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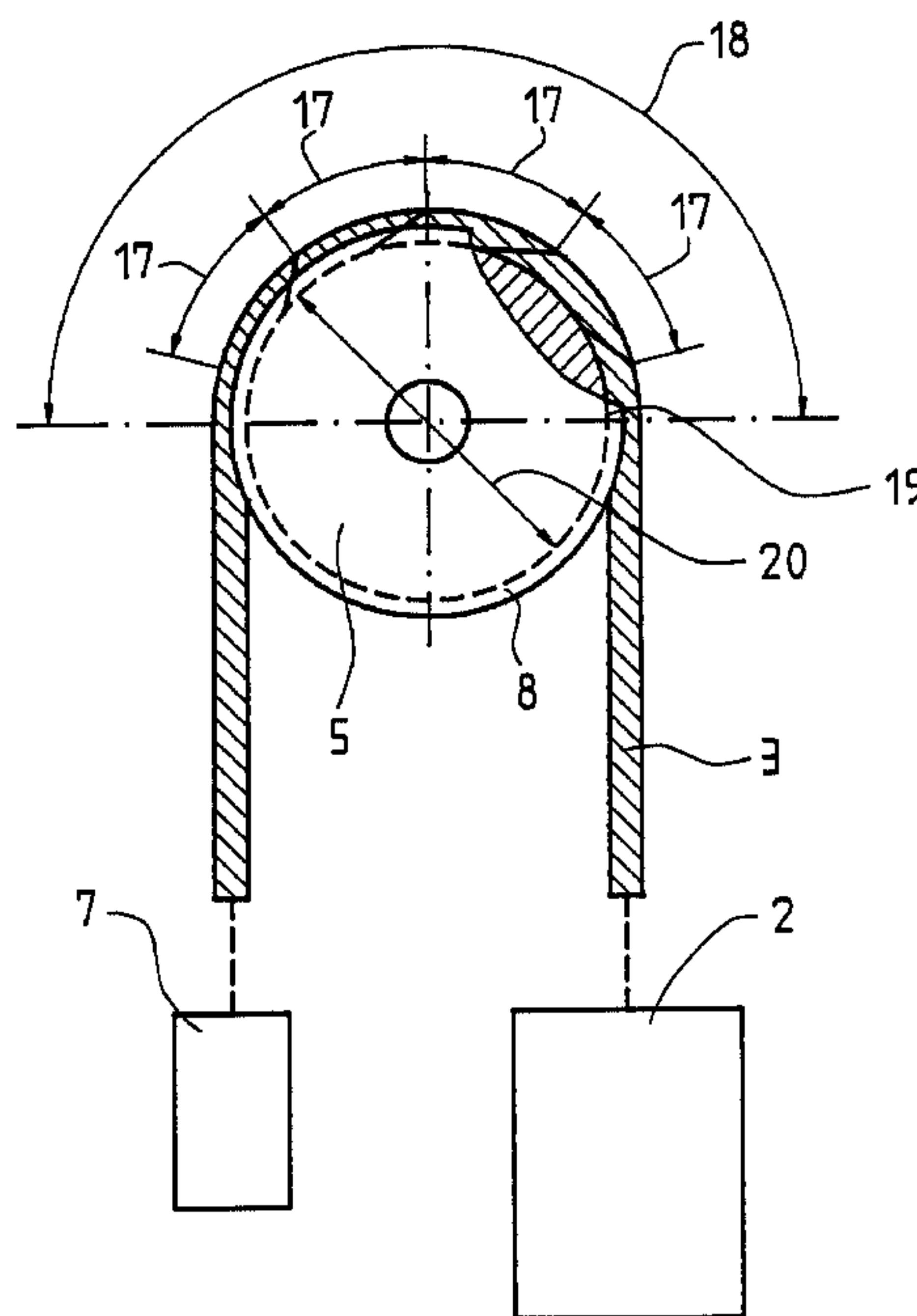
(71) INVENTIO AG, CH

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(54) **DEVIDOR DE CORDE ET CORDE APPROPRIÉE EN FIBRES
SYNTHÉTIQUES AINSI QUE LEUR UTILISATION**

