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(54) HEAT TRANSFER BY CYLIC THERMODYNAMIC PROCESS
(71) FONDATION CUM PLATE
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(57) CLAIM 1. A method for transferring heat energy by means of a cyclic thermodynamic process which method comprises providing a medium comprising a substance (A), which passes through liquid and vapour states during the process, and a substance (B) different from substance (A), separating (A) from (B) at a first location point by inducing a change of state in substance (A), reversing the change of state of (A) at a second location point, maintaining a pressure differential between said two points by subjecting the medium to a force greater than that of gravity, combining (A) with (B), and allowing (A) to return to said first point from the location point of combination by diffusion through substance (B), whereby heat is transferred from the one of said points at which (A) vapourises to the other of said points at which (A) condenses.

Forms and 4

COMMONWEALTH OF AUSTRALIA

Patents Act 1952-1962

501,580

PATENT OFFICE $8 PATENT OFFICE SIXTY DOLLARS PATENT OFFICE $20 PATENT OFFICE $40 FORTY DOLLARS

-1 APR 1975 PATENT OFFICE

APPLICATION FOR A PATENT

(Combined Form – Convention and Non-Convention)

79713/75

~~I~~/We, FONDATION CUM PLATE, a corporate body registered under the laws of Liechtenstein, of Hauptstrasse 26 FL-9490 VADUZ, Liechtenstein,

hereby apply for the grant of a Patent for an invention entitled

"A METHOD FOR CONVERTING ENERGY BY MEANS OF A CYCLIC THERMODYNAMIC PROCESS"

which is described in the accompanying ~~Provisional~~ Complete specification.

Strike out Para. 2 if non convention

~~2. This application is a Convention Application and is based on the application(s) for a patent or similar protection made~~

~~in~~

~~on , numbered~~

~~on , numbered~~

~~on , numbered~~

APPLICATION ACCEPTED AND AMENDMENTS

ALLOWED 10/5/79

3. My Our address for service is: Care of COWIE, THOMSON & CARTER Patent Attorneys, of 343 Little Collins Street, Melbourne, Australia 3000

DATED this 26th day of March, 1975.

COWIE, THOMSON & CARTER

By: R. Cowie

Patent Attorneys for
FONDATION CUM PLATE

To the Commissioner of Patents,
COMMONWEALTH OF AUSTRALIA

109

Melbourne

Declaration in Support of an Application for a Patent

(Combined Form – Convention and Non-Convention)

79713/75

* Strike out for non-convention

In support of the ~~Convention~~* application made for a patent ~~patent of addition~~ for an invention entitled "A METHOD FOR CONVERTING ENERGY BY MEANS OF A CYCLIC THERMODYNAMIC PROCESS"

I, Baltzar Carl von Platen, a member of the Board of ~~XX~~ Fondation Cum Plate, a corporate body registered under the laws of Liechtenstein, of Hauptstrasse 26 FL-9490 VADUZ, Liechtenstein, authorized to sign on behalf of the applicant company, do solemnly and sincerely declare as follows:–

~~I am / We are~~ ~~XXXXXXXXXXXXXXXXXXXXXX patent / patent of addition.~~

(or in the case of an application by a body corporate)

1. I am authorised by FONDATION CUM PLATE the applicant for the patent ~~patent of addition~~ to make this declaration on its behalf.

Strike out Para. 2. for non-convention

~~2. The basic application(s) as defined by section 141 of the Act was/were made at in on the day of 19 ,No. , by , and on the day of 19 ,No. , by , and on the day of 19 ,No. , by~~

~~I am / We are~~ ~~XXXXXXXXXXXXXXXXXXXXXXXXXXX~~

where a person other than the inventor is the applicant)

3. Baltzar Carl von Platen, of Swedish nationality, of ~~XX~~ Salomon Smiths Vag 8, S-271 00 YSTAD, Sweden

is ~~are~~ the actual inventor(~~s~~) of the invention and the facts upon which ~~I am~~ ~~We are~~ | the company is entitled to make the application are as follows:–

The said company is the assignee of the invention from the said actual inventor.

Strike out Para. 4. for non-convention

~~4. The basic application(s) referred to in paragraph 2 of this Declaration was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.~~

DECLARED AT Malmö this 11th day of February 1975.

Baltzar v. Platen

Signature of Declarant

BAD ORIGINAL

COMMONWEALTH OF AUSTRALIA

Form 10

PATENTS ACT 1952-1969

COMPLETE SPECIFICATION

(ORIGINAL)

79713/75

FOR OFFICE USE

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Application Number:

Lodged:

This document contains the amendments made under Section 49.

and is correct for printing.

JUN 1979

Complete Specification—Lodged:

Accepted:

Published:

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

Name of Applicant:

FONDATION CUM PLATE, a corporate body registered under the laws of Liechtenstein, of Hauptstrasse 26 FL-9490 Vaduz, Liechtenstein

Address of Applicant:

Actual Inventor: BALTZAR CARL von PLATEN

Address for Service: Care of: COWIE, THOMSON & CARTER,
Patent Attorneys,
343 Little Collins Street,
Melbourne, Victoria, Australia.

Complete Specification for the invention entitled: "A METHOD FOR CONVERTING ENERGY BY MEANS OF A CYCLIC THERMODYNAMIC PROCESS"

The following statement is a full description of this invention, including the best method of performing it known to me:—

*Note: The description is to be typed in double spacing, pica type face, in an area not exceeding 9¾" in depth and 6¼" in width, on tough white paper of good quality and it is to be inserted inside this form.

14717/73-L

F. D. ATKINSON, Government Printer, Canberra

This invention relates to a method whereby a cyclic thermodynamic process may be induced.

By a method according to the invention a steam engine, a refrigeration plant and a heat pump (to name three relevant devices) of improved efficiency may be constructed. The invention is based upon the combination of two processes, one giving out, and the other absorbing work.

79713/75

In 1850 the German physicist Clausius formulated a proposition which has become known as the second law of thermodynamics. We shall call this Clausius' theory, or the theory. According to this theory (as is well known) heat cannot of itself pass from a lower to a higher temperature, nor can it transform itself into useful work. The theory implies a negation by exclusion, namely that perpetual motion of the second order is not possible.

It is now known and accepted that entropy-reducing processes, i.e perpetual motion processes, exist not only in imaginary experiments but also in reality. According to Clausius' theory, however, such a process must, by nature, always be combined with or join an entropy-increasing, destructive process which (again according to the theory) must dominate and so undo that which the former process would achieve.

The destructive process has (according to the aforementioned theory) always shown itself to be dominant, for otherwise the two processes in combination could constitute second-order perpetual motion - which is unknown.

The following description will show how two such processes may be combined in accordance with the invention and that it will appear likely, at least theoretically, that the destructive entropy-increasing process is also dominant in this case, and for that reason second-order perpetual motion will not occur. It has been established with certainty, however, that the present invention makes possible the construction of a steam engine, refrigeration plant or heat pump of significantly greater efficiency than any such machine at present known, since the entropy-reducing process assists the entropy-increasing process.

The destructive entropy-increasing process is carried out by known mechanical means such as pistons, cylinders et al. To describe and illustrate these devices more than absolutely necessary would tend only to obscure the most interesting part of the invention, namely that which is related to the second law of thermodynamics. The following description will, therefore, be confined mostly to the latter. The well known devices already mentioned will merely be indicated schematically. They are not shown at all in fig. 15, which represents a practical adaptation, since it is assumed there that the second law of thermodynamics is dominant - an assumption which may be allowed to stand until the theoretical description accompanied by the extremely important figs 7 and 8 can be shown to be faulty. The theoretical description relating to the first five figures is also an important proof that the proposition upon which the invention is based, is correct. Nevertheless, the description relating to figs 7 and 8 may, if so desired, be studied without reference to figs 1 - 5.

In the physics of entropy-reducing second law of thermodynamics processes giving out work, one important detail may be noted, namely that diffusion between two or more substances always occurs. In a process such as that represented by the first five figures the path of diffusion is extremely short, or in the order of a fraction of a millimeter. In a process such as that represented by any of the other figures it is many times longer, and in that of fig. 6 for example, is conveniently about 1 cm.

The invention relates to a method for transferring energy by means of a cyclic thermodynamic process which is induced by means of a medium comprising at least two substances or two groups of substances A and B, characterized in that A is caused to diffuse out of B at a location point u' and to diffuse into B at a location point u"; the sum of the individual pressures of A and B i.e. the total pressure, is so regulated that a difference arises between the total pressures at points u' and u", the sign and magnitude of this difference being so chosen that the said cyclic process, in theory at least, tends to indicate a quality of a perpetual motion of the second order.

In accordance with the invention there is provided a method for transferring heat energy by means of a cyclic thermodynamic process which method comprises providing a medium comprising a substance (A), which passes through liquid and vapour states during the process, and a substance (B) different from substance (A), separating (A) from (B) at a first location point by inducing a change of state in substance (A), reversing the change of state of (A) at a second location point, maintaining a pressure differential between said two points by subjecting the medium to a force greater than that of gravity, combining (A) with (B), and allowing (A) to return to said first point from the location point of combination by diffusion through substance (B), whereby heat is transferred from the one of said points at which (A) vapourises to the other of said points at which (A) condenses.

The invention will now be described with reference to figs. 1 - 16. For reasons already stated the first 14 figures are schematic, while figs 15 and 16 show in principle how a practical realization of the invention may be constructed.

Figs. 1 and 3 contribute to a theoretical explanation of the invention.

Figs. 4 and 5 are graphs relating to said figs. 1 and 3.

Fig. 2 shows schematically how a machine might be constructed, which functions according to the principles described in connection with the figures 1, 3, 4 and 5.

Figs. 6, 10, 11, 12 and 13 substance A may be propane (for example) while substance B is a gas, or mixture of gases, which should conveniently be heavy. In fig. 9 substance A may be assumed to be ammonia or some other gas which is readily absorbed by substance B, which is here assumed to be a solid body.

Figs. 7 and 8, which are of great theoretical importance, A is assumed to be ammonia whilst B is a salt dissolved in the ammonia.

