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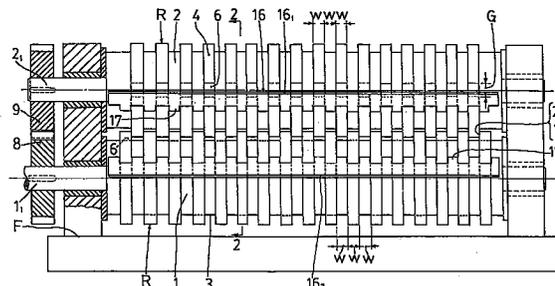
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(54) Method and apparatus for manufacturing paper cushioning members

(57) Disclosed are a method and apparatus for manufacturing paper cushioning members, which ensure continuous mass-production of paper balls, made by crumpling a sheet or sheets of work paper, and permit the use of the paper balls as cushions or packings for transporting objects. According to this method, a sheet or sheets of work paper are inserted between a pair of intermittent cutting roller members (1, 2) to provide multiple rows of thin bands with link portions (7₁-7_n), processed paper is put in cutaway portions (6) each formed in a part of projections (4) of the roller members (1, 2) to form creases, claws of waste-collecting members (17), provided on a discharge side, scrape the processed paper off the cutaway portions and feeding the processed paper to a wave-forming guide (16) while forming crumples, the processed paper is forcibly put through the wave-forming guide (16) to make fine crumples on each unit of thin bands, and the processed paper is discharged while the thin bands are entirely made wavy. The apparatus comprises a pair of elongated roller members (1, 2) having circumferential recesses (3) and projections (4) each of a given width formed thereon and therearound; cutting blades (1', 2') formed at peripheral edges of surfaces (R) of the circumferential projections (4) of the roller members (1, 2); cutaway portions (6) each formed in a part of a circumferential surface of each of the projections (4) along the entire width (W) of that projection (4), work paper (P) being put into the cutaway portions (6), the recesses (3) and projections (4) of one of the roller members (1, 2) being engaged with the projections (4) and recesses (3) of the other roller member respectively; an upper pressing member (16₁) and a lower receiving member (16₂) arranged on a discharge side of the roller members (1, 2); a wave-forming guide (16) with a passage (5) having a height (h) about half of a circumferential length of the roller members (1, 2); waste-collecting members (17)

having claws and recesses, arranged on a roller-member side peripheral portion of the wave-forming guide (16) which is to be engaged with the recesses (3) and projections (4) of the roller members (1, 2); a weight (18) provided at an outlet portion of the upper pressing member (16₁); a casing (20) for covering the roller members (1, 2) and receiving outer-positioned shafts (2₁, 2₂) of the roller members (1, 2); and projections (4) with no cutaway portions (6) formed on lengthwise outer periphery portions of the roller members (1, 2) so as to be able to cut edge portions of work paper to be processed at a same time as the work paper is processed, with an opening formed in a shaft-receiving portion of the casing (20).

FIG.1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a method and apparatus for manufacturing paper cushioning members, and more particularly, to a method and apparatus for cutting a single sheet or plural sheets of work paper to be processed, such as unused paper or old paper like advertisement paper inserted in newspaper or the like, old newspaper, used copying paper, paper printed by an OA (Office Automation) equipment or used corrugated cardboard, to plural rows of thin intermittently-cut bands, forcibly putting the cuts-made work paper through a narrow passage to make the whole thin bands wavy and finely crumpling the thin bands unit by unit, so that the work paper can be used directly without any other processing as various cushions or packings for transporting objects and even work paper to be processed larger than the specified size can be processed with a predetermined width while the unnecessary portions are cut away.

Description of the Related Art

There are cushions made of synthetic resin, which are to be placed between transporting objects and a box to protect the transporting objects against any damage. To avoid any pollution problem, however, there are paper cushions used for the same purpose instead of the synthetic-resin cushions. The simplest type of the paper cushions is a sheet of newspaper crumpled into a ball or paper torn to pieces which are then crumpled, or a corrugated cardboard cut into pieces as an intervening material depending on the usage.

Another known cushion is a strong kraft paper processed to have short cuts and link portions by press working and then stretched to yield a fine almost beehive-like net.

Of those paper cushions, the first type, namely balls made of newspaper, involve a troublesome work and are likely to vary in quality. Although the torn and crumpled pieces of paper, the second type, are soft to serve as good cushions, they are independent piece by piece and are easy to scatter, resulting in a lower working efficiency. In addition, since it is difficult to use the torn and crumpled pieces of paper directly, they are normally placed in a paper bag or a poly bag when in use. If the bag is torn or broken, however, the crumpled pieces of paper undesirably come out of the bag through the torn section.

Although a corrugated cardboard, when cut to pieces, ensure an even thickness, those pieces are still hard and are not so suitable as cushions.

With regard to the pressed kraft paper or the last type of cushion, when the processed kraft paper is stretched, a fine beehive-like net is formed due to the

cuts and link portions. When the net is crumpled, soft and spongy feeling to some degree would be attained. Due to the press working, however, the processing size of a single sheet of kraft paper is limited and it is not possible to simultaneously process plural sheets of kraft paper. Further, as the resultant net is finely formed, the horizontal stretching ratio is small, so that the net, when crumpled into a ball, contain less air. Furthermore, as the link portions are short, the link portions are easily cut when stretched unless the kraft paper is very strong. In addition, as the net is finely formed, the material should be a thin sheet of paper and the net should be formed sheet by sheet. Work paper to be processed larger than the specified size cannot be processed by processing rollers, so that such work paper should be cut by a separate cutter every time it is to be processed.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method and apparatus for manufacturing paper cushioning members, which will overcome the above-described conventional shortcomings.

