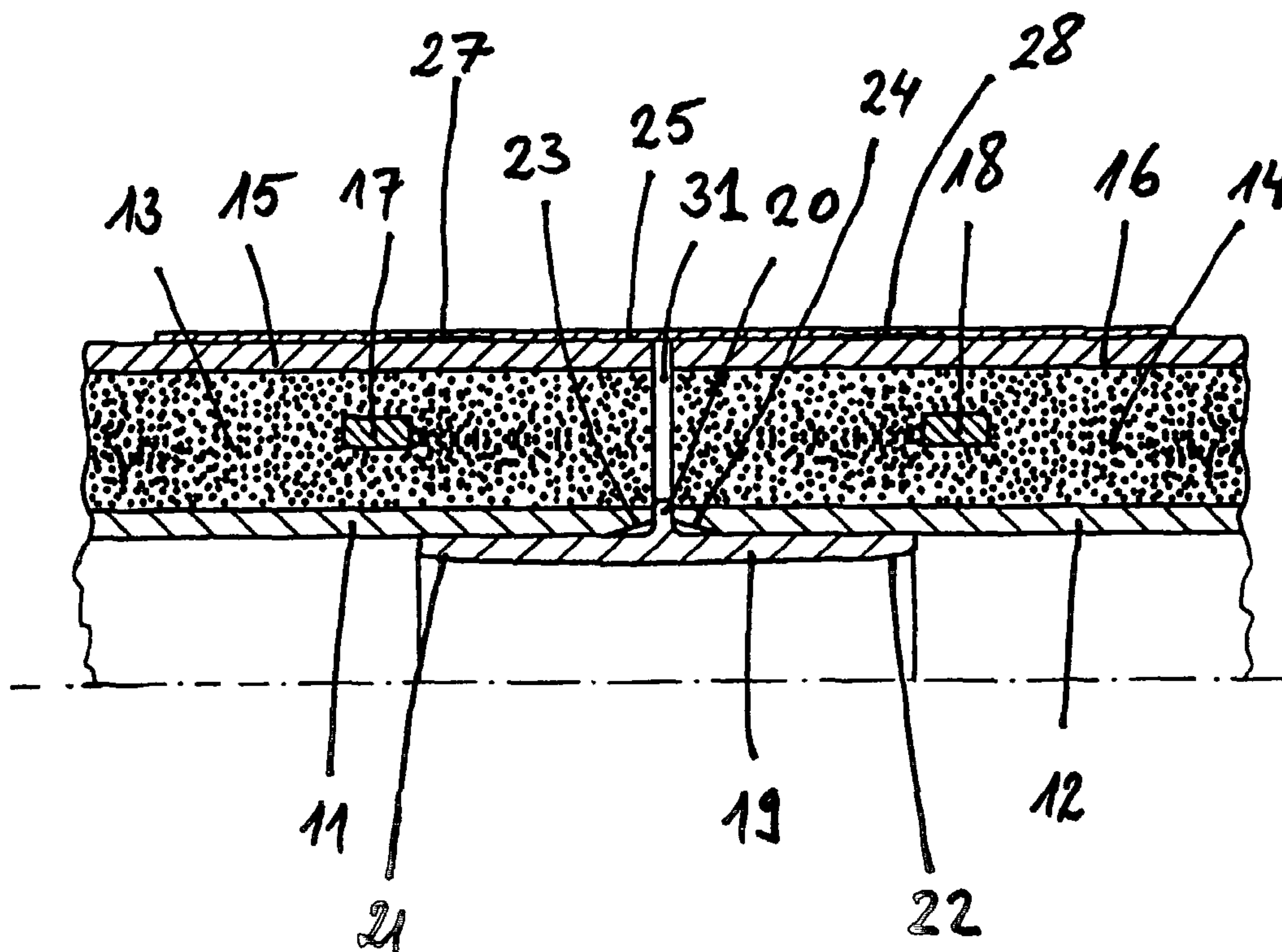




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(54) Titre : PIECE MOULEE DE RACCORD POUR CONDUITES PRE-ISOLEES  
 (54) Title: PIPE-CONNECTOR MOULDED PART FOR PRE-INSULATED PIPE CONDUITS



(57) Abrégé/Abstract:

The invention relates to a pipe-connector moulded part for pre-insulated pipe conduits consisting of plastic, whereby the pipe conduit is pre-insulated with polyurethane foam and the pipe-connector moulded part (19) is positioned so that it can be connected to the internal wall of the pipe conduits to be connected. The invention also relates to a method for connecting pre-insulated pipe conduits consisting of plastic by means of a nipple (19).

