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(54) **Device for chopping up small sized objects, particularly cigarette butts.**

(57) Device (10') for chopping up small sized objects, particularly cigarette butts, comprising:

- a box (11');
- at least one pair of main cutting tools (17', 18') and possibly at least one auxiliary cutting tool (19') contained in a chopping section (14');
- an electric motor (20') connected to a reducer (21') which in its turn makes the said cutting tools (17', 18', 19') rotate;

a device (10') characterized by the fact that the main cutting tools (17, 18; 17', 18') rotate in opposite directions and by the fact that they present diameters and speeds different from each other.

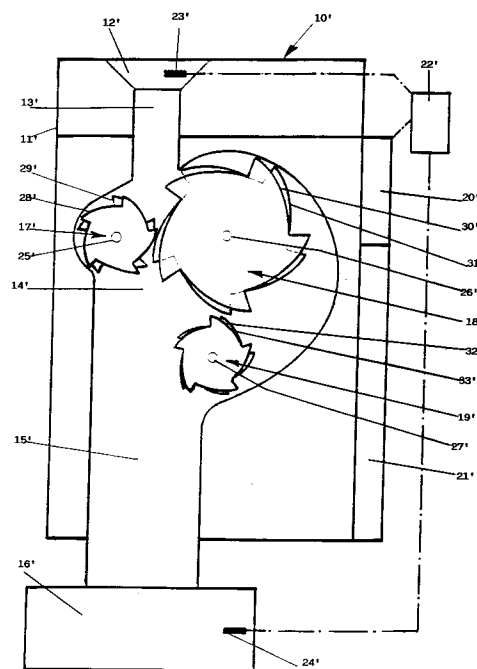


FIG. 2

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1. The field of the invention

The present invention refers to a device for chopping up small sized objects which normally present a high resistance to chopping and mincing operations. In particular, the device object of the present invention may be used in order to extinguish and chop up cigarette butts inserted from time to time into a conveyor to the device, or else to chop up the solid waste produced by the operation of a dishwasher.

2. Prior Art and summary of the invention

It is common knowledge that ashtrays filled with cigarette butts not only are a source of unpleasant odours, due in particular to the fact that combustion often continues even after the smoker has stubbed out the cigarette, but have also an unattractive look. Several solutions have been proposed in order to resolve these problems, solutions which incorporate particular features in order to "swallow" the butts in such a way to exclude the oxygen necessary for them to continue to burn. This type of ash-tray has not met with great public success not only because they do not extinguish the cigarette butts efficiently, but also because there is still the problem of disposal as cigarette butts are composed of materials which are highly resistant to mincing. Above all this is a problem for drivers who are often obliged to empty ash trays full of cigarette butts in places that are unsuitable for this type of operation.

In other technical fields, particular chopping devices are well known for chopping up solid waste finely. For example, it is extremely useful to have a device of this type in dishwashers or in the drain-pipes of sinks in order to chop up leftover food before it goes down the drain. The devices on the market at present are only able to perform to an acceptable standard in the presence of objects which are quite easy to chop up whereas they are totally inadequate for chopping up objects which are highly resistant to this type of operation. Chopping up cigarette butts has proven to be particularly difficult since these objects not only present a high resistance, but also, if for example the cutting tools have not been designed with particular accuracy, skid on the teeth, building up towards the centre of rotation of the same in such a way as to hamper proper functioning, sometimes blocking up the device.

In FR-A-2 510 953 (De Saint Hilaire et al.) and in US-A- 3 331 339 (Blackledge et al.) two devices for chopping up cigarette butts are described. In the first one the butts are chopped by means of a pair of rotating cylinders which show a plurality of reliefs, whereas the second one shows two op-

posed and intermeshed grinding rolls in order to extinguish the burning cigarettes. However, both documents do not describe a working apparatus able to perform an efficient grinding of the butts. In particular, they do not show how the cutting tools must be designed, and which is the most efficient speed of each tool.

For the above reasons the Applicants had to carry out a long sequence of tests before they came to an understanding of the parameters which must be used in order to obtain a satisfactory chopping device.

