Oct. 30, 1945. R. W. SUMAN 2,387,781

STOKER

Filed March 4, 1942 5 Sheets-Sheet 1

Fig. 1.

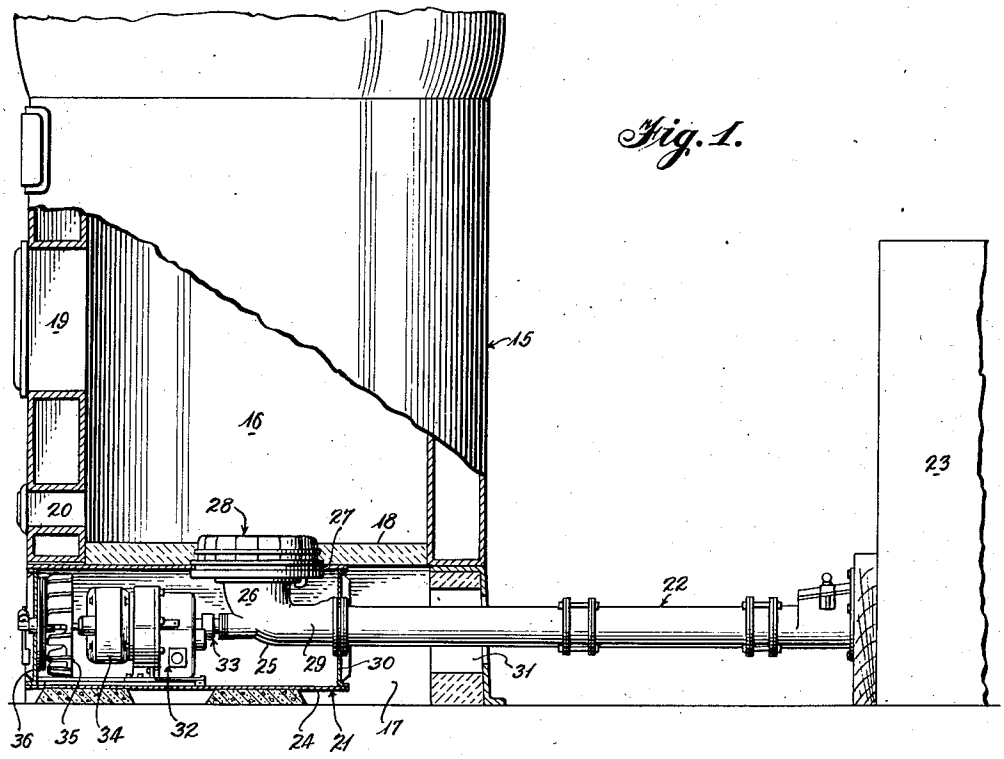
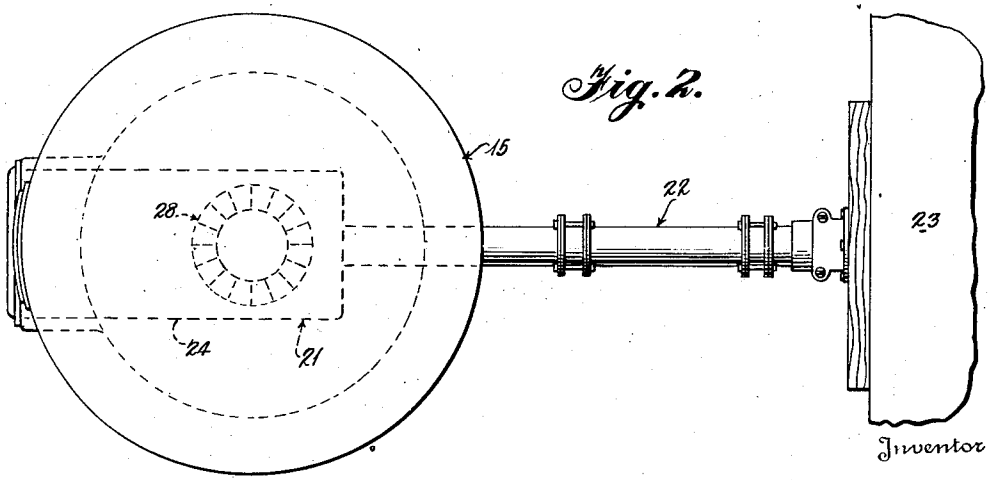


Fig. 2.



Inventor

Robert W. Suman

By L. Donald Myers

Attorney

Oct. 30, 1945. R. W. SUMAN 2,387,781

STOKER

Filed March 4, 1942 5 Sheets-Sheet 2

Fig. 3.

