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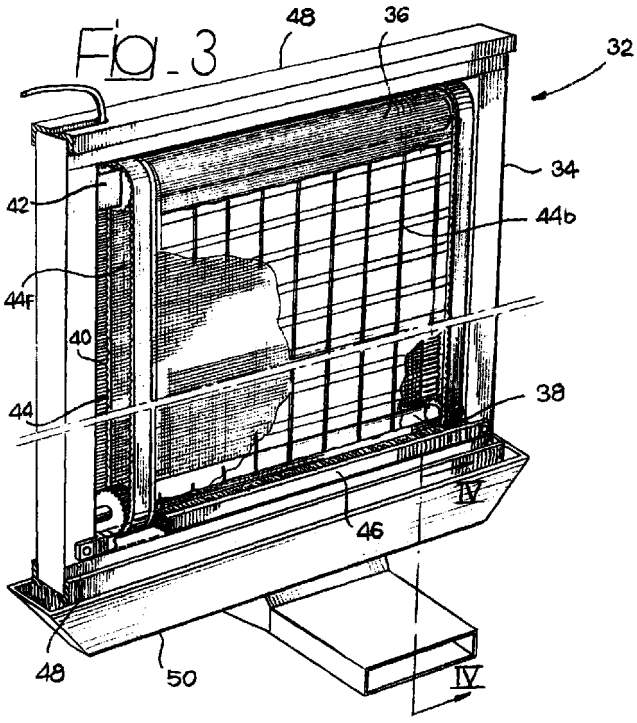
(54) Self-cleaning filtering device for the cooling system of an agricultural machine engine

(57) A self-cleaning filtering device for the cooling system of an agricultural machine engine, comprising a heat exchange block (14) intended to receive a cooling air flow in a direction orthogonal to a front surface (30) thereof. The filtering device (32) comprises:

- a guide and support frame (34) carrying a net (44) in a position frontally facing said front surface (30) of the heat-exchange block (14),
- means (46) for cleaning the net (44), and
- means (42, 36, 38) for producing a relative movement between the net (44) and the cleaning means (46).



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Description

[0001] The present invention relates to a filtering device for the cooling system of an agricultural machine engine.

[0002] The engine of an agricultural machine is normally provided with a cooling system comprising a heat-exchange block including one or more radiators, typically a radiator for cooling the engine, an intercooler and a radiator for cooling the gearbox oil. These radiators are arranged in close mutual relationship and form a block which receives a flow of cooling air directed orthogonally to one of its front surfaces.

[0003] Traditionally, the heat exchange block is housed into the front cowling which is provided with aerating grate openings, provided laterally and/or frontally in the cowling. Normally, such grate openings are structured for keeping outside of the cowling impurities of great dimensions and provide a level of air filtration sufficient for ensuring, for the majority of field works, a certain autonomy of working hours of the agricultural machine, before clogging both the grates and the radiators. Traditional grate openings are not able, in extreme conditions, i.e. when the machine operates in conditions of high contamination, to ensure a sufficiently high filtering level for preventing clogging of the radiators. In these conditions, the operator must frequently stop the work, get off the machine, remove and clean the grates of the cowling, access and clean the heat exchange block. All these operations generate a loss of time and consequently a reduction of productivity. Furthermore, these operations are particularly unconfortable in view of the fact that they must be carried out in the field. On the other hand, a too high filtering level of the openings of the cowling would reduce the passage of cooling air in normal conditions, i.e. in the majority of working conditions of the machine.

[0004] A partial solution of this problem is disclosed in EP-A-0886049 of the same Applicant, which discloses an auxiliary air filtering device for the cooling system of an agricultural tractor engine having a cowling with aerating grate openings. The auxiliary filtering device comprises a net adapted to be removably applied to the cowling so as to define filtering grates temporarily arranged in series with the aerating grate openings. This device increases the air filtering level by applying the net on the grate openings of the cowling when the tractor must operate in conditions of high contamination. However, even with the device disclosed in EP-A-0886049 it is necessary to frequently stop the work for cleaning the auxiliary net.

[0005] The object of the present invention is to provide an improved air filtering device which solves the above drawbacks and which increases the productivity and driving comfort of the agricultural machine.

