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(54) Bag with quadrangular bottom, method for forming such bag, and machine for carrying out the method

(57) A bag with quadrangular bottom is constituted by a substantially rectangular flexible sheet element (2) in which fold lines form and articulate, in a U-like shape, a substantially quadrangular central bottom (4) and two main faces, a front one and a rear one (6), which protrude symmetrically from two opposite sides of the bottom; the bottom and the main faces are extended at their sides by respective foldable flaps (4a, 5a, 6a), which can mutually overlap and form the sides (7) of the bag; elements for the lateral sealing of the bag are also provided.

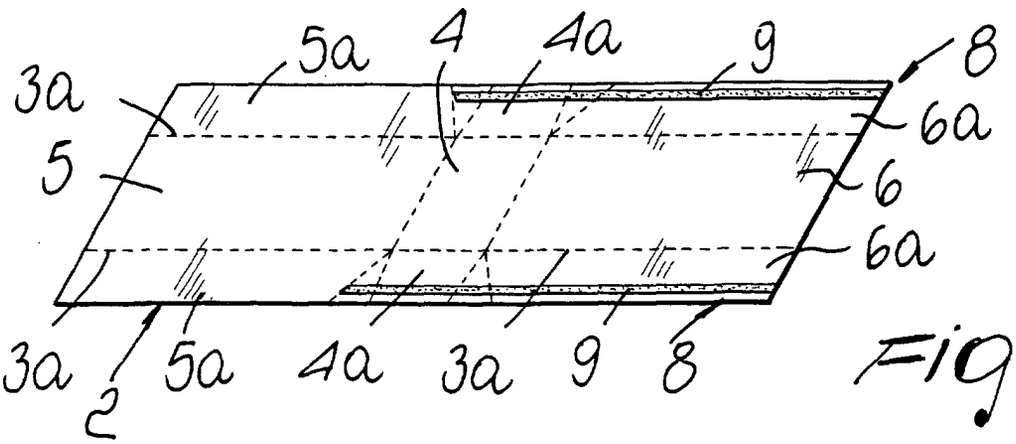

Fig. 2

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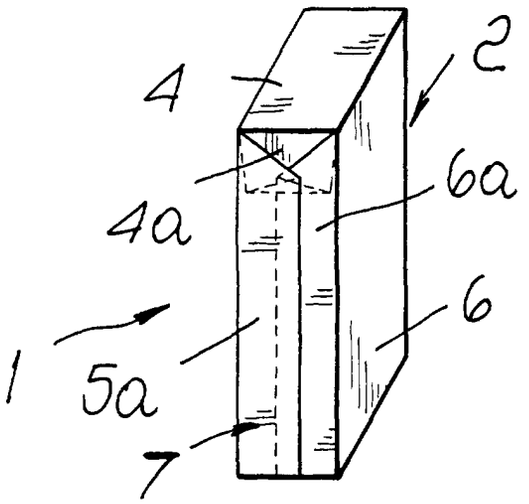

Fig. 4

Description

[0001] The present invention relates to a bag with a quadrangular bottom, to a method for forming the bag, and to a machine for carrying out the method.

[0002] So-called "square-bottom" bags, i.e., bags whose bottom has and/or assumes the shape of a regular quadrangle, are known and are used particularly but not exclusively for packaging foodstuffs or chemicals such as for example sugar, flour-like products, pasta, biscuits, frozen food, adhesives, cement and so forth.

[0003] Each bag of the known type is constituted by a substantially rectangular sheet, made of paper or multi-ply material or plastics and is subjected to successive folding and fixing steps.

[0004] In known bags, the bottom is constituted by flaps and/or tabs and/or wings that are formed in the sheet by means of cutting operations, are mutually folded so as to overlap and are then fixed by gluing or thermal bonding.

[0005] These square-bottom bags of the known type are not devoid of drawbacks, including the fact that their formation requires the use of sheets that have a very large surface, such as to allow to form the flaps (tabs and/or wings) which, once arranged mutually adjacent, joined and folded so as to overlap, constitute the bottoms; this causes an increase in the production costs of such bags and a considerable waste of material, consequently worsening environmental conditions.

[0006] Other disadvantages of known square-bottom bags consist in that on their bottoms there are lines and regions where the flaps (tabs and/or wings) are joined and connected.

[0007] Finally, known square-bottom bags are formed automatically by machines that have a complicated constructive structure and a high cost due to the plurality of stations and/or devices with which they are provided in order to perform the steps for forming, folding and fixing the flaps (tabs and/or wings) that constitute the bottom of the bags.

[0008] Furthermore, it is noted that these machines usually have a substantially fixed format; format changing operations in fact entail a high cost and long execution times with a disadvantageously extended halting of the production of the bags.

[0009] The aim of the present invention is to eliminate the above noted drawbacks of square-bottom bags of the known type, by providing a bag having a quadrangular bottom, a method for forming such bag and a machine for carrying out the method that allow to reduce the surface of the sheets used to form the bags for an equal capacity with respect to known types of bags, with a consequent containment of production costs, a reduction in material waste and in environmental damage.

[0010] An object of the present invention is to ensure the strength of the bottoms of the bags, preventing losses and leakages of the packaged products through them.

[0011] Other objects of the present invention are simplification of the constructive structure, containment of production and installation costs for an equal operating speed, and simplification of operations for changing the format of machines used for forming the bags, further limiting production costs and times.

[0012] Within this aim, another object of the present invention is to provide a structure that is relatively easy to provide in practice, safe in use and effective in operation.

[0013] This aim and these and other objects which will better appear hereinafter are all achieved by the present bag with quadrangular bottom, characterized in that it is constituted by a substantially rectangular flexible sheet element in which fold lines form and articulate, in a U-like shape, a substantially quadrangular central bottom and two main faces, a front one and a rear one, which protrude symmetrically from two opposite sides of the bottom, said bottom and said main faces being extended at their sides by respective foldable flaps which can mutually overlap and form the sides of said bag, means for the lateral sealing of the bag being also provided.

[0014] The method for forming the bag with quadrangular bottom is characterized in that it comprises the steps of: taking a substantially rectangular flexible sheet element, folding it substantially in a U-like shape so as to form and mutually articulate a front main face, a central bottom and a rear main face, folding to the side of said faces the opposite lateral flaps of said bottom, giving the bottom a substantially quadrangular shape, then folding the opposite lateral flaps of each one of said main faces, said flaps being superimposable and suitable to form the sides of the bag, and mutually sealing said flaps.

[0015] The machine for carrying out the method is characterized in that it comprises a plurality of forming bodies that duplicate the shape of the bag and move stepwise, toward the main faces, between a station for cutting and subsequently dispensing flexible sheet elements, a station for locking the bottom of said bag and folding the corresponding flaps, a station for folding the front and rear main faces, a station for forming and then folding the flaps of the main faces, a flap sealing station and a station for removing the formed bag.

