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(54) **Apparatuses for packing products**

(57) An apparatus comprises weakening promoting means (14) suitable for generating weakening line means (15, 16) on a sheet material (4), said weakening promoting means (14) comprising a serrated profile; an apparatus comprises folding means (25), suitable for folding a first portion of said sheet material (4), on an adjacent second portion of said sheet material (4), said folding means comprising comb means (25) that acts on localised zones of said sheet material (4).

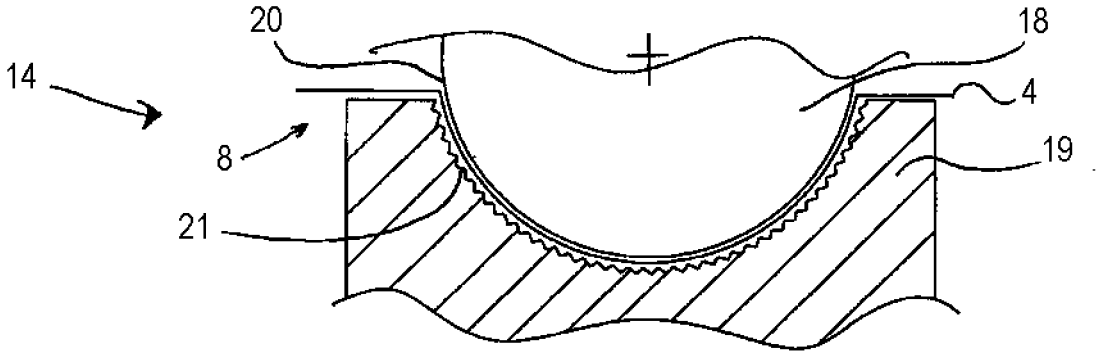

Fig. 2

EP 1 880 813 A2

Description

[0001] The invention relates to apparatuses for packing products. Apparatuses for packing products are known that comprise grippers arranged for indexing to a scoring station a thermoformable sheet material that is unwound from a reel, and a heating station in which the sheet material is heated to a softening temperature necessary for thermoforming. In the scoring station scoring means is provided, for example wheel means provided with a cutting profile, that defines a folding line parallel to an advance direction of the sheet material and arranged in a median region of the latter. There is further provided further scoring means, acting in a direction that is perpendicular to the sheet material and arranged for generating on the sheet material scoring lines, which act as weakening lines that define an opening zone on containers that are obtained by thermoforming the sheet material. The scoring means and the further scoring means are shaped in such a way as to penetrate the thickness of the sheet material by a set amount, without passing through it completely.

[0002] Downstream of the heating station there is provided a forming station; in which containing cavities are formed on the sheet material, which containing cavities are arranged for receiving a product to be packed. In particular, first containing walls are formed that are arranged on a first half of the sheet defined by the folding line, and second containing walls, arranged on a second half of sheet opposite the first half with respect to the folding line. Each first containing wall is aligned on a respective second containing part in such a way that by folding the sheet along the folding line, each second containing wall can face a respective first containing wall for defining a container. On a peripheral edge of the first containing walls projecting portions can be obtained and on a further peripheral edge of the second containing walls recess portions can be obtained. The projecting portions and the recess portions are arranged in such a way that they can couple with one another when the first containing walls and the second containing walls face one another. In this way the projecting portions and the recess portions enable the first containing walls and the second containing walls to be placed in position in relation to one another and the latter to be kept joined together to enable the heat-welding thereof.

[0003] Downstream of the forming station there is provided a filling station, in which a product that it is desired to package is introduced inside cavities defined by the second containing walls. Cutting means is provided that is arranged for cutting the sheet material transversely to the advance direction, for a portion that is substantially equal to half the width of the sheet material, so as to affect only the region occupied by the first containing walls. This enables folding means provided downstream of the forming station to fold a portion of the sheet material, on which the first containing walls have been obtained, on a further portion containing the second containing walls. In this way edge portions of the first containing walls are made to mate with further edge portions of the second containing walls.

[0004] There is provided a welding station in which each container, once it has been filled, is heat-welded. A shearing station arranged downstream of the welding station separates the heat-welded containers from the sheet material.

[0005] During operation, the sheet material is advanced by a step along the advance direction. First, the sheet is advanced by a step and is taken into the scoring station, and is subsequently passed through the heating station, where a first sheet portion that has to be thermoformed is heated to the softening temperature. Subsequently the sheet is advanced by a same step to the forming station, where the first containing walls and the second containing walls are obtained. After a period of time that is sufficient for the shape of the first containing walls and of the second containing walls to stabilise, the sheet material is advanced by a same step to the filling station, where a product is introduced inside the cavities defined by the second containing walls.

[0006] The sheet material is further cut transversely to the advance direction for a portion that affects only the region occupied by the first containing walls. This enables the folding means to rotate the first containing walls around the folding line in a position in which they face the second containing walls. Subsequently, in the welding station, the first containing walls and the second containing walls are peripherally welded together. The containers, after being heat-welded, are taken into the shearing station to be separated singly or in groups from the sheet material.

