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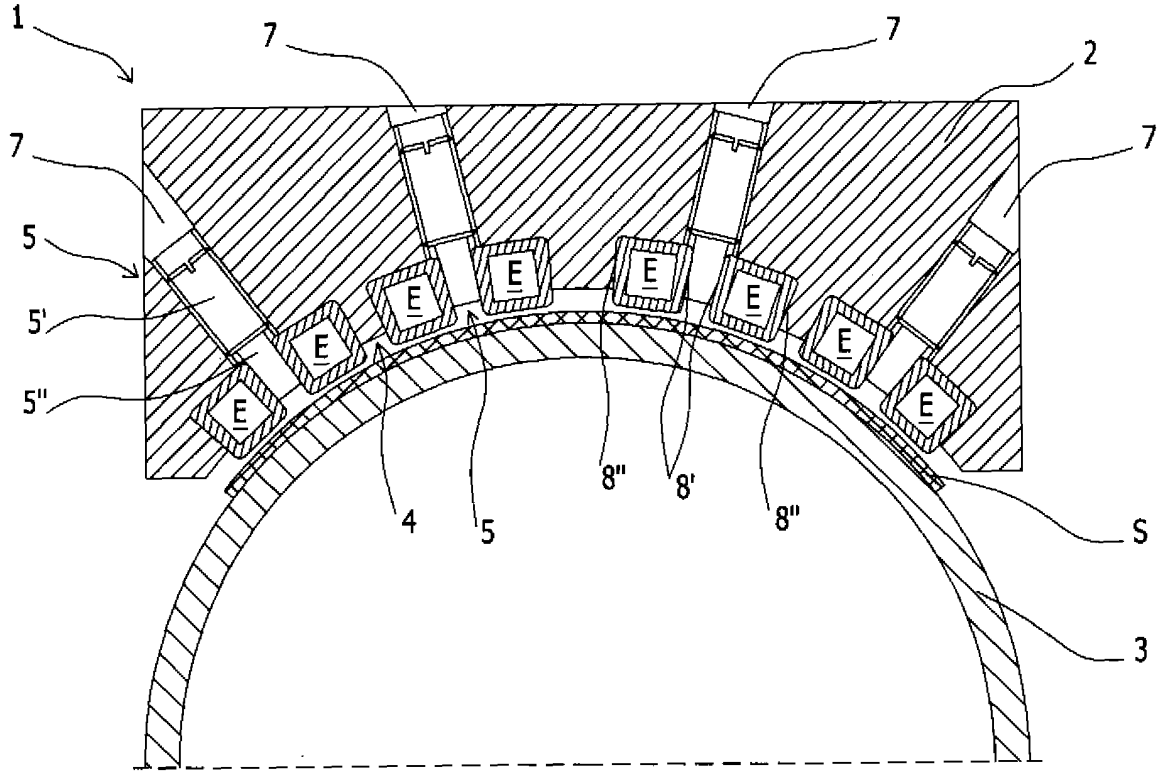
(54) **A device for supporting electrodes of corona treatment machines**

(57) A supporting device (1) for electrodes of corona treatment machines comprising a bridge (2) made of insulating material arranged for supporting, by interference with separator means, ceramic electrodes (E) that interact with a counter-electrode (3), on which a substrate (S) to be treated slides, where said separator means comprise teeth (4) and pins (5) interposed between pairs of electrodes (E), wherein said pins (5) comprise a threaded cylindrical portion (5') and a smooth conical portion (5"), so as to generate a divaricating force between said pairs of electrodes, directed towards said teeth (4).

Fig. 1



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Description

[0001] The present invention is aimed at the sector of production of machines for carrying out surface treatments on various materials: in particular, the invention regards a device for supporting electrodes that can be used with machines for carrying out corona treatment.

[0002] As known, corona treatment in general consists in applying an electrical discharge of considerable intensity to the surface of a given substrate, which may be constituted by a film or an extrusion, or else by sheets, plates, cables, pipes, sheet metal, etc., with the purpose of increasing the active tension thereof and hence improving the capacity of anchorage of printing inks, adhesives, or coatings.

