June 22, 1943. A. H. ROBSON 2,322,469

APPARATUS FOR AIR CONDITIONING

Filed Sept. 12, 1939 2 Sheets-Sheet 1

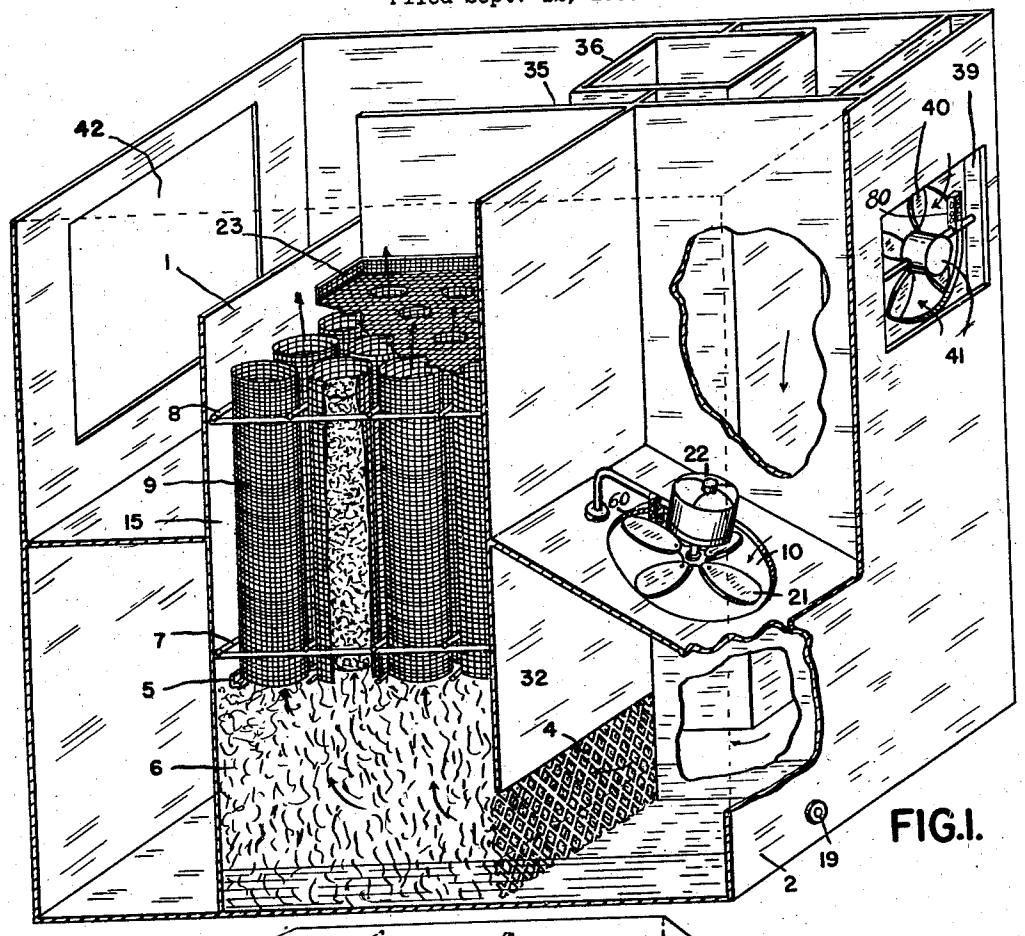


FIG.I.

