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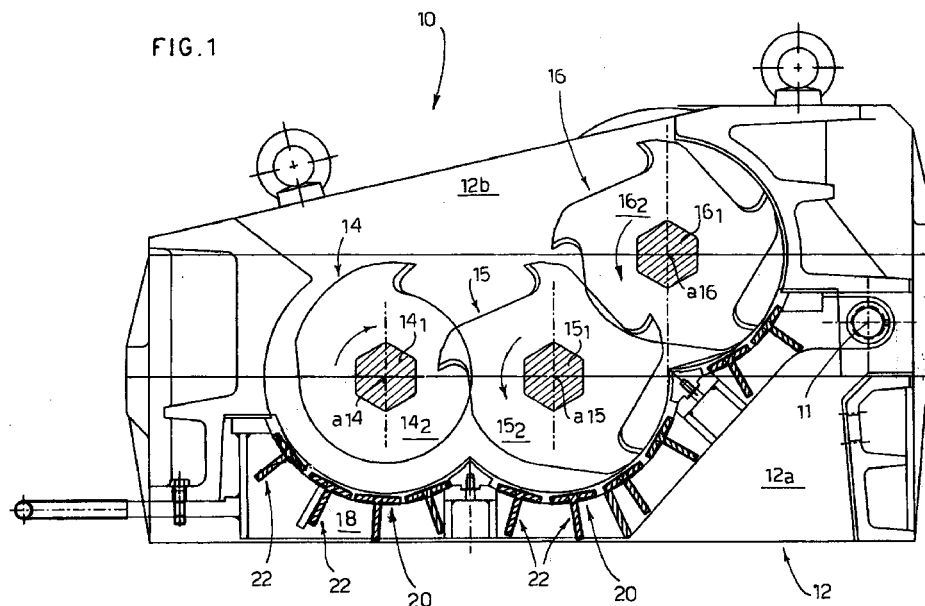
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(54) **A rotary blade chopping machine having stationary toothed bars acting as counterblades and grid**

(57) A chopping or shredding machine with multiple rollers (14, 15, 16) rotating on parallel axle, each roller comprising a plurality of toothed disc blades in longitudinally staggered positions on adjacent rollers, the machine comprising a plurality (20) of stationary lower toothed bars (22) assembled one near the other, but not in contact. The toothed bars (22) collaborate to the shredding of the material as counterblades and they further define openings having the function of a grate.

They can also be disassembled and reassembled also separately in order to remove possible clogging, for being resharpened or replaced; they can be assembled as a circular arc, or as a saw-teeth shape with respect to said circular arc.

A better shredding is obtained and clogging due to bunching of material are easily avoided or solved.



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Description

[0001] The invention relates to the field of chopping or shredding machines with rotary blades, as generally used to chip or shred materials such as wood, paper, refuse, etc.

[0002] The chopping machines of this type now on the market comprise chopping or shredding rollers, namely a number of parallel rotating shafts, each of which is fitted with a plurality of serrated disc blades staggered longitudinally on adjacent shafts so that the routes of the blades on both shafts intersect. A grid, usually made of perforated sheet metal, is situated below the rollers, is shaped like arcs concentric to the rollers, is fitted slightly outside them, and can cooperate with the shredding rollers mentioned above. A device of this kind is described, for example, in Italian patent 1,264,541 by the same applicant.

[0003] In these devices or machines a material is cut between the blades of adjacent rollers (which said blades are usually but not necessarily counter-rotating) and falls onto and through the grid or is pushed through the grid by the blades. The material that fails to pass through the grid is dragged back by the blades and shredded again.

[0004] It is common experience that clogging can take place on the grid as a result of accumulation of material, and this clogging requires shutdowns of the machine for cleaning, which takes time.

[0005] Another drawback is that these accumulations of material can warp the grid, requiring its repair or even replacement.

[0006] An aim of the invention is to improve the crushing of material.

[0007] A further aim is to eliminate the said drawbacks and help prevent the accumulation of material on the sieving element.

[0008] A further aim is to make a sieving element which can easily be cleaned and whose parts can be replaced individually if required.

[0009] A further aim is to make a strong unit that aids cutting and sieving.

