HEAT EXCHANGE UNIT AND SYSTEM

Filed Oct. 22, 1938 3 Sheets-Sheet 1

Fig. 1.

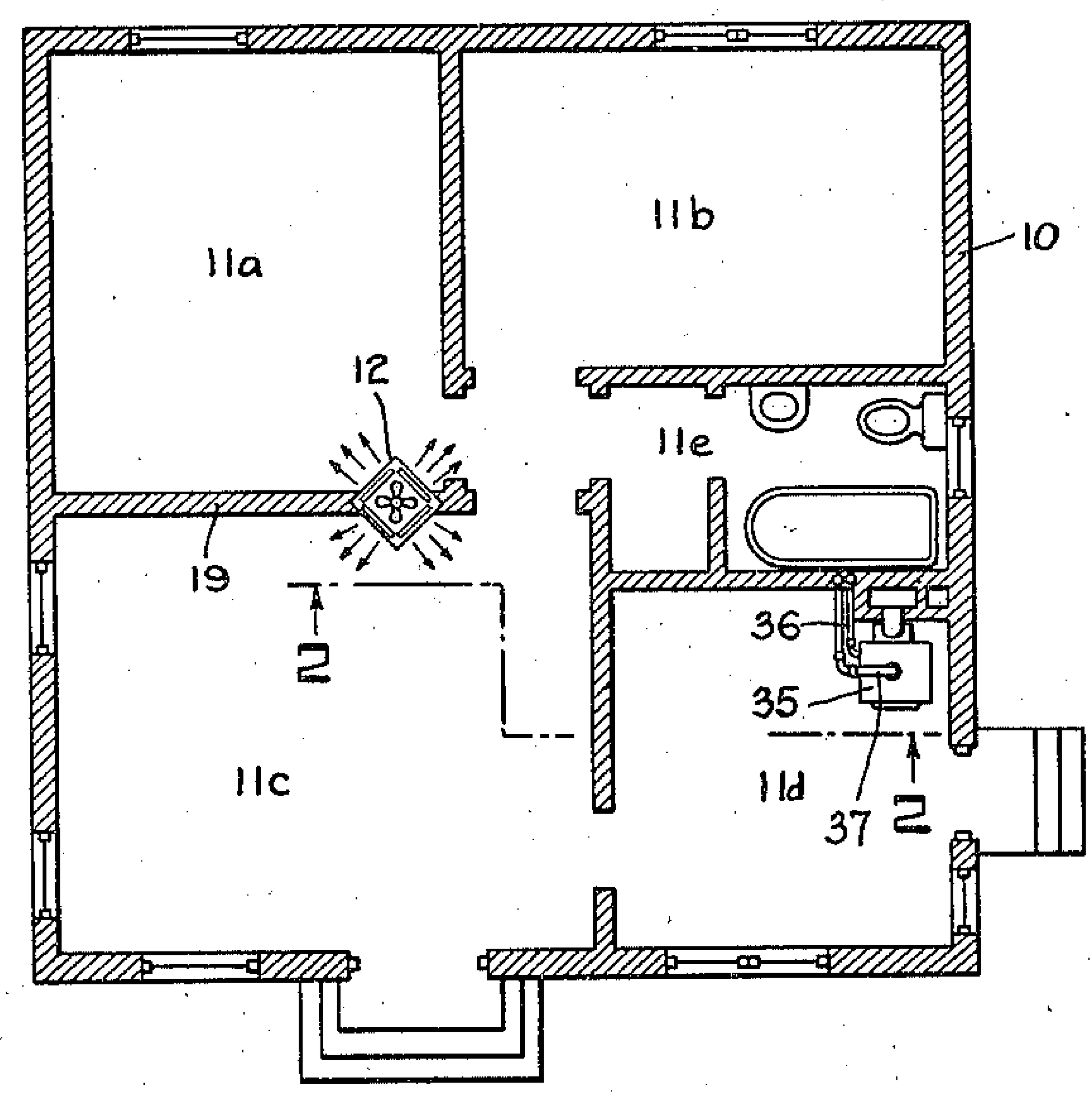

Fig. 2.

