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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) High performance plastic tube for dyeing and finishing processes of yarn packages

(57) Tubular body (1) of yarn dyeing tube comprises flanges (2) and (3) with circumferential hollows (8), longitudinal (4) and circumferential (5) ribbings, hollow areas (6) composed by intersections of the ribbings, supporting disk (7) placed between flanges, circumferentially positioned hollows (17) of the disk, plastic net (11) fixed to the flanges, circumferential (12) and longitudinal (13) ribbings and hollow areas (14) of the net. Grooves (9) at the outer edge of the left flange (2) and grooves (10) at the inner edge of the right flange are used for nesting of plastic net (11) by the help of notches (15) and (16).

Introduced tube structure can be built up both cylindrical and conical form and used for dyeing or finishing processes of yarn packages. Proposed tube provides better dyeing and finishing quality, increased productivity, and energy saving comparing the current dye tubes.

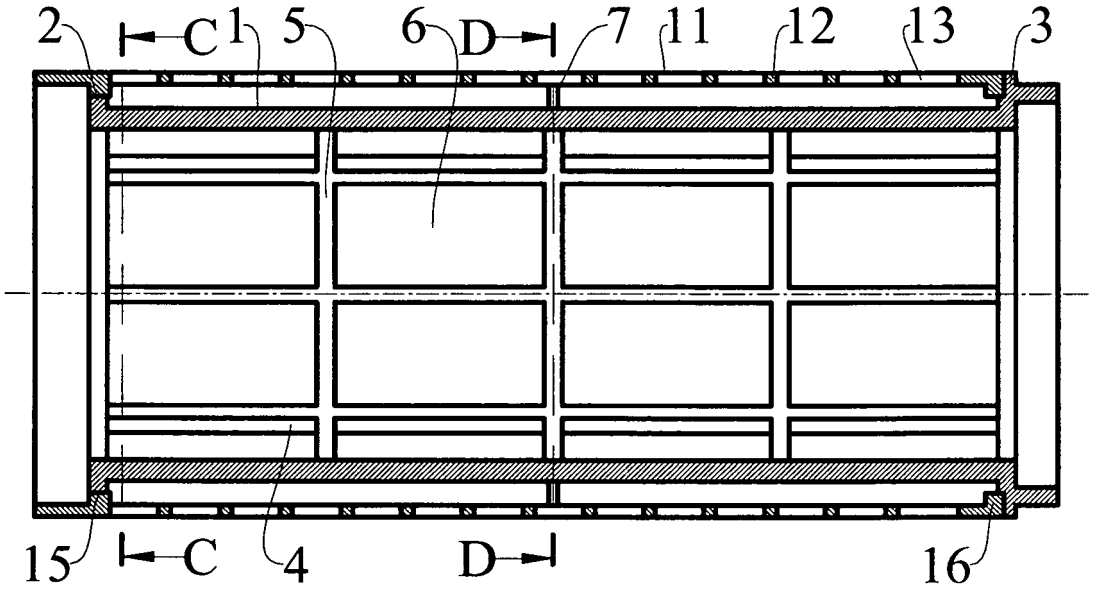

FIG.5

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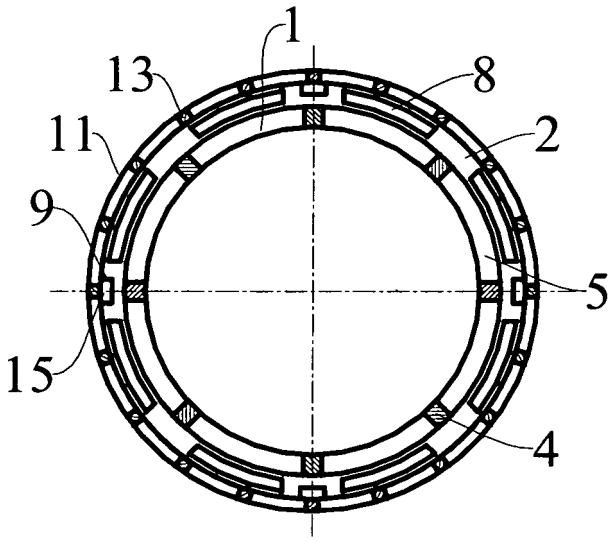

