

**A STAYPLATE FOR HOLDING SEALING MODULES IN A TRANSIT
SYSTEM, USE OF A STAYPLATE, TRANSIT SYSTEM COMPRISING SUCH
A STAYPLATE AND USE THEREOF**

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Technical Field

The present invention concerns a stayplate for holding sealing modules in a transit system for leading cables or pipes through a partition. The sealing modules are arranged for holding the cables or pipes. The stayplate comprises a plate body extending
10 in a plane and having a first surface, an opposite second surface, a front portion and an opposite rear portion, wherein the front and rear portions comprise protrusions extending from the first surface and protrusions extending from the second surface of the plate body to form stops for the sealing modules in the transit system. Such stayplates are used for holding the sealing modules in place in the transit system, such
15 as in a frame of the transit system or in an opening in the partition, and preventing unintentional displacement of the sealing modules.

The present invention is also related to a transit system comprising one or more stayplates. The present invention is also related to a use of a stayplate and also a use of a transit system.

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Background

Transit systems are used for leading cables and pipes through partitions, such as walls, floors and ceilings. Transit systems are used in many different environments, including cabinets, junction boxes, machines and similar, and for different industrial
25 applications, such as for automotive and rolling stock applications, communication, power generation and distribution as well as marine and off-shore applications. Transit systems are often required to have a sealing function, e.g. sealing against different types of liquids, such as water, and/or gases, such as air, depending on the application. To provide a fastening and/or sealing function the cables or pipes are generally arranged in
30 a through opening of a sealing module. One common type of such a module comprises two opposite module halves arranged around the cable or pipe, wherein the modules are

arranged in a frame arranged in an opening in the partition. The modules in the frame are then compressed by means of a compression unit to press the modules against the inside of the frame, against each other if applicable, and against the cables or pipes in the modules to fasten the modules and the cables or pipes and seal the transit. The transit system may be arranged to seal against liquid, such as water, gas, fire, rodents, termites, dust, moisture, etc. The transit system and the modules are, for example, arranged for receiving cables for electricity, communication, computers, etc. or pipes for different gases or liquids, such as water, compressed air, hydraulic fluid and cooking gas. Such transit systems often include one or more stayplates arranged between sealing modules or rows of sealing modules to assist in holding the sealing modules in place. Prior art stayplates comprise a plate body extending in a plane and having a top side, a bottom side, a front portion and an opposite rear portion, wherein the front and rear portions are folded or comprise a folded sheet of metal to form front and rear stops for the sealing modules.

One problem with prior art stayplates is that they are expensive and difficult to handle and transport.

Summary

In view of the above one object of the present invention is to provide a stayplate that is less expensive and easier to transport and handle.

The present invention is related to a stayplate for holding compressible sealing modules in a transit system for leading cables or pipes through a partition, wherein the stayplate comprises a plate body extending in a plane and having a first surface, a second surface, a front portion and an opposite rear portion, wherein the front and rear portions comprise protrusions extending from the plane of the plate body to form front and rear stops for the sealing modules in the transit system, characterised in that the front portion comprises a plurality of first protrusions and a plurality of second protrusions, wherein the first protrusions extend from the first surface of the plate body and are aligned with each other in a first row of protrusions, wherein the second protrusions extend from the second surface and are aligned with each other in a second

row of protrusions, wherein the rear portion comprises a plurality of third protrusions and a plurality of fourth protrusions, wherein the third protrusions extend from the first surface of the plate body and are aligned with each other in a third row of protrusions arranged in parallel to the first row of protrusions, and wherein the fourth protrusions
5 extend from the second surface and are aligned with each other in a fourth row of protrusions arranged in parallel with the second row of protrusions. The structure of the stayplate makes it possible to obtain easy transport and handling. The rows of protrusions in different directions makes it possible to provide stackable and lightweight stayplates, which facilitates transport and handling, saves material and makes the
10 stayplates inexpensive and more environmentally friendly.

