

-1-

SYSTEM FOR SUPPLYING CONSUMERS WITH
HEAT ENERGY, AND APPARATUS THEREFOR

The invention pertains to a system for supplying consumers with heat energy, having a carrier medium heated in at least one heat source. The present invention also relates to distributor devices and collector devices for such a system, and to an apparatus which includes such distributor devices and collector devices, and which serves to control the supply of heated carrier medium to consumers.

For supplying consumers with heat energy, it is known to use environmental collectors, such as solar collectors, waste heat collectors, ground reservoirs, and the like. It is also known, in order to attain a temperature level that meets the demands for heat energy consumers, to raise heat energy of a kind that has a low temperature to heat energy with a high temperature by means of heat pumps.

Since many technical aspects must be addressed in supplying consumers with heat energy, however, the systems known thus far have not met the technical and organizational demands made of them, and for this reason narrow limits are set on such systems in general use:

For instance, the efficiency of environmental collectors, especially solar collectors, is optimal if these collectors are supplied with the carrier medium at a low enough temperature, because only in this way can a large temperature difference be utilized by the environmental collectors so that a high amount of heat energy can be recovered. However, it must be noted that in the majority of environmental collectors, the amount of heat available varies over time. The heat energy that can be removed in environmental collectors depends for instance on the outdoor temperature at the time, which is substantially higher in the summer than in winter and as a rule is higher during the day than at night. The heat energy that can be recovered by means of solar collectors also depends on the position of the sun relative to the solar collector and on the weather. Similar technical aspects pertain to heat collectors of the kind in which the waste heat is recovered from production processes or processing operations, since the amount of heat is dependent on the course over time of these operations. This presents the difficulty that the periods of time in which heat is offered by heat collectors do not match the periods in which consumers of heat energy demand heat, resulting on the one hand in an oversupply of heat energy recovered by heat collectors and on the other in heat consumption that is not covered by the heat collectors.

It must also be taken into account that the carrier medium is output at different temperature levels from different heat

collectors, such as solar collectors, environmental collectors, and heat reservoirs, at the same times; the carrier medium output by various heat sources must therefore never be mixed together, because that would mean that whichever carrier medium is at the highest temperature level would be cooled down to a lower temperature level, with an attendant loss of heat potential. Accordingly, it must be assured that the carrier medium arriving from different heat sources at different temperature levels must be carried to particular consumers of heat energy that are set for those temperature levels.

If a given temperature level is raised by a heat pump to a higher temperature level, to enable supplying certain consumers of heat energy with the heat energy they demand at a high temperature level, then it must also be taken into account that the efficiency of heat pumps is optimal whenever they are supplied with the carrier medium at a temperature value that is within narrow limits. Moreover, in heat pumps there is the requirement that they must remain on continuously for relatively long periods of time, that is, for at least one hour; frequent switching of the heat pumps on and off must be avoided, because otherwise their service life would be greatly shortened. A further aspect is that the maximum capacity of heat pumps must be designed such that they can cover the demand for heat energy even if the supply of heat energy recovered from environmental collectors is low.

Another aspect that must be taken into account in such systems is that in various kinds of buildings, especially hotels, apartment buildings, commercial facilities and factories, not only heat energy but also negative heat energy is needed. In the cold time of the year, especially in winter, heat energy is needed for heating purposes; and over the entire year, heat energy is needed for heating general-purpose water for cleaning uses, for swimming pools, for air-conditioning of rooms, and so forth. All year, negative heat energy is needed for cooling purposes, such as in refrigeration systems for the storage of foods. Since such systems as a rule are located in central regions of buildings, it has been found that the demand for cooling energy in winter is at least as high or even higher than in the summer. The reason for this is that in winter, such buildings are heated, and that heating energy also reaches the refrigeration rooms.

Accordingly, the object of the present invention is to create a system for supplying consumers with heat energy, which has a carrier medium heated in at least one heat source, by which the many aspects discussed above are taken into account, so that as a result such a system meets the technical and organizational demands made of it. According to the invention, this is attained in that the outlet line of the at least one heat source is connected to the inlet of a distributor device associated with it, and that the distributor device is embodied with a plurality of outlets to which the flow lines to

consumers of heat energy at a different temperature level are connected; by means of the distributor device, one of the consumers, to which the heated carrier medium can be delivered, can be selected.

This distributor device thus assures that the carrier medium output by a heat source is supplied to the particular consumer or group of consumers of heat energy for which precisely that temperature level that is output by the heat source is needed.

Preferably, the consumers of heat energy at different temperature levels are connected in series, as a result of which carrier medium can flow through them in succession. Radiators, dishwashers, washing machines, clothes dryers, hot water heaters and floor heating systems can be named as examples of heat energy through which the heated carrier medium flows and which are connected individually or optionally in series; in the process, the carrier medium gives up its heat energy to consumers and is thereby cooled.

Examples of heat sources that may be named are environmental collectors, especially solar collectors, waste heat collectors, heat reservoirs, especially ground reservoirs, and the like. If two solar collectors are provided, which are aimed in different directions, then they give up the carrier medium at different temperature levels. Since then each of these heat sources is assigned its own distributor device, the carrier



medium is directed by means of the respect distributor device to whichever consumer or group of consumers is set to the particular temperature level that the carrier medium output by the associated collector has. As a result, the heat energy is extracted from the carrier medium.

Moreover, further consumers for heat energy at a low temperature level, such as pipelines laid in inner walls, in further floors, in outer walls and the like, may be provided, into which the carrier medium at a low temperature level is introduced, as a result of which on the one hand the heat energy contained in it is stored and on the other insulation is brought about, thus enabling climate control of rooms. Moreover, at least one energy reservoir, such as a ground reservoir, may also be provided.

