

The invention relates to a conveyor belt consisting of a fabric-reinforced web of plastics material having textile reinforcing inserts, extending in a longitudinal direction, of warp and weft threads crossing one another.

5 Such conveyor belts are known for conveying articles in a large number of fields. Depending on the type of article to be transported, such as, for example, luggage at airports, food at the check-outs in supermarkets, bulk goods in mining, etc., these conveyor belts must fulfil
10 different requirements. In the longitudinal direction, owing to the generally very long conveying distances, a low stretchability together with flexibility for guiding along a drive and turning drum is required. In the transverse direction, for flat-running conveyor belts a high degree of
15 stiffness is demanded. The textile inserts acting as traction and strength components essentially determine the properties of a conveyor belt with regard to tensile strength, stretchability and transverse stiffness. By the use of multi-layer inserted flat fabrics, an endeavour is
20 made to obtain the desired strength combined with long life. However, the thickness of the conveyor belt increases with the number of layers of fabric, and this has an adverse effect on the drive system. The different fabric layers tend to slide against one another, so that
25 stretching of the material is unavoidable. The embedding of the fabric layers also raises difficulties regarding the necessary bonding by means of impregnation with plastics material or rubber. In EP-A-0 280 118, therefore, provision is made for threads to be used for weaving the
30 textile fabric which are already completely or partially surrounded by a layer of rubber or rubber-like material, by which means the bonding of the covering layers to the embedding layer is intended to be improved. The production of such conveyor belts is rendered expensive by the use of
35 pre-treated threads. Furthermore, only the bonding of the traction and strength component is altered, and not its

characteristic profile for the conveyor belt. The need for insertion of a plurality of textile inserts remains.

For flat-running conveyor belts, in order to obtain the desired overall strength, high-strength yarns are also
5 used for the textile inserts. These give the fabric a low extension and a high tear strength in the longitudinal and transverse direction, but require the use of expensive yarns. The transverse stiffness of these conveyor belts in the case of one or two layer inserted flat fabrics,
10 however, is still insufficient, so that articles with a higher weight cause troughing of the conveyor belt. This is a drawback, for example, for processing or packaging stations provided along the conveyor path. Furthermore, the degree of quiet running and the noise development
15 resulting therefrom do not fulfil the requirements for conveying articles without harm to the environment.

Finally, from EP-A-0 051 750 a conveyor belt is known which contains as the single strength component^{*} steel cords mutually spaced parallel to one another and running through
20 in a longitudinal direction. In addition, in the upper and/or lower covering layer an air-filled hollow body is embedded as a damping cushion insert, in order to absorb the impact energy of unit goods being conveyed. The cushion insert is formed by a double fabric with two fabric
25 webs which are kept at a distance from and parallel to each other by means of pile threads distributed over the whole surface and are closed towards the outside at the side edges over the entire length of the belt. Such a cushion insert produced from composite fabric does in fact make it
30 possible to accommodate a volume of air, but cannot absorb any tensile forces. On the contrary, owing to the movability of the double fabric constructed with spacing, a separate tension-resistant reinforcing insert is necessary. The transverse stiffness in particular also
35 remains insufficient, in spite of a reinforcing insert, and this is a drawback for flat-running conveyor belts.

* Translator's note: The German text (p.2, para.3, line 3) gives "Stahlseiten" here, but it is assumed that this is a misprint for "Stahlseilen".

The problem on which the invention is based, therefore, is that of providing a conveyor belt according to the preamble of Claim 1 which for secure conveying of articles has a good overall strength and is also simply constructed.

5 This aim is fulfilled according to the characterising portion of Claim 1 by the fact that the reinforcing insert is formed by a strength component in the form of a double pile cloth with upper and lower cloth which, by means of low pile threads woven onto the weft threads, are pulled
10 together in such a way that a tension-resistant unit of upper and lower cloth is formed, the pile threads allowing, when the conveyor belt is subjected to bending stress, a slight movability of the upper and lower cloth with respect to one another which is restorable in the warp direction.

15 By this means a conveyor belt is provided which by means of the insertion of a three-dimensional, stable cloth as the single reinforcing insert gives the conveyor belt a constant length with a high degree of stiffness and perforation resistance, while a residual flexibility in the
20 longitudinal direction ensures that the conveyor belt can be turned. The double pile cloth insert used is suitable for taking-up high tensile forces, the pile threads anchoring the two cloth layers securely to each other, so that the result is a good strength component. The two
25 cloth layers of the double pile cloth can be connected lying upon each other or can be frictionally engaged. Depending on the length of the pile threads, between 0.1 and 2 mm, the cloth layers of the double pile cloth can assume a fixed or guided position, in which the pile
30 surfaces build up a restoring force. The physical properties of the conveyor belt, such as resistance to temperature, fatigue, weather and ageing, lack of sensitivity to the effects of chemicals, low combustibility, type of combustion gases, etc., can be adapted by selection
35 of the raw materials for the yarns of the warp, weft and pile threads to the special requirements of the field of

application, and are no longer predetermined by the need to use high-strength yarns.

