



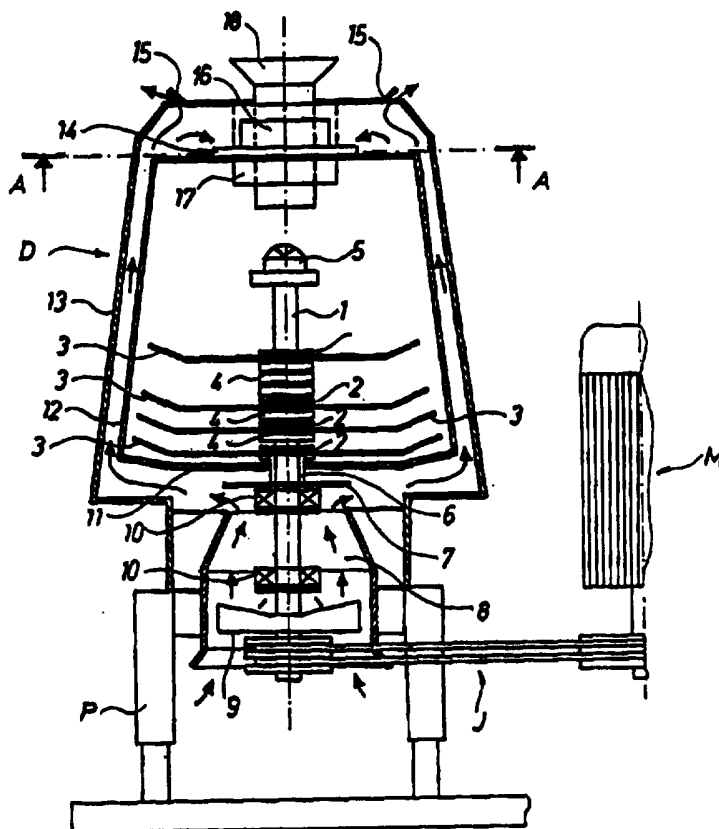
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(54) Title: VERSATILE MILL

(57) Abstract

The invention concerns a versatile mill, particularly the construction of its drive, central and clamping part with the fitting of knives, and the cooling of the milling part. The versatile mill is intended for processing food products and other organic and inorganic substances in the sense of milling, chopping, grinding, mixing or disintegrating the parts inserted into it in an enclosed processing system. A versatile mill in accordance with the invention has its driving motor (M) mounted in the same plane with the milling part (D) of the mill, an improved system of clamping knives (3) on a shaft (1), which is profiled, while the positioning of the knives (3) itself is carried out by means of intermediate discs (2); on the lower part under the bottom (11) of the milling part (D) a plate (7) is fitted which is rigidly linked with the shaft (1) and rotates together with it; in an air inlet (8) on the shaft (1) a fan (9) is fixed, while the bottom (11) of the mill and the stationary lateral parts of the milling compartment are carried out with double walls, whereby on the upper part of the milling compartment there is a collector which directs, along one path, the air inside the enclosed system, or - when the return channels are removed - the air in the open system into the centre of the mill. Along another path, it directs the atmospheric air at the end of the cooling system - in the case of an enclosed system - to the return channels with the purpose of cooling them; two lateral output parts (A), (B) have their outer walls in the shape of two cones facing each other and ending at each side and on one end into output openings.



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VERSATILE MILL

The invention concerns a versatile mill, with particular accent on the construction of its drive, central and clamping part with the fitting of knives and cooling of the milling section. The versatile mill is intended for processing food products and other materials in the sense of milling, chopping, grinding, mixing or disintegrating the materials inserted in it, in an enclosed processing system. The invention belongs to IPC class B 02 C 18/18 or 02 C 23/32.

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The technical problem that is successfully solved by the present construction of a versatile mill is to achieve such constructional solutions on the device that will eliminate the deficiencies of known implementations, especially as regards simple transportation, rapid and simple exchange of knives and successful cooling of the milling compartment, so that a continuous working process as well as all kinds of operations will be made possible.