[0003] Corona treatment is frequently applied to polyethylene, polypropylene, PVC, or polyester films but more in general can be used for all plastic materials and also some non-plastic materials, such as paper and aluminium.

[0004] A machine for carrying out corona treatments (with electrodes coated with insulating material), according to the known art, is basically constituted by a high-frequency generator, by a voltage-booster transformer connected to a plurality of electrodes coated with insulating material, and by a counter-electrode, made of conductive material and electrically connected to ground.

[0005] The substrate to be treated is made to pass in the space that is created between the electrodes and the counter-electrode, with known conveying means: in this way, the surface of the substrate is activated by the electrical discharge that is struck between the electrodes to which the voltage is applied and the counter-electrode connected to ground.

[0006] The electrodes are generally arranged alongside one another, anchored to a given supporting device, set opposite to the surface for sliding of the substrate.

[0007] Traditional electrodes are constituted by a pipe or by a ceramic rod, or other equally insulating material, generally with square or round hollow section, with conductor material inside.

[0008] The electrodes made of insulating material obtained by extrusion have dimensional and geometrical tolerances that are difficult to contain within minimum or negligible ranges: in order to support up to 4-5 electrodes, it is possible to grip the electrodes using an elastic insulating supporting device (of a comb type), which exerts via a tie rod and two insulating rigid plates a closing force on the comb, so as to pack the electrodes together. This system enables a controlled distance between the electrodes and the counter-electrode (air-gap) to be obtained. For a large number of electrodes, there is likely to remain the problem of a non-correct positioning of the electrodes themselves so that the air-gap is rendered irregular.

[0009] In particular, if the size of the cross section of the electrodes is at the maximum of the tolerance, the teeth of the comb are kept wide open, and the lateral electrodes disadvantageously tend to recede from the counter-electrode. If, instead, the size of the cross section of the electrodes is at the minimum of the tolerance, the teeth of the comb close, and the lateral electrodes disadvantageously tend to approach the counter-electrode. In either case, the air-gap is never constant and precise, thus favouring onset of anomalous discharges towards the centre or the periphery of the treatment arc.

[0010] Furthermore, the comb requires teeth of small dimensions in order to be easily deformable, and consequently the electrodes are arranged set alongside one another in a very close way: the electrical discharges, thus concentrated, tend to overheat the machine.

[0011] WO 02/19486 A1 discloses a device for supporting electrodes in corona treatment machines comprising a bridge made of an insulating material suitable for supporting, by use of separating means, ceramic electrodes that interact with a counter electrode on which a substrate to be treated slides, according to the preamble of the independent claim 1.

[0012] The purpose of the invention is to overcome the residual drawbacks mentioned above.

[0013] The main purpose of the invention is to obtain, between the electrodes coated with insulating material and the counter-electrode, a precise and constant air-gap, also with a high number of the electrodes themselves, which is necessary for successful corona treatment and proper striking of the electrical discharge.

[0014] A further purpose of the invention is to enable the use of a higher number of electrodes for each hood (container for the electrodes with suction of the ozone produced by the process) by setting them at a distance to enable a good cooling thereof and consequently a greater concentration of discharge, with consequent increase of speed on each individual hood and reduction of the costs.

[0015] The aims are achieved with a device for supporting electrodes of corona treatment machines comprising a bridge made of insulating material arranged for supporting, by interference with separating means, electrodes coated with insulating material that interact with a counter-electrode on which a substrate to be treated slides, the device being characterized in that said separating means comprise teeth and pins interposed between pairs of electrodes, wherein said pins comprise a threaded cylindrical portion and a smooth conical portion so as to generate a divaricating force between said pairs of electrodes directed towards said teeth.

[0016] According to a preferred aspect of the invention, said separator means comprise also fins on which said pins act.

[0017] According to further preferred aspects of the invention, said cylindrical portion co-operates with holes provided on the bridge, and said conical portion acts either directly or indirectly on the lateral faces of the electrodes.