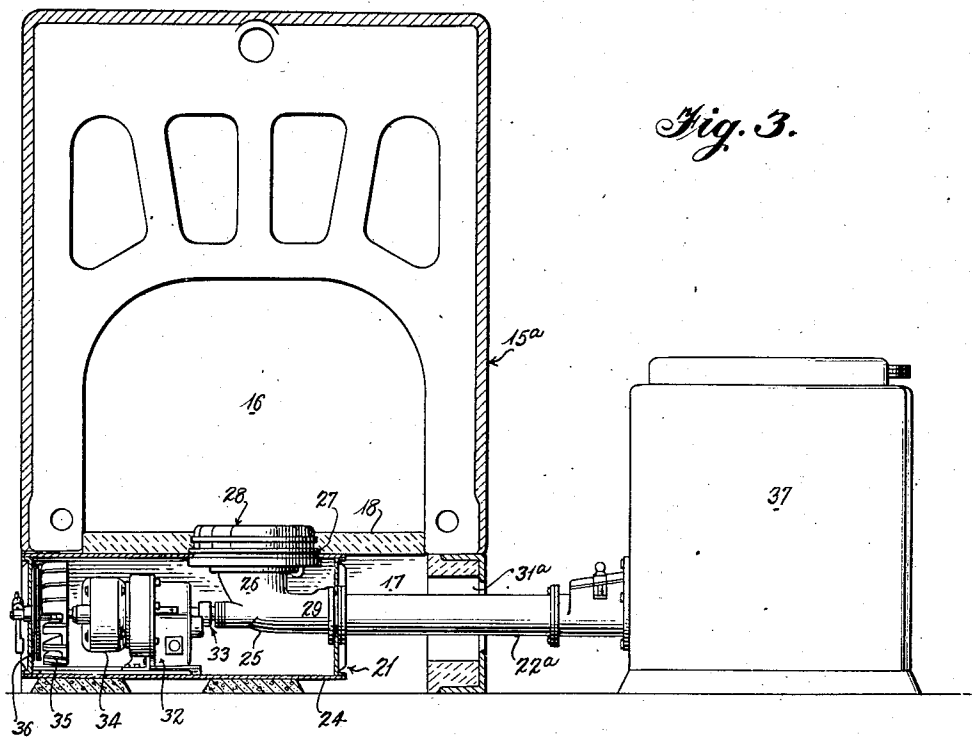
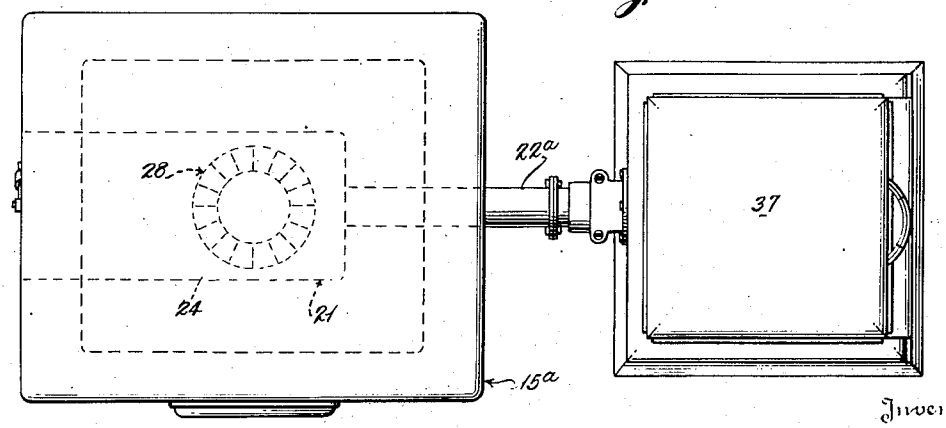


Fig. 4.



Inventor

Robert W. Suman

By L. Donald Myers

Attorney

Oct. 30, 1945. R. W. SUMAN 2,387,781

STOKER

Filed March 4, 1942 5 Sheets-Sheet 3

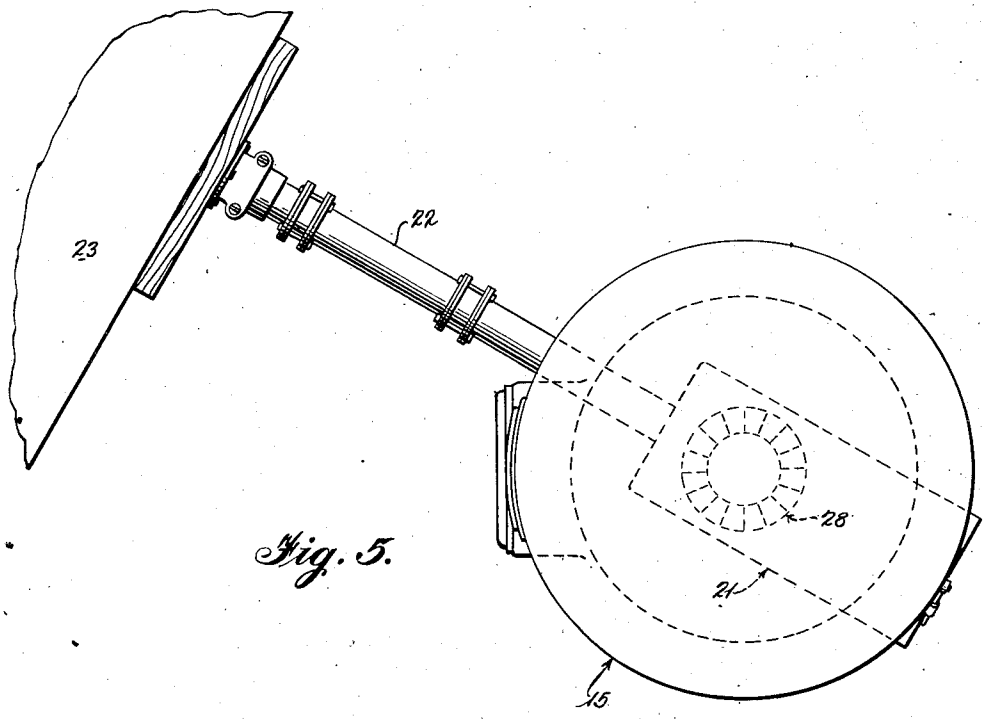
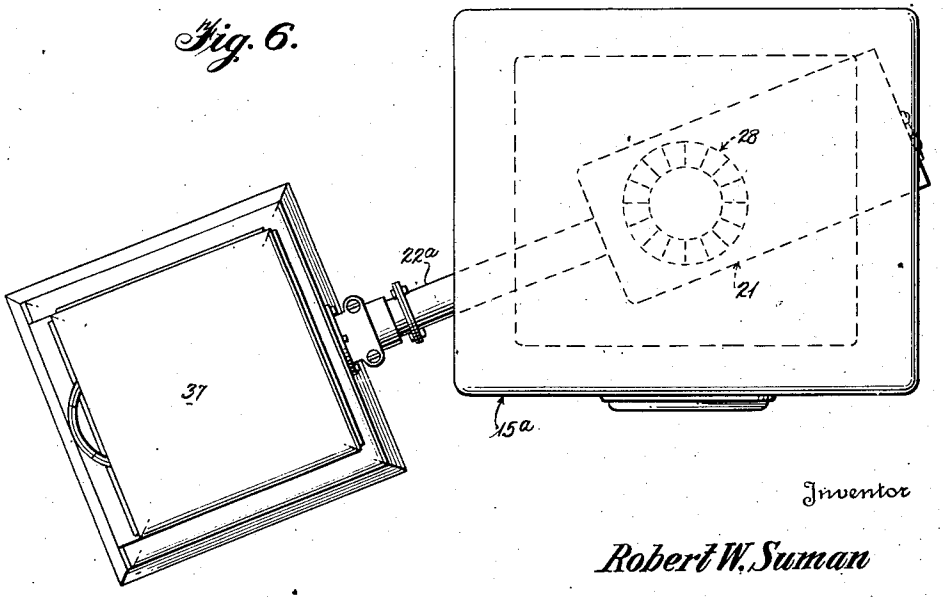


Fig. 5.

