F. E. DONALDSON.

AIR CONDITIONING APPARATUS.

APPLICATION FILED OCT. 13, 1910.

1,008,123.

Patented Nov. 7, 1911.

6 SHEETS—SHEET 1.

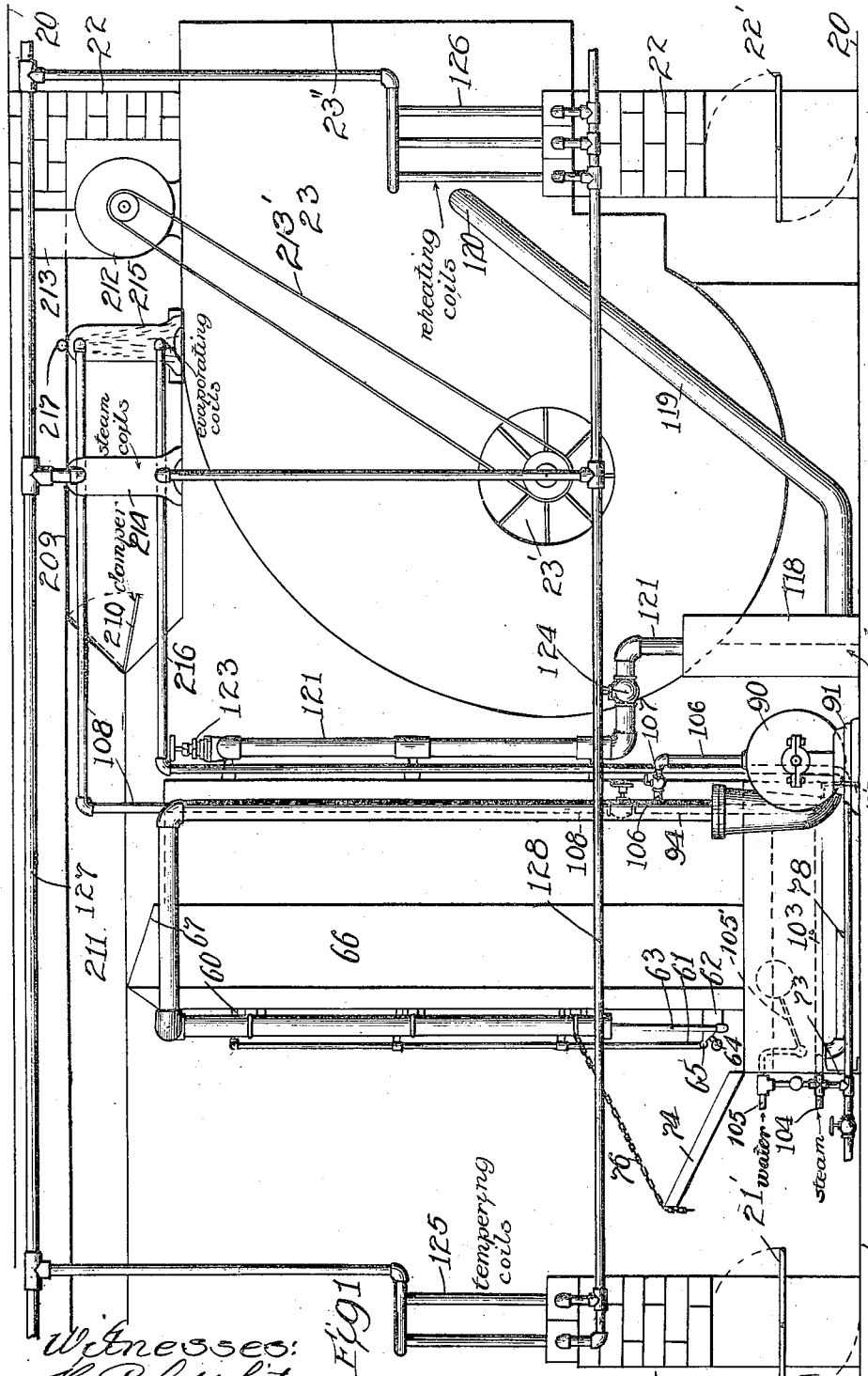

FIG 1

Witnesses:
