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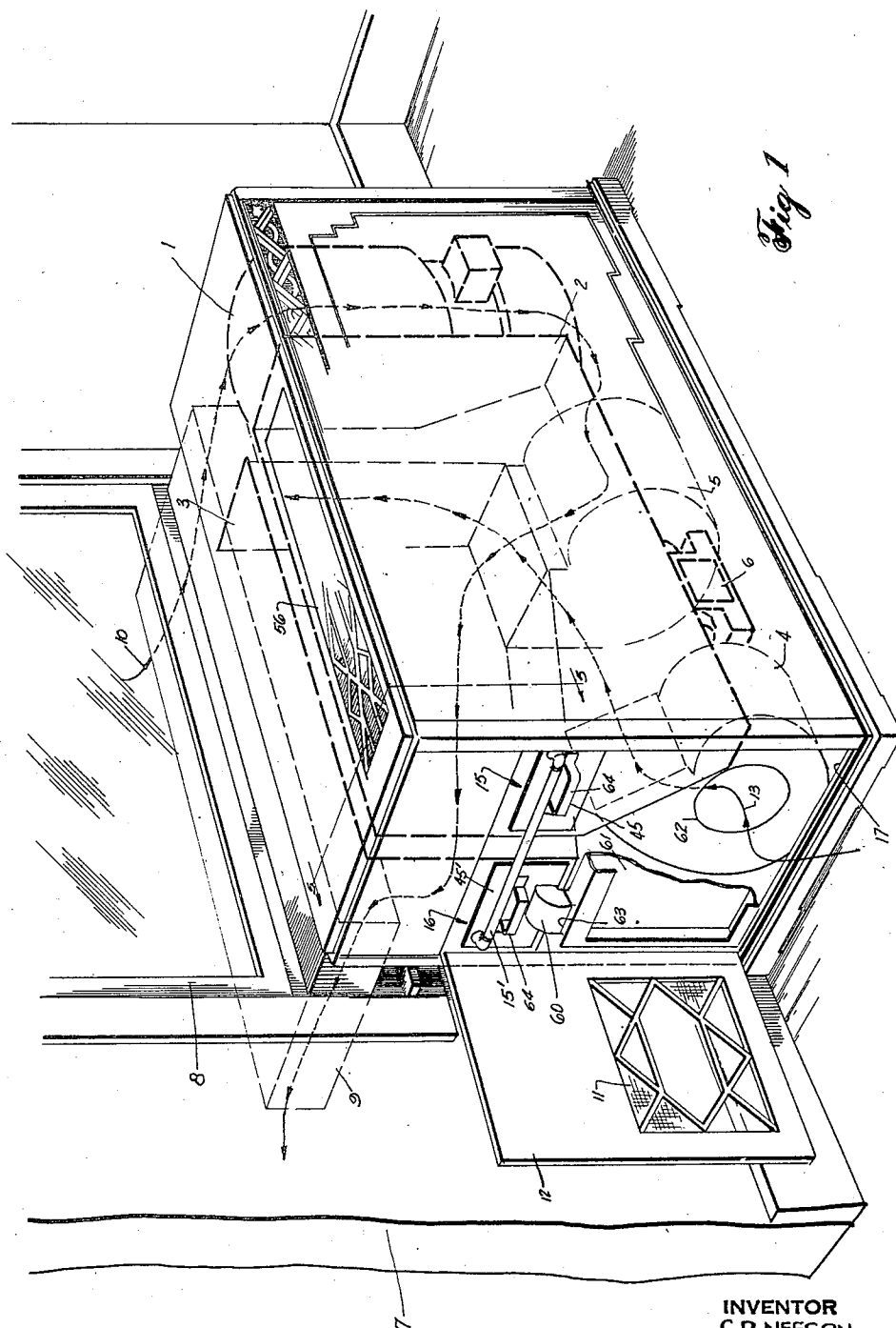
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2,081,553