Milling devices that operate according to various principles have been in use. Since the present application describes a versatile mill operating according to the principle of material processing by means of grinding, chopping, or cutting - depending on the type of the rotating knives used - our description will be restricted to this type of devices.

Versions of mills with rotating knives are known which have the knives positioned one above the other on a vertical and profiled shaft, and the mutual position of the knives as well as the distance between them can be adjusted according to the type of processing. Such is, for example, the basic design of a mill described in the Yugoslav patent documents no. 26030 and 30648. In this design each knife is fitted with a centrically made rectangular opening intended for positioning individual knives between themselves, this opening having the same dimensions as the shaft. In this way individual knives can be shifted aside by an angle of 90° . The positioning of other angles between the knives can be realized by a multi-angular shaft with the knives having the corresponding openings, or by knives which are expressly fitted with openings shifted by a certain

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angle in order to be pushed onto the shaft. A drawback of such positioning is that at a sudden stop of the knife, e.g. due to a foreign object in the material to be milled, both the knife and the shaft may get damaged, and it will be hard or even impossible to remove a knife thus damaged from the shaft. Another drawback lies in the fact that individual knives are predetermined for a definite position, which considerably limits the possibilities of combination.

Because of the installation of the driving motor under the milling compartment, the milling part and thereby the milled material receive excessive heating. Particularly in an enclosed milling system, when operating for a longer time, the mill gets overheated. Therefore, it has to be stopped from time to time, also because the milled substance overheats. In addition, when the driving motor is installed under the bottom of the milling compartment, the driving motor shaft usually extends into the milling compartment. This may cause, due to the unfavourable length of the entire shaft, constructional difficulties and make it difficult to transport the mill because of its height.

The versatile mill in accordance with the invention has the driving motor installed in the same plane with the milling part, an improved clamping system for the knives on the shaft which is profiled, and the positioning of the knives is carried out by means of intermediate disks; on the lower part under the bottom of the milling compartment, a plate is installed which is rigidly linked with the shaft so that it turns together with it; under the bearing case, also on the shaft, a fan is fixed, while the bottom of

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the mill and the stationary flanks of the milling compartment are fitted with double walls; on the upper part of the milling compartment there is a collector which directs, in the one direction, the air of the enclosed system into the centre of the mill, and in the other direction, the atmospheric air at the end of the cooling system to return channels. With the removal of the return channels, an open milling system is obtained through which fresh air is admitted into the mill and out of it at the flanks (when tough materials producing excessive heat are milled). The lateral outlet parts have their outer walls in the shape of two cones facing each other, ending at one end on either side with an outlet opening.

The invention will be described by way of example and with reference to the accompanying drawings in which:

Fig. 1 is a side view illustrating a versatile mill in accordance with the invention in cross-section;

Fig. 1a is a front view of a versatile mill in accordance with the invention;

Fig. 2 is an A-A view of a versatile mill;

Fig. 3 is a top view of a knife 3 and an intermediate disk 2;

Fig. 4a, 4b, 4c, 4d, 4e, 4f
illustrate different shapes of knives.

Figure 1 is a side view of a versatile mill in accordance with the invention in cross-section. A constructional novelty as compared to known designs consists in the positioning of the driving motor M in the same plane

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with the milling part D of the mill and in linking them by means of a belt drive J. Such installation has several advantages. First, the overheating of the milling part D due to the heating of the driving motor M is omitted, which is a very important feature in a process of continuous operation; secondly, the above described positioning of the driving motor M and a telescopic support P make it possible to adjust the height of the support P and thereby of the entire versatile mill. Last but not least, such constructional solution makes it possible to dismantle the versatile mill in accordance with the invention into the support P, the driving motor M with the control box and the milling part D, which makes the versatile mill under invention extremely flexible, as it can easily be dismantled and reassembled on the site. Because of separate installation of the driving motor M, the main shaft - which in known constructional solutions runs through the driving motor M and further into the milling part D, where systems of knives are being fixed to it - is essentially shorter in the solution under invention and no longer prone to break at transport or when overloaded.

