Claims

1. A device for producing packaging material from paper,
with means for feeding at least one first paper web (6) and one second paper web (8) to an embossing region (30) and to a pressing region (32) downstream of the embossing region (30) in the feed direction of the paper webs (6, 8),

with an embossing apparatus (16, 18) arranged in the embossing region (30) of the device for embossing the first paper web (6), wherein the embossing apparatus is designed and set up in such a way that shaped regions (11) are created from the first paper web (6) and project beyond the first paper web (6) and each being limited by a closed circumferential line in the paper web plane of the first paper web (6),

with a pressing apparatus (20, 18) arranged in the pressing region (32) of the device for press-fitting the paper webs (6, 8) free of adhesive and connecting synthetic auxiliary material, in particular free of plastics film, wherein the pressing apparatus (20, 18) is designed and set up in such a way that, in connecting portions (110, 112) between the shaped regions (11), paper fibers of the first paper web (6) are connected to paper fibers of the second paper web (8), and wherein the paper webs (6, 8) limit closed cavities (108) in the region of the shaped regions (11), and

with preconditioning means arranged in the feed direction upstream of the embossing region (30) and/or the pressing region (32) with at least one preconditioning apparatus (12) for preconditioning the first paper web (6) and/or the second paper web (8) for embossing the first paper web (6) or press-fitting the paper webs (6, 8) together.

2. The device according to claim 1, wherein at least one preconditioning apparatus (12, 14) is designed and set up for applying or introducing a preconditioning liquid, which is or contains preferably water, onto or into at least one of the paper webs (6, 8).

3. The device according to claim 1 or 2, wherein at least one preconditioning apparatus (12, 14) is designed and set up for spraying, nebulizing or evaporating a preconditioning liquid in

such a way that the preconditioning liquid is sprayed, nebulized or evaporated onto the associated paper web (6 or 8).

4. The device according to any one of the preceding claims, wherein at least one preconditioning apparatus, in particular a preconditioning apparatus (12) associated with the first paper web (6), is designed and set up for steaming the associated paper web (6) with steam.

5. The device according to any one of the preceding claims, wherein each of the paper webs (6, 8) is associated with a separate preconditioning apparatus (12 or 14) for separate, in particular, different preconditioning of the paper webs (6, 8).

6. The device according to any one of the preceding claims, wherein the first paper web (6) is associated with a first preconditioning apparatus (12) which is arranged on the feed path of the first paper web (6) to the embossing region (30), and wherein the second paper web (8) is associated with a second preconditioning apparatus (14) which is arranged on the feed path of the second paper web (8) to the pressing region (32).

7. The device according to any one of the preceding claims, wherein at least one preconditioning apparatus, in particular, a preconditioning apparatus (14) associated with the second paper web (8), is designed and set up for introducing or applying a preconditioning liquid, preferably water, that contains cellulose fibers or cellulose particles, wherein the cellulose fibers or cellulose particles preferably are or contain microcellulose and/or nanocellulose, in particular, cellulose microfibers (CMF) and/or cellulose nanofibers (CNF).

8. The device according to any one of the preceding claims, wherein a roller arrangement (10) with an embossing roller (16), which is rotatably mounted about an embossing roller axis of rotation (15) and has embossing projections (42) on its circumferential surface for forming the shaped regions (11) in the first paper web (6), is arranged in the embossing region (30), wherein the embossing roller (16) is engaged with a counter roller (18) which is rotatably mounted about an axis of rotation (19) parallel to the embossing roller axis of rotation and has embossing recesses (44) on its circumferential surface which are designed to be complementary to the embossing projections (42) of the embossing roller.

9. The device according to any one of the preceding claims, wherein a press roller (20) which is rotatably mounted about a press roller axis of rotation (21) is arranged in the pressing region (32) and which, for press-fitting the first paper web (6) with the second paper web (8), cooperates with a rotatably mounted counter roller (18), the axis of rotation (19) of which is parallel relative to the press roller axis of rotation (21) and spaced apart in such a way that a press roller gap is formed between the press roller (20) and the counter roller (18) for press-fitting the first paper web (6) with the second paper web (8) away from the shaped regions in the connecting portions of the paper webs (6, 8).

10. The device according to claim 8 or 9, wherein the counter roller of the embossing roller (16) and the counter roller of the press roller (20) are formed by a common counter roller (18), such that the roller arrangement (10) has three rollers (16, 18, 20) that are operatively engaged with one another.