[0016] Further characteristics and advantages of the present invention will become better apparent from the detailed description of a preferred but not exclusive embodiment of a bag having a quadrangular bottom, of a method for forming the bag, and of a machine for carrying out the method, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a perspective view of a flexible sheet element for producing a bag having a quadrangular bottom according to the invention;

Figure 2 is a perspective view of the element of Figure 1, provided with sealing means;

Figure 3 is a perspective view of the element of Fig-

ure 1, illustrating the fold lines for forming the bag according to the invention;
Figure 4 is a perspective view of a bag according to the invention, with its bottom directed upward;
Figure 5 is a schematic front perspective view of the station for cutting and dispensing the flexible elements of the machine for carrying out the method according to the invention;
Figure 6 is a schematic front perspective view of the stations for locking the bottom of the bag, folding the corresponding lateral flaps, and folding the main faces of the machine according to the invention;
Figure 7 is a schematic front perspective view of the station for folding the lateral flaps of the main faces of the machine according to the invention;
Figure 8 is a schematic front perspective view of a first position of the flap sealing station of the machine according to the invention;
Figure 9 is a schematic front perspective view of a second position of the sealing station of the machine according to the invention;
Figure 10 is a schematic front perspective view of the station for picking up the bag formed by the machine according to the invention;
Figure 11 is a schematic front view of a machine according to the invention;
Figure 12 is a schematic side view of the machine of Figure 11;
Figure 13 is a schematic front view of another embodiment of the machine according to the invention;
Figure 14 is a partially sectional enlarged-scale front view of a detail of the stations for locking the bottom of the bag and for folding the corresponding lateral flaps and main faces of the machine according to the invention, during locking;
Figure 15 is a view of the detail of Figure 14 at the beginning of the steps for folding the flaps of the bottom and the main faces of the bag according to the invention;
Figure 16 is a view of the detail of Figure 14 at the end of the steps for folding the flaps of the bottom and the main faces of the bag according to the invention;
Figure 17 is a schematic side view of the detail of Figure 14 at the end of the steps for folding the flaps of the bottom and of the main faces of the bag according to the invention;
Figure 18 is a schematic plan view of the station for folding the flaps of the front faces of the machine according to the invention in the inactive configuration;
Figure 19 is a schematic plan view of the station of Figure 18 in a first active configuration;
Figure 20 is a schematic plan view of the station of Figure 18 in a second active configuration;
Figure 21 is a schematic perspective view of the station of Figure 18.

[0017] With reference to the figures, the reference numeral 1 generally designates a bag having a quadrangular bottom.

[0018] The bag 1 is constituted by a flexible sheet element 2 that has a substantially rectangular elongated shape in which fold lines 3 form and articulate in a U-like shape a substantially quadrangular central bottom 4 and two main faces, a front one 5 and a rear one 6, that extend symmetrically from two mutually opposite sides of the bottom 4.

[0019] In Figures 1 and 2, the numeral 3a designates the imaginary outlines that correspond to the lines 3 and have been shown merely for the sake of clarity and do not correspond to outlines lines actually provided in advance on the sheet 2.

[0020] Indeed, it is noted that the bag 1 is formed starting from a sheet 2 on which no plotting or definition of the outlines 3a is performed beforehand; the folding lines 3 are formed directly and instantaneously during the forming of the bag 1.

[0021] The bottom 4 and the main faces 5 and 6 are extended, at their mutually opposite sides, by respective flaps 4a, 5a, and 6a, which can subsequently be folded and mutually overlapped, so as to form the sides 7 of the bag 1.

[0022] There are also means for the lateral sealing of the bag 1, constituted for example by regions 8 for the mutual fixing of the various overlapping flaps (4a, 5a and 6a); the regions 8 are formed at least along the outer edges of some of the flaps.

[0023] For example, layers of adhesive 9 are distributed on the regions 8; as an alternative, the regions 8 form regions for the bonding (thermal bonding, high-frequency bonding, ultrasonic bonding, or the like) of the flaps.

[0024] The sheet 2 can be made of paper, multi-ply material, plastics or the like.

[0025] The method for forming the bag 1 consists in taking a flexible sheet element 2 having a substantially rectangular elongated shape, in folding the sheet 2 substantially in a U-like shape so as to form, with a mutual articulation, a front main face 5, a central bottom 4 and a rear main face 6, in folding laterally to the main faces 5 and 6 the mutually opposite lateral flaps 4a of the bottom 4, giving said bottom 4 a quadrangular shape, and in then folding the mutually opposite lateral flaps 5a and 6a of each one of the main faces 5 and 6, mutually overlapping them so as to constitute the sides 7 of the bag 1.

[0026] The method according to the invention further consists in mutually sealing the flaps 4a, 5a and 6a that are overlapped so as to close the sides 7.

[0027] The sealing of the flaps consists in distributing on the fixing regions 8 a layer of adhesive 9 that is suitable to fix the flaps once they have been overlapped or in bonding the flaps, at the regions 8, with methods that are known in the field, such as thermal bonding, high-frequency bonding, ultrasonic bonding, or the like.

[0028] The reference numeral 10 generally desig-

nates a machine for carrying out the method according to the invention.

[0029] The machine 10 comprises a star 11 formed by a plurality of forming bodies (forms) 12 that duplicate the substantially parallelepipedal shape of the bag 1.

[0030] The star 11 can rotate stepwise about a substantially horizontal axis 11a with a path that is perpendicular to the main faces 5 and 6 of the bags being formed.

[0031] The star 11 lies below a station 13 for cutting and subsequently dispensing flexible sheet elements 2 and moves the individual forming bodies 12 from a station 14 for locking the bottom 4 and folding the corresponding flaps 4a in a matching direction to a station 15 for forming and then folding the flaps 5a and 6a of the main faces 5 and 6.

[0032] The station 14 coincides with a station for folding in a matching direction the main faces 5 and 6; in the station 14, the sheet 2 assumes the shape of a downward-facing letter U.

[0033] The star 11 then conveys the forming bodies 12 toward a station 16 for sealing the overlapping flaps and from there to a station 17 for picking up and overturning the formed bag 1.

[0034] The overturned bag 1 is removed from the station 17 by way of conveyance lines, which send it toward conventional filling and upper closure stations; said lines and stations are not shown, since they are of a conventional type.

[0035] Filling can be performed by volume or by weight, while upper closure of the filled bag 1 can occur, for example, by bonding or gluing the upper flaps of the bag 1.

[0036] The upper closure can be of the type with or without accordion-like portions and/or with folding of the tips of the joined flaps along the sides 7 or on the upper face of the bag 1.

[0037] As an alternative, upper closure of the bag 1 can occur by way of a double folding of the accordion-like portion or with overlapping crossed tabs, or the like.

[0038] The cutting station 13 is constituted by a reel 18 of a continuous ribbon 19 of flexible element that is unwound by rollers 20 and cut by blades 21 into sheets 2 whose length is predetermined mechanically.

[0039] The cut sheets 2 are sent toward the star 11 by conveyance means of the type with belts 22 or with grippers and are arranged above the forming body 12, which is motionless in the station 14 for locking the bottom 4 and for folding the corresponding flaps 4a and the front and rear main faces 5 and 6.

