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(54) **Energy saving valve for a double panel radiator**

(57) What is described is a building heating system comprising at least one radiator (100) made up of two panels (6-7) fed by means of a valve (1) which comprises a hollow body (2) having a conduit (3) for connecting to the plumbing system and conduits (4-5) for the connection with said panels (6-7). Rotatably housed within said hollow body (2) is a hollow cylindrical selector (11) including a pair of lateral holes (13) disposed 180° apart and an additional lateral hole (13), which is rotatable relative to the hollow body (2) so as to obtain, alternatively, a first configuration whereby both panels (6-7), are fed and a second and third configuration whereby only one of the two panels (6-7) is fed. Said selector (11) houses a vertically movable stem (19) which enables a terminal plug (20) to close the conduit (3) connected to the plumbing system. A second valve (1) for draining the radiator (100) is also provided.

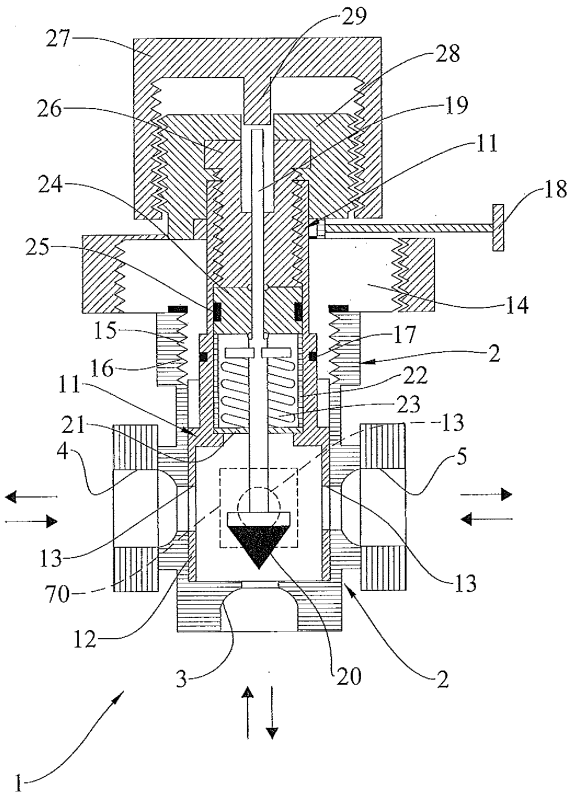

FIG.1

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Description

[0001] The present invention relates to an energy saving valve for a double panel radiator.

[0002] Residential or commercial buildings are usually heated by means of radiators or heaters having several rigidly connected modules in which hot water heated by a common boiler is made to circulate. Each radiator has an inlet conduit at the top and an outlet conduit at the bottom.

[0003] Each room has a radiator with a number of modules that depends on the volume of the room to be heated, normally from four to eight modules.

[0004] Heating systems are designed to guarantee the user the possibility of reaching temperatures well above the values established by law, equal to around 20°C. The system must be able to quickly heat up a cold apartment, for example by raising the temperature from 5°C to 20°C within a few hours.

[0005] The use of controllers that regulate the temperature of buildings by comparing the indoor temperature measured with the temperature desired by the user has been known for some time: a simple thermostat allows the boiler to be switched off once the desired temperature is reached and restarted if the actual temperature measured falls, for example, by 0.4°C.

[0006] In technical terms, restarting a boiler implies heating and recirculating an abundant quantity of water, one that is certainly excessive for recovering 0.4°C. In fact, in a few minutes the room temperature will regain the 0.4°C lost and the boiler will switch off.

[0007] It should also be borne in mind that the radiating surface of each heater is only partly exploited due the position of the inlet and outlet conduits, which are on the same side, at the top and bottom respectively. This means that the heater modules situated furthest from the inlet and outlet conduits are not adequately heated: the water that reaches these modules will have already partially cooled.

[0008] The above-described problems naturally imply an excessive consumption of energy, due essentially to the quantity of water that must be heated and the energy that must be supplied to the pump in order to circulate said water in the system.

[0009] The object of the present invention is to provide a system for heating residential and commercial buildings that is capable of resolving the above-described problems.

