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(54) **Revolving sprinkling assembly for dishwashers, provided with horizontal reciprocating motion**

(57) A revolving sprinkling assembly for dishwasher includes a sprinkler (E) pivoted at an end of a support arm (C) which is in turn vertically pivoted at its other end to a feed duct (A) integral with the washing space so as to allow an oscillation of the support arm (C) limited by a pair of stops, the sprinkler (E) being provided with a propulsion nozzle (F) which generates a reaction force having only a component orthogonal to the longitudinal axis of the sprinkler (E) while the support arm (C) is provided with two opposite nozzles (M, N) suitable to eject jets having a component orthogonal to the longitudinal axis of the arm (C), the emission of said jets being controlled by a rotating shutter (J) whose rotation is controlled by the rotation of the sprinkler (E) according to a transmission ratio greater than unity.

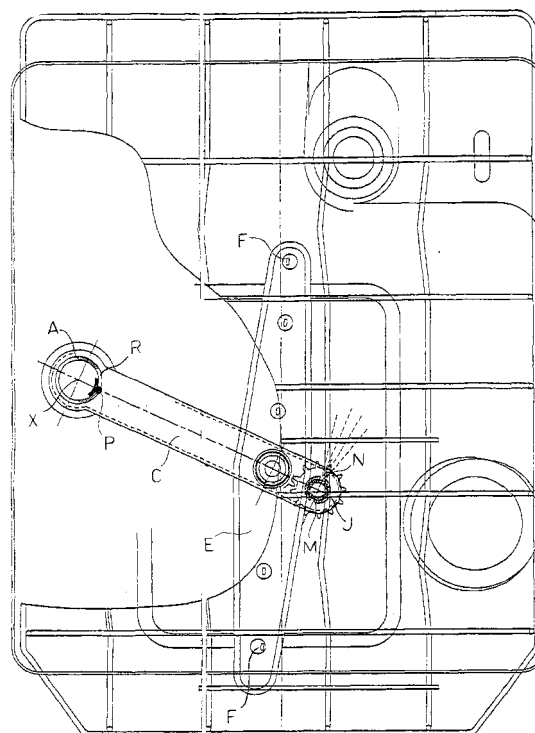


FIG. 3

EP 1 201 178 A1

Description

[0001] The present invention relates to revolving sprinkling assemblies for dishwashers, and in particular to a sprinkling assembly capable of moving also with a reciprocating motion in the horizontal plane.

[0002] It is known that conventional revolving sprinklers essentially consist of a single device pivoted on a vertical axis central shaft and provided with at least one propulsion nozzle at one end, as well as with other nozzles arranged along said device to sprinkle the dishes contained in the dishwasher rack. Since the rotation axis of said device is fixed, the resulting paths of the nozzles consist of circumferences centered on the rotation axis.

[0003] From this follows that the above-mentioned device directly sprinkles always and only the surfaces of the dishes which are along said circular paths, with a limited washing effectiveness. Moreover, the area which can be reached by the water ejected from the nozzles approximately corresponds to the area of the square circumscribed about the circular path of the outermost nozzle.

[0004] The simplest solution in trying to overcome this latter limit is that of giving a greater inclination to the end nozzles of the sprinkler so that the water jets ejected therefrom reach beyond the area of rotation. For example, it is possible to use a sprinkler provided with a nozzle inclined at about 75° so as to cover also the foremost portion of the rack in a dishwasher whose width is smaller than its length (typically 45 x 60 cm).

[0005] This solution has a first drawback of poor washing effectiveness in the end portion of the rack, since very inclined jets are unable to properly enter between the dishes arranged side by side like the almost vertical jets ejected by the other nozzles can do. Moreover, a second drawback stems from the fact that such inclined jets hit the walls of the washing space with a considerable horizontal component thus causing a significant noisiness of the dishwasher.

[0006] An improvement with respect to this simple type of sprinkler is the mobile sprinkler disclosed in EP-0727176 which is pivoted on a shaft located at the end of a support arm which is in turn vertically pivoted at its other end to a feed duct integral with the washing space. This support arm is therefore provided also with a horizontal reciprocating motion generated by the sprinkler itself due to the distance between the axis of the shaft on which it is pivoted and the point where the support arm is pivoted on the feed duct.

[0007] In fact, the inclined jet coming out from a propulsion end nozzle of the sprinkler generates a reaction force which can be broken up in the horizontal plane into a first component along the longitudinal axis of the sprinkler and a second component along a direction perpendicular thereto. While this second component is the one which generates the rotation of the sprinkler, the component along the longitudinal axis is discharged on the shaft located at the end of the support arm. This results,

therefore, in a horizontal rotation of said arm pivoted on the vertical axis of the feed duct, moving alternately from right to left and backwards according to the rotation of the sprinkler, i.e. according to the direction from which the axial component arrives on the sprinkler shaft.

[0008] This arrangement allows to sprinkle also the outermost dishes when they are arranged in a rectangular washing space and also increases the surface directly sprinkled by the jets ejected from the nozzles thanks to the combination of the revolving motion of the sprinkler with the reciprocating motion. In this way, in fact, the nozzle paths have a much more complex development.

