

Aug. 22, 1939.

M. C. RICHARDSON

2,170,277

STOKER AND FURNACE THEREFOR

Filed Sept. 21, 1936

6 Sheets-Sheet 1

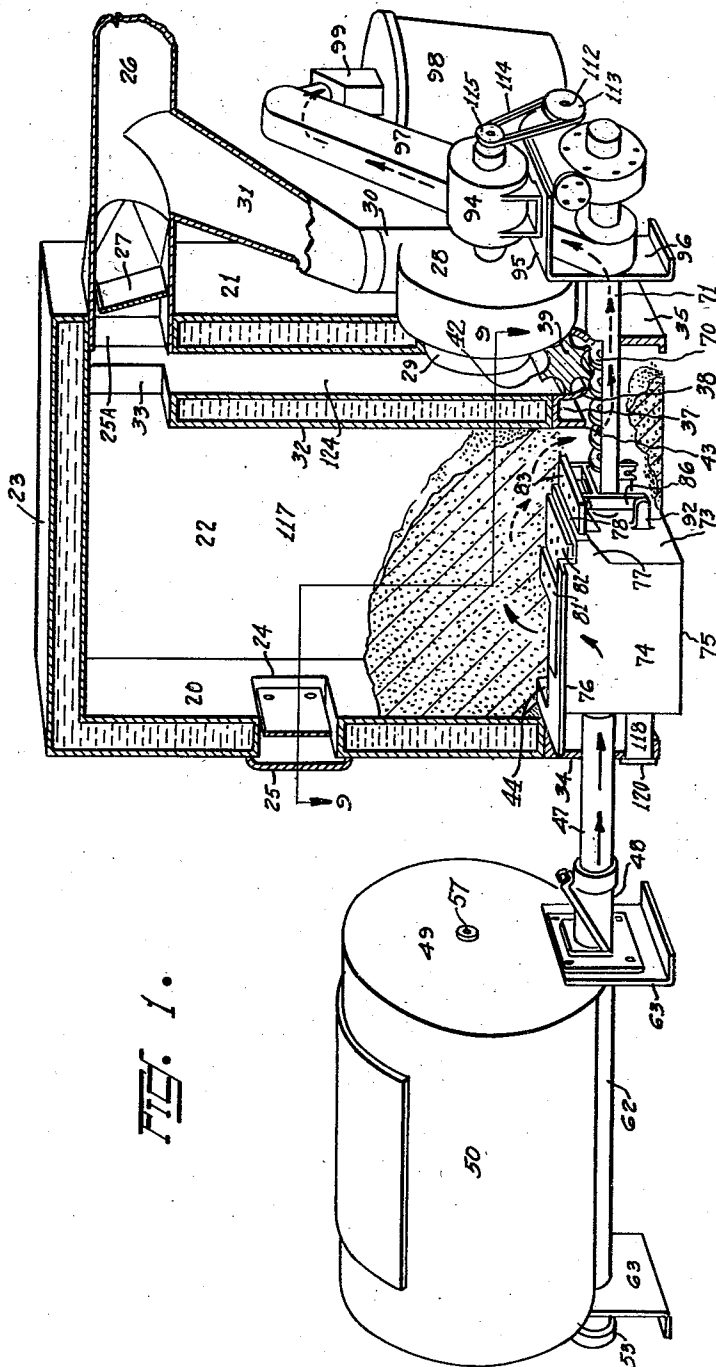


FIG. 1.

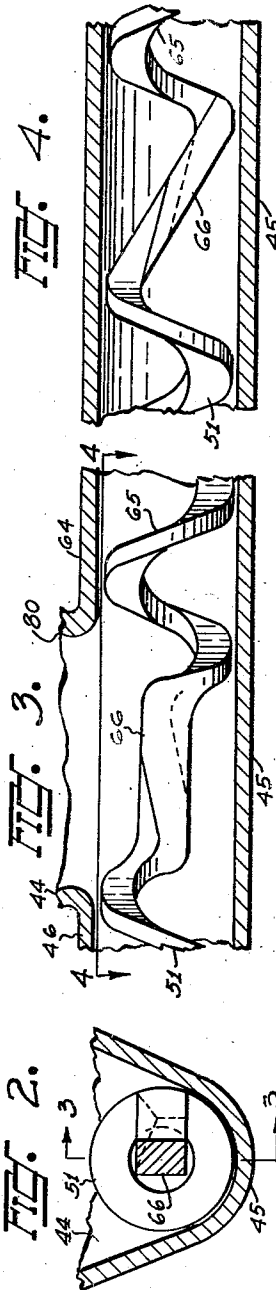


FIG. 2.

FIG. 3.

FIG. 4.