Fig. 14 shows schematically how heat may be conducted to and from a machine functioning according to the invention.

Fig. 15 shows a practical realization of a machine according to the invention in which heat is conducted to and from the machine in a manner different from that shown in fig. 14.

Fig. 16 shows a detail of a portion of the device of figure 15.

Assume that I have a sealed vessel or cylinder 1 in fig. 1. A small quantity of liquid 2 such as ammonia lies at the bottom of this vessel. The space above this liquid in the vessel 1 contains only gaseous ammonia. Ammonia molecules in the gaseous state are designated α-molecules. Of course molecules constantly change places between the gaseous and liquid states, but in the present consideration this is not a significant phenomenon and it may be disregarded.

Imagine now that a thin gold foil (for example) is made to cover the free surface of the liquid. One then pumps into the system an inert gas, for example nitrogen. Only a relatively low nitrogen pressure is required, say 20 atmospheres, but partly in order that the effect I will describe shall be clearly discernible and partly for reasons which will arise in connection with fig. 2, I shall assume a final pressure of the order of several hundred or circa 1000 atmospheres. The temperature of the system remains unaltered, i.e. room temperature. Now imagine that I remove the foil. At once I observe a fall in pressure within the system as a result of the evaporation of fluid ammonia into the nitrogen. At this pressure then, the nitrogen behaves as a solvent for gaseous ammonia. The volume of fluid ammonia descreases by a certain amount which we shall call Δv, and the gas-occupied volume increases by the same amount. The nitrogen therefore expands and its pressure falls. Since the nitrogen pressure is dominant, the pressure in the whole system falls in spite of a rise in the partial pressure of the gaseous ammonia. Those ammonia molecules, which have now found their way into the gaseous state, are designated β - molecules. The solubility of nitrogen in fluid ammonia can be assumed to be nil, or alternatively we may assume that the remaining quantity of fluid ammonia is infinitessimal.

It is fully in accord with Le Chatelier's principle that evaporation of the fluid ammonia in the nitrogen should be accompanied by a fall in pressure. This fall in pressure takes place so that the total rise in pressure as the nitrogen is pumped into the system shall remain as little as possible.

If, when the foil has been removed from the surface of the fluid, the total pressure in the system is maintained at a constant value by means of (for example) a piston, the volume will decrease and the specific weight of the system will rise correspondingly. If in some way the β - molecules are forced back into the fluid state, the volume will increase and the specific weight fall.

One should now apply the above to the physical sequence of a machine whose construction is shown schematically in fig. 2. Each continuous line in this figure represents a channel. I-I is an axis about which the machine rotates at high speed. Thus the contents of the machine lie in an extremely intense force-field. It shall be assumed that this is of the order of 100,000 g at the farthest distance from the axis. No energy is required to keep the machine rotating, if one discounts a small loss through friction. One may assume that channels 6 and 7 are approximately the same distance radially from the said axis of rotation, and channels 8 and 10 also.

The machine contains the said substances A and B. Assume that A is ammonia and B an inert gas of suitable mean molecular weight. A mixture of nitrogen and sulphur hexafluorid will be satisfactory. Also assume (for reasons to be shown shortly) that the contents of the machine flow in the directions indicated by the arrows in fig. 2. The pressure near the axis of rotation is assumed to be about 200 atm., and at the periphery about 1000 atm. One assumes that the inert gas B plus some ammonia A passes through channel 4 towards the centre of rotation and that fluid ammonia flows through channel 5 in the same direction. The gas mixture continues along channel 6 which is parallel to the axis of rotation. From here it passes into channel 7 where it meets the fluid ammonia, which has entered channel 7 from channel 5. Here the ammonia evaporates in the inert gas, wherewith ambient heat is absorbed and cooling occurs. The contact surface here between liquid and gas is the point u'' mentioned previously. The inert gas and gaseous ammonia now pass outwards from the centre of rotation through channel 3, accompanied by a rise if pressure and temperature. The change of state is adiabatic if channels 3 and 4 are thermally insulated from each other. It will be assumed for the time being that they are also insulated. The gas mixture passes from channel 3 into channel 8. Moving towards a point 9, the temperature of the gas mixture falls in consequence of close thermal contact between channel 8 and channel 10. From point 9 to point 11 the temperature falls in consequence of heat loss to the surroundings which are at a lower temperature. At point 9 the ammonia begins to condense. The heat released by condensation is emitted between said points 9 and 11. This contact surface between liquid and gas is the point u', also previously mentioned. At point 11 the fluid ammonia separates off. Since it is lighter than the inert gas, it flows towards the axis of rotation I-I through channel 5. The temperature at point 11 may be assumed to be equal to or slightly higher than that of the surroundings, while at point 9 it is a good deal higher. The inert gas, now impoverished of ammonia, continues through channel 10 where it is reheated, channels 8 and 10 functioning together as a heat-exchanger. The gas having been reheated, it passes into channel 4 and so moves in towards the axis of rotation I-I, cooling adiabatically as it does so. It passes thence through channel 6 (as already described) and comes together with the ammonia once again in channel 7.

Channel 5 can be placed in thermal contact with channels 8 and 3 and also with channel 7, this arrangement winning certain advantages. This is not relevant to the present consideration, however, and is merely mentioned in passing.

It shall now show how circulation in the machine, as described, can occur spontaneously. A number of lines II-II are drawn in fig. 2, all parallel to the axis of rotation I-I and cutting channels 3, 4 and 5. At the point where the first line II-II cuts channel 3 (the first line II-II being nearest the axis of rotation I-I) we observe a very small, though not infinitesimal mass q of the gas-mixture. Its volume is v_1 and thus its specific weight is q/v_1. When this mass of gas-mixture passes through channel 8, fluid ammonia separates off and flows in through channel 5 towards the axis of rotation. This mass of fluid ammonia we shall call q' and the remaining mass of gas-mixture q''. Thus $q = q' + q''$. At points where any of the lines II-II cut channels 5 and 4 we find masses q' and q'' respectively. And at the points where any of the lines II-II cut channel 3 one finds masses q which, taken in order outwards from the axis of rotation, occupy volumes v_1, v_2, v_3 etc. out to the periphery where we have marked the volume v_{10}. At the corresponding points in channel 5 the masses q' occupy volumes v'_1, v'_2, v'_3 etc. out to v'_{10} at the periphery, and at the corresponding points in channel 4 the masses q'' occupy volumes v''_1, v''_2, v''_3 etc. out to v''_{10} at the periphery.

It clearly follows from the description relating to fig. 1 that

$$v'_{10} + v''_{10} > v_{10}$$

v''_{10} in fact contains no β-molecules at all. These have separated in liquid state at point 11 and thus comprise the volume v'_{10}. The above expression holds true even if some α-molecules accompany the condensate, that is to say if there is a shortage of α-molecules in v''_{10}, since the pressure of the inert gas is of a higher order of magnitude than the independent pressure of the ammonia. On the other hand, conditions close to the axis of rotation I-I are quite different. At the temperature which obtains here, the independent pressure of the inert gas is of the same order as that of the saturated ammonia vapour. Thus in the proximity of the axis of roation 1-1 the shortage of α-molecules in the channel 4 brings about a substantial decrease in volume, giving

$$v'_1 + v''_1 < v_1$$

Thus a force capable of propelling the gasses through channels 3, 8, 10, 4, 6 and 7 is generated in the peripheral parts of the system. This force decreases towards the centre and as a general rule changes sign somewhere between the periphery and the centre. If this takes place, it is a function of the pressure and molecular weight of the inert gas. Pressure at the periphery however must not rise above a certain value or the ammonia will not condense. The system is thus fairly complex. The following is a simpler exposition.

Let us now suppose the machine in fig. 2 contains only a convenient quantity of ammonia. As before, the machine rotates at high speed. We now pump into it an inert gas-mixture of suitable mean molecular weight. What is meant here by "suitable" will appear shortly. We pump in a certain quantity of gas until we observe that the liquid ammonia has climbed up channel 5 as far as channel 7, when we stop pumping. Now the centrifugal force on the columns of gas in channels 3 and 4 are equal to or slightly greater than the centrifugal force on the column of liquid in channel 5. Since we have chosen a suitable value for the mean molecular weight of the inert gas-mixture, we will further note that the centrifugal force on the gas column in channel 3 is just a trifle greater than that on channel 4. Yet it is enought to overcome flow resistance in the system. The difference between the two forces is identical to the propelling force that overcomes frictional and flow resistance. Thus the lower the chosen molecular weight, the greater this force will be. But since the centrifugal forces are enormous compared to the flow resitance, the mean molecular weight must be fairly accurately fixed. By means of the process just described, heat passes from a lower temperature near the axis of rotation, to a higher temperature at the periphery.

It may also be of great interest to study what occurs if the process is carried on isothermally, or to be more precise, at the ambient temperature. In this case a fine mist of fluid ammonia will form in channel 3 as the gases come under increasing pressure on their way out towards the periphery. It may be assumed that this mist is carried along in the gas stream beyond the point where the specific weight of the inert gas equals that of the fluid ammonia. Beyond that point of course (that is to say nearer the periphery) the specific weight of the gas-mixture is greater than that of the fluid ammonia. So it may be further assumed that the fluid ammonia, as before, separates off at point 11 and flows through channel 5 towards the centre. The ammonia-impoverished inert gas passes through channel 4 towards the centre for the same reasons as before. Thus the events described previously also take place at ambient temperature. In this instance the only benefit derived from such a machine is mechanical work. The machine can produce work in two distinct ways, or in both ways at once. In one case the mean molecular weight of the gas mixture is so chosen that the amount of mechanical work apportioned to the gas is just sufficient to maintain circulation. The mean density of the gas is high so that the centrifugal force on the gas columns in channels 3 and 4 is significantly greater than that on the liquid column in channel 5. The liquid is thus propelled in towards the centre with great force and therefore, can transmit work to a piston pump or turbine. In the other case an inert gas is chosen with the lowest possible mean molecular weight. Its density, however, must be great enough to enable the liquid in channel 5 to reach up to channel 7. The gas column in channel 4 will be significantly lighter than that in channel 3, so that the gas will circulate with great force and can transmit mechanical work to a pump or turbine.

