No. 777,767. PATENTED DEC. 20, 1904.

C. M. AVERY.

CONTINUOUS DRIER FOR BRIQUETS.

APPLICATION FILED JUNE 3, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1

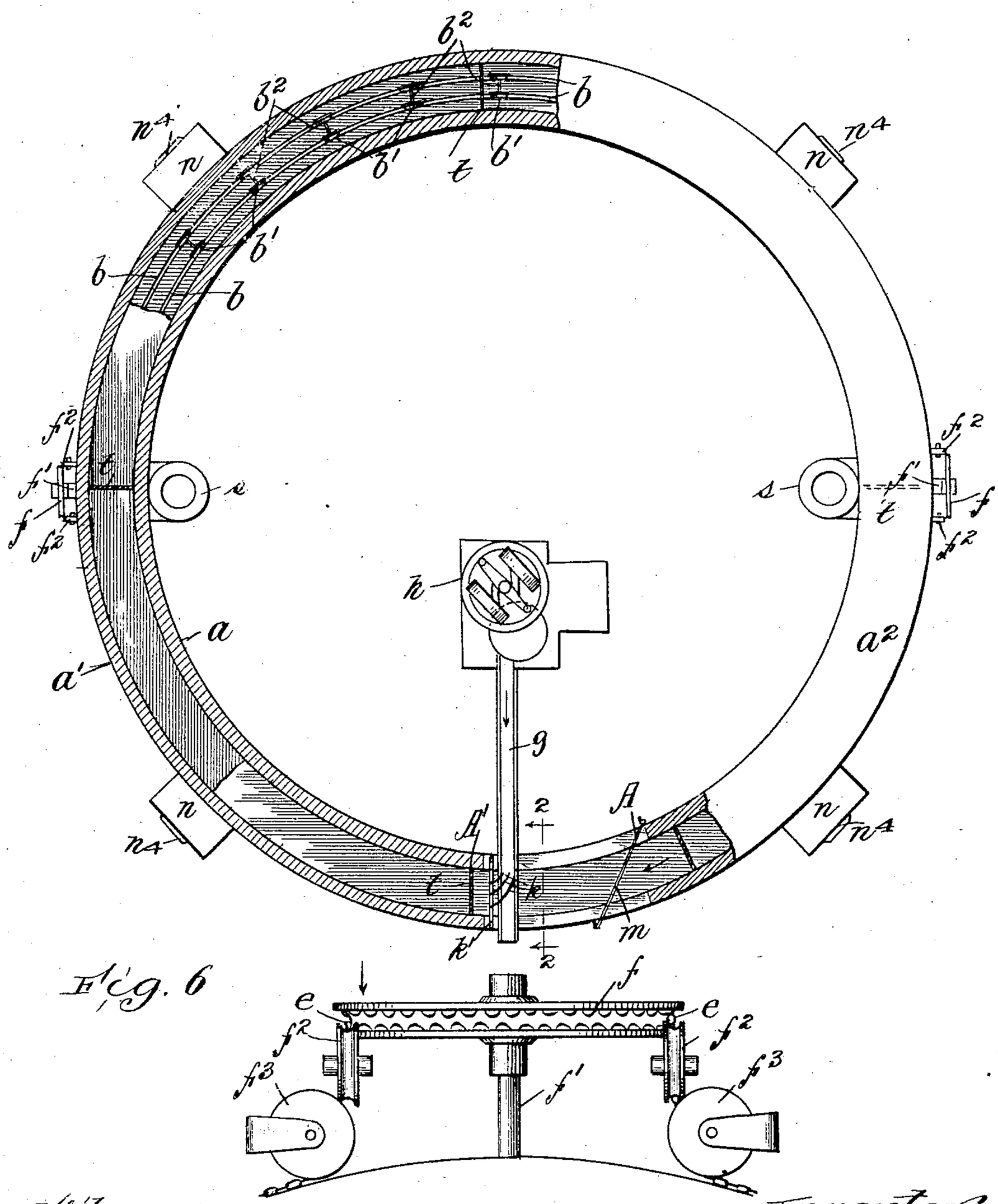

Fig. 6

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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2

