April 6, 1926. 1,579,240

B. J. OWEN

AIR HEATING APPARATUS

Filed Feb. 27, 1925

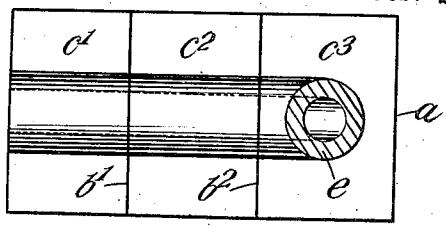


Fig. 2.

Fig. 1.

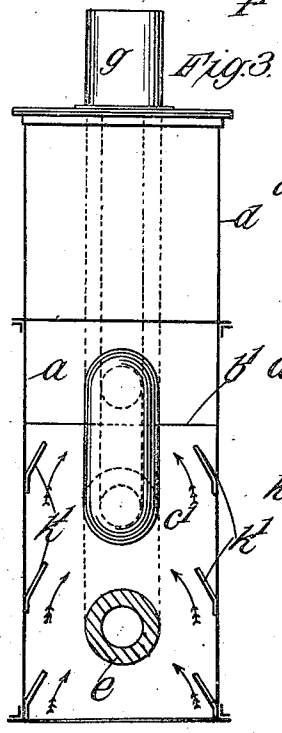


Fig. 3.

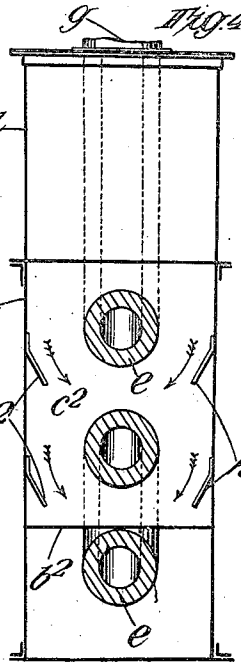


Fig. 4.

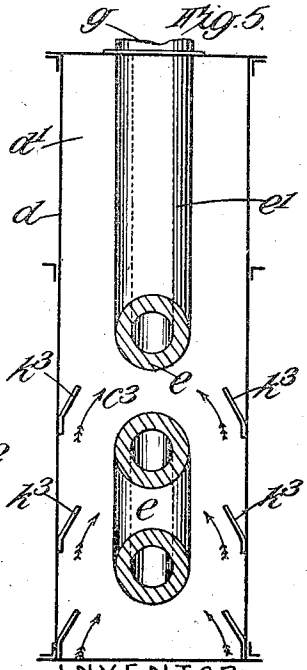


Fig. 5.

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Patented Apr. 6, 1926. 1,579,240

UNITED STATES PATENT OFFICE.

BRYNAR JAMES OWEN, OF OXFORD, ENGLAND.

AIR-HEATING APPARATUS.

Application filed February 27, 1925. Serial No. 12,048.

To all whom it may concern:

Be it known that I, BRYNAR JAMES OWEN, a subject of the King of Great Britain, residing at Augle House, Woodstock Road, in the city of Oxford, in the county of Oxford, England, have invented certain new and useful Improvements in Air-Heating Apparatus, of which the following is a specification.

The present invention relates to air-heating apparatus, more particularly those of the type in which the air to be heated is passed over internally heated pipes or tubes and in which the heating chamber is divided by means of partition plates or the like into adjacent inter-communicating compartments within which the said pipes or tubes are disposed, the air to be heated being caused to circulate through the said compartments in succession over the heating pipes or tubes extending therein. The heating pipes or tubes have heretofore been arranged in the form of coils or banks extending longitudinally or parallel to the partition plates forming the aforesaid compartments, and the air circulating through the latter has generally been caused to pass in succession from the coolest to the hottest pipes or tubes so as to be subjected to a gradual increase of heat during its passage through the heating chamber.

The object of the invention is to provide a light and compact heater by means of which a comparatively large volume of atmospheric air can be rapidly and effectively heated to temperatures such as those which are usually employed for drying and like purposes.

The main feature of the invention consists in the arrangement of sinuous pipes or tubes (one of such pipes being shown in the drawing) disposed transversely in relation to the partition plates forming the various compartments of the heater, said heating pipes or tubes traversing the said partition plates and passing across the said compartments successively and repeatedly and forming along each compartment a series of hot spots the heat-intensity whereof progressively decreases and increases alternately in the said compartments.

Another feature of the invention consists in the provision of a chamber which is adapted to form an extension of the last compartment of the heater and inside which the heating pipes or tubes are extended so as to provide a maximum amount of heating surface in the said compartment.

The invention also comprises further features and advantages which are fully set forth in the following description and claims.

Figure 1 is a sectional elevation of the said heater;

Figure 2 is a sectional plan taken along the line 2—2 in Figure 1, and

Figures 3, 4 and 5 are longitudinal sections taken, respectively, along the lines 3—3, 4—4 and 5—5 in Figure 1.