11. The device according to claim 10, wherein the counter roller (18) axis of rotation (19) is arranged on a straight connecting line between the embossing roller axis of rotation of the (15) and the press roller axis of rotation of the (21).

12. The device according to any one of claims 9 to 11, wherein a preferably motor-driven adjustment apparatus (104) is associated with the press roller (20) for setting the gap width of the press roller gap along a linear axis running radially relative to the press roller axis of rotation (21).

13. The device according to any one of claims 8 to 12, wherein a heating device for heating the respective rollers (16, 18, 20) is associated with the embossing roller (16) and/or the counter roller (18) and/or the press roller (20) for setting the temperature of the rollers (16, 18, 20) preferably separately.

14. The device according to any one of claims 8 to 13, wherein at least one temperature sensor (98 or 100 or 102) is associated with the embossing roller (16) and/or the counter roller (18) and/or the press roller (20), respectively, for detecting the temperature of the respective roller (16 or 18 or 20).

15. The device according to any one of the preceding claims, wherein drying means for drying the paper webs (6, 8), that were press-fitted against each other in the pressing region (32), are arranged in the feed direction between the pressing region (32) and the storage means for the finished packaging material.

16. The device according to claim 15, wherein the drying means has at least two drying apparatuses (24, 26, 28), which are spaced apart from one another in the feed direction.

17. The device according to claim 15 or 16, wherein at least one drying apparatus is designed as an infrared radiation device (24) and at least one drying apparatus (26, 28) is designed as a hot-air drying apparatus.

18. The device according to any one of claims 9 to 17, wherein the press roller (20) consists of an elastic, flexible material, in particular, silicone, at least on its circumferential surface.

19. A method for producing packaging material from paper, wherein at least one first paper web and at least one second paper web are fed to an embossing region and a pressing region downstream of the embossing region in the feed direction of the paper webs,

wherein shaped regions are created from the first paper web in the embossing region by means of an embossing apparatus, the shaped regions projecting beyond the first paper web, and wherein each is limited by a closed circumferential line in the paper web plane of the first paper web,

wherein the paper webs, free of adhesive and connecting synthetic auxiliary material, in particular, free of plastics film, are press-fitted against each other in the pressing region by means of a pressing apparatus in such a way that, in connecting portions between the shaped regions, paper fibers of the first paper web connect to paper fibers of the second paper web, and the paper webs limit closed cavities in the region of the shaped regions, and

wherein, in preparation of the embossing action in the embossing region or press-fitting action of the paper webs in the pressing region, the first paper web and/or the second paper web are/is preconditioned.

20. The method according to claim 19, wherein at least one of the paper webs is preconditioned by introducing or applying a preconditioning liquid thereto, which is preferably water or contains water.

21. The method according to claim 20, wherein the preconditioning liquid is sprayed, nebulized or evaporated onto the associated paper web.

22. The method according to any one of claims 19 to 21, wherein the first paper web is steamed with steam for preconditioning the same.

23. The method according to any one of claims 19 to 22, wherein the paper webs are preconditioned by means of separate preconditioning apparatuses; in particular, they are preconditioned differently.

24. The method according to any one of claims 19 to 23, wherein the first paper web is preconditioned by means of a first preconditioning apparatus, which is arranged on the feed path of the first paper web to the embossing region, and the second paper web is preconditioned by means of a second preconditioning apparatus, which is arranged on the feed path of the second paper web to the pressing region.

25. The method according to any one of claims 19 to 24, wherein at least one paper web, in particular, the second paper web, is preconditioned by introducing or applying a preconditioning liquid thereto, preferably water, which contains cellulose fibers or cellulose particles, preferably microcellulose and/or nanocellulose, in particular, cellulose microfibers (CMF) and/or cellulose nanofibers (CNF).

26. The method according to any one of claims 19 to 25, wherein a roller arrangement with an embossing roller, which is mounted rotatably about an embossing roller axis of rotation, is used in the embossing region, and which has embossing projections on its circumferential surface for forming the shaped regions in the first paper web, wherein the embossing roller is engaged with a counter roller which is rotatably mounted about an axis of rotation parallel relative to the embossing roller axis of rotation and has embossing recesses on its circumferential surface which are designed to be complementary to the embossing projections of the embossing roller.