[0007] In known apparatuses, it may be difficult to make the first containing walls face the second containing walls. In order to enable the first containing walls and the second containing walls to be positioned in relation to one another to be heat-welded, it is often necessary to obtain, along edge zones of the first containing walls and of the second containing walls, projecting portions and recess portions that to a certain extent complicate the structure of the moulds with which the forming station is provided. The projecting portions and the recess portions act as positioning means that keep the first containing walls and the second containing walls joined together.

[0008] A drawback of known apparatuses for packing products is that it does not enable effective and precise scoring to be maintained that is satisfactorily constant after frequent work cycles. In particular, the scoring station, owing to the wear that is generated through the interaction with the sheet material, requires frequent and costly maintenance that is needed to adjust a penetration stroke of the cutting profiles along the thickness of the sheet material. In particular, it is necessary to adjust the stroke in such a way that the cutting profiles do not penetrate the sheet material by a too small amount, thereby generating weakening lines that do not make opening the containers easy. It is further necessary to adjust the

stroke in such a way that the cutting profiles do not penetrate the sheet material by an excessive amount. In such a case, weakening lines would be generated that were too accentuated or even through weakening lines would be generated that would cause an undesired separation of the opening portions of the containers.

[0009] An object of the invention is to improve the known apparatuses for packing products.

[0010] Another object of the invention is to obtain an apparatus that is able to score the sheet material with great precision and efficacy even after frequent work cycles, thus greatly reducing maintenance.

[0011] A further object of the invention is to obtain an apparatus that is able to fold and position together portions of sheet material, on which portions of containers are obtained, in a precise manner. In this way it is not necessary to obtain, along edge zones of the container portions, projections and recesses that couple together to act as positioning means.

[0012] In a first aspect of the invention, there is provided an apparatus comprising weakening promoting means suitable for generating weakening line means on a sheet material, characterised in that said weakening promoting means comprises a serrated profile.

[0013] Owing to this aspect of the invention it is possible to obtain an apparatus provided with the weakening promoting means that enables weakening line means to be obtained effectively and in a precise manner. In particular, the apparatus according to the invention comprises blade elements that, during scoring, abut on abutment elements and do not require a penetration stroke inside the sheet material to be adjusted.

[0014] In a second aspect of the invention, there is provided an apparatus for packing products, comprising gripping means arranged for advancing a sheet material to a forming station, folding means downstream of said forming station arranged for facing an edge portion of said sheet material on a further edge portion of said sheet material, opposite said edge portion, characterised in that it comprises further gripping means suitable for receiving and locking together said edge portion and said further edge portion. Owing to this aspect of the invention, it is possible to obtain an apparatus that enables the sheet material to be positioned with greater precision in the welding station. In this way it is not necessary to obtain cooperating projections and recesses cooperating for positioning and keeping two parts joined together that make up a container so that the latter can be welded.

[0015] In a third aspect of the invention, there is provided an apparatus comprising folding means, suitable for folding a first portion of a sheet material, on an adjacent second portion of said sheet material, characterised in that said folding means comprises comb means that acts on localised zones of said sheet material.

[0016] Owing to the third aspect of the invention, it is possible to obtain an apparatus that is able to fold the sheet material with greater efficacy and precision as the comb means acts only on the localised zones of the sheet material and does not interfere with zones that affect cavity portions with the risk of damaging.them.

[0017] The invention can be better understood and implemented with reference to the attached drawings, that illustrate some embodiments thereof by way of non-limiting example, in which:

Figure 1 is a schematic plan view of an apparatus for packing products ;
Figure 1a is an enlarged detail of Figure 1;
Figure 2 is a fragmentary section of the weakening promoting means;
Figure 3 is a fragmentary section of another embodiment of the weakening promoting means;
Figure 4 is a schematic section of a portion of the apparatus in Figure 1;
Figure 5 is a perspective and fragmentary view that shows folding means of the apparatus in Figure 1.

[0018] Figures 1 to 5 show an apparatus 1 for packing products 2, comprising advancing grippers 3, arranged for taking and advancing a sheet material 4, wound on a reel 5, along an advance direction A and to a heating station 6. The advancing grippers 3 can move with reciprocal movement from a first position nearer the reel 5, in which the sheet material 4 is grasped, to a second position, in which the sheet material 4 is advanced by a step to be positioned near the heating station 6 to be heated to a softening temperature.

[0019] Downstream of the heating station 6 there is provided a forming station 7, in which on the sheet material 4 a plurality of first containing walls 8 is formed, arranged adjacent to one another along a first half of the sheet material that extends longitudinally to the latter, and a plurality of second containing walls 9, arranged adjacent to one another along a second half of the sheet material 4 that extends parallel and adjacent to the first half.