FIG.6

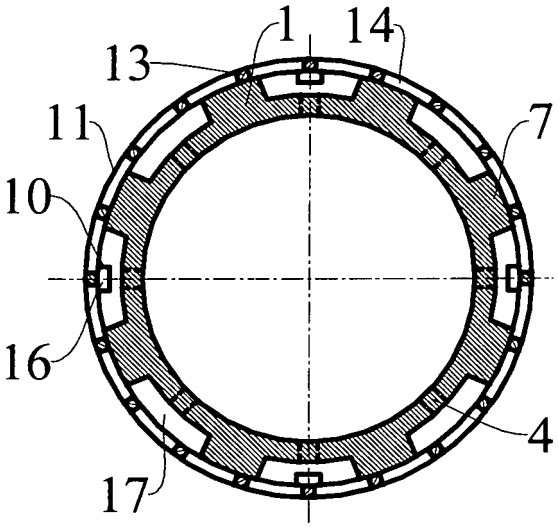

FIG.7

Description

Field of Invention

[0001] The invention concerns a plastic tubular body used during the dyeing and finishing procedure of yam packages. The new tube improves dyeing quality, reduces yam waste and time requirement of dyeing and drying processes. Therefore the invention provides increased productivity, and savings on time and energy consumption of the dyeing process.

Background of the Invention

[0002] It is important to mention the "Useful Surface Coefficient" (U_{SC}) parameter to evaluate the performance of the dyeing tubes.
Useful Surface Coefficient (U_{SC}) is defined as rate of total hollow area on the surface of the tube (S_H) to the total yam winding surface area (S_T).
$U_{SC}=S_H/S_T$ or % $U_{SK} = (S_H/S_T)$ 100
U_{SC} is a structural parameter to characterize the new tube designs, designating the percent of total dye transferable area to the total tube surface area.

[0003] Currently available plastic yam tubes are designed to comprise a tubular or conical body having different shaped hollow areas on their surfaces and the dye effluent is pumped to the yam package from inside of the tube. The U_{SC} value (ratio of total hollow area of the tube surface to total yam winding surface area of the tube) has been determined quite low for the current commercial tubes. Investigations about the U_{SC} of commercial available tubes has shown that U_{SC} value has changed between 0.28 - 0.55. Low U_{SC} value of the current tubes is one of the reasons for dyeing inaccuracy on the lower layers of the wound yam body on the packages. Considering the inside through outside dye effluent flow dyeing process, direct contact of dye effluent and the lowest yam layer of the wound yam body is only limited by the hollow surface area of the tube. Dye effluent directly flows to areas of wound yam body which are befitted on the hollow areas of the tube surface, maintaining better dye pick up than areas of wound yam body which are befitted on the solid areas of the tube surface. Considering the outside through inside dye effluent flow dyeing process, dye solution flows along the yam layers and run out at the lowest yam layer of the wound yam body through the hollow areas of tube surface. On the solid areas of the tube body, contact time of dye effluent and yam layers are longer than those contact time of the hollow areas of the tube. Because of the contact time difference of the wound yam areas, color deepness differences occur along yam length. Color deepness differences may reach up to 3 % to 5 % of the defected yam in yam dye houses.

[0004] Another aspect of the low U_{SC} value of the current tubes is higher time requirement for dyeing and drying processes of the yam packages. Circulation of dye effluent and hot air through surface hollows of the tube is also low resulting low U_{SC} value of the tubes. Low dye effluent and air circulation area require longer dyeing and drying time. Therefore yam package dyeing and drying efficiency becomes lower.

[0005] Structural shape of currently used commercial plastic tubes (especially cylindrical ones) is easily deformed and descended in the middle of the tube body as result of the normal pressure resulting of dyeing and drying processes. Such deformation decreases the lifetime of the tube.

