

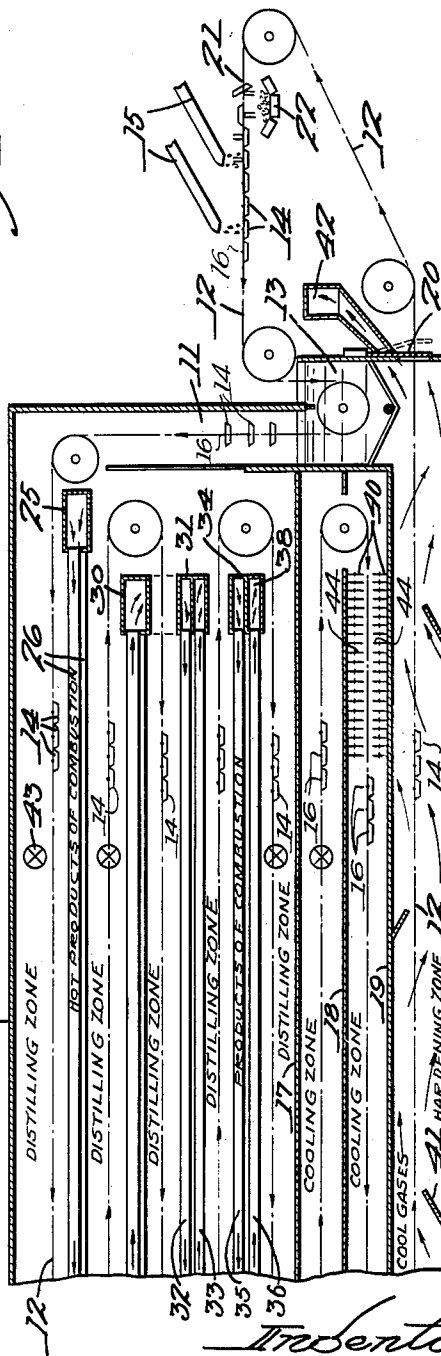
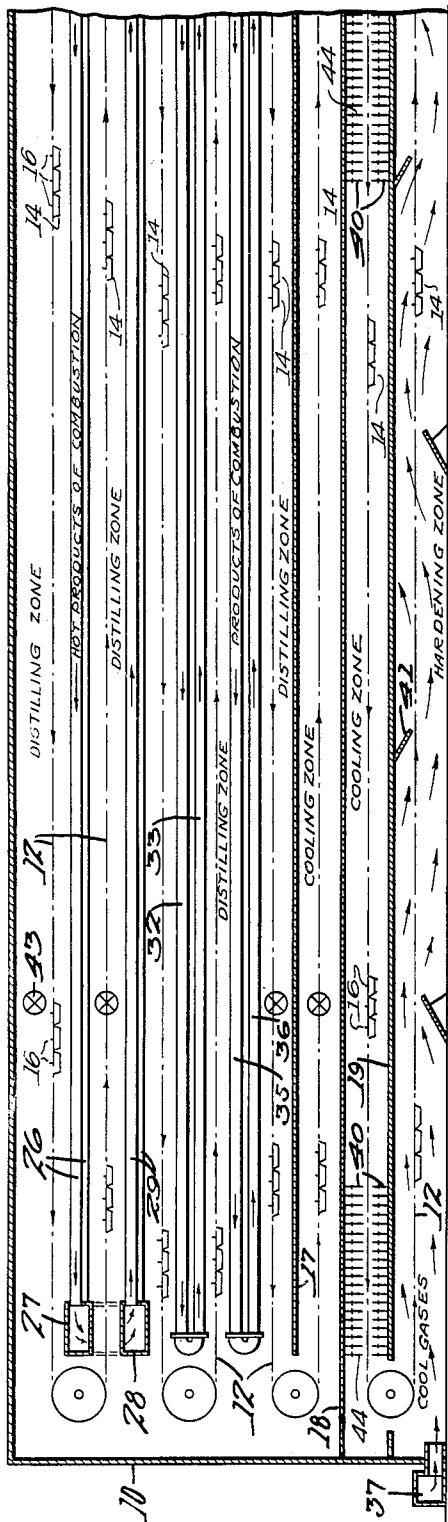
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OVEN FOR CARBONIZING COAL BRIQUETTES

