J. F. LOVEJOY.

BRIQUET MANUFACTURE.

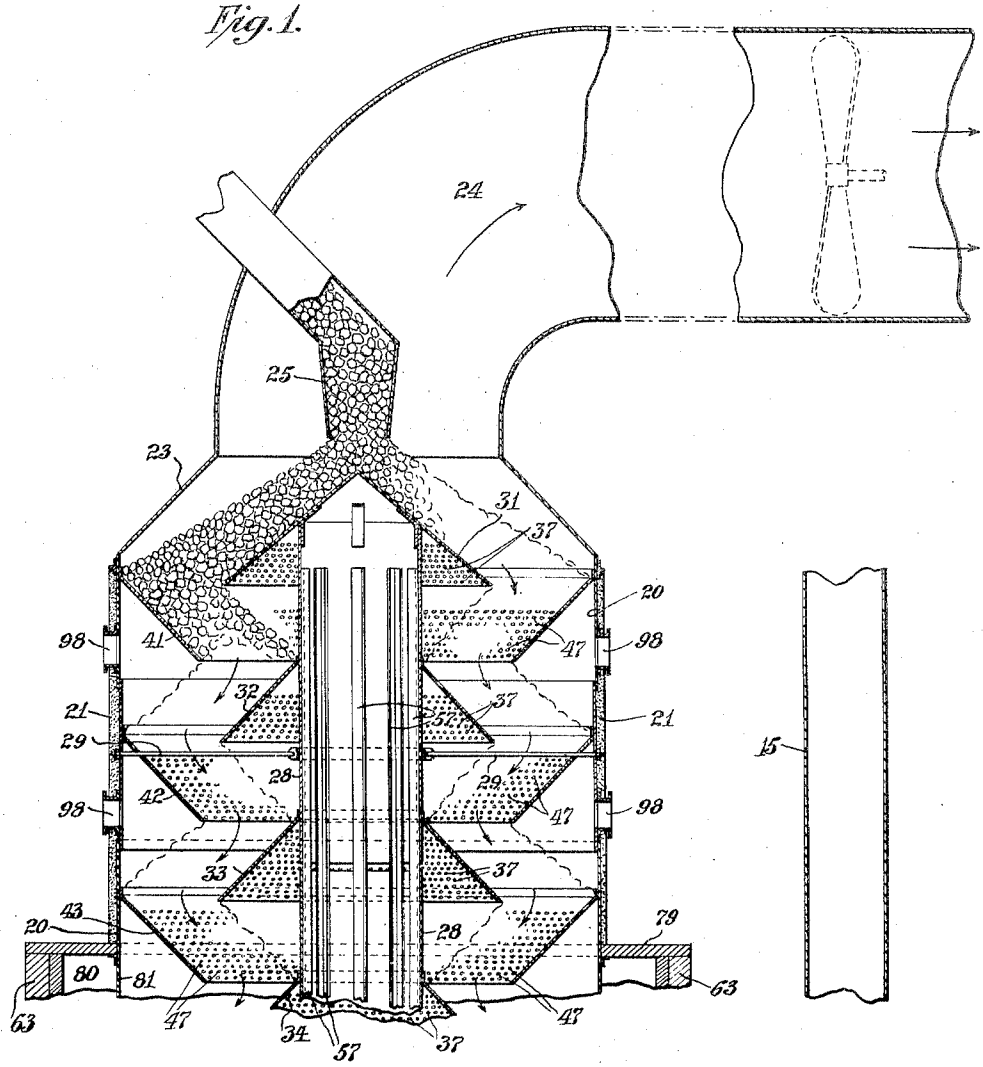
APPLICATION FILED OCT. 15, 1919.

1,366,091.

Patented Jan. 18, 1921.

3 SHEETS—SHEET 1.

Fig. 1.