In order to solve the sealing problem of bearings 10 on the shaft 1, onto which knives 3 are mounted, particularly as concerns the invasion of dust and water into the bearings 10 on the shaft 1, a disk 7 has been mounted on the lower part under the bottom 11 of the milling part, the disk 7 being rigidly linked with the shaft 1 and turning together with it. All particles that may make their way under the bottom 11 of the milling compartment D and fall on the disk 7, will be carried away by the centrifugal force. In an air inlet 8 a fan 9 is mounted on the shaft 1, and the air current produced by the fan 9 will carry the dust particles or particles of milled

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material through the cooling channels formed between the inner wall 12 and the outer coat 13 of the milling part D, and over cooling slits 14 and discharge outlet slits 15 into the atmosphere. In this way the bearings 10 are protected through cooling with the fresh air that flows from the fan 9; the same air, as it continues its way, abundantly cools the bottom 11 of the milling compartment D, and while flowing through the cooling channels, also the inner walls of the milling part D of the versatile mill. Thus in a collector on the upper part which is fitted with outlet slits 15, an inlet hose 16 for the recycled air, a separation hose 17 and an introduction hose 18 (the collector is shown in an A-A view in Figure 2) of the mill under invention the fresh air cools on the one hand the inner walls 12 of the milling part D, and on the other hand the return channels which through an introductory hose 16 close up the enclosed milling system. Therefore the milling process can be continuous, and there is no need to stop the milling because of an overheating of the milling part D, or because of the milled material. It is important, however, that the combination of knives 3 should always provide a sufficient suction effect at the fresh air inlet through the introductory hose 16, even when the return channels are removed (an open milling system).

The output of the milled material is foreseen at both flanks of the versatile mill in accordance with the invention. Depending on the type of milled material, sieves of various gradings may be installed at both flanks. Both sieves have the form of larger, slightly concavely shaped plates which are inserted between the lateral opening of the milling part and the lateral output parts of the mill. The lateral output parts A, B of the versatile mill in

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accordance with the invention are shaped so that the milled material - which is prone to sticking to the walls (e.g. coffee, sugar) - is automatically shedded out. To this purpose, both lateral output parts A and B have their outer walls in the shape of two cones facing each other, which end up on either side on one end into an output opening onto which sacks for milled material are fixed.

Figure 3 illustrates the central part of a knife 3 and an intermediate disc 2 in a view from the top. The shape of knives 3, their fitting and position in relation to each other as well as the distance between individual knives 3 depend on the conditions of milling, cutting, grinding as such. The shaft 1 on which the knives 3 are fitted is profiled, and the positioning of the knives 3 is carried out by means of intermediate disks 2 having the opening 2a profiled to fit the profile of the shaft 1, while along the circumference it is fitted with small circular openings 2b (e.g. 12 openings, which make possible the positioning of individual knife 3 with regard to another knife 3 by an angle of 30°). Each knife 3 has a centrally made, circular opening 3a, and beside this, there are on either side two smaller openings 3b, which dimensionally and in terms of shape coincide with the openings 2b on the intermediate disk 2. To put individual knife 3 into proper position, it is necessary to match, by a safety element in the shape of a small cylinder of soft material, the opening 2b on the intermediate disc 2 with the opening 3b on the knife 3. After the entire combination of knives 3, intermediate discs 2 and washers 4 (these can be more than one between individual knives 3, as shown in figure 1) has been fitted, it is fixed on top by a nut 5. In this way the whole package is clamped between a sleeve 6 and the nut 5. Such

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fitting of knives 3 makes it very easy to put the knives into position, and in the event of a foreign body in the milling material, the safety element will break and the individual knife 3 will rotate freely. No damage to either the clamping part of the knife 3 or the shaft 1 will occur. The exchange of knives 3 and their arrangement into another combination is easy and does not require any special tools. The number of knives 3 fitted on the shaft 1 is optional and depends on the desired content of fine (dust, e.g. ground sugar) granulations in the product, or of such granulations that should contain no fine dust particles (e.g. filter tea).

Because of the possibility of fitting an optional number of knives 3 of various shapes, and with regard to the properties of the milled materials, and on account of the possibility of optional mutual positioning of the knives 3, numberless combinations or solutions can be preset. Additional smaller holes 3b', 3b'' can be made in the knives 3, so that individual knives 3 may also be shifted by 15° or even a smaller angle.