[0009] However even this arrangement is not free from drawbacks in that in this type of structure the revolving and reciprocating motions of the sprinkler are mutually bound, i.e. at each rotation of the sprinkler corresponds a translation thereof due to the oscillation of the support arm. This implies that a high revolving frequency of the sprinkler corresponds to a high oscillating frequency of the support arm and therefore to a certain noisiness since the support arm hits the end stops at the end of each travel. Moreover, it is impossible to reduce said oscillating frequency of the arm without decreasing the revolving speed of the sprinkler thus negatively affecting the washing effectiveness.

[0010] Therefore, the object of the present invention is to provide a revolving sprinkling assembly which overcomes the above-mentioned limitations of prior art sprinklers.

[0011] This object is achieved by means of a sprinkling assembly wherein the ratio between the revolving frequency of the sprinkler and the oscillating frequency of the support arm is no longer one but much greater. In other words, it is possible to set a transmission ratio whereby the oscillation of the support arm occurs only every given number of rotations of the sprinkler.

[0012] The fundamental advantage of the sprinkling assembly according to the present invention is lower noisiness and lower wear achieved thanks to the reduction of the oscillating frequency of the support arm.

[0013] A further advantage comes from the possibility of easily setting within a certain range said transmission ratio, i.e. the time interval between the oscillations of the support arm.

[0014] These and other advantages and characteristics of the sprinkling assembly according to the present invention will be clear to those skilled in the art from the following detailed description of some embodiments thereof, with reference to the annexed drawings wherein:

Fig.1 is a diagrammatic partially sectional front view of a first embodiment of the sprinkling assembly located on the bottom of the washing space of a dishwasher whose width is smaller than its length;

Figs.2a, 2b and 2c are partial top plan views of the above-mentioned sprinkling assembly at a back po-

sition;

Fig.3 is a diagrammatic top plan view of the sprinkling assembly at a forward position;

Figs.4a, 4b and 4c are partial top plan views of the above-mentioned sprinkling assembly at a forward position;

Fig.5 is a diagrammatic top plan view of the sprinkling assembly at a back position;

Fig.6 is a partial top plan view of a second embodiment of the sprinkling assembly; and

Fig.7 is a partial top plan view of a third embodiment of the sprinkling assembly.

[0015] With reference to figures 1 to 5, there is seen that the present sprinkling assembly essentially consists of a vertical feed duct A, secured on one side of the bottom B of the washing space, at the top of which a support arm C is pivoted with a vertical axis X and carries at its free end a vertical shaft D, on which a sprinkler E is in turn centrally pivoted and has a reduced size with respect to the length of the dishwasher, as clearly resulting from the top plan views of figures 3 and 5.

[0016] The pressurized water goes through duct A, arm C and shaft D to sprinkler E which rotates around axis Y due to at least one propulsion nozzle F (two in the illustrated example) which, differently from the above-mentioned device disclosed in EP-0727176, ejects a jet which generates a reaction force having in the horizontal plane only a component orthogonal to the longitudinal axis of the sprinkler E.

[0017] The pivoting of sprinkler E is achieved through a lower socket which is snapped onto shaft D and externally provided with a tooth G. This tooth G engages at each rotation of sprinkler E with an adjacent horizontal toothed wheel H, which is integral with an underlying cylindrical shutter J provided with an opening K. Said shutter J is rotatably inserted within a cylindrical retaining wall L, which is in turn integral with arm C, having two opposite nozzles M, N arranged along a line orthogonal to the longitudinal axis of arm C. Nozzle M can be defined as front nozzle in that it faces the dishwasher door, while the opposite nozzle N facing the back of the washing space is defined rear nozzle.

[0018] From the description above and from the operating diagrams of figures 2-5, the simple and reliable operation of the sprinkling assembly according to the invention can be readily understood.

[0019] Assuming that nozzles F are oriented to rotate sprinkler E clockwise (as seen from above), it follows that tooth G at each rotation causes a partial counter-clockwise rotation of the toothed wheel H. The number of rotations of sprinkler E corresponding to a complete rotation of toothed wheel H is obviously defined by the transmission ratio between said members, namely in practice by the number of teeth of wheel H (12 in the illustrated example).

[0020] Consider to start from the position of fig.2a where arm C is at the back position in the washing space

and opening K of shutter J has just passed beyond the front nozzle M, thus moving towards the rear nozzle N. After four rotations of sprinkler E, and as many partial rotations of wheel H due to tooth G, opening K arrives close to the rear nozzle N as shown in fig.2b.

[0021] Upon the following rotation, opening K arrives at nozzle N which can therefore eject a jet generating a reaction force on arm C such as to cause the rotation thereof around axis X. As a consequence, arm C oscillates towards the front portion of the washing space moving sprinkler E to the forward position illustrated in fig.3. The travel of arm C is obviously limited by a stop, which in the illustrated example is achieved through a horizontal peg P engaged into a slot R formed in the feed duct A. In other words, arm C rotates until peg P integral therewith abuts against the front end of slot R.

[0022] The oscillating cycle of arm C is completed by the similar reverse motion depicted in figures 4 and 5.

[0023] Starting from the position of fig.4a where arm C is at the forward position and opening K has just passed beyond the rear nozzle N, after four rotations of sprinkler E opening K arrives close to the front nozzle M (fig.4b) and upon the following rotation it arrives at said nozzle which can therefore eject a jet causing the rotation of arm C towards the rear portion of the washing space. Sprinkler E is thus moved to the back position illustrated in fig.5, the rotation of arm C being obviously halted when peg P abuts against the rear end of slot R.