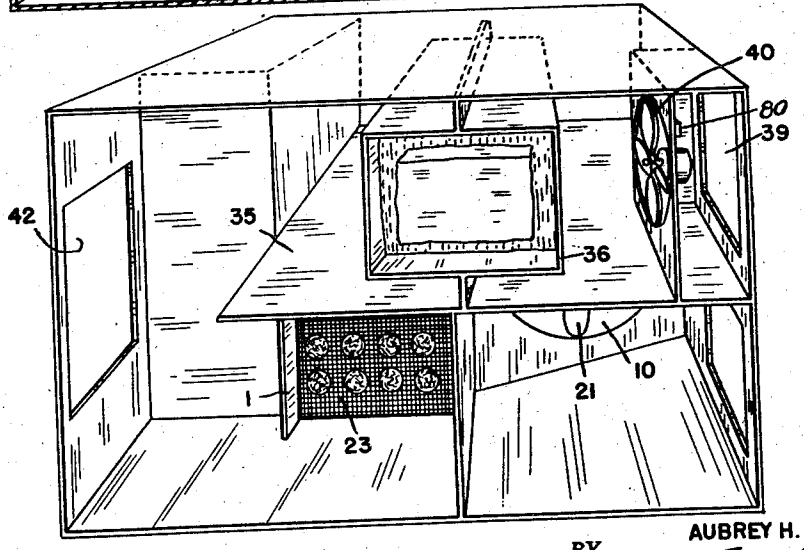


FIG.IA

INVENTOR.
AUBREY H. ROBSON
BY
ATTORNEYS

June 22, 1943. A. H. ROBSON 2,322,469

APPARATUS FOR AIR CONDITIONING

Filed Sept. 12, 1939 2 Sheets-Sheet 2

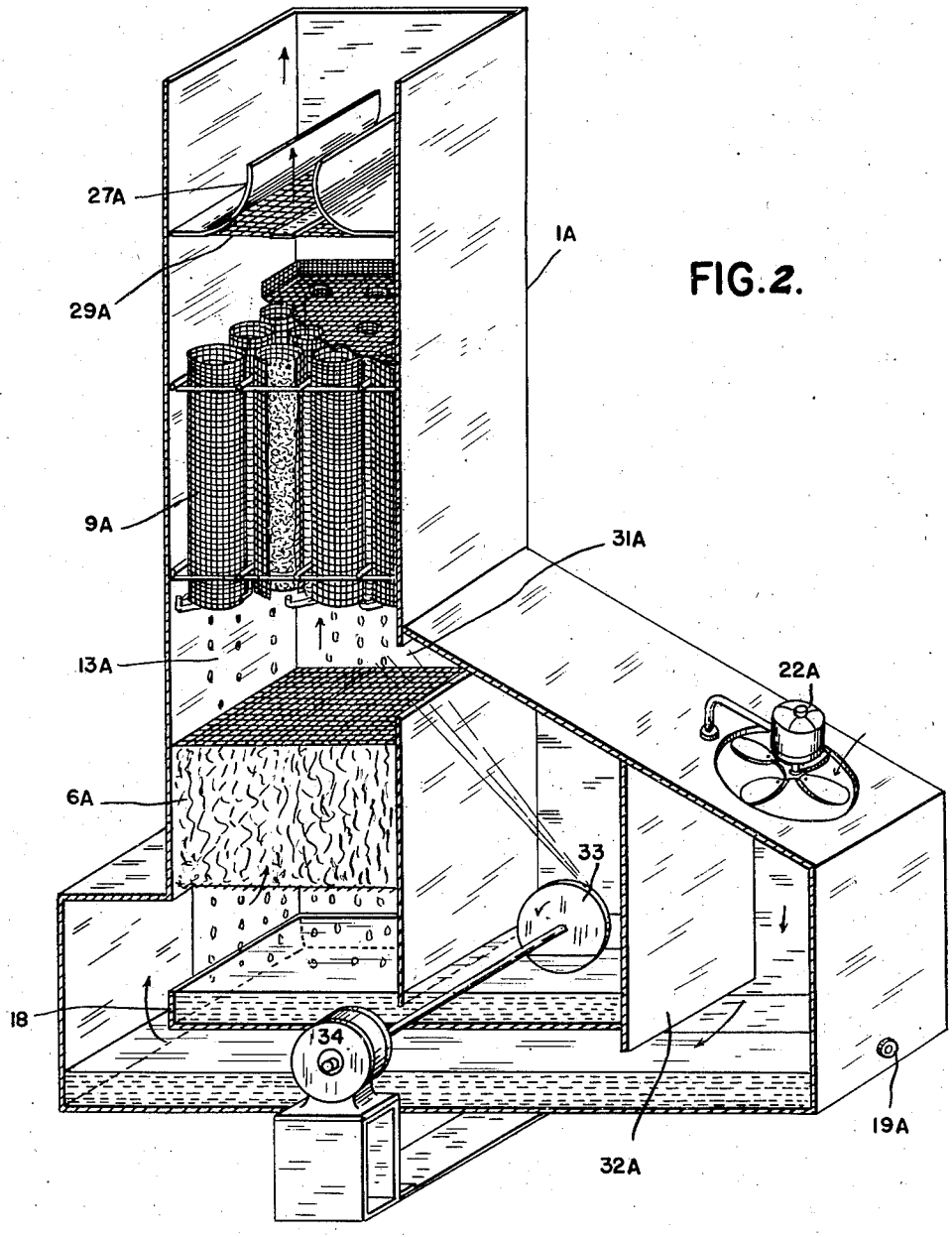


FIG. 2.

INVENTOR.
AUBRY H. ROBSON
BY
ATTORNEYS

Patented June 22, 1943

2,322,469

UNITED STATES PATENT OFFICE

2,322,469

APPARATUS FOR AIR CONDITIONING

Aubrey H. Robson, Detroit, Mich.

Application September 12, 1939, Serial No. 294,518

4 Claims. (Cl. 183—4)

This invention relates to improved apparatus for conditioning air, and aims to provide complete and controlled means, of very simple and inexpensive character, for regulating both the temperature and humidity of the air.