AIR CONDITIONING APPARATUS

Filed Feb. 13, 1933

5 Sheets-Sheet 1



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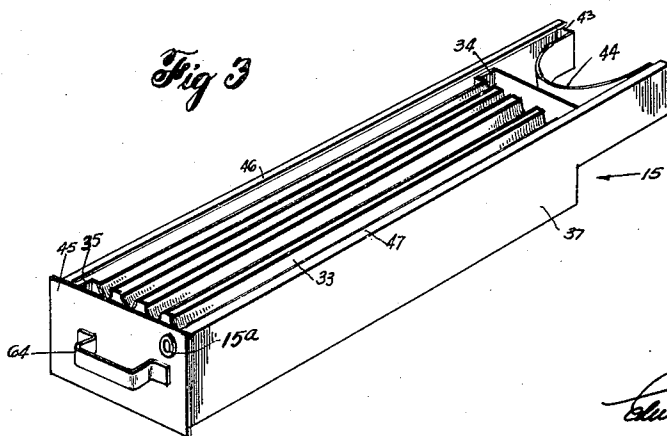
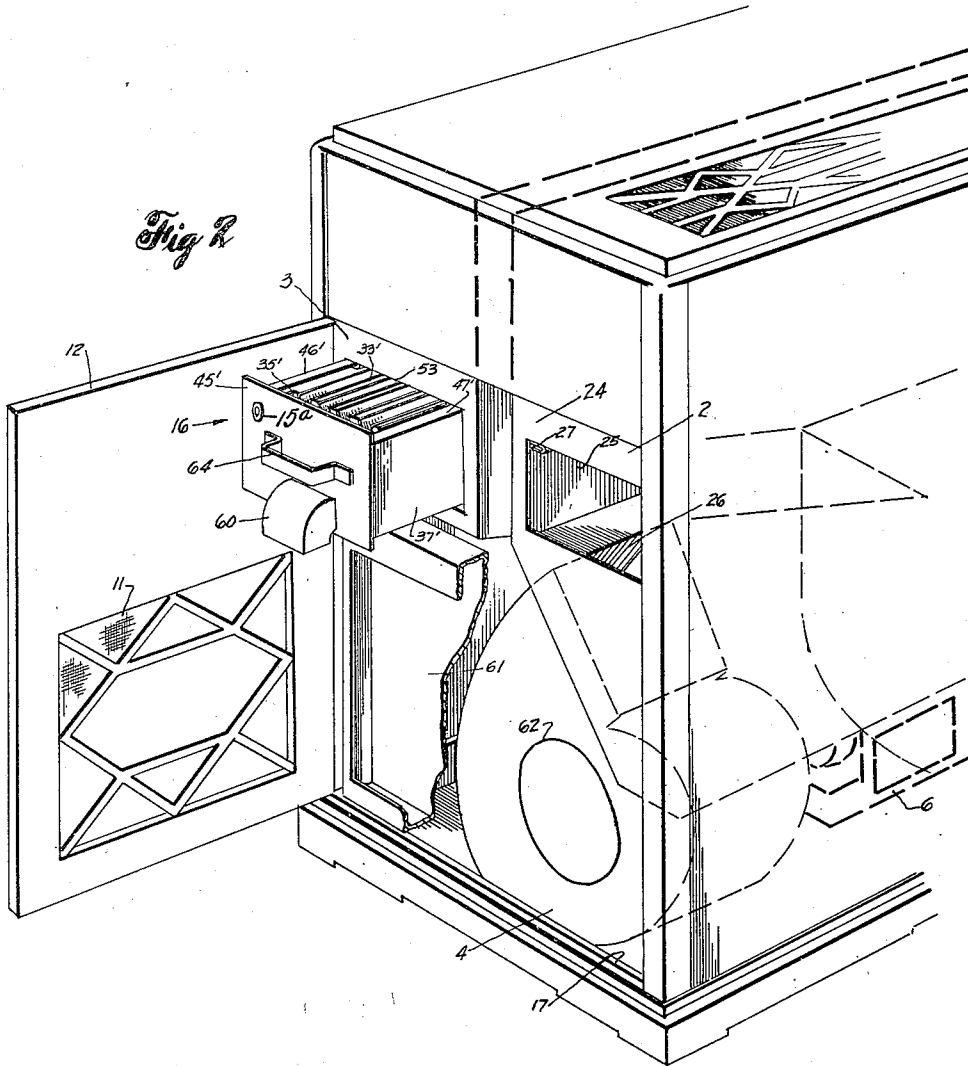
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5 Sheets-Sheet 2