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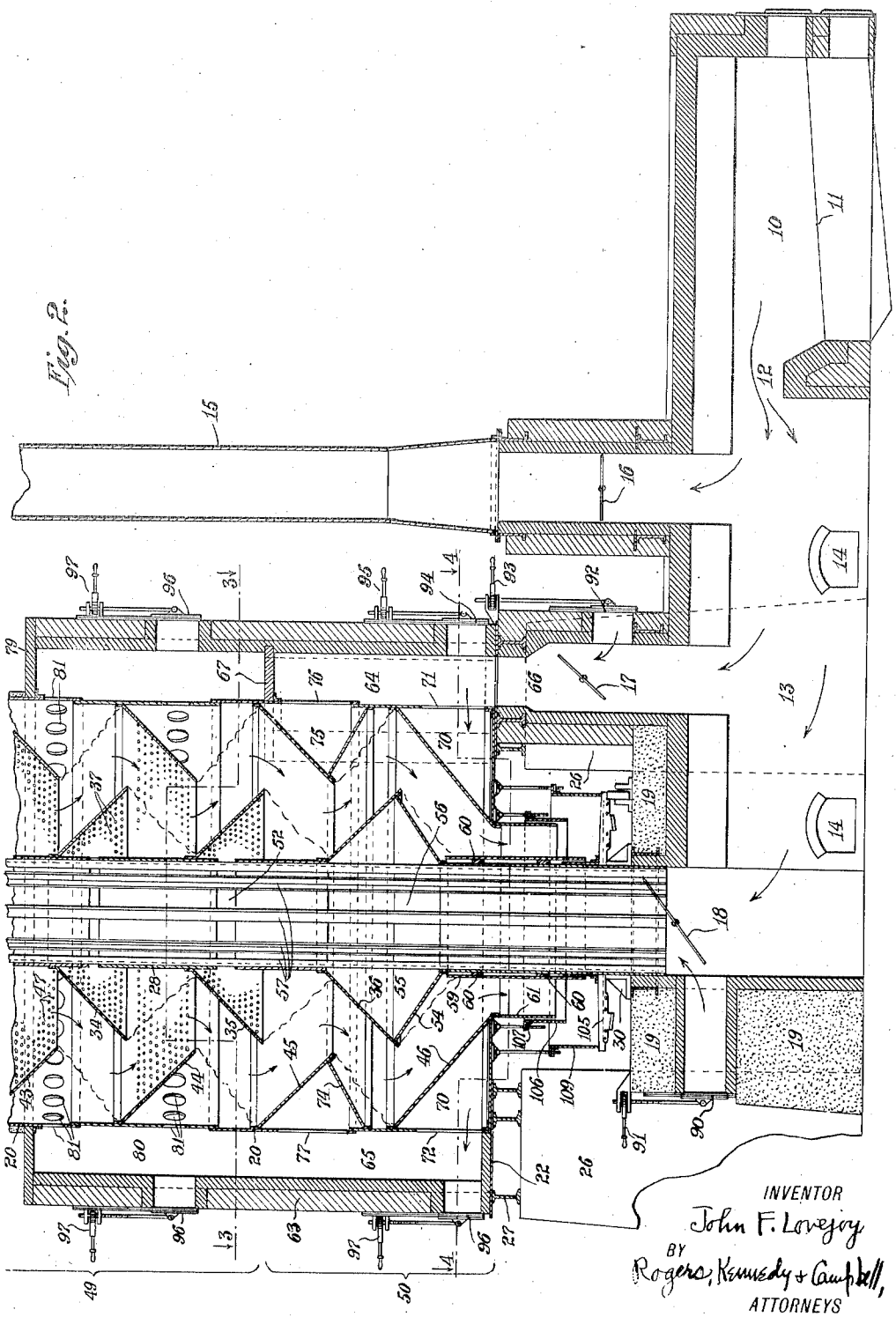
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 4.

