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(54) Longitudinal corrugating system for laminar strips or webs.

(57) Longitudinal corrugating system for laminar strips or webs, characterised by at least one roller or drum (1), around which are juxtaposed, in a sector of its circumferential area, a series of peripheral rollers (2) of smaller diameter which have some corrugating elements in the way of annular grooves which are increased in number from the first peripheral roller to the last; these peripheral rollers (2) are pressed against the drum (1) which has its surface profiled to correspond to the corrugating elements of the peripheral rollers (2) or is resiliently deformable to take the shape of the corrugating elements; all this in such a way that passing a laminar strip or web between the peripheral rollers (2) and the drum (1) causes a progressive corrugation of the said strip, with corrugations aligned in the direction of advance of the strip.

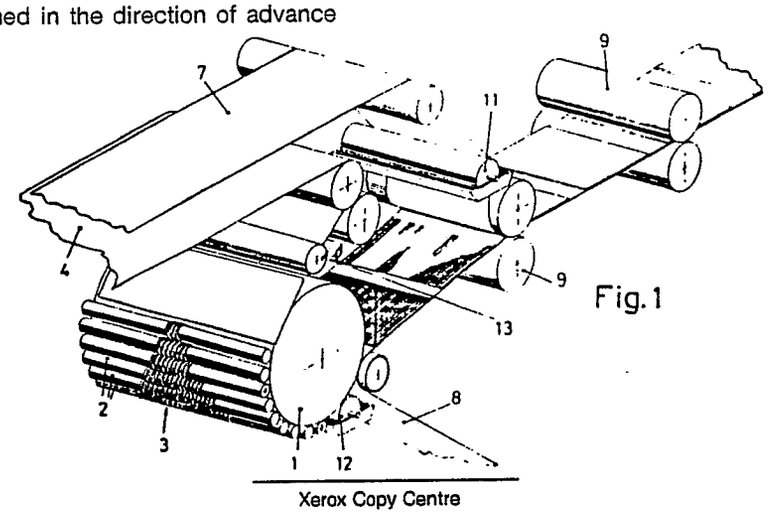

Fig.1

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LONGITUDINAL CORRUGATING SYSTEM FOR LAMINAR STRIPS OR WEBS

The invention relates to a system for longitudinally corrugating strips or webs.

For certain applications, as for example with the manufacture of corrugated cardboard, a continuous process of corrugation of a laminar strip or web is required. When the corrugation has to be transverse to the strip, this is carried out by means of machines incorporating a set of longitudinally grooved rollers which mesh with each other, which, when the laminar strip passes between them, produce the transverse corrugations without any major problems.

But, when it is a matter of producing the corrugation in a longitudinal direction, the problem arises that the material of the strip gathers from the edges to the centre, which brings about tensions which can even end up causing the strip to break.

A solution is already known in which a progressive longitudinal corrugation takes place, by which successive pairs of corrugating rollers, arranged horizontally, are fitted in such a way that the different pairs of rollers are set one behind the other forming a train of progressive corrugating rollers. This solution, although bringing about corrugation in a longitudinal direction of the strip of paper, brings with it the problem that the installation occupies a lot of space, necessary for the train of the pairs of corrugating rollers, and, all things considered, entails a cumbersome and complex installation.

It is an object of the invention to overcome or to mitigate this problem.

According to the invention there is provided a longitudinal corrugating system for laminar strips or webs comprising at least one roller or drum, around which are juxtaposed, in a sector of its circumferential area, a series of peripheral rollers of smaller diameter which have some corrugating elements in the way of annular grooves which are increased in number from the first peripheral roller to the last; these peripheral rollers are pressed against the drum which has its surface profiled to correspond to the corrugating elements of the peripheral rollers or is resiliently deformable to take the shape of the corrugating elements; all this in such a way that passing a laminar strip or web between the peripheral rollers and the drum causes a progressive corrugation of the said strip, with corrugations aligned in the direction of advance of the strip.

Thus a unit is obtained, in which the laminar strip to be corrugated, proceeding from a feeding spool and transported between some suitable guiding and accepting rollers, when passing between the abovementioned drum and peripheral rollers, undergoes, thanks to the pressure between them, progressive longitudinal corrugation, depending on the grooves in the peripheral rollers which it meets, to emerge completely corrugated over the whole width of the strip and with a corrugation which extends in the direction of the longitudinal axis of the strip to be corrugated.

Thus the corrugation of the strip is obtained, in one continuous pass and with one progressive forming action which avoids excessive tension, resulting in higher production output with perfect uniformity of the strip obtained, all this by means of a system which simplifies the solutions already existing in this respect and, above all, significantly reduces the space required for the installation.

The corrugating unit described is completed by a set of rollers which transport the strip from the said forming unit to a collecting spool; at the exit point of the formed strip the arrival point of respective smooth sheets is situated. These are juxtaposed over both surfaces of it to be transported together with it to the collecting spool, the corresponding gluing mechanisms being then brought in, so that the said smooth strips can then be stuck onto the corrugated strip, forming as the end product one single section with it.

Before the arrival point of the strip at the corrugating unit, a cutting mechanism is situated, which, when actuated, enables the sheet which is to be corrugated to be cut into longitudinal pieces, so that when sandwiched between smooth sheets at the exit point, the resulting section remains at intervals without an intermediate corrugated strip. In this way and by means of the system described, one can obtain both strips of laminar sections whose central layer is a continuous longitudinally corrugated element, and strips whose central layer is formed by discontinuous pieces or portions, also corrugated longitudinally, incorporated like a sandwich, between, at least, those smooth strips which are stuck over the portion of the central corrugated layer, or are stuck directly together over their entire area.