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R. P. White

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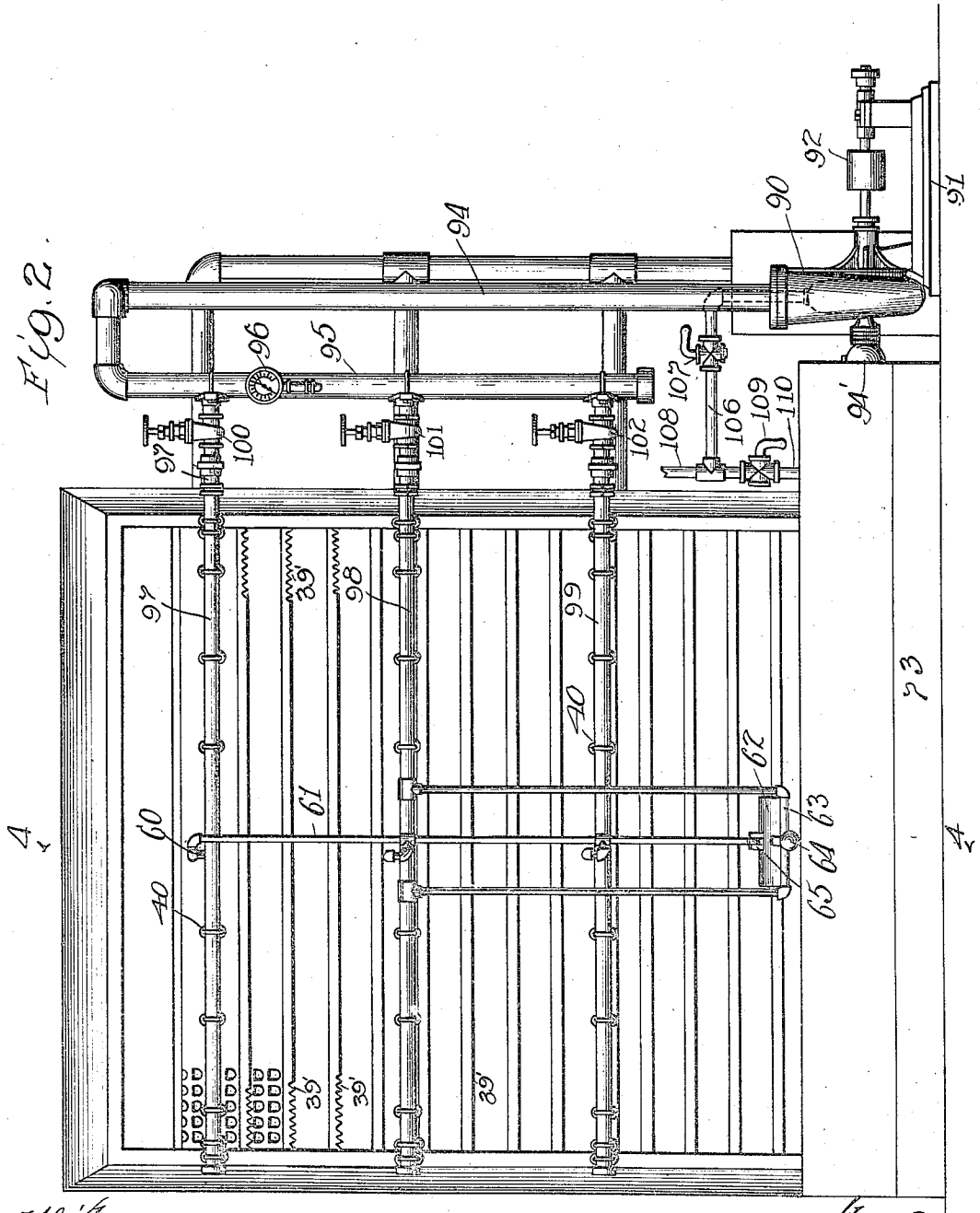
6 SHEETS—SHEET 2.

Fig. 2.



