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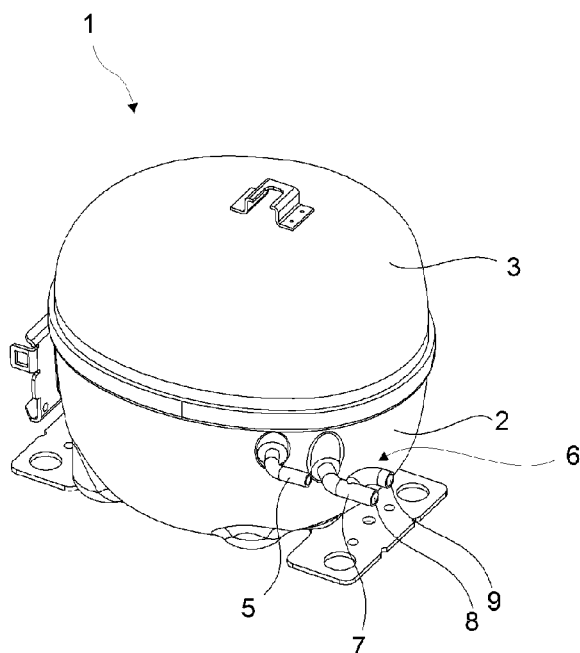
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(54) Title: A REFRIGERATOR WITH A COMPRESSOR HAVING AN IMPROVED TUBE CONNECTION STRUCTURE

Fig. 2a



(57) Abstract: The present invention relates to a refrigerator having a compressor (1) with inlet and outlet tube (4, 5) structures and an improved service inlet tube for maintenance and repair purposes. The present invention more particularly relates to a refrigerator having a compressor (1) in fluid communication with a closed coolant circuit effecting circulation of a refrigerant fluid from the evaporator to the compressor (1) by means of an inlet tube (4) and from the compressor (1) to the condenser by means of an outlet tube (5), the compressor (1) further comprising an additional service tube (6) to effectuate vacuuming and charging of a refrigerant fluid into the closed coolant circuit of the compressor (1) and the evaporator and the condenser.

Description**A REFRIGERATOR WITH A COMPRESSOR HAVING AN IMPROVED TUBE CONNECTION STRUCTURE**

- [0001] The present invention relates to a refrigerator having a compressor with inlet and outlet tube structures and particularly an improved service inlet tube for maintenance and repair purposes.
- [0002] It is well-known that in the refrigerant cycle effected in refrigeration appliances, the thermal energy absorbed from the inner cabin of the appliance is discharged by means of a condenser. The refrigerant fluid is accordingly circulated between a condenser, a tube expander and an evaporator. The refrigerant fluid undergoes a phase transition from the liquid phase into the gas phase by way of absorbing the ambient heat of the foodstuff preserved within the cabin while passing through the evaporator. Cooling devices allowing refrigeration of perishable materials e.g. as a fresh food refrigerator or alternatively, as a deep-freeze, utilize as such an evaporator, which is usually located between the inner plastic liner of the storage compartment and the outer housing of the device.
- [0003] The compressor, being a part of the cooling system of the refrigerator comprises tubes allowing installation of the components of the cooling system as well as performing of the service/maintenance operations.
- [0004] The mounting process of the compressor to the cooling system in an interconnected manner as a closed-circuit component involves connection of an inlet tube as well as an outlet tube. An additional service tube of the compressor is typically needed for vacuuming the system and charging the refrigerant fluid into the system in a conventional manner.
- [0005] It is to be noted that the service tube of the compressor requires cutting a certain portion thereof after every individual maintenance operation leading to progressive shortening of the tube, which in turn necessitates welding of a new service tube piece when the remaining length thereof is not long enough for effectuating a punching operation, which typically function as a blanking plug to seal the open end of the tube. This type of structural design therefore causes additional work involving manual operations and material for service operations. Therefore, the service

tubing requiring manual and non-standard maintenance results in additional work and associated time.