Preferably, the system includes a further heat source in the form of a heat pump. To feed the heat pump, at least one collector device is provided, at whose inlets the return lines of the consumer or consumer groups at a different temperature level are connected, and whose only outlet is connected to the inlet of the heat pump. This makes it possible to take into account the fact that a heat pump functions with optimal efficiency as long as it is supplied with a carrier medium that has a narrowly defined temperature value. By means of the collector device, the particular return line from a consumer or consumer group or one among the plurality of consumers or

consumer groups that consume the heat energy can be selected that has the carrier medium at the temperature level required for the heat pump, and this medium is carried to the heat pump. In the heat pump, the temperature level of the carrier medium is raised to the value required for supplying the heat energy consumer. The feeding of the carrier medium is done via a distributor device associated with the heat pump, and by this device the particular consumer that is to be supplied with heat energy from the heat pump can be selected.

In the energy reservoir, the storage of excess heat energy takes place, and this heat can then be extracted whenever too little heat energy is output by the environmental collectors.

A system according to the invention, distributor and collector devices of the invention, and an apparatus according to the invention are described below in detail, in terms of exemplary embodiments, shown in the drawing. Shown are:

Fig. 1, a system according to the invention in a schematic view;

Fig. 2, an apparatus according to the invention, in an axonometric view; and

Fig. 3, an apparatus according to the invention in an axonometric view, with some components left out.

A system according to the invention includes two distributor devices 1 and 2, to the individual inlets of which the outlet lines 10 and 20 of two heat sources are connected. The heat sources are embodied by way of example by environmental collectors, especially solar collectors A and B, waste heat collectors, ground reservoirs, or the like. The lines 11-19' and 21-29' connected to the outlets of the respected distributor devices 1 and 2 are connected to flow lines 71-79' for consumers of heat energy at different temperature levels. The return lines 71a-79a from the consumers are each connected to the flow lines of the next consumer of heat energy in sequence. Thus the return line 71a is connected to the flow line 72 for a second consumer of heat energy.

The flow lines 71-75 lead to a group of five consumers of heat energy at a high temperature level of approximately 80°C to approximately 30°C, such as, first, radiators; second, machines such as dishwashers, washing machines, dryers and the like; third and fourth, hot water heaters; and fifth, floor heating. The flow lines 76-79 lead to a second group of consumers of heat energy at a low temperature level of approximately 25°C to 20°C, such as lines in inside walls, inside floors, outer walls, and in two different ground reservoirs.

In addition, a third distributor device 3 and a fourth distributor device 4 are provided. The return line 80 of a heat pump 8 is connected to the single inlet of the third

distributor device 3. The outlet lines 31-34 of the third distributor device 3 lead to the flow lines 71-74 of the consumers of heat energy at a high temperature level. A line 90 that comes from a refrigeration system 9 is connected to the single inlet of the fourth distributor device 4. The outlet lines 41-44 of the fourth distributor device are connected to the flow lines 77-79' of the consumers of heat energy at a low energy level.

Two collector devices 5 and 6 are also provided. The inlet lines 51-54 of the first collector device 5 are connected to the outlet lines 12-16 and 22-26 of the two distributor devices 1 and 2 that lead to the flow lines 72-75 for consumers of heat at a high temperature level. The sole outlet line 50 of the first collector device 5 leads to the heat pump 8. The inlet lines 61-65 of the second collector device 6 are connected to the lines 16-19' of the first distributor device 1 and the lines 26-29' of the second distributor device 2 that lead to the flow lines 76-79' to consumers at a low temperature level. The sole outlet line 60 leads to the heat pump 8.

The heat pump 8 includes an evaporator 81 and a condenser 84; the outlet of the evaporator is connected to a compressor 83 via a line 82. The line 60 leading from the collector device 6 to the heat pump 8 includes a mixing device 85, which communicates by means of a line 86 with a three-way valve 87. A pump 89 is also located in a line 88 that leads from the

mixing valve 85 to the evaporator 81. The refrigeration system 9 includes a cooling coil 91, which is connected to the mixing device 85 and to the three-way valve 87.

Located in the line 90 that leads from the three-way valve 85 to the distributor device 4 is a mixing valve 45, to which lines 10a and 20a that lead back to the solar collectors A and B are connected.

Instead of the second solar collector B, an environmental collector or a ground reservoir may also be provided. Pumps 30 are disposed in the majority of the line.

The mode of operation of this system is as follows:

Via the outlet line 10 of the first solar collector A, heated carrier medium is supplied to the first distributor device 1. Depending on the temperature of this carrier medium, this medium is supplied via one of the outlet lines 11-19' to whichever consumer of heat energy is set for the temperature that is available. For instance, if the solar collector A outputs carrier medium at a temperature of approximately 80°C, then this medium is supplied via the distributor device 1 through the line 11 to the flow line 71 for the consumer that has the highest temperature level, such as a group of radiators. Conversely, if the first solar collector A outputs carrier medium at a temperature of 30°C, then it is supplied via the first distributor device 1 through the line 15 to the

flow line 75 to the floor heating system. At a still lower level, the carrier medium is supplied by means of the first distributor device 1 via one of the lines 16-19' to one of the flow lines 76-79' to one of the consumers at a low temperature level.

In an analogous way, the supplied, heated carrier medium from the second solar collector B is delivered, as a function of its temperature, via the outlet line 20 of the second distributor device 2 via one of the lines 21-25 to one of the flow lines 71-75 leading to one of the consumers of heat at a high temperature, and via one of the lines 26-29' to one of the flow lines 76-79' to one of the consumers of heat at a low temperature level.