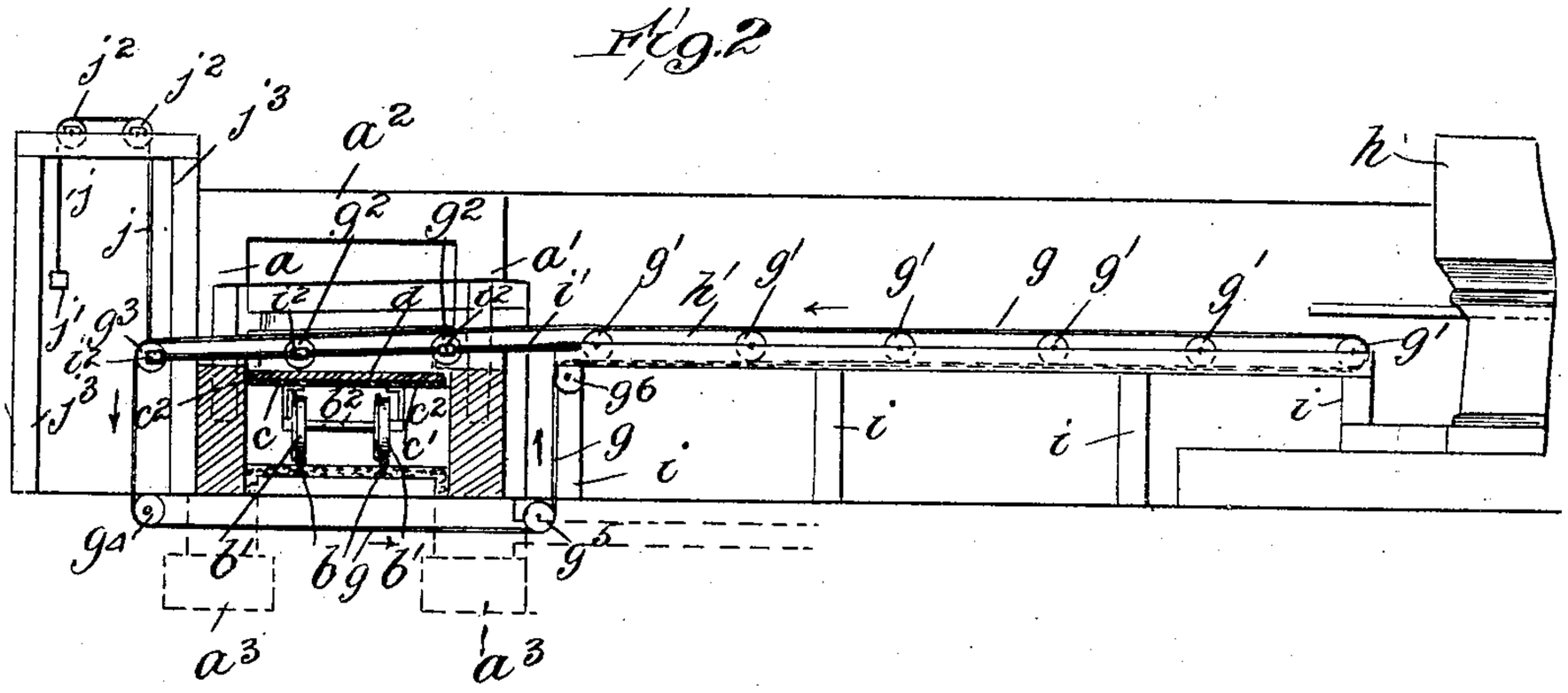


Fig. 3

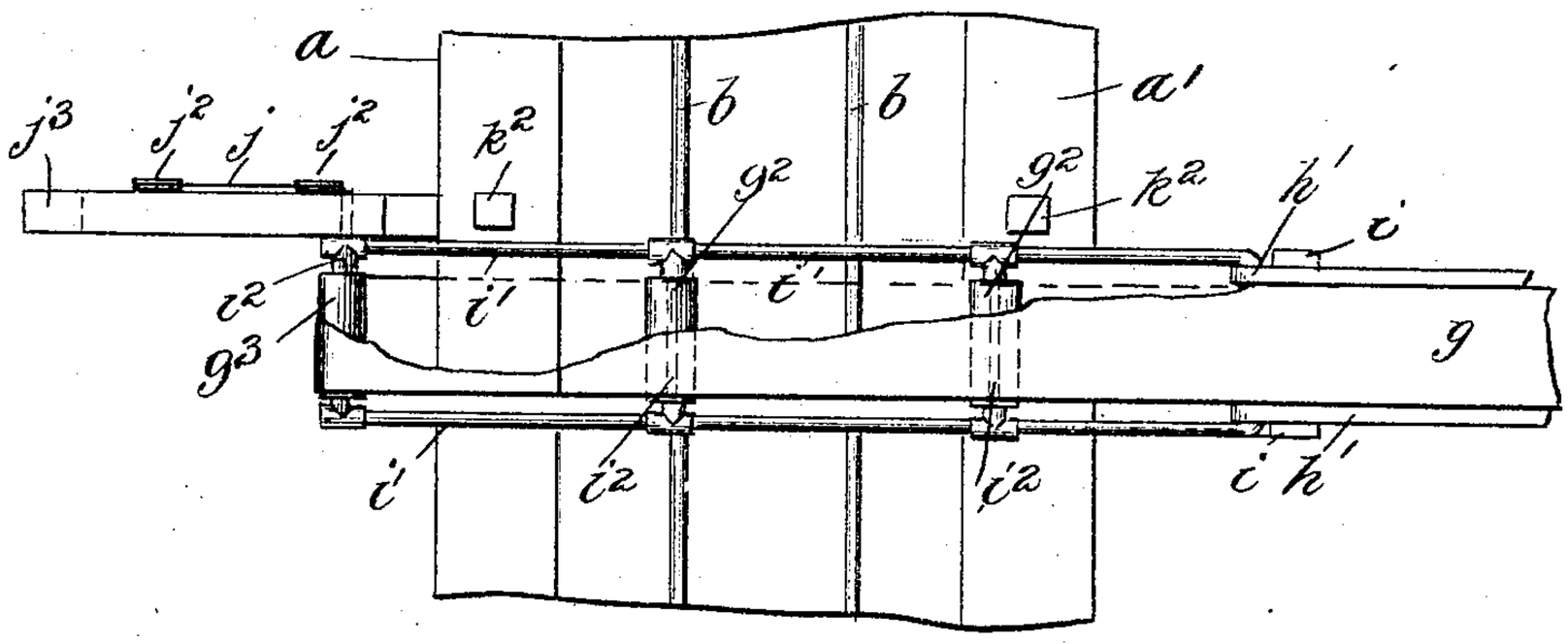
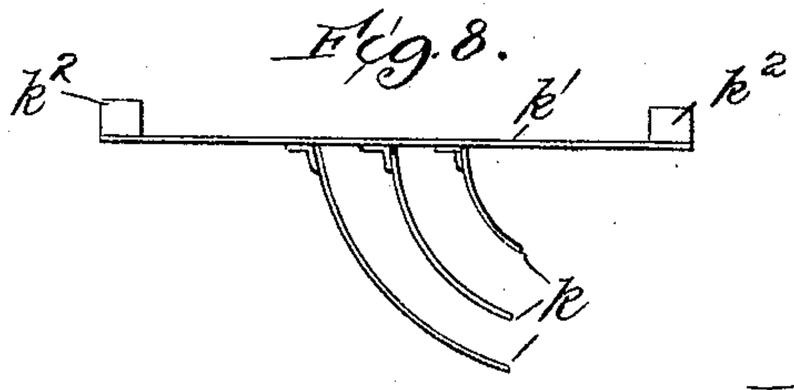


Fig. 8.



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