[0024] Therefore it is clear how this simple structural arrangement allows to move sprinkler E only every 6 rotations, and it is also clear that it is sufficient to change the number of teeth of wheel H to change said moving interval. For example, when using a wheel with 14, 16 or 18 teeth then 7, 8 or 9 rotations respectively would be required to move sprinkler E between one position and the other. The arrangement described above is the simplest, but obviously other similar arrangements are possible.

[0025] For example, in fig.6 there is illustrated a second embodiment which is different from the previous embodiment in that in wall L next to each nozzle M, N there are formed other two adjacent nozzles M', M'' and N', N'' respectively. In this way, upon passage of opening K before each of said nozzles, arm C has the possibility of receiving three pulses for each forward or back shift, which may be useful in case the water pressure is low and a single pulse could therefore be insufficient to complete the oscillation of arm C.

[0026] A third embodiment is illustrated in fig.7, which is different from the first embodiment in the position and number of openings in the rotating shutter. In this case, the rotating shutter U is inserted on the outside of the wall in which there are formed the front nozzle S and rear nozzle T, which are integral with arm C and formed slightly more inside with respect to shutter U. The latter is uninterrupted only along half of its extension whereas in the other half it has a plurality of openings V. In practice this results in a continuous delivery of water through

the two nozzles S, T but only one of them is capable of generating a reaction force since the other jet is blocked by the uninterrupted portion of shutter U. This arrangement implies a greater consumption of water but reduces the risks of seizure of the sprinkler in that the play between the rotating member and the fixed member is much greater than in the preceding cases.

[0027] It should be noted that the illustrated embodiments concerning a sprinkling assembly secured on a side of the washing space are mere examples, in that the same structure can be applied in several other ways. First of all, duct A may be at the rear wall in case the washing space is more short than wide. Secondly, the sprinkling assembly may be located also below or above the upper rack, by overturning it or not according to the desired position. In these cases, duct A can even come out directly from the ceiling or from the rear wall of the washing space, arm C being consequently longer or shorter.

[0028] Furthermore, it is clear that the number of openings in the rotating shutter and/or of nozzles, and consequently the number of pulses received by arm C at each shifting cycle, can vary from the minimum illustrated in the first embodiment to the maximum illustrated in the third embodiment. For example, shutter J could have two or more adjacent openings as shutter U.

[0029] Finally, the transmission ratio can be set at the precise desired value by forming on the socket of sprinkler E even more than one tooth G, possibly arriving at a complete toothed rim which permanently engages toothed wheel H (obviously of larger size).

acterized in that the rotation of the shutter (J; U) is controlled by the sprinkler (E) through a lower socket externally provided with at least one tooth (G) suitable to engage with an adjacent horizontal toothed wheel (H) which is integral with the shutter (J; U).

3. A sprinkling assembly according to claim 2, **characterized in that** the shutter (J) is inserted within a cylindrical wall in which there are formed two opposite nozzles (M, N).

4. A sprinkling assembly according to claim 2, **characterized in that** the shutter (U) is inserted on the outside of a cylindrical wall in which there are formed two opposite nozzles (S, T) slightly more inside with respect to the shutter (U).

5. A sprinkling assembly according to one or more of the preceding claims, **characterized in that** the stops which limit the oscillation of the support arm (C) are the ends of a horizontal slot (R) formed in the feed duct (A), in which slot (R) there is engaged a horizontal peg (P) integral with said arm (C).

6. A dishwasher with a rectangular washing space, **characterized in that** it includes at least one sprinkling assembly according to one or more of the preceding claims arranged on one of the long sides of the washing space.

Claims

1. A revolving sprinkling assembly for dishwasher including at least a sprinkler (E) provided with at least one propulsion nozzle (F) and pivoted at an end of a support arm (C) through which water under pressure is fed, said arm (C) being in turn vertically pivoted at its other end to a feed duct (A) integral with the washing space so as to allow an oscillation of said support arm (C) limited by a pair of stops, **characterized in that** said at least one propulsion nozzle (F) generates a reaction force having in the horizontal plane only a component orthogonal to the longitudinal axis of said sprinkler (E), and **in that** the support arm (C) is provided with at least two opposite nozzles (M, N; S, T) suitable to eject jets having a component orthogonal to the longitudinal axis of said arm (C), the emission of said jets being controlled by a rotating shutter (J; U) provided with at least one opening (K; V), the rotation of said shutter (J; U) being controlled by the rotation of the sprinkler (E) according to a transmission ratio greater than unity.