The stayplate can be formed by stamping the plate body. For example, the plate body is made of sheet metal or sheet plastic. Hence, the stayplate can be produced in an efficient manner to provide stackable stayplates for easy transport and handling. Also, no material needs to be added to the plate body to form the protrusions and thus obtain
15 the stops. Hence, the stayplate according to the present invention can be obtained without folding and pressing an additional sheet onto the plate body and without welding additional material onto the plate body to form the protrusions. Instead, it is possible to use a single piece of material to form the stayplate with the protrusions. Hence, the plate body and the protrusions can be formed from a single piece of material,
20 such as sheet metal or sheet plastic. However, it is possible to add optional inserts and/or coatings to the plate body and protrusions formed by the single piece of material. Such inserts may be of a different material.

The stayplates can comprise openings corresponding to the protrusions, e.g. formed by stamping or moulding, wherein the stayplate can be stackable and the
25 protrusions formed in an efficient and material-saving manner.

The protrusions can be formed by cutting and forming, wherein the protrusions comprise a cut edge. The cut edge of the protrusions results in a distinct and efficient stop function. The cut edge can generally extend in a radial plane to face the axial direction. Alternatively, the protrusions are formed without cutting, such as by
30 embossment.

A distance between the first row of protrusions and the third row of protrusions can be similar to or different from a distance between the second row of protrusions and the fourth row of protrusions. Hence, the stayplate can be adapted for accommodating sealing modules of similar size on both sides or can be adapted for accommodating
5 sealing modules on one side and a frame, compression unit or sealing modules of a different size on the other side. For example, a bottom stayplate can be provided for engaging a bottom part of a frame and a bottom sealing module or row of sealing modules in a transit system to increase to stability of the sealing system and prevent axial displacement of the sealing modules in the frame. Hence, the transit system can
10 withstand higher pressures.

The present invention is also related to a use of a such a stayplate for holding sealing modules in a transit system for leading cables or pipes through a partition.

The present invention is also related to a transit system for leading at least one cable and/or at least one pipe through a partition, wherein the transit system comprises a
15 plurality of sealing modules, a compression unit, and at least one stayplate as set out above, wherein the compression unit, the sealing modules and the at least one stayplate are arranged in an opening of a frame or the partition, and wherein the compression unit is operable to compress the sealing modules arranged in the opening.

The present invention is also related to a use of such a transit system for leading
20 a cable or a pipe through a partition.

Further objects and advantages of the present invention will be clear to a person skilled in the art when reading the detailed description below.

Brief Description of the Drawings

25 The invention will be described further below by way of embodiment examples and with reference to the enclosed drawings, in which:

Fig. 1 is a schematic front view of a transit system according to one embodiment, which transit system is configured to be arranged in a partition and

comprises a frame, sealing modules, stayplates and a compression unit, wherein cables are arranged through some of said sealing modules,

Fig. 2 is a schematic perspective view of a sealing module half for a transit system according to one example,

5 Fig. 3 is a schematic top view of a stayplate according to one embodiment of the present invention,

Fig. 4 is a schematic front view of the stayplate according to Fig. 2, illustrating protrusions of the stayplate seen from the front,

10 Fig. 5 is a schematic side view of the stayplate according to Fig. 2, illustrating the protrusions of the stayplate seen from the side,

Fig. 6 is a schematic perspective view of the stayplate according to Fig. 2,

Fig. 7 is a schematic top view of a stayplate according to another embodiment of the present invention, illustrating side inserts of the stayplate,

15 Fig. 8 is a schematic top view of a stayplate according to yet another embodiment of the present invention, illustrating side inserts and a central insert of the stayplate,

Fig. 9 is a schematic top view of a stayplate according to further embodiments of the present invention,

Fig. 10 is a schematic front view of the stayplate according to Fig. 9, and

20 Fig. 11 is a schematic side view of the stayplate according to Fig. 9.

Description of Embodiments

With reference to Fig. 1, a transit system 10 for passing at least one cable 11 and/or at least one pipe through a partition is illustrated schematically according to one
25 embodiment. The transit system 10 is arranged for passing one or more cables 11 and/or pipes through a partition in the form of a wall, a floor, a roof or a ceiling. The partition is not indicated in the drawings. For example, the transit system 10 is arranged for

passing cables 11, such as cables for electricity, communication, computers etc., or pipes for different gases or liquids, such as water, compressed air, hydraulic fluid, cooking gas or other types of liquids or gases. Cables and/or pipes are led in an axial direction through the transit system 10. For example, the transit system 10 is arranged at
5 a through opening in the partition and is attached to the partition, e.g. by fastening means such as screws, a welding joint or similar.