[0006] The present invention overcomes this inconvenience and the additional work by providing an improved connection structure for the service tubing of the compressor, thereby eliminating the shortening problem thereof after each service operation.

[0007] To this end, the present invention is devised under the recognition that an improved tubing structure by which mounting as well as service operations are performable in more efficient and time-saving manner remains a need.

[0008] Among others, a prior art patent publication relevant to the technical field of the present invention can be referred to as WO2014053364, disclosing a refrigerator, wherein a compressor is provided. The compression is performed in the manner that a cylinder, a cylinder head, which is disposed on the cylinder and a valve table positioned between the cylinder and the cylinder head are disclosed. The leaking from around the valve table situated between the body and the cylinder is prevented and heat or sound isolation and ease of assembly are also obtained with the invention.

[0009] The present invention, on the other hand, proposes a compressor having an improved tubing structure ensuring improved service operation and eliminating need for usage of additional material to replace the service tube as provided by the characterizing features defined in Claim 1 and subsequent claims.

[0010] Primary object of the present invention is to provide a compressor for a refrigerator, having an improved tubing structure ensuring improved service operation involving no punching operation.

[0011] The present invention proposes a compressor for a refrigerator, the compressor having a fluid commination circuit effecting circulation of a refrigerant fluid to a heat exchange unit, typically a condenser providing the refrigerant fluid to be condensed in a refrigerator. The compressor is also in fluid communication with an evaporator effecting refrigeration by absorbing the ambient thermal energy in the refrigeration compartment.

[0012] The compressor of the invention is adapted either to have a service tube in the form of a separate connection in communication with an existing

operational tube or to have a service tube with a flow restriction means to enable selective operational use during service operations for the cooling system of the refrigerator.

- [0013] According to one embodiment of the invention, the position of the service tube is modified such that it is mounted on a lateral surface portion of an operational tube of the compressor so that the on-site manufacturing is much easier compared to the earlier tubing designs of the compressor. An operational tube of the compressor in connection with the evaporator or the condenser is structured to be a T-shaped tube having two ends, one of them being used in connection with the operational tube and the other end used in effectuating service processes.
- [0014] The service tube's primary function is to effect vacuuming within the closed circuit of the cooling system whereby the refrigerant fluid is chargeable into the system. In an effort to repair the cooling system by way of temporarily interacting with the closed circuit of the cooling system, a maintenance worker needs to use the service tube by which it is possible to charge a refrigerant into the system. The invention therefore enables use of an existing operational tube, normally in fluid communication with the compressor as a service tube.
- [0015] According to the second embodiment of the invention, the structure of the service tubing is modifiable so that the tube is provided with a valve mechanism. Therefore, the invention alternatively provides a valve structure for enabling access through the service tubing so that the punching/sealing operation is not needed.
- [0016] Accompanying drawings are given solely for the purpose of exemplifying a compressor whose advantages over prior art were outlined above and will be explained in brief hereinafter.
- [0017] The drawings are not meant to delimit the scope of protection as identified in the claims nor should they be referred to alone in an effort to interpret the scope identified in the claims without recourse to the technical disclosure in the description of the present invention.
- [0018] Fig. 1 demonstrates a perspective side view of the compressor for the refrigerator according to the present invention.

