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DEVICE AND PROCESS FOR GAS REMOVAL FROM LIQUIDS

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Fig. 1

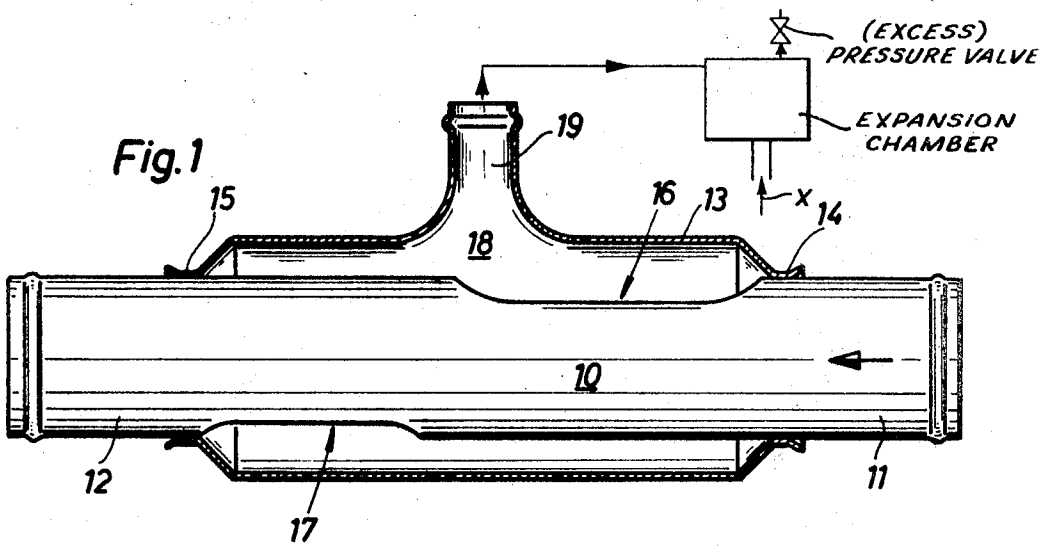


Fig. 2

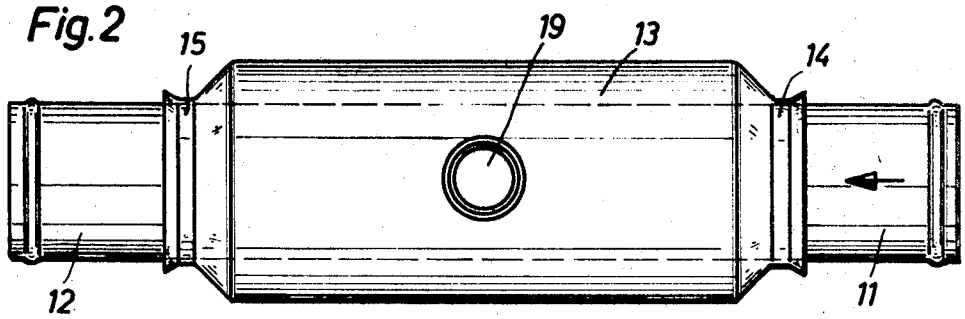
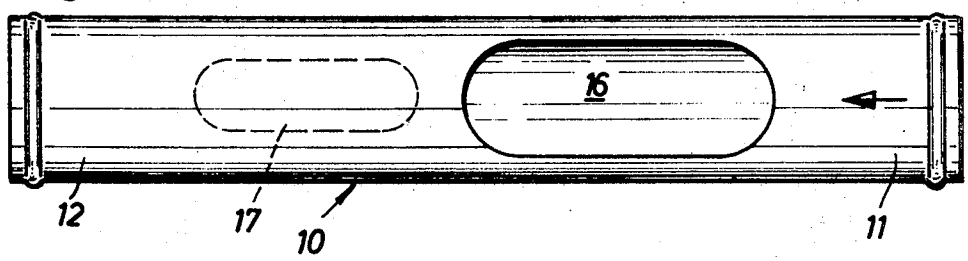