To achieve the above object, according to one aspect of this invention, there is provided a method of manufacturing paper cushioning members, which comprises the steps of inserting a sheet or sheets of work paper between a pair of intermittent cutting roller members (1, 2) to provide multiple rows of thin bands with link portions (7₁-7_n); causing processed paper to be put in cutaway portions (6) each formed in a part of projections (4) of the roller members (1, 2) to form creases; causing claws of waste-collecting members (17), provided on a discharge side, to scrape the processed paper off the cutaway portions and feeding the processed paper to a wave-forming guide (16) while forming crumples; forcibly putting the processed paper through the wave-forming guide (16) to make fine crumples on each unit of thin bands; and discharging the processed paper while the thin bands are entirely made wavy.

According to another aspect of this invention, there is provided an apparatus for manufacturing paper cushioning members, which comprises a pair of elongated roller members (1, 2) having circumferential recesses (3) and projections (4) each of a given width formed thereon and therearound; cutting blades (1', 2') formed at peripheral edges of surfaces (R) of the circumferential projections (4) of the roller members (1, 2); cutaway portions (6) each formed in a part of a circumferential surface of each of the projections (4) along an entire width (W) of that projection (4), work paper (P) being put into the cutaway portions (6), the recesses (3) and projections (4) of one of the roller members (1, 2) being engaged with the projections (4) and recesses (3) of the other roller member respectively; an upper pressing member (16₁) and a lower receiving member (16₂) arranged on a discharge side of the roller members (1, 2); a wave-forming guide (16) with a passage (5) having a height (h) about half of a circumferential length of the

roller members (1, 2); waste-collecting members (17) having claws and recesses, arranged on a roller-member side peripheral portion of the wave-forming guide (16) which is to be engaged with the recesses (3) and projections (4) of the roller members (1, 2); a weight (18) provided at an outlet portion of the upper pressing member (16₁); a casing (20) for covering the roller members (1, 2) and receiving outer-positioned shafts (2₁, 2₂) of the roller members (1, 2); and projections (4) with no cutaway portions (6) formed on lengthwise outer periphery portions of the roller members (1, 2) so as to be able to cut edge portions of work paper to be processed at a same time as the work paper is processed, with an opening formed in a shaft-receiving portion of the casing (20).

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view of an apparatus for manufacturing paper cushioning members according to the present invention;

Fig. 2 is a cross-sectional view taken along the line 2-2 in Fig. 1;

Fig. 3 is a cross-sectional view showing roller members having made a quarter turn in the arrow direction from the state in Fig. 2;

Fig. 4 is a cross-sectional view showing the roller members having made another three-quarter turn in the arrow direction from the state in Fig. 3;

Fig. 5 is a plan view showing intermittent thin bands having cuts and link portions before the thin bands are made wavy;

Fig. 6 is a plan view showing the intermittent thin bands in Fig. 5 stretched to form a large net;

Fig. 7 is a cross-sectional view taken along the 7-7 line in Fig. 5, showing intermittent thin bands having cuts and link portions put through a wave-forming guide to become crumpled and wavy;

Fig. 8 is a longitudinal cross-sectional front view of roller members and a casing for covering the roller members;

Fig. 9 is a plan view of Fig. 8; and

Fig. 10 is a left side view of Fig. 8.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will now be described referring to the accompanying drawings.

In the diagrams, reference numerals "1" and "2" denote a pair of elongated steel roller members whose shaft portions 1₁ and 2₁ at both ends supported on a frame F by means of bearings. Reference numerals "3" and "4" respectively denote rectangular, circumferential recesses and projections with a given width (allowed to be about 3 to 5 mm), which are formed on each of the roller members 1 and 2 that have diameters of 42 mm. The circumferential recesses 3 of one roller member

engage with the circumferential projections 4 of the other roller member, while the circumferential projections 4 of the former roller member engage with the circumferential recesses 3 of the latter roller member.

Cutting blades 1' and 2' are formed at the peripheral edges of the circumferential surfaces R of the circumferential projections formed on the roller members 1 and 2.

Each projection 4 of each roller member has cutaway portions 6 each formed in a part of its circumferential surface in the width direction w of that projection. The circumferential length of each projection 4 and the length G of each cutaway portion 6 can be set arbitrarily. In the example shown in Figs. 1 and 2, the diameter of the projections is 42 mm, the entire circumferential length of the projections is set to about 132 mm, the recesses 3 and projections 4 are to be engaged in such a way that the lengths of one unit of cuts respectively become about 99 mm and 33 mm, the length G of a single cutaway portion 6 of each projection is set to about 6 mm. In this case, when the cutaway portion 6 of one reference projection 4 of the upper roller member 2 comes to the right, the cutaway portions 6 of the adjoining projections 4 come to the left. When the cutaway portion 6 of one reference projection 3 of the lower roller member 1 comes to the top, the cutaway portions 6 of the adjoining projections 4 come to the bottom.

Fig. 1 illustrates the cutaway portions 6 formed in and across the circumferential projections 4.

