APPLICATION FOR A STANDARD PATENT

We W.R. Grace Limited of Northdale House, North Circular Road, London, UNITED KINGDOM.

hereby apply for the grant of a standard patent for an invention entitled:

SHRINKABLE PIPE WRAPPING

which is described in the accompanying complete specification.

Details of basic application

Number of basic application: 8611682
Convention country in which basic application was filed: UNITED KINGDOM
Date of basic application: 13 May 1986

Address for Service:

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Dated: 5 May 1987

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By:

David B. Fitzpatrick

Our Ref: 54431
POF Code: 1460/1230

Lodged at Sub-Office - 7 May 1987
Melbourne
AUSTRALIA

Patents Act

DECLARATION FOR A PATENT APPLICATION

In support of the (a) Convention application made by

W.R. GRACE LTD.,

(hereinafter called "applicant") for a patent (c) for an invention entitled (d) SHRINKABLE PIPE WRAPPING

R F Halle-Smith, Director


do solemnly and sincerely declare as follows:

1. I am/we are the applicant(s).---
(Or, in the case of an application by a body corporate)

1. I am/we are authorized to make this declaration on behalf of the applicant(s):

2. I am/we are the actual inventor(s) of the invention.---
(Or, where the applicant(s) is/are not the actual inventor(s))

KEITH ANTHONY WINGFIELD, a British Subject of;
Draycott, Packhorse Road, Gerrards Cross, Bucks SL9 8HU, England.

is the actual inventor(s) of the invention and the facts upon which the applicant(s) is/are entitled to make the application are as follows:

(u) "The applicants would, if a patent were granted upon an application made by the Inventor, be entitled to have the patent assigned to it".

(Note: Paragraphs 3 and 4 apply only to Convention applications)

3. The basic application(s) for patent or similar protection on which the application is based is/are identified by country, filing date, and basic applicant(s) as follows:

(b) United Kingdom No. 8611682 Filed 13th May, 1986

W.R. Grace Ltd.

4. The basic application(s) referred to in paragraph 3 hereof was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Declared at (d) London

Dated (f) 8th July, 1987

To: The Commissioner of Patents

PHILLIPS ORMONDE & FITZPATRICK
Patent and Trade Mark Attorneys
367 Collins Street
Melbourne, Australia
1. A protective wrapping for application to an elongate article such as a pipe comprising a substrate and a membrane of a self-adhesive compound to contact and adhere to the pipe, the wrapping being locatable around the pipe so that it is locked and prevented against longitudinal shrinkage, the substrate being a plastic sheet material which has been longitudinally extended such that when applied and locked it will at ambient temperature tend to contract to form a tightly applied protection around the pipe.

7. A method of applying a wrapping, comprising a substrate of plastic sheet material and a membrane of a self-adhesive compound onto an elongate article such as a pipeline by extending at least the substrate of the
wrapping, tightly applying the wrapping to the article, locking the wrapping, such that it is unable longitudinally to shorten and allowing ambient conditions to cause the plastic to tend to contract and thus tighten the wrapping upon the article.
Complete Specification for the invention entitled:

**SHRINKABLE PIPE WRAPPING**

Our Ref : 54431
POF Code: 1460/1230

The following statement is a full description of this invention, including the best method of performing it known to applicant(s):
This invention relates to protecting pipes such as subterranean, submarine or surface pipelines for carrying oil and gas.

It is well known to protect steel pipes by providing coatings and claddings thereon. These may be partly factory applied, for instance pipes may be protected with epoxy layers, polyethylene or enamels in the factory and they may be additionally or alternatively applied in the field, for instance concrete claddings are applied to submarine pipes to cause them to sink and it is also known to provide helical wrappings at the point of use. A particular type of protection which is applied on site is that applied in the region of welds formed between adjacent lengths of pipe. Such welds are protected when the pipeline is initially laid. Also during pipeline refurbishment, which is necessary after a number of years of use, pipes may be exposed and inspected and need to be reprotected thereafter.

With regard to wrappings applied on site, the art includes wrappings which may be applied by being wound helically along a length of pipe and also includes wrappings applied in spiral form at a point, for instance to cover a particular weld. Reference is made to European Patent Application 0 169 691 which discloses a method of applying a wrapping in either helical or spiral form under tension wherein the wrapping comprises a substrate with a
membrane of a self-adhesive compound on the one side and successive lengths of the wrapping are joined together by the substrates being directly bonded without the intervention of the adhesive which, were it to carry the tensional forces, would slip and allow the tension of the wrapping to be released. A similar arrangement is possible for spiral wrappings wherein the last applied end of the wrapping is free from adhesive, allowing the projecting adhesive-free substrate to be directly bonded to the underlying exterior facing turn of substrate, thereby locking the wrapping in place with its tension maintained.