Using cereal mills as starting point, they conceived a device with at least two cutting tools, fitted to two shafts, which rotate in opposite directions and at different speeds so that at least one of them (the slower one) drags the objects, while the other (the faster one) carries out the actual chopping and grinding operation. In this context, the term "cutting tool" is used to mean a tool with at least one toothed blade, or a monobloc tool in the shape of a helical cylindrical cutter. Not only does the chopping of the cigarette butts make their disposal easier, making the input materials unrecognizable, but it also has the consequence of completely extinguishing the same.

The present invention concerns a device for chopping up small size objects, in particular cigarette butts, and comprises:

- a box;
- at least one pair of main cutting tools and possibly at least one auxiliary cutting tool, contained in a chopping section; and
- an electric motor connected to a reducer which in turn causes the two cutting tools to rotate, a device characterized by the fact that the main cutting tools rotate in opposite directions and by the fact that they present diameters and speeds different from each other.

3. List of figures

- Fig. 1 is a schematic view in section of a first embodiment of the device object of the present invention which has only one pair of cutting tools;
- Fig.2 is a schematic view in section of a second embodiment with three cutters.

4. Detailed description of the invention

The device 10 which is the object of the present invention will now be described with particular reference to fig. 1 attached herewith.

In its general form, it consists of a box 11 in which the following can be distinguished: a collector 12, an input duct 13 for the objects to be

chopped up (not shown in fig.1) in the chopping section 14 and an outlet duct 15 through which the already finely chopped objects are sent to a final collector 16. The device 10 is completed by at least one pair of main cutting tools 17, 18 contained in the chopping section 14; there is also an electric motor 20 connected to a reducer 21 which in turn causes the two main cutting tools 17, 18 to rotate respectively around the shafts 25, 26.

In a particularly advantageous embodiment, the greater main cutting tool 18 runs faster than the smaller one 17.

Furthermore, the ratio between the angular speeds of the shaft 26 and of the shaft 25 can be comprised between 8 and 15, in particular 10.

The cutting edges of the main cutting tool 17 can be upwardly directed, whereas the cutting edges of the main cutting tool 18 can be downwardly directed. Otherwise, the main cutting tools 17, 18 would push downwardly the cigarette butts without chopping them up.

For convenience of representation in fig. 1, the two main tools 17, 18 have been represented by a single cutting blade; in any case there is no reason why the main tools 17, 18 should not be composed of any number whatsoever of toothed cutting blades, as will be more clearly specified below with particular reference to fig. 2 attached herewith.

It is furthermore possible that said cutting tools take the form of helical monobloc cutters.

The Applicants have found that in order to have satisfactory results without at the same time having undesirable effects of accumulation or squashing of the objects to be chopped, the two main cutting tools 17, 18 must rotate in opposite directions. Generally, the larger main cutting tool 18 operates at a high speed of between 25 and 40 rpm and has the primary function of carrying out the actual chopping and mincing, whereas the main cutting tool 17 is smaller and slower, and with a typical speed of between 3 and 8 rpm drags down the objects to be chopped up.

As already cited, the best results were obtained when the ratio between the angular velocities of the shafts 26, 25 is comprised between 8 and 15, in particular 10, and when the number of teeth on the cutting blades is between 7 and 14. It has also been noted that the teeth must not be too curved, because if this is the case there is a risk of the material being pushed towards the centre of rotation of the blades and consequently clogging them up.

A second embodiment of the present invention is represented in fig. 2, wherein a third auxiliary cutting tool 19 has been introduced in the cutting section 14'.

Fig. 2 emphasises the fact that the cutting tools 17', 18', 19' may be composed of several cutting

blades. For convenience of representation, only two cutting blades have been shown for each cutting tool 17', 18', 19'; in particular, only the two cutting blades 28', 29' can be seen for the main cutting tool 17', only the two cutting blades 30', 31' can be seen for the main cutting tool 18', while only the two cutting blades 32', 33' can be seen for the auxiliary cutting tool 19'. It is clear that each cutting tool may be made up of any number whatsoever of cutting blades, although the most satisfactory results were obtained using cutting tools with between 4 and 8 blades. The electric motor 20', connected to the reducer 21', causes the three cutting tools 17', 18', 19' to rotate respectively around the shafts 25', 26', 27'.

