No. 751,136. PATENTED FEB. 2, 1904.

E. W. ANTHONY.

HOT AIR FURNACE.

NO MODEL. APPLICATION FILED FEB. 7, 1903. 4 SHEETS—SHEET 1.

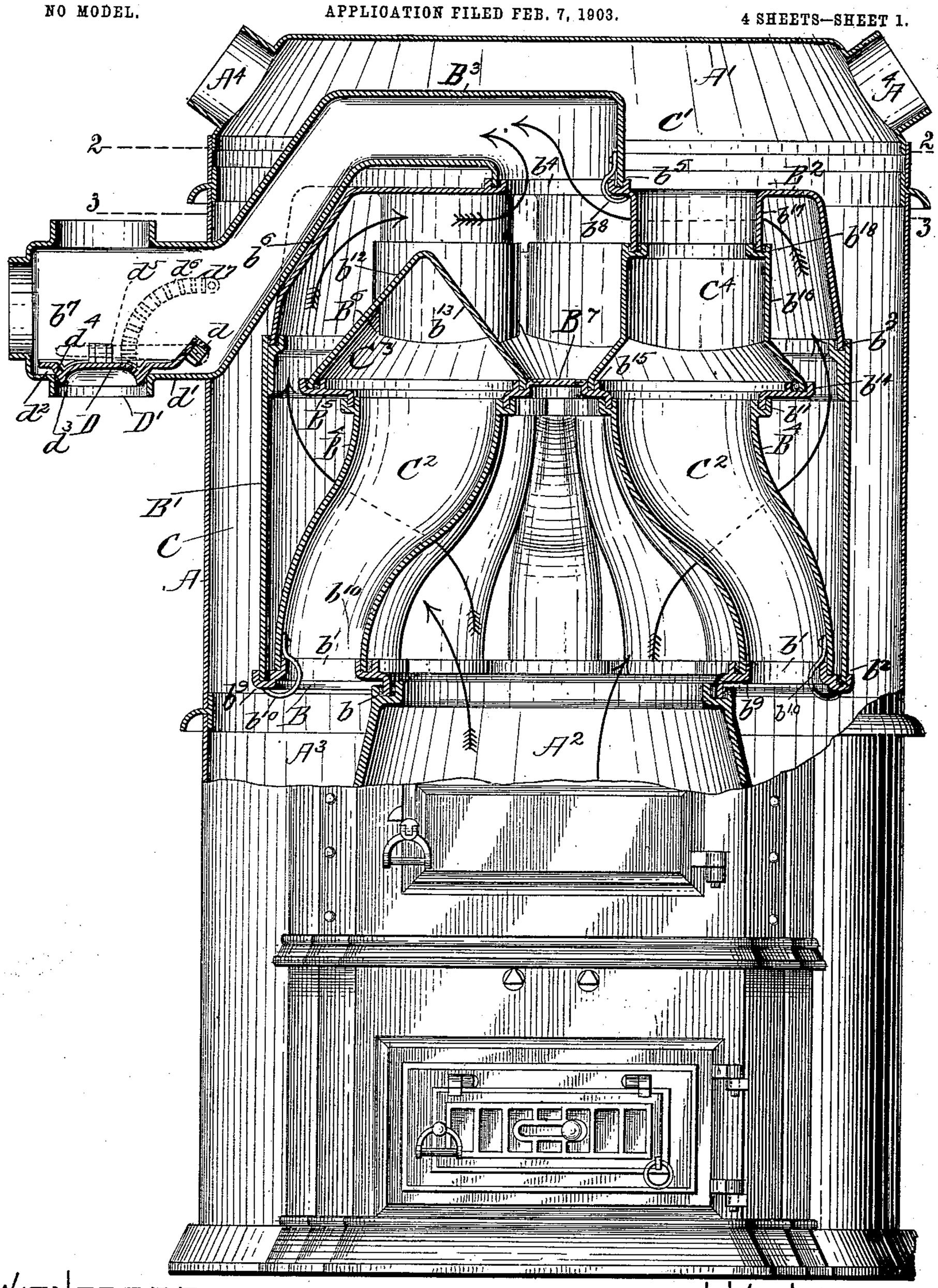

Fig. 1.

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NO MODEL. 4 SHEETS—SHEET 2.