[0010] According to the invention, this object is achieved with a building heating system characterised in that it comprises at least one radiator made up of two panels fed by means of a valve, which comprises a hollow body having a conduit for connecting to the plumbing system and conduits for the connection with said panels; rotatably housed within said hollow body is a hollow cylindrical selector including a pair of lateral holes disposed 180° apart and an additional lateral hole, which is rotatable relative to the hollow body so as to obtain, alternatively, a first configuration whereby both panels are fed and a second and third configuration whereby only one of the two panels is fed. Said selector houses a vertically movable stem which enables a terminal plug to close the conduit connected to the plumbing system. A second valve for draining the radiator is also provided.

[0011] These and other characteristics of the present invention will become more apparent from the following detailed description of a practical embodiment thereof, illustrated solely by way of non-restrictive example in the appended drawings, in which:

figure 1 shows a longitudinal sectional view of a valve;
figure 2 shows an exploded perspective view of the valve;
figure 3 shows a front view of a double panel radiator with water recirculation in both panels;
figure 4 shows a front view analogous to the one in figure 3, with recirculation occurring in only one panel.

[0012] The valve 1 illustrated in figures 1-2 is composed of a hollow outer body 2 comprising a conduit 3 for connecting to the plumbing system and conduits 4-5 for making connections, respectively, to a first panel 6 with five modules 10 and a second panel 7 with three modules 10 of a heater or radiator 100.

[0013] Rotatably housed within said hollow body 2 is a hollow cylindrical selector 11 comprising a lower hollow cylindrical portion 12 with three lateral holes 13, two of which are disposed 180° apart, and a gasket 70 opposite to the third hole 13 to guarantee the tightness of the conduit 4-5 when closed.

[0014] A threaded ring 14 is forcibly applied, with slight play being left to allow rotation, on said selector 11 so as to block movement in an axial direction relative to the hollow body 2, the external thread 15 of the ring mating with an internal thread 16 of the hollow body 2. A gasket 17 limits the wear of components during the relative rotation controlled by an external lever 18. The selector 11 can therefore only rotate forcibly in relation to the hollow body 2. This makes it possible to avoid undesired misalignments between the holes 13 and the conduits 4-5, with consequent advantages in terms of the precision of selection, repeatability, reduction in pressure drops, infiltrations and component wear.

[0015] The selector 11 can be found in three configurations:

- one in which the holes 13 disposed 180° apart are aligned with the conduits 4-5 (maximum recirculation of water, when a large amount of heat is required);
- one in which the third hole 13 is aligned with the conduit 5, while the conduit 4 remains closed (minimum recirculation of water, when little heat is required);
- one in which the third hole 13 is aligned with the

conduit 4, while the conduit 5 remains closed (intermediate recirculation configuration, when a medium amount of heat is required).

[0016] The hollow selector 11 internally houses a stem 19, which terminates in a plug 20 and is embraced by a washer 21, a hollow cylinder 22 suitable for containing a spring 23, and a small cylinder 24 with a gasket 25 suitable for limiting the friction caused by rotation and translation relative to the selector 11. A threaded closure element 26 is rotatably coupled, by means of the thread, to the hollow selector 11 and is suitable for radially blocking the stem 19 relative to the selector 11 and to effect axial movement during the assembly phase, as the force of the spring 23 must be overcome by rotating said threaded element 26. The set of components around the stem 19 has been designed to assure that no radial movements occur, but rather only axial ones serving to close the conduit 3 connected to the plumbing system. At the same time, the translation of the stem must be precise and easy to actuate; the screw mechanism is ideal for this purpose. The spring 23, being one of the most fragile components, is completely protected by the cylinder 22.

[0017] A cap 27 rotatably coupled with a threaded cylindrical body 28 integral with the threaded element 26, permits translation of the stem 19 to be achieved by simple contact of a protuberance 29 thereof with the free end of the stem 19. With this mechanism it is possible to close the conduit 7, thereby isolating the radiator from the plumbing of the heating system.

[0018] The complexity of the valve is justified by the need to have an efficient, long-life product and a standard assembly procedure such as to minimise errors on the part of the installer and user.

[0019] Additional gaskets 30 are provided to favour the relative movements of the components, allowing minimum play between them.