2. A sprinkling assembly according to claim 1, **char-**

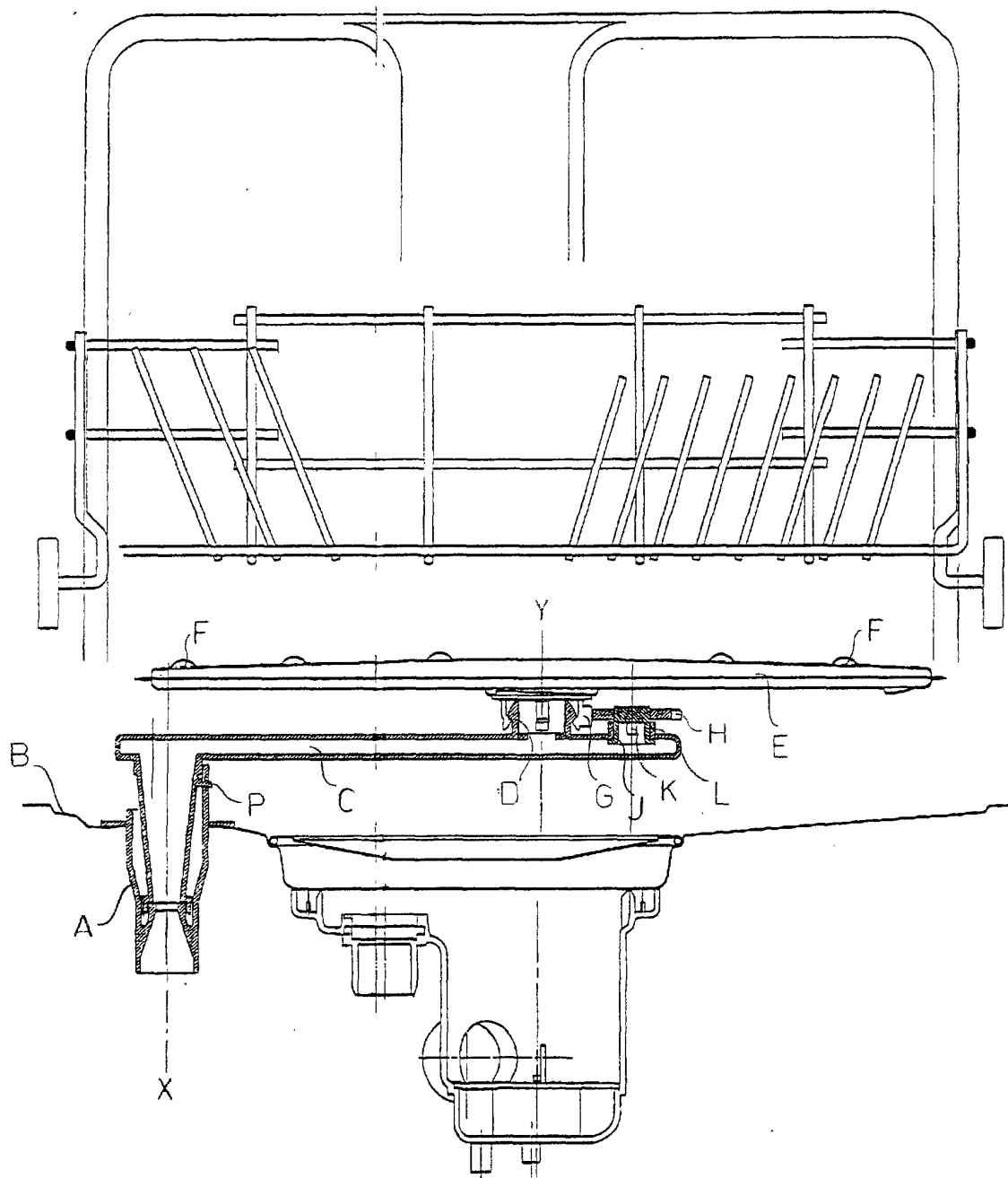


Fig. 1

Fig. 2a

