AUSTRALIA
Convention Application for a Patent

BTR INDUSTRIES LIMITED

of Silvertown House, Vincent Square, London, SW1P 2PL, England

hereby apply for the grant of a Patent for an invention entitled

"AN IMPROVED METHOD AND APPARATUS FOR SEALING LEAKING PIPELINE JOINTS"

which is described in the accompanying complete specification.

This application is a Convention Application and is based on the application numbered 31492/73

for a patent or similar protection made in Great Britain

on 2nd July, 1973

-My address for service is:

Care: SPRUSON & FERGUSON
PATENT ATTORNEYS
ESSO HOUSE, 127 KENT STREET
SYDNEY. NEW SOUTH WALES.
AUSTRALIA.

Dated this 16th day of MAY, 1974

BTR INDUSTRIES LIMITED

Signature of Applicant
Registered Patent Attorney

To: The Commissioner of Patents
In support of the Convention Application made for a patent

for an invention entitled "AN IMPROVED METHOD AND APPARATUS FOR SEALING LEAKING PIPELINE JOINTS"

1. James Brisbane CAMERON, Manager, Central Development of BTR INDUSTRIES LIMITED, Silvertown House, Vincent Square, London, SW1P 2PL, England, do solemnly and sincerely declare as follows:

1. I am the applicant for the patent

(or, in the case of an application by a body corporate)

2. I am authorised by BTR INDUSTRIES LIMITED

the applicant for the patent to make this declaration on its behalf.

3. The basic application as defined by section 141 of the Act made in Great Britain on the Second day of July 1973,

by BTR INDUSTRIES LIMITED, (a British Company, Manufacturers, of Silvertown House, Vincent Square, London, SW1P 2PL, England)

is the actual inventor of the invention and the facts upon which the Applicant is entitled to make the application are as follows: by virtue of an assignment dated 23 April 1972, from the actual inventor to the said applicant

4. The basic application referred to in paragraph 2 of this declaration was, the first application made in a Convention country in respect of the invention the subject of the application.

DECLARED at London this twenty-sixth day of April 1974.

To: The Commissioner of Patents.
"AN IMPROVED METHOD AND APPARATUS FOR SEALING LEAKING PIPELINE JOINTS"

The following statement is a full description of this invention, including the best method of performing it known to us:

""
The invention relates to a method and apparatus for sealing leaking pipeline joints.

The invention provides a method of sealing a leaking joint in a pipeline, which method comprises locating a mould around the joint to provide a mould chamber enclosing the joint, injecting a sealant into the mould chamber and reducing the volume of the mould chamber to pressurize the sealant to a pressure above the pressure within the pipeline until the sealant has solidified around the joint.

The volume of the mould chamber may be reduced by deforming a flexible wall of the mould. Fluid pressure may be applied to said wall to deform it as aforesaid.

The mould chamber may be partly filled with sealant, a vent in the mould being maintained open during pressurisation of the sealant, which vent is closed when sealant exudes from the vent whereby air or gas in the mould is displaced from the mould.

The sealant may be a thermosetting resin, or a thermoplastics material which is injected in a liquid or a semi-liquid state.

The invention also provides apparatus for sealing a leaking joint in a pipeline, which apparatus comprises a separable mould which can be located around and sealed to a pipeline to provide in conjunction therewith a mould chamber enclosing a joint in the pipeline and means to reduce the volume of the mould chamber to pressurise sealant injected into the chamber when the mould is located around a pipeline joint.

The mould may have a flexible wall which can be
deformed inwardly of said chamber.

The mould may comprise an outer rigid casing and a flexible inner lining which in use defines in conjunction with the pipeline said chamber enclosing the joint, means being provided for connecting a space between the lining and the casing to a source of fluid pressure.

The lining may comprise two frusto-conical portions having their larger diameter ends in abutment with one another, both axial ends of each of the portions being secured with respect to the casing.