CONTINUOUS DRIER FOR BRIQUETS.

APPLICATION FILED JUNE 3, 1903.

NO MODEL. 4 SHEETS—SHEET 3.

Fig. 4

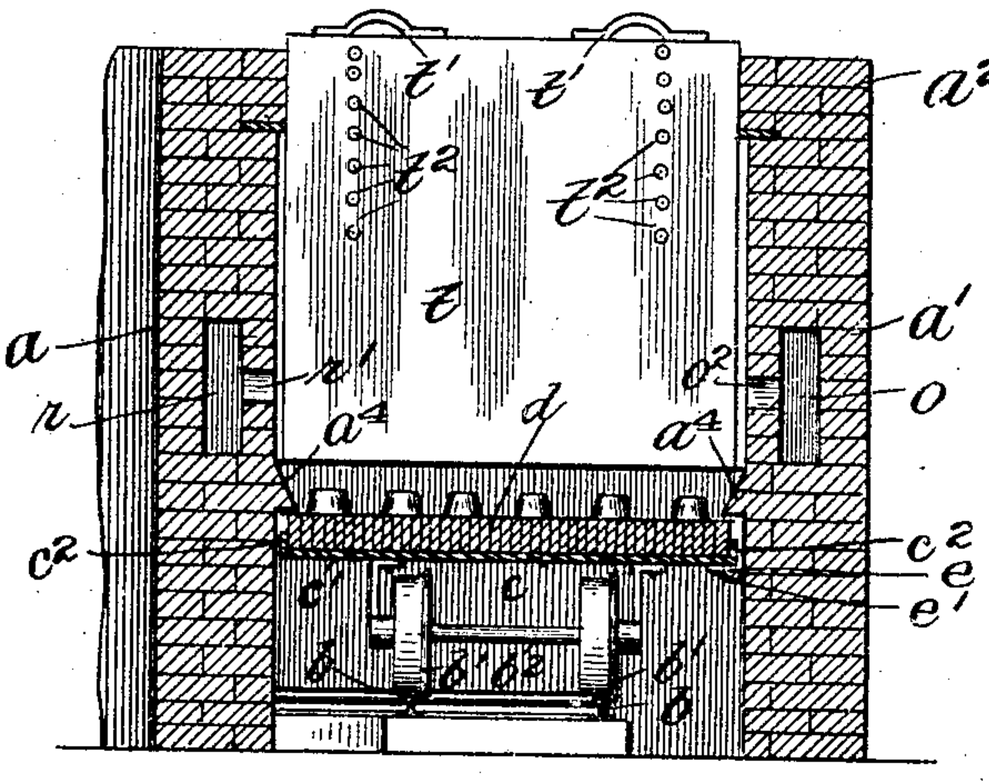


Fig. 5.