(54) **ROPE DEFLECTION AND SUITABLE SYNTHETIC FIBER-
ROPE AND THEIR USE**



(57) On a rope deflection, such as preferably on a traction sheave drive for elevator installations, the diameter (20) of a traction sheave (5), or of a rope pulley, or of a rope drum, and the lay length of a synthetic fiber rope (3) passing over it are adapted to each other in such a way that within the angle of wrap (18) each of the strands (14, 15, 16) of the covering layer of strands lies on the traction sheave (5) at least three times. According to the invention, this achieves a permanently reliable rope drive with a synthetic fiber rope (3) for use on pulleys or traction sheaves, with which irreversible displacements of strands in the covering layer of strands of the synthetic rope can be reliably avoided.

Abstract

On a rope deflection, such as preferably on a traction sheave drive for elevator installations, the diameter (20) of a traction sheave (5), or of a rope pulley, or of a rope drum, and the lay length of a synthetic fiber rope (3) passing over it are adapted to each other in such a way that within the angle of wrap (18) each of the strands (14, 15, 16) of the covering layer of strands lies on the traction sheave (5) at least three times. According to the invention, this achieves a permanently reliable rope drive with a synthetic fiber rope (3) for use on pulleys or traction sheaves, with which irreversible displacements of strands in the covering layer of strands of the synthetic rope can be reliably avoided.

(Figure 3)

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Description

5 **Rope Deflection and Suitable Synthetic Fiber Rope and
 Their Use**

 The invention relates to a rope deflection and a synthetic
 fiber rope suitable for it, with the characteristics
10 stated in the preambles to Claims 1 and 6 respectively,
 and their use.

 Especially in materials handling technology, as for
 example on elevators, in crane construction, in mining, or
15 similar applications, ropes are an important element of
 machinery and subject to heavy use. As a loaded rope
 passes over a deflection element, as for example a rope
 pulley, rope sheave, or rope drum, etc. it is bent over
 the deflection element, which causes special movements of
20 the strands of the rope.

 A correspondingly used rope is known, for example, from
 the applicant's EP 0 672 781 A1. In respect of service
 life, high wear resistance, and high reverse bending
25 strength, the multi-layered parallel twisted aramide fiber
 stranded rope provides very satisfactory values; however,
 it has been established that when the permanently loaded
 synthetic fiber rope is deflected on a traction sheave, a
 rope drum, a rope pulley, or similar, within a short
30 period of operation corkscrew-like rope deformations can
 form in the tensioned area of the covering layer of

strands, which could lead to a reduction in the breaking force of the rope or even to failure of the rope.

For this reason, the invention has as its objective the
5 definition of a permanently reliable rope deflection with a synthetic fiber rope passing over pulleys or traction sheaves.

According to the invention this objective is achieved by
10 means of a rope deflection with the characteristics stated in Claim 1 which is particularly characterized in that the synthetic fiber rope lies on the deflecting element at least along a length of three lay lengths of the rope lay. The dependent claims contain expedient and advantageous
15 further developments and/or embodiments of the invention stated in Claim 1.

The essence of the invention is therefore that the diameter of the deflection element and the lay length of
20 the synthetic fiber rope are adapted to each other in such a way that within the angle of wrap the strands of the covering layer of strands always lie on the deflection element at least three times.

25 Extensive tests by the applicant have shown that the smaller the arc of wrap and the larger the lay length of the covering layer of strands, the more strands are displaced as bending takes place over a rope pulley, a rope sheave, a rope drum, or similar. The shorter the lay
30 length and the larger the deflecting element, the smaller are the movements of the strands relative to each other.

From this the knowledge has been gained that the shorter the rope lay length of the covering layer, the smaller the diameter of the rope pulley, traction sheave, or similar that can be selected. In addition, according to the invention it has been established as a minimal requirement that within the angle of wrap the strands should lie on the traction sheave at least three times for an irreversible displacement of strands to be reliably avoided.

