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(71) Applicant: **G.D SOCIETA' PER AZIONI**
Via Pomponia, 10
I-40100 Bologna (IT)

(72) Inventor: **Draghetti, Fiorenzo**
Via San Donino 506
I-40059 Medicina (IT)
Inventor: **Rizzoli, Salvatore**
Via Galeazza, 21
I-40100 Bologna (IT)

(74) Representative: **Jorio, Paolo et al**
Studio Torta,
Via Viotti, 9
I-10121 Torino (IT)

(54) Method and device for scissor cutting strip material.

(57) A method and device for scissor cutting strip material, whereby a continuous strip (10) is fed by a conveyor (9) to a cutting station (11) where it is cut into bands (3) by a cutting unit (12) presenting a number of inner blades (30) with a cutting edge (37) parallel to the surface of the strip (10), and corresponding outer blades (27) with a cutting edge (28) sloping in relation to the cutting edge (37) of the inner blades (30); each inner blade (30) travels with the conveyor (9) through the cutting station (11) in time with a corresponding outer blade (27), and is gradually moved through the conveyor (9) into a partially extracted cutting position so as to be gradually engaged by the oblique cutting edge (28) of the corresponding outer blade (27) and so scissor cut the strip (10).

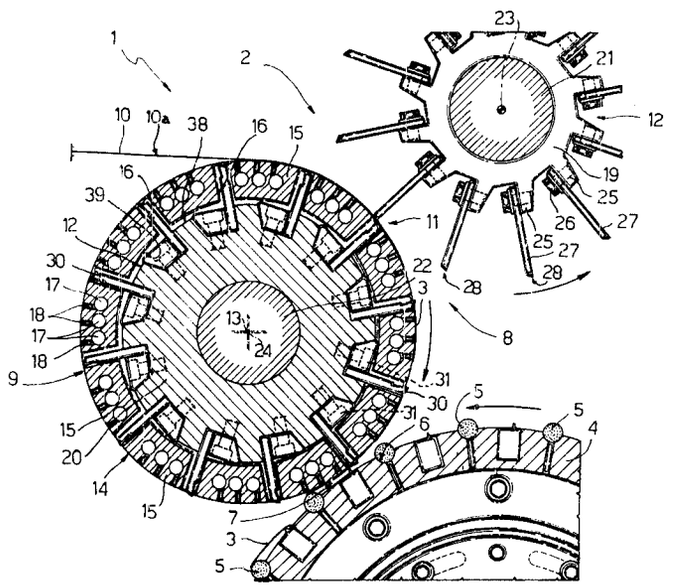

Fig.1

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The present invention relates to a method of scissor cutting strip material.

Here and hereinafter, the term "scissor cutting" is intended to mean a cut made by two blades contacting each other at successive points, which contact may be made in two distinct ways depending on whether the planes of the two blades are inclined or parallel to each other.

With blades in inclined planes, scissor cutting is normally effected by "grazing" of the substantially coplanar cutting edges of the blades which are moved substantially crosswise to their planes. With blades in parallel planes, on the other hand, scissor cutting is normally effected by "penetration", the cutting edge of one blade being positioned obliquely in relation to that of the other, and the two blades being moved in relation to each other within the plane.

Both the above scissor cutting methods are used to advantage in the tobacco industry in general, and in the manufacture of cigarettes in particular to which specific reference is made in the following description purely by way of example, and wherein scissor cutting is employed, among other things, on filter assembly machines, for cutting filter-cigarette connecting bands from a continuous strip.

Connecting bands are known to be graze scissor cut from a continuous strip using the device described in US Patent n. 4,943,341 granted to the present Applicant, wherein a strip feed roller presents a number of inclined blades, the cutting edge of each of which is grazed at successive points by the cutting edge of a respective blade on another roller to cut the strip into segments.

Though highly accurate, in general, graze scissor cutting as described in the above patent requires relatively accurate assembly of the blades, adapts poorly to variations in temperature, and is subject to relatively severe wear of the cutting edges of the blades.

In an attempt to overcome the above drawbacks, British Patent Application n. 2,220,878 relates to a penetration scissor cutting device comprising a conveyor roller for feeding a continuous strip to a cutting station and in turn comprising a succession of peripheral suction sectors separated by grooves extending along respective generating lines of the roller. Each of the grooves presents a cutting edge and is gradually engaged, in the region of the cutting station, by the oblique cutting end of an outer blade positioned substantially radially on a cutting roller parallel to and rotating in the opposite direction and in time with the conveyor roller.