Fig. 6.



Inventor

Robert W. Suman

By L. Donald Myers

Attorney

Oct. 30, 1945. R. W. SUMAN 2,387,781

STOKER

Filed March 4, 1942 5 Sheets-Sheet 4

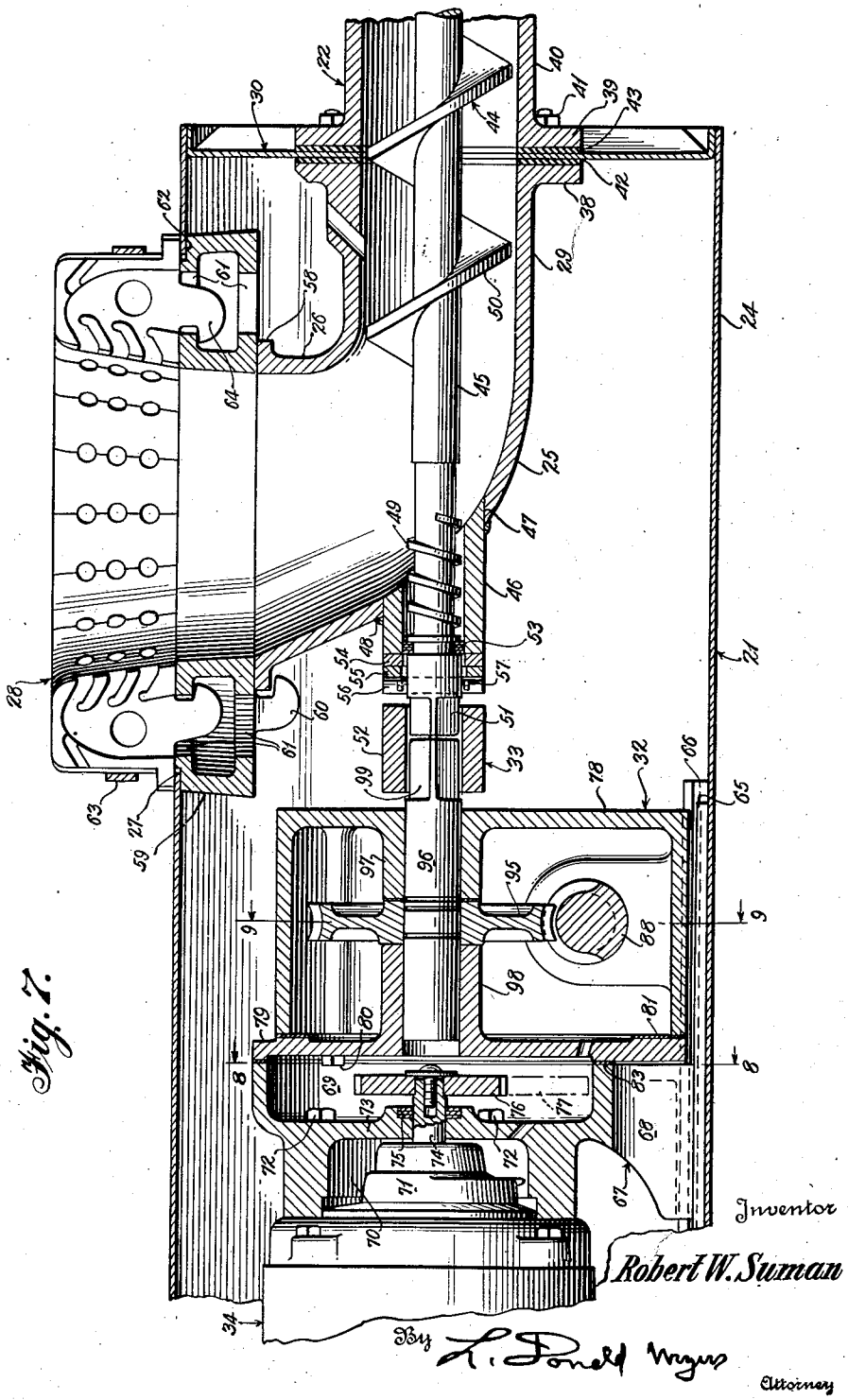


Fig. 7.

Inventor
Robert W. Suman
By L. Donald Wyus
Attorney

Oct. 30, 1945. R. W. SUMAN 2,387,781

STOKER

Filed March 4, 1942 5 Sheets-Sheet 5

Fig. 8.

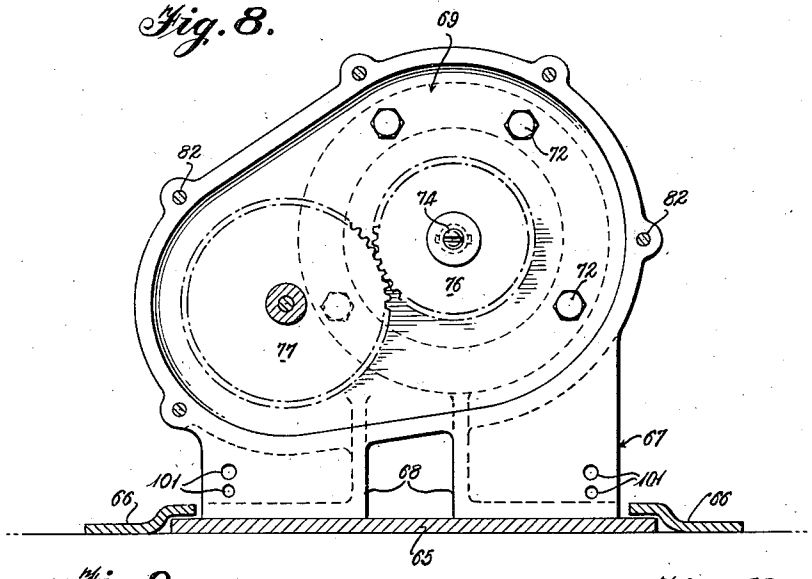


Fig. 9.

