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(54) **REFRIGERATED CABINET**

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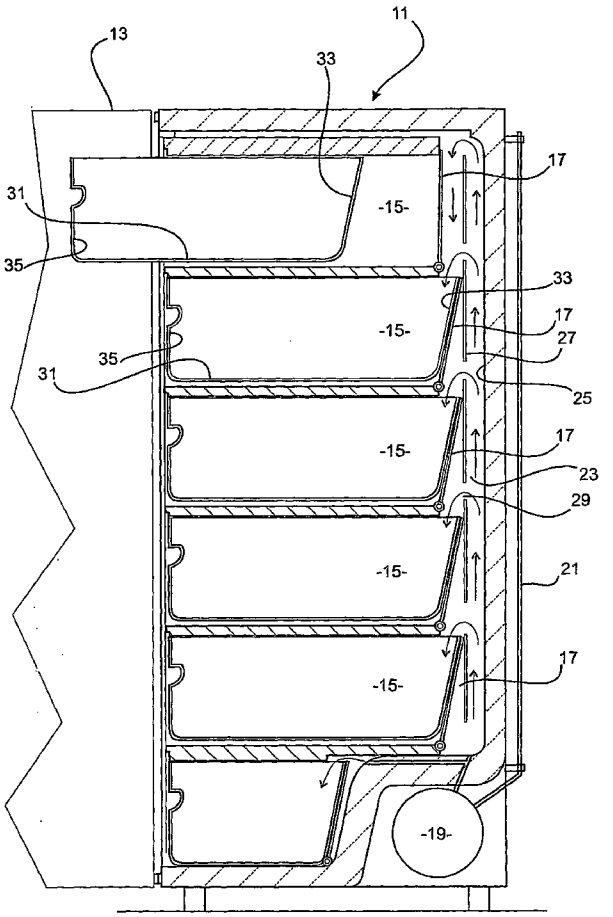
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(57) **ABSTRACT**

A refrigerated cabinet (**11**) comprising storage space having a front opening through which access is gained to the space, the space including a zone subdivided into at least one compartment (**15**), each compartment (**15**) defined by a drawer (**31**), each drawer (**31**) being moveable from a retracted position at which it is accommodated within the zone and an extended position at which it extends forwardly from the space, wherein when the drawer (**31**) is in the retracted position the compartment is connected to a cooling means (**23**) and when the drawer is in the extended position the interior of the compartment is accessible from an upper portion of the drawer (**31**) and the drawer (**31**) is isolated from the cooling means (**23**), the isolation means being associated with the cabinet (**11**) to sealingly isolate the cooling means (**23**) from the compartment (**15**) when the drawer (**31**) is not in the retracted position.