The above penetration scissor cutting device presents several drawbacks which are especially troublesome in the event the strip, as in the specific application referred to herein, presents an outward gummed surface facing the outer blades. In which case, each outer blade, as it penetrates inside the respective groove, draws part of the strip with it inside the groove and is inevitably soiled with gum which, despite the provision of cleaning assemblies contacting the outer blades clear of the cutting station, may result in frequent stoppage of the filter assembly machine for cleaning purposes. Moreover, deformation of the strip by the outer blade, so that part of the strip penetrates inside the groove, may result in inaccurate cutting of the strip.

It is an object of the present invention to provide a method of penetration scissor cutting a continuous strip, designed to overcome the aforementioned drawbacks.

According to the present invention, there is provided a method of scissor cutting strip material, the method comprising the steps of feeding a continuous strip, by means of a first conveyor, to a cutting station and into engagement with a cutting unit comprising a succession of first cutting means moving with the first conveyor; feeding through the cutting station, and in time with the first cutting means, a succession of second cutting means forming part of the cutting unit, the second cutting means being brought gradually into engagement with the corresponding first cutting means to cut the strip into segments; and successively feeding the segments to a second conveyor; characterized in that gradual engagement of the first and second cutting means is achieved by moving each first cutting means in relation to the first conveyor and towards the corresponding second cutting means at least when traveling through the cutting station.

According to a preferred embodiment of the above method, the first cutting means are moved in relation to the first conveyor by moving the first cutting means through the first conveyor and to and from a partially extracted cutting position.

The present invention also relates to a device for scissor cutting strip material.

According to the present invention, there is provided a device for scissor cutting strip material, the device comprising a first conveyor for feeding a continuous strip through a cutting station; a cutting unit for engaging the strip at the cutting station and cutting it into segments; and a second conveyor for successively receiving said segments at a transfer station; the cutting unit comprising a succession of first cutting means moving with the first conveyor, and a succession of second cutting means moving through the cutting station in time with the first cutting means and which gradually engage the corresponding first cutting means to cut the strip into segments; characterized in that the first cutting means are movable in relation to the first conveyor; activating means being provided for moving each

first cutting means in relation to the first conveyor and towards the corresponding second cutting means at least when traveling through the cutting station.

According to a preferred embodiment of the above device, the first cutting means are mounted through the first conveyor and are moved, in relation to the first conveyor and by said activating means, to and from a partially extracted cutting position wherein each first cutting means projects partially outwards of the first conveyor and towards the second cutting means.

A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic cross section of a preferred embodiment of the cutting device according to the present invention;

Figure 2 shows a larger-scale detail of Figure 1;

Figure 3 shows a section of a detail in Figure 2 in a plane perpendicular to the Figure 2 plane.

Number 1 in Figure 1 indicates a filter assembly machine comprising a device 2 for cutting and feeding a succession of bands 3 to a known conveyor roller 4 on which groups 5, comprising two cigarette portions separated by a double filter, are retained pneumatically in known manner inside respective seats 6 parallel to the generating lines of roller 4. Roller 4 feeds groups 5 transversely through a transfer station 7 where bands 3 are applied by device 2 to the outer periphery of respective groups 5.

Device 2 comprises a feed unit 8 in turn comprising a conveyor roller 9 for receiving a strip 10 of sheet material with a gummed surface 10a opposite the surface contacting roller 9, and for feeding strip 10 through a cutting station 11 where it is cut into bands 3 by a cutting unit 12 forming part of device 2.

Roller 9 is rotated clockwise (in Figure 1) by known drive means (not shown) about a substantially horizontal axis 13 perpendicular to the Figure 1 plane, and presents a cylindrical outer surface 14 tangent to conveyor roller 4 at transfer station 7. Roller 9 is a tubular roller defined by a succession of suction segments or sectors 15 equally spaced about axis 13 and each separated from the adjacent sector 15 by a radial axial slit 16. Sectors 15 are connected to one another by end plates 15a (Figure 3), and each presents a number of through axial suction channels 17, each of which communicates on one side with a known suction device (not shown) and on the other with a number of holes 18 extending radially through sector 15 and communicating externally through surface 14.