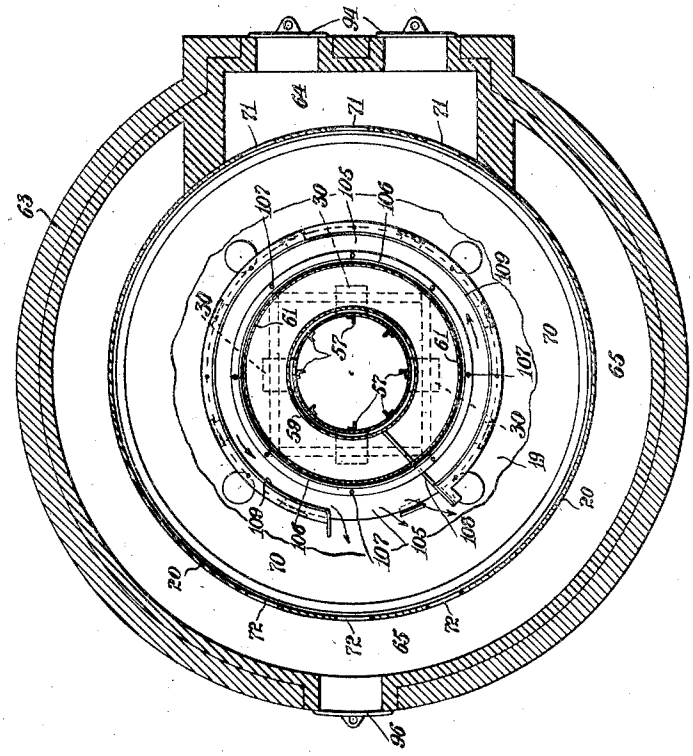
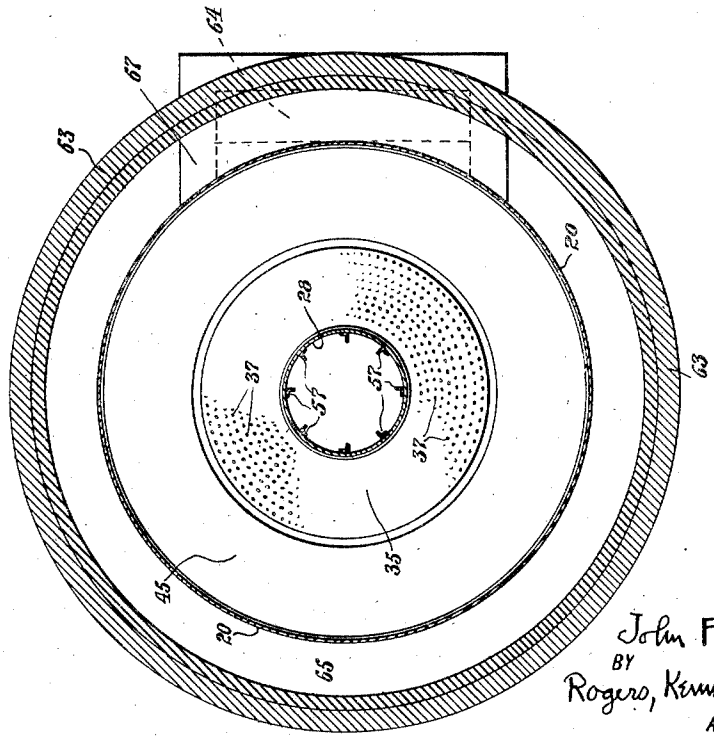


Fig. 5.



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BRIQUET MANUFACTURE.

1,366,091. Specification of Letters Patent. Patented Jan. 18, 1921.

Application filed October 15, 1919. Serial No. 330,823.

To all whom it may concern:

Be it known that I, JOHN F. LOVEJOY, a citizen of the United States, residing at New Rochelle, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Briquet Manufacture, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to briquet manufacture, and, as will be described, involves a new method and also a new apparatus, the method however not being made the subject of claim herein. While certain features of the present invention can be employed in the manufacture of briquets of any sort or for any purpose, the particular embodiment herein illustrated has reference preferably to fuel briquets. These being fabricated or composite blocks of compressed fuel material such as powdered coal or coke, held together by a suitable binding material. In using the term briquets, I intend to include what are known as eggets, boulets, or any other size or form, this matter being one determined by the use to which the article is to be put. In my prior Patent No. 1,221,878, of April 10, 1917, I have shown a machine for compressing such briquets, and that patent also shows a rounded form of product or briquet which is suitable for the purpose of describing the present invention.

