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McDonald et al.

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[54] **PORTABLE AIR CONDITIONER UNIT FOR USE IN MINES AND OTHER LIKE RESTRICTED AREAS**

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[58] **Field of Search** 62/239, 237, 285; 98/50

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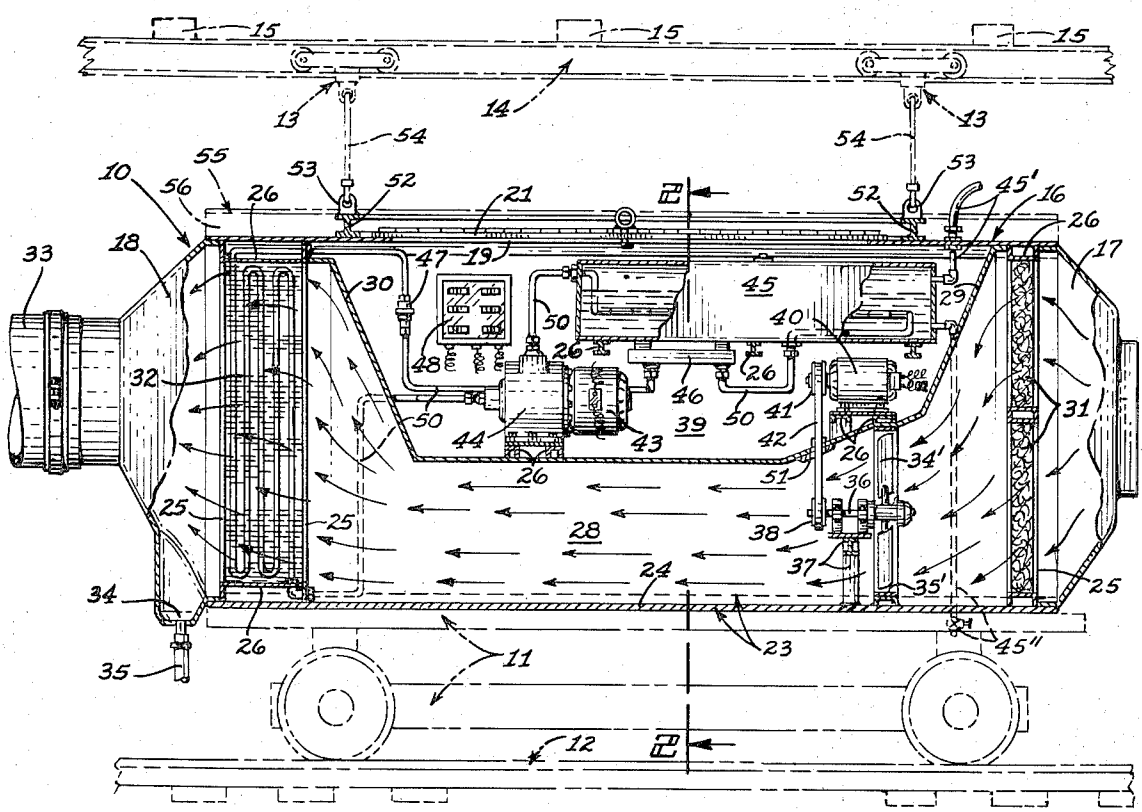
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[57] **ABSTRACT**

A portable air conditioner unit which is entirely self-contained and sized to be readily moved about in the hot, humid, dusty and restricted working areas or passageways of mines or other similar areas which is capable of supplying such working areas with an abundant flow of recirculated, clean, filtered, dehumidified and cooled air when in operation.