The heater illustrated consists of a substantially rectangular casing or tank a, made of sheet metal or other suitable material, which is internally divided by means of partition plates b^1, b^2 into compartments c^1, c^2, c^3 the number and the capacity of the latter depending upon and varying according to the size of the particular heater. The said internal partition plates are dimensioned and arranged so that the adjacent compartments formed thereby communicate with each other alternately at the opposite ends thereof; the partition plate b^1 extending partially upwards from the lower cover plate a^1 of the heater and the partition plate b^2 extending partially downwards from the upper cover plate a^2 of the said heater, as best seen in Figures 1, 3 and 4. The casing or tank a is further provided with an upper extension d which forms an internal chamber d^1 located directly above the compartment c^3 and in open communication therewith.

The heater is provided, in the example illustrated, with a heating pipe or tube e which is coiled or bent so as to pass in succession and at several heights across the compartments c^1, c^2 and c^3 and which terminates in a straight portion e^1 extending inside the upper chamber d, said pipe or tube e comprising a number of substantially straight portions which extend in turn across all the compartments in approximately parallel formation and which are inter-connected alternately in the end compartments by means of suitable bends or elbows as best seen in Figure 1. The pipe or tube e may be made of any suitable material adapted to conserve heat, such as fire-clay for example, in which case the said pipe or tube is preferably encased in thin sheet metal. The number of times that the pipe or tube e is made to traverse the various compartments of the

heater is determined by and varied according to the amount of heating surface which the particular heater is required to provide.

The pipe or tube *e* is internally supplied with heat at the lower orifice thereof from any convenient source, preferably by means of a paraffin oil burner *f* resting on a bracket f^1 carried by the casing or tank *a*, the heating gases being forced by means of a blower f^2 through the said pipe or tube. The heating gases escape by way of a chimney *g* which is situated above the upper extension *d* of the casing or tank *a* and which is provided with a damper g^1 for regulating the necessary draught and preventing any undue loss of heat.

The heater is provided with an air-inlet opening h^1, which is formed in the lower cover plate a^1 of the casing or tank *a* directly underneath the compartment c^1, and with an air-outlet duct h^2, which is formed in the upper extension *d* of the said casing or tank and which communicates with the upper chamber d^1. Any suitable means may be employed for causing the air to circulate through the various compartments of the heater, the air being either driven through the heater by way of the inlet opening h^1 or drawn through the said heater from the outlet duct h^2.

The air circulating upwardly and downwardly through the heater is directed or deflected on to the portions of the heated pipe or tube extending across the successive compartments by means of baffle plates which are adapted to offer a minimum amount of resistance to the stream of air and to expose the latter to a maximum amount of radiation surface. The said baffle plates are arranged inside the compartments c^1, c^2 and c^3 at the sides of the casing or tank *a* as shown at k^1, k^2 and k^3 in Figures 3, 4 and 5, the baffle plates k^1 and k^3 in the compartments c^1 and c^3 being curved upwardly away from the casing or tank *a* and the baffle plates k^2 in the compartment c^2 being curved downwardly away from the said casing or tank. The effect of the aforesaid baffle plates is to produce an inward deflection of the stream of air passing through the various compartments of the heater, as indicated by the arrows in Figures 3, 4 and 5, without however retarding the passage of the air or reducing the static head thereof and without producing turbulence in the said compartments.

The heated air leaving the last compartment c^3 flows into the upper chamber d^1 and passes out of the heater by way of the outlet duct h^2.

It will be readily understood that the air entering the inlet compartment of the heater first comes in contact with a spot of greatest heat-intensity and then passes over a cooler spot of gradually decreasing heat-intensity, while the air flowing through the middle compartment comes in contact with spots of progressively increasing heat-intensity; the air entering the last compartment comes in contact again with a spot of greatest heat-intensity and then passes over the additional cooler radiation surface provided by the extended pipe or tube. The alternate progressive heating to which the air is thus subjected, and the high temperature which is produced by the employment of paraffin oil under pressure as the source of heat, enable a varying volume of air to be rapidly and effectively heated to any required temperature ranging over an increase from ten to seventy degrees over atmospheric temperature. Moreover, the arrangement of the hot spots permits of the passage of a comparatively considerable volume of air through the heater, and the provision of the upper chamber permits of a free expansion of the air passing out of the heater, which latter condition is especially desirable in the case of the drying of crops by means of heated air.

While I have hereinbefore described a form of air-heater in accordance with my present invention, I wish it to be understood that I am aware that considerable modifications and alterations may be made in the disposition and arrangement of the various parts constituting the said heater without for that reason departing from the true nature of the said invention.

What I claim is:

1. An air-heater of the type set forth, comprising a chamber partitioned off to form a number of compartments, a sinuous heating pipe disposed transversely in relation to the partition plates forming the various compartments of the heater, said heating pipe traversing the said partition plates and passing across the said compartments successively and repeatedly and comprising a number of substantially straight portions which extend in turn across all the compartments in approximately parallel formation and which are inter-connected alternately in the end compartments by means of suitable bends, thereby forming along each compartment a series of hot spots the heat-intensity whereof progressively decreases and increases alternately in the said compartments.

