Oct. 6, 1931. L. W. MELCHER 1,825,808

AIR CONDITIONING APPARATUS

Filed Sept. 2, 1930 2 Sheets-Sheet 1

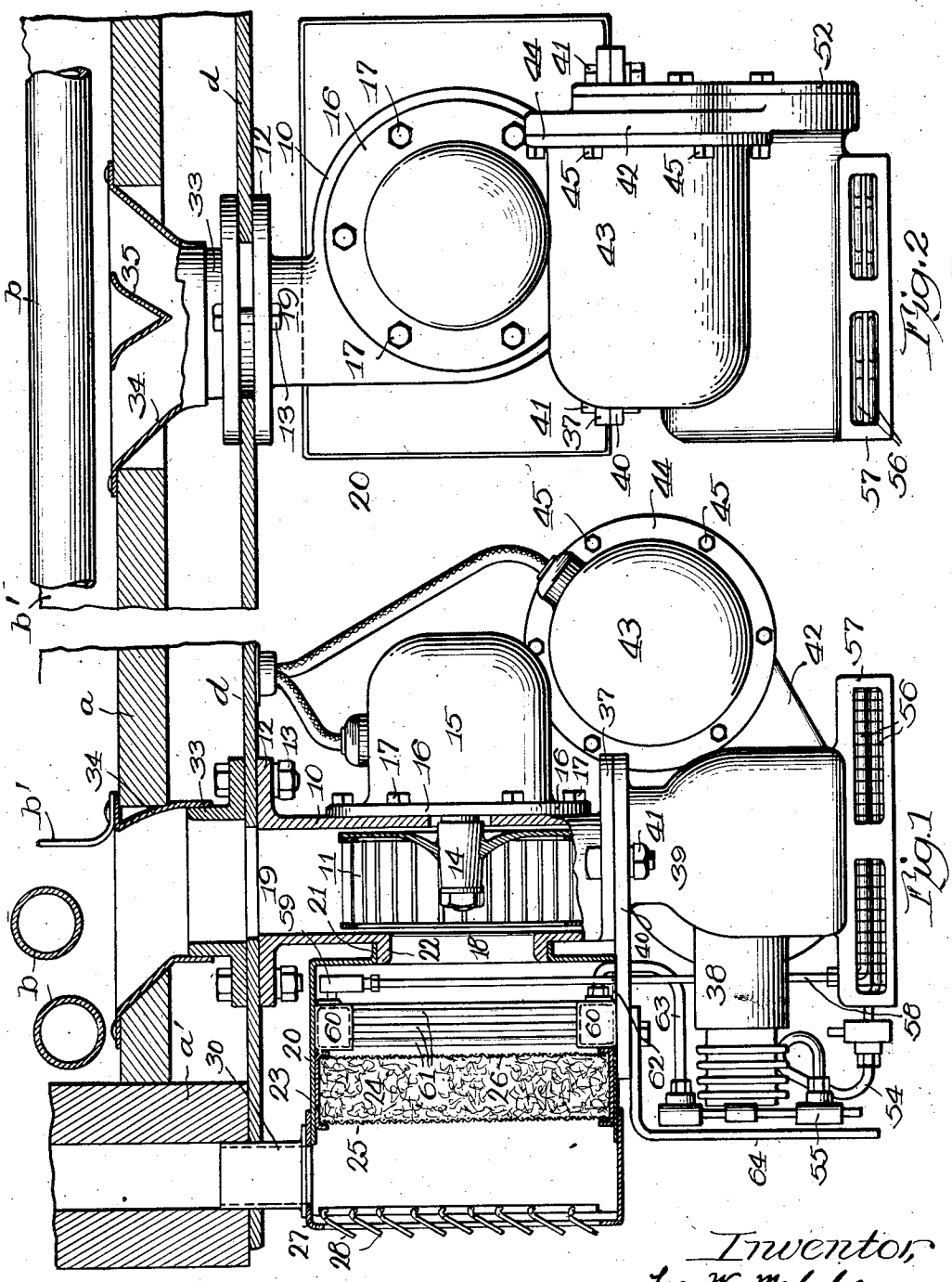


Fig. 1

Fig. 2

Witness:
Chas. L. Lourish.