Heat shrinkable wrappings are also known in the art. They have been available in sleeve form for many years and have been used to cover welded joints but in that event have the disadvantage that they need to be threaded on the pipe before the weld is made, subsequently moved to overlie the weld and then heat treated so as to shrink down into contact with and to protect the weld. More recently, similar heat shrinkable materials have been used to provide wrap-around protection for instance for welded joints. A lap joint is made in the heat shrinkable material and this may for instance be covered by a further section of material secured by hot melt adhesive and the whole is heated so as severely to shrink it into a tight fit around the joint.

It has now been found that heat shrinkage of such materials for making wrappings tightly applied to pipelines
is not in fact necessary and that perfectly adequate cold shrinkage is available which will greatly simplify the task of providing secure wrappings, both initially and at refurbishment of the pipelines.

According to the present invention, there is provided a protective wrapping for application to an elongate article such as a pipe comprising a substrate and a membrane of a self-adhesive compound to contact and adhere to the pipe, the wrapping being locatable around the pipe so that it is locked and prevented against longitudinal shrinkage, the substrate being a plastic sheet material which has been longitudinally extended such that when applied and locked it will at ambient temperature tend to contract to form a tightly applied protection around the pipe.

The invention also provides a method of applying a wrapping, comprising a substrate of plastic sheet material and a membrane of a self-adhesive compound, onto an elongate article such as a pipeline by extending at least the substrate of the wrapping, tightly applying the wrapping to the article, locking the wrapping, such that it is unable longitudinally to shorten and allowing ambient conditions to cause the plastic to tend to contract and thus tighten the wrapping upon the article.

It has been found that longitudinal extension of a plastics support sheet to a relatively small extent, and maintaining that extension during shipping and storage
followed by subsequent application, leads to the plastic, when applied tightly, that is under some tension, such as normal pipe wrapping tension which typically gives about 5% extension, longitudinally contracting so as to tighten itself around the pipe. The wrapping can be applied helically or in spiral form. The amount of extension in the plastic backing imparted during manufacture may be between 10% and 40%, with 15% to 30% being normally used.

The extension of the plastic substrate sheet is most effectively performed when it is heated above ambient temperature, for instance immediately after it has been extruded or at some other convenient time e.g. just before coating with adhesive. In a preferred arrangement, the sheet is then subject to cooling so that the extension is securely maintained. Cold extension may be used instead. Thus stretching may occur either before or after the plastic substrate is attached to the self-adhesive membrane. The material will be supplied in roll form to the point of use and once applied will contract against the longitudinal restraint and thereby tighten itself around the pipe. These materials are in any event compliant and it has been found that the additional tension induced as a result of the present invention ensures that all gaps are securely closed, even in
refurbishment situations of the type where the wrapping may straddle across a weld and cover the ends of existing pre-applied protection on either side of the weld, which has not been removed, such pre-applied protection often being several millimeters thick.

The plastics sheet substrate material is preferably polyvinyl chloride. Many types of p.v.c. may be useful depending on the conditions of manufacture and intended end-use. It is expected that a well plasticised p.v.c. will be most appropriate. A plasticised p.v.c. containing a polymer such as natural or synthetic rubber, polyethylene or urethane elastomer may be an appropriate way of adding the ambient temperature shrinkage properties. Other types of sheet material may be appropriate or developed to be appropriate in the future.

The extension can be effected in a drawing operation wherein the plastic sheet passes through successive pairs of nip rollers, the surface speed of the downstream pair of which is greater than that of the upstream pair. Subsequent to that, air cooling can take place. In the drawing operation there will be transverse shrinkage so that when the wrapping is applied to a pipeline and allowed to contract it will not, at that point, undergo any further transverse shrinkage.

Normally, the wrapping will be provided with a removable protective covering in the form of a siliconised paper.
The material of the self-adhesive compound is self-adhesive at ambient temperature so as to stick to a pipe without the aid of heat or solvent and the layer of adhesive may be reinforced and is typically bituminous, often a bituminous rubber compound with the rubber being natural or synthetic. A release sheet, typically of siliconised paper, will normally be provided between adjacent turns in the stored rolls of wrapping of the invention, to be removed on application and use.

