June 5, 1934. J. ROLAND 1,961,597

REGULATOR FOR REFRIGERATIVE SYSTEMS

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FIG. 1

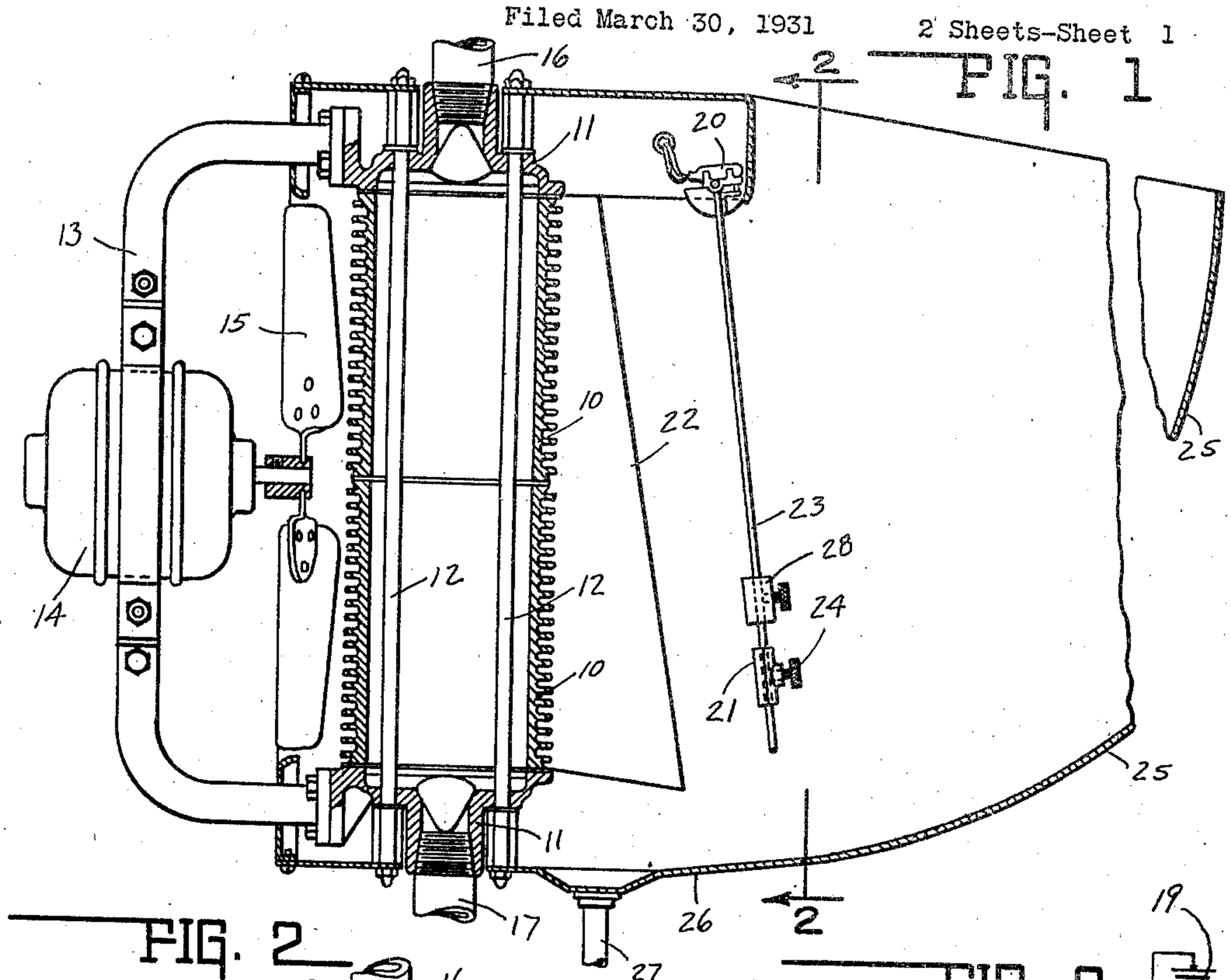


FIG. 2

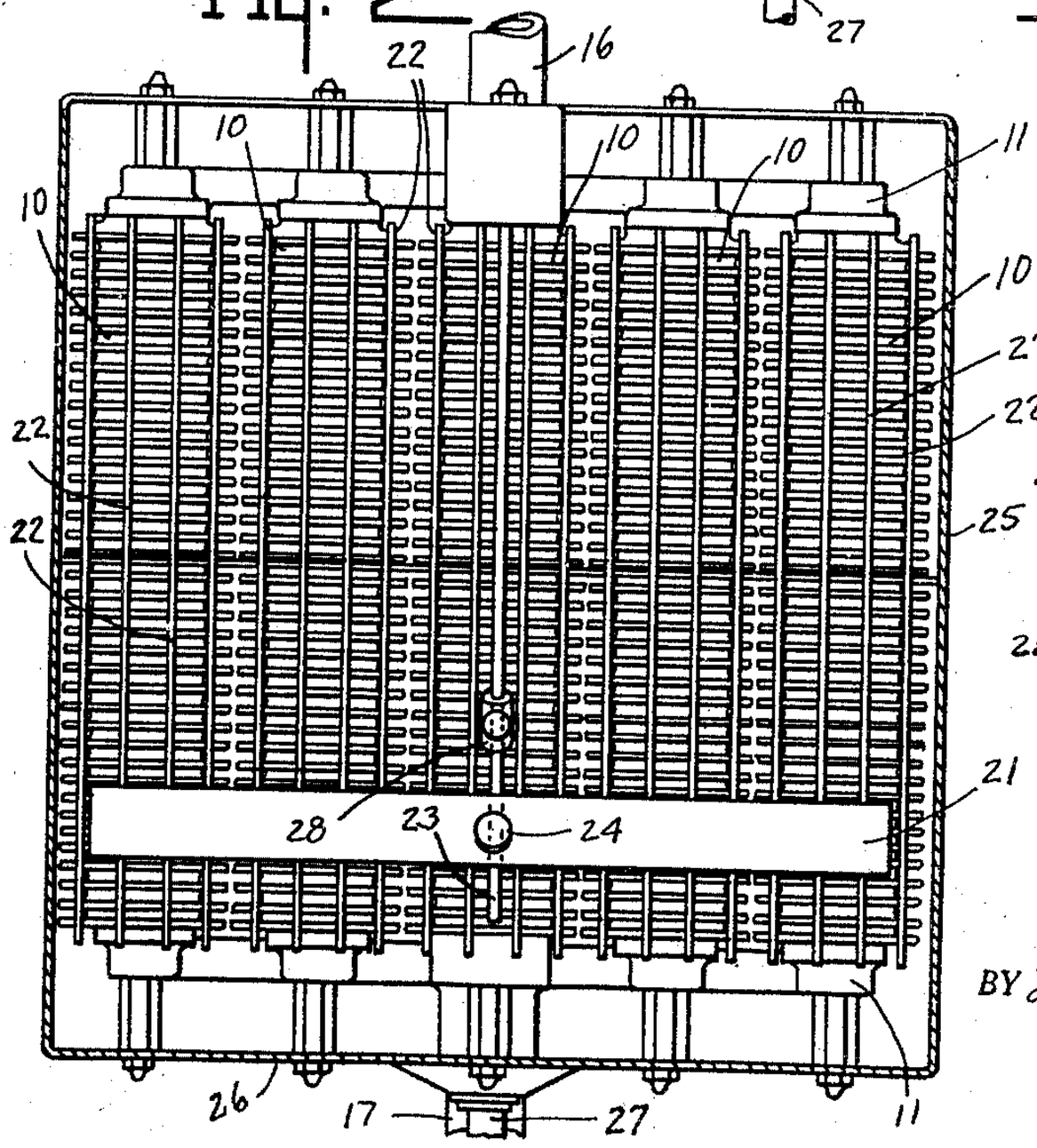


FIG 3

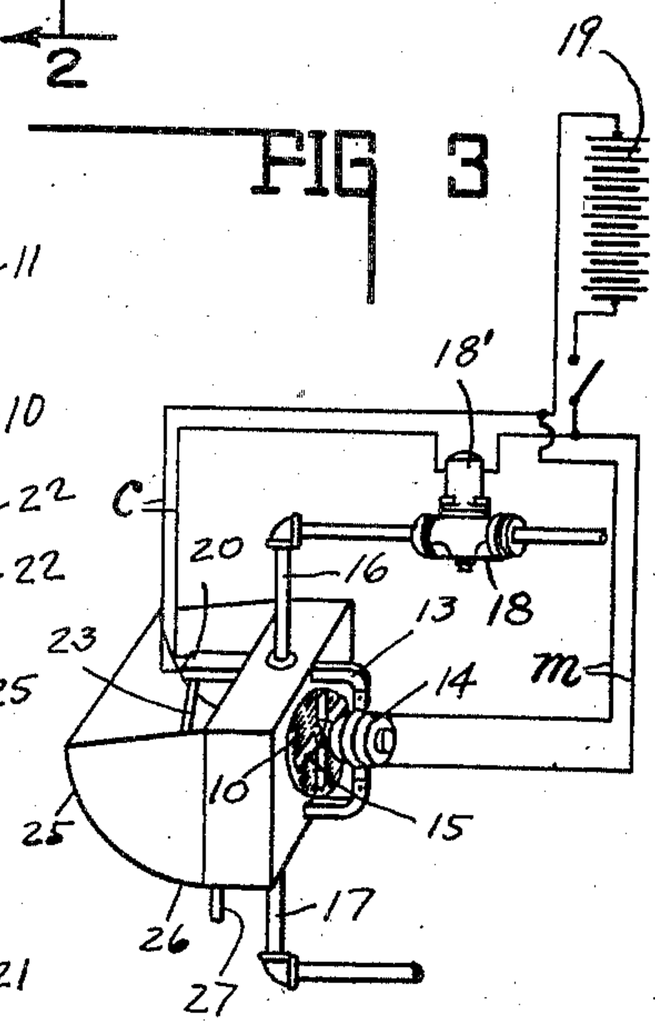


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FIG. 4

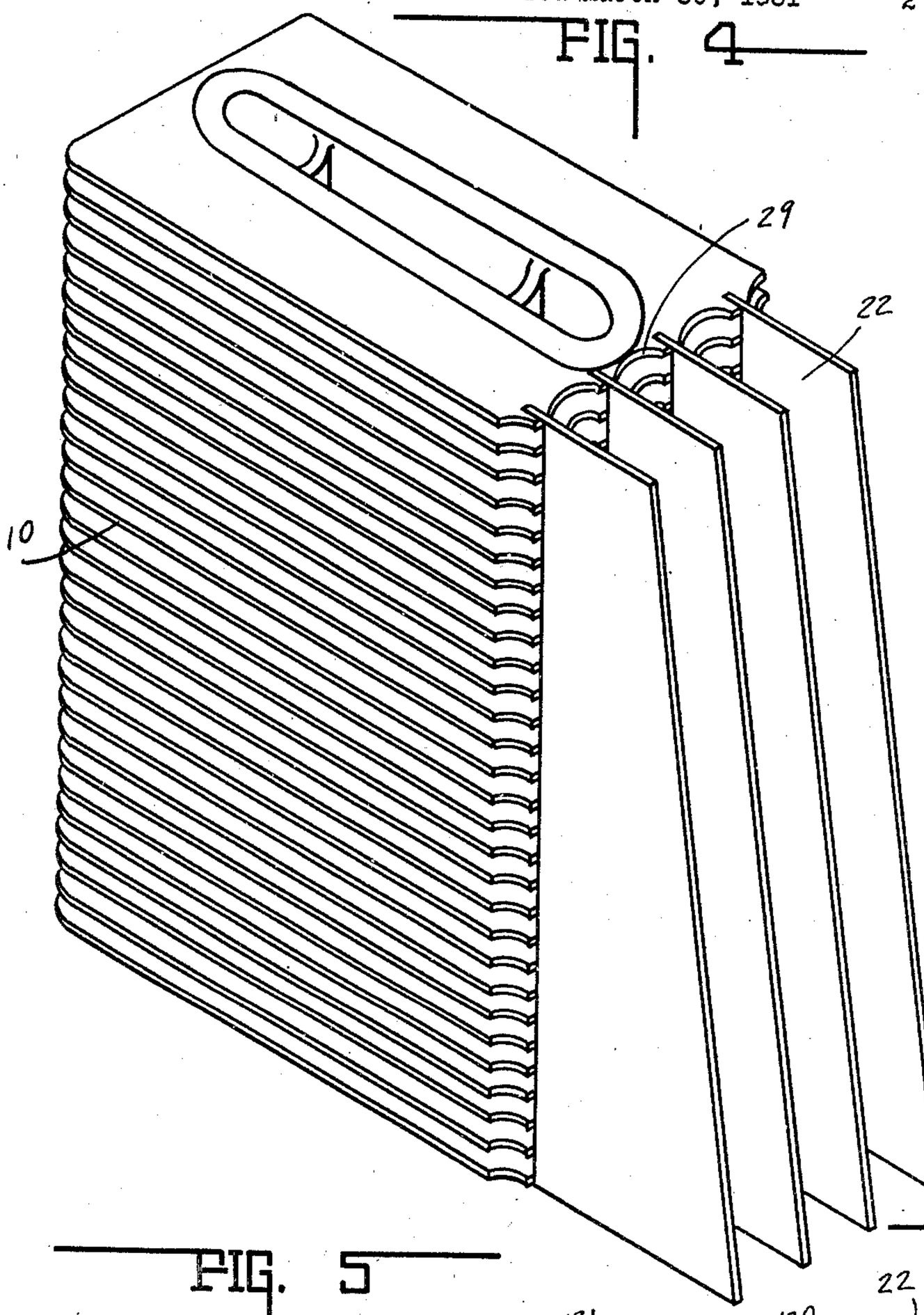



FIG. 5

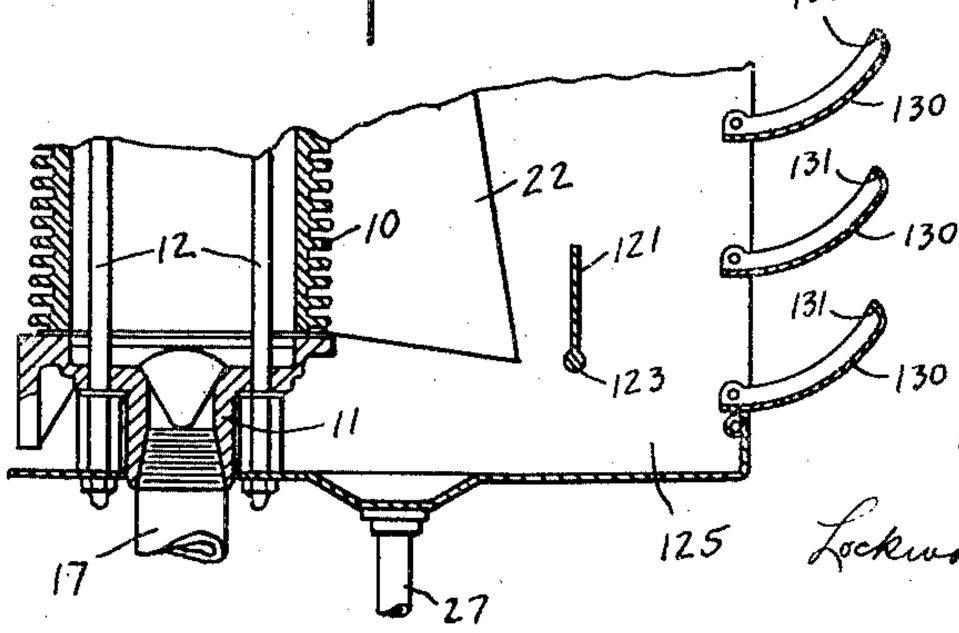
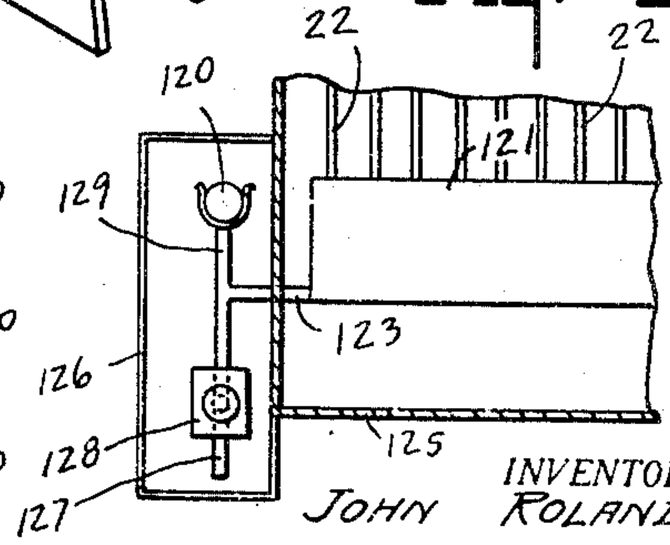



FIG. 6

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Patented June 5, 1934