Inventor,
Lee W. Melcher
By Fred Galasch
his Atty

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Fig. 5

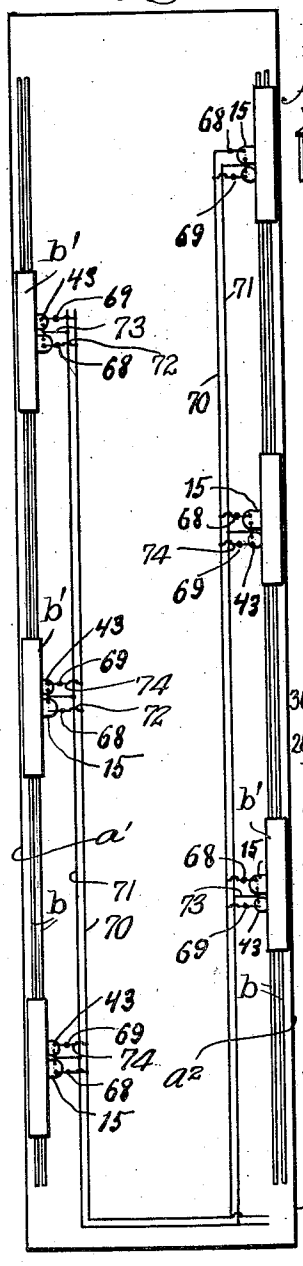


Fig. 6

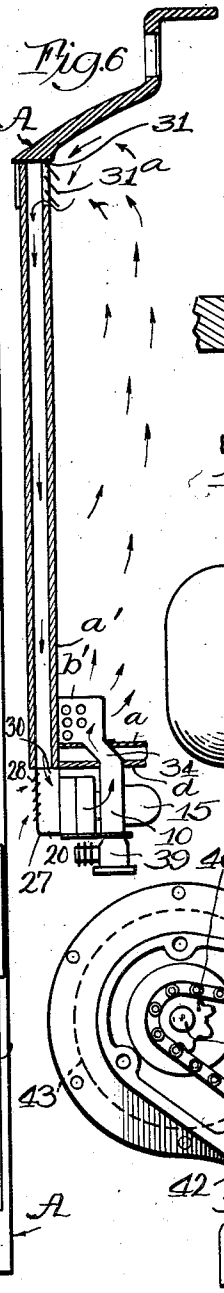


Fig. 3

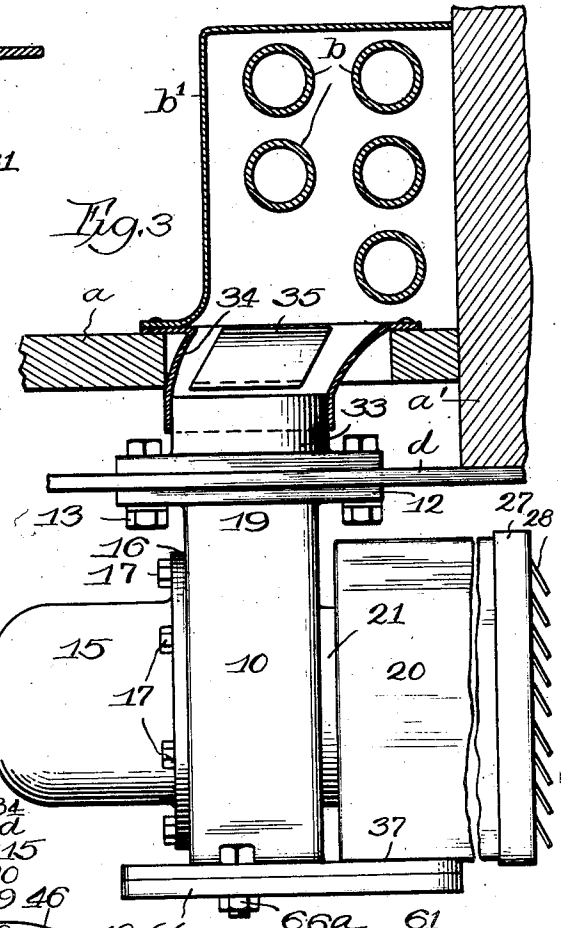
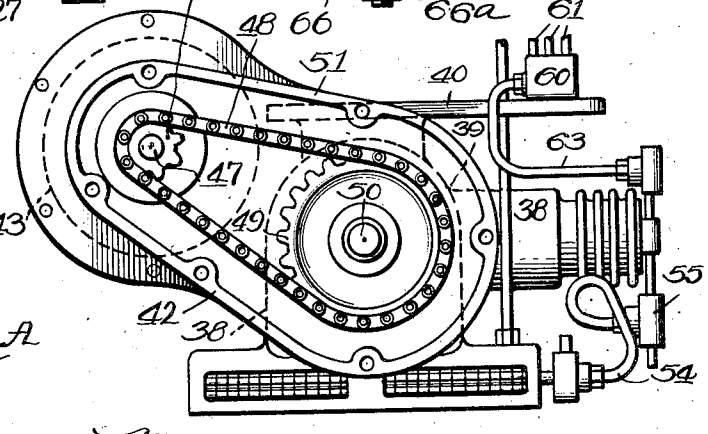