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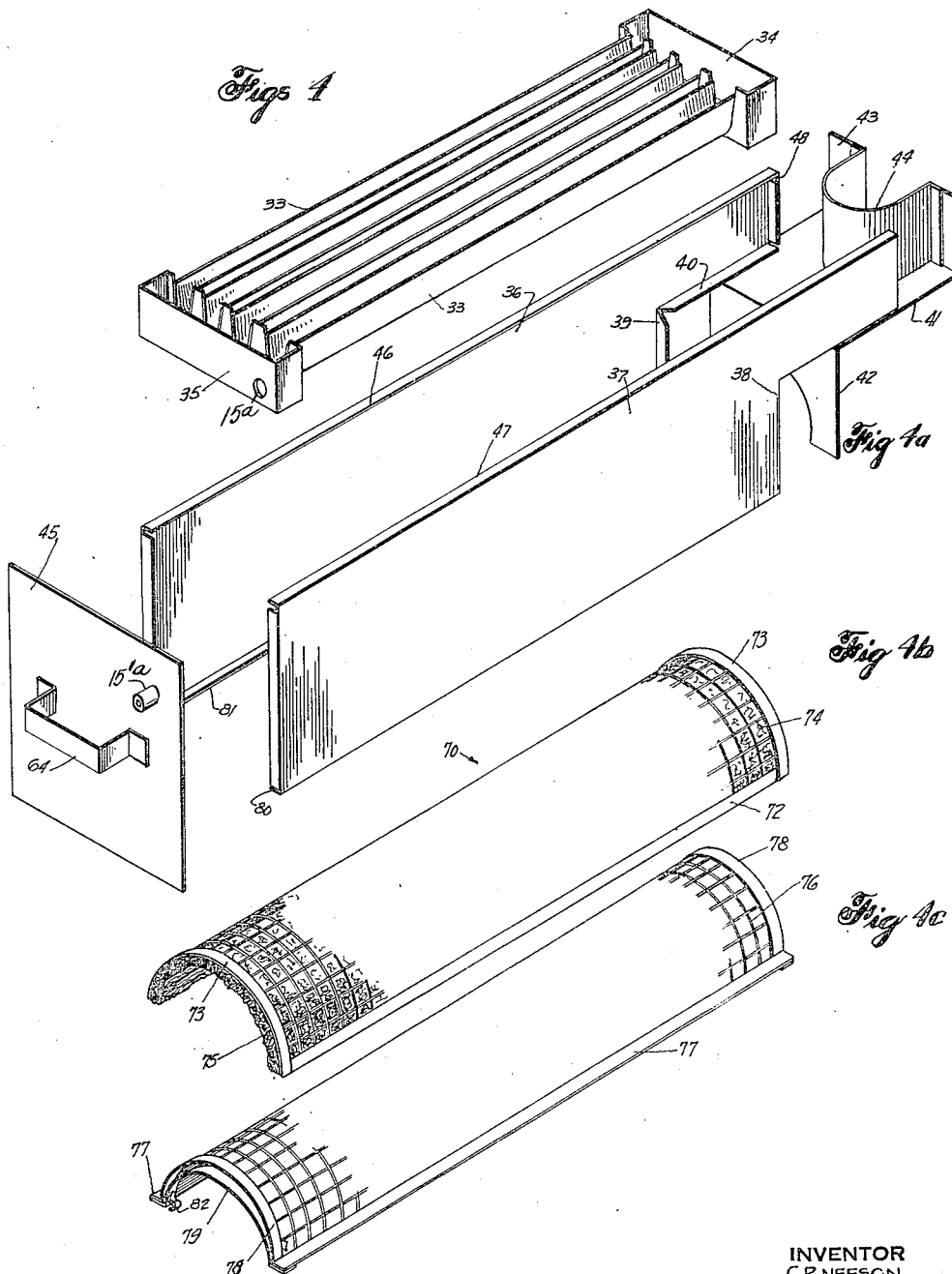
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5 Sheets-Sheet 3



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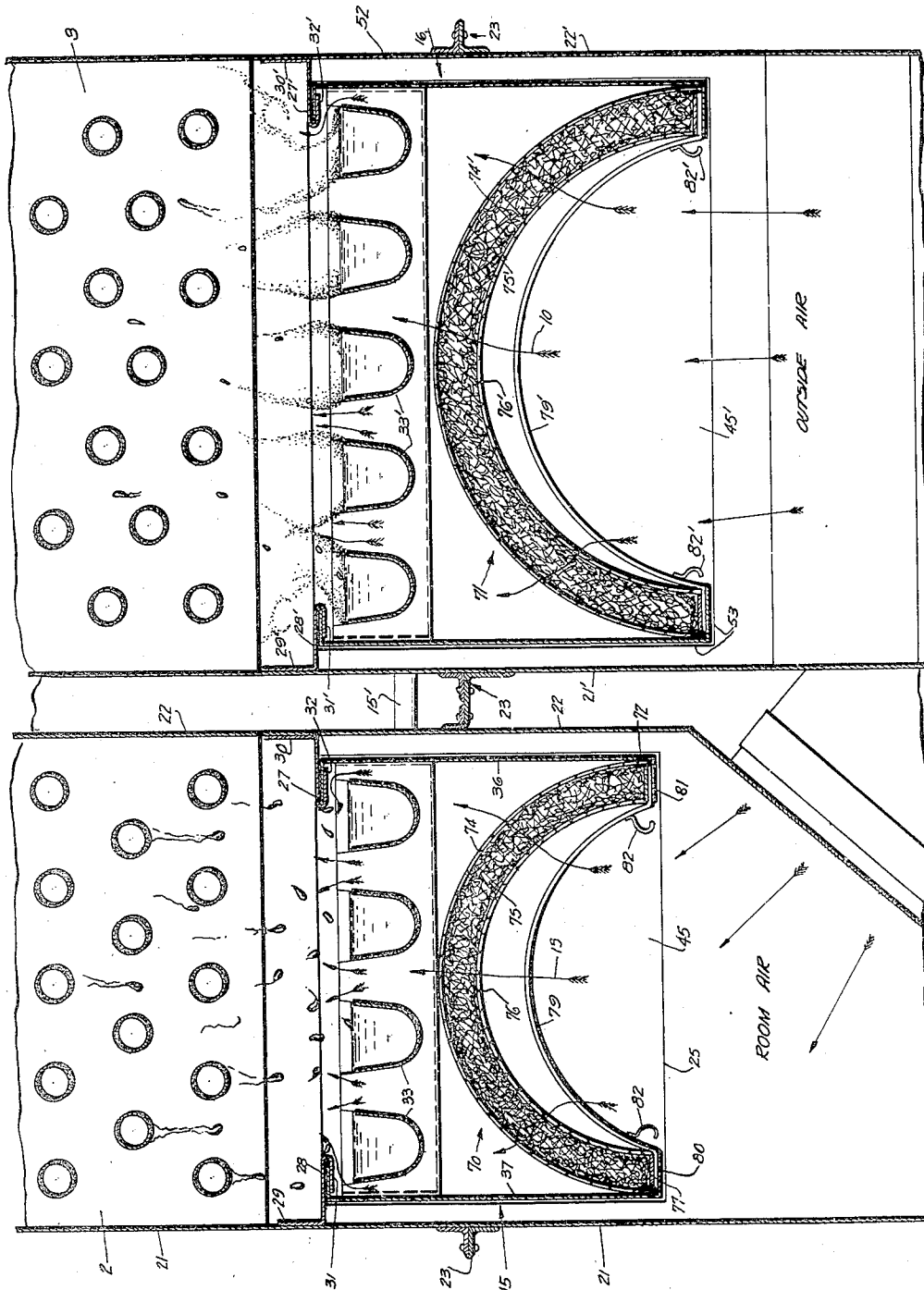


