

Feb. 28, 1939.

G. GRUBB

2,148,983

REFRIGERATOR

Filed June 22, 1936

2 Sheets-Sheet 1.

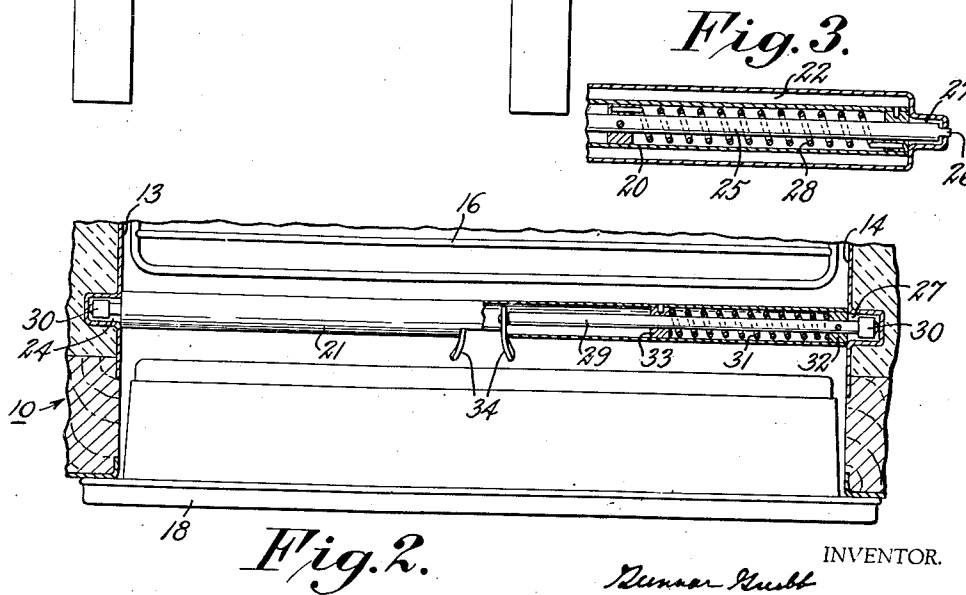
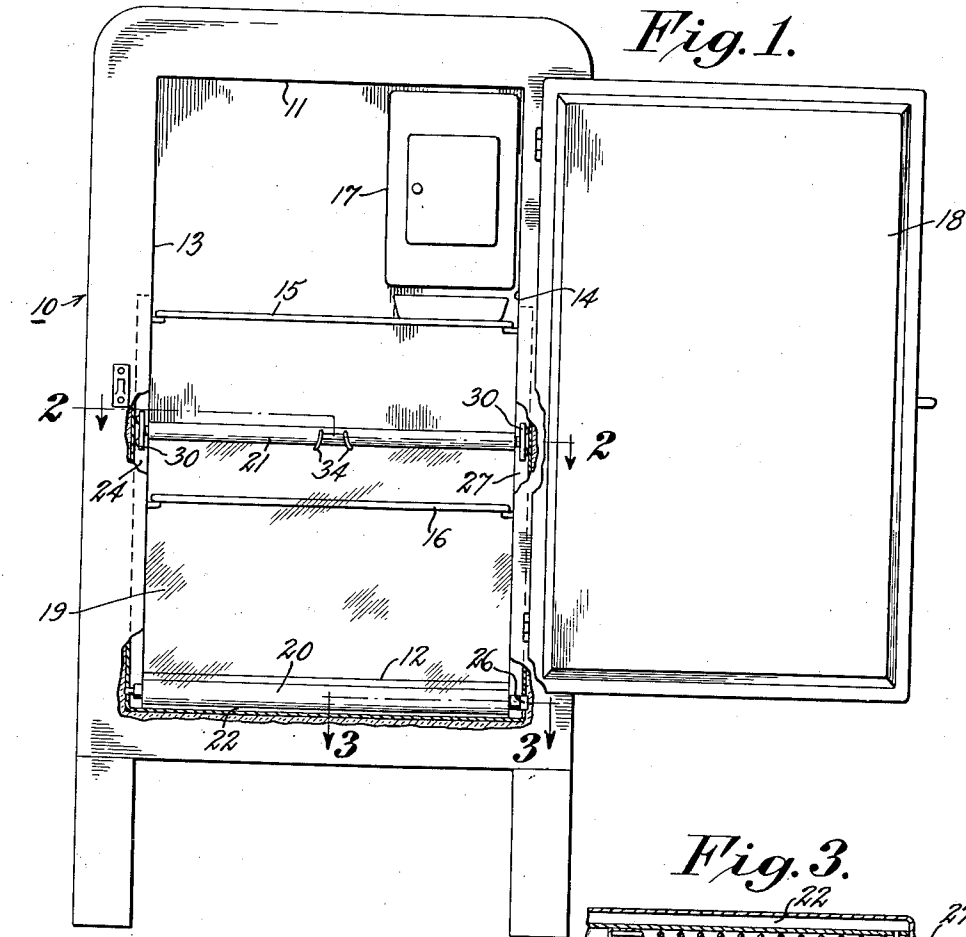
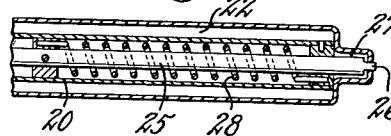