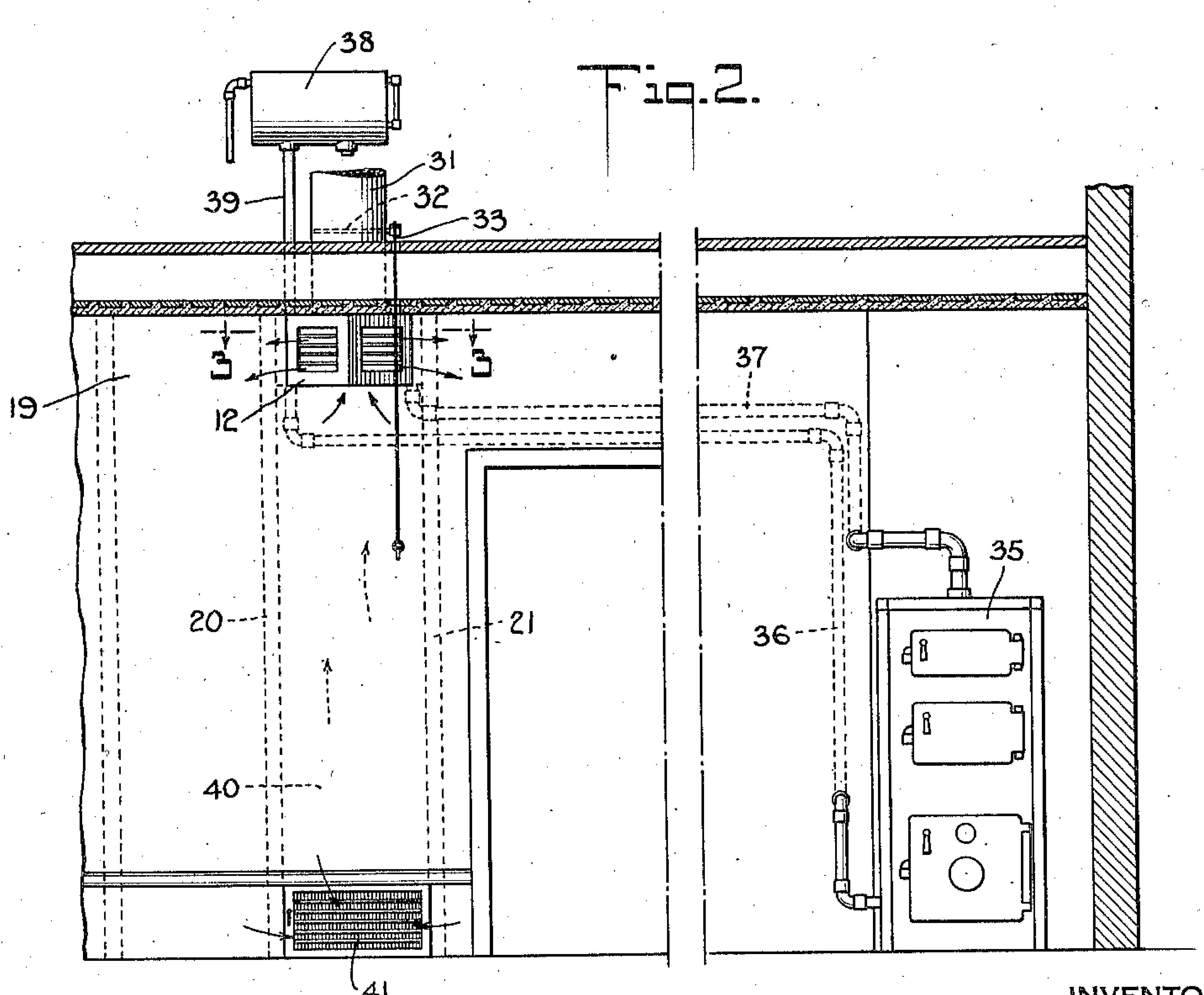

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Fig. 3.