[0018] Further aspects of the invention provide for said pins to be screwed into holes provided on the bridge by means of insertion from the side of the counter-electrode

or from the opposite side thereof.

[0019] Preferably, said threaded cylindrical portion of the pins co-operates with a bushing associated to said bridge.

[0020] The invention presents numerous advantages:

- the action of the separator means on pairs of electrodes, instead of on all of them, guarantees a uniform grip throughout the cross section of the support, reducing possible errors of calibration of the air-gap;
- the action of the separator means on pairs of electrodes, instead of on all of them, decomposes the summation of inevitable errors generated by the wide tolerance range of the electrodes coated with insulating material, reducing in effect the total tolerance of the block of electrodes;
- the air-gap is kept constant and precise throughout the cross section of the support, with a well-calibrated distance between the electrodes and the substrate, completely eliminating the risk of approach between the parts;

- in the case of treatment on roller counter-electrode, the perfect concentricity between the curvature of the discharge arc of the electrodes and the curvature of the counter-electrode roller is guaranteed throughout the cross section of the support, both for the central electrodes and for the peripheral ones;
- it is possible to set the electrodes at a greater distance from one another, with the insertion, in addition to the separator means, of flexible fins, favouring also the passage of gases and of the forced cooling air vacuumed in by the hoods;
- with a good ventilation of the electrodes, it is possible to increase the discharge concentration thereof and hence the power thereof, with consequent increase in speed on each individual hood and reduction of costs.

[0021] Characteristics and advantages of the invention will emerge more clearly from the ensuing detailed description of preferred embodiments, illustrated by way of non-limiting example, with the aid of the attached figures, wherein:

Figure 1 illustrates, in cross section, a device for supporting electrodes associated to a cylindrical counter-electrode, according to a preferred embodiment of the invention;

Figure 2 illustrates, in cross section, a device for supporting electrodes associated to a counter-electrode roller, according to a further preferred embodiment of the invention;

Figure 3 illustrates a detail of the cross section of Figure 2;

Figure 4 illustrates, in cross section, a device for supporting electrodes associated to a plane counter-electrode, according to a further preferred embodiment of the invention;

Figure 5 illustrates, in cross section, an accessory component of the lateral supporting device for electrodes.

[0022] With reference to Figure 1, the invention regards a supporting device 1 for electrodes to be used in machines for corona treatment of a surface or surface portion of a substrate S.

[0023] Said supporting device 1 comprises a bridge 2 made of insulating material, for example plastic material such as teflon, designed to support a plurality electrodes E interacting with a cylindrical counter-electrode 3, for striking electrical discharges necessary for the corona treatment.

[0024] Said electrodes E are connected to a generator and to a voltage-booster transformer according to the known art, whereas the counter-electrode is connected to ground.

[0025] The electrodes E are each constituted by a rod of insulating material, with a trapezoidal cross section, hollow inside and with the smaller base facing the substrate S to be treated, with conductor material connected to the high voltage therein.

[0026] The counter-electrode 3, made of conductive material, can have a cylindrical shape as illustrated in Figures 1, 2 and 5 or a substantially plane shape, as illustrated in Figure 4, and on its outer surface the substrate S advances, appropriately arranged so as to slide in the air-gap existing between the electrodes E and the counter-electrode 3.

[0027] The electrodes E, set alongside one another above the substrate S, are arranged in such a way that the air-gap is well calibrated, i.e., in such a way that their surface facing the counter-electrode 3 reproduces the curvature of the cylinder constituting the counter-electrode itself, i.e., is concentric thereto, or else provides a plane surface parallel to that of the counter-electrode, in the case where the latter is of a plane type. Said electrodes E are supported by a bridge 2, by interference with suitable separator means, constituted in particular by teeth 4 and pins 5 set between pairs of electrodes E.