Fig. 3.



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2 Sheets-Sheet 2

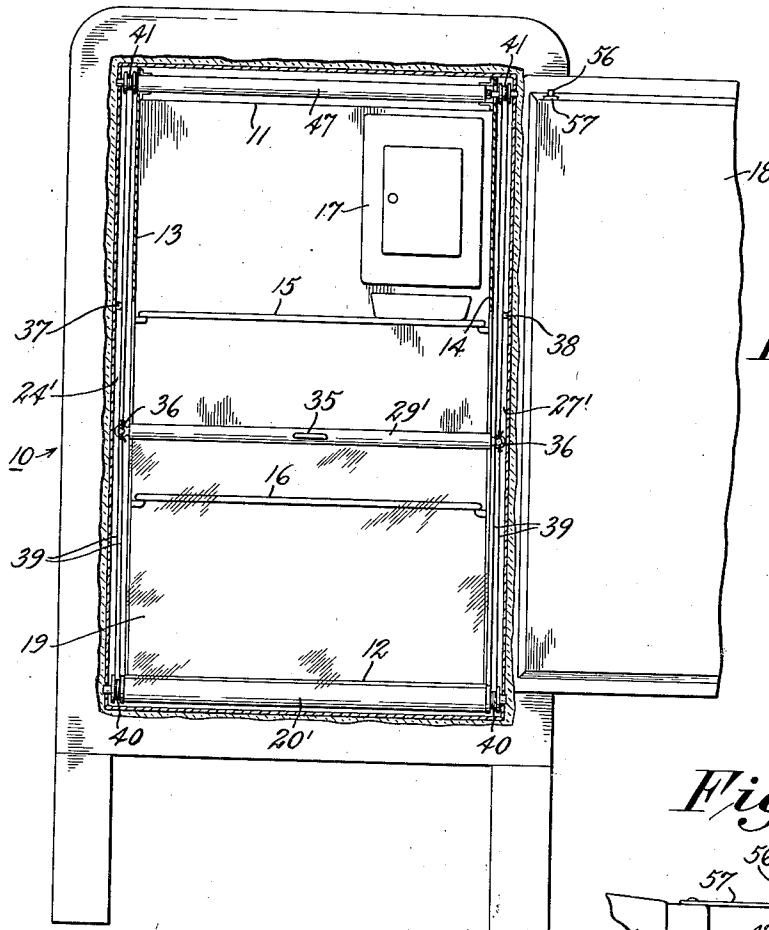


Fig. 4.

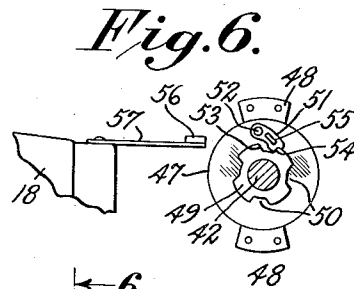


Fig. 6.

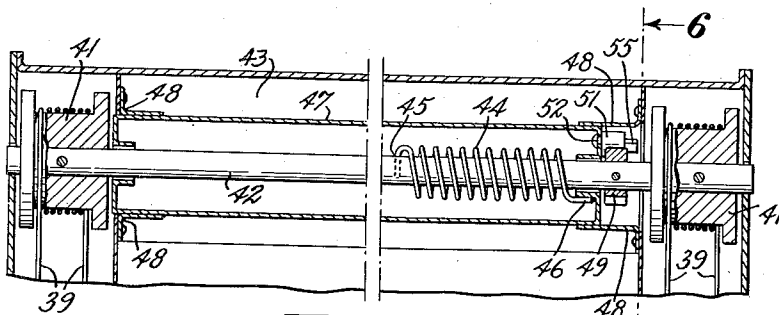


Fig. 5.