Cutting unit 12 comprises two rollers 19 and 20 fitted to respective drive shafts 21 and 22 rotating, the first in the opposite direction and the second in the same direction as roller 9, about respective axes 23 and 24 parallel to axis 13.

Roller 19 presents a number of substantially radial appendixes 25 equal in number to slits 16, equally spaced about axis 23, and each fitted by means of a respective screw 26 with a respective blade 27 (hereinafter referred to as the "outer blade") lying in a plane parallel to axis 23 and presenting a cutting edge 28 on its free end. Each edge 28 is oblique in relation to axis 23, and presents a tip 29 facing surface 14 of roller 9 and traveling along a circular path interfering with surface 14 at cutting station 11.

Roller 20 is a cylindrical roller housed inside roller 9 and which presents a number of substantially radial blades 30 (hereinafter referred to as "inner blades") equally spaced about axis 24 and fitted to the periphery of roller 20 by means of respective fastening devices 31. Inner blades 30 are equal in number to slits 16, and each engages a respective slit 16 in radially-sliding transversely-slack manner.

As shown particularly in Figure 2, each inner blade 30 presents a free end portion 32 in turn presenting an axial groove 33 on the side facing upstream in the rotation direction of roller 20. On the side facing roller 19, portion 32 is also defined by a surface 34 sloping inwards and downstream in relation to a plane tangent to surface 14 and moving with inner blade 30. Groove 33 is defined by a first surface 35 crosswise to respective inner blade 30, and by a second surface 36 extending outwards from surface 35 and obliquely in relation to the mid radial plane of respective inner blade 30, and which intersects surface 34 along an edge parallel to axis 13 and constituting the cutting edge 37 of inner blade 30.

Axis 24 of roller 20 is eccentric in relation to axis 13, and lies within a sector having its apex at axis 13 and subtended by an arc extending between stations 11 and 7; and the diameter of roller 20 is such that the outer surface 38 of roller 20 is substantially tangent to the cylindrical inner surface 39 of roller 9 inside said sector. Moreover, inner blades 30 project outwards of surface 38 by a length greater than the distance between surfaces 38 and 14, and at most equal to the sum of this distance and the difference between the diameters of surfaces 38 and 39, so that, when rollers 9 and 20 are rotated at the same speed about respective axes 13 and 24, inner blades 30 move through roller 9 and to and from an extracted position which is assumed at least at said sector and wherein edge 37 of each inner blade 30 projects outwards of surface 14.

In actual use, rollers 9 and 20 on one side and roller 19 on the other are rotated in opposite directions, at the same speed, and in time with one

another about respective axes 13, 24 and 23, so that each outer blade 27 laterally contacts a respective inner blade 30 at cutting station 11. Strip 10 is fed in known manner on to surface 14 and, due to the eccentricity of axis 24 in relation to axis 13, the inner blade 30 approaching station 11 begins to project outwards of surface 14 before reaching station 11, thus detaching strip 10 from surface 14. At the same time, the oblique cutting edge 28 of the corresponding outer blade 27 contacts successive points of the cutting edge 37 of inner blade 30 and penetrates gradually inside groove 33 to scissor cut strip 10 transversely. The connecting bands 3 so formed are fed successively to station 7 where they are applied by their gummed surfaces 10a to the periphery of respective groups 5.

In connection with the above, it should be pointed out that, by gradually projecting outwards of surface 14, each inner blade 30 constitutes an inner support for strip 10, for preventing strip 10 from folding inwards of slit 16 during the cutting operation, and so ensuring a precise cut, while at the same time preventing outer blade 27, with the exception of cutting edge 28, from contacting gummed surface 10a, thus substantially eliminating fouling of blade 27 by the gum during the cutting operation.

Claims

1. A method of scissor cutting strip material, the method comprising the steps of feeding a continuous strip (10), by means of a first conveyor (9), to a cutting station (11) and into engagement with a cutting unit (12) comprising a succession of first cutting means (30) moving with the first conveyor (9); feeding through the cutting station (11), and in time with the first cutting means (30), a succession of second cutting means (27) forming part of the cutting unit (12), the second cutting means (27) being brought gradually into engagement with the corresponding first cutting means (30) to cut the strip (10) into segments (3); and successively feeding the segments (3) to a second conveyor (4); characterized in that gradual engagement of the first (30) and second (27) cutting means is achieved by moving each first cutting means (30) in relation to the first conveyor (9) and towards the corresponding second cutting means (27) at least when traveling through the cutting station (11).