When applying the system to the manufacture of corrugated cardboard, this enables specific sectors to be determined by alternating smooth areas and those with a corrugated intermediate layer, making it possible for example to manufacture packaging which would thus have corrugated cardboard in the areas requiring most resistance, and over the remaining area smooth cardboard.

Although, in order to make it easier to understand, the system has been described as applied to the corrugation of strips of paper and to the manufacture of corrugated cardboard, it is obvious

that this system is applicable to the longitudinal corrugation of all types of laminar strips, whether paper, plastic, synthetic materials, aluminium foil or analogous metallic solutions, etc.

Altogether the system advocated offers a very advantageous functional unit, whose characteristics give it viability and a preferential nature with respect to conventional systems for the application for which it is designed.

For better understanding of the nature of the invention, we represent in the attached drawings, merely by way of an illustrative and non limiting example, a preferential form of industrial realisation, and would describe the said drawings as follows:

Fig. 1 is a view showing a diagrammatic representation of the functional unit of the system which is the subject of this invention;

Fig. 2 shows a vacuum system in detail;

Fig. 3 is a view showing the progressive corrugation of the strip to be corrugated as it advances;

Figs. 4 to 9 are respective diagrammatic representations of the successive peripheral rollers corrugating the strip, according to the corresponding sections indicated in Figs. 2 and 3;

Figs. 10 and 11 are details showing the respective piles of sections of corrugated cardboard obtained by means of the system of the invention in the two versions, i.e. without a cutting mechanism (13) and with the said mechanism (13) respectively;

Figs. 12 and 13 are lateral views of the system, in one version functioning without the cutter (13) and the other with it, and

Figs. 14 and 15 are diagrams of solutions with two drums (1) linked horizontally and vertically respectively.

Key

1. - Drum
2. - Peripheral rollers
3. - Grooves
4. - Laminar strip to be corrugated
5. - Guide rollers for the entry point
6. - Formation of corrugation
7. - Smooth strip
8. - Smooth strip
9. - Guide rollers for the collecting point
10. - Collecting spool
11. - Gluing mechanism
12. - Gluing mechanism
13. - Cutting mechanism
14. - Aspirating equipment

In corrugating laminar strips such as strips of paper for the manufacture of corrugated cardboard, the formation of the corrugations is already known both in a transverse direction in relation to the direction of advance of the strip, and in a longitudinal direction, i.e. with the corrugations parallel to the direction of advance of the strip to be corrugated.

Industrial machines producing this corrugation generally work with transverse corrugation, although longitudinal corrugation should be produced progressively to avoid tension causing breaking of the strip and this, to date, has led to very cumbersome installations.

The subject of the invention relates to a system of longitudinal corrugation of laminar strips, for application basically in the manufacture of corrugated cardboard, eliminating or mitigating the problems described above. In effect, this new system is based on the utilisation of a basic large diameter roller or drum (1) see Fig. 1, on a wide peripheral area of which is juxtaposed a series of smaller diameter rollers (2), the said peripheral rollers (2) being provided, see Figs. 4 to 9, with a series of annular grooves (3), which increase progressively in number over the successive rollers from the centre to the outside.

The drum (1) itself has annular grooves, corresponding inversely in the higher and lower parts with those grooves (3) of the peripheral rollers (2), or is of an elastic material which is able to distort according to the abovementioned grooves (3) of the rollers (2).

In this way an assembly is formed such that the peripheral rollers (2) are pressed against the drum (1), when a laminar strip or web (4) passes between them, having come from a feeding spool and been guided by guide rollers (5), the said web (4) undergoing progressive longitudinal corrugation, as can be seen from Fig. 3, following the shape (trapezoidal, sinusoidal, etc.) of the grooves (3), either cold or heated for greater effectiveness.

But in any case, as can be seen from Fig. 3, the said corrugation takes place progressively over the width of the strip (4), from the centre to the edges, which is effective, thanks to the progression in number of grooves (3) of the rollers (2), according to the succession of them which comes into contact with the web (4) as it advances, succeeding in this way in the corrugation (6), which necessarily has to occur with gathering of the web (4) from the edges to the centre, not causing excessive transverse tension which could cause the web (4) to break or to crease resulting in an imperfect, uneven finished product.

From Fig. 12 it can be seen how, at the exit point of the abovementioned corrugating unit, the arrival is arranged of smooth webs (7 & 8) which come from other feeding spools juxtaposed one above and one below the surfaces of the cor-

rugated web (4), forming with it a sandwich which is led through a series of guide rollers (9) to a corresponding collecting spool (10).

Since with the corrugated cardboard which we are trying to obtain the smooth webs (7 & 8) have to be joined to the corrugated strip (4) forming one single unit with it, at the exit point of the corrugating unit gluing mechanisms (11 & 12) are also arranged which apply adhesive material at the same pass of the webs so that the said smooth webs (7 & 8) are conveniently stuck to the corrugated web (4), in this way giving corrugated cardboard in a continuous manner which is completely finished on arrival at the collecting spool (10).

Moreover, before the entry point of the web (4) at the corrugating unit, a cutting mechanism (13) has been incorporated, whose operation is optional, which, when operated, enables the web (4) to be cut in longitudinal portions, as can be seen from Fig. 13, so that the final sandwich between the smooth webs (7 & 8) and the corrugated web results at intervals with portions without intermediate corrugated cardboard web (4). In Figs. 10 and 11 can be seen those piles of portions of corrugated cardboard resulting respectively, firstly from a functional version of the system without actuating the cutter (13) and secondly, represented in Fig. 11, actuating the cutter (13), in accordance with the last operational form described.