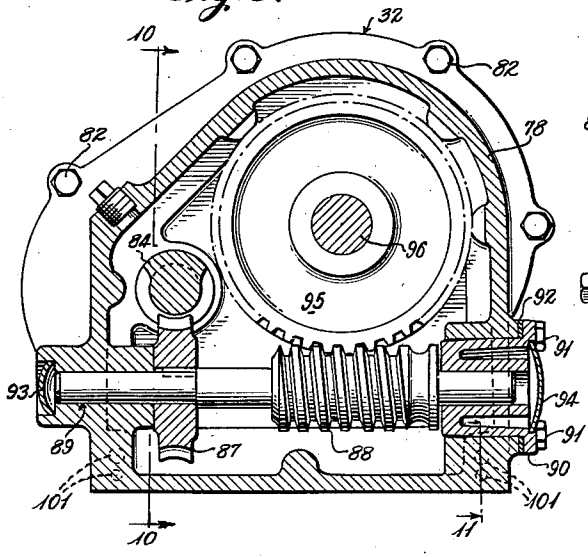


Fig. 10.

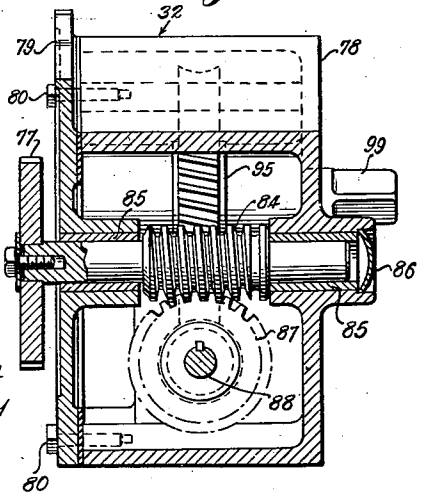
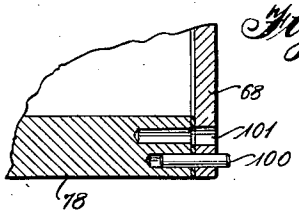


Fig. 11.



Inventor

Robert W. Suman

By L. Donald Myers

Attorney

Patented Oct. 30, 1945 2,387,781

UNITED STATES PATENT OFFICE

2,387,781

STOKER

Robert W. Suman, Chicago, Ill., assignor to Link-Belt Company, a corporation of Illinois

Application March 4, 1942, Serial No. 433,357

21 Claims. (Cl. 110—45)

This invention relates to new and useful improvements in stokers which are particularly adapted for use with heating furnaces or boilers.

It is the present practice, in designing stokers for use with the furnaces or boilers that constitute a part of the heating systems for private dwellings and smaller office buildings, stores, apartment houses, or the like, to construct the retort and its associated tuyère and windbox or plenum chamber so that these elements are all that may be located in the base portion or ash pit. The coal feeding conveyor, such as a tube with its feed screw, and the air duct extend from these elements through the wall of the furnace or boiler casing for proper connection with the remaining equipment of the stoker which is located outside of the casing. This exteriorly located equipment must necessarily include a prime mover for driving all of the moving parts of the stoker, some form of speed reducer unit, an encased apparatus for delivering air to the air duct, special bases or mountings for supporting and tying together the aforementioned devices, and suitable drive connections between the prime mover and the speed reducer unit as well as between this unit and the conveyor and air apparatus. For several obvious reasons, a suitable casing must be provided to enclose this exteriorly located equipment.

If the stoker is of the bin-fed type the casing for the exterior equipment will utilize space in the basement which might advantageously be used for some other purpose. Where the use of a hopper for supplying the coal to the conveyor is more desirable or feasible, the aforementioned exteriorly located equipment may be enclosed within the hopper casing by resorting to either one of the objectionable practices of reducing the coal capacity of the hopper or enlarging the casing.

It frequently is necessary to either alter the existing arrangement of the heating plant, the coal bin, a possible hot water heater, or the like, to provide space for this exterior equipment or resort to the use of some more expensive, less desirable stoker layout which can be adapted to the available floor space.

It is the primary purpose of this invention to overcome all of the above noted disadvantages or undesirable features that are inherent in present day conventional stokers and this desired result is made possible by providing a stoker assembly which, with the exception of the fuel supply bin or hopper and a portion of the fuel conveyor, can be installed within, or approximately within the base or ash pit of boilers or furnaces, including even the smaller sizes which are employed for heating dwellings, with the result that the floor space usually required for accommodating the aforementioned exteriorly located equipment of conventional stokers will be made available for other uses and the general appearance of the heating plants will be materially enhanced.

A further important object of this invention is to provide a coal stoker assembly of the above mentioned type which can be installed with the coal feeding conveyor extending horizontally in any desired direction from the boiler or furnace so that it can adapt itself to any arrangement of heating plant, coal bin, hot water heater, air ducts, etc.

Still another important object of the invention is to design and arrange the basic units of the stoker so that the air duct or plenum chamber may be employed as the casing or housing for the retort, the prime mover, the speed reducer unit, the various mountings or bases which are required by the aforementioned elements, and the means employed for supplying the retort with the necessary combustion supporting air, said designing or arranging of the basic units also making possible the elimination of other parts of conventional stokers, with the result that a material reduction in manufacturing costs may be effected.

