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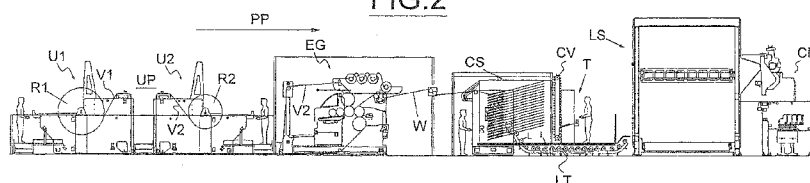
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(54) Title: PLANT AND PROCESS FOR THE PRODUCTION OF PAPER ROLLS

FIG.2



(57) Abstract: Process for the production of paper rolls, comprising a step of producing logs (L) of paper material by winding a pre-determined amount of paper web (W) about a tubular core (C) oriented transversely with respect to a direction (PP) of entering of the paper web (W) in a rewinder (R) in which said winding is executed, and a step of transverse cutting of the logs (L) to obtain rolls (R) of predetermined length. The cores (C) are produced by a tube-forming machine (T) whose position is intercepted by the direction (PP) of the paper (W) entering the rewinder (R).

TITLE

Plant and process for the production of paper rolls.

DESCRIPTION

5 The present invention relates to a plant and a process for the production of paper rolls.

It is known that the production of paper logs involves the feeding of a continuous paper web along a predefined path. At a preset point of said path, a transverse discontinuous cut is made on the paper to
10 subdivide it into portions or sheets each having a predetermined length. This known technique involves the use of tubular cardboard elements, commonly said cores, on whose surface is distributed a predetermined amount of glue to allow the gluing of the first sheet
15 of the log to be formed. This technique also provides for the use of winder rollers, positioned and acting in a logs forming station, which cause the rotation of the core on which the paper web is wound. The formation of a log is completed after that a predetermined amount
20 of paper is wound on the core. At this point, another log is formed. At the end of the log formation process it is necessary to glue the last sheet of each log on the underlying one in order to avoid the spontaneous unwinding of the paper web. Cutting-off machines are
25 subsequently used to subdivide each log into several rolls of smaller length to be packed.

Generally the production of paper rolls according to the scheme described above require that the tube-forming machines that produce the cores and the
30 cutting-off machines are oriented transversely with respect to the path followed by the paper. This implies, however, the need for very large spaces and, therefore, high financial investments are required for the acquisition of the necessary spaces. Typically, a
35 plant of the type described above, in fact occupies a

very wide surface.

The main purpose of the present invention is to propose a plant and a process for the production of paper rolls allowing a remarkable reduction of the space required for the installation of the machines, without compromising the efficiency of the process or the quality of the finished product.

This result is achieved in accordance with the present invention, by providing a system a plant and a process having the features indicated in the independent claims. Other features of the present invention are the subject of the dependent claims.

Among the main advantages offered by the present invention there is the fact that, by reducing the space required for the installation of the machines, less economic resources are required, which I positively reflects also on the cost of the finished product. In addition, since the production cycle is changed only with reference to some operational phases, the plant can be managed also by personnel that normally operates the traditional systems. A further advantage is the relatively low cost of the modifications required to implement the present invention with respect to conventional plants and processes. Furthermore, in case of a plant comprising two or more production lines, given the lesser surface occupied by each line, the lines can be arranged closer to each other and the plant occupies a less extended area and therefore offers the possibility of using less operators , in particular a smaller number of plant managers or supervisors, compared to a conventional plant having the same number of production lines.

These and other advantages and features of the present invention will be best understood by anyone skilled in the art thanks to the following description and to the

attached drawings, provided by way of example but not to be considered in a limitative sense, wherein:

- Fig.1 is a schematic top view of a plant in accordance with the present invention;
 - 5 • Fig.2 is a schematic side view of the plant shown in Fig.1;
 - Fig.3 is a view similar to that of Fig.2 but it refers to a further embodiment of the plant;
 - Fig.4 shows the path of the cores and the logs in
10 the area between the rewinder and the tube forming machine;
 - Fig.5 is a diagram showing the movements of the cores in the area between the rewinder and the tube forming machine;
 - 15 • Fig.6 shows the path of the logs and the cut rolls in the area between the accumulator for the logs and the cutting-off machine;
 - Figs. 7-9 schematically represent a part of the logs transport unit (LT);
 - 20 • Fig.10 is an enlarged detail of Fig.3.
- Reduced to its basic structure and with reference to the attached drawings, a plant for the production of paper rolls (for example, rolls of toilet paper or rolls of kitchen paper) in accordance with the present invention typically comprises:
- 25 - a paper unwinding station (UP) with one or more unwinders (in the example, the unwinders are two in number and are indicated by references "U1" and "U2") that support a corresponding number of paper reels
30 (R1, R2) from each of which a paper ply (V1, V2) unwounds;
 - a unit (EG) for coupling of the paper plies coming from the unwinding station (UP), an embossing in which said plies can be be embossed and joined together by

gluing to form a two-plies paper web (W);

