July 9, 1946. W. W. HIGHAM 2,403,528

REFRIGERATING APPARATUS

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FIG. 1.

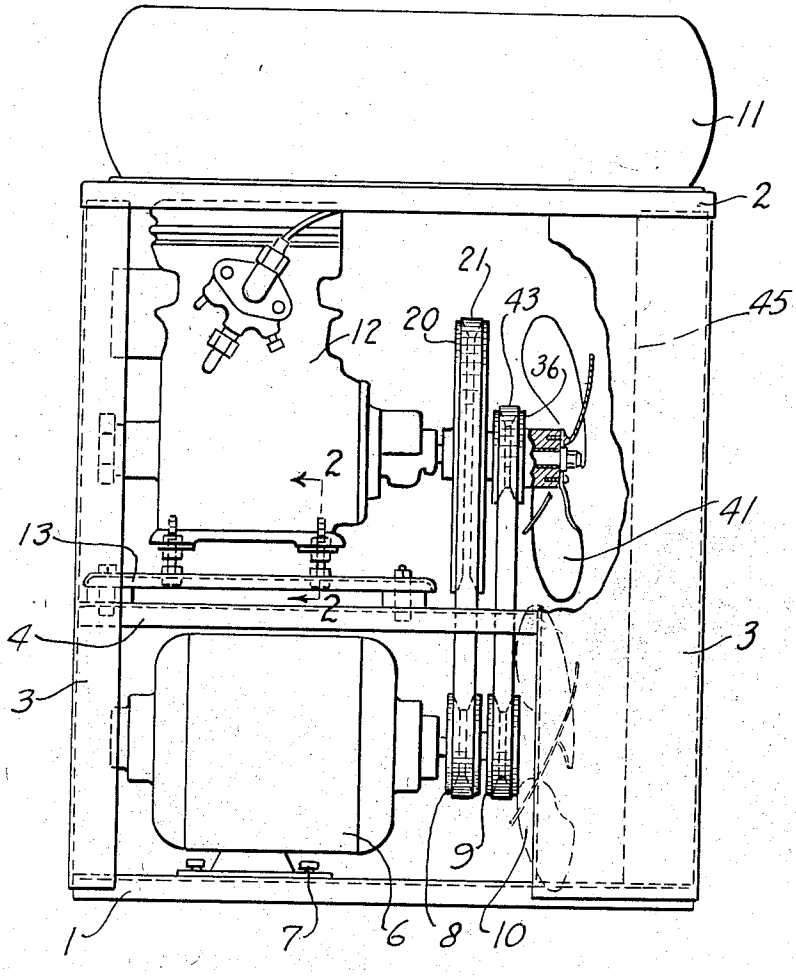
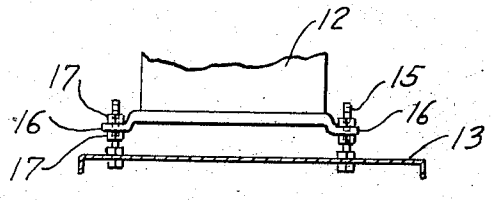


FIG. 2.



