

PATENT SPECIFICATION

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- (21) Application No. 52197/71 (22) Filed 10 Nov. 1971
(23) Complete Specification filed 20 Oct. 1972
(44) Complete Specification published 24 April 1974
(51) International Classification B29C 27/00
B29D 31/00
(52) Index at acceptance
B5A 1R100 1R14C1X 1R22X
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(19)



(54) JOINTING WATERSTOPS

(71) We, BURMAH INDUSTRIAL PRODUCTS LIMITED, a British Company, of Chase Road, London, N.W.10., do hereby declare the invention, for which we pray
5 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 waterstops which
10 are used for sealing joints in concrete structures against the passage of water and which comprise a strip with two or more keying ribs extending along and projecting from it for keying the strip to the concrete
15 at the two sides of the joint to be sealed. Such waterstops are subsequently referred to as being of the kind described. They are commonly made either of rubber or of polyvinyl chloride.

20 In a water retaining structure having a number of joints, it is essential that the waterstops in the various joints should be joined to each other to provide a continuous seal throughout the joint system
25 which is subject to water pressure.

Where substantial movement is expected in a joint, it is preferred to use a waterstop made of rubber as rubber waterstops are able to withstand greater stretching and distorting than polyvinyl chloride waterstops
30 without rupturing. Rubber waterstops are, however, appreciably more expensive than those made of polyvinyl chloride and for economic reasons therefore it is often
35 desirable to be able to use rubber waterstops in some joints in a structure and waterstops made of polyvinyl chloride in other joints. The jointing of rubber and polyvinyl chloride waterstops to each other
40 does however give rise to very considerable difficulty and this has in the past frequently made it impossible to use both forms of waterstop in a single structure where it would otherwise be economically most
45 desirable.

[Price 25p]

The aim of the present invention is to provide a junction piece for use in joining together two waterstops of the kind described, one of rubber and the other of polyvinyl chloride, the junction piece comprising a strip with two or more keying ribs
50 for keying into concrete extending along it, one end part of the junction piece being of rubber and the other of polyvinyl chloride with a joint between these parts. Using such
55 a junction piece it is a relatively simple matter to join a length of rubber waterstop to a length of polyvinyl chloride waterstop on site by joining the rubber waterstop to the rubber end part of the junction piece,
60 and joining the polyvinyl chloride waterstop to the polyvinyl chloride end part of the junction piece, the joints between the two similar materials being readily made.

According to this invention, such a
65 junction piece is made by coating the surface of a portion of the strip of a length of polyvinyl chloride waterstop of the kind described with a heat curable chemical bonding agent, sandwiching the coating portion
70 between portions of vulcanisable rubber with a further portion of rubber extending from the end of the coated polyvinyl chloride strip to form an assembly and subjecting the assembly to heat and pressure
75 in a mould to cause the rubber to flow into intimate contact with the polyvinyl chloride strip, to vulcanise and mould the rubber and to cure the bonding agent to join the rubber and polyvinyl chloride parts
80 to each other.

The junction piece is manufactured under factory rather than under site conditions and it has been found that with this method an extremely satisfactory joint between the
85 rubber and polyvinyl chloride parts can be made and the joint will stand up well to deformations in use.

The rubber portions may be in the form of a length of unvulcanised rubber water-
90

stop of the kind described and this may be slit in the plane of and extending across the width of the strip after which the coated portion of the polyvinyl chloride strip is inserted into the slit to form the sandwich. It is however difficult to form such a slit in an unvulcanised rubber waterstop and preferably therefore the rubber portions are formed by two separate sections of unvulcanised rubber sheeting which are placed one on each side of the coated portion of the polyvinyl chloride strip, a thicker section of unvulcanised rubber sheeting which extends from the end of the polyvinyl chloride strip and two or more separate unvulcanised rubber strips for forming the keying ribs of the rubber end of the junction piece. All these separate sections of rubber are vulcanised together to form the rubber end of the junction piece of waterstop section when they are subjected to heat and pressure in the mould. As an alternative to this, the rubber portions may be formed by a length of unvulcanised rubber waterstop of the kind described together with two sections of unvulcanised rubber sheeting. One end of the strip part of the rubber waterstop is cut away from between the keying ribs and the coated portion of the polyvinyl chloride strip is inserted between the keying ribs of the rubber waterstop where the strip has been cut away. The sections of rubber sheeting are then placed one on each side of the polyvinyl chloride strip in between the rubber keying ribs. The keying ribs of the unvulcanised rubber waterstop about the keying ribs of the polyvinyl chloride waterstop and upon vulcanisation in the mould, the sections of rubber sheet are bonded to the polyvinyl chloride strip by the chemical bonding agent and vulcanisation causes them to become integral with the remainder of the rubber waterstop.