It is preferable if said shafts 25', 26', 27' can be in hexagonal section so that the cutting blades 28', 29', 30', 31', 32', 33' may be rotated at a certain angle in relation to the corresponding ones fitted to the other shafts in order to minimize the overall force that the electric motor 20' needs to produce. The third auxiliary cutting tool 19' serves to prevent undesirable blockages between the cutting blades of the main cutting tools 17', 18'. The auxiliary cutting tool 19' serves to free said blades from any fragments which may have become caught in them. If the auxiliary cutting tool 19' occupies the position illustrated in fig. 2, it only clears away fragments which have become caught between cutting blades 30', 31' of the main cutting tool 18', however it is evident that inside the chopping section 14' it is possible to place the auxiliary cutting tool 19' differently so that at the same time it can remove material caught between the cutting blades 28', 29' of the main cutting tool 17' and between the cutting blades 30', 31' of the main cutting tool 18', without however presenting an obstacle to material moving down through the device. While the cutting blades 28', 29', which belong to the main cutting tool 17' are located exactly opposite the corresponding cutting blades 30', 31' of the main cutting tool 18', the cutting blades 32', 33' of the auxiliary cutting tool 19' are offset in relation to the blades which belong to the main cutting tools so that said blades 32', 33' are positioned in the empty spaces between adjoining blades fitted on the same shaft. It may be advantageous to have the external diameter of the auxiliary cutting tool 19' equal to the external diameter of the main cutting tool 17'.

In order to optimize the performance of the present device 10, 10' (fig.s 1, 2) which is the subject matter of the present invention, it is possible to make use of an electronic control or adjustment switchboard 22 or 22' connected to the probe 23 or 23' present in the collector 12 or 12' and to the probe 24 or 24' which is located in the container 16 or 16' where objects which have already

been chopped up are collected. The probe 23 or 23' sends a signal to the electronic switchboard that at least one object to be chopped has entered collector 12 or 12'; the electronic switchboard 22 or 22' starts the motor 20 or 20' which in turn via the reducer 21 or 21' rotates the cutting tools 17, 18 or 17', 18' and 19', the material chopped up by the faster main cutting tool 18 or 18' is sent by the cutter 17 or 17' which is slower than the former to the container 16 or 16' via the outlet duct 15 or 15'. When some seconds have passed during which time the probe 23, 23' has not detected material falling through the device, it sends a signal to the electronic switchboard 22 or 22' which stops the motor 20 or 20' and thus interrupts the chopping process. The probe 24 or 24' is also responsible for signalling the electronic switchboard when the container 16 or 16' is completely full, and in this way, using warning lights for example, it is possible to draw the operator's attention to the fact that the container 16 or 16' needs to be emptied. It is evident that similar observations may be made about a tool which, instead of being composed of a plurality of cutting blades rotated among one another mounted on the same shaft, is in the form of a helical monobloc cylinder. The electronic switchboard 22 or 22' is also programmed in such a way as to halt the chopping process if any object that is difficult to chop up finely accidentally falls into the collector 12 or 12'. In fact, if an object of this type accidentally falls into the collector 12 or 12', the probe 23, 23' will send a signal to the electronic switchboard 22 or 22' which will start the motor 20 or 20' and the chopping process would continue indefinitely if there was not a safety system designed to halt the motor 20 or 20' after a few seconds have passed during which time the probe 24, 24' has not detected falling fragments.

The motor 20 or 20' may for example be a 12 V direct current electric motor with an output of between 40 and 100 W. It is also possible to make the main cutting tools 17 and 18 or 17' and 18' rotate in the opposite direction for a moment after they have completed the chopping cycle in order to clear out possible blockages. It is evident that this operation too is regulated through the electronic switchboard 22 or 22'.

