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## (54) Hammer rotor for crushing plants

(57) Crushing plant comprising a cage (21) within which there rotates at high speed a generally cylindrical rotor (3), on the periphery of which there are provided longitudinal hinge pins (32) for crushing hammers (30), in which the retention seats (5; 55) for said pins each open into the outer surface of the rotor via a respective generally radial cut (7) having, at least in proximity to its connection to said seat, a width less than the pin diameter, said pins presenting, at least in correspondence with those portions contained in said seat, a non-circular cross-section, one transverse dimension of which is slightly less than said width, said pins being arranged to rotate within their seats between a first angular position or locked position, and a second angular position or released position, in which said one transverse dimension of said non-circular cross-section lies substantially parallel to, and respectively generally oblique to, said cut.

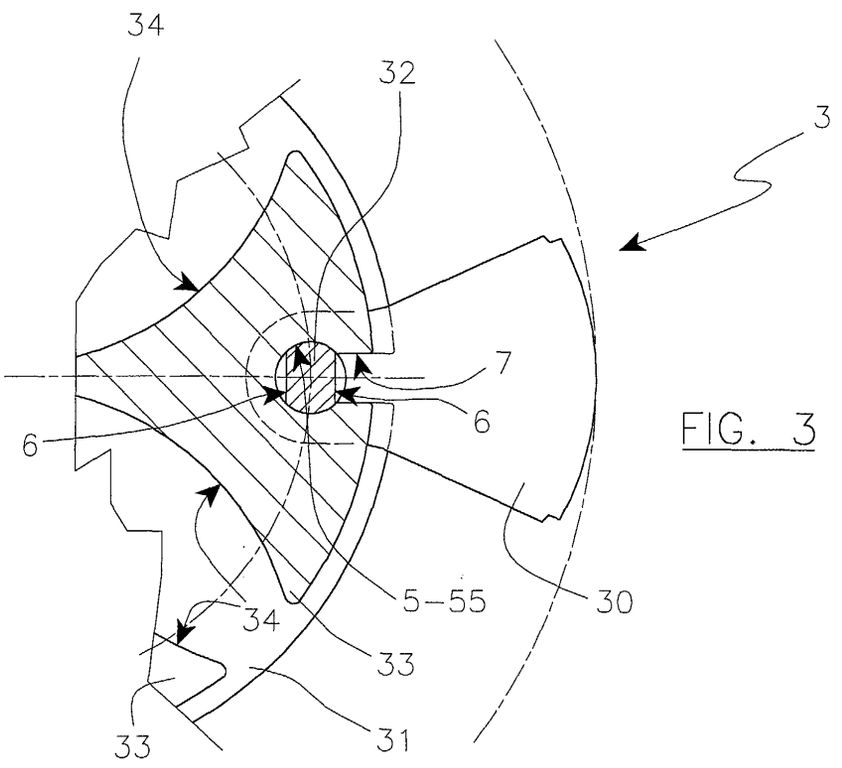


FIG. 3

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## Description

**[0001]** This invention relates to plants for reducing loose materials into pieces of relatively small dimensions, and in particular plants for crushing ferrous and non-ferrous metal materials originating from the recovery of scrapped materials.

**[0002]** Said metal materials are in the form either of parallelepipeds obtained by compacting automobile bodies, or of variously shaped pieces deriving from the sectioning of scrapped articles and requiring crushing or breaking into small pieces prior to their reuse as a source of raw material, for example prior to their melting and conditioning in blast furnaces which transform them into ingots.

**[0003]** For crushing such materials, plants are used commonly known as hammer crushers, comprising essentially a stationary robust metal cage within which a rotor rotates at high speed.

**[0004]** Hinged to the rotor periphery, there are a certain number of slabs, commonly known as hammers, which swing about a non-barycentric axis and are maintained facing outwards by the centrifugal forces in play.

**[0005]** The material to be crushed is struck by said hammers which, either alone or in combination with one or more fixed anvils, reduce it into generally small pieces which pass through the cage apertures and are collected on the outside.

**[0006]** The invention relates specifically to said hammer rotors.

**[0007]** Rotors are known comprising a central shaft on which there are keyed generally circular parts supporting the hinge pins for the hammers, which rotate within the space between two circular parts. Said pins are supported by through cylindrical holes provided in said circular parts Hammer rotors which do not have said central shaft are also known, and are fully described in patent application RE2000A000112 in the name of the same Applicant.

