

Oct. 9, 1934.

R. A. ILG

1,976,401

AIR CONDITIONING AND FILTERING DEVICE

Filed May 17, 1933

2 Sheets-Sheet 1

*Fig. 1.*

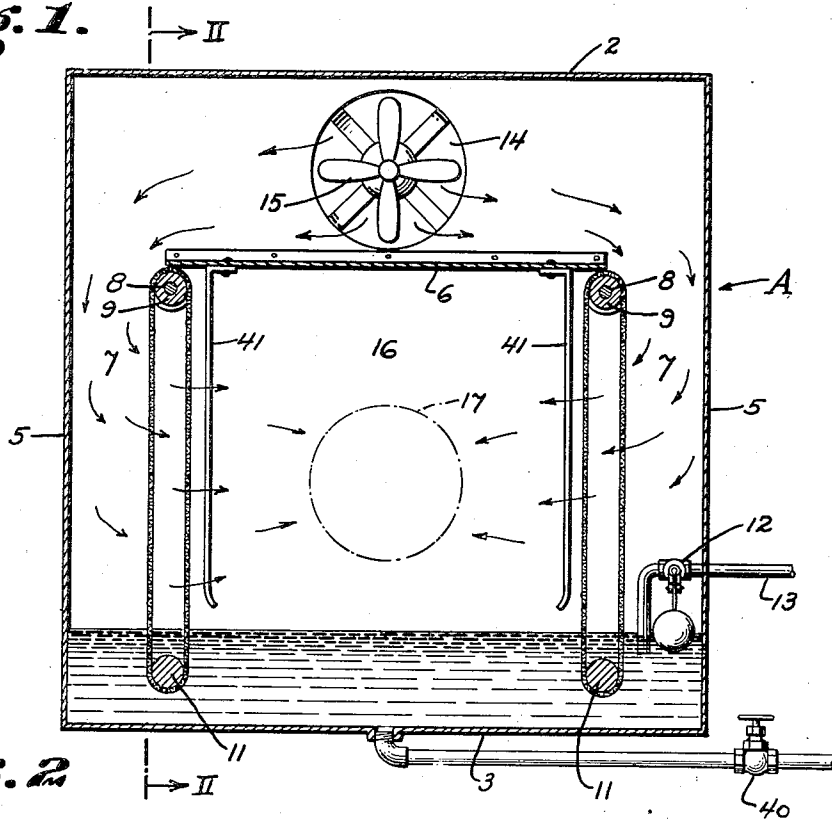
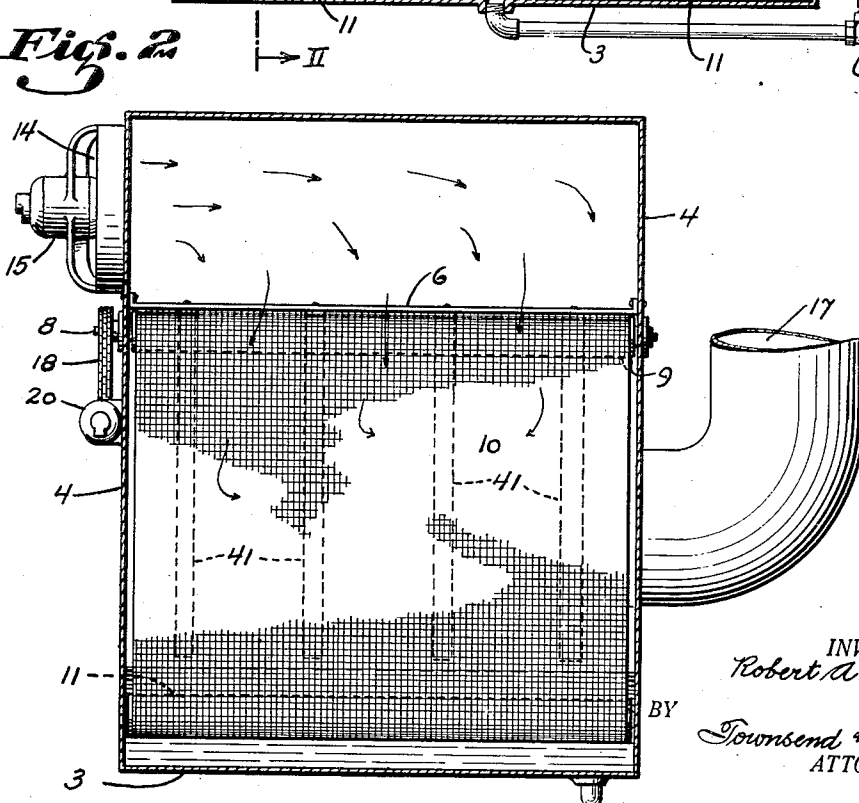