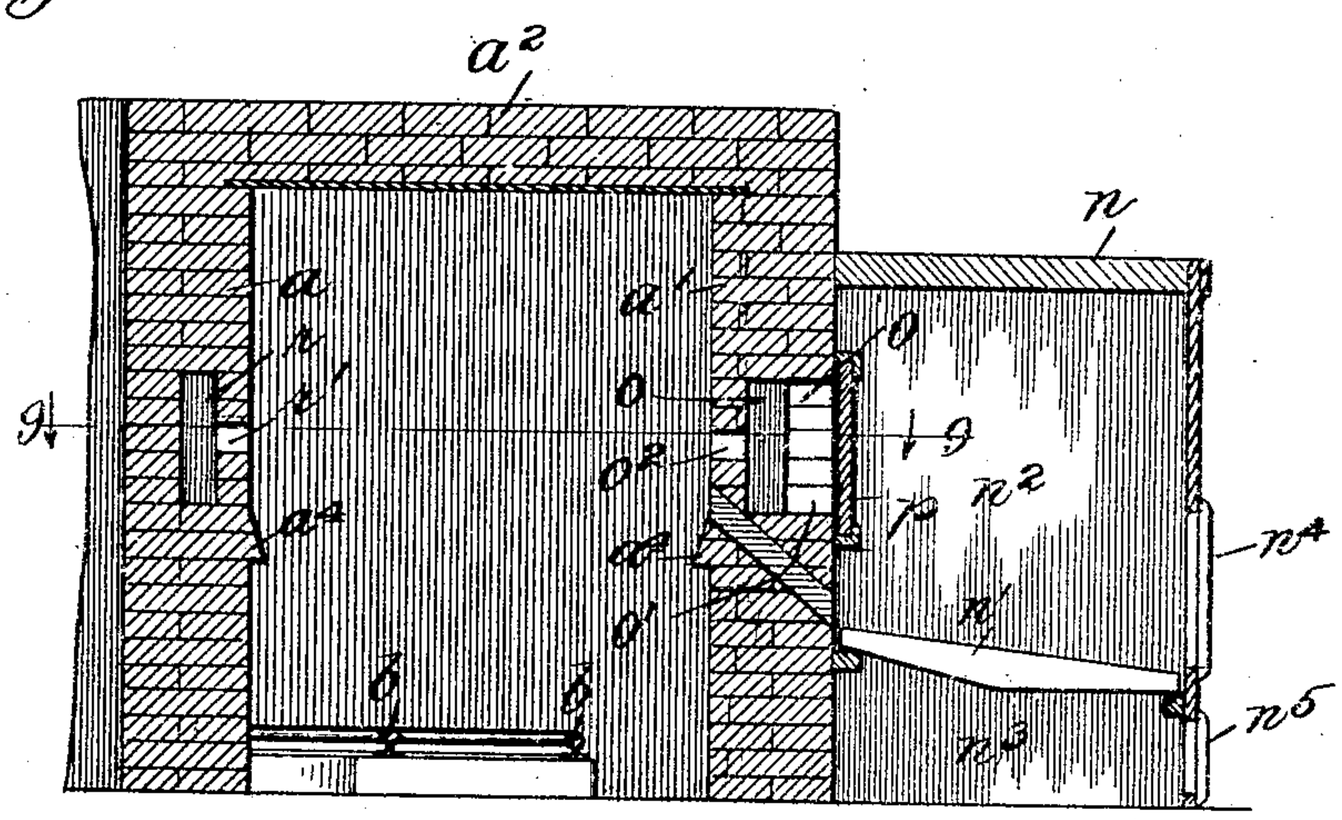
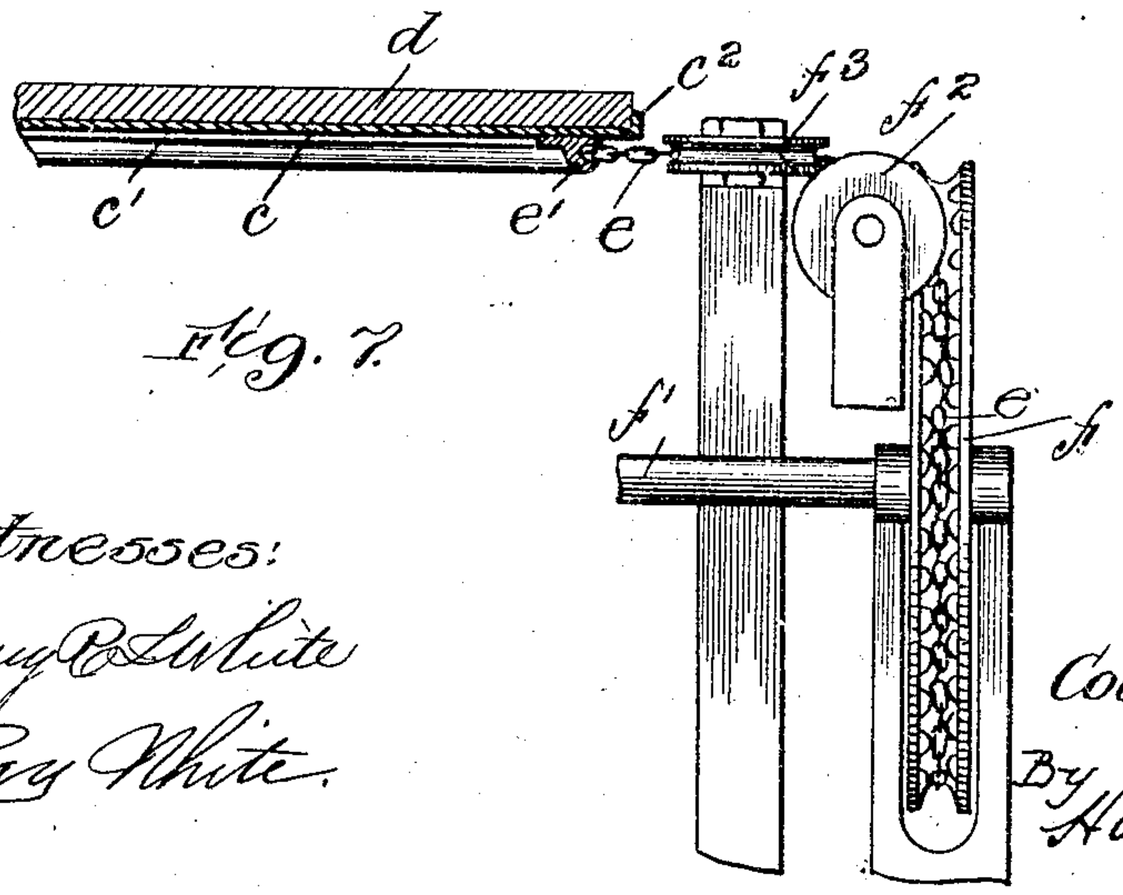


