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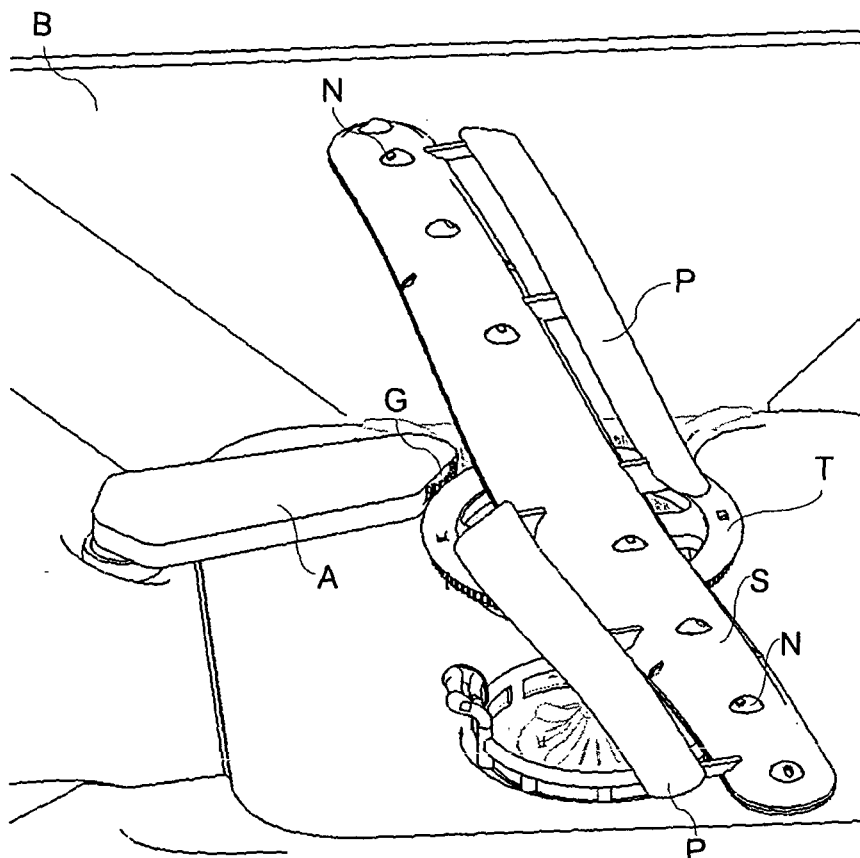
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(54) **Dishwasher with improved drying system and relevant operating cycle**

(57) A dishwasher provided with a drying system includes a revolving sprinkler (S), arranged on the wash tank bottom (B), having a pair of blade-shaped profiles (P) arranged along opposite sides of its two arms as well

as driving means (A, G, T) suitable to rotate the sprinkler (S) during the drying step so that it acts in practice as a fan rotor, generating a vertical air stream that significantly improves the drying performance of the dishwasher.

Fig.2



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Description

[0001] The present invention relates to dishwashers, and in particular to a dishwasher with an improved drying system and a relevant operating cycle.

[0002] It is known that the operating cycle of a dishwasher usually includes a final drying step intended to make the dishes ready for use as soon as they are extracted from the dishwasher, and to this purpose the dishwasher is provided with a drying system that can be made in various more or less sophisticated ways. The most advanced systems include members outside the wash tank, such as devices for capturing, condensing or discharging vapor, with possible heating of the air reintroduced into the tank.

[0003] However, these known drying systems have the drawback of causing an "indirect" drying, in the sense that they act by decreasing the relative humidity of the air contained in the tank to allow the subsequent evaporation of the water clinging to the dishes. This implies long drying times and a high power consumption for heating the air reintroduced into the tank.

[0004] Furthermore, in order to reduce the power consumption, the latest developments in the field of dishwashers have led to a decrease in rinse temperatures and this enhances the above-mentioned drawback, which therefore partially cancels the reduction in consumption achieved by decreasing the rinse temperatures.

