

PATENT SPECIFICATION

(11)

1 549 848

1 549 848

- (21) Application No's 49672/78 (22) Filed 11 April 1975
49673/78 14 Jan. 1976
(62) Divided out of No. 1 549 847
(23) Complete Specification filed 2 April 1976
(44) Complete Specification published 8 Aug. 1979
(51) INT. CL.² F16L 57/00
(52) Index at acceptance
F2P 1A11 1A16B 1B5D 1B7
(72) Inventor JOHN HURST

(19)



(54) PIPE PROTECTED WITH 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 pipe provided with a protective wrapping structure particularly a steel pipeline 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 pipe with a wrapping structure which provides such a barrier.

According to the present invention there is provided a pipe laid or to be laid below the ground or sea, the pipe being protected by a wrapping structure having a plurality of ribs and a plurality of apertures between the ribs, the structure being flexible and being wrapped around the pipe, with the surfaces of the ribs which are the parts of its structure in contact with the pipe lying in a generally cylindrical surface, and the apertures being exteriorly uncovered.

More particularly, the present invention provides a pipe laid or to be laid below the ground or sea, the pipe being protected by a wrapping 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, the surfaces of the ribs which are the parts of the structure which are in contact with the pipe lying in a generally cylindrical surface, the apertures being exteriorly uncovered and the structure 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

(b)

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.

Preferably the ribs are rounded on the side of the structure adjacent the pipe. 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 can be rounded on the side of the structure adjacent the pipe, the other side being generally planar. The ribs preferably lie in a single plane (in the situation when the structure is laid flat prior to application to the pipe), so that the rounded or other surfaces thereof will also lie in a single plane, with the result that when the structure is pulled tight on the pipe there are no projections to cut into the previously applied wrappings thereon.

The structure is wrapped around the pipe, to protect the normally provided coatings and wrappings, and the projecting ribs, or the rounded sides of the ribs, face 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 structure 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, preferably 1/4 to 1 square inch (0.4 to 6.5 cms²) in area, and may comprise 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 cathode protection system.

The structure is itself 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 pipe can have the wrapping structure helically wound around it, but if desired the structure can be wrapped round the pipe so that the or a set of ribs are parallel with the axis of the pipe; in the latter case adjacent edges of the structure abut each other, and 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 suitable for use in 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 suitable for use in 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 the covered pipe 14 (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 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 if cathodic protection has to be used then the large number of apertures permit the passage of the electrical current there-through. 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 for use in 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.

The above described pipe wrapping structures form the subject of our cognated, co-pending Applications 14992/75 and 1389/76 (Serial No. 15498417).

WHAT WE CLAIM IS:

1. A pipe laid or to be laid below the ground or sea, the pipe being protected by a wrapping structure having a plurality of ribs and a plurality of apertures between the ribs, the structure being flexible and being wrapped around the pipe, with the surfaces of the ribs which are the parts of the structure in contact with the pipe lying in a generally cylindrical surface, and the apertures being exteriorly uncovered.

2. A pipe according to claim 1, wherein the apertures of the structure each have an area of from 0.4 to 6.5 cm².

3. A pipe according to claim 1 or 2, wherein the apertures of the structure together occupy from 40% to 90% of the area of the structure.

4. A pipe according to claim 1, 2 or 3, wherein the ribs of the structure are at least 0.2 cm deep perpendicular to the general plane of the structure.

5. A pipe laid or to be laid below the ground or sea, the pipe being protected by a wrapping 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, the surfaces of the ribs which are the parts of the structure which are in contact with the pipe lying in a generally cylindrical surface, the apertures being exteriorly uncovered and the structure offering an exterior discontinuous surface which is free of projections.

6. A pipe according to any preceding claim, wherein the structure is of a polymeric material which is also resilient.

7. A pipe according to claim 6, wherein the resilient material is air entrained polyethylene.

8. A pipe according to any preceding claim, wherein the ribs of the structure are rounded on the side of the structure adjacent the pipe.