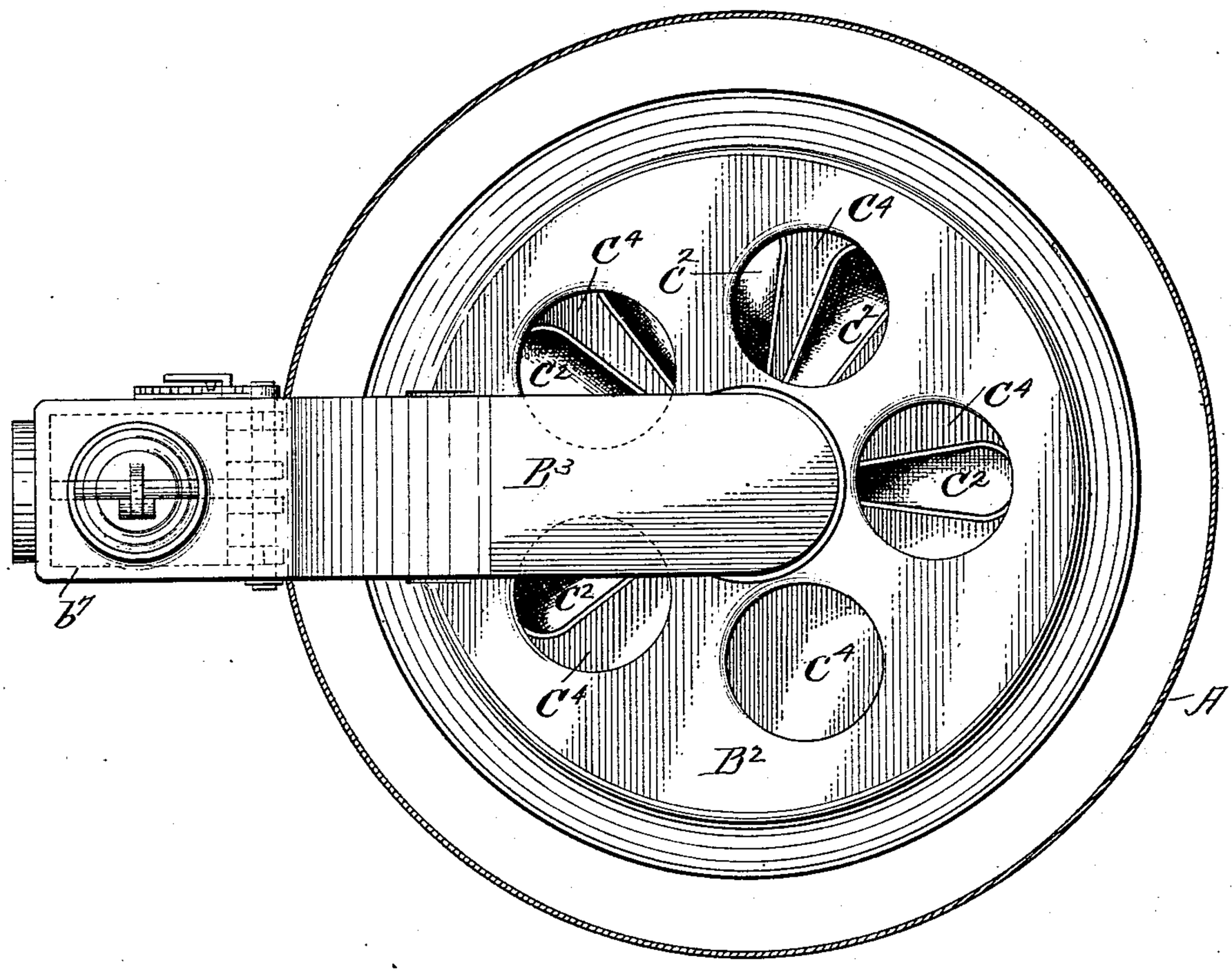

Fig. 2.

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NO MODEL. 4 SHEETS—SHEET 3.