[0006] In accordance with the present invention, this object is achieved mainly by an air filtering device having the features forming the subject of the main claim.

[0007] Subordinately, the invention relates to a device having the further features forming the subject of the dependent claims.

[0008] The present invention will now be disclosed in detail with reference to the attached drawings, given purely by way of non-limiting example, in which:

- figure 1 is a perspective view showing the front portion of an agricultural tractor provided with an air filtering device according to the present invention,
- figure 2 is a schematic lateral view showing the part indicated by the arrow II in figure 1,
- figure 3 is a perspective view of the filtering device according to the invention, taken along the arrow III of figure 2, and
- figure 4 is a schematic cross-section taken along the arrow IV-IV of figure 3.

[0009] With reference to figure 1, the numeral reference 10 indicates the front portion of an agricultural tractor, comprising a cowling 12 in which the tractor internal combustion engine (not shown) is housed. The present description relates specifically to an agricultural tractor but it is understood that the invention can be applied also to other types of agricultural machines, such as for instance combine harvesters and the like.

[0010] The cowling 12 is provided with grate openings (not shown) for entrance/exit of a cooling air flow.

[0011] A heat exchange block 14 is housed into the front portion of the cowling 12. In a conventional way, the heat exchange system comprises an engine radiator 16, a gearbox oil radiator 18, an intercooler 20, etc. In a known way, the radiators 16, 18 and 20 are mounted on transversal guides and can be extracted laterally after having raised the cowling 12, in order to carry out cleaning and washing operations.

[0012] As shown in figure 2, in the rear part of the heat exchange block 14 there is applied a ventilation assembly 22 including a conveyor 24 and an aspirating fan 26 driven by a belt 28. In a conventional way, the fan 26 produces an air flow indicated by the arrows in figure 2, which extends in a direction substantially orthogonal to a frontal surface 30 of the heat exchange block 14.

[0013] With reference to figures 2 and 3, a self-cleaning filtering device according to the present invention is indicated 2. The device 32 faces the frontal surface 30 of the heat exchange block 14 and is sealed so that impurities can not enter in the space between the filtering device 32 and the heat exchange block 14. The filtering device 32 comprises a guide and support frame 34 carrying an upper roller 36 and a lower roller 38 parallel to each other. The rollers 36, 38 are connected to each other by a toothed belt 40 and an electric motor 42 is provided for driving in rotation one of the two rollers, for instance the upper roller 36. A filtering net 44 is positioned between the rollers 36, 38. A filtering net 44 is positioned between the rollers 36, 38. The net 44 forms

a closed loop with a front branch 44f and a rear branch 44b. Preferably, as shown in figure 3, the front branch 44f has fine meshes whereas the rear branch 44b is formed by wide meshes. However, the two branches 44f, 44b could have meshes with the same dimensions. The net 44 is stretched between the rollers 36, 38, so that the rotation of the rollers about the respective axes produces a vertical movement in opposite directions of the two branches 44f, 44b. The position of one or both rollers 36, 38 with respect to the frame 34 could be adjustable both in a horizontal direction and in a vertical direction for enabling adjustment of the tension of the net 44.

[0014] A cleaning element 46, formed for instance by a brush, is carried by the frame 44 in a stationary position. The cleaning element 46 acts on the net 44 and extends in a transversal direction for the whole length thereof. The cleaning element 46 can be placed, for instance, in correspondence with the lower roller 48, on the rear side of the device 32.

[0015] The frame 34 is preferably slidably mounted along an either horizontal or vertical transversal direction on a pair of stationary transversal, guides 48 so that the device 32 can be removed laterally like the radiators 16, 18 and 20 for maintenance of washing operations.

[0016] With reference to figure 2 and 4, a hopper 50 is placed in a stationary position below the frame 34. The hopper 50 is connected to a section channel 52 terminating with a mouth 54 facing the aspirating fan 26 (figure 2).

[0017] The operation of the filtering device according to the present invention is the following.

[0018] The net 44 extends frontally in front of the heat exchange block 14 and during the operation is invested by the whole air flow aspirated by the fan and carries out a filtering action which removes from the air flow dirt and impurities which are kept on the frontal branch 44f of the net having meshes with small dimensions.