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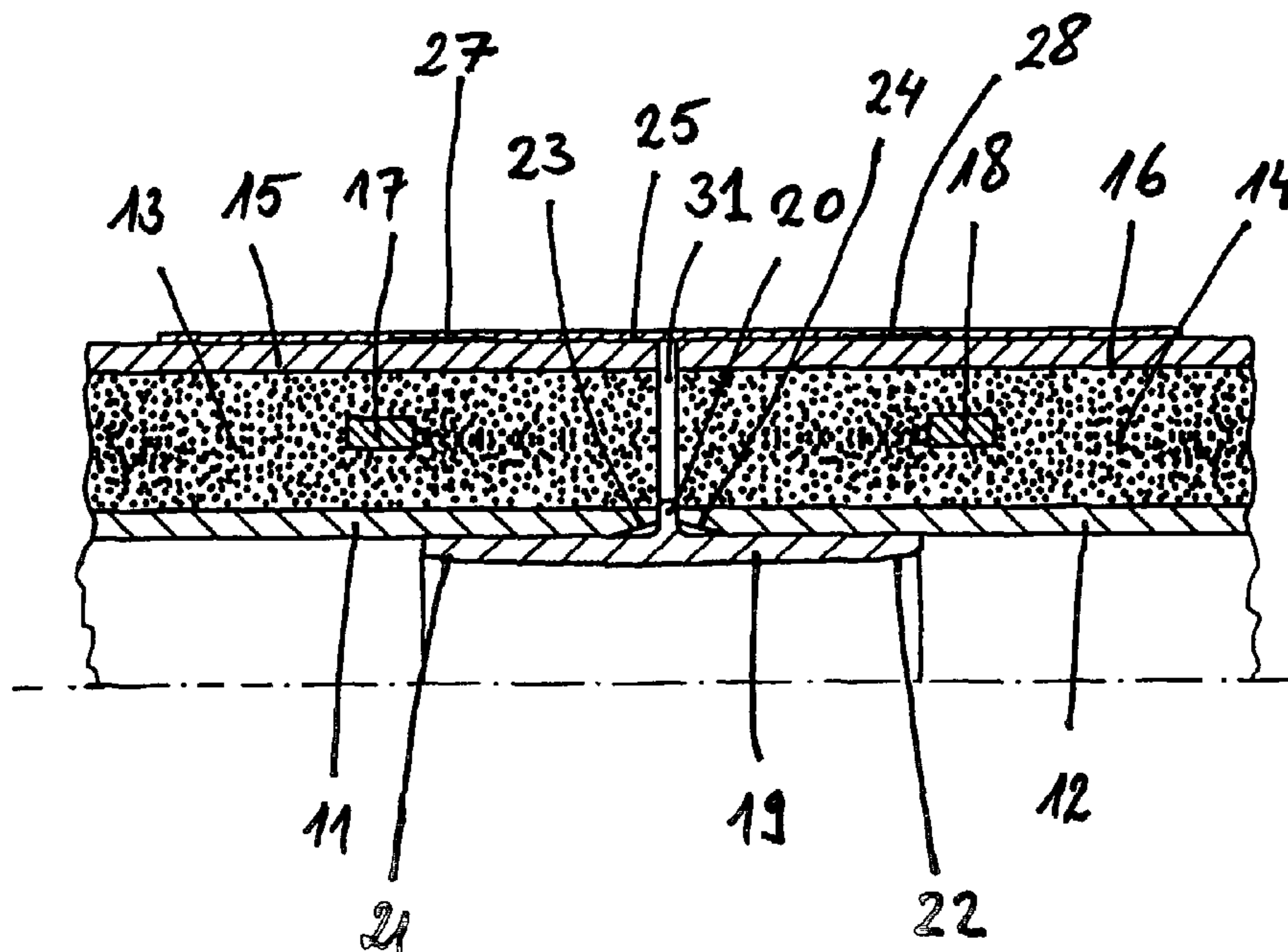
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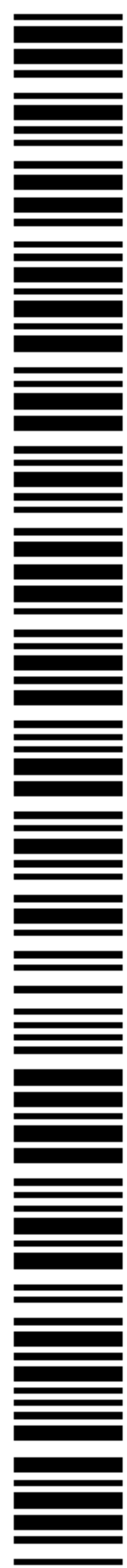
(54) Title: PIPE-CONNECTOR MOULDED PART FOR PRE-INSULATED PIPE CONDUITS