Moreover, in developing the invention further, it became known that the less frequently the moving strand lies on the base of the groove of the driven rope sheave, the more easily overlengths can occur in the area experiencing tension.

It is well known that the function of such rope drives is based on the driving force being transferred to the rope via the section of rope which is in contact with the traction sheave at any specific time. As the rope passes over the traction sheave it is bent and, as this occurs, especially in the area in the covering layer of strands which is experiencing tension, the missing length is correspondingly displaced. At the same time, mainly in the area of the rope experiencing pressure, the strands are pushed away from the traction sheave. To meet these many and varied stresses on the rope, the internal balancing of the rope system is of especial importance.

For this reason, according to a preferred embodiment of

the invention, in the case of a rope drive with a synthetic fiber rope with intersheath, the formation of overlenghts in the area of tension is prevented if the diameter of the traction sheave and the length of the rope lay are adapted to each other in such a way that the strands of the covering layer of strands lie on the traction sheave at least four times. With this form of rope with intersheath, overlenghts in the area of tension are less reversible the higher the coefficient of friction between the intersheath and the covering layers of strands, because when the rope is loaded the strands are fixed by the constrictive pressure.

A preferred exemplary embodiment of the invention is described in detail below by reference to drawings. The drawings show:

Fig. 1 a diagrammatic view of a rope deflection on an elevator installation with a car connected to a counterweight by means of synthetic fiber stranded ropes according to the invention;

Fig. 2 a diagrammatic representation of a twisted stranded rope;

Fig. 3 a view of a rope sheave in the direction of its axis of rotation and a laid drive rope according to the invention passing over it.

According to Fig. 1, a car 2 guided in a hoistway 1 hangs on several, here six, drive ropes 3 of load-bearing

aramide fibers, which pass over a traction sheave 5 which is connected to a drive motor 4. On the car 2 there are rope end connectors 6, to each of which an end of the ropes 3 is fastened. The other end of each of the ropes 3 is fastened in the same manner to a counterweight 7 which is also guided in the hoistway 1. Compensating ropes 9 are fastened in a similar manner by their first end to the underside of the car 2. The compensating ropes 9 pass over a deflector sheave 11, which is located on the hoistway floor 10 and aligned directly beneath the hitch point on the car floor, and over an adjacent deflector sheave 12, which is also mounted on the hoistway floor 10 and aligned to the counterweight 7, to the lower part of the counterweight 7 and attached there. Along their length between the car 2 and the counterweight 7 the compensating ropes 9 are tensioned with the aid of weights or as shown here by means of the pulley 12. The purpose is served here by an extension spring 13 which is anchored to the hoistway wall and pulls the deflector sheave 12 in the direction of the hoistway wall, thereby tensioning the compensating ropes 9. Instead of the extension spring the deflector sheave can also be fitted with a suitable kinematic device to tension the compensating ropes.

25 The traction sheave 5 has six grooves 8 lying close to each other, each of which is for a twisted drive rope 3 according to the invention as described further below. In elevator construction, traction sheaves with from two to twelve grooves are usual hitherto. In the embodiment described here, grooves 8 are formed having a semicircular section. Other forms of groove are, however, also possible

which the specialist knows and can provide according to the form of the rope cross section used in each case without the essence of the invention thereby being altered.

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For the purpose of defining terms, Fig. 2 shows as an example a synthetic fiber rope 3' of three aramide fiber strands 14 laid in a manner which in itself is known, with twist Z. The aramide strands 14, 15, 16 lie helically close to each other, the slope of the helix essentially following the central stroke of the letter Z. The length of the lay is shown in the drawing by taking as example the black-hatched aramide strand 16 and designating the lay length as 17. The designations in the example illustrated here can be transferred beyond it to the actual multi-layer synthetic fiber ropes 3 in the invention, on which the advantages which can be achieved with the knowledge according to the invention become greater as the number of layers of strands increases. The direction of twist of the individual layers of strands is here of lesser importance; it is much more the sequence of layers of strands having different directions of twist, especially adjacent to the covering layer of strands, which is essential to the invention.