[0019] When the net must be cleaned, the operator starts the electric motor 42 by means of a push-button placed in the cab. As an alternative, a suitable automatic control system can be provided which activates the cleaning cycle at programmed time intervals or when a predetermined clog level of the net is detected. The cleaning operation can be carried out without the need for stopping the machine. The motor 42 moves the net 44 with respect to the stationary cleaning device 46 fixed to the frame 34, which removes the dirt deposited on the surface of the net, the whole surface of the net is cleaned and the motor 42 stops after the net has made one or more complete passages with respect to the cleaning device 46. The net 44 stops in the original position, in which the branch 44f with smaller dimensions of the meshes is placed in the front portion. When the net 44 has front end rear branches with the same mesh dimensions it is not necessary to provide a precise reference for positioning the net after the cleaning thereof.

[0020] The dirt removed from the cleaning device 46 falls in the hopper 50 and is aspirated from the suction channel 52. The dirt is ejected towards the rear portion of the fan 26 and is expelled together with the air flow through the rear grate of the cowling.

[0021] The Applicant has carried out a test on the device according to the invention on a tractor equipped with a front shredder. During work in field, this implement, which is carried by the front hoister, produces dust and impurities around the aerating grates and creates a particularly critical contamination condition. With a tractor which does not have the self-cleaning filtering device according to the invention, the operator must stop the work for cleaning the aspirating grates and the heat exchange block about every 15 minutes. For cleaning the heat exchange block, it is necessary to raise the cowling, extract the various radiator and cleaning the same. With the self-cleaning filtering device according to the present invention, cleaning of the filtering net 44 is carried out periodically and automatically without stopping the tractor and it is sufficient to clean only the aspirating grates about every 30 minutes for removing the largest pieces of dirt on the outside of the cowling. The heat exchange block 14 can be cleaned only at the end of the day during the normal maintenance of the tractor.

[0022] The device according to the invention permits the use of grates with larger meshes on the cowling, with obvious advantages for the tractor cooling system. This device reduces drastically, even in the most critical working conditions, the number of cleaning operations of the heat-exchange block and prevents engine overheatings of due to lack of maintenance. The device according to the invention permits a safe and reliable use of the tractor even in the presence of diffused dirt in the air and increases the operating autonomy of the machine. Furthermore, the filtering device has a relatively great permeability and does not compromise the passage of the engine cooling air in normal working conditions, which represent the largest part of the working life of the tractor, ensuring however in any condition an excellent level of air filtration for the heat exchange block.

Claims

1. A filtering device for the cooling system of an agricultural machine engine, comprising a heat exchange block (14) intended to receive a cooling air flow in a direction orthogonal to a frontal surface (30) thereof, the filtering device (32) comprising a net (44) adapted to filter the air flow (A) directed towards said heat exchange block (14), characterized in that it comprises:

   - a guide and support frame (34) carrying said net (44) in a position frontally facing said front surface (30) of the heat exchange block (14),

- means (46) for cleaning said net (44), and
- means (42, 36, 38) for producing a relative movement between the net (44) and the cleaning means (46).

2. A device according to claim 1, characterized in that it comprises a suction exhaust pipe (52) for collecting and ejecting dirt removed from said net.

3. A device according to claim 1, characterized in that it comprises a stationary cleaning device (46) and means for moving said net (44) with respect to the cleaning device (46).

4. A device according to claim 3, characterized in that the net (44) is closed in a loop and cooperates with a pair of rollers (36, 38) at least one of which is associated with driving means (42).

5. A device according to claim 4, characterized in that the net (44) has two parallel branches (44f, 44b) with different dimensions of the meshes.

6. A device according to claim 1, characterized in that said guide and support frame (44) is slidably mounted in a transversal direction on a pair of guides (48).