Heretofore the powdered fuel has frequently been consolidated by means of a binder of coal tar pitch or other combustible and volatilizable pitch. While this increases the amount of combustible material in the briquet, it produces certain disadvantages, including intense smokiness of the briquet when burned as fuel. It is desirable to avoid this, and at the same time it is desirable to employ as a binder some otherwise waste material or material of low value. I prefer for this purpose certain waste products of paper mills. One of these is known as sulfite liquor, which, however, contains much water which must be largely driven off to bring it substantially to the consistency of a pitch binder. This material when so produced is, in fact, known as sulfite pitch. Sulfite powder would serve the same purpose if mixed with water to the aforesaid consistency. This sulfite pitch is to be mixed with the finely powdered coal or coke, and then treated by compression, for example, as in my aforesaid prior patent, to give quantities of compressed briquets, for example, of the shape therein disclosed. While the sulfite pitch has the advantages mentioned, it has the disadvantage that it is soluble in water, and therefore it is an object of the present invention to so treat the briquets as to render them waterproof, and thus proof against deterioration, owing to the soluble nature of the binder.

One feature of the present invention relates to what I may term the perfecting steps in the manufacture of briquets, namely, the treatment performed on the briquets after the mixing, shaping and compression thereof, as aforestated. Briquets as they first come from the compressor have not a sufficiently hard constitution or surface to withstand the violence involved in transportation and other handling. The briquets are thus practically defective unless they have had ample time to dry out, and any remoistening would restore their objectionable characteristics. Moreover, briquets as heretofore made, even if allowed to dry out, will if exposed to rewetting by rain or the like, soften, break down and become unfitted for use. This disadvantage is enhanced by the fact that the sulfite binder is soluble in water, so that under conditions of moisture the briquets soften the more readily. It is, therefore, an object hereof to afford a process and apparatus for giving a perfecting treatment to briquets, which will drive out the moisture, render the briquets less breakable, and harden and waterproof the substance thereof. Incidentally the operation of the present invention at the same time would drive off any volatile materials possibly present which are apt to result in objectionable smokiness, although this objection may be minimized by the employment of the particular binder hereinabove mentioned.

Broadly speaking, this invention operates on the principle of preliminarily subjecting the briquets to a gradually increasing heating and drying action, and thereafter subjecting them to an intense heat for the special purposes to be described. Apparatuses have heretofore been suggested for progressively treating briquets by heat, but I am aware of no apparatus capable of the operation or results of the present invention, nor any apparatus not involving prohibitive

first cost, high running expense and great liability to get into disrepair. It is, therefore, another object of the present invention to afford an apparatus capable of carrying out the steps of the present invention, and which will be of low first cost, free from liability to disrepair, inexpensive of operation and high in output.

Other and further objects and advantages of the present invention will be made clear in the hereinafter following description, or will be apparent to those skilled in the art. To the attainment of such objects and advantages the present invention consists in the novel features of method, procedure, apparatus, combination, arrangement and structure herein illustrated, described or claimed.

I will first refer to some of the general and characterizing features of the present invention, especially with relation to the method or operation involved. Preferably a continuous process is to be carried out, a constant supply of briquets in mass passing progressively through the operations. As a source of heat I preferably employ a furnace burning any fuel and delivering its hot gases for the processes hereof. One feature of this invention consists in preferably passing the briquets in mass through two successive operations or zones, in the first of which they are progressively heated and dried by actual and intimate contact with the hot gases, and in the second of which they are more intensely heated or superbaked, not by intimate contact with the gases, as in the first zone, but by proximity to metallic plates or surfaces which themselves are highly heated by the hottest gases, so as to operate by radiation. This high temperature baking gives effective carbonization of the briqueted material. In this part of the process combustion is prevented by excluding air and oxygen, giving a muffling action. This treatment I find gives the operations, results and advantages in the final product which have been heretofore set forth as an object of this invention. Another feature is that in each operation or zone the advance of the mass of briquets is by gravity as distinguished from conveying mechanism. Another feature is that preferably, as the mass of briquets descends through and from the first operation or zone, the same passes directly and without interruption into the second operation or zone, although the underlying principles could be carried out notwithstanding a physical separation of the two. Another feature is that the gravity feed of the briquet mass is not a mere vertical descent, and preferably not a continuous inclined travel, but rather an alternating movement from one to the next of a succession of interior plates, for example, so as to give the material a zigzag or crooked motion as it descends, thus permitting the apparatus as a whole to be substantially vertical, yet permitting gradual travel and effective control of the rate of feed. As the gases circulate through all parts of the mass, the individual briquets are rolling and tumbling along their route, presenting all of their surfaces to the heating action, and thus insuring the most intimate action of the heated gas upon the briquets. Also preferably the rate of supply of briquets at the top of the apparatus and the drawing off of them at the bottom is controlled in harmony with temperature and rate of supply of the hot gases, and of air introduced at various points to affect or reduce the temperature of the gases when excessive, which preferably ascend first in the superbaking zone, so as to give the most intense heat to the second stage, and then directly into contact with the briquets in the heating and drying zone, to give the described action in the first stage of the process. In respect to the first zone of action, one feature of this invention is to compel intimate contact of the hot gases with the mass of briquets by so conducting the gases that they must pass through perforations in the supports or plates over which the briquets travel, thus insuring a most intimate and thorough contact. These and further method features will be better understood by the following description of one form of apparatus in which the same may be carried out.