Reference numeral "7" denotes cuts formed in work paper P at a given width W (about 5 mm in the illustrated example) by the pair of roller members 1 and 2. Reference numerals "7₁," "7₂," "7₃," ... "7_n" denote link portions which link the associated cuts 7 together. The cuts 7 and the link portions 7₁ to 7_n are set by the intermittent recesses of the circumferential recesses 3 and projections 4 of the roller members 1 and 2 and the lengths between the intermittent recesses. In the example of Fig. 5, when the lengths L' of one type of cuts 7₁-7₂, 7₂-7₃, 7₃-7_n, 7_n-7₁ to be made to the work paper P are set to about a quarter of the circumference or 33 mm, the lengths L" of the other type of cuts 7₁-7_n, 7₂-7₁, 7₃-7₂, 7_n-7₃ are set to about 99 mm 7₁-7₁, ..., 7_n-7_n and the adjoining three lines of thin bands 11, 12 and 13 are linked by the individual link portions 7₁ to 7_n with the lengths G' of about 6 mm.

Reference numerals "8" and "9" are gears, which are attached to the shafts 1₁ and 2₁ of the roller members 1 and 2 and are engaged with each other to transmit power. Power from a motor (not shown) is transmitted to one of the gears, 8, through a belt or a chain.

Reference numeral "16" is a wave-forming guide for processed work paper, which is located on the discharge side of the elongated steel roller members 1 and 2 in the lead-in direction thereof. The wave-forming guide 16 comprises an upper pressing member 16₁ and a lower receiving member 16₂, and defines waste-collecting members 17, which have claws and recesses formed on the roller-member side edge portions thereof

that match with the recesses and projections of the roller members 1 and 2. Formed in the wave-forming guide 16 is a passage 5 of a predetermined height h which has a certain relation with the circumferential length of the roller members 1 and 2. More specifically, given that the circumferential lengths L of the projections of the roller members 1 and 2 are set to about 132 mm, one unit cut length L'' is set to 99 mm, the other unit cut length L' is set to 33 mm and the lengths G of the cutaway portions 6 are set to 6 mm, the height h of the passage 5 of the wave-forming guide 16 is set to about 33 mm.

The upper pressing member 16₁ has its base attached to be rotatable by a hinge 19, with a weight 18 provided at the outlet portion of the upper pressing member 16₁. When unprocessed work paper P' does not pass the upper pressing member 16₁, the passage 5 is narrowed by the distal end portion of the upper pressing member 16₁. When processed work paper passes there, however, the paper moves against the weight 18 while being compressed by the narrowed passage 5, gradually widening the passage 5, and is discharged while forming waves a having the height h of that passage 5, and those portions of the processed paper in the recesses 3 are scraped off by claws 17₁ and 17₁' of the waste-collecting members 17, thus forming crumples b .

In this case, the recesses and projections of the roller members 1 and 2 form waves (i.e., when the paper on the lower roller member side waves upward, the adjacent portion of the paper on the upper roller member side waves downward), and each unit of thin bands are fitted in the recesses 3. When those thin bands are scraped off by the waste-collecting members 17, those portions fitted in the cutaway portions 6 are also scraped off, thus forming creases c .

Reference numeral "20" denotes a casing for covering the roller members 1 and 2. The casing 20 receives the outer-positioned shafts 2₁' and 2₂' of the roller members 1 and 2. Formed in the shaft-receiving portion of the casing 20 is an opening 21 through which work paper to be processed can pass.

Reference numerals "23" and "24" denote projections which are formed, without the cutaway portions 6, on the lengthwise outer periphery portions of the recesses 3 and projections 4 of the roller members 1 and 2.

Reference numeral "25" is a reinforcement member provided on the work-paper discharge side of the opening-side casing. The reinforcement member 25 stabilizes the mouth portion of a cantilever type opening 21.

Specific examples of the paper-cushioning member manufacturing steps of this invention will now be described. In the embodiment shown in Figs. 1 through 4, the cutting blades 1' and 2' of a given width are formed on the roller member pair 1 and 2, the cutaway portions 6 are formed in the circumferential surface R of each projection 4 in the same direction, and the recesses 3 and projections 4 of one roller member are

engaged with the projections 4 and recesses 3 of the other roller member respectively. When a single sheet or plural sheets of work paper P' of a predetermined length are inserted in the engaging portion between the roller members 1 and 2, the cuts 7 and link portions 7₁, 7₂, ..., 7 _{n} are alternately formed along the cutting blades 1' and 2', so that one row of cuts 7 and single link portions 7₁, 7₂, ..., 7 _{n} are formed for two rows of thin bands 11 and 12. The processed paper which have passed the roller members 1 and 2 tend to be fitted in and on the recesses and projections of each roller member and to stick around the outer surface of each roller member. As those portions of the work paper P in the recesses 3 of the roller members 1 and 2 are scraped off by the claws of the waste-collecting members 17 and is discharged straight, however, the waves a are formed and the crumples b are formed on the waves. The processed paper is also inserted in the wave-forming guide 16 continuous to the waste-collecting members 17. At this time, the processed paper in the recesses 3 of the lower roller member 1, when separated by the claw 17₁ of the lower waste-collecting member 17, moves upward while forming crumples, and the processed paper in the recesses 3 of the upper roller member 2, when separated by the claw 17₁' of the upper waste-collecting member 17, moves downward while forming crumples. As the paper moves toward the front of the guide passage 5 that is narrowed by the weight 18 at the distal end of the upper pressing member 16₁, it is compressed, forming the entire thin bands into waves a in the guide passage 5 within the height h and making fine crumples b of each unit of thin bands. When the upper pressing member 16₁ moves upward via the hinge 19 against the weight 18, the paper is discharged from the outlet of the wave-forming guide 16 while stretching the passage 5 (see Fig. 7).

