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(54) Machine for the destruction of worn pneumatic tyres.

(57) The machine for the destruction of worn pneumatic tyres comprises means (19 ; 21) for supporting and handling the tyre (P) that is to be destroyed and means (9, 11 ; 21, 25) for cutting the tyre, which means have first cutting members (9, 11) for making radial cuts in the tyre, and second cutting members (21, 25) for making at least one tangential cut in the tyre.

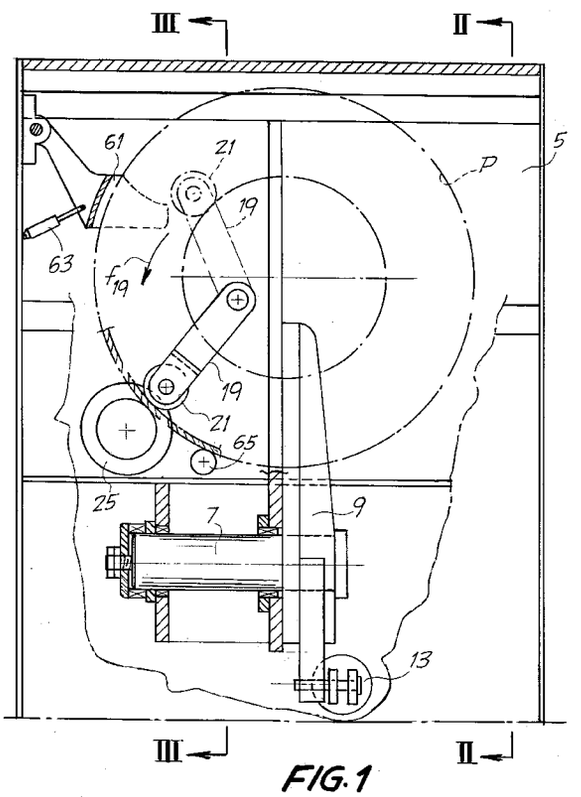

FIG.1

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The invention relates to a machine and a method for the destruction of worn pneumatic tyres.

Tyres for motor vehicles are often given remoulds, especially in the case of large tyres such as tyres for the drive wheels of farm tractors. After some number of remoulds the tyre's body plies can no longer take further remoulds and the tyre must consequently be destroyed. Similarly, small inexpensive tyres such as tyres for cars, motorcycles and the like are often destroyed after use if unsuitable for remoulding.

To avoid accumulating worn tyres at refuse sites and in order to allow the raw materials to be recovered (rubber and steel in particular), the tyres can be reduced to low-volume sections that are easy to transport and process for the recovery of the raw materials. A tyre cutting machine and a corresponding method are described, for example, in Italian Patent Application 9353 A/89 by the same proprietor. This machine provides means for supporting and handling the tyre, and means for cutting said tyre which make a plurality of radial cuts performed in such a way as not to affect the bead toe of the tyre which incorporates the steel bead wires.

The subject of the invention is a machine which enables worn tyres to be destroyed efficiently and quickly by cutting them into a greater number of sections of small dimensions.

Essentially, the machine according to the invention comprises means for supporting and handling the tyre that is to be destroyed and means for cutting the tyre, which characteristically comprise first cutting members for making radial cuts in the tyre, and second cutting members for making at least one tangential cut in said tyre.

With a machine of this type it is therefore possible simultaneously to make both a tangential cut that divides the tyre into at least two symmetrical portions, and a plurality of radial cuts that break up the two portions into a plurality of sections of small volume and hence easily transportable.

Further and advantageous characteristics of the machine according to the invention are indicated in the appended claims. In particular, the members that make the longitudinal cut may be combined with members that cause the tyre to rotate and hence advance it to enable it to be cut. For example, there may be combined with a rotating blade or counterblade, gripping means that act on the tyre's surface to drive it round. In this case, the same cutting means provides the motion by which the tyre is advanced.

The invention relates also to a method for the destruction of worn tyres by the cutting up of said tyres into a plurality of pieces, characterised in that a plurality of radial cuts and, simultaneously with said radial cuts, at least one tangential cut are made.

Further advantageous characteristics of the method according to the invention are indicated in the attached claims.