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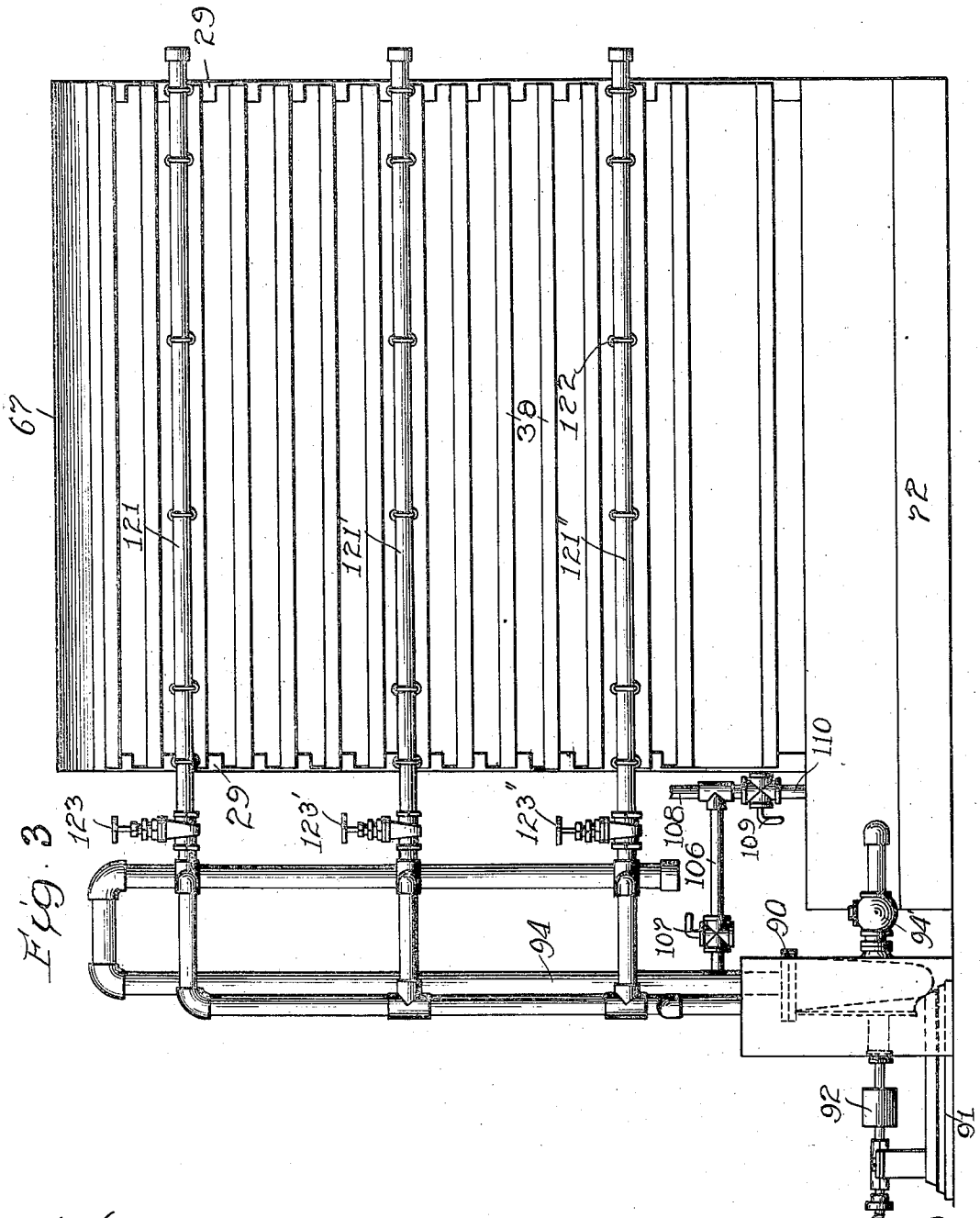

Fig. 3

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6 SHEETS—SHEET 4.

Fig. 4

Fig. 13

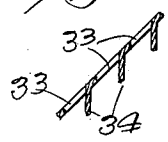
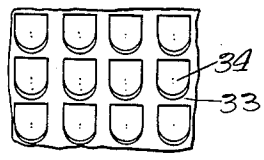


Fig. 12



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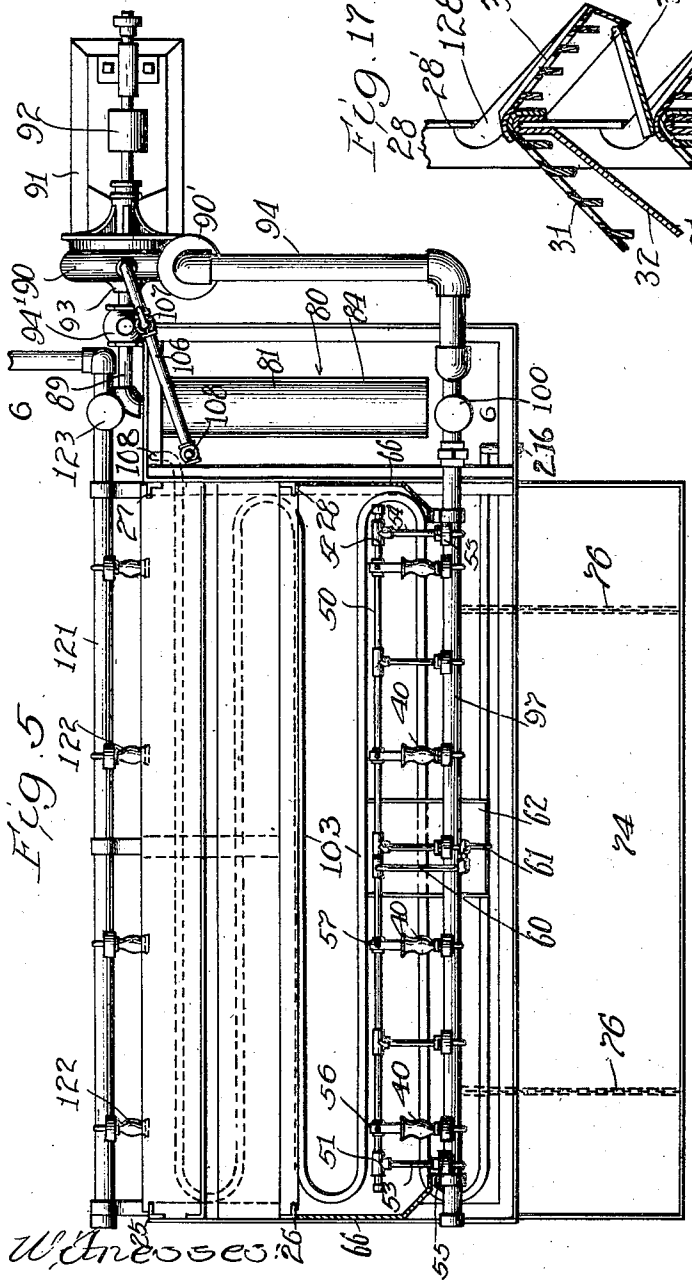