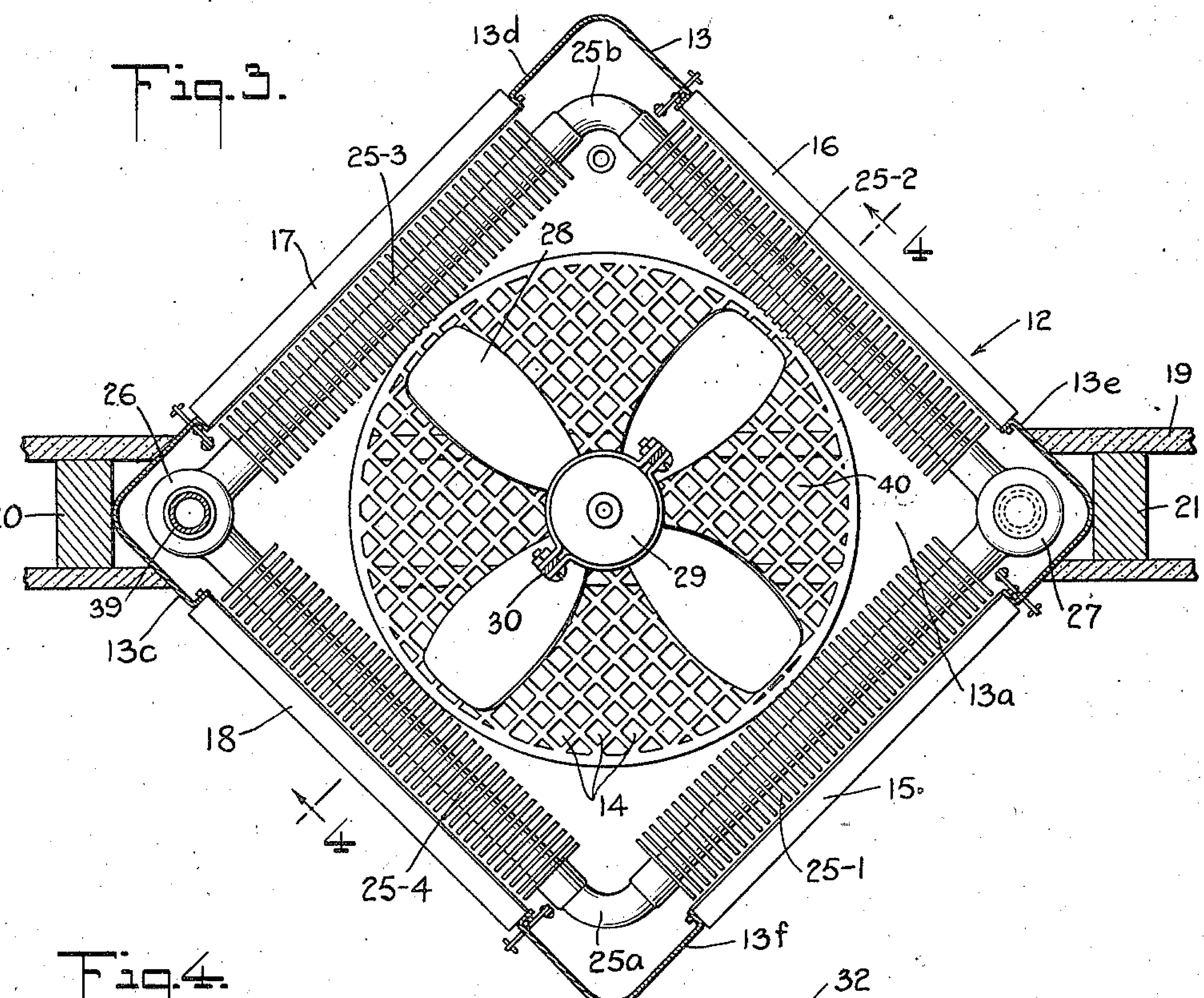

Fig. 4.

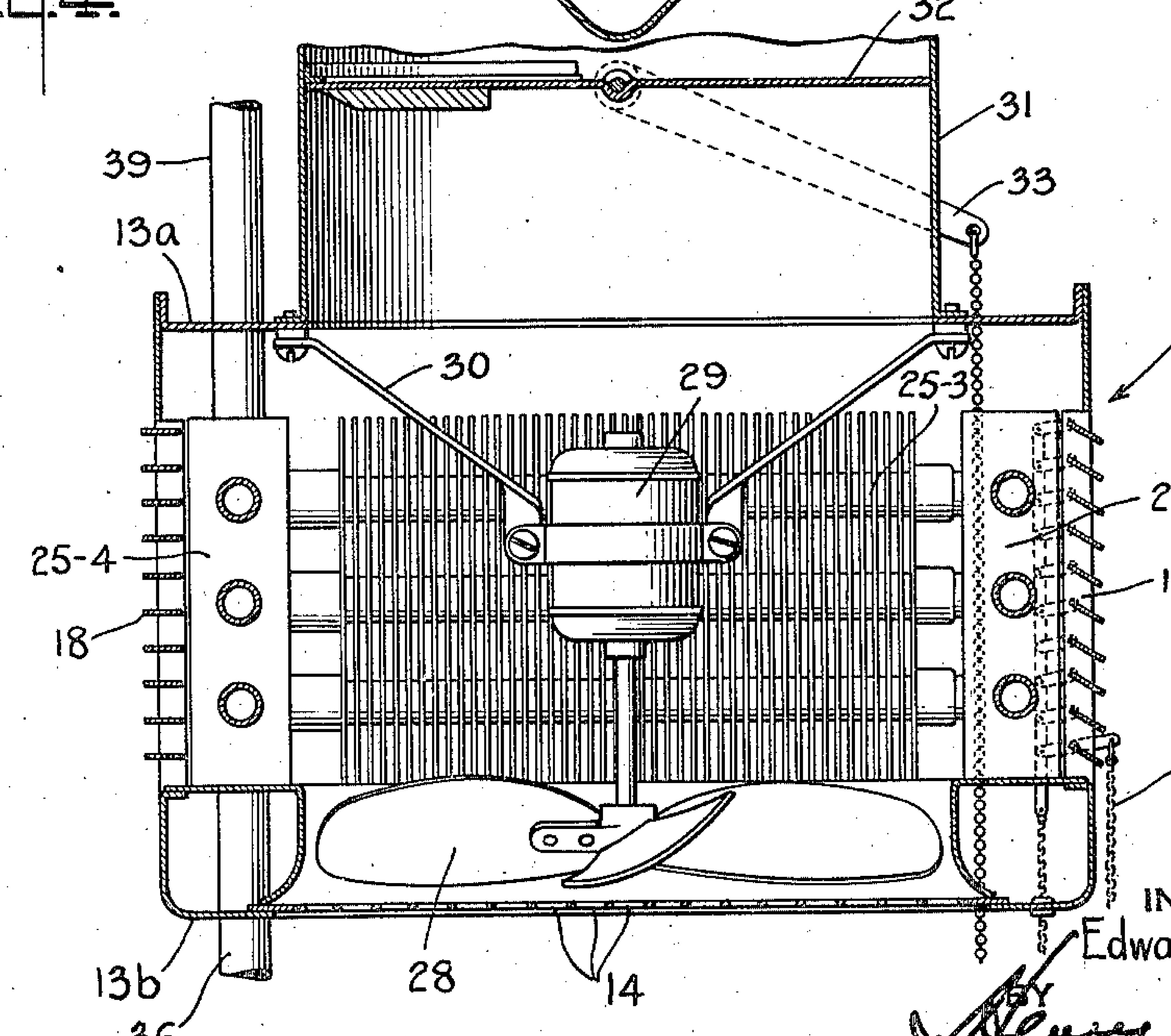

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Fig. 5.