*Fig. 2.*



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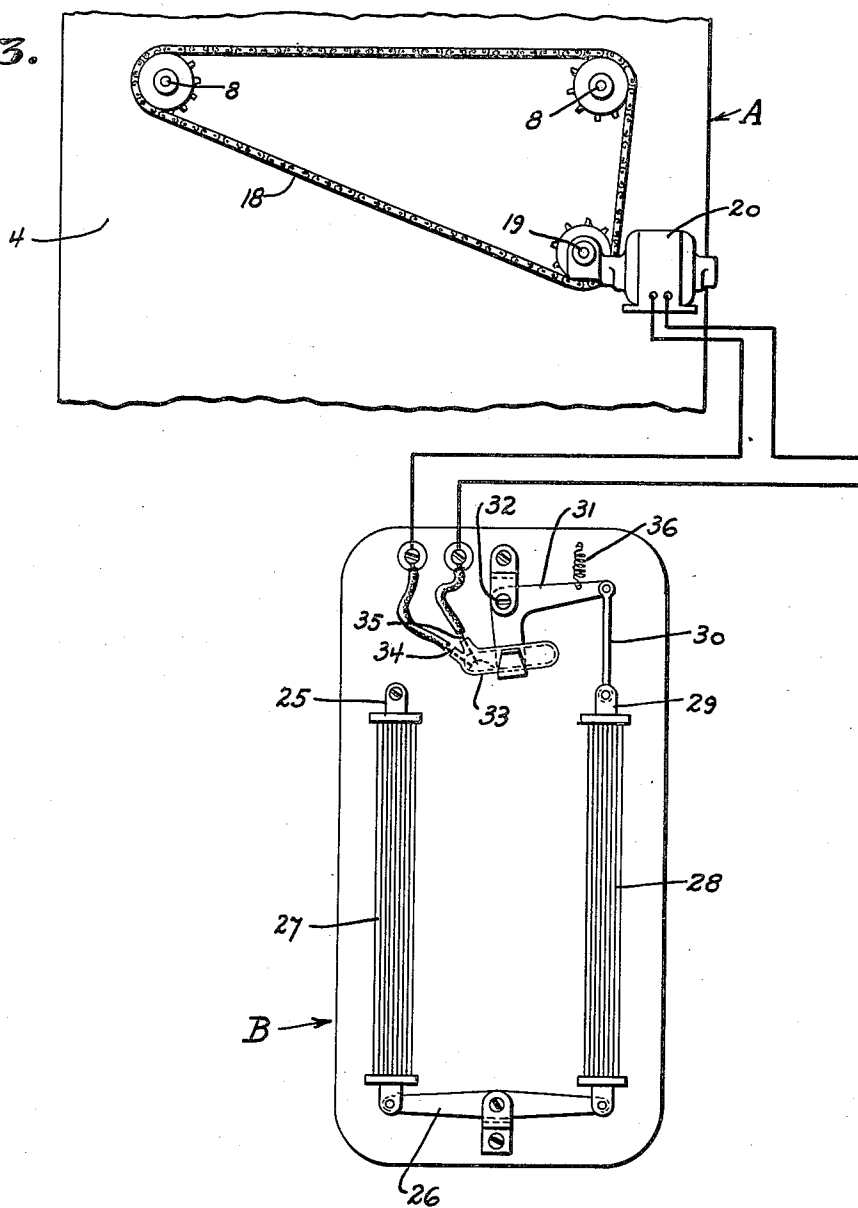
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*Fig. 3.*



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## UNITED STATES PATENT OFFICE

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AIR CONDITIONING AND FILTERING  
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Application May 17, 1933, Serial No. 671,498

2 Claims. (Cl. 183—9)

This invention relates to an apparatus for filtering or cleaning air and for regulating the humidity or moisture content thereof.

The object of the present invention is to generally improve and simplify the construction and operation of air conditioning and filtering devices; to provide an apparatus of the character described which may be used either in conjunction with air cooling or air heating system and which may be used for filtering air or humidifying air, or both; to provide an apparatus of the character described in which filtering areas of large capacity may be readily provided so as to reduce air flow resistance to a minimum; to provide an air filtering device in which the filtering medium functions as a carrier for water and from which the water is evaporated and removed by passage of air through the filtering medium; to provide a filtering medium in the form of an endless fabric belt which is maintained in continuous movement and to which water is applied by maintaining a portion of the belt in a submerged condition; and further, to regulate the humidity content of the air during or after filtering by varying the speed of movement of the belt and hence the quantity of water elevated and evaporated.