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# UNITED STATES PATENT OFFICE

1,961,597

## REGULATOR FOR REFRIGERATIVE SYSTEMS

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Application March 30, 1931, Serial No. 526,217

11 Claims. (Cl. 62—115)

This invention relates to the control for a refrigerative system and particularly for defrosting the heat exchange unit thereof, reference being had to the co-pending application of T. W. Carraway, Serial No. 480,594 filed September 8, 1930, and Louis Schwitzer, Serial No. 511,118 filed January 26, 1931.

The principal object of the invention is to provide a control for a refrigerative system wherein the control member is effected by the flow of air through the heat exchange unit for the purpose of controlling the passage of refrigerant therethrough in such manner as to automatically cut off the passage of refrigerant to permit defrosting of the unit and upon such defrosting permit the flow of refrigerant for cooling purposes until such frost has accumulated as to cause the defrosting action to be repeated.

Difficulty is had in that the moisture or dripping which occurs during the defrosting action gathers between the fins of the unit, freezes therein and builds up a solid frozen obstruction to the passage of air therethrough, and also affects the heat absorbing ability of the unit. It has been found in actual practice that this ice deposit very rapidly builds up, beginning at the bottom of the unit and gradually approaches the top of the unit so as to render the system inoperative to all practical purposes within a short time.

It is the purpose of this invention to provide a means for carrying off the drippings from the heat exchange unit in such manner as to prevent accumulation thereof between the fins and disposition thereof at a point distant from the unit. Thus, the unit is maintained substantially free from accumulation of moisture or drippings during the defrosting operation, such as may freeze therein.

One means of accomplishing this result is shown herein as constituting a plurality of drip plates mounted vertically in parallel spaced relation, their inner edges being set adjacent to or between the forward faces of the fins on the unit. Preferably, the lower edge of the drip plates slope downwardly.