- a rewinder (R) which on side receives the paper web (W) and on another side receives the tubular cores on which the paper web is wound to form the logs (L);

5 - a tube-forming machine (T) that produces the tubular cores;

- a first accumulator (CS), which receives and accumulates the cores produced by the tube-forming machine (T) and feeds the rewinder (R);

10 - a second accumulator (LS) which receives the logs produced by the rewinder (R);

- a transport unit (LT) which receives the logs outgoing from the rewinder (R) and transports them to the second accumulator (LS);

15 - a cutting-off machine (CM) which receives the logs coming from the second accumulator (LS) and subdivides them into rolls of lesser length.

The unwinders (U1, U2) allow the unwinding of the plies (V1, V2) from the reels (B1, B2). Said plies are

20 embossed and glued in the station (EG) that produces the web (W) formed by the embossed and glued plies.

The web feeds the rewinder (R) that provides for winding a predetermined amount thereof on each core (C) coming from the first accumulator (CS) and produced

25 by the tube-forming machine (T). The core (C) allows the winding of the web (W) around an axis defined by the longitudinal axis of the same core (C). The logs thus produced in the rewinder (R) reach the conveyor

(LT) which conveys them up to the second accumulator (LS).

30 The latter feeds the cutting-off machine (CM) that cuts the logs to obtain rolls of the desired length.

The tube-forming machine (T) and the cutting-off machine (CM) are oriented transversely to the path

(PP) followed by the paper web. Therefore, the cores produced by the tube-forming machine (T) and exiting from the latter move along a direction substantially perpendicular to said path (PP) and the rolls produced by the cutting-off machine (CM) go out from the latter also in a direction substantially perpendicular to said path (PP).

The first accumulator (CS) receives the cores produced by the tube-forming machine (T) by means of a vertical conveyor (VC).

The unwinders (U1, U2), the embossing and sizing unit, the rewinder, the accumulator for the cores, the accumulator for the logs, the tube-forming machine, the means for transferring the cores from the tube-forming machine to the first accumulator, the means for transferring the logs from the second accumulator to the cutting-off machine, and the cutting-off machine can be of the type normally used for the production of paper rolls. EP0454633 and US6715709 disclose rewinders; WO2011/089634 discloses an accumulator for tubular cardboard cores; WO2004/014641 discloses a tube-forming machine; US3926299 and US3762582 disclose devices for handling and storage of paper logs.

According to the example shown in Fig.2, the tube-forming machine (T) is placed downstream of the rewinding machine (R) and is positioned on a platform (1) under which is arranged the transport unit for the logs (LT). The cutting-off machine (CM) is placed downstream of the second accumulator (LS). Since the transport unit (LT) imposes a lateral deviation to the logs while they move towards the second accumulator (LS), the cutting-off machine (CM) may be positioned within the outline "A" of the production line, that is, within line formed by the unwinders, the embossing-

sizing unit, the rewinder, the first accumulator and the tube-forming machine. In the example, the transport unit (LT) determines a deviation (LD) of the logs to the left while the logs advance along the path comprised between the rewinder (R) and the second accumulator (LS). Thanks to the lateral deviation imposed to the logs that move towards the second accumulator (LS), the cutting-off machine (CM) can be arranged as described above and this reduces the overall width of the overall production line compared to the traditional plants that provide for a straight advancement of the logs between the rewinder and the accumulator for the logs. When seen from above, according to the example shown in the drawings, the transport unit for the logs (LT) is "S"-shaped. It is understood that, if required, when seen from above the transport unit of the logs (LT) can comprise a first rectilinear section, a second "S"-shaped section, and a third straight section. Otherwise, when seen from above the transport unit for the logs (LT) may include a "S"-shaped section preceded or followed by a straight section. Again, when seen from above the transport unit for the logs is rectilinear, oriented with a predetermined angle with respect to the above-mentioned path (PP). In any case, the output section of the transport unit for the logs (LT) is laterally displaced with respect to the centerline of the rewinder of a predetermined amount "B".

It is observed that with the current production requirements, characterized by high operating speeds (production rate of at least 60 logs per minute), the lateral displacement of the logs (not combined with the advancement) would require a conveyor surface with an extremely high friction coefficient which, however, implies damages to the surface of the logs. In the

past, such a solution has been adopted but for lower production rates (about 20 logs per minute). The combination of the advancement and the lateral displacement of the logs implies a lower speed lateral component without imposing any reduction of operating speeds.

Referring to the diagram of Figure 1, in an experimental facility built by the applicant's the dimension "A" was about 12.00 (twelve) meters and dimension "B" was 2.265 (two-point-two-hundred-sixty-five) meters. The experimental plant was intended to produce logs having a maximum size of 2850 mm.