Fig. 7.



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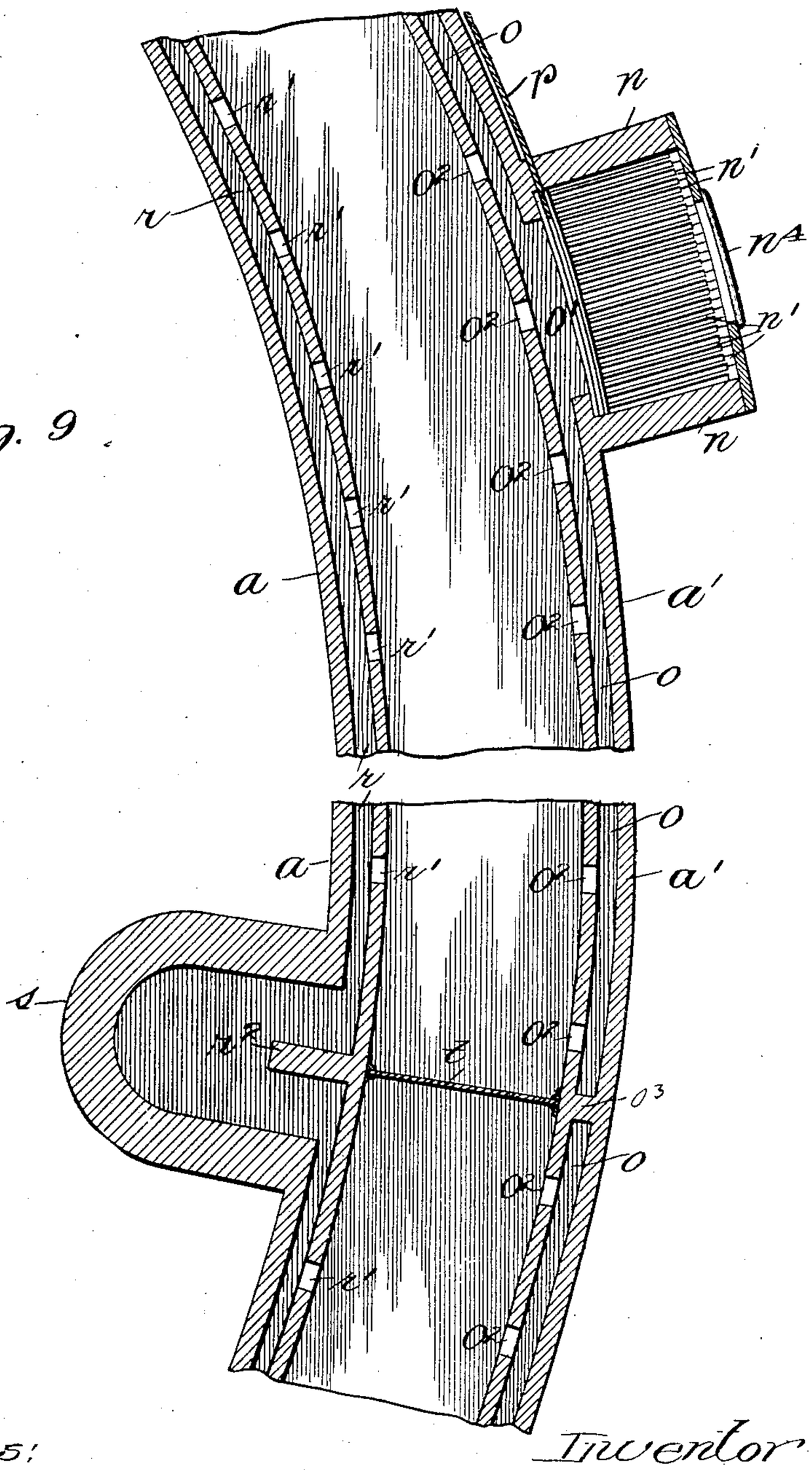
CONTINUOUS DRIER FOR BRIQUETS.