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## UNITED STATES PATENT OFFICE

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## OVEN FOR CARBONIZING COAL BRIQUETTES

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This invention relates to the manufacture of briquettes made from ground fuel, particularly low grade anthracite combined with hydro-carbons used as a binder. Such briquettes require treatment in an oven having a distilling zone and a baking or hardening zone and an apparatus has been provided for treating the briquettes in bulk in such a way as to reduce the length of the apparatus. One of the principal objects of this invention is to provide means whereby the briquettes can be subjected to heat in two zones only, a distilling zone and a hardening or baking zone, without undue length and without the use of the additional apparatus.

The invention also involves the method and means whereby the briquettes are subjected to their highest temperature when they first entered the oven and the temperature is maintained until distillation has progressed to the point desired. The temperatures to which they are subjected as they progress further through the oven are then lowered until finally, before they leave the oven, they are subjected to a temperature lower than that of the briquettes themselves, which subsequently acts as a cooling medium. The invention also involves the elimination of a water seal through which the briquettes have been previously passed just before they are discharged from the oven. The improvement here involves the elimination of this wetting of the briquettes and the necessity of subsequent removal of moisture and yet means is provided for preventing transfer of heat or intermixture of gases from one portion of the oven to another and particularly from the outlet back into the interior.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawing, in which

Fig. 1 is a longitudinal sectional view, partly diagrammatic, of a complete oven constructed in accordance with this invention, showing only the end at which the briquettes are introduced and discharged; and

Fig. 1<sup>a</sup> is a similar view constituting a continuation of Fig. 1 and illustrating the other end of the oven.

The invention is designed to be applied to that type of ground coal briquettes in which the coal is mixed with hydrocarbon oils constituting a binder, formed into briquettes, and deposited on an endless conveyor. The conveyor passes through a carbonizing oven for the purpose of treating the briquettes, first to drive off the volatile constituents of the binder and coal, and second, to harden the binder and bring the briquettes into suitable condition for handling and use.

The invention is shown in a form in which a carbonizing oven 10 is provided, formed at the intake end with an uptake 11 into which an endless conveyor 12 is introduced through a water seal 13. As will be understood from the diagrammatic showing at the right in Fig. 1, the endless conveyor 12 is provided with a series of buckets 14 pivoted to the conveyor at 16 and adapted to receive the briquettes in a more or less plastic form and introduced from chutes 15 coming from the machines in which the briquettes are molded but are not shown. The conveyor passes around into the water seal and then through the up-take 11 to the top of the oven. The conveyor is supported at various points by suitable sprocket wheels or the like and passes horizontally along the top of the oven from one end to the other in the first strand and then backwardly and forwardly several times from the top downwardly. Finally it comes to a floor or partition 17 extending from the front end of the oven nearly to the rear end. The chain comes back under this floor or partition and over a lower one 18 which extends from the rear end of the oven nearly to the front end and then passes back under that and over a third partition or floor 19 which is constructed like the one numbered 17. Below this floor 19 the discharge strand of the conveyor passes through a pivoted and freely closing outlet door 20 and up to the discharge point 21. Here the buckets are tipped over and the carbonized briquettes

discharged into a conveyor 22 which takes them out to some desired point.

Products of combustion from a furnace (not shown) are introduced through an inlet directly into a header 25 having pipes 26, preferably in two series, extending under the top strand of the conveyor 12 to the other end of the oven, into another header 27 which discharges downwardly into a header 28. This header is connected by pipes 29 like the pipes 26 to a similar header 30 at the other end. It will be seen that the second strand of the conveyor passes backwardly toward the front between these two sets of pipes 26 and 29. The header 30 discharges into the upper half of a header 31 directly beneath it and a single series of pipes 32 extends from this header 31 to the opposite end of the oven. The ends of these pipes are connected by U-shaped couplings with another series of pipes 33 so that the products of combustion pass backwardly in the latter to the lower half of the header 31. This is connected with the upper half of another header 34 which by pipes 35 and 36 in the same way conduct heat back to the lower half of this header 34 which discharges the heat either out finally into the waste stack or into a cool gas intake 37. Preferably the latter method is employed. There is no connection between the lower half and the upper half of the headers 31 and 34 and the circulation of the heat in these two series of pipes 32, 33, 35 and 36 is different, as will be clear, from the circulation in the pipes 26 and 29.