By means of the distributor devices 1 and 2, it is thus assured that the carrier medium will reach the particular consumers that are set to the temperature of that carrier medium. Since the return lines 71a-79a of the consumers of heat energy are connected to the flow lines of the next consumer in sequence, the carrier medium can be passed through the further consumers as a function of the heat requirements, and as a result the heat energy contained in it is given up to these further consumers.

However, if there is a need to feed additional heat energy into the system, then via one of the lines 51-54 from the two

collectors A and B or from the consumers at a high temperature level, inflowing carrier medium is carried via the first collector device 5 and via the line 50 leading to the heat pump 8 to the condenser 84 of the heat pump 8. In the condenser 84, the temperature of the carrier medium is raised to the particular temperature value required in one of the consumers for heat at a high temperature level. By means of the third distributor device 3, via one of the lines 31-34 to one of the flow lines 71-74 for consumers at a high temperature level, carrier medium output by the heat pump 8 is supplied at a temperature of 80°C to 30°C. Since the heat pump 8, is supplied with carrier medium at a high temperature level via the first collector device 5, the temperature thereof can be raised by the heat pump 8 to the required high temperature values.

By means of the second collector device 6, carrier medium is supplied to the evaporator of the heat pump 8 via the distributor devices 1 and 2 from the solar collectors A and B or from one of the consumers of heat at a low temperature level. Because of the selection, made possible by means of the second collector device 6, of which of the collectors or consumers will be the source of inflowing carrier medium to be supplied to the heat pump 8, it is possible to take into account the fact that the efficiency of the heat pump 8 is optimized whenever the heat pump 8 is supplied with the carrier medium at a relatively accurately fixed temperature value, for instance of 30°C.

The cold carrier medium output by the evaporator 81 of the heat pump 8 is supplied via the three-way valve 87 to the cooling coil 91 of the refrigeration system 9. The return flow from the refrigeration system 9 can be mixed with the incoming flow via the three-way valve 87. Moreover, the return flow from the refrigeration system 9 can be added via the mixing valve 85 to the incoming flow for the evaporator 81. As a result, the temperature of the carrier medium supplied to the refrigeration system 9 can be controlled. Moreover, the return flow from the refrigeration system 9 is brought via the mixing valve 85 and the line 90 to the inlet of the fourth distributor device 4, from which, via one of the lines 41-44, it reaches the flow lines 77-79' leading to one of the consumers of heat at a low temperature level. Since the return flow lines 75a-79a are connected to the mixing valve 85 via the collector device 6 and its outlet line 60, carrier medium at a low temperature can be fed from one of the consumers of heat at a low temperature level into the refrigeration system.

Disposed in the various lines are temperature sensors, by which the temperatures of the carrier medium located in these lines are measured. The outputs of the temperature sensors are carried to a central control unit. Moreover, all the data required for operation of the system, such as the outdoor temperatures, the heat demand of the individual consumers, and the like, are fed into the central control unit. By means of a control program, the distributor devices and the collector

devices are controlled such that as a function of the supply of heat energy and the demand for heat energy, optimal utilization of the system is assured. Since carrier medium at very low temperatures is returned to the solar collectors A and B, their efficiency is optimized. From the solar collectors A and B, the heated carrier medium is supplied to those consumers that are to be acted upon at a corresponding temperature. By connecting the consumers of heat energy of different temperature levels in series with one another, the heat energy contained in the carrier medium is utilized completely. Excess heat energy is stored in one of the heat reservoirs, and if not enough heat energy is supplied by the environmental collectors, it can be made up by extracting heat from these reservoirs.

If the demand for heat energy cannot be met by the environmental collectors and the heat reservoirs, then the heat pump 8 is put into operation as well. By means of the collector device 5, carrier medium with a high temperature value is supplied to the heat pump 8, and as a result the carrier medium is raised to the required high temperature by the heat pump 8. By means of the collector device 6, carrier medium is supplied to the heat pump 8 at such temperature values as assure its optimal efficiency.

The heat energy produced in the refrigeration system is also recovered and returned to the system. If negative heat energy is output by the collectors A or B, then it can be carried to

the refrigeration system 9 via the distributor devices 1 and 2 and the collector device 6 and via the mixing valve 85.

As a result, by means of this system, the disadvantages of the known prior art, residing in the fact that optimal operation is not made possible, are overcome.

An apparatus is described below, in conjunction with Figs. 2 and 3, which includes the distributor devices, the collector devices, and the lines required between them. As soon as the connecting lines for the heat sources, especially solar collectors, the lines that lead to the consumers of heat energy at different temperature levels and that lead to the heat pump, the ground reservoirs and the refrigeration system are connected to such an apparatus, and in addition as soon as the control motors for the distributor devices and the collector devices are connected to the central control unit, the entire system is functional.

This apparatus comprises a housing 100, which is embodied on its top with two bores 101 and 102 that serve to connect the lines 10 and 20 that come from the heat collectors, in particular the solar collectors A and B. These bores 101 and 102 lead, via conduits located in the housing 100, to 10 transverse bores 103, which in turn discharge into two distributor devices 110 and 120 that are provided on the front and back of the housing 100 and are located in a symmetrical

position with respect to the central plane of the housing 100. Only the front distributor device 110 can be seen in the drawing and will be described below. The distributor device 120, which is located on the back of the housing 1, has an identical structure.

The distributor device 110 has a distributor chamber 111 into which the transverse bores 103 discharge. A rotatably supported disk 112 rests on the rear end face of the distributor chamber 111, in which chamber the transverse bores 103 terminate; the disk is embodied with a single bore 113. The distributor chamber 111 is closed off by a lid 114. Located on the lid 114 are a gear 115 and a control motor 116. By means of the control motor 116, the disk 112 can be rotated in such a way that its bore 113 is located above one of the transverse bores 103.