The transit system 10 comprises one or more sealing modules 12, a compression unit 13 and one or more stayplates 14. The transit system 10 according to Fig. 1 comprises a plurality of the sealing modules 12, the compression unit 13, a plurality of
10 the stayplates 14 and a frame 15 for receiving the sealing modules 12, the compression unit 13 and the stayplates 14. The sealing modules 12 may be arranged in different sizes and a plurality of different sealing modules 12 may be arranged in different configurations, which is illustrated in Fig. 1. For example, the sealing modules 12 and the compression unit 13 are of conventional type. For example, the sealing modules 12
15 are resilient and comprises two opposite module halves 16, wherein each module half 16 comprises a plurality of optional peelable sheets 17 placed in a semi-cylindrical groove 18 as illustrated in Fig. 2. Optionally, a suitable number of peelable sheets 17 are removed to adapt the sealing module 16 to the diameter of the cable or pipe, wherein the cable 11 or pipe is placed in the module half 16 and a sealing module 13 is formed
20 by placing two module halves 16 on top of each other. The module half 16 also comprises an outer surface. The sealing modules 12 are resilient, and are for example made of natural or synthetic rubber, such as an EPDM rubber, optionally with additional fillers, or TPE.

For example, the compression unit 13 is a conventional wedge comprising a
25 plurality of wedge elements, such as four wedge elements, operated by one or more compression screws 19. The compression screws 19 is, e.g. arranged to move the compression unit from a non-compressed position to a compressed position in which the compression unit 13 expands in a radial direction towards and/or away from the sealing modules 12 to press on the sealing modules 12 and optionally also on the frame 15.

The frame 15 according to Fig. 1 is arranged for receiving a plurality of the compressible sealing modules 12 for holding the cables 11 or pipes. Two of the sealing modules 12 in Fig. 1 are illustrated with a cable 11 or pipe therein in cross section and it is understood that the cable 11 or pipe continues. It is also understood that the sealing modules 12 can be provided with a conventional blind plug 20 if no cable 11 or pipe is arranged therein.

The stayplates 14 are arranged to prevent displacement of the sealing modules 12 in the axial direction. The stayplates 14 are arranged between sealing modules 12, such as between rows of sealing modules, or between a sealing module 12 or a row of sealing modules and the frame 15. For example, the stayplates 14 are arranged in the frame 15 as illustrated in Fig. 1. According to one example, a stayplate 14 is arranged between a bottom or a side of the frame 15 and a bottom sealing module 12 or bottom row of sealing modules 12. A stayplate 14 may be arranged between any sealing modules 12 or rows of sealing modules. In Fig. 1 a stayplate 14 is arranged between each row of sealing modules 12. For example, the stayplates 14 are arranged horizontally.

The stayplate 14 according to one embodiment is illustrated with reference to Figs. 3-6. The stayplate 14 comprises a plate body extending in a plane and has a first surface, such as a top side, and an opposite second surface, such as a bottom side. The stayplate 14 and the plate body comprise in common a front portion 21, a rear portion 22 and a central portion 23 arranged between the front and rear portions 21, 22. The front and rear portions 21, 22 are arranged at a distance from each other, so that the central portion 23 can accommodate the sealing modules 12. The central portion 23 is, e.g. arranged to contact an outer side of the sealing modules 12. Optionally, the central portion 23 is provided with a cut-out as illustrated in Fig. 1. Hence, according to the embodiment of Fig. 1, the stayplate 14 is formed with a central through opening for material saving, weight reduction and/or increased friction by partial direct contact between adjacent sealing modules 12 through said through opening.

The stayplate 14 according to the illustrated embodiment is formed with optional side projections 24 for engaging the frame 15 or the partition around the opening thereof. The side projections 24 extend in the plane of the plate body in opposite

directions on each of the front and rear portions 21, 22 to prevent axial displacement of the stayplate 14 when arranged in the frame 15 or the opening of the partition. Hence, the projections 24 extend in a radial direction, so that the front and rear portions 21, 22 are arranged with a bigger width than the central portion 23.

5 The stayplate 14 according to Figs. 3-6 is formed with side cut-outs 25 extending in the plane of the plate body for material saving, weight reduction and/or increased friction by partial direct contact between adjacent sealing modules 12 through the side cut-outs 25. The side cut-outs 25 are arranged between the front and rear portions 21, 22 and form the outer periphery at the sides of the stayplate 14.