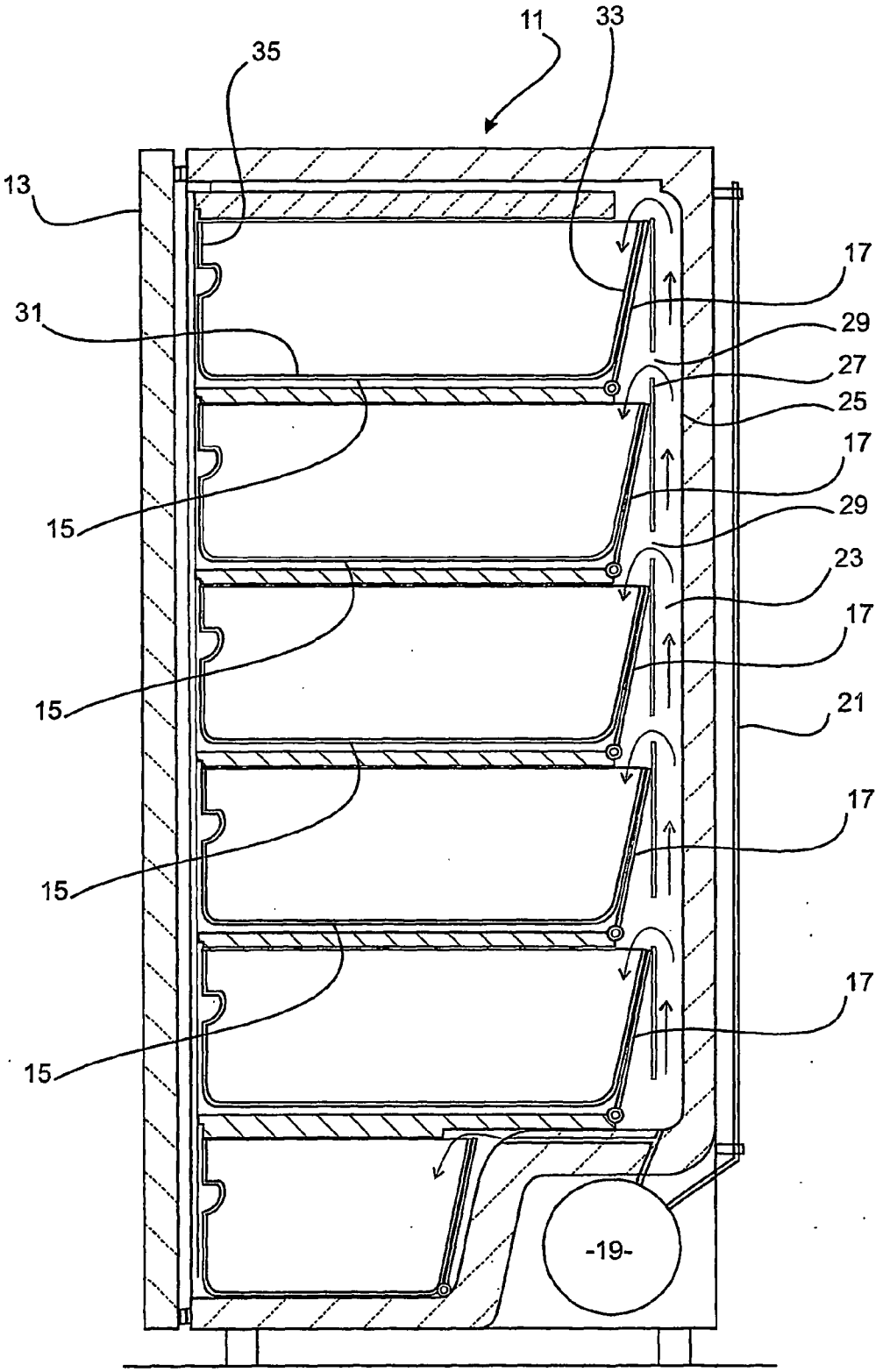


Fig. 1

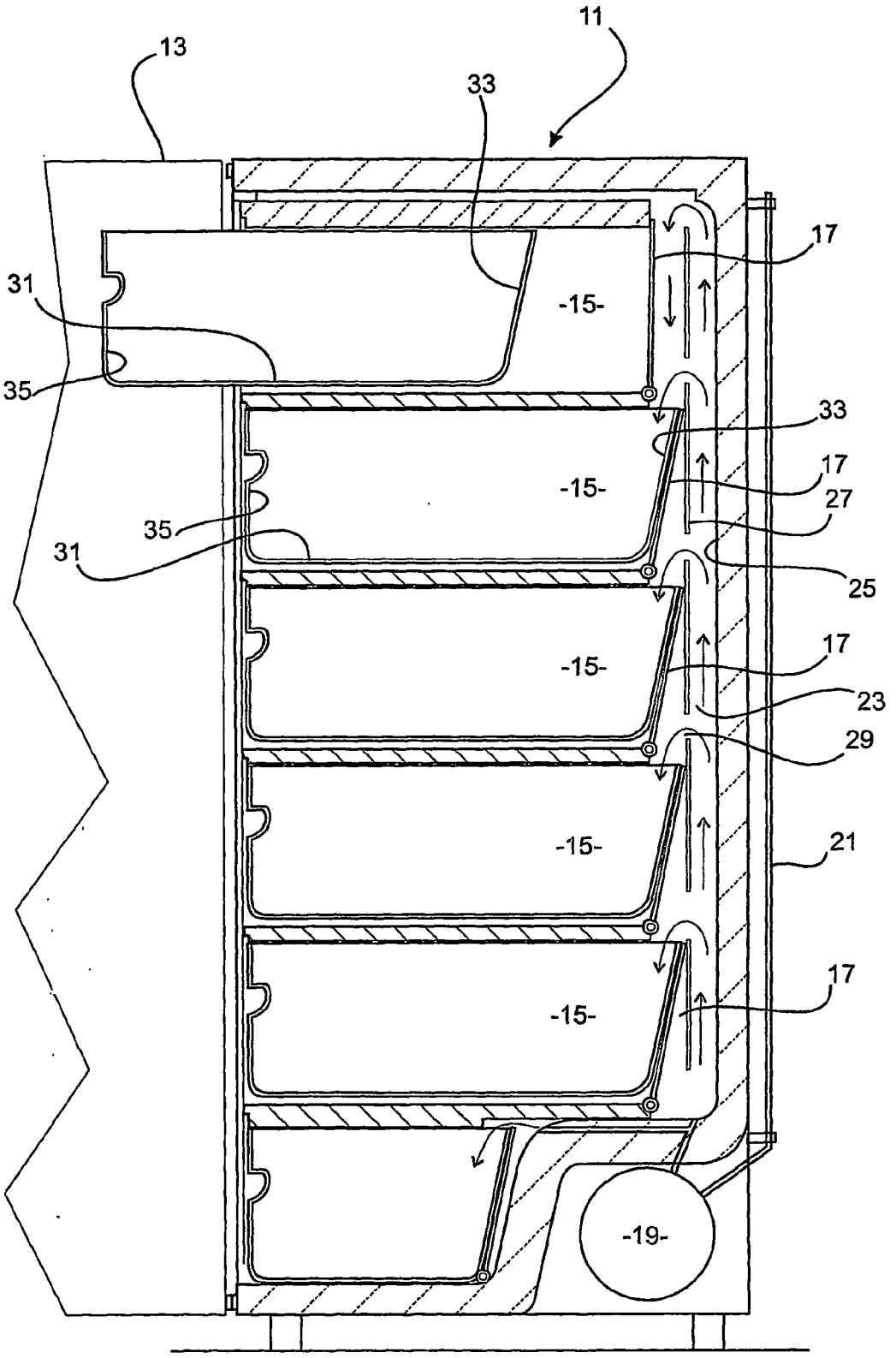


Fig. 2