Fig. 3



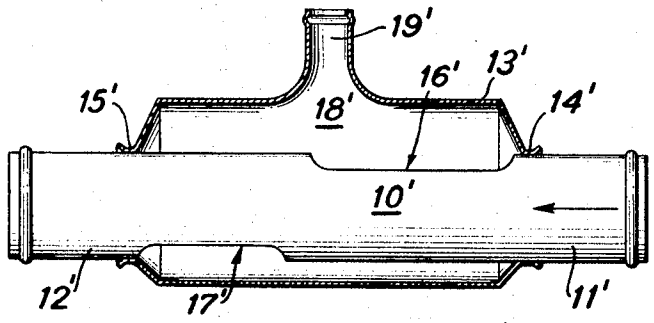


Fig. 4

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DEVICE AND PROCESS FOR GAS REMOVAL FROM LIQUIDS

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U.S. Cl. 55—52 12 Claims

ABSTRACT OF THE DISCLOSURE

A device for removing air or gases from flowing liquids in particular in heated water circuits includes an inner preferably tubular housing having inlet and outlet openings of about the same diameter as the flow lines surrounded by a housing of larger diameter, the inner housing being provided with an opening in the region of the upper flow path upstream and another opening near the lower flow path downstream. Vent gases are exhausted by an upper opening of the larger diameter housing which is preferably connected with an expansion chamber provided with a pressure relief valve. In the process for deaerating or degassing liquids the liquid flow is moved through the inner housing along the openings thereby allowing air or gas to escape by the upstream opening and discharged fluid to re-enter by the downstream opening of the inner housing.

BACKGROUND OF THE INVENTION

Devices for deaerating and degassing respectively of liquids are known whiech comprise means for passing the liquid which has been subjected to centrifugal forces into a discharge chamber for vent gases having perforated inner walls. The perforated walls extend archlike thus increasing the cross sectional area whereby the flow rate of the liquid decreases. Means may be provided to force the liquid through a narrow path before entering the vent discharge chamber. A disadvantage of such devices consists in the necessity to lead the total amount of liquid a different path thereby decreasing its flow rate. Substantial loss of energy is encountered with subjecting the liquid to centrifugal forces. The vent discharge chambers are rather complicated and bulkily constructed and have substantial space demand.

Another known cup-shaped air separating device for liquids comprises a base plate provided with a centrally located inlet opening and an outlet opening and a demountable jacket arranged to said base plate, the jacket being provided with an air exhaust. The jacket extends above a diverging orifice mounted to the central inlet of said base plate. The orifice is provided with a flanged edge at the flow exit and is covered at a distance by a cover having a flanged rim which extends parallel to the flanged edge of the orifice exit. A number of air passage tubes extend through the cover rim outside the exit of the orifice along the periphery of the cover. This device has the same disadvantages mentioned above.

SUMMARY OF THE INVENTION

The invention relates to a device for removing gas from liquids in particular for deaeration and degasification respectively of water in heated water circuits of heating systems and cooling installations for internal combustions engines in particular in motor vehicles, and to a process for removing gas from liquids in particular in such systems.

It is an object of the invention to provide for a device and process being extremely well suited to remove gas or air from liquids in systems with a minimum of space required. The device according to the invention is of simple but effective construction and operates without any maintenance.

In accordance with the invention a device for removing air or gases from flowing liquids comprises an inner housing having inlet and outlet openings of about the same diameter as the flow lines connected therewith, said inner housing being surrounded by an outer housing having a larger diameter, said inner housing being provided with an opening in the region of the upper flow path upstream and another opening near the lower flow path downstream.

According to a further feature of the invention any flow resistance is prevented by providing the device with a straight continuous tube as the inner housing. The tube may be provided with hose connections to allow the hose tips being connected adjacent to the joints of the outer housing with the inner housing, if desired.