Preferably, the plastic support sheet is at least 30-50 and preferably 40, thousandths of an inch thick (0.75 to 1.25, preferably 1 mm) and preferably the adhesive is from 30 to 50 thousandths of an inch thick (0.75 to 1.25 mm) again preferably 1 mm. The width of the wrapping will suit the application concerned, for instance the wrapping may be slightly wider than the width of the bare metal at the weld so as to overlap the exposed ends of the factory applied coating. The length of each wrapping will suit the diameter of the pipe to be protected, it normally being the case that a single turn lapped for a short length is sufficient.

The invention allows fast and simple manual application requiring only unskilled labour but nevertheless offering all the advantages normally associated with heat shrunk wrappings without the difficulties of effecting such heat shrinkage. Moreover, it can be compatible with and have excellent adhesion
characteristics with respect to epoxy, polyethylene, enamel and other coatings presently found on pipelines.

The invention has the need to "lock" the wrapping against longitudinal shortening and the procedures disclosed in European Application 0 169 691 are preferred for this. In the case of helical wrapping, this involves wrapping successive lengths around the article with the substrate of the initially applied part of each length of wrapping being directly bonded to the substrate of the last applied part of the preceding length of wrapping, preferably by a welding or solvent bonding procedure without the intervention of the adhesive. The end of the last applied part can be held with a separate patch of substrate material or can itself have an extended substrate without adhesive to be bonded to the underlying turn. In spiral winding applications, the substrate of the last applied part of the wrapping is directly bonded to the substrate of a previously applied part of that or an earlier length of the wrapping by a similar bonding procedure, using either a patch or a part of the substrate without adhesive.

The substrate to substrate bonding, between a patch and the substrate, or between substrate lengths or involving the last applied end can be effected in various ways. The way selected will generally depend upon the particular substrate in the wrapping material. The
presently contemplated methods include high frequency welding, heat bonding brought about by application of hot air or a heated surface such as the surface of a heated pad, solvent welding, ultrasonic welding and the use of an adhesive. Solvent welding is preferred, in particular for a substrate of polyvinyl-chloride. Heated pads may be obtained from Radyne Limited.

By solvent welding we mean welding brought about by the surface of at least one of the substrates (or the patch) being treated with solvent and the surfaces then being brought together. When the solvent flashes off the bond between the substrates remains, making them, in a sense integral with each other. Where successive lengths of wrapping are connected, the area of direct bonding is preferably displaced slightly from the end of the previously applied length of wrapping. In other words the overlap between successive lengths of wrapping is such that a part of the adhesive membrane of a length of wrapping being applied overlies part of the substrate of the previously applied tape. In practice, shortly after commencement of application of each fresh length or roll of wrapping, and before the first circumferential turn has been completed, the bonding is effected between the area of the end of the fresh length where adhesive is not provided or has been removed and the upper surface of the substrate at the end of the preceding role.
Thus in the case of solvent welding or use of an adhesive, the flap with no compound on it at the end of the fresh length is exposed, the solvent adhesive is applied onto the flap and/or the area immediately beneath it making sure that total coverage occurs, and the flap is then immediately pressed down and air excluded by wiping, and surplus solvent or adhesive will be wiped off. With the high frequency, ultrasonic or heat welding possibilities, the bonding will again take place shortly after the adhesive of each length contacts the pipe. It is preferred to use solvent welding and for the solvents to be supplied in an aerosol can or compressible tube as these appear to be the quickest and most convenient ways of applying it.

To assist in understanding the invention, the following further description is given by way of example only, with reference to the three accompanying drawings, in which:

Figure 1 is a schematic longitudinal cross sectional view of a region of connection between two lengths of a pipeline with a wrapping of the invention applied thereto,

Figure 2 is a transverse cross section of the same arrangement and

Figure 3 is a similar sectional view showing a modification.
In Figure 1 two lengths of pipe 10 are welded together at 12, each being provided with a permanent coating 11 which does not extend right up to the weld. The area between the edge of the coatings 11 and covering and including the weld needs to be protected by a wrapping, illustrated at 13 which is in accordance with the invention and which comprises a plastic substrate 14 and a self-adhesive compound layer 15 in contact with the pipe and overlapping the upstanding edges of the coating 11.

After application, which is performed with the wrapping under tension, so that it is tightly applied, the plastic substrate 14 contracts and the wrapping is pulled more tightly into engagement with the pipe and tightly around the edge of the coating 11 so much so that all gaps are closed, even where the end of the coating meets the outer surface of the pipe.

