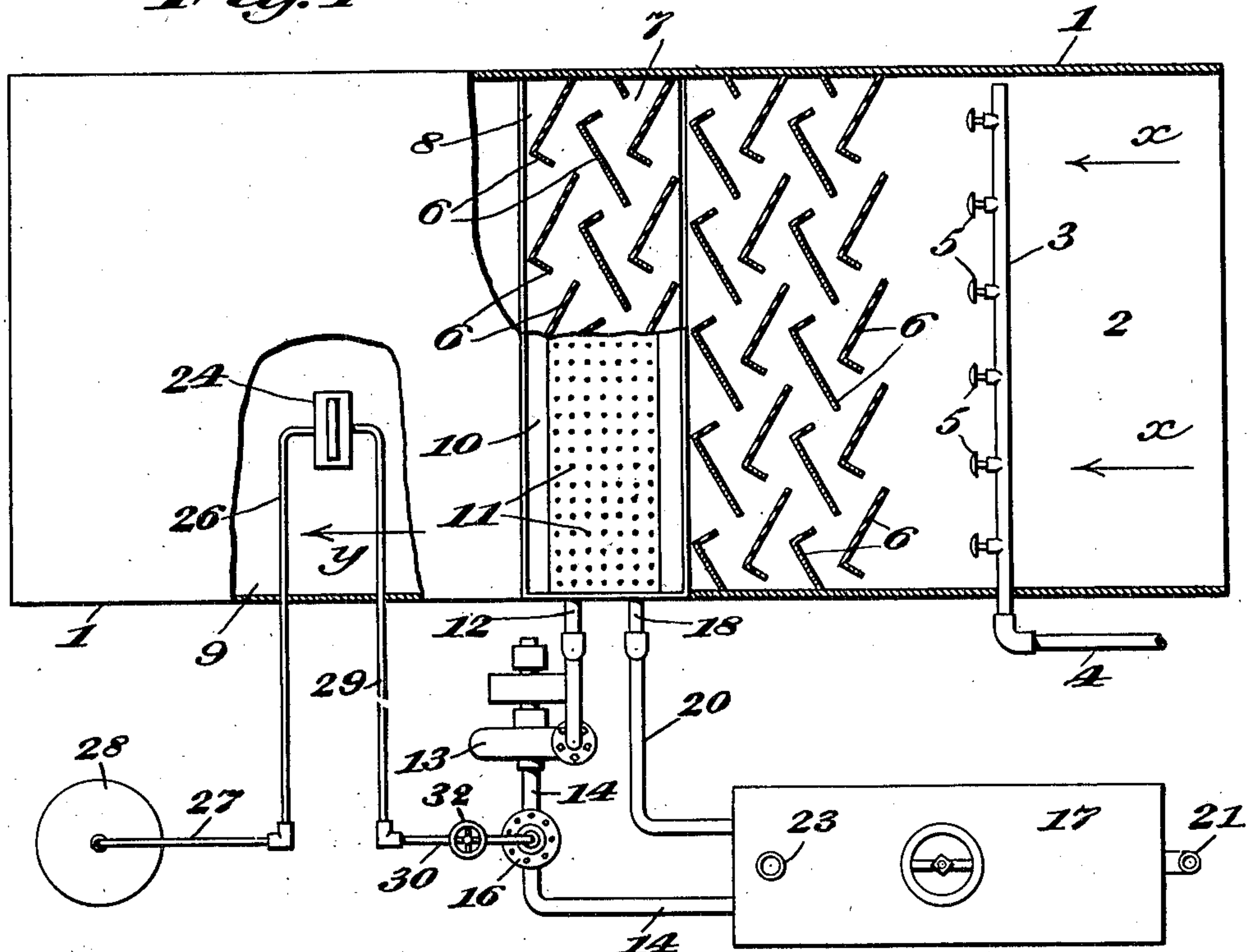


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