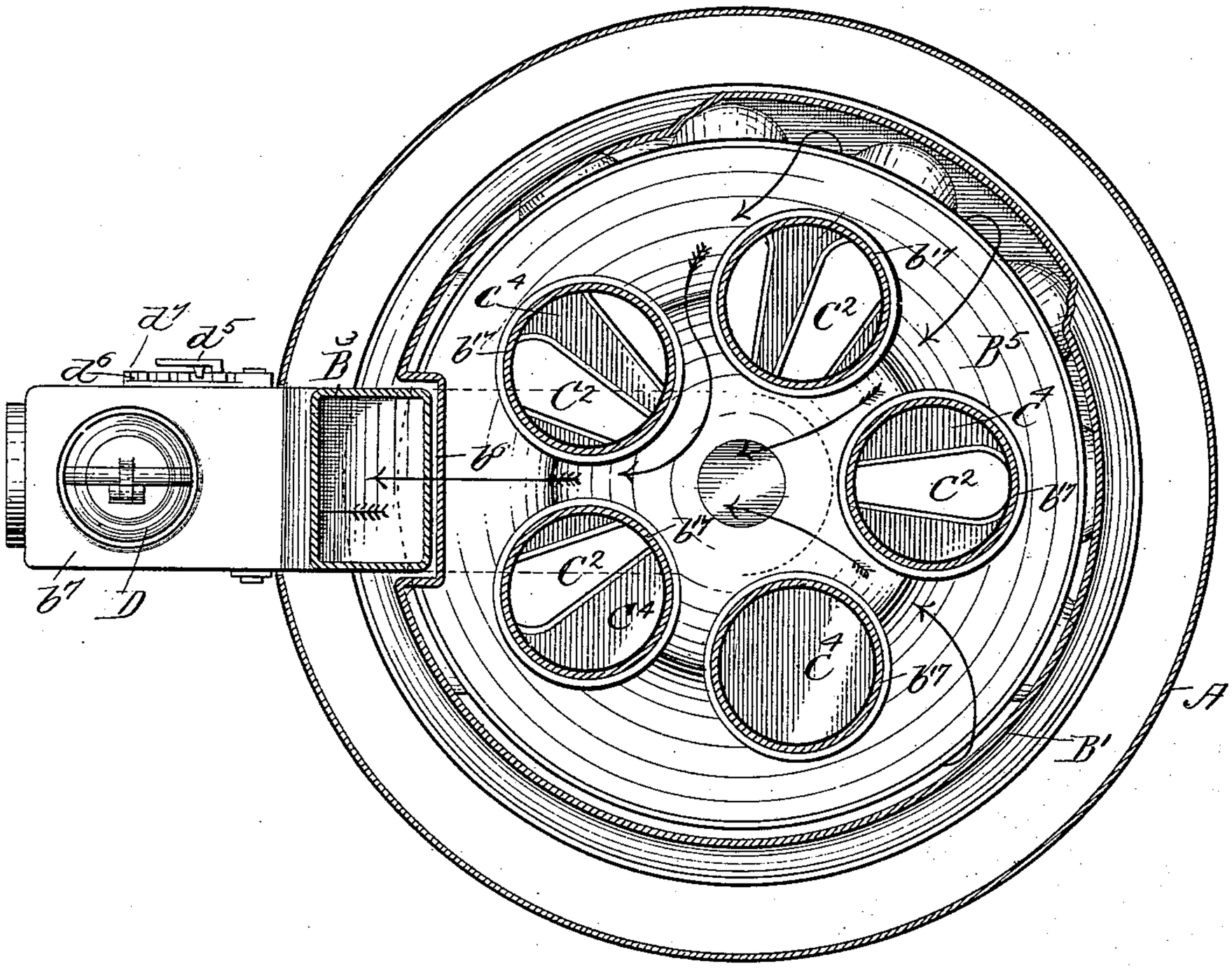

Fig. 3.

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NO MODEL. 4 SHEETS—SHEET 4.

