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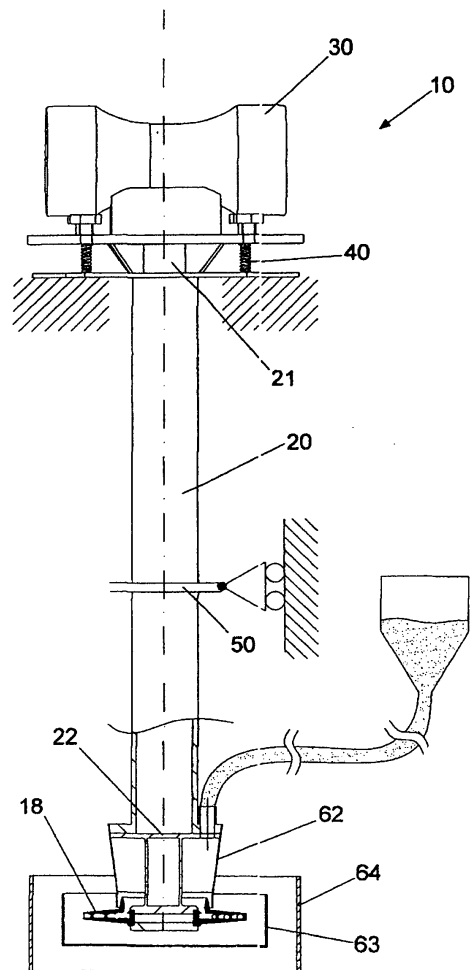
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(54) **Vibrotumbling machine**

(57) Vibrotumbling machine (10) in particular for inner surfaces of a manufactured product (18) by means of an abrasive mix comprising several elements of not particularly hard material, abrasive particles, water and additives, the machine (10) comprises vibrating means (20,30) to cause a relative movement between the various elements of the abrasive mix and the manufactured product (18) in order to obtain a surface processing of the same, the vibrating means are associated with the manufactured product (18) to make it vibrate directly, thus obtaining the surface processing of the same.

The machine (10) comprises pressure means for obtaining a forced flow of the abrasive mix with respect to the manufactured product (18), in particular for obtaining a forced flow inside at least one cavity of the manufactured product (18).

Fig. 2



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Description

[0001] The present invention relates to a vibrotumbling machine, in particular applicable for the processing of manufactured products having at least one cavity or inner surface.

[0002] Vibrotumbling processes represent an economical solution for removing the surface layer in the case of at least one surface obtained in particular by means of electro-erosion techniques.

[0003] A surface layer which is substantially hard and fragile, or in any case such as to have micro-structural and morphological characteristics which are not acceptable for certain types of applications, is in fact obtained through electro-erosion.

[0004] An example of this type of manufactured product consists of objects having at least one cavity, such as rotors, in particular.

[0005] The processing of external surfaces with vibrotumbling is simple and economical, as the manufactured product to be processed is immersed in an abrasive mix.

[0006] This is kept in a container which, in turn, is vibrated by means of vibrating means.

[0007] The abrasive mix normally includes various elements of material which is usually not particularly hard, known by the English term as "media", abrasive particles, water and additives.

[0008] The function of the various material elements, i.e. the media, is to transmit kinetic energy to the abrasive particles so that these strike against the manufactured product to be processed.

[0009] Each media element is surrounded by abrasive particles present in the abrasive mix and receives the vibrations from the vibrating means through the container.

[0010] In this way, the various elements of the abrasive mix strike the external surface of the manufactured product to be processed, causing the abrasive particles to rub against the same surface.

[0011] By rubbing against the surface, said particles cause the removal of material from the external surface of the manufactured product with the consequent abrasion of the surface layer and removal of material therefrom.

[0012] A vibrational movement is therefore conferred to the abrasive mix machines for vibrotumbling or vibrofinishing currently on the market, which is subsequently transmitted to a manufactured product to be processed or surface smoothed.

[0013] In other terms, a vibration is transmitted to a manufactured product to be processed by means of an abrasive mix in which the manufactured product is fully immersed; the abrasive mix is kept in a container which is subjected to vibration.

[0014] The vibration is, in turn, transmitted to the abrasive mix and, consequently, to the manufactured product.

[0015] The relative movement of the abrasive mix with respect to the surface of the product to be processed is

exclusively created by the vibration induced to the abrasive mix by means of the vibration means.