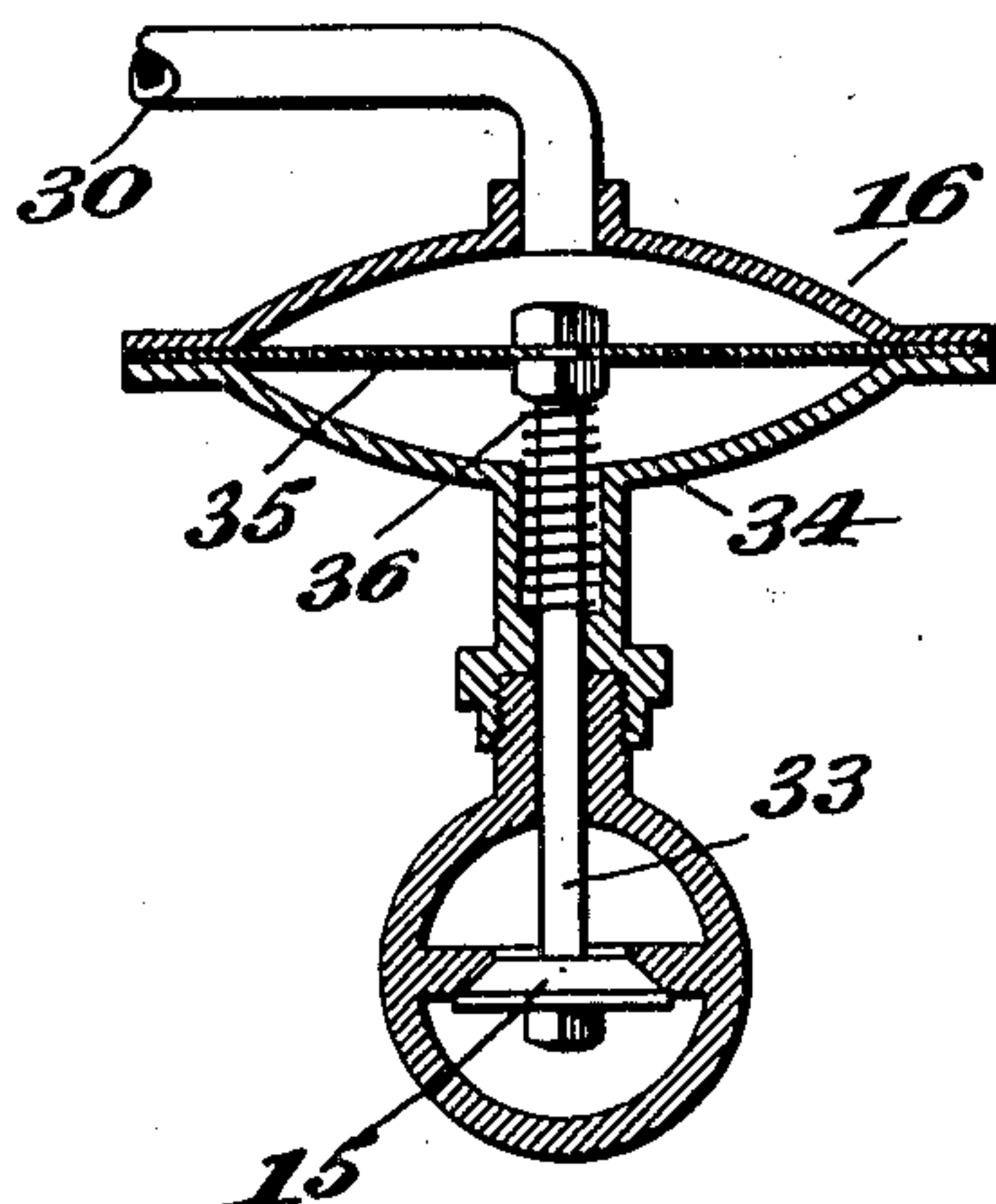
APPLICATION FILED OCT. 23, 1905.