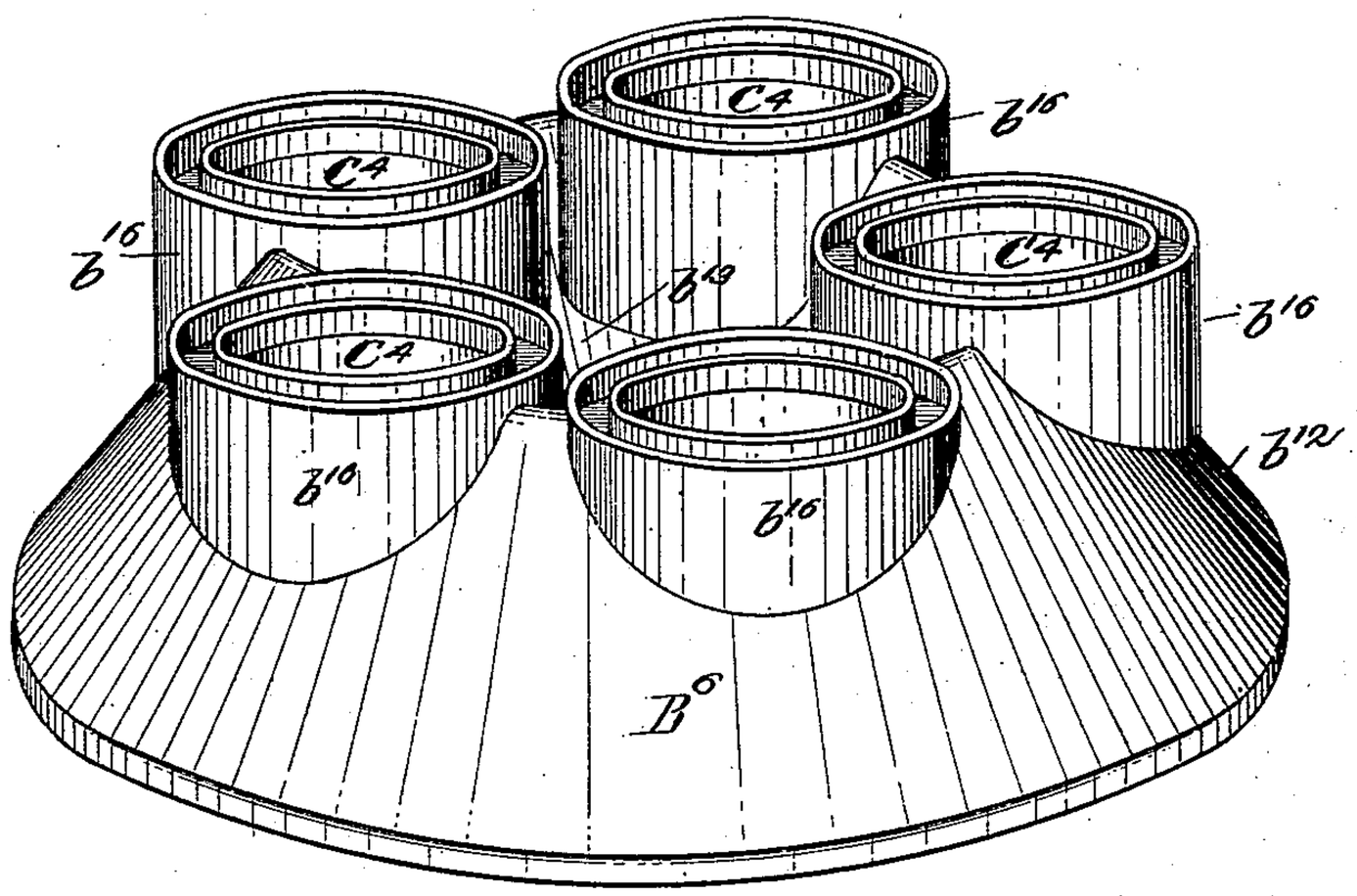

Fig. 4.

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No. 751,136. Patented February 2, 1904.

UNITED STATES PATENT OFFICE.

EDGAR W. ANTHONY, OF BROOKLINE, MASSACHUSETTS.

HOT-AIR FURNACE.

SPECIFICATION forming part of Letters Patent No. 751,136, dated February 2, 1904.

Application filed February 7, 1903. Serial No. 142,431. (No model.)

To all whom it may concern:

Be it known that I, EDGAR W. ANTHONY, a citizen of the United States, and a resident of Brookline, in the county of Norfolk and State of Massachusetts, have invented a new and useful Improvement in Hot-Air Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

My invention relates to an improved hot-air furnace.

It is especially desirable in the construction of a hot-air furnace that as large an amount of radiating-surface as possible be presented to the currents of air flowing through its various passages. It is also desirable that the walls forming these radiating-surfaces have such an arrangement within the combustion-chamber or placement relatively thereto that they will be acted upon as quickly as possible by the heat rising from the products of combustion or before it has lost its intensity by long-continued flow. There should also be a uniformity in the arrangement of these radiating-walls in order that the products of combustion may best be utilized. The passages which they form and through which the currents of air flow should be distributed in uniform order throughout or relative to the combustion-chamber that the heat rising therein and filling the chamber may act evenly upon the walls forming these passages and so heat the air flowing within them. It is also desirable that the flow of heat be as direct and free as possible to the smoke or exit pipe of the furnace, so tending to make a good circulation by cutting out chambers or flue-passages where dead air might accumulate. Still the flow of heat should not be too quick lest its intensity be lost, but should rather be retarded to flow slowly along the radiating-surfaces. Another very important feature in furnace construction is that the flue-passages for the products of combustion be such that they are not clogged with soot. Many good heaters of large radiating-surface have been short-lived and condemned because of the impossibility of cleaning them after a season's use. The construction of the furnace should also be such that the danger of gas leaking or the entry of dust into the air-passages be entirely eliminated.

My invention consists, therefore, in an improved means for presenting as large an amount of heat-radiating surface as possible to heat the currents of air flowing through the passages which they tend to form; in such an arrangement of the walls and passages that they will be quickly acted upon by the heat of combustion and with a directness and uniformity of application; in such placement of the parts that the flue-passages for the products of combustion will mold the heat to flow with a direct instead of an indirect course to the smoke-pipe, still with placement such as to retard the flow, so that it will rather pass slowly than flow quickly, thus tending to better obtain, direct, and utilize the circulation of heat from the products of combustion; in such placement of the parts that the said flue-passages will be practically self-cleaning from soot, and in a method of jointure of the parts tending to prevent the entry of gas or dust into the air-passages, which method of jointure also permits of an adjustment of the upper parts of the furnace and smoke-pipe, as will hereinafter be shown.

My invention pertains also to other features which tend to the betterment of the furnace, but which, with the features before referred to, can best be seen and understood by reference to the drawings forming a part of this specification, wherein—

Figure 1 represents the furnace partly in elevation and partly in vertical cross-section. Fig. 2 shows a cross-section on the line 2 2 of Fig. 1. Fig. 3 shows a cross-section on the line 3 3 of Fig. 1. Fig. 4 shows in plan a feature of my improved structure to which special reference will hereinafter be made.