The rubber and polyvinyl chloride end parts of the junction piece may be of the same cross section as each other or they may be of different sections. If the polyvinyl chloride end part is of the same section or of a bigger section than the rubber end part, the end portion of the polyvinyl chloride waterstop strip is first trimmed to reduce its section before it is sandwiched between the rubber portions.

Generally speaking under these circumstances it is best for the keying ribs, when these are at the edges of the polyvinyl chloride strip, to be cut away so that the portion of the polyvinyl chloride strip which is coated with the bonding agent is in the form of a flat tongue.

We have found that a bonding agent consisting of or comprising a halogenated polymer is very satisfactory and in particular we have found that a priming coat of a

bonding agent known by the trade name of Chemlock (Registered Trade Mark) 205 followed by a coat of Chemlock 231, both made by Durham Raw Materials has produced particularly satisfactory joints.

The moulding temperature depends upon the nature of the unvulcanised rubber and must of course be sufficiently high to bring about the necessary flow and vulcanisation. The preferred moulding temperature is in the range from 130° to 150°C and the temperature used should be as high as possible within this range commensurate with maintaining the shape of the end portion of the polyvinyl chloride waterstop strip while moulding takes place. The polyvinyl chloride tends to soften and distort quite badly at temperatures above 150°C. Maintaining the temperature below this level makes it necessary to carry out the moulding operation under pressure for a long time to ensure that the required intimate contact between the rubber and polyvinyl chloride is obtained and that the rubber portions, when these are initially separate, are integrally fused together.

The moulding pressure is not critical and is dependent to some extent upon the nature of the presses available, but we have found that a moulding pressure of at least $\frac{1}{4}$ ton per square inch and a pressure of not more than 2 tons per square inch is desirable. The preferred pressure is about $\frac{1}{2}$ a ton per square inch.

To increase the strength of the joint in tension along the length of the junction piece, one or more holes may first be made through the polyvinyl chloride waterstop strip. When this is done, the holes are preferably first filled with vulcanisable rubber plugs which, when vulcanisation takes place, become integral with the rubber portions between which the polyvinyl chloride strip is sandwiched so that the rubber and polyvinyl chloride parts are positively keyed together and the adhesion brought about by the chemical bonding agent is not relied upon exclusively to provide the necessary strength. At least two holes are preferably punched through the polyvinyl chloride strip and these may be of various sizes and shapes although circular holes of approximately 1 inch in diameter are convenient.

Two examples of methods of making junction pieces in accordance with the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is an exploded perspective view of the polyvinyl chloride strip and rubber strips used in one example shown in the course of assembly and before insertion in a mould;

Figure 2 is a similar view of the polyvinyl chloride and rubber strips used in a

second example; and,

Figure 3 is a somewhat diagrammatic perspective view of a mould which can be used in both examples, the mould being shown open.

In the first example, a polyvinyl chloride waterstop 1 of the common dumb-bell section comprising a flat strip 2 and circular keying ribs 3 and 4 along both edges of the strip 2 has parts of its keying ribs 3 and 4 cut away at one end to form of projecting tongue 5. The tongue 5 has holes 6 punched out of it and it is coated back to a position just beyond the ends of the keying ribs 3 and 4 with a priming coat of a halogenated polymer bonding agent known as Chemlock 205 manufactured by Durham Raw Materials Limited. After this a second coat of Chemlock 231 made by the same manufacturers and also a halogenated polymer bonding agent is applied.

Next plugs 7 of unvulcanised rubber are inserted in the holes 6 and two sections of calendered rubber sheet 8 are applied one to each face of the coated tongue 5. The sub-assembly thus formed is then placed in a mould cavity 9 of a bottom mould section 10 shown in Figure 3. To the sub-assembly are added a further section of calendered rubber sheet 11 and two cylindrical unvulcanised rubber strips 12 and 13. The rubber sheet 11 is of a thickness substantially equal to the combined thickness of the sandwich formed by the tongue 5 and the two sheets of the sandwich formed by the tongue 5 and the two sheets 8 and when in position in the mould it abuts the end of the tongue 5. Similarly the strips 12 and 13 abut the ends of the keying ribs 3 and 4 respectively.

A top mould section 14 which is connected by hinges 15 to the mould section 10 is now closed and the closed mould is inserted into a press. The press is operated to apply pressure to the assembly within the mould and this pressure is approximately $\frac{1}{2}$ ton per square inch over the area of the mould cavity 9. While the assembly is held under pressure in the mould, the two mould halves are heated to a temperature of 140°C by electrical heating elements which are not shown. The heat and pressure are maintained for a period sufficient to vulcanise the rubber and after this the mould is removed from the press and opened and the junction piece is removed.