2 SHEETS—SHEET 1.

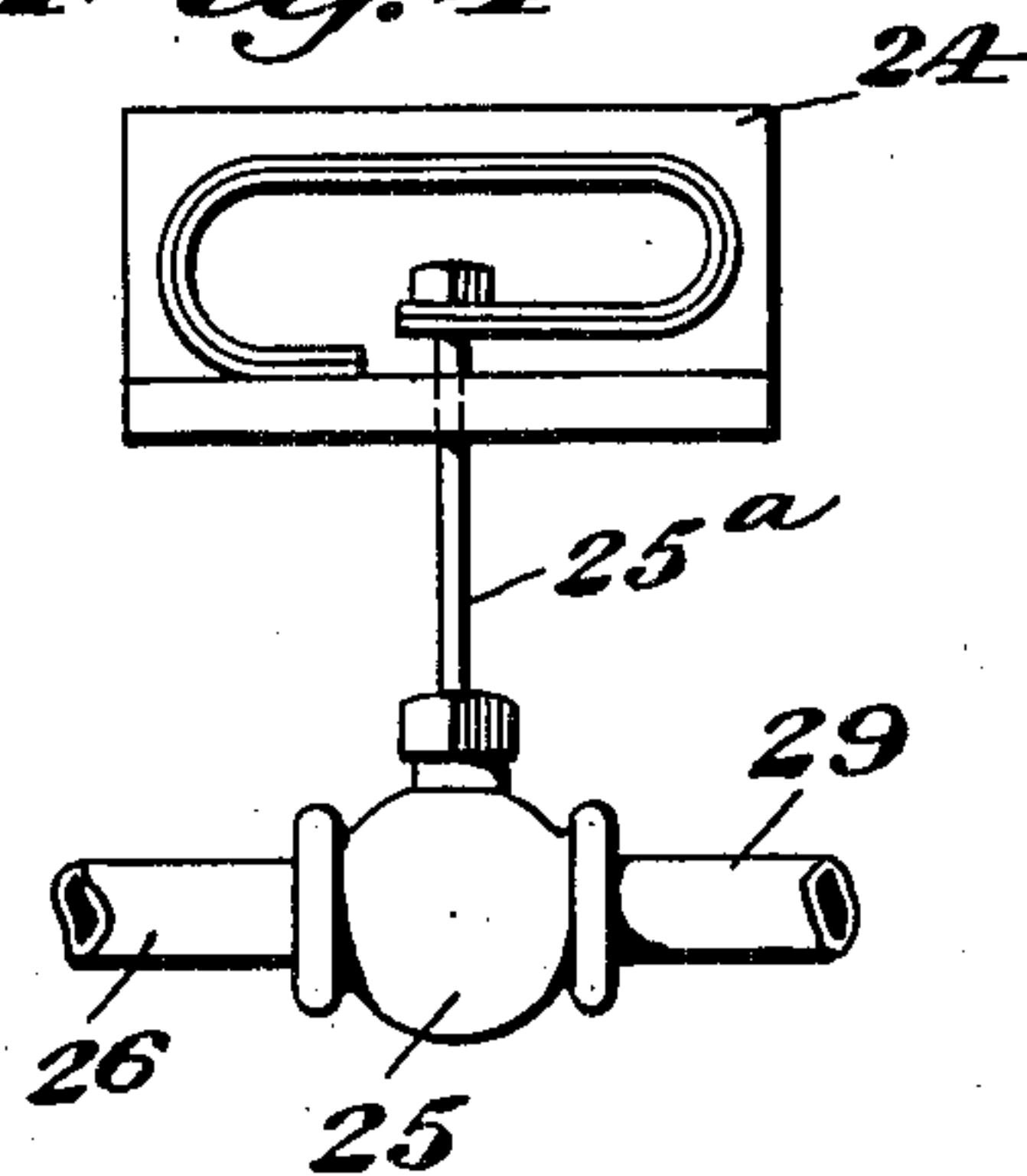
*Fig. 1*



*Fig. 3*



*Fig. 4*



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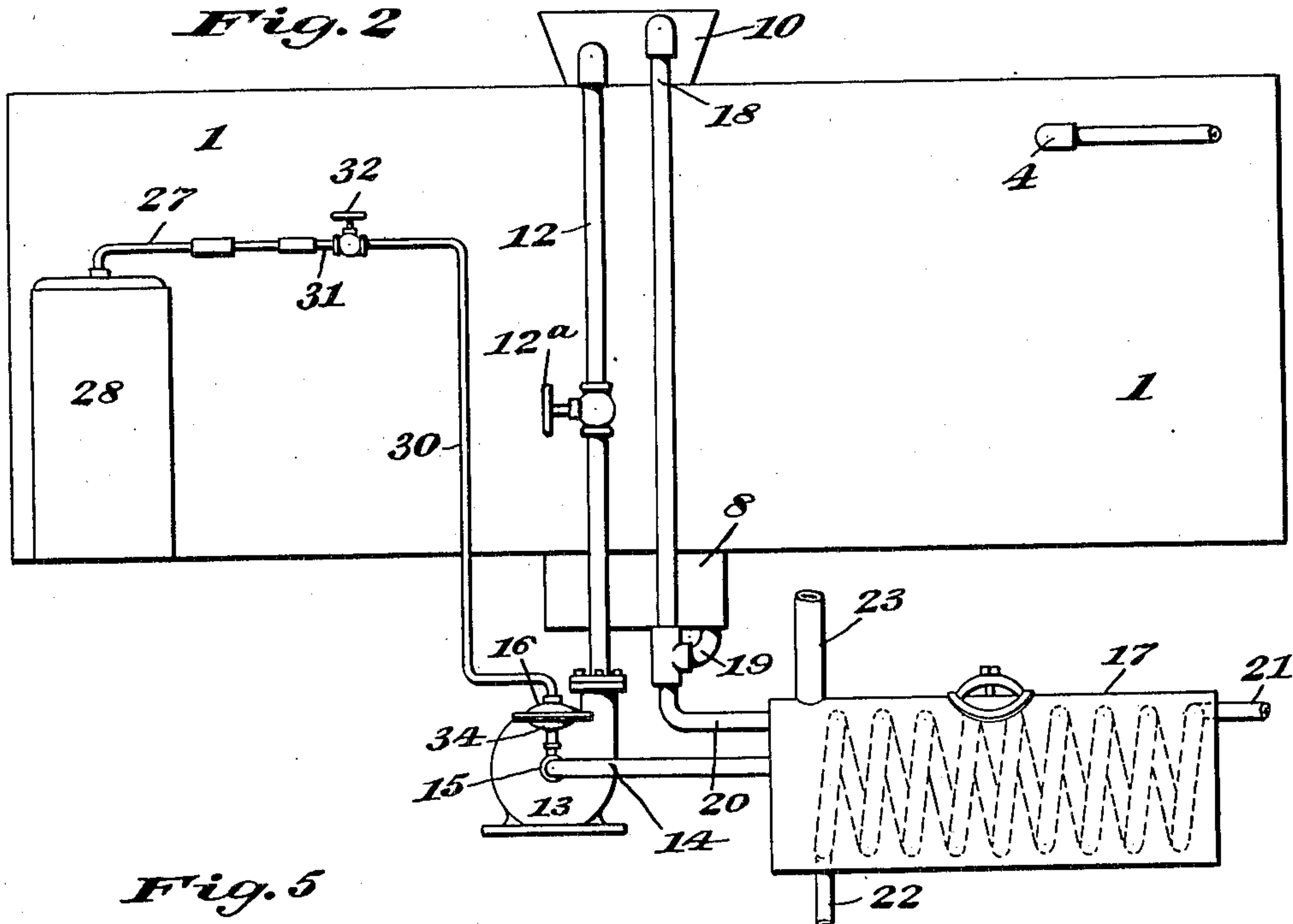
