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(54) Embossing assembly for web-like materials

(57) An embossing assembly comprising a support housing (3) and a pair of cylinders (1, 2) with parallel and counterrotating axes, supported by the housing so as to define a lamination gap (G) between them, characterized in that each of said cylinders comprises a pair of frusto-conical end sections (1c, 1d, 2c, 2d) having respective conicities that are directed equally in the same cylinder and oppositely between one cylinder and the other, the sections being in matching pairs between the cylinders (1, 2) and radially pressing each other with a certain degree of preload. The assembly comprises means (7, 8) for controlling the axial position of at least one of said cylinders, thereby a variation of said positioning is responded to by a radial approaching between said cylinders (1, 2) and a consequent variation in height of said gap (G).

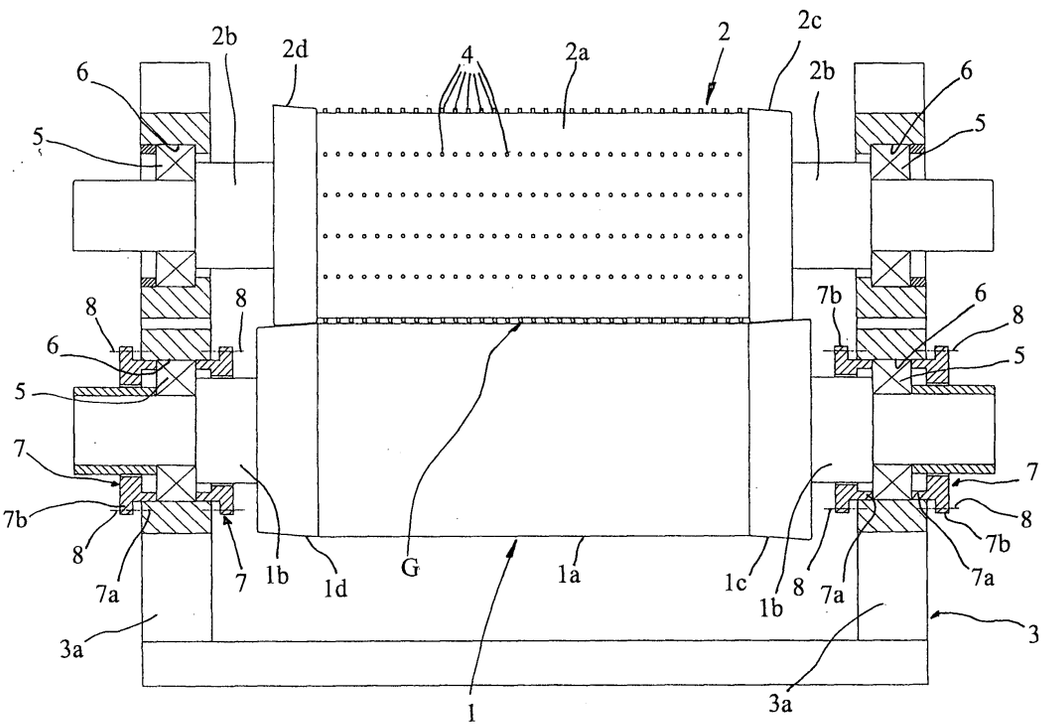

Fig. 1

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Description

[0001] The present invention refers to a device for embossing web-like materials such as - typically - plies of paper, tissue-paper and the like, for producing multi-ply articles, for example serviettes or tissues, consisting of two or more embossed and mutually joined plies.

[0002] In the production of the aforementioned products, the embossing operation is used to increase the bulk and softness of the finished product, improving its moisture holding capacity and giving it a more attractive appearance, thanks to the decoration that the embossing points are able to compose over the surface of the material.

[0003] In the prior art, embossing is carried out according to various methods in which the web of material passes into a lamination gap defined between two counter-rotating cylinders. In one of such methods, known as "tip-to-plane" embossing, one of the two cylinders is provided with a distribution of radial projections, constituting the embossing points. The other cylinder, on the other hand, has a smooth surface. The height of the lamination gap, that is a function of the radial distance between the cylinders, is suitably sized in relation to the thickness of the material being treated, so that the latter is pressed by the points of one cylinder against the smooth surface of the other, thus realizing the embossing.

[0004] The radial reaction that the two cylinders exchange with each other clearly discharges between the tips and the area in contact with them on the surface of the other cylinder, thus creating very high specific pressures. The two cylinders therefore suffer from relatively quick wear, with a consequent increase in height of the lamination gap and progressive deterioration of the embossing action. Regarding this, it must be kept in mind that, when a material like tissue-paper is treated, the dimensions involved are very small, for which reason a minimal wear is capable of compromising the effectiveness of the result.