Referring to the drawings, A represents the exterior shell of the furnace, having the cap or dome A'. A^2 represents the fire-pot. A^3 represents the cold-air chamber extending around on the sides and back of the fire-pot and which makes connection with the source of cold-air supply, while A^4 represents the various exit-passages leading from the dome of the furnace for the distribution of hot air,

the air of course being heated by the products of combustion as it rises from the cold-air chamber toward the dome of the furnace. These features present no peculiarities of construction or method of arrangement, but as features common to furnaces are referred to to show the relative relation of the new parts and arrangement of the parts constituting my invention. This primarily consists in a new way of forming the interior of the furnace above the fire-pot or for so directing the air rising from the cold-air chamber through the chambers and passages that it can best be acted upon by the heat rising from the products of combustion. The means by which this is done are as follows:

B represents an annular plate encircling the top edge of the fire-pot, to which it is secured by the cup jointure b, to extend out on all sides flange-like. The plate B has cut through it all around the circular openings b'. These openings are cut at uniform distances from each other. From the top edge of the fire-pot the extension of the plate B is such that it will leave a comparatively narrow annular space between its outer edge and the exterior shell of the furnace. This formation and disposition of the plate B is to be specially noted in the fact that it breaks the cold air rising from the cold-air chamber to course up within the furnace through a variety of passages, which include the annular passage which extends up from beyond the outer edge of said plate between it and the exterior shell of the furnace and those which connect with the circular openings formed in the plate B and which pass up within the furnace to make connections, as will hereinafter be shown. The parts forming the walls of these several air-passages or flue are built upon the plate B as a superstructure. For the annular passage C, through which the air courses up in a comparatively thin blanket all around the furnace and which is formed on the outside by the exterior shell of the furnace, there is provided for its inside wall the tubular shell B′, supplemented by the top or crown sheet B^2. The tubular shell B′ rises upon the annular plate B along its outer edge and with which it makes a cup jointure b^2 all around, and the top or crown sheet B^2 fits on top of the shell B′, making a cup jointure b^3 all around its upper edge. The tubular shell B′ extends up on lines parallel with the exterior shell A of the furnace, but the side wall of the crown-sheet converges in slightly. The crown-sheet is formed substantially as represented, and its extension is such that its top plate is somewhat removed from the dome of the furnace, whereby there is formed the hot-air chamber C′. There is therefore formed by the construction just described the shell-like structure which on the one side confines the heat and products of combustion and upon the other provides the annular air-passage C, broadening out the top into the chamber C′, with points of exit out through the distributing-passage A^4, as before referred to. An opening b^4 is cut through the center of the crown-sheet B^2, and through its opening as a mouth the products of combustion pass up through the smoke or exit pipe B^3, the inner end of which is formed to make a cup jointure with the crown-sheet at the point b^5 around the opening b^4 cut therein, and then extends laterally, in part, through the air-chamber C′ and is inclined downward to lie alongside the wall of the crown-sheet within the groove or recess b^6 formed therein by its casting, and then proceeds laterally to a point of egress cut through the side of the furnace. The placement of the smoke-pipe is such as to enable the furnace to be placed in comparatively low confined places. By its placement also the pipe avoids interference with other necessary parts and its end is formed into an integral box-like structure b^7, carrying the means for draft regulation, which is readily accessible to a direct hand operation. The smoke-pipe is also worthy of mention in the fact that it is made integral throughout, which eliminates the danger of gas escaping, which it might do if the pipe were made jointed. By the smoke-pipe resting within the recess b^6, as aforesaid, it is held against any lateral displacement, and in this connection the hook b^8 is to be noted as furthering the retention of the pipe, for with its shank fastened inside the wall of the smoke-pipe approximately at its inner end where it makes the jointure with the crown-sheet and by its hook part fastening down beneath the edge of the opening cut in said sheet it tends to hold the smoke-pipe in place, counteracting its tendency to become overbalanced and so displaced by reason of its lateral extension.

As supplementary to the passages and chambers just described there are provided the air-passages C^2, which lead up from the cold-air chamber through the plate B and are formed by the pipes or flues B^4 to course up inside the furnace to the common air-chamber C^3, which connects with the chamber C′, as will hereinafter be explained. The pipes or flues B^4 have such placement as to continue the wall of the openings formed through the annular plate B that they may direct the air-currents passing through them. They accordingly are fitted to the plate by a cup jointure b^9 about the openings, to which each pipe corresponds. The pipes B^4 are of peculiar formation. At their base they are circular in form, but as they extend up they converge in over the fire-pot A, which, with the pipes being placed comparatively near together at their base and in order to retain the same relative area throughout, necessitates that they be flattened or become of a more oval formation as they extend up until at their tops they are substantially of the for-