Fig. 5

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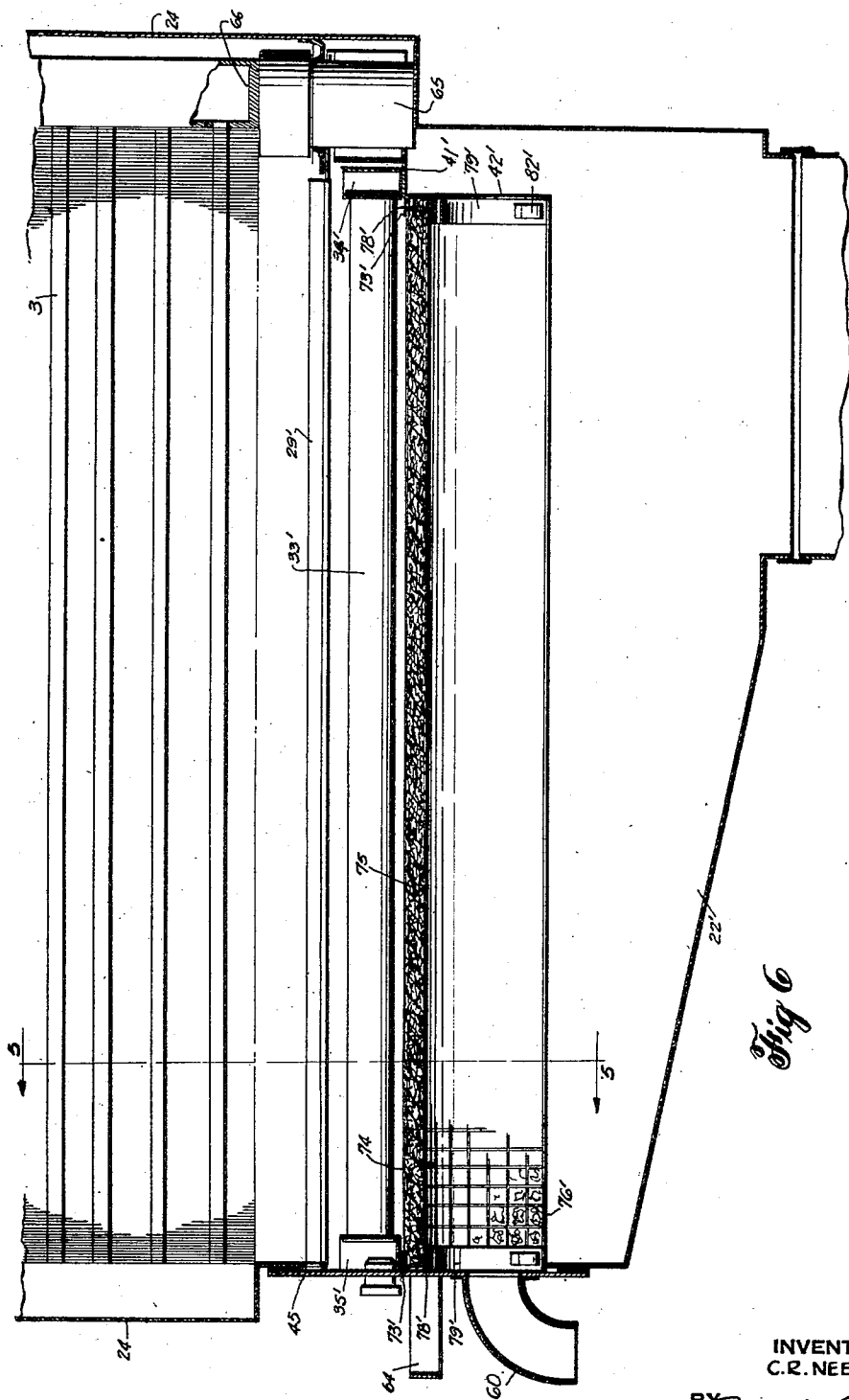
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AIR CONDITIONING APPARATUS