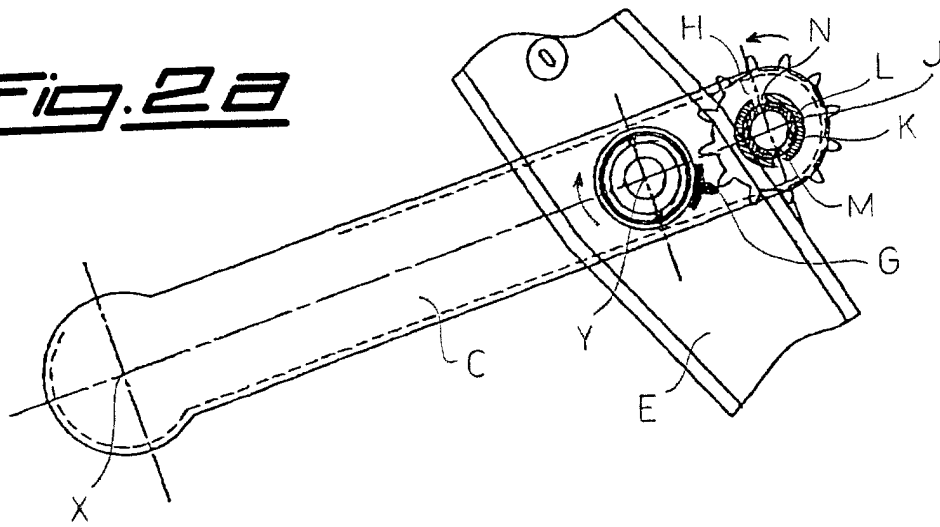


Fig. 2b

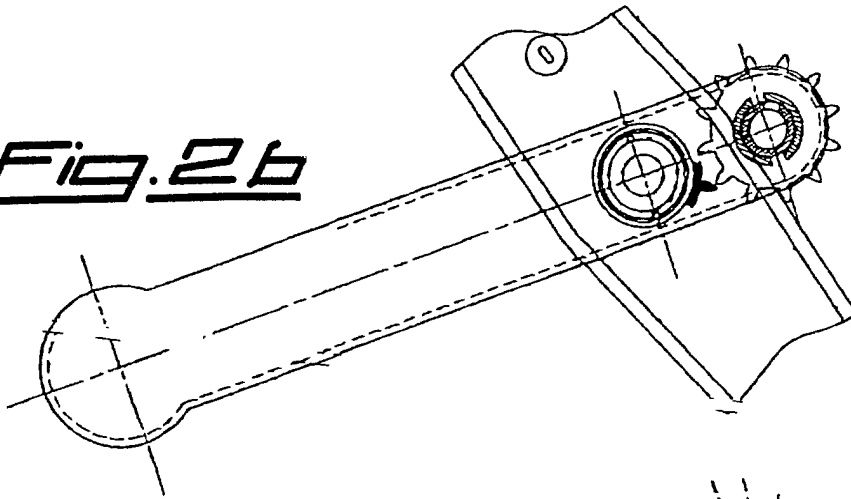
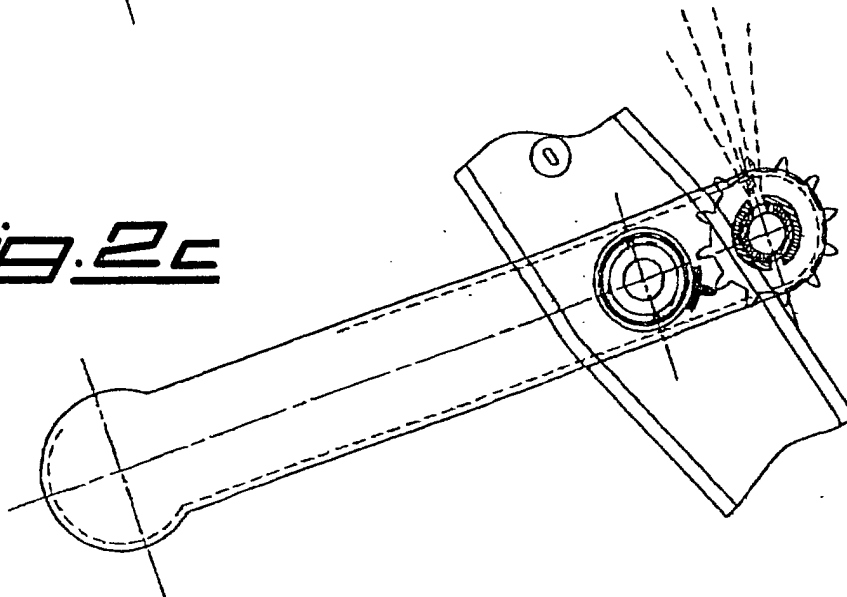