27. The method according to any one of claims 19 to 26, wherein a press roller, which is rotatably mounted about a press roller axis of rotation, is used in the pressing region, and which, for press-fitting the first paper web with the second paper web, cooperates with a counter roller, the axis of rotation of which is spaced apart from the press roller axis of rotation in such a way that a press roller gap is formed between the press roller and the counter roller for press-fitting the first paper web with the second paper web, away from the shaped regions, in the connecting portions of the first paper web.

28. The method according to claim 26 or 27, wherein a common counter roller is used as the counter roller of the embossing roller and as the counter roller of the press roller, such that the roller arrangement has three rollers that are operatively engaged with one another.

29. The method according to claim 28, wherein the counter roller axis of rotation is arranged on a straight connecting line between the embossing roller axis of rotation and the press roller axis of rotation.

30. The method according to any one of claims 27 to 29, wherein a press roller with a preferably motor-driven adjustment apparatus is used for setting the gap width of the press roller gap along a linear axis running radially relative to the press roller axis of rotation.

31. The method according to any one of claims 27 to 31, wherein the embossing roller and/or the counter roller and/or the press roller is/are heated.

32. The method according to any one of claims 27 to 31, wherein the temperature(s) of the embossing roller and/or the counter roller and/or the press roller is/are measured.

33. The method according to any one of claims 19 to 32, wherein the paper webs, press-fitted against each other in the pressing region, are dried, in the feed direction, between the pressing region and a storage space for the finished packaging material.

34. The method according to claim 33, wherein the paper webs, press-fitted against each other, are dried in several stages by at least two drying apparatuses spaced apart from one another in the feed direction.

35. The method according to claim 33 or 34, wherein the paper webs, press-fitted against each other, are dried by means of at least one drying apparatus designed as an infrared radiation device and by at least one drying apparatus designed as a hot air drying apparatus.

36. The method according to any one of claims 19 to 35, wherein a press roller is used which consists of an elastically flexible material, in particular, silicone, at least on its circumferential surface.

37. A method for producing packaging material from paper using a device according to any one of claims 1 to 18.

38. A packaging material made of paper,

with a first paper web (6) and with a second paper web (8),

wherein shaped regions (11) are created from at least one paper web (6), the shaped regions projecting beyond the paper web (6) and each being limited by a closed circumferential line in the paper web plane,

characterized in that

the paper webs (6, 8), on their surfaces facing one another, are made exclusively of paper and press-fitted against each other free of adhesive and connecting synthetic auxiliary material, in particular free of plastics film, preferably after preconditioning of the paper webs (6, 8), in such a way that in connecting portions (110, 112) between the shaped regions (11), paper fibers of the first paper web (6) are connected to paper fibers of the second paper web (8) and wherein the paper webs (6, 8) limit closed cavities (108) in the region of the shaped regions (11).

39. The packaging material according to claim 38, characterized in that the circumferential line limiting a shaped region (11) is, in each case, circular or approximately circular, such that the shaped regions (11) are formed like spherical surfaces.

40. The packaging material according to claim 38 or 39, characterized in that shaped regions (11) are created from both paper webs and that the paper webs are connected to one another in such a way that shaped regions in one paper web are arranged opposite corresponding shaped regions in the other paper web.

41. The packaging material according to any one of claims 38 to 40, characterized in that the shaped regions (11) form a regular pattern, in particular, they are arranged in rows and/or columns.

42. The packaging material according to any one of claims 38 to 41, characterized in that the paper webs (6, 8) consist of recycled paper.

43. The packaging material according to claim 42, characterized in that the recycled paper has at least one, in particular all of the following characteristic parameters:
- specific basis weight/grammage [ISO 536]: 60 - 140 g/m^2
- water absorption according to Cobb60 [ISO 535]: 26 - 113 g/m^2
- roughness according to Bendtsen [ISO 8791-2]: ≥ 300 ml/min
- bursting strength [ISO 2758]: 160 - 240 kPa
- SCT INDEX in cross direction [ISO 9895]: 1.1 - 1.9 kN/m

44. The packaging material according to any one of claims 38 to 43, characterized in that the connecting portions (110, 112) between the shaped regions (11) are designed in a web-like manner.

45. The packaging material according to any one of claims 38 to 44, characterized in that the paper webs (6, 8) are compressed at least in sections in the connecting portions (110, 112).