Suppose the temperature continues, as before, to be the same throughout the machine. In channel 7 where the pressure of the inert gas is low, ambient heat is absorbed as the fluid ammonia evaporates. In channel 3 (channel 8 may be disregarded in this instance) gaseous ammonia condenses in the presence of inert gas which is at considerably greater pressure than in channel 7. With condensation, heat is emitted to the surroundings. Disregard the absorbtion and emission of heat taking place in the inert gas alone, since the process was assumed to be isothermal, and at ambient temperature. It is expected that condensation heat emitted in the presence of an inert gas becomes less, the greater the independent pressure of the gas. More heat must then be absorbed when the ammonia evaporates in channel 7, than is emitted when it condenses in channel 3. This difference is identical with the work done, expressed in units of heat, by the piston machinery or turbine.

It is now known that condensation heat diminishes as the pressure of the inert gas increases. This seems to be an encouraging sign for the value of the hypothesis. Also relevant to this theme is another isothermal process, which will be described.

Fig. 3 represents a cylinder 1 closed by a movable piston 15. In the lower part of the cylinder is a small amount of liquid ammonia. The cylinder also contains inert gas. So that the liquid ammonia will remain at the bottom of the cylinder and not flow upwards when the pressure increases, we assume that the inert gas is light - say hellium. The total pressure in the cylinder, when the piston is in the position shown in fig. 3, can be 200 atm. This state is represented by point a in the PV-graph fig. 4. The gas volume contains both helium molecules and ammonia molecules, the latter being differentiated as before into α-molecules and β-molecules.

Now drive the piston into the cylinder, keeping the temperature constant. The ensuing change of state is shown on the PV-graph fig. 4 by the curve abc. At c the mass of fluid ammonia at the botton of cylinder 1 is greater than at a, ammonia having condensed out under the increased pressure.

Imagine now that one can cover the free surface of the liquid with a gold foil. This done, allow the piston 15 to move out. At c, of course, β-molecules were also present in the gas, and since the foil now prevents any evaporation of the liquid, these β-molecules quickly become α-molecules as expansion takes place. At d on the curve all the β-molecules have been transformed. Here then, one has the same number of ammonia vapour at the same temperature. In this state, point d, imagine that one pricks a small hole in the foil which will permit diffusion of just sufficient molecules to ensure that the mass per unit volume of gaseous ammonia remains constant, as the piston continues to move out. Thus during the change of state d - e in fig. 4 there is a full complement of α-molecules present in the gaseous state but no β-molecules at all. As in the case of fig. 1, the total pressure during the change of state d - e is higher than during b - a. For the same reason it is also higher during c - d than during c - b.

When the state has reached e in fig. 4 remove the foil. A quantity of liquid then evaporates, that is to say gaseous ammonia dissolves in the helium, i.e. β-molecules find their way into it. The change of state here will be e - a in fig. 4, i.e. a fall in pressure at constant total volume. The perpetual motion work released is then equal to the area a-b-c-d-e-a. This work implies that there is an absorbtion of heat from the surroundings. It is easy to understand how this occurs. When the volume diminishes, a - b - c, ammonia condenses all the while. When the volume increases, c - d - e, only some of the ammonia evaporates. During c - d of course, there is no evaporation at all and during d - e only so much that the number of α-molecules per unit volume remains constant. The pressure in the inert gas is thus greater during condensation than during evaporation and, therefore, (as we know) the heat lost to the surroundings in condensation must be less than the heat gained in evaporation.

In fig. 5 the abscissa v shows the volume of liquid 2 in the cyclic process described with reference to fig. 4 and as before, the ordinate p is the total pressure, i.e. the liquid pressure. In fig. 5 points a', b', c', d', e' correspond to a, b, c, d, e in fig. 4.

It is worthy to note that a perpetual motion process such as that indicated by the graph in fig. 4 could theoretically be possible at the lowest pressure one cares to choose for the inert gas. The lower this pressure is, however, the more difficult it is to make the process function. On the other hand, the pressure may not exceed a certain value or the ammonia will not condense. We have, of course, only chosen ammonia as an example.

The processes represented in figs. 3 and 4 can also be explained in another, perhaps simpler way. Begin the process at point e in fig. 4 and have the cylinder 1 and piston 15 (fig. 3). At the bottom of the cylinder 1 is a small quantity q_x of fluid ammonia 2. Thus the volume between liquid and piston contains only α-molecules. Lay a thin gold foil over the surface of the liquid. Then pump helium (for example) into the chamber, the total pressure rising to e.g. 200 atm. Escape of β-molecules into the gaseous state is prevented by the gold foil. All this takes place at constant - e.g. room - temperature. Now we remove the gold foil. β-molecules immediately disperse into the gaseous state. The quantity of liquid q_x is so chosen that when equilibrium has been reached almost all the liquid has evaporated, there remaining only a vanishingly small though not infinitessimal quantity at the bottom of the chamber. The position of the piston has until now remained unchanged. As instanced previously in connection with Le Chatelier's principle, when evaporation takes place total pressure falls. When equilibrium is reached, total volume having remained constant, total pressure will have fallen from e to a in fig. 4.

Now drive in piston 15. Note that in accordance with what has previously been said, this may be done at any total pressure chosen within wide limits. The ammonia condenses. Point c in fig. 4 is so chosen that when it is reached, the exact quantity q_x of ammonia has condensed. Now lay the gold foil once more over the surface of the liquid, and then allow the piston to return to its original position. Clearly we have now reached point e where we started the process. Once again remove the foil, wherewith β-molecules immediately disperse into the gaseous state. When equilibrium has been reached, and only a vanishingly small though not infinitessimal quantity of liquid remains (in accord with what has just been said), we have arrived at point a. Perpetual motion work e - a - c - e has been released.

Returning now to fig. 2. If the pressure in this machine is below a certain value or if the mean molecular weight of the inert gas is chosen wrongly one may still get perpetual motion work from the machine if the circulation is maintained by the sacrifice of external work, i.e. if it is kept going by force. This will be less than the perpetual motion work that is obtainable theoretically. In these circumstances then, the useful work produced is equal to the difference between two other quantities of work. This conclusion, can only be of theoretical interest since it is simpler to choose the said pressure and mean molecular weight so that the process as described earlier shall occur spontaneously. In saying this of course, one presupposes that no destructive, entropy increasing process causes sacrifice work in maintaining the circulation. Thus in circumstances where losses exceed a certain value, the final advantage of the invention is only that it enables one to construct, for example, a refrigerator or heat pump of greater efficiency than any yet known, but not so great that the second law, which holds that it is impossible to achieve second order perpetual motion, should still hold true.

When liquid e.g. fluid ammonia forms in the presence of the inert gas or gas mixture, a diffusion of the condensing medium A takes place close to and in the direction of the liquid. The path of this diffusion through the gas is extremely short, but exists nevertheless.

In the course of the cyclic thermodynamic process just described, it is supposed that substance A, which oscillates between the gas and liquid state, be ammonia. But there are many other substances to choose from. Propane (C_3H_8) is one of these. Its pressure-temperature function, i.e. PT-curve, approximately coincides with that of ammonia. Its molecular weight as well as vapour density is higher, and its specific weight in the liquid state lower than that of ammonia, and these characteristics contribute to a considerable lowering of total pressure in the machine. (Other suitable substances A as well as other inert gasses B can easily be found with the aid of physical tables).

The machine could have many such channels 6, 7, 8 and 10 (fig. 2) placed about the axis of rotation. Alternatively (as will be shown by analogy in figs. 14 and 15 and, therefore, have not been included in fig. 2) each channel may be a geometrically circular ring with rectangular cross-section. Each such geometric ring is defined by or formed from two concentric circles whose centres lie in the geometric axis I-I. The channels 6, 7, 8 and 10 thus take the form of concentric cylindors. Channels 3 and 4 may be formed from discs whose centre is also in I-I. All the channels participating in the heatexchange function, whatever geometric form they may have in cross-section, should be narrow enough to achieve a high coefficient of heat transmission between gas- or vapour-stream and solid wall.

Even if circulation in the system occurs spontaneously (perhaps against expectations, according to Clausius' theory) it may be useful to control the circulation through two pumps, one each for liquid and gas. The pumps are built into the hermetically sealed system and so absorb no work except that lost to friction. They are conveniently driven by three-phase induction motors whose armatures are also built in. If circulation does occur spontaneously "against expectations" we will have (as mentioned) a second order perpetual motion in reality, which as yet the second law does not permit us to believe. In whichever case, this machine also will be more efficient than any existing refrigerator of heat pump.

Heat may be taken to and from the hermetically sealed machine with the aid of another system (presented in greater detail in connection with fig. 14) which is fixed to the machine and rotates with it. If these rotate in very low air-pressure, unnecessary losses through friction can be avoided. This second system, whose technology is familiar, need not be hermetically sealed. A fluid oil is driven or circulates within it.

If heat is to be transferred from the high temperature of the hermetically sealed system to its low temperature, this may be done by means of an ordinary steam engine which will release useful work.

In the entropy-reducing perpetual motion processes described above, mentioned the path of diffusion of substance A through, out of and into substance B was very short. Other such processes were mentioned, in which the path of diffusion was many times greater. These we will now describe with reference to figs. 6 - 16.

Fig. 6 represents a hermetically sealed vessel 21 of convenient material e.g. steel. The vessel contains a beaker 22 of other suitable material such as glass which has low thermal conductivity. We suppose that the bottom 22a of beaker 22 is porous glass, china clay or other such suitable material. The beaker stands on a thin porous tile 23 which covers the bottom of the vessel 21. There is thus contact between bodies 22a and 23. We also suppose that the beaker 22 is filled nearly to the brim 22b with a suitable liquid 24 substance A. The upper surface of this liquid 24 is marked y", which also designates a level. The brim 22b of the beaker and the surface y" lie very close to the ceiling 21a of vessel 21. The substance A may be propane (C_3H_8), ammonia (H_3N), water et al. The remaining volume 25 of vessel 21 contains of course, gas or vapour of substance A. It also contains substance B in gaseous state. A mixture of the heavy inert gases sulphur hexafluoride SF_6 and xennon X is suitable. The whole device is at room temperature T_0 and is subject to a force-field expressed as ng, where g is earth gravity and n a variable factor. Assume that heat Q can leave the device only through the porous tile 23 and enter it only through the liquid surface y". We choose the partial pressure of B so that the mean specific weight of the gas mixture in chamber 25 equals the specific weight of the liquid 24. When B is composed of said substances SF_6 and X, the said partial pressure is of the order of 100 atm.