[0005] Therefore the object of the present invention is to provide a dishwasher which overcomes the above-mentioned drawbacks.

[0006] This object is achieved by means of a dishwasher provided with a bottom sprinkler including members suitable to generate an air stream, as well as driving means suitable to rotate said bottom sprinkler during the drying step.

[0007] The main advantage of the drying system of the present dishwasher is that of acting directly on the dishes, in particular those located in the bottom rack, by generating an air stream that "spreads" the water drops present on the dishes favoring their evaporation.

[0008] A second advantage stemming from this air stream is the creation of convective motions that take the vapor contained in the air more into contact with the tank walls favoring its condensation, since the tank walls provide a heat exchange greater than the dishes.

[0009] Still a further advantage of the present dishwasher stems from the fact that the auxiliary members of the drying system are few, simple and inexpensive, so as to improve the drying performance with a minimum increase in cost and without negatively affecting reliability.

[0010] These and other advantages and characteristics of the dishwasher according to the present invention will be clear to those skilled in the art from the following detailed description of an embodiment thereof, with reference to the annexed drawings wherein:

Fig.1 is a front perspective view, with some portions removed, of a dishwasher provided with an improved drying system according to the present invention; **Fig.2** is an enlarged detail of the dishwasher of **Fig.1**; **Figs.3 and 4** are views similar to the preceding one, with some portions removed; **Fig.5** is a detail further enlarged of **Fig.2**; and **Figs.6 and 7** are bottom views showing the activation and deactivation of the bottom sprinkler driving mechanism.

[0011] Referring to figures 1 and 2, there is seen that a dishwasher according to the present invention conventionally includes a pair of revolving sprinklers S, S' respectively arranged on the bottom B of the wash tank and under the top rack R (the bottom rack is not shown).

[0012] It should be noted that although specific reference is made to the conventional structure of a dishwasher with stacked racks, what is being said is also readily applicable to a horizontal dishwasher with racks side by side comprising two sprinklers on the tank bottom that can both be provided with the auxiliary members of the drying system, which are arranged partly under the tank bottom B and partly above it.

[0013] As shown in the enlarged detail of **Fig.2**, the novel members arranged above the tank bottom B include a mobile arm A carrying a drive gear G suitable to engage a toothed wheel T integral with the bottom sprinkler S, which is provided with a pair of blade-shaped profiles P arranged along opposite sides of its two arms.

[0014] When arm A is in the rest position illustrated in **Fig. 2**, and therefore gear G does not engage the toothed wheel T, sprinkler S operates in the conventional way revolving under the effect of the reaction to the water jets ejected through nozzles N, since it is mounted idle on the tube connecting it to the wash pump.

[0015] As shown in **Fig.3**, where arm A and the tank bottom B are omitted, the other novel members of the drying system secured under the tank bottom B include a mounting support essentially consisting of a plate H with a cylinder J perpendicular thereto and whose top projects through the tank bottom B. Under plate H there are secured a mechanism for moving arm A, that will be better described further on, and an electric motor M whose drive shaft D projects at the top of the support through said cylinder J and carries an end gear E.

[0016] It should be noted that arm A rotates with respect to the mounting support thanks to a vertical cylindrical portion slidably inserted in cylinder J, i.e. arm A has a vertical cross-section that is substantially L-shaped.

[0017] The enlarged detail of **Fig.4**, where the cover of arm A and the tank bottom B are omitted, clearly shows how the end gear E engages a first gear F arranged inside arm A, and in turn said first gear F is connected to the drive gear G of arm A through a kinematic chain K comprising a plurality of other gears.

[0018] Adequate sealing means, such as O-rings or

the like, are obviously located between arm A and cylinder J, as well as at the point where shaft D enters arm A.

[0019] In the light of the description above and with reference also to figures 5 to 7, the simple and effective operation of the drying system of the dishwasher according to the present invention will be readily understood.