APPLICATION FILED JUNE 3, 1903.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 9.



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UNITED STATES PATENT OFFICE.

COLBY M. AVERY, OF CHICAGO, ILLINOIS, ASSIGNOR TO CHISHOLM, BOYD & WHITE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CONTINUOUS DRIER FOR BRIQUETS.

SPECIFICATION forming part of Letters Patent No. 777,767, dated December 20, 1904.

Application filed June 3, 1903. Serial No. 159,922.

To all whom it may concern:

Be it known that I, COLBY M. AVERY, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Continuous Driers for Briquets, of which the following is a specification.

My invention relates to means for drying and burning material molded into form, and is especially adapted for drying and burning briquets composed of pulverulent ores and smelter flue-dust.

In making briquets of metalliferous substances it is necessary to supply a bond to hold the particles together, and for metallurgical reasons and also on account of expense it is necessary that only a slight proportion of bonding substances be employed. As a result when the briquets formed in this manner are green, they are somewhat fragile and have to be carefully handled in order to prevent breakage and partial disintegration. In order that such briquets may be rendered of sufficient strength and toughness to be practical for use in smelting, they require to be heated and dried, the briquets in the heating and drying process sometimes being raised to a temperature of 200° up to 400° or 500° Fahrenheit.

It is the object of this present invention to provide automatic and continuously-operating means whereby such briquets and other articles molded into form may be handled without undue shock and jar and may be subjected to the proper temperatures for a period of time long enough to render them sufficiently hard and tough. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a general plan view of the drier. Fig. 2 is a fragmentary view in vertical section on the line 2 2, Fig. 1. In this figure is shown the means for conveying the briquets to the drier ring or table. Fig. 3 is a fragmentary plan view showing the conveyer-frame indicated in Fig. 2. Fig. 4 is a vertical sectional view of the housing and drier-table and shows a baffle-curtain in position. Fig. 5 is a vertical sectional view of the housing, taken at one of the furnaces. Fig. 6 is is a plan view of the driving-gear. Fig. 7 is a view of the driving-gear looking in the direction of the arrow, Fig. 6. Fig. 8 is a detail plan view of the plows and plow-bridge, whereby the molded articles are transferred from the conveyer-belt to the drier-table. Said plows and bridge are omitted from Fig. 3 to prevent confusion. Fig. 9 is a fragmentary horizontal sectional view of the housing-walls, showing the flues therein.

Similar letters refer to similar parts throughout the several views.

The housing consists of an annular chamber composed of material adapted to resist heat and has an inner wall a, an outer wall a', and roof a^2. I prefer to construct the housing of ordinary brick lined with firebrick and build the side walls upon foundations a^3 a^3, as indicated in Fig. 2. The roof extends over the major portion of the housing, but is discontinued between the points indicated by the letters A A', Fig. 1, where the briquets or other articles are supplied to and removed from the drier-table hereinafter described. The outside diameter of the housing should be seventy-two feet, more or less, depending upon the capacity which the drier is desired to have. Upon the floor inside of the housings are laid the rails b b, which are concentric with said housing and form a track for the wheels b' of the drier-table c. In order that the wheels may better maintain their position upon the rails, all of the wheel-flanges are located on the outer side of the rails.