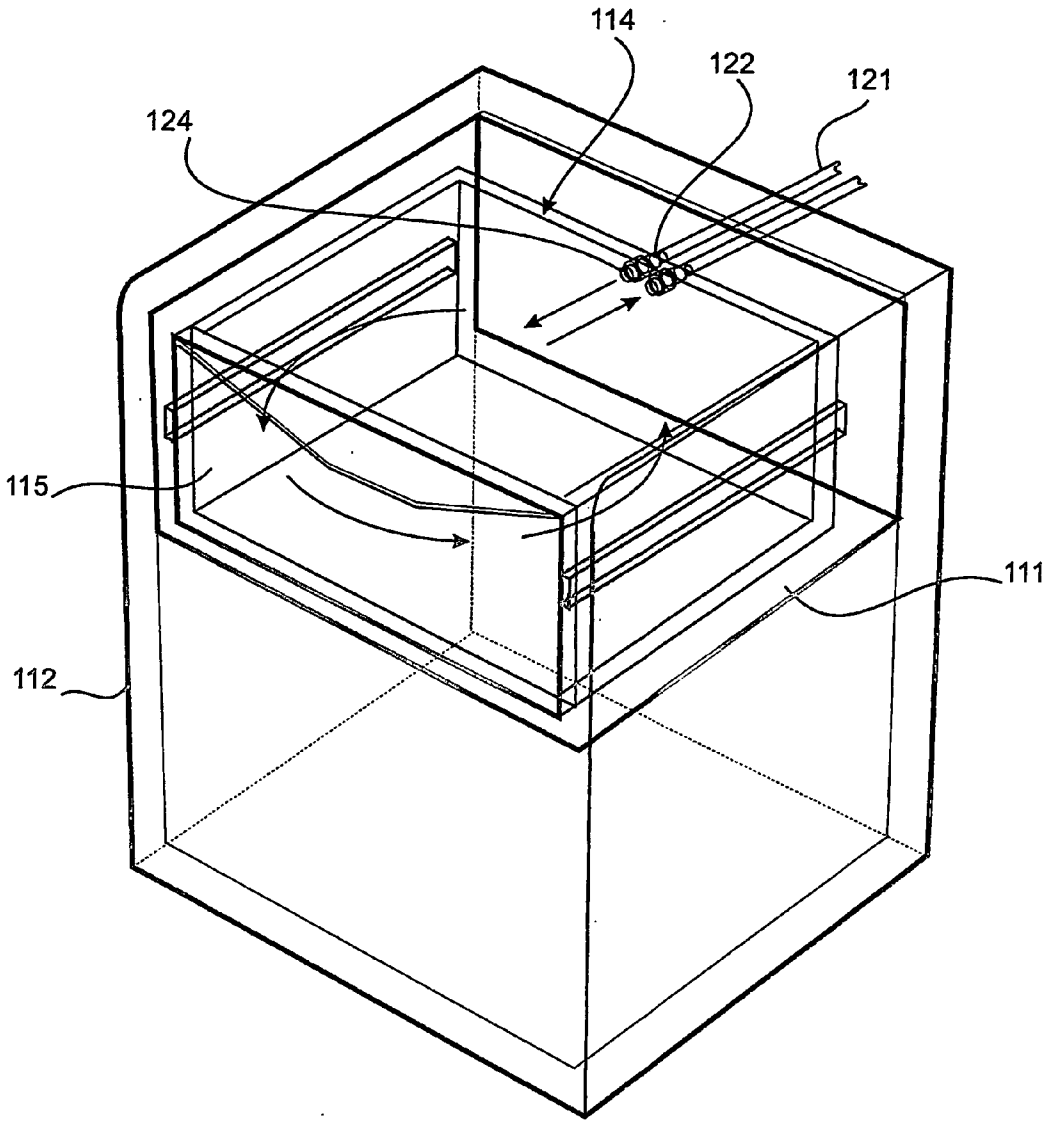


Fig. 3

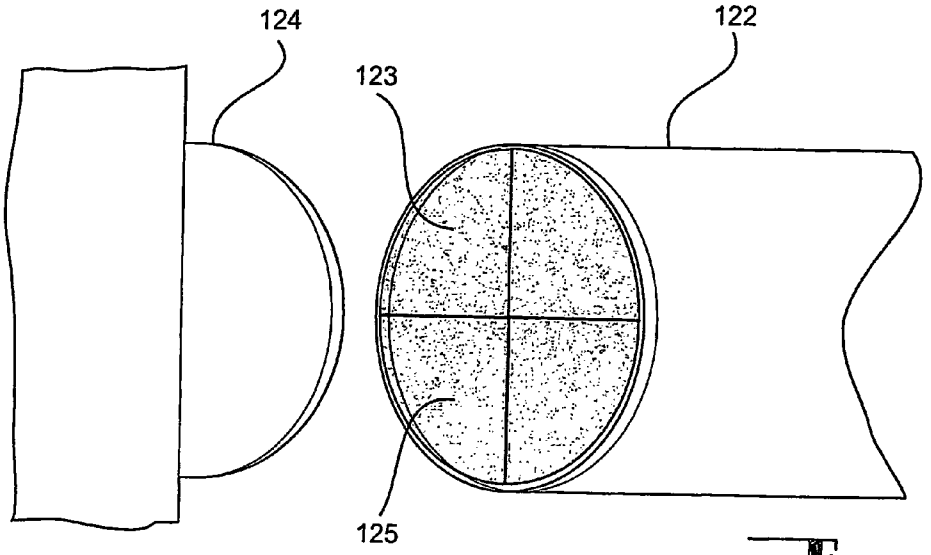


Fig. 4A.