Sealing means may be provided on the mould to seal the mould to a pipeline on each side of a joint in the pipeline.

The sealing means may comprise resilient sealing members located with respect to respective parts of the separable mould at locations one on each side of the chamber, which members co-operate to provide sealing rings on each side of the chamber when the mould parts are fitted together.

Means may be provided for restraining the sealing rings from axial deformation when subjected to fluid pressure.

The sealing members may be U-shaped in cross-section with the limbs of the U projecting radially outwardly from the base of the U, a rigid element being located...
between the free ends of the limbs of each member to
define a space between the sealing member and the rigid
element, and means being provided to connect that space
to a source of fluid pressure.

Means may be provided for restraining the
sealing rings from axial deformation when subjected to
fluid pressure.

Said restraining means may comprise arcuate
plates which are made of a material substantially more
rigid than that of the sealing members and are located one
on each side of a sealing member.

The sealing means may be releasably secured to the
mould so that they can be removed and replaced by
further sealing means.

Specific embodiments of a method and apparatus
according to the invention for sealing a leaking pipeline
joint will now be described by way of example and with
reference to the accompanying drawing, in which:-

Figure 1 shows a side view of a mould embodying
the invention and position around a pipeline joint;

Figure 2 shows a section through the upper portion
of the mould and pipeline joint of Figure 1;

Figure 3 shows an exploded view of the upper
half of the mould of Figure 1; and

Figure 4 shows a scrap section of another mould
embodying the invention.

Referring to Figures 1 to 3 of the drawing, there
is shown a pipeline joint between adjacent ends of two pipes 10 and 11. The joint comprises a joggled end portion 12 on the pipe 10, the free end of which is provided with an outwardly extending flange 13. An L-section gland ring 14 is located around the pipe 11 at a short distance from its end. The end of pipe 11 engages within the joggle portion 12 and a sealing ring 9 is located therebetween. The joint is made by bolting together the flange 13 and the outwardly directed portion of the ring 14.

During use of a pipeline for conveying gas at pressures substantially above atmospheric, the sealed joints therein, such as the one shown in the drawing, may begin to leak due to shrinkage or stress relaxation in the flexible sealing ring and it has been found generally to be unsatisfactory or impossible to remake the seal by tightening the bolts on the gland ring.

According to the embodiment of the invention shown in the drawings, such leaking pipeline joints are sealed by using an encapsulation mould comprising an upper half 15 and lower half 16 which are placed around the joint to be encapsulated and are bolted or otherwise joined at integral flanges 17. Each mould half comprises two main shells 18, made in a suitable strong light material such as aluminium, bonded, or otherwise secured to elastomeric forming liners 19 and equipped with end seals 20. The elastomeric liners 19 are in the form of truncated cone halves equipped with flanges on all edges which flanges are bonded or otherwise secured to mating flanges on the main shells 18 so that pressure tight chambers 21 are formed when the mould is assembled.

The end seals 20 comprise a semi-circular metallic
outer member, 22, a U-section elastomeric sealing member 23 within the member 22 with its limbs embracing the member 22, and a semi-circular locking plate 24. One of the limbs of the elastomeric sealing member 23 is trapped between the locking plate 24 and a side face of the outer member 22. The other limb of the sealing member 23 is trapped between the other side face of the outer member 22 and a flange 25 on one of the liners 19 when the end seal is attached to the mould half by a suitable number of bolts. The sealing member 23 is equipped with flanges 26 which are trapped between the ends of the outer member 22 and the mating lower sealing member when the mould is assembled on the pipe joint.

Air or other pressurising fluid can be admitted into the space enclosed between the outer members 22 and the sealing members 23 and all four such members are connected to a common source of pressurised fluid after the mould is assembled on the joint. This has the effect of deforming the sealing members radially inwardly so that they seal tightly against the pipe surfaces and prevent the egress of gas or sealant.