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UNITED STATES PATENT OFFICE

2,148,983

REFRIGERATOR

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mesne assignments, to Servel, Inc., New York,
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Application June 22, 1936, Serial No. 86,573
In Germany July 10, 1935

5 Claims. (Cl. 62—89)

My invention relates to refrigerators, and has for its object the provision of suitable apparatus for reducing the rate at which cold air escapes from the storage compartment of a refrigerator when the refrigerator door is opened.

Further objects and advantages of my invention will become apparent from the following description, and the various features of novelty which characterize my invention are pointed out with particularity in the claims appended to and forming a part of this specification.

For a better understanding of my invention reference may be had to the following description and accompanying drawings in which Fig.

1 is a front view, partly broken away and in section, of a refrigerator cabinet embodying my invention; Fig. 2 is a fragmentary view, partly in section, taken at line 2—2 of Fig. 1 with the refrigerator door shown in its closed position; Fig. 3 is a fragmentary view, in section, taken at line 3—3 of Fig. 1; Fig. 4 is a view similar to Fig. 1 illustrating a modification of my invention; Fig. 5 is an enlarged fragmentary view, in vertical section, of the upper portion of the refrigerator shown in Fig. 4; and Fig. 6 is a view taken at line 6—6 of Fig. 5 and also illustrates a fragmentary view of the upper hinge side of the refrigerator door.

Referring to Figs. 1 to 3 inclusive, I have shown my invention applied to a refrigerator 10 having a top wall 11, bottom wall 12, and side walls 13 and 14 defining a thermally insulated storage compartment. Spaced shelves 15 and 16 are provided for dividing the storage compartment into several sections, and a suitable cooling element 17 for producing cold is arranged in the uppermost section. At the front of the refrigerator cabinet a door 18 is pivotally supported by hinges for closing the opening and for providing access to the storage compartment.

In accordance with my invention, in order to reduce the rate at which cold air escapes from the storage compartment and is replaced by surrounding warmer air when the refrigerator door 18 is opened, I provide a shutter 19 arranged substantially at the opening of the refrigerator for closing the storage compartment. The shutter 19 is preferably flexible and comprises a sheet of flexible material sufficiently wide to extend from one side wall 13 to the opposite side wall 14 of the storage compartment. The supporting means for the shutter 19 is so constructed and arranged that the shutter is movable upwardly from and downwardly toward the bottom wall 12 in a plane substantially parallel to and closely

adjacent to the rear side of the door 18 when it is in its closed position. As shown in Fig. 1, a roller 20 is provided upon which the sheet of flexible material is adapted to be rolled, and a hollow rod 21 is secured to the upper free edge of the sheet of material. The roller 20 is located in a compartment 22 formed below the bottom wall 12 of the storage compartment, and the sheet of material extends through a slot in the bottom wall 12. One projecting end 23 of the roller is journaled in a groove or recess 24 which is formed in the side wall 13 and extends vertically upward to a point slightly above the upper shelf 15. A shaft 25 is journaled within the roller 20 and its flat projecting end 26 extends into a slot in a groove 27 which is formed in the opposite side wall 14 and extends vertically upward the same distance as the groove 24. A helical spring 28 is disposed about the shaft 25 with one end thereof fixed to the roller 20 and the opposite end thereof fixed to the shaft 25 for biasing the roller to rotate in such a direction that the sheet of material is automatically wound thereon.

Within each half of the hollow rod 21 is disposed a bar 29 having a slide bar 30 fixed to its outer end which is adapted to extend into and move along one of the vertically extending grooves. The slide bars 30 are normally urged outward by helical springs 31 disposed about the bars 29 between collars 32 and 33 fixed, respectively, to the bars 29 and hollow rod 21. The slide bars 30 normally render the helical spring 28 inoperative to roll the shutter 19 on the roller 20, so that the extent of the opening closed by the shutter 19 can be readily regulated by moving the rod 21 to the desired vertical position. When the two parts of a handle 34, secured to the inner ends of the bars 29 and extending through an opening in the hollow rod 21, are pressed together, the slide bars 30 are moved inward to release the hollow rod 21 whereby the rod can be moved upward against the tension of the spring 28, or the spring 28 is rendered operative to roll the shutter 19 onto the roller 20. The edges of the sheet of material may be increased slightly in thickness or strengthened in any other suitable manner so that they will withstand ordinary usage and wear.