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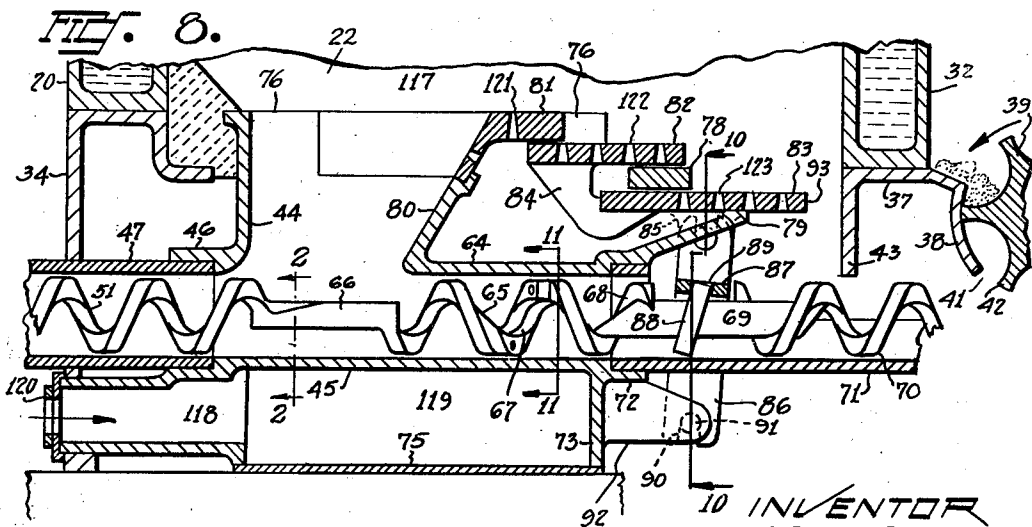
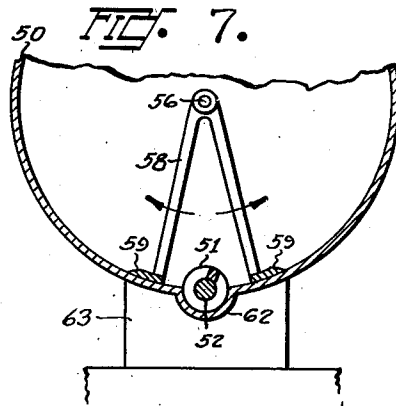
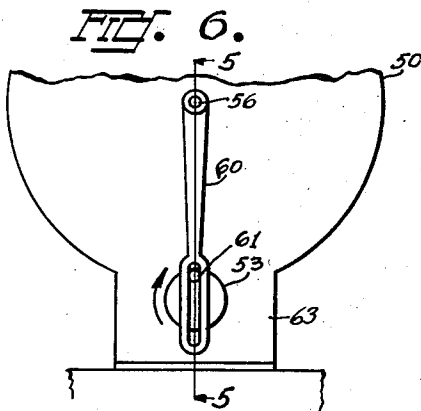
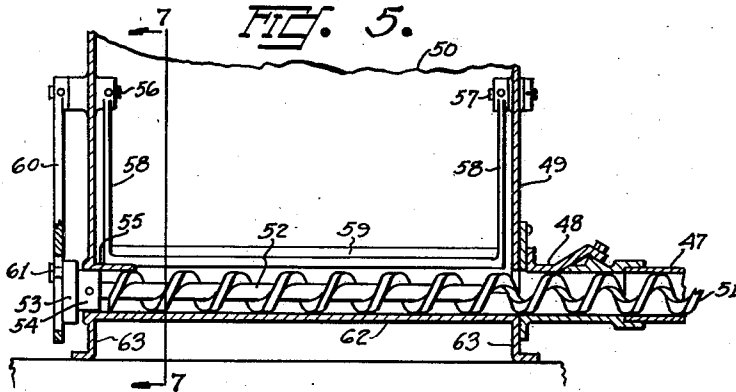
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STOKER AND FURNACE THEREFOR