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5 Sheets-Sheet 5



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2,081,553

AIR CONDITIONING APPARATUS

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Application February 13, 1933, Serial No. 656,487

5 Claims. (Cl. 183—18)

This invention relates generally to air conditioning equipment of the type employing refrigerating apparatus, and particularly to improved filters and removable condensate collecting and disposal means in a self-contained portable air conditioning unit for homes and offices.

In a self-contained air conditioning unit of the type herein disclosed, there is provided a refrigerating system having a pair of complementary heat exchange elements functioning respectively as a condenser or evaporator representing the high and low sides of the system. To effect said high pressure I prefer to employ a compression refrigerating mechanism, although any other suitable means or system may be employed.

In any event, however, proper cooling and conditioning of room air requires elimination or reduction of humidity and this in turn necessitates the use of means for collecting the moisture which condenses on the evaporator and for suitably disposing of the condensate without returning it to the room air. To accomplish this, a suitable pan or other means is provided beneath the evaporator to collect moisture dripping therefrom, and this collecting means communicates with moisture disposal means associated with the condenser, the result being that moisture condensed from the room air is conducted away from the path of such air and into the path of outside air flowing over the condenser for cooling the same. This moisture is thereupon entrained by the condenser cooling air and brought into contact with the hot condenser to be evaporated thereby, whereupon the vapor is carried with the stream of air to the outside.

To permit interchange of the evaporator and condenser functions so that the unit may be used for heating of the room instead of cooling and at the same time to permit condensate to be entrained by the room air so as to be vaporized by the hot condenser and thus humidify the room air, I have provided improved collecting and disposal means preferably of substantially the same construction and so inter-related that their functions of collecting or disposing may be effectively interchanged. However, it will be understood that when the unit functions as a room cooler, the flow of cooled room air will not entrain moisture from the collector pan to rehumidify the air because the evaporator is interposed between the collector and discharge of room air, thus causing any such entrained moisture to be intercepted by the evaporator so as to drip back into the collector with other condensed moisture. It is one object of my invention to accomplish all of the

foregoing in an improved manner together with an improved construction of the collecting and disposal means.

Another object is to insure sanitary and efficient operation of the unit over a long period of time. To accomplish this in a simple and economical manner I have removably supported the collecting and disposal means in the unit in an improved manner. More specifically an object of my invention in this respect is to have the collecting and disposal means in the form of separate trays which are so constructed and supported that they may be readily and easily individually removed or otherwise manipulated from a side of the room cooler unit, specifically the end thereof, although the trays may be formed together as a single removable unit.

A further object of my invention is to provide improved filtering means between the air circulating means and heat exchange elements and more particularly to dispose air filters on the discharge or pressure side of the air circulating means thereby insuring maximum flow of air through the unit. A further object is to obtain these results by associating the filters with the removable collecting and disposal trays and to provide improved means for permitting ready removal or assembly of the filter material with the removable trays.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawings in which:

Fig. 1 is a partial diagrammatic perspective of a self-contained air conditioning unit embodying features of my invention;

Fig. 2 is a perspective of one end of the unit showing one moisture pan or tray entirely removed and the other only partially removed;

Fig. 3 is a perspective of the tray removed from the room air duct of the unit;

Figs. 4, 4a, 4b and 4c are perspectives of component parts of the water pan and filter arrangement, Fig. 4 showing the water trough, Fig. 4a the frame for the water trough and filter, Fig. 4b the filter, and Fig. 4c the removable means for holding the filter;

Fig. 5 is a vertical transverse section through the heat exchange elements and water pans taken on line 5—5 of Figs. 1 and 6;

Fig. 6 is a vertical longitudinal section through

one of the heat exchange elements and removable pans or trays.