[0028] Once again with reference to Figure 1, said pins 5 comprise a threaded cylindrical portion 5', arranged for co-operating with holes 7 provided on the bridge 2, and a smooth conical portion 5", which acts directly on first lateral faces 8' of the trapezoidal electrodes E, so as to keep them in position, generating a force of divarication of said pairs of electrodes, which pushes second lateral faces 8" of the electrodes themselves to rest against corresponding plane shoulders constituted by the lateral surfaces of the teeth 4.

[0029] In particular, said pins 5 can be screwed into the threaded holes 7, provided on the bridge 2, with insertion from the side opposite to the counter-electrode 3.

[0030] Figures 2-4 illustrate a possible variant embodiment of the supporting device 1 of Figure 1, in which the separator means, provided on the bridge 2, furtherly com-

prise fins 6 on which the pins 5 act, in such a way that the conical portion 5" of the pin 5 will exert a more extensive pressure on the electrode E, using all the surface area of the fin 6 itself, and not only the segment of tangency between the electrode E and the conical portion 5", as occurs instead in the first variant.

[0031] In this particular case, the pins 5 can be screwed into the holes 7 provided on the bridge 2, with insertion from the side of the counter-electrode 3. The cylindrical portion 5' of the pins 5 co-operates with a bushing 9 that can be stably associated to the bridge 2, according to a known technique, and is made of a material harder and more resistant than the teflon of which only the bridge 2 is made. Said bushing 9 is purposely provided with a thread arranged for co-operating with the corresponding thread of the cylindrical portion 5' of the pin 5 so as to ensure a fit with higher mechanical resistance.

[0032] Figure 5 shows the conformation of an accessory component 100 of the device for supporting electrodes, which can be used as first and last bridging lateral support to be positioned beyond the outer edge of the surface to be treated S and of the counter-electrode 3. The case represented applies for to a roller counter-electrode 3, but a similar component is provided for a plane counter-electrode.

[0033] In any case the bridging supports 100 are provided with shaped gaps having the same shape as the cross section of the electrodes and, if the cross section is trapezoidal as in the case illustrated, the minor bases of the trapezia are arranged according to a surface that reproduces that of the counter-electrode 3 increased by the thickness of the substrate to be treated and of the air-gap.

[0034] Fixing of the electrodes E in said gaps occurs by means of threaded cylindrical pins 5, which can be inserted in holes 7 on the opposite side with respect to the counter-electrode 3 and press the electrodes E against the minor bases of said gaps.

[0035] The arrangement with which the electrodes E can be fixed on the bridge 100 cannot be modified with adjustments, but reproduces exactly the form of the surface of the counter-electrode 3 so that it can constitute a fixed reference for the intermediate bridging supports 2.

[0036] The preferred embodiment of the electrodes E, shown in Figures 1-5, is substantially trapezoidal with the smaller base facing the substrate S; the insulating material of which said electrodes E are made is prevalently ceramic.

[0037] In equivalent embodiments, as will be clear to the person skilled in the field, the electrodes can have a cross section different from the substantially trapezoidal cross section: by way of example, the electrodes can have a square, or else polygonal, cross section, provided that said cross section co-operates in a correct and advantageous way with the conical portion of the pins.

[0038] It is likewise clear that the insulating material of the electrodes may be any whatsoever and is not limited to ceramic, which has been mentioned as preferential.

[0039] The invention may be applied to substrates to be treated, whether plastic or non-plastic, such as paper and aluminium, and to the various known types of corona treatment machines.

Claims

1. A device (1) for supporting electrodes of corona treatment machines comprising a bridge (2) made of an insulating material arranged for supporting, by interference with separating means, ceramic electrodes (E) that interact with a counter electrode (3) on which a support (S) to be treated slides, **characterized in that** said separating means comprise teeth (4) and pins (5) interposed between pairs of electrodes (E), wherein said pins (5) comprise a threaded cylindrical portion (5') and a smooth conical portion (5"), so as to generate a divaricating force between said pairs of electrodes directed towards said teeth (4).

2. A supporting device according to claim 1, **characterized in that** said separating means comprise fins (6) on which said pins (5) act.