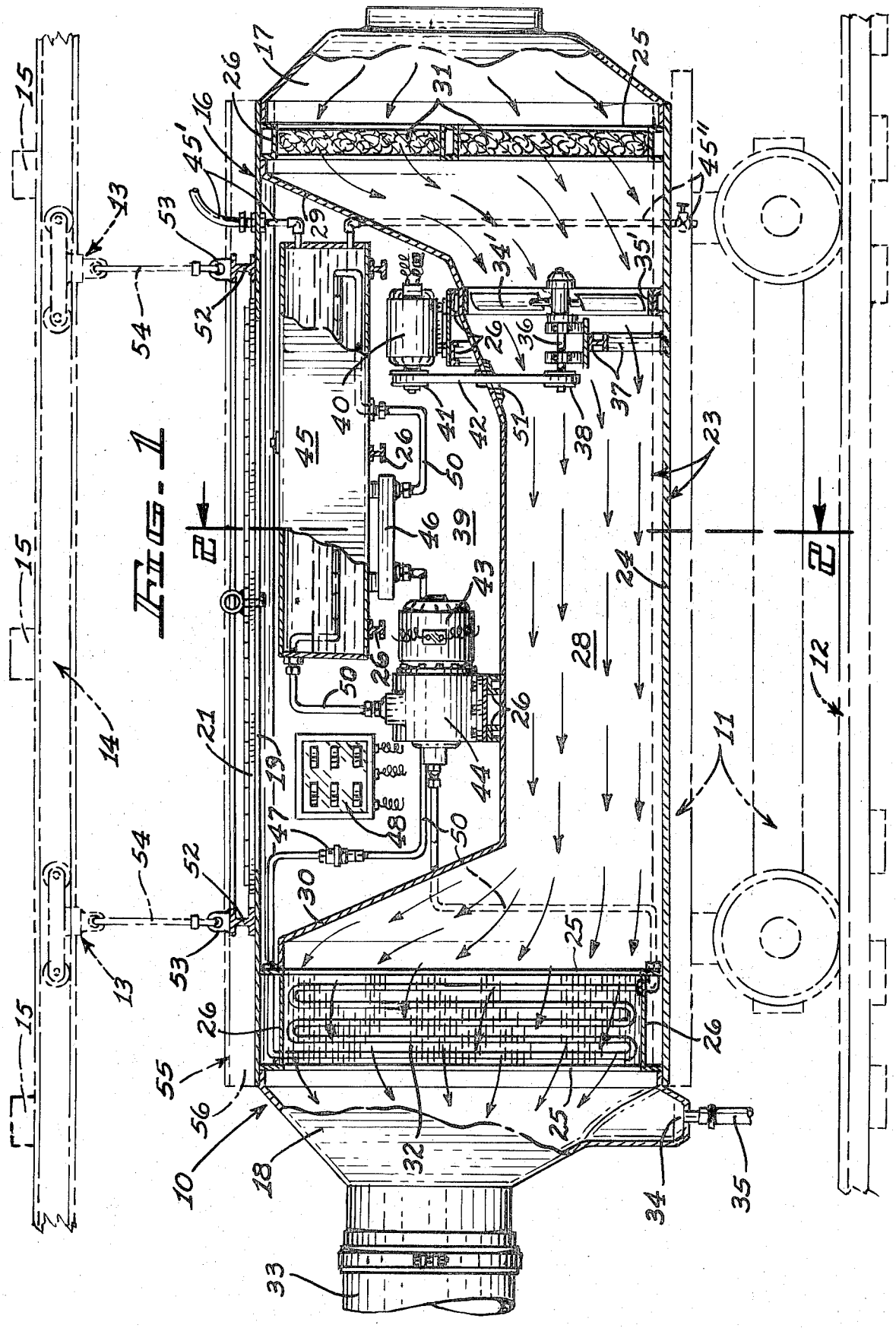
5 Claims, 3 Drawing Figures



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SHEET 1 OF 2



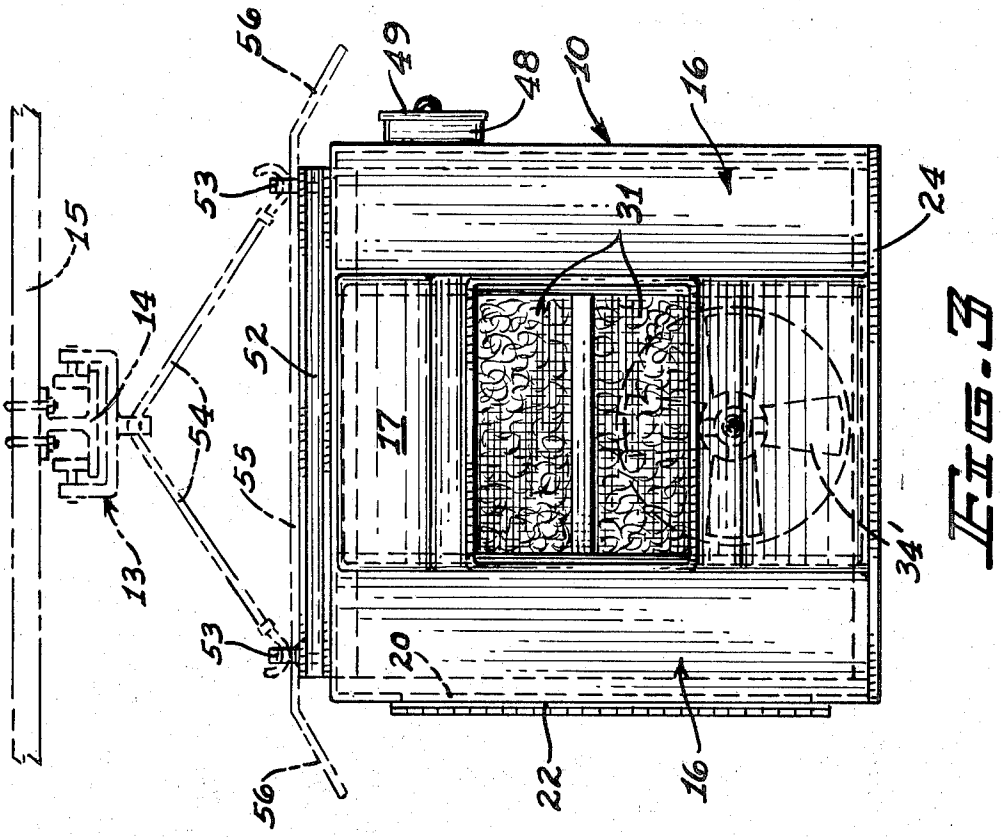


FIG. 3

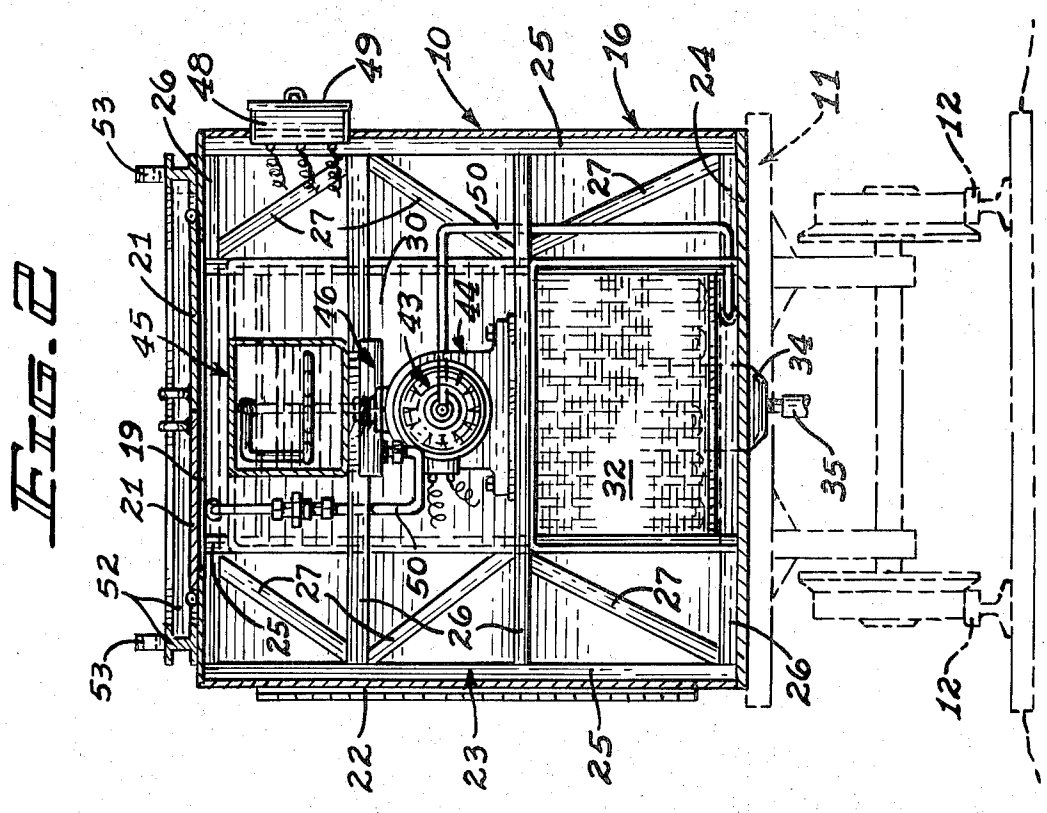


FIG. 2

PORTABLE AIR CONDITIONER UNIT FOR USE IN MINES AND OTHER LIKE RESTRICTED AREAS

BACKGROUND OF THE INVENTION

This invention relates to power operated, self-contained, portable air conditioner units.