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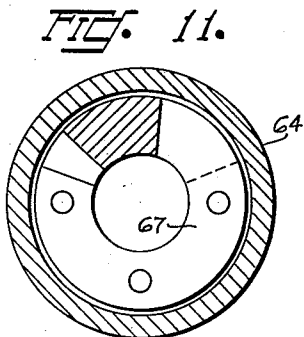
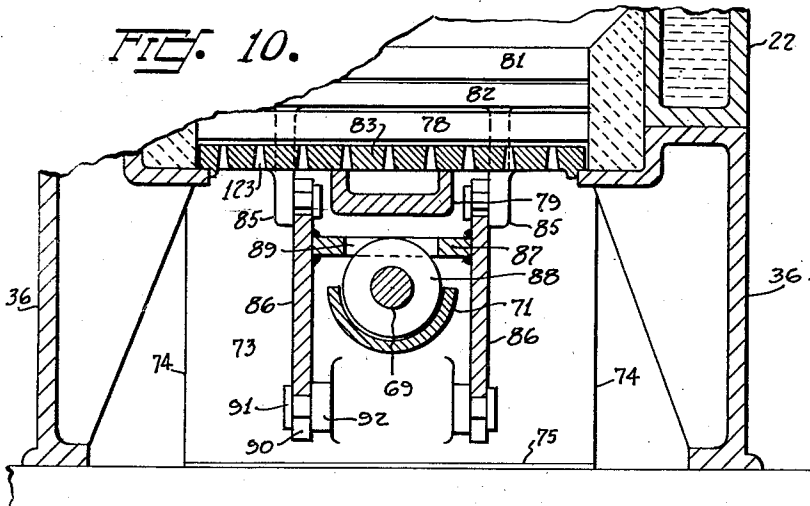
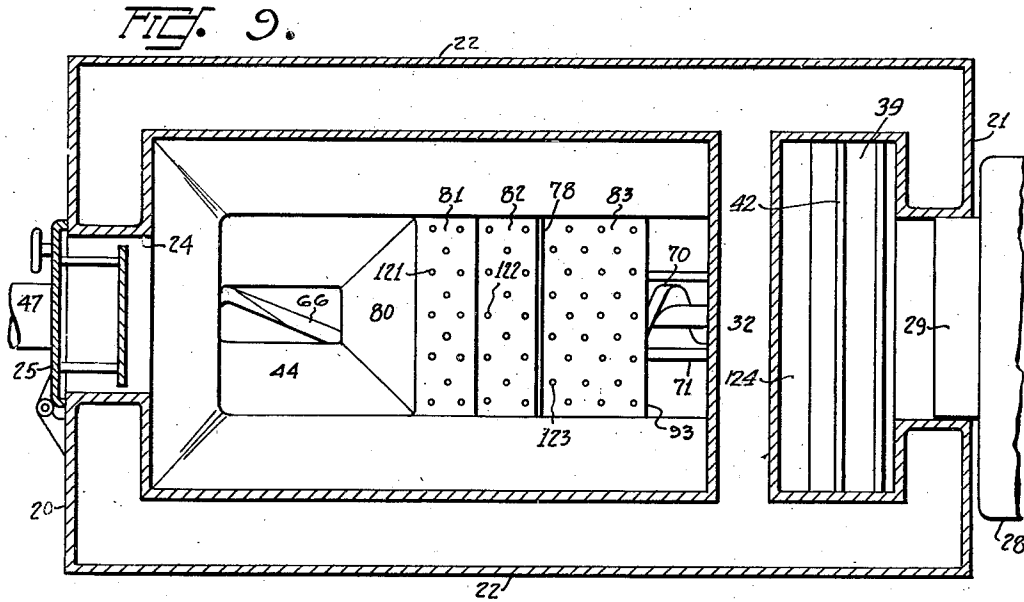
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STOKER AND FURNACE THEREFOR

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STOKER AND FURNACE THEREFOR

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FIG. 12.

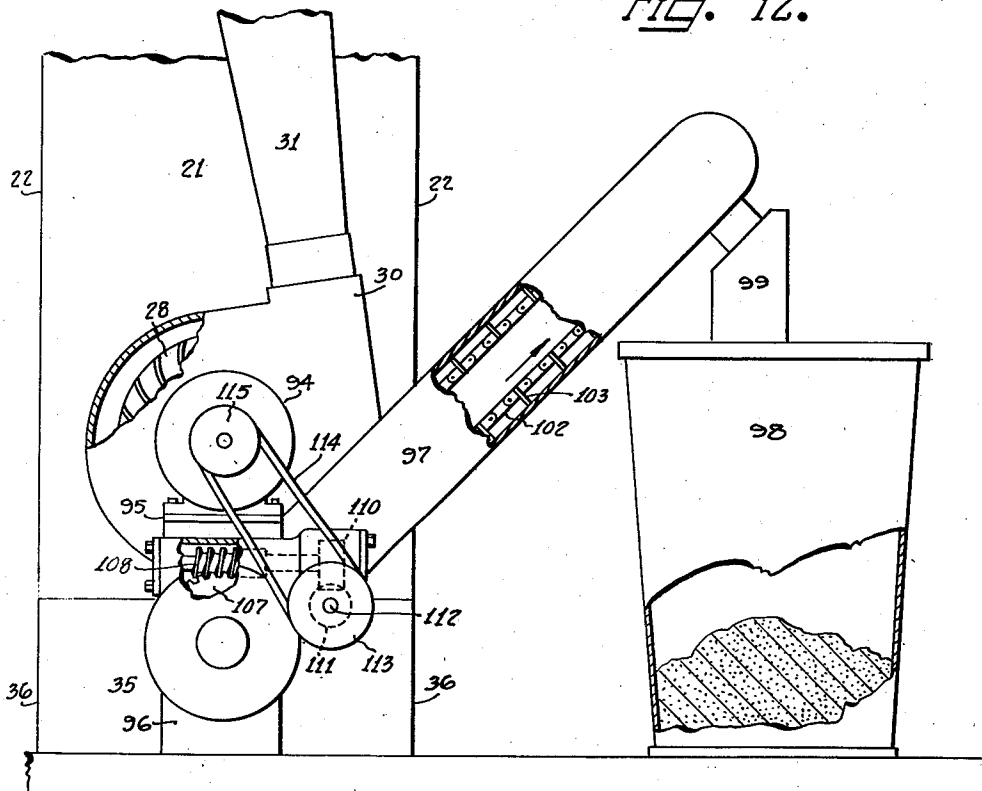
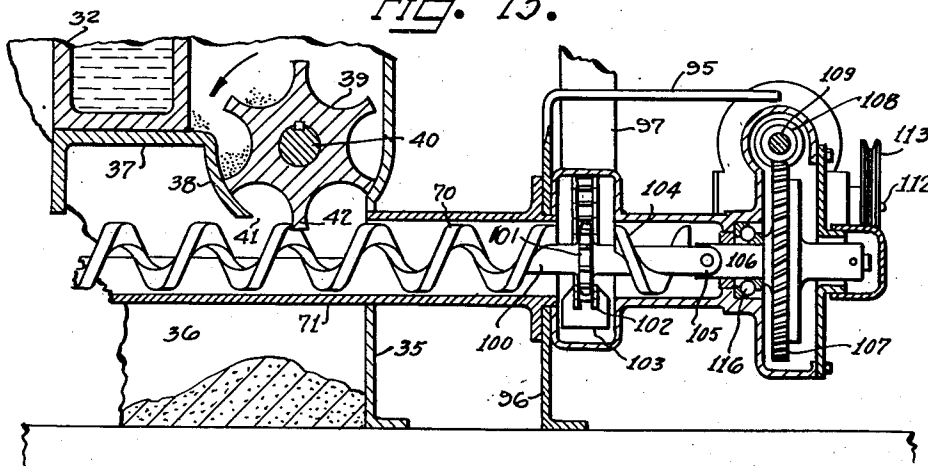