[0006] There are other patents concerning increased dye effluent flow through tube surface, such as EP 1473400 A2, US patent of 3,929,301; 4,181,274; 4,872,621; 4,997,141; 5,131,595. Most of the above mentioned patents are related to tubes for yam bobbins of the type having variable length in axial direction. Such tubes have higher U_{SC} value than the other current tube types. However original U_{SC} value of tubes has decreased under the longitudinal compression process of yam packages. Decrease about the total area of transfer holes for dye effluents still causes high level of color defects along yam length.

[0007] Similar inventions are explained in the patents of Russia (former Soviet Union SU1832778A1), and Turkish Patent Institute, (TR 2006 01193Y).

[0008] SU1832778 A1 introduces a stainless steel conical hollowed tubular body with ribbing rings around outer surface, and screen clothing attached to the rings. The tube comprises a hollowed body with rear and middle disks riveted around and screen clothing attached to the outer surfaces of the disks. Attachment of the screen clothing onto the rear disks is fixed using elastic rings and round springs.

[0009] Patent of TR 2006 01193Y comprises a plastic tubular body, and screen clothing fixed onto the outer surface of the circumferential disks of the plastic tubular body. Plastic tubular body also comprises flanges at the right and left edges, longitudinal and circumferential ribbings attached to the main tubular body, and replaceable segmented screen clothing to cover the whole tubular body.

[0010] Although U_{SC} value of both patents described above is around 0.80-0.90, they are not practically usable in the yam dye houses. Manufacturing of the tubes is time consuming process because of several distinct parts and requirement of extra fixing process of the screen clothing to the main body. Equipment used for the fixation of screen clothing is also affected by the dyeing conditions and it can be oxidized, resulting color degradation of the yam in some layers of the yam package. Another disadvantage of the proposed tube is about screen clothing which causes wearing of winding drum. Worn off surface of the drum causes increased number of yam breakage during the winding of yam package.

Summary of the Invention

[0011] Main aims of the proposed invention are to im-

prove dyeing quality of yam packages, to reduce yam waste of dyeing defects, to increase dyeing and finishing efficiency of the yam packages, provide energy savings.

[0012] The invention comprises a plastic tubular body and a plastic net placed around the tubular surface of the plastic body. Surface of the plastic net has high dye flow rate (high value of U_{SC}) and material of the net has high rigidity property to bending and inflection.

[0013] Details of the invention will be described in greater detail here under with reference to the example of the accompanying drawings which show constructional details of the high performance plastic tube. In the drawings:

FIG. 1 shows longitudinal cross section of the tubular body in horizontal position;
FIG. 2 is a cross sectional view, A-A of FIG.1;
FIG. 3 is longitudinal cross section of the plastic net in horizontal position;
FIG. 4 is a cross sectional view of plastic net, B-B of FIG.3;
FIG. 5 is longitudinal cross section of the tube in horizontal position;
FIG. 6 is cross sectional view, C-C of FIG.5;
FIG. 7 is cross sectional view, D-D of FIG.5;

[0014] Components of the tube figures are numbered as it is listed below:

(1) - main body of the tube,
(2) - left flange of the body,
(3) - right flange of the body,
(4) - longitudinal ribbings of the body,
(5) - circumferential ribbings of the body,
(6) - hollow areas of main body surface ,
(7) - supporting disk,
(8) - hollow areas of the flanges,
(9) - grooves of the body left flange,
(10) - grooves of the the body right flange,
(11) - plastic net,
(12) - circumferential ribbings of the net,
(13) - longitudinal ribbings of the net,
(14) - hollow areas of the net,
(15) - left edge notches of the net,
(16) - right edge notches of the net,
(17) - hollow places of supporting disk.

Detailed description of a preferential embodiment

[0015] Tubular body of the tube (1) shown in FIG.1, FIG.2, FIG.5, and FIG.7 comprises left (2) and right (3) flanges having circumferential hollows (8), longitudinal (4), circumferential (5) ribbings of tubular body, hollow areas of main body (6), supporting disk (7) placed in the mediaval of flanges at equal distances, and hollow places (17) of supporting disk Plastic net (11) is fixed on to the tubular body. Fixation of the plastic net onto the tubular body is completed by the help of transverse grooves of the left flange (9), and grooves (10) of right flange inner diameter.