The invention will be better understood by following the description and accompanying drawing, which latter shows a practical, non-limiting illustrative embodiment of said invention. In the drawing:

Fig. 1 shows a side elevation and partial cross-section through the line I-I of Fig. 2 of the machine according to the invention;

Fig. 2 shows a transverse section through II-II of Fig. 1;

Fig. 3 shows a local transverse section through III-III of Fig. 1;

Fig. 4 shows a local section through IV-IV of Fig. 3;

Fig. 5 shows a detail of the blade which makes the tangential cut, in axial cross-section; and

Fig. 6 shows a modified embodiment, in a similar cross-section to the section of Fig. 2.

The machine comprises a base 1 with a pair of uprights 3 and 5. On the base 1 is a shaft 7 to which is keyed a mobile blade 9 for cooperating with a fixed counterblade 11 integral with the machine frame. As shown in detail in Fig. 2, the mobile blade 9 oscillates between two extreme positions indicated in solid and broken lines respectively. The oscillating movement of the blade 9 is generated by an actuator 13, for example a cylinder-piston system. The blade 9 and the counterblade 11 are a kind of shears which, as described in greater detail below, make the radial cuts in the tyre to be destroyed, indicated as a whole by P.

The upright 5 supports by means of a sleeve 15 a shaft 17 to which is fixed an oscillating arm 19 carrying at one end a counterblade 21 mounted idly on a shaft 23. The counterblade 21 is intended to cooperate with a blade 25 which is rotated about a fixed axis by a motor 27, for example a hydraulic motor.

The rotating blade 25 is shown in detail in Fig. 5. Said blade 25 is carried by a spindle 28 supported via bearings 29 in a sleeve 31 attached to the machine upright 5. Also keyed to the spindle 28 are two toothed wheels 33 and 35 positioned either side of the blade 25. The toothed wheels 33 and 35 act on the tyre P surface and drive it round when the blade 25 is turned by the hydraulic motor 27. The toothed wheels 33 and 35 cooperate with the counterblade 21 which is suitably shaped as shown in Fig. 4.

Keyed to the shaft 17 which carries the arm 19 is a gear 39 cooperating with a rack 41 which extends vertically inside the upright 5, as shown in detail in Fig. 3. The rack 41 moves vertically with a reciprocating motion, in which it is controlled by an actuator 43, for example a cylinder-piston system the rod of which 45 is attached to the rack 41. The rack 41 is guided in its reciprocating movements by means of a straight guide 47 integral with the upright 5 and by a plurality of rollers or bearings 49 mounted idly on corresponding pins 51 supported by said upright 5. The reciprocating movement of the rack 41 imparted by the

actuator 43 serves to cause an oscillation of the arm 19 and hence of the counterblade 21 about the axis of the shaft 17 for the purposes indicated below.

The apparatus described above operates in the following manner. When the arm 19 is in the raised position indicated in solid lines in Fig. 3 and in broken lines in Fig. 1, the tyre P that is to be cut up is rested on the counterblade 21. A suitable pusher 61 stressed by a spring (in the example illustrated an air spring 63) holds the tyre P against the counterblade 21. Next, a movement of the rack 41 causes the rotation of the gear 39 and hence of the shaft 17 and a consequent oscillating movement in the direction f19 (Fig. 1) of the arm 19 and counterblade 21. At the end of this movement the arm 19 and counterblade 21 are in position for cooperating with the rotating blade 25, with said blade 25 penetrating into the annular groove 21A (Fig. 4) of the counterblade 21. In this position the tyre is held between the blade 25 and the counterblade 21 and in addition rests on an idle supporting roller 65. The subsequent rotation of the blade 25 imparted by the hydraulic motor 27 causes the tyre P to be cut in a tangential cutting line and also to advance owing to the pulling action exerted by the teeth of the toothed wheels 33, 35 and of the counterblade 21 on the outside and inside surfaces, respectively, of the tyre P. Dowstream of the blade and counterblade system 25, 21 are the shears formed by the blade 9 and counterblade 11 which, under the control of the actuator 13, make radial cuts in the tyre, which reaches the cutting section of the shears 9, 11 already cut along the tangential cutting line. The action of the rotating blade 25 may be intermittent and synchronised with the oscillating movement of the mobile blade 9 of the shears system 9, 11.