More specific objects of the invention are to so assemble the prime mover, the speed reducer unit, and the air supplying means relative to each other that they may be mounted on a single base for ready insertion and withdrawal, as a unit, through one end of the air duct or plenum chamber to facilitate maintenance and servicing, and to so design the air duct or plenum chamber and the various equipment items that are associated therewith for forming the basic stoker assembly that fuel feeding conveyors of different lengths, and suitable for cooperating with either hoppers or bins, may be interchangeably connected thereto, whereby the problem of manufacturing and maintaining in stock numerous different sizes and styles of stokers is materially simplified and the necessity for maintaining large stock inventories is overcome.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevational view, partly broken

away, of a coal burning furnace with the type of stoker embodying this invention properly associated therewith and obtaining its fuel supply from a bin,

Figure 2 is a top plan view of the installation shown in Fig. 1,

Figure 3 is a front elevational view of a boiler type of heating plant, with the front wall of the casing removed, and with the base portion or ash pit shown in vertical section, in which is installed the stoker of this invention that is receiving its supply of fuel from a hopper,

Figure 4 is a top plan view of the installation shown in Fig. 3,

Figure 5 is a plan view of the furnace, stoker and bin of Figs. 1 and 2 but showing the basic stoker assembly and its fuel conveyor mechanism installed in the furnace in a manner which will adapt itself to a different arrangement of furnace and bin,

Figure 6 is a similar view to Fig. 5 but illustrates the stoker installed in a boiler in a manner to accommodate a different boiler and hopper arrangement,

Figure 7 is a detail, enlarged, vertical sectional view of the principal portion of the basic stoker assembly with the delivery end portion of the fuel conveyor properly associated therewith,

Figure 8 is a detail view of a portion of the speed reducer unit and taken on line 8—8 of Fig. 7,

Figure 9 is a detail vertical sectional view taken on line 9—9 of Fig. 7,

Figure 10 is a detail vertical sectional view taken on line 10—10 of Fig. 9, and

Figure 11 is a fragmentary vertical sectional view taken on line 11—11 of Fig. 9.

In the drawings, wherein for the purpose of illustration is shown the preferred embodiment of this invention, and first particularly referring to Figs. 1 and 2, the reference character 15 designates a conventional heating furnace, the interior of which has been divided into a fire box or combustion chamber 16 and base compartment 17 by means of the horizontal partition 18 which is formed of a suitable castable refractory material. In other words, the partition 18 has been constructed to take the place of the grates of this type of furnace when it is hand fired. The front wall of the furnace body or casing is formed with the conventional coal admitting opening 19 and the conventional clinker removing opening 20. The stoker structure to be specifically described in connection with the several figures is illustrated as having a burner head or tuyère assembly associated therewith which is adapted for burning bituminous coal. It is to be understood, however, that this same basic stoker assembly can be provided with proper types of burner heads or tuyère structures for burning anthracite coal or coke. With the type of burner head illustrated, either or both of the openings 19 and 20 may be employed for removing the clinkers and the ash from the fire box or combustion chamber 16. When the stoker employs a burner head for anthracite coal, suitable mechanism will be employed for breaking off the ash and collecting it in the base or ash pit compartment 17 for removal by hand or by means of a suitable conveyor. No attempt has been made to illustrate such facilities for handling anthracite ash as it forms no part of the present invention.

These Figs. 1 and 2 disclose the furnace 15 as having installed therein the basic stoker assembly which will be identified in its entirety by the reference character 21. This basic assembly is installed in the base compartment or ash pit 17. It is arranged so that it will extend from the front to the back of the furnace. When thus arranged, the fuel feeding conveyor 22 will extend through the rear wall of the furnace casing. This fuel conveyor is suitably connected at its outer end to a bin type of fuel supply 23. It is to be understood, however, and as will be illustrated in connection with subsequently described figures, the basic stoker assembly 21 can be connected to fuel conveyor mechanism which can receive its supply from a hopper.

The basic stoker assembly 21 will be broadly described in connection with the disclosure of Fig. 1. A more detailed description will be presented in connection with subsequently referred to figures. This basic assembly includes a sheet metal air duct 24 that may be supported in any desired manner in the base compartment or ash pit 17. The air duct preferably is of substantially rectangular formation in top plan.

A retort 25 is arranged in the inner portion of the air duct 24 with its coal delivery branch 26 in alignment with an opening formed in the top wall of the air duct. This opening accommodates the tuyère assembly 28 which also passes through a suitable opening left in the refractory partition 18. The receiving branch 29 of the retort terminates adjacent the inner end wall 30 of the air duct for connection in a suitable manner to the fuel conveyor mechanism 22. This fuel conveyor extends through a suitable opening 31 formed in the rear wall of the furnace casing so that it may extend to the bin 23.

A speed reducer unit 32 is positioned in the air duct 24 between the retort 25 and the front or outer end of the air duct. A suitable drive connection 33 is provided between the power output shaft of the speed reducer unit 32 and the shaft of the conveyor mechanism 22.

A suitable electric motor, or other form of prime mover, 34 is attached to the speed reducer unit 32 for directly driving the power input shaft of this unit. This motor, therefore, is positioned on the far side of the speed reducer unit 32 from the retort 25.

One end of the armature shaft of the motor 34 is extended sufficiently to permit the air pressure fan 35 to be mounted thereon. This fan is located at the front or outer end of the air duct 24 and will function to force air into the air duct for delivery to and through the tuyère assembly 28 to support combustion of the fuel as it is delivered in any desired manner to the fuel bed. It will be appreciated, therefore, that the air duct 24 additionally functions as a casing or housing for the various devices which constitute the basic stoker assembly. The forced draft of air through the air duct 24 will naturally maintain the motor 34 and the speed reducer unit 32 at proper operating temperatures.

The admission of air to the air duct 24 through the front or outer end preferably is controlled by a shutter mechanism 36 which may be either automatically or manually regulated.

It will be explained at a later point how the speed reducer unit 32, the motor 34, the air pressure fan 35 and the shutter 36 may be moved as a unit into and out of the air duct 24 through the outer end of the latter. Such an arrangement permits these elements of the basic stoker assembly to be quickly and easily removed from the air duct and either serviced on the premises or taken to a repair shop for servicing. If repairs

are required during a season of the year when operation of the furnace is necessary, a reconditioned unit may be rented or loaned to the customer or an entirely new unit may be sold and permanently installed.

Figs. 3 and 4 disclose a heating boiler 15a which is divided into a combustion chamber or fire box 16 and a base compartment or ash pit 17 by a refractory partition 18.