In conclusion, the features of the present invention make it possible to miniaturize the chopping device using powers of an acceptable size, avoiding blockages while the objects to be chopped up are passing through the device and in the end obtaining a chopped up end-product that can be easily disposed of. These advantages are of particular importance when a chopper needs to be made to be positioned below an ashtray.

Claims

1. A device (10;10') for chopping up small sized objects, in particular cigarette butts, comprising:
 - a box (11;11') which contains a collector (12, 12'), an input duct (13, 13') through which objects to be chopped up pass into the chopping section (14, 14'), and an outlet duct (15; 15') through which the already finely chopped objects are sent to a final container (16; 16');
 - at least one pair of main cutting tools (17, 18; 17', 18') contained in the said chopping section (14; 14') and mounted respectively on the shafts (25, 26; 25', 26'); and
 - an electric motor (20; 20') connected to a reducer (21; 21') which in turn causes the main cutting tools (17, 18; 17', 18') to rotate around said shafts (25, 26; 25', 26'), a device (10, 10') characterized by the fact that said main cutting tools (17, 18; 17', 18') rotate in opposite directions and by the fact that they present diameters and speeds different from each other.
2. The device (10; 10') according to claim 1, wherein the greater main cutting tool (18; 18') runs faster than the smaller one (17; 17').
3. The device (10; 10') according to claim 2, wherein the ratio between the angular speeds of said shaft (26; 26') and of said shaft (25; 25') is between 8 and 15, in particular 10.
4. The device (10; 10') according to claim 1, wherein the cutting edges of the main cutting tool (17; 17') are upwardly directed, whereas the cutting edges of the main cutting tools (18; 18') are downwardly directed.
5. The device (10') according to claim 1, wherein said cutting tools (17', 18') are composed of a plurality of toothed cutting blades (28', 29', 30', 31') mounted on said shafts (25', 26', 27').
6. The device (10') according to claim 5, wherein the number of teeth of said cutting blades (28', 29', 30', 31', 32', 33') is comprised between 7 and 14.
7. The device (10; 10') according to claim 1, wherein said cutting tools (17, 18; 17', 18', 19') take the form of cylindrical monobloc cutters with helical teeth.

8. The device (10, 10') according to claim 1, which is controlled by an electronic switchboard (22; 22') on the basis of signals sent to said electronic switchboard (22; 22') by at least one pair of probes (23, 24; 23', 24') located respectively in said collector (12; 12') and in said final container (16; 16'). 5
9. The device (10; 10') according to claim 8, wherein said electronic switchboard (22; 22') is programmed in such a way as to reverse the direction of rotation of said cutting tools (17, 18; 17', 18', 19') once the chopping cycle has finished. 10
10. The device (10; 10') according to claim 8, wherein said switchboard (22; 22') is programmed in such a way as to interrupt the operation of said motor (20; 20') when the probe (24; 24') does not detect that chopped up material is falling through the device. 15 20
11. An ash-tray comprising a device (10; 10') according to Claims 1-10. 25

