Patent claims

1. An induction connection sleeve ~~(1)~~ for connecting by fusing plastic pipes ~~(2, 3),~~ comprising:

– a sleeve body ~~(9)~~made from an injection-molded thermoplastic plastics material, having a first ~~(5)~~ and a second receptacle portion ~~(7)~~ for receiving first ~~(4)~~ and second connection portions ~~(6)~~ of the plastic pipes ~~(2, 3)~~ to be connected, said receptacle portions ~~(5, 7)~~ being disposed in a mutually coaxial manner;

– a first induction heating element ~~(12)~~ which is configured in a bush-shaped manner and has recesses ~~(16)~~ that are disposed in the circumference, said first induction heating element ~~(12)~~ being embedded in the sleeve body ~~(9),~~ wherein the first induction heating element ~~(12)~~ surrounds the first receptacle portion ~~(5)~~ of the sleeve body ~~(9);~~

– a second induction heating element ~~(13)~~ which is configured in a bush-shaped manner, and has recesses ~~(16)~~ arranged in the circumference said second induction heating element ~~(13)~~ being embedded in the sleeve body ~~(9),~~ wherein the second induction heating element ~~(13)~~ surrounds the second receptacle portion ~~(7)~~ of the sleeve body ~~(9);~~

~~characterized in~~ wherein that the sleeve body ~~(9)~~ comprises an internal part ~~(10),~~ said internal part ~~(10)~~ configuring the two receptacle parts ~~(5, 7),~~ and the induction heating elements ~~(12, 13)~~ being received on said internal part ~~(10)~~ in such a manner that the recesses ~~(16)~~ of the induction heating elements ~~(12)~~ are penetrated by the internal part ~~(10),~~ said recesses ~~(16)~~ on the external shell surfaces ~~(14, 15)~~ thereof in the region of the induction heating elements ~~(12, 13)~~ terminating flush with the internal part ~~(10),~~ and ~~in that~~wherein the sleeve body ~~(9)~~ comprises an external part ~~(11)~~ which is connected in a materially integral manner to the internal part ~~(10)~~ and surrounds the external shell surfaces ~~(14, 15)~~ of the induction heating elements ~~(12, 13),~~ wherein the induction heating elements ~~(12, 13)~~ are entirely enclosed by the internal part ~~(10)~~ and by the external part ~~(11).~~.

2. The induction connection sleeve as claimed in claim 1, ~~characterized in that~~wherein the internal part ~~(10)~~ of the sleeve body ~~(9)~~ is formed from a first plastics

from the group of thermoplastic plastics which has a first melting point, and ~~in that~~ the external part ~~(11)~~ of the sleeve body ~~(9)~~ is formed from a second plastics, different from the first plastics, from the group of thermoplastic plastics which has a second melting point, wherein the melting point of the second plastics is higher than the melting point of the first plastics.

3. The induction connection sleeve as claimed in either of claims 1 and 2, ~~characterized in that~~ wherein an adhesive agent layer ~~(38)~~ is configured between the internal part ~~(10)~~ and the external part ~~(11).~~.

4. The induction connection sleeve as claimed in any one of the preceding claims, ~~characterized in that~~ wherein a continuous receptacle portion ~~(17)~~ having a cylindrical internal shell surface ~~(18)~~ for receiving connection portions ~~(4, 6)~~ of the plastic pipes ~~(2, 3)~~ to be connected is configured on the internal part ~~(10),~~, wherein the first and the second receptacle portion ~~(7)~~ are configured in the continuous receptacle portion ~~(17).~~.

5. The induction connection sleeve as claimed in any one of the preceding claims, ~~characterized in that~~ wherein an external shell surface ~~(41)~~ of the external part ~~(11)~~ is configured so as to emanate from the longitudinal center of the sleeve body ~~(9)~~ and taper in the direction toward an end face ~~(44, 45)~~ of the sleeve body ~~(9).~~.

6. The induction connection sleeve as claimed in any one of the preceding claims, ~~characterized in that~~wherein the wall thickness ~~(32)~~ of the induction heating element ~~(12)~~ is between 40% and 60% in relation to the wall thickness ~~(39)~~ of the internal part ~~(10)~~ of the sleeve body.

7. The induction connection sleeve as claimed in one of the preceding claims, ~~characterized in that~~wherein the width ~~(47, 48)~~ of the first ~~(12)~~ and the second induction heating element ~~(13)~~ is between 25% and 35% in relation to a width ~~(46)~~ in the axial direction of the sleeve body ~~(9).~~.