In the accompanying drawings, Figure 1 is a central vertical section of the upper part of an apparatus for perfecting briquets embodying the principles of the present invention.

On account of the size of the drawing, it is broken off, and in Fig. 2 is shown the lower part of the apparatus. The two figures form continuations of each other.

Figs. 3 and 4 are horizontal sections taken respectively on the lines 3—3 and 4—4 of Fig. 2, with, however, all of the underlying structural and foundation work omitted for simplicity.

Any suitable type of furnace, for example, the arched roof furnace 10 may be employed. Behind the grate 11 is shown a bridge wall 12, over which the hot products of combustion pass to the chamber or box 13. Doors 14 are shown at the sides of the furnace, and these may be used for admitting air if so desired, although the main purpose of these doors is to permit access for cleaning out purposes. Whenever it is desired to partly or wholly shut down the operation of the present invention, a suitable outlet for the hot gases is required, and I have shown a stack 15 for this purpose, the damper 16 of which is shown closed, but may be opened when and as desired. Two

other dampers 17 and 18 are shown, controlling the ascent of the hot gases to different parts of the apparatus hereof. Above and to the rear of the furnace are shown concrete or foundation portions 19, which serve to support the central part of the apparatus to be described.

Rather than an inclined arrangement, I have shown a vertical casing or cylinder 20, which extends substantially the full height of the apparatus, and within which the operations described take place. The upper exterior part of the casing 20 is jacketed with asbestos 21. At its lower end the cylinder rests upon a large circular bottom plate 22, which except at its central aperture forms the bottom of the casing. At the top of the casing is a converging plate or cone 23, from which extends a large pipe or passage 24, which may lead to an exhaust apparatus or fan by which the passage of the hot gases through the apparatus is caused or expedited. An infeed pipe or hopper 25 is shown for conveying a continuous supply of briquets to the top of the apparatus. The further travel and operations upon the mass of briquets will be later described.

All of these described parts are supported upon four concrete piers 26. Above the piers extend a series of structural members or I-beams 27, and directly on these rests the bottom plate 22, above which is the large cylindrical casing 20.

Vertically arranged at the center of the main casing is an interior tower 28, which serves to conduct hot gases to perform their described function, and also give support to certain of the plates or cones over which the descending fuel advances by gravity. The upper part of the aforesaid interior tower 28 is shown as braced against the main casing by radial rods 29. At the bottom of the tower are bolted a number of angle pieces 30, which rest directly upon the furnace top or the concrete part 19 before mentioned.

In order to give the briquet mass inclined rather than vertical descent, and at the same time to keep the individual briquets in relative motion, I have provided a series of successive plates or cones so arranged that the advancing briquets pass over one of them, being delivered to the next, and thence over it to the next, and so on downwardly through the apparatus. Some of these deflecting plates or cones are arranged on the interior tower 28, and others on the exterior casing 20, and may conveniently be termed interior and exterior deflectors respectively.