Fig. 4



Witness:
Chas. K. Kousek.

Inventor,
Lee W. Melcher
By Fred Gulach
his Atty

Patented Oct. 6, 1931 1,825,808

UNITED STATES PATENT OFFICE

LEE W. MELCHER, OF WINNETKA, ILLINOIS

AIR CONDITIONING APPARATUS

Application filed September 2, 1930. Serial No. 479,227.

The invention relates generally to air conditioning apparatus. More particularly the invention relates to that type of apparatus which is designed to condition the air in a railway car and comprises a filter, a fan for drawing air through the filter and delivering the filtered air into the car, and a refrigerating unit for cooling the filtered air prior to delivery into the car.

One object of the invention is to provide an air conditioning apparatus of this type which is in the nature of an attachment and is so constructed and arranged that it may be readily applied to a railway car of standard design without substantial change in the construction of the car.

Another object of the invention is to provide an apparatus of the type under consideration in which the refrigerating unit is supported so that it may be readily removed from the filter and fan for repair or replacement purposes.

A further object of the invention is to provide an air conditioning apparatus of the last mentioned character in which the filter is spaced from the fan so as to form a pocket therebetween and the refrigerant line of the refrigerating unit is disposed in the pocket so as to cool the air after passage thereof through the filter.

A still further object of the invention is to provide an apparatus for conditioning air which is generally of new and improved construction and may be manufactured at a low and reasonable cost, and in which removability of parts is combined with compactness and durability of construction.

Other objects of the invention and the various advantages and characteristics of the present construction will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Fig. 1 is a view, partly in section and partly in end elevation, illustrating an apparatus embodying the invention applied to a railway car;

Fig. 2 is a side view of the apparatus;

Fig. 3 is an end elevation of the filter and fan after the refrigerating unit has been detached therefrom;

Fig. 4 is an end elevation of the refrigerating unit, the closure plate of the gear-case of the unit being removed;

Fig. 5 is a diagrammatic plan view showing a railway car equipped with a plurality of air conditioning apparatuses embodying the invention; and

Fig. 6 is a vertical section of the car.

The air conditioning apparatus which forms the subject matter of the invention is designed primarily for use in connection with a railway car of standard construction. The car which is illustrated in the drawings is designated by the letter A and comprises a floor *a* and a pair of hollow side sills *a'* and a^2. A series of pipes *b* of standard construction is located adjacent the lower portion of each side sill. During cold weather, steam is supplied to these pipes in order to heat the car, as well understood in the art.