8. The induction heating element as claimed in any one of the preceding claims, ~~characterized in that~~ wherein at least one position-securing element ~~(22)~~ is disposed on the sleeve body ~~(9),~~ said position-securing element ~~(22)~~ in relation to one of the receptacle portions ~~(5, 7)~~ being disposed so as to project radially in the direction toward the center of the sleeve body ~~(9).~~.

9. A method for producing an induction connection sleeve ~~(1),~~ in particular an induction connection sleeve ~~(1)~~ as claimed in one of the preceding claims, ~~characterized in that~~ wherein the production method comprises the following method steps:

- laying up a first induction heating element ~~(12)~~ in a first injection-mold half ~~(50),~~ wherein the first injection-mold half ~~(50)~~ has a first molding cavity ~~(52)~~ for receiving the first induction heating element ~~(12),~~ said first molding cavity ~~(52)~~ having an available diameter ~~(53)~~ which corresponds to the external diameter ~~(28)~~ of the first induction heating element ~~(12),~~ wherein the first induction heating element ~~(12)~~ is received in a positioned manner in the first injection-mold half ~~(50);~~;
– laying up a second induction heating element ~~(13)~~ in a second injection-mold half ~~(51)~~ that interacts with the first injection-mold half ~~(50),~~ wherein the second injection-mold half ~~(51)~~ has a second molding cavity ~~(54)~~ for receiving the second induction heating element ~~(13),~~ said second molding cavity ~~(54)~~ having an available diameter ~~(55)~~ which corresponds to the external diameter ~~(30)~~ of the second induction heating element ~~(13),~~ wherein the second induction heating element ~~(13)~~ is received in a positioned manner in the second injection-mold half ~~(51);~~;
– mutual compressing of the first ~~(50)~~ and the second injection-mold half ~~(51),~~ wherein the first ~~(50)~~ and/or the second injection-mold half ~~(51)~~ have/has a first mold core ~~(56)~~ which for receiving the induction heating elements ~~(12, 13)~~ is disposed so as to be centric to the molding cavities ~~(52, 54)~~ and serves for molding a first ~~(5)~~ and a second ~~(7)~~ receptacle portion of the induction connection sleeve ~~(1);~~;
– injecting a thermoplastic plastics material into the first ~~(52)~~ and the second molding cavity ~~(54),~~ wherein an internal part ~~(10)~~ of a sleeve body ~~(9)~~ of the induction connection sleeve ~~(1)~~ is formed, said internal part ~~(10)~~ in the internal side having the

first ~~(5)~~ and the second receptacle portion ~~(7),~~ and the induction heating elements ~~(12, 13)~~ at least in regions being embedded in said internal part ~~(10),~~ wherein recesses ~~(16)~~ that are disposed in the circumference of the induction heating elements ~~(12, 13)~~ are penetrated by the plastics material of the internal part ~~(10);~~

– opening the first ~~(50)~~ and the second injection-mold half ~~(51);~~

– ejecting the internal part ~~(10)~~ of the sleeve body ~~(9)~~ having the induction heating elements ~~(12, 13)~~ from one of the injection-mold halves ~~(50; 51);~~

– laying up the internal part ~~(10)~~ of the sleeve body ~~(9)~~ having the induction heating elements ~~(12, 13)~~ in a third injection-mold half ~~(60),~~ wherein the third injection-mold half ~~(60)~~ has a third molding cavity ~~(62)~~ for receiving the internal part ~~(10)~~ of the sleeve body ~~(9),~~ a further mold core ~~(64)~~ for positioning the internal part ~~(10)~~ being disposed in said third molding cavity ~~(62),~~ and wherein a radial gap ~~(66)~~ for molding an external part ~~(11)~~ of the sleeve body ~~(9)~~ is configured between the external circumference of the internal part ~~(10)~~ and the third molding cavity ~~(62);~~

– closing the third molding cavity ~~(62);~~

– injecting a thermoplastic plastics material into the third molding cavity ~~(62),~~ wherein an external part ~~(11)~~ of the sleeve body ~~(9)~~ is formed;