In order to achieve special milling effects, the shapes shown in figures 4a through 4f of the knives 3 can be used. Thus the knife in figure 4a has a flat body 19 and pins 20 positioned alternately on both sides in two rows, each pin 20 consisting of two cylindrical parts of different thickness. The knife in figure 4b has a flat body 19' on which flat angular forms 20' of adjustable angle are fitted alternately on one side. The flat body 19'' of the knife in figure 4c is fitted, on each front (striking) side, with beams 20'' turned alternately up/down.

The knives 3 shown in figures 4a, 4b and 4c in various mutual

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combinations are intended for processing materials which produce dust particles (e.g. flour, sugar, pepper, brick, etc.).

The shapes of knives shown in figures 4d through 4f, fitted in various combinations, make it possible to cut or chop the material. For this purpose the fronts of the knives are sharpened on both sides. Thus the knife in figure 4d has a flat body 21 and an acute-angled front 22, while at different distances from the end, in the direction of rotation, on the upper side, two flat attachments 23, 23' are fitted with the sides ending up in acute angle in the direction of the knife's rotation.

The knife in figure 4e has a flat body 21' and an acute-angled front 22', where approximately in the middle of the front 22', an attachment 24 is bent more or less upwards with the front 24' lying in the same direction as the front 22' of the body 21'.

The knife in figure 4f has a flat body 21'' and an acute-angled front 22'', where an attachment 25 is bent more or less upwards approximately in the middle of the front 22'', with its front 25' being turned in the opposite direction from the front 22' of the body 21''.

All the above described knives 3, as well as the knives known from earlier descriptions and the knives (or tools) of other shapes, can be fitted on the shaft 1 at different mutual spacing, which is made possible by the insertion of intermediate disks 2. One or more than one spacer washers 4 may be inserted between individual knives, and the knives 3 may be shifted from each other by a certain angle either by means of holes 2b on the intermediate disks 2 and/or by means of additional holes 3b', 3b'' in the

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knives 3. Thus through various combinations of different or identical knives 3, through their different mutual spacing and through their different mutual shifting, the shape of the milled material after treatment in the versatile mill under invention can be defined.

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CLAIMS

1. A versatile mill,

characterised in that,

the driving motor (M) lies in the same plane with the milling part (D) of the mill being linked with it by a belt drive (J), where through a support (P) telescopic adjustment of the height of the combination of the milling part (D) and the driving motor (D) can be attained.

2. A versatile mill as claimed in Claim 1,

characterised in that

the milling part (D) has an inner wall (12) and an outer coat (13), where a channel thus formed is linked with an air inlet (8) in which also a fan (9) is installed in such a way that the air flows past bearings (10), the bottom (11) of the milling compartment, the inner walls (12) of the milling compartment, and to a collector where cooling slits (14), discharge outlet slits (15), an inlet hose (16) of recycled air, a separating hose (17) and an input hose (18) are carried out.

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3. A versatile mill as claimed in Claims 1 and 2,

characterised in that

knives (3) in combination with intermediate discs (2) and spacer washers (4) are fitted on a shaft (1) which runs through the milling part (D), with the knives on the shaft (1) being fitted in a free-rotating way, while the holes (2a) of the intermediate discs (2) are shaped so as to fit the profile of the shaft (1).

4. A versatile mill as claimed in Claim 3,

characterised in that

the intermediate discs (2) are fitted, along their circumference, with small, circular holes (2b) in the same position and of the same shape as the holes (3b, 3b', 3b'') made in the knives (3), into which a cylindrical safety pin is fitted after the positioning of the knives.

5. A versatile mill as claimed in Claim 1

characterised in that

the outer walls of the lateral output parts (A) and (B) are carried out in the shape of two cones facing each other, ending on each side at one end in an output opening.

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6. A versatile mill as claimed in Claims 1 and 2,

characterised in that

on the shaft (1), in the lower part under the bottom (11) of the milling part (D), a plate (7) in the shape of a disk is fitted which is rigidly linked with the shaft (1) and rotates together with it.