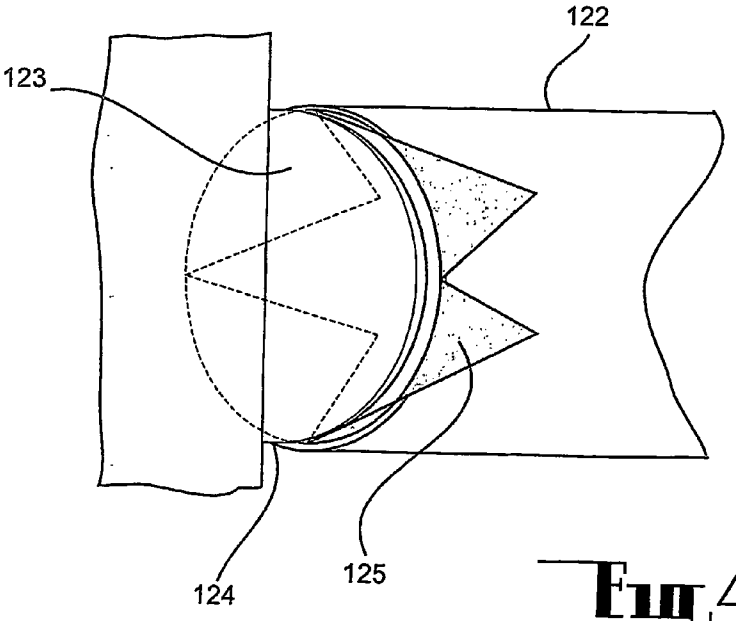


Fig. 4B.