FIG. 13.



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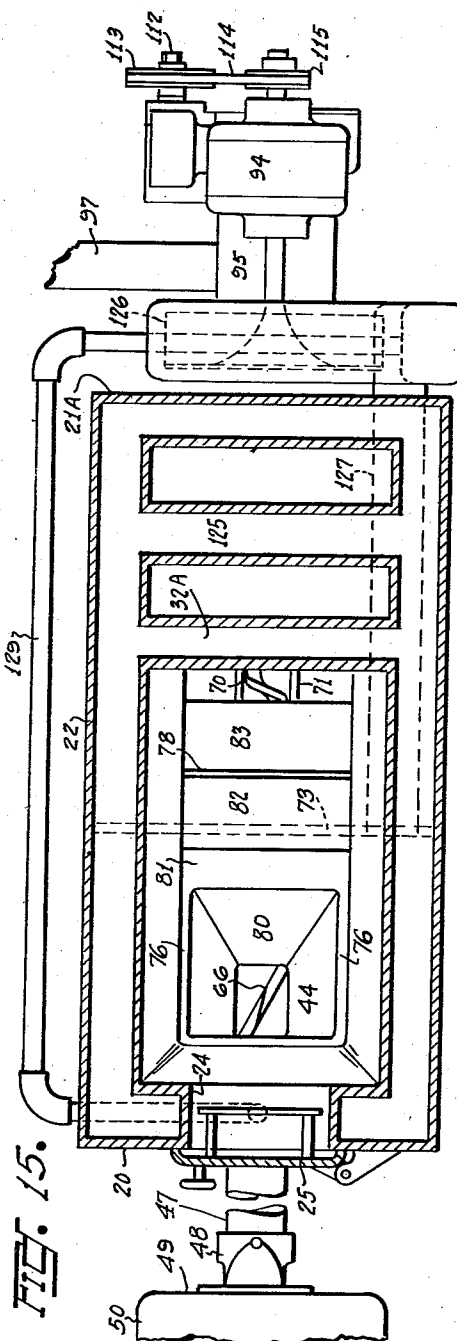
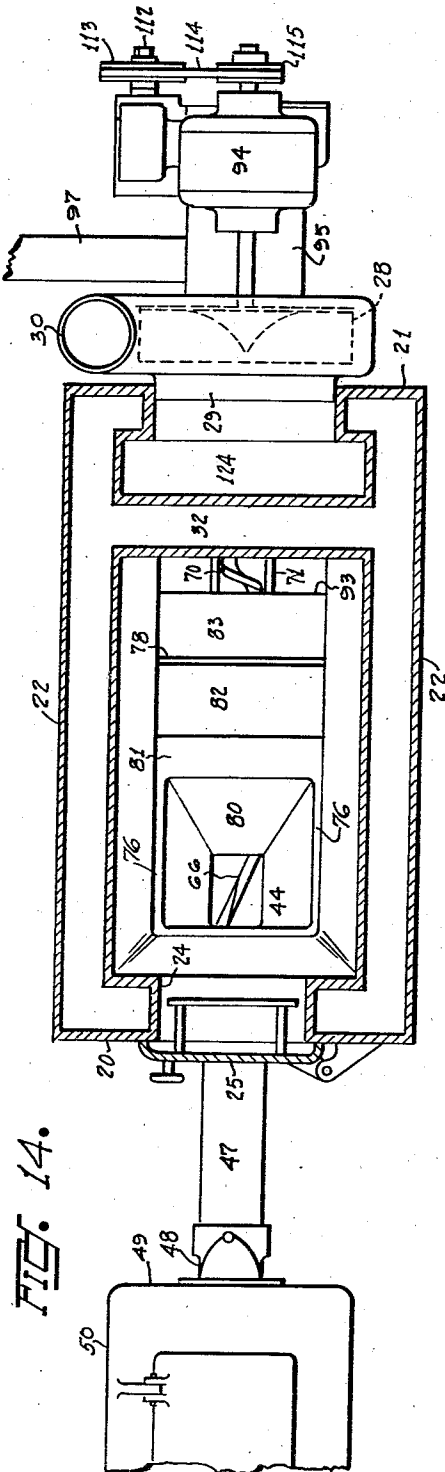
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FIG. 16.