Suppose that the value of n is between 60.000 and 100.000, which is easily achieved centrifugally. Assume for practical purposes that force-field ng is the same throughout the inner volume of vessel 21. Suppose finally that substance A is propane (C_3H_3), which happens to have a fairly high molecular weight or vapour density and fairly low specific weight in liquid state.

For reasons which will be clarified shortly, when we consider figs. 7 and 8, we have the right to assume that the following can take place. The propane evaporates under partial pressure p" from the surface y", whose temperature in dynamic equilibrium is T_2. Force-field ng causes propane vapour to diffuse downward through the inert gas (SF_6 and X) in chamber 25, following which it condenses under partial pressure p' at the floor 23, whose temperature in dynamic equilibrium is T_1. One then has $p' > p''$ and $T_1 > T_2$. In this process, then, heat passes of itself from a lower to a higher temperature, since no work is required to maintain force-field ng if small frictional losses are discounted. As has just been said, this is merely yet an assumption. But in considering figs. 7 and 8 we will begin to see how great the possibility is that the assumption accords with reality.

Now designate a fraction of the pressure p' as $p'\beta$, and a fraction of p'' as $p''\beta$. The existence of these fractional pressures is analogous to conditions already described in conjunction with figs. 1 to 5, that is to say that β-molecules of propane are forced from the liquid into the gaseous state by the inert gas. Clearly $p'\beta > p''\beta$, since the pressure of the inert gas due to the action of force-field ng is greater at the floor 23 than at the surface y''. This difference, $P'\beta - P''\beta$, tends to lower the temperature T_1 immediately above the floor 23 or, expressed another way, the propane molecules coming down from surface y'' have difficulty penetrating the zone immediately above the floor 23 because some of the space is already taken by the β-molecules that are generating pressure $p'\beta$. This phenomenon appears to indicate that the molecular weights of substances A and B could be chosen relative each other so as to eliminate the perpetual motion effect attempted to be obtained.

As an example of substance A was named propane (C_3H_8) as was mentioned its relatively high molecular weight. It is, however, considerably less than that of sulphur hexafluoride and xenon, which mixture was named as an example of substance B. Now exchange the latter mixture for hydrogen, or hydrogen plus nitrogen (H_2,N_2). The pressure in the device, which was previously of the order of 100 atm, will now of course be several times greater since the weight of the gas column in chamber 25 must equal that of the liquid column in beaker 22. It is now easier to visualise that the propane vapour diffuses downwards through the inert gas to the floor 23 and there condenses at a higher temperature T_1 than the temperature T_2 at which it evaporated from surface y". One can believe this because both hydrogen and nitrogen are considerably lighter than propane. For analogous reasons one could visualise diffusion of A against the direction of force-field ng instead of with it; that the floor 23 and condensation at higher temperature at the surface y", if one simply exchanged the propane for ammonia (H_3N) which has a low molecular weight, and used SF_6 and X as previously mentioned for the inert medium B. In this case the force engendered by the β-molecules is acting in the same direction as diffusion.

That said about fig. 6, further detailed explanation is not possible due to lack of experimental data. A formula exists for deriving values of p'β and p"β, but it cannot serve, partly because it is based on the assumption that Clausius' theory is generally applicable and partly because of lack of data. Fig. 6 will, however, emerge clearly after discussion of fig. 7 and 8, partly because it is closely related to them and partly because a description of them is not hindered by any lack of experimental and theoretical data in the case where diffusion of A through B takes place against the direction of the force-field ng.

The vessel 30 in fig. 7 corresponds to vessel 21 in fig. 6 above. In this vessel 30 is a beaker 31. A partition 34 divides the interior of the beaker into two parts, 35a and 35b. These spaces communicate with each other through the opening 36 at the bottom of partition 34 and through the opening 37 over the top of partition 34, which does not reach fully to the brim of beaker 31. Out of the bottom of beaker 31 runs a short channel 38 reaching almost to the bottom 30' of vessel 30. Chambers or channels 35a and 35b together with the partition 34 can form a heat exchanger 35. The interior of the vessel 30 outside beaker 31 is divided by a wall 40 into two parts, an upper chamber 30a and a lower 30b, which chambers are connected only by the gas pump or compressor 41. The bottom of beaker 31 is covered by a porous tile 42 whose upper surface is itself covered by a semi-permeable coating or membrane 44 which is hermetically sealed to the interior surface of beaker 31. In this connection it may be mentioned that it is known that a liquid which is not or is very little soluble in the liquid with which it is in contact, can function as a semi-permeable member. However, at least for the time being one assumes that membrane 44 is a common membrane of the prior art.

Beaker 31 is almost entirely filled with a suitable liquid whose free surface y" (which also denotes a level) lies between the upper edge of partition 34 and the brim of said beaker. This liquid also occupies the pore of the semi-permeable membrane 44 and the tile 42, channel 38 and, as a thin layer, the bottom of chamber 30b up to the level y' which may also be described as the free surface of the liquid in that chamber. One presupposes that the two said free surfaces of the liquid are maintained by convenient means at the constant levels y' and y". Apart from that occupied by the liquid, the entire remaining volume of vessel 30 contains gas or the liquid vapour.

Assume (only for example) that the liquid is ammonia.

Temperature of the upper part of the vessel 30 may be denoted T_2, of the lower part T_1, and of the surroundings T_a. The whole apparatus is subject to a force-field ng.

Assume n = 1, i.e. the apparatus is subject only to gravity, with ambient temperature throughout, $T_1 = T_2 = T_a$. Now let T_1 rise to e.g. 50°C and let T_2 sink to e.g. -10°C and in doing so the force field n must be raised from 1 to a value designated n_0, which is precisely enough to keep the liquid levels y' and y" unaltered. Vapour pressure p' of the ammonia in chamber 30b is that which obtains at the exemplary temperature T_1, i.e. 50°C, and this value for p' will remain constant during the argument which follows. On the other hand, as will soon show, vapour pressure p" above surface y" will vary. At this stage of course, p" is the vapour pressure of fluid ammonia at the exemplary temperature T_2, i.e. -10°C. In order to maintain the value of T_1 and T_2 start up the pump or compressor 41. Ammonia vapour is pumped from chamber 30a and pressure p" to chamber 30b and pressure p'. The ammonia boils away from the liquid surface y", absorbing heat, and condenses at liquid surface y' emitting heat. The liquid formed from condensation at temperature T_1 flows against the force-field ng through channel 38, the porous bodies 42 and 44 and the channels 35a and 35b, finally reaching the low temperature T_2 where it changes to vapour. The arrangement functions just like an ordinary compressor refrigerator. It will be supposed that the cycle takes place without loss and that the work required, delivered only to compressor 41, has consequently the minimum value given by Carnot's equation, which work will be called L_c. It should be mentioned that, for the cycle to take place without loss, liquid must pass from T_1 to T_2 by means of a reversible process which delivers a little work to the compressor 41. This consideration is elementary and so need not be amplified. The gas compressor 41 could be exchanged for a liquid pump by which liquid ammonia in chamber 30b would be pumped into beaker 31, and in this case the gas pressure p' would be generated solely by the force-field ng acting on the gas in chamber 30a and, if T_2 is constant, T_1 would clearly be a function of n.

Now shall be investigated how one may minimise the work sacrificed, or arrange that it is less than L_c without, of course, reducing the quantity of heat that is to be transferred from the lower temperature T_2 to the higher T_1. In the fluid ammonia in beaker 31 now dissolve a substance such as a salt or a mixture of two salts e.g. $LiNO_3$, NaJ, KJ, $NH_4NO_3KNO_3$ or KNO_2. Said substance may of course also be a liquid which is wholly or partially soluble in the substance A (e.g. H_3N). All these substances have considerably greater molecular weight than ammonia. One must of course take care that the addition of the salts does not give too great a volume of liquid in beaker 31. Thus arrange in some way that the liquid circulates through heat-exchanger 35 in the direction indicated, and it shall be assumed that no heat losses occur, i.e. that it is completely efficient efficient. The dissolved salt has a high osmotic pressure which seeks to draw liquid from the chamber 30b through the membrane 44. In order to maintain equilibrium so that the liquid level in chamber 30b will remain unaltered at y' and similarly the liquid level in beaker 31 unaltered at y", one must increase the value of factor n, say from n_o to n_1.

Now, work will be released in the heat exchanger 35 since the liquid flowing upwards through channel 35a contains a little more ammonia and, therefore, has a lower specific weight than the liquid flowing downwards in channel 35b. But theoretically this work can be retained and passed on to the compressor 41. For this and other physical reasons which need not be described, one may disregard this phenomenon; that is, may fairly assume that the work dissipated by the heat-exchanger is nil or, in the case of combinations other than ammonia and a salt, that the work consumed by it is likewise nil. The apparatus described here functions in a manner equivalent to an ordinary so-called resorbtion refrigerator, and it follows that since no irreversible losses occur, the work that must be transferred to the compressor 41 remains constant or equal to L_c. Since the vapour pressure p' of the pure ammonia above surface y' remains unaltered, T_1 being constant, and since the work required by the process according to Carnot also remains unchanged, T_2 and the quantity of heat to be transferred from T_2 to T_1 both likewise being constant, then the pressure immediately above the compressor, P_x, and with it the factor $p' - p_x$ which is proportional to the work, must also remain unaltered in spite of the increase of factor n from n_0 to n_1. All these conditions follow from Carnot's equation, hence a physical-chemical proof is not required. Further, no perpetual motion process exists in this case.