[0005] The disassembly of the cylinders, having a remarkable size, and restoring them to their original condition are extremely problematic, laborious and expensive operations, in particular involving that accurate surface finishing treatments be carried out. Therefore, embossing assemblies have been proposed equipped with a system for adjusting the radial distance between the cylinders, suitable for allowing the elimination of the excess clearance that progressively forms due to the wear.

[0006] In particular, according to that which is described in European Patent Publication EP1080876, cylinders have been proposed equipped with ends having a dismountable structure. In brie, each of said end structures comprises, between a support upright and the actual body of the cylinder, an annular element, defining on the inside a frusto-conical seat for engagement with a corresponding portion formed by said body. On the outside, the annular element defines a cylindrical surface cooperating with the other cylinder of the assembly. Through an adjustment device comprising screws arranged axially in the frusto-conical portion of the cylinder, it is possible to control the relative axial position between said body and the annular element, so as to reduce the height of the lamination gap, when required for the elimination of the clearance.

[0007] The solution just described actually allows the useful life of the cylinders to be substantially extended, since thanks to the elimination of the clearance the assembly can continue to work with maximum effectiveness also as wear progressively increases. Nevertheless, such a result is achieved at the expense of a substantial structural complication of the cylinders, for which reason the embossing assembly is more expensive and more problematic to maintain.

[0008] The object of the present invention is therefore that of providing a new embossing assembly for web-like materials, in particular but not exclusively for the production of multi-ply paper articles, which allows an accurate adjustment of the height of the lamination gap defined between the two counter-rotating cylinders, by means of a much simpler solution with respect to the known one referred to above.

[0009] Such object is achieved with the embossing assembly according to the present invention, the essential characteristics of which are defined in the first of the attached claims.

[0010] Characteristics and advantages of the embossing assembly according to the present invention shall become clearer from the following description of an embodiment thereof, given as a non-limiting example, with reference to the attached figure 1, which shows an axial section view of an embossing assembly according to the present invention.

[0011] With reference to said figure, a tip-to-plane embossing assembly according to the invention comprises a pair of cylinders 1, 2 rotatably supported by a housing 3. The general configuration of the assembly corresponds to the conventional one, with the two cylinders on top of one another so as to define a lamination gap G along a generatrix of mutual tangency. Traditional is also the drive system of the cylinders, not represented in the figure.

[0012] The lower cylinder 1 exhibits a smooth surface on the lamination gap G, whereas the upper cylinder 2 is the actual embossing cylinder, carrying a distribution of embossing points 4. Both of the cylinders have respective shaft portions 1b, 2b, projecting axially from the actual body 1a, 2a and rotatably supported by uprights 3a of the housing 3, through rolling bearings 5 arranged in seats 6. However, according to the invention, one of the two cylinders, in the example the upper cylinder 2, is supported in an axially fixed manner, whereas the position of the other cylinder 1 along its own axis can be varied.

[0013] Indeed, the arrangement of each shaft portion 1a on the corresponding upright 3a comprises a pair of

stop rings 7, engaged but not locked within the seat 6, defining respective shoulders 7a on which there abuts at the two sides the outer ring of the bearing 5, in turn not locked within the seat 6. At the opposite end with respect to the shoulders 7a, outside the seat 6, the rings also have respective peripheral lips 7b, projecting radially a certain distance from the upright 3a. The upright 3a and the lips 7a are connected via screw members 8, schematically represented by the relative axes, distributed equally spaced apart along the perimeter of the lips. The connection is such that thanks to a coordinated screwing of the screw members it is possible to control the axial position of the rings 7, and consequently of the bearings 5, and thus of the entire lower cylinder 1.

[0014] Returning to the cylinders 1, 2, the body 1a, 2a of each of them has frusto-conical end sections 1c, 1d, 2c, 2d, forming matching pairs and radially pressing each other with a certain degree of preload. More specifically, with reference to the configuration of the example, the lower cylinder 1 has, at the right-hand end (seen as in the figure), a section 1c with increasing diameter starting from the diameter of the body 1a, up to the edge beyond which the relative shaft portion 1b projects. Correspondingly, the body 2a of the upper cylinder 2 has an equal and opposite tapering section 2c, i.e. with a decreasing diameter towards the end. In this second case, the end section detaches from the working surface of the relative body with a step, this being obviously necessary to ensure a suitable spacing between the working surfaces of the two cylinders, i.e. those which define the lamination gap G. At the other end, two frusto-conical sections 1d, 2d fit together in an analogous manner, the lower cylinder 1 and the upper cylinder 2 having this time, respectively, a decreasing and increasing diameter moving towards the extreme edge of the body.