[0020] Each first containing wall 8 is aligned with a respective second containing wall 9. In this way, by folding the sheet material 4 longitudinally, once a median folding line 24 has been generated, it is possible to make a first containing wall 8 and a second containing wall 9 face one another in such a way as to generate a container 10.

[0021] Downstream of the forming station 7 there is provided a filling station 11 in which a product 12 can be introduced for example inside the cavities defined by the second containing walls 9.

[0022] Downstream of the filling station 11 there is provided a scoring station 13 comprising weakening promoting means 14 that is used to generate weakening lines 15 and further weakening lines 16 on the sheet material 4. The weakening lines 15 and the further weakening lines 16 define an opening portion 17 of the container 2 that can be partially or entirely removed from the latter to enable the product 12, once it has been packed, to be picked up. In an embodiment, shown in Figure 2, the weakening promoting means 14 comprises a disc blade

18, provided with a cutting profile 20 having a shape that depends on the shape of the portion of container on which it is necessary to act. In the example disclosed, the container 10 is provided with first containing walls 8 and with second containing walls 9 having a curved section. The cutting profile 20 is shaped to interact with an abutment element 19 provided with an operating surface 21 on which the sheet material 4 to be scored and the cutting profile 20 are supportingly received. In particular, the cutting profile 20 always abuts on the operating surface, and it is therefore not necessary to adjust a penetrating stroke of the cutting profile through the thickness of the sheet material 4.

[0023] The operating surface 21 has, as the section in Figure 2 shows, a serrated profile, provided with protruding and substantially pointed zones and with recessed zones. A portion of sheet material that has to be scored, on which the weakening lines 15 therefore have to be obtained, is rested on the abutment element 19, in such a way as to be pressed against the-latter by the cutting profile 20. In particular, zones of the sheet material 4 portion are substantially pressed that are in contact with the protruding zones of the abutment element 19. In fact, the cutting profile 19 is able to penetrate only the zones in which the sheet material 4 opposes the push thereof, so in the zones interacting with the protruding zones. The geometry of the operating surface 21 can be chosen in such a way as to enable greater or lesser penetration of the cutting profile 20 into the sheet material 4.

[0024] Figure 3 shows an embodiment of the weakening promoting means 14 in which the abutment element 19 is provided with a further smooth operating surface 22. In this embodiment the disc blade 18 is provided with a further serrated cutting profile 23, provided with further protruding zones and with further recessed zones. In this case, when the sheet material 4 is pressed between the abutment element 19 and the disc blade 18, it is the further protruding zones that penetrate therein without, however, necessarily penetrating the entire thickness of the sheet material 4, thus generating a weakening line 15.

[0025] In order to obtain the further weakening lines 16 and the median folding line 24, which are arranged on flat portions of the sheet material 4, it is possible to provide weakening promoting means 14 provided with blade elements comprising rectilinear cutting profiles and with further abutment elements comprising further serrated operating surfaces the protruding zones of which lie on the same plane. In an embodiment, it is possible to provide for the folding line 24 being generated during forming.

[0026] Similarly to the embodiment disclosed with reference to Figure 3, it is possible to provide further blade elements provided with further serrated cutting profiles the protruding zones of which define a straight line and with still further abutment elements provided with still further flat operating surfaces.

[0027] In an embodiment of the apparatus 1 it is possible to provide a filling station arranged downstream of the scoring station, if it is desired to score also the second containing walls 9 to obtain openings of the containers 10 having a greater extent.

[0028] Downstream of the scoring station 13 comb folding means 25 is provided, arranged for folding a first portion of sheet material 4, on which first containing walls 8 are obtained on an adjacent second portion of sheet material on which the second containing walls 9 are obtained. The folding means 25 comprises a shaft element 26, arranged below and parallel to the sheet material 4, near a median zone of the latter. On the shaft element 26 there is fixed a plurality of pushing elements 27 that are parallel to one another that protrude transversely to the advance direction A. The pushing elements 27 are provided with operating ends 28 shaped in such a way as to act on zones of the sheet material interposed between adjacent first containing walls 8. There are provided abutting bars 38 arranged below the sheet material 4 and shaped for cooperating with the operating ends 28. In this way, during folding, the zones of the sheet material on which the pushing elements 27 act are pushed against the abutting bars 38.

[0029] The shaft element 26 is rotatable around a rotation axis X, and can rotate according to the rotation direction F shown in Figure 5, in such a way that the operating ends 28 can be moved near the second containing walls 9.

[0030] The operating ends 28 are shaped in such a way as to press on zones interposed between adjacent first containing walls 8, in such a way that the first portion of sheet material 4 that supports the latter can be rotated around the folding line 24 and be made to face the second portion of sheet material 4.

[0031] A cutting element is provided that is arranged downstream of the scoring station 13 that cuts the sheet material 4 transversely to the advance direction A, for a portion that is substantially equal to half the width of the sheet material 4, so as to affect only the region occupied by the first containing walls 8. This enables the folding means 25 to fold the first portion of sheet material, on which the first containing walls 8 have been obtained, on the second portion of sheet material that supports the second containing walls 9.