mation shown in Figs. 2 and 3. The pipes also are placed or come very near together as they extend up. The pipes are held locked in place at their base by the hooks b^{10}, which in kind and function are like the hook b^8, which holds the smoke-pipe in place, as before explained. They also counteract the normal tendency of the pipes to displacement by reason of their converging posture. The tops of the pipes B^4 are held supported in place by the annular plate B^5, with which each pipe along its upper edge makes a cup jointure b^{11} and with a placement such that the passages C^2 through the several pipes may be continued through openings cut through the plate B and into the chamber C^3. The chamber C^3 is formed by combining the dome-like casting B^6 with the annular pipe-supporting plate B^5. The casting B^6 is formed substantially as shown in Fig. 4. It has an annular dome-like structure, and the inclination of its exterior wall b^{12} and interior wall b^{13} is to be noted, especially when the casting is combined with the annular plate B^5, which it is by the edge of its exterior wall b^{12}, which fits upon the plate B^5 along and around its outer edge and makes a cup jointure b^{14} therewith, while the inner wall of the casting B^6 fits along its edge around the inner circular edge of the plate B^5 and makes a cup jointure therewith, b^{15}. The air-chamber C^3 has communication with the air-chamber C' by means of a plurality of passages C^4. These passages are obtained by a plurality of openings cut through the dome of the casting B^6 and up through the crown or top sheet B^2, before referred to as forming the bottom wall of the chamber C', and the passages are formed by pipe connections provided by the pipe-sections b^{16}, cast integral with the plate B^6, extending up and connecting with the pipe-sections b^{17}, which extend down from the crown or top sheet B^2 and are cast integral therewith, the pipe-sections where they come together making a cup jointure b^{18}.

At B^7 there is shown a small circular cover which fills the central opening left by the annular formation of the plate B^5. This is removable for purposes which will hereinafter be explained.

With such placement and relative arrangement of the parts the heat and products of combustion would be inclosed in a chamber, as it were, on all sides above the fire-pot, and the flow would be directed around and between the pipes forming the air-passages leading to the interior hot-air chamber and along beneath the bottom of said chamber, thence up alongside the tubular wall forming said annular passage, thence between the walls to the upper and interior air-chambers and around and between the pipes connecting said chambers to the central outlet formed in the bottom wall of the upper air-chamber, from whence it would be carried away by the smoke or exit pipe extending laterally. The rays of heat therefore would act upon the pipes B^4, serving as radiators to the air-currents passing through them on all sides throughout their lengths. The oval formation of the pipes as they extend up would also tend to the better heating of the air within them, for the oval formation of the pipe would mold the air to flow relatively shallow, whereby it would be more susceptible to heat influence. The direct application of heat to these pipes is also to be noted in the fact that converging in, as they do, over the fire-pot they would be exposed to the direct rays of heat when at its greatest intensity. The annular plate B^5, acting as a bottom radiating-wall to the air-chamber C^3, would also receive the heat directly, especially when the latter flowed between the pipes B^4 to course up through the annular passage C. In this connection the placement of the pipes B^4 is to be noted in the fact that they are placed uniformly all around the fire-pot to receive the heat as it emanates therefrom on all sides. Then they are placed relatively near together, with the spacing between them lessening as the pipes extend up, as before explained, which would tend to so mold the rays of heat flowing between them that they would be applied to the plate B′, acting as a radiator to the currents of air passing through the annular passage B^3 all over its interior surface from the base up. The annular plate B^5, extending out as it does to leave but a comparatively narrow passage between its outer edge and the shell B′, would tend to retard the upward flow of heat, so storing it, as it were, in the combustion-chamber, whereby its effect upon the radiating-walls would better be utilized. Continuing the heat passes up between the crown-sheet B^2 and the annular casting B^6, where it would heat the air confined in the upper portion of the passage C and that confined in the chamber C' on the one side and on the other it would heat the air confined in the chamber C^3 by its action upon the wall B^6 acting as a radiating-surface. In point of fact the chamber C^3 would be heated on all sides. The currents of air passing up from the air-chamber C^3 to the chamber C' would also be heated, for, as before explained, the passage of the heat is around and between the pipes, which serve as radiating-walls to these air-passages. Even the disposition of the smoke-pipe would tend to utilize the heat flowing through it, for extending laterally through the chamber C', as it does, the heat passing through it would tend to heat the air confined in said chamber.

By such a construction practically all the heat from the products of combustion is utilized. The heat is also supplied to the heating-surfaces with a directness and uniformity of application, while the heating-surfaces in turn heat the currents of air divided to flow in relatively small volumes, which coördination is attended with the best results. The

uniformity of heat distribution is primarily obtained, because all the products of combustion are drawn to the central outlet at the center of the top of the furnace, from which outlet the heat products are led away through the smoke-pipe, as before described. The central disposition of the outlet permits also of the uniform disposition of the radiating-walls, particularly those forming the interior air-chamber and its connecting air-passages. It is also to be noted that the heat products pass directly from the fire-pot to the central outlet and the smoke-pipe connected with it, whereby there is obtained a perfect circulation through the furnace, which circulation is not too rapid, lest the effect of the heat be lost, but is retarded by the disposition of the radiating-walls, as before referred to, and which retardation is supplemented by the outlet-passage itself, which is of relatively small area, and so prevents the heat passing away through the smoke-pipe too fast. The directness of circulation, however, prevents any tendency to stagnation.