During the subjection of the assembly to heat and pressure, the rubber parts 7, 8, 11, 12 and 13 all become integral with each other and are vulcanised so that they form a length of rubber waterstop and faces of the sheets 8, one edge of the sheet 11, and edges of the strips 12 and 13 are bonded to the tongue 5 and to the ends of the keying

ribs 3 and 4 which are also coated with a chemical bonding agent.

In the second example, a polyvinyl chloride waterstop 1' comprising a strip 2' and keying ribs 3' and 4' is trimmed in a manner similar to that described with reference to Figure 1 except that the ends of the keying ribs 3' and 4' are trimmed away at acute angles as shown.

In place of the section of rubber sheeting 11 and the rubber strips 12 and 13, however, an unvulcanised rubber waterstop 16 is used. This comprises a strip 17 with keying ribs 18 and 19. An end section of the strip 17 is cut away from between the ribs 18 and 19 and the adjacent ends of the ribs 18 and 19 are chamfered as shown at 20 and 21 to the same angles as the ribs 3' and 4' are trimmed away.

The tongue 5' and the adjacent end faces of the ribs 3' and 4' are coated with a chemical bonding agent as in the first example; unvulcanised rubber plugs 7' are inserted in the holes 6' and sections of calendered rubber sheet 8' are applied to the tongue 5' as in the first example. This sub-assembly together with the trimmed rubber waterstop 16 are then inserted in the mould section 10 with the tongue 5' abutting the strip 17 and the ribs 18 and 19 abutting the ribs 3' and 4' respectively. The remainder of the method then proceeds exactly as in the first example.

WHAT WE CLAIM IS:—

1. A method of making a junction piece for use in joining together two waterstops of the kind described, one of rubber and the other of polyvinyl chloride, the junction piece comprising a strip with two or more keying ribs for keying into concrete extending along it, one end part of the junction piece being of rubber and the other of polyvinyl chloride with a joint between these parts, the method comprising coating the surface of a portion of the strip of a length of polyvinyl chloride waterstop of the kind described with a heat curable chemical bonding agent, sandwiching the coated portion between portions of vulcanisable rubber with a further portion of rubber extending from the end of the coated polyvinyl strip to form an assembly and subjecting the assembly to heat and pressure in a mould to cause the rubber to flow into intimate contact with the polyvinyl chloride strip, to vulcanise and mould the rubber, and to cure the bonding agent to join the rubber and polyvinyl chloride parts to each other.

2. A method according to claim 1, in which the rubber portions are formed by two separate sections of unvulcanised rubber sheeting which are placed one on each side of the coated portion of the poly-

second example; and,

Figure 3 is a somewhat diagrammatic perspective view of a mould which can be used in both examples, the mould being shown open.

In the first example, a polyvinyl chloride waterstop 1 of the common dumb-bell section comprising a flat strip 2 and circular keying ribs 3 and 4 along both edges of the strip 2 has parts of its keying ribs 3 and 4 cut away at one end to form of projecting tongue 5. The tongue 5 has holes 6 punched out of it and it is coated back to a position just beyond the ends of the keying ribs 3 and 4 with a priming coat of a halogenated polymer bonding agent known as Chemlock 205 manufactured by Durham Raw Materials Limited. After this a second coat of Chemlock 231 made by the same manufacturers and also a halogenated polymer bonding agent is applied.

Next plugs 7 of unvulcanised rubber are inserted in the holes 6 and two sections of calendered rubber sheet 8 are applied one to each face of the coated tongue 5. The sub-assembly thus formed is then placed in a mould cavity 9 of a bottom mould section 10 shown in Figure 3. To the sub-assembly are added a further section of calendered rubber sheet 11 and two cylindrical unvulcanised rubber strips 12 and 13. The rubber sheet 11 is of a thickness substantially equal to the combined thickness of the sandwich formed by the tongue 5 and the two sheets of the sandwich formed by the tongue 5 and the two sheets 8 and when in position in the mould it abuts the end of the tongue 5. Similarly the strips 12 and 13 abut the ends of the keying ribs 3 and 4 respectively.

A top mould section 14 which is connected by hinges 15 to the mould section 10 is now closed and the closed mould is inserted into a press. The press is operated to apply pressure to the assembly within the mould and this pressure is approximately $\frac{1}{2}$ ton per square inch over the area of the mould cavity 9. While the assembly is held under pressure in the mould, the two mould halves are heated to a temperature of 140°C by electrical heating elements which are not shown. The heat and pressure are maintained for a period sufficient to vulcanise the rubber and after this the mould is removed from the press and opened and the junction piece is removed.