A further feature of the device according to the invention provides an exit opening for gas and liquid in the region of the upper flow path of the inner housing which is larger than the opening in the region of the lower flow path. The gas exit opening may reach up to a point below an exhaust opening for vent gases provided in the outer housing. The vent gas opening of the outer housing is preferably connected to an expansion chamber provided with a pressure relief valve.

The process for removing gases according to the invention comprises moving a liquid stream such as a stream of a liquid coolant medium without changing its cross sectional area through an enlarged housing of larger diameter along an opening in the region of the upper flow path serving as an opening for venting gas and some liquid and further along another opening in the region of the lower flow path serving as a re-entry opening for the liquid which has collected in the outer housing.

In the process according to the invention gas bubbles are vented through the opening in the region of the upper flow path and pass the outer housing and the exhaust opening provided therein. If further gas is enclosed in the liquid this gas is eliminated from the liquid flow discharged from the first opening upstream in the region of the upper flow path by conveying said secondary flow along a helical path at the outer wall of the inner housing to the second opening in the region of the lower flow path with reduced flow rate. This liquid flow re-enters the main stream through the second opening. A further degassing effect is reached by the stemming of liquid at the downstream joint between the inner and the outer housing.

An embodiment of the device according to the invention is illustrated in the accompanying drawings which are described in detail in the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side sectional view illustrating a device for removing gas from liquids comprising an inner housing and an outer housing in accordance with the invention;

FIG. 2 is a plan view illustrating the device for removing gas of FIG. 1 in accordance with the invention, and

FIG. 3 is a plan view illustrating the inner housing of the device of FIG. 1 and FIG. 2 respectively.

FIG. 4 is a side sectional view showing structure similar to that of FIG. 1 though modified so that eccentricity of location of inner and outer housings results in space above the inner housing being greater than space below the inner housing.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 the device in accordance with the invention comprises an inner housing **10** which in the embodiment shown consists of a straight continuous tube having a circular cross section. The diameter of tube **10** corresponds to the diameter of the connecting lines (not shown).

The inner housing **10** is provided with an inlet socket **11** and an outlet socket **12** for liquid flow. Both sockets **11** and **12** are preferably shaped to allow a liquid-proof connection to hoses which are shoved over the sockets and connected therewith.

The inner housing **10** is surrounded by an outer housing **13** having a larger diameter, the outer housing **13** being connected tightly with the inner housing in order to prevent gas and liquid from escaping. Depending upon the materials used for construction both housings are connected by welding, soldering, or glueing, or the like. The assembly is shown in FIG. 2.

Referring to FIG. 3 the inner housing **10** is provided with an opening **16** in the upper region of the flow path and with an opening **17** in the lower region of the flow path of the liquid. The upper exit opening **16** is larger than the lower re-entry opening **17**. During operation in the upper section of the flow path gas and some liquid is vented through opening **16** whereas completely degassed liquid enters re-entry opening **17**.

Gases which have been collected within space **18** between the inner housing **10** and the outer housing **13** are exhausted by exhaust opening **19** on the top of the outer housing **13** and flow through a line to a simple expansion chamber provided with a pressure valve and an overflow line. Gas or air is gathered above the level of liquid within the expansion chamber and is finally vented.

The liquid flows in the direction of the arrow shown in FIGS. 1–3. Preferably the device is connected horizontally into the main flow line which should desirably run horizontally before entering the device. In this section a separation of pure liquid and gas enriched liquid can take place. Pure liquid flows unaffected as a core flow through inner housing **10** whereas the liquid enriched with gas forms a secondary flow which escapes through opening **16** and releases air or gas within space **18**. The degassing effect is increased by the formation of a secondary liquid flow around inner housing **10** having a reduced flow rate because the opening **17** for re-entry of liquid is smaller than exit opening **16**. A further increase of the degassing effect is reached by the accumulation of liquid at the connecting joint **15** of the front wall of the outer housing **13** with the inner housing **10**.