7. A versatile mill as claimed in Claims 1 through 6,

characterised in that

the knife (3) can have a flat body (19) on which pins (20) are fitted on both sides alternatively in two rows, each pin (20) consisting of two cylindrical parts of different thickness.

8. A versatile mill as claimed in Claims 1 through 6,

characterised in that

the knife (3) has its flat body (19') fitted alternatively on one side with flat angular forms (20') of adjustable angle.

9. A versatile mill as claimed in Claims 1 through 6,

characterised in that

the knife (3) has its flat body (19'') fitted at each front (striking) side with alternatively up/down bent beams (20'').

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10. A versatile mill as claimed in Claims 1 through 6,

characterised in that

the knife (3) has a flat body (21) and an acute-angled front (22) and is fitted, at various distances from the end in the direction of the knife's rotation on the upper or lower side, with flat attachments (23, 23') whose sides end up in an acute angle in the direction of the knife's rotation.

11. A versatile mill as claimed in Claims 1 through 6,

characterised in that

the knife (3) has a flat body (21') and an acute-angled front (22'), where in approximately the middle of the front (22') an attachment (24) bent more or less upwards is fitted with its front (24') being turned in the same direction as the front (22') of the body (21').

12. A versatile mill as claimed in Claims 1 through 6,

characterised in that

the knife (3) has a flat body (21'') and an acute-angled front (22''), where in approximately the middle of the front (22'') an attachment (25) bent more or less upwards is fitted with the front (25') being turned in the opposite direction from the front (22'') of the body (21'').

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13. A versatile mill as claimed in Claims 7 through 13,

characterised in that

on the shaft (1) an optional number of knives (3) of various shapes, intermediate discs (2) and spacers (4) are fitted, all clamped between a sleeve (6) and a nut (5).

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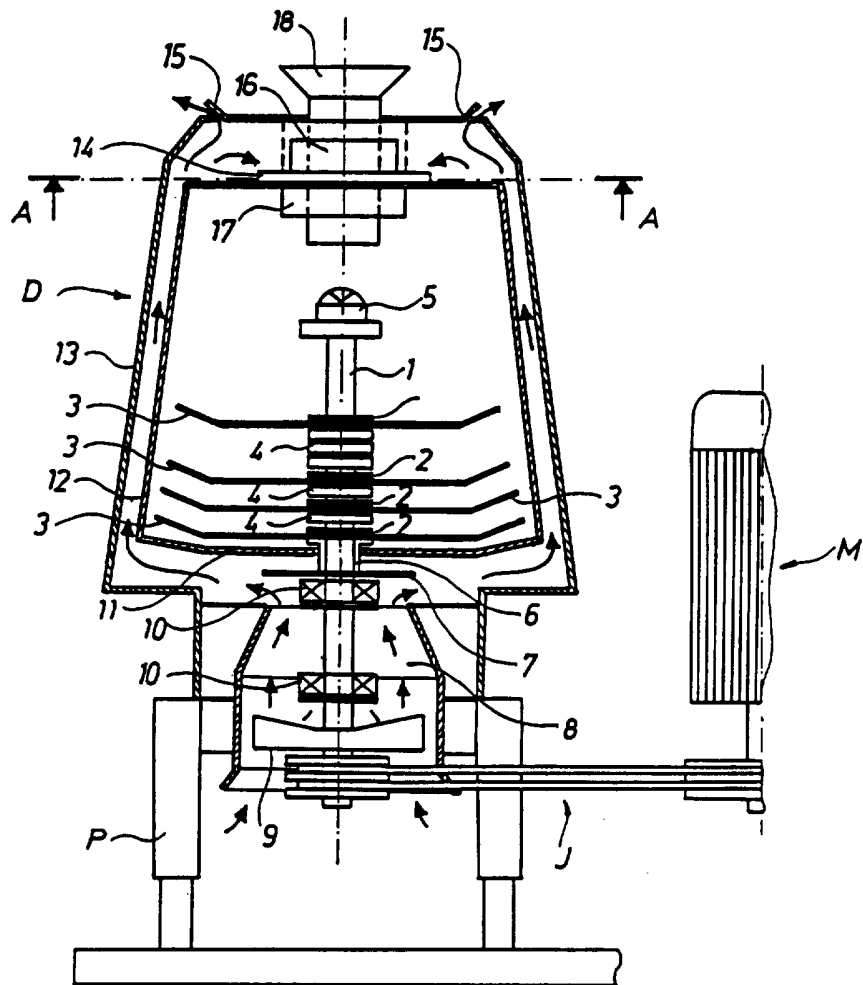