An important object of the invention is to provide improved means for controlling the dehumidification of air by means of a deliquescent agent, such as calcium chloride, and to improve upon the method and apparatus disclosed in the copending application of Hiram J. Kaufman, Serial No. 687,995, filed September 2, 1933, now Letters Patent No. 2,175,469, dated October 10, 1939.

Another important object of the invention is to provide improved means for supporting the hygroscopic or deliquescent agent, in a manner which allows such agent to work its way downwardly with respect to its supporting means while being consumed, and to be dissolved away without unwanted sticking or binding in the supporting means, despite the tendency of such substances to cake into a block-like mass while absorbing moisture.

Another object of the present invention is to provide improved means for utilizing the saturated solution which drips from the deliquescent agent to provide a secondary dehumidifying stage, having a greatly extended surface area with which the air to be treated must engage before reaching the solid deliquescent agent.

A further object is to so arrange the secondary dehumidifying stage that it is self-cleaning.

Another object is to provide means for recirculating the calcium chloride solution which drips from the secondary stage, to maintain the relatively large secondary surface in thoroughly wetted condition.

Still another important object is to provide means for accumulating the water removed from the air in the bottom of the casing, and to provide extremely simple, completely automatic and fool-proof means for rendering the apparatus inoperative when the liquid level rises too high therein, thereby eliminating danger of overflow.

Another object is to provide automatic means for preventing back-flow of air through the device when shut off, which back flow would otherwise occur owing to the low vapor pressure of the deliquescent agent, and would cause considerable waste of such agent, and interfere with the effectiveness of the apparatus by wetting the dehydrating agent near the outlet.

Other objects and advantages will be apparent from the following description, wherein reference is made to the accompanying drawings illustrating preferred embodiments of my invention and wherein similar reference numerals designate similar parts throughout the several views.

In the drawings:

Figure 1 is an isometric perspective view, partly broken away, of an air conditioning system incorporating the principles of this invention.

Figure 1—A is a perspective view of the same from above, with the top removed.

Figure 2 is a perspective view, similar to Figure 1, but showing the dehumidifying unit only of a somewhat modified construction.

Referring now to the drawings, and particularly to Figures 1, 1—A, which show the juxtaposed cooling and dehumidifying units, which are ordinarily covered by a common casing (not shown), it will be seen that reference character 1 designates a stack-like portion forming part of an inner sheet metal casing for the dehumidifying unit. The dehumidifying unit also includes a base portion, 2, having an air inlet, 10, in which is mounted a fan 21. The inflowing air is directed downwardly, and enters the stack from below, through a grille 4, whereafter it flows upwardly through the dehumidifying agencies contained in the stack.

Such dehumidifying agencies consist of a primary surface, generally designated 15, and a secondary surface, generally designated 6. The secondary surface is that first engaged by the air, and consists of a relatively finely divided and pervious material having a relatively large surface area, such as steel or copper wool, glass wool or the like. Such secondary surface is adapted to be kept wet by the solution dripping from the primary surface, which is located in the stack above the secondary surface. In the shown construction a copper wool bat 6 is held between the grille 4 and a transverse top grille 5, which also supports the primary surface.

The primary surface consists of a plurality of spaced, vertically disposed open-topped cylindrical or tubular vessels 9, formed of screening or other foraminous material, resting upon the grille 5, and held in spaced relation by separator grids 7, 8. A top screen 23, placed over the tops of the vessels 9, is provided with openings registering with each vessel, through which the tubes may be filled. The screen 23 is preferably fine enough to prevent the hygroscopic material, which is used in flaked or granular form, from passing through the same.

The cooling unit, shown beside the dehumid-

ifying unit just described, consists of a casing portion 35 enclosing cooling means shown as consisting of a tank 36 adaped to contain ice and/or cold water, although it will be understood that cooling coils, or any other suitable cooling means might be employed. A separate fan, 40, arranged in a separate air inlet 39, forces air against and around the tank to cool the same before it is discharged from the outlet 42.

It will be noted that the moisture flows downwardly to the bottom of the casing, where it may be allowed to collect, and that the upward counterflow of the air tends to promote most effective moisture removal due to the fact that the drying air in its upward flow meets constantly dryer dehumidifying surface. Caking of the hygroscopic material in the primary containers 9 does not interfere with airflow, since in the primary section the air may travel in the spaces between the tubular containers, and merely passes over the surface of the hygroscopic material therein. As such material dissolves at the surface, it works its way downward in solution, and flows downwardly onto the secondary surface, where it spreads over the extended surface, and by keeping it moist, provides a greatly increased area having dehumidifying action and which is adapted to remove a proportion of the water vapor from the air before the primary surface is reached.

One side of the stack is extended downwardly inside the inlet casing, to provide a baffle, designated 32, adapted to limit the amount of water or solution which may collect in the casing by shutting off the flow of air when the liquid level rises so high as to engage the baffle. A plug as 19 may be provided for convenience in draining.