[0016] One of the drawbacks of current machines is consequently that the relative movement is reduced or completely absent in grooves, openings, cavities and narrow fins, as said abrasive mix is stagnant in said inner cavities, causing a so-called "plug" effect.

[0017] As an efficient relative movement between the abrasive mix and the inner surfaces, often inaccessible, of the product to be processed, is not possible with current machines, it is consequently not possible to efficiently process said inner surfaces.

[0018] This leads to the fact that, as it is not possible to process said inner surfaces by means of the abrasive action of an abrasive mix, it is often necessary to obtain the products through different technologies, usually having higher operating costs, accompanied at the same time by a lower quality result.

[0019] Even when the use of vibro-erosion machines is possible, these are not efficient for processing inner surfaces such as those with grooves and thin cavities having narrow sections, in particular, for example, in the case of some rotors.

[0020] In this case, the abrasive means reach the inner surfaces with no vibrational energy or, even worse, remain inside said grooves or cavities.

[0021] In both cases an efficient action cannot be obtained of the abrasive mix on the inner surfaces, accessible through rather thin and narrow sections, in which a minimum section value can range from 5 to 10 millimetres.

[0022] Another drawback is that, for wider sections, in any case, a non-uniform abrasion of the surface is obtained, mainly close to the external portions of the product to be processed.

[0023] This is due to the fact that the change of direction and velocity causes a higher frequency and intensity of the impact of the elements of the abrasive mix on the object.

[0024] An objective of the present invention is to provide a vibrotumbling machine capable of processing inner surfaces such as grooves, cavities, housings and holes, even when these are thin and narrow.

[0025] Another objective of the present invention is to produce a vibrotumbling machine capable of uniformly removing material from at least one inner surface of a manufactured product having at least one cavity or indentation to be processed.

[0026] A further objective is to provide a vibrotumbling machine capable of effectively and uniformly processing both inner and outer surfaces.

[0027] Yet another objective is to have a simple and economical vibrotumbling machine.

[0028] These objectives, according to the present invention, are achieved by producing a vibrotumbling machine as specified in claim 1.

[0029] Further characteristics of the invention are indicated in the subsequent claims.

[0030] The characteristics and advantages of a vibrotumbling machine according to the present invention will appear more evident from the following illustrative and non-limiting, description, referring to the enclosed schematic drawings wherein:

Figure 1 is a raised right-side perspective view of a preferred embodiment of a vibrotumbling machine according to the present invention;

Figure 2 is a schematic, partially sectional, raised view of the vibrotumbling machine of figure 1;

Figure 3 is a detail of figure 2;

Figure 4 is a detail of figure 1.

[0031] With reference to the figures, these show a machine 10 for the vibrotumbling of a manufactured product 18, such as, for example, a rotor, by means of an abrasive mix comprising various elements of not particularly hard material, abrasive particles, water and additives.

[0032] Said machine 10 comprises vibration means for causing a relative movement between said abrasive mix and said manufactured product 18, to obtain its processing.

[0033] Said vibration means are associated with said manufactured product 18 to make it vibrate directly and obtain its processing.

[0034] Said vibration means are preferably associated with said manufactured product 18 by means of a rod 20 or said vibration means are directly connected to said manufactured product 18.

[0035] Said machine 10 also comprises pressure means for obtaining a forced flow of said abrasive mix with respect to said manufactured product 18, in particular for obtaining a forced flow inside at least one cavity of said manufactured product 18.

[0036] Said pressure means preferably include a column of abrasive mix situated above said manufactured product 18 to force the relative flow with respect to the same of a part of abrasive mix which is close to the manufactured product 18, in order to uniformly remove material therefrom.

[0037] At the same time, said rotor 18 is fed with the commercial abrasive mix (means, abrasive product, water, additives) by means of a rubber collector 62, shown in figure 3, which receives the mix from a feeding duct 61 connected to a tank 60, suspended about 1,000 mm above.

[0038] According to a preferred embodiment, said machine 10 preferably comprises a frame 12 to which said rod 20 is constrained by means of elastic means 40, such as, in particular, a series of springs.

[0039] Said rod 20 is preferably constrained at a first upper end 21 to said frame 12 by means of a series of vertical guides 45 and suspended to said frame by means of said elastic means 40, which allow a relative movement

of the rod 20 with respect to the frame 12 in a vertical direction.

[0040] Said vertical rod 20 also has a lower end 22 on which said rotor 18 is tightened, and said upper end 21 is connected to vibration means such as, in particular, a non-balanced motor 30 which transmits vibrations thereto.

