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COMPRESSOR

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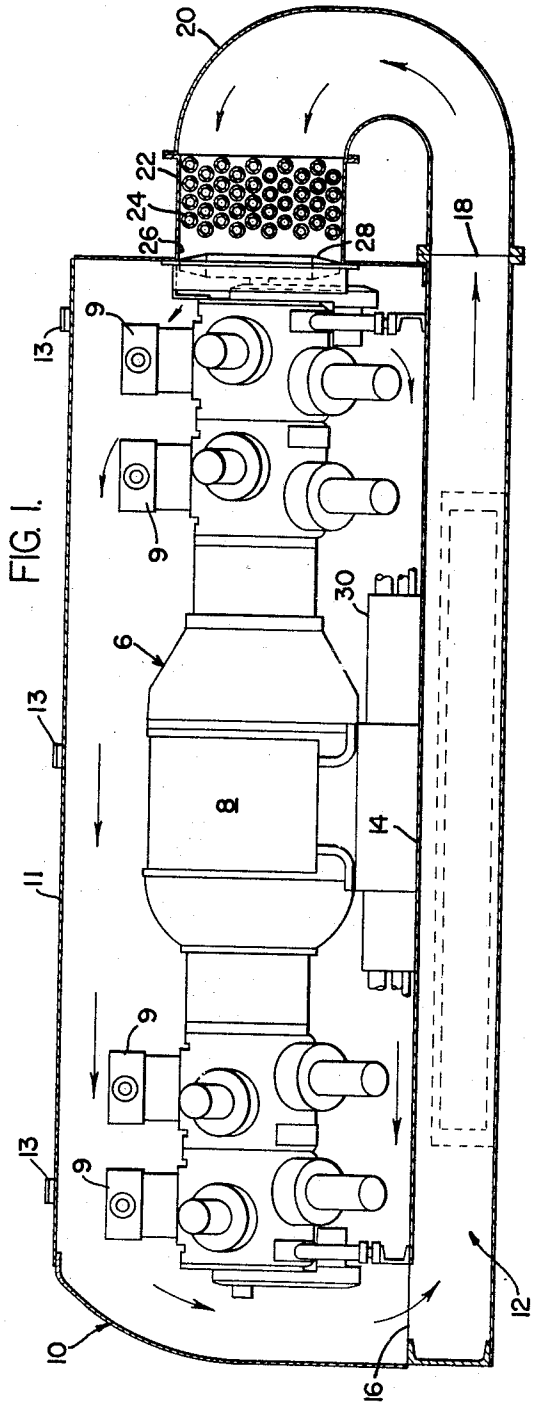


FIG. 1.

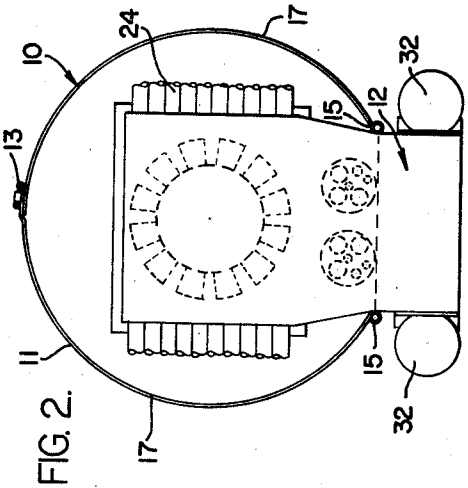


FIG. 2.

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COMPRESSOR

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This invention relates to compressors and more particularly to the removal of the heat of a compressor (as differentiated from the heat of compression) as well as the heat of its driving mechanism so that air used for cooling the compressor is isolated from the atmosphere of the room or compartment in which the compressor is installed.

Compressors produce a substantial amount of heat when operating, which heat must be removed by some form of cooling system, which system is differentiated from intercoolers and aftercoolers which are used to remove the heat of compression. The presently used systems for removing the heat of a compressor use fluid jackets wherein fluid is circulated; however, in such instances the heat is eventually dissipated into the surrounding atmosphere. Under certain conditions of service where the availability of the cooling liquid is corrosive or varies greatly in pressure (both of which conditions are found in the operation of a modern submarine) such liquid cooling adds greatly to the manufacturing expense and reduces the reliability of the apparatus, therefore rendering the fluid jacketing of the compressor undesirable and unacceptable. Where the cooling jackets use corrosive waters, the jacketing design is intricate and expensive. Reliability of the apparatus is most greatly affected by cooling liquid pressures which vary from approximately zero to a value greater than the fluid pressure within the compressor thus reversing the stress on any gaskets or other sealing elements and thereby increasing the chances of mechanical failure. The corrosive effect of salt waters as a cooling medium is well known. Air cooling, which comprises suitable fins on the heat producing portions of the compressor and a supply of air rapidly circulated about such heat producing portions is satisfactory in many applications; but, considering the small spaces and limited air supply available within a submarine or other crowded environment, such air cooling is not satisfactory because of its effect upon the temperature of the surrounding atmosphere.