Mounted upon the wheel-axles b^2 are the plates c', which form the body or foundation of the drier-table, and consist, preferably, of cast-iron segments bolted together in any suitable manner to form a ring concentric with the drier-housing. In width the plates c' extend completely across the housing from the inner to the outer wall thereof without actually making contact therewith, and in order to impede the passage of air between the edges of the segments and the adjacent walls of the housing a hood or inverted ledge a^4 is

formed on said walls just above the top of the drier-table. At the edges of said plates are the vertical flanges c^2 for retaining in position the fire-bricks d. Said fire-bricks completely cover the upper surface of the segmental plates c' of the drier-table and protect said table from the heat above. In the preferred construction the space between the top of the drier-table and the roof of the housing is about one-half to two-thirds of the entire inside height of said housing, thus leaving a heating-chamber above the top of the table. The wheels b' are supplied at suitable intervals under the entire length of the drier-table, and said table is rotated in the housing by means of a chain e, adapted to lodge in the chain-groove e', formed upon the under side of the plate c'. Said chain-groove is so formed that it will engage the links of said chain and be driven thereby irrespective of the position of the different links of the chain.

The power for rotating the drier-table is furnished by the chain-wheels f, which are preferably two in number, located on the outside of the housing on opposite sides thereof. In the preferred construction the wheels f are mounted upon horizontal shafts f', and the chain e is guided from said driving-wheels to the chain-groove e' by means of the guide-sheaves f^2 f^2 and f^3 f^3. By thus applying the driving power from two opposite sides lateral strains are avoided and the friction of the wheel-flanges upon the rails b is reduced to a minimum. The chain e preferably leaves the chain-groove e' at a plurality of points, but is continuous and is so guided by said sheaves that there is no tendency for it to become dislodged.

The briquets or other articles to be dried are supplied to the drier-table c by means of the belt conveyer g, which extends from a point within the inclosure to a point outside thereof, passing over the belt and traveling in the following path, to wit: from the molding-machine h along the guide-rollers g' and g^2 to the guide-rollers g^3, thence downward to the guide-roller g^4, thence returning to the guide-roller g^5, thence upward to the roller g^6, and back to the machine. The guide-rollers g' are supported in any suitable framework i, and the location of the rollers g^2 and g^3 is such that the belt at these points passes directly over the drier-table c at a slight distance above the same. The guide-roller g^3 is on the outside of the housing, while the rollers g^4 and g^5 are located below the rails b, so that the belt will not interfere with the rotation of said drier-table. The guide-rollers g^2 and g^3 in the preferred construction do not have fixed bearings, but are mounted in a frame which consists of the longitudinal rods or pipes i' i', connected by the cross-rods i^2 i^2, said cross-rods forming axles for the rollers g^2 and g^3. The rods i' and i^2 constitute a swinging framework, the inner end thereof being pivotally supported in the framework i and the outer end, which carries the roller g^3, being supported by means of the cable j, attached to the counterweight j'. Said cable j trains over the sheaves j^2 j^2, mounted in the framework j^3, and the parts are so arranged that the influence of the weight j' is to draw the outer extremity of the rods i' upward, so as to impart a tightening effect to the belt g.

The briquets or other molded articles are removed from the conveyer-belt g to the drier-table c by means of the plows k, which are by preference three in number and so located that as said belt moves along under them they will sweep the briquets from said belt onto the top of the drier-table and distribute them thereon. The precise manner of mounting said plows is immaterial, but by preference they are secured to the bridge k', extending transversely to the drier-table and supported upon the uprights k^2 k^2 at the walls of the housing. The molded material is removed from the drier-table in an analogous manner by means of the plow m, so located as to operate after the material has remained on the drier-table for a complete revolution thereof.

Heat is supplied to the housing by means of the furnaces n, which in a drier of the size above mentioned should be four in number, located equidistant from each other and so located that the two furnaces nearest to the opening where the molded material is delivered to and removed from the drier-table are at some distance from said point of supply and removal. The object in thus arranging the furnaces relatively to the last-named point, where the housing is necessarily open to a greater or less extent, is to economize the amount of fuel required and minimize the loss of heat. The preferred construction of the furnaces n is shown in vertical section, Fig. 5, in which n' denotes the grate-bars, n^2 the fire-box, n^3 the ash-pit, n^4 the fire-door, and n^5 the ash-door. Each furnace connects with its flue o through the passage o'. The said flue o extends horizontally in the outer wall a' one-eighth of a circumference in each direction, and at suitable intervals, preferably every three or four feet, are apertures o^2, which lead from said flue o to the interior of the housing a. By thus supplying apertures at intervals along the flue o the heat is more evenly distributed throughout the housing. In order to regulate the amount of heat going into the flue o from the furnace, a door p is provided and arranged to slide across the face of the opening o', preferably in a horizontal direction. In the inner wall a is a flue r, extending horizontally and corresponding to the flue o in the outer wall a. Each flue r extends approximately one-half of a circumference and terminates at the outlet or stack s. It is advisable that the individual flues o be separated from each other in order to better control the direction of flow of the heated gases, and this is easily accomplished