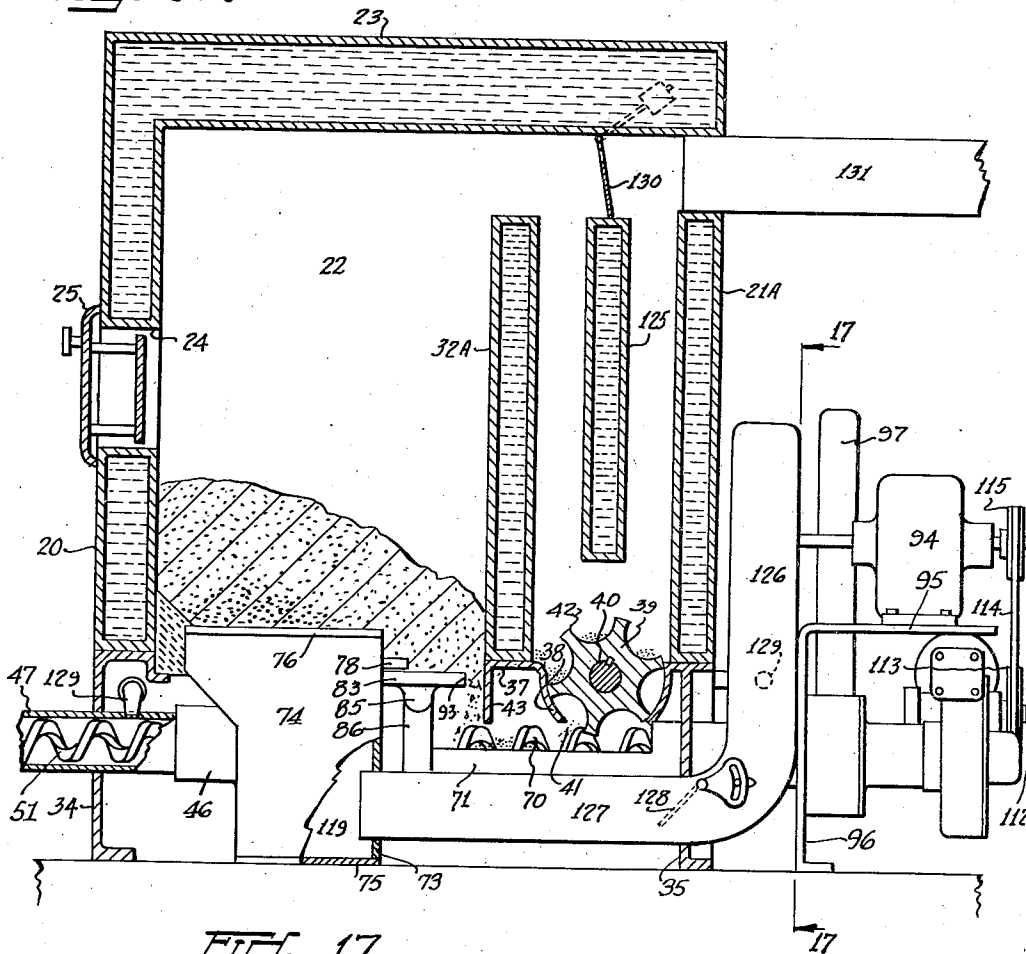
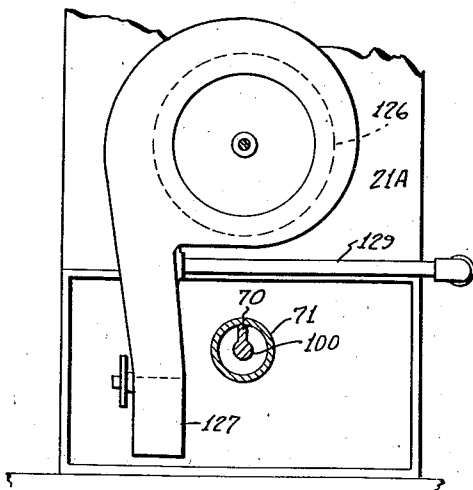


FIG. 17.



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UNITED STATES PATENT OFFICE

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STOKER AND FURNACE THEREFOR

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Application September 21, 1936, Serial No. 101,800

6 Claims. (Cl. 110—45)

This invention relates generally to heating systems and particularly to a combined form of stoker and boiler.

The main object of this invention is to provide a complete heating system in which a large part of the stoking mechanism is incorporated in the boiler itself.

The second object is to provide a combined boiler and stoker having a straight line arrangement for the coal conveyor between the coal storage section and the coal burning section and a continuous conveyor from the coal burning section to the ash discharge point.

The third object is to construct a heating system of the type described so the fly ash which may pass over into the passages of the boiler will fall into locations above and adjacent to the ash worm in a manner such that it may be readily dumped into the ash worm without other manual handling.