[0016] Plastic net (11) of the tube is shown in FIG.4, FIG.5, FIG.6, and FIG.7 and comprises circumferential (12) and longitudinal (13) ribbings and rectangular hollows (14) constituted by intersections of ribbings (12) and (13). Inner circumference of net left and right edges comprise notches (15) and (16). Fixation of the net onto the tubular body is completed by nesting of notches (15) to the grooves (9) of left flang and notches (16) to the grooves (10) of right flange. Width of the net ribbings is not wider than 1.5 mm and depth thickness of net ribbings is not more than 3 mm.

[0017] Utilization of the high performance plastic tube; A regular yam package winding machine is equipped with the proposed tube, required amount of yam is wound onto the tube at desired density and wound yam package is sent to the package dyeing machine. Yarn packages are placed onto the perforated cylinder of the dyeing machine tank. Right flange (3) (becomes bottom edge flange) of the yam package is nested to the left flange (2) (becomes upper edge flange) of the below yam package. After completing the yam package placement of the dye tank, dyeing process is started.

[0018] Dye effluent is pumped through wound layers of yam packages from the inside of the tubes, starting from the hollow areas (6) of the tubular body (1), hollow areas (14) of the net (11) and bottom layers of the yam wounds. When the pumping of dye effluent from inside to outside of the yam package is stopped, collected dye liquid flows and drained to innerside of the yam package through hollow areas (14) of the net (11) to the hollow areas (6) of the main body and hollows of the flanges (8). If the dye liquid is feed from the outside of the yam package, dye liquid moves inside of the yam layers quickly, and absorbed by the yam layers. Over fed dye liquid flows through hollow areas (14) of the plastic net (11) to hollow areas (6) of the tube and hollows (17) of the supporting disk(7). Therefore effective and quick circulation of dye liquid through inner structre of yam package is completed.

[0019] Proposed tube minimizes contact surface of the lowest yam layers and solid parts of the tube, does not allow any dye liquid collection between the intersection surface of lowest yam layers and ribbings (12) and (13) therefore constitution possibilty of deeper color dyeing defects on the lowest yam layers is minimized. Color difference among layers of yam package is therefore eliminated.

[0020] Employment of supporting disk (7) between flanges (2) and (3) provides long life to the tube, maintaining higher resistance to bending and deformation of the tube against high stress loads of dyeing and drying processes of the yam packages. Hollow areas (17) of the supporting disk help complete and quick discharging of dye effluent from the yam package.

[0021] Useful Surface Coefficient (U_{SC}) value of the proposed tube is increased to the 0.85 from the 0.28-0.55

value of current commercial tubes by the use of introduced tubular body and net structures. Increased U_{SC} value of proposed tube provides better dye effluent flow efficiency, by the help of 1.6 to 2.5 times increased dye effluent flow surface areas comparing the current comercial tubes. Enlargement of dye effleunt flow area of the tube enable to decrease dyeing and drying time and pumping presure requirements, therefore energy requirement is decreased with increased efficiency.

Claims

1. Invention is a plastic tube for the use of dyeing and finishing process of yam packages; it comprises circumferential hollows (8) of left flange (2), right flange (3), longitudinal ribbings (4), circumferential ribbings (5), hollow areas (6) composed by intersections of the ribbings, supporting disk (7) positioned between flanges, plastic net (11) attached to the flanges, circumferential (12) and longitudinal (13) ribbings, hollow areas (14) of the net and tubular body (1).

2. A dye tube as in claim 1, in which said comprising hollows (8) on the left (2) and right (3) flanges of tubular body (1) to prevent dye effluent collection.

3. A dye tube as in claim 1 and claim 2, in which said comprising grooves (9) on the outer circumference of left flange (2) and grooves (10) on the inner circumference of right flange (3) of the tubular body (1).

4. A dye tube as in claim 1, claim 2, and claim 3, in which said comprising notches at the inner sides of left (15) and right (16) edges of the net (11).

5. A dye tube as in claims 1, claims 2, and claim 3, in which said possibilty of building up cylindrical or conic shaped tube.