[0020] As shown in Fig.5, when arm A is rotated towards sprinkler S at the end of the wash cycle, the drive gear G engages the toothed wheel T whereby motor M can set into rotation sprinkler S through the above-described members D, E, F, K, G and T. In particular, as indicated by the arrows, sprinkler S is rotated such that profiles P are on the leading edge and therefore can operate with the maximum aerodynamic efficiency (said direction may coincide or not with the revolving direction of sprinkler S during the wash step).

[0021] In this way, the bottom sprinkler S acts in practice as the rotor of a fan generating a vertical air stream that significantly improves the drying performance of the dishwasher, as explained in the introductory portion. At the end of the drying step, gear G is disengaged from the toothed wheel T by returning arm A to the rest position, whereby sprinkler S is again free to revolve idle on its vertical axis.

[0022] It should be noted that the period of activation of the auxiliary members of the drying system must not necessarily coincide with the duration of the drying step, and it is also possible to provide more than one period of activation during said step.

[0023] A possible mechanism for moving arm A between the rest position and the work position is illustrated in figures 6 and 7, where there is seen a linear actuator X fixed under plate H, with the stem Y of said actuator X connected to a screw Z screwed into the vertical cylinder of arm A through a slot L formed in cylinder J. On the same screw Z there is also secured a first end of a return spring C whose second end is fixed under plate H.

[0024] In this way, when actuator X is powered its stem Y is extended and screw Z rotates arm A to the work position, whereby motor M can rotate sprinkler S, whereas when actuator X is switched off the return spring C causes the rotation of arm A to the rest position, disengaging the drive gear G, and the retraction of stem Y.

[0025] It is clear that the above-described and illustrated embodiment of the dishwasher according to the invention is just an example susceptible of various modifications. In particular, the exact shape and arrangement of the auxiliary members of the drying system could be changed according to specific manufacturing needs, e.g. by using a different type of actuator to move arm A or a different kinematic chain to connect motor M to sprinkler S (e.g. two pulleys and a belt).

[0026] Similarly, sprinkler S could have members suitable to generate an air stream that are different from the above-illustrated profiles P and possibly integrated in the sprinkler itself, that could be shaped like a fan rotor.

Claims

1. Dishwasher provided with a drying system and comprising at least one revolving sprinkler (S) arranged on the wash tank bottom (B), **characterized in that** said revolving sprinkler (S) includes members suitable to generate an air stream and said drying system includes driving means suitable to rotate said revolving sprinkler (S) during the drying step.
2. Dishwasher according to claim 1, **characterized in that** the sprinkler (S) is provided with a pair of blade-shaped profiles (P) arranged along opposite sides of its two arms.
3. Dishwasher according to claim 2, **characterized in that** the driving means are suitable to rotate the revolving sprinkler (S) in such a direction that the blade-shaped profiles (P) are on the leading edge.
4. Dishwasher according to claim 1, **characterized in that** the sprinkler (S) is shaped like a fan rotor.
5. Dishwasher according to any of the preceding claims, **characterized in that** the driving means suitable to rotate the sprinkler (S) include an arm (A), mobile between a rest position and a work position, carrying a drive gear (G) suitable to engage a toothed wheel (T) integral with the sprinkler (S), said drive gear (G) receiving the motion from an electric motor (M) through a kinematic chain located in said arm (A).
6. Dishwasher according to the preceding claim, **characterized in that** the mechanism for moving the arm (A) between the rest position and the work position includes a linear actuator (X) whose stem (Y) is connected to a member (Z) secured on the arm (A) in such a way as to take the arm (A) to the work position when said linear actuator (X) is powered, as well as a return spring (C) also connected to said member (Z) secured on the arm (A) in such a way as to return the arm (A) to the rest position when said linear actuator (X) is switched off.
7. Operating cycle for a dishwasher according to any of the preceding claims, comprising a drying step, **characterized in that** said drying step includes at least one period of activation of the driving means suitable to rotate the revolving sprinkler (S).
8. Operating cycle according to the preceding claim, **characterized in that** the period of activation substantially coincides with the duration of the drying step.