5 The stiffness in the transverse direction can be additionally improved by the use of monofilaments as weft threads, while the weaving of multifilaments as warp threads improves the flexibility in the longitudinal direction.

10 The so-called "shrink effect" occurring during the turning of a conveyor belt, with its tensile and compressive stresses, is dissipated by the three-dimensional cloth. In particular, by means of a staggered arrangement of adjacent pile threads the forces acting thereon can be transposed.

15 The yarns that can be used are in particular yarns made of synthetic fibres, such as polyamide fibres, acrylic fibres, polyester fibres, polyvinyl chloride fibres, etc. Polyamide fibres are lye-resistant, sea-water-resistant and rot-resistant and have a high tear strength and abrasion resistance. Owing to their high elasticity, however, they
20 have hitherto been used only as weft threads for trough-forming conveyor belts. More heat-resistant than polyamide fibres are acrylic fibres, which because of their low strength have hitherto scarcely been used. The most prominent properties of polyester fibres are a very high
25 melting point, an outstanding rebound capability, low extension and low moisture absorption, as well as weather resistance. Polyvinyl chloride fibres, owing to their high chlorine content, are non-combustible, non-inflammable, and even smother fire, and are therefore particularly suitable
30 for underground mining use. Furthermore, mixed fibres, for example of polyester and cotton or polyamide and viscose staple fibre, can also be used. High-strength fibres such as, for example aramide, can also be used.

35 The conveyor belt is generally an endless conveyor belt which is guided with its running side over at least one drive and turning roller and along supporting rollers.

In order to improve quietness of running, provision can be made for this conveyor belt running side to be formed by a pile side of a web of plush cloth, which can be applied on the running side with an outwardly-directed pile side and
5 also extending continuously in the longitudinal direction on the conveyor belt.

To prevent the build-up of an electrostatic charge, this pile side can be provided with electrically conductive pile naps, or be formed at least partially of pile naps of
10 conductive yarns.

A plurality of cloth inserts of a double pile cloth can also be arranged adjacent to and spaced from one another, running in the longitudinal direction, this double pile cloth at the same time alternating with flat cloth
15 inserts or being enclosed by the latter on the inside and the outside.

Further embodiments of the invention are revealed by the subsidiary claims and the following description.

The invention is explained in greater detail herein-
20 after with reference to the exemplary embodiments shown in the accompanying drawings.

Figure 1 shows a partial longitudinal section through a first exemplary embodiment of the conveyor belt,
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Figure 2 shows a partial longitudinal section through a second exemplary embodiment of the conveyor belt,

Figure 3 shows a partial longitudinal section through a third exemplary embodiment of the conveyor belt,
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Figure 4 shows a partial longitudinal section through a fourth exemplary embodiment of the conveyor belt,

Figure 5 shows a partial longitudinal section through a fifth exemplary embodiment of the conveyor
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belt,

Figure 6 shows a partial longitudinal section through a sixth exemplary embodiment of the conveyor belt,

5 Figure 7 shows a partial longitudinal section through a seventh exemplary embodiment of the conveyor belt.

10 The part areas, shown in the Figures, of different exemplary embodiments of a conveyor belt 1, relate to a so-called endless sliding belt, which runs flat even over long conveyor runs. Depending on the application, the width of the belt is between 1 and 300 cm, so that flat drive belts can also be produced from this belt.

15 According to Figure 1, a first exemplary embodiment of the conveyor belt 1 consists of a web 8 of plastics material forming an upper covering layer and onto which, as strength component, a single reinforcing insert in the form of a cloth insert 9 is placed so that it adheres thereto. On the upper side of the plastics material web 8 is the carrying side 21 of the conveyor belt 1, while the running side 22 of the conveyor belt 1 is formed on the underside of the cloth insert 9.