10 The stayplate 14 comprises protrusions 26, 27, 28, 29 extending from the plane of the plate body to form stops for the sealing modules 12. The stayplate 14 comprises the plate body and the protrusions 26-29. The protrusions 26-29 are connected to the plate body. The front portion 21 comprises a plurality of first protrusions 26 extending from the first surface of the plate body, and a plurality of second protrusions 27
15 extending from the second surface of the plate body. The first and second protrusions 26, 27 extend in different directions away from the plane of the plate body. For example, the first and second protrusions 26, 27 extend in opposite directions. Hence, when the stayplate 14 is arranged horizontally, the first protrusions 26 extend upward, wherein the second protrusions 27 extend downward. The first and second protrusions
20 26, 27 form front stops of the stayplate 14 to prevent sealing modules 12 from being displaced in the axial direction. For example, the first protrusions 26 are upper protrusions extending at least partially upward from the plate body to form upper stops, wherein the second protrusions are lower protrusions 27 extending at least partially
25 downward from the plate body to form bottom stops. For example, the first protrusions 26 are aligned with each other to form a first row of protrusions, wherein the second protrusions 27 are aligned with each other to form a second row of protrusions. The first protrusions 26 are spaced apart and the second protrusions 27 are spaced apart. For example, the first protrusions 26 are optionally spaced apart with a distance corresponding to at least the corresponding dimension of the second protrusions 27. The
30 first and second rows of protrusions extend along the front portion 21 and in a direction

perpendicular to the axial direction. Optionally, the first and second rows are aligned. Similarly, the rear portion 22 comprises a plurality of third protrusions 28 extending from the first surface and a plurality of fourth protrusions 29 extending from the second surface to form rear stops of the stayplate 14 to prevent sealing modules 12 from being

5 displaced in the axial direction. For example, one sealing module 12 or one row of sealing modules 12 is accommodated between the first and third protrusions 26, 28 of a stayplate 14, wherein another sealing module or another row of sealing modules 12 is accommodated between the second and fourth protrusions 27, 28. Alternatively, a portion of the frame 12 is accommodated between the second and fourth protrusions 27,

10 28. For example, an upper sealing module 12 or row of sealing modules 12 can be accommodated between the first and third protrusions 26, 28 of a stayplate 14, wherein a sealing module 12 or row of sealing modules 12 arranged below the upper sealing module 12 or upper row of sealing modules can be accommodated between the second and fourth protrusions 27, 28. The first row of protrusions 26 is arranged in parallel to and with a gap to the third row of protrusions 28, wherein the second row of protrusions 27 is arranged in parallel to and with a gap to the fourth row of protrusions 29. In the illustrated embodiment, which can be seen particularly in Fig. 4 and Fig. 6, the first and second protrusions 26, 27 are formed alternately, wherein the third and fourth protrusions 28, 29 are formed alternately. Alternatively, the protrusions 26-29 are

20 formed in a different pattern, such as two first protrusions 26 followed by one or more second protrusions 27 or vice versa or another suitable pattern. Optionally, the distance between the first and third rows of protrusions 26, 28 is similar as the distance between the second and fourth rows of protrusions 27, 29, which is illustrated in Fig. 5. Alternatively, the distances are different, which is described more in detail below.

25 According to one embodiment the protrusions 26-29 are formed by a forming process, such as stamping, including forming (such as embossing) or both cutting and forming. In the illustrated embodiment, the protrusions 26-28 are formed by cutting and forming, wherein a cut edge of the protrusion 26-28 is facing a sealing module 12. For example, the first and third protrusions 26, 28 are formed by stamping in a first

30 direction, wherein the second and fourth protrusions 27, 29 are formed by stamping in the opposite direction. For example, the stayplate 14 is made of sheet metal or

comprises sheet metal, wherein the protrusions 26-29 are formed by a metal forming process. For example, at least the front and rear portions 21, 22 and one or more parts of the central portion 23 connecting them are made of sheet metal. The stayplate 14 comprises openings corresponding to the protrusions 26-28, wherein the side opposite
5 the side with the protrusion is provided with the corresponding opening in the same position as the protrusion. Hence, the stayplates 14 may be stackable.