- [0019] Fig. 2a demonstrates a perspective side view of the compressor according to a first embodiment of the present invention. Fig. 2b demonstrates an enlarged view of a T-shaped tube of the compressor according to the first embodiment of the present invention.
- [0020] Fig. 3 demonstrates a perspective side view of the compressor according to a second embodiment of the present invention.
- [0021] Fig. 4a demonstrates a general perspective view of the tube with a valve mechanism according to the second embodiment of the present invention. Fig. 4b demonstrates an enlarged view of the valve mechanism according to the second embodiment of the present invention.
- [0022] The following numerals are referred to in the detailed description of the present invention:
1. Compressor
 2. Lower cover
 3. Upper cover
 4. Inlet tube
 5. Outlet tube
 6. Service tube
 7. T-shaped tube
 8. T-tube first end
 9. T-tube second end
 10. Valve mechanism tube
 11. Valve mechanism
- [0023] The present invention proposes a compressor (1) for a refrigerator (not shown), which comprising a cooling or refrigeration compartment for preserving foodstuff. The compressor (1) circulates a refrigerant fluid to a condenser providing the refrigerant fluid to be condensed and to an evaporator placed in an evaporator interspace effecting refrigeration by absorbing the ambient thermal energy in the refrigeration compartment.
- [0024] The compressor (1) of the refrigerator, being covered with a cover consisting of two parts, a lower cover (2) and an upper cover (3), conventionally has three tubes operatively in fluid communication with the condenser and the evaporator, the latter two constituting the two

components of the closed circuit the compressor (1) directly communicates with, with the exception of the expansion tube between the same.

- [0025] The compressor (1) has an inlet tube (4), an outlet tube (5), respectively in fluid communication with the evaporator and the condenser, the compressor (1) also comprising a service tube (6), conventionally effectuating sucking and charging of refrigerant fluid into the system in a conventional manner. In other words, the service tube (6) acts as an additional inlet serving for maintenance purposes, typically for temporary communication with the closed coolant circuit, typically for charging the refrigerant into the system.
- [0026] The operational tubes located on the compressor (1) as the inlet tube (4) and outlet tube (5) are conventionally disposed in a neighboring manner whereas the service tube (6) is generally situated on another side of the compressor (1). In accordance with the present invention, this conventional structure of the tubes is modified with two different structural designs, a T-shaped tube (7) structure and a service tube (6) in the form of a valve mechanism tube (10) with a valve mechanism (11) as will be delineated hereinafter.
- [0027] The tubing system of the compressor (1) in accordance with a first embodiment of the invention is structured to involve a conventional outlet tube (5) while the service tube (6) is structured to be projecting from a lateral surface portion of the inlet tube (4), thereby forming a T-shaped tube (7) having a T-tube first end (8) and a T-tube second end (9) so that the T-shaped tube (7) both acts as an inlet pipe and a service pipe advantageously allowing working of the maintenance staff at the same location of the compressor (1) for all of the service operations.
- [0028] In another embodiment of the invention the piping system of the compressor (1) can be designed such that the service tube (6) is structured to have a modified structure, that is, so as to feature a tube with a valve mechanism (11). The tube with a valve mechanism (11), i.e. the valve mechanism tube (10) therefore has a valve mechanism (11) directly mountable to existing service tubes (6) such that a selective fluid

communication into the compressor (1) is established through the valve mechanism (11), thereby facilitating maintenance operations by eliminating cutting of a certain length of the existing service tubes (6) in order for effecting the punching operation so as to create a blanking plug. On the contrary, the maintenance staff can handle maintenance work by way of using the valve mechanism (11) in a facilitated manner without having to spend extra working time for manual operations.

- [0029] In summary, the present invention proposes a refrigerator having a compressor (1) in fluid communication with a closed coolant circuit effecting circulation of a refrigerant fluid from the evaporator to the compressor (1) by means of an inlet tube (4) and from the compressor (1) to the condenser by means of an outlet tube (5), the compressor (1) further having an additional service tube (6) to effectuate sucking and charging of a refrigerant fluid into the closed coolant circuit of the compressor (1) and the evaporator and condenser.
- [0030] According to one embodiment of the present invention, the additional service tube (6) is either integrated to the inlet or outlet tube (4, 5) to be structured in the form of a separate tubular opening of a T-shaped tube (7) or structured as a valve mechanism tube (10) having a valve mechanism (11).
- [0031] According to a further embodiment of the present invention, the additional service tube (6) is structured in the form of a separate tubular opening of the T-shaped tube (7) having two tubular openings, an opening thereof forming the inlet or the outlet tube (4, 5) and the other opening forming the additional service tube (6).
- [0032] According to a further embodiment of the present invention, the T-shaped tube (7) is integrated to the inlet tube (4).
- [0033] According to a further embodiment of the present invention, the T-shaped tube (7) comprises a T-tube first end (8) and a T-tube second end (9).
- [0034] According to a further embodiment of the present invention, the T-tube first end (8) of the T-shaped tube (7) constitutes the inlet tube (4) and the T-tube second end (9) thereof constitutes the additional service tube (6).
- [0035] According to a further embodiment of the present invention, the T-tube first