Fig. 1

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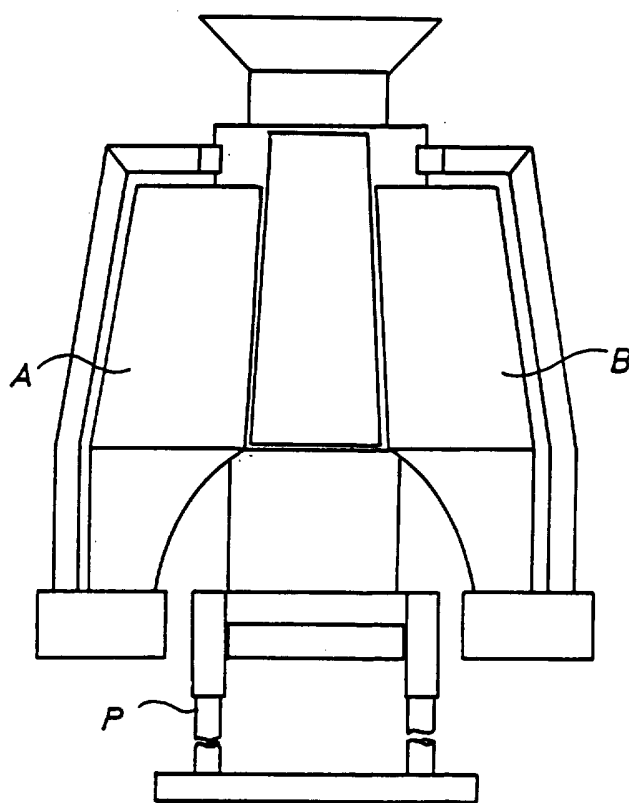


Fig. 1a

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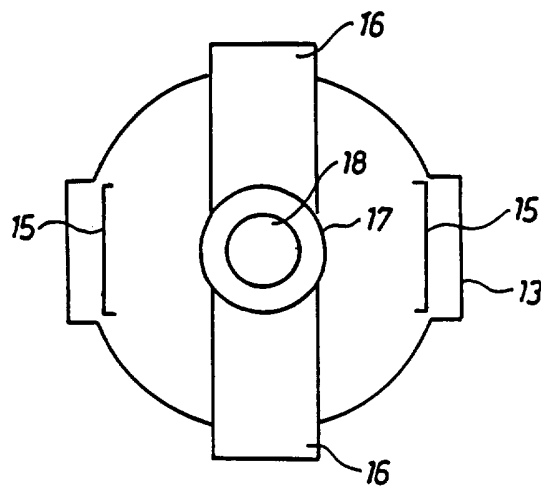


Fig. 2

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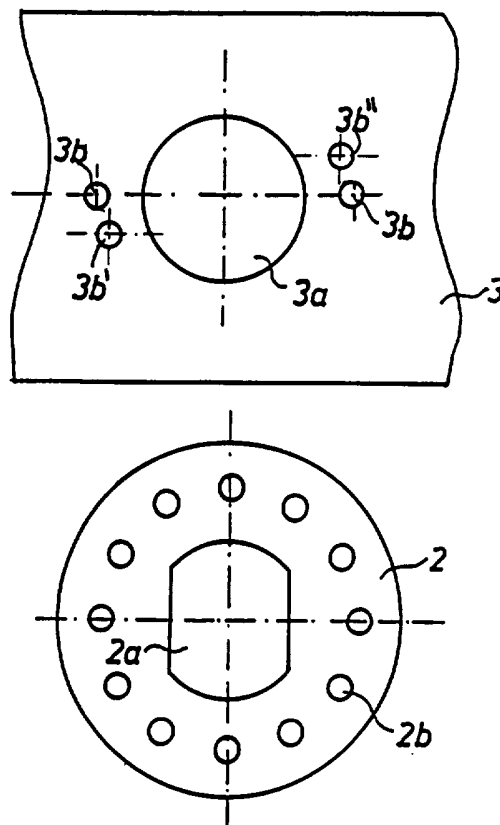