Each protrusion 26-28 comprises a first end, a second end and a middle portion. The first end of each protrusion 26-28 is directly connected to and contacting the plate body. The second end of the protrusions 26-28 may be either a free end or directly
10 contacting the plate body. According to the embodiment of Figs. 3-6, both ends of the protrusions 26-29 are directly connected to and contacting the plate body, wherein the middle portion is displaced from the plane of the plate body. The protrusions 26-28 in the embodiment of Figs. 3-6 are arc-shaped, such as U-shaped, optionally, with a rounded connection to the front or rear portion 21, 22. For example, the arc extends in a
15 plane perpendicular to the plane of the plate body. The protrusions 26-28 form an opening in the form of an indentation in the radial direction and a through opening in the axial direction in a plane parallel to the plane of the plate body. Hence, cut edges of the protrusions 26-28 form a perpendicular stop for the sealing modules 12. For example, the cut edges extend in a plane perpendicular to the axial direction to form
20 said stop.

With reference to Fig. 7 another embodiment of the stayplate 14 is illustrated schematically. The stayplate of Fig. 7 comprises the front and rear portions 21, 22 and the central portion 23, wherein the front and rear portions 21, 22 are provided with the protrusions 26-29. The stayplate of Fig. 7 differs from the stayplate of Figs. 3-6 in that
25 the cut-outs 25 are provided with side inserts 30 of a material different than the material of the front and rear portions 21, 22 and the parts connecting them. For example, the side inserts 30 are made of an elastic material, such as rubber, TPE or similar material, to provide high friction and/or favourable sealing properties. Optionally, the side inserts 30 are arranged so that the projections 24 are maintained. In the embodiment of Fig. 7,
30 the central portion 23 is integral and of the same material as the front and rear portions

21, 22. For example, the front and rear portions 21, 22 and the central portion 23 are made in one piece of sheet metal. For example, the central portion 23 is flat or substantially flat and is arranged for contacting a side, such as a bottom side or a top side, of one or more sealing modules 12.

5 With reference to Fig. 8 another embodiment of the stayplate 14 is illustrated schematically, wherein the stayplate 14 comprises the side inserts 30 and also a central insert 31. For example, the central insert 31 is made of an elastic material, such as rubber, TPE or similar. Alternatively, the central portion 23 is provided with a through opening instead of the central insert 31.

10 With reference to Figs. 9-11 another embodiment of the stayplate 14 is illustrated schematically. The stayplate of Figs. 9-11 comprises the front and rear portions 21, 22, the central portion 23 and the protrusions 26-29. In the embodiment of Figs. 9-11 the first row of protrusions 26 is arranged with a first distance D1 to the third row of protrusions 28, wherein the second row of protrusions 27 is arranged with a second
15 distance D2 to the fourth row of protrusions 29. Hence, the distance D1 between the first protrusions 26 and the third protrusions 28 on the first surface of the stayplate 14 is different from the distance D2 between the second protrusions 27 and the fourth protrusions 29 on the second surface of the stayplate 14. Thus, the distance between the rows of protrusions on the upper side of the stayplate 14 is different from the distance
20 between the rows of protrusions on the bottom side. For example, the first distance D1 is adapted to accommodate the sealing modules 12, wherein the second distance D2 is adapted to accommodate the frame 15, the compression unit 13 and/or sealing modules 12 with different dimensions. The option of having different distances D1, D2 between the rows of protrusions on the upper side and lower sides of the stayplate 14 is different
25 from the distance between the rows of protrusions on the bottom side is applicable to all embodiments.

 Optionally, the size of the first and third protrusions 26, 28 differs from the size of the second and fourth protrusions 27, 29. For example, the second and fourth protrusions 27, 29 are smaller than the first and third protrusions 26, 28. A bigger size
30 and thus contact surface against the sealing modules 12 may be favourable. For

example, the frame 12 is made of metal or plastic and may be harder than the sealing modules 12, wherein the second and fourth protrusions 27, 29 can be made smaller as a smaller contact surface can be used. The option of having different sizes of the protrusions is applicable to all embodiments.