The cuts 7 and link portions 7₁, 7₂, ..., 7 _{n} are alternately formed on the processed paper P by the roller members 1 and 2 along the cutting blades 1', so that three two of cuts 7 and two link portions 7₁ and 7₁, 7₂ and 7₂, ..., 7 _{n} and 7 _{n} are formed for three rows of thin bands 11, 12 and 13. When the resultant sheet or sheets of processed paper are stretched in a direction perpendicular to the cutting direction, a net 7' of the size as shown in Fig. 6 is formed. The creases c are formed by the cutaway portions 6 on the processed paper, fitted in the cutaway portions 6 across the thin bands that form the net, and the waves a are formed with the fine crumples b on the processed paper by the wave-forming guide 16.

For the work paper P' to be processed which has a larger width than the specified size, when this work paper P' is inserted between the roller members 1 and 2, the laterally sticking, unnecessary portions of the work paper are cut away by the engagement of the projections 4 of the roller members 1 and 2 located at the lengthwise outer periphery portions thereof while the work paper is being processed by the recesses 3 and the projections 4.

The reinforcement member 25 is provided on the work-paper discharge side of the casing 20. Because the unnecessary portions of the work paper are cut by the projections 23 and 24, which have no cutaway portions and are located on the lengthwise outer periphery portions of roller members 1 and 2, before reaching this reinforcement member 25, however, the processed paper P and the unnecessary portions thereof do not hit against the reinforcement member 25 so that the reinforcement member 25 does not interfere with the discharge of the processed paper.

With the above-described structure, according to the present invention, various types of paper members, when cut, will not be scattered around and no chemicals are used to provide necessary paper cushioning members, thus overcoming the conventional problem of pollution.

As paper cutting is done by a pair of elongated roller members, plural rows of thin and intermittent cuts are made in a single sheet or a stack of sheets of ordinary work paper, such as unused paper or old paper like advertisement paper inserted in newspaper or the like, old newspaper, used copying paper, paper printed by an OA equipment or used corrugated cardboard, and the cuts-formed work paper is made wavy. This processed paper can therefore be used directly as cushioning members.

At the time processed paper is cut by the roller members and is discharged, the thin bands located in the recesses in the roller members tend to stick around the roller members without the waste-collecting members which having claws. According to this invention, however, fine crumples can be formed while separating the thin bands by means of the waste-collecting members. It is therefore possible to form relatively large waves on processed paper and form fine crumples on the wavy thin bands to thereby provide softer cushioning members accompanied with a larger amount of air.

Further, when the processed paper with intermittent cuts is put through the wave-forming guide to make the entire thin bands wavy and finely crumple each unit of thin bands, the processed paper can have a significant height in the direction of the thickness of the paper. The resultant paper, even without being processed any further, can serve as effective cushioning members.

Furthermore, even when the work paper to be processed has a larger width than the specified size, the laterally sticking, unnecessary portions of this work paper, when inserted between the roller members, are cut away by the engagement of the projections of the roller members located at the lengthwise outer periphery portions thereof while the work paper is being processed by the recesses and the projections. It is therefore possible to process sheets of paper which are larger than the specified size and are different in size.

Claims

1. A method of manufacturing paper cushioning mem-

bers, comprising the steps of:

inserting a sheet or sheets of work paper between a pair of intermittent cutting roller members (1, 2) to provide multiple rows of thin bands with link portions (7_1-7_n);
causing processed paper to be put in cutaway portions (6) each formed in a part of projections (4) of said roller members (1, 2) to form creases;
causing claws of waste-collecting members (17), provided on a discharge side, to scrape said processed paper off said cutaway portions and feeding said processed paper to a wave-forming guide (16) while forming crumples;
forcibly putting said processed paper through said wave-forming guide (16) to make fine crumples on each unit of thin bands; and
discharging said processed paper while said thin bands are entirely made wavy.

2. An apparatus for manufacturing paper cushioning members, comprising:

a pair of elongated roller members (1, 2) having circumferential recesses (3) and projections (4) each of a given width formed thereon and therearound;
cutting blades (1', 2') formed at peripheral edges of surfaces (R) of said circumferential projections (4) of said roller members (1, 2);
cutaway portions (6) each formed in a part of a circumferential surface of each of said projections (4) along an entire width (W) of that projection (4), work paper (P) being put into said cutaway portions (6), said recesses (3) and projections (4) of one of said roller members (1, 2) being engaged with said projections (4) and recesses (3) of the other roller member respectively;
an upper pressing member (16_1) and a lower receiving member (16_2) arranged on a discharge side of said roller members (1, 2);
a wave-forming guide (16) with a passage (5) having a height (h) about half of a circumferential length of said roller members (1, 2);
waste-collecting members (17) having claws and recesses, arranged on a roller-member side peripheral portion of said wave-forming guide (16) which is to be engaged with said recesses (3) and projections (4) of said roller members (1, 2);
a weight (18) provided at an outlet portion of said upper pressing member (16_1);
a casing (20) for covering said roller members (1, 2) and receiving outer-positioned shafts ($2_1, 2_2$) of said roller members (1, 2); and
projections (4) with no cutaway portions (6) formed on lengthwise outer periphery portions

of said roller members (1, 2) so as to be able to cut edge portions of work paper to be processed at a same time as said work paper is processed, with an opening formed in a shaft-receiving portion of said casing (20).