[0040] Figures 11 and 12 illustrate a machine 10 in which the reel 18 is constituted by a ribbon 19, which is equal in width to the larger dimension of the sheets 2 and is arranged to the rear of the star 11 (wide-reel dispensing).

[0041] Figure 13 illustrates another embodiment of the machine 10, in which the reel 18 is constituted by a ribbon 19, which is equal in width to the smaller dimension of the sheets 2 (narrow-reel dispensing) and is arranged laterally to the star 11. No fold lines or outlines are impressed on the sheet 2; the lines 3 are in fact formed during the formation of the bag 1 and are evident in the formed bag 1.

[0042] The locking station 14 comprises a pusher 23, which can move at right angles to the bottom 24 of the forming body 12 that is motionless in the station and above which a sheet 2 is arranged.

[0043] The pusher 23 supports, with the interposition of spring-loaded elastic means 25, a pad 26 that can slide parallel to the direction of the motion of the pusher 23 and rests on the bottom 24 of the forming body 12 in order to lock and fix thereon the portion of the sheet 2 that corresponds to the bottom 4 of the bag 1 being formed.

[0044] Two fins 27 for folding the main faces 5 and 6 are articulated to the pusher 23 at two first mutually opposite sides. The pusher 23 also has, at second mutually opposite sides that are substantially perpendicular to the first sides, two lower wings 28 that are rigidly coupled thereto and are suitable to engage the mutually opposite sides 29 of the forming body 12 in order to fold thereon the flaps 4a of the bottom 4.

[0045] The fins 27 are rotationally actuated by respective links 30, in which one end is rigidly coupled to the corresponding fin 27 and the other end is associated with a retention element that is not shown for the sake of simplicity of illustration.

[0046] The motion of the pusher 23 is such as to engage the wings 28 along the sides 29 of the forming body 12 so as to fold the flaps 4a of the bottom 4 and cause the rotation of the fins 27 for the matching folding of the main faces 5 and 6 of the bag 1; in this manner, the sheet 2 is given a substantially U-like shape and the bottom 4 is given a substantially quadrangular shape.

[0047] The station 15 for forming and folding the flaps 5a and 6a comprises rear folding units 31 that are arranged at the sides of the station and oscillate about respective axes 31a and in mutually opposite directions in order to move from a position of noninterference to a position in which they rest (sliding contact, tangential contact) against the forming body 12.

[0048] The station 15 further comprises front folding units, which are constituted by two plates 32 that are arranged substantially parallel to the sides 29 of the forming body 12 and can move alternately from a configuration in which they are spaced from the sides 29 of the forming body 12 to a configuration in which they are close thereto: in this last configuration, the plates 32 are suitable to fold the flaps as the forming body 12 passes between them.

[0049] During the step for folding the main faces 5 and 6 and the flaps 4a, the rear folding units 31 and the plates 32 are fixed respectively in a noninterference and spaced configuration (Figure 18) with respect to the forming body 12.

[0050] The folding of the flaps 5a and 6a to form the

sides 7 of the bag 1 occurs by moving the plates 32 toward each other and by rotationally actuating the star 11 and the rear folding units 31 about their respective axes 11a and 31a.

[0051] The rear folding units 31 rotate at a higher peripheral speed than the star 11, so as to fold onto the sides 29 of the forming body 12 the flaps 6a of the rear face 6 before the flaps 5a of the front face 5 are folded by contrast during the passage of the forming body 12 between the plates 32 (Figures 19 and 20).

[0052] Once the flaps 5a and 6a have been folded so that they mutually overlap over the flaps 4a, the forming body 12 is moved toward the sealing station 16, in which the regions 8 for fixing the overlapping flaps are sealed by means of known methods that depend on the material that constitutes the sheet 2 and on the kind of adhesive 9 applied, if any.

[0053] For example, if the sheet 2 is made of thermoplastic material, sealing can occur due to the temperature and the station 16 is constituted by a heating section 16a and a cooling section 16b; in the figures, the reference numeral 33 designates presser elements that act on the regions 8.

[0054] Once sealing has occurred, the forming body 12 is moved into the pickup station 17, in which the formed bag 1 is removed from the forming body 12 and overturned by grip means 34 that move between a configuration for gripping and extracting the bag 1 and a configuration for overturning said bag.

[0055] In practice it has been found that the described invention achieves the intended aim and objects, and provides a bag having a quadrangular bottom which, for an equal containment capacity with respect to known types of square-bottom bag, allows to reduce the surface area of the sheets 2 that constitute said bags.

[0056] The average reduction of the surface area of the sheets 2 and therefore the saving on the materials that constitute them is estimated to vary between 5% and 20%, and this therefore achieves a reduction of bag production costs and environmental damage.

[0057] These reductions are due to the fact that the bottom 4 of the bag 1 is constituted by a continuous portion of the sheet 2 formed by successive folding operations: the bottom of the bag is no longer constituted by flaps and/or tabs and/or wings that must be predefined by operations for cutting the sheet 2 and then overlapped and sealed.

[0058] Moreover, it is noted that the bottom 4 of the bag according to the invention, by being constituted by a continuous portion of the sheet 2, has no folded, overlapped and fixed regions and/or lines; accordingly, the bottom 4 is such as to avoid the escape through it of the product packaged in the bag.

[0059] Finally, the machine for carrying out the method according to the invention is constructively simpler and has lower production costs and higher operating flexibility than known machines, since it does not have the stations for forming, cutting, folding and fixing the flaps (tabs and/or wings) that constitute the bottoms of known types of bag because the bottom of the bag is constituted by a continuous portion of the sheet 2.

[0060] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0061] All the details may further be replaced with other technically equivalent ones.

[0062] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

[0063] The disclosures in Italian Patent Application No. M02000A000225 from which this application claims priority are incorporated herein by reference.

[0064] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A bag with quadrangular bottom, **characterized in that** it is constituted by a substantially rectangular flexible sheet element in which fold lines form and articulate, in a U-like shape, a substantially quadrangular central bottom and two main faces, a front one and a rear one, which protrude symmetrically from two opposite sides of said bottom, said bottom and said main faces being extended by respective foldable flaps which can mutually overlap and form the sides of said bag, means for the lateral sealing of the bag being also provided.

2. The bag according to claim 1, **characterized in that** said flaps can be folded substantially at right angles.

3. The bag according to claim 1, **characterized in that** said sealing means comprise, at least along the edges of some of said flaps, regions for fixing to the other flaps for the lateral closure of said bag.

4. The bag according to claim 3, **characterized in that** layers of adhesive are distributed on said fixing regions.

5. The bag according to claim 3, **characterized in that** said fixing regions can be bonded.

6. The bag according to claim 1, **characterized in that** said flexible sheet element comprises die-cutting lines.

7. A method for forming a square-bottom bag accord-

ing to one or more of the preceding claims, **characterized in that** it comprises the steps of: taking a substantially rectangular flexible sheet element, folding said element in a substantially U-like shape so as to form, in a mutually articulated arrangement, a front main face, a central bottom and a rear main face, folding laterally to said faces the opposite lateral flaps of said bottom, giving said bottom a substantially quadrangular shape, then folding the opposite lateral flaps of each one of said front faces, said flaps being able to mutually overlap and being suitable to form the sides of the bag, and mutually sealing said flaps.