5 With reference particularly to Fig. 11, the protrusions 26-29 of the embodiment illustrated in Figs. 9-11 are formed with a free end. For example, the free end is a cut edge. For example, the protrusions 26-29 comprise three cut edges, one of which is the free end and the other two are the edges neighbouring the free end. The protrusions 26-29 are inclined, wherein the first and third protrusions 26, 28 are inclined in a first
10 direction, such as upward, wherein the second and fourth protrusions 27, 29 are inclined in a second direction, such as downward. Hence, the protrusions 26-29 are inclined in relation to the plane of the plate body. The free ends of the protrusions 26-29 are arranged generally facing the central portion 23. The first protrusions 26 and the third protrusions 28 are inclined towards each other, wherein the second protrusions 27 and
15 the fourth protrusions 29 are inclined towards each other. Hence, the free ends of the first protrusions 26 are generally facing the free ends of the third protrusions 28, wherein the free ends of the second protrusions 27 are generally facing the free ends of the fourth protrusions 29. The free ends of the first and third protrusions 26, 28 are arranged to form stops for the one or more sealing modules. The free ends of the second
20 and fourth protrusions 27, 29 are arranged to contact an outer surface of the frame 12, the compression unit 13 or to form stops for sealing modules of a different size. Alternatively, the protrusions 26-29 extend perpendicular to the plane of the plate body.

CLAIMS

1. A stayplate (14) for holding compressible sealing modules (12) in a transit system (10) for leading cables (11) or pipes through a partition, wherein the stayplate (14) comprises a plate body extending in a plane and having a first surface, an opposite second surface, a front portion (21) and an opposite rear portion (22), wherein the front and rear portions (21, 22) comprise protrusions (26, 28) extending from the plane of the plate body to form front and rear stops for the sealing modules (12) in the transit system (10), characterised in that
- the front portion (21) comprises a plurality of first protrusions (26) and a plurality of second protrusions (27), wherein the first protrusions (26) extend from the first surface of the plate body and are aligned with each other in a first row of protrusions, wherein the second protrusions (27) extend from the second surface and are aligned with each other in a second row of protrusions, wherein the rear portion (22) comprises a plurality of third protrusions (28) and a plurality of fourth protrusions (29), wherein the third protrusions (28) extend from the first surface of the plate body and are aligned with each other in a third row of protrusions arranged in parallel to the first row of protrusions, and wherein the fourth protrusions (29) extend from the second surface and are aligned with each other in a fourth row of protrusions arranged in parallel with the second row of protrusions.
2. The stayplate of claim 1, wherein the protrusions (26-29) are formed by stamping the plate body.
3. The stayplate of claim 1 or 2, wherein the stayplate (14) comprises openings corresponding to the protrusions (26-29).
4. The stayplate of any of the preceding claims, wherein the protrusions (26-29) are formed by cutting and forming.

5. The stayplate of any of the preceding claims, wherein the protrusions (26-29) comprise a first end and a second end, wherein the first end is connected to the plate body and the second end is either a free end or is connected to the plate body, and wherein the free end is displaced from the plane of the plate body and/or a portion of each of the protrusions (26-29) between the first and second ends thereof is displaced from the plane of the plate body.
6. The stayplate of any of the preceding claims, wherein the first and second protrusions (26, 27) are arranged alternately, and wherein the third and fourth protrusions (28, 29) are arranged alternately.
7. The stayplate of any of the preceding claims, wherein the first row of protrusions and the second row of protrusions are aligned.
8. The stayplate of any of the preceding claims, wherein a distance between the first row of protrusions and the third row of protrusions is similar to a distance between the second row of protrusions and the fourth row of protrusions.
9. The stayplate of any of claims 1-7, wherein a distance (D1) between the first row of protrusions and the third row of protrusions is different from a distance (D2) between the second row of protrusions and the fourth row of protrusions.
10. Use of a stayplate according to any of the previous claims for holding sealing modules (12) in a transit system (10) for leading cables (11) or pipes through a partition.
11. A transit system (10) for leading at least one cable (11) and/or at least one pipe through a partition, wherein the transit system comprises a plurality of sealing modules (12), a compression unit (13), and at least one stayplate (14) according to any of claims 1-9, wherein the compression unit (13), the sealing modules (12) and the at least one stayplate (14) are arranged in an opening of a frame (12) or the partition, and wherein

the compression unit (13) is operable to compress the sealing modules (12) arranged in the opening.

12. Use of a transit system (10) according to claim 11 for leading a cable (11) or a pipe
5 through a partition.