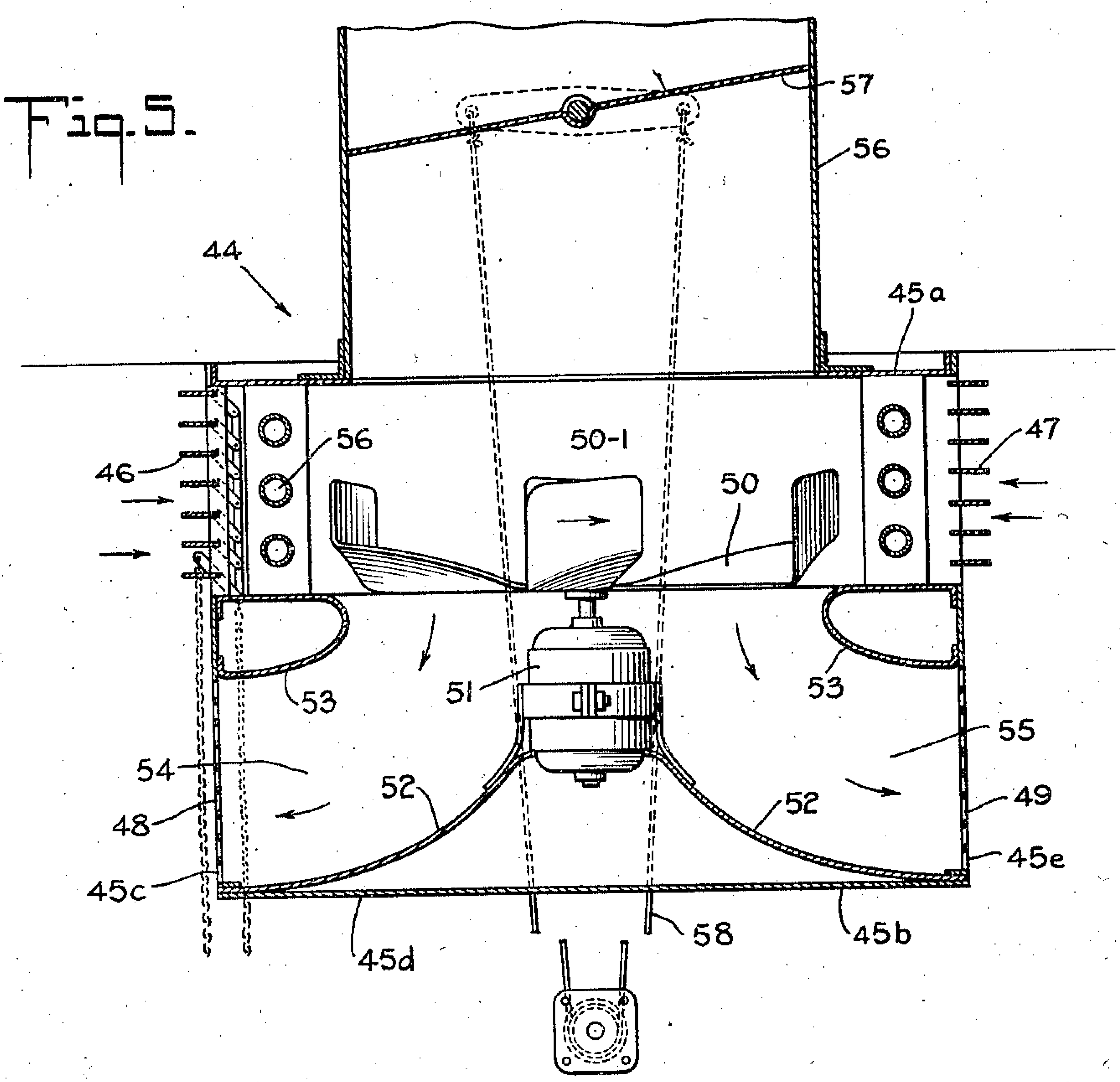


Fig. 6.