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FIG.3

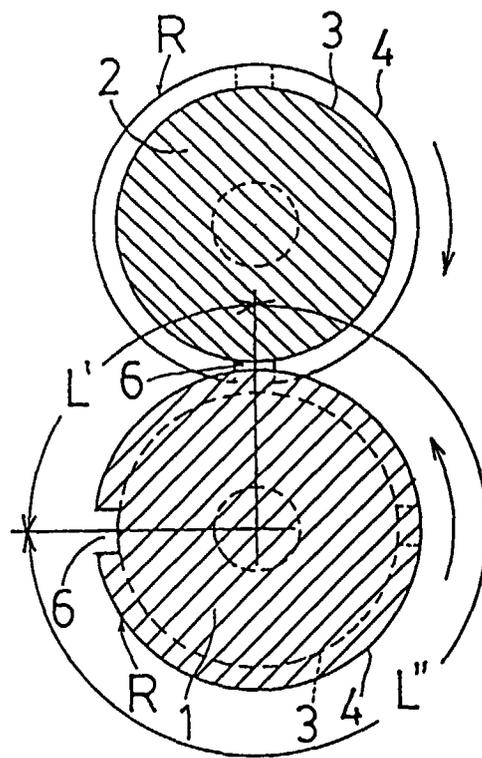


FIG.4

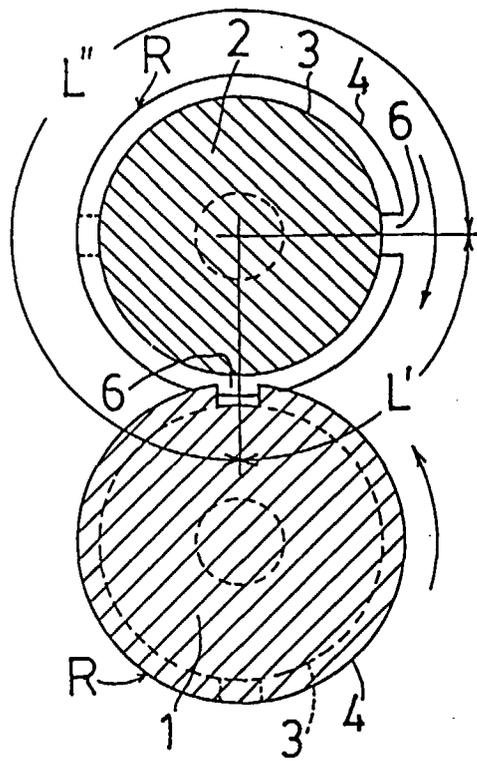


FIG.5

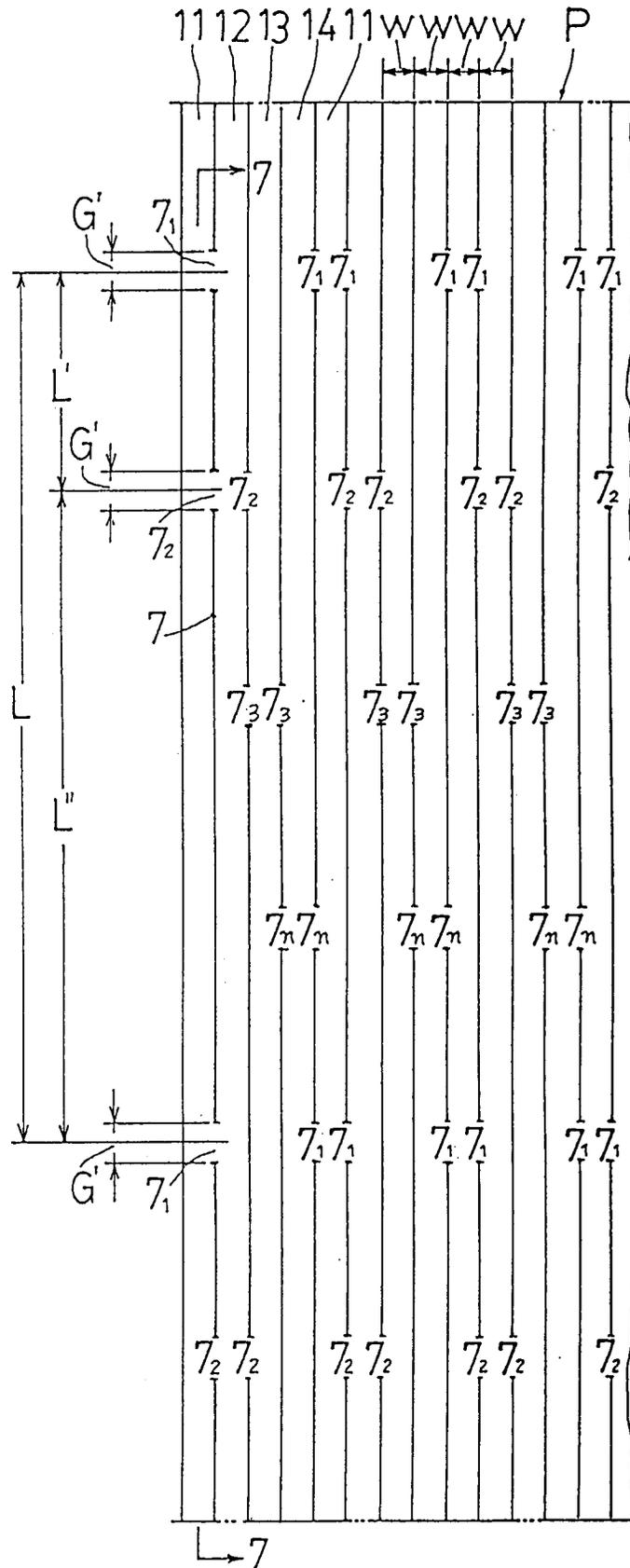


FIG.6

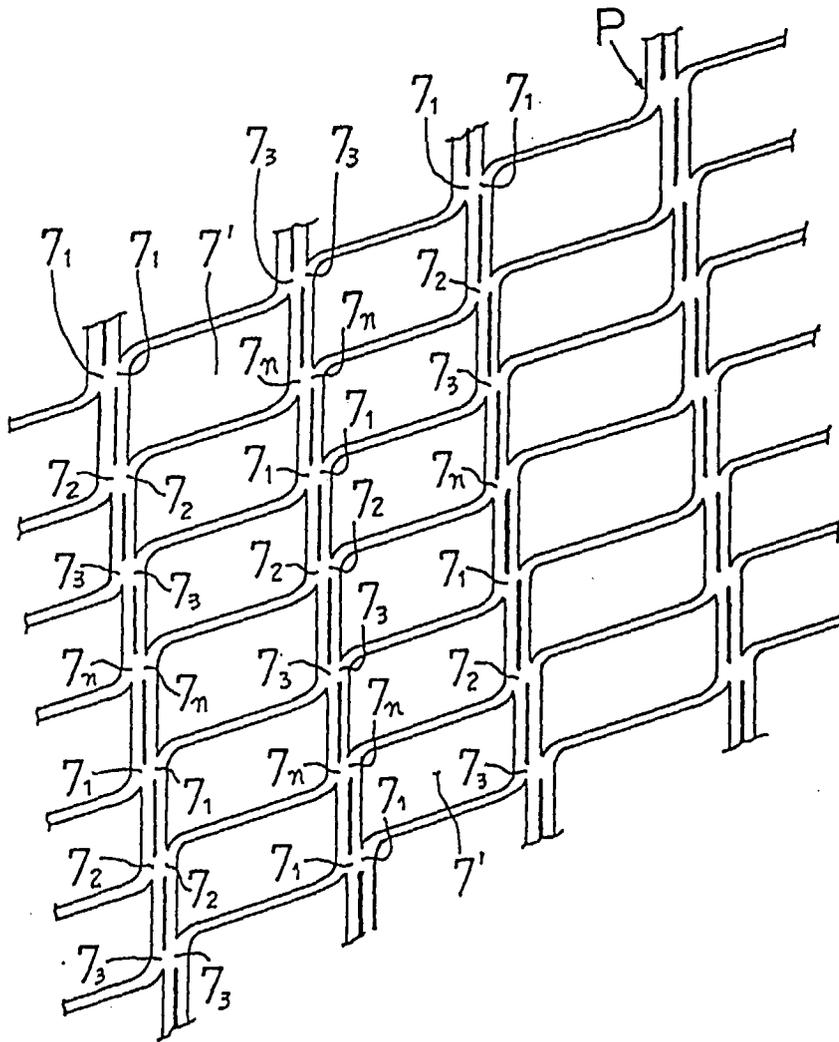


FIG.7

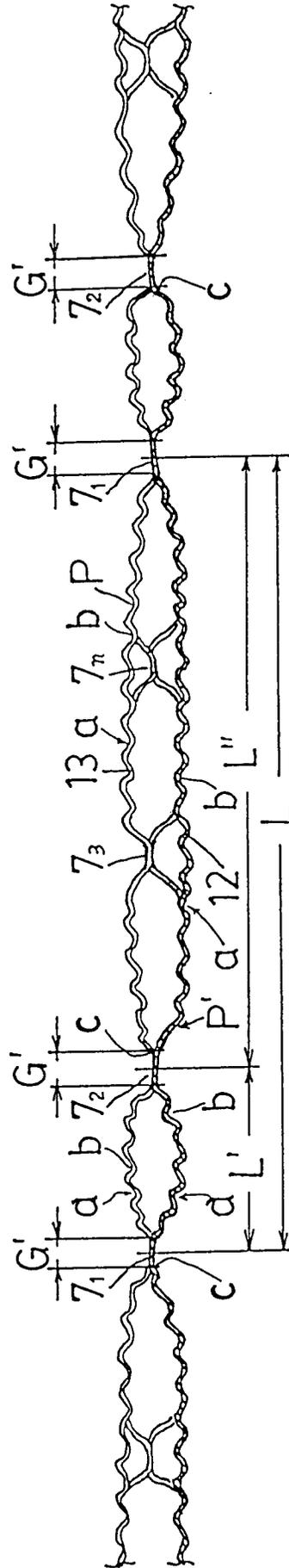