In this way the cutting members 21, 25 and 9, 11 make cuts both along a tangential line (blade 25 and counterblade 21) and in radial lines (blade 9, counterblade 11), so dividing the tyre up into a great many pieces or sections that will take up little space and are therefore particularly suitable for transport to raw materials recovery units.

The shearing system 9, 11 may also be replaced by rotating blade means or the like.

Fig. 6 shows a transverse section, corresponding to the section of Fig. 2, of a modified embodiment, with a rotating blade 40 cooperating with the fixed counterblade 11. Parts corresponding to the embodiment of Figs 1 to 5 are indicated by the same numerals. The rotating blade 40 is supported by a shaft 42 (equivalent to the shaft 7 of Figs 1 and 2) and has a plurality of cutting edges 44. The blade 40 turns through a fraction of a revolution to cut one section of the tyre (in cooperation with the counterblade 11). After this the shaft 42 stops to allow the tyre to advance. The next rotation of the shaft 42 cuts the next section of the tyre.

It will be understood that the drawing shows only an illustrative embodiment which is given purely as a practical demonstration of the invention, it being possible for said invention to vary as regards shapes and arrangements without thereby departing from the scope of the concept underlying said invention. Any reference numbers appearing in the accompanying claims are intended to facilitate the reading of the claims with reference to the description and drawing, and do not limit the scope of the protection represented by the claims.

Claims

1. Machine for the destruction of worn pneumatic tyres comprising means (19; 21) for supporting and handling the tyre (P) that is to be destroyed and means (9, 11; 21, 25) for cutting the tyre, characterised in that said cutting means comprise first cutting members (9, 11) for making radial cuts in the tyre and second cutting members (21, 25) for making at least one tangential cut in the tyre (P).

2. Machine according to Claim 1, characterised in that said second cutting members (21, 25) are combined with means (33, 35) for causing the tyre to advance during the cutting phase.

3. Machine according to Claim 1 or 2, characterised in that said second cutting means comprise a rotating blade (25) acting tangentially on the tyre and cooperating with a counterblade (21), with at least this said blade (25) or said counterblade (21) being made to rotate.

4. Machine according to Claims 2 and 3, characterised in that there are integral with said blade (25) and/or with said counterblade (21), gripping means (33, 35) that act on the tyre's surface to drive it round.

5. Machine according to Claim 3 or 4, characterised in that said counterblade (21) is carried by an oscillating arm (19) for alternately assuming an active position for cutting and an inactive position.

6. Machine according to one or more of the preceding claims, characterised in that said first cutting members (9, 11) comprise shearing means.

7. Machine according to one of more of Claims 1 to 5, characterised in that first said cutting members comprise rotating blade means (40).

8. Machine according to Claim 7, characterised in that said rotating blade means have a plurality of cutting edges (44) which cut successive sections

of the tyre.

9. Machine according to one or more of the preceding claims, characterised in that it comprises a means (61) for elastically stressing the tyre (P) against the cutting means.

10. Method for the destruction of worn pneumatic tyres by the cutting up of said tyres into a plurality of pieces, characterised in that a plurality of radial cuts and, simultaneously with said radial cuts, at least one tangential cut are made.

11. Method according to Claim 10, characterised in that said tyre is caused to rotate, during which rotation said tangential cut is made, and in that the radial cuts are made on that portion of the tyre which has already been cut longitudinally.

12. Method according to Claim 11, characterised in that the tyre is caused to rotate intermittently.

13. Method according to Claim 11 or 12, characterised in that the rotation of the tyre is brought about by the same means that make the tangential cut.