The different strands of the conveyor pass between the pipes in the manner shown. It will be observed that the direct heat of the products of combustion does not as yet come into contact with the briquettes. It will also be observed that the hottest heat from the furnace comes in at 25 and by the time it gets down to the outlet 38, these gases necessarily have cooled off somewhat. Furthermore, the heat in the oven rises naturally and the whole process results in applying the maximum volume of heat to the briquettes carried by the first strand of the conveyor at the top of the oven. This temperature which may be conveniently brought up to about 700° F. is maintained until distillation has progressed as far as desired and then the temperatures in the spaces below will gradually fall until, when in the bottom of the oven, that is, in the cooling zone below the floor 18, the temperature will be approximately 100° F. This is cooler than the briquettes and therefore this is a cooling zone.

The conveyor passes back under the floor 18 to the rear end of the oven and mechanical sealing plates 40, freely pivoted at 44, are employed to prevent the escape of the products of combustion from the cool gas intake

37 into the part of the oven above the floors 18 and 19. In other words, the briquettes are heated by indirect heat in the distilling zone above these floors and heated or cooled by the direct products of combustion, mixed or not with air, in the cooling zone. The hardening takes place partially by the action of the air and the gases coming in at 37 on the binder of the briquettes. It is desired to have these gases and air flow throughout the area of the oven through which the conveyor passes to come into contact with the briquettes repeatedly. For that reason, alternating baffles 41 are employed above and below the return strand of the conveyor. These gases finally escape through the off-take 42. I have shown a series of off-takes 43 having dampers which can be opened and closed to exhaust the products of distillation at different elevations in the oven.

In describing the apparatus, I have described also the process and the operation in full. By the means shown, the briquettes are first brought up to the maximum degree of heat which is maintained until distillation has progressed as far as desired and when the temperature is reduced as they pass down through the oven. All elements of the device tend to retain this relationship and there is nothing to disturb it, such as having the gases or heat pass in the wrong way through the oven. The briquettes, after having been heated to their highest temperature and subjected to that temperature as long as required are cooled down in the hardening zone where they are subjected to the action of spent products of combustion containing air to harden and oxidize the briquettes sufficiently to permit of their being handled, shipped and sold in the condition in which they are delivered from this apparatus.

Although I have illustrated and described only a single form of the apparatus for carrying out this method, I am aware of the fact that other modifications can be made therein by any person skilled in the art without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to all the details of construction herein shown and described, but what I do claim is:—

1. The combination of an endless conveyor having buckets for receiving fuel briquettes for treatment, of a carbonizing oven having means therein for guiding said conveyor across the top of it and back and forth in a number of strands to the bottom of the oven, a series of headers located transversely and oppositely under the several strands of the conveyor, conducting pipes extending from one set of headers to the other headers, means for introducing heated gases into one of said headers at the top, whereby the gases will be moved along the

top, means for connecting the two headers at the opposite end of the oven adjacent to each other, whereby the gases will flow back through the pipes to one header, and means  
 5 for keeping the gases from contact with the atmosphere of the oven so that the briquettes will be subjected to a high heat when they first enter the oven and will gradually be cooled off but still subjected to a degree of  
 10 heat less than the maximum as they pass down through the oven.

2. The combination of an endless conveyer for receiving fuel briquettes for treatment, of a carbonizing oven having ends, means  
 15 therein for guiding said conveyer across the top of it and back and forth in a number of strands to the bottom of the oven, a series of headers at opposite ends of the oven under the several strands of the conveyor, horizontal  
 20 conducting pipes extending from the headers at one end of the oven to the headers at the other end, means for introducing heated gases into the header at the top, and means for connecting the two headers at  
 25 the opposite end adjacent to each other.