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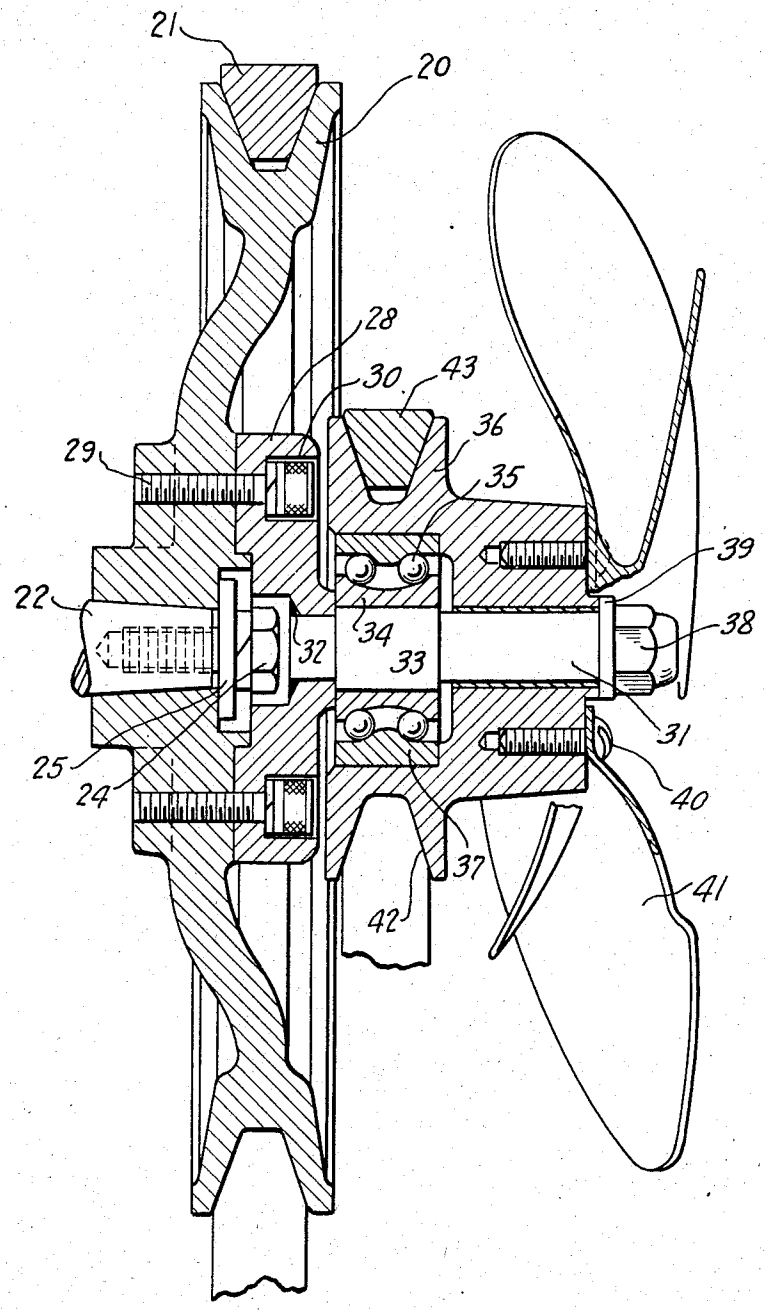
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FIG. 3.



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FIG. 6.

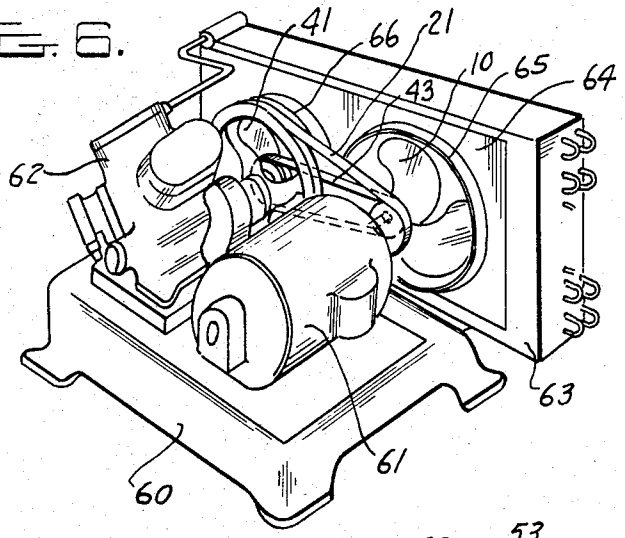
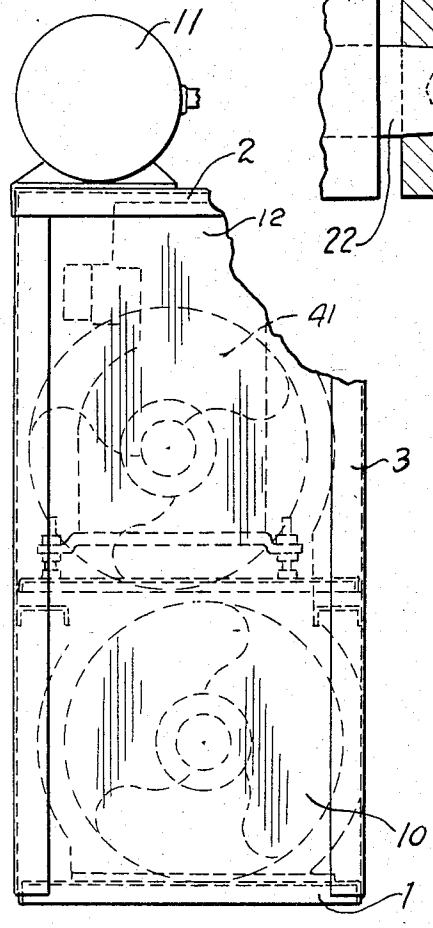