**[0008]** The rotors of said document essentially comprise two opposing end plates between which there are sandwiched flat profiled parts mounted on a circumferential series of parallel rods which connect said two end plates together, each individual part presenting at least one concavity within which there rotates a hammer pivoted on the rod which passes through the concavity in an axial direction.

**[0009]** Essentially, said rods perform two functions, one consisting of making the rotor coherent, and the other consisting of acting as the hinge pins for the hammers. Again in this case, the seats by which the rods (or pins) are engaged with the profiled parts consist of through cylindrical holes provided in these latter.

**[0010]** For other details regarding such rotors without a central shaft, reference should be made to the aforesaid document.

**[0011]** A problem common to both the aforedescribed known types of hammer rotor lies in the fact that interventions for maintenance purposes, for example to replace the hammers and/or their pins, are particularly complex, uncomfortable, lengthy and costly.

**[0012]** This derives from the fact that to replace for example even a single hammer, the end of the rotor has to be operated on, to at least partly withdraw the respective pin from its seats by sliding it parallel to itself in one direction, then in the opposite direction once the damaged hammer has been replaced.

**[0013]** An idea of this operational complexity can be obtained by imagining for example a plant sited up against other equipment or against fixed structures such as brickwork.

**[0014]** The main object of this invention is to provide a hammer rotor on which such operations can be performed more simply, more comfortably, more rapidly and more economically.

**[0015]** Another object of the invention is to attain said object within the context of a simple, rational, reliable, robust and economical construction.

**[0016]** Said objects are attained by virtue of the characteristics indicated in the claims.

**[0017]** In a totally general sense, according to the invention the engagement between the hammer support pins and the respective through holes provided in the flat parts of the rotor is achieved by a system by which said pins can be removed and mounted by operating in a direction generally radial to the rotor, for example by acting via the mouth through which the cage is filled.

**[0018]** By virtue of said system, described in detail hereinafter, operations of the aforesaid type are extremely simplified and facilitated, as has been proved by appropriate tests carried out on a crusher equipped with a rotor according to the invention.

**[0019]** The constructional characteristics and merits of the invention will be more apparent from the ensuing reference to the figures of the accompanying drawings, which show a particular preferred embodiment thereof by way of non-limiting example.

**[0020]** Figure 1 is a schematic sectional side view of a crusher according to the invention.

**[0021]** Figure 2 is a section on the line II-II of Figure 1, showing only the rotor for simplicity.

**[0022]** Figure 3 is a detail of Figure 1 on an enlarged scale, the hammer support pin being shown in its locked configuration.

**[0023]** Figure 4 is a view similar to the preceding but showing the hammer in its released configuration.

**[0024]** Firstly it should be noted that the illustrated hammer crusher is of the type without a central shaft, and forms one of the possible preferred embodiments of the plant described in the document mentioned in the introduction.

**[0025]** It should also be noted that the teachings of the invention can also be applied to other types of hammer rotor, such as the hammer rotor with a central shaft mentioned in the introduction.

**[0026]** Said figures, and in particular Figure 1, show

a crusher comprising an outer casing 1 in which there is installed a robust cage 2 within which a rotor 3 rotates at high speed.

**[0027]** The cage 2 is formed from a series of curved side-by-side beams 20 of open ring shape, or ribs, connected together by a series of horizontal straight beams, or longitudinal members, terminating in the side walls 10 of the casing 1.

**[0028]** The interrupted portions of said ribs 20 form the loading mouth of the cage through which the material to be crushed is loaded by a convenient conveyor 4.

**[0029]** At least one longitudinal member 21 is more robust than the others and acts as an anvil for the hammers 30 of the rotor 3.

**[0030]** As can be seen in Figure 2, the rotor 3 comprises a pair of generally circular opposing end plates 31 provided with suitable coaxial supports 35. The plates 31 are connected together by four rods 32 which pass through the plates 31 via respective cylindrical holes 55, and are angularly equidistant along a circumference coaxial with the supports 35.

**[0031]** Profiled flat parts 33 are mounted on said rods 32, via respective cylindrical through holes 5, and are sandwiched together between the plates 31 to ensure consistency of the rotor 3.

**[0032]** Each profiled part 33 presents two opposing concavities 34 which are swept by the respective hammers 30 during one complete rotation.

**[0033]** Said profiled parts 33 are each joined to only two opposing rods 32, each part being rotated through 90° relative to the immediately preceding and following part.

**[0034]** In that manner those portions of the rods 32 which face the concavities 34 act as swing pins for the hammers 30.