3. A supporting device according to claim 1, **characterized in that** said cylindrical portion (5') co-operates with holes (7) provided on the bridge (2) and said conical portion (5") acts either directly or indirectly on first lateral faces (8') of the electrodes (E).

4. A supporting device according to claim 1, **characterized in that** said electrodes (E) comprise second lateral faces (8") designed to co-operate by interference with said teeth (4).

5. A supporting device according to claim 1, **characterized in that** said pins (5) can be screwed into the holes (7) provided on the bridge (2), by means of insertion from the side opposite the counter electrode (3).

6. A supporting device according to claim 1, **characterized in that** said pins (5) can be screwed into the holes (7) provided on the bridge (2), by means of insertion from the side of the counter electrode (3).

7. A supporting device according to claim 1, **characterized in that** said threaded cylindrical portion (5') of the pins (5) co-operates with a bushing (9) stably associated with said bridge (2).

8. A supporting device according to claim 1, **characterized in that** it comprises an accessory component (100) which can be used as first and last bridging lateral support to be positioned beyond the outer edge of the support (S) to be treated and of the coun-

ter electrode (3).

9. A supporting device according to claim 8, **characterized in that** said accessory component (100) comprises shaped gaps having the same shape as the cross-section of the electrodes (E) and arranged so as to exactly reproduce the trend of the surface of the counter electrode (3).

10. A corona treatment machine **characterized in that** it comprises a supporting device (1) for electrodes according to at least one of the previous claims.