8. The method according to claim 7, **characterized in that** said sealing step consists in distributing, on fixing regions defined at least along the edges of some of said flaps, a layer of adhesive suitable to fix the overlapping flaps.

9. The method according to claim 7, **characterized in that** said sealing step consists in bonding the overlapping flaps at fixing regions defined at least along the edges of some of said flaps.

10. A machine for performing the method according to claims 7 to 9, **characterized in that** it comprises multiple forming bodies that duplicate the shape of the bag and move stepwise toward the main faces between a station for cutting and then dispensing flexible sheet elements, a station for locking the bottom of the bag and for folding the corresponding flaps, a station for folding the front and rear main faces, a station for forming and subsequently folding the flaps of the main faces, a flap sealing station and a station for removing the formed bag.

11. The machine according to claim 10, **characterized in that** said stations for locking and folding the flaps of the bottom and main faces comprise a pusher that can move at right angles to the bottom of the forming body and supports, with elastic means interposed, a pad for resting against the bottom of the forming body, two fins for folding the main faces being articulated to said pusher at two first mutually opposite sides, two lower wings for folding the flaps of the bottom of the bag being rigidly coupled to said pusher at second mutually opposite sides that are substantially perpendicular to the first sides, said fins being rotationally actuated by respective links in which one end is rigidly coupled to the corresponding fin and the other end is associated with a fixed element.

12. The machine according to claim 10, **characterized in that** said station for forming and folding the flaps of the main faces comprises rear folding units, which are arranged at the sides of the station and oscillate in mutually opposite directions between a noninterference position and a position for resting against the forming body, and front folding units, which are suitable to fold the flaps during the passage of the forming body.