The purposes of the invention are accomplished by reason of the confinement of the air current passing through the heat exchanger and between the drip plates, thus causing the air velocity to be maintained after passing beyond the front surface of the unit as distinguished from permitting it to freely expand with reduced velocity upon emerging therefrom. This velocity, coupled with the capillary attraction of the plates, causes the moisture or drippings to be carried beyond the front face of the exchanger so as not to accumulate between the fins. Thus, carried beyond the front face and onto the surface of the drip plates, there is no obstruction to the free dripping from the drip plates at a distance from the unit.

Another feature of the invention resides in the adjustable weight of the pendulum-like vane. This may be accomplished either by the raising and lowering of a sliding weight on the supporting rod or by the sliding adjustment of the vane itself thereon.

When there is no frost and the full air current forces the vane outwardly, the valve is open. Thus, frost begins to accumulate upon the lowering of the temperature, due to the freezing of the condensed moisture upon the evaporator or heat exchange unit. As the frost accumulates, the air current will be reduced, and thus the valve will be closed to start the defrosting operation upon a decrease of the air current due to the increase of the accumulation of frost. Since lesser air current will permit the vane to swing to normal position for closing the valve when the pendulum is lengthened by sliding the weight or vane to a lower position, it results that an increased amount of frost will be permitted to accumulate. Conversely, when the pendulum is shortened by raising the weight or vane, a lesser amount of frost will be permitted to accumulate before the defrosting operation sets in. In other words, the pendulum is lengthened to accumulate a greater amount of frost and shortened to accumulate a lesser amount of frost—either through the medium of the weight or the vane.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

Fig. 1 is a central vertical section through the heat exchange unit showing the drip plates in elevation. Fig. 2 is a front elevation of the drip plates mounted upon the unit. Fig. 3 is a diagrammatic view of the refrigerating system. Fig. 4 is a perspective view of one section of the unit and drip plates. Fig. 5 is a modified form showing a vertical section through a portion of the device. Fig. 6 is the same as Fig. 5 showing a plan view thereof.

In the drawings there is shown a heat exchanger unit comprising the sections 10 having a plurality of fins formed thereon, headers 11 and tie rods 12.

Mounted on the rear of the heat exchange unit is a bracket 13 which supports a motor 14 and a

directly connected fan 15. The means for conducting refrigerant to and from the unit comprises a supply line 17 connected to the bottom header and a suction line 16 connected to the top header. In the latter line is a control valve 18 which is actuated by an electro-magnet 18'. This is connected to a source of electrical energy, for example the battery 19, and in the circuit *c* is a Mercoid tube or switch 20. The latter is mounted on the upper end of a rod 23 which is pivotally mounted adjacent the top header.

When the rod 23 hangs vertically, the Mercoid tube is so disposed that its mercury is clear of its contact points and the circuit *c* through the electro magnet 18' is open. The consequent de-energization of the magnet permits valve 18 to close and thus stop the flow of refrigerant. When the rod is swung forward a predetermined amount the Mercoid tube will be shifted to bring its charge of mercury against the contact points and thus close the circuit *c* through the electro-magnet 18'. The consequent energization of the latter effects the opening of valve 18 with resulting flow of refrigerant through the heat exchange unit.

Adjustably mounted on the rod 23 is a vane 21. This is positioned in the path of the air driven through the unit by the fan 15. When the unit is substantially free from frost the force of the air flow, acting on the vane, keeps the pivoted rod disposed from the vertical and thus the valve 18 is kept open and the flow of refrigerant continues. As the moisture in the air condenses and is deposited on the fins of the unit sections, it freezes thereon and in time this accumulation of ice or frost affects the velocity of the air flow so that the air, acting on the vane, is no longer capable of holding the rod 23 away from the vertical. Consequently when the latter swings back to the vertical, the valve 18 is closed and the flow of refrigerant stopped. But the air continues to be driven against the unit by the fan because the opening of the circuit *c* through the electro-magnet 18' has no effect on the circuit *m* through the motor 14, as seen in Figure 3. Since the motor and its fan operate continuously the air will continue to be driven against the unit and this will gradually cause the ice and frost to melt.

