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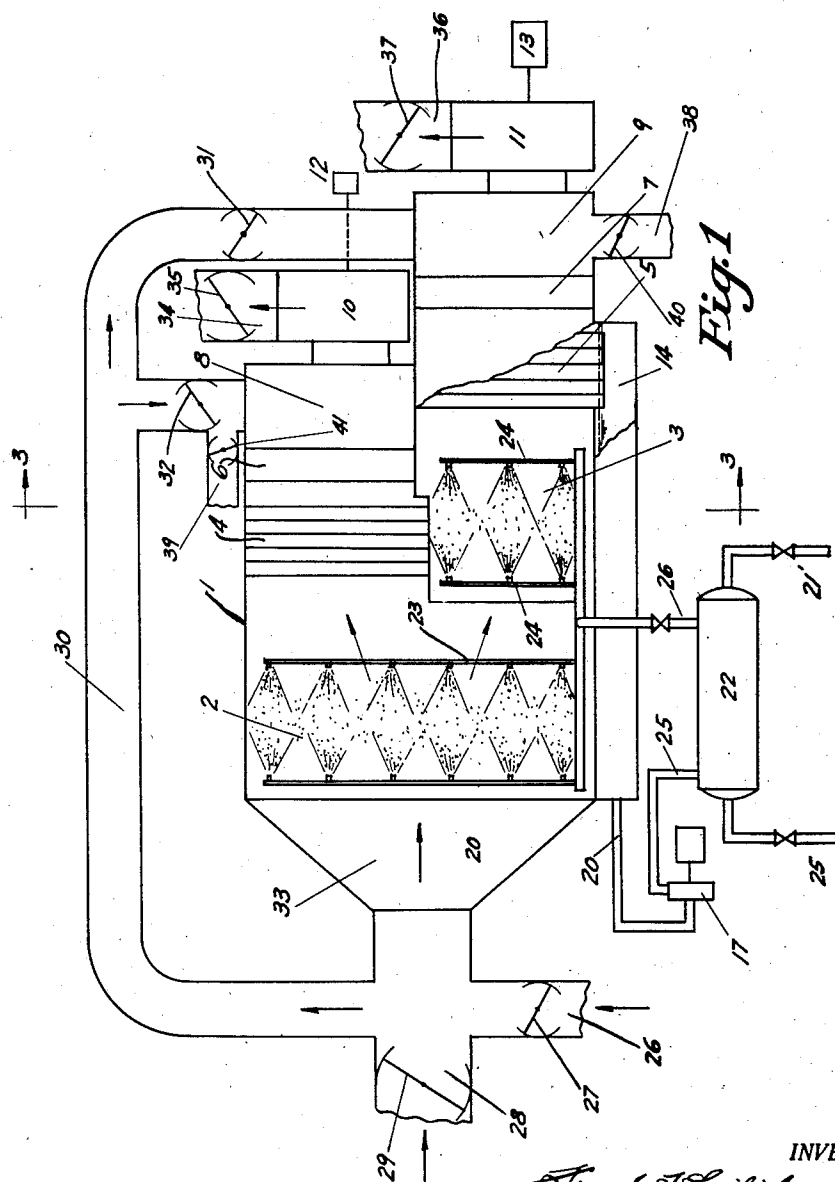
F. T. LEILICH

1,929,176

SYSTEM OF AIR CONDITIONING

Filed Dec. 24, 1930

3 Sheets-Sheet 1



INVENTOR.

Frank J. Leilich

BY

William W. Varney
ATTORNEY.