[0010] These and other aims are achieved by a machine as said in claim 1 and a unit as said in claim 7. A bar for a cut-cooperating and sieving unit, as specified in claim 9, also forms part of this application. Other new and useful characteristics are stated in the dependent claims.

[0011] In other words, the new chopping machine comprises a cut-cooperating and sieving unit situated under the rotary blades which comprises a number of bars that extend transversely to the direction of movement of the blades, said bars having a serrated profile and being fitted adjacent to but not in contact with one other so as to form apertures between the serrated profiles. Each bar preferably has a T profile in cross-section and is fixed with its ends in special housings in the walls of a support frame.

[0012] According to a preferred embodiment, the profiles of the teeth are sharp and can be sharpened.

[0013] A cross-sectional shape of the bars is preferably a T-shape for additional rigidity.

[0014] According to one embodiment, the serrated bars are fitted with their toothed working surfaces located according to a substantially arc-shaped area around the axis of the corresponding roller. In a modified embodiment, the serrated surfaces are inclined in saw-teeth form in relation to the arched surface.

[0015] The new machine attains the aims specified above; in particular it reduces clogging; enables any obstructions to be removed easily by removing one or more serrated bars; improves shredding of the material by means of cooperation between the rotating blades and the serrated bars; and allows sharpening of the serrated bars and replacement of one bar at a time.

[0016] The above will be clarified by reference to the annexed drawings, which illustrate the invention by way of exemplary unrestrictive embodiments and in which:

- Fig. 1 is a schematic cross-sectional view taken on a vertical plane through a machine of the invention
- Fig. 2 is a top-plan view of the machine, with the shredding rollers removed to show the cut-cooperating and sieving unit in accordance with the invention situated below the said rollers
- Fig. 3 is a top plan view of an individual bar element used to make the cut-cooperating and sieving unit in accordance with the invention; the element is enlarged compared with the preceding figures
- Fig. 4 is a right-hand side elevational view of the element shown in Fig. 3
- Fig. 5 is a cross-sectional view taken along 5-5 in Fig. 3
- Fig. 6 shows a variation on the section of the bar element with respect to Fig. 5
- Fig. 7 is a cross-sectional view similar to the one shown in Fig. 1, and shows a different arrangement of the bar elements that form the cut-cooperating and sieving unit; and
- Fig. 8 is an enlarged, interrupted view of the detail A shown in Fig. 7.

[0017] In the figures, reference 10 is a chopping or shredding device as a whole. It comprises a frame 12 which, in the example, is divided into a lower part 12a and an upper part 12b hinged at 11. Upper part 12b carries three chopping or shredding rollers referenced 14, 15 and 16. Each chopping roller comprises a rotary shaft referenced 14₁, 15₁ and 16₁ respectively. Each shaft is rotated by known means, not shown, and rotates around a corresponding axis a14, a15 or a16, the said three axes being parallel to one another.

[0018] Shaft 14₁ carries rotary roller blades 14₂ axially spaced along it; shaft 15₁ carries blades 15₂ which

are spaced axially along it and are axially interleaved with the blades of shaft 14; shaft 16₁ carries blades 16₂ which are axially interleaved with the blades of roller 15. The two rollers 14 and 15 are counter-rotating. The directions of rotation of the rollers are marked by arrows in the figure.

[0019] Lower part 12a of the frame has end walls or flanges referenced 18, on which a cut-cooperating and sieving unit 20 is fitted. According to the invention, the cut-cooperating and sieving unit comprises a plurality of bars 22 with serrated heads or flanges, supported on end walls 18 and extending generally parallel to the axes of the rollers. Each bar 22 has one or preferably two serrated surfaces 24, 24, of any appropriate shape. By way of example, the shape in plan view of the toothed surfaces is shown with teeth having a right-angled tip. However, their shape could obviously be different. Each bar 22 is preferably a T-shaped cross-section for better rigidity; serrated surface 23 is the bar flange, and 25 is the bar web. Each bar element 22 could also have stiffening ribs.