In the version represented in Figs. 11 and 13, i.e. with the cutting mechanism (13) actuated, the result obtained is translated into some pieces of cardboard with smooth areas and with areas having a corrugated central section, which is covered over its entire surface by smooth webs (7 & 8). These pieces can contain the portions with a corrugated central section which are required, with those dimensions and shapes which will make them suitable for their application in the sphere of packaging, since the sandwich can offer a content of corrugated cardboard in the areas where more resistance is required, and be smooth in the remaining area, with the characteristic that the total covering of the intermediate corrugated part or parts will prevent humidification in later use.

On the other hand, the peripheral rollers (2) have been arranged on a movable mounting, either following a longitudinal axis, or pivoting, or by means of eccentrics in such a way that, by conventional means, they are applied against the drum (1).

These peripheral rollers (2), according to the requirements of each mounting, can turn freely, as satellites of the drum (1), or all have their own motive means, or alternately motive means which would be synchronised with those of the drum (1).

The connecting of the laminar web (4) with the drum (1), above all when it is cut into portions, is carried out via already known means, either mechanical, such as vacuum inside the drum (1), or via pressure curtains of compressed air. In Fig. 2, by way of example, a solution is represented of vacuum means utilising a vacuum pump (14).

The system has been described with one single drum (1), around which are arranged a series of peripheral rollers (2), but obviously nothing is changed essentially if there are several drums (1), each one of which has a series of peripheral rollers (2), and being arranged horizontally or vertically, see Figs. 14 and 15.

It should also be pointed out that for better comprehension the system has been described as applied to the manufacture of corrugated cardboard, but the system is also applicable to the longitudinal corrugation of any laminar strip - paper, plastic, metal etc., working either hot or cold, and obtaining in each case the most suitable form of profile of corrugations.

This invention thus provides a new system of longitudinal corrugation with which, starting from the same principal of progressive shaping of the strip to be corrugated, the problems of the prior art described above are eliminated or mitigated, giving an installation which requires a smaller number of rollers, resulting in much less cost and at the same time giving an innovative arrangement of the rollers enabling the dimensions of the space required to be kept to a minimum, allowing the corrugating unit to be combined without any great difficulty with the plant required for feeding and collecting the laminar web or strip, and using it in conjunction with other mechanisms for incorporating other smooth laminar webs on the surfaces of the corrugated web to obtain corrugated cardboard in its finished state, all of which with much smaller dimensions.

Claims

1. Longitudinal corrugating system for laminar strips or webs, characterised by at least one roller or drum (1), around which are juxtaposed, in a sector of its circumferential area, a series of peripheral rollers (2) of smaller diameter which have some corrugating elements in the way of annular grooves which are increased in number from the first peripheral roller to the last; these peripheral rollers (2) are pressed against the drum (1) which has its surface profiled to correspond to the corrugating elements of the peripheral rollers or is resiliently deformable to take the shape of the corrugating elements; all this in such a way that passing a laminar strip or web between the peripheral rollers and the drum causes a progressive

corrugation of the said strip, with corrugations aligned in the direction of advance of the strip.

2. Longitudinal corrugating system for laminar strips or webs as claimed in claim 1, characterised in that the system can consist of one or more corrugating units (1, 2), arranged either horizontally or vertically in relation to each other, each unit being made up every time of a drum (1) and its corresponding series of peripheral rollers (2).

3. Longitudinal corrugating system for laminar strips or webs as claimed in claim 1 or claim 2, characterised in the progressive increase in number of corrugations can be carried out one or several at a time, symmetrically from the transverse centre of the drum and rollers or asymmetrically.

4. Longitudinal corrugating system for laminar strips or webs according to any preceding claim, characterised in that the corrugations can be equal, different, symmetrical, asymmetrical, straight, curved, or mixed according to the movement of the appropriate components.

5. Longitudinal corrugating system for laminar strips or webs according to any preceding claim, characterised in that the laminar strip or web or portions of the strip or web which it is wished to corrugate are held over the drum (1) by means of internal vacuum, external air or mechanical elements which guide it and maintain it in the required position.

6. Longitudinal corrugating system for laminar strips or webs according to any preceding claim, characterised in that the corrugation can be carried out continuously or discontinuously and cold or hot.