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F. T. LEILICH

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3 Sheets-Sheet 2

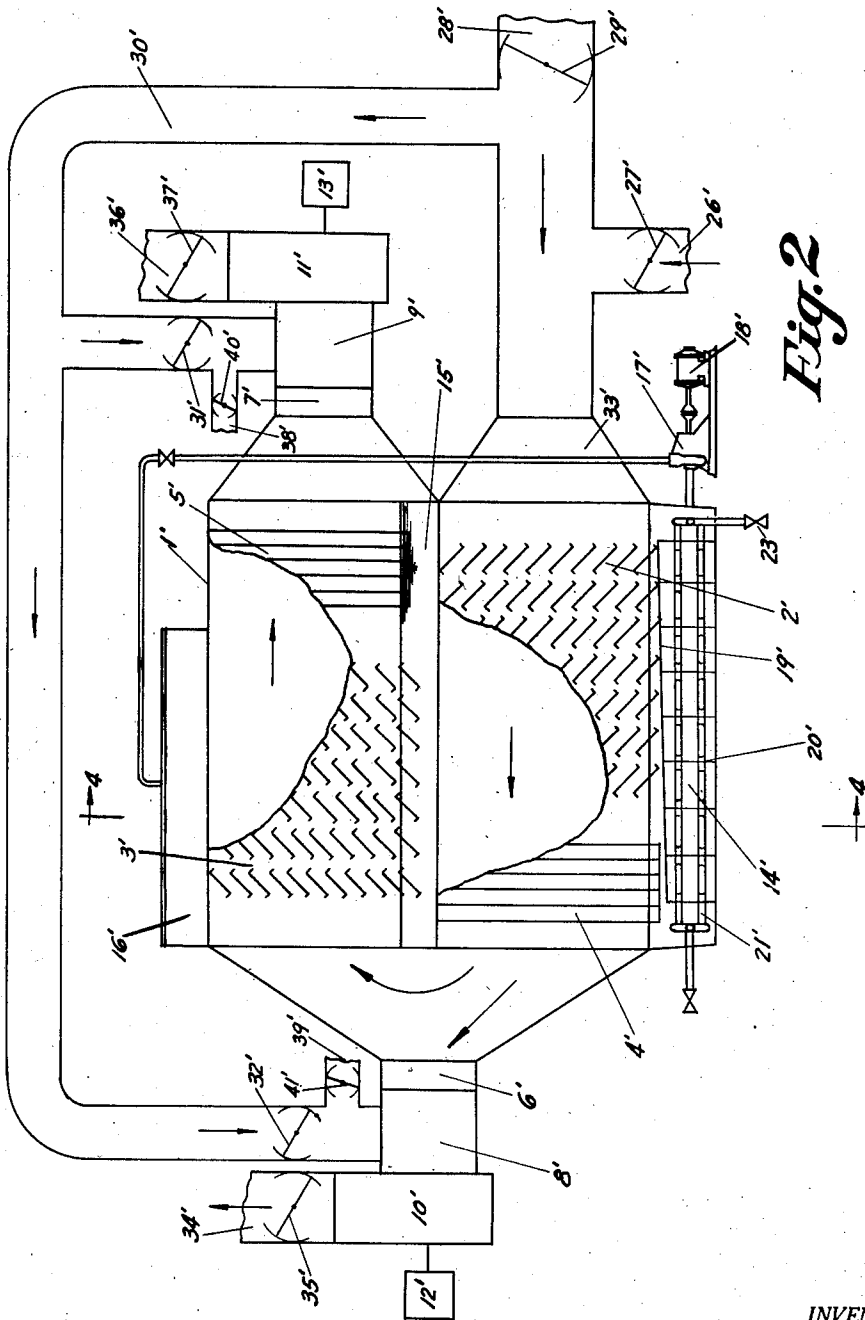


Fig. 2

INVENTOR.

Frank T. Leilich

BY

William W. Varney

ATTORNEY.

Oct. 3, 1933.