The fourth object is to provide an improved form of burning grates adapted to be used in conjunction with the stoker.

The fifth object is to use an exhaust fan arrangement for drawing off the products of combustion and to use a simple form of damper which will permit the furnace to be automatically freed of explosive gases during the shutdown period and which will automatically cause the combustion gases to travel the proper heating path during the operation of the stoker.

The sixth object is to arrange the combined boiler and stoker so an exhaust fan will draw off the burned gases and that the fan may be mounted adjacent to a gear case and that both the fan and the worm driving gears may be driven from a single motor.

The seventh object is to use an improved form of hollow or coreless worm.

The eighth object is to construct the system so it may be used either in connection with a coal bin or a hopper.

The ninth object is to so construct the system that it can be used to an equal advantage with warm air furnaces as well as in connection with steam and hot water boilers.

The tenth object is to provide an improved form of system of the type described in conjunction with a special form of ash remover.

The eleventh object is to construct a stoker of the type described with a view to keeping the weight thereof at a minimum and accomplishing this saving by starting from the basis of a small diameter, hollow worm in conjunction with which

parts of relatively small dimensions may be employed.

The twelfth object is to provide a coal feeding worm adapted to extend through a stoker retort in which the helix of the worm opposes itself under the retort and in which the connection between the opposing worm parts serves as an agitator.

The thirteenth object is to provide an improved form of horizontal, tank type of hopper.

The fourteenth object is to develop a heating system in which there is a straight line progress of coal from the bin to the combustion section, and upward progress of coal into the combustion section, then a straight forward progress of coal during combustion, and a dropping of the refuse into the ash worm on the same axis as the coal worm, and the collection of fly ash from the boiler and the depositing of same into the ash worm.

I accomplish these and other objects in the manner set forth in the specification following as illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view showing the boiler and furnace portion in vertical section in which the firepot is shown in elevation.

Fig. 2 is a section taken along the line 2—2 in Fig. 8.

Fig. 3 is a section taken along the line 3—3 in Fig. 2.

Fig. 4 is a section taken along the line 4—4 in Fig. 3.

Fig. 5 is a section taken along the line 5—5 in Fig. 6.

Fig. 6 is a fragmentary rear elevation of the coal tank or hopper.

Fig. 7 is a vertical section taken along the line 7—7 in Fig. 5.

Fig. 8 is an enlarged vertical section taken longitudinally through the furnace.

Fig. 9 is a horizontal section taken along the line 9—9 in Fig. 1.

Fig. 10 is a broken vertical section taken along the line 10—10 in Fig. 8.

Fig. 11 is a vertical section taken along the line 11—11 in Fig. 8.

Fig. 12 is a fragmentary rear elevation of the system showing the fan casing, transmission casing, the ash elevating conveyor, and the ash can broken away in section to disclose the interior thereof.

Fig. 13 is an enlarged vertical section through the drive mechanism of the coal and ash worm.

Fig. 14 is a horizontal section showing the employment of an exhaust fan.

Fig. 15 is a view similar to Fig. 14 but showing the employment of a pressure fan.

Fig. 16 is a vertical section through a modified form of the device shown in Fig. 15 in which a pressure fan is employed.

Fig. 17 is a section taken along the line 17—17 in Fig. 16.

Similar numbers of reference refer to similar parts of the drawings throughout the several views.

Referring in detail to the drawings, there is shown a boiler including a double front, rear, and side walls 20, 21, and 22, respectively, over which extends the double top 23. The front 20 is provided with a fire door opening 24 in front of which is placed a fire door 25. The back 21 is provided with a smoke outlet opening 25A which communicates by means of a smoke duct 26 with a stack not shown. Within the smoke duct 26 is placed a hanging damper 27 which is adapted to close when the furnace is operating and open under a negative pressure produced by the stack when the stoker is not being operated for the purpose of permitting the removal of gases from within the furnace. The smoke duct 26 communicates with a suction fan 28 whose intake 29 extends through the back wall 21 and whose discharge 30 communicates by means of the duct 31 with the smoke duct 26.

Within the boiler is placed the transverse wall or water leg 32 through whose upper portion is formed the opening 33 which in this instance registers with the opening 25 of the back 21. The walls 20, 21, and 22 and the wall 32 rest upon the rectangular base composed of the front 34, the back 35, and sides 36. Between the sides 36 and directly underneath the wall 32 is placed a wall 37. Between the wall 37 and the back 35 is formed a curved trough 38 in which is free to rotate the fluted ash gate 39 which is rotatably mounted on the shaft 40 which journals in the sides 36. The trough 38 is provided with an opening 41 along its lower side through which the blades 42 project. The front side 43 of the wall 37 projects downwardly to approximately the bottom of the trough 38.

Within the base and surrounded by the front, back, and sides 34, 35, and 36 respectively is mounted a retort 44 along the bottom of which extends the worm housing 45 whose end 46 communicates with a coal tube 47 which extends through the front 34 to the cleanout box 48 which is mounted on one end 49 of a tank or hopper 50. Extending along the bottom of the tank 50 to the front side of the retort 44 is a worm 51. A portion of the worm 51 which is within the tank 50 is provided with a core 52 on the front end of which is secured a crank 53 whose hub 54 journals in the bearing 55 which forms a part of the tank 50.