FIG. 5.



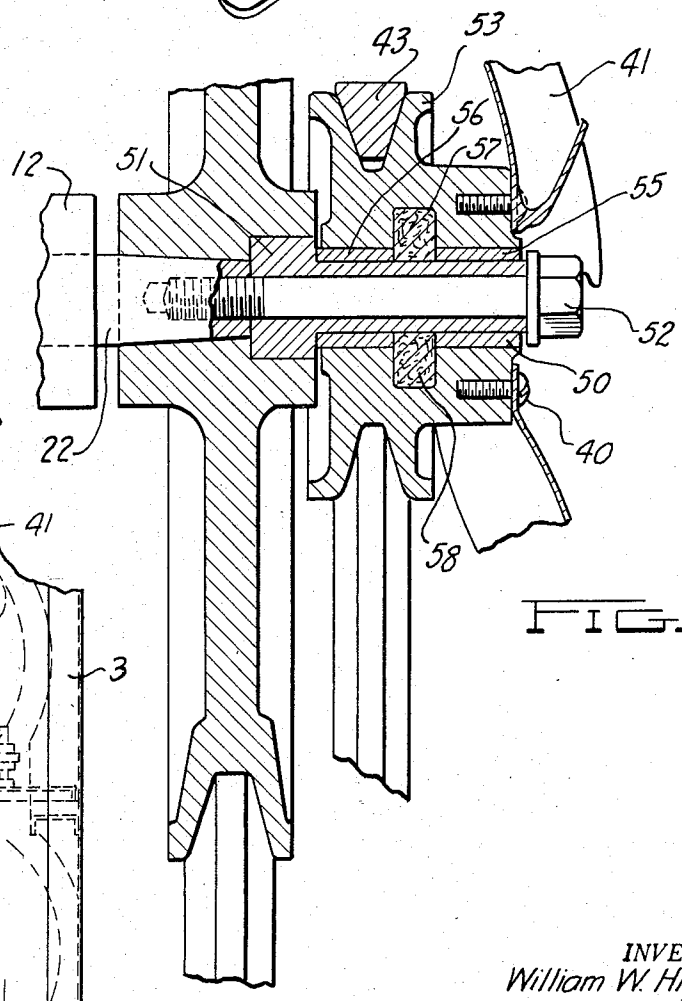


FIG. 4.

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2,403,528

UNITED STATES PATENT OFFICE

2,403,528

REFRIGERATING APPARATUS

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Application June 7, 1944, Serial No. 539,133

3 Claims. (Cl. 62—115)

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This invention relates to refrigerating apparatus and particularly to a unit construction self-contained refrigerant condensing assembly.