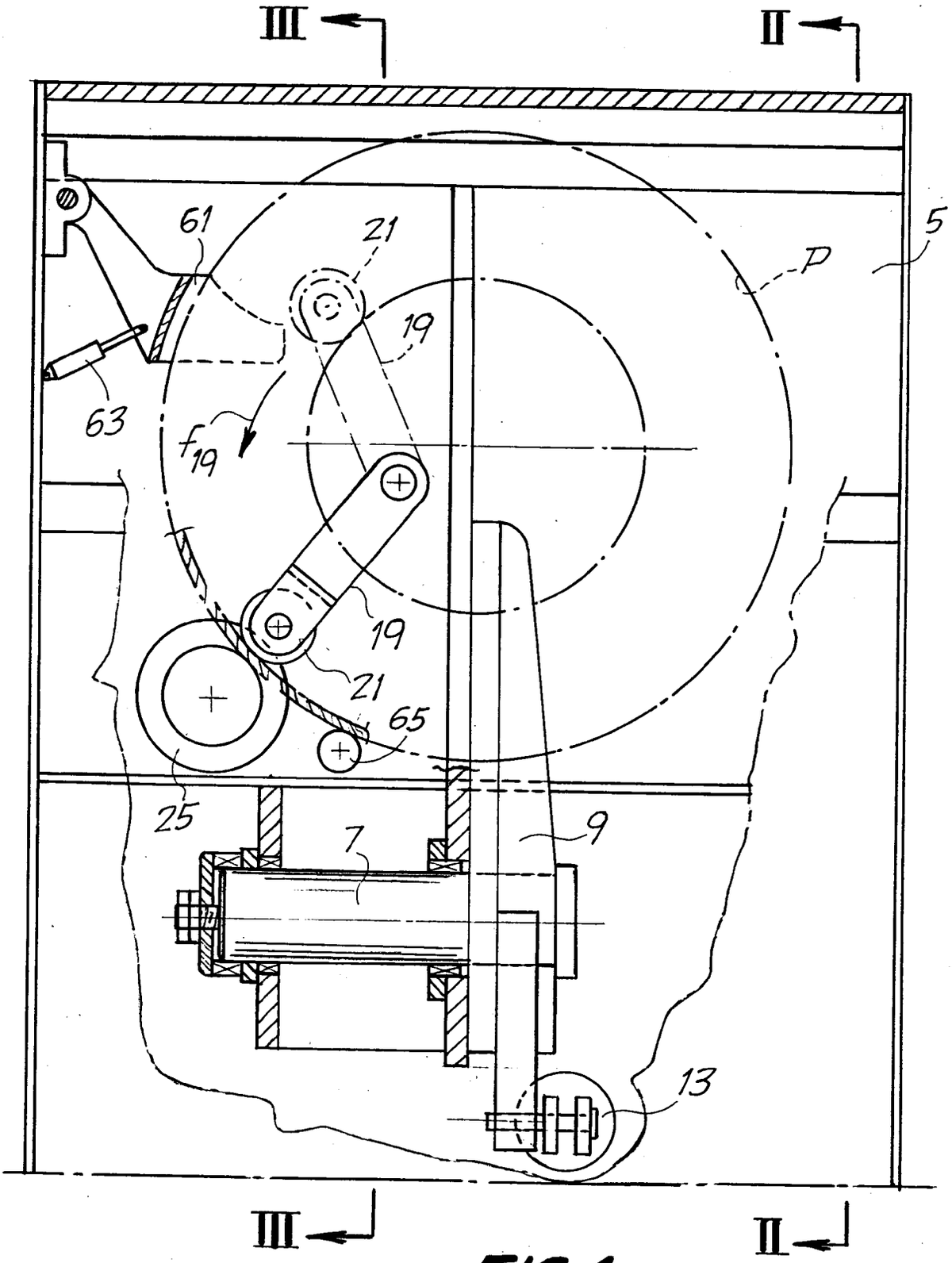

FIG. 1

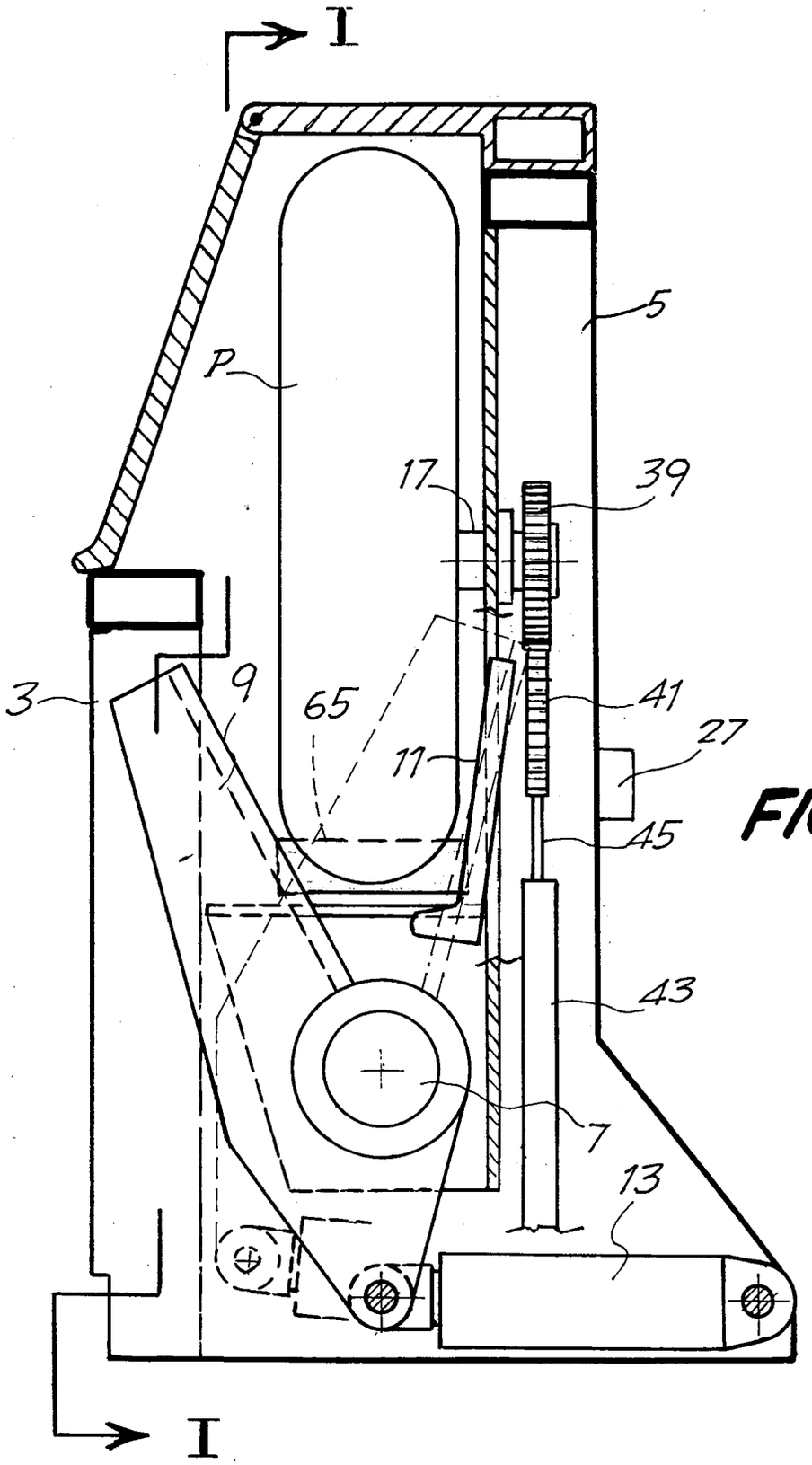

FIG. 2

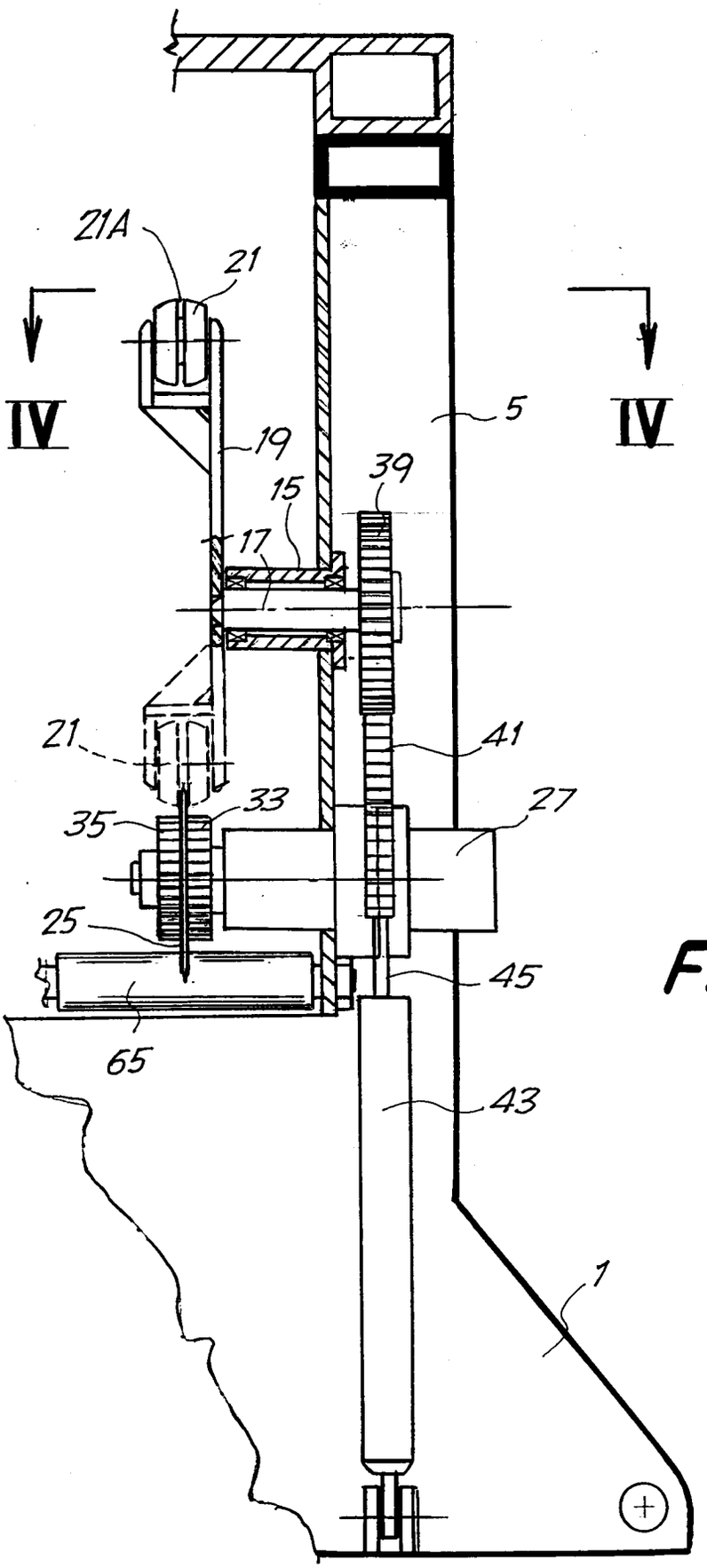

FIG.3

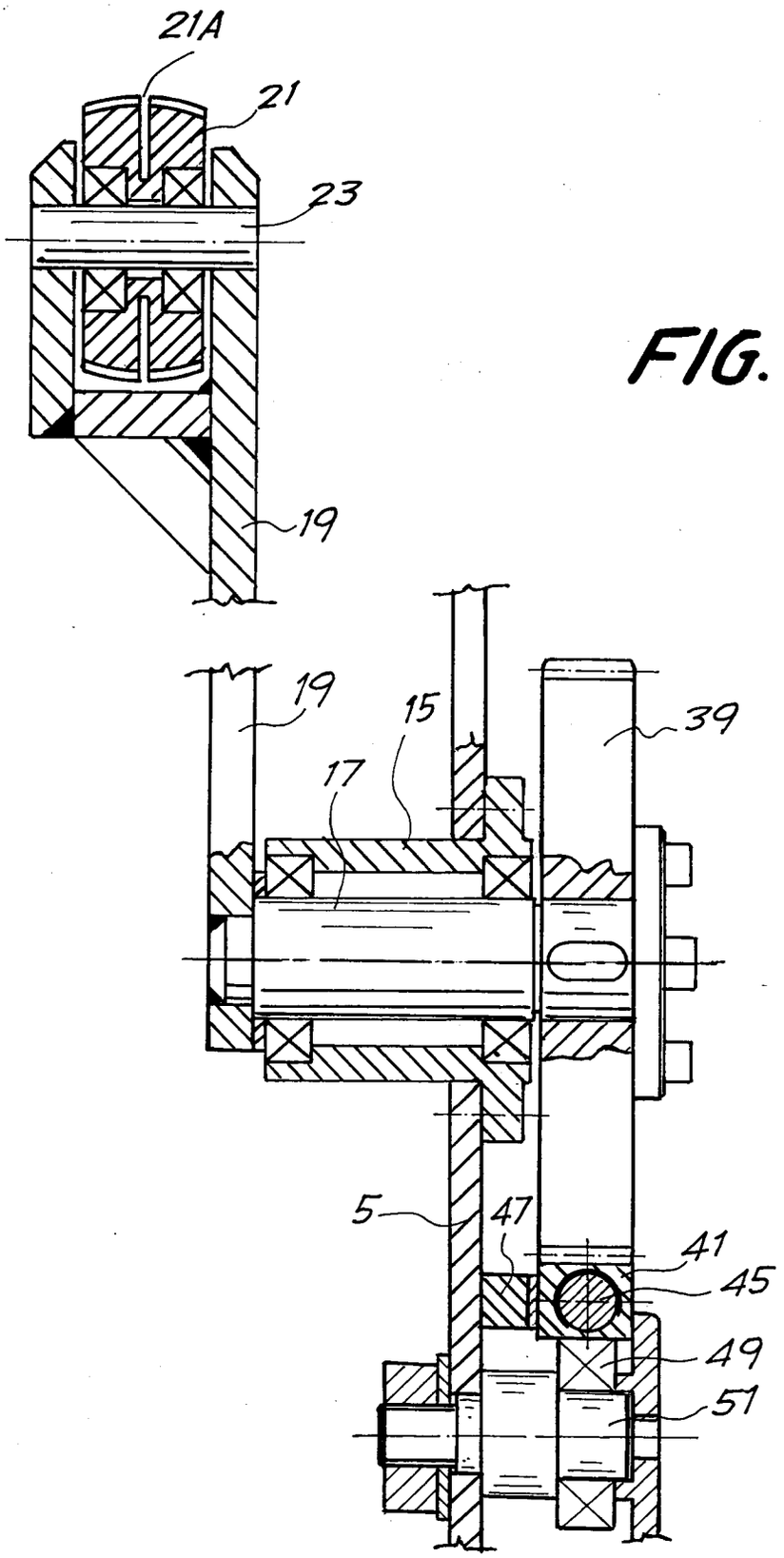

FIG. 4

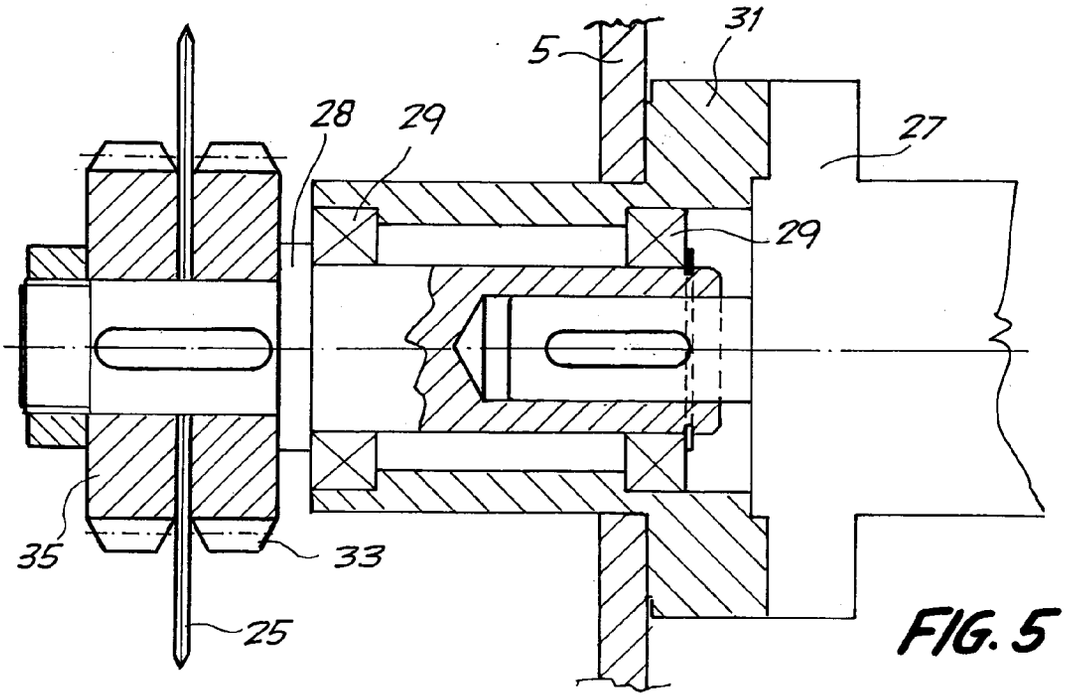