The air conditioning and filtering device is shown by way of illustration in the accompanying drawings, in which—

Fig. 1 is a central vertical cross section of the air conditioning and filtering apparatus.

Fig. 2 is a side elevation in section taken on line II—II of Fig. 1.

Fig. 3 is a diagrammatic view showing the driving motor and the hygrostat whereby the circuit through the motor is controlled.

Referring to the drawings in detail, A indicates, in general, a housing consisting of a top portion 2, a bottom section 3, end sections 4, and side sections 5. Extending from end to end of the housing and adjacent the upper end thereof is a partition or baffle plate 6. This plate has the same length as the length of the housing but its width is less so as to form two side passages, such as indicated at 7—7. Disposed lengthwise of the housing just below the baffle or partition plate 6 are a pair of shafts 8—8. Secured on each shaft is a pulley or roller 9 and surrounding each roller is a belt 10. The belts shown are endless and are suspended and they are weighted down by rollers 11—11 at the lower end. In actual practice the belts 10 may be formed of any suitable fabric material, whether it be metallic, or otherwise. A finely woven copper or brass mesh fabric has been successfully employed and will, in this instance, function both as a filtering medium and as a medium for elevating water, or other liquids.

The bottom of the housing forms a well and contains a suitable liquid which may be maintained at a level sufficiently high to keep the lower

ends of the belts 10 in a submerged condition. Any suitable means may be employed for maintaining a predetermined liquid level, for instance a float actuated valve of standard construction, such as shown at 12. If water is to be employed, the valve 12 is to be connected with any suitable source of water supply as a city main, or the like, indicated at 13. When the liquid level drops below a predetermined level, valve 12 is opened by the float and the liquid is thus replenished and the valve naturally closes when a predetermined high level is obtained. If another liquid other than water is to be employed, for instance an oil, or the like, pipe 13 may be connected with a tank containing the same and such liquid may flow by gravity through the valve and the elevation will be controlled by the float actuated valve 12. The housing is provided with an inlet opening 14 and a discharge opening 15 and any suitable means may be employed for maintaining a forced circulation of air through the housing, for instance a fan, or blower, such as indicated at 15.

In actual operation if it is desired to employ the apparatus for filtering and humidifying air, fan 15 is set in operation and air will thus enter the housing through the opening 14 at a point above the baffle plate 6. The air will then be directed downwardly through the passages 7 and air will pass through the metal fabric forming the belts 10 and will finally enter a central chamber 16 formed between the belts, and as this chamber is connected with the outlet 17 the flow of air through the housing is completed. The belts 10 will under normal operating conditions be maintained in continuous motion by transmitting a slow rotation to the shafts 8 and the pulleys 9 carried thereby. Such motion may be transmitted through a sprocket chain 18 which is driven through means of a reduction drive 19 and an electric motor 20. As the belts 10 are slowly traveling in an upward direction on one side and a downward direction on the other side, water will be elevated by the upwardly traveling sides of the respective belts and as the air passes through the fabric forming the belts the water will evaporate and the humidity content of the air will be raised. Hence, the belts 10 function as a means for not only filtering the air but for cooling the same, and also for raising the humidity content.

Filtration of the air is obtained by employing a sufficiently closely woven fabric and also by maintaining the screen surface moist so that dust and other impurities will adhere thereto. Any adhering matter will be freed whenever the belt becomes submerged in the water and each belt is thus self-cleaning.

In order that a predetermined humidity content may be maintained a hygrostat of any suitable character may be employed. Such an instrument is diagrammatically indicated at B in Fig. 3.

Briefly described it comprises an anchor member 25 which is connected with a pivotally mounted lever 26 through means of a plurality of hair strands 27, the hair employed being in some cases horse hair and in other cases human. The opposite end of the lever 26 is similarly connected by hair strands 28 with a member 29 and this is connected through a link 30 with a crank arm 31, said crank arm being pivotally mounted as at 32.

The crank arm is extended to support a mercury tube switch 33 which is provided with electric terminals 34 and 35 at one end. A spring 36 is connected with the crank arm and this maintains the strands 27 and 28 in a taut condition.