In the interior of the housing 100, five conduits 104, which lead to five transverse bores 105, and five further conduits 106, which lead to five transverse bores 107, originate at the 10 transverse bores 103.

On the front of the housing 100, the flow lines 71-75, which lead to the consumers of heat at a high temperature level, can be connected to the transverse bores 105. The flow lines 76-79', which lead to the consumers of heat at a low temperature level, can be connected to the transverse bores

107. By comparison, on the back of the housing 100, the lines 71a-79a that come from the consumers can be connected to the transverse bores 105 and 107. A line leading to one of the consumers originates at each of the transverse bores 105 and 107, and is returned to the respectively adjacent transverse bore 105 through 107. The last conduit 106a, which connects the transverse bores 103a and 107a, is also embodied with a connection piece 108, to which the lines 10a and 20a that lead back to the heat collectors A and B.

From the transverse bores 105, conduits 122 lead in the interior of the housing 100 to five transverse bores 123, which discharge into a distributor device 130, located on the front of the housing 100, and a collector device 150, located on the back of the housing 100. The distributor device 130 is in turn embodied with a distributor chamber 131, in which a turntable 132 embodied with a single bore 133 is located, which turntable is rotatable by means of a control motor 136 and an intervening gear 135. The collector device 150 has the same structure. Leading to the distributor chamber 131 is a conduit 180, to which the line 80 leading away from the condenser 84 of the heat pump 8 can be connected.

A conduit 150a begins at the collector chamber of the collector device 150, and to it the line 50 leading to the condenser 84 of the heat pump 8 can be connected.

From the transverse bores 107, five conduits 124 extend, discharging into five transverse bores 125 which extend between a second collector device 160 and a third distributor device 140. The collector device 160 likewise has a collector chamber 161, a turntable 162 with a bore 163, a lid plate 164, a gear 165, and a control motor 166. The distributor device 140 is analogously embodied. Connected to the collector device 160 is a conduit 160a, which leads to a mixing valve 185. Also originating at the mixing valve 185 is a conduit 188, to which the line 88 leading to the heat pump 8 can be connected. From the mixing valve 185, a conduit 186 also leads to a three-way valve 187, at which a conduit 189 begins to which the line leading to the evaporator 81 of the heat pump 8 can be connected. A conduit 190 also begins at the distributor chamber of the distributor device 140 and leads to the mixing device 185. A conduit 191 begins at the mixing device 185, and a conduit 192 begins at the three-way valve 187, to both of which conduits the refrigeration system 9 can be connected.

The housing 100 shown in Figs. 2 and 3 accordingly contains all the devices and connections shown in the diagram of Fig. 1, and as a result, once the connecting lines and the requisite pumps are connected and once the control motors of the distributor devices 110, 120, 130 and 140 and of the collector devices 150 and 160 are connected to the central control unit, by means of the housing 100, the mode of operation explained in conjunction with Fig. 1 can be carried out. This is attained by providing

that the turntables of the distributor devices and collector devices are adjusted in such a way that the carrier medium can flow in and out, through one transverse bore each, in such a way that the optimal efficiency of the system sought at the time is attainable.

In order that the disks 112, 132; 162 can be rotated by means of the control motors 116, 136; 166, respectively, without difficulty, the distributor device is rendered pressureless by the closure of shutoff valves provided in the system or by shutoff of the feed pump; as a result, the disks 112, 132; 162 can be rotated into a new position by the control motors associated with them. As soon as this new position is reached, the disks 112, 132; 162 are again pressed against the back wall of the chambers 111, 131; 161 by means of control cylinders 112', 132'; 162' disposed on the disks, and as a result the requisite sealing is attained with respect to the selected inlet conduit 103, 123; 125.

THIS SHEET HAS BEEN
REPLACED



PATENT CLAIMS

1. A system for supplying consumers with heat energy, having a carrier medium heated in at least one heat source, characterized in that the outlet line of the at least one heat source (A, B, 8) is connected to the inlet of at least one distributor device (1, 2) associated with it, and that the distributor device (1, 2) is embodied with a plurality of outlets to which the flow lines (71-79') to consumers of heat energy at a different temperature level are connected, wherein by means of the distributor device (1, 2), one of the consumers to which the heated carrier medium can be delivered, can be selected.

2. The system of claim 1, characterized in that the consumers of heat energy at a different temperature level are connected in series, as a result of which carrier medium flows through them in succession.

This Sheet Has Been Replaced

A barcode located at the bottom right of the page.

THIS SHEET HAS BEEN
REPLACED

3. The system of one of claims 1 and 2, characterized in that at least one heat source is formed by a solar collector (A, B).

4. The system of one of claims 1-3, characterized in that at least one heat source is formed by an environmental collector and/or a ground reservoir or the like.

5. The system of claim 3, characterized in that at least two solar collectors (A, B) are provided, which are aimed in different directions.

6. The system of one of claims 1-5, characterized in that at least one heat source is formed by a heat pump (8).

7. The system of one of claims 1-6, characterized in that the return lines (75a-79a) from consumers at a low temperature level are connected to the inlets of a collector device (6), which is embodied with a single outlet line (60) that can be connected to the inlet of a heat pump (8), wherein by means of the collector device (6), the consumer whose return can be connected to the heat pump (8) can be selected.

8. The system of one of claims 5 and 6, characterized in that the return lines of the consumers of heat energy at a low temperature level can be connected via the collector device (6) to the evaporator (81) of the heat pump (8), and the return lines of the consumers of heat energy at a high temperature



This Sheet Has Been Replaced



level can be connected via a further collector device (5) to the condenser (84) of the heat pump (8).