[0020] Advantageously, there is a high degree of interchangeability among components.

[0021] As regards operation, if the temperature of an apartment needs to be raised, for example, from 5°C to 20°C following a lengthy absence during the wintertime, the selector 11 of all radiators inside the apartment will be set in the maximum position (figure 3). In just a few hours the target will be achieved. Compared to traditional single panel systems, the efficiency is higher because the last modules 10 of the radiator are better exploited thanks to a better circulation of the water. Therefore, the 20°C desired may be reached much more quickly.

[0022] When a temperature of 20°C is reached the boiler will switch off and the selectors 11 will be positioned in the other configuration, i.e. with the conduit 5 open and the conduit 4 closed. If the temperature falls by a few fractions of a degree, normally 0.4°C in home heating systems, the boiler will switch back on, heating and circulating much less water, but in any case a sufficient amount to bring the indoor temperature back up to 20° within a few minutes.

[0023] Finally, an intermediate solution can be obtained by selecting the panel 6, which has more modules 10.

[0024] It is apparent that the heating solution described above saves energy compared to prior systems: much less water needs to be heated and pumped.

[0025] The increase in efficiency may be quantifiable as at least in the order of 50%, resulting in economic benefits that can be readily inferred.

[0026] It should be highlighted that the object of the present invention can be easily applied to existing heating systems. It is sufficient to remove a module 10 in the central portion of the radiator and have the connection to the plumbing system set in a central position (one of the two panels generated can be moved based on the spaces available, or the plumbing connection can be moved with simple masonry work). The valve 1, which has a standard flange, is then applied and the system will already be ready for an "intelligent" use.

[0027] It has been estimated that the cost of the modification can be recouped in about one year in view of the immediate and considerable increase in efficiency.

[0028] The aforesaid embodiment provides for manual control of the selector 11. It is however possible to provide for an automated control system comprised of:

- zone thermostats 50 (one for each heater)
- zone controllers 51 (one for each heater)
- actuator devices 52 (two for each heater, i.e. one for the inlet valve 1 and one for the outlet valve 1)
- a central control unit 53 (one per apartment in the case of independent boilers, or one for the entire building in the case of central boilers plus controllers, if any, for each apartment).

[0029] The actuator devices 52 comprise two motors 60 which drive the clockwise and anticlockwise rotation of the gears 61 so as to automatically turn the selectors 11, and an additional motor 62 suitable for driving the vertical translation of the stem 19, and hence the closure of the conduit 3; this can be achieved, for example, by providing an external thread on the end part of the stem 19 to be mated with an internal thread of the drive shaft of the motor 62. The electronic control of the plug 20 makes it possible to avoid using cumbersome and complex valves such as the classic thermostatic valves, relying, for example, on fluid evaporation. For example, it may be established that at 20°C the controllers 51 will cause the motors 62 to effect an immediate closure (e.g. a complete turn of the thread) or else a progressive closure (e.g. a quarter of a turn for each half degree Celsius). Progressive closure has the advantage of causing less wear on the plug 20.

[0030] The transmission of rotation between the motors 60 and the selector 11 may be achieved for example by providing, in the lower portion 11, two recesses suitable for housing threaded elements that interact with the drive shafts of the motors 60, thus causing the selector

11 to rotate.

[0031] The zone thermostats 50 measure the temperature in each room: if the temperature in one or more rooms is detected to be lower than the setpoint, also considering the threshold interval, the corresponding zone controller 51 will activate the selector 11 of a specific radiator by means of a simple electric impulse. If the detected temperature is much lower than the set temperature, for example 5°C below the set value of 20°C, both panels 6-7 will be activated (operation at maximum capacity). If, on the other hand, the gap to be overcome is a few fractions of a degree, e.g. 0.4°C, only panel 7 with three modules will be activated (operation at minimum capacity).

[0032] It is also possible to provide for an intermediate operating configuration (e.g. in the case of a gap of 3°C) in which panel 6, having more modules, will be selected (clockwise or anticlockwise rotation of the selector 11).