Thus, secured to the upper part of the tower 28 is a top interior cone or deflector 31, and successively below this are similar deflectors 32, 33, 34 and 35. Below this is a similarly located cone 36, but only the cones 31 to 35 are provided with perforations 37, by which gases ascending through the tower are caused to enter and mix intimately with the body or mass of the descending briquets.

Opposed to the interior cones are exterior cones 41, 42, 43 and 44, perforated similarly to the interior cones 31 to 35, and cones 45 and 46 which are unperforated.

The bottommost perforated cone or deflector is the interior one 35, and this marks substantially the division between the preliminary preheating or drying zone 49, extending from the top of the apparatus to this point, and the superbaking zone 50, extending from this point to the bottom of the apparatus. The differences in function and operation will be explained. The interior tower 28, it will be perceived, is made up of vertical bars or angle irons 57, and between these at certain points are gaps or openings 52, by which the hot gases pass directly from the tower to points beneath the respective cones 31 to 36. In the case of each perforated cone the gases thus pass directly into the body of the mass of briquets. In the case, however, of the bottommost cone 36, this does not take place. An inverted cone 54 is located beneath the cone 36, the two forming a closed chamber 55, the walls of which become highly heated by direct contact with the hottest incoming gases, and preferably short of red heat, and these acting upon the descending briquets by radiation, not by contact. The gases pass directly into the chamber 55 through openings or spaces 56 between the vertical bars 57. The interior tower 28, it will be noted, is made up of the vertical bars and a number of cylindrical portions surrounding the same, but slightly separated to afford the gaps or openings 52 and 56 before mentioned.

The mode of travel of the briquets is sufficiently indicated at the upper portion of the apparatus. It will be noted that a gas space exists under each of the cones, and each portion of the mass travels radially inward and outward with a sort of zigzag action, which is sufficiently indicated below the topmost cones by the broken lines of contour. At the bottom of its travel within the casing 20 the mass of briquets passes vertically downward adjacent to the interior tower 28. To keep the now completed briquets from actual contact with the hot tower at this point, a protecting sleeve 59 is shown, slightly spaced away from the tower by blocks 60. A fixed sleeve or flange 61 extends downwardly from the lower end of the exterior cone 46, thus forming with the sleeve 60 an annular downward passage by which the outfed material leaves the tower.

So far I have described merely the supply and travel of the gases passing from the furnace up into the central or interior tower

28. In practice it is preferable to have the treatment effected not only from the interior or center, but also from the exterior, and I will now describe the means for this purpose. A brick wall 63 is shown as surrounding and spaced outwardly from the main upright casing 20. It rests upon the bottom plate 22 already mentioned, and is preferably lined with fire brick, as are also other parts of the apparatus, according to well understood principles. The brick wall, as shown in Fig. 4, is so shaped as to give a vertical flue or gas chamber 64 at one side of the apparatus, and beyond this chamber the brick wall forms within it an incomplete annular chamber 65. The travel of the hottest gases is past the damper 17 through passage 66 leading to the vertical chamber or flue 64. At a suitable point 67 is a fire brick plate or tile, which marks the upper termination of the flue or chamber 64. This further is located approximately at the line of demarcation between the two zones of operation of the apparatus.

The gases passing into the flue 64 enter the annular chamber 70 through openings 71. This chamber affords a highly heated surface, namely, the inclined plate or cone 46, which takes part in the superbaking or carbonizing operation. The gases entering this chamber at the right pass around both sides of it to the left, and thence through an exit 72 into the annular chamber 65.

An inclined or conical wall 74 is provided below and opposite the cone 45 to provide a second hot chamber 75, similar to the previous one 70. As before, the hot gases pass from flue 64 through inlets 76 into the chamber 75, and thence around to the left and by outlet 77 into the annular chamber 65.

In some cases it may be desirable to give to the descending briquets within the zone 50 a more abrupt or vertical and regular descent than shown, which may readily be accomplished, for example, by omitting the cones or members 45 and 74, and rearranging the cone 46 so that it extends from the present upper edge of the cone 45 to the lower edge of cone 46: and by similarly omitting the perforated cone 35, placing the unperforated cone 36 approximately where 35 is, and rearranging cone 54 so that it extends from the lower edge of shifted cone 36 to its own present lower edge.