The principal object of the invention is to provide an improved unit of refrigerating mechanism of a compact nature and which is designed to have a relatively high capacity for the overall size of the unit. Such refrigerating machinery comprises essentially a prime mover, such as an electric motor, a compressor for the refrigerant and a condenser, together with pertinent parts and elements including air propelling means for causing flow of air over the condenser. In order for a condenser to function efficiently, where the condenser is air-cooled, the air should be moved in a stream or draft over all parts, or at least the major portions of the condenser. In an assembly embodying a compressor and a motor there are two locations adapted for the reception of a fan. One of these is the motor shaft and the other is the compressor shaft. Sometimes, however, the size of the condenser is such that a fan, if it is to be large enough to move air efficiently over the condenser, must be of considerable diameter. This requirement leads to such difficult and undesirable arrangement and structures as the placing of the fan shaft centrally of the condenser resulting in a misplacement of the motor or compressor so that the overall space required by the unit is increased or inefficiently used. On the other hand, if a relatively small fan is used as compared to the condenser, some shrouding may be necessary to form and define an air flow passage.

The principal object of the invention is accordingly to provide an arrangement wherein a compact self-contained unit of machinery is provided and wherein two air fans are employed for moving air through a condenser which otherwise would be too large for a single fan for efficient operation. To this end, the electric motor and the compressor are disposed relative to each other in a manner as to best and most economically consume the involved space, and the shaft of each serves as a support for a fan. The two fans are thus located side by side and function to set up a movement of air through different parts of the condenser. Where it is preferable that the fans rotate in unison at least one of the fans may be arranged so that the speed of rotation is different than the speed of rotation of the shaft which forms the support and axis for the fan.

The invention is disclosed in the accompanying drawings and in these drawings:

Fig. 1 is a side elevational view with some parts cut away and illustrating a refrigerating apparatus constructed in accordance with the invention.

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Fig. 2 is a detailed sectional view taken substantially on line 2—2 of Fig. 1.

Fig. 3 is a sectional detailed view showing one form of mounting for one of the fans wherein the fan operates on an anti-friction bearing.

Fig. 4 is a detailed view in section showing a form of fan mounting where a friction bearing is employed.

Fig. 5 is a somewhat diagrammatic end view of the apparatus.

Fig. 6 is a general perspective view of a form where the motor and compressor are spaced horizontally.

As shown in Fig. 1 the apparatus is mounted as a unit in a suitable framework which comprises a base frame structure 1, top structure 2, and vertical frame elements 3. At an intermediate location between the top and bottom of the frame is an intermediate supporting or frame element 4.

The motor and the compressor are mounted, in the form shown, in superposed relationship although it is within the invention to mount motor and compressor side by side. As shown, the motor 6 is mounted on the base of the frame as at 7. The shaft of the motor carries a double pulley for V type belts, one pulley portion being illustrated at 8 and the other pulley portion at 9. The pulley portions 8 and 9 may be integral with each other. Also mounted on the shaft by connection directly to the shaft or pulley structure is a suitable fan 10. The top of the frame structure may carry a suitable receiver tank 11 and any other pertinent controls or valves (not shown).

The compressor is illustrated at 12 and it is mounted on the intermediate frame part 4. This may be accomplished through the means of a separate supporting plate or platform 13 provided with upstanding screw threaded studs 15. The compressor has feet 16 with apertures therein for receiving the studs, and nuts 17 provided below and above the feet so that the compressor may be vertically adjusted. The compressor shaft projects so as to overlie the motor shaft and it is provided with a grooved fly wheel 20 for the reception of a V belt. There is a V belt 21 which operates over the pulley portion 8 on the motor shaft and the fly wheel 20 of the compressor to thus establish a driving connection between the motor and the compressor.