The same basic stoker assembly described in connection with Figs. 1 and 2 is installed in this boiler 15a. The assembly, however, is arranged so that it will extend transversely, or from side to side, of the heating boiler. That is to say, the outer shutter controlled end of the air duct 24 will be arranged at one side of the boiler. The air duct will be inserted through a suitable opening formed in the boiler base. With the basic stoker assembly arranged in this manner, the fuel conveyor mechanism 22a will extend through a suitable opening 31a formed in the opposite side wall of the boiler base. This conveyor mechanism is of a proper design to be attached to the fuel supply hopper 37 that is positioned at one side of the boiler. By substituting the conveyor mechanism 22 of Figs. 1 and 2 for the conveyor mechanism 22a of Figs. 3 and 4, the stoker assembly installed in the boiler 15a may receive its supply of fuel from a bin 23 instead of the hopper 37. As was pointed out above, the same type of substitution may be made for the stoker assembly of the furnace in Figs. 1 and 2 to permit the hopper 37 to be used in place of the bin 23. As all of the elements of the basic stoker assembly in Figs. 3 and 4 are identical with the elements of the assembly shown in Figs. 1 and 2, the same reference characters will be applied to like elements and these elements will not be specifically referred to.

Fig. 5 is provided to illustrate the manner in which the basic stoker assembly 21 and the fuel conveyor mechanism 22 may be arranged with respect to the furnace 15 so that they will properly cooperate with the supply bin 23 when the latter is located at an entirely different point with respect to the furnace. Fig. 6 is intended to illustrate the same possibilities for the boiler 15a and its basic stoker assembly 21, fuel conveyor mechanism 22a and hopper 37. In other words, by considering the disclosures of Figs. 1 to 6 collectively, it will be appreciated that the stoker embodying this invention can be installed in any conventional heating furnace or boiler so that it may receive its supply of fuel from either a bin or a hopper which is arranged at any point relative to the outside of the furnace or boiler. Because of this flexibility of installation, it should not be necessary to disturb any existing arrangement of heating plant, bin, hot water heater, air ducts, or the like which may be encountered.

The disclosures of Figs. 7 to 11 inclusive will be employed for providing a more detailed description of the basic stoker assembly and the fuel conveyor mechanism. Fig. 7 discloses the retort 25 as having its horizontally arranged branch 29 flanged at its outer end 38 for connection with the inner end wall 30 of the air duct 24 and the adjacent flanged end 39 of the tube 40 which forms a part of the coal feeding mechanism 22. Suitable bolts and nuts 41 are employed for providing this connection. Gaskets 42 and 43 are interposed between the flanges 38 and 39 and the end wall 30 to provide a gas and dust tight joint. The end wall 30 of the air duct may be either permanently or detachably secured in place either by welding or by means of suitable fastening devices. This attaching method helps to support the retort 25 in the inner end portion of the air duct 24 and maintains the receiving end or branch 29 of the retort in proper alignment with the tube 40.

Although the fuel feeding mechanism need not be so limited, Fig. 7 shows the feed screw 44 for delivering the fuel from a bin or a hopper through the tube 40 to the retort 25. It will be understood, of course, that the tube 40 may be made up of any desired number of sections to provide the proper length to reach to the bin or hopper source of supply while the feed screw, or other suitable types of feeding mechanism, will be of proper length to extend entirely through the tube 40 and a proper distance into the bin or hopper to pick up the coal and deliver it to the tube.

Fig. 7 discloses the shaft 45 of the feed screw 44 as extending into a tubular extension 46 that is fitted in an aperture 47 formed in the wall of the retort. This tubular extension is suitably secured in place, as by welding 48. This projecting end portion of the feed screw shaft is provided with the flight 49 which is pitched in the opposite direction to the flight 50 and functions to prevent fines from working out of the retort through the bore of the extension 46. The feed screw shaft extends beyond the outer end of the tubular extension 46 and is formed with a squared end 51 that is adapted to enter the coupling sleeve 52. A felt stuffing ring 53 surrounds the shaft 45 at the location of the outer end portion of the tubular retort extension 46. A thrust washer 54 surrounds the shaft 45 and bears against the outer end of the extension 46. A steel washer 55 is placed next to the thrust washer. A thrust pin 56 passes through the shaft and is held in place by cotter pins 57. The thrust of the feed screw shaft 44 is in the direction of the source of fuel supply and is delivered to the retort 25 through the thrust pin 56 and the two washers 54 and 55.

The vertically directed branch, or outlet end, 26 of the retort is flanged at 58 for connection with the retort spacer ring 59 by means of the lugs 60. This spacer ring is hollow and is formed with openings 61 for the passage of air from the interior of the air duct 24 into the tuyère assembly 28. The upper side of the retort spacer ring cooperates with the opening 27 formed in the top wall of the air duct 24 and is provided with a shoulder 62 for his purpose. This shoulder seats the spacer ring against the air duct wall and the inner margin of the shoulder prevents the ring from shifting relative to the opening 27.

The assembly 28 is made up of a suitable number of tuyère bars and tuyère spacers in any conventional manner. The tuyère band 63 retains the bars and spacers assembled in a ring. Suitable lugs 64 retain the tuyère assembly in position on the retort spacer ring 59 so that the opening through the tuyère assembly will properly register with the center opening of the ring 59 and the bore of the retort 25. It will be understood as fuel is passed through the feed tube 40 and into the retort 25, it will be forced upwardly through the retort ring 59 and into the tuyère assembly to form the fuel bed. Combustion supporting air is passed through the air duct 24 and the retort ring 59 into the tuyère assembly from which it will be delivered to the fuel bed through the tuyère openings in the conventional manner.

The remainder of the basic stoker assembly;

i. e., the speed reducer unit 32, the prime mover 34, the fan 35 and the shutter mechanism 36 has been briefly described above as being movable as a single unit into and out of the air duct 24 to facilitate maintenance and servicing. These various devices will be referred to collectively as the stoker sub-assembly unit. This sub-assembly unit is provided with a mounting plate 65 which is guided in its movements into and out of the air duct 24 by the two reversely bent strips 66 which are anchored to the bottom wall of the air duct 24. This guide arrangement is best illustrated in Figs. 7 and 8.