9. The system of one of claims 1-8, characterized in that the outlet of the heat pump (8) is connected to the inlet of a further distributor device (3), which is embodied with a plurality of outlets that lead to consumers at a high temperature level, wherein by means of this further distributor device (3), one of the consumers, to which the carrier medium from the heat pump (8) can be supplied, can be selected.

10. The system of claim 9, having a heat pump (8), which is embodied with an evaporator (81), a compressor (83) and a condenser (84), characterized in that a consumer (9) for negative heat energy is connected to the evaporator (81).

11. The system of claim 10, characterized in that the return line (90) of the consumer (9) of negative heat energy is connected to the inlet of a further distributor device (4), to whose outlets consumers at a low temperature level are connected, wherein by means of this further distributor device (4), one of the consumers, to which the carrier medium heated in the consumer (9) of negative heat energy can be supplied, can be selected.

12. The system of claim 11, characterized in that the return line for the consumer (9) of negative heat energy is connected to a mixing valve (85), to which lines leading to the heat



This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

collectors (A, B) and to the evaporator (81) of the heat pump (8) are connected.

13. A distributor device for a system of one of claims 1-12, characterized in that a housing (100) is provided, which is embodied with at least one inlet conduit (101) for the incoming line of the heat carrier from a heat source (A) and with a plurality of outlet conduits (105, 107) for the flow lines for the consumers of heat at a different temperature level, wherein between the inlet conduit (101) and the outlet conduits (105, 107), at least one distributor device (110, 130, 140) with a control device, by which one of the outlet conduits (105, 107) can be selected, is provided.

14. A collector device for a system of one of claims 1-12, characterized in that a housing (100) is provided, which is embodied with a plurality of inlet conduits (107) for connecting the return lines from the consumers of heat energy and with an outlet conduit (160A) for the incoming line of the carrier medium to a heat pump (8), wherein between the inlet conduits (105, 107) and the outlet conduit (160A), at least one collector device (150, 160) with a control device is provided, by which one of the inlet conduits (105, 107), from which the carrier medium can be supplied to the heat pump (8), can be selected.



This Sheet Has Been Replaced





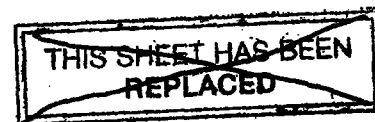
15. A distributor device or collector device of one of claims 13 and 14, characterized in that the control device is formed by a disk (112, 162), which is embodied with a bore (113, 163) and is rotatable by means of a control motor (116, 166), by which means one of the inlet conduits (103, 125) can be selected.

16. An apparatus for controlling the supply of consumers with heat by means of a heated carrier medium, characterized in that a housing (100) is provided, which is embodied with connections (101, 102) for feeding heated carrier medium from at least heat source (A, B, 8) and for carrying the carrier medium to consumers of heat energy, wherein at least one distributor device (110, 120, 130, 140) is located between the connections for feeding and removing the carrier medium, by which distributor device a conduit (103, 123, 125), through which heated carrier medium can be supplied to one of a plurality of consumers, can be selected.

17. The apparatus of claim 16, characterized in that in the housing (100) at least one collector device (150, 160) is provided, at whose outlet a heat pump (8) can be connected.

18. The apparatus of one of claims 16 and 17, characterized in that the housing contains four distributor devices (110, 120, 130, 140) and two collector devices (150, 160), which are connected to one another by means of conduits (104, 106, 122,