PATENTED NOV. 19, 1907.

R. H. THOMAS.  
HUMIDITY REDUCING APPARATUS.

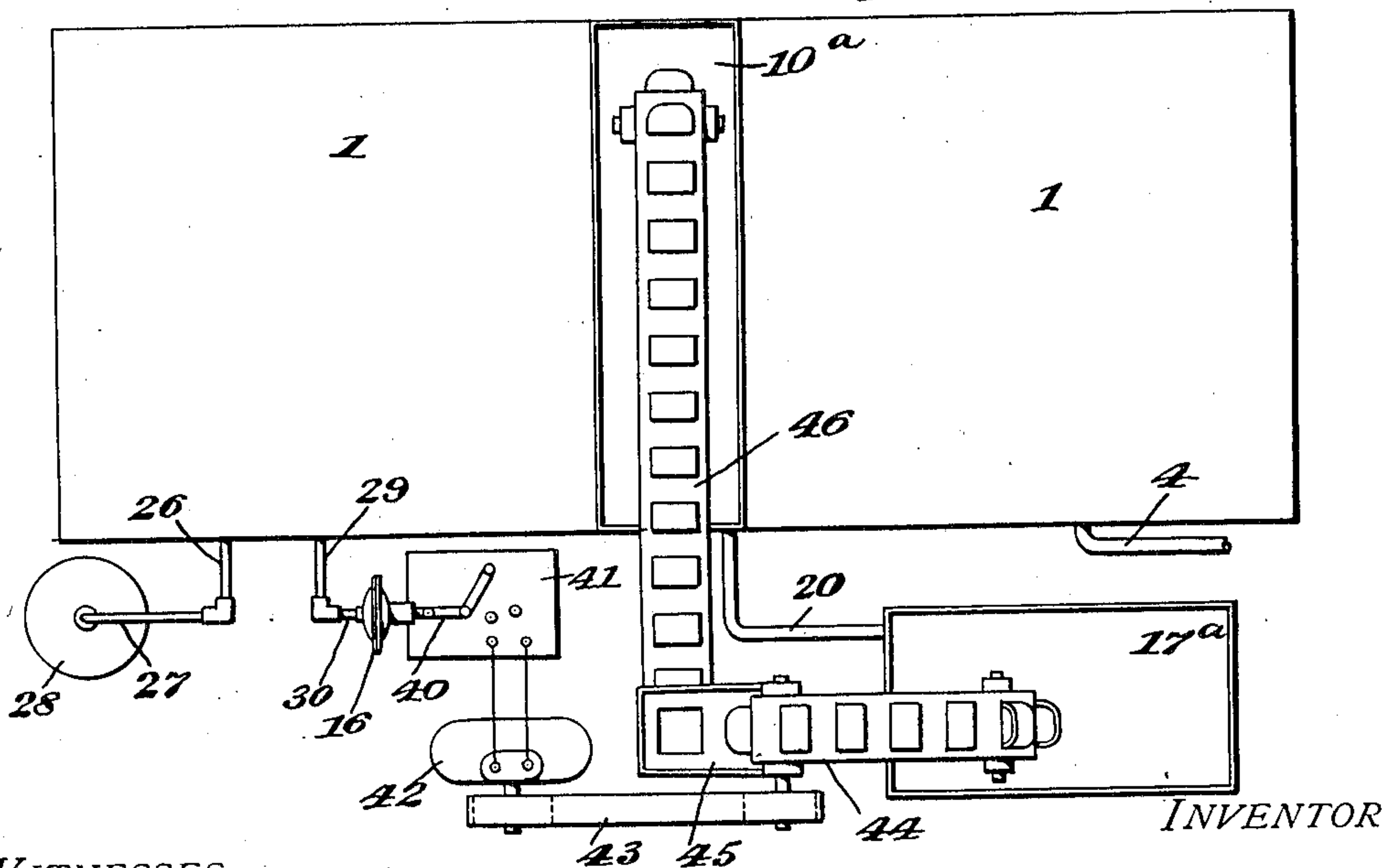
APPLICATION FILED OCT. 23, 1905.