Fig. 5

Fig. 17

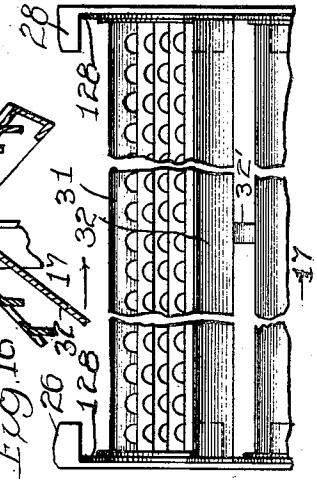


Fig. 16

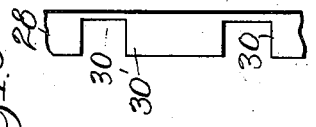
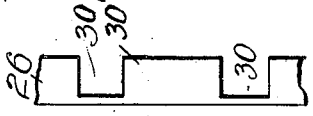


Fig. 15



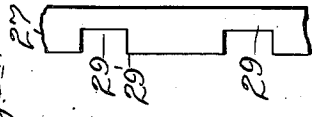
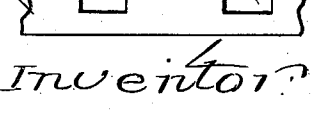


Fig. 14



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1,008,123.

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6 SHEETS—SHEET 6.

Fig. 6

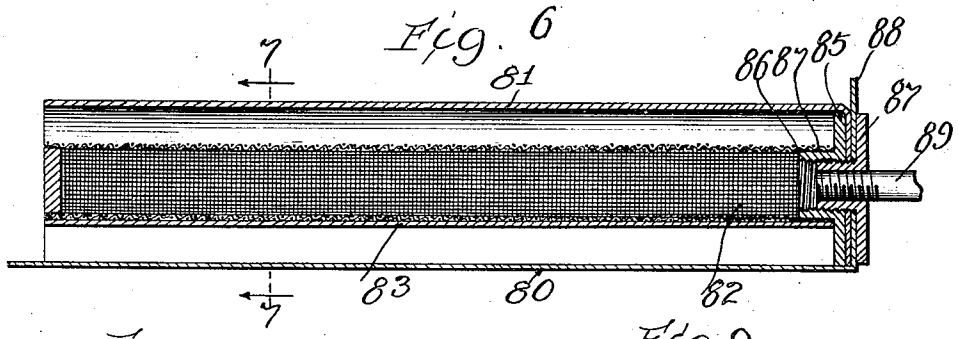


Fig. 7

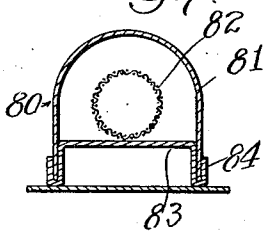


Fig. 9

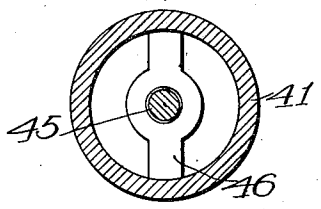


Fig. 8

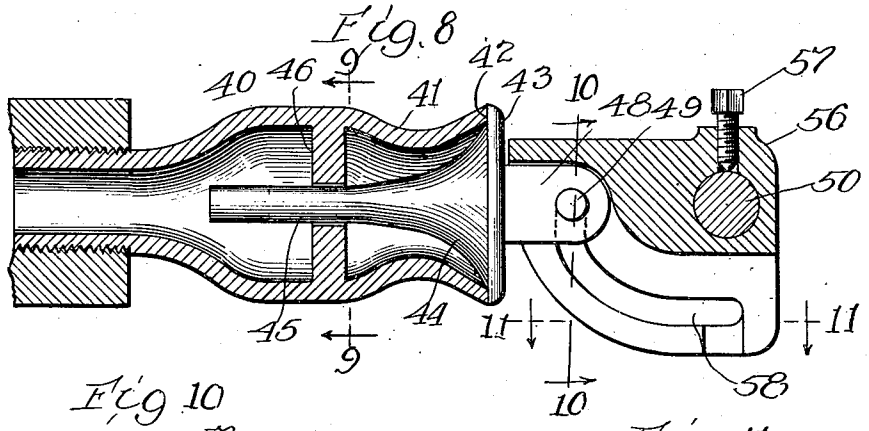


Fig. 10

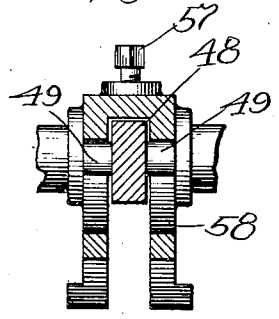
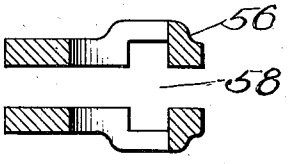


Fig. 11



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UNITED STATES PATENT OFFICE.