The instrument is placed in the air stream, or in a room where humidity content is to be controlled, and if the humidity content increases beyond a predetermined point, the strands contract thereby imparting a rocking movement to the crank arm and the mercury tube switch 33. The mercury thus runs to one end of the tube and breaks the circuit through the motor 20, and as this comes to a stop, so will the belts 10 which are driven thereby, and as no water is being elevated by the belts the humidity content of the air will naturally decrease and if it drops below a predetermined point the strands 27 and 28 expand, or lengthen, the circuit through the mercury switch and motor will be closed and water will again be elevated by the belts for purposes of evaporation so as to increase the humidity content.

The hygrostat here shown is of a well known type and obviously any other type may be employed. The air filtering and humidifying portion of the apparatus is exceedingly simple in construction and operation. Enormous volumes of air may be handled as the filtering areas provided by the belts 10 may be exceedingly large. Resistance to air flow is accordingly reduced to a minimum and as the fabric screens are self-cleaning by being continuously passed through liquid they will always be free and open to the flow of the air. The humidity content of the air can be raised to a maximum with the apparatus here shown wherever such a condition is required, as enormous evaporating areas are presented by the belts, or in other words the filtering medium employed, and as the air travels at comparatively high velocity through the filtering medium evaporation should be rapid.

The apparatus, as previously stated, may be employed for filtering purposes alone; it may be employed for humidifying purposes alone, or for both. If employed for filtering purposes alone, particularly where it is desired to keep the air as dry as possible, oil may be substituted for water. An oil which is odorless and which is difficult to evaporate is obviously preferable; in fact, any other medium which will moisten the surface and which will not readily evaporate may be employed as the only function of the oil, in this instance, is to present wet surfaces for the dust and impurities to adhere to and settle on. Such a filter is self-cleaning as the belt is continuously passing through the liquid medium employed as a portion of each belt is submerged.

If air cooling and humidifying alone is desired and filtration is not so important, a fabric belt of comparatively coarse mesh may be employed. This permits a free flow of air but as the meshes become saturated and coated during the period of submersion large areas are presented to the flowing air to evaporate the liquid, or water,

which is elevated. The air, whether filtered or humidified, or both, may be cooled or heated either prior to or after. The filter is reversible as far as air flow is concerned as the air may just as well enter through the opening 17 and discharge through the opening 14 as to flow in the direction already specified. The dirt and other impurities adhering to the screen and released in the liquid medium will settle to the bottom of the well and as the sump or well may be of considerable depth, large quantities of solid matter may be collected before cleaning will be necessary. One or more valves connected to a drain line may be employed, as shown at 40, and if water is employed the valves may be opened and the bottom of the housing flushed out.

It was previously stated that the only driving rollers employed were the upper rollers, indicated at 9—9, and that the lower rollers 11 were entirely free as they are suspended within the lower ends of the belts. This method of mounting the belts simplifies construction as it does away with two sets of bearings, cross shafts, etc. It furthermore leaves the belts free to sway back and forth as the air is rushing or passing through the belts and it, furthermore, prevents creeping of the belts which is an annoying problem when belts of considerable width are employed. If the air passing through the housing has a fairly high velocity the belts may have a tendency to swing toward each other but guard bars are placed adjacent the inner surfaces of the respective belts, as indicated at 41. These bars may be spaced a foot or more apart lengthwise of the belts and any spacing between the bars crosswise of the housing may be maintained thus preventing the belts from swinging together.

While these and other features have been more or less specifically described, I wish it understood that various changes may be resorted to within the scope of the appended claims. Similarly, that the materials and finish of the several parts employed may be such as the manufacturer may decide, or varying conditions or uses may demand.

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

1. An apparatus of the character described comprising a housing having an air inlet and an outlet formed therein, an endless fabric belt in the housing through which air passes in flowing through the housing, a shaft having a pulley surrounded by an upper loop of the belt and from which the belt is suspended, a free roller hung in the lower loop of the belt, means for driving the pulley to impart movement to the belt, and means limiting swaying movement of the belt when the belt is subjected to comparatively high air velocities.

2. An apparatus of the character described comprising a housing having an air inlet and an outlet formed therein, an endless fabric belt in the housing through which air passes in flowing through the housing, a shaft having a pulley surrounded by an upper loop of the belt and from which the belt is suspended, a free roller hung in the lower loop of the belt, means to impart movement to the belt, and a plurality of spaced bars disposed at one side of the belt to limit swaying movement of the belt when the belt is subjected to comparatively high air velocities.

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