[0032] The apparatus 1 comprises a holding gripper 29 provided on a side of the sheet material 4 and arranged for grasping edge ends of the first portion of sheet material and of the second portion of sheet material in such a way that, after folding, the first containing walls 8 and the second containing walls 9 remain facing one another and do not separate because of the effect of the elastic return of the sheet material 4. Further, the holding gripper 29 is able to advance the first portion and the second portion of sheet material 4 to a welding station 30 arranged further downstream, in such a way that correct positioning of the zones that have to be welded can be obtained.

[0033] The holding gripper 29 is shaped in a similar manner to the advancing grippers 3 and is movable be-

tween a position nearer the folding means 25, and a further position nearer the welding station 30. The holding gripper 29 comprises a bar element 31, extending parallel to the sheet material 4, on which there is obtained a longitudinal cavity 32 facing the sheet material 4 and shaped for receiving internally a peripheral zone 33 of the first portion of sheet material and a further peripheral zone 34 of the second portion of sheet material. Along the longitudinal cavity 32 an elastic conduit 36 extends connected to a hydraulic circuit. Inside the conduit 36 there is contained a fluid that according to an operating position of the holding gripper 29 can be taken to a high pressure value that makes the conduit 36 dilate, pressing and locking the peripheral zone 33 and the further peripheral zone 34 against a wall 35 of the longitudinal cavity 32. During operation, the holding gripper 29 is positioned in such a way that the peripheral zone 33 and the further peripheral zone 34 can be introduced inside the longitudinal cavity 32. In order for this to be able to occur, the pressure of the fluid inside the conduit 36 is taken to a minimum value in such a way that the conduit 36, being in a rest state, i.e. not dilated, does not prevent the peripheral zone 33 and the further peripheral zone 34 from entering the longitudinal cavity 32. Subsequently, the pressure in the conduit 36 is increased in such a way as to dilate the conduit 36 in such a way it presses the peripheral zone 33 and the further peripheral zone 34 against the wall 35. At this point the holding gripper 29 is driven in such a way as to advance the sheet material 4 to the welding station 30. Subsequently, the pressure inside the conduit 36 is again decreased so that the holding gripper 29 can disengage from the sheet material 4 and return to the folding means 25 to perform a new work cycle.

[0034] Near the folding means 25 blowing means is provided that is able to direct a jet of pressurised air that pushes the first portion of sheet material against the second portion of sheet material, in such a way that, after folding, the two portions of sheet material can be kept facing and nearer one another, contrasting effects of elastic return. This facilitates grasping by the holding gripper 29 of the first portion and of the second portion of sheet material 4.

[0035] In another embodiment of the apparatus 1, it is possible to provide advancing means arranged for advancing a film, that is unwound from a further reel and is interposed between the first containing walls 8 and the second containing walls 9, in such a way as to be peelable. In this case, there is provided a device that enables the film to be directed so that it is suitably interposed between the first portion of sheet material and the second portion of sheet material. Containers 2 can thus be obtained in which two separate containing cavities are defined, each of which may contain the same product, which can therefore be consumed or used at different dates, or may contain a different product.

[0036] The welding station 30 enables the first containing walls 8 and the second containing walls 9 to be welded together along the edge zones, possibly with the film interposed between them. Downstream of the welding station 30 there is provided a shearing station 37 that is used to separate from the sheet material 4 the containers 10 or groups of containers 10 that have been welded. The shearing station 37 can be shaped in such a way that after shearing gripping appendages are formed on the containers that facilitate the opening thereof.

[0037] During operation, the sheet material 4 is unwound from the reel 5 by means of the advancing grippers 3 and is indexed, along the advance direction A. First, the sheet material 4 is advanced by a step and is taken to the heating station 6, to be brought to softening temperature. Subsequently, the sheet material 4 is advanced by a further step to the forming station 7, where the first containing walls 8 and the second containing walls 9 are obtained and where the folding line 24 can be obtained.

[0038] After a period of time that is sufficient for the form of the first containing walls 8 and of the second containing walls 9 to stabilise, the sheet material 4 is advanced by a further step to the filling station 11, where a product is introduced inside the cavities defined by the second containing walls 9.

[0039] Subsequently, the sheet material 4 is taken inside the scoring station 13, where the weakening promoting means 14 generates the weakening lines 15 and the weakening lines 16. The sheet material 4 is then cut transversely to the advancing direction A for a portion that affects only the region occupied by the first containing walls 8. Subsequently, the folding means 25 rotates the first containing walls 8 around the folding line 24 in such a way as to face the second containing walls 9. The blowing means directs a jet of air that keeps the first portion of sheet material in contact with the second portion of sheet' material, thus enabling the holding gripper 29 to grasp the peripheral zone 33 and the further peripheral zone 34. Subsequently, in the welding station 30, the first containing walls 8 and the second containing walls 9 are peripherally welded together. The containers 10 after being heat-welded, are taken into the shearing station 37 where they are separated from the sheet material 4 singularly or in groups.