The apparatus is in the nature of an attachment and comprises a fan and an air filter. It is designed to be placed under the car-body and is suspended from a plate *d* which is secured beneath floor *a* of the car in any suitable manner. The fan operates to draw air through the filter and to deliver the filtered air into the car and comprises a casing 10 and a fan-wheel 11. The fan-casing 10 is formed of cast metal and is provided at the upper end thereof with a flange 12. The latter is secured by bolts 13 to the plate *d* and forms with the bolts a connection whereby the fan is detachably suspended from the bottom of the railway car. The fan-wheel 11 is disposed in the casing and is secured to the armature shaft 14 of an electric motor 15. The casing of this motor is provided with a flange 16 which is secured by bolts 17 to the inner side of the fan-casing 10. The

other side of the fan-casing is provided with an eye 18. During operation of the motor 15, the fan-wheel 11 is driven and operates to draw air through the eye 18 and to discharge the air upwardly through an outlet duct 19 in the fan-casing.

The air-filter is removably secured in a housing 20. This housing is positioned in front of the fan and is provided at the inner side thereof with a flange 21. The latter fits around a flange 22 which is formed integrally with the fan-casing and defines the eye 18. The filter is self-contained and comprises a rectangular frame 23, a mass of fibrous filter-material 24, such as hair, and sheets 25 and 26 of wire gauze. The frame fits removably in the outer side portion of the housing 20 and serves to hold the sheets 25 and 26 in spaced relation. The filter-material 24 is confined between the sheets. The filter is usually dipped in [illegible] oil to cause the impurities in the air passing therethrough to adhere to the fibrous material and the wire gauze sheets 25 and 26. Being removably held in the outer side portion of the housing 20, the filter can be easily cleansed in a solution of soda and water or any suitable mixture and then dipped in light oil and replaced in the housing. Air is drawn through the filter from the outer side thereof and into the eye 18 of the fan, and cleaned as it passes through the filter-material so it will be delivered by the fan through the outlet duct 19 in filtered form.

A hood 27 is removably secured to the outer side of the housing 20 and supports a series of shutters 28. The latter are supported pivotally by the housing so they may be opened or closed to control the ingress of air from the outside of the car to the filter. Any suitable mechanism may be employed to control this series of shutters. In some instances, for example in cold weather, it is desirable to cut off some or all of the air from the outside and to draw air from the car. For this purpose, a pipe 30 is connected to the top of the hood 27. This pipe extends upwardly through an opening in the plate *d* and projects into the space between the inner and outer side walls of the side sill *a'*. The pipe 30 receives air from the car through an opening 31 in the inner side wall of the sill *a'*. This opening is located adjacent the roof of the car and is controlled by a series of shutters 31ª. In cold weather, it is desirable to draw some or all of the air from the inside of the car in lieu of drawing all of it from the outside. Any suitable controlling mechanism may be provided for the shutters 28 and 31ª. By regulating the openings between the shutters 28 and 31ª, the air entering the filter may be controlled so that all or a portion of the air may be taken either from the outside or from the inside of the car. During warm weather, the shutters 31ª may be closed and all of the air drawn through the shutters 28.

A flanged ring 33 is bolted on the top of plate *d* and communicates with the outlet 19 of the fan-casing by way of an opening in the plate *d*. A duct 34 is connected to the ring. This duct passes upwardly through floor *a* and delivers the filtered air from the fan to the space around the series of pipes *b* which is associated with the side sill *a'* of the car-body. An open-ended shield *b'* is placed over a portion of the pipes *b* adjacent the duct 34 to cause the air to pass longitudinally of said pipes before it is discharged into the car. A deflector 35 in duct 34 directs the air longitudinally of the pipes in opposite directions. When steam is supplied to the pipes *b*, the air from the fan will be heated in passing along said pipes and before it passes out of the ends of the shield into the car.