Figure 2 illustrates how an appropriate length of the wrapping 13 can be applied around a pipe or pipes shown at 10 such that an end 17 of the wrapping overlaps a first applied end thereof to be adhered thereto. In accordance with the invention of European Application 0 169 691, a part 16 of the plastic substrate extends beyond the end of the adhesive membrane and can be directly bonded to the first applied part of the substrate 14 beneath it so that the wrapping is locked against longitudinal shortening and tension is maintained with the result that shrinkage
necessarily leads to increased tightening of the wrapping around the pipe. As an alternative, as shown in Figure 3 in place of adhesive free part 16 a separate patch 30 of substrate material can be directly bonded both onto the substrate of the exposed end of the wrapping and onto the previously applied substrate adjacent thereto.

To assist in use of the wrappings of the invention it may be appropriate to prime the surface to be protected prior to application of the wrapping. An additional possibility, particularly where there is a step or discontinuity in the smoothness of the surface to be covered, e.g. at the junctions between bare metal and a factory applied coating, or at a longitudinal pipe-forming weld, is to apply a narrow filling strip, typically of bituminous adhesive of a conformable texture having a thin flexible support. This is applied in the region of the step so as to fill any such gap which might otherwise be present in the initial stages of contraction of the wrapping. Additionally, such a strip could be used at the end of the wrapping, for instance in the gap shown, on an enlarged scale, at 19 in Figure 2.
The claims defining the invention are as follows:

1. A protective wrapping for application to an elongate article such as a pipe comprising a substrate and a membrane of a self-adhesive compound to contact and adhere to the pipe, the wrapping being locatable around the pipe so that it is locked and prevented against longitudinal shrinkage, the substrate being a plastic sheet material which has been longitudinally extended such that when applied and locked it will at ambient temperature tend to contract to form a tightly applied protection around the pipe.

2. A wrapping according to claim 1 wherein the membrane extends throughout the length of the substrate except at or near the leading edge thereof where the substrate is free to be directly bonded to the substrate of a previously applied length of wrapping or an earlier turn of the same length of wrapping.

3. A protective wrapping according to claim 1 wherein the membrane extends throughout the length of the substrate except at or near the trailing end, and optionally the leading end, thereof whereby the substrate is free to be directly bonded to the substrate of an underlying lap of the wrapping.

4. A protective wrapping according to claim 1 together with a separate patch of substrate material by which the last applied end of the wrapping can be secured to a previously applied part of the substrate.
5. A protective wrapping according to claim 1, 2
3 or 4 wherein the substrate is extended from 10 to 40%.
6. A protective wrapping according to Claim 5
when the substrate is extended 15 to 30 %.
7. A method of applying a wrapping, comprising a
substrate of plastic sheet material and a membrane of a
self-adhesive compound onto an elongate article such as a
pipeline by extending at least the substrate of the
wrapping, tightly applying the wrapping to the article,
locking the wrapping, such that it is unable longitudinally
to shorten and allowing ambient conditions to cause the
plastic to tend to contract and thus tighten the wrapping
upon the article.
8. A method according to Claim 7 wherein the
substrate of the initially applied part of each length of
wrapping is directly bonded to the substrate of a
previously applied length of wrapping.
9. A method according to Claim 8 wherein the last
applied end of one length of the wrapping is directly
bonded to part of the substrate of a previously length of
the wrapping or the same length which it overlies by means
of a patch of the substrate material being bonded to said
end and said part.
10. A method according to Claim 7 wherein the
substrate of the last applied part of the wrapping is
directly bonded to the substrate of a previously applied part of that or an earlier length of wrapping.

11. A method according to Claim 10 wherein the wrapping is wound spirally upon itself so that each turn, or part turn, after the first lies directly upon a preceding turn.

12. A method according to any one of claims 8 to 11 wherein the bonding is heat bonding.

13. A method according to any one of claims 8 to 11 wherein the bonding is by solvent welding.

14. A method according to claim 13 wherein the solvent is applied by an aerosol or compressible tube.

15. A method according any one of claims 8 to 11 wherein the bonding is by high frequency welding.

16. A method according to any one of claims 8 to 11 wherein the bonding is by means of an adhesive.

17. A method according to any one of claims 8 to 11 wherein when the bonding is by ultrasonic welding.

18. A protective wrapping for application to an elongate article such as a pipe and substantially as hereinbefore described and with reference to and as illustrated in the accompanying drawings.

19. A method of applying a wrapping onto an elongate article such as a pipe substantially as hereinbefore described with reference to the accompanying drawings.
20. A pipe having a protective wrapping according to any one of claims 1 to 6 and 18 or with a wrapping applied by the method of any one of claims 7 to 17 and 19.

DATED: 5 May 1987

PHILLIPS ORMONDE & FITZPATRICK
Attorneys for:
W.R. GRACE LIMITED

[Signature]
Fig. 1.

Fig. 2.

Fig. 3.