

PATENT SPECIFICATION

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(54) PIPE WRAPPING STRUCTURE

(71) We, W. R. GRACE LIMITED, a British Company of Elveden Road, Park Royal, London N.W.10, England do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a wrapping structure for protecting a pipe, particularly steel pipelines which may be subjected to impact by hard objects, for example rocks and pebbles.

It is well known that steel pipelines, whether buried in the ground, or resting on the surface of the sea-bed, can be protected with coating compositions or wrappings. In order to prevent localised corrosion occurring at holes or tears in these protective coatings or wrappings, cathodic protection is often employed as a second line of defence. This cathodic protection involves placing adjacent to the pipe an anode of a metal which is higher than iron in the electrochemical series, or the impression of electrical current. The cathodic protection is normally only required when the protective coating or wrapping becomes damaged, although, of course, with a buried or submarine pipeline one cannot know whether this has happened.

When a pipeline protected by a coating or wrapping is laid in rocky terrain or a sub-soil containing sharp and abrasive aggregates, it is desirable to protect the protective coating or wrapping against damage by abrasion or impact with such rock or sharp aggregate by means of a barrier sufficiently robust to protect the coating or wrapping against damage by such impact or abrasion. This is clearly desirable even though a cathodic protection may also be provided, because quite severe damage may otherwise occur in the pipe

laying operation. At the same time, the barrier must permit a system of cathodic protection to function by allowing the electrical current that is generated to reach any areas of metal which are exposed as a result of localised damage to the protective coating or wrapping which may, despite the barrier, have occurred.

It is an aim of the invention to provide a wrapping structure which may be used to provide such a barrier.

According to the present invention there is provided a wrapping structure for protecting a pipe to be laid below the ground or sea against damage by abrasion or impact while allowing a cathodic protection system for the pipe to function, the structure having a plurality of ribs and a plurality of apertures between the ribs, the ribs having a height of at least 0.2 cm perpendicular to the plane of the structure, the apertures each having an area of up to 6.5 cm² and together occupying from 40% to 90% of the area of the structure, and the structure being of flexible plastics material and being elongate so as to be wrappable helically, or while extending longitudinally, around the pipe with the surfaces of the ribs which are the parts of the structure in contact with the pipe being rounded and lying in a generally cylindrical surface and the structure, when so wrapped, offering an exterior discontinuous surface which is free of projections.

The wrapping structure is preferably made of a polymer. At least the following polymers can be used: Polyethylene, polypropylene, polyvinylidene chloride, polyvinylchloride, polychloroprene and rubbers can also be used.

It is particularly preferred for the wrapping structure to be of a polymeric resilient material. A particular example of such a material which is suitable is air entrained polyethylene.

The purpose of this preferred feature is to provide for the wrapping structure to be better able to absorb the impact of rocks or other articles falling on the pipe, either when situated for use, or prior to being located in the desired position with the minimum displacement or damage to the normally provided pipe wrap or the protective coating.

The ribs are rounded on one side of the structure. The ribs can be provided to project on one side of the structure, the structure then including a web in which the apertures are formed and which connects the ribs, the ribs preferably being parallel to each other. Alternative embodiments include two sets of parallel ribs, the ribs of the sets being inclined, preferably at right angles to each other. In this case the web is not essential and all ribs are rounded on the one side of the structure, the other side being generally planar. The centre lines of the ribs preferably lie in a single plane when the structure is laid flat, so that the rounded surfaces thereof will also lie in a single plane, with the result that when the structure is pulled tight on a pipe there are no projections to cut into the previously applied wrappings thereon.

The structure is to be wrapped around a pipe, to protect the normally provided coatings and wrappings the rounded sides of the ribs facing inwardly so that only a small proportion of the structure is in physical contact with the pipe, or, more particularly, the exterior coating thereon, thus using the minimum contact area. This means that the exterior surface of the barrier is spaced from the pipe, so that sharp aggregate will in general be kept well clear of the pipe even if it can penetrate the apertures to some extent. The apertures will be quite small, up to 1 square inch (6.5 cms²) and preferably more than 0.4 cm² in area, and comprises 90% to 40%, preferably about 50% of the area of the structure. After pipe laying, the apertures permit the passage of the electrical current in a cathodic protection system.