In the illustrated embodiment of my invention which is one form among possible others that the invention may take, I have shown a portable self-contained air conditioning room unit for heating or cooling, the unit being of type employing the same general arrangement and construction shown in the application of H. L. Galson, Serial No. 648,772, filed December 24, 1932. Hence it is not deemed necessary in this application to describe in detail the specific construction and arrangement of the vertical shaft motor-compressor unit 1, heat exchange elements or assemblies 2 and 3, room air blower 4 and outside air blower 5 commonly driven by a motor 6. It will further suffice to state that the unit is placed adjacent a suitable opening in the wall 7 of the room, preferably adjacent a window 8, thus permitting an outside duct casing 9 to project rearwardly from the uppermost portion of the unit through the window. As a result, outside air may flow, as indicated by the dotted line arrows 10, through one end of casing 9, thence down over motor-compressor unit 1, through fan 5 and upwardly over the heat exchange element 3 and thence out to the outside air. The room air flows through a suitable opening 11 formed in a cabinet door 12 and thence along the path indicated by the dotted line arrows 13 as through room air blower 4 and upwardly over the heat exchange element 2.

It will be understood that the heat exchange elements will serve alternatively as a condenser and evaporator depending upon whether the unit is functioning as a room cooler or heater. Suitable means are employed to reverse the functions of these heat exchange elements such as shown in my copending application, Serial No. 653,466, filed January 25, 1933. Hence it need not be described here except to understand that when the unit is used as a room cooler, heat exchange element 2 serves as an evaporator to cool the room air flowing thereover along the path of dotted line arrows 13 during which operation the heat exchange element 3 serves as a condenser which is cooled by outside air flowing along the path of dotted line arrows 10. When the unit serves as a heater, heat exchange element 2 functions as a condenser to heat room air flowing thereover while element 3 serves as an evaporator to abstract heat from the outside air.

In describing the various constructional features of the invention, the unit will be considered as operating as a room cooler in which case the heat exchange elements 2 and 3 will respectively be called the evaporator and condenser.

The humidity of the room air is lowered due to condensation of moisture on the evaporator surface and this moisture, as shown more clearly in Fig. 5, drips down from the evaporator 2 and collects in suitable collecting means herein specifically shown as a removable drawer or tray generally indicated at 15. This condensed moisture then flows laterally through a suitable removable pipe 15' to a moisture disposal means herein generally indicated at 16 and also specifically shown as a tray or drawer. Pipe 15' is connected across the front ends of the tray through suitable openings 15a and 15'a. As shown in Figs. 1 and 2 these trays are removable from the end of the unit through a door opening 17 of the cabinet thereby being readily accessible for removal or insertion. Inasmuch as the trays 15 and 16 are respectively disposed in the paths of outside air

and room air, they may hereinafter be referred to generally as the outside air tray and the room air tray, although specifically they will also be referred to as collecting and disposal means, pans or trays.

The two trays 15 and 16 are of the same general construction except tray 16 as shown in Fig. 5 has a somewhat greater depth and width than tray 15 for purposes of insuring proper volume and velocity and air flow and permitting use of proper size air filters to be described later. Hence it will suffice to describe the construction of only one of the trays as it will be understood that the other tray is of the same construction except for the differences just mentioned.

As shown in Fig. 5 the evaporator 2 is preferably of the horizontal tube flooded type disposed between passage walls 21 and 22 which are suitably supported upon a framework generally indicated at 23. Walls 24 are provided at each end of the evaporator while the wall thereof adjacent door 12 has an opening 25 disposed beneath the evaporator but above the fan outlet 26 leading into the evaporator passage. Disposed longitudinally of the evaporator and beneath the same are two guideways 27 and 28, Fig. 5, formed from suitable sheet metal secured as at 29 and 30 to the sides 21 and 22, as by soldering, sheet metal screws or otherwise, the guideways being formed by reversely outwardly bent portions 31 and 32.

The condensate collecting means 15 in the form of a tray or drawer comprises generally a series of substantially horizontal parallel U-shaped troughs 33 connected at their ends by headers 34 and 35, Figs. 3, 4 and 6. These troughs and headers constitute a unit which specifically is shown as formed of component parts suitably soldered together, although the same may be formed from a single stamping or any other construction may be employed. In any event the bottom of headers 34 and 35 is closed while their upper ends are open. This trough unit is then set between and secured to sides 36 and 37 which preferably are cut back as at 38 and 39 and suitably flanged around its entire edges. One end of the trough assembly rests on flanges 40 while the other end is suitably secured to sides 36 and 37 by soldering or welding. An end plate or element is received in the cut-out portions 38 and 39 and comprises a sheet metal plate 41 bent downwardly at 42 and upwardly at 43 while an arcuate end wall 44 projects upwardly from around the edge of a similarly shaped recess in the portion 41. A drawer front 45 is soldered or otherwise suitably secured to the front ends of sides 36 and 37 so that when the complete tray is assembled as a unit, it has the appearance shown in Fig. 3. When so assembled the upper edge flanges 46 and 47 of sides 36 and 37 provide guides which are longitudinally slidably receivable in guideways 27 and 28. The outer ends of flanges 46 and 47 are slightly spaced as at 48 from the ends 43, thus permitting flanges 46 and 47 to be initially received in guideways 27 and 28. The whole assembly including the trough sub-assembly is preferably suitably fused or soldered together, thus providing a strong, economical unit.