[0041] Said motor 30 is preferably situated above said frame 12 and it is preferably constrained to said upper end 21 of said rod 20 by means of a disk 24 integral with said rod 20.

[0042] The vibration means are thus directly associated with the manufactured product 18 to be processed and are therefore capable of transmitting vibrations to the same without any kind of attenuation.

[0043] Said machine 10 preferably comprises a rubber collector 62 to channel said mix into said at least one cavity of said manufactured product 18, or thereon.

[0044] Said pressure means preferably include a tank 60 and a feeding duct 61 which comprises a first end and a second end, said first end is situated downstream of said tank 60 and said second end is upstream of said manufactured product 18 to allow the abrasive mix to flow against said manufactured product 18.

[0045] Said tank 60 is situated above said duct 61, below which a rubber collector 62 is connected to channel said abrasive mix into said at least one cavity of said manufactured product 18.

[0046] Said second end of said feeding duct 61 is preferably connected upstream of said collector 62 to allow the abrasive mix to flow against said manufactured product 18.

[0047] Said tank 60 is preferably suspended about 1,000 mm above said manufactured product 18, so that the weight of the column of abrasive mix itself, contained in the duct 61, causes a pressure on the part of the abrasive mix in contact with, or close to, said manufactured product 18.

[0048] In this way, the same is forced to flow with respect to the manufactured product 18, thus uniformly removing material from the surface of the same.

[0049] Said machine 10 preferably comprises a basin 63 constrained to said manufactured product, which surrounds said manufactured product to allow both inner and outer surfaces of the same to be contemporaneously processed.

[0050] After flowing through said at least one cavity of said rotor 18, said abrasive mix is, in fact, collected inside said basin 63, and in this way it also processes the outer surface of said manufactured product 18.

[0051] This continues until a maximum level is reached in the basin 63, over which the abrasive mix overflows from the same and is collected in a container 64 constrained to the frame 12.

[0052] Said machine 10 preferably comprises said container 64, which collects said abrasive mix when this falls from the basin 63.

[0053] The exhausted abrasive mix collected in the

container 64 is then washed, mixed with new abrasive material and then reintroduced into the upper tank 60.

[0054] This functioning can be effected by manual means or with automatic means to provide a continuous working cycle.

[0055] The abrasive machine 10 has the following innovative characteristics:

- it transmits the vibration directly to the manufactured product to be processed, instead of through an abrasive mix;
- the fluid is forced to flow relatively with respect to the manufactured product to be processed, in particular with respect to the inner surfaces, such as, for example, cavities, holes or grooves in particular thin and narrow.

[0056] By directly vibrating the object to be processed, it is thus possible to obtain a relative movement between an inner surface to be processed, having a very narrow section, and the abrasive mix flow, which is forced to flow inside said at least one inner cavity, obtaining a vibro-abrasion effect capable of smoothing the surface of the same or, in any case, uniformly removing material therefrom.

[0057] The abrasive mix is forced to flow inside at least one inner surface by means of pressure means, increasing the relative movement between the abrasive particles dispersed in the mix and the inner surface of said inner cavity to be processed.

[0058] This causes the abrasive particles to strike against at least one inner surface to be processed creating an abrasive effect on the surface itself.

[0059] The use of pressure means for forcing said abrasive mix onto said at least one inner surface to be processed, advantageously prevents the abrasive mix from stagnating inside the holes and cavities of the rotor and other components, obtaining the evacuation of the eroded material.

[0060] The vibrotumbling machine of the present invention is advantageously extremely efficient in the case of inner surfaces which are difficult to reach or inaccessible, such as grooves, cavities and holes, in particular.

[0061] It can thus be seen that a vibrotumbling machine according to the present invention achieves the objectives specified above.

[0062] The vibrotumbling machine of the present invention thus conceived can undergo numerous modifications and variants, all included in the same inventive concept.

[0063] Furthermore, in practice, the materials used, as also the dimensions and components can vary according to technical demands.

Claims

1. A vibrotumbling machine (10) in particular for inner

surfaces of a manufactured product (18), by means of an abrasive mix comprising several elements of not particularly hard material, abrasive particles, water and additives, said machine (10) comprises vibrating means to cause a relative movement between said abrasive mix and said manufactured product (18) in order to obtain a surface processing of the same, **characterized in that** said vibrating means are associated with said manufactured product (18) to make it vibrate directly, thus obtaining the surface processing of the same, and **in that** it comprises pressure means for obtaining a forced flow of said abrasive mix with respect to the manufactured product (18), in particular for obtaining a forced flow inside at least one cavity of said manufactured product (18).