Fig. 1

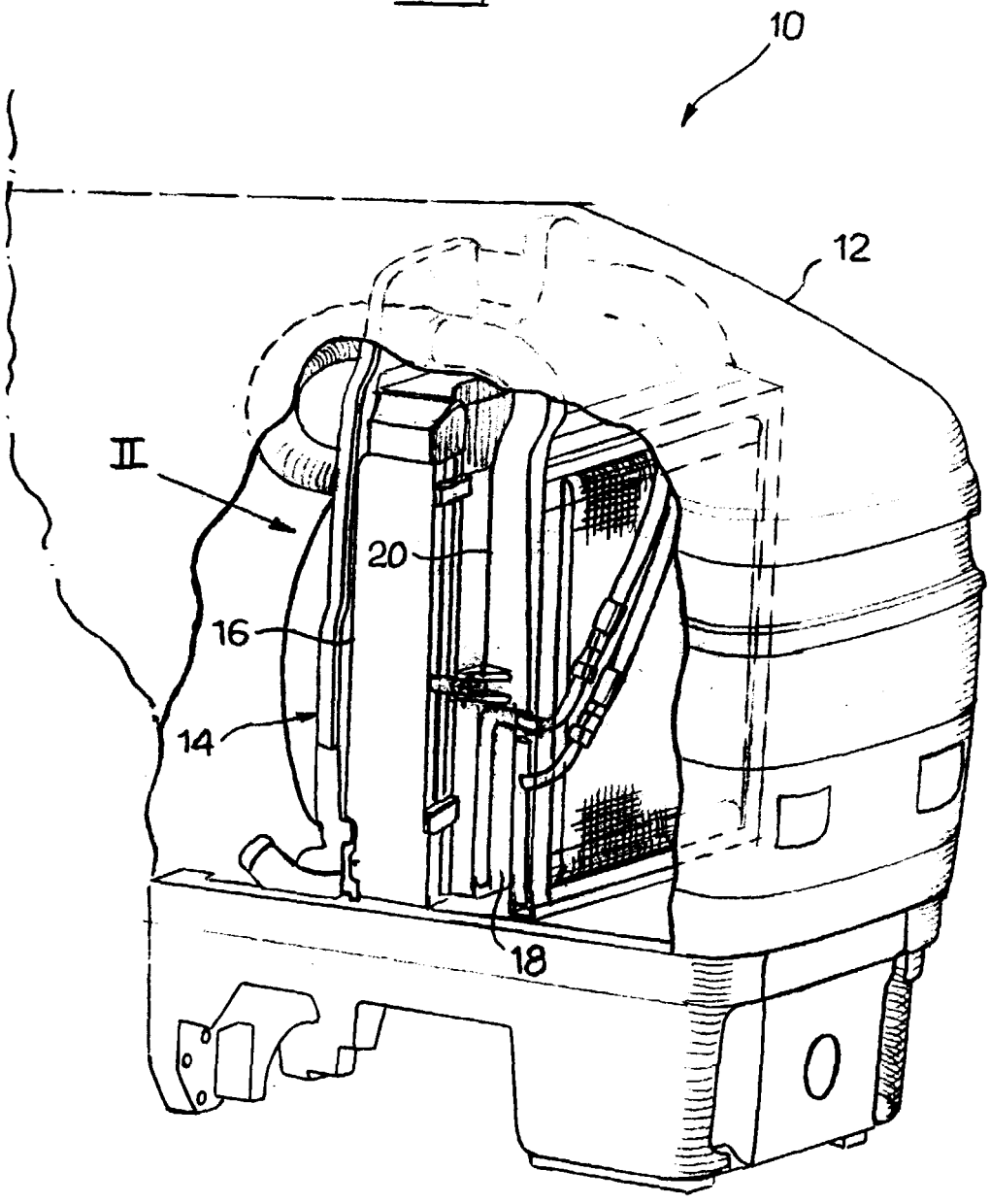


Fig. 2

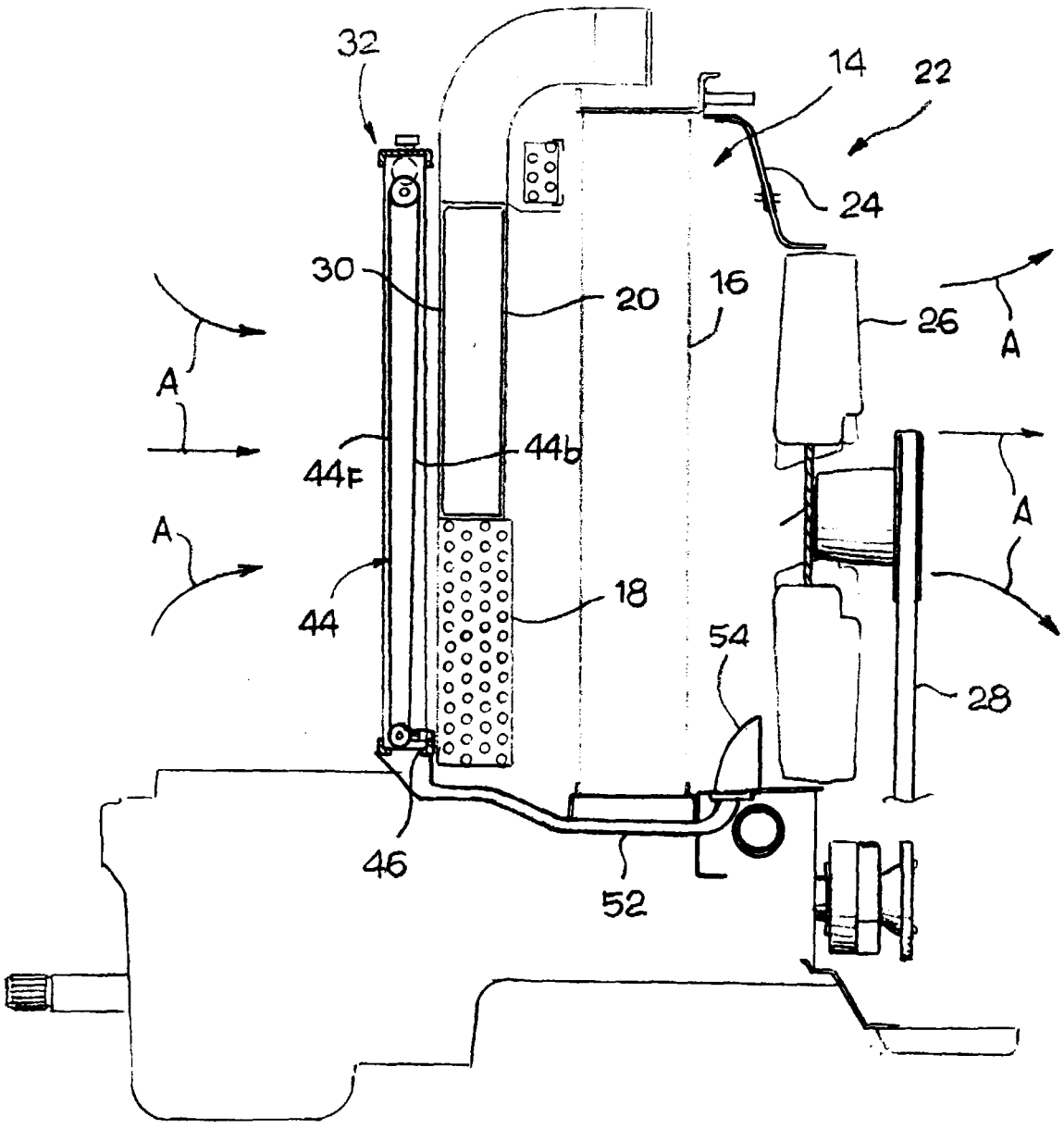


Fig_3

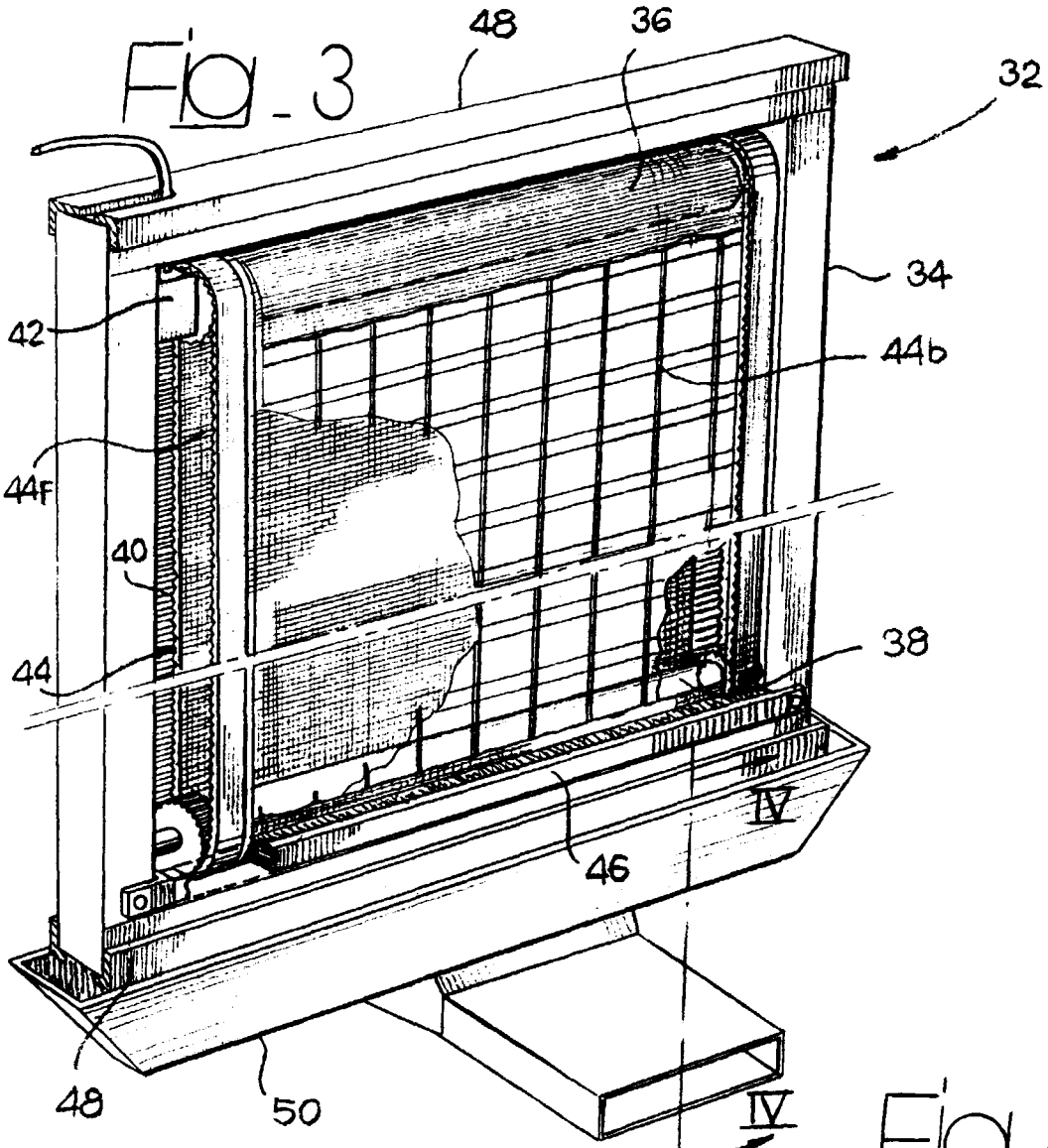