The structure is preferably at least 36 inches (1 metre) wide, but narrower structures can be used if desired. Any length can be provided. The ribs may be 1/8 to 1/4 inch, (0.3 to 0.6 cm) wide parallel to the general plane of the structure and preferably have a maximum depth, perpendicular to the structure of 3/8 inch (0.9 cms). They may be spaced apart transversely of their length to give a gap about equal to their width. The ribs are preferably parallel both for ease of formation and ease of application, and may be continuous.

The wrapping structure of the invention may be helically wound round a pipe, but

if desired it can be wrapped round a pipe so that the ribs are parallel with the axis of the pipe; in the latter case adjacent edges of structure abut each other, and it can be kept in place by interlacing the adjacent edges with a cord or rope or by the use of non-metallic clips, or using self-locking straps or tapes provided, for instance, with a ratchet mechanism.

The present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:—

Figure 1 is a top-plan view of a portion of a length of a pipe wrapping structure of the present invention;

Figure 2 is a cross-sectional view of the structure shown in Figure 1;

Figures 3A and 3B show two methods of fixing of the pipe wrapping structure shown in Figures 1 and 2, and

Figure 4 shows another form of pipe wrapping structure according to the invention.

Referring initially to Figures 1 and 2 the pipe wrapping structure 10 comprises an elongate web 11 with a plurality of longitudinally extending, laterally spaced parallel rounded ribs 12 on one side. Intermediate the ribs 12, elongate apertures 13 are provided in rows in the web. As shown in Figure 1 the apertures 13 in adjacent rows are staggered with respect to each other.

The wrapping structure, which may be of a polymeric material or other suitable material, may be made by extrusion or moulding. If desired the elongate apertures 13 may be formed by punching after the web 11 with the ribs 12 integral therewith has been formed.

The pipe wrapping structure shown in Figures 1 and 2 may be wrapped helically about a pipe 14 to be covered (Figure 3B) or may be arranged so that the ribs 12 extend generally parallel to the longitudinal axis of the pipe 14 as in Figure 3A. In either arrangement only the ribs 12 contact the surface of the pipe 14 with the web 11 spaced from the pipe, and the area of contact between the wrapping structure 10 and the pipe 14 is kept to a minimum.

In the case of the pipe wrapping structure 10 being secured with the ribs 12 parallel to the longitudinal axis of the pipe 14 the longitudinal edges of the web, or webs in the case of two or more lengths of material being used, to surround the pipe, are held in butting relationship by laces 15 which pass through the apertures adjacent to the butting edges of the web or webs or by means of non-metallic clips which encircle the wrapping structure 10 when in position about the pipe and clamp it to the pipe 14. An alternative is to use straps or tapes which self-lock, e.g. by

(11)

being provided with a ratchet mechanism.

In the embodiment shown in Figures 1 and 2, the ribs 12 are 1/4 inch (0.6 cm) wide at their maximum width, extend the same amount upwardly from the web and are spaced approximately 1/2" (1.25 cm) between centres. The apertures 13 are made as large as possible consistent with maintaining the desired strength in the web and yet small enough to ensure that aggregate is kept clear of the pipe surface. This ensures that of cathodic protection has to be used then the large number of apertures permit the passage of the electrical current therethrough. Typically the apertures are 5/8" (1.6 cms) long, 1/4" (0.6 cm) wide and are separated lengthwise by 1/8" (0.3 cm). The apertures thus comprise just under half the area of the web.

Figure 4 shows an alternative embodiment of wrapping structure according to the invention comprising two sets of parallel ribs extending at right angles to one another. Rectangular apertures (41) are accordingly provided in the structure, and it will be seen that the ribs are rounded to one side of the structure, this being the side which will be placed upon a pipe. The other side of the structure is substantially planar. The wrapping structure of this Figure is again attached by clips, laces or straps to a pipe with the rounded sides of the ribs in contact therewith, or is helically wound on the pipe. In one embodiment according to Figure 4, the ribs have a maximum depth of about 0.4 cms, and a width of 0.7, the apertures being 2.2 cms long by 0.5 cms wide.