Similarly air or other pressurising fluid, at a pressure less than that in the end seals, can be admitted into the chambers 21 which are suitably
inter-connected to maintain equal pressure inside them.

A passage 27 is provided in the bottom half of the mould to enable the sealant material to be admitted to the cavity formed by the forming liners 19, the end seals 20 and the pipe and joint surfaces. A valve is provided to shut off the passage 27 when necessary. A similar passage 28 equipped with a bleed valve 29 is provided in the top half of the mould to enable gas and excess sealant to be evacuated from the cavity.

In use the two mould halves are bolted together around a pipe joint which is to be sealed, the surfaces of the pipes adjacent the joint and the gland rings having first been cleaned by grit blasting or other suitable means. The valve 29 on the top half of the mould is open at this stage and air or other suitable fluid is admitted to the end seals 20 at a pressure considerably in excess of the pressure of the gas in the pipeline so that the elastomeric members 23 of the end seals 20 are forced against the pipe surface forming complete circumferential seals. If the pipe joint is leaking at a considerable rate the bleed valve 29 is kept open until gas has displaced the air within the mould cavity so that air cannot be forced into the pipeline during subsequent pressurisation. The valve is then shut off and the liquid sealant resin is pumped in through the passage 27 in the bottom half of the mould at a pressure in excess of the pressure in gas in the pipeline.

The sealant may be any suitable thermo-setting
resin such as polyurethane, epoxide or polyester or may be a thermo-plastic material heated to a liquid or semi-liquid state and may contain bulk fillers and reinforcing agents.

After sufficient sealant has been injected the valve in the passage 27 is shut off and air or other pressuring fluid is admitted to the four chambers 21 at a pressure greater than that of the gas in the pipeline but not greater than that in the end seals 20. This has the effect of deflecting the elastomeric liners 19 towards the axis of the pipeline. The bleed valve 29 is opened to allow air or gas above the sealant to escape and is closed again when sealant starts to exude through it.

Because the elastomeric liners 19 are fixed to the main shells at the vertical equator, the liners are prevented from folding as they are forced inwards and they therefore confine the sealant in fillets and the pipe joint in areas of possible gas leakage. On the horizontal parting line of the mould, the liners 19 are joined to the flanges of the main shells by flanges 30 of the same elastomeric material which flanges 30 are bonded only on their outer edges to the flanges of the main shells. Thus the major area of the flanges 30 are free to stretch inwards when pressure is applied, thereby minimising the web of sealant which otherwise would form at the mould parting line.

The pressure is maintained in the cavities 21 and end seal 20 until the sealant has set to a stage where it will withstand the gas pressure in the pipelines. The encapsulation mould is then removed for re-use on other joints.

In the embodiment of the invention shown in Figure 4 the end seals are removable so that alternative
end seals can be fitted to accommodate smaller pipe diameters. The alternative smaller diameter seals comprise an outer member 31 with a U-section elastomeric seal 32 of appropriate internal diameter combined with two semi-circular plates 33 of inside radius only slightly greater than the outside radius of the pipeline adjacent the joint to be sealed, arranged to prevent the elastomeric seal 32 from deformation along the pipeline axis in either direction.

The advantages of using a method and apparatus described above rather than using conventional moulds which are expanded to a certain extent by the injection of sealant to maintain pressure of the sealant by virtue of strain energy in the mould material, are that by reducing the volume of the mould chamber to pressurize the sealant a saving in the amount of sealant used is achieved. Also a single mould can be used to seal different joint designs without using an excessive volume of sealant. Furthermore, leakage from the mould chamber does not reduce the pressure of the sealant as with the use of conventional moulds hitherto, since a constant pressure is applied to the flexible lining 19 during
hardening of the sealant. The inflatable seals which are releasable from the mould allow a single mould to be used for a range of pipe diameters merely by changing the seals, again without an excessive amount of sealant being used. Leakage from the inflatable seal is less likely than with seals on conventional moulds especially when undersize or badly pitted pipes are encountered.
CLAIMS
The claims defining the invention are as follows:

1. A method of sealing a leaking joint in a pipeline, which method comprises locating a mould around the joint to provide a mould chamber enclosing the joint, injecting a sealant into the mould chamber, and reducing the volume of the mould chamber to pressurize the sealant to a pressure above the pressure within the pipeline until the sealant has solidified around the joint.