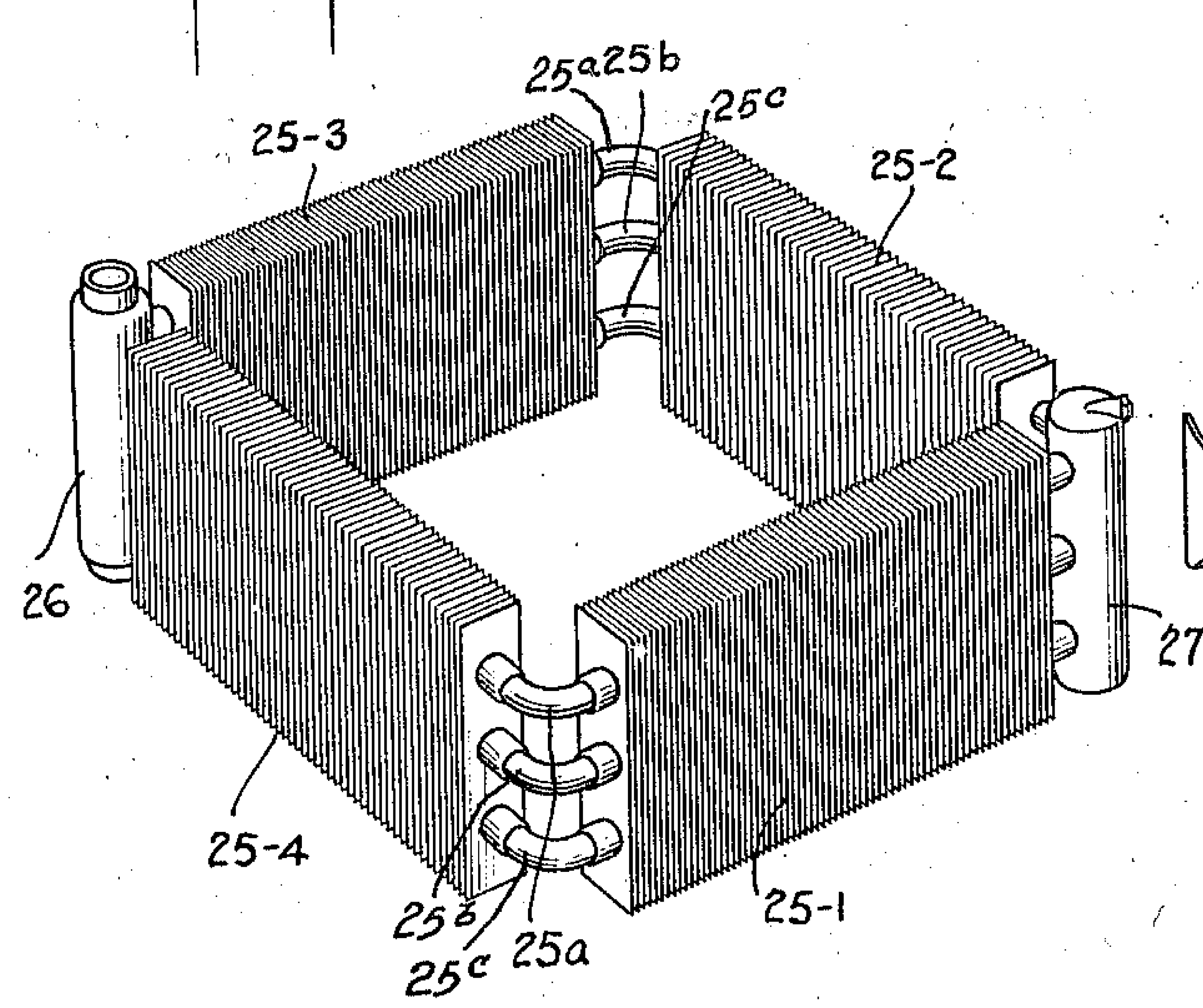
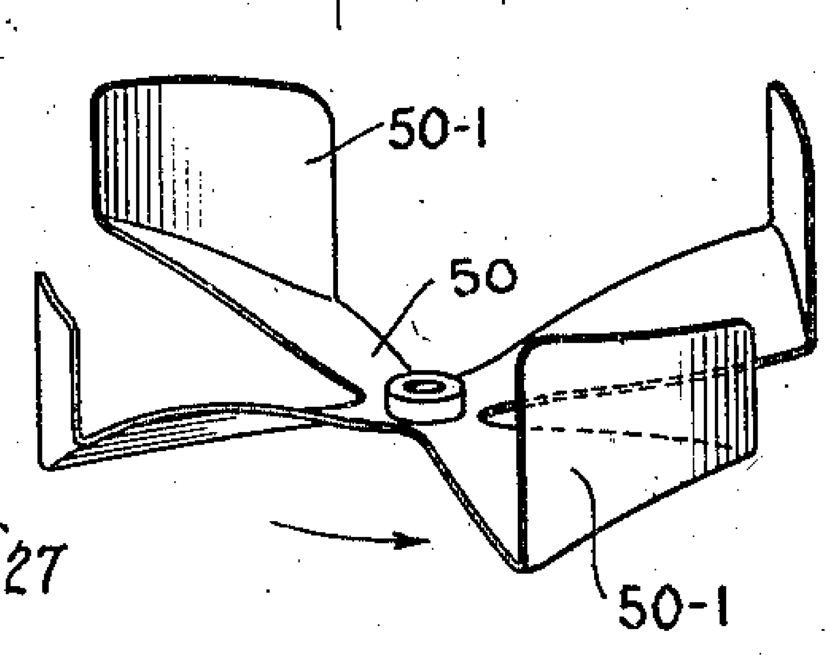


Fig. 7.