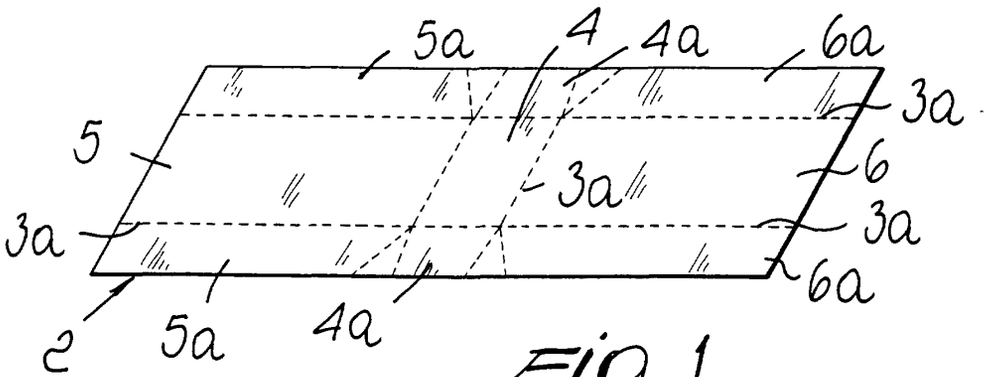

Fig. 1

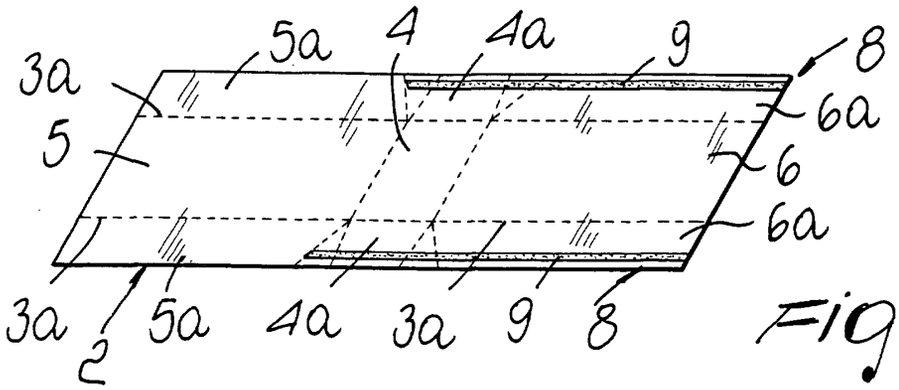

Fig. 2

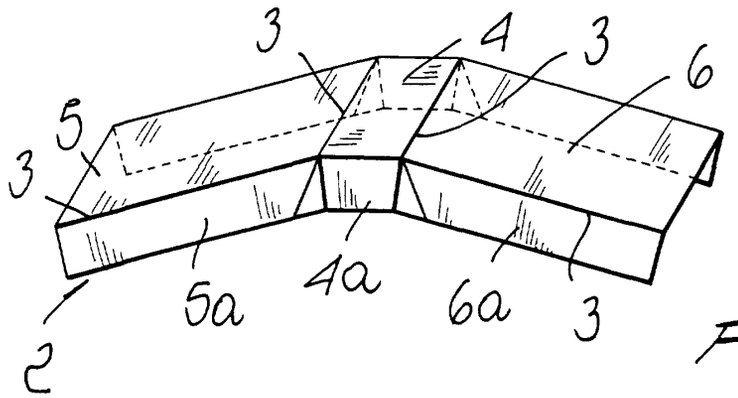

Fig. 3

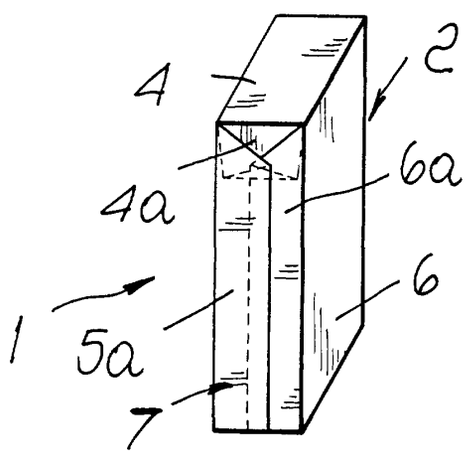

Fig. 4

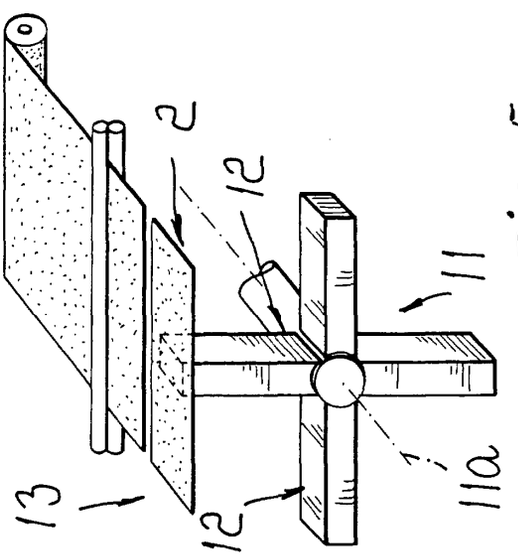

Fig. 5

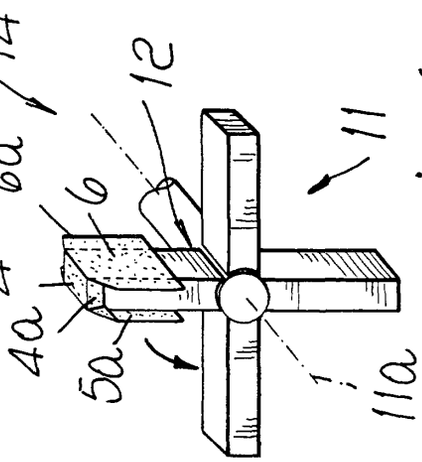

Fig. 6

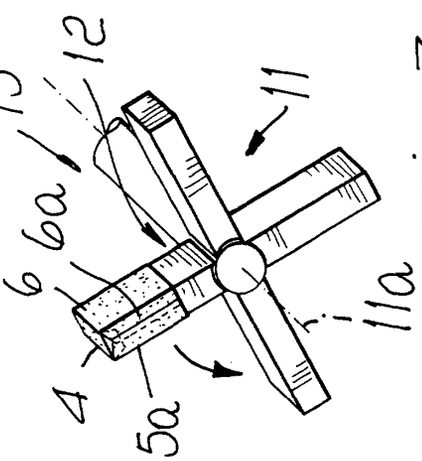

Fig. 7

Fig. 8

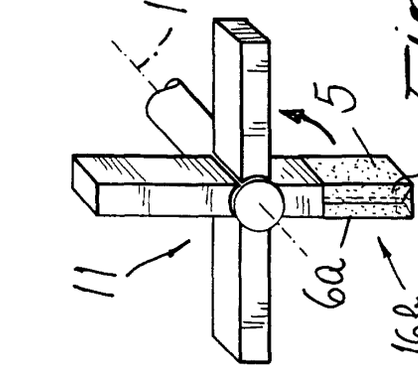

Fig. 9

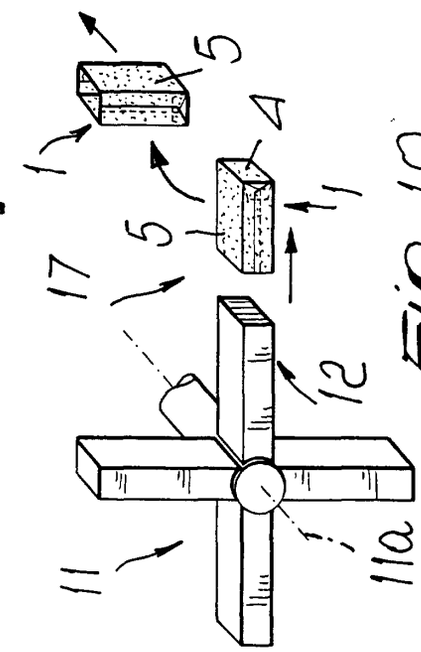

Fig. 10

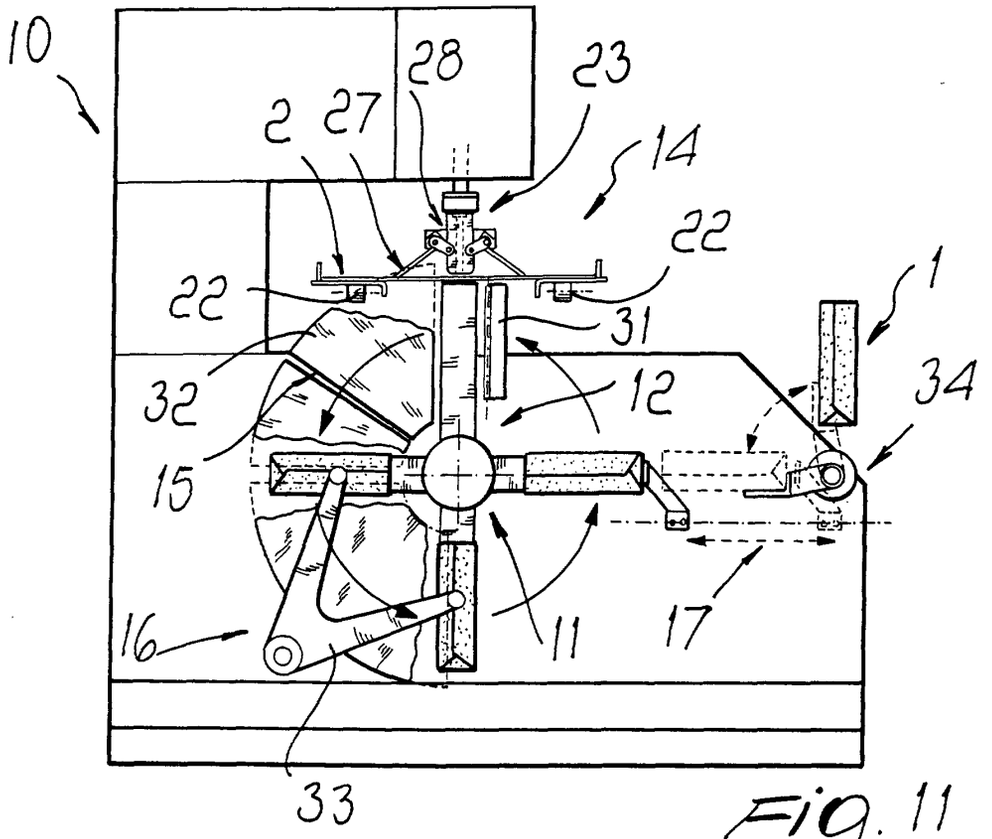
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Fig. 11