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AIR-CONDITIONING APPARATUS.

1,008,123. Specification of Letters Patent. Patented Nov. 7, 1911.

Application filed October 13, 1910. Serial No. 586,851.

To all whom it may concern:

Be it known that I, FRANK E. DONALDSON, a citizen of the United States, residing at Palos Park, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Air-Conditioning Apparatus, of which the following is a specification.

My invention relates to improvements in air conditioning apparatus for cleansing, cooling, or heating, and extracting the moisture from air; charging it with ozone, and generally improving the quality of air introduced into buildings for breathing purposes.

It has especial reference to specific constructions of the type of devices and machines disclosed in my Letters Patent No. 910,045, dated January 19, 1909.

Some of the specific objects of my invention are to provide a structure that may be readily "knocked-down" and reassembled, particularly wherein the baffle plates may be readily and quickly removed for transit, cleansing, replacing, and repairing, and which plates may be galvanized to cover all the exposed parts after they have been completely constructed; wherein a greater number of plates may be added to the structure at any time if higher velocity is desired than primarily contemplated by a structure of smaller capacity; to cause the nozzles to become automatically self-cleaning; and the use of an adjustable apron to catch the spray.

Another object of the invention is to compel the air to pass through the lip projections in the respective plates, thereby dividing the air into a large number of independent currents of small paths, and subsequently uniting the air currents at such a velocity that a dehumidifying effect is produced while the air is passing through the eliminator.

Other and further objects of my invention will become readily apparent to persons skilled in the art from a consideration of the following description taken in conjunction with the drawings, wherein—

Figure 1 is a vertical side elevation of the completely installed system, in accordance with my invention; Fig. 2 is a front view of the same; Fig. 3 is a rear view; Fig. 4 is a vertical section taken on line 4—4 of Fig. 2; Fig. 5 is a plan view, partly in section, taken on line 5—5 of Fig. 4; Fig. 6 is a longitudinal section of the strainer taken on line 6—6 of Fig. 5; Fig. 7 is a cross sectional view of the same taken on line 7—7 of Fig. 6; Fig. 8 is a longitudinal central section of the sprayer head or nozzle; Fig. 9 is a cross sectional view of the same taken on line 9—9 of Fig. 8; Fig. 10 is a sectional view on the line 10—10 of Fig. 8; Fig. 11 is a section taken on line 11—11 of Fig. 8; Fig. 12 is an enlarged fragmentary view of one of the perforate inclined baffle plates shown in Fig. 4; Fig. 13 is a cross sectional view of the same; Fig. 14 is a fragment of the front supporting frame; Fig. 15 is a similar view of the rear supporting frame; Fig. 16 is a modification of the baffle plate structure; and Fig. 17 is a cross sectional view of the same taken on line 17—17 of Fig. 16.

In all of the views the same reference characters refer to similar parts.

The arrangement and association of the parts composing my invention is shown in Fig. 1. The other views show more specifically some of the details of construction of the various devices.

20 indicates the side wall of a casing, or room, in which substantially the entire apparatus is contained. An end wall, 21, partially closes the inlet end of the casing, and the wall 22 partially closes the outlet of the casing. Dampers, 21′ and 22′, are provided in the respective walls of the casing as convenient means for adjusting the opening areas of the respective ends of the casing. The casing, 23, of an air-moving fan, 23′, is arranged so that its air-discharging opening 23″, projects through and beyond the wall, 22, through which the treated and conditioned air of the apparatus is projected into the area for which said treated air is intended.

In my system, the air is tempered in cold weather and cooled in warm weather, as it is taken in, then washed and purified by elimination of the particles of matter carried in suspension in the air, and its temperature raised or lowered as the case may be by contact with the washing water which may be of a higher or lower temperature as desired. When the washing water is relatively warm, the humidity of the air is thereby increased. The air is then charged with ozone to further purify it after which it is

further heated to the desired temperature, and finally discharged into the room where it is to be used.

24 is an eliminator, composed in part of a vertical frame and removable baffle plates. The frame is conveniently made of the four angle bars, 25, 26, 27, and 28, as shown in Figs. 14 and 15. Notches, 29 and 30, respectively, are made in one wing of each of the angle bars, at intervals to provide shoulders, 29′ and 30′, respectively, upon which the baffle plates rest. It will be observed that the notches in the rear angle bars, 26 and 28, are deeper than those in the angle bars, 25 and 27, in the front of the eliminator, to permit the parts to be more readily removed from the rear. In the exemplification illustrated the air baffles consist each of two members one of which is perforated, the other imperforate, indicated respectively by 31 and 32. The plates 31, it will be observed by reference to Figs. 12 and 13, are perforated, as at 33. A lip, 34, is offset from each perforation at such an angle as to be in a substantially vertical position in the machine, and acts as a barrier or baffle to prevent the direct projection of the air through the associated perforations, so presenting a means whereby the air is diverted from a straight horizontal course through the perforations around the depending lips, thereby to provide a more or less tortuous passage for the air through the structure, whereby it is brought more intimately into contact with the water that covers surfaces of said plates.