As shown in Fig. 3, the compressor shaft 22 may have a tapered end and the fly wheel 20 is attached thereto as by means of a cap screw 24 and washer 25. An auxiliary spindle is carried coaxially with the compressor shaft, and in the

form shown in Fig. 3, this spindle has a hub portion 28 butted against the fly wheel and secured thereto by screws 29, the heads of which may be recessed for the reception of a turning tool and the heads of which may lie in recesses 30 in the hub. A spindle member proper 31 is attached to the hub as by means of welding or the like as at 32 and it has an enlargement 33 upon which the inner race 34 of an anti-friction bearing is disposed advantageously by press fitting. The bearing has a double row of balls 35 and a pulley 36 is disposed on the outer race 37. The pulley is held in position on the spindle by a nut 38 and flat washer 39. Attached to the end of the hub as by means of screws 40 is a fan 41. The pulley has a groove 42 for the reception of a V belt 43. This V belt operates over the pulley portion 9 as shown in Fig. 1.

It will accordingly be observed that the two fans 10 and 41 lie adjacent each other on parallel axes and that the motor drives the fan 10 directly, the compressor through the means of the belt 21, and the fan 41 through the means of the belt 43. In the form shown, the fans 10 and 41 are substantially the same and, therefore, should operate at the same R. P. M. if it is desired to create the same air draft with each fan. Under these conditions the pulley 36 and the pulley portion 9 are to be of the same size. The tightness of the fan belts can be regulated by raising or lowering the compressor on the studs 15.

The motor operates the compressor at a lower R. P. M. than that of the motor as will be observed by the difference in the sizes of the pulley portion 8 and the pulley 20, while with the arrangement shown, the fan 41 operates at the same R. P. M. as the motor and the fan 10. In doing so the hub 36 rotates on the spindle 30 at a different R. P. M. than that of rotation of the spindle 31. The condenser is disposed vertically along the right hand side of the frame structure as Fig. 1 is viewed, and extends from the base of the frame 1 to the top 2 and its outline is indicated by the broken lines as at 45. Thus, it will be seen that the condenser is quite large and by the use of two fans thus arranged, air drafts may be caused to move through the condenser substantially uniformly through its upper and lower parts. This makes for an efficient arrangement in that both the upper and lower parts of the condenser are efficiently and substantially uniformly air-cooled.

The modified form shown in Fig. 4 illustrates a fan mounting where a friction bearing is used. Such parts as have heretofore been described are, for convenience, given the same reference characters. This includes the motor and its shaft, the fly wheel and the belt. In this form a sleeve 50 has an enlarged portion 51 accurately fitted in the recess in the fly wheel and the sleeve is held in position by a long cap screw 52 extending therethrough and threaded into the end of the motor shaft. The pulley 53 for the belt 43 has the fan 41 secured thereto by screws 40. Suitable friction bearings as shown at 55 and 56 are disposed between the pulley and the sleeve. These bearings or bushings may be pressed fitted into the hub of the pulley and they have a bearing fit with the sleeve. These bearings or bushings may be made of suitable bearing material such as a metal of a porous nature for absorbing a lubricant. The pulley hub may be recessed internally between the bushings, as shown at 57, and in this recess a body of felt or other material 58 soaked with a lubricant is disposed. In this arrangement the fan

is journalled and supported concentrically with the compressor shaft so that it can rotate on the axis of the compressor shaft at a speed of rotation different than that of the speed of the compressor.

In the form shown in Fig. 6 the motor and compressor are positioned in substantially the same plane but spaced horizontally. The base of the structure is shown at 60, upon which the motor 61 and the compressor 62 are mounted. The condenser 63 is also carried by the base and it is provided with a shroud 64 leaving a fan opening 65 and a fan opening 66. The motor operates the compressor by the belt 21. The fan 10 is mounted on the motor shaft and is positioned in the opening 65. The fan 41 is mounted on the extension of the compressor shaft by the structure shown in Fig. 3 or in Fig. 4, while the belt 43 operates over a pulley on the motor shaft and a pulley on the hub of the fan 41 after the manner above described. This form can be used where a horizontal placement is preferred and this form may be desirable for units of larger capacity where the relatively heavy motor and compressor are mounted on a strong base. This form demonstrates also the employment of a condenser having an area considerably larger than that convenient to be ventilated by a single fan, and it also demonstrates how the condenser may be shrouded to accommodate the two fans.