end (8) of the T-shaped tube (7) is provided with a valve mechanism (11). This advantageously combines the first and the second embodiments in accordance with the invention so that a tubular opening of the T-shaped tube (7) can be selectively accessed through a valve mechanism (11).

[0036] According to a further embodiment of the present invention, the additional service tube (6) is structured as a valve mechanism tube (10) with a valve mechanism (11), the valve mechanism (11) providing selective fluid communication with the compressor (1). In this embodiment, the service tube (6) forms a separate tubular opening accessible via a valve mechanism (11).

[0037] The present invention therefore provides an advantageous and time-saving solution to the problem of inefficiency of the service operations that might cause additional time and material usage. The solution substantially contributes to the service efficiency of the compressor (1). The compressor (1) of the invention is adapted either to have a service tube (6) in the form of a separate connection in communication with an existing operational tube (inlet or outlet tube (4, 5)) or to have a service tube (6) with a flow restriction means (valve mechanism (11)) to enable selective operational use during service operations for the cooling system of the refrigerator.

Claims

1. A refrigerator having a compressor (1) in fluid communication with a closed coolant circuit effecting circulation of a refrigerant fluid from the evaporator to the compressor (1) by means of an inlet tube (4) and from the compressor (1) to the condenser by means of an outlet tube (5), the compressor (1) further comprising an additional service tube (6) to effectuate sucking and charging of a refrigerant fluid into the closed coolant circuit of the compressor (1) and the evaporator and the condenser, **characterized in that** the additional service tube (6) is either integrated to the inlet or outlet tube (4, 5) to be structured in the form of a separate tubular opening of a T-shaped tube (7) or structured as a valve mechanism tube (10) having a valve mechanism (11).
2. A refrigerator as in Claim 1, **characterized in that** the additional service tube (6) is structured in the form of a separate tubular opening of the T-shaped tube (7) having two tubular openings, an opening thereof forming the inlet or the outlet tube (4, 5) and the other opening forming the additional service tube (6).
3. A refrigerator as in Claim 2, **characterized in that** the T-shaped tube (7) is integrated to the inlet tube (4).
4. A refrigerator as in Claim 3, **characterized in that** the T-shaped tube (7) comprises a T-tube first end (8) and a T-tube second end (9).
5. A refrigerator as in Claim 4, **characterized in that** the T-tube first end (8) of the T-shaped tube (7) constitutes the inlet tube (4) and the T-tube second end (9) thereof constitutes the additional service tube (6).
6. A refrigerator as in Claim 5, **characterized in that** the T-tube first end (8) of the T-shaped tube (7) is provided with a valve mechanism (11).
7. A refrigerator as in Claim 1, **characterized in that** the additional service tube (6) is structured as a valve mechanism tube (10) with a valve mechanism (11), the valve mechanism (11) providing selective fluid communication with the compressor (1).