[0033] The automated system described is useful for independent systems, but even more so for centralised systems, which substantially become semi-independent: each apartment has its own controller, which can be "seen" by the central control unit. If a user is absent for a prolonged period in the winter, he can control the temperature inside his apartment independently from the others, despite there being a single central boiler. The calculation of consumption is likewise simplified and easily verifiable: by integrating the valve 1 with known devices for measuring water flow, beyond those for measuring temperature, it is possible to calculate precisely the energy expenditure of each apartment. At present, if an apartment is left unoccupied for a certain period of time during the winter, even if the heaters are turned off, the consumption is the same as if someone were living in the apartment.

Claims

1. Building heating system **characterised in that** it comprises at least one radiator made up of two panels (6-7) fed by means of a valve (1), which comprises a hollow body (2) having a conduit (3) for connecting to the plumbing system and conduits (4-5) for the connection with said panels (6-7), and in which is rotatably housed a hollow cylindrical selector (11) including a pair of lateral holes (13) disposed 180° apart and an additional lateral hole (13), rotatable relative to the hollow body (2) so as to obtain, alternatively, a first configuration whereby both panels (6-7), are fed and a second and third configuration whereby only one of the two panels (6-7) is fed, said selector (11) housing a vertically movable stem (19) which enables a terminal plug (20) to close the conduit (3) connected to the plumbing system, there also being provided a second valve (1) for draining the radiator.

2. System according to claim 1, **characterised in that** said valve (1) comprises a threaded ring (14) forcibly applied, with slight play being left to allow rotation, on said selector (11) so as to block movement in an axial and radial direction relative to the hollow body (2), an external thread (15) of the ring mating with an internal thread (16) of the hollow body (2).

3. System according to either of claims 1 or 2, **characterised in that** said stem (19) is embraced by a hollow cylinder (22) suitable for containing a spring (23), a small cylinder (24) with a gasket (25), and a threaded closure element (26) suitable for blocking the radial movement of the stem (19) relative to the selector (11), with which it is rotatably coupled, while an outer cap (27) effects the vertical movement of the stem (19) against the resistance of the spring (23).

4. System according to any of the preceding claims, **characterised in that** the first panel (6) has more modules (10) than the second (7).

5. System according to any of the preceding claims, **characterised in that** it comprises, for each radiator (100), zone controllers (51) which control the actuator devices (52) of the valves (1).

6. System according to claim 5, **characterised in that** each actuator device (52) comprises two motors (60) which drive the rotation of the selector (11), and an additional motor (62) suitable for driving the vertical translation of the stem (19) and hence the closure of the conduit (3).

