the loose wrap or wraps to remove the looseness without appreciably increasing the external diameter of the flexible pipe.

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of United States patent application Ser. No. 648,039, filed June 22, 1967, now abandoned.

BACKGROUND OF THE INVENTION

The field of this invention is methods of manufacturing flexible pipe suitable for use in performing well operations.

As disclosed in U.S. Pat. Nos. 2,825,364; 2,915,323; 3,004,779; and others, flexible hose or pipe may be constructed with armor wires wrapped thereon and secured at appropriate end couplings. It has been found that it is desirable to exert an end pull load on each section of flexible pipe of approximately 80% to 90% of the yield strength of the armor wires to test the flexible pipe for end pull loading prior to use. In some instances, such pulling during the test pulls the swage rings of the end couplings upwardly on its inclined surface until further movement is prevented by an increased tightening or gripping action on the wires.

When such swaging rings thus move, some looseness develops in the outer layer of armor wires, and sometimes in the wire layers therebelow. This looseness may be detrimental since there is a tendency for such looseness to accumulate at the end of each section as the flexible pipe is passed through the grippers of a retractor apparatus such as that shown in U.S. Pat. No. 2,892,535. Such accumulation may result in bending of the wires by the grippers which would interfere with subsequent use of the flexible pipe in the grippers and other equipment and might result in failure of the wires themselves.

SUMMARY OF THE INVENTION

With the present invention, the problem of looseness in the armor wires caused by testing, poor manufacturing or hard field usage is solved by inserting one or more tapes of metal or other stiff or slightly bendable material circumferentially below the loose wrap of wires. When the outer layer of wires is loose, the metal tape or tapes are inserted between the outer wire layer and the next layer therebelow by forcing each such tape to follow the internal curvature provided by the outside wire layer. The slight increase in diameter thus developed does not interfere with the use of the flexible pipe in the retractor or other equipment. The method thus employed may be readily performed in the field using conventional hand tools so that if looseness develops in the field, it can be readily and economically removed in accordance with this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation illustrating a flexible pipe upon which the method of this invention has been employed for removing looseness in the outer wire wrap or layer;

FIG. 2 is a cross-sectional view, partly in elevation, and with some portions removed for illustration purposes, illustrating the product produced by the method of the present invention;

FIG. 3 is a cross-sectional view taken on line 3—3 which schematically illustrates the preferred method of the present invention; and

FIG. 4 is an enlarged fragmentary view in elevation of the end of the tightening strip shown in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the drawings, the letter F designates generally a flexible hose or pipe which may take many different forms, but which is preferably made in accordance with one of the types disclosed in United States patent application Ser. No. 648,039. The flexible pipe F is normally formed with an outer layer of wires W-1 which is helically wound and is disposed over an inner layer of wires W-2 which is helically wound in the opposite direction. Such layers W-1 and W-2 are formed of armor wires which provide primarily for the end pull strength of the entire flexible pipe F, and such layers of wires W-1 and W-2 are anchored at end couplings E-1 and E-2 at the ends of each of the sections of flexible pipe F (FIG. 1). A plurality of the flexible pipe sections is connected together to make up an entire flexible pipe string for use in a well or for performing similar operations. The method of this invention is utilized in the event the outer layer of wires W-1 becomes loosened for any reason such as sometimes occurs when applying an initial end pull in testing each section of the flexible pipe F. If such loosening occurs, one or more tapes or strips P are inserted between the external layer of wires W-1 and the next layer of wires W-2, in a manner to be hereinafter described in detail.

In the form of the flexible pipe F illustrated in FIG. 2, a portion 10 of an end coupling E-1 (FIG. 1) is disposed inwardly of a plurality of collapse rings 12 (FIG. 2). The collapse rings 12 are formed of aluminum or other rigid material and they are longitudinally spaced from each other to assure flexibility of the entire flexible pipe F in use. The collapse rings 12 form the inner surface of the flexible pipe F, although they may be coated or formed internally thereof with a plastic material or a rubber-like material if desired. The rings 12 are formed as a unit and are held in their longitudinally spaced relationship by a hose or core 14 which may be entirely formed of neoprene or other synthetic rubber or rubber-like material. As illustrated in FIG. 2, the core 14 includes two circumferentially spaced wire reinforcing layers 14a and 14b which are disposed in the neoprene or other material formed in the core 14.

A helically wound spring 16 or other similar member formed of metal such as steel is disposed around the core 14 in the form shown in FIG. 2 so as to provide for burst strength. The two layers of wire W-1 and W-2 are externally disposed with respect to the burst strength layer 16 in the form of the invention illustrated in the drawings. For each section of the flexible pipe F, the end couplings E-1 and E-2 may be of any form illustrated in the above-identified United States patents or any other patents disclosing end couplings capable of holding the ends of the flexible pipe F.