The control mechanism consists of separate humidity and temperature responsive devices, located in the inlets 10, 39, respectively, and arranged to independently control the operation of the fan motors 22, 41 in response to the humidity and temperature of the air flowing in from the served zone.

In the somewhat modified construction shown in Figure 2, the primary and secondary dehumidifying agencies 9A, 6A, are somewhat spaced from one another in the stack 1A, a chamber 13A being left therebetween, while the air inlet is separated from the stack by a baffle 32A which forces the air to flow downwardly beneath a pan 18, which is elevated above the bottom of the casing, the air passing around the opposite end of the pan and entering the bottom of the stack, where it flows upwardly in similar fashion through the secondary surface and then the primary surface.

An opening 31A is left in the side of the stack, through which a spray of solution may be thrown by a spray disc 33, which dips into the upper tank 18. The disc may be turned by a motor 34. The upper tank is kept filled by the drip from the dehumidifying agencies, while the overflow from such pan falls into the bottom of the casing, from which it may be drained through an outlet 19A. The baffle 32A is of such length as to cause the air inlet to be shut off by the rising solution when the level of the latter reaches it, thus preventing the liquid from rising too high. The capacity of the liquid-containing portion may be such that the level rises to the baffle 32A and shuts off the inlet at about the same time that the hygroscopic material is exhausted. The recirculating spray disc will be seen to maintain the secondary surface thoroughly wetted regardless of the rate of drip from the primary surface, and to assist in keeping the upper portions of the primary material dry, thus assisting the action of the latter in dehydrating the air as fully as possible.

A removable screen 29A is preferably arranged above the primary surface, and carries, secured along opposite edges, dampers 27A formed of silk, or other light and relatively impervious material. The dampers are easily lifted by the upflowing air when the fan is in operation, but close the stack, to prevent down flow of air, when the machine is idle. It will be understood that without such provision, due to the lower vapor pressure of such hygroscopic material in solution, air would flow downwardly into the stack and act upon the upper part of the primary material.

Due to the counter flow arrangement, the secondary surface is self-cleaning, and the removal of water from the air is most effective due to the fact that the air contacts progressively drier deliquescent material as the air becomes dried out, in passing upwardly through the stack.

It will be noted that the entire dehumidifying means may be removed through the open top of the stack at will, to enable convenient repair and replacement of these parts, which are subjected to the strongest corrosive action of the salt or other hygroscopic material.

I am aware that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire the present embodiments to be considered in all respects as illustrative and not restrictive; reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

I claim:

1. Dehydrating means comprising in combination with means for guiding air to be treated, a plurality of independent reticulated tubular containers arranged in substantially vertical, parallel and spaced relation and each adapted to contain a quantity of deliquescent material, said guiding means being arranged to direct air over and through the spaces between said containers, a covering member for said containers arranged over the open tops thereof, pervious to air, and having individual openings therein registering with the open tops of said tubular containers, said covering member being sufficiently dense to support deliquescent material placed thereupon during charging, said parts being arranged in such manner that excess deliquescent material may be brushed from the covering member into the tubular containers.

2. In combination with dehydrating means including a casing, a quantity of deliquescent material therein, means for directing a flow of air over said deliquescent material, said casing having a lower portion adapted to collect drip from said deliquescent material, said casing having air inlet and outlet portions, and said air guiding means including a baffle located between the inlet and outlet and projecting downwardly into said portion of the casing in which said drip is adapted to collect, in position to coact with such collected drip to close communication between the inlet and outlet when the accumulated drip rises into contact with said baffle.

3. Air-conditioning means comprising in combination with a casing having a base portion and a substantially vertical stack portion, a plurality of superpositioned dehumidifying agencies ar-

ranged in said stack portion, an upper one of said dehumidifying agencies including a plurality of reticulated tubular containers independent of and spaced from one another to allow airflow upwardly therebetween and over the contents of said containers, a quantity of hygroscopic material in said containers, and cover means arranged over the tops of said containers comprising a screen member of a mesh too fine to allow the hygroscopic material to pass therethrough, said cover means having a plurality of filling openings therein, one such opening being arranged over and registering with each of said containers.

4. Air conditioning means comprising in combination with a casing having a base portion and a substantially vertical stack portion, a plurality of superposed dehumidifying agencies arranged in said stack portion, an upper one of said dehmidifying agencies including a plurality of reticulated tubular containers independent of and spaced from one another to allow air flow upwardly therebetween and over the contents of said containers, a quantity of hygroscopic material in said containers, and cover means arranged over the tops of said containers comprising a screen member of a mesh too fine to allow the hygrostatic material to pass therethrough, said cover means having a plurality of filling openings therein, one such opening being arranged over and registering with each of said containers, the stack being open topped, and said cover means and containers being removable therethrough.

AUBREY H. ROBSON.