2. A method as claimed in claim 1 wherein the volume of the mould chamber is reduced by deforming a flexible wall of the mould chamber.

3. A method as claimed in claim 2 wherein fluid pressure is applied to said flexible wall to deform it so as to reduce the volume of the mould chamber.

4. A method as claimed in any of claims 1 to 3 wherein the mould chamber is partly filled with sealant, a vent in the mould being maintained open during pressurisation of the sealant, which vent is closed when sealant exudes from the vent whereby air or gas in the mould chamber is displaced from the mould chamber.

5. A method as claimed in any of claims 1 to 4 wherein the sealant is a thermosetting resin.

6. A method as claimed in any of claims 1 to 4 wherein the sealant is a thermoplastics material which is injected in a liquid or a semi-liquid state.

7. A method of sealing a leaking joint in a pipeline, substantially as hereinbefore described with reference to the accompanying drawings.

8. Apparatus for sealing a leaking joint in a pipeline, which apparatus comprises a separable mould which can
be located around, and sealed to, a pipeline to provide in conjunction therewith a mould chamber enclosing a joint in the pipeline, and means to reduce the volume of the mould chamber to pressurize sealant injected into the mould chamber when the mould is located around a pipeline joint.

9. Apparatus as claimed in claim 8 wherein the mould has a flexible wall which can be deformed inwardly of the mould chamber.

10. Apparatus as claimed in claim 9 wherein the mould comprises an outer rigid casing and a flexible inner lining which in use defines in conjunction with the pipeline the mould chamber enclosing the joint, means being provided for connecting a space between the lining and the casing to a source of fluid pressure.

11. Apparatus as claimed in claim 10 wherein the lining comprises two frusto-conical portions having their larger diameter ends in abutment with one another, both axial ends of each of said portions being secured with respect to the casing.

12. Apparatus as claimed in any of claims 8 to 11 wherein sealing means are provided on the mould to seal the mould to a pipeline one on each side of a joint in the pipeline.

13. Apparatus as claimed in claim 12 wherein the sealing means comprise resilient sealing members located with respect to respective parts of the separable mould at locations one on each side of the mould chamber which members co-operate when the mould parts are fitted together, to provide sealing rings one on each side of the mould chamber.
14. Apparatus as claimed in claim 13 wherein the sealing members are U-shaped in cross-section with the limbs of the U projecting radially outwardly from the base of the U, a rigid element being located between the free ends of the limbs of each member to define a space between the sealing member and the rigid element.
and means being provided to connect that space to a source of fluid pressure.

15. Apparatus as claimed in claim 14 wherein means are provided for restraining the sealing rings from axial deformation when subjected to fluid pressure.

16. Apparatus as claimed in claim 15 wherein said restraining means comprise arcuate plates which are made of a material substantially more rigid than that of the sealing members and are located one on each side of a sealing member.

17. Apparatus as claimed in any of claims 12 to 16 wherein the sealing means is releasably secured to the mould so that they can be removed and replaced by further sealing means.

18. Apparatus for sealing a leaking joint in a pipeline, substantially as hereinbefore described with reference to and as shown in Figures 1 to 3 or Figures 1 and 2 when modified as shown in Figure 4 of the accompanying drawings.

DATED this SIXTEENTH day of MAY, 1974

BTR INDUSTRIES LIMITED

Patent Attorneys for the Applicant
SPRUSON & FERGUSON
DRAWINGS
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