The layer of wires W-1 is normally initially applied in a helical wrap as disclosed in FIG. 2 of the drawings and is tightly disposed about the layer W-2 therebelow. In the event, however, such wires W-1 become loosened,

either during testing or in use, the method of this invention may be employed to tighten same and thereby remove the looseness so as to prevent damage to the wires forming the layer W-1 when used in a retractor of the type shown in U.S. Pat. No. 2,892,535.

In carrying out the method of this invention, and assuming a slight amount of looseness has developed in the layer of wires W-1, a strip of tape T which is narrow as compared to the length of the section of flexible pipe F is inserted into the space between the outer layer of wires W-1 and the layer W-2 therebelow. The tip or forward end 20 of the tape T is bent inwardly or towards the center of the flexible pipe F at an angle so that it guides the tape T as it is inserted below the layer of wires W-1 in a circular or slightly helically annular path and in conformity to the inner diameter of the layer of wires W-1. The inner diameter of the layer W-1 is increased in the vicinity of the tape by at least the thickness of the tape T so as to take up some or all of the looseness in the wires of such layer W-1.

Initially, the forward end or tip 20 of the tape T is disposed between a pair of adjacent wires in the layer W-1 and then is forced below such layer W-1 as illustrated in FIG. 3. The end force may be applied to the tape T by any suitable means, but it has been found that any manually operated tools such as a hammer which is indicted schematically at 21 (FIG. 3) may be used for applying successive impacts or blows to the exposed end of the tape T for accomplishing the application of the end force to the tape T to force same in the circular path beneath the layer of wires W-1 (FIG. 3). Ordinarily, the width of the tape T would be approximately one inch, whereas the length of the section of flexible pipe F may be of the magnitude of 100 feet or more. The length of the tape T is such that it will go around the full 360° or more at an angle so that the tape does not pile upon itself if that amount of the tape T is required to effect a tightening of the layer of wires W-1. If the tightening occurs before the full 360° or full circumference or more has been covered by the Tape T, the rear end portion of the tape T is cut and slipped below the wires of the layer W-1 so that the entire tape T is covered by the wires W-1.

If it requires more than one tape T to remove the looseness in the layer of wires W-1, additional tapes or strips T are inserted as indicated by the dotted lines in FIG. 1. Each of such tapes T is inserted in the same manner as described above with respect to the tape T shown in FIG. 3, and the number of tapes will depend upon the extent of looseness of the layer of wires W-1.

Although the invention has been described herein with respect to the layer of wires W-1, it is possible to apply the method of this invention for the tightening or removal of looseness which occurs in the layer of wires W-2, or other layers therebelow, in the same manner as heretofore described for the layer W-1. Although the tape T is preferably made of steel, it may be made of any suitable stiff or slightly bendable material which can be forced inwardly in accordance with the method described above.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape and material, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A method of removing looseness in a layer of wires wrapped on a flexible pipe, comprising the steps of:

(a) inserting the tip of a stiff tape beneath the loose layer

(b) thereafter applying an end force to said tape to force it to move in a path around the pipe in substantial conformity with the inner diameter of said layer of wires.

2. The method set forth in claim 1, including the additional step of:

(a) inserting an additional tape at a spaced longitudinal distance from said tape and below said loose layer of wires.

3. The method set forth in claim 1, including the additional step of:

(a) inserting a plurality of additional tapes at a spaced longitudinal distance from said tape and below said loose layer of wires.

4. The method set forth in claim 1 wherein:

(a) said tip of said tape is initially bent to an angle relative to the rest of said tape so as to guide the tape inwardly and below the loose layer of wires as it is forced in said circumferential path.

5. The method set forth in claim 1 wherein:

(a) said end force is applied by successive impacts until the desired length of tape is disposed below said layer of wires.

6. The method set forth in claim 1 wherein:

(a) said wires forming said layer are helically wrapped relative to the longitudinal axis of said flexible pipe; and

(b) said path of said tape is slightly angular relative to a plane perpendicular to the longitudinal axis of said flexible pipe.

7. The method set forth in claim 1 wherein:

(a) said layer of wires is a first layer;

(b) the flexible pipe includes a second layer disposed inwardly of said first layer; and

(c) said tape is disposed between said first and second layers.

8. The method set forth in claim 1 including:

(a) removing a portion of the outer end of said tape has been at least partially inserted beneath said loose layer of wires to obtain a predetermined length for completely disposing same below said layer of wires.

9. The method set forth in claim 1 wherein:

(a) the end force is applied until the entire tape is disposed below said layers of wire.

References Cited

UNITED STATES PATENTS

963,800	7/1910	McIntosh et al.	29—401
1,899,343	2/1933	Mackey et al.	29—526 X
2,303,187	11/1942	Wood et al.	29—401
2,756,484	7/1956	Booth	29—526 X
3,004,779	10/1961	Cullen et al.	285—149
3,027,631	4/1962	Nathan	29—526 X
3,297,343	1/1967	Oetiker.	
3,353,255	11/1967	Short	29—401

CHARLIE T. MOON, Primary Examiner

U.S. Cl. X.R.

29—433, 446, 526