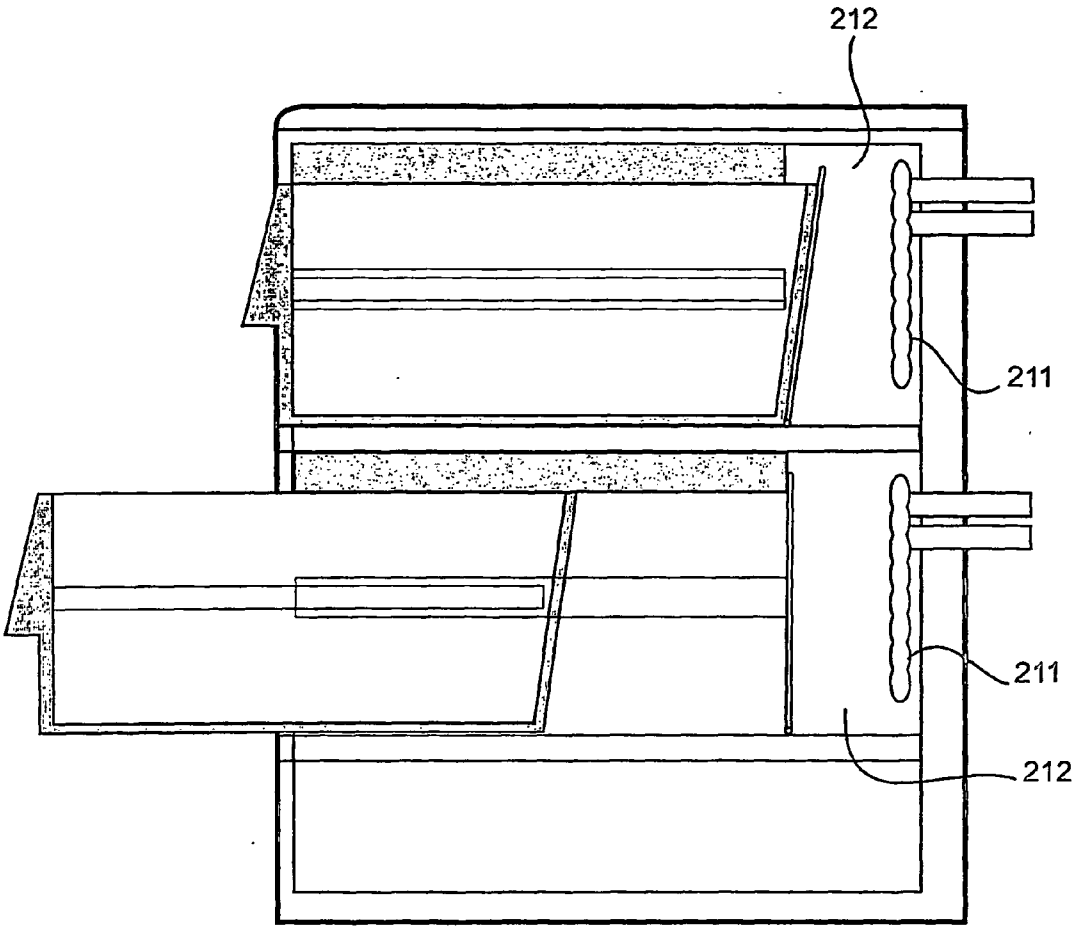


Fig. 5

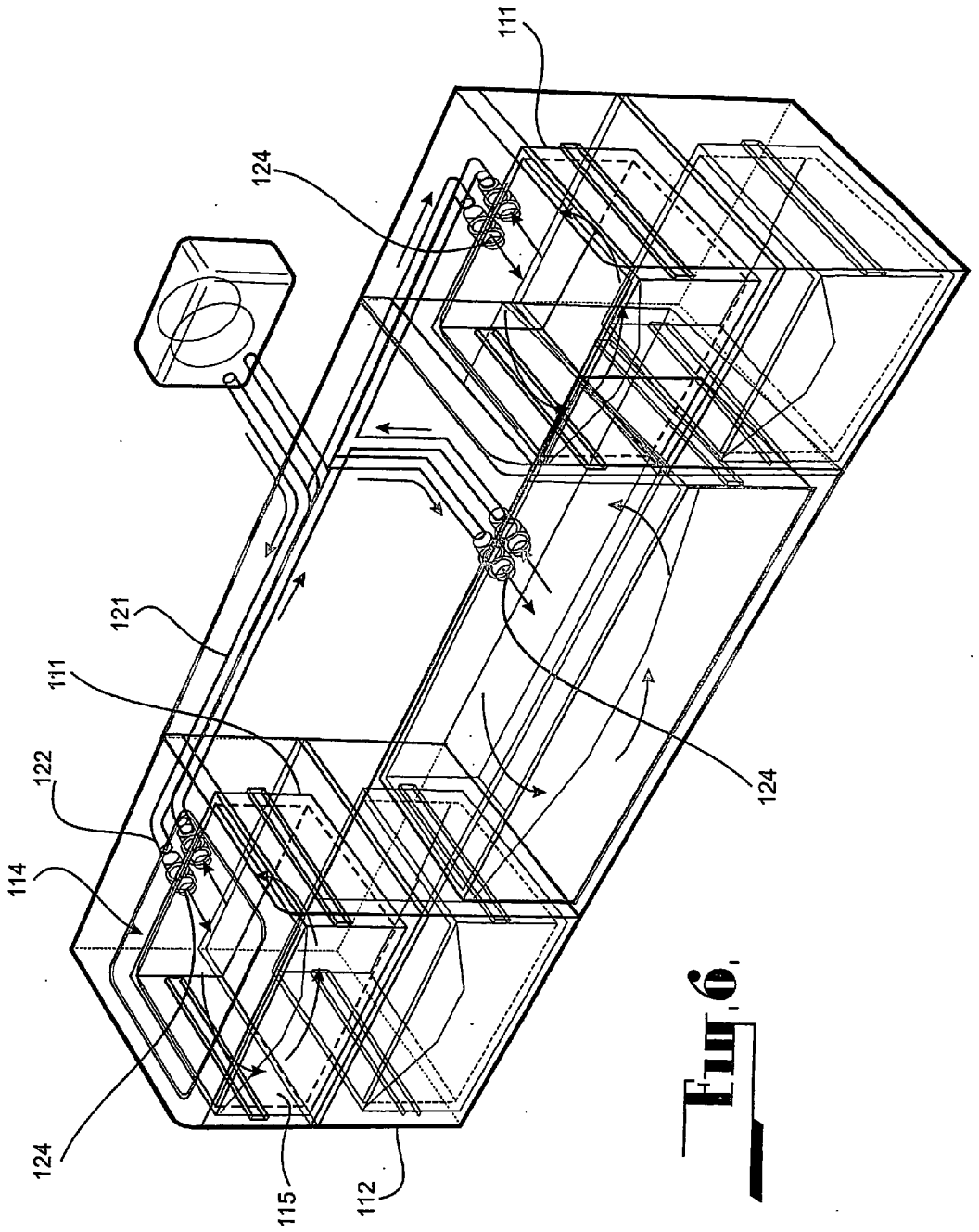


Fig. 6

REFRIGERATED CABINET

FIELD OF THE INVENTION

[0001] This invention relates to a refrigerated cabinet.

BACKGROUND

[0002] It is a characteristic of refrigerated cabinets such as domestic refrigerators that they provide a storage space and have a front door which is opened to enable access into the storage space. A difficulty with conventional domestic refrigerators arises from the circumstance that when the door is opened, all of the cold air contained within the storage cabinet is able to readily escape through the open front opening of the storage space. In addition in commercial situations it is an established practice to provide cool rooms with doors which facilitate access into the cool room for the purposes of extracting goods from the cool room and/or the purposes of entry. Furthermore in retail sites it is common practice to provide refrigerated cabinets which have a permanently open front opening to facilitate access by customers to the goods contained within that cabinet through the open front opening. In order to prevent the loss of cool air from the cabinet it is usual practice to generate a forced air flow through the space which tends to control the flow of cool air to limit its loss through the open front opening of the cabinet and/or to provide a curtain-like closure which provides a temporary closure to the space but which is readily capable of being displaced to enable access into the space.

DISCLOSURE OF THE INVENTION

[0003] Accordingly the invention resides in a refrigerated cabinet comprising a storage space having a front opening through which access is gained to the space, the space including a zone subdivided into at least one compartment, each compartment defined by a drawer, each drawer having been moveable within the zone from a retracted position at which it is accommodated within the zone and an extended position at which it extends forwardly from the space, wherein when in the extended position the interior of the compartment is accessible from an upper portion of the drawer and when the drawer is in the retracted position the compartment is able to communicate with the remainder of the space, a cooling means adapted to cool at least the upper portion of the remainder of the space.

[0004] According to a preferred feature of the invention the isolation means is associated with the cooling means.

[0005] According to a preferred feature of the invention the isolation means is associated with the compartment.

[0006] According to a preferred feature of the invention a portion of the compartment is associated with a closure, said closure being moveable between an open position and a closed position wherein when the drawer is in its retracted position the closure is moved to the opened position to provide said communication and when the drawer is in its extended position the closure is in its closed position.