[0020] A number of bars 22 are fitted adjacent to but not in contact with one another, supported by walls 18 as shown in Fig. 2, to form openings 27 between them. The closeness of the bars determines the size of apertures 27. In addition to a sieving function as is performed by the grid openings of known chopping machines, apertures 27 also allow the material to fall and be cut between the cutting part of bar 22 and the tooth of the chopping roller blade (see Fig. 8). Flanges 23 of bars 22 are arranged in a circle substantially coinciding with or slightly distanced from the circle described by the ends of the teeth of the blades on the corresponding chopping roller. Thus the sieving unit not only acts as a sieve but also cooperates with the rotating blades to cut or chop the material.

[0021] In the event of clogging or obstructions, the chopper or chopping machine can be opened and one or more of elements 22 can easily be removed or replaced, with no need to replace the entire sieving unit.

[0022] Elements 22 can be fitted to the end walls in any suitable way accessible to a person skilled in the art, which is not specifically illustrated here. In addition to the end walls, intermediate walls could also be added for improved support.

[0023] Fig. 6 shows a modified embodiment of elements 22, referenced 22a. Element 22a has a flange 23a whose serrated surfaces 24a have an acute-angled profile. Each flange 23a can be sharpened by removing part of the metal without losing its cutting properties.

[0024] A further modified embodiment 10a of the invention is shown in Fig. 7, in which the elements of the chopping machine that are the same as or correspond to the elements of chopping machine 10 shown in Fig. 1 have the same reference numbers, and will not be described in detail. Cut-cooperating and sieving unit 20b in Fig. 7 comprises plates 22b with serrated surfaces fitted in a "toothed" configuration when seen in

vertical section; flange 23b of each bar element 22b has its "leading" edge 23 b/ (the edge first confronted by the rotating blade) spaced from axis a₁₄ (a₁₅, a₁₆) of the corresponding roller by a distance r/ less than distance r_t of the output edge 23bt (ie. the edge subsequently confronted by the rotating blade). This arrangement increases the cooperating function of bars 22. In particular, as will be seen more clearly in Fig. 8, a strip S of material to be chopped is cut by the cooperating action of knife tooth 15.2 and the cutting edge 23b/ of bar 23b while it passes through an opening formed between adjacent bars 22b.

[0025] Although the invention has been described with reference to a machine with three chopping rollers, it could equally well apply to machines having two, four or more chopping rollers.

Claims

1. A chopping machine comprising a plurality of cooperating chopping rollers (14, 15, 16, ...) with parallel axes, each of which rollers comprises a rotationally driven shaft (14₁, 15₁, 16₁) and a plurality of rotary blades (14₂, 15₂, 16₂) axially spaced along it, the blades of adjacent rollers interleaving axially characterised in that it also comprises a cut-cooperating and sieving unit which cooperates with the said blades, the cut-cooperating and sieving unit (20) comprising a plurality of serrated cutting bars (22; 22a; 22b) fitted transversely to the direction of movement of the edge of the blades.
2. A machine as claimed in claim 1, characterised in that the said bars define sieving apertures (27) between the teeth thereof.
3. A machine as claimed in claim 1, characterised in that each bar has a T-shaped section and that the said teeth are formed on the edges of a flange (23) of the T.
4. A machine as claimed in claim 1, characterised in that the serrated bars have a profile with acute-angled edges in cross-section, so that they can be sharpened.
5. A machine as claimed in claim 1, characterised in that the said bars are fitted adjacent to but not in contact with one another, the flange of each bar being arranged substantially along a chord of a circle concentric to the axis of the corresponding roller with which they cooperate and at a radial distance from the said axis slightly greater than the distance from the end of the blade with which they cooperate.
6. A machine as claimed in claim 1, characterised in that at least some of the said bars are in a tooth-like

arrangement as seen in cross section; i.e. they have their leading side (23bL, the side cooperating first with the rotating blade) which is fitted at a lesser distance from the rotational axis of the blade than the trailing side thereof.