Claims

1. Apparatus comprising weakening promoting means (14) suitable for generating weakening line means (15, 16) on a sheet material (4), **characterised in that** said weakening promoting means (14) comprises a serrated profile.

2. Apparatus according to claim 1, wherein said weakening promoting means (14) comprises abutment means (19) arranged for receiving said sheet material (4).

3. Apparatus according to claim 2, wherein said weakening promoting means (14) comprises blade means

(18) cooperating with said abutment means (19).

4. Apparatus according to claim 3, wherein said serrated profile is obtained on an operating surface (21) of said abutment means (19) that is shaped for supportingly receiving said blade means (18).

5. Apparatus according to claim 4, wherein said blade means (18) comprises a uniform cutting profile (20) arranged for interacting with protruding zones of said operating surface (21).

6. Apparatus according to claim 3, wherein said serrated profile is obtained on a cutting profile (23) of said blade means (18).

7. Apparatus according to claim 6, wherein said abutment means (19) comprises a uniform operating surface (22) shaped for supportingly receiving protruding portions of said cutting profile (23).

8. Apparatus according to any one of claims 1 to 7, and further comprising gripping means (3) arranged for advancing said sheet material (4) to a forming station (7).

9. Apparatus according to claim 8, and further comprising folding means (25) downstream of said forming station (7) arranged for facing an edge portion (33) of said sheet material (4) on a further edge portion (34) of said sheet material (4), opposite said edge portion (33).

10. Apparatus according to claim 9, and further comprising further gripping means (29) suitable for receiving and locking together said edge portion (33) and said further edge portion (34).

11. Apparatus according to claim 10, wherein said further gripping means (29) comprises a bar element (31) extending parallel to an advancing direction (A) of said sheet material (4) arranged for advance said sheet material (4) by a step to a welding station (30).

12. Apparatus according to claim 11, wherein in said bar element (31) there is obtained a longitudinal cavity (32) shaped for receiving internally said edge portion (33) and said further edge portion (34).

13. Apparatus according to claim 12, and further comprising conduit means (36) extending along said longitudinal cavity (32) and arranged for interacting with said edge portion (33) and said further edge portion (34).

14. Apparatus according to claim 13, wherein said conduit means (36) contains a driving fluid internally.

15. Apparatus according to claim 14, and further comprising adjusting means suitable for varying pressure of said driving fluid in such a way as to deform elastically said conduit means (36).

16. Apparatus according to any one of claims 9 to 15, wherein said folding means comprises comb means (25) that acts on localised zones of said sheet material (4).

17. Apparatus according to claim 16, wherein said localised zones comprise undeformed zones of said sheet material (4).

18. Apparatus according to claim 17, wherein between adjacent undeformed zones there are defined containing cavities (8, 9) obtained on said sheet material (4).

19. Apparatus according to any one of claims 16 to 18, wherein said comb means (25) comprises prong elements (27) mutually parallel and fixed to an end of a shaft element (26).

20. Apparatus according to claim 19, as claim 16 is appended to any one of claims 11 to 15, wherein said shaft element (26) is rotatable around a rotation axis (X) parallel to said advance direction (A).

21. Apparatus according to claim 19 or 20, wherein said shaft element (26) is arranged at a certain distance from an advance plane of said sheet material (4) and near a median zone of said sheet material (4).

22. Apparatus according to claim 21, and further comprising abutting bar elements (38) arranged for interacting with said prong elements (27) near said advance plane.

23. Apparatus according to claim 22, wherein each prong element (27) comprises an operating end (28) shaped for acting on said localised zones and movable towards and away from, a respective abutting bar element (38).

24. Apparatus according to claim 23, wherein each prong element (27) comprises an intermediate portion arranged between said operating end (28) and said shaft element (26) shaped in such a way as not to interfere with said sheet material (4).

25. Apparatus for packing products (2), comprising gripping means (3) arranged for advancing a sheet material (4) to a forming station (7), folding means (25) downstream of said forming station (7) arranged for facing an edge portion (33) of said sheet material (4) on a further edge portion (34) of said sheet material (4), opposite said edge portion (33), **characterised**

in that it comprises further gripping means (29) suitable for receiving and locking together said edge portion (33) and said further edge portion (34).

26. Apparatus according to claim 25, wherein said further gripping means (29) comprises a bar element (31) extending parallel to an advance direction (A) of said sheet material (4) and arranged for advancing said sheet material (4) by a step to a welding station (30).

27. Apparatus according to claim 26, wherein in said bar element (31) there is obtained a longitudinal cavity (32) shaped for receiving internally said edge portion (33) and said further edge portion (34).

28. Apparatus according to claim 27, and further comprising conduit means (36) extending along said longitudinal cavity (32) and arranged for interacting with said edge portion (33) and said further edge portion (34).