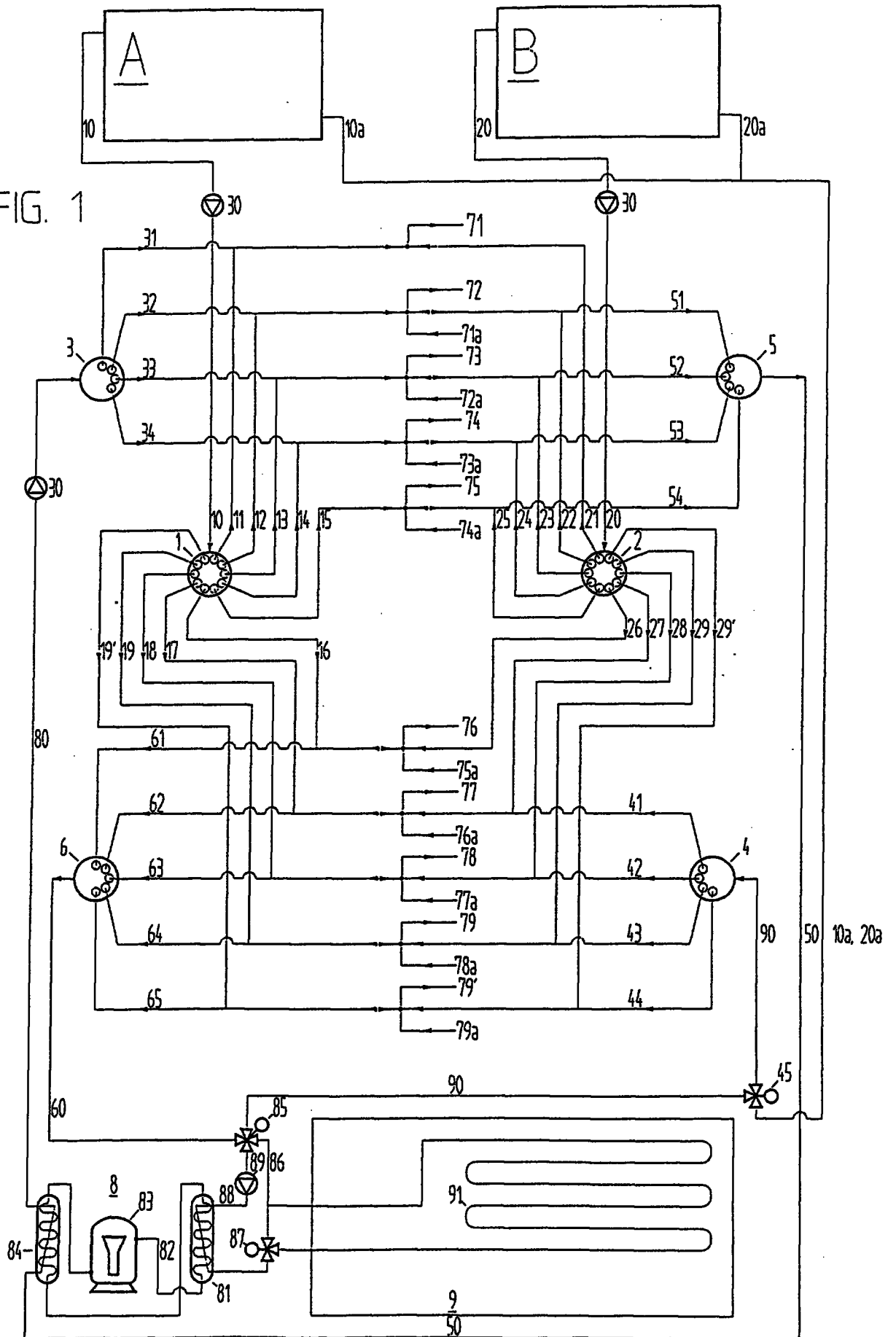


124) and by means of connecting bores (103, 105, 107, 123, 125) and are connected with one another for communication with heat sources (A, B, 8) and with consumers of heat energy and negative heat energy, wherein by means of the distributor devices (110, 120, 130, 140) and the collector devices (150, 160), the feeding of heat energy and negative heat energy to the consumers with a carrier medium flowing in from the heat sources (A, B, 8) can be controlled.

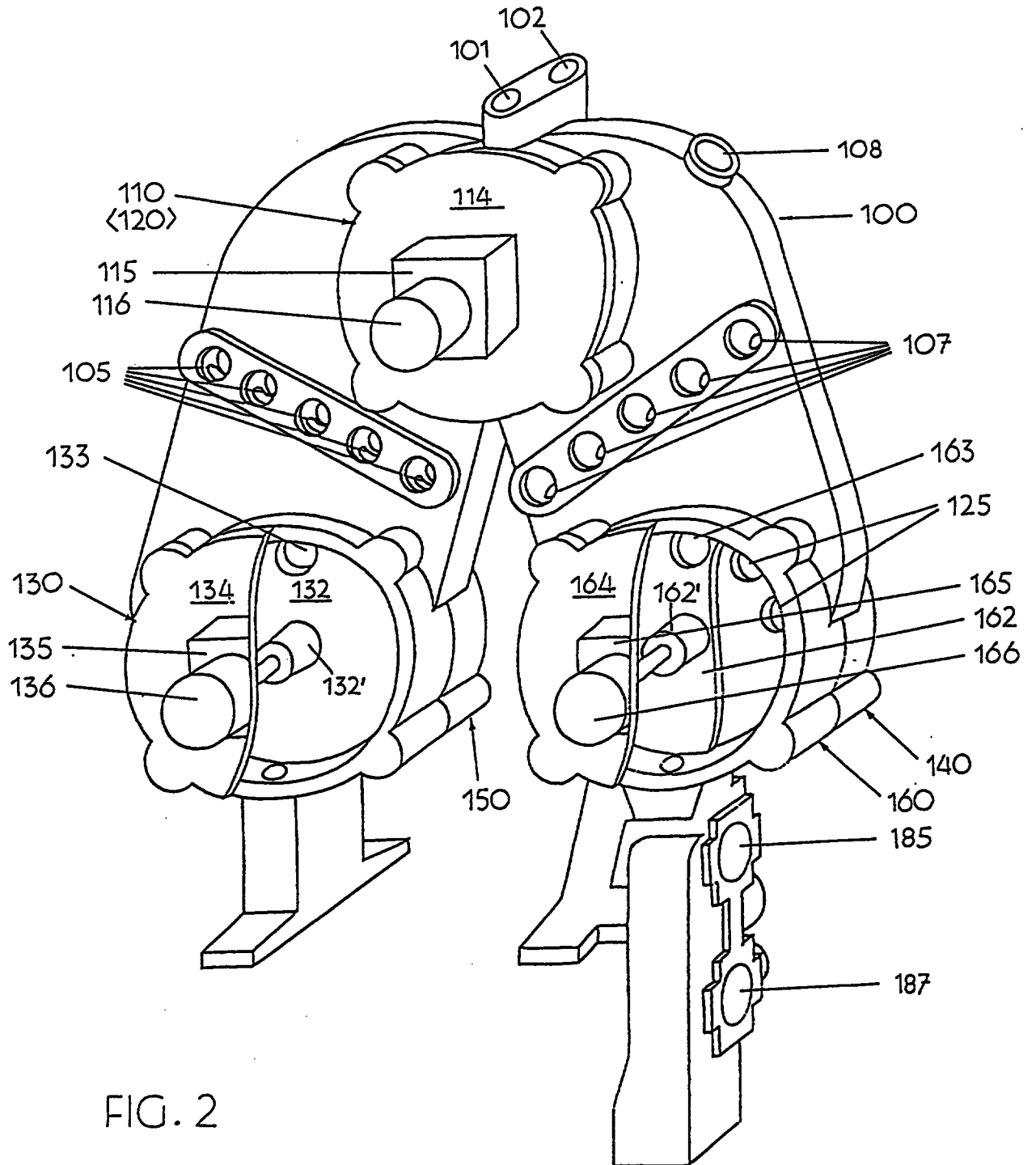
19. The distributor device or collector device of claim 15, characterized in that the disk (112, 132, 162) is assigned a control cylinder (112', 132', 162'), by means of which the disk after its rotation can be connected in a sealing manner to the selected inlet conduit (103, 123, 125).