During the subjection of the assembly to heat and pressure, the rubber parts 7, 8, 11, 12 and 13 all become integral with each other and are vulcanised so that they form a length of rubber waterstop and faces of the sheets 8, one edge of the sheet 11, and edges of the strips 12 and 13 are bonded to the tongue 5 and to the ends of the keying

ribs 3 and 4 which are also coated with a chemical bonding agent.

In the second example, a polyvinyl chloride waterstop 1' comprising a strip 2' and keying ribs 3' and 4' is trimmed in a manner similar to that described with reference to Figure 1 except that the ends of the keying ribs 3' and 4' are trimmed away at acute angles as shown.

In place of the section of rubber sheeting 70 and the rubber strips 12 and 13, however, an unvulcanised rubber waterstop 16 is used. This comprises a strip 17 with keying ribs 18 and 19. An end section of the strip 17 is cut away from between the ribs 18 and 19 and the adjacent ends of the ribs 18 and 19 are chamfered as shown at 20 and 21 to the same angles as the ribs 3' and 4' are trimmed away.

The tongue 5' and the adjacent end faces 85 of the ribs 3' and 4' are coated with a chemical bonding agent as in the first example; unvulcanised rubber plugs 7' are inserted in the holes 6' and sections of calendered rubber sheet 8' are applied to the tongue 5' as in the first example. This sub-assembly together with the trimmed rubber waterstop 16 are then inserted in the mould section 10 with the tongue 5' abutting the strip 17 and the ribs 18 and 19 abutting the ribs 3' and 4' respectively. The remainder of the method then proceeds exactly as in the first example.

WHAT WE CLAIM IS:—

1. A method of making a junction piece for use in joining together two waterstops of the kind described, one of rubber and the other of polyvinyl chloride, the junction piece comprising a strip with two or more keying ribs for keying into concrete extending along it, one end part of the junction piece being of rubber and the other of polyvinyl chloride with a joint between these parts, the method comprising coating the surface of a portion of the strip of a length of polyvinyl chloride waterstop of the kind described with a heat curable chemical bonding agent, sandwiching the coated portion between portions of vulcanisable rubber with a further portion of rubber extending from the end of the coated polyvinyl strip to form an assembly and subjecting the assembly to heat and pressure in a mould to cause the rubber to flow into intimate contact with the polyvinyl chloride strip, to vulcanise and mould the rubber, and to cure the bonding agent to join the rubber and polyvinyl chloride parts to each other.

2. A method according to claim 1, in which the rubber portions are formed by two separate sections of unvulcanised rubber sheeting which are placed one on each side of the coated portion of the poly-



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vinyl chloride strip, a thicker section of
unvulcanised rubber sheeting which extends
from the end of the polyvinyl chloride strip
and two or more separate unvulcanised
5 rubber strips for forming the keying ribs of
the rubber end of the junction piece.

3. A method according to claim 1, in
which the rubber portions are formed by
a length of unvulcanised rubber waterstop
10 of the kind described together with two
sections of unvulcanised rubber sheeting,
one end of the strip of the rubber waterstop
being cut away from between the keying
ribs, the coated portion of the polyvinyl
15 chloride strip being inserted between the
keying ribs of the rubber waterstop where
the end of the strip has been cut away and
the sections of rubber sheeting being placed
one on each side of the polyvinyl chloride
20 strip in between the keying ribs of the
rubber waterstop.

4. A method according to any one of the
preceding claims, in which the bonding
agent comprises a halogenated polymer.

5. A method according to any one of
25 the preceding claims, in which the assembly
is heated in the mould to a temperature of
from 130° to 150°C.

6. A method according to any one of
the preceding claims, in which the assembly
is subjected in the mould to a pressure of 30
from $\frac{1}{2}$ ton to 2 tons per square inch.

7. A method according to any one of
the preceding claims, in which one or more
holes are formed through the portion of
the polyvinyl chloride strip which is coated 35
with the bonding agent.

8. A method according to claim 1, sub-
stantially as described with reference to
Figure 1, or Figure 2, and Figure 3 of the
accompanying drawings. 40

9. A junction piece made by a method
in accordance with any one of the preced-
ing claims.

10. Two waterstops of the kind des-
cribed one of rubber and the other of poly-
vinyl chloride, the waterstops being joined 45
together by the use of a junction piece in
accordance with claim 9.

For the Applicants:—

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1974.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies
may be obtained.