Moisture disposal means, in the form of tray 16, is removably supported beneath condenser 3 in the outside air duct 52 therefor and is constructed in the same manner as tray 15 except that it is of larger size as previously mentioned. Therefore, corresponding parts of trays 15 and 16 are given the same reference numbers except the numbers for tray 16 are primed. A suitable

opening 53 is formed in the end wall of the duct to receive tray 16.

One advantage of the superimposed relation of the condensate trays and filters is that any moisture which might drip through the air openings of the trays will fall upon the filter material. Due to the character of usual filter materials, any water which drips thereon will be spread over a relatively large filter surface thus allowing the flowing air to more effectively evaporate the film of water spread over the filter material. While most of the water will be taken care of in the manner hereinbefore described, yet a certain limited amount of water may fall on the filter such, for example, as immediately after the unit is shut down.

Another feature shown herein, but not forming part of my invention, is the provision of a ventilator outlet 60 which diverts a portion of the outside air from the condenser passage 52, this diverted air entering a suitable chamber 61 which communicates in turn with the inlet 62 of blower 4 thereby to add fresh air to the room air. It will suffice to state that passage 60 has a breakable joint 63 with the frame of chamber 61, thus permitting unobstructed removal of tray 16. Also the trays are provided with suitable handles 64 to permit their removal or insertion.

To obtain as compact a unit as possible together with an arrangement of elements which will permit efficient operation, there is provided a pair of refrigerant pressure reducing means broadly corresponding to expansion valves and one of which is generally shown at 65, Fig. 6, as being secured to one of the headers 66 of the condenser. The other reducing means is similarly secured to a header of evaporator 2. A detailed description of these pressure reducing means and the means for interchanging the condenser and evaporator functions to permit the unit to serve either as a room cooler or heater need not be described here as that forms the subject matter of my copending application, Serial No. 653,466, filed January 25, 1933. However, in my present invention I provide an improved arrangement permitting the trays to accommodate the pressure reducing means 65 in order to effect a compact unit and maintain the various elements in close cooperating relation. To this end it will be noted in Figs. 3 and 6 that the semi-cylindrical recess 44 at the end of the trays is adapted to receive the reducing means 65 in nested relation therewith when the trays are in their operative position as shown in Fig. 6.

Filtering means.—To provide a filter arrangement that will be economical to manufacture and yet highly efficient and easily removed for cleaning or renewing of the filters, I have provided as shown in Figs. 5 and 6 a semi-cylindrical or arcuate filter generally indicated at 70 for the room air and 71 for the outside air. Inasmuch as the two filters have the same construction, position and mode of operation, it will suffice to describe only the filter 70, it being understood that the filter 71 is the same except somewhat larger for purposes of greater air flow. Specifically the filter comprises a frame having a pair of longitudinally extending bars 72 connected by transverse arcuate bands 73. A wire screen 74, preferably of relatively large mesh, is secured to the inside of the frame members while a filter 75 of any suitable material, preferably flexible, is disposed on the inside of screen 74 and held in position by an inner screen 76 formed on a framework having a pair of flat side bars 77 secured

to out-turned ends of transverse arcuate members 78. To impart resilient holding pressure to the inner screen 76, there is provided at each end thereof a flat spring 79 having preferably out-turned ends secured to the frame members 77 and 78, thus tending to spread the side bars 77 although if desired the arcuate members 78 may be of resilient material and thus used without springs 79.

As shown in Fig. 5 the filter is disposed between the sides 36 and 37 of the tray 15 and extends longitudinally thereof beneath the troughs 33. The filter assembly is supported by having side bars 77 rest upon the lower inturned flanges 80 and 81 of plates 36 and 37 and is held against these sides by the radial pressure imparted by the springs 79. To facilitate manipulation of spring 79 a pair of finger handles 82 are provided on each spring.

From the foregoing it is seen that the filter is solely supported by the tray 15 to form a unit therewith and hence upon removing the tray the filter is carried therewith. With the tray and filter completely removed from the room cooler unit, a person may easily remove the filter by pulling handles 82 toward each other to move side bars 77 inwardly to clear flanges 80 and 81, whereupon the screen 76 and its frame will drop downwardly from the tray, thus permitting the filter to be removed from screen 74 while the latter remains in position or if desired the screen 74 and filter may be removed simultaneously. With the filter and screens removed, it is seen that the filter may be renewed or cleaned as may be desired and the frame likewise cleaned at the same time.