2 SHEETS—SHEET 2.

*Fig. 2*



*Fig. 5*



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# UNITED STATES PATENT OFFICE.

RICHARD H. THOMAS, OF CHICAGO, ILLINOIS.

## HUMIDITY-REDUCING APPARATUS.

No. 871,194.

Specification of Letters Patent.

Patented Nov. 19, 1907.

Application filed October 23, 1905. Serial No. 284,006.

*To all whom it may concern:*

Be it known that I, RICHARD H. THOMAS, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented a new and Improved Humidity-Reducing System or Apparatus, of which the following is a specification.

This invention relates to certain improvements in that class of systems or apparatuses which are designed for reducing or lessening the humidity or moisture present in air and more especially in such systems or apparatuses of this character as are more especially adapted for use in connection with air purifying means, and the object of the invention is to provide a humidity reducing system or apparatus of a simple and comparatively inexpensive nature and of an improved and compact construction which shall permit of being operated in a substantially continuous manner for the reduction and regulation of the humidity of the air passed through the improved apparatus.

The invention consists in certain novel features of the construction, combination and arrangement of the several parts of the improved humidity reducing system or apparatus, whereby certain important advantages are attained and the improved system or apparatus is rendered simpler, cheaper and otherwise better adapted and more convenient for use, all as will be hereinafter fully set forth.

The novel features of the invention will be carefully defined in the claims.

In the accompanying drawings which serve to illustrate the invention—Figure 1 is a plan view showing a system or apparatus constructed according to my invention, portions of the same being broken out and shown in section for the illustration of certain features of construction to be hereinafter referred to. Fig. 2 is a side elevation of the improved apparatus as shown in Fig. 1. Fig. 3 is a sectional detail view, drawn to a larger scale and showing features of construction of the diaphragm regulator forming part of my improved apparatus. Fig. 4 is an enlarged detail view showing, detached, the regulating or controlling valve actuated from the hygostat for regulating or controlling the operation of the improved apparatus. Fig. 5 is a view somewhat

similar to Fig. 1 but illustrating a modified form of the improved system or apparatus.

Referring first to Figs. 1 to 4, it will be seen that the improved system or apparatus comprises a casing 1 which may be of any suitable construction, being provided with an air passage extended through it, in which air passage are arranged the several instrumentalities for treating the air for the removal or reduction of its humidity. The casing 1 is here shown as also forming the casing of an air purifier with which the improved apparatus is combined, but I make no claim herein to the details of said air purifier, nor do I desire to be understood as limiting myself to the use of my present improvements in connection with this or any other air purifier, since it is evident that the improved humidity reducing system or apparatus is adapted for use equally well where purification of the air is not required.