FIELD OF THE INVENTION

This invention is particularly directed to an electrically powered, self-contained, portable air conditioner unit which is sized to be mobile in the confined areas of a mine passageway or tunnel and in which the major electrical components of the system such as the compressor motor, blower or fan motor, dryer and temperature control box or panel are arranged in a vented compartment. This vented compartment is completely isolated from the moving air chamber or plenum which extends longitudinally through the center of the unit from its filtered inlet end to its evaporator cooled outlet end to thereby eliminate any possibility of the hot, moisture laden air passing through the plenum and any unfiltered particles of abrasive dust from coming in contact with its electrical and mechanical components. Without this specific separation and arrangement of components, corrosion, wear and frequent break down of the system would result causing expensive work stoppages and frequent servicing of the units. Further, the lubricating oil in the moving parts of the prior art air conditioners has been worked out by moisture laden air passing over them.

DESCRIPTION OF THE PRIOR ART

Heretofore, many types of cooling units, some of which were portable, have been designed, built and utilized in mines to provide some degree of comfort and healthier working conditions for the miners. These units cooled, dehumidified and decreased the amount of dust in the recirculated air in the mine passage to which the miners are continually exposed.

Most of the portable air conditioner or cooling units used in the past for the purposes described above provided fairly efficient performance in cooling, dehumifying and removing dust particles from the air being recirculated in the mine passage. They do so, however, at the expense and frustration resulting from recurrent breakdowns of the cooling equipment caused by the lack of protection of the vital electrical and mechanical components of the system from the corrosive and damaging effects of extremely high humidity and dusty air to which they are constantly exposed when the unit is operating.

In accordance with the invention claimed, a new and improved electrically powered, portable air conditioner is provided, the size and compactness of which makes it suitable for easy portability and use in the passageway or tunnels of mines and like areas. The novel features of this air conditioner involves the arrangement of its electrical and mechanical components relative to the forced circulation of hot humid air therethrough such that a minimum amount of corrosive damaging moisture or dust is allowed to contact or accummulate on these vital components of the system.

SUMMARY OF THE INVENTION

It is therefore one object of this invention to provide an improved portable air conditioner unit that is especially adaptable for use in the hot, humid and dusty atmosphere usually prevalent in mines.

Another object of this invention is to provide an improved air conditioner that is compact and sized to allow for easy portability within the limited area of a mine passageway or tunnel either by means of a flat car operating on rails on the floor of the tunnel or by overhead carriage equipment which is supported by the usual rigging in the roof of the tunnel.

A further object of this invention is to provide a compact portable air conditioner unit in which the electrically powered components and other vital elements of the system are completely enclosed, compartmented and separated from any contact with the hot, humid air that is drawn in through filters at one end of a longitudinal air passage or plenum chamber and forced out in cool, dehumidified condition through the evaporation coil at the other or outlet end of that chamber.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be more readily described by reference to the accompanying drawings in which:

FIG. 1 is a combined side elevational and sectional view of the portable air conditioner unit of this invention with those parts in section taken substantially on the line 1—1 of FIG. 2 to better illustrate the relationship to each other of the various components of the unit.

FIG. 2 is a vertical transverse sectional view of the unit taken on the line 2—2 of FIG. 1, showing it mounted on a flat bed rail car (in dot-dash phantom lines) for mobility purposes.

FIG. 3 is an elevational view of the intake end of the unit showing it supported by overhead carriage equipment (in dot-dash phantom line) also for mobility purposes.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings by characters of reference, FIG. 1 discloses a portable air conditioner unit **10** mounted or carried for mobility in the mine passageway or tunnel either by means of a flat bed mine car **11** supported on the usual rails **12** on the floor of the passageway or supported by overhead carriages **13** which are adapted to roll on an I-beam **14** which is securely attached to the usual mine rigging **15** in the ceiling of the passageway. This equipment is shown in dot-dash or phantom line to illustrate the portability features of the compact unit.