Although the grooves 24 and 27 may be formed in the side walls 13 and 14 so that they will extend to the top of the storage compartment, it is not absolutely necessary to do this because the articles most frequently used can be placed on the top shelf 15 and the articles less frequently

placed on the shelf 16 and bottom wall 12. Since the coldest air in the storage compartment flows downwardly to replace air having a higher temperature, it will be seen that it is distinctly advantageous to provide the shutter 19 to enclose the bottom section or both the intermediate and bottom sections of the storage compartment, in order to reduce the rate at which such cold air escapes and is replaced with surrounding warmer air when the refrigerator door 18 is open.

In many instances the shutter 19 may inadvertently not be raised to its highest position after articles have been removed from or placed on the intermediate shelf 16 and bottom wall 12. In order to make certain that the shutter 19 will always be in its uppermost position when the refrigerator door 18 is opened, I provide suitable automatic apparatus for raising the shutter when the refrigerator door is moved to its closed position. Such a modification is illustrated in Figs. 4 to 6 inclusive with parts similar to those shown in Figs. 1 to 3 designated by the same reference numerals.

In Fig. 4, the rod 29' secured to the free end of the shutter 19 is not provided with any locking mechanism inasmuch as it is desired, if the situation arises, to raise the shutter automatically when the door is moved to its closed position. For this reason the bar 29' is provided with a simple handle 35 and to the outer ends thereof are secured rings 36 which extend through vertical slots in the side walls 13 and 14 into the recesses 24' and 27'. The rings 36 move upward and downward in the recesses 24' and 27' which extend the full height of the storage space. However, the upward movement of the shutter is limited to a point slightly above the upper shelf 15, as in the previous embodiment, by limiting the height of the vertical slots and by providing projections in the recesses 24' and 27', as indicated at 37 and 38 in Fig. 4. To each ring 36 is secured the end of a cord or wire 39 which extends downwardly in one of the recesses and is wound about a pulley 40 provided at each end of the rotatable member or roller 20' which in this modification in a simple roller having no helical spring.

From the pulleys 40 the wires 39 extend upward in the recesses 24' and 27' to the extreme top of the storage compartment where they are wound about pulleys 41 which are fixed to the ends of a shaft 42. The shaft 42 is journaled in the recesses 24' and 27' in a manner similar to the roller 20' and is located in a compartment 43 formed above the top wall 11 of the storage compartment. The wires 39 are wound about the pulleys 41 and extend downwardly and are secured at their lower ends to the rings 36 on the bar 29'.

In view of the foregoing, it will be apparent that when the bar 29' is moved upward and downward the wires 39 are effective to rotate both the shaft 42 and the roller 20', and that with rotation of the roller 20' the shutter 19 will be wound onto and from the roller 20', sufficient turns of wire being provided on the pulleys 40 and 41 to insure a positive driving of the roller 20' and the shaft 42.

In order to move the shutter 19 upward automatically when it is inadvertently left in a position below the shelves 15 or 16 and the door is closed, I provide suitable mechanism which is actuated to cause vertical movement of the shutter when the door is moved to its closed position. Referring to Figs. 5 and 6, this mechanism may

comprise a helical spring 44 disposed about the shaft 42 with the inner end thereof fixedly secured at 45 to the shaft 42, and the outer end thereof fixedly secured at 46 to the inwardly extending flange formed at the opening of an enclosed housing or sleeve member 47 through which the shaft 42 extends. The sleeve member 47 is stationary and rigidly secured by upper and lower brackets 48 at each end thereof to the extended upper ends of the side walls 13 and 14 of the storage compartment.

A ratchet wheel 49 having a plurality of spaced notches 50 about its periphery is rigidly secured to the shaft 42, and a pawl or locking device 51 cooperating with the ratchet wheel is pivotally secured at 52 to the end wall of the sleeve member 47. The wires 39 are so wound about the pulleys 41 that the tension of the spring 44 is increased when the bar 29' is moved downwardly. As the tension of the spring 44 is being increased the ratchet wheel 49, referring to Fig. 6, rotates in a clockwise direction. The notches 50 on the ratchet wheel are so formed that the rear walls 53 are inclined sufficiently to permit the pawl 51 to fall and slip out of each notch as the ratchet wheel 49 is rotating in a clockwise direction. The leading walls 54 of the notches 50 are so inclined that, when the shutter is slowly brought to a stop with the pawl 51 extending its full depth into one of the notches 50, the pawl 51 will effectively engage such notch and maintain the spring 44 under tension. By moving the bar 29' downward slightly to cause the pawl 51 to slip out of the notch it is effectively engaging, the bar 29' can be moved upward manually if this rate of upward movement is such that the pawl 51 is not permitted to extend its full depth into any one notch during counterclockwise movement of the ratchet wheel 49, the angle of inclination of the leading walls 54 of the notches 50 being such that the pawl 51 will only effectively engage a notch when it is extending its full depth into the notch. It will therefore be seen that the shutter 19 can be moved downward and upward manually, and that when the shutter is moved to a position below the shelf 15 the tension of the spring 44 is increased and the pawl 51 is effective to render the spring 44 inoperative to rotate the shaft 42 and immediately raise the shutter 19.