The present invention contemplates the provision of a closed circuit air cooling system in which compressors of an air cooled type are cooled by circulation of air thereabout with subsequent cooling of the circulating air in a liquid cooled heat exchanger which utilizes the sea waters before recirculating the air over the compressors to remove additional heat therefrom. Thus the corrosive contact of the sea waters is reduced to a minimum with the provision being made that only the least expensive portion of the heat exchanger be contacted by the corrosive waters thereby confining the corrosion resistance portion to the relatively simple tubing rather than the intricate castings and the parts of the compressor.

It is therefore an object of this invention to provide a new and improved apparatus for removing the heat of a compressor.

It is another object of this invention to provide a new and improved totally enclosed fluid compressor.

It is a further object of this invention to provide a new and improved compressor and heat exchanger housing which provides for circulation of air within such housing.

It is still another object of this invention to provide a new and improved fluid compressor totally enclosed within a housing, which housing provides for circulation of air within such housing to remove heat from the compressor and which air subsequent to such heat removal is circulated to a liquid cooled heat exchanger to give up such absorbed heat to a liquid medium before such air is recirculated for further cooling of the compressor.

It is a further object of this invention to provide a new and improved fluid compressor and driving mechanism totally enclosed within a housing which provides for air cooling of the compressor and driving mechanism by air entirely contained and circulated within such housing, the temperature of the air being maintained at a predetermined satisfactory temperature by means of a heat exchanger employing a suitable cooling liquid.

It is another object of this invention to provide a new and novel method of cooling a fluid compressor and driving mechanism therefor, which method comprises enclosing the compressor and driving mechanism in a closed housing and providing for circulation of the air surrounding the compressor within such housing through a liquid cooled heat exchange device and over the compressor and driving mechanism in continuous closed circuit circulation.

These and other objects and advantages of this invention will become more readily apparent upon consideration of the following detailed description and drawings wherein:

FIG. 1 is a side elevational view of a plurality of compressors and a driving mechanism positioned within a housing (shown in longitudinal section) constructed according to the principles of this invention;

FIG. 2 is an end elevational view of the apparatus of FIG. 1.

In FIG. 1 there is shown a fluid compressor apparatus generally indicated at **6** comprising a driving mechanism such as an electric motor **8** and a plurality of compressor units **9** of any suitable type but preferably of the air cooled type. The electric motor **8** is suitably connected to drive the compressors **9** within an elongated generally cylindrical, closed housing **10**. Housing **10** comprises an upper cylindrical portion **11** and a lower rectangular conduit portion **12** separated from the upper cylindrical portion **11** by an elongated flat plate element **14**. The conduit portion **12** communicates, through the left hand portion (as viewed in FIG. 1) of its upper surface with the lower interior of the cylindrical portion **11** through an opening **16** whereas the righthand portion of conduit portion **12** terminates in an opening **18** which communicates with a rectangular cross section conduit **20** which in turn connects with a rectangular heat exchanger unit **22** (of a type well known in the art). Briefly, heat exchanger **22** has a plurality of transversely extending liquid conducting tubes **24** which extend through the heat exchanger **22** and communicate directly with the exterior of the chamber or room which houses the compressor apparatus **6** and the housing **10**, which in the case of a submarine would be the sea waters. The heat exchanger **22** has passageways transversely of the cooling tubes **24** which communicates with the righthand end of the upper cylindrical portion **11** of housing **10** through a circular opening **26**. Housing **10** adjacent opening **26** has an axial flow fan **28** suitably mounted therein, which fan **28** is drivingly connected to the electric motor **8** such that whenever the compressors are operating the fan will be rotated in the direction which will move air from the right to the left as viewed in FIG. 1.

The compressors **9** are suitably connected through an intercooler-aftercooler **30** with suitable elongated cylindrical receivers **32** (FIG. 2) suitably located outside the housing **10**, which receivers **32** store the compressed fluid from the compressors **9**.