With reference to the example shown in Fig.3, the machines arrangement (in particular, the arrangement of the unwinders, the embossing-sizing unit, the rewinder, the accumulators and the cutting-off machine) is the same as in the previous case but the tube-forming machine (T) is on the same base of the other machines and the transport unit (LT) has an ascending section for passing over the tube-forming machine (T). Also in this case, the transport unit (LT) obliges the logs to deviate sideways while advancing towards the second accumulator (LS).

In Fig.4 and Fig.6, where the constructive details of the individual machines (in particular, the constructive details of the rewinder and the first and second accumulator) are not illustrated, it is shown the path of the cores (C) and the logs (L) in the area between the rewinder (R) and the tube-forming machine (T).

In particular, Fig.4 shows: a first horizontal translation (1C) of the cores leaving the tube-forming machine above the transport unit (LT); a second horizontal translation (2C) of the cores (C) when entering the first accumulator (CS), the second

translation (2C) being orthogonal to the first (1C);
a third ascending vertical movement (3C) of cores (C)
in a stage prior to their exit from the first
accumulator (CS); a fourth descending vertical
5 movement (4C) of cores (C) when leaving the first
accumulator; a fifth horizontal translation (5C) of
cores (C) in the direction opposite to the first (1C);
a sixth horizontal translation (6C) of cores (C) when
they enter the rewinder (R); the transport unit (LT)
10 that determines the advancement and the simultaneous
lateral deviation of the logs (L). Fig.5 shows the
overall path followed by cores (C).

The translation (1C) is determined by the tube forming
machine (T) that, while producing the cores (C),
15 advances them, that is, forces them to move as shown
in Fig.4 (arrow "1C"). The translation (2C) is
determined by the inlet section of the first
accumulator (CS) which is normally provided with an
input section that picks up the cores from the tube-
20 forming machine (T). Within the first accumulator
(CS), the cores are supported by shaped bars that move
along a trajectory consisting of a succession of
vertical and horizontal sections. The translation (3C)
is the last run of the cores (C) within the first
25 accumulator (CS). The translation (4C) takes place at
the exit of the cores (C) from the first accumulator
(CS) and ends with the deposition of the same cores on
a belt conveyor (CW) that receives and transports the
cores determining the fifth translation (5C). The sixth
30 translation (6C) is determined by the fact that the
conveyor (CW) is provided, in a per se known manner,
of inclined cylindrical rollers (CR) that determine
the sliding of the cores (C) towards the rewinder: in
fact movements 5C and 6C are combined even if in the
35 drawings they are represented as separated movements

for the sake of clarity.

In Fig.6, where the constructive details of the individual machines (in particular, the constructive details of the rewinder, the second accumulator and the cutting-off machine) are not illustrated, it is shown the path of the logs (L) in the area between the rewinder (R) and the cutting-off machine (CM).

In particular, Fig.6 shows, downstream of the transport unit (LT) that, as mentioned above, moves the log (L) along an advancing path comprising a lateral deviation: a first ascending vertical translation (1L) of logs (L) when entering the second accumulator (LS); a second descending vertical movement (2L) of logs (L) in a stage prior to their exit from the second accumulator (LS); a third horizontal translation (3L) of the logs (L) when exiting from the second accumulator (LS); a fourth horizontal translation (4L), orthogonal to the third (3L), of the logs in a step of advancing towards the blade of the cutting-off machine (CM). In Figure 6 the rolls produced by the cutting of the log (L) by means of the cutting-off machine (CM) are denoted by reference "RO". Inside the second accumulator (LS), the logs (L) are supported by shaped bars that move along a trajectory consisting of a succession of vertical and horizontal sections. In its terminal part (part facing the cutting-off machine), the second accumulator (LS), that can be of the known type comprising a series of log-supporting bars (PL) moved by chains, is extended horizontally above the channels (CT) on which the logs normally slide when entering the cutting-off machine. Between the log-supporting bars (PL) and the channels (CT) are interposed corresponding so-called pre-load channels (CC) that receive the logs from the log-supporting bars of the

accumulator (LS) and discharge them onto the channels (CT) of the cutting-off machine in synchronism with the pushers acting on the logs in the cutting-off machine according to a process known per se.

5 The transport unit for the logs (LT) that makes the logs to deviate laterally while they advance towards the cutting-off machine (CM) allows to make use of conventional machines for making the plant and, at the same time, allows the positioning of the cutting-off
10 machine (CM) and the tube-forming (T) within the outline of the production line arranged upstream and comprising the rewinder (R), the embossing-sizing unit (EG) and the unwinding unit (UP).

The transport unit for the logs (LT) consists, for
15 example, of three motor-driven loop chains constituted by meshes (MC) joined together by ball joints (SM), contained in guides (GC) having the desired orientation and equipped, at regular intervals, with blades (PC) that in operation are destined to be in
20 contact with the back of the logs.