The air conditioner unit **10** comprises an elongated box-like structure **16** substantially closed on all four sides and at both ends except for centrally located rectangular shaped vertical openings provided at each end to which is fitted similarly shaped air intake and air outlets generally called air plenums **17** and **18.** These air plenums are open at their outer ends to the atmosphere

of the mine tunnel where the conditioner is being utilized and their longitudinal axes are shown as being coaxially aligned. Other openings in the top and side walls of the structure such as ceiling opening **19** and one or more side wall openings **20** covered with hinged doors **21** and **22** provided access to the interior of the structure in which the components of the refrigeration or cooling system are located.

The enclosed box-like structure **16** is formed by attaching exterior panels of corrosion resistant material to a rigid structural steel frame **23** which includes base plate or floor member **24**, vertical angle or channel members **25**, horizontal transverse angle or channel members **26** and suitable diagonal reinforcing members **27** all welded or otherwise secured together in their preferred relationship to complete the structure and provide rigid support means for the various components of the cooling system.

A completely enclosed air passageway or plenum **28** extends longitudinally to the near ends of the box-like structure **16** along its base. This plenum's longitudinal axis is below the longitudinal axes of air inlet and air outlet and is provided with angular upstanding end portions **29** and **30** that communicate with the intake and air-plenum **17** and the outlet air-plenum **18** to cause the passage of air through one or more removable dust filters **31.** Dust filters **31** are inserted in the communicating plenum **18** at its intake end. An evaporator coil **32** is inserted in the communicating plenum at its outlet end. It should be noted that a flexible conduit or duct **33** may be removably attached to the outlet end of the plenum **18** to provide better distribution of clean cooled air in the mine tunnel area being worked. Plenum **18** is also provided at its outlet end downstream of the evaporator coil **32** with a suitable water trap **34** and drain hose **35**, the purpose of which is to collect and disperse the condensed water that drains off of the evaporator coils and thereby prevent it from entering the air stream of cooled, clean air that is emerging therefrom.

The circulation of air described in the preceeding paragraph is accomplished by means of a high capacity blower fan **34'** which is installed in a framed transverse opening **35'**. Opening **35'** extends across the air-plenum **28** parallel to and closely adjacent the intake end of the plenum and the vertically installed filters **31.** The fan's drive shaft **36** is journaled in suitable bearings mounted on a rigid support member **37** installed in the plenum and has a pulley **38** attached to its extending end in driving relationship with the hub of the fan. Directly above fan **34** within an area **39** of the air conditioner unit **10** separated from the closed plenum chamber **28** is mounted an electric motor **40** which is utilized to drive blower fan **34** through pulleys **41** and **38** connected in driving relationship by drive belt **42.**

It should be noted that the principle object of this invention is to separate or isolate the several electrical and mechanical components of the cooling or refrigeration system from the damaging effects of high heat, humidity and dust that is prevalent in the air of the mine tunnel which is being circulated through the cooling system. Therefore, all of these components are located and installed in the substantially closed area **39** located above air passageway or plenum **28** which is separated from the outside atmosphere and the moving air in the plenum chamber. If fan **34'** employs a sealed, shaft mounted motor, this motor can be located in plenum chamber **28** and still fulfill the objects of this invention.

Further components of the system mounted in area **39** of the air conditioner unit **10** and the blower fan motor **40** comprise the compressor drive motor **43**, compressor **44**, water cooled condenser **45**, dryer **46**, expansion valve **47** and electrical control panel **48.** The control panel **48** is accessible from the outside of the unit through a hinged door **49.** All of the electrical items connected to the control panel by suitable wiring (not shown) and the items of the refrigeration system including the evaporator coil **32** are connected in operating relationship by suitable piping or tubing **50.** The water-cooled condenser **45** is provided with the usual intake pipe and hose **45'** and outlet pipe and control valve **45''** as shown in FIGS. **1** and **2** of the drawings to complete the system.

With the construction and arrangement of the components shown in FIG. **1**, it is necessary that two small holes be provided in the top portion of the plenum chamber **28** to allow for passage and movement of the fan drive belt **42** therethrough and these openings are substantially closed by suitable seals **51** so as to allow only a minimal amount of air to escape from the closed area **39** into the plenum chamber **28** or visa versa. Should this minimal escape of air be undesirable, the electric fan drive motor **40** could be mounted in the air passageway or plenum **29** and connected in direct driving relationship to the fan drive shaft **36** providing the motor was built, sealed and shielded to resist the corrosive effects of the water vapor passing through the plenum as heretofore explained.