29. Apparatus according to claim 28, wherein said conduit means (36) contains a driving fluid internally.

30. Apparatus according to claim 29, and further comprising adjusting means suitable for varying a pressure of said driving fluid in such a way as to deform elastically said conduit means (36).

31. Apparatus according to any one of claims 25 to 30, wherein said folding means comprises comb means (25) that acts on localised zones of said sheet material (4).

32. Apparatus according to claim 31, wherein said localised zones comprise undeformed zones of said sheet material (4) .

33. Apparatus according to claim 32, wherein between adjacent undeformed zones there are defined containing cavities (8, 9) obtained on said sheet material (4).

34. Apparatus according to any one of claims 31 to 33, wherein said comb means (25) comprises prong elements (27) mutually parallel and fixed to an end of a shaft element (26).

35. Apparatus according to claim 34, as claim 31 is appended to any one of claims 26 to 30, wherein said shaft element (26) is rotatable around a rotation axis (X) parallel to said advance direction (A).

36. Apparatus according to claim 34 or 35, wherein said shaft element (26) is arranged at a certain distance from an advance plane of said sheet material (4) and near a median zone of said sheet material (4).

37. Apparatus according to claim 36, and further comprising abutting bar elements (38) arranged for interacting with said prong elements (27) near said advance plane.

38. Apparatus according to claim 37, wherein each prong element (27) comprises an operating end (28) shaped for acting on said localised zones and movable towards and away from, a respective abutting bar element (38).

39. Apparatus according to claim 38, wherein each prong element (27) comprises an intermediate portion, arranged between said operating end (28) and said shaft element (26) shaped in such a way as not to interfere with said sheet material (4).

40. Apparatus comprising folding means (25), suitable for folding a first portion of a sheet material (4), on an adjacent second portion of said sheet material (4), **characterised in that** said folding means comprises comb means (25) that acts on localised zones of said sheet material (4).

41. Apparatus according to claim 40, wherein said localised zones comprise undeformed zones of said sheet material (4).

42. Apparatus according to claim 41, wherein between adjacent undeformed zones there are defined containing cavities (8, 9) obtained on said sheet material (4).

43. Apparatus according to any one of claims 40 to 42, wherein said comb means (25) comprises prong elements (27) mutually parallel and fixed at an end to a shaft element (26).

44. Apparatus according to claim 43, wherein said shaft element (26) is rotatable around a rotation axis (X) parallel to an advancing direction (A) of said sheet material (4).

45. Apparatus according to claim 43 or 44, wherein said shaft element (26) is arranged at a certain distance from an advancing plane of said sheet material (4) and near a median zone of said sheet material (4).

46. Apparatus according to claim 45, and further comprising abutting bar elements (38) arranged for interacting with said prong elements (27) near said advance plane.

47. Apparatus according to claim 46, wherein each prong element (27) comprises an operating end (28) shaped for acting on said localised zones and movable towards and away from, a respective abutting bar element (38).

48. Apparatus according to claim 47, wherein each prong element (27) comprises an intermediate portion, arranged between said operating end (28) and said shaft element (26) shaped in such a way as not to interfere with said sheet material (4)..

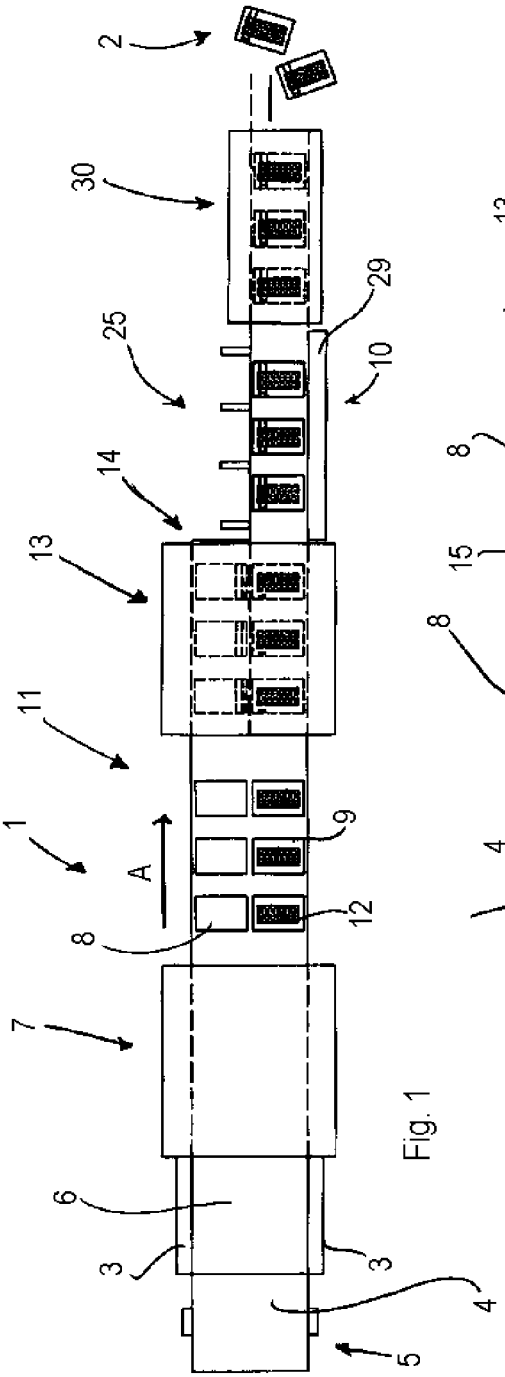
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Fig. 1

