P A T E N T C L A I M S

1. An injector (21) for delivery of a pharmaceutical composition, the injector (21) comprising a cylinder (22) having an inner wall (23), and a piston rod (10), and a stopper (1), the stopper (1) having a stopper body (2) with an actuating surface (3) opposite an outlet surface (4), an axial length between the actuating surface (3) and the outlet surface (4), and a transverse diameter, ~~the stopper body (2) having a tubular section having an access diameter,~~

the stopper (1) at an axial location from the actuating surface (3) comprising a deformable sealing element (5) made from a thermoplastic elastomer (TPE), ~~which~~the deformable sealing element (5) ~~surrounds~~surrounding the stopper body (2~~), has~~) and having an outer diameter, which is larger than the transverse diameter, ~~and~~which deformable sealing element (5) has an axial extension in the range of 5% and 95% of the axial length of the stopper body (2), which deformable sealing element (5) seals an annular gap between the stopper body (2) and the inner wall (23) of the cylinder (22), and

c h a r a c t e r i s e d in that

the stopper (1) ~~comprising~~comprises a cavity (6) at the axial location of the deformable sealing element (5),

~~c h a r a c t e r i s e d in that the~~ which cavity (6) ~~comprises a compressible fluid and~~ has an axial extension in the range of 5% to 50% of the axial length of the stopper body (2) ~~a lateral extension larger than the access diameter and in the range of 50% to 65% of the outer diameter of the deformable sealing element (5)~~, and in that

the stopper body (2) has a tubular section for housing the piston rod (10) in an access diameter, and in that the cavity (6) is formed at an interface between the stopper body (2) and the piston rod (10) and/or at an interface between the deformable sealing element (5) and the piston rod (10~~).~~) and in that the cavity (6) has a lateral extension that is at least 50% of the outer diameter of the deformable sealing element (5) and larger than the access diameter,

or in that

the stopper (1) comprises a cavity (6) at the axial location of the deformable sealing element (5), which cavity (6) has an axial extension in the range of 5% and ~~95~~50% of the axial length of the stopper body (2), and in that

the cavity (6) is a partial cavity having a lateral extension of at least 50% of the outer diameter of the deformable sealing element (5) and an opening facing the actuating surface (3) of the stopper (1) or an opening facing the outlet surface (4) of the stopper (1).

2. The injector (21) according to claim 1, wherein the lateral extension in the range of 50% to 65% of the outer diameter of the deformable sealing element (5).

~~2. The injector (21) according to claim 1 or 2, wherein the cavity (6) has an axial extension in the range of 5% and 95% of the axial length of the stopper body (2).~~

3. The injector (21) according to claim 1, wherein the cavity (6) has a cylindrical, an ellipsoidal or a toroidal shape.

4. The injector (21) according to claim 1, wherein the stopper body (2) comprises an actuating stopper element (81) and an outlet stopper element (82) each comprising a deformable sealing element (5) as defined in claim 1, which actuating stopper element (81) and which outlet stopper element (82) are linked together by a resilient frame (83), the outlet stopper element (82) being located at a first axial location from the actuating surface (3), and the actuating stopper element (81) being located at a second axial location from the actuating surface (3), the stopper (1) having the cavity (6) at the first axial location.

5. The injector (21) according to claim 4, wherein the stopper (1) comprises a second cavity (6) at the second axial location.

6. The injector (21) according to claim 4, wherein the resilient frame (83) has a cylindrical shape.

7. The injector (21) according to claim 1, wherein the deformable sealing element (5) is an O-ring with a recess along the inner diameter of the O-ring so that upon mounting of the O-ring on the stopper body (2) ~~or the piston rod (10)~~ the cavity (6) is formed between the O-ring and the stopper body (2~~) or between the O-ring and the piston rod (10~~) at the recess of the O-ring.

8. The injector (21) according to claim 1, wherein the stopper body (2) has a cylindrical shape and the deformable sealing element (5) is comprised on a cylindrical structure for mounting on the stopper body (2~~) or the piston rod (10~~), so that upon mounting of the cylindrical structure on the stopper body (2~~) or the piston rod (10~~), the cavity (6) is formed between the stopper body (2~~) or the piston rod (10~~) and the cylindrical structure.

9. The injector (21) according to claim 1, wherein the deformable sealing element has or the stopper body (2) and the deformable sealing element (5) have a Shore A hardness in the range of 30 to 90.

10. The injector (21) according to claim 1, wherein the stopper body (2) is made from a thermoplastic elastomer (TPE).

11. The injector (21) according to claim 1, wherein the stopper (1) comprises a first deformable sealing element (5) at a first axial location from the actuating surface (3) and a cavity (6) at the first axial location and a second deformable sealing element (5) at a second axial location from the actuating surface (3) and a second cavity (6) at the second axial location.

12. The injector (21) according to claim 1, wherein the stopper (1) comprises a first deformable sealing element (5) at a first axial location from the actuating surface (3) and a second deformable sealing element (5) at a second axial location from the actuating surface (3) and the cavity (6) extends between the first axial location and the second axial location.

13. The injector (21) according to claim 1, wherein the cylinder (22) has an inner diameter, and the outer diameter of the deformable sealing element (5) is in the range of 1.5% to 10% larger than the inner diameter of the cylinder (22) before inserting the stopper (1) into the cylinder (22).

14. The injector (21) according to claim 1, wherein the deformable sealing element (5) has a Shore A hardness in the range of 30 to 90, and wherein the injector (21) does not comprise an external lubricant.

15. The injector (21) according to claim 1, wherein the cylinder (22) is made from glass.

16. The injector (21) according to claim 1, wherein the cylinder (22) has an inner diameter in the range of 2 mm to 12 mm.

~~18~~17. The injector (21) according to claim 1, wherein the cylinder (22) is prefilled with a pharmaceutical composition.