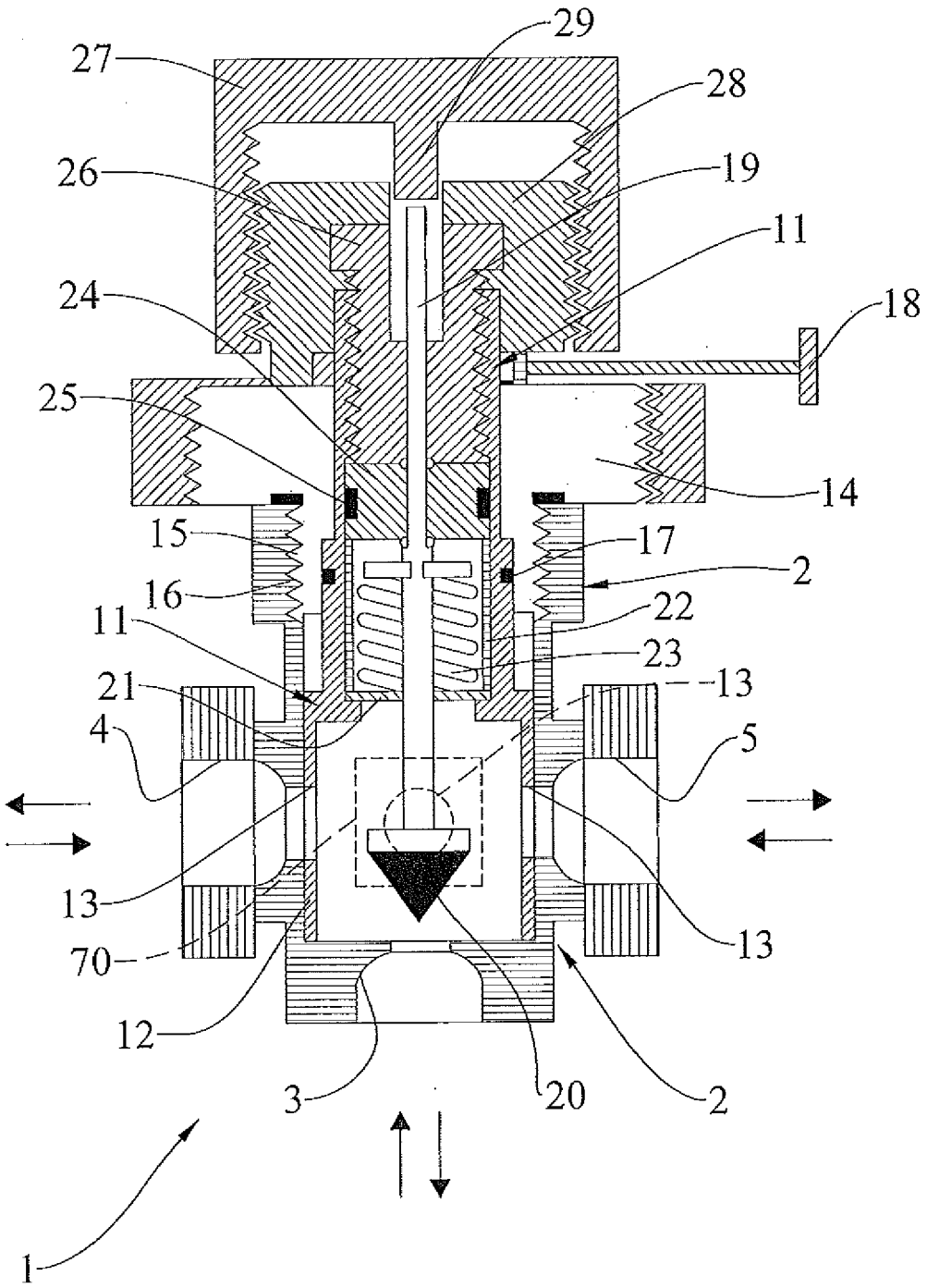
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FIG.1