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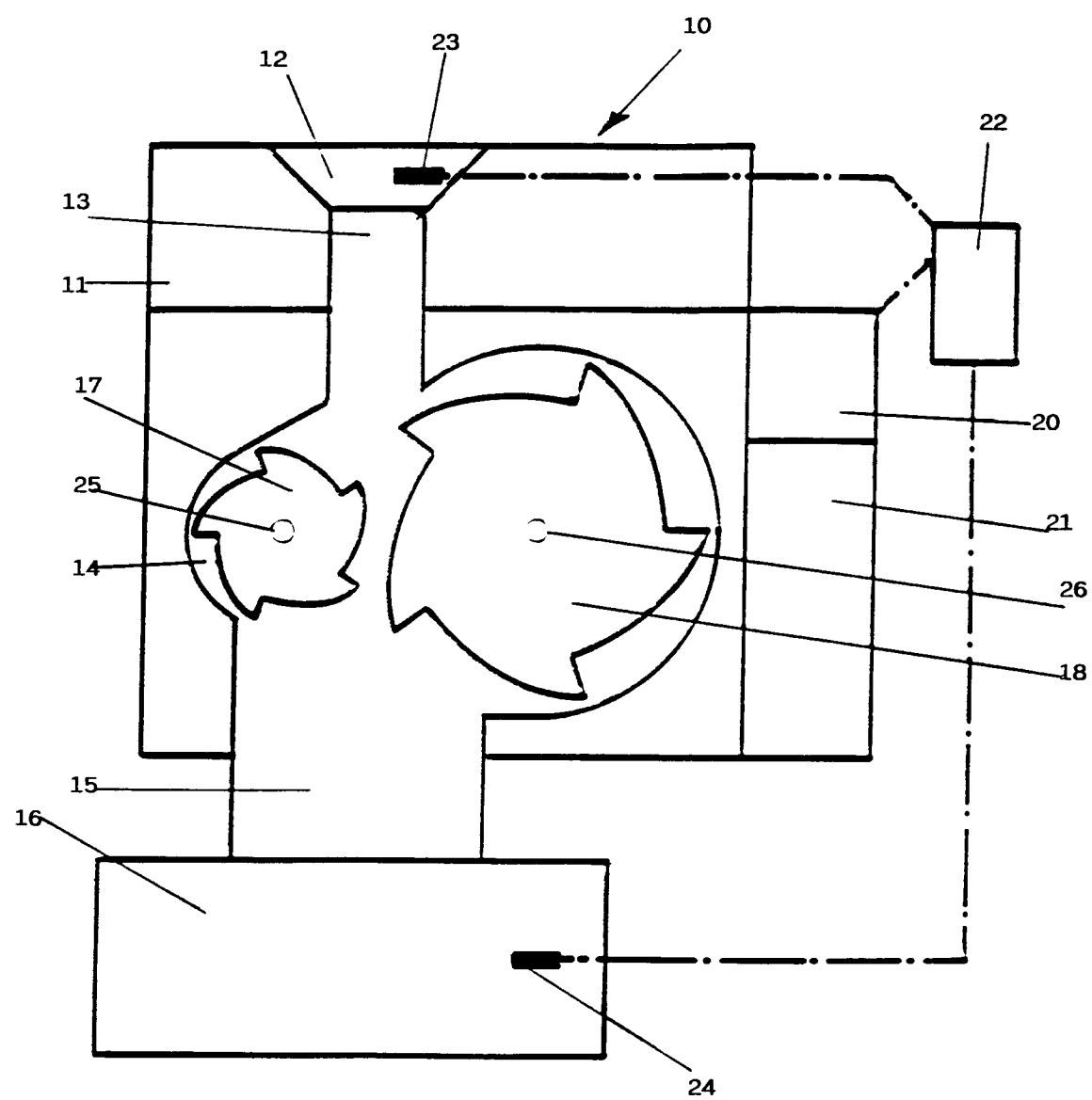