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When use is made of synthetic fiber ropes with an intersheath between individual layers of strands, displaced overlenghts in that part of the bent rope which is under tension are less reversible for an increasing coefficient of friction between the intersheath and the covering layer of strands, because when the rope is loaded

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the pulled strand is fixed by the constrictive pressure. For this reason, according to the invention the higher the coefficient of friction between the intersheath and the covering layer of strands, the more frequently a strand of
5 the covering layer should lie on the traction sheave within the angle of wrap.

Figure 3 shows the rope sheave 5 and, here representing the usual several ropes 3, a drive rope 3 passing over the
10 rope sheave 5. The rope 3 is connected by one end to the car 2 and by its second end to the counterweight 7, due to whose inertia forces the rope 3 is permanently loaded as it passes over the rope sheave 5. The weight of car 2 and counterweight 7 ensures an adequate frictional engagement
15 between the traction sheave 5 and the section of rope lying over the angle of wrap 18 on the traction sheave 5. In this embodiment of a rope drive according to the invention, the diameter 20 of the traction sheave 5 has a dimension of 260 mm. Consequently, the lay length 17 of
20 the covering layer of strands may not be longer than 60 - 80 mm. Within the meaning of the invention, the minimum allowable angle of wrap is therefore 120° . In Fig. 3 an angle of wrap of 180° is shown. However, an angle of wrap of 140° is also common, as shown implemented in the
25 embodiment according to Fig. 1, for example. With such embodiments, however, it is the case anyway that as the rope passes over the traction sheave it always lies over an arc of wrap on the traction sheave 5 whose length is greater than three lay lengths 17 of the twisted drive
30 rope 3.

As well as being used purely as a suspension rope, the rope can be used in a wide range of equipment for handling materials, examples being elevators, hoisting gear in mines, building cranes, indoor cranes, ship's cranes, 5 aerial cableways, and ski lifts, as well as a means of traction on escalators. The drive can be applied by friction on traction sheaves or Koepe sheaves, or by the rope being wound on rotating rope drums. A drive rope is to be understood as a moving, driven rope, which is 10 sometimes also referred to as a traction or suspension rope.

List of Reference Numbers

	1	Hoistway
	2	Car
5	3, 3'	Drive rope
	4	Drive motor
	5	Traction sheave
	6	Rope end connector
	7	Counterweight
10	8	Rope grooves
	9	Compensating rope
	10	Hoistway floor
	11	Deflector sheave
	12	Deflector sheave
15	13	Extension spring
	14	Aramide fiber strands
	15	Aramide fiber strands
	16	Aramide fiber strands
	17	Lay length
20	18	Angle of wrap
	19	First point of contact
	20	Traction sheave diameter

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Patent Claims

- 5 1. Rope deflection, in which a laid synthetic fiber rope comprising at least load-bearing synthetic fiber strands laid to an outer layer of strands is passed in the form of an arc of a circle over a deflection element,
- 10 characterized in that the synthetic fiber rope lies on the deflection element along a length of at least three lay lengths.
- 15 2. Rope deflection according to Claim 1, characterized in that the deflection element has at least one shaped groove in each of which a synthetic fiber stranded rope lies, the strands of the covering layer lying on the bed of the groove at least three times.
- 20 3. Rope deflection according to Claim 1 or 2, characterized in that the stranded synthetic fiber rope lies on the deflection element along an arc of a circle defined by
- 25 an angle of wrap in a range from 120° up to and including 180° .
- 30 4. Rope deflection according to one of Claims 1 to 3, characterized in that the diameter of the deflection element is selected to be greater than $D = 250 \text{ mm}$.