F. T. LEILICH

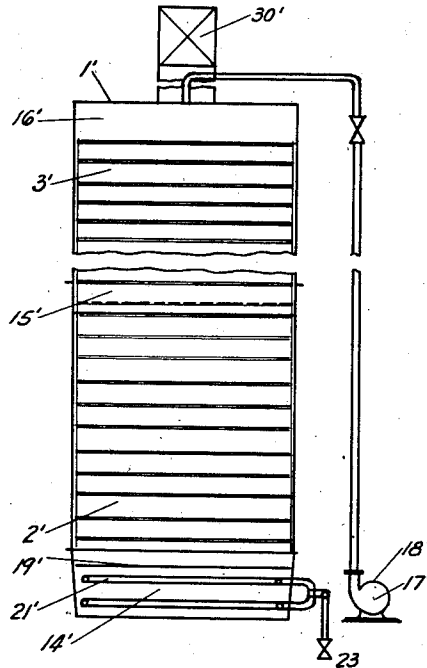
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SYSTEM OF AIR CONDITIONING

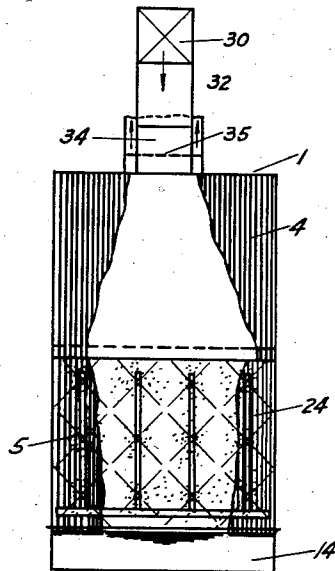
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3 Sheets-Sheet 3

SECTION 4-4
FIG. 2



SECTION 3-3
FIG. 1



INVENTOR.

Frank T. Leilich

BY

William W. Varney
ATTORNEY.

UNITED STATES PATENT OFFICE

1,929,176

SYSTEM OF AIR CONDITIONING

Frank T. Lellich, Baltimore, Md., assignor, by
mesne assignments, to William W. Varney,
Baltimore, Md.

Application December 24, 1930
Serial No. 504,514

6 Claims. (Cl. 261-11)

In many installations, particularly industrial, the requirements in different parts of the plant differ and it usually means conditioners for each part, or if a central machine is used, in the case of dehumidifying, the air passing through the conditioner is dehydrated to the extent necessary to provide the required quantity of air with the minimum moisture content specified and then heated and in some cases humidified to give the required conditions for the other parts. Such operation is uneconomical and if separate machines are used for the different processes, the total investment costs are high, space requirements large, and undue multiplication of mechanical equipment results, all of which is objectionable.

It is desirable in practically every case to reduce the number of mechanical parts and centralize the machinery to expedite its supervision and control. This invention is a process or arrangement in which part of the air is withdrawn after being conditioned to the desired extent and the remainder continues through the machine and is drawn off at conditions different from that of the air drawn off nearer the inlet of the conditioner. We can effect economy of conditioning by withdrawing the desired quantities of air after these quantities have been conditioned to the desired degree only and passing the remaining air through the following stages or sections of the conditioner until the air has been conditioned to the desired degree. While I have shown only two stages in the drawings, where desired three or more stages may be used and the air drawn off at a number of locations before reaching the final stage.

The object of my invention is to provide a system to accomplish the above mentioned requirements, whereby a single plan costing less, occupying less space, and simple in mechanical equipment and construction, is provided to perform the multifarious functions previously described.

A further object of my invention is a system for air conditioning whereby either fresh air or re-circulated air or mixtures thereof may be admitted to the conditioner and treated therein, diverting air after such treatment to further continue the treatment of portions thereof, and delivering such divided portions after leaving the conditioner for different uses, and providing a desired amount of re-circulated air or fresh air or a mixture thereof to each of said divided portions as may be desired in the final product of air in each diversion, respectively.

With the foregoing and other objects in view,

my invention consists of the methods employed, combination and arrangement of systems, apparatus and means as herein specifically set forth, provided and illustrated in the accompanying drawings wherein is shown a preferred embodiment of my invention, but it is understood that changes, variations and modifications may be resorted to which come within the scope of the claims hereunto appended.