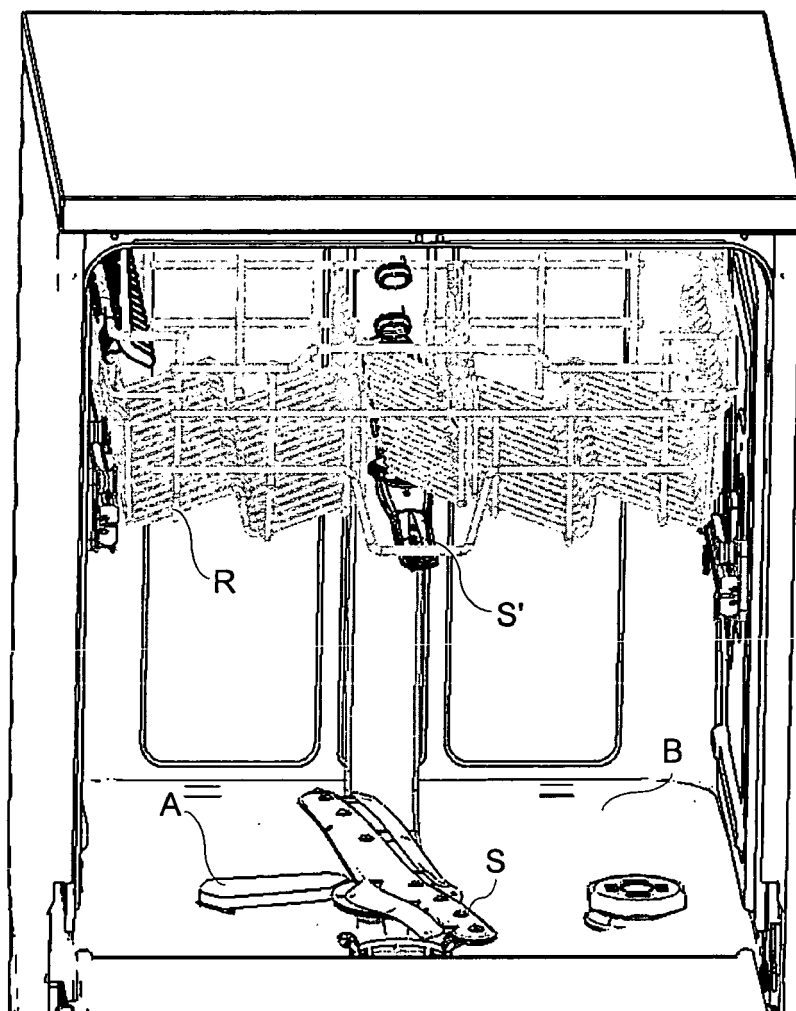


Fig.1

Fig.2