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7. A cut-cooperating and sieving unit for a rotary-blade chopping machine, characterised in that it comprises a plurality of bars (22; 22a; 22b) with serrated edges, the said bars being fitted adjacent to one another to form sieving apertures (27). 10
8. A cut-cooperating and sieving unit as claimed in claim 7, characterised in that the said bars have sharp serrated edges. 15
9. A bar for a cut-cooperating and sieving unit for a chopping machine as claimed in claim 1, characterised in that it has at least one longitudinal serrated edge. 20
10. A bar as claimed in claim 9, characterised in that both longitudinal edges thereof are serrated.
11. A bar as claimed in claim 9, characterised in that it has a T-shape cross-section, with the serrated edges on the edges of the flange of the T-shape. 25
12. A bar as claimed in claim 9, characterised in that the serrated edges have an acute-angled section so that they can be sharpened. 30

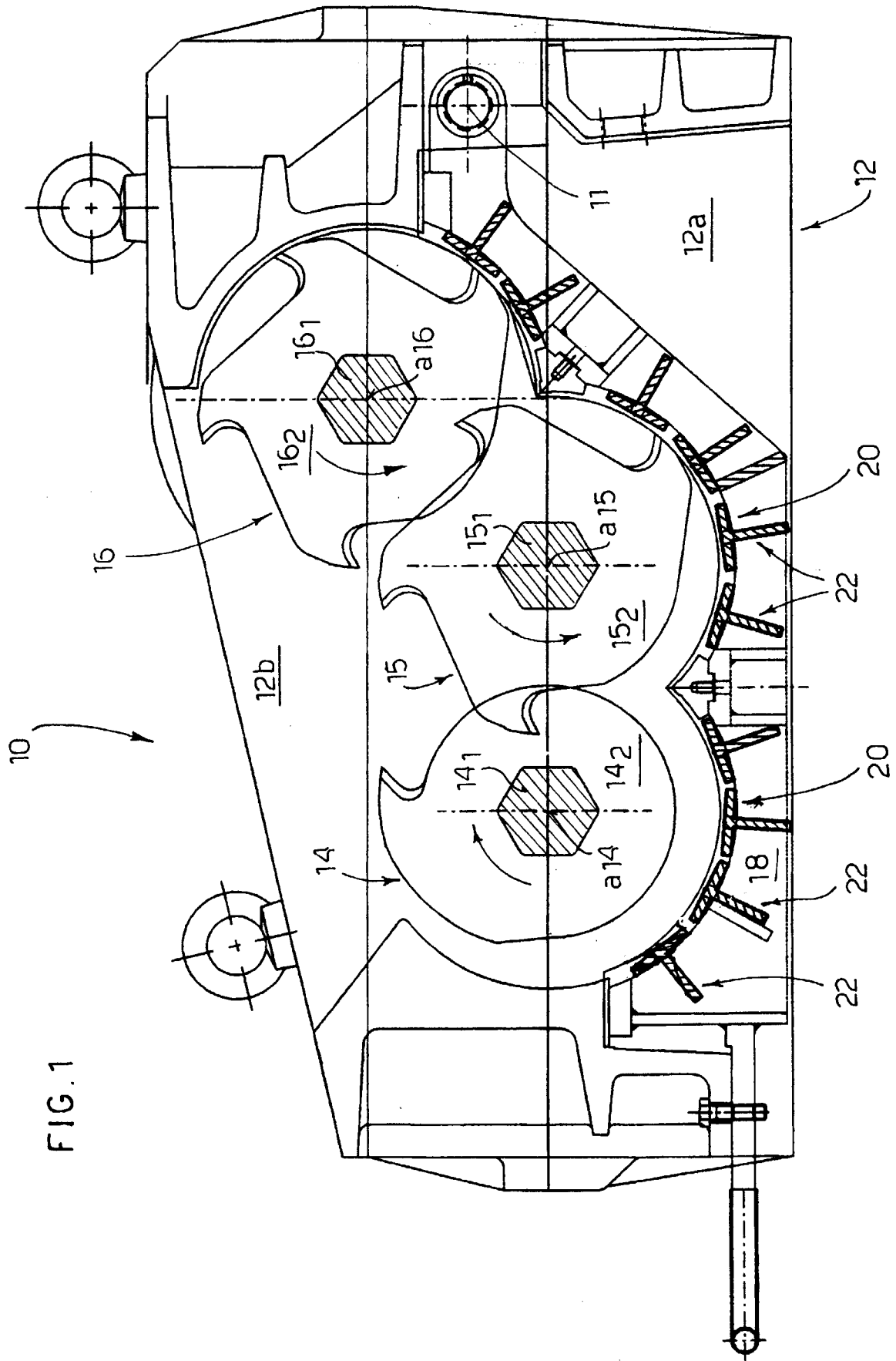
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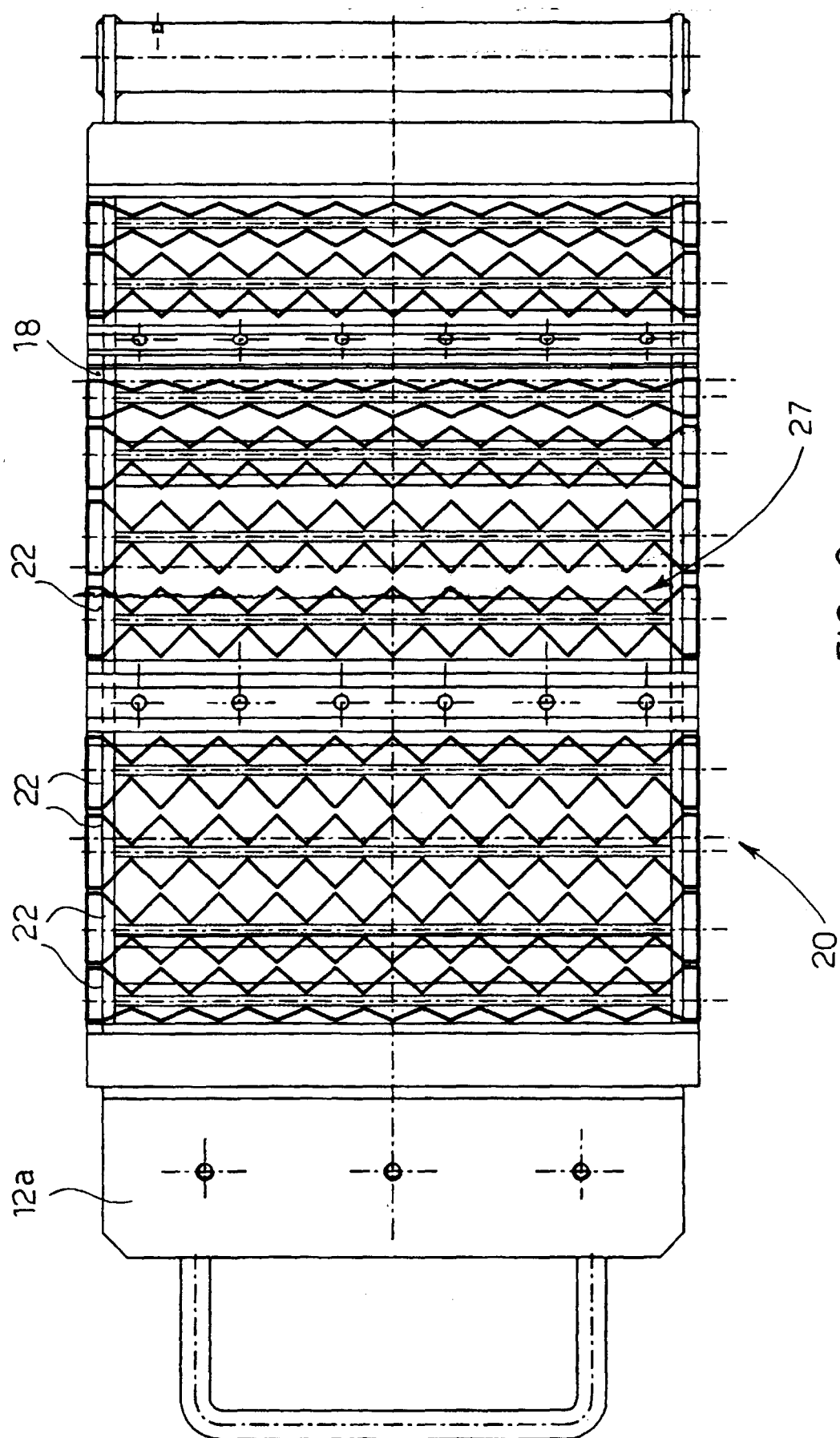