Fig. 2c



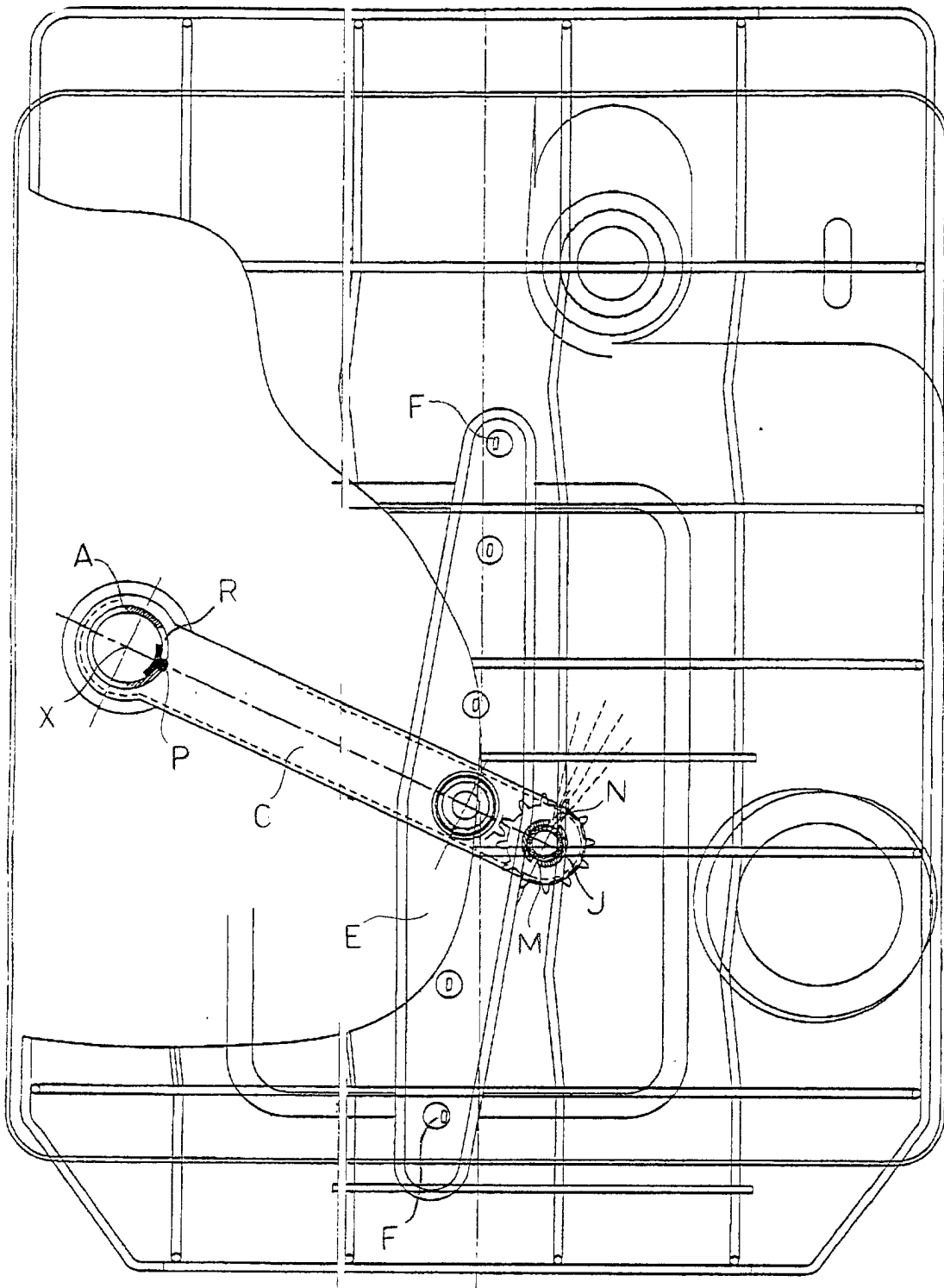


Fig. 3

Fig. 4a

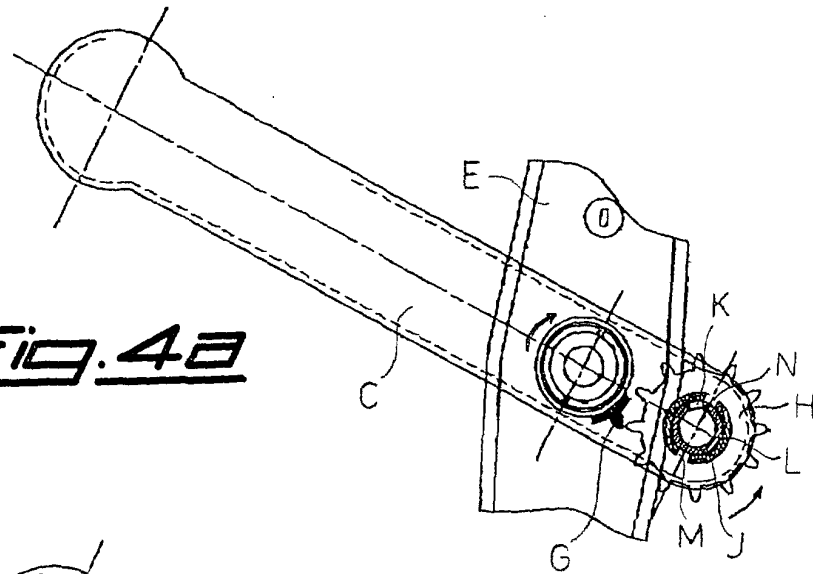


Fig. 4b

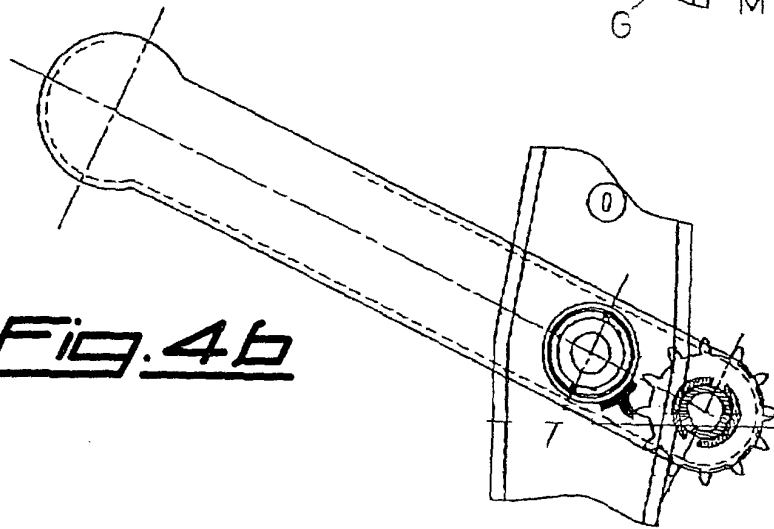
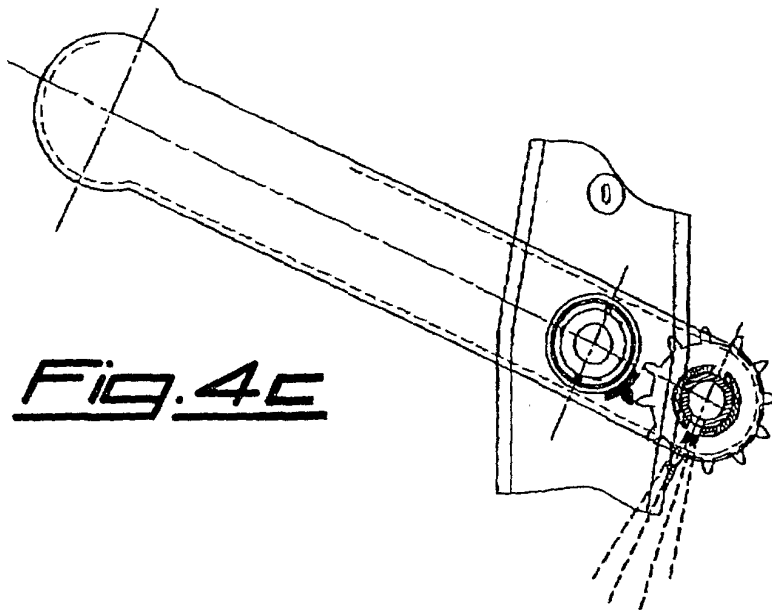