In the drawings of the herein described embodiment of my invention, Figure 1 is a partial elevation diagrammatic flow plan of an apparatus capable of performing and carrying out my system of air treatment and distribution, and might be considered as illustrating a bleeder type conditioner in which part or parts of the air or gas being conditioned is bled off after conditioning to a lesser degree than the remainder of the air. The machine illustrated is of the spray type, although the general design is also applicable to shed machines. Also the design is such that the spraying liquid passes through the cooler or heat exchanger 22 in its path to the sumps or sprays. Also, heat exchanger 22 may be replaced by coils in the bottom sump tank or coils in the path of the air, these coils to be wetted by the cooling fluid or chilling the air by direct contact. But sprays may be used, in which case a second spray pump with its suction connected to the sump tank of the second stage 3' and feeding the sprays of the first stage 2' would be required. Fig. 2 shows a modification of the system as adapted to what might be considered a two-stage counter flow bleeder conditioner of the shed type.

In Fig. 2 the counter flow principle is utilized in that the colder air meets the colder liquid. With the shed type, the machine is of the two-stage type and functions with only one pump, although it may be built for any number of stages.

Fig. 3 is a vertical sectional view taken through 3-3, of Fig. 1, and Fig. 4 is a vertical sectional view taken through 4-4, of Fig. 2.

Similar numerals refer to similar parts throughout the several views, the prime numerals indicating parts in Figs. 2 and 4.

1 and 1' is the outside casing. 2 and 2' is the primary treating section or stage and may comprise sheds, spray, or other humidifying or dehumidifying appliances, such as coils or modifications thereof. In this specification, when I use the term, "aqueous treating", I mean treating the air to produce a desired humidity thereof, whether by adding water to it by sprays of

water or brine, or reducing its temperature by cold water or brine to below its dew point, or cooling it with external means below its dew point.

3 and 3¹ is the second section or stage. 4 and 4¹ are primary stage baffles or eliminators. 5 and 5¹ are secondary stage eliminators. 6 and 6¹ are primary stage heaters. 7 and 7¹ are secondary heaters. 8 and 8¹ is the first stage mixing chamber. 9 and 9¹ is the second stage mixing chamber. 10 and 10¹ is the first stage bleeder exhaust fan and 11 and 11¹ is the second stage exhaust fan, said fans being driven by motors 12, 12¹, 13 and 13¹, respectively.

In the apparatus shown in Fig. 1, sprays are used in both stages. In the apparatus shown in Fig. 2, sheds are used.

Referring to Fig. 2, 14¹ is the first stage sump tank, and 15¹ is the intermediate sump tank, forming the supply tank for treating stage 2¹. 16¹ is the supply tank for secondary treating appliance 3¹. 17¹ is a circulating pump circulating the fluid from sump tank 14¹ to supply tank 16¹; this pump is driven by any ordinary means such as a motor 18¹.

In sump tank 14¹ is a shed or drain plate 19¹ which catches the fluid from treating appliance 2¹ and carries it to the end of sump tank 14¹ away from the suction of pump 17¹. In sump tank 14¹ are baffles 20¹ arranged to produce a counter flow of liquid and refrigerant. A high rate of heat transfer in the refrigerating coils 21¹ is effected, because drain plate 19¹ drains the shed fluid into one end of the sump tank, and from this end it flows along the coils, its path being definitely determined by said baffles 20¹, to the circulating pump suction. The refrigerant flows through the cooling coils in the opposite direction to the liquid flowing from the drain plate end of the sump to the pump suction.

The sump tank 14¹ is built slightly tapering from the bottom to the top to prevent damage by expansion in case the cooling liquid solidifies.

While I have shown cooling coils in the sump tank, in Fig. 2, and an external cooling means for the fluid in Fig. 1, the reverse may be used with substantially equal efficiency; but I have shown the two systems as being applicable.

Referring to Fig. 1, 22 is a cooler for the fluid to be sprayed, the fluid being circulated from sump tank 14 through pump 17, cooler 22 and spray nozzles 23 and 24 in the primary and secondary treating appliances, respectively. 25 are the refrigerant connections to cooling means 22.