As herein shown, the air for treatment by my improved system or apparatus is supplied to the casing 1 at the right hand end thereof, being directed through the passage as indicated by the arrows  $x, x$  in Fig. 1, and at said right hand end of the air passage in the casing is produced a spraying chamber 2, wherein is arranged suitable spraying means herein indicated at 3 and consisting of a spray pipe having suitable nozzles for spraying water or other suitable cleansing and purifying agent through the entering air supply. 5, 5 represent the spray nozzles on the pipe 3 and 4 represents a water supply pipe which may be connected with any suitable source of supply and which communicates with spray-pipe 3 for supply of water thereto. By means of the spray thus produced in the chamber 2 of the casing 1, the entering air is freed from solid impurities together with such vapors and gases as are soluble in water, such impurities falling to the floor of chamber 2 with said spray and being withdrawn by way of a suitable outlet. 6 6 represent inclined angular baffle plates or deflectors vertically extended in chamber 2 beyond the spraying device and designed to laterally deflect the air passing through the casing to cause such air to circulate between said plates in the circuitous passages intervening between said plates, by which means the air will be freed from the spray carried in suspension, such spray condensing upon the



plates 6, 6 on contact therewith so as to flow down the plates to the floor of chamber 2 whence it may escape at the outlet provided as above described. The air thus treated, while being purified from solid impurities and of a certain proportion of those gases and vapors which are soluble in water, still carries with it a certain percentage of moisture and of gases and vapors which were not removed by the spraying treatment and for the removal of such moisture and gases and vapors I provide in the passage of the casing 1, beyond the spraying chamber 2 the means which I will now describe, premising that the removal of the moisture or humidity from the air is the principal function of such means, the removal of other impurities therefrom being only incidental to the operation of the said means.

7 represents a chamber produced in the passage of the casing 1 beyond the spraying chamber 2 and which I will term for convenience, the drying chamber, and in said drying chamber as herein shown are arranged transverse series of laterally inclined or angular baffle plates or deflectors 6, 6 vertically extended and similar in all respects to the baffle plates or deflectors of the spraying chamber and also adapted to laterally deflect the air passing through the drying chamber, although this is not essential to my present invention since said baffle plates in the drying chamber 7 may be of any desired kind or may in some cases, be altogether omitted. Beyond the drying chamber 7, the air passage of the casing 1 forms an outlet or discharge chamber 9 which is herein shown at the left hand end of the casing and which serves to receive certain regulating or controlling means as will be hereinafter explained.

10 represents a tank or trough supported at the upper part of the drying chamber 7 and having its bottom formed with perforations 11 designed for the discharge of a drying solution or agent from the trough or tank into the drying chamber. When such agent is used in the form of a solution, it is evident that it will be permitted to trickle down through the drying chamber from trough or tank 10 in the spaces between the baffle plates 6 as well as over the surfaces of said plates so that the air circulating through the drying chamber between said plates will be brought into intimate contact with such solution for substantially complete removal of its moisture or humidity when desired. When the laterally inclined baffle plates are employed in the drying chamber, it is evident that the drying material is brought into more intimate contact with the air owing to the circuitous path traversed by the air, and in this way it is possible to make the drying chamber of much smaller dimensions than would otherwise be necessary. I do not,

however, desire to be understood as limiting myself to the employment of this special means for supplying the drying agent to the drying chamber, nor to the employment of such agent in the form of solution, since it will be obvious that other means for the supply thereof may be provided in lieu of the devices herein shown and also that the agent may be in the form of powder or other form adapted for being brought into intimate relation with the air to be treated.

8 represents a tank or trough arranged at the base of the drying chamber 7 for the collection of the drying solution or agent after the same shall have trickled or passed down through said drying chamber, and 12 represents a supply pipe by way of which the drying solution is supplied to the trough or tank 10 from a pumping device 13, drawing its supply of such solution by way of a pipe 14 from a supply tank 17.

18 indicates an overflow pipe connected with the upper part of the trough or tank 10, as seen in Figs. 1 and 2 for drawing off therefrom any excess of solution which may be supplied by the pumping device 13, and said pipe 18 has at its lower end a connection 19 with the trough 8 at the base of the drying chamber 7, so that the spent solution from said receiving trough or tank 8 is also discharged into said pipe 18. A waste pipe 20 connects the lower end of pipe 18 with the supply tank 17 so that the excess of solution in tank or trough 10 together with the spent solution falling in trough 8 is returned by way of pipe 20 to tank 17.