[0015] The normal working of the embossing assembly according to the invention is totally conventional. The two cylinders 1 and 2 rotate in opposite directions with the frusto-conical sections 1c, 2c, 1d, 2d that are kept in contact with each other. However, when through wear the lamination gap G starts to get too high, compromising the effectiveness of the result, the screw members 8 are operated to command an axial displacement of the lower cylinder 1, in this case from left to right. The axial displacement of the frusto-conical sections 1c, 1d of the lower cylinder is responded to, with the partial release of the initial load, by a downward displacement of the matching sections 2c, 2d of the upper cylinder, and a consequent radial approach between the working surfaces of the two cylinders 1, 2 to give again the desired height to the gap G.

[0016] The displacements described above, although outlined macroscopically, have actually a substantially micrometric magnitude. The operation can therefore be repeated many times over, until the degree of wear shall be such as to prevent any elimination of the clearance, and then one inevitably has to proceed to the disassembly of the cylinders for them to be restored.

[0017] From the above it will be apparent that the object of allowing a precise adjustment of the radial distance of the two cylinders of the embossing assembly, in order to eliminate the excess clearance caused by wear, is accomplished with a much simpler solution with respect to the one offered by the prior art mentioned in the introductory part. Indeed, the structure of a single cylinder does not provide for dismountable and/or mutually mobile parts, and is thus much more simple and cost-effective to manufacture. In practice, with respect to a normal assembly without the possibility of adjustment, the assembly according to the invention only requires the realization of the frusto-conical sections, and the axially mobile arrangement of one of the two cylinders, characteristics that can be achieved by means of relatively basic workings and constructive measures. Also from the operational point of view, the solution hereby proposed stands out for its simplicity, cost-effectiveness and reliability.

[0018] The invention has been described with reference to its general configuration, the constructive details that have not been specified being obvious for a man skilled in the art. In particular, the angle of the frusto-conical sections shall be selected according to the specific circumstances of use, above all in relation to the size of the cylinders and the characteristics of the means for controlling the axial position. A semi-opening angle of the cone of around 5° shall, however, be compatible with the most typical sizes of the assemblies adopted in the field to which reference has been made.

[0019] The invention is not, however, limited to the embodiment described and illustrated above, but comprises any constructive variation thereof. In particular, an equivalent result can be obtained with an axially movable arrangement of also (or only) the upper cylinder, and with the frusto-conical sections arranged mirror-like with respect to the arrangement of the illustrated embodiment. The means for controlling the axial position can also have different constructive arrangements from those exemplified with the rings 7 and the adjustment screw members 8.

Claims

1. Embossing assembly comprising a support housing (3) and a pair of cylinders (1, 2) with parallel and counter-rotating axes, supported by said housing (3) so as to define a lamination gap (G) between them, **characterized in that** each of said cylinders (1, 2) comprises a pair of frusto-conical end sections (1c, 1d, 2c, 2d), said sections having respective conicities that are directed equally in the same cylinder, and oppositely between one cylinder and the other, said sections being in matching pairs between the cylinders and radially pressing each other with a certain degree of preload, the assembly being also **characterized in that** it comprises means

(7, 8) for controlling the axial position of at least one of said cylinders, thereby a variation of said position is responded to by a radial approaching between said cylinders (1, 2) and a consequent variation in height of said gap (G).

2. Assembly according to claim 1, wherein one of said cylinders (1, 2) exhibits a smooth surface to said lamination gap (G), whereas the other cylinder carries a distribution of embossing points (4), said control means (7, 8) being arranged on the cylinder (1) with a smooth surface.

3. Assembly according to claim 2, wherein said cylinders comprise respective bodies (1a, 2a) defining the actual working surfaces and axially extending shaft portions (1b, 2b), which are rotatably connected to said housing (3), said frusto-conical sections (1c, 1d, 2c, 2d) being defined at the axial ends of said bodies (1b, 2b).

4. Assembly according to claim 3, wherein said smooth surfaced cylinder (1) has two frusto-conical sections (1c, 1d) of respectively increasing and decreasing diameter starting from said working surface and moving towards the ends, and said embossing cylinder (2) has two frusto-conical sections (2c, 2d) of equal and opposite tapering with respect to the frusto-conical sections (1c, 1d) of said smooth surfaced cylinder (1), and which depart from the working surface of the relative body (2a) with a step of a height substantially corresponding to said lamination gap (G).