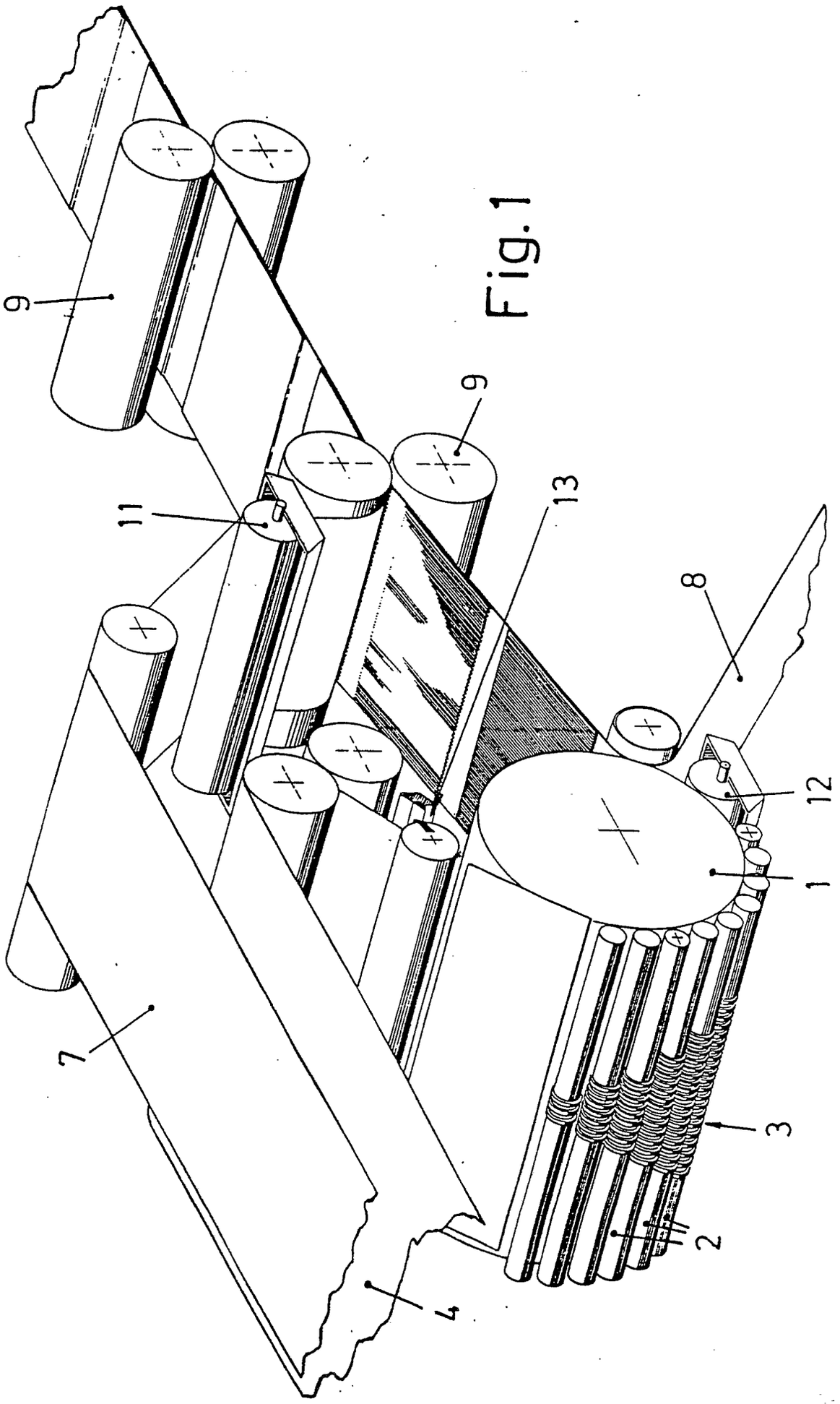


Fig.1

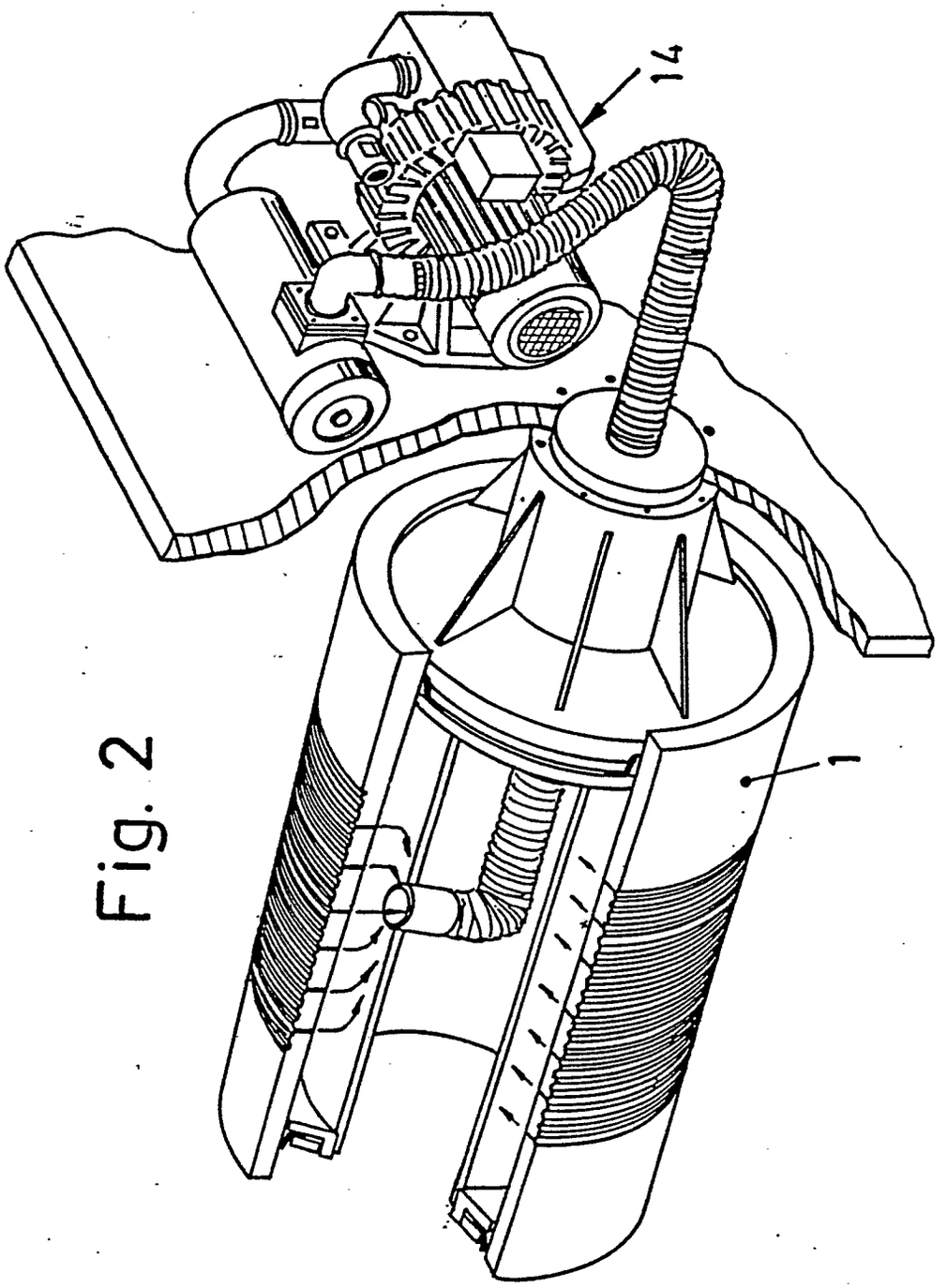


Fig. 2