Now stop circulation of the liquid in the heat-exchanger 35 and keep factor n unchanged at the value n_1. The salt concentration immediately above the membrane 44 now rises due to diffusion of the salt downwards under the influence of force-field ng. The small amount of fluid ammonia at the bottom of chamber 30b, in channel 38 and in the porous tile 42 is new drawn up through the membrane 44 into the beaker 31. Ammonia gas makes contact with the underside of membrane 44 and the liquid filling each pore in the membrane acquires a concave surface facing downwards towards chamber 30b. These surfaces are concave since, if menisci were to form in the downward-facing pores of the membrane 44 in the absence of diffusion, they would be plane; surface y' being plane. When diffusion takes place osmotic pressure builds up, and the menisci must become concave to withstand it. The gas pressure p' sinks in consequence. Salt concentration in the upper part of the beaker falls due to diffusion downwards of the salt under the influence of force-field ng. As a result gas pressure p" increases and with it gas pressure p_x. Thus the difference between the pressure p' and p_x has been reduced and in consequence less work needs to be supplied to the compressor for it to move the same quantity of heat from T_2 to T_1. This work which we will call L_p is thus less than L_c, which (according to what has already been stated) implies that the process is perpetual motion of the second order.

When L_p is greater than zero but less than L_c ($L_c > L_p > 0$) the process may be described as incomplete second-order perpetual motion. When L_p is equal to or less than zero ($L_p \leq 0$) the process may be called complete. When T_2 is equal to T_1, p_x is greater than p' and the compressor then functions as a motor, delivering mechanical work. This also means that $L_p<0$. It will been seen from this that, at a certain difference between T_1 and T_2, L_p will equal zero. This condition will now be illustrated.

Assume that the machine is functioning as a resorbtion refrigerator. The liquid is circulating in the heat-exchanger 35. Suppose $T_1 = T_2$. The machine is pumping heat from T_2 to T_1 but since $T_1 = T_2$ and thus $\Delta T = 0$ the work required by the pump equals zero, in accord with the ordinary laws of thermodynamics. Thus $p_x = p'$. We now stop the circulation of liquid in the heat-exchanger 35. Diffusion of the salt causes p' to fall and p'', also p_x, to rise. Thus $p_x > p'$ and the compressor 41 now functions as a motor or steam engine. At a certain value for T_1, $P_x = p''$. The machine then delivers no work, that is, the compressor 41 no longer functions as a motor, and the machine becomes merely a refrigerator - a perpetual motion refrigerator.

In a case where there is no circulation in the heat-exchanger (as in the preceding paragraph) the partition 34 can be removed and the beaker 31 could contain, instead of the ammonia, a mixture of two liquids of limited solubility. This could be advantageous in certain circumstances which will not be described in further detail. Suffice it to say that a perpetual motion process could also be induced in this case.

In fig. 7 the previously mentioned point u'' is formed at the upper surface of membrane 44 while u' clearly coincides with surface y''.

Fig. 8 differs only slightly from fig. 7. Two channels 52 and 53 lead out of the bottom of beaker 31 down to the bottom of vessel 30. In each is a liquid pump 52a and 53a. One of these, say 52a, pumps out liquid from beaker 31 while the other pumps liquid into it. so that the liquid is an ammonia-salt solution. Liquid is circulating in the heat-exchanger 35, compressor 41 is functioning and force-field ng is operative. The ammonia is absorbed at surface y' and is then pumped into beaker 31 by liquid pump 53a. Heat is emitted at the higher temperature T_1 and absorbed at the lower temperature T_2. The process is assumed to be reversible, and so the work sacrificed is the same as the value given by Carnot, L_c, i.e. the difference between work demanded by 53a and work delivered by 52a, plus work demanded by compressor 41. The said difference is almost exactly equal to the work required (we will call it L_A) to pump the amount of ammonia in question (substance A) in fluid state, from surface y' to the bottom of beaker 31. It is exactly equal to $L_A - \Delta'L$ where $\Delta'L$ is a correction term dependent upon a certain shrinkage of volume which takes place when the fluid ammonia mixes with the fluid salt solution. The mean concentration of the latter may be called C'. We now stop the circulation in heat-exchanger 35 and diffusion begins. The salt concentration of mean value C' now increases at the bottom of beaker 31 to C'', decreases at the top, and of course also increases to C'' at the bottom of vessel 30 through pump 52a. Suppose now that one keeps pressure p' unaltered. Then the difference between work supplied to pump 53a and work delivered by pump 52a also remains virtually unchanged at L_A since, the force-field being constant uniform, the hydraulic pressure at the bottom of beaker 31 is independent of diffusion. In other words (as is self-evident) a salt molecule weights the same whether it is at the top or the bottom of the beaker or, the weight of liquid in the beaker is not dependant on the distribution of salt in it. The exact value of the difference between work demanded and supplied by the two pumps is $L_A - \Delta$ "L". The correction term Δ "L is somewhat larger than the previous term Δ 'L, since C" is larger than C'. The work required from the pumps is now a little less than before, so it is fair to take it as constant. This allows us to disregard the pumps 53a and 52a altogether in the argument which follows.

Now if the gas pressure p' is to remain unaltered as suggested, in spite of increased salt concentration at the bottom of beaker 31 caused by diffusion, the temperature T_1 must be raised, say to ϕ T_1 where $\phi > 1$. But if T_2 is held constant at, say, ambient temperature, the gas pressure p" will rise because of the decreased salt concentration in the upper part of beaker 31 similarly caused by diffusion. As p" rises, p_x also rises and it follows that, since p' remains unaltered, the compressor 41 demands less work. Before diffusion began the work demanded by the process was that given by Carnot, L_c. Now the demand is less than L_c, and this in spite of an increase in temperature T_1 to ϕT_1.

This clearly shows the process to be second-order perpetual motion. If it does not to lead to a practical useful perpetual motion machine there must be present, according to Clausius, a destructive process of sufficient intensity. One such is that the diffusion resistance in a liquid is so great that in all probability no difference between T_1 and T_2 will be discernible, in which case our experiment becomes merely imaginary. But not let T_1 and T_2 equal. On the basis of our imaginary experiment and the argument presented with fig. 7 it is now seen that the compressor or machine 41 will deliver a quantity of work.

It should be added that the temperature T_1 at the bottom of vessel 30 ought strictly speaking to be given $T_1 + \Delta T$ on the left side and $T_1 - \Delta T$ on the right side of the vessel, where ΔT is a very small correction depending on the fact that salt concentration is a little higher on the left than on the right. During absorbtion the salt concentration decreases from left to right, since it was assumed that liquid was flowing out of the lower end of channel 52. This variation, however, was of no concern in the theoretical argument accompanying fig. 8.

In figs. 7 and 8 it was noted that the molecular weight of the dissolved substance B (one, or a couple of salts) was considerably greater than that of the solvent A, ammonia. The salt B therefore diffuses downwards in the beaker 31 under the action of force-field ng and then comes to rest, so that the salt concentration at the bottom of the beaker remains greater than at the surface y'' of the liquid, while at the same time ammonia diffuses upwards against the force-field ng and evaporates at the said surface. This is clearly what occurs - the cycle having its causes in simple and well-known natural phenomena. But support that the soluble substance B is arranged in place of the salts - has a considerably lower molecular weight than the solvent, substance A. The concentration B will not be greater at the surface y'' than at the bottom of beaker 31. So it is probable that the process will work in the opposite direction with A evaporating below at surface y' and condensing or being absorbed at surface y'' at a higher temperature, and thereafter diffusing down in the direction of force-field ng through substance B in beaker 31.

Considering the similarity between the process illustrated by fig. 6 and those illustrated by figs. 7 and 8, it is probable that a perpetual motion process could be achieved in accordance with the first-named fig. 6. In figs. 10, 11, 12 and 13, which are closely related to fig. 6, diffusion of A through B occurs in the direction of the force-field, although (as mentioned) it might be convenient to reverse the direction. One has only to select the substances A and B according to requirements.

A process according to fig. 7 could be combined with one according to fig. 6. Suppose for example that the liquid in fig. 7 is ammonia and a salt, and that in chamber 30a there is a light inert gas such as a mixture of nitrogen and hydrogen. Suppose also that the wall 40 and compressor 41 are taken away. Judging from previous considerations, it is probable that the process now induced in the liquid in beaker 31 will abet the process induced in the gas mixture in chamber 30a.

It is well known that a gas diffuses through another gas (as in fig. 6, its closely related other figs. and also figs. 1 - 5) with wastly less resistence than a liquid or salt through another liquid (as in figs. 7 and 8). For this reason a perpetual motion process employing diffusion between gases must be considered to be technically highly viable.

The theoretical arguments put forward in connection with figs. 7 and 8 appear to be incontrovertible, at least when diffusion of A occurs in the opposite direction to force-field ng. This cannot be said, however, for the realization illustrated by fig. 9, probably because here the diffusion of substance A through substance B occurs in the same direction as the force-field, and in this case I am not sufficiently familiar with the physical phenomena involved. Nevertheless, the figure shall be described. It shows an hermetically sealed vessel 49. In this vessel is a pillar 50 of e.g. porous active coal, suitably encased in a gas-tight envelope or skin 50' which, however, does not reach all the way to the base of the pillar, nor cover its top surface. Volume 51 in vessel 49 contains (for example) gaseous ammonia. As is well known, ammonia is forcefully absorbed by active coal. Absorbtion increases as the temperature falls, which means there are more ammonia molecules crowded onto a unit surface of coal at a lower temperature than at a higher. The whole is subject to force-field ng. Assume first that n = 1, that is to say the force-field is equal to the earths gravity. Temperature throughout is equal to the ambient temperature T_0. The specific weight per unit volume of ammonia within the coal pillar is significantly greater than that of the gas in chamber 51. The ammonia in the coal pillar may be considered as a liquid. When factor n is increased significantly over the value of 1, we may suppose that the concentrated (or perhaps liquid) ammonia in the coal pillar travels downwards. Thus equilibrium is disturbed by the force-field. There is reason to believe that evaporation occurs at the bottom part of the pillar, accompanied by a fall in temperature can be expected at the pillars upper surface. Such a phenomenon has not been observable, however, in spite of a value for n of over 2000. Undoubtedly the ammonia molecules are too strongly bound to the coal. It is quite conceivable that ultra sound could act as a lubricant between the ammonia molecules and the coal pillar, but this experiment has not yet been performed. It might be an advantage to replace the coal with fine fibres such as glass, for example, since the ammonia molecules would then travel over smooth surfaces instead of in the matt surfaces of coal. In the event that this phenomenon could be induced using combinations of substances other than those named, it is strikingly similar to the phenomena described in connection with figs. 6, 7 and 8. The points u'' and u' mentioned previously coincide respectively with the upper and lower ends of the coal pillar. As well as gas A, chamber 51 may contain heavy gas of lesser density than liquid A.