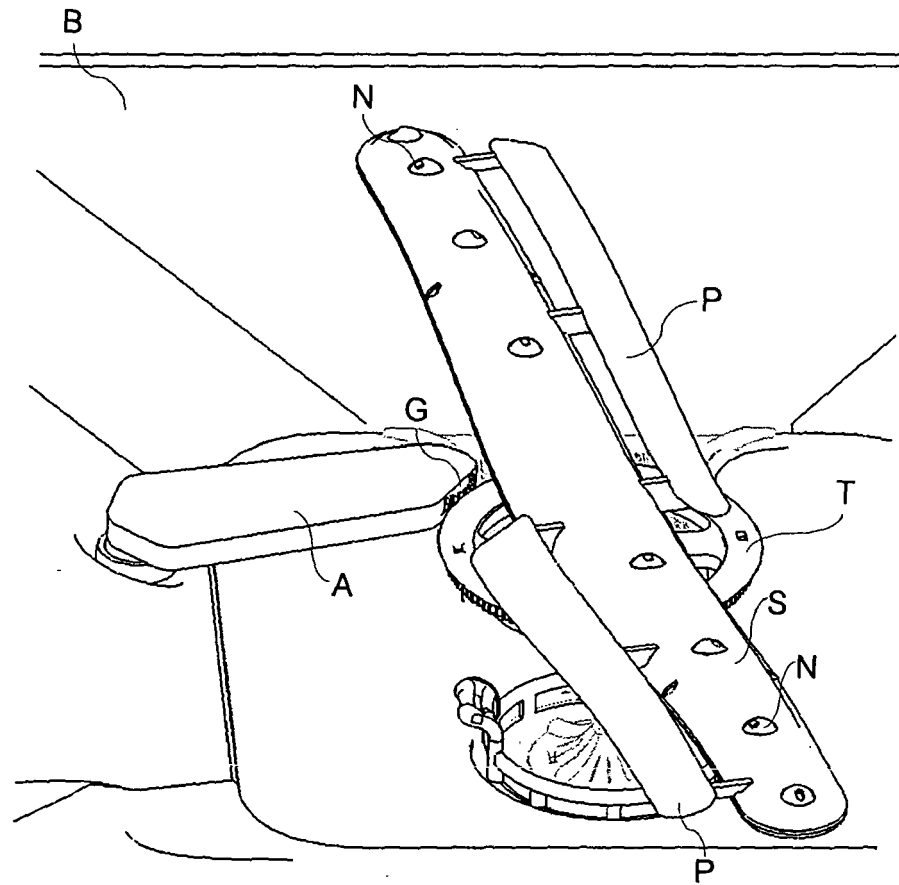
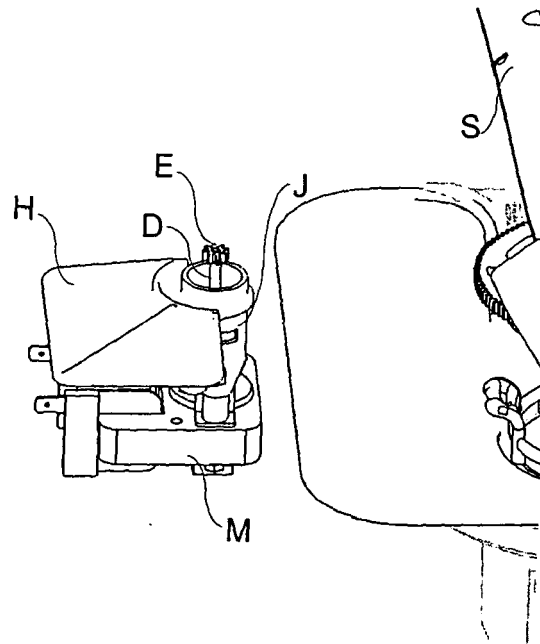