**[0035]** As shown also in Figures 3 and 4, the rods or pins 32 have a non-circular cross-section.

**[0036]** Specifically, each pin 32 presents two diametrically opposing identical flats 6 of total extension.

**[0037]** The holes 55 and 5 provided respectively in the end plates 31 and in the profiled parts 33 each open into the outer face of the respective member by virtue of a cut 7 disposed generally radial to the rotor 3.

**[0038]** The width of said cut 7 is less than the diameter of the holes 5, 55 and pins 32, and is preferably slightly more than the distance which separates the two flats 6.

**[0039]** Each pin 32 can be rotated about itself to occupy either a locked position or a released position.

**[0040]** In Figures 3 and 4, said rotation is of 90°. When in said locked position the distance between the flats 6 lies parallel to the cut 7, whereas when in the released position said distance lies transversely to the extension of the cut 7.

**[0041]** When the pin 32 has been released it can be separated from the rotor 3 together with its own hammers 30, extracted from the cage 2 through its loading mouth, inspected and overhauled, and finally remounted by operating in the reverse manner.

**[0042]** There are also provided indicator means to facilitate correct orientation of the flats 6, engagement means by which the pins 32 can be rotated about themselves, and retention means for retaining the pins 32 in their locked position.

**[0043]** For example said indicator means, not shown for simplicity, can consist of at least one mark associated with one end of the pin 32 and cooperating with at least one reference marking for example provided on the outer face of the plate 31.

**[0044]** Said engagement means can be the actual flats 6 themselves, providing a seat for a key, or another equivalent seat, for example at least one diametrical end slot indicated by 9 at the top left in Figure 2, or at least one through diametrical end hole indicated by 99 at the bottom left in the same figure.

**[0045]** With regard to said retention means, these can consist for example of a profiled key as indicated schematically by 77 at the bottom right in Figure 2, and intended to be forcibly inserted into the gap between the hole 55 and the inner flat 6 of the respective pin 32.

**[0046]** The merits and advantages of the invention, as well as its operation, are apparent from the aforegoing and from an examination of the accompanying figures.

**[0047]** The illustrated embodiment is not the only one possible. For example, the two diametrically opposing flats 6 could be provided only along those portions of the pins 32 passing through the profiled parts, the remaining portions being perfectly cylindrical.

**[0048]** As a variant, just one flat could be provided, of total extension or not, in which case one side of the cut 7 would be tangential to the respective hole 5 or 55, and the opposite side would be disposed in accordance with a secant chordal plane.

## Claims

1. A crushing plant comprising a cage (21) within which there rotates at high speed a generally cylindrical rotor (3), on the periphery of which there are provided longitudinal hinge pins (32) for crushing hammers (30), **characterised in that** the retention seats (5; 55) for said pins each open into the outer surface of the rotor via a respective generally radial cut (7) having, at least in proximity to its connection to said seat, a width less than the pin diameter, said pins presenting, at least in correspondence with those portions contained in said seat, a non-circular cross-section, one transverse dimension of which is slightly less than said width, said pins being arranged to rotate within their seats between a first angular position or locked position, and a second angular position or released position, in which said one transverse dimension of said non-circular cross-section lies substantially parallel to and respectively generally oblique to said cut.

**2.** A plant as claimed in claim 1, **characterised in that** said non-circular cross-section is achieved by at least one flat.

**3.** A plant as claimed in claim 2, **characterised in that** said at least one flat extends for the entire length of the pin.

**4.** A plant as claimed in claim 1, **characterised by** comprising means for retaining the pin in its locked position, such as at least one key intended to be forcibly inserted into the gap defined between the pin seat and said at least one flat.

**5.** A plant as claimed in claim 1, **characterised by** comprising means for rotating the pin about itself, such as at least one key seat provided at one end of the pin.

**6.** A plant as claimed in claim 1, **characterised by** comprising means for indicating at least the locked position of the pin, such as a mark applied to the end of the pin and at least one reference marker associated with the respective seat.