The device according to the invention is particularly useful in coolant circuits of internal combustion engines because these circuits frequently form leaks, for instance, in the region of the cylinder head or at porous places of the cast metal of the crankshaft housing thus causing enrichment of cooling water with gases and air respectively. This reduces the effectiveness of the coolant circuit and of the heating system of the vehicle connected therewith.

The device according to the invention is not limited to the example shown in the drawings. For instance, the inner housing can be replaced by the flow circuit pipe itself which is lead through the outer housing **13** and connected therewith at joints **14** and **15**. The pipe must then be interrupted by openings **16** and **17**. According to a further embodyment of the invention the outer housing **13** can be made of rubber if the inner housing or coolant circuit pipe **10** consists of rubber. It may then be possible to shove the outer housing **13** onto the inner housing or pipe **10** and to connect both firmly at joints **14** and **15**. This embodiment results in substantial savings in weight and material as well as in easier assembly of the device.

It may also be possible to provide more than one exit and re-entry openings within the region of the upper and lower flow paths.

FIG. 4 illustrates structure similar to that described with FIG. 1 and therefore correspondingly numbered structures identified by reference numerals with primes can be seen illustrating the eccentric relationship of inner and outer housings resulting in space above the inner housing being greater than space below the inner housing.

What is claimed is:

1. Device for removing air or gases from flowing liquids, in particular in heated water circuits comprising an inner housing of about the same diameter as the flow lines connected therewith, said inner housing being surrounded by an outer housing having a larger diameter, said inner housing provided with an opening in the region of the upper flow path upstream and another opening near the lower flow path downstream.

2. A device as claimed in claim **1** in which said inner housing is shaped as a straight continuous tube.

3. A device as claimed in claim **1** in which said opening in the region of the upper flow path has larger dimensions than said opening in the region of the lower flow path.

4. A device as claimed in claim **1** in which said opening in the region of the upper flow path reaches up to a point below an exhaust opening for vent gases being provided in said outer housing.

5. A device as claimed in claim **1** in which said outer housing is concentrically surrounding said inner housing.

6. A device as claimed in claim **1** in which said outer housing is eccentrically surrounding said inner housing thus forming a space above said inner housing which is greater than the space below said inner housing.

7. A device as claimed in claim **1**, in which said outer housing is provided with a vent gas opening connected to an expansion chamber, and in which a pressure relief valve is associated with said expansion chamber.

8. A device as claimed in claim **1** wherein the inner and outer housings are connected to each other by joints and wherein said inner housing is provided with inlet and outlet hose fittings adapted for connecting hoses therewith by slipping the hose tips over said fittings up to points adjacent to the joints of said inner and outer housing.

9. A device as claimed in claim **1** in which said inner housing is replaced by a liquid flow pipe, said pipe is connected to said outer housing and provided with said openings in the upper and lower regions of flow paths.

10. A process for removing gases in particular in heated water circuits comprising the steps of moving a gas-enriched liquid stream without changing its cross sectional area through a housing along an opening in the region of the upper flow path of said liquid stream, said opening serving as an opening for venting gas and some liquid, and moving said liquid stream further along another opening in the region of the lower flow path, said opening serving as re-entry opening for said liquid.

11. A process as claimed in claim **10** in which part of the gas enriched liquid stream is conveyed along a helical path on the outer surface of the wall of said inner hous-

ing from said opening in the region of the upper flow path to said other opening in the region of the lower flow path, said part of the liquid stream being made to re-entry the core of the liquid stream with reduced flow rate.

12. A process as claimed in claim 11 in which said part of the liquid stream is penned at the front wall of an outer housing surrounding said inner housing in the region of the joints between said outer housing and said inner housing before re-entry into said opening in the region of the lower flow path.

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