Although two alternative embodiments of the wrapping structure 10 have been described it should be understood that the wrapping structure may take many other forms. In general the wrapping structure has a small area of surface contact with the pipe and at the same time provides a large overall passage for the flow of electrical current in the event of cathodic protection having to be used.

Preferably the wrapping structure will be of the order of 36 inches (approximately 90 cms) wide. Any length of structure can be provided.

Pipes wrapped with structures as above described form the subject of our copending cognated applications Nos. 49672/78 and 49673/78 (Serial No. 1549847).

WHAT WE CLAIM IS:

1. A wrapping structure for protecting a pipe to be laid below the ground or sea against damage by abrasion or impact while allowing a cathodic protection system for the pipe to function, the structure having a plurality of ribs and a plurality of apertures between the ribs, the ribs having a height of at least 0.2 cm perpendicular to

the plane of the structure, the apertures each having an area of up to 6.5 cm² and together occupying from 40% to 90% of the area of the structure, and the structure being of flexible plastics material and being elongate so as to be wrappable helically, or while extending longitudinally, around the pipe with the surfaces of the ribs which are the parts of the structure in contact with the pipe being rounded and lying in a generally cylindrical surface and the structure, when so wrapped, offering an exterior discontinuous surface which is free of projections.

2. A structure according to claim 1, which is of a material which is also resilient.

3. A structure according to claim 2, wherein the resilient material is air entrained polyethylene.

4. A structure according to any preceding claim wherein the apertures occupy about 50% of the area of the structure.

5. A structure according to any preceding claim, wherein the ribs are from 0.3 to 0.6 cms wide parallel to the plane of the structure.

6. A structure according to any preceding claim, wherein the gaps between the ribs are as wide as the ribs.

7. A structure according to any preceding claim wherein the apertures are formed in a web which connects and is integral with the ribs, the ribs projecting on one side of the web.

8. A structure according to claim 7, wherein the ribs are parallel to each other.

9. A structure according to any one of claims 1 to 7, wherein the structure comprises two sets of parallel ribs, the ribs of the sets being inclined to each other and the apertures being defined between the ribs.

10. A structure according to claim 9 wherein the sets of ribs are perpendicular to each other.

11. A structure according to any preceding claim, wherein the ribs are up to 0.9 cms deep, perpendicular to the plane of the structure.

12. A wrapping structure for protecting a pipe to be laid below the ground or sea against damage by abrasion or impact while allowing a cathodic protection system for the pipe to function, the structure comprising first and second mutually perpendicular sets of ribs with apertures defined between the ribs, the ribs having a height of at least 0.2 cm perpendicular to the plane of the structure, the apertures each having a surface area of up to 6.5 cm² and together occupying from 40% to 90% of the area of the structure, the structure being of air entrained polyethylene so as to be flexible and resilient and being elongate so as to be wrappable helically, or while extending longitudinally around the



(11)

being provided with a ratchet mechanism.

In the embodiment shown in Figures 1 and 2, the ribs 12 are 1/4 inch (0.6 cm) wide at their maximum width, extend the same amount upwardly from the web and are spaced approximately 1/2" (1.25 cm) between centres. The apertures 13 are made as large as possible consistent with maintaining the desired strength in the web and yet small enough to ensure that aggregate is kept clear of the pipe surface. This ensures that of cathodic protection has to be used then the large number of apertures permit the passage of the electrical current therethrough. Typically the apertures are 5/8" (1.6 cms) long, 1/4" (0.6 cm) wide and are separated lengthwise by 1/8" (0.3 cm). The apertures thus comprise just under half the area of the web.