Referring to the several figures of the drawings, it should be noted that if the portable air conditioner **10** is to be moved through the mine passageways by means of the overhead carriages **13** previously mentioned, it would be necessary to reinforce the roof or top surface of the structure by means of a frame preferably composed of lateral and longitudinal I-beam members **52** which are securely attached to said top surface of the air conditioner unit. At least two pairs of laterally aligned I-brackets **53** are also attached to the unit to which chains or cables **54** having hook members at each end and angularly depending from the overhead carriages **13** may be attached to suitable protrusions such as eye hooks on the brackets for supporting the unit.

It should be noted that to further protect the air conditioner unit from condensed vapor that may drip from the ceiling of the mine passage or tunnel, an auxilliary roof or umbrella like waterproof covering **55** having extending and angularly depending eaves **56** could be utilized to cover the entire conditioner unit.

OPERATION AND USE

Refrigeration systems utilized for cooling air are available in many types and forms and usually consist of standardized components associated with each other in operating relationship by piping or tubing precharged with a suitable refrigerant, such as "Freon." The electric components of the system are usually connected by suitable wiring to a control panel available to the operator from outside of the enclosure containing the system.

Because the particular type of refrigeration system utilized has little or no bearing on the performance of the portable air conditioner unit of this invention, it is

sufficient to say that the arrangement and separation of these components from the hot, humid and dusty air drawn in and passing through the air chamber of the conditioner unit is pertinent to the efficient functioning of such a unit as described in the foregoing paragraphs.

In use, the air conditioner unit of this invention, because it is portable, may be easily transported to the working area of a mine tunnel and floor or wall mounted and then operated to provide this area with a constant supply of clean, dehumidified air to greatly improve the working conditions of the miners.

The hot, dusty and usually very humid air of the mine is drawn into the air passageway or plenum **28** of the unit through the intake end **17** of the plenum and through the filters **31** by the action of the blower fan **34** which provides suction on the intake side and pressure on the outlet side of the air chamber. As the air passes through the removable and cleanable filters **31**, most of the dust and large particles of debris are removed and the cleaned, but still very hot, humid air passes on under pressure to the outlet end of the chamber where it passes through the removable and cleanable evaporator coils. At this point, it is cooled by the refrigeration system in the usual manner and passes out through the removable outlet end **18** of the plenum into the flexible conduit or duct **33** from which is distributed to any desired location in the mine passageway.

The evaporator **32** through which the humid air passes as described above is provided with suitable fins which surround the coils and against which the humid air impinges causing the moisture to condense on the evaporator coils and drained by gravity to the bottom of the evaporator into the water trap **34**. From trap **34** it is drained through hose **35** to some remote area of the mine passageway. The hot air that accumulates in area **39** of the enclosure where condenser **45** and other heat generating components of the refrigeration system are arranged may be provided with suitable vents (not shown) which discharge into the mines ventilating system (also not shown) to dissipate this harmful hot air to the outside atmosphere of the mine.

Although but one embodiment of the invention has been shown and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

What is claimed is:

1. A mine cooling unit comprising:
a housing,
said housing being of a size capable of being positioned in and moved along a mine passageway,
said housing including an air intake, an air outlet and an air passageway extending between said air intake and air outlet at the base of said housing,
a removable filter mounted in said air intake,
a fan positioned in said air passageway adjacent said air intake for drawing air therethrough,
an enclosed chamber arranged in said housing above said air passageway and isolated therefrom,
a motor operatively connected with said fan,
refrigeration apparatus comprising a compressor, a condenser and an evaporator coil,
said compressor and condenser being located in said chamber and said coil being located within said air passageway juxtapositioned to said air outlet,
whereby the passage of air through said air passageway is cooled at the air outlet end of said housing to avoid condensation in said housing upstream thereof, and
a drain trap and outlet mounted at the base of said coil downstream thereof for collecting and draining from said housing water condensed by said coil.

2. The mine cooling unit set forth in claim **1** wherein:
said housing is mounted on a carriage.

3. The mine cooling unit set forth in claim **1** wherein:
said motor is located in said chamber.

4. The mine cooling unit set forth in claim **1** wherein:
the longitudinal axis of said air passageway is below the longitudinal axes of said air intake and said air outlet.

5. The mine cooling unit set forth in claim **4** wherein:
the longitudinal axes of said air intake and said air outlet are coaxially aligned.

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