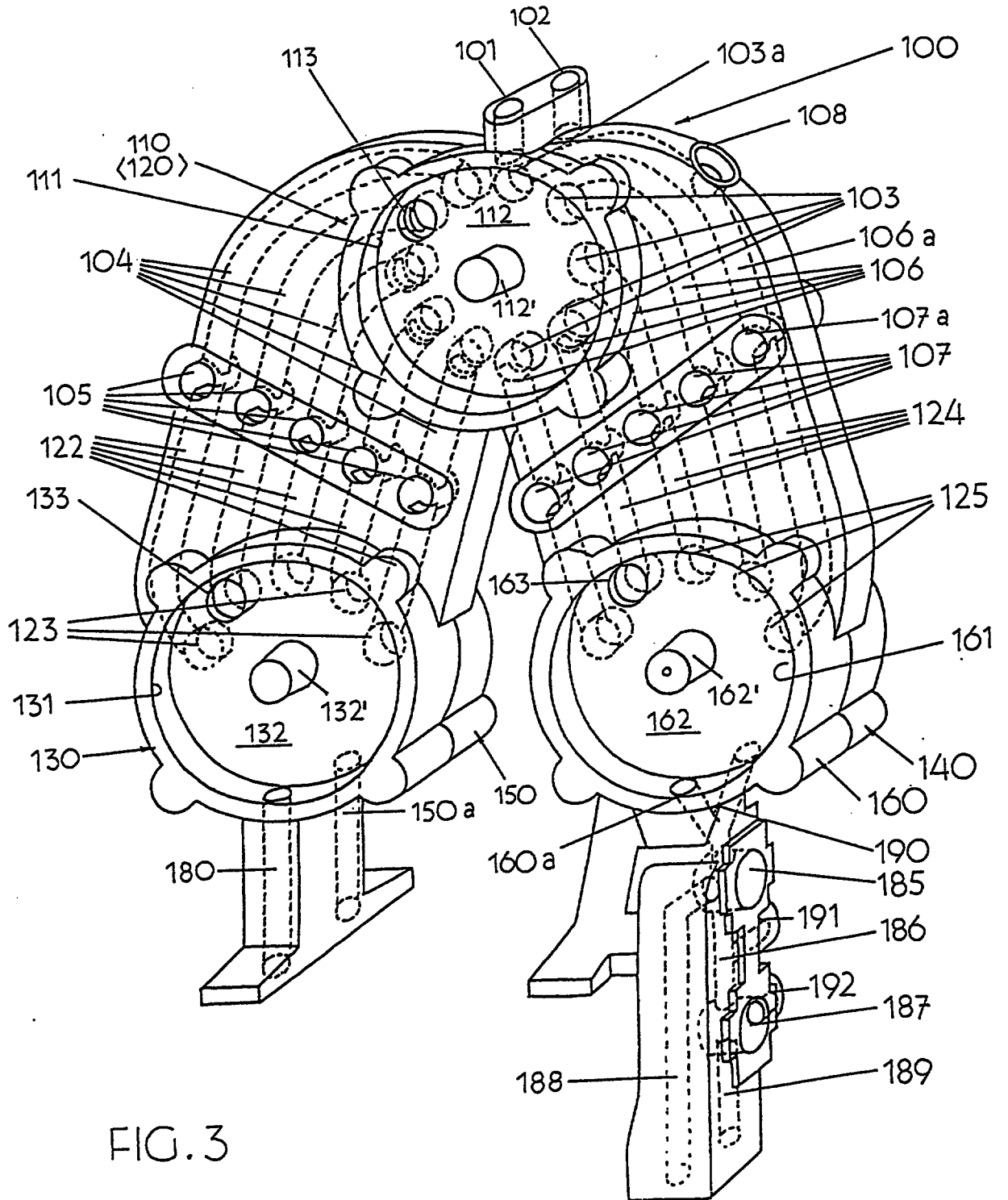


FIG. 1



-2-





**SYSTEM FOR SUPPLYING CONSUMERS WITH HEAT ENERGY,
AND APPARATUS THEREFOR**

ABSTRACT

A system for supplying consumers with heat energy, having a carrier medium heated in at least one heat source. The outlet line of the at least one heat source (A, B, 8) is thereby connected to the inlet of at least one distributor device (1, 2) associated with it, and the distributor device (1, 2) is embodied with a plurality of outlets to which the flow lines (71-79') to consumers of heat energy at a different temperature level are connected, wherein by means of the distributor device (1, 2), one of the consumers to which the heated carrier medium can be delivered, can be selected (Fig. 1).

Figure 1 of the drawings should accompany the abstract when published.

REPLACEMENT SHEET
Date : 18/2/97

Substitute sheet
17 February 1997

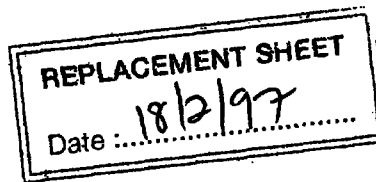
- 5 -

consumers of heat energy at a different temperature level are connected; by means of the distributor device, one of the consumers, to which the heated carrier medium can be delivered, can be selected; and the consumers of heat energy at different temperature levels are connected in series, as a result of which carrier medium can flow through them in succession.

This distributor device thus assures that the carrier medium output by a heat source is supplied to the particular consumer or group of consumers of heat energy for which precisely that temperature level that is output by the heat source is needed.