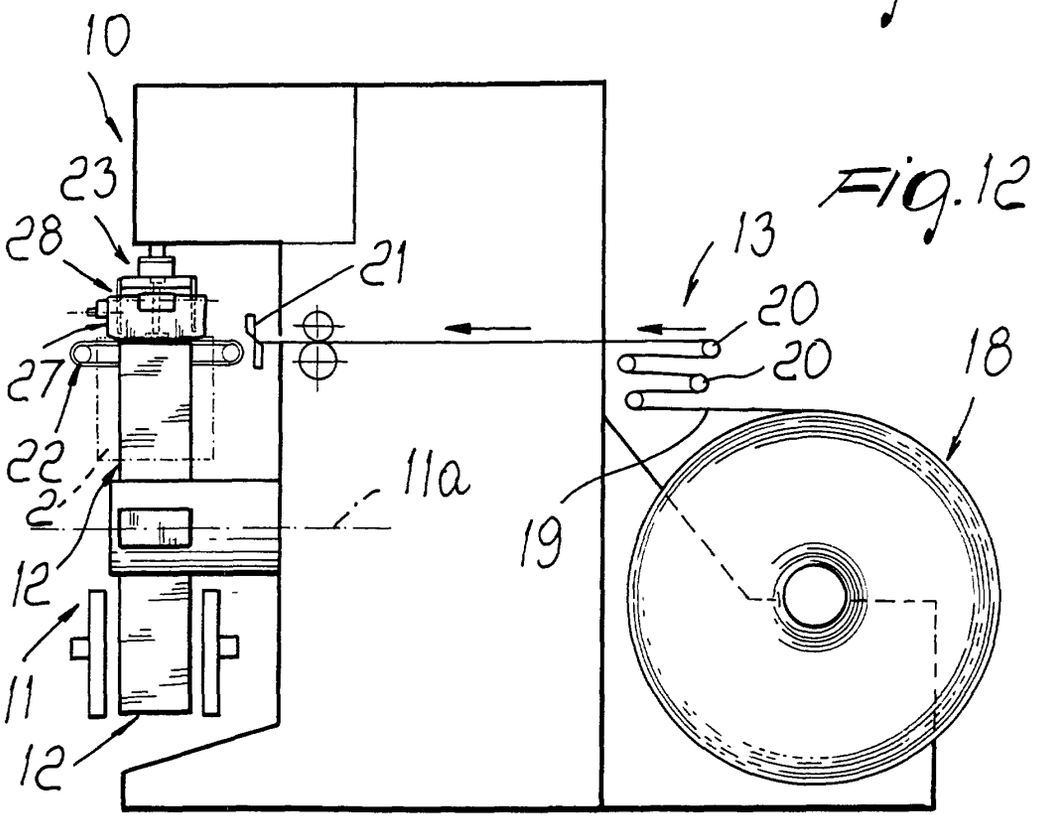
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Fig. 12

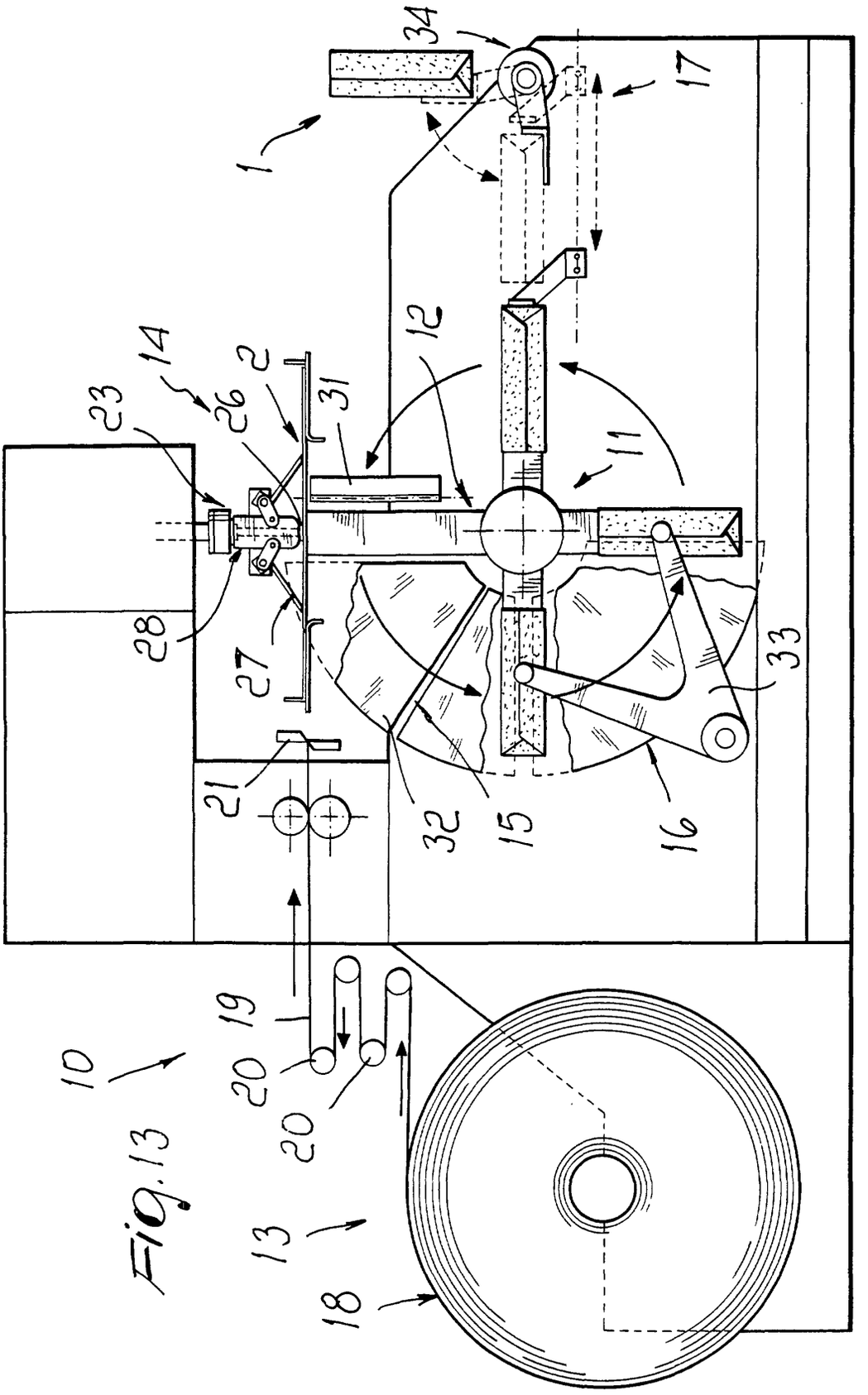

Fig. 13

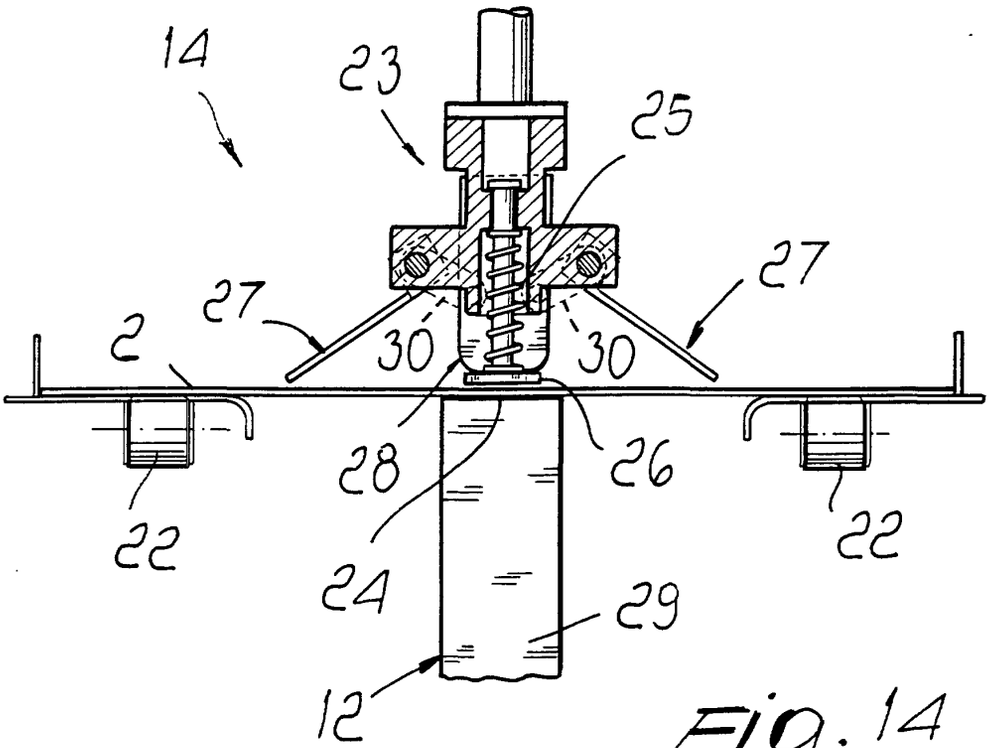
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Fig. 14