Another feature consists in the aptitude of construction for preventing the accumulation of soot. Following the course of the products of combustion, it is to be noted that the flow for the most part is over inclined surfaces on which soot could hardly collect, so that the flue-surfaces are practically self-cleaning. Any deposit of soot which might accumulate in the conical recess formed by the inside converging wall of the annular chamber B^6 could readily be removed through the trap or cover B^7, formed through the plate B^5, as before explained.

Another feature of construction consists in the combination of all the separate parts by means of a system of cup-jointure, the joints being formed deep, so as to be filled with sand, putty, or like substance, whereby any danger from the leakage of gas or the escape of dust into the air-passages is entirely eliminated. The method of cup-jointure is also noteworthy as furnishing a means of connection which permits of the rotation of the member B^2 relatively to the member B' and the member or part B^6 relatively to the member B^5. As previously explained, the top or crown sheet B^2 is made circular in form, and it rests upon the top edge of the tubular shell B', so that with suitable means of jointure, which is provided by the cup-jointure b^3, a circular bearing is obtained and the member B^2 is capable of rotation. It is the same with the member B^6. Its cup-jointures b^{14} and b^{15} along the outer and inner edges of the annular plate B^5 form suitable circular bearings, permitting of rotation. The members B^2 and B^6 will rotate together by reason of their pipe connection, as before explained, and their rotation will permit of or be accompanied by the rotary movement of the smoke or exit pipe B^3, with the advantage that in whatever way the furnace may face the smoke-pipe can be removed in any direction to a position where the best pipe connection can be made. By the rotation of the parts B^2 B^6 also the position of the passages C^4, connecting the said chamber C' and C^3, can also be changed, whereby a pipe connection might easily be made with any of the hot-air-distributing pipes A^4, and in this connection it is to be noted that considerable difficulty has often been had with furnaces owing to the more direct connection that some pipes have over others or by reason of atmospheric conditions some rooms are very hard to heat. Any difficulty of this kind might be obviated or at least lessened by putting the hot-air-distributing pipes into direct communication with the inside heat-passages, so that they might lead directly into the distributing-pipes, and so the heat and circulation made positive for the rooms with which the distributing-pipes connect. Accordingly the rotative capability of the upper part of the furnace would facilitate any such pipe communication, if such were used.

Another feature and one which tends to the betterment of the furnace is the improved disposition of the damper D, placed in the end of the smoke-pipe and which tends to regulate the draft to the furnace by controlling the passage of said pipe, and simultaneously a cold-air inlet D', entering into the same. The cold-air inlet, it is to be noted, is formed in the bottom wall of the box formed in the end of the smoke-pipe, and the pipe-damper is pivoted to turn down to close it. This type of damper is common, so no special mention is made of its mode of operation. Now one very natural disadvantage in the ordinary construction is that by reason of the accumulation of soot the damper cannot turn down tight to close the cold-air inlet, as occasion might require. The soot lodges all around the inlet on the seat the damper would take, especially if it were fitted to close down flat. The soot also tends to cramp the damper at its pivot of turning. Any difficulty of this kind is entirely eliminated by so pivoting the damper at the point d that it will not fit down close on the bottom of the box at d', surrounding the cold-air inlet, but will be removed from the same, so leaving a space d^2 in which soot might accumulate and still cause no injury. There thus is provided on the bottom of the damper the flange d^3, which fits all around the edge of the cold-air inlet as a seat, tightly closing the inlet when the damper is shut down, and it is especially to be noted that the flange d^2 closes down on its seat with a beveled edge d^4 and a practically side contact, so that it would be impossible for the soot to accumulate so as to interfere with its proper closure. It is also to be noted that the point d,

where the damper is pivoted, is removed some distance away from the bottom wall of the pipe, which not only prevents the damper being cramped by any accumulation of soot as it is turned, but also facilitates its even closure. The pivoting of the damper is accomplished by means of the handle d^5 fitting into slots d^6, formed in the segment d^7, the handle fitting into any of the slots, depending upon the degree of the damper's opening or closure. These latter features to which I have referred, however, for controlling the damper show no special novelty of construction.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States—

1. In a furnace or heater of the character specified, walls disposed to form a combustion-chamber, having in combination therewith, upon the inside of said combustion-chamber, a plurality of independent, hot-air pipes B^4 curving upwardly and inwardly and arranged as specified, a plate for supporting said pipes, having holes formed therein in continuation of their hot-air passages, a dome-like casting fitting upon said plate to form an internal hot-air chamber, and pipe connections leading from said casting to connect with the upper wall of the combustion-chamber to form hot-air passages leading from said internal chamber through the upper wall of said combustion-chamber.