Return now to fig. 6. The specific weight of the inert gas in the lower part of chamber 25, i.e. in the vicinity of tile 23, is greater than that of the liquid. There is thus a risk that liquid can gather in a layer at some level between the ceiling 21a and the tile or floor 23. One could then arrange, as fig. 10 shows, a porous rod 62 whose upper tip 62a extends into a tiny chamber 63 which occupies a very small part of chamber 25. This part 63 is thermally isolated from the remaining larger portion of chamber 25 by a screen 64. A small quantity of heat may be supplied electrically to the tip 62a of rod 62, by which means the liquid in the said layer is taken up in the rod and eventually evaporates off, the vapour then being carried by the force-field ng towards the floor 23 where it condenses. It is simpler, however, to do as shown in principle in fig. 11. The interior 25 of vessel 21 contains (for example) propane, sulphur, hexafluoride and zenon. The pressure of the inert gas mixture is great enough - something up to 100 atm. at room temperature -- that a thin layer 55 of propane is always at the ceiling of chamber 25. Under the influence of force-field ng propane evaporates from this layer at a certain partial pressure p_2 and temperature T_2. Propane vapour condenses at the floor of chamber 25 at a certain pressure p_1 and temperature T_1.

When a drop has formed on the floor and grown large enough for its buoyancy to overcome adhesion, it floats up and joins the liquid layer 55. To facilitate heat transfer from condensing vapour to the floor, the latter may be provided with a large number of small studs 56 of a heat conducting material. They are shown as being pointed upwards, in which case the drops will be fairly small. If the drops are to become larger before detaching themselves, the studs must be made blunt or given other appropriate configeration. Of course the ceiling may be similarly studded to facilitate heat transfer to the liquid layer 55.

Fig. 12 shows a porous tile 57 of e.g. porcelain covering the bottom of the vessel 21. Standing out of this tile 57 is a porous pillar 58 of porcelain or other material having low thermal conductivity. A layer of fluid propane at the ceiling of the chamber 25 is marked 55 as in fig. 11. Fluid propane travels out of tile 57, where propane vapour has condensed, through pillar 58 up to the ceiling where it rejoins the layer of liquid 55. The movement occurs because the liquid is lighter than the gas.

In figs. 11 and 12 temperature T_1 is higher than T_2, since pressure p_1 is greater than p_2. Heat thus passes of itself from a lower to a higher temperature, as long as the force-field ng is operative. We have not yet touched on the destructive entropy-increasing process which, if Clausius' theory is generally applicable, must reveal itself if the processes illustrated in figs. 6, 10, 11 and 12 are not to be second-order perpetual motion. Suppose that a symptom of such destructive process is that the pressure and there with the specific weight of the inert gas (eg. SF_6 and X) may not be great enough to float the fluid propane all the way up to the ceiling of chamber 25 by itself. The liquid must then be pumped up the last part of the way by pump 70, shown schematically in fig. 13. Pump 70 is thus both suction and pressure pump. The liquid, now somewhat heavier than the gas in the upper part of chamber 25, flows out of the pipe 71 into the trough 72, of which many such can be placed at this level. From trough 72 the liquid evaporates at the lower temperature T_2. The vapour diffuses downwards and condenses on the porous tile 57 at the higher temperature T_1. It is possible that this destructive process could be intense enough to make Clausius' theory valid in this case also. But it cannot be so intense, that significantly improved efficiency over an ordinary compressor refrigerator cannot be won. Because condensation at the floor takes place in a higher partial pressure of the gas mixture than evaporation at the ceiling, less heat is emitted at the higher temperature T_1 in the course of the thermodynamic cycle - it having been stated that heat released by condensation diminishes under increased pressure of an inert gas. This carries the inescapable conclusion, according to the first law, that to keep the process in function now requires less work.

It may be interesting to note that the inert gas or gas mixture, substance B, behaves as a semi-permeable body which transports substance A when that is a vapour or gas but not when it is a liquid (figs. 6, 7, 8, 10, 11, 12 and 13).

In accordance with previous observations, liquid of A (e.g. H_3N, H_2O) may have higher specific weight than gas of B (e.g. SF_6, X) but lower molecular weight. Diffusion will then occur in the opposite direction to force-field ng. In fig. 11 for example, the liquid 55 would lie at the floor instead of the ceiling in vessel 21. Substances A and B are chosen to suit requirements. In the following figs. 14 and 15, A and B are assumed to be so chosen that diffusion occurs in the direction of the force-field.

Fig. 14 shows, in principle, a practical realization of the invention. Several containers 21^1, 21^2 etc. are grouped together so that the floor of one is the ceiling of the next. The force-field ng is produced by rotation as before. The geometric axis of the axis of rotation is marked C-C. Each container encloses a circular chamber 25^1, 25^2 etc. Whose geometric axis is the same as the above. The chambers contain propane and inert gas. The force-field ng is proportional to the mean radius of each chamber and thus the temperature difference between floor and ceiling, if all the chambers are the same height, will be least in chamber 25^1 and greatest in the chamber on the periphery, 25^5 in the drawing. The temperature differences are additive. Heat is supplied to a low temperature T_2 by means of the liquid flowing through channel R_2, and drawn off from the higher temperature T_1 through channel R_1. The channels are shown only by dotted lines. The inflow and outflow ends of these channels lie in the immediate proximity of the axis of rotation C-C. To avoid unnecessary energy losses the whole rotates in a high-vacuum chamber, whose housing has not been illustrated.

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In fig. 15 the axis of rotation is marked C-C as before. Only three chambers are shown, 25^1, 25^3, though of course the number may be greater. The geometric axis of each chamber coincides with said axis C-C. The material of the wall 81 enclosing each chamber is suitably steel of the highest possible tensile strength. Parts 81a to left and right of the drawing are suitably joined to the rest of walls 81 by a seam weld 82 (fig. 16). The inner wall 81 of chamber 25^1, i.e. that nearest to axis C-C, rests on or is shrunk onto an axle 83. The inner wall of 25^2 lies against the outer wall of 25^1 etc. To the left and right in each such chamber is a plug 84 of glass, porcelain or other material of low thermal conductivity. Each such plug may be divided in sectors to prevent random breakage and destruction (not shown in the drawings). The axle 83 is fitted at its ends 83a and 83b in a static housing 85. This consists of a part on the right with a similar part on the left, 85b and 85a, and a central part 85c which is hermetically sealed to the said two parts by soldered seams 86a and 86b. The whole housing is thus hermetically sealed. It communicates with the surroundings only by removal of a screw 87. The extremeties of the housing to left and right are marked 85a' and 85b'. The axle 83 contains a circular chamber 83c whose geometric axis coincides with axis C-C. The diameter of this chamber increases from the centre outwards towards the ends of the axle, giving conical inner surfaces to a part to the left and a part to the right in this chamber. The chamber communicates with its surroundings only by removal of screw 88. The chamber contains a small quantity of a liquid and its vapour, which can be ammonia, propane or any other suitable substance.

That wall 81 having the greatest diameter rests in a cylinder 89. The wall of this cylinder is thicker and stronger than said wall 81. The ends of axle 83 have a very slightly smaller diameter than the inner diameter of the ends 85a' and 85b' of housing 85. The gaps 90 are thus very narrow, preferably only a fraction of a millimeter. Similarly the gap between housing 85c and cylinder 89 is very small. The volume between the static housing and the body composed of components 83, 81 and 89 rotating about axis C-C, is suitably filled with hydrogen. The pressure of this gas is low but not so low that its thermal conductivity is markedly less than at atmospheric pressure. A fraction of a torr is the right order of magnitude. The chambers 25^1, 25^2 etc, contain the same substances A and B as previously named in connection with figs. 6, 10, 11, 12 and 13. Substance A can then appropriately be propane and substance B a mixture of xenon and sulphur hexafluoride at the states pressure. These substances are pumped into each chamber through a short channel 82' (fig. 16) which is afterwards closed by welding or soldering. A pillar 58 and pump 70 such as shown in fig. 13 may be used here but is not shown since it is similar. Assume, now, for the sake of clarity that the thermodynamic process taking place in a machine such as that in fig. 15, is a complete second-order perpetual motion. Reinforced by the previous arguments, and knowing that the general applicability of Clausius' theory has not been proved, this assumption, which is in the interests of simplifying the description to follow, may be made.

The axle 83 and its constituent bodies 81, 84 and 89 may be set in rotation by the same means as the rotor in an ordinary three-phase induction motor. The stator is fixed round part 85a' or 85b'. In every chamber 25^1, 25^2 etc. vapour of substance A (eg.propane) condenses on the floor, that is to say the surface in the chamber furthest from the axis of rotation C-C, while liquid of the same substance evaporates from the ceiling of the chamber, or the surface nearest the axis of rotation. If the centrifugal force in the outer chamber (25^3 in fig. 15) is in the region of 10^5g and the distance between floor and ceiling is 1 cm, there can be a temperature difference between them of 5° to 10°C. This value is dependent upon the mean temperature in the chamber. If it is too little, another substance other than propane may be chosen for that particular chamber. Since the mean temperature is higher in the outer chambers it will often be advisable to have different substances A in the different chambers.