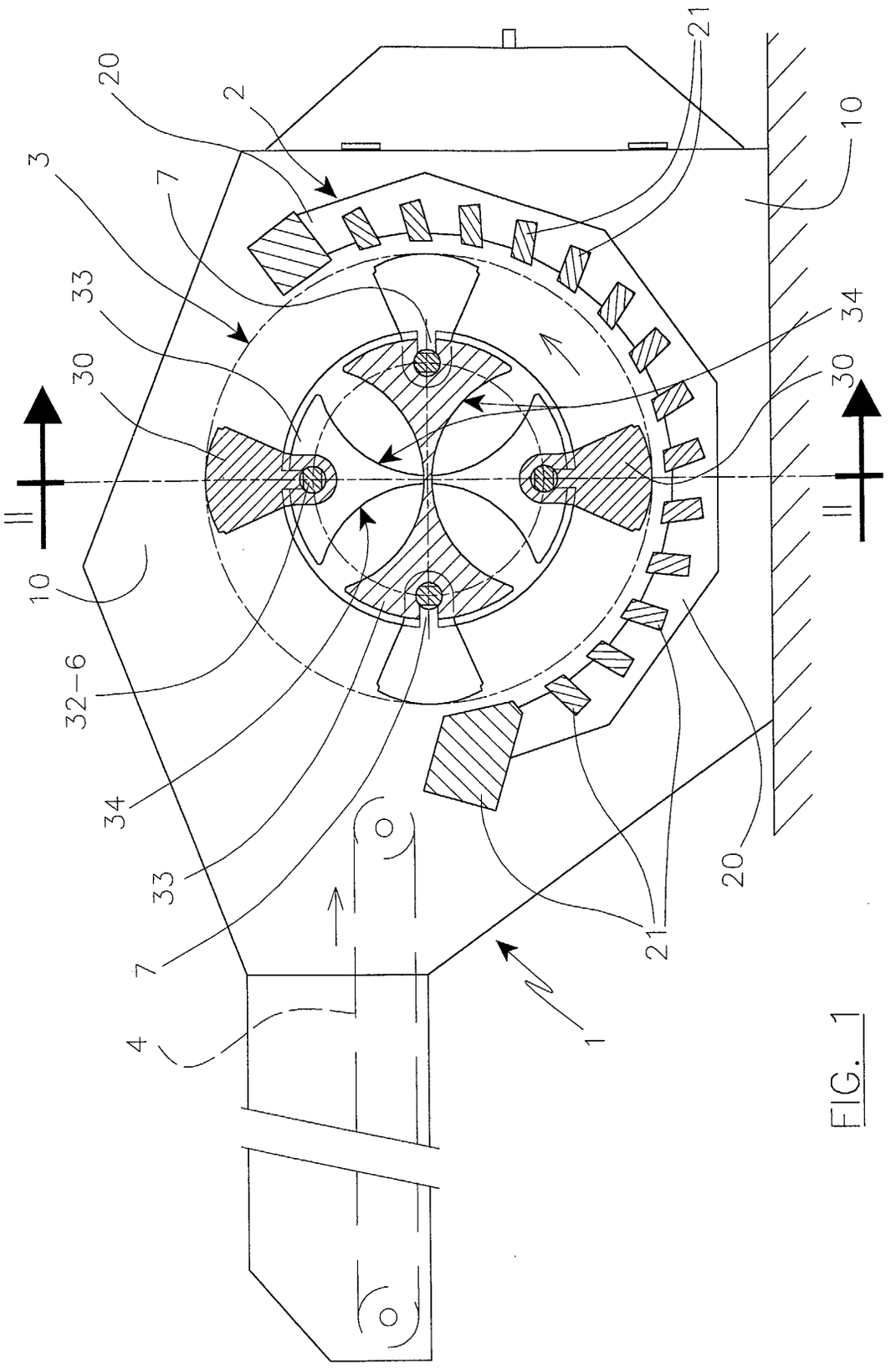


FIG. 1

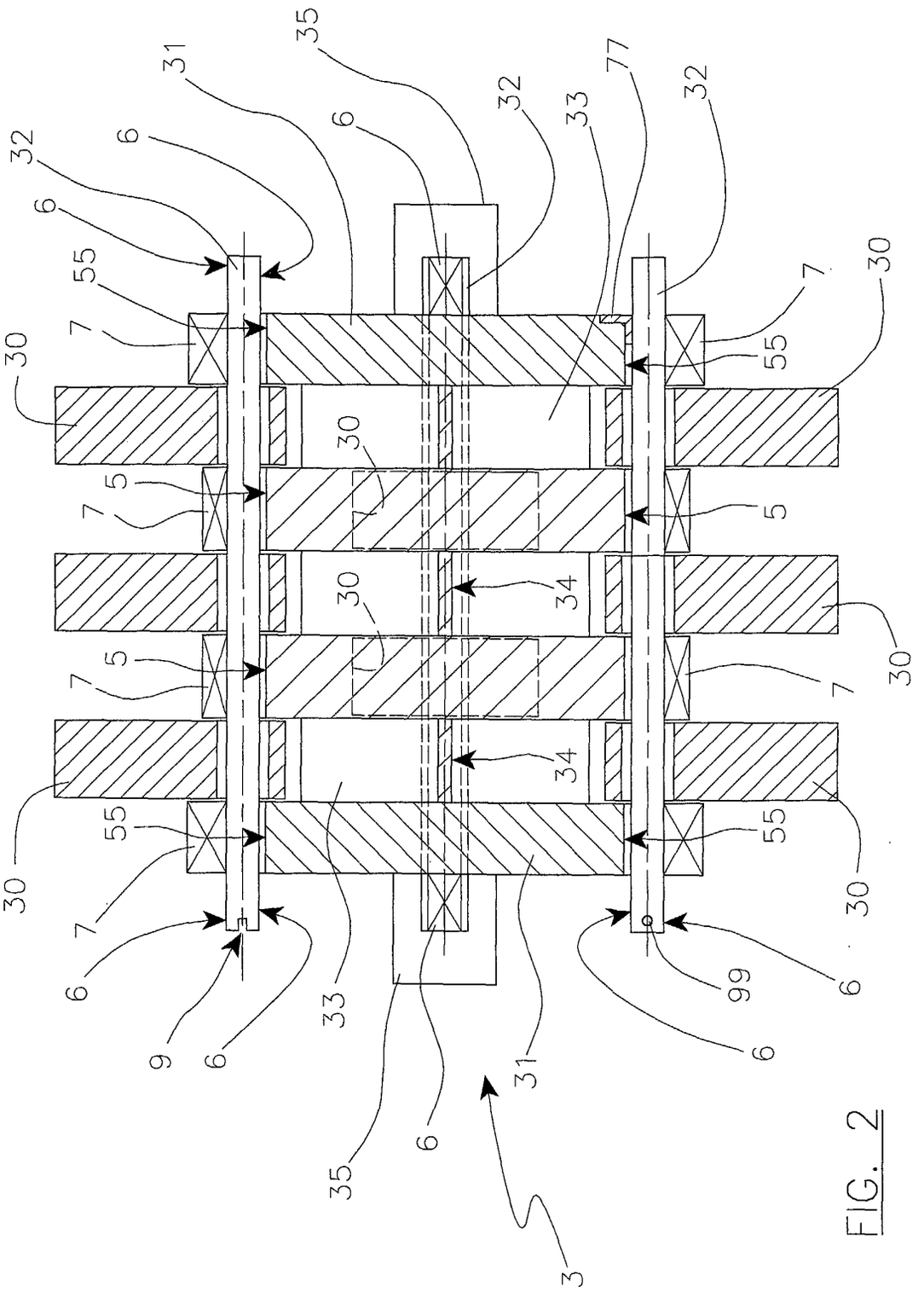
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FIG. 2