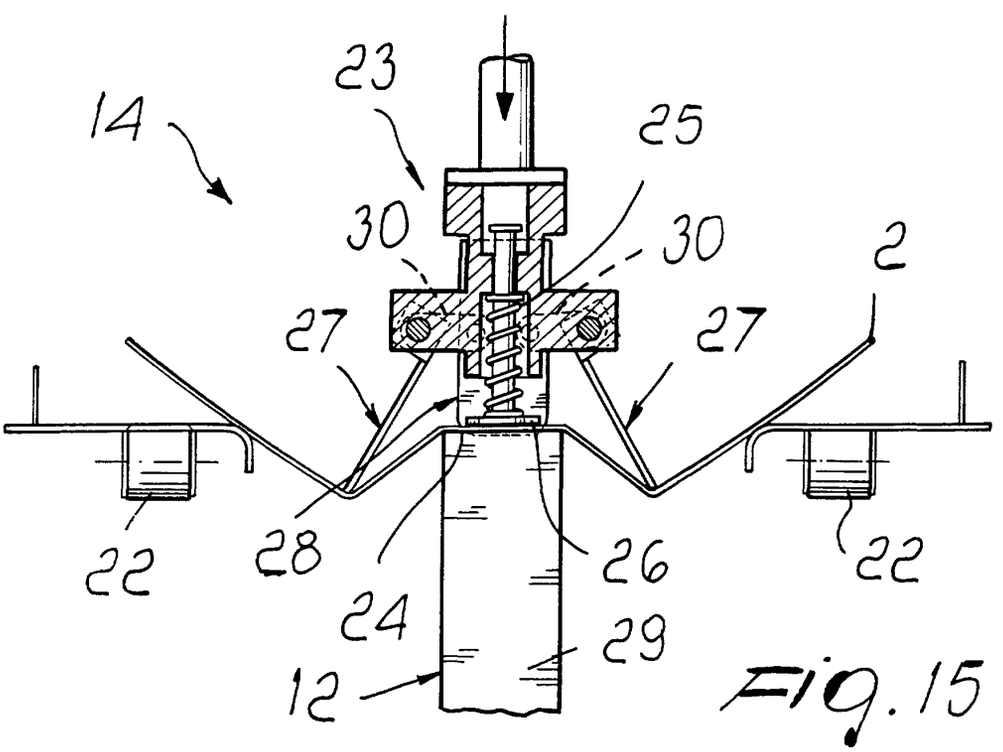
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Fig. 15