Radiators, dishwashers, washing machines, clothes dryers, hot water heaters and floor heating systems can be named as examples of heat energy through which the heated carrier medium flows and which are connected individually or optionally in series; in the process, the carrier medium gives up its heat energy to consumers and is thereby cooled.

Examples of heat sources that may be named are environmental collectors, especially solar collectors, waste heat collectors, heat reservoirs, especially ground reservoirs, and the like. If two solar collectors are provided, which are aimed in different directions, then they give up the carrier medium at different temperature levels. Since then each of these heat sources is assigned its own distributor device, the carrier



Substitute sheet
17 February 1997

- 20 -

CLAIMS:



1. A system for supplying consumers with heat energy, having a carrier medium heated in at least one heat source, characterized in that the outlet line of the at least one heat source is connected to the inlet of at least one distributor device associated with it, and that the distributor device is embodied with a plurality of outlets to which the flow lines to consumers of heat energy at a different temperature level are connected, wherein by means of the distributor device, one of the consumers to which the heated carrier medium can be delivered, can be selected and wherein the consumers of heat energy at a different temperature level are connected in series, as a result of which carrier medium flows through them in succession.
2. The system of claim 1, characterized in that at least one heat source is formed by a solar collector.
3. The system of any one of claim 1 or claim 2, characterized in that at least one heat source is formed by an environmental collector and/or a ground reservoir or the like.
4. The system of claim 2, characterized in that at least two solar collectors are provided, which are aimed in different directions.
5. The system of any one of claims 1 to 4, characterized in that at least one heat source is formed by a heat pump.
6. The system of one of claims 1 to 5, characterized in that the return lines from consumers at a low temperature level are connected to the inlets of a collector device, which is embodied with a single outlet line that can be connected to the inlet of a heat pump, wherein by means of the collector device, the consumer whose return can be connected to the heat pump can be selected.

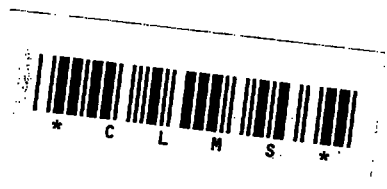
REPLACEMENT SHEET
Date : 18/2/97

Substitute sheet
17 February 1997

- 21 -

7. The system of one of claims 5 and 6, characterized in that the return lines of the consumers of heat energy at a low temperature level can be connected via the collector device to the evaporator of the heat pump, and the return lines of the consumers of heat energy at a high temperature level can be connected via a further collector device to the condenser of the heat pump.
8. The system of any one of claims 1 to 7, characterized in that the outlet of the heat pump is connected to the inlet of a further distributor device, which is embodied with a plurality of outlets that lead to consumers at a high temperature level, wherein by means of this further distributor device, one of the consumers, to which the carrier medium from the heat pump can be supplied, can be selected.
9. The system of claim 8, having a heat pump, which is embodied with an evaporator, a compressor and a condenser, characterized in that a consumer for negative heat energy is connected to the evaporator.
10. The system of claim 9, characterized in that the return line of the consumer of negative heat energy is connected to the inlet of a further distributor device, to whose outlets consumers at a low temperature level are connected, wherein by means of this further distributor device, one of the consumers, to which the carrier medium heated in the consumer of negative heat energy can be supplied, can be selected.
11. The system of claim 10, characterized in that the return line for the consumer of negative heat energy is connected to a mixing valve, to which lines leading to the heat collectors and to the evaporator of the heat pump are connected.
12. A distributor device for a system of any one of claims 1 to 11, characterized in that a housing is provided, which is embodied with at least one inlet conduit for the incoming line of the heat carrier from a heat source and with a plurality of outlet conduits for the flow lines for the consumers of heat at a different temperature level, wherein between the inlet conduit





REPLACEMENT SHEET
Date .. 18/2/97 ..

Substitute sheet
17 February 1997

- 22 -

and the outlet conduits, at least one distributor device with a control device, by which one of the outlet conduits can be selected, is provided.

13. A collector device for a system of any one of claims 1 to 11, characterized in that a housing is provided, which is embodied with a plurality of inlet conduits for connecting the return lines from the consumers of heat energy and with an outlet conduit for the incoming line of the carrier medium to a heat pump, wherein between the inlet conduits and the outlet conduit, at least one collector device with a control device is provided, by which one of the inlet conduits, from which the carrier medium can be supplied to the heat pump, can be selected.
14. A distributor device or collector device of one of claim 12 or claim 13, characterized in that the control device is formed by a disk, which is embodied with a bore and is rotatable by means of a control motor, by which means one of the inlet conduits can be selected.
15. An apparatus for controlling the supply of consumers with heat by means of a heated carrier medium, characterized in that a housing is provided, which is embodied with connections for feeding heated carrier medium from at least heat source and for carrying the carrier medium to consumers of heat energy, wherein at least one distributor device is located between the connections for feeding and removing the carrier medium, by which distributor device a conduit, through which heated carrier medium can be supplied to one of a plurality of consumers, can be selected.
16. The apparatus of claim 15, characterized in that in the housing at least one collector device is provided, at whose outlet a heat pump can be connected.
17. The apparatus of one of claim 15 or claim 16, characterized in that the housing contains four distributor devices and two collector devices, which are connected to one another by means of conduits and by means of connecting bores and are connected with one another for communication with heat sources and with consumers of heat energy and negative heat

REPLACEMENT SHEET
Date : 18/2/97

Substitute sheet
17 February 1997

- 23 -

energy, wherein by means of the distributor devices and the collector devices, the feeding of heat energy and negative heat energy to the consumers with a carrier medium flowing in from the heat sources can be controlled.

18. The distributor device or collector device of claim 14, characterized in that the disk is assigned a control cylinder, by means of which the disk after its rotation can be connected in a sealing manner to the selected inlet conduit.