2. An air-heater comprising in combination, a housing, partitions within said housing extending alternately from opposite sides thereof and dividing said housing into a number of adjacent compartments communicating with each other alternately at the opposite ends thereof, a sinuous heating pipe disposed transversely in relation to the said partitions and comprising a number of substantially straight portions which successively traverse the said partitions and extend across all the compartments in ap-

proximately parallel formation and which are inter-connected alternately in the end compartments by means of suitable bends, means for heating the said sinuous pipe internally at one orifice thereof, and means for causing the air to be heated to circulate through the said compartments in succession, whereby the circulating air comes in successive contact with a series of hot spots the heat-intensity whereof progressively decreases and increases alternately in the said compartments.

3. An air-heater comprising in combination, a housing, partitions within said housing extending alternately from opposite sides thereof and dividing said housing into a number of adjacent compartments communicating with each other alternately at the opposite ends thereof, a sinuous heating pipe disposed transversely in relation to the said partitions and comprising a number of substantially straight portions which successively traverse the said partitions and extend across all the compartments in approximately parallel formation and which are inter-connected alternately in the end compartments by means of suitable bends, an internal chamber which communicates with the last compartment and inside which the said heating pipe is extended, means for heating the said sinuous pipe internally at one orifice thereof, and means for causing the air to be heated to circulate through the said compartments in succession, whereby the circulating air comes in successive contact with a series of hot spots the heat-intensity whereof progressively decreases and increases alternately in the said compartments.

4. An air-heater comprising in combination, a housing, partitions within said housing extending alternately from opposite sides thereof and dividing said housing into a number of adjacent compartments communicating with each other alternately at the opposite ends thereof, a sinuous heating pipe disposed transversely in relation to the said partitions and comprising a number of substantially straight portions which successively traverse the said partitions and extend across all the compartments in approximately parallel formation and which are inter-connected alternately in the end compartments by means of suitable bends, an internal chamber which communicates with the last compartment and inside which the said heating pipe is extended, means for heating the said sinuous pipe internally at the orifice thereof situated in the first compartment, an air-inlet duct formed in the said first compartment, an air-outlet duct formed in the said internal chamber, and means for causing the air to be heated to circulate through the said compartments in succession by way of the said inlet and outlet ducts, whereby the circulating air comes in successive contact with a series of hot spots the heat-intensity whereof progressively decreases and increases alternately in the said compartments.

5. An air-heater comprising in combination, a housing, partitions within said housing extending alternately from opposite sides thereof and dividing said housing into a number of adjacent compartments communicating with each other alternately at the opposite ends thereof, a sinuous heating pipe disposed transversely in relation to the said partitions and comprising a number of substantially straight portions which successively traverse the said partitions and extend across all the compartments in approximately parallel formation and which are interconnected alternately in the end compartments by means of suitable bends, a burner supplied with paraffin oil under pressure for heating the said sinuous pipe internally at one orifice thereof, a damper for regulating the draught of heating gases through the said sinuous pipe provided at the other orifice thereof, and means for causing the air to be heated to circulate through the said compartments in succession, whereby the circulating air comes in successive contact with a series of hot spots the heat-intensity whereof progressively decreases and increases alternately in the said compartments.

6. An air-heater comprising in combination, a housing, partitions within said housing extending alternately from opposite sides thereof and dividing said housing into a number of adjacent compartments communicating with each other alternately at the opposite ends thereof, a sinuous heating pipe disposed transversely in relation to the said partitions and comprising a number of substantially straight portions which successively traverse the said partitions and extend across all the compartments in approximately parallel formation and which are inter-connected alternately in the end compartments by means of suitable bends, means for heating the said sinuous pipe internally at one orifice thereof, means for causing the air to be heated to circulate through the said compartments in succession, and baffle plates located at the sides of the said compartments and curving away therefrom alternately in opposite directions in the successive compartments, whereby the circulating air comes in successive contact with and is directed onto a series of hot spots the heat-intensity whereof progressively decreases and increases alternately in the said compartments.

7. An air-heater comprising in combination, a housing, partitions within said housing extending alternately from opposite sides thereof and dividing said housing into a number of adjacent compartments communicating with each other alternately at the op-

posite ends thereof, a sinuous heating pipe disposed transversely in relation to the said partitions and comprising a number of substantially straight portions which successively traverse the said partitions and extend across all the compartments in approximately parallel formation and which are interconnected alternately in the end compartments by means of suitable bends, an internal chamber which communicates with the last compartment and inside which the said heating pipe is extended, a burner supplied with paraffin oil under pressure for heating the said sinuous pipe internally at the orifice thereof situated in the first compartment, a damper for regulating the draught of heating gases through the said sinuous pipe provided at the other orifice thereof, an air-inlet duct formed in the said first compartment, an air-outlet duct formed in the said internal chamber, means for causing the air to be heated to circulate through the said compartments in succession by way of the said inlet and outlet ducts, and baffle plates located at the sides of the said compartments and curving away therefrom alternately in opposite directions in the successive compartments, whereby the circulating air comes in successive contact with and is directed onto a series of hot spots the heat-intensity whereof progressively decreases and increases alternately in the said compartments.

In testimony whereof I have signed my name to this specification this fourteenth day of February, 1925.

BRYNAR JAMES OWEN.