Fig. 1

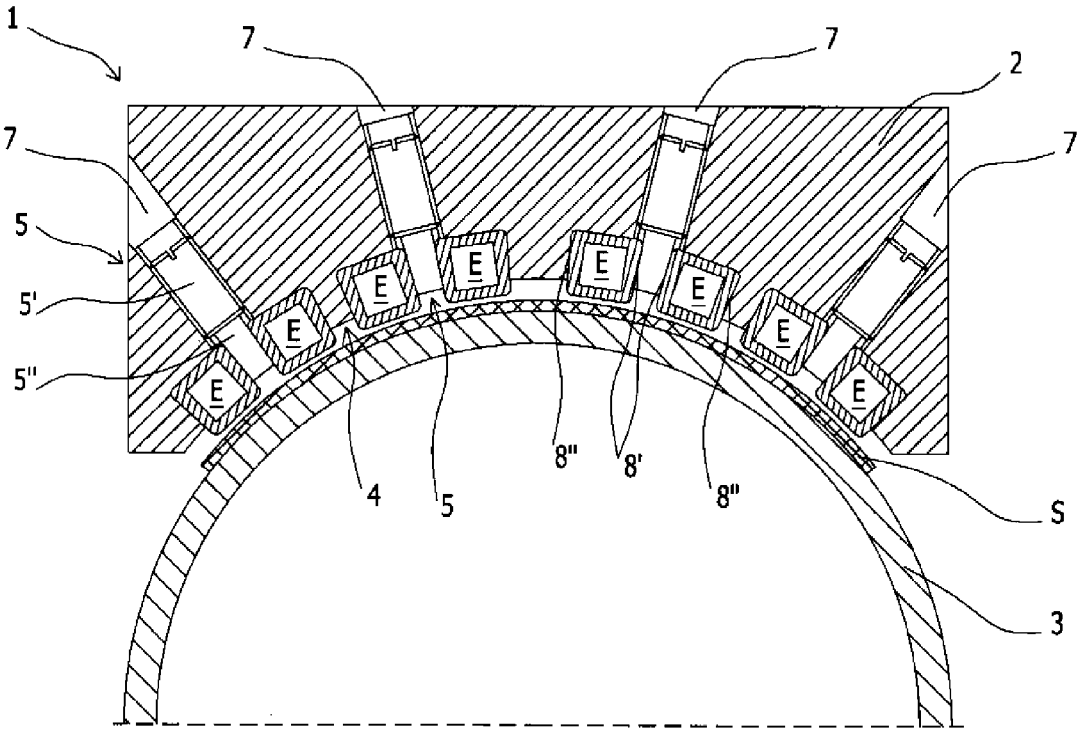


Fig. 2

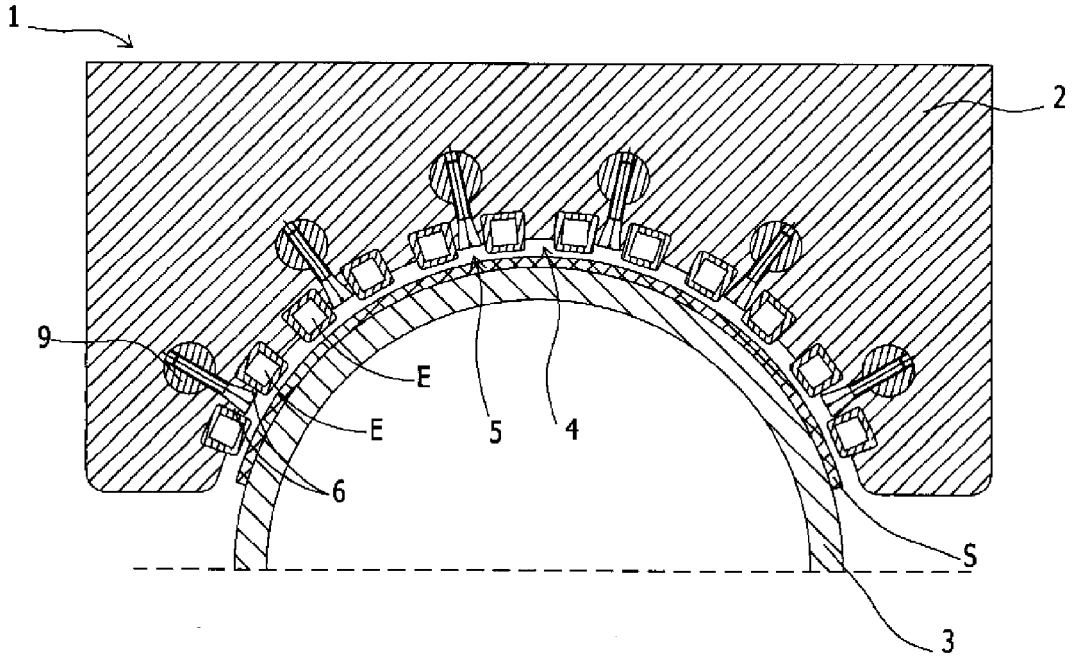


Fig. 3

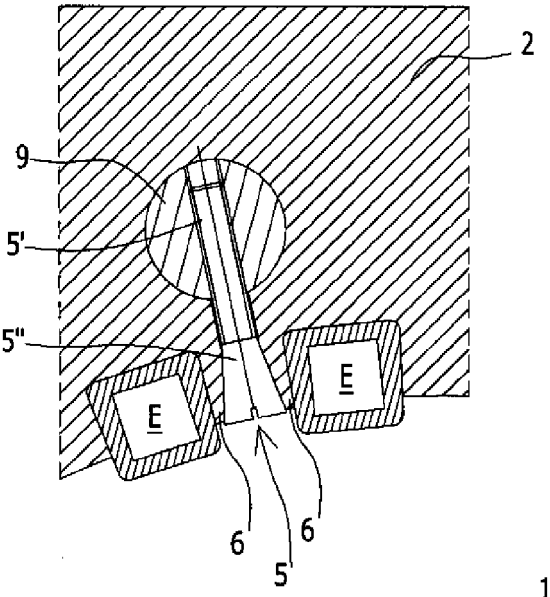


Fig. 4

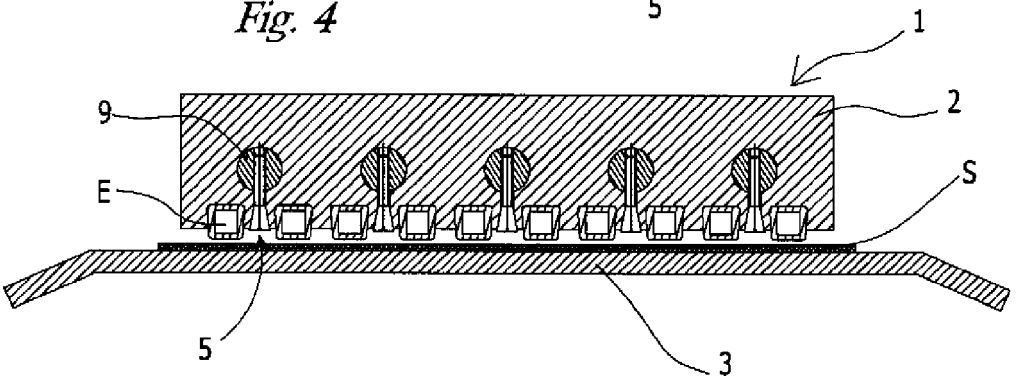
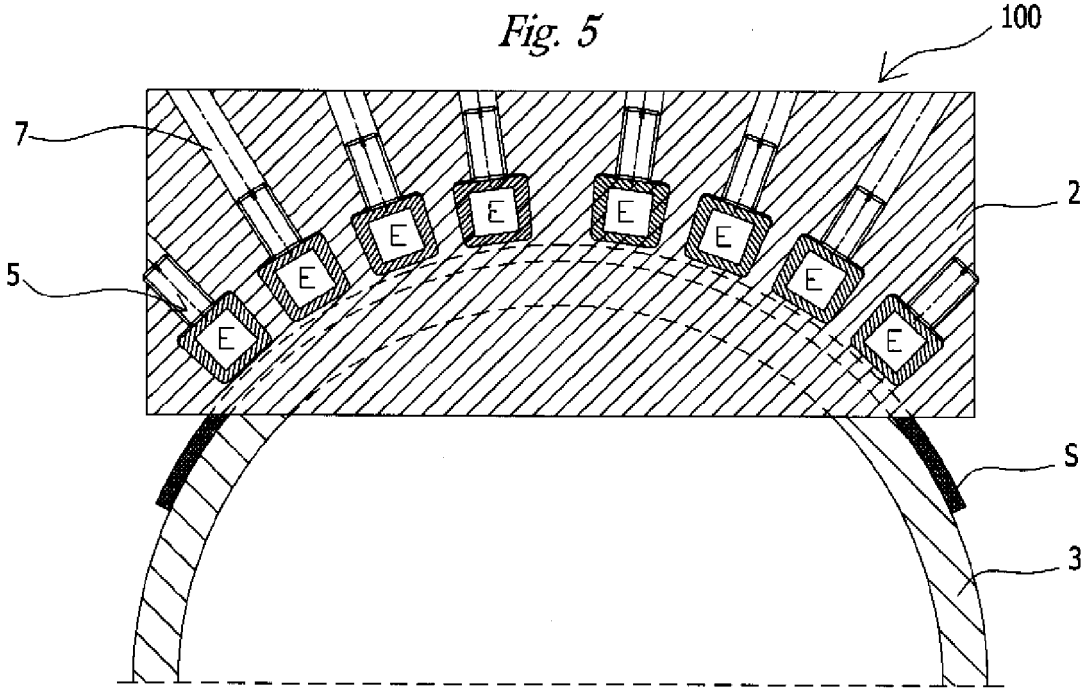


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 10 17 0971

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 02/19486 A1 (AFS ENTWICKLUNGS & VERTRIEBS G [DE]; ARLT GERHARD [DE]; DINTER WOLFGAN) 7 March 2002 (2002-03-07) * page 3, line 3 - page 4, line 14; figure 1 *	1	INV. H01T19/00
			TECHNICAL FIELDS SEARCHED (IPC)
			H01T

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 September 2010	Bijn, Eric

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 17 0971

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13-09-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0219486 A1	07-03-2002	AT 279801 T	15-10-2004
		AU 9177301 A	13-03-2002
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		EP 1316130 A1	04-06-2003
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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