FIG. 2

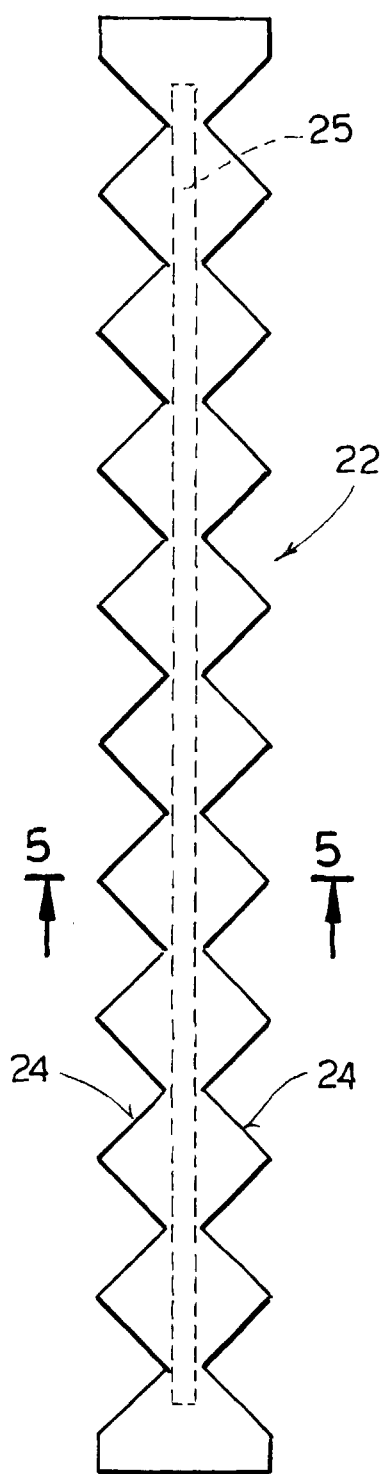


FIG. 3

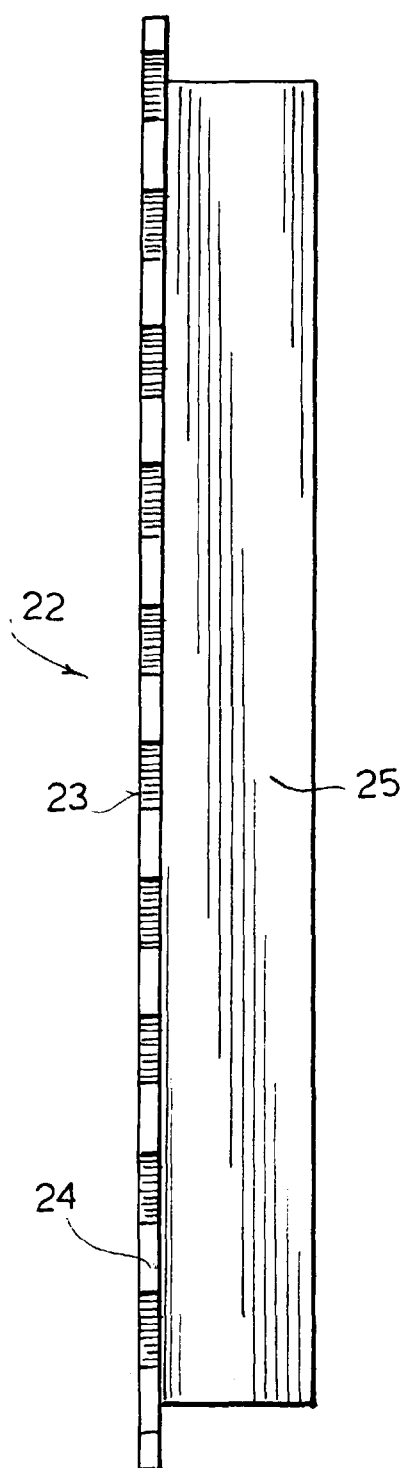


FIG. 4

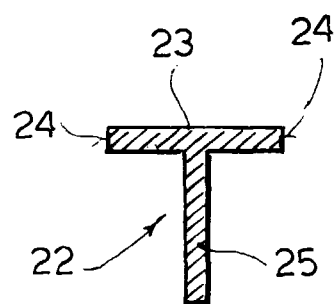


FIG. 5

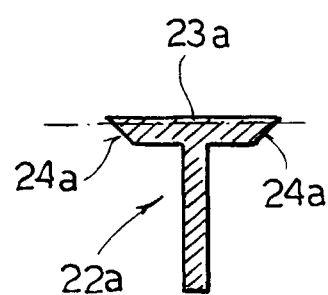
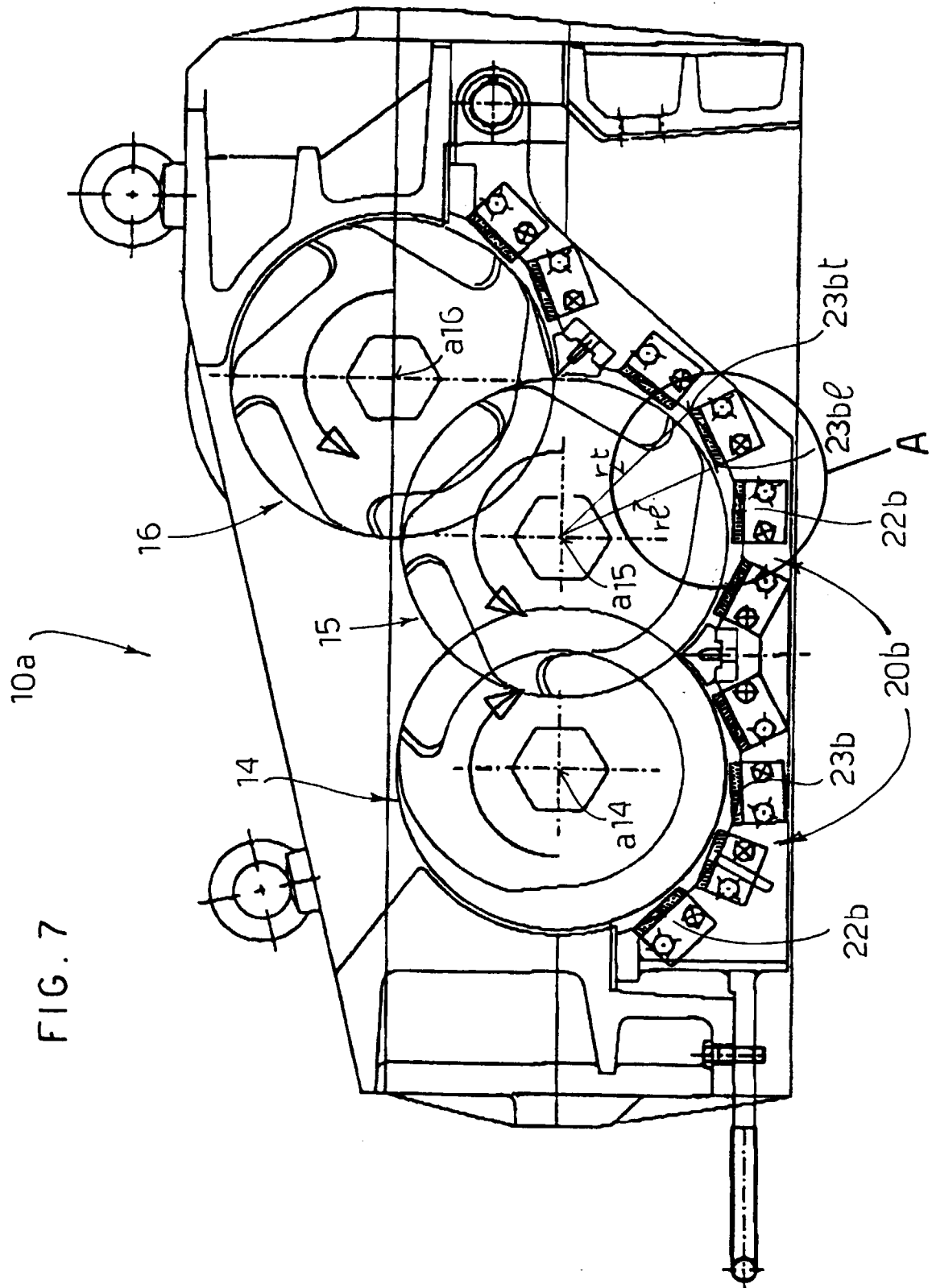
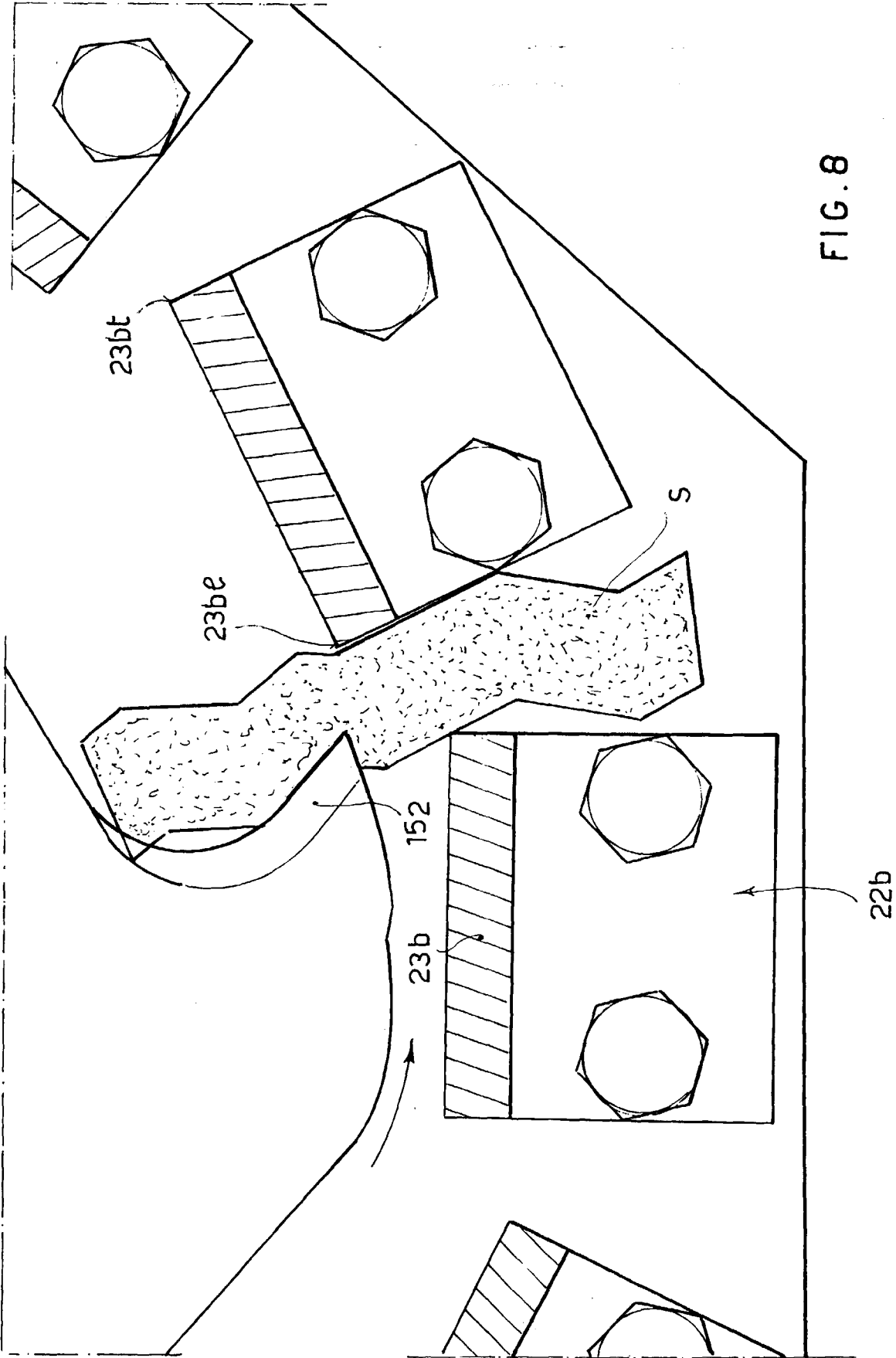


FIG. 6







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EUROPEAN SEARCH REPORT

Application Number
EP 00 10 7738

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	DE 296 11 773 U (KOBBER AG) 6 November 1997 (1997-11-06) * page 4, line 28 - page 5, line 20; figures 1-5 *	7,8	B02C18/14 B02C23/16
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B02C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 January 2001	Examiner Verdonck, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document 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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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 10 7738

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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03-01-2001

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