FIG. 5

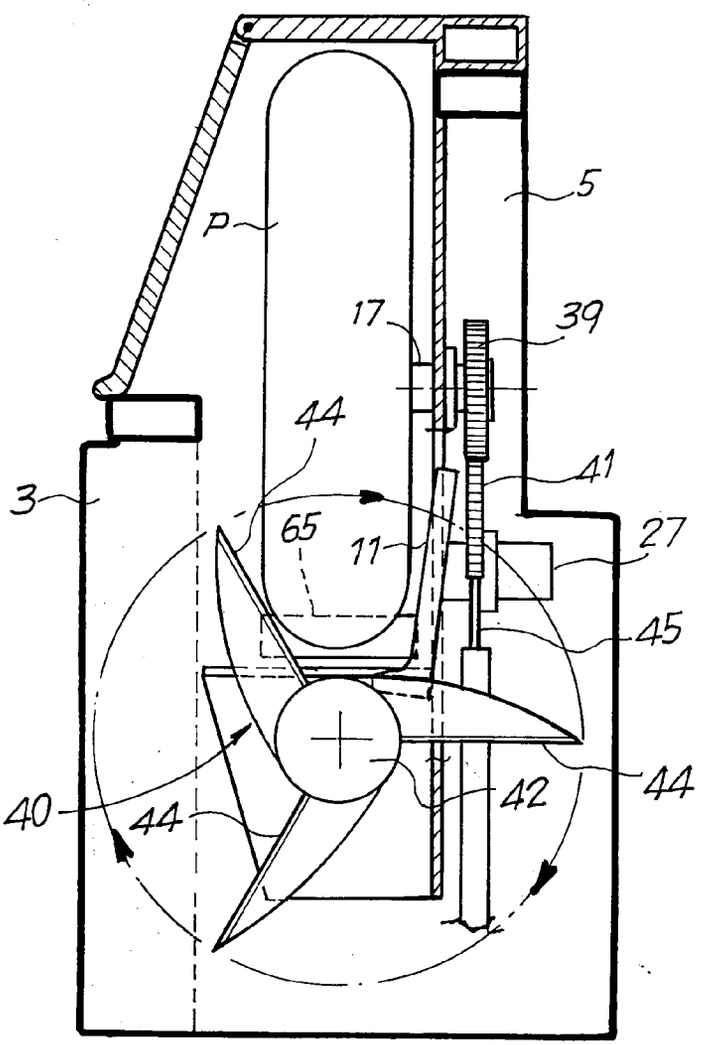

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number

EP 91 83 0469

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.5)
X	DE-C-1 579 098 (CHEMOLIMPEX MAGYAR VEGYIARU KULKERESKEDELMI VALLALAT) * claims; figures 2-6 *	1,6,10, 11	B26D1/00
A	US-A-3 830 120 (H. S. PETERSON) * column 2, line 8 - line 18 * * column 2, line 60 - column 3, line 10 * * column 3, line 64 - column 4, line 15; claims 1,2,3; figures 1-3,6 *	1-5,9-13	
A	US-A-4 072 072 (M. A. HARB) * claims 1,8; figures 1-4,9,10 *	1,2,5, 9-13	
A	US-A-3 922 942 (W. E. FAWCETT) * claims 1,5,7,8; figures *	1,6,10, 11	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B29D
B29B
B26D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 JANUARY 1992	KOSICKI T. R.

CATEGORY OF CITED DOCUMENTS

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