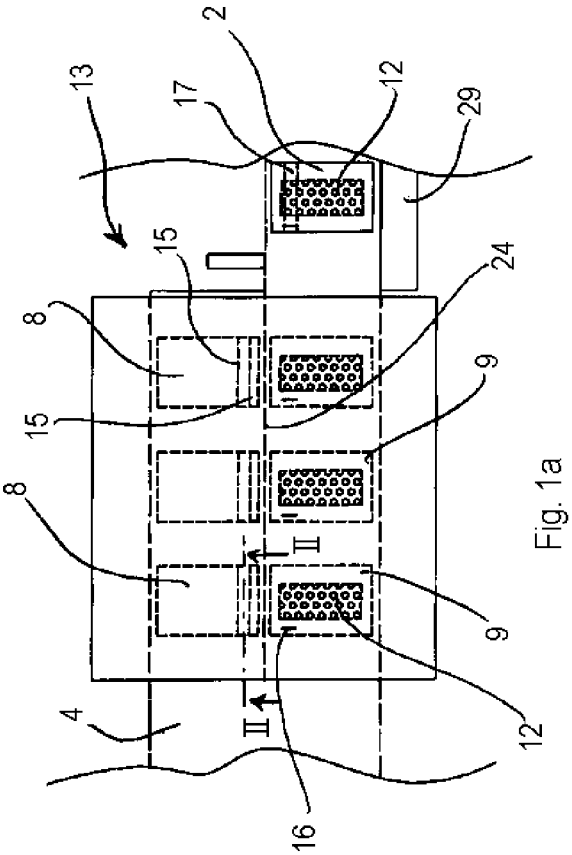
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Fig. 1a