In addition to the fan and air filter, the apparatus comprises a refrigerating unit for cooling the air in warm weather. This unit is supported removably from the fan-casing 10 and comprises a compressor 38. The latter is of usual construction and is contained in a casing 39 which is provided at the upper end thereof with a flange 40. This flange is secured by bolts 41 to a flange 37 on the bottom of the fan-casing 10 and forms with the bolts a connection whereby the refrigerating unit is supported removably from the fan-casing. A gear-case 42 is associated with the compressor casing 39. The compressor is driven by an electric motor 43. This motor embodies a housing which is provided with a flange 44. The latter is secured by bolts 45 to the gear-case 42. The compressor is driven by the motor through the medium of a sprocket 46 which is fixed on the armature shaft 47 of the motor and drives a chain 48. The chain drives a sprocket 49 which is fixed to the crank shaft 50 of the compressor. The sprockets 46 and 49 and the chain 48 are contained in the gear-case 42 and are accessible for repair or replacement purposes through an opening which is normally closed by a removable plate 52. A pipe 54 is provided with a suitable control valve 55 and receive refrigerant from the high-pressure side of the compressor 38. This pipe conducts the refrigerant to a condenser coil 56 which is contained in an open housing or frame 57 on the bottom portion of the compressor casing 39. A pipe 58 delivers the cooled refrigerant to an expansion-valve 59. An expansion coil of the radiator type comprises upper and lower heads 60 and connecting pipes 61 and is disposed in the filter-housing 20 between the filter and the eye of the fan so that the air, after passing through the filter, will be cooled in transit to the fan while the refrigerating unit is in operation. The upper head 60 is connected to the

expansion valve 59. The expansion coil is supported on an extension of the flange 40 of the compressor-casing so that it forms a part of the refrigerating unit and extends upwardly through an opening 62 in the bottom of the housing into the space between the filter and fan. It is removable from the housing 20 when the unit is disconnected or detached from the fan-casing 15. The lower head 60 is connected by a pipe 63 to the low-pressure side of the compressor. A plate 64 extends over the outer side portion of the compressor and the parts connected thereto to prevent them from being damaged by moving objects. The entire refrigerating unit, including the compressor, motor, condenser coil, expansion coil and pipe connections, are secured together. Whenever it is desired to dispense with the refrigerating unit or to remove it for repair, it is only necessary to detach the unit from the fan-casing by loosening the bolts 41. The expansion coil while supported on the compressor-casing is free to be lowered through the opening 62 in the filter housing 20. This makes it possible in event of a repair being necessary, to remove quickly the refrigerating unit and replace it with another.

If it is desired to use the fan and filter unit without the refrigerating unit, the unit is removed and a plate 66 is secured to the fan casing 10 by a bolt 66ª. This plate will close the opening 62 in the housing 20 so that the fan will be effective to draw air directly through the filter.

The motor 15 for the fan and the motor 43 for the refrigerating unit, are supplied with current by means of a pair of line conductors 70 and 71. The motor 15 is connected to the conductor 70 by a branch conductor 72 which includes a control switch 68. The latter is preferably mounted within the car so that it may be manipulated from within when it is desired to start or stop the fan. The motor 15 is connected to the conductor 71 by a branch conductor 73. The motor 43 for the refrigerating unit is connected to the conductor 70 by means of a branch conductor 74. The latter includes a switch 69 which is mounted within the car so that the unit may be controlled from within. The branch conductor 73 is connected to the motor 43 and serves to connect the latter to the conductor 71 so as to complete the circuit for the motor 43.

The operation is as follows:

When the air is too warm for the comfort of the passengers in the railway car A, the conductor or any other attendant of the car will close the switches 68 and 69 to cause both the fan and the refrigerating unit to operate so as to cause cooled and filtered air to be circulated through the car. When the temperature of the air is such that cooling is unnecessary, the refrigerating unit may be left inoperative while the filter and fan unit are operated. In such instances, the air that is supplied to the car by the fan will be cleaned without being cooled. In cold weather, when steam is supplied to the pipes *b*, the refrigerating unit may be removed entirely or left inoperative, so that the cleaned or filtered air from the fan 11, drawn either from the car through duct 30 or from outside the car or both, will be forced around and heated by the pipes *b* before it is discharged into the car. The air will at all times be cleaned by the filter 24.