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

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

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

12. A pipe according to any preceding claim, wherein the apertures are formed in a web of the structure which connects and



13

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 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 if cathodic protection has to be used then the large number of apertures permit the passage of the electrical current there-through. 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 for use in 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.

The above described pipe wrapping structures form the subject of our cognated, co-pending Applications 14992/75 and 1389/76 (Serial No. 15498417).

WHAT WE CLAIM IS:

1. A pipe laid or to be laid below the ground or sea, the pipe being protected by a wrapping structure having a plurality of ribs and a plurality of apertures between the ribs, the structure being flexible and being wrapped around the pipe, with the surfaces of the ribs which are the parts of the structure in contact with the pipe lying in a generally cylindrical surface, and the apertures being exteriorly uncovered.
2. A pipe according to claim 1, wherein the apertures of the structure each have an area of from 0.4 to 6.5 cm².
3. A pipe according to claim 1 or 2, wherein the apertures of the structure together occupy from 40% to 90% of the area of the structure.
4. A pipe according to claim 1, 2 or 3, wherein the ribs of the structure are at least 0.2 cm deep perpendicular to the general plane of the structure.
5. A pipe laid or to be laid below the ground or sea, the pipe being protected by a wrapping 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, the surfaces of the ribs which are the parts of the structure which are in contact with the pipe lying in a generally cylindrical surface, the apertures being exteriorly uncovered and the structure offering an exterior discontinuous surface which is free of projections.
6. A pipe according to any preceding claim, wherein the structure is of a polymeric material which is also resilient.
7. A pipe according to claim 6, wherein the resilient material is air entrained polyethylene.
8. A pipe according to any preceding claim, wherein the ribs of the structure are rounded on the side of the structure adjacent the pipe.
9. A pipe according to any preceding claim, wherein the apertures occupy about 50% of the area of the structure.
10. A pipe according to any preceding claim, wherein the ribs are from 0.3 to 0.6 cms wide parallel to the general plane of the structure.
11. A pipe according to any preceding claim, wherein the gaps between the ribs of the structure are as wide as the ribs.
12. A pipe according to any preceding claim, wherein the apertures are formed in a web of the structure which connects and

14

4.

1 549 848



4

is integral with the ribs, the ribs projecting on one side of the web towards the pipe.

13. A pipe according to claim 12, wherein the ribs of the structure are parallel to each other.

14. A pipe according to any preceding claim, 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.

15. A pipe according to claim 14, wherein the sets of ribs are perpendicular to each other.

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

17. A pipe according to any preceding claim, wherein the structure is helically wound around the pipe.

18. A pipe according to any one of claims 1 to 16, wherein the structure is wrapped around the pipe while extending longitudinally therealong.

19. A pipe laid or to be laid below the ground or sea, the pipe being protected by a wrapping 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, the structure being of air entrained polyethylene so as to be flexible

and resilient, and being elongate and wrapped around the pipe by being helically wound thereon or while extending longitudinally therealong, the surfaces of the ribs into which are the parts of the structure in contact with the pipe lying in a generally cylindrical surface, and the apertures being exteriorly uncovered.

20. A pipe according to claim 19, 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.

21. A pipe according to any preceding claim, wherein the structure is such that, when laid flat, all the ribs lie in a single plane.

22. A pipe laid or to be laid below the ground or sea and being protected by a wrapping structure, such structure being substantially as hereinbefore described with reference to and as illustrated in Figures 1, 2, 3A or 3B of the accompanying drawings.

23. A pipe laid or to be laid below the ground or sea and being protected by a wrapping structure, such structure being substantially as hereinbefore described with reference to and as illustrated in Figure 4 of the accompanying drawings.

J. A. KEMP & CO.
Chartered Patent Agents,
14 South Square,
Gray's Inn,
London WC1R 5EU.