In practice, the transport unit (LT) forms a flow diverter for the logs (L), in the sense that it makes possible possible to divert the flow of logs exiting from the rewinder and place the cutting-off machine
25 (CM) with its feeding channels (CT) also in an offset position with respect to the rewinder.

As shown in the drawings, the tube-forming machine (T) is located within the outline of the production line formed by the unwinders, the embossing-sizing unit and
30 the rewinder.

Compared to a conventional plant, in which the tube-forming machine (T) is external to the production line formed by the unwinders, the embossing-sizing unit and the rewinder, there is a considerable saving of ground
35 area in manufacturing the logs production plant. For

example, for equal maximum size of the logs (logs length equal to 2850.00 mm) and hence the same machines used, in a traditional system the dimension "A" previously mentioned assumes a value of about 20
5 meters. By contrast, as mentioned earlier, positioning the tube (T) as in the diagram of Fig.1, that is, by placing the tube-forming machine (T) such that it is intercepted by the direction (PP) that represents the path of the paper (W) from the unwinders to the
10 rewinder, the dimension "A" has a value almost halved. It is understood that, where the accumulation of the logs (L) upstream of the cutting-off machine (CM) is not required, the transport unit (LT) directly connects the rewinder (R) with the cutting-off machine
15 (CM).

The tube-forming machine (T) can be placed downstream of the rewinder and upstream of the cutting-off machine, or upstream of the rewinder.

In practice the details of execution may vary according
20 to what regards to the individual elements described and illustrated, without thereby departing from the scope of the adopted solution idea and, thereby, remaining within the limits of the protection granted by this patent.

CLAIMS

- 1) Process for the production of paper rolls, comprising
a step of producing logs (L) of paper material by
winding a predetermined amount of paper web (W) about
5 a tubular core (C) oriented transversely with respect
to a direction (PP) of entering of the paper web (W)
in a rewinder (R) in which said winding is executed,
and a step of transverse cutting of the logs (L) to
obtain rolls (R) of predetermined length,
10 characterized in that said cores (C) are produced by
a tube-forming machine (T) whose position is
intercepted by the direction (PP) of the paper (W)
entering the rewinder (R).
- 2) Process according to claim 1 characterized in that
15 comprises a step of transporting the logs (L) from a
rewinder (R) that produces the logs(L) toward a
cutting-off machine (CM) that cuts them transversely
and characterized in that said transporting step
involves the handling of the logs (L) along a path
20 comprising a lateral deviation, so that, as they
advance, the logs (L) are subjected to said lateral
deviation.
- 3) Process according to claim 2 characterized in that,
seen in plan view, the said path comprises a "S"-shaped
25 part.
- 4) Process according to claims 1 and 2 characterized in
that said path comprises a part that passes beneath
the tube-forming machine (T) which produces the cores
(C).
- 30 5) Process according to claims 1 and 2 characterized in
that said path comprises a part that passes over the
tube-forming machine (T) which produces the cores (C).
- 6) Process according to claim 1 characterized in that
comprises a step of accumulation of the logs in an

- accumulator for logs (LS) before their entry into the cutting-off machine (CM), so that said path is comprised between the rewinder (R) and the accumulator of the logs (LS) and the latter supplies the cutting-off machine (CM).
- 5
- 7) Process according to claim 1, characterized in that the said cores (C) are produced at a point located downstream of the rewinder (R).
- 8) Plant for the production of paper rolls, comprising a rewinder (R) that produces logs (L) of paper material (W) wound around a tubular core oriented transversely with respect to a direction (PP) of entering of the paper web (W) in the rewinder (R), and comprising a tube-forming machine (T) that produces the cores (C),
- 10
- characterized in that the tube-forming machine (T) is located at a position that is intercepted by the direction (PP) of the paper (W) entering in the rewinder (R).
- 15
- 9) Plant according to claim 8, comprising a cutting-off machine (CM) that cuts the logs (L) transversely to obtain rolls (RO) of predefined length, and a transport unit (LT) adapted to move the logs (L) from the rewinder (R) toward the cutting-off machine (CM), wherein said transport unit (LT) comprises an inlet section and an outlet section for the logs (L),
- 20
- characterized in that said transport unit (LT) comprises a part between said logs input and output sections adapted to impose a lateral deviation to the same logs while they advance towards the outlet section, the output section of the transport unit (LT) being laterally offset by a predetermined value (B) with respect to the input section.
- 25
- 30
- 10) Plant according to claim 8, characterized in that, seen in plan view, said logs (L) transport unit comprises a "S"-shaped part.
- 35

- 11) Plant according to claim 8 characterized in that said logs transport unit (LT) comprises a part that passes beneath a tube-forming machine (T) which produces the cores (C).
- 5 12) Plant according to claim 8 characterized in that said logs transport unit (LT) comprises a part that passes over a tube-forming machine (T) which produces the cores (C).
- 10 13) Plant according to one or more of claims 8 to 12 characterized in that it comprises an accumulator for logs (LS) upstream of the cutting-off machine (CM), so that said logs transport unit is positioned between the rewinder (R) and the accumulator for logs (LS) and the latter supplies the cutting-off machines (CM).
- 15 14) Plant according to one or more of claims 8 to 13, characterized in that the tube-forming machine (T) is located downstream of the rewinder (R) with respect to the path (PP) followed by the paper web (W) entering the same rewinder (R).
- 20 15) Plant according to claim 8, characterized in that the tube-forming machine (T) is positioned downstream of the rewinder (R) and upstream of the cutting-off machine.
- 25 16) Plant according to claim 8, characterized in that the tube-forming machine (T) is positioned upstream of the rewinder.