Referring to the air or gas piping and flow, we will follow Fig. 1 first. 26 is the fresh air supply, controlled by damper 27. 28 is the returned air inlet, controlled by damper 29. 30 is the by-pass duct, controlled by dampers 31 and 32. 33 is the inlet to the conditioner. 34 is the outlet from the primary stage, controlled by damper 35, and 36 is the outlet from the secondary stage, controlled by damper 37.

In Fig. 2, 26¹ is the fresh air supply, controlled by damper 27¹. 28¹ is the return air inlet, controlled by damper 29¹. 30¹ is the by-pass duct, controlled by dampers 31¹ and 32¹. 33¹ is the inlet to the conditioner; 34¹ is the outlet from the primary stage, controlled by damper 35¹; and 36¹ is the outlet from the secondary stage, controlled by damper 37¹.

In this apparatus, as shown in the drawings, the various controls may be hand operated. The heaters may be controlled by hand, and the vari-

ous air mixture and withdrawals may be also hand controlled as well as the refrigeration and fluid for the sheds or sprays.

The speeds of the pumps and fans may be hand controlled.

Automatic controls and combination of controls are the subject matter of another application.

38, 38¹, 39 and 39¹, are fresh air inlets controlled by dampers 40, 40¹, and 41 and 41¹, respectively.

As an illustrative example, referring particularly in this example to Fig. 2, the return air enters return air inlet 28¹ controlled by damper 29¹ and is divided, some going through by-pass duct 30¹ and the remainder continuing to the conditioner 2¹, fresh air being admitted at 26¹ controlled by damper 27¹. After passing the conditioner 2¹ and eliminator 4¹ the conditioned air is divided, part of it going through conditioner 3¹ to secondary mixing chamber 9¹ where returned air is mixed with it as desired from by-pass duct 30¹ controlled by damper 31¹ and may have mixed with it fresh air if desired entering at 38¹ controlled by damper 40¹; this conditioned and mixed air is delivered at outlet 36¹ and controlled by damper 37¹. Returning to the other portion of the divided air coming from conditioner 2¹, the same enters primary mixing chamber 8¹ where returned air is mixed with it from by-pass duct 30¹ controlled by 32¹, and fresh air may be mixed through duct 39¹ controlled by damper 41¹. This conditioned air is delivered at delivery 34¹ controlled by damper 35¹.

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

1. The process of air treating consisting of, treating a body of moving air to change its condition as to temperature and humidity as a first stage treatment, then dividing said air for individual treatment of said divided parts and then treating one of said parts to change its condition as to temperature and humidity with reference to the other part of said divided air, then mixing with one of said divided portions initial air to be delivered with said divided portion separate from the other divided portion.

2. The process of treating a mixture of fresh and recirculated air to change its condition as to temperature and humidity in a plurality of stages whereby portions of said air may be withdrawn between said stages and treating a divided portion separately with reference to temperature and humidity and mixing thereafter with one of said divided portions re-circulated air.

3. The process of treating a mixture of fresh and re-circulated air to change its condition as to temperature and humidity in a plurality of stages whereby portions of said air may be withdrawn between two of said stages and treating a divided portion separately with reference to temperature and humidity and mixing thereafter with one of said divided portions re-circulated air and a mixture of fresh and re-circulated air to another of said portions.

4. The process of conditioning gas or air consisting of, aqueously treating a body of gas in a plurality of stages, abstracting portions of said body of gas before reaching the final stage, then mixing said withdrawn portions with gas to change its characteristics as to temperature and humidity.

5. The process of air treating consisting of, treating a body of moving air to change its condition as to temperature and humidity as a first stage treatment, then dividing said air for in-

dividual treatment of said divided parts and then treating one of said parts to change its condition as to temperature and humidity with reference to the other part of said divided air, then mixing 5 with one of said divided portions fresh air to modify its condition.

of, aqueously treating a body of air, then dividing said body of air for further aqueous treatment of a portion thereof in order that a reduced quantity of air may undergo such treatment, then mixing with one of said divided portions fresh 80 air to modify its condition.

FRANK T. LEILICH.

10	85
15	90
20	95
25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150