20 The cloth insert 9 consists of a three-dimensional, uncut double pile cloth, which comprises an upper cloth 10 and a lower cloth 11, and also low pile threads 12 alternating to and fro between the upper cloth and lower cloth. By means of the pile threads 12, the upper and lower cloths 10 and 11 are pulled together and thus closely connected to each other. This anchoring of the two cloth layers is a connection with slight movability in the warp direction of upper and lower cloth under bending stress. Longitudinally and transversely arranged thread systems (warp and weft threads), which by means of the pile thread system are fixed in position, interlocked with one another to form a unit, serve as traction elements. In addition,

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the pile threads 12 can serve to conduct away a voltage. Preferably, the pile threads 12 are so low that the upper cloth 10 and the lower cloth 11 are connected so that they lie on each other without spacing. Moreover, the length of
5 the pile threads 12 is from 0.1 to 2 mm between two weaving points.

Warp threads 13 and weft threads 14, woven in a plain weave in each case, form the upper and lower cloths 10 and 11. The pile threads 12 are woven in by a 2V weft pile on
10 weaving. Depending on the desired density of the pile threads 12, between the upper and lower cloths 10 and 11 the pile threads 12 may also be woven in by a 2/4V or 3/6W weft pile on weaving. In the direction of the weft threads 14, adjacent pile threads 12 can each be woven in on the
15 same weft thread 14, or on different weft threads 14, the latter alternative being capable of producing a more even distribution of forces acting thereon. The number of pile threads is between 5 and 20 per cm. of width. The cloth insert 9 extends with its warp threads 10 in the longitu-
20 dinal direction of the conveyor belt 1, while the weft threads 14 lie in the transverse direction of the conveyor belt 1. If, as shown in Figure 1, the plastics material web 8 is provided only on the carrying side 21, so that the lower cloth 11 forms the running side of the conveyor belt
25 1 on a drive roller or turning roller, the build-up of electrostatic charges can be countered by using conductive yarns for the lower cloth 11.

The yarns used are multifilaments which ensure flexibility in the longitudinal direction. For a high degree of
30 stiffness in the transverse direction, the weft threads 14 are preferably formed by monofilaments. The yarn thickness ranges between 10 and 600 Tex, preferably 100 and 180 tex.

Polyester serves as the fibre material. Other synthetic fibres, such as, for example, polyamide, polypropyl-
35 ene, etc., and also mixed fibres may also be used. The same applies to high-strength fibres, such as, for example,

aramide.

5 The plastics material web 8 consists of an elastomeric plastics material, preferably rubber or PVC. For the intensive connection of cloth and plastics material, known rubberising and coating processes may be used.

10 Figure 2 shows a second exemplary embodiment of the conveyor belt 1, likewise with only one reinforcing insert in the form of a cloth insert 9 which in this case, however, is arranged centrally between an upper and a lower covering layer of the plastics material web 8. Layers of the plastics material web 8 which have different thicknesses may also be applied on the upper side and the underside. The result of this is that the embedding of the cloth insert 9 is displaced towards the carrying side 21 or
15 the running side 22 of the conveyor belt 1. For the remainder, the formation of the conveyor belt 1 corresponds to the first exemplary embodiment described above.

20 Figure 3 shows a third exemplary embodiment of the conveyor belt 1 with a cloth insert 15 which corresponds to the second exemplary embodiment described above, except for the weaving-in of the pile threads 12. The pile threads 12 in this case are woven in by means of a 3/6W weft pile through weaving. Depending on the desired density, the pile threads 12 may also connect the upper and lower cloths
25 10 and 11 by means of a 3/8W, 4/8W weft pile through weaving.

30 Figure 4 shows a fourth exemplary embodiment of the conveyor belt 1 which differs^{*} from the second exemplary embodiment according to Figure 2 in that a velour cloth 23 is arranged on the running side 22, that is to say, the inside of the conveyor belt 1. This velour cloth 23 has an outwardly-directed pile side with which the conveyor belt 1 runs on drive or turning rollers. This pile side makes very quiet running possible. By using conductive yarns for
35 this velour cloth 23, the build-up of an electrostatic charge in the conveyor belt 1 can be avoided at the same

*Translator's note: The German text (p.8, para. 2, line 2) gives "durch das" here, but it is assumed to be an error and should be "von dem" (cf. last line)

time.

Figure 5 shows a fifth exemplary embodiment of the conveyor belt 1 with a reinforcing insert consisting of two cloth inserts 9 arranged adjacent to and spaced from each other. Both cloth inserts 9 extend in the longitudinal direction of the conveyor belt 1 and have the same construction as described with reference to Figures 1, 2 and 3. The webs, arranged adjacent to each other, of the cloth inserts 9 may furthermore be so combined that cloth inserts with different weaving-in, length and density of the pile threads 12 can alternate with one another. Furthermore, the plastics material web 8 consists of an upper covering layer, a lower covering layer, and a middle covering layer. Regarding the construction of the cloth insert 9 and of the plastics material webs 8, reference should be made to the preceding exemplary embodiments.