(54) Bezeichnung: ROHRVERBINDUNGSFORMTEIL FÜR VORISOLIERTE ROHRLEITUNGEN



(57) Abstract: The invention relates to a pipe-connector moulded part for pre-insulated pipe conduits consisting of plastic, whereby the pipe conduit is pre-insulated with polyurethane foam and the pipe-connector moulded part (19) is positioned so that it can be connected to the internal wall of the pipe conduits to be connected. The invention also relates to a method for connecting pre-insulated pipe conduits consisting of plastic by means of a nipple (19).

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**(57) Zusammenfassung:** Rohrverbindungsformteil für vorisolierte Rohrleitungen aus Kunststoffmaterial, wobei die Rohrleitung mit Polyurethanschaum vorisoliert ist, und wobei das Rohrverbindungsformteil (19) mit der Innenwand der zu verbindenden Rohrleitungen verbindbar angeordnet ist. Es wird auch ein Verfahren zur Verbindung von vorisolierten Rohrleitungen aus Kunststoffmaterial mittels eines Nippels (19) vorgeschlagen.

**PIPE-CONNECTOR MOULDED PART FOR PRE-INSULATED PIPE**  
**CONDUITS**

The invention relates to a pipe-connection molded part for pre-insulated pipe conduits of plastic material, the pipe conduit being pre-insulated with polyurethane foam.

10 In pipe conduit construction, in particular in applications in which good insulation of the medium relative to the environment is required, such as, for example, in pipe conduit systems for the transport of refrigerants, pre-insulated pipe conduit sections are being increasingly used. A readily suitable material for the insulation of refrigerant pipe conduits is foamed polyurethane. Arranged around the pipe conduit is an outer pipe or a tubular outer casing which is kept at a uniform distance from the outer wall of the pipe conduit concentrically around the pipe conduit by means of spacers. The annular space between the inner wall of the casing and the outer wall of the pipe conduit is completely filled with polyurethane foam.

20 The polyurethane foam is injected as a reactive foam-forming liquid, and the foam produced hardens. The foam readily adheres to the surfaces of the pipe conduit and the outer casing and also gives the pipe conduit pre-insulated in this way greater rigidity.

30 If a plurality of such pipe conduit sections have to be connected to one another, the effort required for preparing and producing the pipe conduit connection is relatively large. The pipe conduit itself must be exposed, cleaned of foam and connected to the next pipe conduit section by means of a sleeve. The outer casing must be made continuous again by means of a heat-shrinkable tube around the connection point, and the annular intermediate space between outer casing and the

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point connected to the sleeve must be filled with new foam.

EP182604 B1 discloses an arrangement and a method for  
5 connecting pipe conduits pre-insulated with  
polyurethane foam. In the insulating material in the  
intermediate space between pipe conduit and outer  
casing, an annular space is formed at the connection  
point. A special annular element which shrinks under  
10 the action of heat is introduced in this annular space.  
The special element consists of a nickel-titanium  
alloy. After the shrink-fit operation, the annular  
element exerts such a high force on the connection  
point between the two pipe conduits that no further  
15 connection of the pipe conduits is necessary.

Instead of the special element, a commercially  
available sleeve or adhesive sleeve may also be used.  
To this end, the polyurethane foam must also be removed  
20 from the connection region before the connection is  
produced. In order to obtain a sound connection between  
sleeve and pipe, the outside of the inner pipe must be  
peeled with a special peeling implement and cleaned.

25 Based on the prior art, the object of the invention is  
to specify a pipe-connection molded part for pre-  
insulated pipe conduits which permits a medium-tight,  
cost-effective and environmentally safe connection  
between two pipe conduit sections at any desired point  
30 of the pipe conduit.