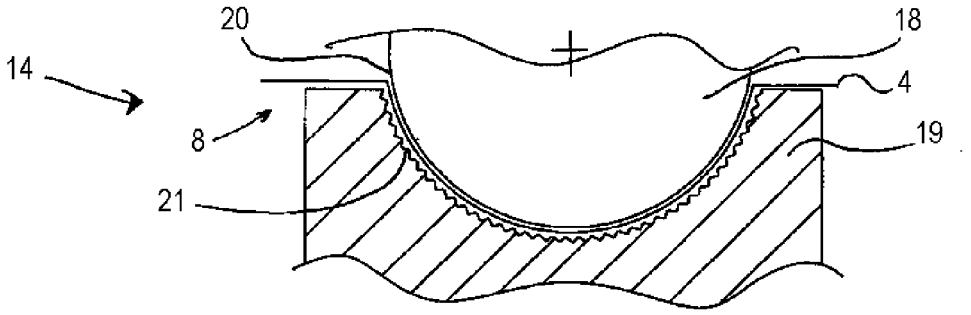

Fig. 2

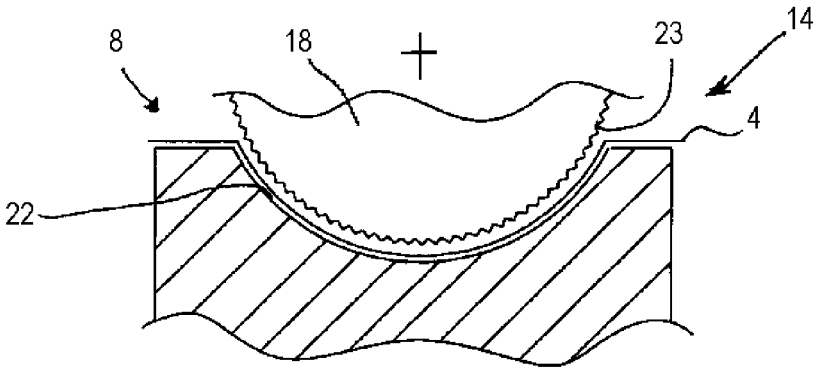

Fig. 3

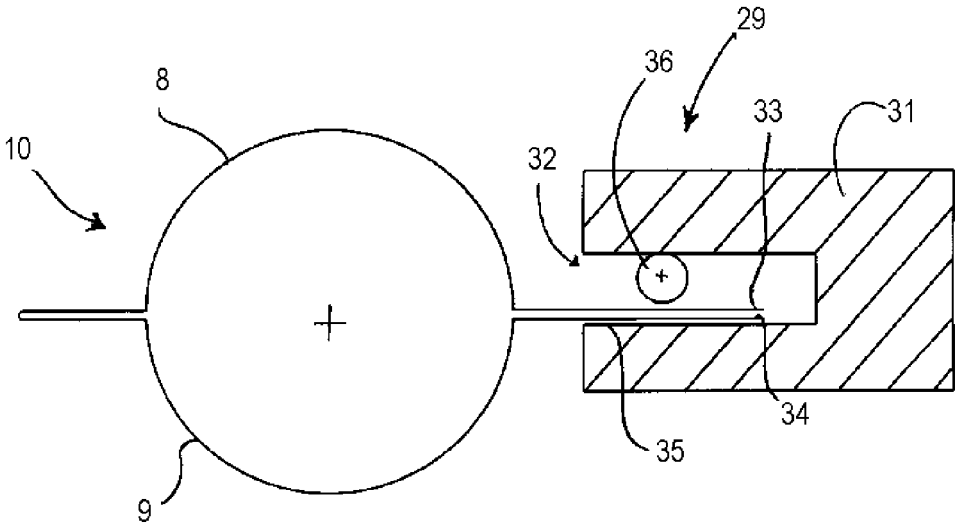

Fig. 4

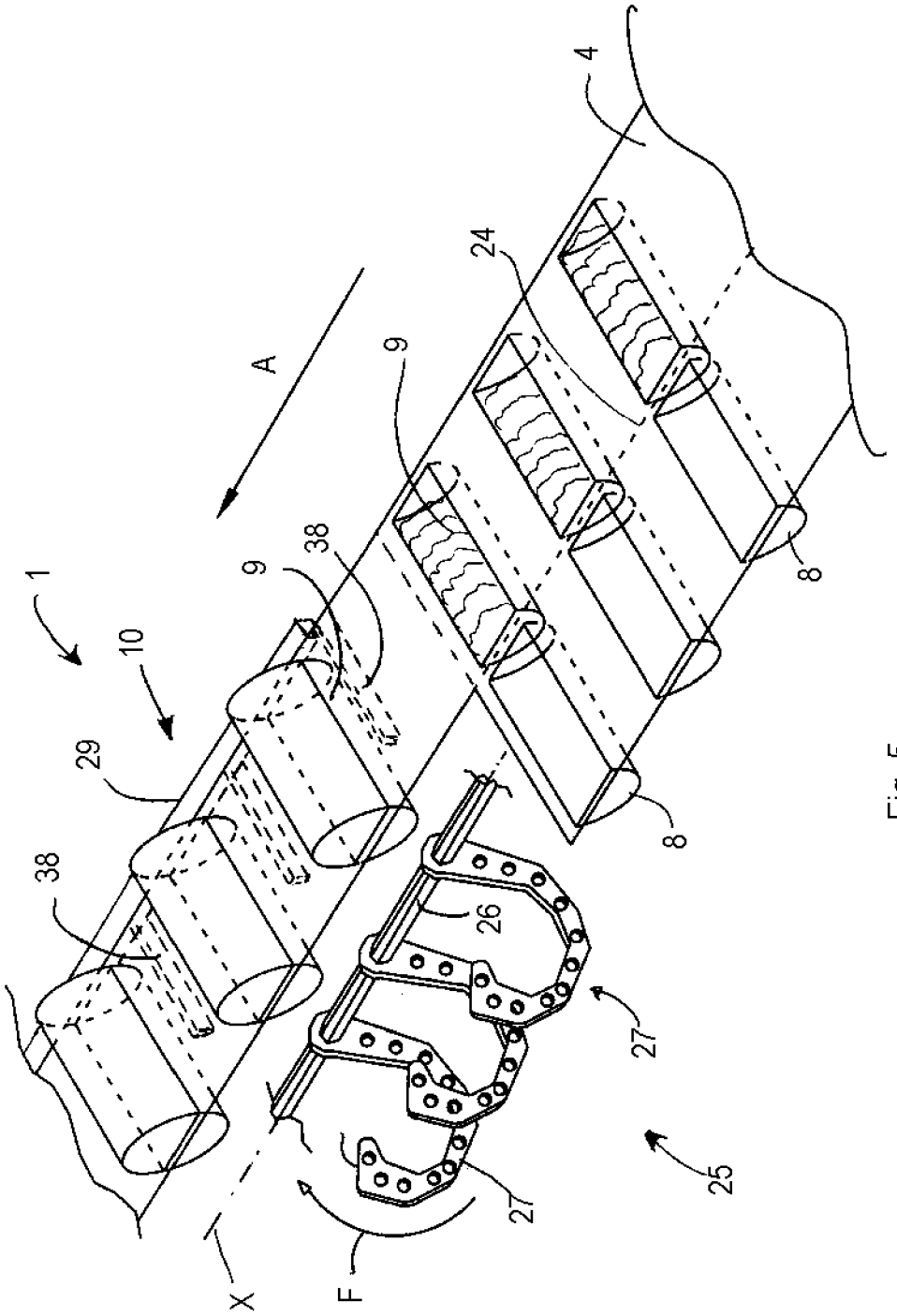

Fig. 5