Operation.—Assuming the unit to be functioning as a room cooler, motor-compressor unit 1 will compress the refrigerant which is then condensed in condenser 3 and evaporated in evaporator 2. The condenser is cooled by outside air flowing along the path indicated by dotted line 10 as through window duct 9, thence downwardly over the motor-compressor unit 1, through blower 5 and up through a suitable casing 52 (Fig. 5) and over condenser 3 and thence to the outside air through a suitable duct in casing 9. The room air flows through a suitable opening 11 in a door 12 of the unit and thence along the path of dotted line 13 through the inlet of blower 4 and upwardly through a passage defined by walls 21 and 22 (Fig. 5) and over the evaporator 2 to be discharged to the room air through a suitable outlet 56 in the top of the cabinet. Humidity in the room air, as shown in Fig. 5, is condensed on the evaporator which is preferably of the flooded type but may be of any other suitable type, this moisture dripping down to be collected in a series of spaced horizontal troughs 33 having a header 35, Fig. 4, from which the liquid flows through a preferably removable pipe 15' to a similar header of troughs 33' of the moisture disposal means. As the upward flow of outside air passes through the troughs 33' along path 10, the liquid therein is entrained in the air flow on the downstream side of the troughs, the downstream side being on the side of the trough away from which the air flows while the upstream side is on the side of the trough toward which the air flows. The entrained liquid, upon impinging against the hot surfaces of condenser 3, is evaporated and carried to the outside air. In this manner the humidity or moisture in the room air is removed therefrom and discharged to the outside air. Room air flowing upwardly along the path 13

and between the spaced troughs 33 will not entrain liquid therefrom so as to rehumidify the room air because any liquid that is entrained will simply impinge upon the cool surfaces of the evaporator tubes or fins thereof and drip down with other condensed moisture. The evaporator by thus being on the discharge side of the collector pan or tray will effectively serve to intercept moisture and prevent its return to the room. In this way the room air cannot be rehumidified, thus insuring complete comfort to the occupants of the room as elimination or reduction of humidity is of the utmost importance. However, when the unit operates as a room heater wherein the functions of the evaporator and condenser 2 and 3 are interchanged, then moisture in the outside air will condense on what will now be the evaporator 3 and will accumulate in trays 33' to flow through pipe 15' to troughs 33 and then the upward flow of room air upon entraining liquid from troughs 33 will cause this moisture to impinge against the hot surfaces of what is now condenser 2, thereby to evaporate such moisture and humidify the room air which is desirable when heating a room.

If it is desired to remove the trays for purposes of cleaning the same as is highly desirable whenever liquid is allowed to accumulate, it is only necessary to open door 12 and pull the trays 15 and 16 by their handles 64. The trays slide out from guideways 27 and 28 on their flanges 46 and 47 and can be completely removed from the unit so as to be thoroughly cleaned. At the same time as previously described the filters 70 and 71 may be removed merely by pressing handles 82 toward each other to release the tension of spring 79 on the holding screen 76, Figs. 4b, 4c and 5.

From the foregoing it is seen that I have provided an extremely simple and yet very satisfactory and economical means of not only collecting condensed moisture and disposing of the same but also of insuring sanitary operation of the apparatus at all times and in addition of permitting effective interchange of the functions of the collecting and disposal means so that the unit may be used either as a room cooler or heater. Furthermore, the filtering means is such that it is not only on the discharge side of the blowers thus insuring minimum effective resistance to the air flow but also the filters by being arranged in arcuate form are adapted to present a large area in a relatively narrow space and to be arched into a natural position for maximum strength

and rigidity, although if desired under certain conditions the filters may have various other shapes such as being flat and merely resting upon the flanges 80 and 81 and then tilted to permit removal thereof through the bottom of the tray. It will also be noted that filter 71 is in the path of outside air flow whether the unit is used as a cooler or heater, this being for the purpose of obtaining high efficiency of heat transfer from the surfaces of heat exchange element 3 as by maintaining said surface free from dust or other foreign matter which materially reduces heat transfer.

It will of course be understood that various changes may be made in the details of the various elements and arrangements thereof without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. An air conditioning unit comprising, in combination, a heat exchange element, a liquid tray removably supported beneath the same, and filtering means supported by said tray so as to be removable therewith.

2. An air conditioning unit comprising, in combination, a heat exchange element, and a combined liquid and filter tray removably disposed beneath said heat exchange element, the liquid portion of said tray being interposed between the filter portion and said heat exchange element.

3. An air conditioning unit comprising, in combination, a heat exchange element, means for circulating air thereover, a frame, air filtering material supported therein, yieldable curved means for holding said filter material in position within said frame, and means yieldingly engaged by said yieldable means to hold the latter in position.

4. An air conditioning unit comprising, in combination, a heat exchange element, a removable condensate tray therefor disposed longitudinally beneath said element, an arcuate filter carried by the sides of said tray and arched upwardly toward the center thereof beneath the condensate portion thereof.

5. An air conditioning unit comprising, in combination, an air flow passage, arcuate filtering means therein including opposed perforated arcuate members and filter material disposed between said members, and arcuate springs for pressing said perforated members toward each other thereby to hold said filter material.

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