After taking these circuitous routes, the gases ascend in the chamber 65, which, however, is tightly covered at the top by an annular tile or plate 79, below which is a completely annular chamber 80, forming substantially a continuation of the incompletely annular chamber 65, before mentioned.

The hot gases having thus passed above the final or superbaking zone have reached the preliminary or drying zone, and passages are provided whereby the gases are next brought into direct and intimate contact with the gradually advancing mass of briquets. Thus, beneath the perforated cone 44 is shown a series of openings 81 leading from the annular chamber 80, and similar openings lead to a point beneath the perforated cone 43. It will be perceived that the gases, which are now somewhat reduced in temperature, will pass into the air spaces beneath these perforated cones, and thence through the perforations directly into the body of the briquets, so as to penetrate and permeate the same and bring the heating and drying action to every part of the mass. While this is going on, the center of the mass is being similarly treated with the hot gases fed from the central tower beneath the perforated cones 35, 34, etc. Above the level of the tile plate 79 the action continues substantially the same, but at decreasing rate, clear to the top of the apparatus, although the upper two exterior cones 41 and 42 are not provided directly with hot gases, but only indirectly through the gases that rise from a lower point. By the described treatment every briquet, after it is dumped upon the topmost cone 31 from the hopper 25, is caused to advance gradually by gravity through gases of gradually increasing temperature, so that there is no sudden change of temperature, and each briquet is thus subjected to an effective and progressive drying and preliminary heating action as it descends, until, when reaching the baking zone 50, it is in a completely dried condition, and in readiness for the final or carbonizing action, which renders it entirely suitable for commercial purposes.

It is an important part of the present apparatus that complete and practically universal regulation of conditions is permitted. As will be seen, the rate of advance of the briquets can be expedited or delayed according to the ability of the furnace to supply gases of proper temperature and quantity to perform the desired functions. Also, by the described dampers the rate of combustion in the furnace and the rate of supply of the products thereof is controlled. It is desirable to have extremely high temperature in the carbonizing zone, yet the gases in the preliminary zone should not be too high. I have provided regulable air inlets for admitting cold air to the ascending gases at different points, both before and after the carbonizing zone.

While the dimensions, the contents, the speed or rate of output of finished briquets and the prevailing temperatures at different points may be extensively varied according to the conditions prevailing and the results

desired, I may cite the data for one possible embodiment in order to give a rough idea of the conditions. The casing 20 may be in the neighborhood of from 25 feet to 45 feet in height, and the passages therein which are occupied by the advancing briquets may accommodate from 40 to 60 tons. Each portion of the mass of briquets may occupy substantially 60 minutes in travel, so that the output will be about 40 to 60 tons per hour. Of course, if the temperature of the gases is to be lower, the time of travel will be increased, and I may operate the plant so that each portion of the mass occupies as high as two or three hours, or even more, in passing through the apparatus.

The gases from the furnace may have a temperature of 2000° or higher, but this would be reduced to from 500° to 1000° more or less at the point where the gases enter the carbonizing zone. The gas temperature decreases extensively and may be reduced to 300° to 500° more or less at the top of the apparatus. The briquets themselves, entering at ordinary temperatures, will become gradually heated until, as they pass downwardly out of the carbonizing zone, they may possess a temperature of between 450° and 750°.

The air admissions before mentioned may include a gate 90, controlled by a screw device 91, for admitting cold air to the gases entering the central tower 28. A similar gate 92 with regulator 93 may be provided for admitting air at a point within the entrance 66, which leads to the flue 64. An additional gate 94 with regulator 95 is shown in the walls of the flue 64. At the left side for admitting cold air to the chamber 65, and at a point above that to the chamber 80, are similar air gates 96 controlled by devices 97. At higher points are shown openings at 98, which may be used either for admitting further air or for access to the interior of the structure.