3. The combination with a carbonizing oven, of an endless conveyer having buckets thereon for receiving and carrying ground coal briquettes, said conveyer being adapted  
 30 to pass directly to the top of the oven and then back and forth along the oven in a series of horizontal strands and then finally to pass out adjacent the bottom, a plurality of pipes for conducting products of combustion, without admitting them into the atmosphere  
 35 of the oven at the top gradually down toward the bottom of the oven so that the top strand of the conveyer will be located in an atmosphere of the highest temperature and the temperature will gradually diminish  
 40 all the way to the bottom of the oven, this part of the oven constituting a distilling zone, the conveyer being adapted to pass down to the bottom of the oven to an outlet, means for introducing cool products of  
 45 combustion mixed with air into the atmosphere of the lower part of the oven, this part of the oven constituting a hardening zone, and a series of mechanical sealing plates near the bottom of the oven comprising  
 50 plates in an upper series and lower series between which the conveyer passes, to exclude the air and gases introduced into the bottom of the oven from the gases in  
 55 the upper distilling zone.

4. In an apparatus for carbonizing ground coal briquettes, the combination with a carbonizing oven, of a conveyer consisting of  
 60 a plurality of horizontal strands and having buckets for receiving the briquettes, a water seal through which the conveyer enters the oven, the oven having a vertical passage adjacent one end and through which the conveyer passes upwardly in the oven and then  
 65 across the top to the opposite end of the

oven and back and forth from one end of the oven to the other downwardly to the bottom thereof, means for heating the oven between  
 the horizontal strands of the conveyer by indirect heat to a high degree at the top of  
 70 the oven and to lower degrees at the lower parts of the oven, the oven having two partitions in the bottom portion, one extending from one wall nearly to the opposite wall  
 75 of the oven and the other extending from the opposite wall in the opposite direction, spaced apart, through which space a lower strand of the conveyer passes, plates located  
 80 between the partitions to practically prevent the exchange of gases from below the lower partition to the oven above the upper partition, and means for introducing cool products of combustion directly into the oven  
 below the lower partition.

5. The combination with a carbonizing  
 85 oven, of an endless conveyer consisting of a plurality of horizontal strands and having buckets thereon for receiving and carrying ground coal briquettes, said conveyer being adapted to pass directly to the top of the  
 90 oven and then back and forth along the oven in a general downward direction and then finally to pass out at the bottom at the same end of the oven at which it enters, a plurality of pipes for conducting hot products of combustion, without admitting them  
 95 into the atmosphere of the oven, horizontally arranged between the different strands of the conveyer, said conducting means including a header for admitting hot combustion gases at the top, pipes for passing the combustion gases gradually down toward  
 100 the bottom of the oven so that the top strand of the conveyer will be located in an atmosphere of the highest temperature and the temperature will gradually diminish as the conveyer moves down in the oven, the strands of the conveyer being adapted to  
 105 move downwardly to the bottom of the oven to an outlet, and means for introducing products of combustion mixed with air into the atmosphere of the lower part of the oven at a temperature lower than the briquettes so as to cool them off.

6. In an apparatus for carbonizing  
 115 ground coal briquettes, the combination with a carbonizing oven, of a conveyer having buckets for receiving the briquettes, the conveyer being adapted to pass up in the oven and then across the top to the opposite  
 120 end and back and forth to form a series of horizontal strands one over another and passing from each to the next downwardly to the bottom thereof, means for heating the oven, located between the horizontal strands  
 125 of the conveyer, to the highest degree at the top of the oven and to lower degrees at the lower parts of the oven, the oven having two horizontal partitions at the bottom, one extending from one wall nearly to the op-  
 130

posite end of the oven and the other extending from the opposite wall in the opposite direction, spaced apart, through which space a lower strand of the conveyer passes, and means for introducing cool products of combustion, below the lowest partition.

In testimony whereof I have hereunto affixed my signature,

HENRY F. MAUREL.