5. Rope deflection according to one of Claims 1 to 4,
characterized in that
the synthetic fiber stranded rope has an outer
covering layer of strands with a lay length of 60-80
5 mm.
6. Synthetic fiber rope to pass over deflection elements
over which the rope can be passed in the form of an
arc of a circle, comprising at least load-bearing
10 synthetic fiber strands laid to an outer layer of
strands,
characterized in that
the diameter of the deflection element and the lay
length of the synthetic fiber rope are adapted to each
15 other in such a way that within the angle of wrap the
strands of the covering layer of strands each lie on
the deflection element at least three times.
7. Synthetic fiber rope according to Claim 6,
20 characterized in that
the outer covering layer of strands has a lay length
of 60-80 mm.
8. Synthetic fiber rope according to Claim 6 or 7,
25 comprising at least load-bearing synthetic fiber
strands laid together into two concentric layers of
strands and an intersheath formed between the inner
layer of strands and the outer layer of strands.
- 30 9. Synthetic fiber rope according to one of Claims 1-9,
characterized in that
the load-bearing synthetic fiber strands are composed

of aromatic polyamides.

10. Rope drive with a rope deflection according to one of Claims 1-5.

Fig. 1

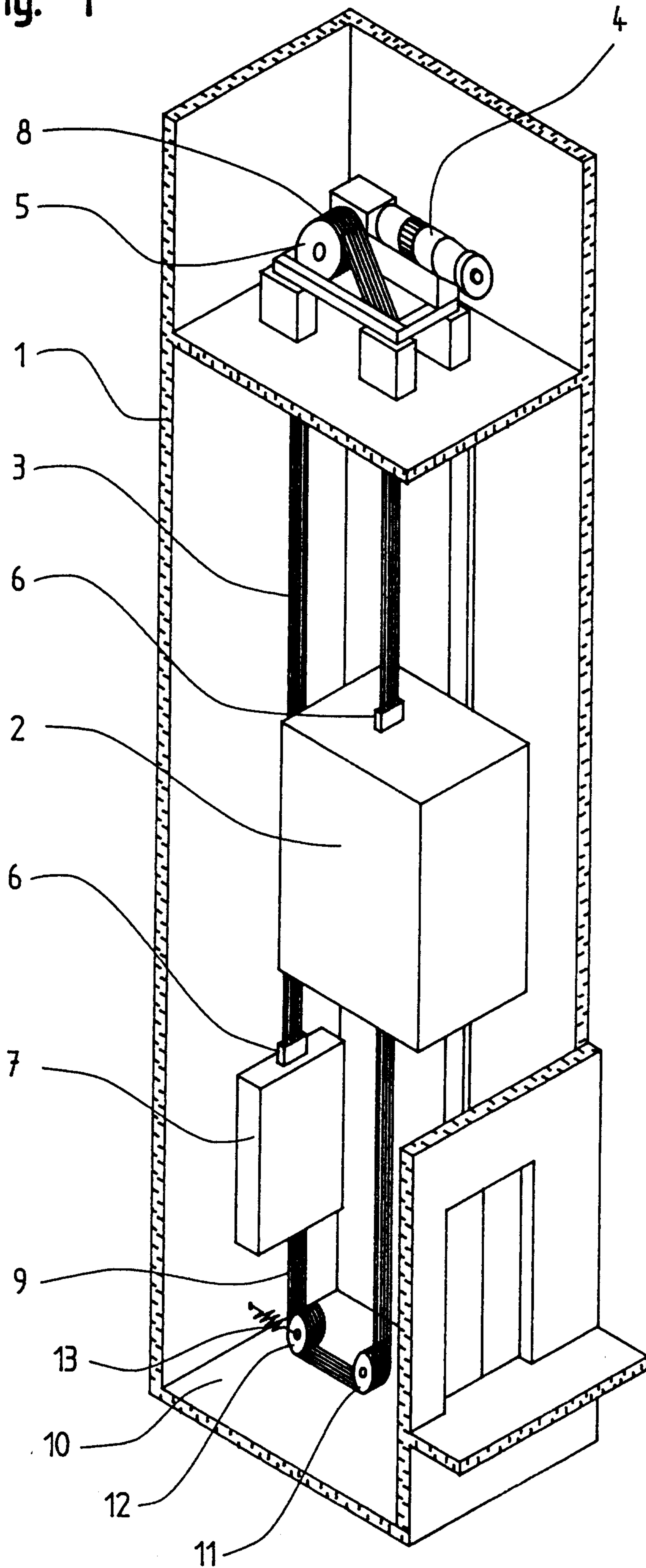


Fig. 2

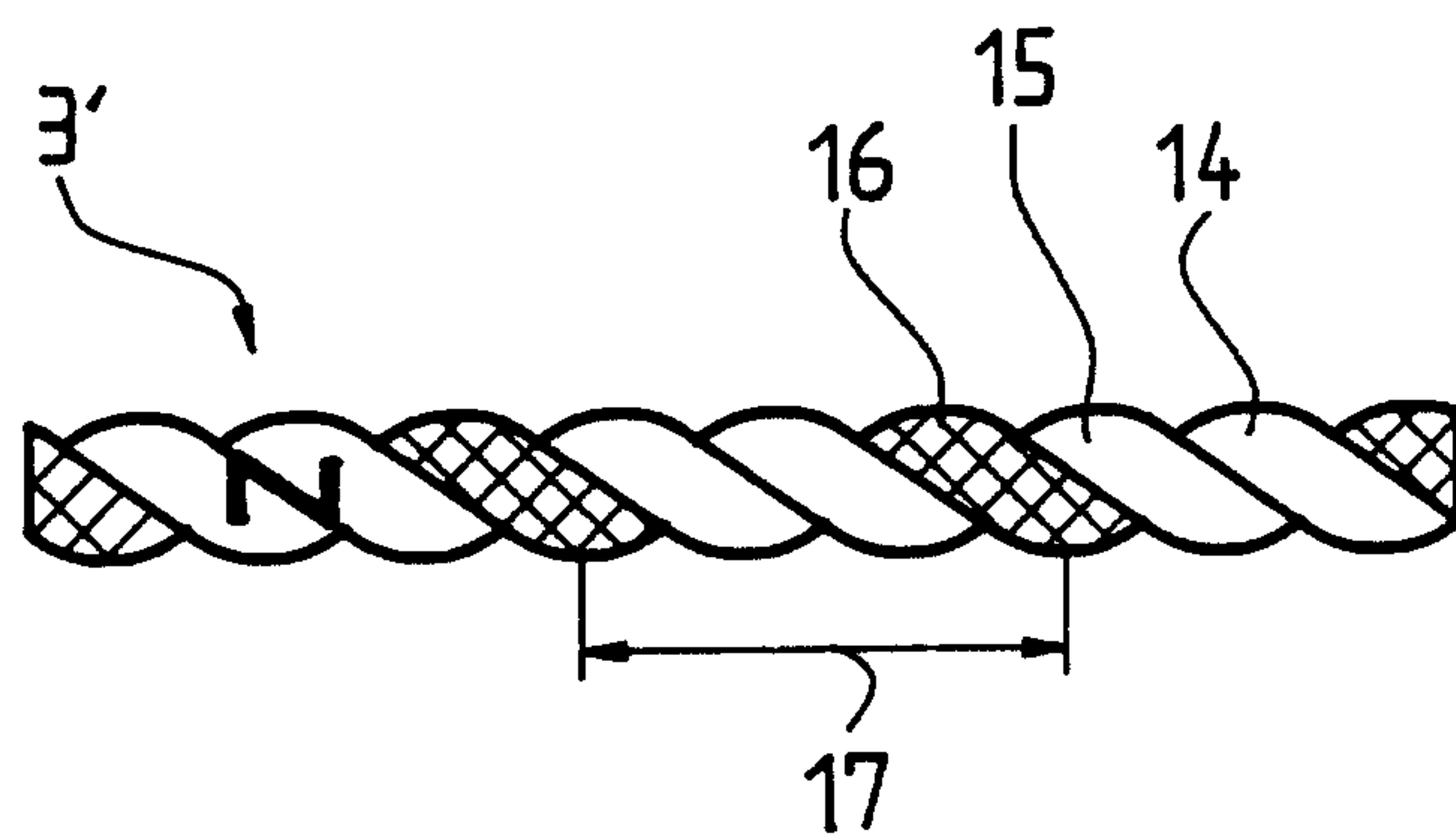


Fig. 3