This object is achieved by a pipe-connection molded  
part for pre-insulated pipe conduits of plastic  
material, the pipe conduit being pre-insulated with  
35 polyurethane foam, and the pipe-connection molded part  
being arranged in such a way that it can be connected  
to the inner wall of the pipe conduits to be connected.

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Preferred developments of the invention follow from the dependent claims.

5 It is advantageous that no insulating material and no outer pipe material has to be removed and disposed of for the connection of the pipe conduit sections. This is achieved by the pipe conduit sections pre-insulated with polyurethane foam being arranged in the connection region in such a way that they can be pushed into  
10 position on a nipple matching the inside diameter of the inner pipes.

It is also advantageous that no additional preparatory effort and no tools, such as, for example, peeling  
15 tools for the outside of the inner pipe, are required for the connection. In the connection region, the inner surfaces of the pipe conduit and the nipple which are to be connected to one another are not treated by the insulating process or contaminated with foam residues.

20 It is also advantageous that, in the connection region between the pipe conduit and the pipe-connection molded part, the connecting conditions are matched to one another and can be reproduced. This is achieved by the  
25 pipe inside diameter and the nipple outside diameter being precisely definable in the connection region.

Overall, considerable material and time are saved by the connection on the inside of the inner pipe. The  
30 removal of the outer pipe and of the polyurethane foam, the environmentally compatible disposal of the polyurethane foam residues and the complicated cleaning of the outside, contaminated with polyurethane foam, of the inner pipe are dispensed with. It is not necessary  
35 to procure a special peeling implement for the outside of the inner pipe. The pipe conduit sections of the pipe conduits pre-insulated with polyurethane foam,

which are relatively expensive, can be processed virtually without waste and losses.

An exemplary embodiment of the invention is described  
5 with reference to the figures.

In the drawing:

10 Figure 1 shows a section through a connection between two pipe conduit sections pre-insulated with polyurethane foam, and

15 Figure 2 shows a section through a connection between two pipe conduit sections pre-insulated with polyurethane foam and having a nipple according to the invention.

A known connection between two pipe conduits for temperature-sensitive media, for example for  
20 refrigerants in industrial cooling line systems, is shown sectioned in figure 1. The pipe conduits consist of an inner pipe 1, 2, are pre-insulated with a layer 3 of polyurethane foam and are encased with an outer pipe 4, 5. The inner pipes are made of an acrylonitrile-  
25 butadiene-styrene (= ABS) and the outer pipes are made of a high-density polyethylene (= HDPE). Polyurethane foam (= PUR) is best suited for cold insulation. The pipe conduit is connected in a conventional manner using an adhesive sleeve 6. The pre-insulated pipe  
30 conduits are obtainable in nominal diameters of 16 to 225 mm.

The connection is produced as follows: the pipe conduits are severed in the connection region in order  
35 to expose the ends of the inner pipes 1, 2. The outer pipe 4, 5 and the polyurethane foam layer 3 are removed from the connection region. After the layer 3 has been removed, the outside of the inner pipe 1, 2 must be

- 5 -

cleaned and prepared for the connection. The polyurethane foam forms a permanent connection with most surfaces. The outside of the inner pipe 1, 2 must be peeled with a special peeling implement. In the  
5 process, care must be taken to ensure that not too much material is removed, since otherwise a gap which is too large would be produced between the inner wall of the sleeve 6 and the outer wall of the inner pipe 1, 2, and this gap can only be connected correctly and in a  
10 medium-tight manner with difficulty.

After both pipe conduit sections have been prepared in this way, an adhesive connection or a welded connection to the sleeve 6 is produced. On the inside of the inner  
15 pipe, the adhesive forms a bead 7 at the point where the two inner pipes are pushed into the adhesive sleeve 6. Beads 7 of molten plastic material can also be produced during the "sleeve welding process". The space which is left between the sleeve 6 and the outer pipe  
20 4, 5 is then filled again with polyurethane foam.

What are referred to as half shells, or half-ring-shaped elements of polyurethane foam, which are obtainable on the market are used for this purpose. The  
25 half shells have a length which corresponds to the length of the connection region. The length of each half shell is slightly greater than twice the length of the polyurethane foam layers 3 which have been removed at both pipe conduit sections in order to expose the  
30 ends for the adhesive bonding. Finally, the pipe connection point, by means of a heat-shrinkable tube 8 of polyethylene and a sealing agent or an adhesive tape 9, 10, is sealed off again against the ingress of air or moisture.