Within the tank 17 is a steam or other heating coil as shown in dotted lines in Fig. 2 and said coil has at one end a steam connection 21 at which live steam is supplied thereto from a boiler (not shown) the opposite end of said coil having connection with a drip-pipe through which the condensation is discharged as shown at 22. 23 is a vapor pipe fitted to the tank and by the employment of the steam coil it will be understood that the spent solution in the tank 17 may be heated and partially evaporated so as to concentrate such solution after its employment for removal of moisture from the air in chamber 7 so that the same solution may be repeatedly employed, the vapor escaping from the tank 17 by way of pipe 23.

The solution employed will be, by preference, a strong solution of some such substance as calcium chlorid having strong affinity for water and by the evaporation or concentration effected in the tank 17 such solution will be maintained at a strength sufficient to cause the solution when allowed to trickle through the drying chamber 7, to abstract the watery vapor from the air flowing through the casing 1, a certain proportion of the other gaseous or vaporous impurities of such air being likewise taken up by said solu-



tion. When the solution is returned to tank 17 the excess of water thus acquired, together with such other impurities will be dissipated by the heat applied from the steam coil, or other heating medium.

The pumping device may be driven from any desired source of power and in the pipe 14 leading from tank 17 to said pumping device is arranged a valve 15 controlling the supply of solution to said pumping device and itself controlled by a diaphragm regulator 16 the detailed structure of which is shown in Fig. 3 and comprises a flexible diaphragm 35 extended in a casing 34 and connected with the stem 33 of valve 15, a spring 36 being coiled on the valve stem to hold said diaphragm uplifted and valve 15 normally closed. The casing 34 has a cover fitted above the diaphragm 35 and within said cover is a chamber with which connects a pipe 30, adapted to convey compressed air, the regulated admission of which serves to depress the diaphragm 35 and open valve 15 so that solution may flow through pipe 14 to the pumping device.

24 indicates a hygrometer which, as shown in Fig. 4, comprises two strips suitably supported at one end and laid one on the other and bent in volute form, said strips being made from substances adapted to expand and contract unequally at different degrees of humidity of the air whereby movement is transmitted to the free end of the device. The outer strip may be conveniently formed from cat-gut, hair or the like while the inner strip may be conveniently made of metal. This hygrometer is arranged in the outlet or discharge chamber 9 or otherwise of the casing 1 and its free movable end is connected to operate the stem 25<sup>a</sup> of a valve 25 from variations in humidity of the air in said discharge chamber 9, said valve 25 being inserted between air pipes 29 and 26, the former of which has connection with pipe 30 leading to the diaphragm regulator 16 and the latter of which connects with a pipe 27 leading to a tank or reservoir 28 adapted to hold a supply of compressed air which is discharged from said tank through pipes 27, 26, 29 and 30, valve 25 being opened, to the diaphragm chamber to regulate the extent of opening of the valve 15 whereby the flow of solution to the pump is likewise regulated from the operation of the hygrometer. In this way it will be understood that the supply of the drying solution is directly controlled in accordance with the condition of the air in the discharge chamber 9 so that a uniform and even degree of humidity or dryness of the treated air is automatically attained by the use of my improved apparatus. By proper adjustment it will also be obvious that the degree of humidity or dryness of the discharged air may also be varied so that the operation of

the apparatus may be accommodated to different requirements.

32 indicates a valve or cock controlling the flow of air through pipe 30 from the valve 25 controlled by hygrometer 24 to the diaphragm regulator 16 and by the use of this valve 32 it will be evident that the hygrometer will be prevented from influencing the supply of solution to the drying chamber. It is sometimes desirable to operate the apparatus without recourse to said hygrometer and when the valve 32 is closed, this may be done a valve 12<sup>a</sup> in pipe 12 permitting regulation of the supply of solution by hand.

In Fig. 5 I have shown a modified form of the improved apparatus which is adapted for use in connection with some form of solid drying agent, such for example, as dry or powdered calcium chlorid which may be contained in a concentrating or drying pan 17<sup>a</sup> and fed by conveyers 44 and 46 communicating by way of a hopper 45 and of any preferred construction, to a hopper or trough 10<sup>a</sup> at the top of the drying chamber in casing 1, falling through the air current in the drying chamber and taking up the moisture or humidity from such air so that it attains a liquid or semi-liquid state on reaching the base of said chamber where it is received in a trough and returned therefrom by way of pipe 20 to tank or pan 17<sup>a</sup>.