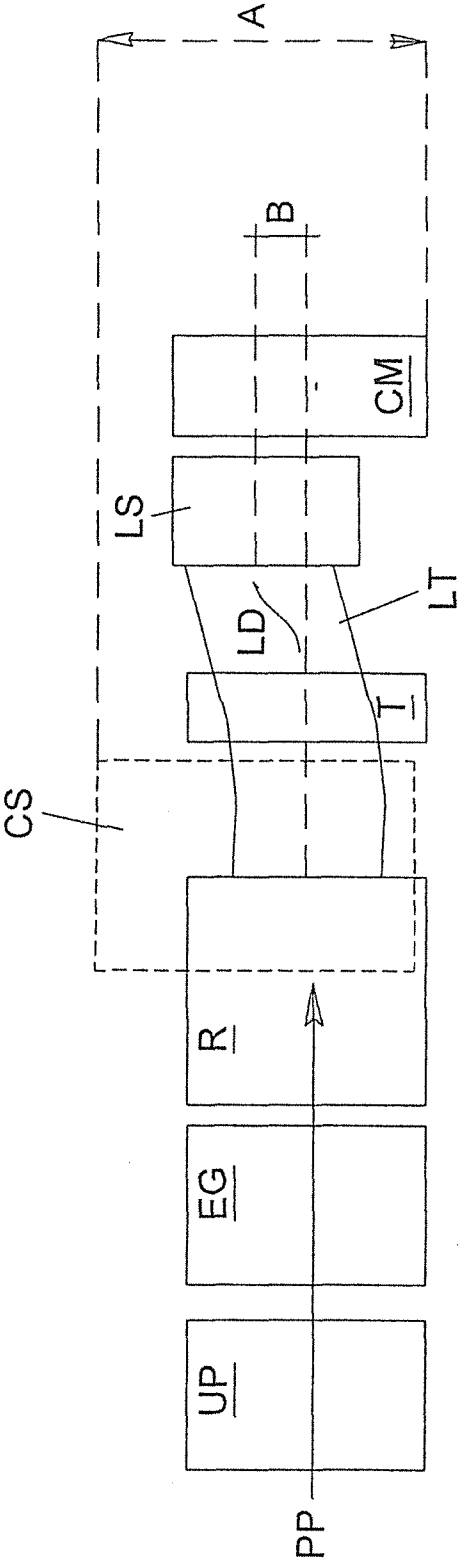


FIG.1

FIG.2

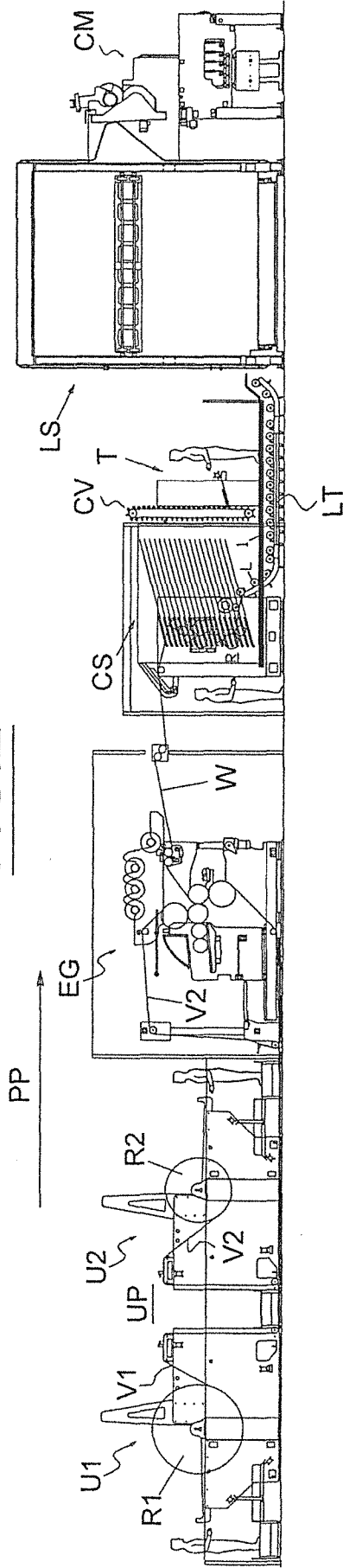