2. A method as claimed in Claim 1, characterized in that the first cutting means (30) are moved in relation to the first conveyor (9) by moving the first cutting means (30) through the first conveyor (9) and to and from a partially extracted cutting position.

3. A device for scissor cutting strip material (10), the device comprising a first conveyor (9) for feeding a continuous strip (10) through a cutting station (11); a cutting unit (12) for engaging the strip (10) at the cutting station (11) and cutting it into segments (3); and a second conveyor (4) for successively receiving said segments at a transfer station (7); the cutting unit (12) comprising a succession of first cutting means (30) moving with the first conveyor (9), and a succession of second cutting means (27) moving through the cutting station (11) in time with the first cutting means (30) and which gradually engage the corresponding first cutting means (30) to cut the strip (10) into segments (3); characterized in that the first cutting means (30) are movable in relation to the first conveyor (9); activating means (20) being provided for moving each first cutting means (30) in relation to the first conveyor (9) and towards the corresponding second cutting means (27) at least when traveling through the cutting station (11).

4. A device as claimed in Claim 3, characterized in that the first cutting means (30) are mounted through the first conveyor (9) and are moved, in relation to the first conveyor (9) and by said activating means (20), to and from a partially extracted cutting position wherein each first cutting means (30) projects partially outwards of the first conveyor (9) and towards the second cutting means (27).

5. A device as claimed in Claim 3 or 4, characterized in that said first conveyor (9) comprises a tubular roller (9) presenting a cylindrical outer surface (14) with a number of radial slits (16), and rotating at a given angular speed about a first, its own, axis (13); the first cutting means (30) being mounted, together with said activating means (20), inside the tubular roller (9); and each first cutting means (30) engaging a respective said slit (16) in radially sliding manner.

6. A device as claimed in Claim 5, characterized in that said activating means (20) comprise an inner roller (20) mounted eccentrically inside the tubular roller (9) so as to rotate at said angular-speed about a second, its own, axis (24) parallel to the first axis (13); the inner roller (20) presenting a diameter smaller than the inside diameter of the tubular roller (9).

7. A device as claimed in Claim 6, characterized in that the second axis (24) lies within a sector having its apex at the first axis (13) and subtended by an arc through said cutting and transfer stations (11, 7); the diameter of the inner roller (20) being such that the outer surface (38) of the inner roller (20) is substantially tangent to the cylindrical inner surface (39) of the tubular roller (9) within said sector.

8. A device as claimed in Claim 7, characterized in that each said first cutting means (30) comprises an inner blade (30) projecting radially outwards from the inner roller (20); each inner blade (30) projecting outwards of the outer surface (38) of the inner roller (20) by a length greater than the distance between the inner (39) and outer (14) surfaces of the tubular roller (9), and at most equal to the sum of this distance and the difference between the diameters of the inner surface (39) of the tubular roller (9) and the outer surface (38) of the inner roller (20).

9. A device as claimed in Claim 8, characterized in that each inner blade (30) presents a cutting edge (37) parallel to said second axis (24).

10. A device as claimed in Claim 9, characterized in that each second cutting means (27) comprises an outer blade (27) moving about a third axis (23) parallel to the first (13) and second (24) axes; said first (13) and third (23) axes being located on either side of the cutting station (11).

11. A device as claimed in Claim 10, characterized in that each outer blade (27) is positioned radially in relation to the third axis (23), and presents a cutting edge (28) sloping in relation to the third axis (23).