The outfeed of the briquets from the bottom of the furnace and the regulation of their travel through the apparatus may be by means of a revolving table 105. This may be provided with a gear by which it may be driven at varying speeds. It is located directly beneath the annular descending passage formed by opposite walls 59 and 61. The rate of outflow may also be regulated by a cylindrical gate or sleeve 106, mounted just outside the fixed sleeve 61 and movable up and down by a regulating screw 107, so as to control the depth of material on the table 105. As shown in Fig. 4, the table rotates beneath a fixed blade or cam 108, the action of which is to steer or throw the outgoing fuel from the table, there being a cylindrical wall 109 surrounding the periphery of the table, except at the point where it is interrupted to permit the radial outflow of completed briquets, which latter at this point may be dropped into water for cooling purposes.

The particular manner of gravity travel herein shown is of great advantage, inasmuch as the heated gases which ascend through the tower by force or suction, are compelled to reach intimately into the very heart of the mass of briquets at every stage of their advance. The briquets are being attacked by the hot gasses at both sides up to a certain point, and thereabove at the inner side, and at every stage the ascending gases are compelled to advance transversely through the tumbling and descending stream of briquets. By reason of this very thorough heating and drying action, I am enabled to control the action, and thereby insure against too rapid heating, and the detriment to the final product resulting therefrom.

It will thus be seen that I have described a method and also an apparatus for manufacturing briquets, the same embodying the principles and attaining the advantages of the present invention. Since many matters of method, order of steps, operation, apparatus, arrangement, combination, mechanism and detail may be variously modified without departing from the principles involved, it is not intended to limit the invention to such matters excepting as set forth in the appended claims.

What is claimed is:

1. An apparatus for perfecting fuel briquets comprising a generally upright casing, through which the mass of briquets may travel gradually downwardly by gravity through a preheating and drying zone and lower down through a superbaking zone within the casing, fixed interior deflector plates arranged in opposite series to give zigzag briquet travel and a mixing action in the slow downward advance of the briquet mass, passages for conducting hot furnace gases first behind the walls inclosing the descending briquet mass in the superbaking zone, such walls being unperforated, so as to give a muffled action and carbonization of the briquets, and passages for next conducting the partly spent gases into direct contact with the briquets in the upper or preheating zone, the walls being perforated, so that the ascending gases intimately permeate every part of the descending briquet mass.

2. Apparatus as in claim 1, and wherein an upright gas passage is centrally arranged, so that the briquet passage through the lower zone is annular, and an exterior annular gas passage is provided, so that the briquet mass is acted on in the lower zone both from the interior and exterior.

3. An apparatus for continuous-operation perfecting of fuel briquets comprising containing walls through which the mass of

briquets infed from above may travel gradually downwardly by gravity through a preheating and drying zone and lower down through a superbaking zone, mechanism for steadily outfeeding the completed briquets at the bottom, the same being adjustable to regulate the rate of travel of the briquet mass, passages for conducting hot furnace gases first behind the walls inclosing the descending briquet mass in the superbaking zone, such walls being unperforated, so as to give a muffled action and carbonization of the briquets, and passages for next conducting the partly spent gases through wall perforations into direct contact with the briquets in the upper or preheating zone so that the ascending gases intimately permeate the descending briquet mass.

4. Apparatus as in claim 3 and wherein means are provided for regulating the furnace gas flow, and for moderating its temperature by admixture of cool air.

5. An apparatus for perfecting fuel briquets comprising a casing, through which the mass of briquets may travel gradually downwardly by gravity first through a preheating and drying zone and lower down through a superbaking zone, a series of fixed deflector plates arranged within the casing to give crooked briquet travel and a mixing action in the slow downward advance of the briquet mass, passages for conducting hot furnace gases first behind the walls inclosing the descending briquet mass in the superbaking zone, such walls being unperforated, so as to give a muffled action, and passages for next conducting the partly spent gases into direct contact with the briquets in the upper or preheating zone so that the ascending gases reach and act upon every part of the descending briquet mass.

6. Apparatus as in claim 5 and wherein mechanism at the bottom is provided for effecting regular outfeed of finished briquets, together with means to adjust such mechanism for regulating the rate of travel of the briquet mass through the casing.

In testimony whereof, I have affixed my signature hereto.

JOHN F. LOVEJOY.