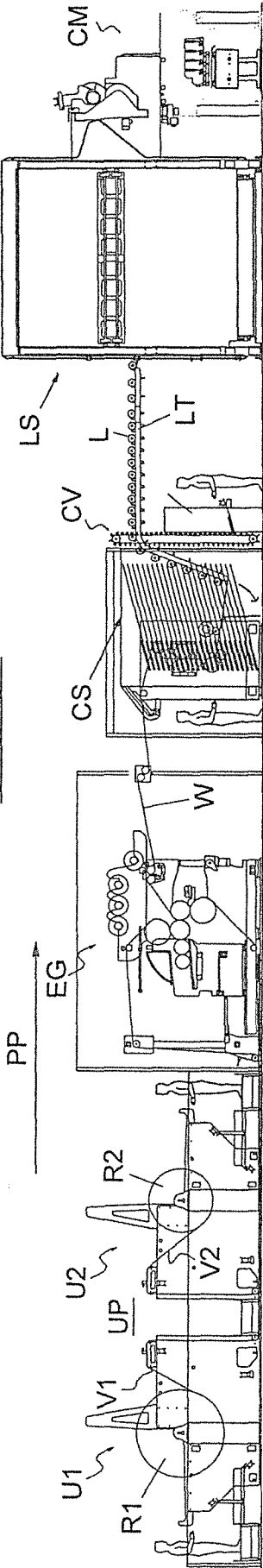
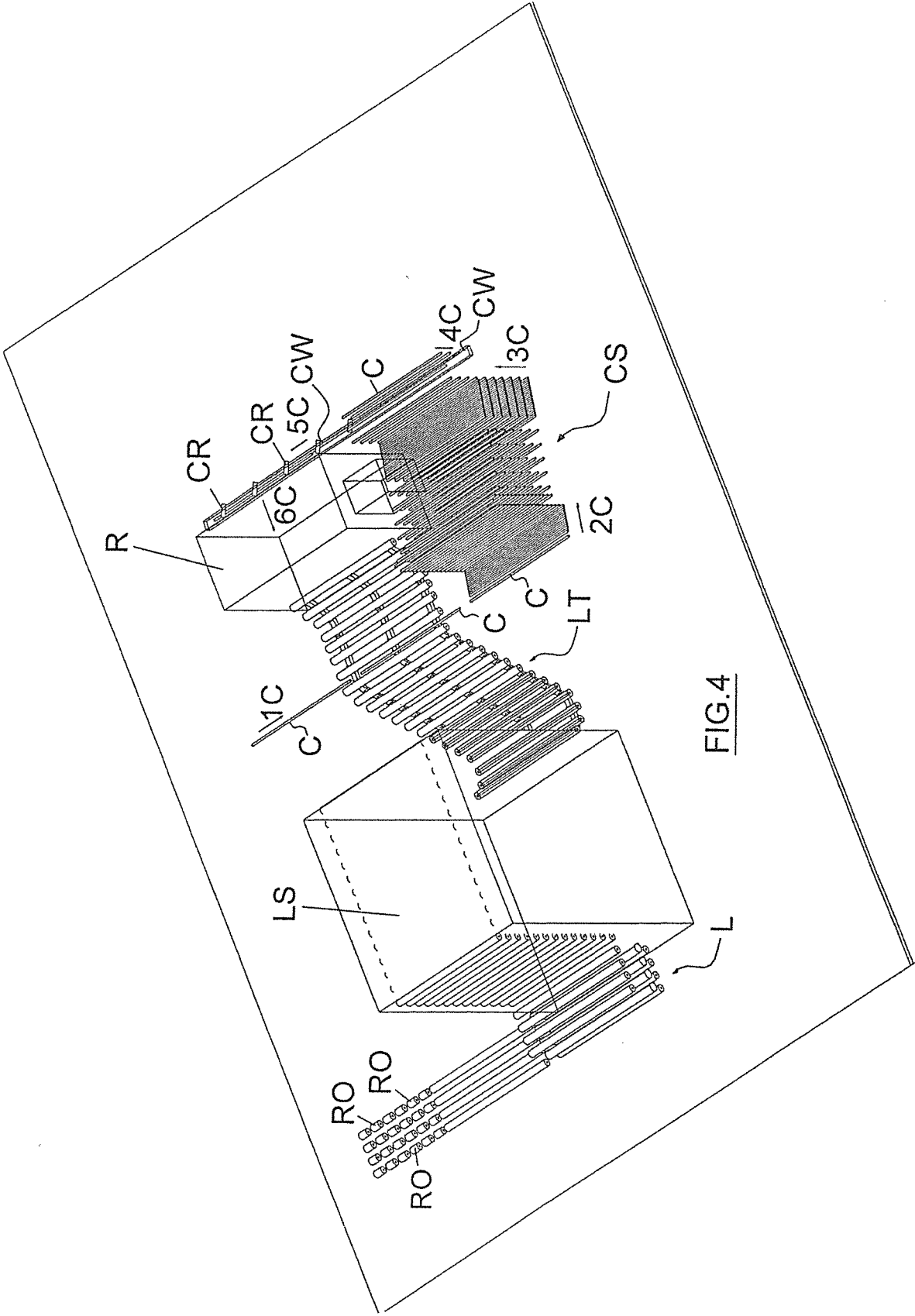
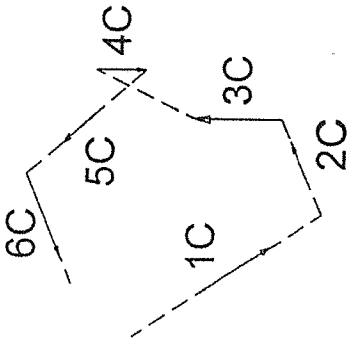