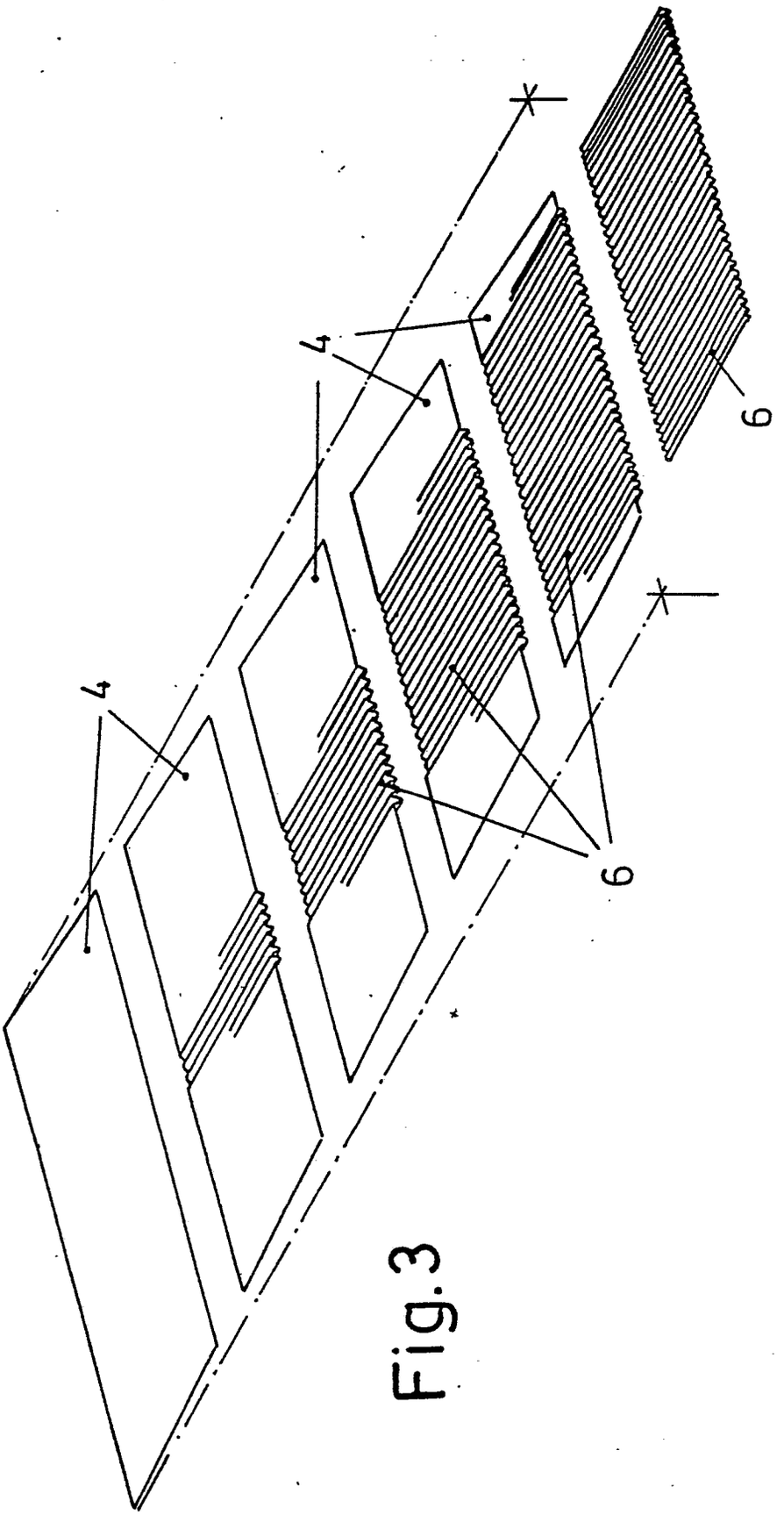


Fig.3

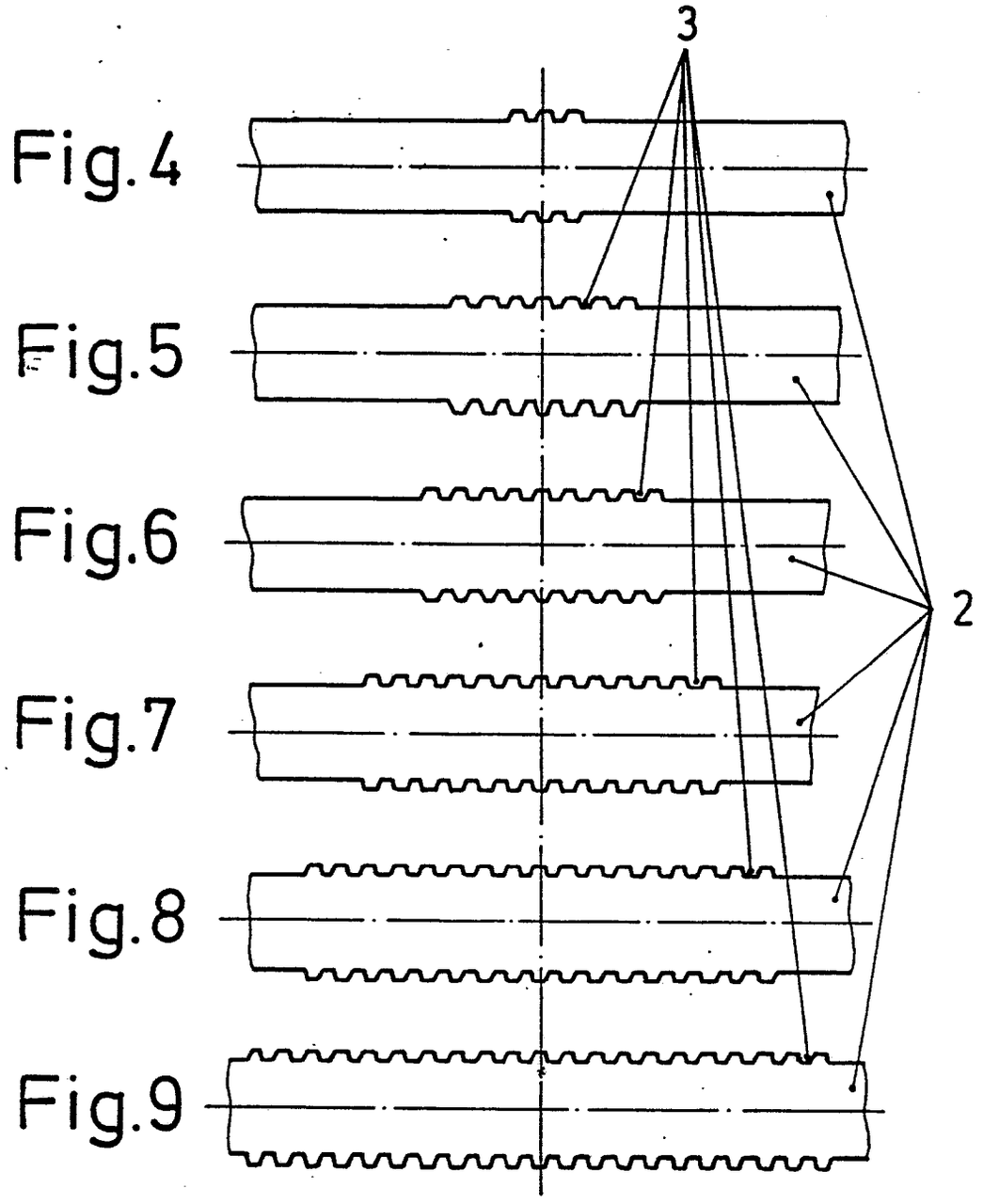


Fig.4

Fig.5

Fig.6

Fig.7

Fig.8

Fig.9