Along the longitudinal axis of the tank 50 are placed the short shafts 56 and 57 from the inner ends of which are suspended the forked arms 58 on the lower ends of which are disposed the agitator shoes 59. A rocking motion is imparted to the shaft 56 by means of the slotted arm 60 which is attached to one of the shafts 56. The lower end of the arm 60 is slotted to receive the pin 61 of the crank 53.

A rotary movement of the worm 51 will cause a rocking movement to take place at the arm 60 and a corresponding movement at the forked arms 58, causing the shoes 59 to move to and from the edges of the trough 62, which is formed

in the bottom of the tank 50. The tank 50 is supported by means of the standards 63.

The end 64 of the retort is cylindrical and coaxial with the coal tube 47. The end 64 constitutes an ash removing duct and contains a worm flight 65 which is threaded oppositely to the worm 51. The members 51 and 65 are joined by an agitator bar 66 which is inclined with relation to the axes of the members 51 and 65. The hollow worm flight 65 is provided with a spliced coupling 67, and its end 68 is secured to the cam shaft 69 which forms the core for the end of the ash removing worm 70. The ash removing worm 70 is disposed within the ash removing tube 71 which extends into the end 72 on the wall 73 which connects the sides 74. The sides 74 and the wall 73 extend from the floor plate 75 to the outwardly flanged edges 76. Brackets 77 project from the sides 74 and support the transverse bar 78. A central support 79 projects from the wall 73 above the connection 72. The side 80 of the retort 44 is sloping and its upper edge lies between the side walls 74.

Between the bar 78 and the edge 81 of the side 80 is disposed the upper sliding grate 82. Between the bar 78 and the support 79 is the lower sliding grate 83. The grates 82 and 83 are perforated and integral with the side members 84.

Projecting downwardly from the lower grate 83 are the lugs 85. Hinged to the lugs 85 are the upright arms 86, which are joined by the slotted transverse bar 87. On the shaft 69 is disposed a cam 88, which engages the slot 89 in the bar 87. The lower ends of the arm 86 are provided with slots 90 which receive the pins 91 which project outwardly from the adjacent faces of the lugs 92, which are integral with the wall 73.

The portion of the device just described constitutes the shaking grate by means of which ashes are carried away from the retort to the ash worm 70. It can be seen that a rotary motion imparted to the worms 51 and 70 will cause the cam 88 to move the arms 86 and reciprocate the grates 82 and 83, permitting the burning coal to spread over a relatively large grate surface, upon which it may be burned before passing over the edge 93 of the lowermost grate 83.

It will be noted that the upper side of the ash duct 71 is cut away from the connection 72 to the back 35 in order to permit the ashes which are discharged from the grate 83 to find their way into the ash duct 71.

The fan 28 is operated by a motor 94 which rests upon a shelf 95 formed at the upper end of the upright standard 96 through which the ash duct 71 projects. The ash duct 71 communicates with an ash conveyor housing 97 which is preferably inclined and discharges downwardly into the ash can 98 through a convenient connection 99.

The ash removing worm 70 has secured to the driven end thereof a shaft 100 on which is placed a sprocket wheel 101, which carries the chain 102 whose flights 103 travel around the interior of the housing 97 and serve to elevate the ashes from the bottom of the housing 97 and discharge them through the connection 99.

The shaft 100 is provided with a short section of worm flight 104 which is reversed with relation to the worm 70 in order to prevent ashes from passing axially beyond the conveyor housing 97. The shaft 100 is joined by the universal joint 105 to the shaft 106 of the worm wheel 107, 75

which is driven by the worm 108 on the shaft 109. The shaft 109 is driven through the helical gears 110 and 111, the latter of which is secured on the shaft 112, on the outer end of which is secured a pulley 113 whose belt 114 passes around the pulley 115 of the motor 94. The shaft 106 is provided with a thrust bearing 116 which permits the entire worm sections to be operated in tension. Obviously, the details of construction may be modified greatly without departing from the spirit of this invention.

It will be noted that the blades 42 engage the flights of the worm 70, the purpose being to cause the rotation of the worm 70 to produce a rotation of the ash gate 39.

In this form of the system, it is contemplated to rely upon a mechanically created negative pressure being formed within the combustion chamber 117.

Air is admitted to the combustion chamber 117 through an air duct 118, which connects the plenum chamber 119 formed around the retort 44 and the atmosphere under the control of the damper 120. Air is drawn through the air duct 118 and delivered to the burning fuel through the openings 121, 122, and 123 and between the grates 82 and 83 and their adjacent members 81, 78, and 79. The gaseous products of combustion are drawn through the opening 33 and thence carried downwardly through the passageway 124 through the fan inlet 29 into the fan 28 from whence they are discharged through the duct 31 into the smoke duct 26. Obviously, such an action produces a higher pressure within the duct 26 than exists within the combustion chamber 117, thereby causing the damper 27 to close.