When sufficient frost has been removed in this manner so that the air current striking the member 21 forces it forwardly through a slight arc, the mercury switch will be moved to a circuit closing position for energizing the valve and permitting the flow of refrigerating medium to be renewed. Thereupon there will be a cooling action until such time as frost again accumulates on the fins to such a degree as to retard the passage of air over the surfaces thereof.

Mounted in front of the heat exchanger, on the opposite side thereof from the fan, there are a plurality of vertically extending drip plates 22 extending in parallel relation with each other and spaced a relatively slight distance apart. They are arranged with their side surfaces facing each other and with their rear edge directly engaging between the fins of the unit adjacent the forward edge thereof. Said drip plates extend forwardly from the front of the unit a greater distance at the bottom than at the top, and the bottom edge slopes downwardly for directing the water from the unit.

The vane 21 comprises a horizontal strip of metal extending substantially across the lower face of the unit in front of the drip plates, said horizontal strip being adjustably mounted upon the swinging rod 23 and secured in adjusted position by the set screw 24. A sliding and adjustable weight 28 may also be mounted on said rod. Thus, an adjustable pendulum is provided, decreasing in resistance to the action of the air as it is lengthened by lowering the weight or vane and increasing as it is shortened by adjusting one or the other to a higher position. By adjustment of the weight or vane upon the supporting rod, frost may be permitted to accumulate to a predetermined amount and over a predetermined period of time before the defrosting action is caused to set in.

In order to protect the vane 21 and the drip plates, as well as direct the air upwardly and drain away the water or drippings, there is a housing which forms a shield 25 for directing the air upwardly, and a bottom portion 26 for catching the drippings and causing them to be discharged into the drain pipe 27.

From the above, it will be noted that upon the defrosting action becoming effective, the frost will be turned to moisture which will accumulate into drops of water. These drops will gather upon the surfaces of the fins. While ordinarily they would drip to the bottom of the unit, whereupon they would become frozen and build up a pack of ice, by reason of the drip plates, the air current will be confined after passing through the unit for a substantial distance. This will cause the current of air to maintain its velocity at a point beyond the forward face of the unit which will serve to force the drops from the unit onto the drip plates.

This action will further be aided by capillary attraction as the drops are urged forwardly by the air current. They will thus pass from the surface of the fins on which they would normally accumulate, directly onto the surface of the drip plates and roll to the lower edge thereof from which they will drop into the drip pan, or by reason of the current of air and capillary attraction they will move downwardly with the sloping lower edge thereof to the forward lower corner from whence they will drop into the pan and be carried away by the drain pipe. Thus, no ice formation due to accumulated drippings will occur upon the fin surfaces which will thereby be maintained at all times during the defrosting operation free of ice and substantially free of accumulated moisture.

As shown in Fig. 4, the front surface of the unit section is scalloped as indicated at 29 so that the portions of the unit engaging with the drip plates curve forwardly theretoward for directing and facilitating the movement of the free moisture onto the surface of the drip plates.

In the modified forms shown in Figs. 5 and 6, the vane 121 is pivotally mounted transversely of the shield 125 upon the shaft 123 having its ends pivotally mounted in the side walls of the said shields. Connected with the shaft 123 on the exterior of the shield 125 and mounted in the box 126, there is a downwardly extending rod 127 upon which a weight 128 is adjustably mounted. Extending upwardly from said shaft, there is a rod 129 to which the mercury switch 120 is operably connected. By means of this arrangement, the air current will affect the vane 121 as above described, and the adjustment of the weight 128 will control the period of defrosting and the amount of frost permitted to accumulate.