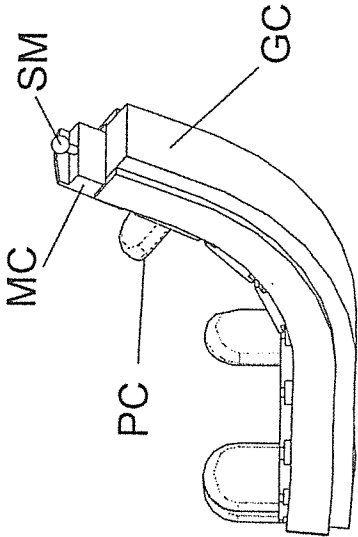
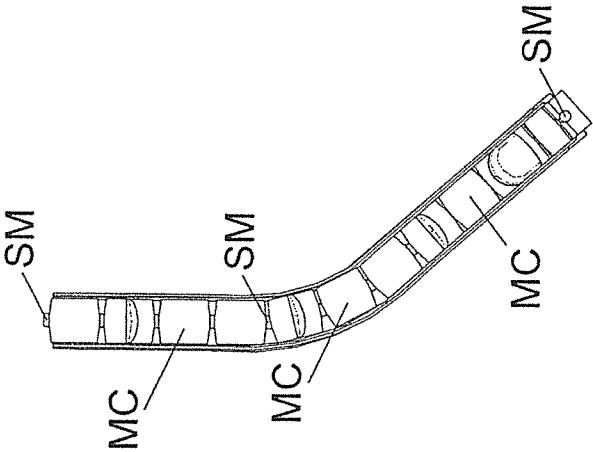
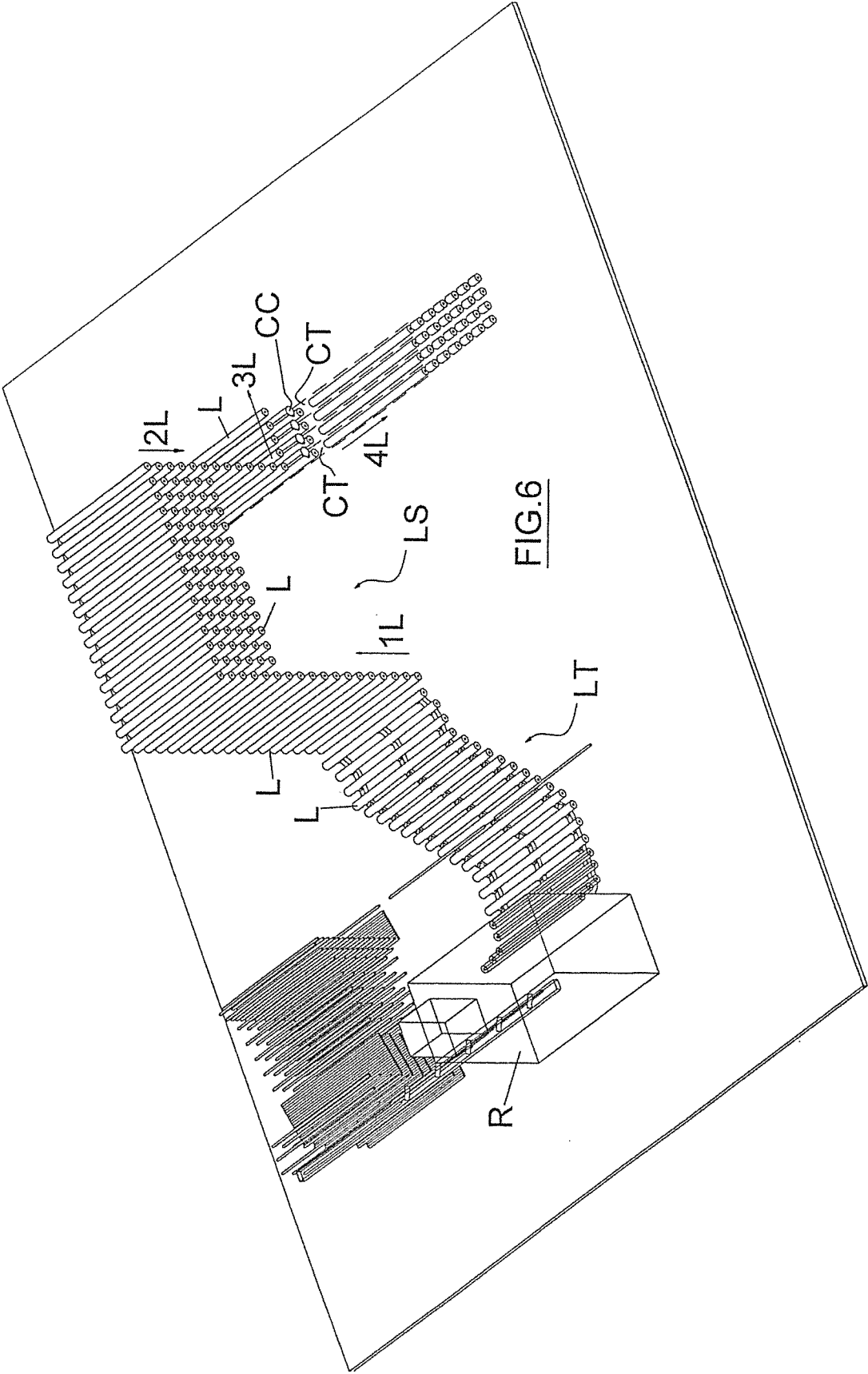


