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Apparatus for ~~reducing the roughness~~ and abrasive shedding of coated tapes

- 5 The invention relates to an apparatus for reducing the roughness and abrasive shedding of coated tapes by means of a rotating polishing element having a structured circumferential surface.

Coated tapes of the type which are "rough" and cause abrasive
10 shedding have a coating with a binder which comprises, for example, a polymer softer than PVC.

If such coated tapes are operated in equipment sensitive to abrasively shed material in such a way that these tapes come into
15 contact with surfaces of fixed or moving parts of the equipment, malfunctions may occur as a result of deposition or accumulation of the abrasively shed material.

It is consequently an object of the present invention to remove
20 such abrasively shed material from coated tapes which are intended for use in equipment of the type described above.

We have found that this object is achieved according to the invention with an apparatus for reducing the roughness and
25 abrasive shedding of coated tapes by means of a rotating polishing element having a structured circumferential surface, by means of a thread-like structure provided on the circumference of the polishing element.

30 Consequently, when the coating surface is taken past the circumferential structure mentioned, its roughness is reduced by grinding away the peaks of the surface roughness and, surprisingly, at the same time the abrasively shed material is removed from the surface, which was not possible to achieve by
35 cleaning alone.

In a practical refinement, the polishing element is a cylinder of which the height corresponds at least to the width of the coated tape, and in particular is twice the width.
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This ensures simple production of the polishing element and provides an adequate contact surface for the coated tape.

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The circumferential structure of the cylinder may expediently substantially comprise coaxially arranged grooves, which may also have thread-like forms and may also be arranged with a minimum pitch of 0.16 mm.

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To increase the effectiveness of the polishing element, there are advantageously also axially arranged grooves on the cylinder circumference.

- 10 The axial grooves may be formed with a V form, which encloses in particular an angle of 112° , but they may also have a sawtooth form, which may enclose in particular an angle of 63° .

The number of coaxial grooves may lie between about 1 and 20 and
15 should be about 10 to achieve optimum results.

The coaxial grooves may have substantially a V form and the ridges in between may have a flank width of 0.1 mm at the circumferential surface of the cylinder.

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The material of the cylinder circumference expediently comprises hardened steel. However, it may also advantageously comprise oxide ceramic or a hard metal alloy.

- 25 The material of the cylinder circumference should have a hardness of at least 60 Rockwell.

Embodiments of the apparatus according to the invention are represented in the drawing and described below with reference to
30 it.

In the drawing:

Figure 1

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shows a polishing cylinder of relatively small diameter, having coaxial or thread-like grooves and axial grooves,

Figure 2

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shows a polishing cylinder of relatively large diameter, having coaxial or thread-like grooves and axial grooves.

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A polishing element is represented in Figures 1 and 2 as a polishing cylinder 5 and 5A, respectively, having a central bore 6 and 6A, respectively, for receiving a spindle (not shown) of a rotating element.

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Provided on the circumference 7 of the polishing cylinder 5, 5A are either coaxial grooves 8 of annular form or else coaxial grooves arranged helically in a thread-like manner. The cylinder 5 has the diameter $2r$, the cylinder 5A has the diameter $2R$ up to the outer circumferential surface, in which the tips of the ridges 9 between the grooves 8 also lie. The grooves 8 are made, for example in a known way by turning or grinding, on the cylinder circumference 7. As shown enlarged in detail X, the grooves 8 may have a V form, for example with an angle β of about 40°. However, other forms of groove can also be used. After producing the grooves 8, the peaks of the ridges 9 are ground away by suitable grinding devices, so that they still have a defined "flank width" of about 0.1 mm and consequently also have two polishing edges, instead of previously only one.