It is within the invention to operate the two fans at different speeds of rotation even though the arrangement shown herein operates the fans at the same speed. Under these modified conditions fans of different sizes or capacities may be used. For that matter, two fans otherwise of similar structure and capacity, may be operated at different speeds of rotation. It will be observed now a condenser covering a fairly large area can be efficiently cooled by the passage of air current through substantially all portions thereof by the two separate fans. If only one fan were used, of a size substantially corresponding to one of the fans shown herein, the fan would have to be placed more or less centrally of the condenser and this would interfere with the design or other features of the unit or make it more awkward and space consuming. Also some shrouding may be required to form a guiding passage for the air currents. With the present invention each fan moves air current directly through that part of the condenser immediately in front of it. The invention also permits of a condenser shape and size which is considerably greater in one direction than the other; for example, the condenser shown in Fig. 5 may have a height approximating the combined diameter of the fans and a width approximating the diameter of but one fan.

I claim:

1. A refrigerating apparatus comprising, a frame, a condenser along one side of the frame and extending substantially from the bottom to the top thereof, a motor and a compressor, one of which is mounted in the lower portion of the frame and the other of which is mounted in the upper portion of the frame, the motor having the shaft projecting toward the condenser, a plural pulley on the motor shaft, a fan on the motor shaft positioned adjacent the condenser, the compressor having a shaft projecting toward the condenser, a pulley on the compressor shaft, a spindle carried by and concentric with the condenser shaft, a pulley journalled on said spindle, a fan carried by the last named pulley and positioned adjacent the condenser, belts operating over the

plural pulley on the motor shaft and operating over the condenser pulley and over the pulley on the spindle for driving the compressor shaft and the pulley on the spindle at different speeds of rotation, the combined diameters of the two fans substantially corresponding to the vertical dimension of the condenser and the diameter of each fan substantially corresponding to the horizontal dimension of the condenser.

2. A refrigerating apparatus comprising, a substantially rectangular condenser having a long dimension and a short dimension, an electric motor, a condenser, the motor and condenser being positioned side by side lengthwise of the condenser, the motor having a shaft projecting toward the condenser, a plural pulley on the motor shaft, a fan on the motor shaft adjacent the condenser, the compressor having a shaft projecting toward the condenser, a pulley on the compressor shaft, a spindle projecting toward the condenser carried by and concentric with the compressor shaft, a pulley journalled on the spindle, a fan mounted on the last named pulley and positioned adjacent the condenser, a plurality of belts operating over the plural pulley and operating over the compressor pulley and over the pulley on the spindle with the pulley sizes being

such that the compressor and the pulley on the spindle operate at different speeds of rotation, said fans being substantially of the same diameter, the length of the condenser corresponding substantially to the combined diameters of the fans and the width of the condenser corresponding substantially to the diameter of one fan.

3. A refrigerating apparatus comprising supporting means, a motor and compressor mounted on the supporting means in spaced relationship, a condenser extending substantially at right angles to the motor shaft and compressor shaft and overlapping the motor shaft and compressor shaft, a fan on the motor shaft for cooperating with a portion of the condenser, a plural pulley on the motor shaft, a pulley on the compressor shaft, belt means operating over the pulley on the compresssor shaft and pulley means on the motor shaft for establishing a drive between the motor and compresssor, an extension on the compressor shaft and co-axial therewith, a fan journalled on the extension, a pulley for the second named fan and a belt operating over the fan pulley and the pulley on the motor shaft for driving the fan on the compresssor shaft, said fan on the compressor shaft cooperating with a portion of the condenser.

WILLIAM WALKER HIGHAM.