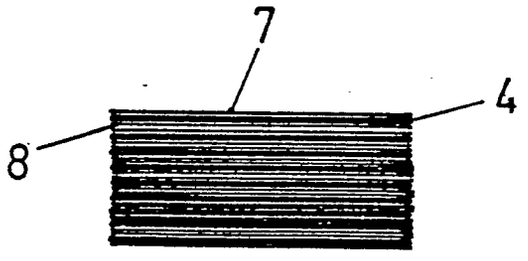


Fig.10

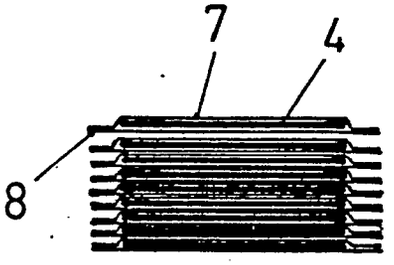


Fig.11

Fig. 12

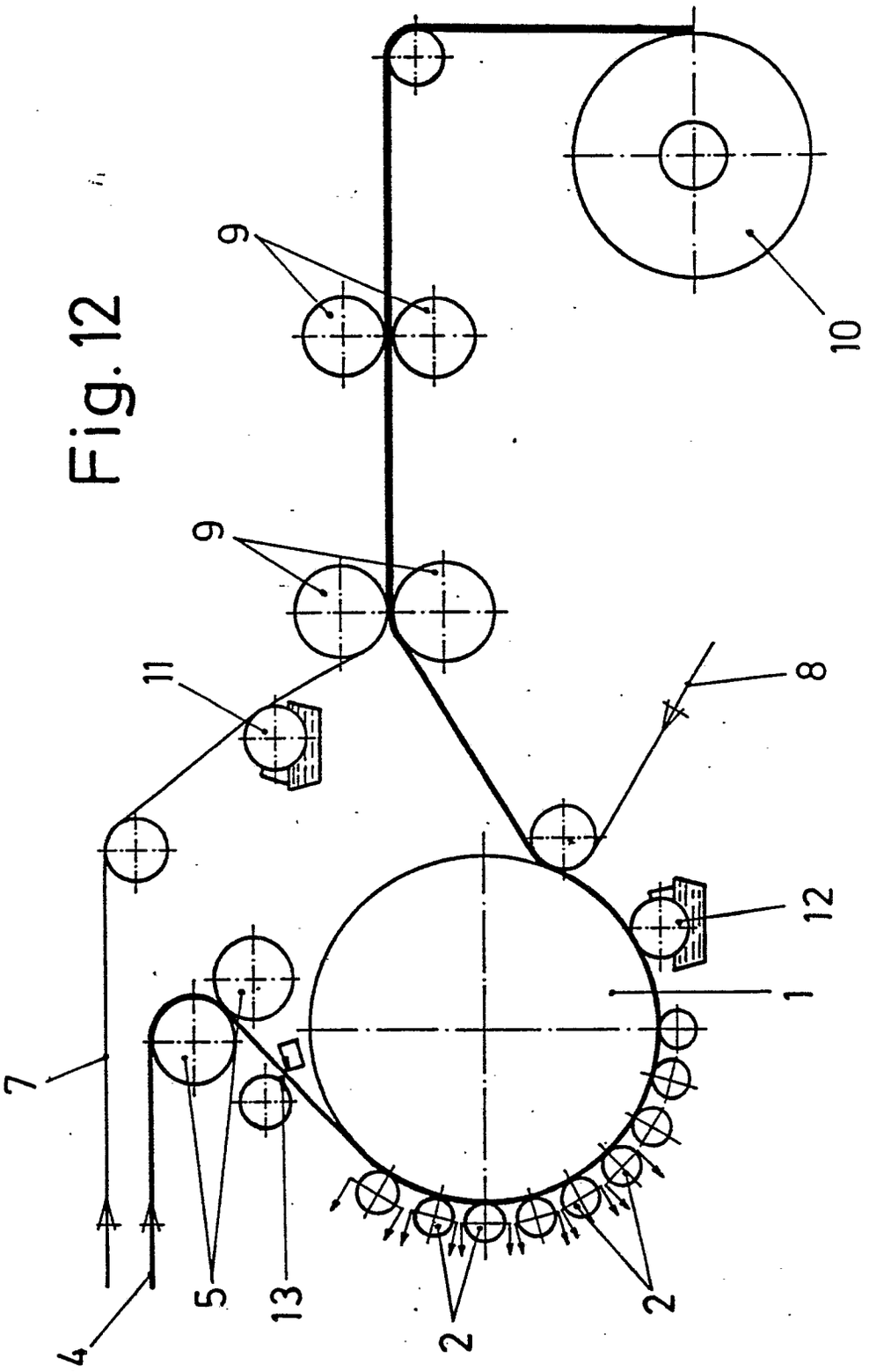


Fig.13

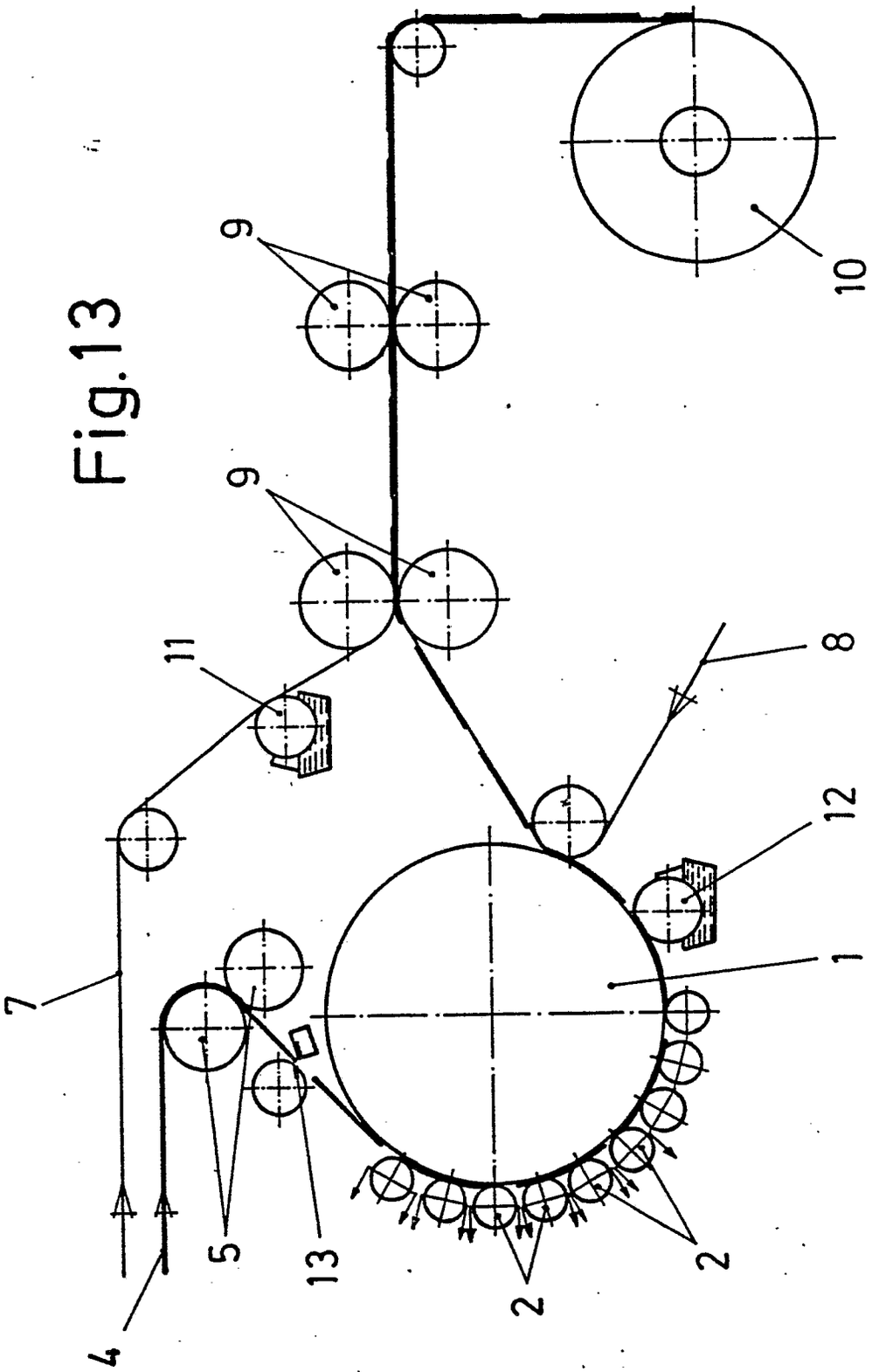
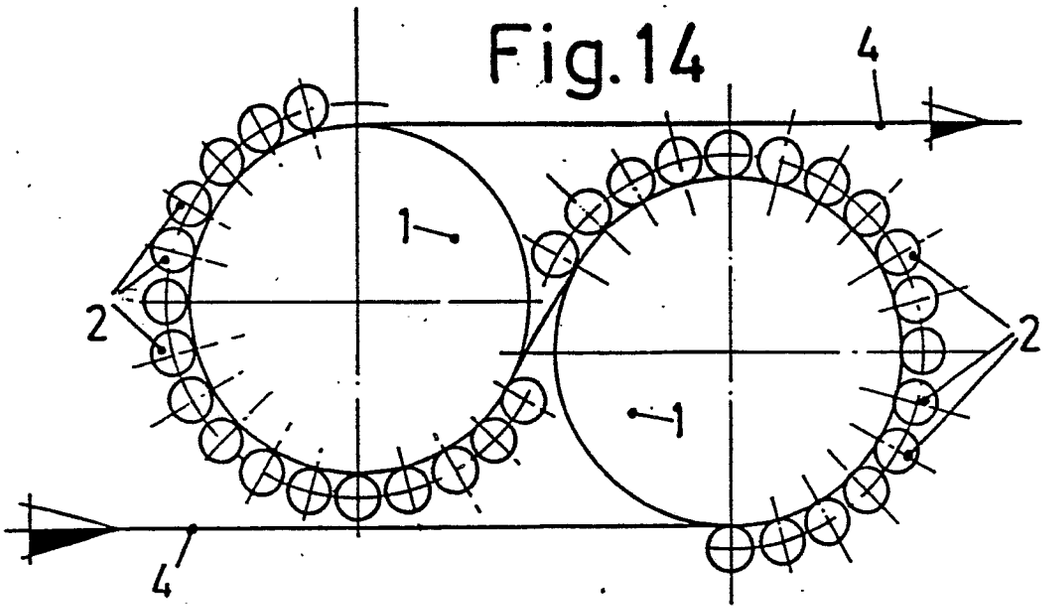