It will be observed that during the downward travel of the burned gases through the passageway 124, the solids will be inclined to pass the fan opening 29 and be deposited between the blades 42 of the ash gate 39 and thence be discharged into the ash removing worm 70. Ashes may enter the ash worm 70 directly from the lower grate 83 while fly ash may enter the worm 70 by passing around the ash gate 39.

When the motor 94 is not operating, that is, when the fan 28 and the worms 51 and 70 are not being operated, a reverse condition exists, and there is a negative pressure within the smoke duct 26 which causes the damper 27 to open, and gases which may have formed within the combustion chamber 117 are allowed to pass through the openings 33 and 25 and to escape through the smoke pipe 26 to the atmosphere.

In Fig. 11 is shown the preferred type of coupling for the sections of the worm flight 65. It will be noted that this construction facilitates the joining of the worm parts and permits the separation of the entire worm assembly into lengths convenient for handling.

In the form of the device shown in Figs. 15 to 17 inclusive, the construction is the same as in the first described form of the device except in the following particulars. An additional baffle 125 is interposed between the back 21A and the transverse baffle 32A, the baffle 125 being directly above the ash gate 39. Instead of employing an exhaust fan in this form of the device, I use a pressure fan 126 which delivers air through the air duct 127 to the plenum chamber 119. It is also desirable in this form of the construction to employ an air regulating damper 128 within the duct 127. When a pressure fan is employed, it is desirable to provide an auxiliary

air line 129, which establishes communication between the fan 126 and the coal tube 47.

In the last described form of the device, the automatic damper 130 may be placed at the top of the baffle 125 instead of in the smoke pipe 131. The remaining parts are substantially the same as in the first described form of the device.

I claim:

1. In a device of the class described, the combination of a furnace having a bridge wall across one end thereof adapted to form a combustion chamber on one side of said bridge wall and a down draft passage on the other side of said bridge wall, said wall extending upwardly and terminating near the upper part of the furnace, an ash gate forming a closure for the bottom end of said down draft passage, said gate consisting of a revoluble fluted member, a retort at the end of said combustion chamber opposite said bridge wall, stepped shaker grates between said retort and bridge wall, a duct extending through said furnace and retort and below said grates and ash gate, said duct being cut away on its top side to admit ashes thereto, a revoluble conveying element within said duct consisting of a coal conveying screw flight extending from one end of said duct to the near side of said retort, an ash removing flight extending from under said grates to an ash outlet, a reversed flight secured between said coal and ash flights, the junction of said coal and reverse flights being at the bottom of the retort and consisting of a diagonal bar connecting the adjacent ends of the reversely wound flights, a lever hinged at one end to a support and at the other end to the shaker grates and a cam on the axis of said conveyor for actuating said lever in a manner to reciprocate said grates as the conveyor is turned.

2. The combination of a retort having a coal conveyor worm associated therewith with means for feeding fuel upwardly into said retort, grates for carrying the incombustibles away from the end of said retort and an ash conveying worm forming a continuation of the coal conveyor for carrying ashes away from the end of said grates.

3. In a furnace the combination of a combustion chamber having a vertical bridge wall disposed transversely across one end thereof to form a down draft passage between said bridge wall and one adjacent end of the combustion chamber, said combustion chamber being provided with ash outlets in front of and behind said bridge wall, a closure for the ash outlet of said down draft passage, a retort in the bottom of said combustion chamber including moving grates for discharging ashes through the outlet in front of said bridge wall, a worm conveyor extending through said retort and having one end projecting into a coal container to draw coal therefrom and having the other end extending past said ash outlets to carry ashes therefrom, a can for drawing gaseous products of combustion from said down draft passage and a damper for permitting the gaseous products of combustion to be drawn off over said bridge wall by natural draft when said fan is not being operated.

4. The combination of a retort, a conveying worm extending therethrough, one end of said worm constituting a coal conveyor for drawing coal into said retort and the other end of said worm constituting an ash conveyor for removing ashes from said retort, a shaker grate along one end of said retort over which ashes can pass into said ash conveying worm, a cam mounted on said

ash conveying worm and a lever actuated by said cam and connected to said grates whereby the rotation of said ash conveying worm will produce a reciprocating motion at said grates.

- 5 5. The combination with a combustion chamber of a retort, a conveying worm extending there-
10 through, one end of said worm constituting a coal conveyor for drawing coal into said retort and the other end of said worm constituting an ash
15 conveyor for removing ashes from said retort, a shaker grate along one end of said retort over which ashes can pass into said ash conveying worm, a cam mounted on said ash conveying worm, a lever actuated by said cam and con-
15 nected to said grate whereby the rotation of said ash worm will produce a reciprocating motion at said grates, and a transverse bridge wall extend-

ing across said combustion chamber above the ash worm, the front side of said bridge wall being spaced from said grate, for the purpose of providing an ash outlet and the rear side of said bridge wall having a gated outlet through which 5
ashes can pass from behind said bridge wall into said ash worm.

6. The combination of a retort, a worm extending therethrough, one end of said worm being adapted to draw coal from a storage point to said 10
retort and the other end of said worm constituting an ash conveyor for removing ashes from said retort, a shaker grate at one end of said retort over said ash removing worm and means for actuating said shaker grate from said ash 15
worm.

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