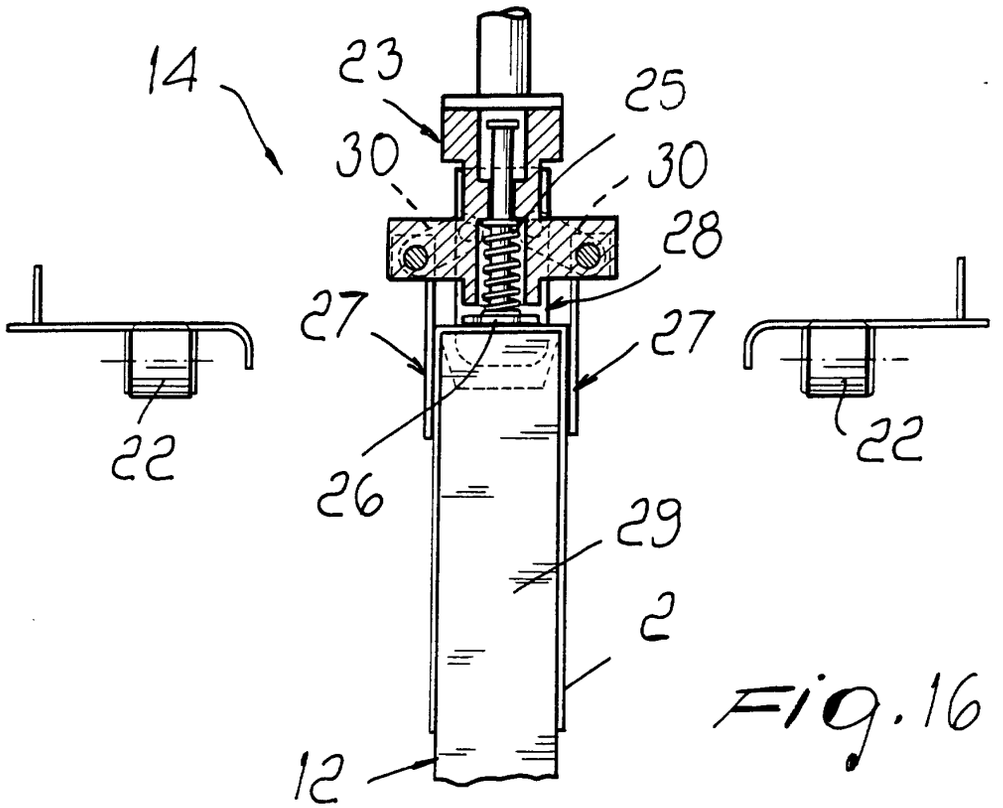

Fig. 16

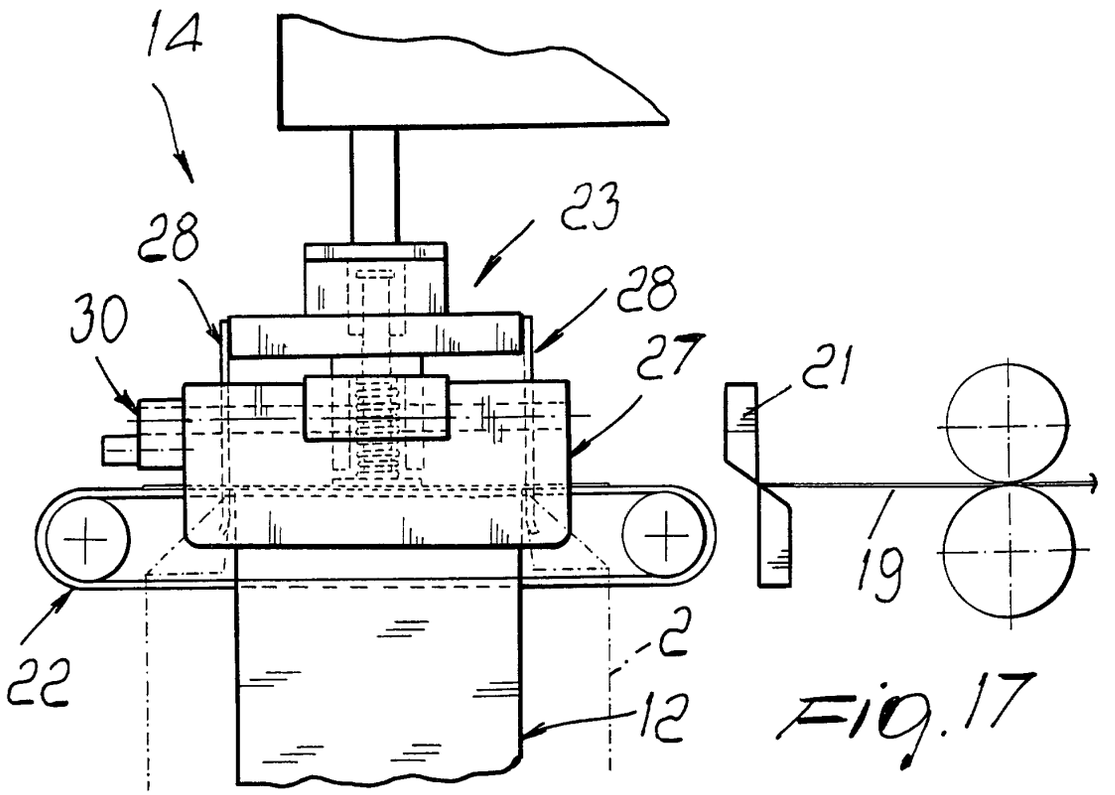

Fig. 17

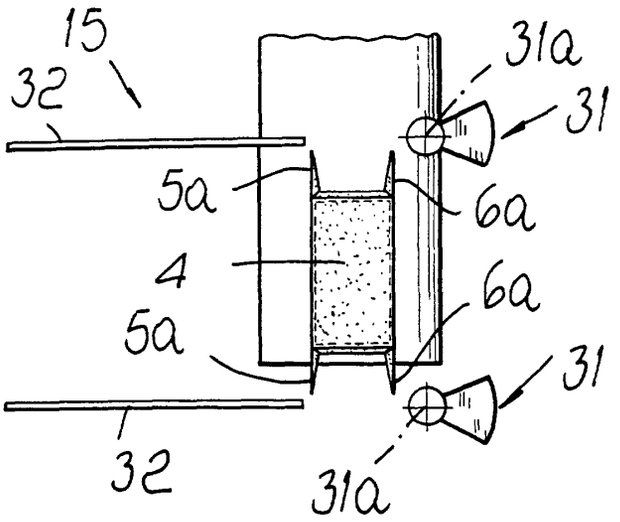

Fig. 18

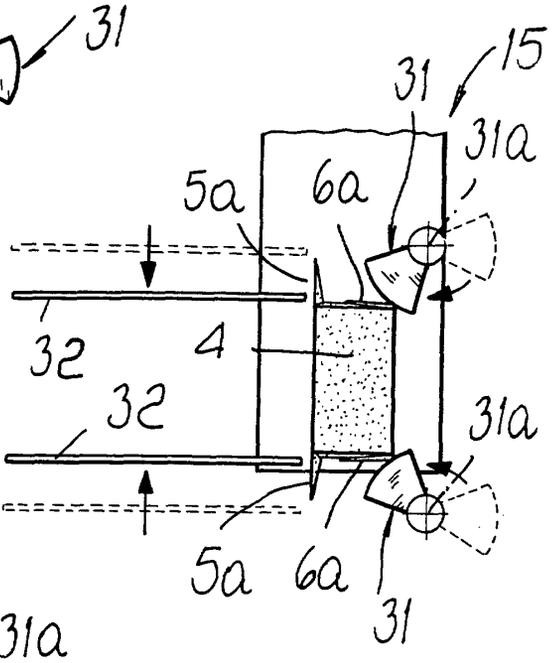

Fig. 19

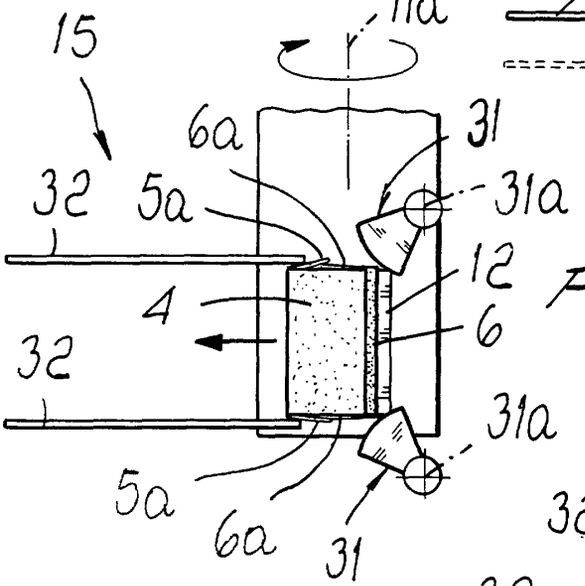

Fig. 20

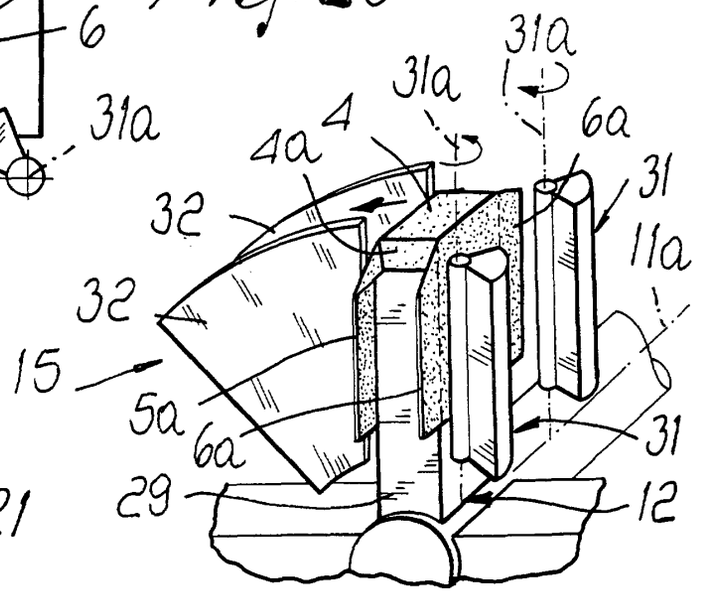

Fig. 21

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EUROPEAN SEARCH REPORT

Application Number
EP 01 12 3390

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	4 March 2002	Schultz, O

CATEGORY OF CITED DOCUMENTS

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