FIG. 1

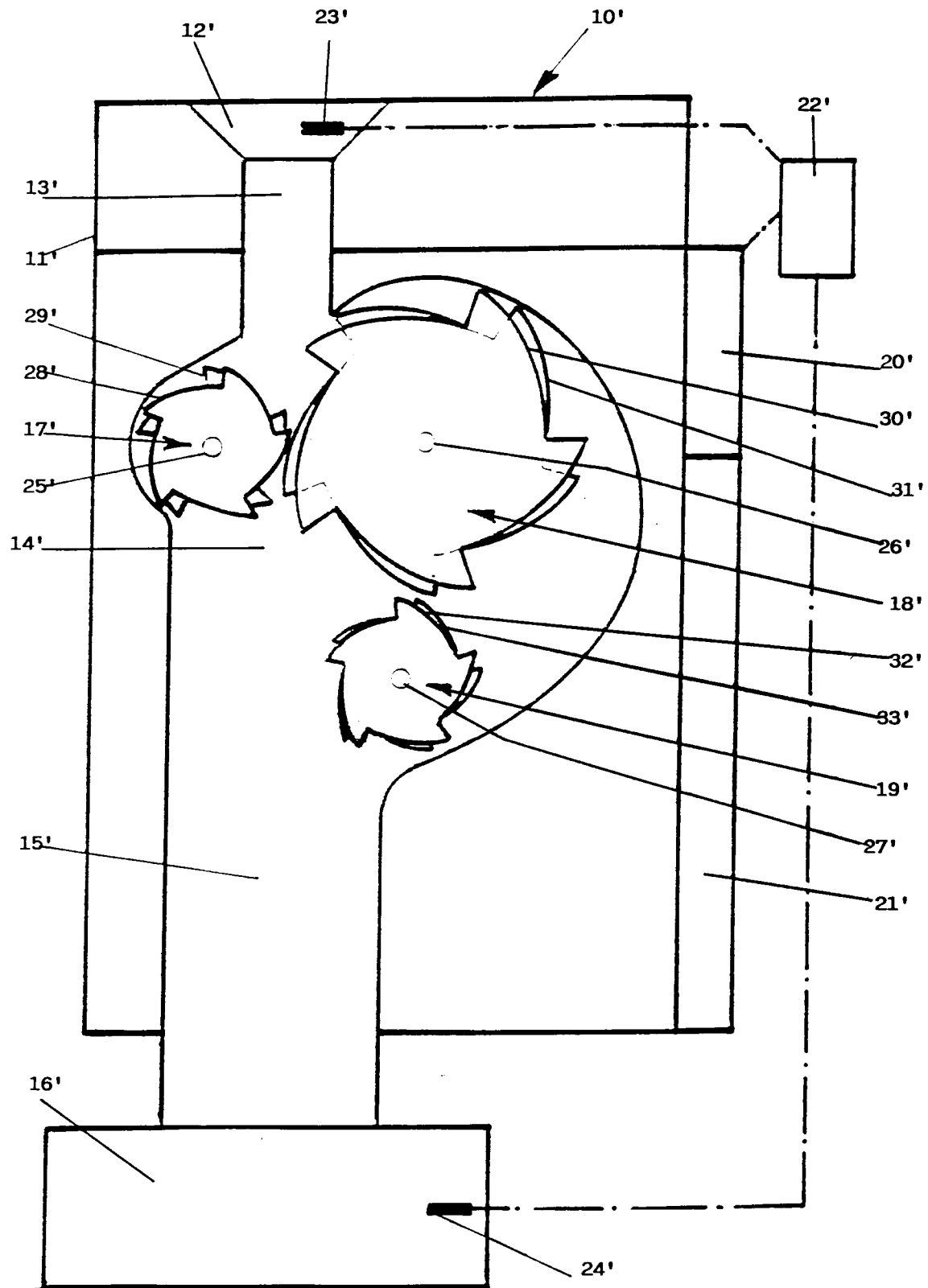


FIG. 2



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EUROPEAN SEARCH REPORT

Application Number
EP 95 10 7358

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,D	FR-A-2 510 953 (DE SAINT HILAIRE) * the whole document * ---	1,5,6,8,11	A24F19/14 B02C18/14
A,D	US-A-3 331 339 (BLACKLEDGE) * the whole document * ---	1,5,11	
A	EP-A-0 124 449 (SOCIETE D'ETUDES ET DE REALISATION THERMIQUES SERT) * the whole document * ---	1,5,6	
A	GB-A-1 569 375 (DRESSER EUROPE S.A.) * the whole document * ---	1,3,5,8-10	
A	EP-A-0 374 481 (GAO GESELLSCHAFT FÜR AUTOMATION UND ORGANISATION) * the whole document * ---	8,10	
A	FR-A-2 334 314 (AUE) * page 7, line 4 - page 8; figures 10,10A * ---	1,11	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	US-A-2 737 350 (CRAIG) * the whole document * ---	1,11	A24F B02C B60N
A	EP-A-0 567 740 (VON LEPEL) * the whole document * -----	1,8,11	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 5 September 1995	Examiner Riegel, R
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			