Fig.3



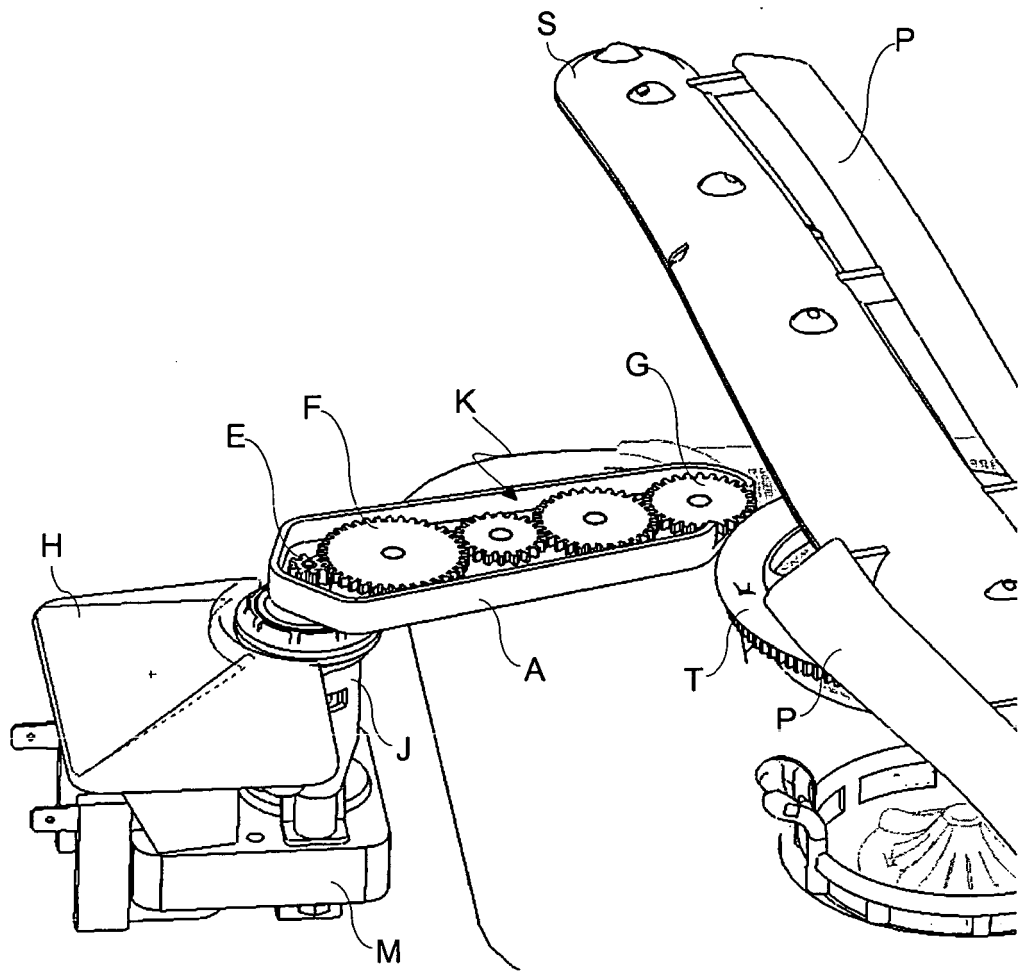


Fig. 4

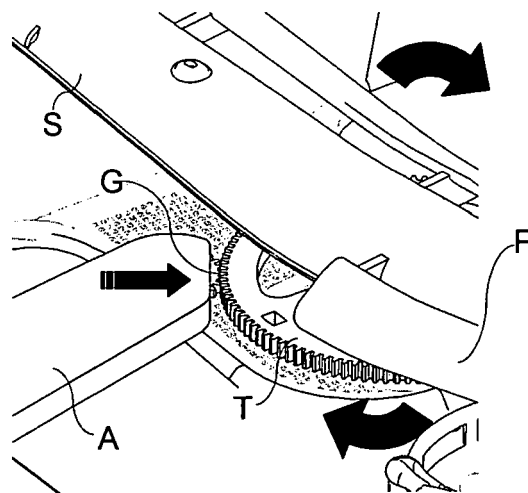


Fig. 5

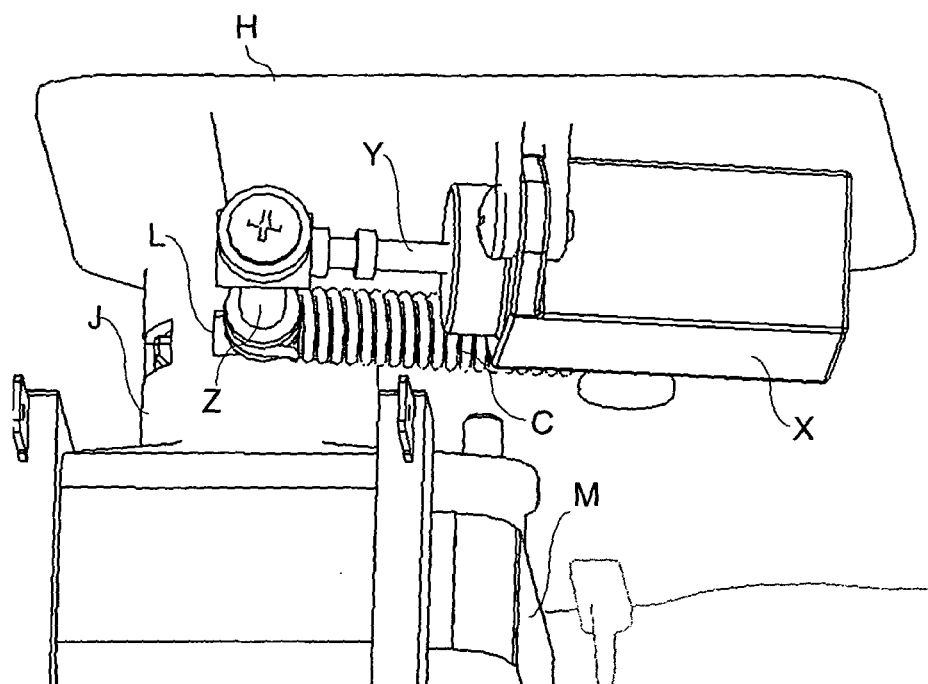


Fig.6

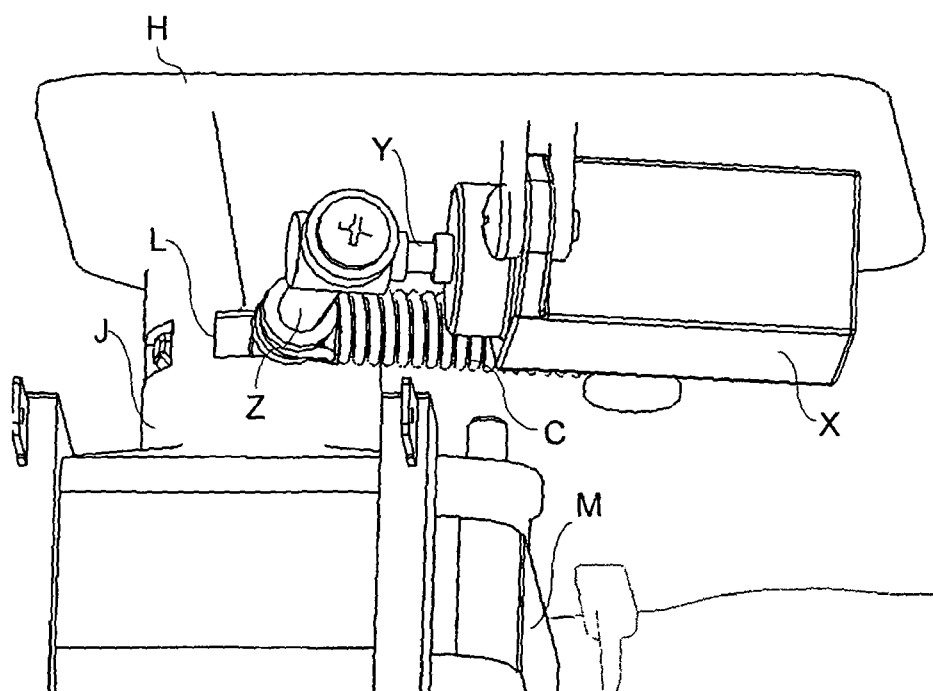


Fig.7



EUROPEAN SEARCH REPORT

Application Number
EP 09 42 5115

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 August 2009	Examiner Lodato, Alessandra
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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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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