5. Assembly according to claim 3 or 4, wherein said means (7, 8) for controlling the axial position of a cylinder (1) comprise, for each shaft portion (1b), a pair of stop rings (7), engaged but not locked within a seat (6) formed in an upright (3a) of said housing (3), defining respective shoulders (7a) on which there abuts at the two sides the outer ring of a bearing (5) on which said shaft portion (1b) is mounted, said bearing being in turn engaged but not locked within said seat (6), said rings (7) also having, at the opposite end with respect to the shoulders (7a), said opposite end being arranged outside of said seat (6), respective peripheral lips (7b) projecting radially at a certain distance from said upright (3a), said control means also comprising screw members (8) extending between said lips (7b) and said uprights (3a), thereby the coordinated operation of said screw members (8) is able to control the axial position of said rings (7), and with them of the relative bearings (5) and thus of the entire cylinder (1).

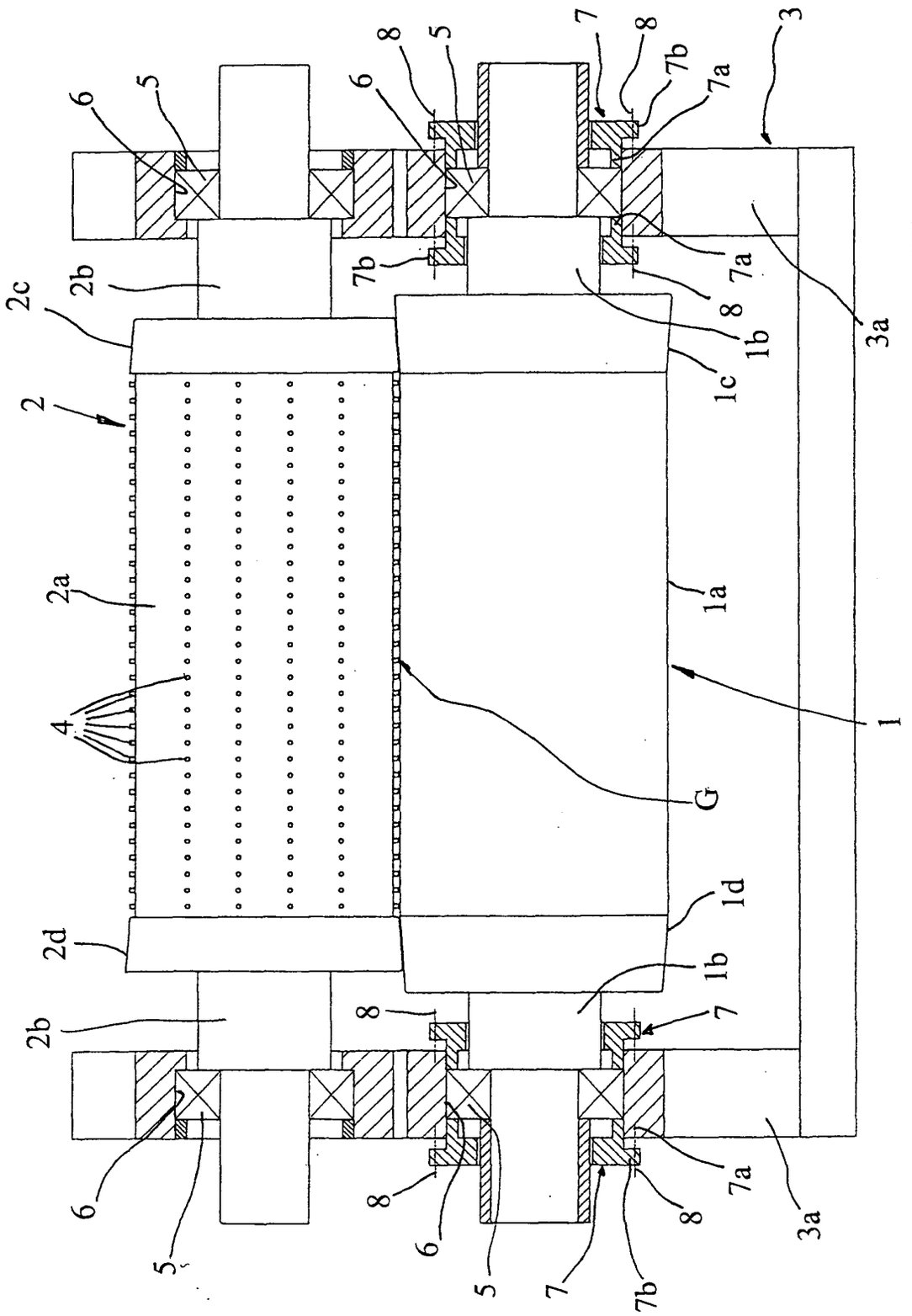

Fig. 1