The stoker sub-assembly unit is directly attached to the base plate 65 by means of the mount 67 which is a casting that is formed with the spaced mounting legs 68. Above these legs the mount is formed with two oppositely opening chambers or recesses 69 and 70. The chamber or recess 70 receives and properly seats the end-bell 71 of the electric motor 34. Suitable screws 72 are employed for attaching the motor to the mount 67. The wall or partition 73 that separates the two chambers or recesses 69 and 70 has an opening formed therein to accommodate the end 74 of the motor shaft. An oil wiper washer 75 is seated in a pocket formed in the wall or partition 73 and surrounds the motor shaft 74. The end of this shaft that projects into the chamber or recess 69 has mounted thereon the driving spur gear 76. This spur gear is employed for directly driving the driven spur gear 77 of the speed reducer unit, see Figs. 7, 8 and 10.

The speed reducer unit is best illustrated in Figs. 7, 9 and 10. It includes a housing 78 that is formed with a separable cover 79 for one side thereof. The cover is attached to the housing by the screws 80, see Figs. 7 and 10, and a gasket 81 is employed between the housing and the cover to prevent leakage of a suitable lubricant. The cover 79 extends beyond the top and side walls of the housing 78 to provide a flange by means of which the cover, and its attached housing, are secured to the mount 67. The screws shown in Figs. 8 and 9, and identified by the reference character 82, pass through the flange of the cover and into the mount 67 to effect this connection. A gasket 83 seals the joint between the mount 67 and the cover 79 to prevent loss of lubricant.

By inspecting Fig. 10, it will be seen that the driven spur gear 77 is mounted on the end of the primary worm shaft 84 journaled in the bearings 85 suitably carried by the outer wall of the housing 78 and the housing cover 79. A suitable plug 86 closes the outer end of the bearing 85 which is carried by the outer wall of the housing.

Figs. 9 and 10 show the worm of the primary worm shaft 84 meshing with the primary worm gear 87 that is keyed on the secondary worm shaft 88. This secondary worm shaft is journaled at its opposite ends in bearings 89 and 90 which are carried by the opposite side walls of the housing 78. The bearing 90 is held in place by the screws 91 and is of such construction that its removal will permit the secondary worm shaft 88 to be withdrawn from the housing. A suitable gasket 92 seals between the bearing 90 and the housing 78. Plugs 93 and 94 close the ends of the bearings 89 and 90 against the loss of lubricant.

Figs. 7, 9 and 10 show the secondary worm gear 95 as meshing with the worm of the secondary shaft 88. This secondary worm gear is suitably fastened to the drive or power output shaft 96 of the speed reducer unit. This shaft is supported in bearings 97 and 98 that are carried by the outer wall of the housing 78 and the cover 79 respectively. This drive shaft is axially aligned with the motor shaft 74 and the feed screw shaft 45. One end of the same is squared, as at 99, for entering the squared bore of the coupling sleeve 52. This coupling sleeve, therefore, connects the speed reducer drive shaft 96 to the feed screw shaft 45.

Figs. 8, 9 and 11 show dowel pins 100 or holes 101 formed in the mounting legs 68 of the mount 67 and the housing 78 for receiving the dowel pins.

It will be appreciated, by inspecting Figs. 1 and 7 that when the stoker sub-assembly unit is inserted through the outer end of the air duct 24 the base plate 65 of this unit will cooperate with the guides 66 for lining up the coupling sleeve 52, which is suitably attached to the squared end 99 of the drive shaft 96, with the squared end 51 of the feed screw shaft 45 so that the coupling sleeve may be slipped onto the shaft end 51. The coupling sleeve will only have driving connection with this shaft end 51 and for that reason the stoker sub-assembly unit may be withdrawn from the air duct whenever desired. The withdrawal of the sub-assembly unit will result in disconnecting the coupling sleeve 52 from the end of the feed screw shaft.

From the above detail description of the basic stoker assembly, the fuel conveyor mechanism and the stoker sub-assembly unit, presented in connection with Figs. 1 and 7 to 11 inclusive, it will be appreciated that whenever the circuit for the electric motor 34 is closed, the fuel feed screw 44 will be driven by the motor through the speed reducer unit for delivering coal from either a bin 23 or a hopper 37 to the fuel bed in the retort 25 and tuyère assembly 28. Operation of the motor 34, also, will result in driving the air pressure fan 35 which is directly mounted on the projecting end of the motor shaft. The operation of the fan 35 will cause air to be drawn into the air duct 24 through the shutter mechanism 36, that controls the air inlet to the outer end of the air duct, and this air will be delivered to the fuel bed through the retort ring 59 and the tuyère assembly 28. When the circuit for the electric motor 34 is broken, the feeding of fuel and air to the fuel bed is stopped and the air inlet is closed.

It readily will be appreciated that the broad features of this invention are not dependent on the use of the specific types of air pressure fan, speed reducer gearing, etc. that have been illustrated and described as other suitable types may just as readily be employed.

It is intended that the air duct 24 should be manufactured in one or more standard sizes which will permit the duct to be placed entirely within the base of standard sizes of furnaces or boilers. However, it is recognized that in certain cases or installations it may be necessary to allow the air duct to project a few inches beyond the side of the furnace or boiler base. Figs. 5 and 6 intentionally illustrate this possibility. It will be appreciated, however, that this limited departure from the preferred arrangement will not in fact be a departure from the spirit of the invention. For that reason, when the air duct 24 and the devices located in the end portions of the same are described in the claims as being located "in" the boiler or furnace base, this definition should be construed to cover installations where the end portion or portions of the air duct,

and the devices located therein, project to a limited extent beyond the actual margins of the boiler or furnace base as well as installations where the air duct, etc., are located entirely within said base.