35

A novel connection between two pipe conduits for temperature-sensitive media, for example for refrigerants in an industrial cooling line system, is

shown sectioned in figure 2. From the inside to the outside, the pipe conduits are composed of: an inner pipe 11, 12 of plastic, for example of an acrylonitrile-butadiene-styrene, a layer 13, 14 of insulating foam, for example polyurethane foam, and an outer pipe 15, 16, for example of high-density polyethylene. In order to keep the outer pipe 15, 16 at a uniform distance concentrically around the inner pipe 11, 12 during the introduction and curing of the polyurethane foam, plastic spacers 17, 18 are arranged between the inner pipe 11, 12 and the outer pipe 15, 16 at regular intervals in the longitudinal direction of the pipe conduit. The differences in diameter between the inner pipe and the outer pipe, which lead to intermediate spaces of different size for the foam layer 13, 14, are automatically compensated for through the use of the spacers 17, 18.

The connection between the two pipe conduits is produced by means of a nipple 19 of plastic which can be connected to the plastic of the inner pipe 11, 12, that is to say it can be adhesively bonded or welded to said plastic of the inner pipe 11, 12, and is compatible with it. The nipple 19 can be made adhesive before being connected to the pipe conduits. To this end, either those surfaces of the nipple 19 and the inner pipes 11, 12 which are to be connected to one another are heated by a "sleeve welding process", or the surfaces to be connected are adhesively provided with a suitable adhesive. In the center, on the outer circumference, the nipple 19 has an annular web 20 which is directed radially outward and serves as a stop for the inner pipes 11, 12 during the connection. The web 20 ensures that both pipes 11, 12 are pushed sufficiently deep over the nipple 19. At the start and at the end, the nipple 19 has wall regions 21, 22 rounded off or beveled inward. This ensures that the flow of the refrigerant through the pipe conduit is

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hindered as little as possible and that the pressure loss in the pipe conduit on account of changes in diameter is kept as small as possible.

5 At the end, on the pipe inside, the inner pipes 11, 12 may be beveled with a "draw-in bevel" or be rounded off with a draw-in radius. In figure 2, the ends of the inner pipes 11, 12 have a bevel 23, 24, the "draw-in bevel 23, 24, directed obliquely inward. This ensures  
10 that the pipe conduits can be pushed into position on the nipple 19 as simply as possible. During the adhesive bonding, the bevel 23, 24 also serves to draw in excess material which is displaced when the pipe conduits are pushed onto the nipple 19. If the inside  
15 diameter of the inner pipes 11, 12 is too small in relation to the outside diameter of the nipple 19, the inner pipes 11, 12 must be calibrated beforehand, that is to say they must be given a matching inside diameter by a peeling or scraping operation.

20

Before the connecting operation, the pipe conduit sections are aligned with the pipe conduit axis as accurately as possible. If the pipe conduit sections are processed on site in shorter lengths than the  
25 lengths delivered by the manufacturer, a new bevel 23, 24 has to be made as single preparation at the interface. No material is removed from the insulating layer 13, 14 or from the outer pipe 15, 16. In all cases, it is not necessary to remove polyurethane foam or polyethylene if the nipple 19 is used. No  
30 polyurethane foam or polyethylene need be disposed of. The connection on the inside of the pipe 11, 12 is simpler, since no polyurethane residues have to be removed from the surface of the inner pipe 11, 12.

35

Before the connection is produced, a "heat-shrinkable tube" 25 is put loosely over one of the pipe conduits, that is to say a tube of plastic material which has

been modified in such a way that it shrinks under the action of heat. After the curing of the connection between nipple 19 and the inner pipes 11, 12, the tightness of the connection is tested.

5

Due to the formation of the web 20, a gap 31 is produced in the region of the web. 20 between the pipe conduits, that is to say between the insulating foam layers 13, 14 and the outer pipes 15, 16. This gap 31 can readily be inspected during the test for pressure tightness, which is carried out following the actual connecting operation and before the welding to the heat-shrinkable tube. During the pressure tightness test, it can be observed in the gap 31 whether medium is escaping from the inner pipe 11, 12 in the event of a leaky connection. If there were no gap 31, the escaping test medium would be absorbed by the insulating foam.