[0007] According to a preferred feature of the invention said remainder of the space includes a plenum formed between the walls of the space and the at least one compartment, said communication being between the plenum and the at least one compartment.

[0008] According to a preferred feature of the invention the closure comprises at least a portion of the rear wall of the drawer and the plenum is located between the rear wall of the face of the rear walls of the at least one compartment.

[0009] According to a further preferred feature of the invention the plenum is defined by a wall of the space and an opposed wall, said opposed wall being provided with a set of closures which are in one to one relationship with the compartments, said closures being moveable between a closed position and an open position wherein when the drawers are in the retracted position they cooperate with the closures moved to the open position to provide said communication when said drawers are moved from the retracted position the closures are closed to prevent said communication.

[0010] According to a preferred feature of the invention wherein a least a portion of the upper face of the compartment is open. According to a further preferred feature of the invention the portion of the upper face communicates with the source when the drawer is in the retracted position.

[0011] According to a preferred feature of the invention the front opening of the at least one compartment sealingly cooperates with the front opening when the drawer is in the retracted position.

[0012] According to a preferred feature of the invention a plurality compartments are accommodated within the zone. According to a preferred feature of the invention the compartments are supported in a vertical array.

[0013] According to a further feature of the invention the front opening is associated with a door which controls said access. According to a further preferred feature of the invention the door accommodates one or more storage zones, the space defined between the door and front opening communicating with the remainder of that space. According to an embodiment the storage zones are closed by a closure which is capable of being opened wherein the interior of the storage zones communicate with the remainder of the space. According to a preferred feature of the embodiment the communication between the remainder of the space and the space defined between the door and front opening and/or storage zones is through passageways provided in the door.

[0014] According to a preferred feature of the invention the cooling means comprises a duct element and the isolation means comprises a valve associated with said duct element, and the drawer comprises a member adapted to open said valve when the drawer is in the retraced position and the valve comprises means to close said valve when the drawer is not in the retracted position.

[0015] According to a further aspect, the invention resides in a refrigeration system comprising a plurality of refrigerated cabinets of a type as previously referred to wherein the cooling means is provided to each refrigerated cabinet from a common cooling source.

[0016] The invention will be more fully understood in the light of the following description of several specific embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The invention is described with reference to the accompanying drawings of which;

[0018] FIG. **1** is a schematic sectional side elevation of a refrigerated cabinet according to the first embodiment with the door in a closed position; and

[0019] FIG. **2** is a schematic sectional side elevation of a refrigerated cabinet according to the first embodiment with the door in the open position and a drawer in an extended position.

[0020] FIG. **3** is a schematic isometric view of a refrigerated compartment according to the fourth embodiment.

[0021] FIG. **4**A is a diagrammatic representation of a leaved valve in a connecting duct according to the fourth embodiment, the valve being in the closed position.

[0022] FIG. **4**B is a diagrammatic representation of a leaved valve in a connecting duct according to the fourth embodiment, the valve being in the open position.

[0023] FIG. **5** is a schematic sectional side elevation of a refrigerated compartment according to the fifth embodiment.

[0024] FIG. **6** is a schematic isometric view of a refrigeration system using three refrigerated compartments according to the fourth embodiment connected to a common cooling source.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

[0025] The first embodiment shown in the accompanying drawings relates to a domestic refrigerator which comprises a cabinet **11** which defines a storage space within its interior. The cabinet **11** is open at its front opening and is provided with a door **13** which is associated with the front opening to be moveable from a closed position as shown at FIG. **1** to prevent access to the front opening of the cabinet and an open position as shown at FIG. **2** which enables access to the front opening of the cabinet. The storage space of the cabinet includes a zone which is defined by a set of compartments **15**. Each compartment **15** is closed at its lower and upper face. In addition the rear face of each compartment is closed by a closure element **17** which is pivotally supported from the lower wall of the respective compartment such that it is moveable between a closed position at which the upper edge of the closure **17** substantially sealingly cooperates with the rearmost end of the upper wall of the compartment and an open position at which the compartment is declined rearwardly to provide communication into the compartment through the gap defined between the upper edge of the closure and the rear edge of the uppermost wall of the respective compartment.

[0026] The cabinet is associated with a conventional refrigeration circuit comprising compressor **19** supported in the lower portion of the cabinet, a condenser **21** supported from the rear exterior face of the cabinet and a vaporiser **22** which is accommodated at the upper end of the compartment of the space. If desired the refrigerator can be provided with a fan which causes air to pass over the vaporiser and thence through the space.

[0027] The space within the cabinet comprises a plenum **23** defined between the rear wall **25** of the space at an intermediate wall **27** which is spaced inwardly from the rear wall **25**. The intermediate wall is provided with a plurality of openings **29** which provide communication between plenum **23** and an intermediate portion **24** of the space defined between the intermediate wall **27** and the rear walls of the compartments.

[0028] Each compartment **15** slidably supports a drawer **31** which is moveable from a retracted position at which it is fully accommodated within the compartment **15** (as shown in FIG. **1**) and an extended position at which it extends forwardly from the compartment (as shown in the case of the uppermost compartment of FIG. **2**). Each drawer comprises a lower wall, a front wall **35** and a rear wall **33** has an open top. The front face **35** of each drawer sealingly cooperates with the front opening of the cabinet such that when the drawer is in its retracted position the compartment is sealingly closed at the front face. The rear wall of **33** of each drawer cooperates with the closure **17** of each compartment to move the closure to its open position when the drawer is in its retracted position. Each closure **17** is biased such that on the drawer being moved towards its extended position out of engagement with the closure the closure will move to its closed position.