Fig.14



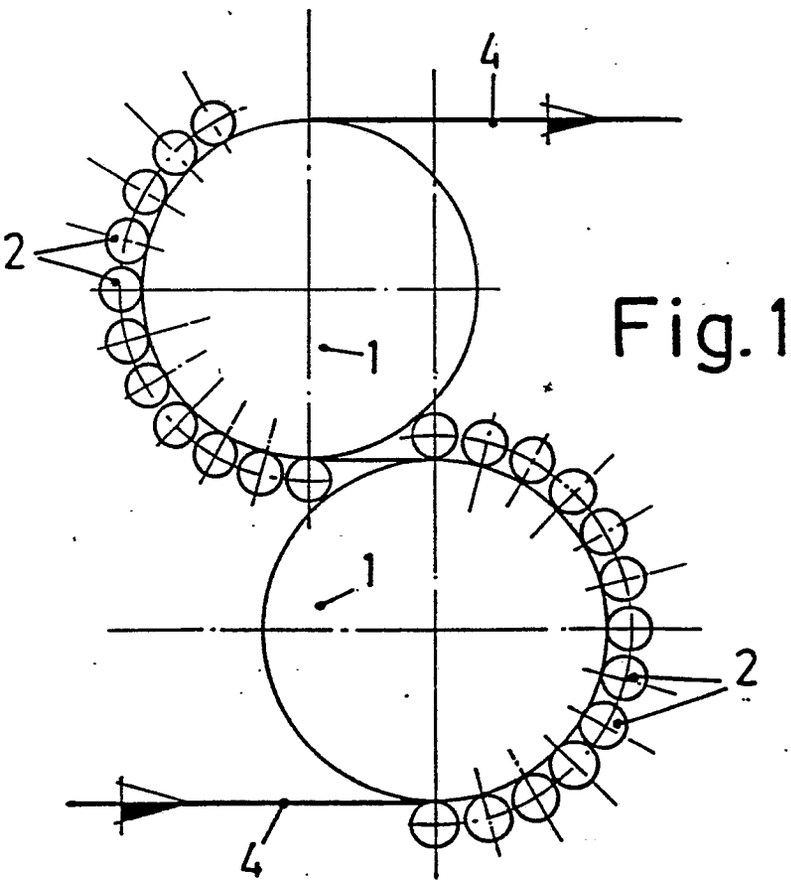


Fig.15

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 89308280.0

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.4)
X	AT - B - 191 726 (THEODOR BELL & CIE.) * Totality * --	1	B 31 F 1/22
X	DE - A1 - 3 611 134 (BAUMGARTNER PAPIERS S.A.) * Totality * ----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 31 F 1/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	04-12-1989	KRUMPSCHMID

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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