"Refrigerated Cabinet"

Field of the Invention

This invention relates to a refrigerated cabinet.

Background

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.

Refrigerator and freezer arrangements have been proposed which segregate the storage space into a number of drawers each of which may be extended one or more at a time to gain access to the goods stored within the drawers. Another improvement is disclosed in German specification DE19546984 by Hans SIMON. This disclosure reveals several embodiments which incorporate means by which the refrigerated space is sealed when the drawer is removed or sufficiently extended for normal access to the drawers. While such appliances may reduce

the loss of cooled air in comparison to those of the conventional prior art, they still, by the nature of their design allow some loss. They essentially comprise a space which is substantially occupied by the drawer when the drawer is in the fully retracted position, leaving little additional free space. However, when a drawer is extended from the zone, the magnitude of free space within the zone is substantially increased. This requires air to be drawn in from outside the refrigerator. This air then mixes with the cooled air present in the refrigerator, and because the relative volume of the space vacated by the drawer compared with the volume of free space when all drawers are fully retracted within the zone is quite significant, the body of air is warmed substantially by the incoming air. Of course, when a drawer is returned to its retracted position, the additional air is expelled from the refrigerator. However, this air is a mixture of the warmed and cooled air, and thus there is a significant loss of cooled air from the refrigerator.

The preceding discussion of the background to the invention is intended only to facilitate an understanding of the present invention. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was part of the common general knowledge in Australia as at the priority date of the application.

Disclosure of the Invention

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 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.

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

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

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 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.

According to a preferred feature of the invention 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.

According to a preferred embodiment, 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.

According to a further preferred embodiment, 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 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 to move the closures 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.

According to a preferred embodiment, at least a portion of the upper face of the compartment is open. According to a preferred embodiment, the portion of the upper face communicates with the source when the drawer is in the retracted position.

According to a preferred embodiment, the front opening of the at least one compartment sealingly cooperates with the front opening when the drawer is in the retracted position.

According to a preferred embodiment, a plurality compartments are accommodated within the zone. According to a preferred embodiment, the compartments are supported in a vertical array.

According to a further embodiment, the front opening is associated with a door which controls said access. According to a further preferred embodiment, the door accommodates one or more storage zones, the space defined between the door and front opening communicating with the remainder of the 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 storage space. According to a preferred 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.

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.

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.

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

Brief Description of the Drawings

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

Figure 1 is a schematic sectional side elevation of a refrigerated cabinet according to the first embodiment with the door in a closed position; and

Figure 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.

Figure 3 is a schematic isometric view of a refrigerated compartment according to the fourth embodiment.

Figure 4A is a diagrammatic representation of a leaved valve in a connecting duct according to the fourth embodiment, the valve being in the closed position.

Figure 4B is a diagrammatic representation of a leaved valve in a connecting duct according to the fourth embodiment, the valve being in the open position.

Figure 5 is a schematic sectional side elevation of a refrigerated compartment according to the fifth embodiment.

Figure 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

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 Figure 1 to prevent access to the front opening of the cabinet and an open position as shown at Figure 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.

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.

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.

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 Figure 1) and an extended position at which it extends forwardly from the compartment (as shown in the case of the uppermost compartment of Figure 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.

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.

In addition the door 13 supports a set of storage zones (not shown) which are each associated with a separate closure which enables access into each storage zone. Each storage zone is connected to a duct in the door which connects with a corresponding positioned passageway 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 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.

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.

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.

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.

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 Figure 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.

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.

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 Figures 3 and 4A, 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.

In the embodiment, as shown in Figure 4A and 4B, 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.

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 Figure 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.

As mentioned earlier, the cooling means may take many forms. In a fifth embodiment, as shown in Figure 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.

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 Figure 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.

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.

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.

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

The claims defining the invention are as follows:

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 at 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 at claim 1 or claim 2 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 at 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 at claim 3 or claim 4 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 at any one of the previous claims wherein at least a portion of the upper face of the compartment is open.

7. A refrigerated cabinet as claimed at any one of the previous claims 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 at any one of the previous claims 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 at any one of the previous claims wherein a plurality compartments are accommodated within the zone.

10. A refrigerated cabinet as claimed at any one of the previous claims wherein the compartments are supported in a vertical array.

11. A refrigerated cabinet as claimed at any one of the previous claims wherein the front opening is associated with a door which controls said access.

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

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

17. A refrigerated cabinet as claimed at 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 any one of the previous claims wherein the cooling means is provided to each refrigerated cabinet from a common cooling source.

19. A refrigerated cabinet substantially as herein described.

20. A refrigerated cabinet substantially as herein described with reference to the accompanying drawings.

21. A refrigeration system substantially as herein described.