2. The machine (10) according to claim 1, **characterized in that** said vibrating means are associated with said manufactured product (18) by means of a rod (20).

3. The machine (10) according to claim 1, **characterized in that** said vibrating means are directly constrained to said manufactured product (18).

4. The machine (10) according to any of the claims from 1 to 3, **characterized in that** said vibrating means comprise a non-balanced motor (30).

5. The machine (10) according to any of the claims from 1 to 4, **characterized in that** said pressure means comprise a basin (60) and a feeding duct (61) which comprises a first end and a second end, said first end is connected downstream of said basin (60) and said second end is upstream of said manufactured product (18) to allow said abrasive mix to flow against said manufactured product (18).

6. The machine (10) according to any of the claims from 1 to 5, **characterized in that** said pressure means comprise a column of abrasive mix which is situated above said manufactured product (18) to force the flow relatively with respect to this of a part of abrasive mix which is close to the manufactured product (18) itself in order to uniformly remove material therefrom.

7. The machine (10) according to any of the claims from 1 to 6, **characterized in that** it comprises a frame (12) to which said rod (20) is attached by means of elastic devices (40).

8. The machine (10) according to any of the claims from 1 to 7, **characterized in that** it comprises a rubber collector (62) for sending said abrasive mix into said at least one cavity of said manufactured product (18).

9. The machine (10) according to claim 8, **character-**

ized in that said second end of said feeding duct (61) is connected upstream of said collector (62) to allow said abrasive mix to flow against said manufactured product (18).

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- 10.** The machine (10) according to any of the claims from 1 to 8, **characterized in that** it comprises a basin (63) fixed to said manufactured product, which surrounds said manufactured product (18) to allow inner and outer surfaces thereof to be processed contemporaneously.