2. In a furnace or heater of the character specified, the combination with walls forming a combustion-chamber of a series of internal hot-air passages, a relatively flat plate B^5 for holding said pipes in place, a dome-like casting B^6 having exterior and interior inclined sides b^{12} and b^{13}, respectively, with exterior and interior bearings upon said plate when the members are joined, said casting having also integral pipe-sections forming in part hot-air passages leading from the inside of the internal hot-air chamber formed thereby, pipe connections forming a continuation of said hot-air passages through the upper wall of the combustion-chamber, a smoke-outlet and smoke-pipe leading therefrom.

3. In a furnace or heater of the character specified, the combination with walls forming a combustion-chamber of a series of independent, hot-air pipes contained therein, which pipes, placed near together, are made rounding at their lower ends and more flattened or oval-shaped as they extend upward to converge in over the fire-pot of the furnace, a flat plate of relatively large diameter for receiving and supporting the tops of said pipes, said plate having holes or openings formed therein to register with or in continuation of the hot-air passages through said pipes, a casting of dome-like character resting upon said plate with inclined edges, having exterior and interior bearing and forming an internal hot-air chamber, and pipe connections forming hot-air passages C^4 leading from said internal hot-air chamber through the top wall of the combustion-chamber.

4. In a furnace or heater of the character specified, the combination with a fire-pot of a plate fixed to extend laterally from the upper edge thereof, the tubular shell B′ surmounted by the top or crown sheet B^2 resting upon said plate and formative of a combustion-chamber having a smoke-outlet disposed centrally through its said top or crown sheet, a smoke-pipe on the outside leading laterally therefrom and upon the inside of said combustion-chamber a series of independent, hot-air pipes mounted upon the said plate and registering with holes cut therein, a relatively wide, flat plate for supporting the upper ends of said independent pipes, said plate having a removable center, a casting with inclined exterior and interior sides, resting upon said plate to form an internal hot-air chamber, and pipe connections forming passages which extend from said internal hot-air chamber through the top or crown sheet B^2 of said combustion-chamber, substantially as described.

5. In a furnace or heater of the character specified, walls disposed to form a combustion-chamber having in combination therewith the interior pipes B^4 forming air-passages, the annular pipe-supporting ring B^5, the annular interior dome-like casting B^6 mounted upon said annular ring and pipe forming connections connecting the said annular dome-like casting B^6 with the upper wall of the combustion-chamber, substantially as described.

6. In a furnace or heater of the character specified, the combination of a series of members forming a cup jointure with each other, the same comprising the annular plate B, fixed to the fire-pot of said furnace to extend laterally therefrom, the tubular shell B′ mounted upon and making cup jointure with said plate, the top or crown sheet B^2 mounted upon and making cup jointure along the top edge of said tubular shell B′, said top or crown sheet having a central smoke outlet or opening b^4, the smoke-pipe B^3 leading therefrom and making cup jointure with said top or crown sheet all around its smoke outlet or opening, the interior hot-air pipes B^4 resting upon said plate B and making cup jointure therewith around openings b' formed therein, a relatively flat, pipe-supporting plate B^5 making cup jointure with the upper ends of said pipes, the casting B^6 resting upon said plate with its inclined sides making exterior and interior cup jointure therewith, said casting having pipe-sections b^{16} making cup jointure with pipe-sections b^{17} of the top or crown sheet aforesaid, substantially as described.

7. In a furnace or heater of the character specified, a lower radiating-wall forming a por-

tion of the inclosure for the combustion-chamber, an upper rotative dome mounted upon the same, said dome having holes or openings formed therein, a structure within the combustion-chamber forming heat-passages extending through the same, which interior structure coöperates with said dome that the heat-passages formed thereby may be extended through the said holes or openings formed therein, and means for forming the upper portion of said interior structure to be rotative with said dome.

8. In a furnace or heater of the character specified, the combination of the tubular wall B′, the upper dome-like wall B^2 mounted upon the top edge of the same, the interior pipes B^4, the annular, pipe-supporting ring B^5, the annular, interior, dome-like casting B^6 mounted upon said annular ring and with interior and exterior bearings, the pipe forming sections connecting the said annular, dome-like casting B^6 with the upper dome-like wall aforesaid, a central opening through said upper dome, and a smoke or exit pipe connecting with said wall B^2 and extending laterally from said opening formed therein, and means whereby the said upper, dome-like wall B^2 and simultaneously the inner, annular, dome-like wall B^6 may be made to turn together with their interposed pipe-sections, substantially as and for the purposes set forth.

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