The conveyers may be operated by belting as seen at 43 from an electric motor 42, the circuit of which is controlled by a switch or controller 41 comprising an arm actuated by a link connection 40 from a diaphragm regulator 16 similar to that described above except that said link connection takes the place of the valve-stem 33. The regulator 16 is controlled automatically by the hygrometer in substantially the same way as above described so that the supply of the drying agent to the drying chamber is automatically regulated through the electrical connection from the degree of humidity or dryness of the air in the discharge chamber of casing 1 in order to insure uniform and even operation of the apparatus.

From the above description it will be evident that the improved apparatus is of a very simple and comparatively inexpensive nature and is especially well adapted for use by reason of the automatic action which insures uniform dryness of the treated air. The drying agent is also continuously supplied so that the operation of the apparatus or system is made practically continuous and by repeatedly using the same supply of drying agent and concentrating the same for the removal of the excess of water therefrom an important economy is attained in the cost of operation.

It will also be obvious from the above description that the improved system or appa-



ratus is capable of considerable change without material departure from the principles and spirit of the invention and for this reason I do not desire to be understood as limiting myself to the precise form and arrangement of the several parts of the apparatus herein shown and described in carrying out my invention in practice. Nor do I desire to be understood as limiting myself to the employment of any particular drying agent, either liquid or solid, or to the means for supplying the same nor to the peculiar means for regulating such supply herein shown, since all these features are capable of change without departure from my invention.

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

20 1. An apparatus of the character described having a drying chamber adapted for the passage of air, means for supplying a drying agent to said chamber for abstraction of moisture from such air and means, controlled from the degree of moisture or dryness of the air discharged from said chamber and connected with said supplying means to regulate the supply of such drying agent to said drying chamber.

30 2. An apparatus of the character described having a drying chamber adapted for the passage of air in a horizontal direction, means to laterally deflect the air through said chamber, means at the upper part of said chamber, for discharging a supply of drying agent thereto, whereby such drying agent is permitted to fall through the air passing through the drying chamber in a direction transverse to the direction of the flow of air through said chamber, and means at the base of said drying chamber for discharging such drying agent therefrom.

3. An apparatus of the character described having a drying chamber adapted for the passage of air in a horizontal direction, inclined devices in said chamber and adapted to laterally deflect the air flowing through the same, a device at the upper part of said chamber for discharging a supply of drying agent thereto, whereby such drying agent is permitted to fall through the air passing through the drying chamber in a direction transverse to the direction of the flow of air circulating through said chamber, a trough at the base of the drying chamber to receive the drying agent thus supplied, and means for withdrawing the drying agent from said trough.

4. An apparatus of the character described having a drying chamber provided with vertically extended laterally inclined baffle plates between which is produced a circuit-

ous passage for air horizontally directed through said chamber, a device at the upper part of said chamber for discharging a supply of drying agent thereto, whereby said drying agent is permitted to fall through the air passing between the baffle plates in a direction transverse to the direction of the flow of said air, and means at the base of the drying chamber for discharging such drying agent therefrom.

5. An apparatus of the character described comprising a drying chamber adapted for the passage of air, means for supplying a drying agent to said chamber for abstraction of moisture from such air and comprising a pumping device, a supply receptacle with which the pumping device has connection, means for heating said receptacle, a connection extended from the drying chamber to the supply receptacle for the return of the drying agent from said chamber to the receptacle, a hygrostat exposed to the air discharged from the drying chamber and actuated from variations in the degree of dryness or humidity thereof and means, operated by the hygrostat and controlling the supply of drying agent from said receptacle through the pumping device to the drying chamber.

6. An apparatus of the character described having a drying chamber adapted for the passage of air, means for supplying a drying agent to said chamber for abstraction of moisture from such air and comprising a pumping device, a receptacle for the drying agent having heating means and connected with the pumping device, a connection extended from the drying chamber to said receptacle for the return of the drying agent from said chamber to said receptacle, a valve controlling the connection of the receptacle with the pumping device, a diaphragm regulator connected to operate the valve and having a diaphragm chamber, a tank to contain compressed air and having pipe connection with the diaphragm chamber of said regulator, a valve controlling said pipe connection and a hygrostat exposed to the air discharged from the drying chamber and actuated from variations in the degree of drying or humidity thereof and having connection with said last-named valve to operate the same for regulating the supply of compressed air from said tank to the diaphragm chamber of said regulator.

In testimony whereof I have hereto signed my name at Chicago, Illinois, this 19th day of October 1905, in the presence of two subscribing witnesses:

RICHARD H. THOMAS.

Witnesses:

CHAS. C. TILLMAN,  
J. D. CAPLINGER.