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Fig. 1

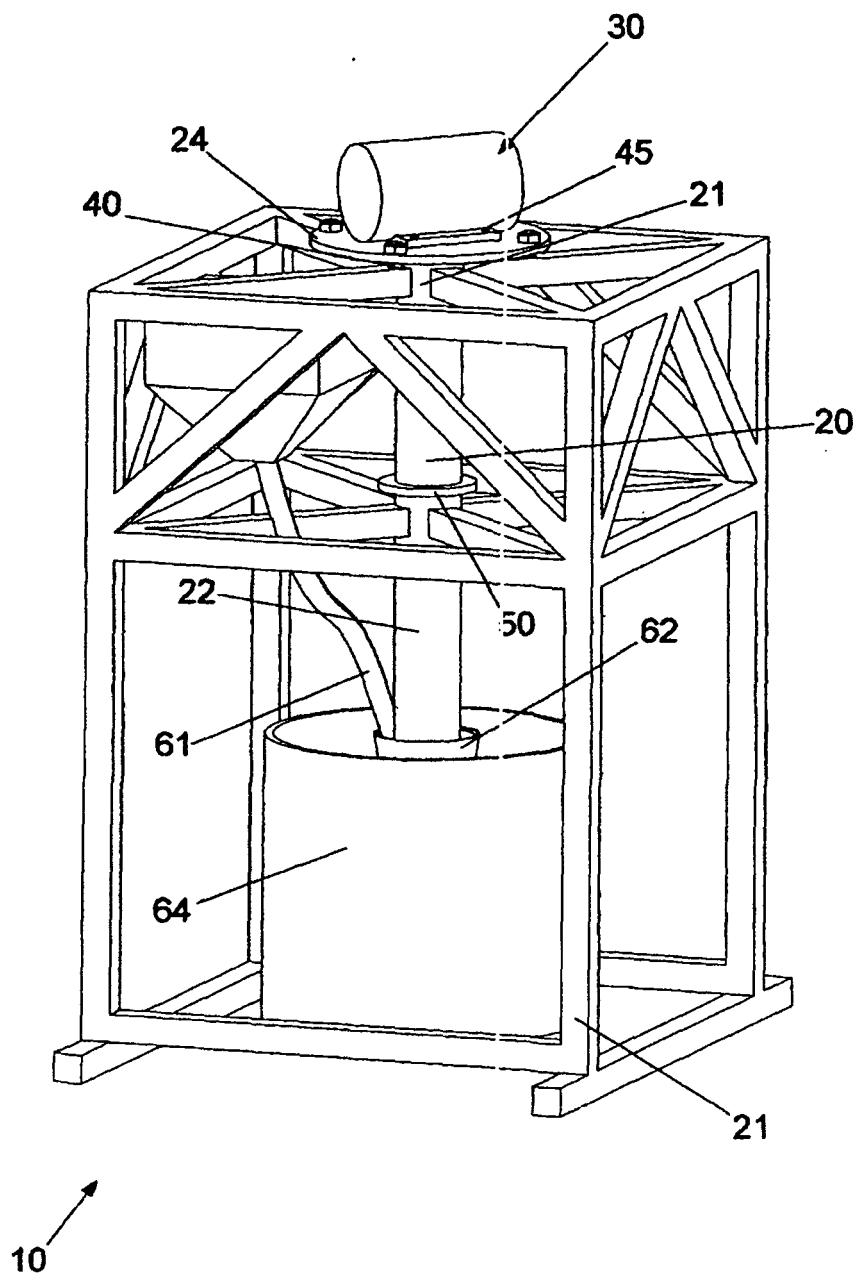


Fig. 2

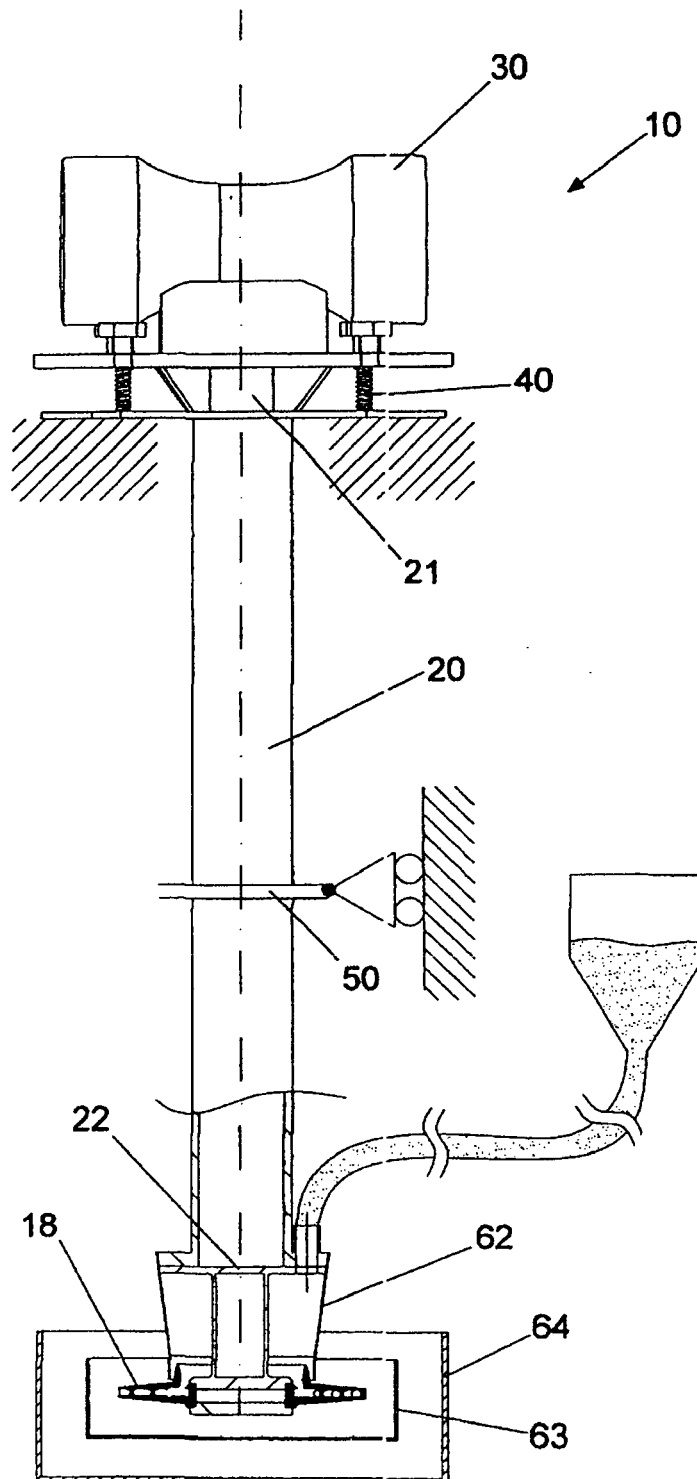


Fig. 3

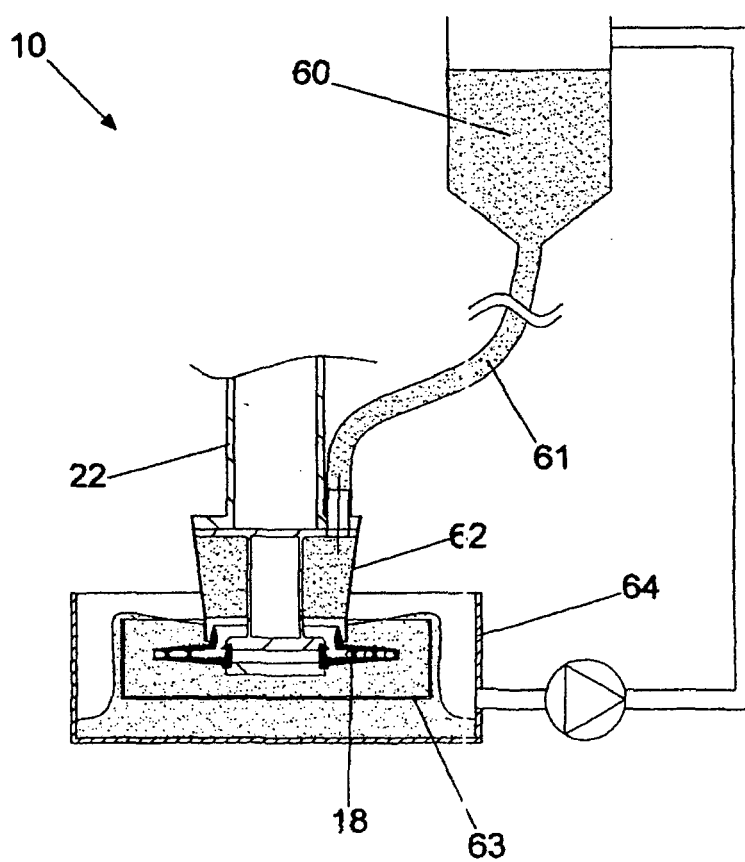
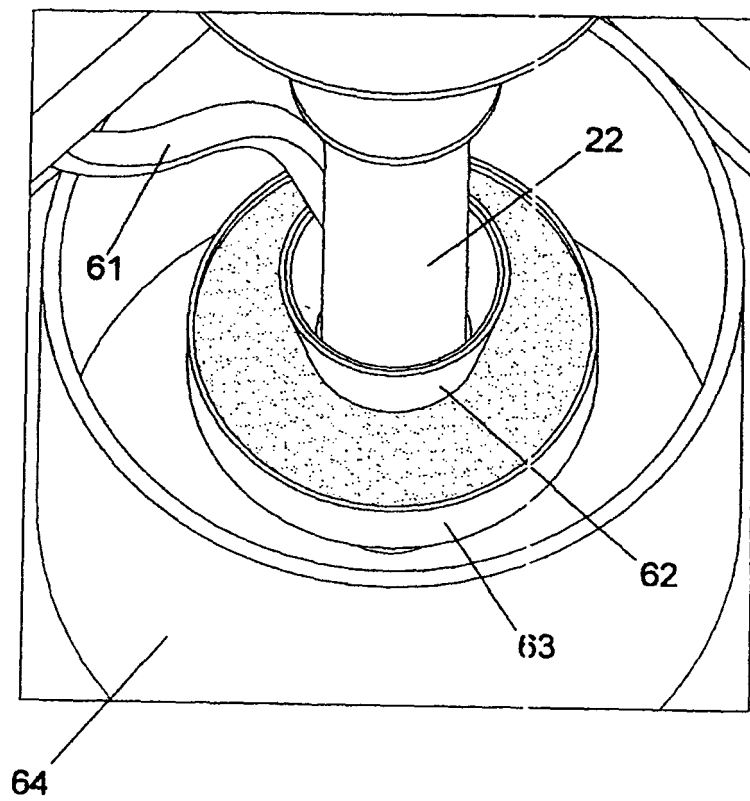


Fig. 4





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EUROPEAN SEARCH REPORT

Application Number
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Place of search Munich		Date of completion of the search 27 February 2006	Examiner Eder, R
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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