Figure 4 shows an alternative embodiment of wrapping structure according to the invention comprising two sets of parallel ribs extending at right angles to one another. Rectangular apertures (41) are accordingly provided in the structure, and it will be seen that the ribs are rounded to one side of the structure, this being the side which will be placed upon a pipe. The other side of the structure is substantially planar. The wrapping structure of this Figure is again attached by clips, laces or straps to a pipe with the rounded sides of the ribs in contact therewith, or is helically wound on the pipe. In one embodiment according to Figure 4, the ribs have a maximum depth of about 0.4 cms, and a width of 0.7, the apertures being 2.2 cms long by 0.5 cms wide.

Although two alternative embodiments of the wrapping structure 10 have been described it should be understood that the wrapping structure may take many other forms. In general the wrapping structure has a small area of surface contact with the pipe and at the same time provides a large overall passage for the flow of electrical current in the event of cathodic protection having to be used.

Preferably the wrapping structure will be of the order of 36 inches (approximately 90 cms) wide. Any length of structure can be provided.

Pipes wrapped with structures as above described form the subject of our copending cognated applications Nos. 49672/78 and 49673/78 (Serial No. 1549847).

WHAT WE CLAIM IS:

1. A wrapping structure for protecting a pipe to be laid below the ground or sea against damage by abrasion or impact while allowing a cathodic protection system for the pipe to function, the structure having a plurality of ribs and a plurality of apertures between the ribs, the ribs having a height of at least 0.2 cm perpendicular to

the plane of the structure, the apertures each having an area of up to 6.5 cm² and together occupying from 40% to 90% of the area of the structure, and the structure being of flexible plastics material and being elongate so as to be wrappable helically, or while extending longitudinally, around the pipe with the surfaces of the ribs which are the parts of the structure in contact with the pipe being rounded and lying in a generally cylindrical surface and the structure, when so wrapped, offering an exterior discontinuous surface which is free of projections.

2. A structure according to claim 1, which is of a material which is also resilient.

3. A structure according to claim 2, wherein the resilient material is air entrained polyethylene.

4. A structure according to any preceding claim wherein the apertures occupy about 50% of the area of the structure.

5. A structure according to any preceding claim, wherein the ribs are from 0.3 to 0.6 cms wide parallel to the plane of the structure.

6. A structure according to any preceding claim, wherein the gaps between the ribs are as wide as the ribs.

7. A structure according to any preceding claim wherein the apertures are formed in a web which connects and is integral with the ribs, the ribs projecting on one side of the web.

8. A structure according to claim 7, wherein the ribs are parallel to each other.

9. A structure according to any one of claims 1 to 7, wherein the structure comprises two sets of parallel ribs, the ribs of the sets being inclined to each other and the apertures being defined between the ribs.

10. A structure according to claim 9 wherein the sets of ribs are perpendicular to each other.

11. A structure according to any preceding claim, wherein the ribs are up to 0.9 cms deep, perpendicular to the plane of the structure.

12. A wrapping structure for protecting a pipe to be laid below the ground or sea against damage by abrasion or impact while allowing a cathodic protection system for the pipe to function, the structure comprising first and second mutually perpendicular sets of ribs with apertures defined between the ribs, the ribs having a height of at least 0.2 cm perpendicular to the plane of the structure, the apertures each having a surface area of up to 6.5 cm² and together occupying from 40% to 90% of the area of the structure, the structure being of air entrained polyethylene so as to be flexible and resilient and being elongate so as to be wrappable helically, or while extending longitudinally around the

(12)

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pipe with the surfaces of the ribs which are the parts of the structure in contact with the pipe being rounded and lying in a generally cylindrical surface and the structure, when so wrapped, offering an exterior discontinuous surface which is free of projections.

13. A structure according to claim 12, wherein the apertures are 2.2 cms long by 0.5 cms wide, the ribs having a depth of 0.4 cms and a width of 0.7 cms.

14. A structure according to any preceding claim in which structure, when laid flat, the centre lines of the ribs lie in a single plane.

15. A wrapping structure for protecting pipes, such structure being substantially as hereinbefore described with reference to and as illustrated in Figures 1 and 2 of the accompanying drawings.

16. A wrapping structure for protecting pipes, such structure being substantially as hereinbefore described with reference to and as illustrated in Figure 4 of the accompanying drawings.

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