[0029] As a result of the embodiment the space within the refrigerated cabinet is divided into a plurality of spaces which are each defined by the drawers **31**. Access to the drawers **31** is gained by opening the door **13** of the cabinet and moving the respective drawer **31** to its extended position. In so doing the communication between the plenum **23** and the respective compartment **15** is closed as a result of the closing of the closure **17**. Access to the contents of drawer **31** are gained through the open top of the drawer. As a result communication between the plenum **23** and each compartment is only effected when the drawer contained within the compartment is in its retracted position. Therefore when the door **13** of the cabinet is open substantially little cold air is lost from the storage space within the cabinet even when access is gained to the interior of a drawer. With the door **13** open and a drawer **31** in its extended position the plenum **23** is closed and access to the drawer is through the open top only and therefore little cool air is lost through the compartment. The most significant loss of cool air is a result of disturbance of the contents of the drawer.

[0030] In addition the door **13** supports a set of storage zones **41** which are each associated with a separate closure which enables access into each storage zone. Each storage zone is connected to a duct **43** in the door which connects with a corresponding positioned passageway **45** in the upper wall of the cabinet when the door is closed and which communicates with the space around the vaporiser to enable cool air to flow into each storage zone to cool the contents thereof. If desired the passageway **45** can also communicate with the space defined between the door and the front opening of the cabinet when the door is in its closed position.

[0031] According to a second embodiment of the invention (not shown) the closure of each compartment may be accommodated by the rear wall of the drawer which cooperates with the walls of the compartment to sealingly close the compartment on a drawer being moved from the retracted position to the extended position but when the drawer is in the closed position opens to provide communication between the source of cool air and the interior of the drawer.

[0032] According to a third embodiment of the invention the drawer substantially cooperates with the walls of the

compartment to substantially prevent any substantial movement of cool air from the plenum past the drawer and through the front opening. The engagement need not be a sealing engagement. In addition the upper face cooperates with the upper wall of the compartment whereby when on the drawer moving to the retracted position the upper open face of the drawer opens into the plenum space. According to this embodiment no closure is provided between the respective compartment and the plenum space to isolate the compartment from the plenum space when the drawer is moved towards its extended position.

[0033] Each of the embodiments of the invention described above can be applied to a domestic refrigerated cabinet, domestic freezers, commercial cool rooms, commercial refrigerated cabinets and the like.

[0034] However, by the application of the invention a number of the constraints to the design of refrigerator systems are removed and a designer is able to provide quite innovative designs which embrace the invention. In a fourth embodiment, as shown in FIG. **3**, a refrigeration system is provided which embraces the freedoms provided by the invention. The embodiment comprises at least one compartment **111** providing a storage space which in use is installed within a suitable enclosure **112**. Unlike the embodiments previously described, the enclosure for the compartment of the fourth embodiment is not a specialised refrigerator cabinet but rather may be any convenient enclosure such as a conventional kitchen cabinet.

[0035] The compartment **111** comprises an insulated wall and has a front opening through which access is gained to the space and encloses a drawer **114** adapted to slide between an extended position for access to the drawer and a retracted position wherein the drawer **114** is substantially enclosed within the compartment **111**. The front, external wall **115** of the drawer is insulated and sealing means is provided between the drawer and the compartment (not shown) so that when the drawer is in the retracted position the contents of the drawer are fully sealed and insulated within the compartment. A suitable cooling means is provided so that when the drawer **114** is in its retracted position the cooling means is adapted to cool the contents of the drawer and when the drawer **114** is not in the retracted position the drawer is isolated from the cooling means.

[0036] This arrangement allows considerable freedom of choice over the selection of the cooling means. In the fourth embodiment, chilled air produced by a remote source is distributed through a suitable ducting system **121**. As shown in FIGS. **3** and **4**A, in the vicinity of a compartment, the ducting system **121** is provided with valved porting means **122** in the form of a short connecting duct entering the compartment and housing a valve **123** which is adapted to be engaged by corresponding porting means in the drawer **114** in the form of a suitable nozzle **124** at the rear of the drawer **114**. When the drawer **114** is in the retracted position, the nozzle **124** opens the valve **123** and thereby enables chilled air to enter the drawer space.

[0037] In the embodiment, as shown in FIG. **4**A and **4**B, the valve in the connecting duct **122** comprises a plurality of flexible leaves **125** normally extending across the throat of the connecting duct **122** to thereby seal the duct **122**. The leaves **125** are readily displaced by the nozzle **124** to permit communication of the chilled air into the drawer space. As the chilled air is circulated at low pressure, absolute sealing is not essential and a fairly simple valving arrangements will be found satisfactory.

[0038] In certain adaptations, the nozzle **124** is also valved although this is not considered important as external air must enter space behind the drawer when the drawer is in the extended position. In the embodiment as shown in FIG. **3**, a pair of ports are provided, one inlet and one outlet port, thereby promoting good circulation of the chilled air. Again, this may not be considered necessary in certain configurations. The porting arrangement just described should be considered as an example only of the type of disengagable connection that might be used and it should be recognized that one of many other known arrangements could also be adapted to the embodiment.