– opening the third molding cavity ~~(62);~~

– ejecting the finished induction connection sleeve ~~(1).~~

10. The method for producing an induction connection sleeve ~~(1)~~ as claimed in claim 9, ~~characterized in that~~wherein a fourth injection-mold half ~~(61)~~ having a fourth molding cavity ~~(63)~~ is provided for closing the third molding cavity ~~(62),~~ said fourth molding cavity ~~(63)~~ interacting with the third molding cavity ~~(62)~~ of the third injection-mold half ~~(60).~~

11. The method for producing an induction connection sleeve ~~(1)~~ as claimed in claim 10, ~~characterized in that~~wherein the first ~~(50)~~ and the third injection-mold half ~~(60)~~ are disposed on a common clamping plate, and ~~in that~~ the second ~~(51)~~ and the fourth injection-mold half ~~(61)~~ are disposed on a common clamping plate, wherein the first ~~(50)~~

and the third injection-mold half ~~(60)~~ form a nozzle side, and the second ~~(51)~~ and the fourth injection-mold half ~~(61)~~ form an ejector side and are moved simultaneously.

12. The method for producing an induction connection sleeve ~~(1)~~ as claimed in any one of claims 9 to 11, ~~characterized in that~~wherein the ejecting of the internal part ~~(10)~~ of the sleeve body ~~(9)~~ having the induction heating elements ~~(12, 13)~~ molded thereon and/or ejecting the finished induction connection sleeve ~~(1)~~ are/is carried out by means of ejectors ~~(67)~~ which are disposed in one of the injection-mold halves ~~(50, 51, 60, 61).~~.

13. A method for producing a welded connection between a first plastic pipe ~~(2)~~ and a second plastic pipe ~~(3),~~, in particular while using an induction connection sleeve ~~(1)~~ as claimed in one of claims 1 to 8, ~~characterized in that~~wherein the method comprises the following method steps:

– providing the first plastic pipe ~~(2);~~;

– providing the induction connection sleeve ~~(1)~~ having a sleeve body ~~(9)~~ which has a width ~~(46)~~ in the axial direction;

– push-fitting the induction connection sleeve ~~(1)~~ onto the first plastic pipe ~~(2)~~ such that the induction connection sleeve ~~(1)~~ by way of the entire width ~~(46)~~ of the sleeve body ~~(9)~~ surrounds the first plastic pipe ~~(2);~~;

– providing the second plastic pipe ~~(3);~~;

– coaxially aligning the second plastic pipe ~~(3)~~ in relation to the first plastic pipe ~~(2)~~ and disposing the former directly next to the latter;

– axially displacing the induction connection sleeve ~~(1)~~ such that the latter in part surrounds the first plastic pipe ~~(2)~~ and the second plastic pipe ~~(3);~~;

– positioning an inducing device ~~(69)~~ in the region of the induction connection sleeve ~~(1)~~ and by means of the inducing device ~~(69)~~ inducing a current in the induction connection sleeve ~~(1)~~ such that the sleeve body ~~(9)~~ at least in part is plasticized and connects in a materially integral manner to the two plastic pipes ~~(2, 3).~~.

14. The method as claimed in claim 13, ~~characterized in that~~wherein for producing a welded connection between double-walled plastic pipes ~~(2, 3),~~ each having one internal pipe ~~(70, 71)~~ and one external pipe ~~(72, 73),~~ prior to the method step of axially displacing the induction connection sleeve ~~(1)~~ in which the induction connection sleeve ~~(1)~~ in part surrounds the first plastic pipe ~~(2)~~ and the second plastic pipe ~~(3),~~ at least the following method step is additionally carried out:

– welding the two internal pipes ~~(70, 71)~~ of the double-walled plastic pipes ~~(2, 3).~~

15. The method as claimed in claim 14, ~~characterized in that~~wherein the two internal pipes ~~(70, 71)~~ of the double-walled plastic pipes ~~(2, 3)~~ at the end side are welded by heating-element butt welding by means of a welding mirror ~~(75).~~

16. The method as claimed in either of claims 14 and 15, ~~characterized in that~~wherein, after the welding of the two internal pipes ~~(70, 71)~~ of the double-walled plastic pipes ~~(2, 3)~~ and before the method step of axially displacing the induction connection sleeve ~~(1)~~ in which the induction connection sleeve ~~(1)~~ in part surrounds the first plastic pipe ~~(2)~~ and the second plastic pipe ~~(3),~~ the mutually welded internal pipes ~~(70, 71)~~ are subjected to a pressure test.