The imperforate plate, 32, is bent as at 35 to form a trough, and at each end it is turned over, as at 36, to form a hook at its upper end, and it is also bent, as at 37, at its lower end; these deflected portions, at the respective extremities engage the angle bars, 27 and 28, respectively, resting upon the supporting shoulders, 29′ and 30′, provided by the notches made in the respective wings of the angle bars. The overlying perforated plates 31 are bent similarly at their upper edges, so as to overlie the bent ends of the underlying plates, 32, as shown at 38, and they are also deflected as at 39, at the lower ends and provided with drip teeth 39′, by which the water is divided into numerous drops or streams, thus exposing more water surface to the passing air. From this construction, it will be observed that the plates may be readily and quickly removed by lifting them from their supports and sliding them out between the slots made in the respective rear angle bars, or beginning at the top of the structure, they may be taken out through the openings provided in the upper part of the frame.

Immediately in front of the tiers of baffle plates, composing in part the eliminator, are a series of spraying nozzles 40, of which there are three tiers, there being six in each tier of the exemplification illustrated. These nozzles 40 are shown in detail in Figs. 8, 9, 10, 11. The casting 41 is cylindrical and provided with a bell-shaped mouth or discharge opening, as at 42. A sliding valve 43, tapering as at 44, and provided with a stem 45 for support in the cross bar 46, closes the mouth of the nozzle to a greater or less extent as desired. For the purpose of spraying, the valve 43 is adapted to be longitudinally moved in the casting 41 in its sliding support 46. Upon the front end of the valve 43 is a lug, 48, carrying a pin 49. A transverse shaft 50 is rotatable in its bearings 51 and 52 secured in position by studs, 53 and 54, respectively, attached to lugs, 55, of the frame. For each sprinkler head 40 a casting 56 is provided which is secured to the shaft 50 by a set screw 57. Each casting is provided with a slot 58, one on each side of the part 48, through which slot the lugs 49 pass. When the shaft, 50, is rocked the castings, 56, through the coöperation of the slots 58 and the respective lugs 49 draw the heads 43 outwardly from the parts 42 of the spraying nozzles 40, thus opening the spraying nozzles to a greater or less extent. Should any material, or undesirable matter, accumulate in the ports provided between the valves 43 and the bell-shaped mouths 42 of the nozzles 40, the opening of the valves by rocking of the shaft serves to clean the nozzles of such accumulation. The shafts 50 are each provided with arms 60, which pivotally engage a vertical rod, 61, so that when the vertical rod 61 is raised, the shaft 50 is thereby oscillated for the purposes described.

Situated at the lower end of the structure is a pan, 62, which is pivotally supported, as at 63, at one side of its center. A weight 64 substantially counterbalances the pan and normally holds it in horizontal position shown in Fig. 4. The rod 61 is pivotally connected to the pan as at 65, so that when the front edge of the pan 62 is depressed, the rod 61 is raised and the three shafts 50 controlling the respective tiers of the spraying nozzles 40 are oscillated. After the device has been in operation for some time, the pan 62 is filled with water resulting from the spray, the front part of which, becoming heavier than the weight, overcomes the weight of the rod, 61, and the counterbalancing weight, 64, thereby depressing the pan and the water contained therein is emptied into the tank below, when the weight 64 and the rods 61 will restore the pan to its normal position. In the meantime, the shafts 50 have been oscillated to slide the valves 43 in and out and the respective spraying nozzles have thus been cleansed. This action will take place automatically and periodically from time to time when the device is in operation, thus auto-

matically cleansing the spraying head of any accumulation of foreign matter that may be deposited therein, thus always providing a clean nozzle capable of exerting its full capacity at all times.

In front of the eliminator and partly surrounding the series of nozzles, are preferably sheet metal end walls 66 which project above the eliminator as shown in Fig. 4, designed to prevent the escape of the spray from the vicinity of the baffle plates.