A quantity of heat, eg Q/2, enters through each part 85a' and 85b', passes easily through the hydrogen in gaps 90 and makes its way in through both ends of the axle 83. Here it causes the liquid of an appropriate substance eg ammonia, to boil. The ammonia condenses on the central parts of the wall of chambers 83c, wherewith heat at, say, temperature T_2, is transferred to the ceiling of the innermost chamber 25^1. Ammonia - the condensate - flows back under the action of centrifugal force to the two ends of chamber 83c. These could be appropriately joined by a channel, preferably straight and so formed that no more condensate could accumulate in one end of chamber 83c than in the other. (Such a channel is not shown in the drawing). The quantity of heat 2 x Q/2, i.e. Q, passes from cylinder 89 through gap 91 to the housing 85c, and on to where it will be used. The incoming heat has a lower temperature than the outgoing.

Heat conduction from floor to ceiling within each chamber (25^1, 25^2 etc.) is retarded by the presence of bodies 84, whose low thermal conductivity requires the heat to travel the long way round through the metal parts 81a.

Suppose that work must be sacrificed to pump liquid A from floor to ceiling in each of the chambers 25. Such a device can be constructed with known means in several ways, all simple, for which reason none are shown in the drawing. It should be added that if work is required it must be introduced into chambers 25 in such a way that they remain hermetically sealed. This could be done electrically, magnetically or with the aid of an elastically resilient membrane. As previously shown, if such work must be sacrificed, the machine at the very best will only show an incomplete second-order perpetual motion contrary to Clausius' theory; otherwise it will constitute a refrigeration plant or heat pump of greater efficiency than any such known, but not in contravention with the theory.

It may be mentioned that there is advantage to be gained in choosing substance A so that its critical temperature is not too much greater than the temperature in which it will be used, but is of a technically optimun value above the latter. In this way total pressure in the chambers 25 will be minimised, whereby the temperature difference between floor and ceiling will be maximised.

When substance B is an inert gas such as SF_6 and X, it is very slightly soluble in the liquid substance A, and to a small extent will share in A cycle, oscillating between two states of matter, but in the main, the state of matter of substance B is constant.

The temperature difference won by the process can of course be used to drive a steam engine which delivers work. If the process takes place at a very low temperature, say -100°C or lower, and work is delivered at that mean temperature, heat passes to it from the ambient temperature T_0. This transfer of heat can take place via another steam engine which will thus also deliver work.

Finally it must be said that as a matter of course losses occur in the system, such as through vibration in the centrifuge and friction in its bearings. There are also conduction losses in the material. These, and perhaps others could be (as suggested) so great that the second law of thermodynamics still stands, in spite of the invention being theoretically correct. The techinal usefulness of the invention will then lie only in the increased efficiency it can bring to an ordinary refrigeratore, heat pump or thermal power machine. Nevertheless the invention is highly significant.

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The claims defining the invention are as follows:-

1. A method for transferring heat energy by means of a cyclic thermodynamic process which method comprises providing a medium comprising a substance (A), which passes through liquid and vapour states during the process, and a substance (B) different from substance (A), separating (A) from (B) at a first location point by inducing a change of state in substance (A), reversing the change of state of (A) at a second location point, maintaining a pressure differential between said two points by subjecting the medium to a force greater than that of gravity, combining (A) with (B), and allowing (A) to return to said first point from the location point of combination by diffusion through substance (B), whereby heat is transferred from the one of said points at which (A) vapourises to the other of said points at which (A) condenses.

2. A method as claimed in Claim 1, wherein (A) is combined with (B) at said second point.

3. A method as claimed in Claim 1 or 2, wherein said pressure differential is maintained by subjecting said medium to an accelerative force.

4. A method as claimed in Claim 3, wherein the accelerative force is provided by a centrifugal force field.

5. A method as claimed in any preceding claim, wherein (B) is a gas and separation is induced by condensing (A).

6. A method as claimed in any preceding claim, wherein (A) is propane and (B) is an inert gas.

7. A method as claimed in any one of Claims 1 to 5, wherein (A) is ammonia or water and (B) is an inert gas.

8. A method as claimed in any one of Claims 1 to 4, wherein (B) is a solid dissolved in (A) and (A) is separated from (B) by

evaporation of (A).

9. A method as claimed in any one of Claims 1 to 4 and 8, wherein (A) is ammonia and (B) is a salt.

10. A method as claimed in Claim 9 wherein (B) is sodium iodide, potassium iodide, lithium nitrate or ammonium nitrate.

11. A method as claimed in any one of Claims 1 to 4, wherein (A) and (B) are so chosen that (B) behaves with (A) as a semi-permeable body.

12. A method for transferring heat energy by a cyclic thermodynamic process substantially as hereinbefore described with reference to Figs. 13 to 15 of the accompanying drawings.

13. A method as claimed in Claim 1 and substantially as herein described.

14. Apparatus for carrying out a method as claimed in Claim 1 and comprising a series of coaxial annular chambers mounted for rotation about a common axis and separated from each other by substantially cylinderical walls defining the chamber, and across which chambers heat is transferred radially from a lower temperature adjacent one wall to a higher temperature adjacent a radially spaced wall, the chambers each being filled with a medium comprising a substance (A) which passes through liquid and vapour states during the process and a substance (B) different from (A), supply means for supplying heat to said medium adjacent said one wall and removal means for removing heat from said medium adjacent a radially spaced wall, the arrangement being such that, when the chambers are rotated to create a pressure gradient radially across each chamber thereby subjecting the medium to a force greater than that of gravity, (A) separates from (B) by condensation at one of said walls of each chamber and combines therewith by vapourisation at the

other of said walls of each chamber, vapour of (A) being carried between the said two walls by diffusion through substance (B), whereby heat is transferred across each chamber from said one wall to the other radially spaced wall.

15. Apparatus as claimed in Claim 14, wherein (A) and (B) are so chosen that diffusion of (A) occurs in a radially inward direction and heat is transferred across said chambers in a radially outward direction.

16. Apparatus as claimed in Claim 15, wherein (A) is propane and (B) is an inert gas.

17. Apparatus as claimed in Claim 14 and substantially as hereinbefore described.

18. Apparatus for transferring heat energy by means of a cyclic thermodynamic process substantially as hereinbefore described with reference to Figures 14 to 16 of the accompanying drawings.

DATED this 30th day of April, 1979.

FONDATION CUM PLATE.

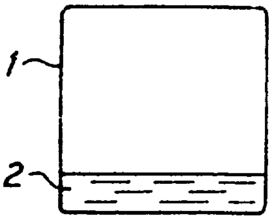

FIG. 1

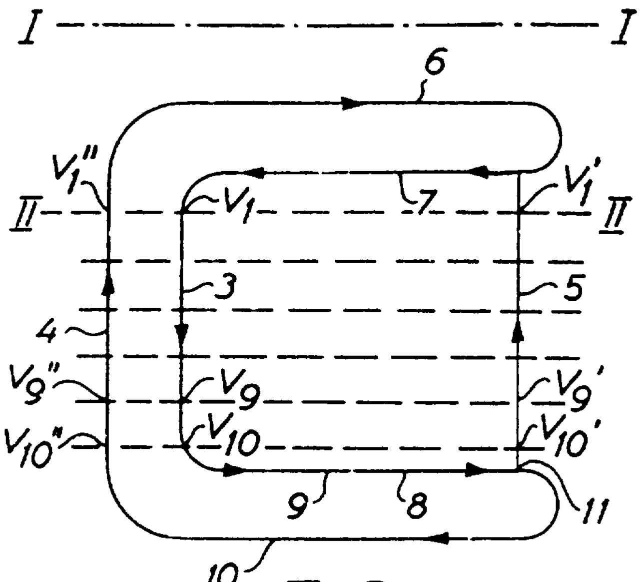

FIG. 2

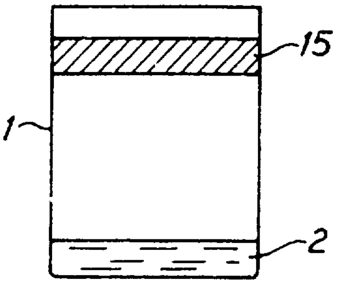

FIG. 3

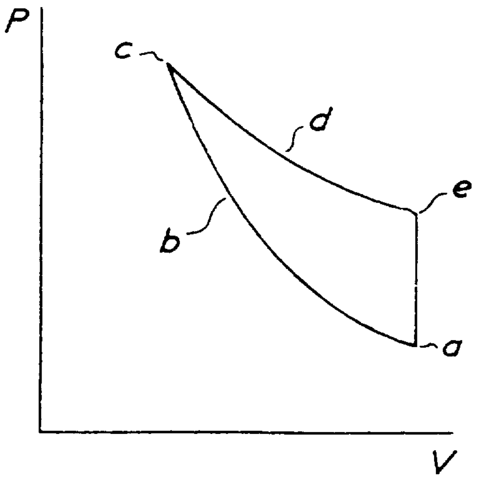

FIG. 4

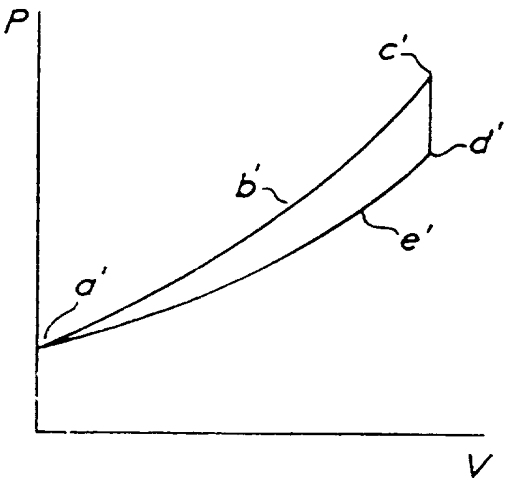

FIG. 5

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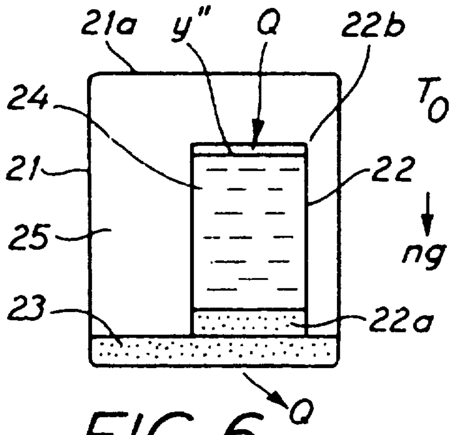