Figure 6 shows a sixth exemplary embodiment of the conveyor belt 1, likewise with a reinforcing insert, which comprises two cloth inserts 16 arranged adjacent to and spaced from each other. The sixth exemplary embodiment of the conveyor belt 1 differs from the fifth exemplary embodiment of the conveyor belt 1 according to Figure 5 in that^{*}(in) the cloth inserts 16 pile threads 12 having a height of approximately 1 to 1.5 mm are arranged between the upper and lower cloths 10 and 11. In this case, the upper cloth 10 and lower cloth 11 likewise enter into a position-stable working engagement, with good dissipation of the shrinking effect at the same time by reason of differing bending stresses of the upper cloth 10 and the lower cloth 11 at the turning points of the conveyor belt 1. The pile threads 12 here act like a restoring force on the arrangement of the upper and lower cloths 10 and 11. Preferably, the pile threads 12 are arranged closely between the upper cloth 10 and the lower cloth 11 of the respective cloth insert 16.

Finally, Figure 7 shows a seventh exemplary embodiment

^{*}Translator's note: It is assumed that a word has been omitted in the German here (p.9, para. 1, line 3).

of the conveyor belt 1 with a reinforcing insert in the form of the cloth insert 16 (according to Fig. 6) and two cloth webs 17, consisting of a flat cloth, which sandwich the cloth insert 16 between them. The cloth webs 17 are
5 conventionally known flat cloths for conveyor belts. Such a sandwich-type embedding of the reinforcing layer in the form of a double pile cloth can also be effected with a cloth insert 9, as described in Figure 1.

In all the exemplary embodiments described above, the
10 reinforcing inserts in the form of double pile cloth inserts extend in the longitudinal direction of the conveyor belt 1 and substantially over the width of the conveyor belt 1.

Furthermore, in the reinforcing inserts in the form of
15 a double pile cloth insert 9, 15 or 16 which are described above, the manner in which the warp 13 and weft 14 are interwoven in the cloth can be suitably selected. In addition to plain weave, weaves with floating threads, such as, for example, basket weave, satin weave or twill weave
20 may be used. In particular, for weaving in a high weft number with a view towards transverse stiffness, a weave with floating threads is preferred.



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

1. Conveyor belt consisting of a fabric-reinforced web of plastics material having a textile reinforcing insert, extending in a longitudinal direction, of warp and weft threads crossing one another, characterised in that the reinforcing insert is formed by a strength component in the form of a double pile cloth (9, 15, 16) with upper and lower cloth (10,11) which, by means of low pile threads (12) woven onto the weft threads, are pulled together in such a way that a tension-resistant unit of upper and lower cloth (10,11) is formed, the pile threads (12) allowing, when the conveyor belt is subjected to bending stress, a slight movability of the upper and lower cloth (10,11) with respect to one another which is restorable in the warp direction.

2. Conveyor belt according to Claim 1, characterised in that upper and lower cloth (10,11) are connected so that they lie upon each other with no spacing.

3. Conveyor belt according to Claim 1 or 2, characterised in that the length of the pile threads (12) between two weaving points is around 0.1 to 2 mm.

4. Conveyor belt according to one of Claims 1 to 3, characterised in that the warp threads (13) consist of multifilament yarns and the weft threads (14) of monofilament yarns.

5. Conveyor belt according to one of Claims 1 to 4, characterised in that upper and lower cloth (10,11) consist of warp and weft threads (13,14) crossed in a plain weave, and the pile threads (12) are woven in by weft pile on-weaving or pile through-weaving.

6. Conveyor belt according to one of Claims 1 to 5, characterised in that in the weft direction, pile threads (12) arranged adjacent to one another are woven in so that



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they are staggered.

7. Conveyor belt according to one of Claims 1 to 6, characterised in that the double pile cloths (9, 15, 16) consist of synthetic fibres or mixed fibres.

5 8. Conveyor belt according to one of Claims 1 to 7, characterised in that the running side is formed of an outwardly-directed pile side of a velour cloth (23).

9. Conveyor belt according to Claim 8, characterised in that the pile side has naps of conductive yarns.

10 10. Conveyor belt according to one of Claims 1 to 9, characterised in that yarns having a weight of from 10 to 600 Tex, preferably 100 to 180 Tex, are used.

11. Conveyor belt according to one of Claims 1 to 10, characterised in that a plurality of double pile cloths (9,15,16) are provided, arranged at a distance from one another.

12. Conveyor belt according to one of Claims 1 to 11, characterised in that additional flat cloth inserts (17) extending in a longitudinal direction are provided which sandwich the double pile cloth (9, 15, 16) between them.