Fig.1

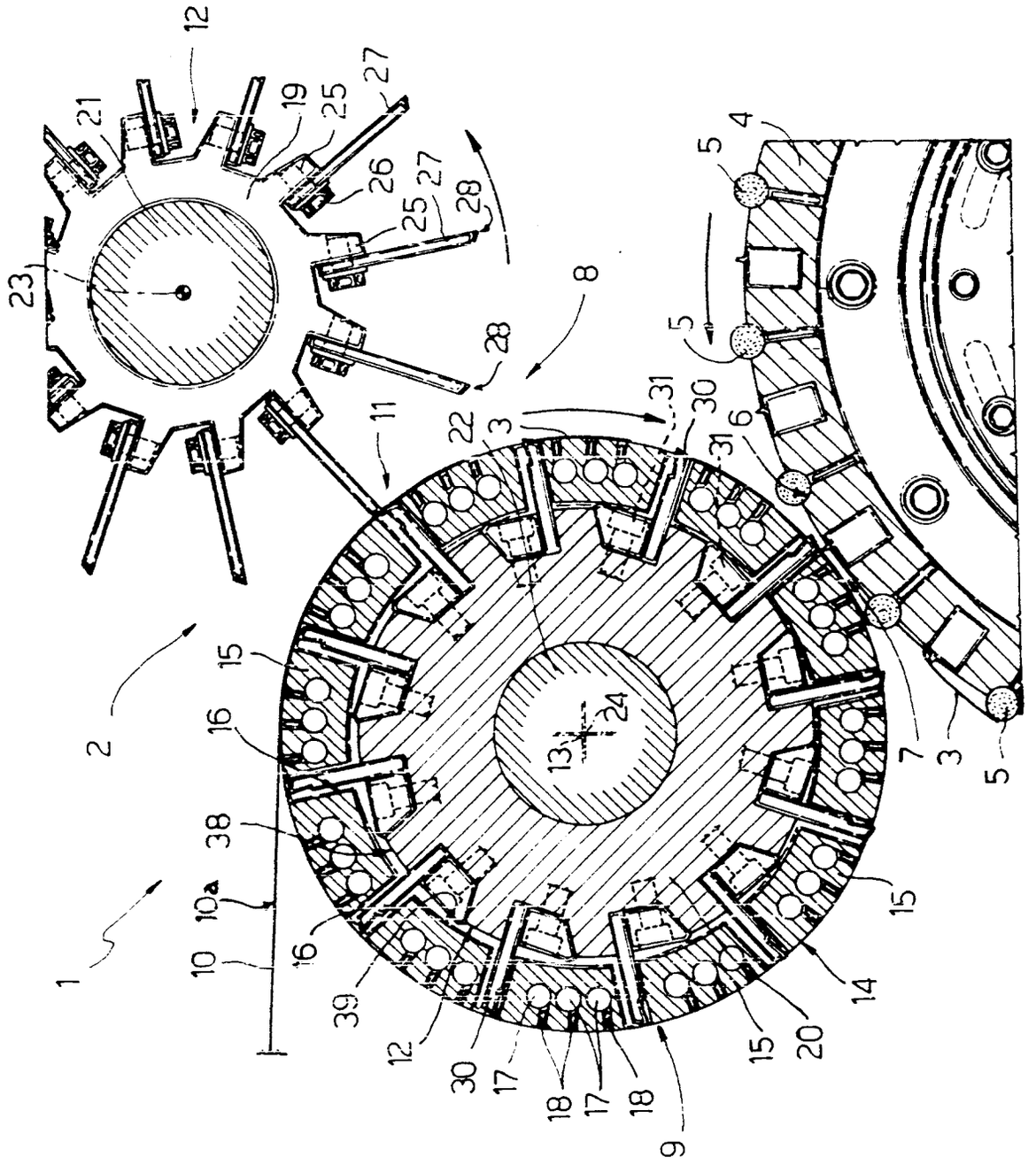
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Fig. 3