FIG.8

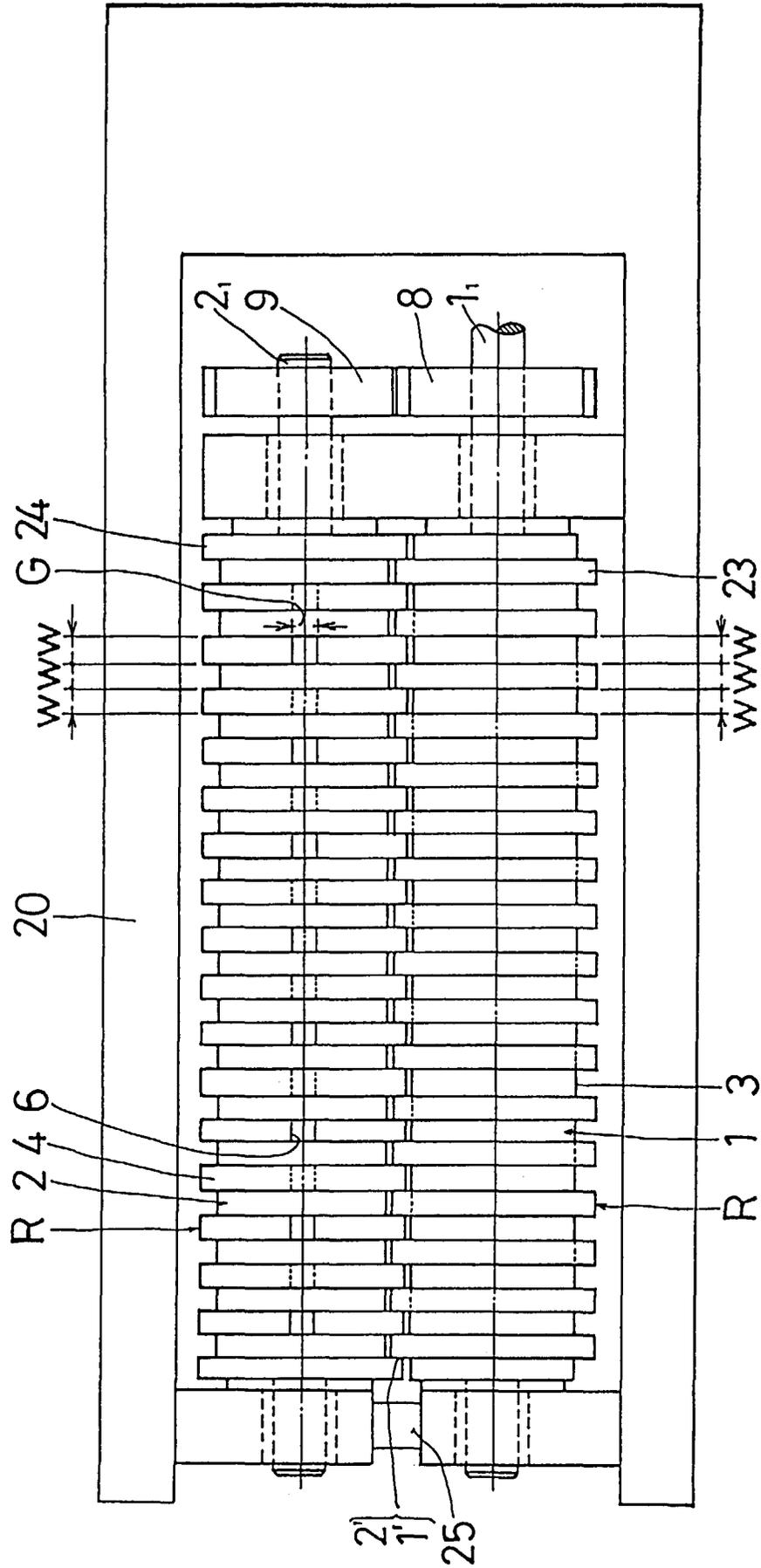


FIG.9

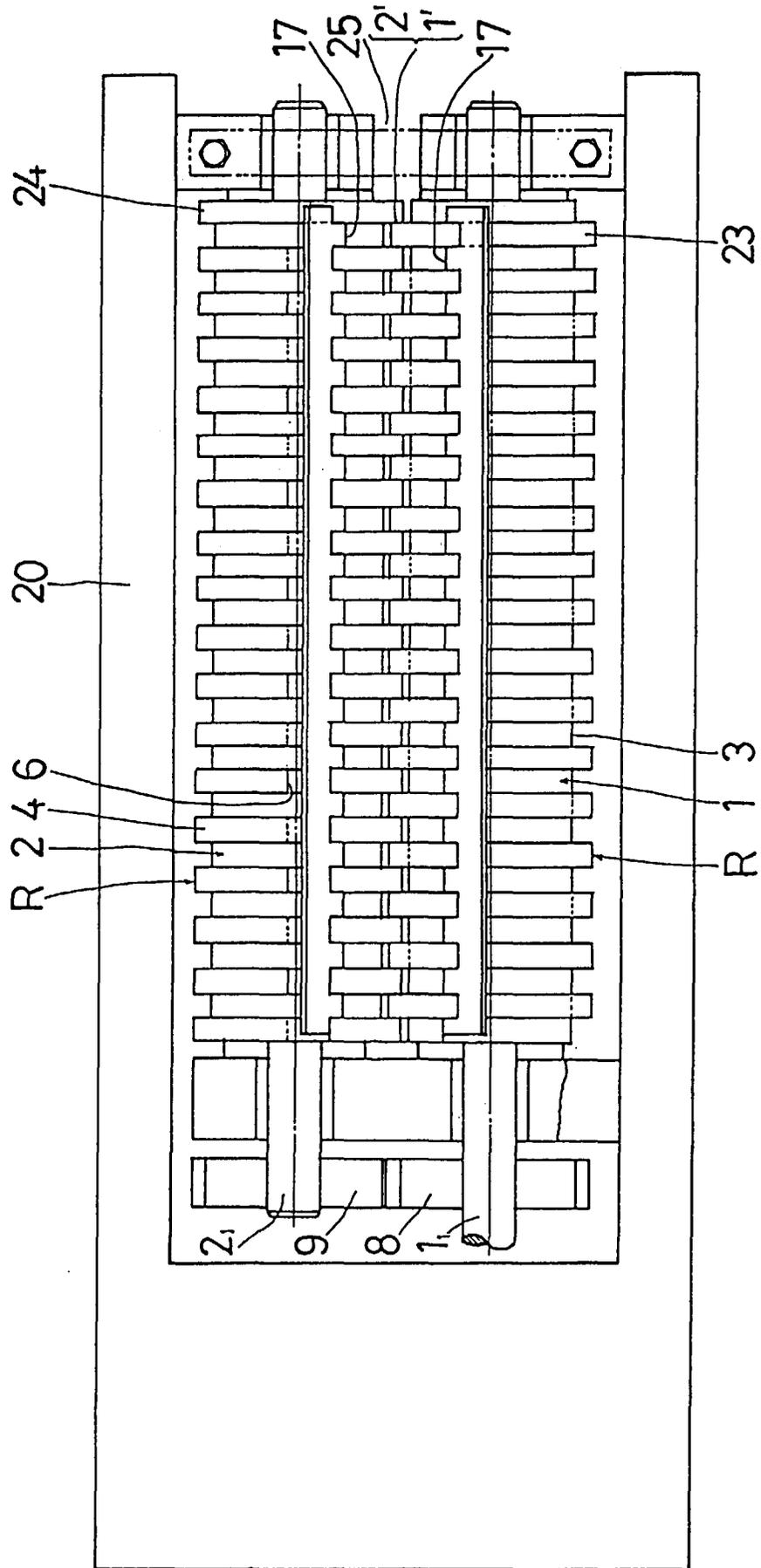
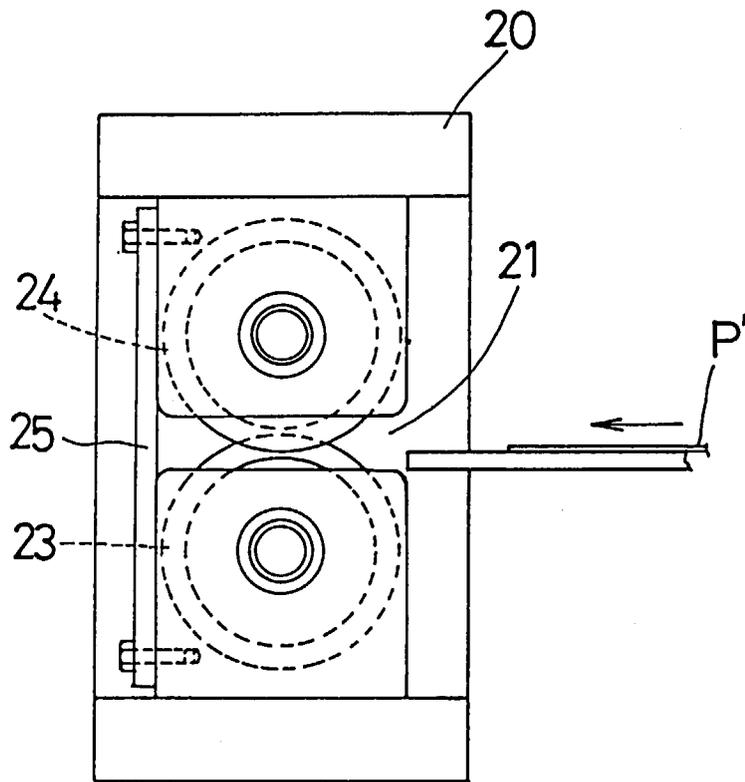


FIG.10





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 96 10 9805

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 523 382 A (SEALED AIR CORP) 20 January 1993 ---	1,2	B31D5/00 B31F5/02
A	EP 0 650 827 A (MERCAMER OY) 3 May 1995 ---	1,2	
A	WO 93 19931 A (RANPAK CORP) 14 October 1993 ---	1,2	
A	GB 1 420 139 A (PAPER CONVERTING MACHINE CO) 7 January 1976 ---	2	
A	GB 995 980 A (KONINKLIJKE NEDERLANDSCHE HEIDEMAATSCHAPPIJ) ---	2	
T	WO 96 40493 A (RANPAK CORP) 19 December 1996 -----	1,2	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B31D B31F B65D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 March 1997	Examiner Roberts, P
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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