Below the eliminator and series of spraying nozzles, is a portion of the frame which carries a settling tank, 71, mounted upon channel bars 72 and 73. This tank is open at the top and the entrained water from the inclined baffle plates drops back into the tank. An apron 74 is hinged, as at 75, to the structure, being held in inclined position by means of chains 76. The apron is also designed to prevent the escape of spray and to catch any water that may be projected beyond reasonable limits. An open end nozzle 77 is connected to waste pipe 78, for conducting the overflow from the tank 71 to the sewer. A strainer 80 lies across the bottom of the tank 71, and consists of an open ended housing 81, partially surrounding a tube, 82, made of reticulated material, such as wire cloth or the like. A base 83, of the housing 81, is turned up at its side edges, as at 84, to provide longitudinal slots for the lower edges of the housing 81. The reticulated tube 82 rests upon this bench-like base, and the housing 81 slides into the slots 84, thus provided, which serve to secure the housing in place and permit its removal for access to the tube. One end of the housing is closed by a casting 85 provided with a central hub, 86, around which the reticulated tube 82 is secured. This casting is screw-threaded interiorly, into which is threaded a similar casting 87, which serves as a means for providing a water-proof joint between the wall 88 of the tank, in which the cleaner is located, and the intake pipe 89 of the centrifugal water pump 90. The pump 90 is mounted on a base 91 and driven by a belt around the pulley 92. The intake 93 of the pump is connected to the strainer by the intake pipe 89. A valve 94′ is provided in the pipe 89, between the strainer and the pump whereby communication therebetween may conveniently be cut off. The discharge orifice, of the pump is connected to the delivery pipe 94 which immediately rises to a point near the top of the eliminator, and then turns downwardly into a branch 95 which latter contains laterally extending pipes 97, 98, 99, secured to and communicating with the pipe 95. Each of these lateral pipes is controlled by a gate valve as 100, 101, and 102 respectively. To these pipes are secured the nozzle heads 40 as clearly shown in Fig. 4. Water is taken from the settling tank 71, raised by the pump through the pipes 94 and 95, to the respective lateral pipes 97, 98, and 99, and thence sprayed through the nozzles 40. The spray from the nozzles covers the baffle plates, and all of the exposed surfaces, and through the spray all air entering the device must pass. The air thus saturated with moisture impinges against the inclined surface of the baffle plates and the vertically extending lips and all foreign matter, such as dust and the like, contained in the air is washed from it, and conveyed by the entrained water into the settling tank. The humidified air strikes the faces of the lowermost sections of the plates 31, passes through the perforations 33 from which the vertically inclined lips 34 were taken, and around the lips, and into the intervening space between the perforate (31) and imperforate (32) plates, through this space and out again through the perforations provided by the lips above, into contact with the superposed imperforate plate, and out through the rear eliminator, as shown by arrows in Fig. 4. In the passage of air through the eliminator, it comes in contact with the moisture that has accumulated on the surfaces of the baffle plates, causing a rapid evaporation of said moisture, which in turn produces a cool metal surface by which the temperature of the passing air is lowered; and, having its direction changed and divided several times and its path restricted, the velocity of the air is sufficiently increased to bring the divided currents of air together with sufficient force to unite several particles of moisture into drops of water, too large to be carried farther by the passing air,—thus producing a de-humidifying effect. The precipitated moisture drips back into the settling tank to be again pumped up through the pipes and passed through the steps just described.

The water contained in the settling tank may be heated, or cooled by coils 103, located in the bottom of the settling tank. Either steam or water, or other fluid, may be admitted to the pipes 103 through the pipes 104 and 105, respectively, and each pipe may contain a valve for controlling the fluid supply. A connection 106, including valve 107, and leading from the pump to pipe 108, may, if desired, be used to force water into pipe 108. Said pipe 108 is the flow pipe to coil or other receptacle 215, wherein considerable exterior surface thereof is exposed to the evaporating cooling action of the dry air that is caused to flow around it. Pipe 108 is connected to one end of the submerged temperature changing coil 103, contained in the settling tank, 71, from which the spraying water is taken. The pipes 108, 216, and the coils 215 form a closed conduit and are filled with a liquid to be cooled. Water will answer the purpose,

but I do not desire to be limited to the exclusive use of water. The use of the above arrangement will now be stated. At the upper portion of the system is shown (Fig. 1) a chamber 209 provided with a damper 210, which is capable of opening the front end of the chamber for admission of air. The front end of this chamber is connected to an air-admission pipe 211. In the rear end of the chamber is an exhaust fan 212, driven by a belt 213′, from the shaft which rotates the fan 23′. This fan 212 discharges into the open atmosphere through a conduit 213. In the chamber 209 is located a series of steam air heating coils 214, a similar coil or receptacle for circulation of a medium for cooling the spraying water being shown at 215. Pipe 216 is connected to the coil or receptacle 215, the lower end of which is connected to coil 103 in the settling tank. The arrangement which I have just described is intended for cooling the spraying water so as to reduce the temperature of the incoming air when the system, as a whole, is used in the summer time, the operation of which is as follows: The liquid contained in coil 103 in the settling tank is made to circulate through the system just described by the operation of gravity,—the water or other suitable liquid being circulated in receptacle 215 through pipes 108 and 216 to coils of pipe located in the settling tank 71, and the circulating medium being cooled in the following manner: Warm dry air is drawn, preferably from the heated boiler room, on the premises in which the system is located, through the pipe 211 through the opening affected by the damper 210 to the chamber 209: The incoming air impinges upon the pipes of the heating coil, 214, thereby becoming heated and thoroughly dried. A water pipe 217 is provided with porous sections, or with openings, immediately over the coil 215, through or over which the water constantly drips and by which the entire exterior surface of the coil of pipes or evaporating surfaces is constantly covered. The dry air, passing through the chamber 209, absorbs the water contained on the evaporating surface 215, the quick evaporation of the water thus producing reduction of temperature of the water flowing in such coils. The humidified air is then exhausted to the outside atmosphere. The water or other liquid when thus cooled falls into coil 103, heat is thereby absorbed and the heated liquid rises in pipe 108, thus automatically producing a rapid circulation of the cooling medium. By this means the spraying water is maintained at a much lower temperature than the incoming air designed to be conditioned by the operation of my system. A float valve 105′ (Fig. 1) may be associated with pipe 105, to maintain uniform level in the tank by supplying water as it is evaporated.