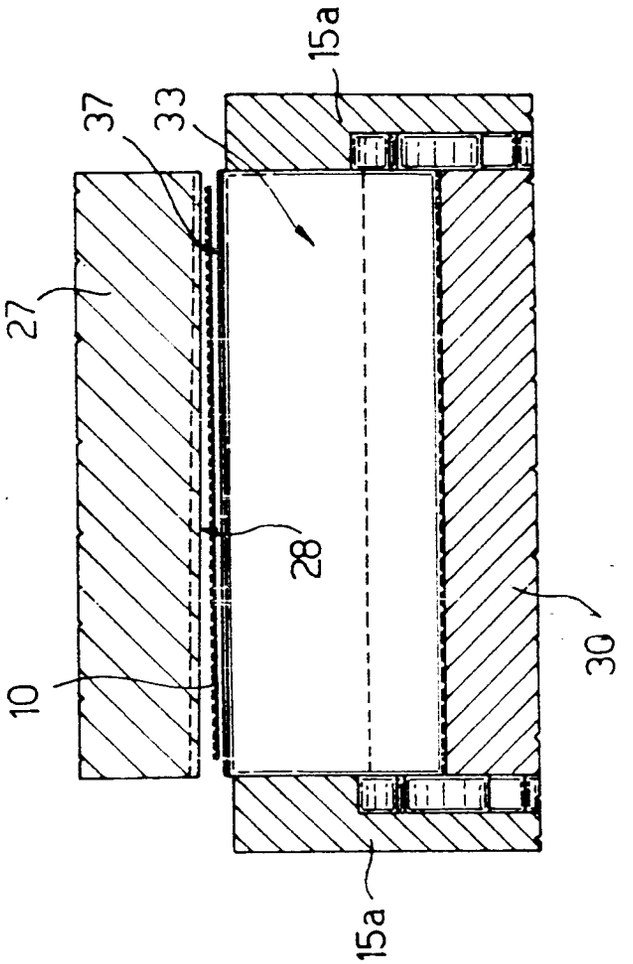
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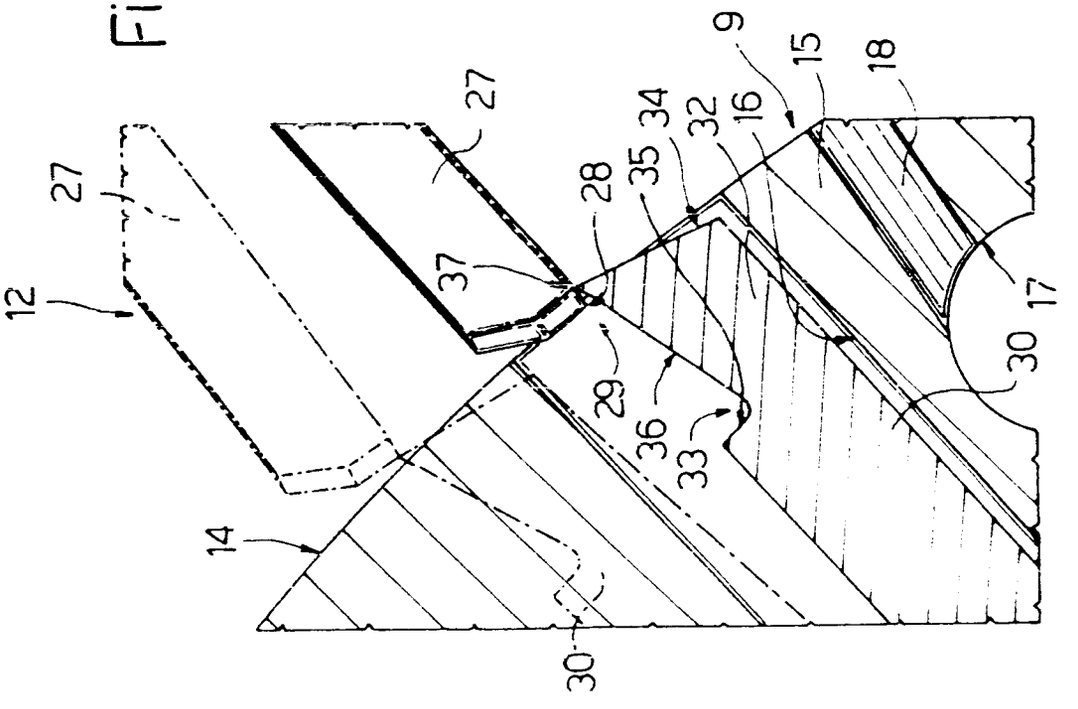
Fig.2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EUROPEAN SEARCH REPORT

Application Number
EP 94 11 8063

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)
X	FR-A-1 465 464 (WINDMÖLLER & HOLSCHER) * the whole document *	1-4	B26D1/42 B26D1/62 A24C5/47
D,Y A	GB-A-2 220 878 (KORBER A.G.) * the whole document *	1-7 9-11	
Y	BE-A-655 845 (SCHMERMUND) * the whole document *	1-7	
A	FR-A-2 414 986 (CENTRE TECHNIQUE DU BOIS) * figure 2 *	9	
A	WO-A-93 12974 (R.A. JONES & CO.)		
A	BE-A-663 094 (PAPER CONVERTING MACHINE CO., INC.)		
A	DE-C-502 976 (RADO)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B26D B65H B41F A24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 February 1995	Vaglienti, G

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