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HEAT EXCHANGE UNIT AND SYSTEM

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Application October 22, 1938, Serial No. 236,462

2 Claims. (Cl. 237—49)

This invention relates to heat exchange devices and to thermal systems, and, more particularly, to heat exchange devices of the type embodying means for circulating air over a heat exchanger, and to systems embodying such type of heat exchange devices in association with apparatus for supplying a thermal medium thereto.

A broad objective of the invention is the attainment of advantageous heating of several rooms, or other divisions of an enclosure by the use of a single thermal device, and, if desired, to also provide for cooling, as well as for mere air circulation or air exhaustion by the same device.

The invention was developed primarily for the purpose of providing efficient and inexpensive air conditioning for small buildings having a plurality of rooms defined in part by partition walls, but is not necessarily restricted thereto in its usefulness.

A characteristic of embodiments of the heat exchange device of the invention, which adapts it for the above purpose, resides in the fact that the individual device is multiplex, that is, it is capable of utilization in multiple for the simultaneous conditioning of the air of the several rooms.

The multiplex character of the heat exchange device is attained by the fact that an enclosing casing is provided with air-flow ports in a plurality of its walls, certain of the ports being adapted for the inflow of air to the casing and certain of the ports being adapted for outflow of air from the casing. The casing walls and the ports therein are so arranged that, if desired, a plurality of sections may be formed by means exteriorly of the casing, such as by one or more of the aforementioned partition walls, each of the so formed sections of the casing being provided with ports for the inflow of air and with ports for the outflow of air. Each of these sections is, therefore, adapted for the direct servicing of a room or rooms or other space, but all of the sections collectively form only a single device.

Heat exchange means are disposed within the casing adjacent, and extending across, respectively, certain of the air-flow ports, and air circulating means is provided adjacent the mid-portion of the casing for drawing air into the casing through the inflow ports and for discharging that air from the casing through the outflow ports, such air passing through the casing in intimate heat-exchange contact with the heat exchange means.

The air-flow ports, particularly those for the outflow of air, may be made adjustable from closed to open position and vice versa, and a passage, equipped with a suitable damper, may be provided in communication with atmospheric air exteriorly of the building for supplying outside air either supplementary to or in place of air normally within the building, or for providing means for exhaustion of spent air from the building.

Also, in the specific aforementioned instance of use relative to partition walls of a building, additional passage means may advantageously be provided from adjacent the floor area of the building, running up through a partition wall to communicate with the interior of the casing, for drawing cold air from the floor area directly into the heat exchange device.

Accordingly, it is an object of the invention to provide a single heat exchange device adapted for placement, in part, respectively, within the confines of a plurality of rooms of a building for multiplex function in simultaneously thermally treating the air of such rooms.

It is an object to provide a fluid circulating thermal system for the heat exchange device.

It is an object to provide a compact, inexpensive, heat exchange device embodying a heat exchanger, and means for drawing air into the vicinity of the heat exchanger and for discharging air from the vicinity of the heat exchanger at a plurality of locations.

Further features and objects will be apparent from the following detailed description and the accompanying drawings.

In the drawings:

Fig. 1 represents a floor plan of a house embodying a heat exchange device and system pursuant to this invention.

Fig. 2 represents a section taken on the line 2—2 of Fig. 1.

Fig. 3 represents a horizontal section taken on the line 3—3 of Fig. 2.

Fig. 4 represents a vertical section taken on the line 4—4 of Fig. 3.

Fig. 5 illustrates another embodiment of heat exchange unit in vertical section corresponding to Fig. 4.

Fig. 6 illustrates in top perspective a preferred type of heat exchange element, per se.

Fig. 7 represents a perspective view of the fan, per se, of the embodiment of heat exchange device illustrated in Fig. 5.

Referring to the drawings: embodiments of the instant invention are particularly advantageous in their application to the thermal treatment of the air of small one story buildings divided into a plurality of rooms.

As illustrated in Fig. 1, the building may be a dwelling house 10, divided into rooms 11a, 11b, 11c, 11d and 11e.

The thermal system of the invention, designed, in the present instance, to thermally treat the air of the house 10, desirably comprises a single heat exchange device 12 utilizing a circulating thermal medium—here, hot water. In certain instances, several of the heat exchange devices 12 may be incorporated in a single system, but an outstanding object of the invention, namely, economical thermal treatment of the air of a small building, is attained in most cases by the use of but one heat exchange device.

The heat exchange device 12 is multiplex in formation and function. It is constructed to, and does, adequately serve the several rooms of the building.

For accomplishment of its multiplex function, the heat exchange device 12, comprises an enclosed casing 13, see Figs. 3 and 4, having, in the present instance, two major walls, 13a and 13b, respectively, spaced apart by a plurality of lateral walls 13c, 13d, 13e and 13f.

One of the major walls, here shown as 13b, is generously ported throughout the greater part of its mid-portion, as is indicated by 14, and forms the bottom of the device. The lateral walls 13c, 13d, 13e and 13f are each ported. The ports in such lateral walls are advantageously provided by sets of louvers adjustable from open to closed position and vice versa. The louvers for the respective lateral walls are indicated 15, 16, 17 and 18, suitable pull chain adjusting means being indicated at 16—1, Fig. 4. Each set of louvers desirably extends across the greater part of the length and breadth of the particular lateral wall concerned.