Fig. 4c



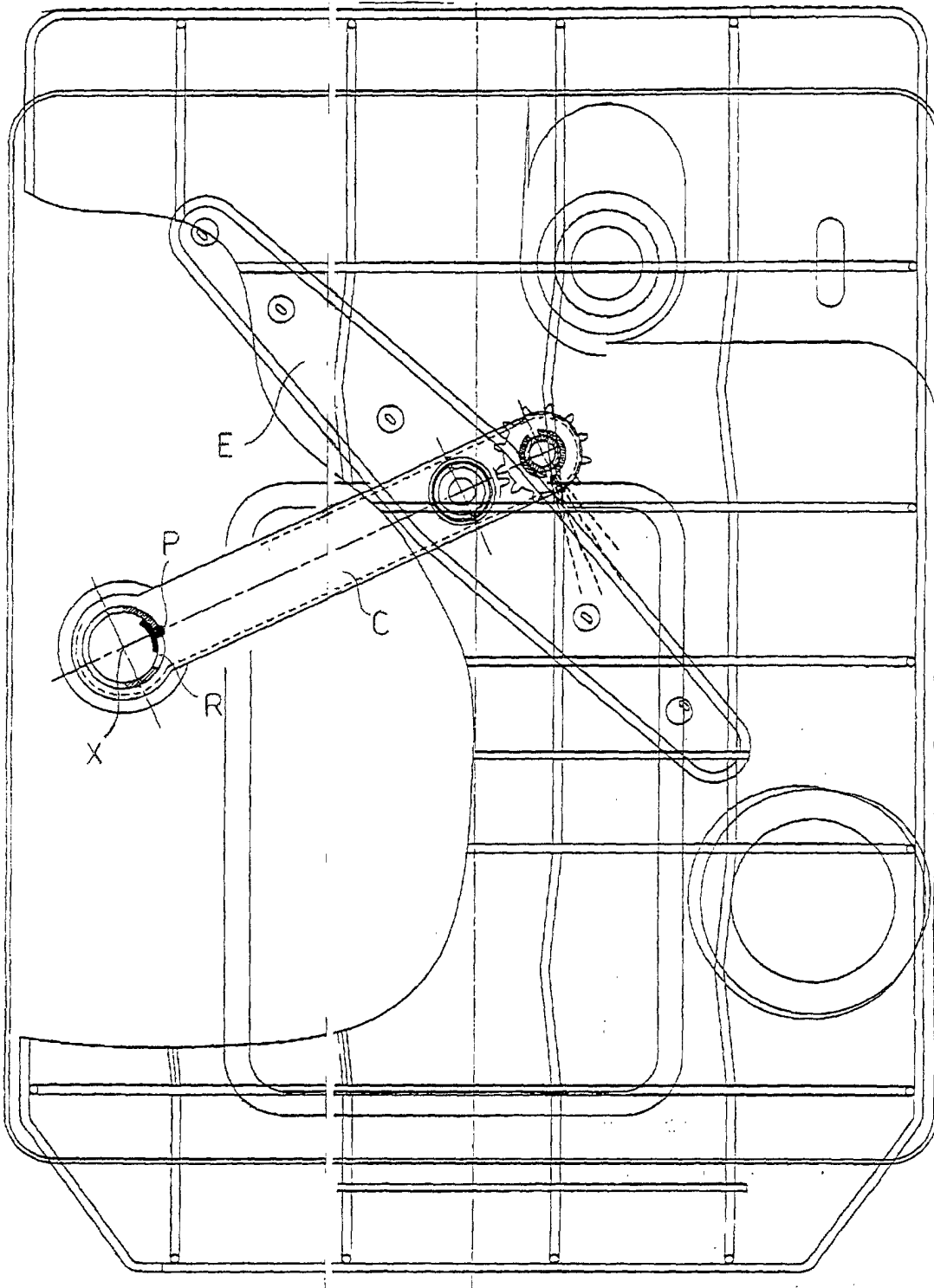
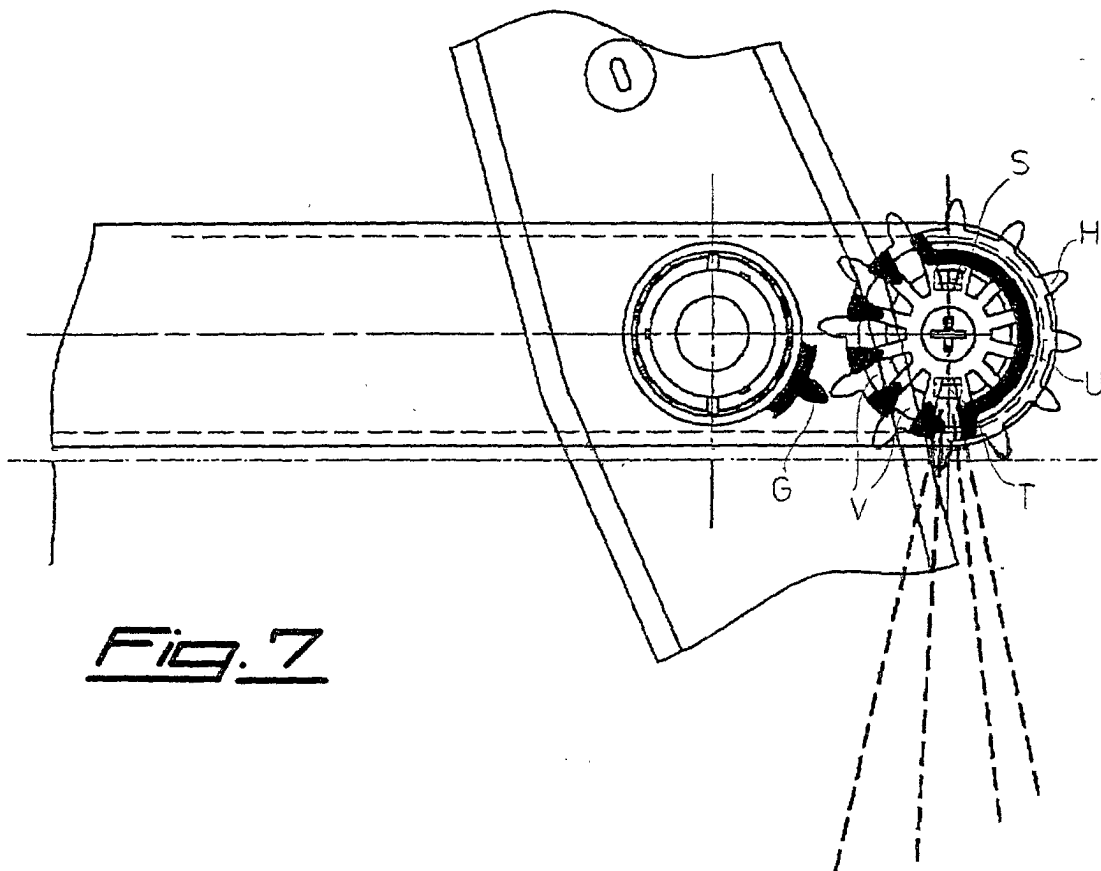
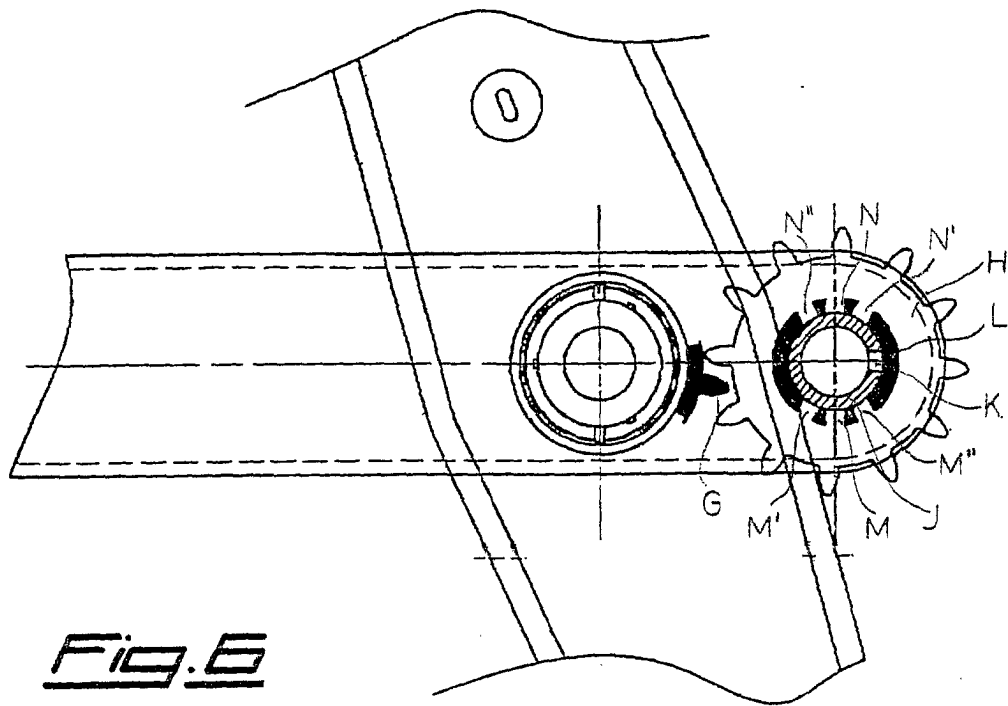


Fig. 5





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EUROPEAN SEARCH REPORT

Application Number
EP 00 83 0711

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Place of search THE HAGUE		Date of completion of the search 19 April 2001	Examiner Fairbanks, S
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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