[0039] As mentioned earlier, the cooling means may take many forms. In a fifth embodiment, as shown in FIG. **5**, chilled coolant is distributed rather than chilled air. A localised evaporator **211** is provided in a plenum **212** associated with each compartment and isolation means is provided between the drawer and the cooling means which is generally of the form described in relation to the first embodiment. It is thought that this arrangement may provide a system whereby localised thermostatic control may be provided to each drawer in a multi drawer system.

[0040] The arrangements such as those described in relation to the fourth and fifth embodiments lend themselves to providing a plurality of separated compartments in a single refrigeration system, as shown in FIG. **6**. The compartments might be produced in a number of standardised sizes and an interior designer might select several and locate them at different positions around a kitchen area. These might be linked to a single, common cooling source which could be located remote from the compartments thereby removing the main noise source to another location. Some compartments could be provided immediately below bench-top level and provided with a transparent viewing panel to enable a user to identify the contents without opening the drawer. In such an arrangement, the transparent panel might be sealingly hinged so that it could be opened to thereby provide an additional means of access as well as by extending the drawer. Within such a system, where individual thermostatic control is provided, certain compartments could be configured as freezer units while others are less cooled for general chilled goods. Indeed, other compartments might only be slightly chilled, for example for storing wine.

[0041] All of the embodiments show a considerable improvement in total efficiency over conventional refrigerators, as a result of the fact that there is a very substantial reduction in the volume of cooled air which is lost when a compartment is opened. In addition, they are more accessible because the goods are arranged in the drawers rather than being stacked on shelves where the rearmost items are relatively inaccessible. This is an advantage to the general user but even more particularly to those suffering from a disability.

[0042] Throughout the specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[0043] It should be appreciated that the scope of the present invention need not be limited to the particular scope of the embodiments described above.

1. A refrigerated cabinet comprising a storage space having a front opening through which access is gained to the space, the space including a zone subdivided into at least one compartment, each compartment adapted to be occupied by a drawer, each drawer being moveable within the compartment from a retracted position at which it is accommodated within the compartment and an extended position at which it extends forwardly from the zone, and whereby the interior of the drawer is accessible from an upper portion of the drawer, the cabinet further comprising cooling means wherein when the drawer is in the retracted position, the cooling means is in communication with the drawer and when the drawer is in an extended position the cooling means is isolated from the compartment by isolation means.

2. A refrigerated cabinet as claimed in claim 1 wherein a portion of the compartment is associated with a closure, said closure being moveable between an open position and a closed position wherein when the drawer is in its retracted position the closure is moved to the opened position to provide said communication with the drawer and when the drawer is in its extended position the closure is in its closed position to thereby isolate the compartment from the cooling means.

3. A refrigerated cabinet as claimed in claim 1 wherein said cooling means comprises a plenum formed between the walls of the storage space and the at least one compartment said communication being between the plenum and the at least one compartment.

4. A refrigerated cabinet as claimed in claim 3 wherein the closure comprises at least a portion of the rear wall of the drawer and the plenum is located between the rear wall of the drawer and the face of the rear walls of the at least one compartment.

5. A refrigerated cabinet as claimed in claim 3 wherein the plenum is defined by a wall of the storage space and an opposed wall, said opposed wall being provided with a set of closures, each compartment being associated with at least one closure, each closure being moveable between a closed position and an open position wherein when a drawer is in the retracted position it cooperates to move the at least one respective closure to the open position to provide said communication and when said drawer is moved from the retracted position the respective at least one closure is closed to prevent said communication.

6. A refrigerated cabinet as claimed in claim 1 wherein at least a portion of the upper face of the compartment is open.

7. A refrigerated cabinet as claimed in claim 1 wherein the portion of the upper face communicates with the source when the drawer is in the retracted position.

8. A refrigerated cabinet as claimed in claim 1 wherein the front opening of the at least one compartment sealingly cooperates with the front opening when the drawer is in the retracted position.

9. A refrigerated cabinet as claimed in claim 1 wherein a plurality of compartments are accommodated within the zone.

10. A refrigerated cabinet as claimed in claim 1 wherein the compartments are supported in a vertical array.

11. A refrigerated cabinet as claimed in claim 1 wherein the front opening is associated with a door which controls said access.

12. A refrigerated cabinet as claimed in claim 11 wherein the door accommodates one or more storage zones, the space defined between the door and front opening communicating with the remainder of the space.

13. A refrigerated cabinet as claimed in claim 12 wherein the storage zones are closed by a closure which is capable of being opened wherein the interior of the storage zones communicate with the storage space.

14. A refrigerated cabinet as claimed in claim 13 wherein the communication between the remainder of the space and the space defined between the door and front opening and/or storage zones is through passageways provided in the door.

15. A refrigerated cabinet as claimed in claim 1 wherein the isolation means is associated with the cooling means.

16. A refrigerated cabinet as claimed in claim 1 wherein the isolation means is associated with the compartment.

17. A refrigerated cabinet as claimed in claim 15 wherein the cooling means comprises a duct element adapted to convey chilled air and the isolation means comprises a valve associated with said duct element, and the drawer comprises a means operative to open said valve when the drawer is in the retraced position and the valve comprises means to close said valve when the drawer is not in the retracted position.

18. A refrigeration system comprising a plurality of refrigerated cabinets as claimed in claim 1 wherein the cooling means is provided to each refrigerated cabinet from a common cooling source.

19. (canceled)

20. (canceled)

21. (canceled)

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