The herein described air conditioning apparatus may be manufactured at a comparatively low cost by virtue of the fact that it consists of but a comparatively small number of parts. It is compact and operates efficiently to supply either cleaned warm or cold air into the railway car with which it is used. Inasmuch as the refrigerating unit is removably supported with respect to the fan-casing, it is possible entirely to dispense with the use of the refrigerating unit simply by detaching the unit and closing the opening 62 by means of the plate 66.

If desired, the air within the railway car may be conditioned by a group or battery of apparatuses embodying the invention. In the event that more than one apparatus is used, the motors are connected to the conductors 70 and 71 so that they are individually controllable (see Fig. 5 of the drawings).

Whereas the apparatus which forms the subject matter of the invention has been described as being adapted primarily for use in connection with a railway car, it is to be understood that it may be used with other vehicles or with whatever it has utility. It is also to be understood that the invention is not to be restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. In an air conditioning apparatus of the character described, the combination of a supporting structure, an air filter supported on the structure, a motor-driven fan also supported on the structure and operative to force air through the filter and to discharge the filtered air under pressure, and a refrigerating unit connected detachably to the supporting structure and comprising a compressor and a refrigerant line positioned to cool the air forced through the filter by the fan and adapted to be removed from its operative position upon detachment of the unit from the supporting structure.

2. In an air conditioning apparatus of the character described, the combination of a supporting structure, an air filter supported on the structure, a motor-driven fan also sup-

ported on the structure and operative to draw air through the filter and to discharge the filtered air under pressure, and a refrigerating unit connected detachably to the supporting structure and comprising a motor-driven compressor and a refrigerant line positioned between the filter and the fan to cool the filtered air prior to discharge by the fan and adapted to be removed from its operative position upon detachment of the refrigerating unit from the supporting structure.

3. In an air conditioning apparatus of the character described, the combination of a supporting structure including a housing having an inlet, an air filter mounted in the housing, a motor-driven fan supported on the structure and operative to draw air into the housing and through the filter and to discharge the filtered air under pressure, and a refrigerating unit connected detachably to the supporting structure and comprising a motor-driven compressor and a refrigerant line connected to the compressor and extending through an opening in the housing into an operative position within the housing wherein it is disposed between the filter and the fan and operates to cool the filtered air prior to discharge by the fan, said refrigerant line being removable from its operative position through the opening in the housing upon detachment of the refrigerating unit from the supporting structure.

4. In an air conditioning apparatus of the character described, the combination of an air filter, a motor-driven fan embodying a casing and arranged to force air through the filter and to discharge the filtered air under pressure, and a refrigerating unit connected detachably to the fan-casing and comprising a compressor and a refrigerant line positioned to cool the air prior to discharge by the fan and adapted to be removed from its operative position upon detachment of the unit from the fan-casing.

5. In an air conditioning apparatus of the character described, the combination of an air filter, a motor-driven fan embodying a casing and positioned so as to force air through the filter and to discharge the filtered air under pressure, a refrigerating unit comprising a motor-driven compressor and a refrigerant line connected to the compressor and arranged to cool the air prior to discharge by the fan, and a detachable connection between the compressor and the fan-casing whereby the refrigerating unit is held in supported relation with respect to the filter and the fan.

6. In an air conditioning apparatus of the character described, the combination of a supporting structure comprising a housing having an inlet, an air filter mounted in the housing, a motor-driven fan for drawing air into the housing and through the filter embodying a fan-casing connected to the housing, and a refrigerating unit connected detachably to the fan-casing comprising a compressor and a refrigerant line extending through an opening in the housing into a position wherein it is between the filter and the fan and serves to cool the filtered air prior to discharge by the fan, said line being removable from within the housing through the opening upon detachment of the unit from the fan-casing.

7. The combination with a railway car, of an air filter mounted under the body of the car, a motor-driven fan also mounted under the car-body and connected to force air through the filter and to discharge the filtered air into the car under pressure, and an independent refrigerating unit supported detachably under the body of the car and comprising a compressor and a refrigerant line connected to the compressor and positioned to cool the air prior to delivery into the car by the fan.

Signed at Chicago, Illinois, this 12th day of August, 1930.

LEE W. MELCHER.