After the air has been washed, cleansed, and cooled, it is charged with ozone. To this end the box marked 118 is what I have designated an "ozonator" that is to say, an apparatus in which ozone is contained or produced. Any device which will perform this function will come within the contemplation of this invention, and for this reason I have not detailed its construction. The pipe 119 is connected to the casing of the fan 23, as at 120, so that a small quantity of air may be blown, by the operation of the fan, through the piping 119 into the ozonator 118. The air passing through the pipes and the ozonator becomes charged with ozone and is delivered to the pipes 121, 121′, 121″ through a series of distributing nozzles, 122. These nozzles project the ozone-laden air within the path of the cleansed humidified air as it emerges from the eliminator. Valves 123, 123′, 123″ and 124 are placed in the pipe 121, so as to shut off this part of the device if necessary.

It is not essential to the operation of my system that the ozonator shall be used, but its use adds a quality to the air that is very desirable.

Steam coils 125 are used, or may be, for tempering the air and raising its temperature slightly upon admission into the system. If it is desired further to increase the temperature of the air, the coils 126 are placed in the path of the air as it is about to emerge from the fan, so that all of the air projected into the apartment to be heated and ventilated may be caused to impinge upon the heated surfaces of the heating coils and thereby its temperature be raised. Steam pipe 127 is connected to the proper source of heat and the return pipe 128 is connected with the coils in the system as in the usual manner.

Figs. 16 and 17 show a means whereby the surfaces of the eliminator may be readily extended, the plate 31′ supporting one end of the pan 32′, and the latter directing the entrained water to the surfaces of the adjacent perforate plate on the other side of the support 28. A nose 128 engages the inner edge of the wing 28′ of the angle bar 28 and holds the plate 31′ at the desired angle, at its lower end to engage a shoulder on the front member of the frame.

While I have herein described in some detail a particular embodiment of my invention, it will be apparent to persons skilled in the art that numerous changes might be made in the details of construction and arrangement of parts thereof without departure from the spirit of the invention and within the scope of the appended claims.

What I claim is:

1. In a system of the character described, the combination with means for moving air, of an eliminator comprising a frame having

front and rear supporting members, each provided with supporting shoulders, a series of imperforate plates having their upper and lower ends resting on rear and front shoulders respectively, and superposed perforate plates overlying said imperforate plates and supported by same respective shoulders.

2. In a system of the character described, the combination with means for moving air, of an eliminator comprising a frame having front and rear supporting members, of a series of perforate plates and a series of imperforate plates, the latter deflected near their respective bottoms to an angle, the apex thereof to lie in substantial contact with the surface of the perforate plate immediately below to constitute a baffle wall to the air entering the space between said plates in front of the eliminator, one of said perforate plates overlying one each of said imperforate plates to form a tier of such plates and a series of air paths therebetween.

3. In a system of the character described, an eliminator comprising a frame containing front and rear members each provided with a vertical series of properly spaced shoulders, an imperforate plate turned upon itself to form a hook at its upper end and bent at an angle at its lower end to engage a shoulder on the front member of the frame, a perforate plate similarly bent immediately to overlie the respective ends of the imperforate plate, said perforate plate at its end deflected to provide a baffle wall interposed between each perforate plate and the overlying adjacent imperforate plate.

4. In a system of the character described, a series of spraying nozzles adapted for normal opening to produce a spray and for further abnormal opening to permit greater flow of fluid, a pan to catch the fluid coming from the spray, pivoted at one side so as to tilt when filled with fluid, and means connected with said nozzles and pan adapted and arranged to open said nozzles abnormally and automatically when the pan is tilted to flush and clean said nozzles.

5. In a system of the character described, an eliminator providing a tortuous path for the air, a series of spraying nozzles in front of the eliminator, a source of water supply for said nozzles, a series of nozzles in the rear of the eliminator adapted to distribute ozone to the issuing air, a source of ozone supply for said last-mentioned nozzles, and a fan having connection with both the eliminator and the ozonator to actuate air flow therethrough respectively by exhaustion and pressure.

6. In a system of the character described, the combination of an eliminator, an ozonator, and air fan, and suitable conduits connecting said fan, eliminator, and ozonator, from the intake and outlet side of said fan, whereby operation of said fan draws air through said eliminator and forces air through said ozonator to mingle before discharge of said treated air from said system through said fan.

In testimony whereof I hereunto set my hand in the presence of two witnesses.

FRANK E. DONALDSON.

In the presence of—
J. E. GARDNER,
ANDREW KROGH.