In order to release the pawl 51 from the ratchet wheel 49 when the spring 44 is under tension, so that upward movement of the shutter is automatically effected when the door is moved to its closed position, the pawl 51 is provided with a projecting tongue 55, as shown in Figs. 5 and 6, and a projecting pin 56 is fixed to the inner wall of the door 18. The pin 56 may be secured to an end of a bracket 57 extending inwardly from the door, as shown in Fig. 6, so that, when the door is moved to its closed position, the projecting tongue 55 will be in the path of movement of the pin 56. The pin is arranged to slide on the under inclined side of the projecting tongue 55 and raise the pawl 51 from the notch it is engaging, thereby rendering spring 44 operative to rotate the shaft in such a direction that the shutter 19 will be raised to enclose the intermediate and lower sections of the storage compartment. When the shutter 19 has been automatically raised and the refrigerator door 18 is again opened, any downward movement of the shutter 19 will always increase the tension of the spring 44 so that, if the shutter 19 is not manually moved upward, the spring 44 will drive the pulleys

40 and 41 to raise the shutter 19 when the door is subsequently moved to its closed position.

The shutter 19 may be formed of suitable transparent material, such as that known under the trade-mark "Cellophane", or the material may be colored so that the shutter will be readily visible to indicate that the lower or both the intermediate and lower sections of the storage compartment are closed.

10 In the embodiments of my invention that I have described and illustrated the compartments and recesses for housing the operating mechanism are so formed that the walls of the storage compartment do not have any projecting portions.
15 The walls of the storage compartment may also be so formed that projecting compartments are provided for housing the operating mechanism directly behind the door at the opening of the storage compartment. While I have shown and described particular embodiments of my invention, therefore, such variations and modifications are contemplated as fall within the true spirit and scope of my invention, as pointed out in the following claims.

25 What is claimed is:

1. A refrigerator including walls forming an insulated storage compartment having a door opening in a vertical side thereof, a door for closing said opening and means for cooling said compartment, a shutter of the shade roller type including a flexible transparent member, a roller at the bottom of said door opening and means acting on said roller and tending to keep said shutter in a rolled position, and means for maintaining the shutter in a selectively extended position, said shutter cooperating with the adjacent edges of the compartment to form a seal restricting the loss of cooled air while permitting substantially full view of the compartment.

40 2. A refrigerator including walls forming an insulated storage compartment having a door opening in a vertical side thereof, means for cooling said compartment, a shutter of the shade roller type including a flexible transparent member and a roller at the bottom of the said door opening, means tending to keep said shutter in rolled position upon said roller, and means for maintaining the shutter in a selectively extended

position, said shutter when extended cooperating with the adjacent edges of the compartment to form a seal restricting the loss of cooled air.

3. A refrigerator including means forming a food storage compartment having a door opening in a vertical side thereof, means for cooling said compartment, a shutter of the shade roller type including a flexible transparent member, a roller upon which one end of said shutter is attached, means tending to keep said shutter in a rolled position, and means whereby the transparent member may be maintained in a selectively extended condition and a seal may be formed at the edges of said shutter for restricting the loss of cooled air.

4. A refrigerator including means forming a food storage compartment having a door opening in a vertical side thereof, means for cooling said compartment, a shutter of the shade roller type including a flexible transparent member and a roller at the bottom of said compartment attached to one end of said shutter, means tending to keep said shutter in a rolled position, and means whereby the transparent member may be maintained in a selectively extended condition and a seal may be formed at the edges of said shutter for restricting the loss of cooled air, whereby the bottom of the compartment, the shutter in its extended condition, together with the side walls of the compartment cooperatively form a well for cooled air.

5. A refrigerator including means forming a food storage compartment having a door opening in a vertical side thereof, channel means extending along each side wall adjacent the door opening, a door for closing said opening and means for cooling said compartment, a shutter of the shade roller type including a flexible transparent member adapted to slide in said channels, a roller upon which one end of said shutter is rolled, means tending to keep said shutter in its rolled position, and means whereby the transparent member may be maintained in a selectively extended condition and a seal may be formed at the side edges thereof for restricting the loss of cooled air and permitting substantially full view of the interior of said compartment.

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