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As shown in the plan view of Figures 1B and 2B, axial grooves 10 may also be provided on the circumference of the cylinder 5 and 5A, respectively. The minimum number is one or two axial grooves per cylinder circumference. Shown are configurations with $\varphi = 10^\circ$, which corresponds to 36 grooves 10 (detail Y, Fig. 1) or $\epsilon = 8^\circ$, which corresponds to 45 grooves 10 in details Y1 and Y2 in Figure 2. The groove forms are as follows: V-form in the case of grooves 10A with an angle α of about 112° , sawtooth form in the case of grooves 10B with an angle δ of about 63° and rectangular form in the case of grooves 10C with an angle γ of about 3.6° . Other groove forms are also suitable for the purposes of the invention, to detach and pick up abrasively shed material from the coated tape. The grooves 10 are produced by sawing, milling, grinding or else by spark erosion methods or EDM (Electrical Discharge Milling) methods.

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Apart from hardened steel (hardness about 60 Rockwell), suitable materials for the cylinder circumference are also oxide ceramic or hard metal alloys, for instance based on titanium carbide, tungsten carbide etc., in particular if the coating of the coated tape contains hard particles.

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By means of the polishing element, the surface of the coated tape is heated so intensely in a thickness range of just a few molecule layers that the roughness peaks are melted away and, in a pasty state, are smeared into the valleys, the surface becoming smooth and glossy. This melted layer is known as a "Beilby

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layer". It is important here that the polishing does not remove any material, either in the form of chips or other particles, or in any other form. In this way, surprisingly, any occurrence and deposition of abrasively shed material, with its disadvantages mentioned above, can be deliberately avoided.

To obtain good polishing results, it has been found that a relative speed between the cylinder circumference and the coated tape in the range from -10 to +10 m/s is advantageous, the negative sign indicating a slower circumferential speed than the speed of the coated tape, the positive sign indicating a faster speed.

Depending on the material of the coated tape, the contact angle between tape and cylinder circumference and the tape tension during tape movement can be optimized.

It has been possible by means of the apparatus according to the invention to reduce the abrasive shedding of coated tapes by a factor of 10, with low expenditure on the apparatus, production and maintenance.

A polishing apparatus for reducing the roughness and abrasive shedding of coated tapes comprises a cylinder having coaxial channels or grooves of various forms, which are advantageously thread-like. Axial grooves may be additionally provided.

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We claim:

1. Apparatus for reducing the roughness and abrasive shedding of coated tables by means of a rotating polishing element having a structured circumferential surface, which comprises a thread-like structure (8) provided on the circumference (7) of the polishing element (5, 5A).
2. Apparatus as claimed in claim 1, which comprises a cylinder as the polishing element (5, 5A) of which the height corresponds at least approximately to the width of the coated tape and is in particular about twice the width.
3. Apparatus as claimed in claim 1 or 2, wherein the structure comprises substantially coaxially arranged grooves (8).
4. Apparatus as claimed in claim 1 or 2, wherein the structure comprises thread-like grooves (8) having a minimum pitch of 0.16 mm.
5. Apparatus as claimed in claim 3 or 4, wherein axially arranged grooves (10) are additionally provided on the cylinder circumference (7).
6. Apparatus as claimed in claim 5, wherein the axial grooves (10) have a V form, which encloses in particular an angle (α) of about 112° .
7. Apparatus as claimed in claim 5, wherein the axial grooves have a sawtooth form, which encloses in particular an angle (δ) of about 63° .
8. Apparatus as claimed in claim 3 or 4, wherein the number of coaxial grooves (8) is about 1 to 20, in particular 10.
9. Apparatus as claimed in claim 3 or 4, wherein the coaxial grooves (8) have a substantially V form and the flank width of the ridges (9) at the circumferential surface (7) of the cylinder (5, 5A) between the coaxial grooves (8) is about 0.1 mm.

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Drawing

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10. Apparatus as claimed in claim 1 and one or more of claims 2 to 10, wherein the material of the cylinder circumference (7) comprises hardened steel.
- 5 11. Apparatus as claimed in claim 1 and one or more of claims 2 to 10, wherein the material of the cylinder circumference (7) comprises oxide ceramic.
- 10 12. Apparatus as claimed in claim 1 and one or more of claims 2 to 10, wherein the material of the cylinder circumference (7) comprises a hard metal alloy.
- 15 13. Apparatus as claimed in claims 10 to 12, wherein the material of the cylinder circumference (7) has a hardness of at least 60 Rockwell.

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