FIG.3









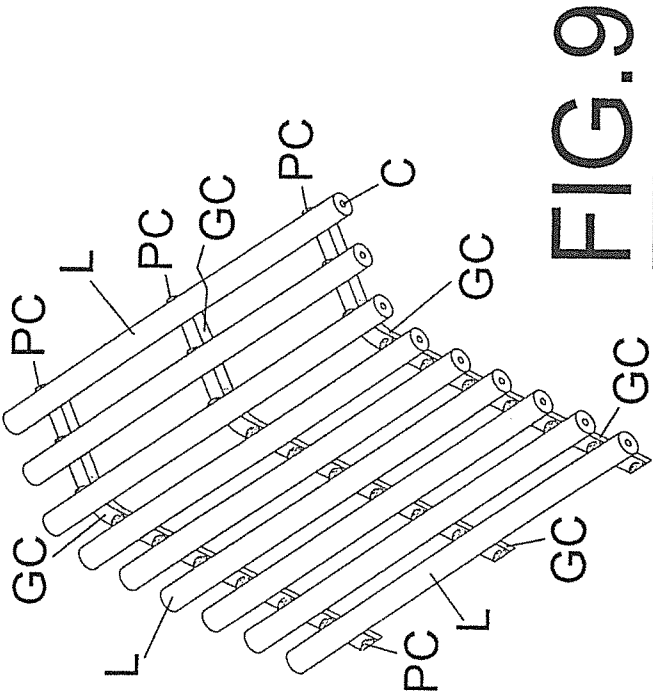


FIG. 9

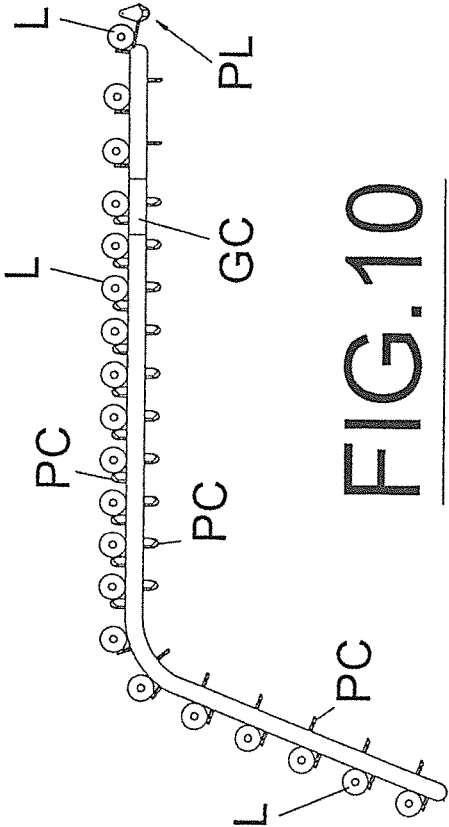


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2015/000276

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65H19/22
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 344 091 A (MOLISON ROBERT E [US]) 6 September 1994 (1994-09-06) column 6, line 54 - column 9, line 42; figures -----	1,8
A	US 2012/297944 A1 (MADDALENI ROMANO [IT] ET AL) 29 November 2012 (2012-11-29) -----	1,8
A	US 2007/023562 A1 (PERINI FABIO [IT]) 1 February 2007 (2007-02-01) -----	1,8
A	US 2006/052196 A1 (GELLI MAURO [IT] ET AL) 9 March 2006 (2006-03-09) abstract; figures -----	1,8



Further documents are listed in the continuation of Box C.



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