The heat exchange device 12 is preferably placed adjacent the ceiling structure of the building. Its casing 13 is advantageously positioned astride the width of that partition wall which is most centrally located in the building, see the partition wall 19, Fig. 1. A section of the top portion between studs—see the studs 20 and 21, Fig. 2—of such partition wall may be cut out for its reception. Thus, a length of the casing rests over the partition wall, and the remainder thereof extends outwardly at either side of the partition. In the instance of a square casing, as is here shown, one diagonal of the square is preferably positioned centrally along a length of the partition wall substantially parallel therewith, and the other diagonal extends across the partition wall perpendicularly thereto. The lateral walls of the casing, therefore, are grouped in sets of two on either side of the partition wall, the two walls of each set being directed oppositely by an angle of 90°.

Disposed within the casing 13 adjacent to and extending across the ports of the respective lateral walls are heat exchange means. It is preferred that the heat exchange means be supplied with a circulating fluid medium such as hot water or steam where the device is utilized for heating and with chilled water or other refrigerant where the device is utilized for cooling.

The illustrated heat exchanger 25 is of radiant convector type made up of fin tube heat exchange members 25—1, 25—2, 25—3, and 25—4 collectively arranged in square formation for coordination with the square casing. The fins and tubes of the heat exchange members are preferably of copper. The tubes in any one level, see the levels 25a, 25b, and 25c, Fig. 6, are interconnected by suitable pipe fittings such as wrought copper elbows. Piping for the supply of thermal medium, in the present instance hot water, connects with the tubes of the respective levels as by means of a header 26. Piping for the return of the thermal medium connects with the tubes of the respective levels as by means of a fitting 27.

Means for drawing air into the casing 13 and for discharging air therefrom subsequent to passage over the heat exchange means is provided preferably centrally of the casing. Such means may take the form of a fan, as at 28, mounted on a depending shaft of an electric motor 29, the latter being suspended from the top 13a of the casing by means of a resilient mounting, indicated generally at 30. The fan 28, may have an effective area of rotation commensurate with the ported area 14 in the bottom wall 13b of the casing. Thus, upon rotation of the fan 28, air will be drawn into the casing through ports 14.

The top wall 13a of the casing may have secured thereto the conduit 31 leading upwardly through a suitably provided aperture in the ceiling structure of the building to communication with atmospheric air. The damper 32 preferably of counterweighted butterfly type, as illustrated, may be manually opened and closed to desired extent by means of a handle 33 and pull chain 34. Normally, when the heat exchange device is employed for heating or positive cooling, the damper 32 will be entirely closed to provide a completely closed top for the casing.

The heat exchange means advantageously forms a part of a thermal system arranged for the circulation of a thermal medium. For heating purposes, the thermal medium is preferably hot water heated in a conventional boiler and circulated to and from the heat exchange device through conventional piping.

In the illustrated instance, the heat exchanger 25 is supplied with hot water from a boiler 35 through supply piping 36, return to the boiler taking place through return piping 37. As a part of the system, an overflow tank 38 may be provided, according to conventional practice, for compensating for changes in level of the water, such overflow tank being connected directly to heat exchanger 25 through piping 39.

The heat exchange device may be utilized for cooling as well as for heating by the provision of suitable refrigerating apparatus for the proper conditioning of the thermal medium employed.

As aforestated, the heat exchange device 12 advantageously extends across the width of the partition wall 19 at a location between adjacent studs, see 20 and 21. The studs may serve, together with the outer facing material of the partition wall, to define a passage 40 extending upwardly of the partition wall from communication at its lower end with the room or rooms adjacent thereto, preferably through a register or registers adjustable in opening and closing, as for instance that indicated 41. The passage 40 preferably opens into the interior of the casing 13 through the ports 14 of the bottom wall 13b thereof, see Fig. 3.

Accordingly, assuming the system is being utilized for heating, proper temperature, which may be thermostatically controlled pursuant to conventional practice, is maintained in the heat exchanger 25 by means of the circulating hot water. The fan 28 will draw air inwardly of the casing 13 through the air inlet ports 14 and either side of the partition wall 19, and, should the register or registers 41 be open, will draw air in from adjacent the floor level of the room or rooms. The operation of the fan will coincidentally discharge the air outwardly of the casing over the heat exchange members 25—1, 25—2, 25—3, and 25—4 of the heat exchanger 25 and out through the outlet ports in the lateral walls of the casing, provided all of the sets of louvers 15, 16, 17 and 18, are open. Essentially the same operation takes place when the heat exchange device is utilized for cooling.

During hot weather, assuming it is not desirable to provide for refrigerated cooling, the damper 32 may be opened and the fan 28 utilized to exhaust air from the building. Under these conditions, of course, the boiler 35 is not in operation.

Another embodiment of heat exchange device pursuant to the invention is indicated 44 in Fig. 5. The casing of this device is designated 45, and is, in the illustrated instances, similar in configuration to casing 13. It is provided with two major walls, i. e. the top wall *45a* and the bottom wall *45b*, spaced apart by lateral walls, as at *45c*, *45d* and *45e*.