In operation the electric motors **8** are suitably supplied with current from a source (not shown) for operating the compressors **9** and fan **28**. The compressors **9** operating in the usual manner are provided with a suitable compressible fluid, from a suitable source, which fluid is compressed and passed through the intercooler-aftercooler **30** for storage in the receivers **32** until needed. As the compressors **9** operate they heat up in the usual manner, and the movement of air from the fan **28** circulating about the heated portions of the compressors **9** and the electric motor **8** absorbs and carries away heat as it passes from the right to the left through the upper cylindrical portion **11** of the housing **10**. When the air reaches the left hand portion of the housing **10** it is conducted downwardly through the opening **16** and forwardly through the conduit portion **12** and its forward opening **18** into the conduit **20**. The conduit **20** conducts the air into the heat exchanger **22** where the heat is absorbed from the air by the cold circulating liquid in the tubes **24**, thereby cooling the air to any desired temperature. The cooled air again passes through the fan **28** and repeats the cycle.

It is to be noted that the inner portion of the housing **10** is rendered accessible as the housing **10** is made in two generally semi-cylindrical shell elements **17** removably secured together by a plurality of latches **13** on the upper portions. The semi-cylindrical shell elements **17** are easily removable as the lower side portions are secured to the conduit portion **12** by a plurality of hinge elements **15**, which hinge elements **15** are provided with removable pins (not shown).

It is to be further noted that the housing **10** is not sealed or otherwise rendered air tight since it is unnecessary and indeed undesirable that a pressure difference should exist between the interior of the housing **10** and the surrounding atmosphere, which condition could develop, due to the change in temperature between the operating and nonoperating states of the compressor apparatus **6**, if any attempt were made to render the housing **10** air tight.

It is to be appreciated that, although the illustration shows an electric motor and four compressors, any type or number of driving mechanisms and compressors can be enclosed within a housing constructed according to the principles of this invention without departing from the scope thereof. The descriptions of the housing **10** and heat exchanger **22** are illustrative only and not to be considered limitative on this invention.

A preferred embodiment of this invention having been described and illustrated it is to be noted that modifications thereof may be made without departing from the spirit and scope of this invention. Accordingly, it is respectfully requested that this invention be interpreted as broadly as possible and be limited only by the prior art.

What I claim is:

1. A totally enclosed compressor unit comprising: an elongated housing having an inlet opening longitudinally spaced from an outlet opening by substantially the full length of said housing, a compressor and driving means therefor mounted in said housing adapted to deliver an output of compressed air; a heat exchanger unit mounted adjacent said inlet opening for communication with said inlet opening, said heat exchanger unit having coolant tubes mounted therein for cooling air passing through said heat exchanger unit; conduit means contiguous with and extending longitudinally of an outer element of said housing connecting said outlet opening with; external conduit means connecting said contiguous conduit means with said heat exchanger unit to define a closed continuous flow path through said housing, said conduit means, and said heat exchanger unit; and means mounted in said housing for circulating air in said closed flow path.

2. A totally enclosed motor compressor unit as set forth in claim 1 wherein said coolant tubes are corrosion resistant and connectible to an external cooling medium.

3. A compressor unit comprising: an elongated housing member, a compressor and driving means therefor mounted in said housing member, said housing member having longitudinally spaced inlet and outlet means, a passageway member connecting said inlet and said outlet means, said passageway member having a greater portion thereof contiguous with and extending longitudinally of an external element of said housing, means in one of said members to circulate the air within said members through said members, and coolant circulating tubes extending through a portion of said passageway member for cooling the air moving through said passageway member.

4. A compressor unit as set forth in claim 3 wherein said coolant tubes are corrosion resistant.

5. A totally enclosed compressor unit comprising: an elongated casing with longitudinally spaced inlet and outlet openings, a compressor and driving means therefor mounted within said casing, a fan operatively connected to said compressor for moving air through said casing from said inlet opening, a heat exchanger unit having a discharge opening connected to said inlet opening, said heat exchanger having inlet means spaced from the discharge opening connected to a passageway communicating with with said outlet opening, said passageway being closely adjacent to and longitudinally coextensive with a bottom element of said casing, and cooling coils in said heat exchanger being connected to an external source of cooling fluid.

6. A totally enclosed compressor unit as set forth in claim 5 wherein said cooling coils are corrosion resistant.

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