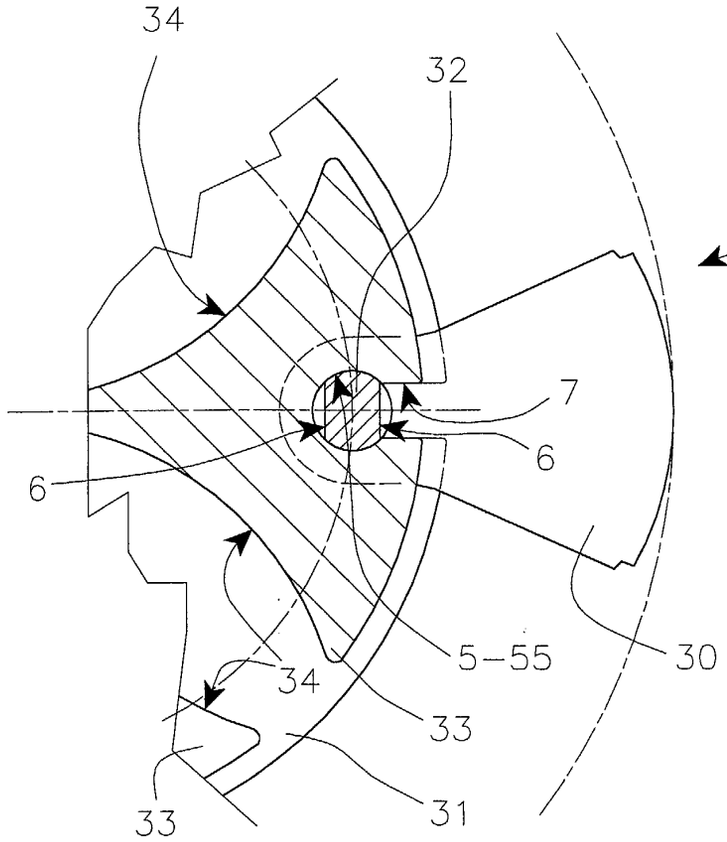


FIG. 3

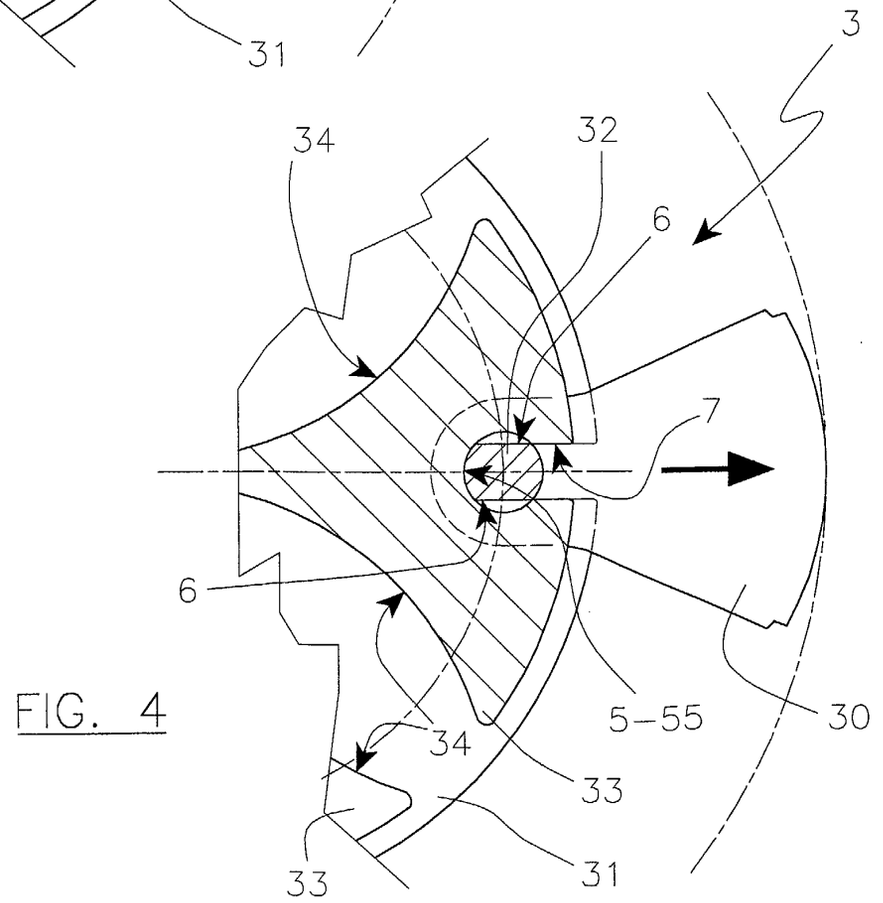


FIG. 4

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# EUROPEAN SEARCH REPORT

Application Number
EP 03 07 5999

## 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.7) |
|---|---|---|---|
| Y | DE 37 44 241 A (LINDEMANN MASCHFAB GMBH) 6 July 1989 (1989-07-06)<br>* column 3, line 52 - column 4, line 19 *<br>* column 9, line 27 - line 40 *<br>* column 10, line 53 - column 11, line 38; figures 1,4,5,6A,6B,11-14 * | 1-6 | B02C13/04<br>B02C13/28 |
| Y | DE 662 128 C (SCHUECHTERMANN & KREMER BAUM A) 5 July 1938 (1938-07-05)<br>* page 2, line 56 - line 69; figures 1-4 * | 1-6 | |
| A | DE 33 17 070 C (MAIER B MASCHF GMBH CO KG) 26 July 1984 (1984-07-26)<br>* column 2, line 13 - line 25 *<br>* column 4, line 4 - line 9; figures 1-3 * | 1-6 | |
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| | | | TECHNICAL FIELDS SEARCHED (Int.Cl.7)<br>B02C |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| MUNICH | 2 October 2003 | Kopacz, I |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 07 5999

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02-10-2003

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