Fig. 1

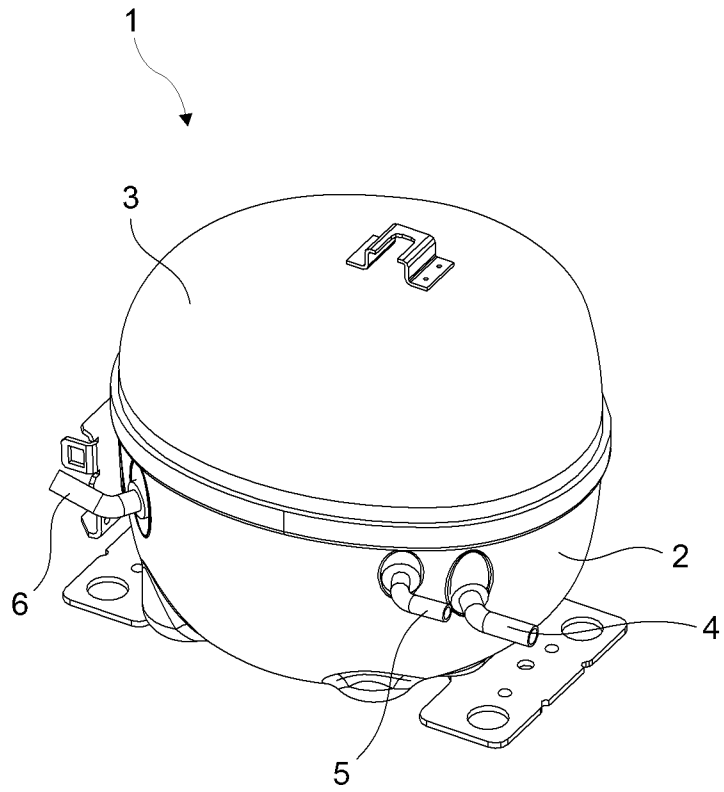


Fig. 2a

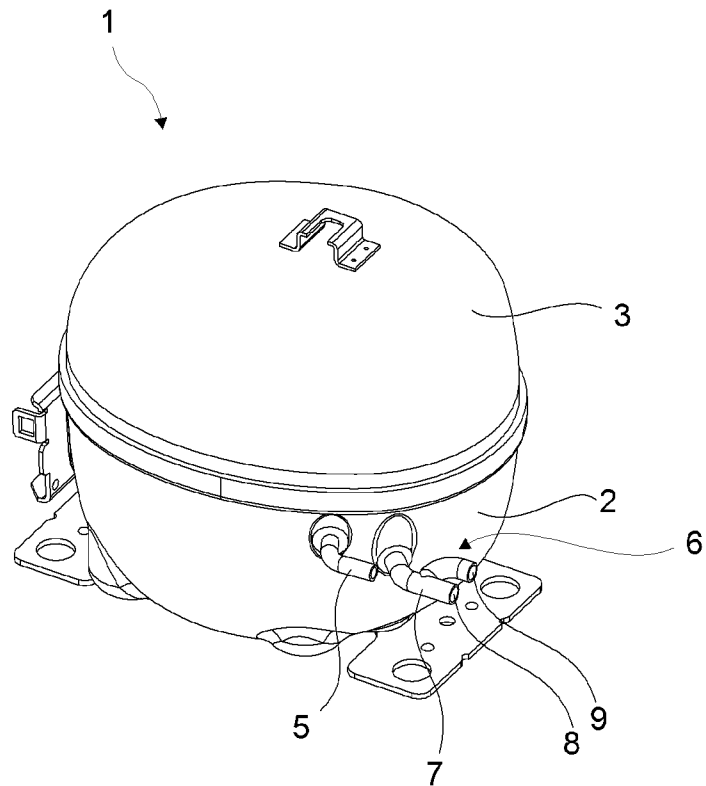


Fig. 2b

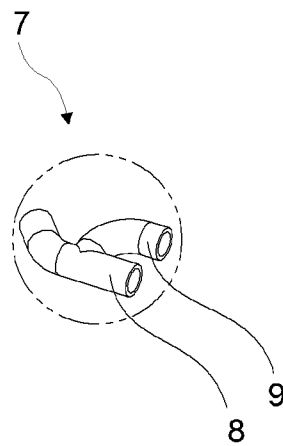


Fig. 3

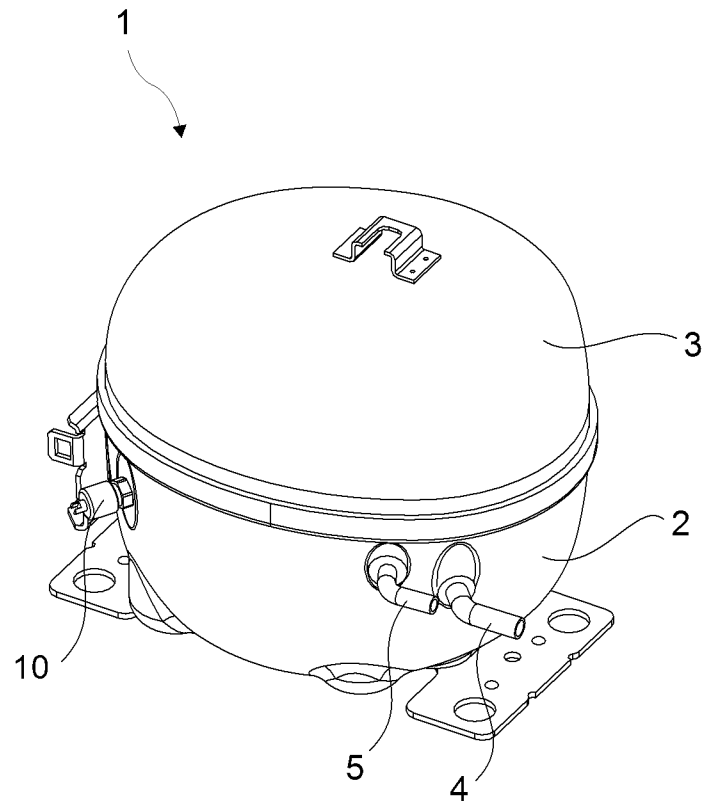


Fig. 4a

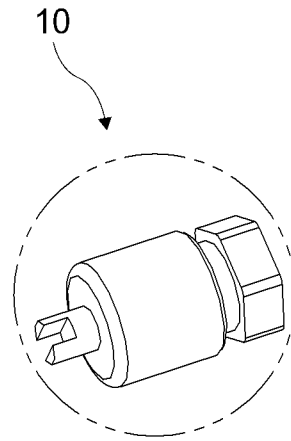
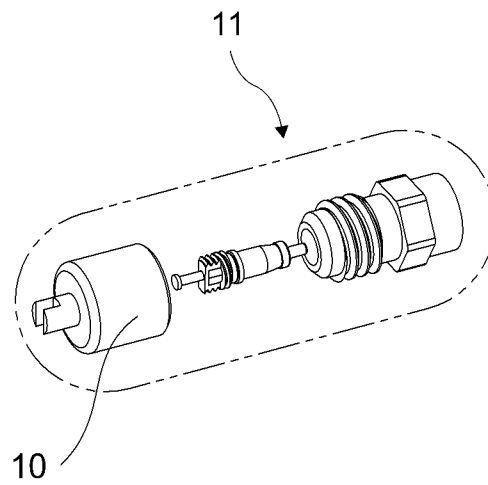


Fig. 4b



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/054282

A. CLASSIFICATION OF SUBJECT MATTER
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ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F25B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP H03 160285 A (SANYO ELECTRIC CO) 10 July 1991 (1991-07-10) abstract; figure 1	1-7
X	----- US 3 336 936 A (MULLINS JOHN W) 22 August 1967 (1967-08-22) abstract; figure 1	1,7
X	----- US 5 975 151 A (PACKO JOSEPH J [US]) 2 November 1999 (1999-11-02) abstract; figure 2	1-7
X	----- US 4 745 772 A (FERRIS JAMES E [US]) 24 May 1988 (1988-05-24) abstract; figure 1	1-7
	----- -/-	



Further documents are listed in the continuation of Box C.



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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/054282

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102 679 603 A (HENAN FRESTECH ELECTRIC APPLIA; UNIV XI AN JIAOTONG) 19 September 2012 (2012-09-19) abstract; figure 2 -----	1,7

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2015/054282

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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US 3336936	A	22-08-1967	NONE	
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