Fig. 3

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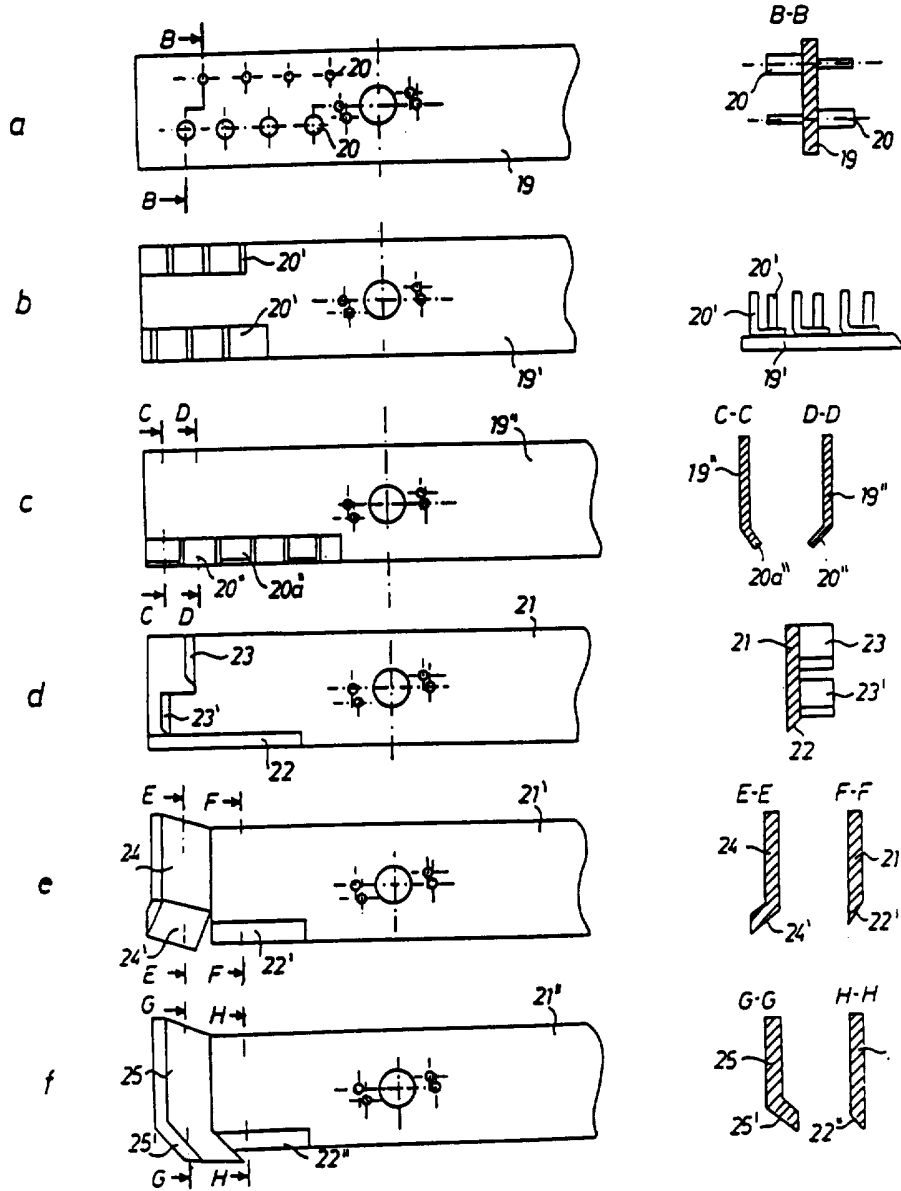


Fig. 4