The device 44 may be placed relative to a partition wall in manner similar to the placement of the device 12. Its bottom wall is, however, imperforate, the air inflow passages being formed in the lateral walls.

The heat exchange device 44 is adapted for the mixing of a quantity of atmospheric air with the room air during circulation of the latter. Accordingly, its arrangement of air inlet and air outlet ports is, desirably, different than is the case with the aforedescribed unit 12. Sets of louvers, see 46 and 47, are provided in the upper portions of the respective lateral walls for affording inflow of air. The lower portions of such lateral walls are ported respectively, see 48 and 49, over areas substantially commensurate with the areas comprehended by the sets of louvers.

A fan 50 may be mounted on the upper end of the upwardly extending rotor shaft of an electric motor 51, such motor being preferably resiliently supported on the bottom *45b* of the casing by means of the structure 52.

The structure 52 may consist of arcuate plates which, together with upper baffle structure 53, define throats, as at 54 and 55, leading outwardly toward the outlet ports.

A heat exchanger, indicated at 56, and preferably similar in every respect to the heat exchanger 25 of the embodiment of Fig. 3, is positioned within the upper portion of the casing 45 so that the individual heat exchange members extend across the air inflow passages provided by the respective sets of louvers. The heat exchanger 56 may be supported by the baffle structure 53.

The fan 50 preferably has novel characteristics in that the tips of the individual blades are angularly, and preferably right-angularly, related to the bodies proper of the blades, see the tips 50—1, such tips being also set at an angle as respects the circumference traced by an edge of a tip as it rotates. Accordingly, such blades of the fan are adapted to draw air into the zone of rotation of the fan from laterally of the fan as well as from above or below—in the illustrated instance, from above.

As mounted in the present instance, the fan 50 rotates in the direction of the appended arrows, draws air into the casing through the air inflow passage—defined by the sets of louvers, see 46 and 47—, and projects such air downwardly into the discharge throats, as represented by the throats 54 and 55, and thus out of the casing through the outflow ports, see 48 and 49.

The top *45a* of the casing has a conduit 56 leading thereinto, a butterfly damper 57, regulatable by means of suitable pull chain mechanism, as is indicated at 58, being mounted within the conduit for controlling inflow of atmospheric air to the casing 45, all substantially as is the case in the heat exchange device 12. It is, of course, assumed that the conduit 56 leads to communication with the atmosphere or other desired source of fresh air.

Assuming suitable adjustment of damper 57 to afford an air inflow opening of desired extent, rotation of fan 50 will draw fresh air down through the conduit 56 into the casing for intermixing with the room air which is drawn in through the air passages of the sets of louvers, and will discharge such intermixed air out through the outlet ports by way of the discharge throats.

The novel fan 50 may be employed in connection with the heat exchange device 12 of Figs. 1 through 4 to effect generally the same action as has just been described with respect to heat exchange device 44. That is, should the fan 50—with its upward mounting—replace the fan 28—with its downward mounting—in the device 12, room air would be drawn into the casing through the passages of the sets of louvers 15, 16, 17 and 18 respectively, and, upon suitable opening of the damper 32 fresh air would be drawn in through the conduit 31. Such fresh air would intermix with the room air, which had been drawn in through the passages in the sets of louvers, and the intermixed air would be discharged from the casing through the ports 14 in the bottom wall thereof.

Also, the mounting of fan 50 in the heat exchange device 44 might be reversed so that the fan depends into the lower part of the casing 45. In such case, room air would be drawn into the casing through the ports represented by 48 and 49, and would be passed over the heat exchanger 56 for discharge through the air passages of the sets of louvers represented by 46 and 47, it being understood, of course, that damper 57 would then be normally closed. If so constructed, the heat exchange unit 44 might be utilized to exhaust air from the room in substantially the same manner as heretofore described with respect to the heat exchange device 12. Under such condition of operation, the damper 57 would be maintained fully open, and no thermal medium would be supplied to the heat exchanger 56.

Whereas this invention has been described with respect to preferred embodiments thereof, it is to be clearly understood that changes may be freely made without departing from the spirit of the invention as set forth herein and in the claims that follow.

I claim:

1. In a thermal system, a thermal device which includes a casing, said casing being positioned astride partition wall means of a building, adjacent the ceiling structure of the building, and having a bottom wall, a normally closed top, and a plurality of lateral walls, the said lateral walls being adapted to face inwardly of the rooms which are defined in part by said partition wall means; air outlet means disposed in respective

lateral walls, said air outlet means being adjustable in degree of opening relative to one another; air inlet means so arranged in the bottom wall of said casing as to communicate with the said rooms; thermal exchange means disposed within the casing adjacent respective lateral walls thereof and extending across the said outlet means; and air circulating means disposed within said casing and arranged to draw air from the rooms in through said air inlet means of the bottom wall of the casing, and to discharge air outwardly of the casing over the said thermal exchange means, and into the rooms through said outlet openings in the said lateral walls.

2. Structure as recited in claim 1 wherein passage means extends upwardly through the partition wall means and opens into the bottom of the casing in registry with the air inlet means thereof, said passage means being open at the lower end adjacent the bottom of the partition wall means.

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