FIG. 6

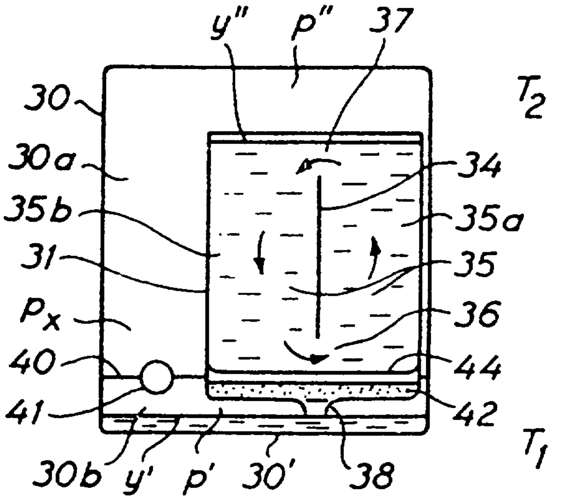

FIG. 7

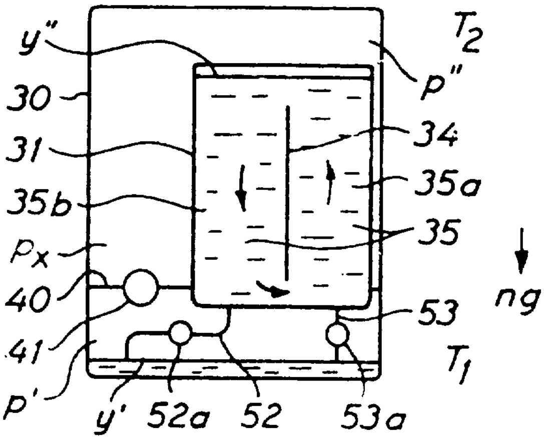

FIG. 8

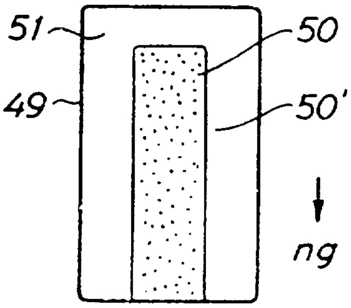

FIG. 9

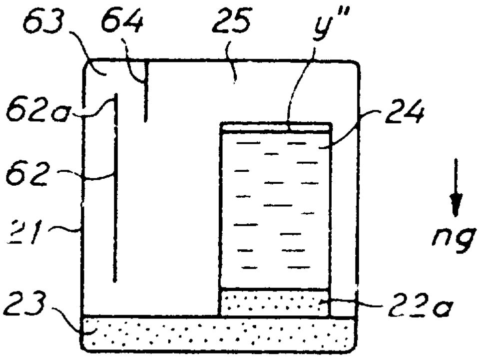

FIG. 10

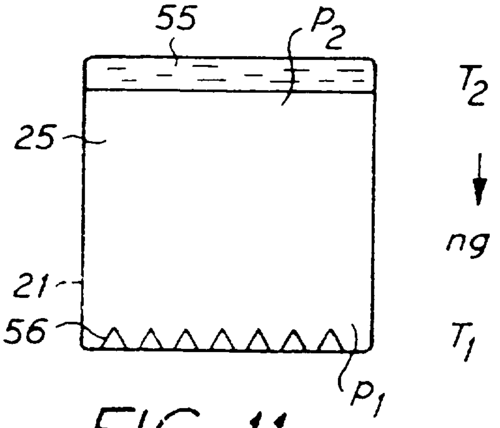

FIG. 11

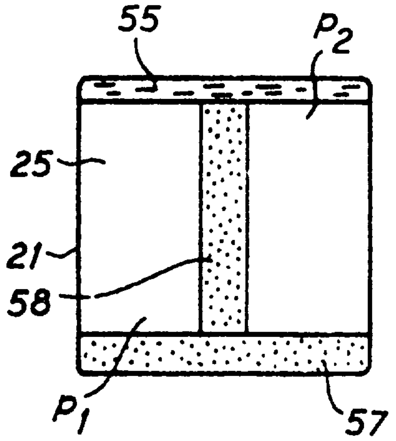

FIG. 12

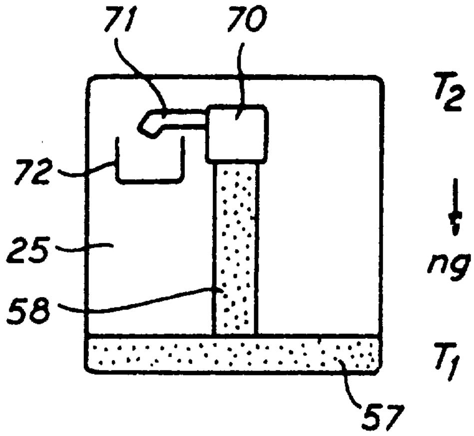

FIG. 13

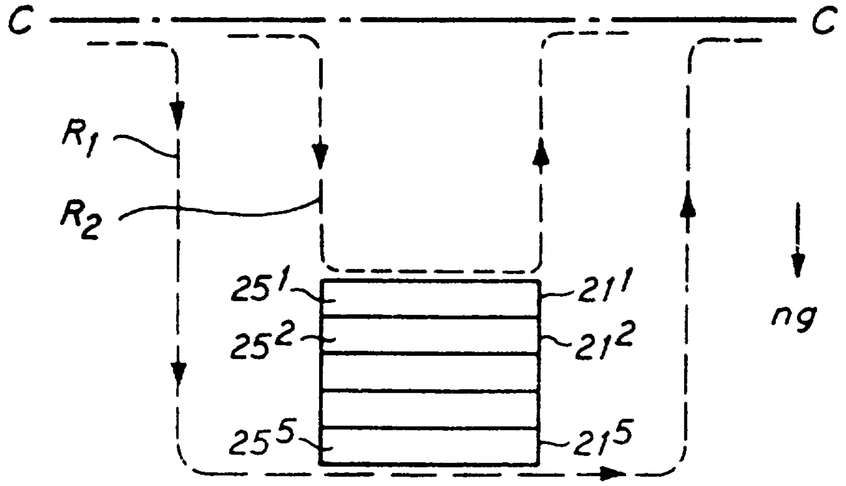

FIG. 14

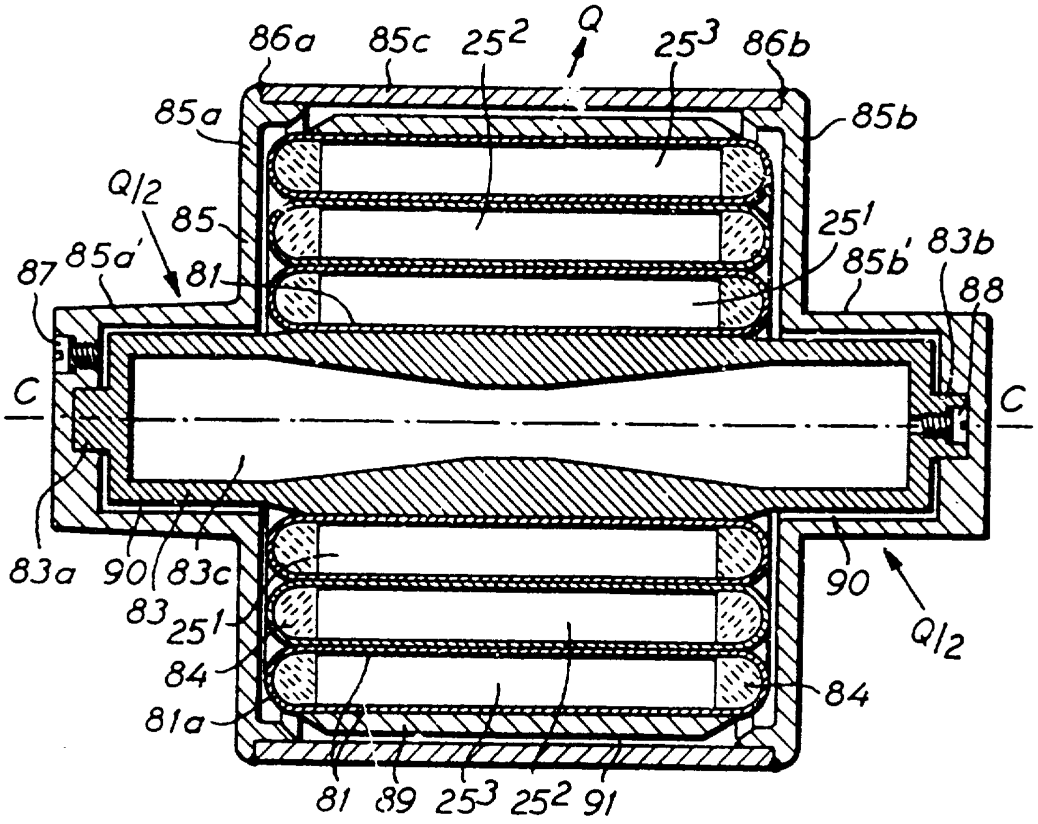
86a
85c
25^2
Q
25^3
86b
85a
85b
Q/2
85
25^1
87
85a'
81
85b'
83b
88
C
C
83a
90
83c
83
25^1
84
81a
90
Q/2
84
81
89
25^3
25^2
91

FIG. 15

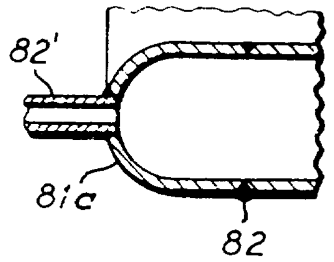
82'
81c
82

FIG. 16