20 After the testing of the tightness of the connection between nipple 19 and the inner pipes 11, 12, an adhesive sealing tape or a sealing adhesive tape 27, 28 is wound around the ends of the outer pipes 15, 16 in the region of the nipple 19. In order to achieve better 25 adhesion on the heat-shrinkable tube 25 and on the outer pipe 15, 16, the adhesive tape 27, 28 may be a double-sided adhesive tape. Sound sealing in the region of the heat-shrinkable tube 25 is necessary in order to retain the insulating properties of the insulating foam 30 13, 14 even after the connecting. The heat-shrinkable tube 25 is then shrunk to the diameter of the outer pipes 15, 16 by the action of heat in the connection region.

**Patent claims**

1. A pipe-connection molded part for pre-insulated pipe conduits of plastic material, the pipe conduit  
5 being pre-insulated with polyurethane foam, and the pipe-connection molded part (19) being arranged in such a way that it can be connected to the inner wall of the pipe conduits to be connected.
- 10 2. The pipe-connection molded part as claimed in claim 1, characterized in that the connection molded part is designed as a nipple (19).
- 15 3. The pipe-connection molded part as claimed in at least one of claims 1 or 2, characterized in that the connection molded part is designed as a nipple (19) which can be connected by a sleeve welding process.
- 20 4. The pipe-connection molded part as claimed in at least one of claims 1 or 2, characterized in that the connection molded part is designed as an adhesive nipple (19) which can be connected by an adhesive bonding process.
- 25 5. The pipe-connection molded part as claimed in at least one of claims 1 to 4, characterized in that the nipple (19) has a web (20) directed radially outward, the web (20) being formed on the outer circumference in the center of the nipple (19) and serving as a stop for  
30 the pipe conduits to be connected.
6. The pipe-connection molded part as claimed in at least one of claims 1 to 5, characterized in that a gap (31) is formed in the region of the web (20) between  
35 the pipe conduits to be connected.
7. The pipe-connection molded part as claimed in at least one of claims 1 to 6, characterized in that the

nipple (19), at the start and at the end, has beveled or rounded-off inner wall regions (21, 22) which taper inward and serve to optimize the flow in the pipe conduit.

5

8. A method of connecting pre-insulated pipe conduits of plastic material by means of a nipple (19) as claimed in at least one of claims 1 to 7, the pipe conduit being pre-insulated with polyurethane foam and  
10 being at least composed of an inner pipe (11, 12), a foam layer (13, 14) and an outer pipe (15, 16), comprising at least the following steps:

- right-angled cutting off of the pipe conduits to be connected,
- 15 - beveling the inner wall of the inner pipe (11, 12),
- pushing a heat-shrinkable tube (25) into position on the outer pipe (15, 16),
- preparing the connecting surfaces of the nipple  
20 (19) and of the inner pipe (11, 12) by the action of heat or by the action of adhesive in such a way that they are capable of adhesion,
- pushing together the pipe conduits to be connected and the nipple (19) up to the web (20),
- 25 - testing the tightness of the connection,
- coating the outer pipe (15, 16) with a sealing agent (27, 28), and
- shrinking the heat-shrinkable tube (25) by the action of heat.

30

9. A method of connecting pre-insulated pipe conduits of plastic material by means of a nipple (19) as claimed in at least one of claims 1 to 7, the pipe conduit being pre-insulated with polyurethane foam and  
35 being at least composed of an inner pipe (11, 12), a foam layer (13, 14) and an outer pipe (15, 16), comprising at least the following steps:

- 11 -

- right-angled cutting off of the pipe conduits to be connected,
- calibrating the inside diameter of the inner pipes (11, 12),
- 5 - beveling the inner wall of the inner pipe (11, 12),
- pushing a heat-shrinkable tube (25) into position on one of the outer pipes (15, 16),
- preparing the connecting surfaces of the nipple 10 (19) and of the inner pipe (11, 12) by the action of heat or by the action of adhesive in such a way that they are capable of adhesion,
- pushing together the pipe conduits to be connected and the nipple (19) up to the web (20),
- 15 - waiting, during a waiting period, until the strength of the connection is achieved,
- testing the tightness of the connection between nipple (19) and inner pipes (11, 12),
- coating the outer pipe (15, 16) with a sealing 20 agent (27, 28), and
- shrinking the heat-shrinkable tube (25) by the action of heat.