As shown in this form, pivotally mounted shutters 130 are provided on the front of the shield 125, said shutters being adapted to extend upwardly and provided with curved ends 131 for

catching the free moisture and causing it to drain back into the shield.

The invention claimed is:

1. A refrigerative system comprising a heat exchange element, means for moving air past said element, means for conducting refrigerant to and from said element, means actuated by said air movement for controlling the refrigerant conducting means and means for confining the air flow after passing said element to maintain its velocity beyond the surface thereof whereby the air will carry free moisture off the element.

2. A refrigerative system comprising a heat exchange element, means for moving air past said element, means for conducting refrigerant to and from said element, means actuated by said air movement for controlling the refrigerant conducting means, and means forming a plurality of channels on the air discharge side of said element whereby the velocity of flow past the element is maintained beyond the element.

3. A refrigerative system comprising a heat exchange element, means for moving air past said element, means for conducting refrigerant to and from said element, means actuated by said air movement for controlling the refrigerant conducting means, and drip plates on the air discharge side of said element arranged and constructed to maintain the velocity of air flow beyond said element and to receive free moisture from the air.

4. A refrigerative system comprising a heat exchange element, means for moving air past said element, means for conducting refrigerant to and from said element, means actuated by said air movement for controlling the refrigerant conducting means and vertical drip plates mounted on the air discharge side of said element edgewise thereto; the said element on the air discharge side thereof being formed to direct moisture, moved along the surface of the element by the passing air, onto said plates.

5. A refrigerative system comprising a heat exchange element, means for moving air past said element, means for conducting refrigerant to and from said element, means actuated by said air movement for controlling the refrigerant conducting means, and vertical drip plates mounted in parallel relation on the air discharge side of said element with their edges in contact with the element.

6. A refrigerative system comprising a heat exchange element having fins, means for moving air along the surfaces of said fins, means for conducting refrigerant to and from said element, means actuated by said air movement for controlling the refrigerant conducting means, and drip plates mounted on the air discharge side of said element in contact with said fins, said plates being in spaced relation to confine the air flow beyond said element and thereby maintain its velocity, whereby free moisture formed on said fins will be moved onto said plates by the air.

7. A refrigerative system comprising a heat exchange element having fins, means for moving air along the surfaces of said fins, means for conducting refrigerant to and from said element, means actuated by said air movement for controlling the refrigerant conducting means, a casing surrounding said exchanger and extending in the direction of air flow arranged to deflect the discharged air upward and providing a drainage pan for free moisture, and fixed means on the air discharge side of the element, within the confines of said casing, adapted to receive free moisture from the air leaving said element and conduct it to said pan.

8. A refrigerative system comprising a heat exchange element, means for moving air past the element, means for conducting refrigerant to and from said element, means actuated by the air movement for controlling the refrigerant conducting means comprising a pivotally mounted vane in the path of flow of said air, and means for adjusting the effective moment arm of said vane.

9. A refrigerative system comprising a heat exchange element, means for conducting refrigerant to and from said element, means for moving air past said element, means actuated by said air movement for controlling the refrigerant conducting means comprising a vane mounted in front of said element so as to be swung about a pivot by the force of the said air acting on the vane, and means for adjusting the relation of said vane to the said pivot to vary the moment arm of the vane.

10. A refrigerative system comprising a heat exchange element, means for conducting refrigerant to and from said element, means for moving air past said element, means actuated by said air movement for controlling the refrigerant conducting means comprising a pivoted rod depending in front of said element, an air resistance plate movably mounted on said rod and means for fastening said plate in adjusted position thereon.

11. A refrigerative system comprising a heat exchange element, means for conducting refrigerant to and from said element, means for moving air past said element, means actuated by said air movement for controlling the refrigerant conducting means comprising a pivoted rod depending in front of said element, an air resistance plate movably mounted on said rod, a weight movably mounted on said rod, and means for separately fastening said plate and said weight in adjusted positions on said rod.

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