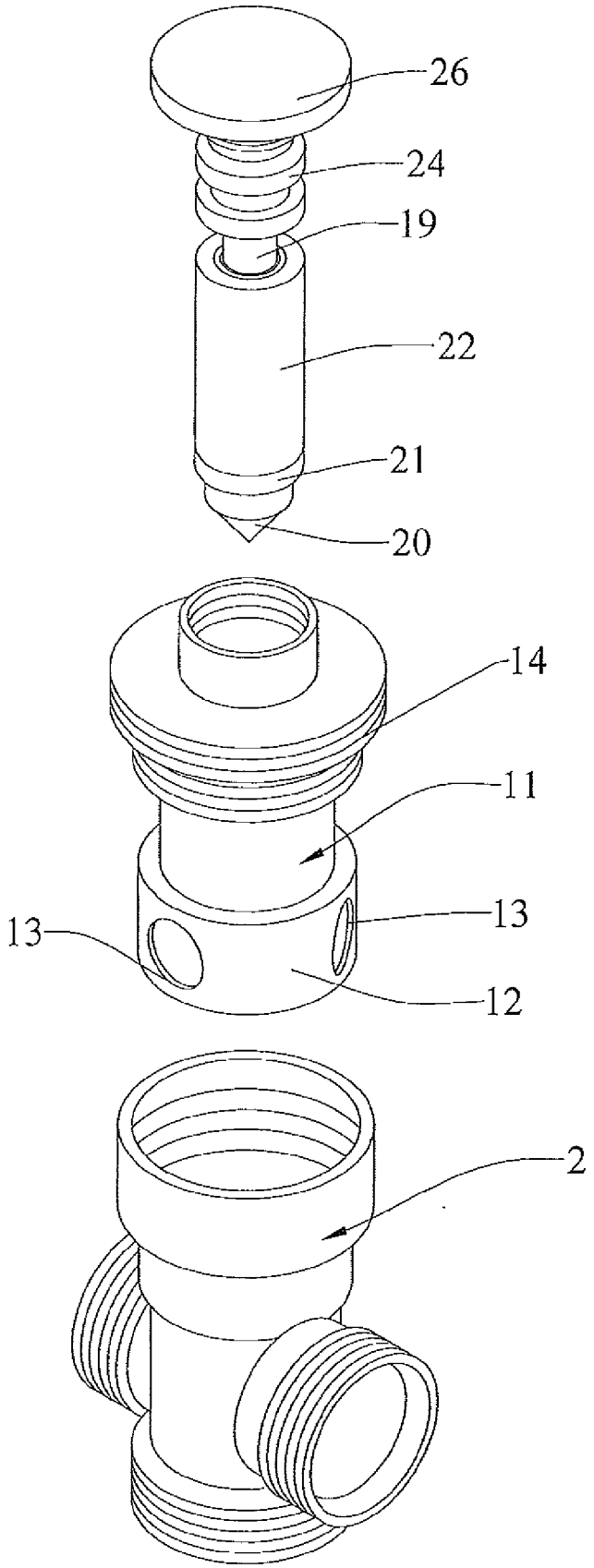

FIG.2

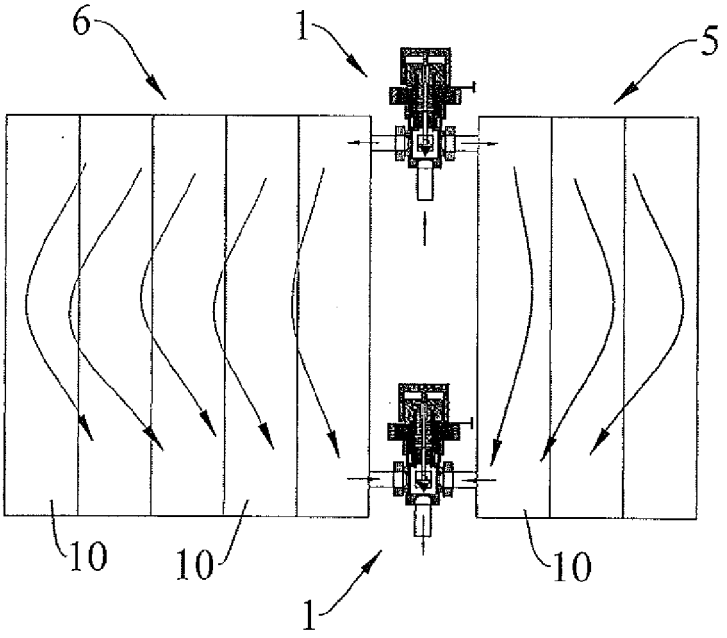

FIG.3

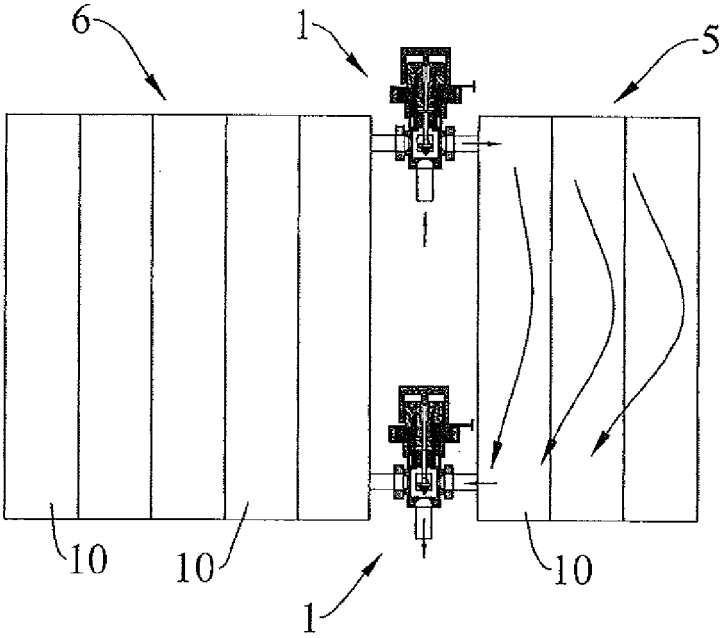

FIG.4