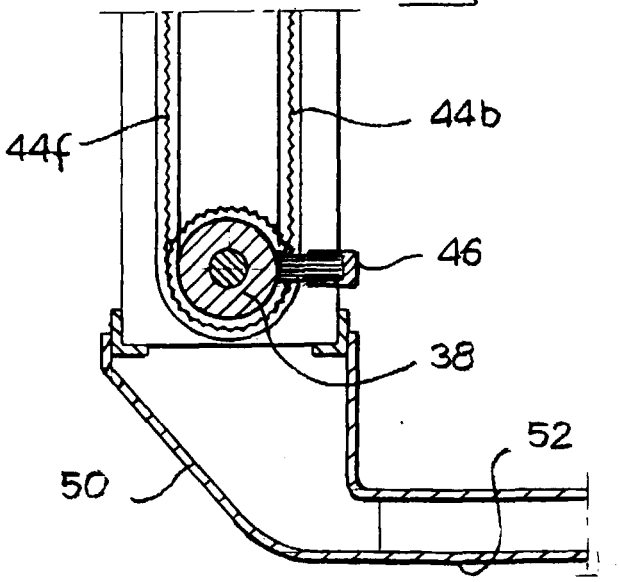


Fig_4



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EUROPEAN SEARCH REPORT

Application Number
EP 99 83 0700

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)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 March 2000	Kooijman, F

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