Amended claims in accordance with Rule 137(2) EPC.

1. Plastic tube for dyeing of yarn packages comprising a plastic tubular body (1) and a plastic tubular net (11) placed around the tubular body (1), said tubular body (1) comprising longitudinal ribbings (4), circumferential ribbings (5) and hollow areas (6) composed by intersections of said ribbing (4.5), first and second flanges (2,3) being located at the ends of said tubular body (1), a supporting disc (7) being positioned between said flanges (2,3), said first and second flanges (2,3) being provided with circumferential hollows (8); said tubular net (11) being provided with longitudinal ribbings (13), circumferential ribbings (12) and hollow areas (14).

2. A dye tube as in claim 1, in which said comprising drain (canal) (9) on the outer circumference of first flange (2) and grooves (10) on the inner circumference of second flange (3) of the tubular body (1).

3. A dye tube as in claim 1 and claim 2, in which said comprising notches at the inner sides of left (15) and right (16) edges of the net (11).

4. A dye tube as in claims 1. in which said can also be build up as conic shaped tube.

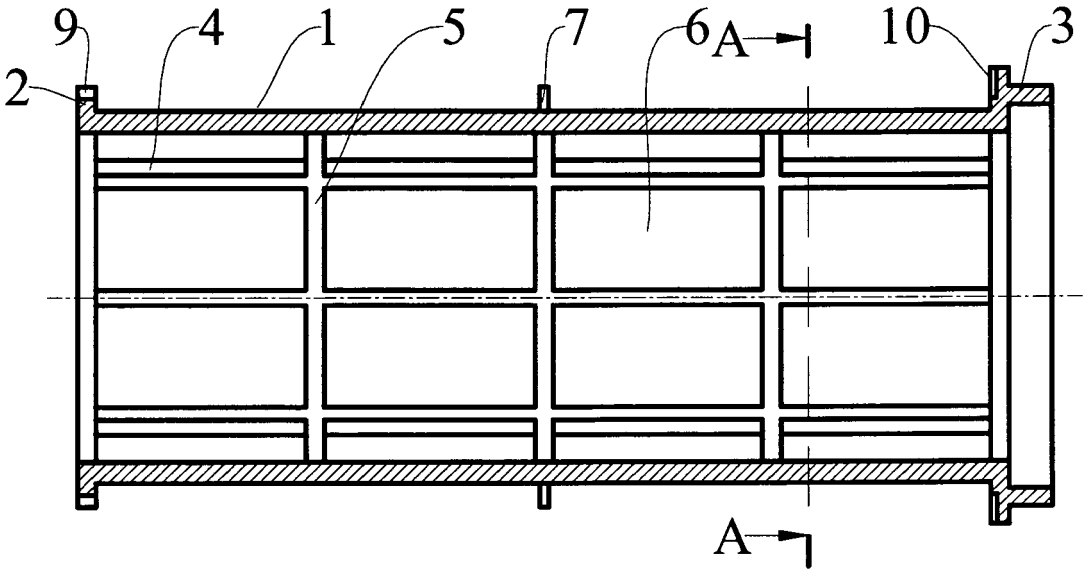

FIG.1

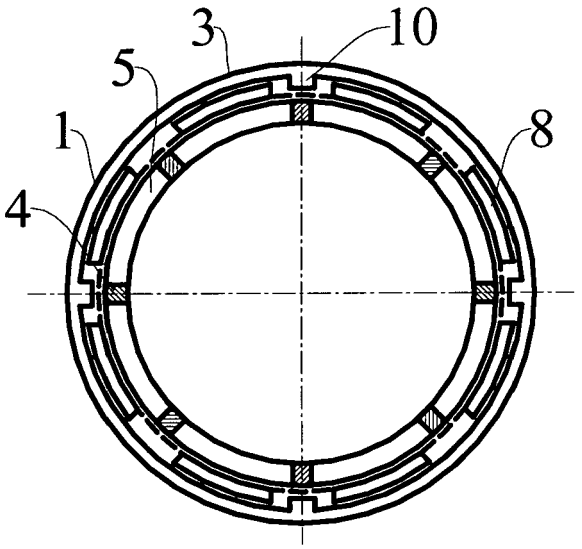

FIG.2

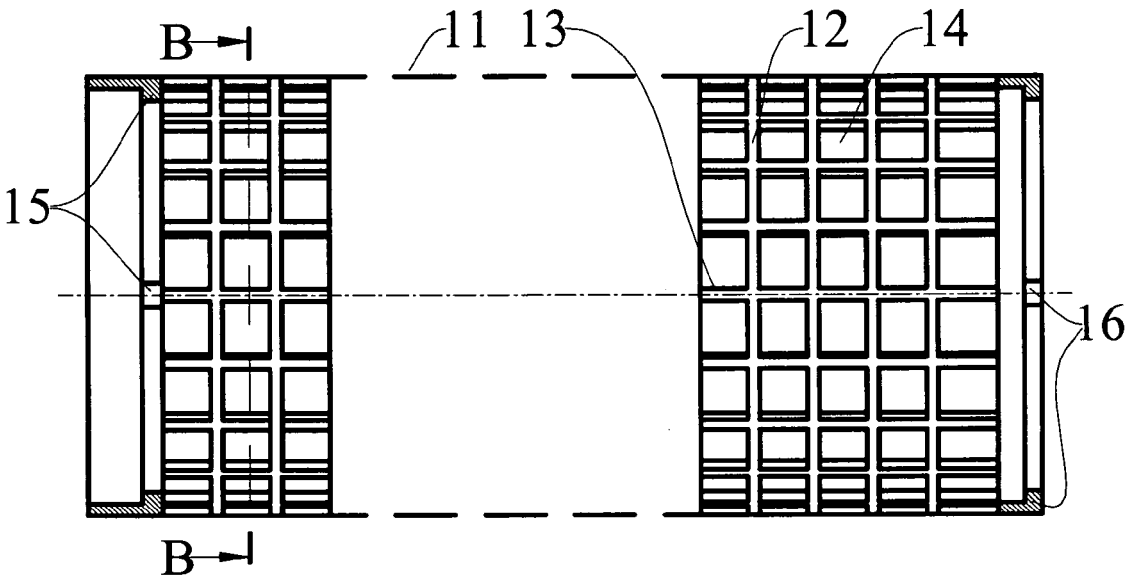

FIG.3

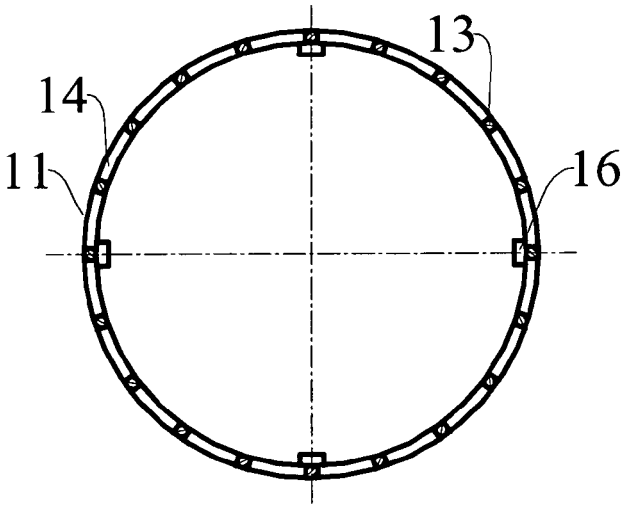

FIG.4

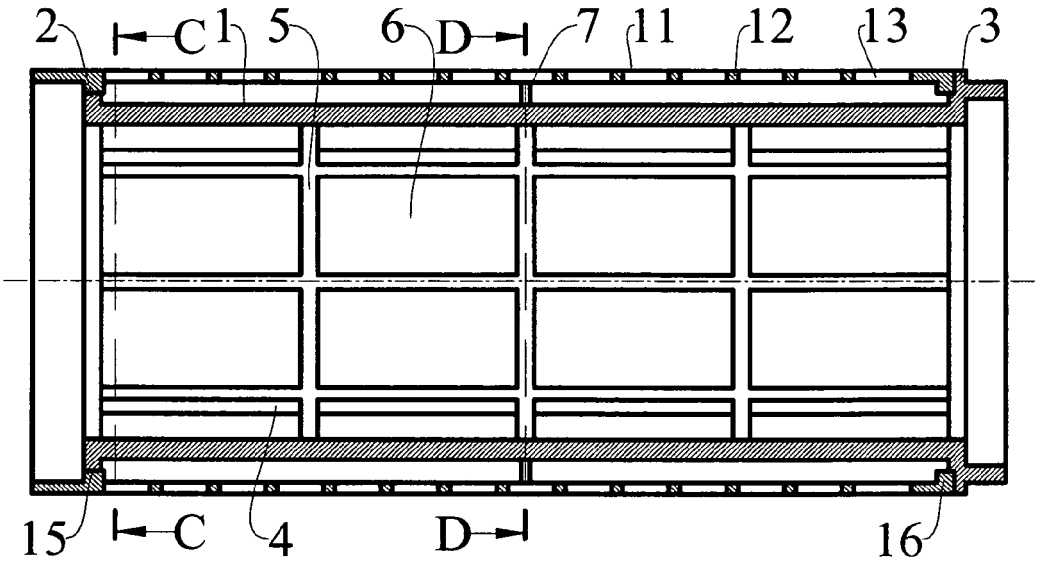

FIG.5

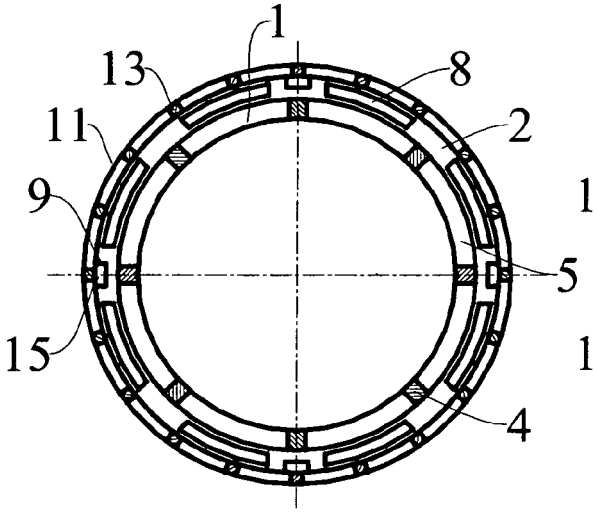

FIG.6

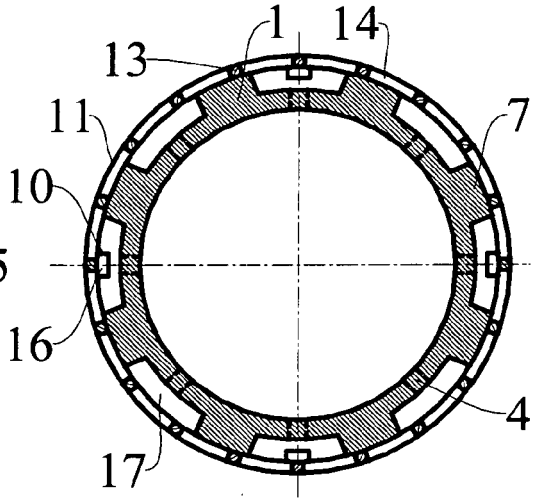

FIG.7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 00 0878

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	DE 10 56 569 B (JOSE JUNGBECKER) 6 May 1959 (1959-05-06) * the whole document *	1-5	INV. D06B23/04
A	US 2004/016842 A1 (COUCHEY BRIAN P [US]) 29 January 2004 (2004-01-29) * the whole document *	1-5	
A	US 3 882 698 A (LIVINGSTONE STANLEY ET AL) 13 May 1975 (1975-05-13) * the whole document *	1-5	
			TECHNICAL FIELDS SEARCHED (IPC) D06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 June 2008	Bichi, Marco

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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24-06-2008

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- US 5131595 A **[0006]**
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- TR 200601193 Y **[0007] [0009]**