Patent Claims

1. Protective element for connecting to a concrete element (10) of a tunnel lining and having at least one protective portion (21, 22, 23) which has a side which faces the concrete element (10) and on which is provided at least one connecting element (24, 25, 26, 27, 28) for producing a durable connection of the protective portion (21, 22, 23) to the concrete element (10), wherein the protective portion (21, 22, 23) has a base portion (21) and/or a wall portion (22, 23) and at least one region consisting of at least one plastics material, and the protective element has at least one seal (30) which is connected in a single piece to the protective portion (21, 22, 23), wherein the connection is gas-tight and liquid-tight, and the single-piece connection of the seal to the protective portion is produced by injection moulding with the at least one plastics material and thereby forms a first portion of the base portion (21) and/or of the wall portion (22, 23) of the protective portion (21, 22, 23), **characterized in that** the base portion (21) and/or the wall portion (22, 23) of the protective portion (21, 22, 23) have/has at least one second portion, in that the second portion has an areal extent, and in that the second portion is connected to the first portion by injection moulding.

2. Protective element according to Claim 1, characterized in that the second portion essentially consists of a film, a plate or a sheet which is preferably connected to connecting elements, and/or in that the second portion is formed from a further plastics material.

3. Protective element according to Claim 1 or 2, characterized in that the base portion (21) of the protective portion (21, 22, 23) is essentially formed

from the second portion, and/or in that the connection between the first and second portion is a butt joint, or in that the first portion at least partially encloses the second portion in certain portions.

4. Protective element according to one of Claims 1 to 3, characterized in that the connecting element is a honeycomb structure (24), a crosspiece (25), a pin and/or a sheet-like element (25, 27, 28) with openings (26).

5. Protective element according to one of Claims 1 to 4, characterized in that the protective portion (21, 22, 23) is connected in a single piece to the at least one connecting element (24, 25, 26, 27, 28), wherein preferably the single-piece connection is produced by injection moulding the plastics material.

6. Protective element according to one of Claims 1 to 5, characterized in that the injection-mouldable plastics material is a polydicyclopentadiene (pDCPD), preferably resistant to high temperatures, or a resin, wherein preferably glass fibres are introduced.

7. Protective element according to one of Claims 2 to 6, characterized in that the plastics material of the sheet-like element is a thermoplastic, preferably PE.

8. Concrete element for producing a tunnel lining and having a convex outer surface (12) and an inner surface (12) located opposite, wherein a protective element (20) is connected to the inner surface (12) via at least one connecting element (24, 25, 26, 27, 28), characterized in that the protective element (20) is a protective element according to one of Claims 1 to 7.

9. Method for producing a concrete element according to Claim 8, in which a protective element (20) according to one of Claims 1 to 7 is produced from plastics material by injection moulding, the completed protective element (20) is inserted into a mould, and the protective element (20) is connected to concrete (16) and, once setting has taken place, is removed from the mould.

Claims

1. Protective element for connecting to a concrete element (10) of a tunnel lining having at least one protective portion (21, 22, 23) which has a side which faces the concrete element (10) and on which at least one connecting element (17, 24,) is provided for producing a durable connection of the protective portion (21, 22, 23) to the concrete element (10), wherein the protective portion (21, 22, 23) has a base portion (21) and a wall portion (22, 23), and at least one region consisting of at least one plastics material, wherein the protective element has at least one seal (30) which is connected in a single piece to the protective portion (21, 22, 23), wherein the connection is gas-tight and liquid-tight, and the single-piece connection of the seal (30) to the protective portion is produced by injection moulding with the at least one plastics material and thereby forms a first portion of the protective portion (21, 22, 23), **characterized in that** part of the protective portion (21, 22, 23) is at least one second portion, the second portion being an area element, and in that the second portion is connected to the first portion by injection moulding.

2. Protective element according to Claim 1, characterized in that the second portion essentially consists of a film, a plate or a sheet, or in that the second portion is formed from a further plastics material.

3. Protective element according to Claim 2, characterized in that the film, the plate, or the sheet is connected to connecting elements.

4. Protective element according to one of Claims 1 to 3, characterized in that the base portion (21) of the protective portion (21, 22, 23) is essentially formed from the second portion.

5. Protective element according to one of Claims 1 to 4, characterized in that the connection between the first and second portion is a butt joint.

6. Protective element according to one of Claims 1 to 4, characterized in that the first portion at least partially encloses the second portion in certain portions.

7. Protective element according to one of Claims 1 to 6, characterized in that the connecting element is a honeycomb structure (24), a crosspiece, a pin (17) or a sheet-like element with openings (26).

8. Protective element according to one of Claims 1 to 7, characterized in that the protective portion (21, 22, 23) is connected in a single piece to the at least one connecting element (17, 24).

9. Protective element according to Claim 8, characterized in that the single-piece connection is produced by injection moulding the plastics material.

10. Protective element according to one of Claims 1 to 9, characterized in that the injection-mouldable plastics material is a polydicyclopentadiene (pDCPD), or a resin.

11. Protective element according to Claim 10, characterized in that glass fibres are introduced into the resin.

12. Protective element according to one of Claims 2 to 11, characterized in that the plastics material of the area element is a thermoplastic.

13. Protective element according to Claim 12, characterized in that the plastics material of the sheet-like element is PE.

14. Concrete element for producing a tunnel lining and having a convex outer surface (11) and an inner surface (12) located opposite, wherein a protective element (20) is connected to the inner surface (12) via at least one connecting element (17, 24), characterized in that the protective element (20) is a protective element according to one of Claims 1 to 13.

15. Method for producing a concrete element according to Claim 14, in which a protective element (20) according to one of Claims 1 to 13 is produced from plastics material by injection moulding, the completed protective element (20) is inserted into a mould, and the protective element (20) is connected to concrete (16) and, once setting has taken place, is removed from the mould.