by providing cut-offs o^3 in the wall a'. In a similar manner a cut-off r^2 is provided in the wall a' at each stack s. For the same purpose and to prevent the escape of heated gases to the air curtains t are provided at suitable points. These curtains t should be located one at each of the stacks s and one at the points A A', where the roof a^2 of the housing terminates. Under ordinary conditions two is a sufficient number of stacks, and the best location is approximately one-quarter of a circumference in each direction away from the open portion A A' of the housing. By preference these curtains consist of heavy sheet metal and are made to slide vertically within the housing. The handles t' afford convenient means for raising and lowering the curtains, and the apertures t^2 therein are adapted to receive pins whereby said curtains may be adjusted to any height desired, thus making it possible to control the opening between the lower edge of the curtain and the top of the drier-table c.

In operation the conveyer-belt g carries the briquets or other molded material to the plows k, whereby said material is transferred to the burner-table c. Said table, which in the present instance is arranged to revolve in a clockwise direction, then carries the molded material under the first curtain t into the housing. At this point the housing is comparatively cool; but as the material is brought toward the first furnace n the temperature gradually increases. The table c revolves slowly—for example, at a peripheral speed of one to two feet per minute. When the briquets are being dried, the rate of travel should be such that a complete revolution of the drier-table would require from one to three hours, depending upon the kind of bond employed and upon other conditions. The advantage of thus slowly raising the temperature of the molded material as it is brought to the first furnace is to permit a gradual heating, so as to prevent any tendency toward case-hardening. By "case-hardening" I mean the premature hardening or drying of the outer portions of the briquets or other articles, which would prevent the escape of the gases from the interior thereof. In case four furnaces are used, as indicated in the drawings, the furnaces which are second and third in order may be brought to a higher temperature than the first furnace, the relative temperature of the furnaces, however, being regulated to suit the various conditions under which the plant is run. As the walls of the housing and the top of the drier-table are preferably lined with fire-brick, the temperature within the housing may be brought up to a red heat—for example, 600° Fahrenheit—without detriment. When the table has completed the revolution, the material is swept off by means of the plow m. It will thus be seen that the drier is continuous in its operation and is automatic, it being unnecessary to perform any manual labor upon material in supplying it to or removing it from the drier-table.

I do not wish to be understood as limiting myself in regard to the number or location of the furnaces or of the stacks nor as to the dimensions of the housing, as these are matters which may be varied to suit conditions without departing from the spirit of my invention.

Although I have referred to briquets and other molded articles as being dried and burned in this device, it is also within my contemplation at the present time to employ it for driving off sulfur from ores in the process known as "roasting."

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

1. A continuous drier having an annular housing; means for heating the same; an annular table in said housing; a plurality of driving-wheels located outside of said table; and a chain passing over said wheels and around said table for driving the latter.

2. In a continuous drier, the combination of an annular housing; an annular table revolubly mounted therein, and fitting the same somewhat closely to prevent the passage of heated gases downwardly between the edges of the table and the walls of the housing; means for supplying heated gases to said housing above said table; a chain; and a groove for receiving said chain to thereby drive said table, said groove being formed upon the under side of said table, whereby the chain is protected from the heated gases above the table.

3. In a continuous drier, the combination of an annular housing; a horizontal annular table revolubly mounted in said housing; a chain encircling said table for driving the same; a wheel revolving in a vertical plane for driving said chain; and two pairs of guide-wheels for guiding said chain from said driving-wheel onto said table, whereby said driving-wheel has an axis of rotation parallel to the plane of rotation of said table substantially as described.

4. In a continuous drier, the combination of an annular rotatable table; an annular housing therefor, consisting of concentric walls each having a flue running lengthwise therein, said walls having apertures at frequent intervals forming passages from said flues to the interior of the housing; a furnace connected with the flue in one of the walls of the housing for supplying heat to such flue and through such flue and connecting-apertures to different points of the housing; and a stack connected with the flue in the other wall of the housing for drawing off the gases from the housing.

5. In a continuous drier, the combination of an annular rotatable table; an annular hous-

ing therefor, consisting of concentric walls each having a flue running lengthwise therein, said walls having apertures at frequent intervals forming passages from said flues to the interior of the housing; a plurality of furnaces connected to the flues in one of the walls of the housing; a plurality of stacks connected to the flue in the other wall of the housing at points remote from the furnaces, and cut-offs in the furnace-flues approximately midway between the different furnaces.

6. A continuous drier comprising an annular housing; an annular table revolving therein; means for heating said housing; a conveyer-belt for supplying material to said table; means for automatically transferring material from said belt to the table; a pivoted framework for supporting said belt above said table; said belt passing downward over the free end of said framework; and a weight tending to raise the free outer extremity of said framework to thereby tighten said belt.

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