It is to be understood that the form of this invention herewith shown and described is to be taken as the preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, I claim:

1. The combination with a heating boiler or furnace, of an air duct, having an air inlet, located within the base of the boiler or furnace, a stoker retort supported in said air duct and having a tuyère projecting outside the air duct and communicating with the interior of the retort and the air duct, a conveyor for delivering fuel to the retort from a source of supply exterior of the air duct, a prime mover in the air duct for driving the conveyor means driven by the prime mover for delivering combustion air to the interior of the air duct through its inlet for supplying the tuyère, and shutter mechanism for controlling the air inlet for the air duct.

2. The combination with a heating boiler or furnace, of an air duct, having an air inlet, located in the base of the boiler or furnace, a stoker retort supported in said air duct and having a tuyère projecting outside the air duct and communicating with the interior of the retort and the air duct, a conveyor for delivering fuel to the retort from a source of supply exterior of the air duct, a prime mover in the air duct for driving the conveyor, means in the air duct and driven by the prime mover for drawing combustion air into the air duct through its inlet to supply the tuyère, and shutter mechanism for controlling the air inlet for the air duct.

3. The combination with a heating boiler or furnace, of an air duct located in the base of the boiler or furnace, a stoker retort supported in said air duct and having a tuyère outside the air duct and communicating with the interior of the retort and the air duct, a conveyor for delivering fuel to the retort from a source of supply exterior of the air duct, a speed reducer unit in the air duct and operatively connected to the conveyor, a prime mover in the air duct for driving the speed reducer unit, and means driven by the prime mover for delivering combustion air to the interior of the air duct for supplying the tuyère.

4. The combination with a heating boiler or furnace, of an air duct located in the base of the boiler or furnace, a stoker retort located in said air duct and having a tuyère outside the air duct and communicating with the interior of the retort and the air duct, a conveyor for delivering fuel to the retort from a source of supply exterior of the air duct, a speed reducer unit in the air duct and operatively connected to the conveyor, a prime mover in the air duct for driving the speed reducer, and means in the air duct and driven by the prime mover for drawing combustion air into the air duct to supply the tuyère.

5. The combination with a heating boiler or furnace, of an air duct located in the base of the boiler or furnace, a stoker retort supported in said air duct and having a tuyère outside of the air duct and communicating with the interior of the retort and the air duct, a fuel tube connected to the retort in the air duct for delivering fuel from a source of supply exterior of the air duct, a feed screw extending the length of the tube for delivering fuel to the retort and having a driving end projecting into the air duct, a prime mover located in the air duct for driving said end of the screw, and means located in the air duct and driven by the prime mover for supplying the air duct with combustion air for delivery to the tuyère.

6. The combination with a heating boiler or furnace, of an air duct extending from one side of the base of the boiler or furnace to the central portion thereof, a stoker retort supported in the inner end portion of said air duct and having a tuyère outside the air duct and communicating with the interior of the retort and the air duct, a fuel tube connected to the retort in the air duct for delivering fuel from a source of supply exterior of the air duct, a feed screw extending the length of the tube for delivering fuel to the retort and having a driving end projecting into the air duct, and a sub-assembly insertable and removable through the outer end of the air duct and comprising a mounting plate, a speed reducer supported on the mounting plate and drivingly connected to the projecting end of the feed screw, a prime mover supported on and adapted for driving the speed reducer, and a fan mounted on a projecting end of the prime mover shaft for supplying the air duct with combustion air for delivery to the tuyère.

7. A fuel burner comprising an air duct, a retort supported in said air duct, a tuyère for the retort located outside the air duct, a conveyor for delivering fuel to the retort from a source of supply exterior of the air duct, a speed reducer unit in the air duct and operatively connected to the conveyor, a prime mover mounted in the air duct for driving the speed reducer unit, and means driven by the prime mover for delivering combustion air to the interior of the air duct for supplying the tuyère.

8. A fuel burner comprising an air duct, a retort supported in said air duct, a tuyère for the retort located outside the air duct, a conveyor for delivering fuel to the retort from a source of supply exterior of the air duct, a prime mover in the air duct for driving the conveyor, a speed reducer unit in the air duct and interposed between the prime mover and the conveyor for operating the latter at a reduced speed, and means in the air duct and driven directly by the prime mover for drawing combustion air into the air duct to supply the tuyère.

9. A fuel burner comprising an air duct, a retort supported in said air duct, a tuyère for the retort located outside the air duct, a fuel tube connected to the retort in the air duct for delivering fuel from a source of supply exterior of the air duct, a screw extending the length of the tube for delivering fuel to the retort and having a driving end projecting into the air duct, a prime mover located in the air duct for driving said end of the screw, and means located in the air duct and driven by the prime mover for supplying the air duct with combustion air for the tuyère.

10. The combination with a heating boiler or furnace, of a fuel burner comprising an air duct in the base of the boiler or furnace and having an air inlet, a retort supported in said air duct, a tuyère supported by the top wall of the air duct to open outwardly of and to communicate with the interior of the air duct, said tuyère also communicating with the interior of the retort, a conveyor for delivering fuel to the retort from a

source of supply exterior of the air duct, a prime mover in the air duct for driving the conveyor, and means driven by the prime mover for delivering combustion air to the interior of the air duct through its inlet for supplying the tuyère.

11. The combination with a heating boiler or furnace, of a fuel burner comprising an air duct in the base of the boiler or furnace and having an air inlet, a retort supported in said air duct, a tuyère supported by the top wall of the air duct to open outwardly of and to communicate with the interior of the air duct, said tuyère also communicating with the interior of the retort, a conveyor for delivering fuel to the retort from a source of supply exterior of the air duct, a prime mover in the air duct for driving the conveyor, and means located in the air duct and driven by the prime mover for drawing combustion air into the air duct through its inlet and delivering it to the tuyère.

12. The combination with a heating boiler or furnace, of a fuel burner comprising an air duct in the base of the boiler or furnace and having an air inlet, a retort supported in said air duct, a tuyère supported by the top wall of the air duct to open outwardly of and to communicate with the interior of the air duct, said tuyère also communicating with the interior of the retort, a conveyor for delivering fuel to the retort from a source of supply exterior of the air duct, a speed reducer unit located in the air duct and drivingly connected to the fuel conveyor, a prime mover in the air duct for driving the speed reducer unit, and means driven by the prime mover for delivering combustion air to the interior of the air duct through its inlet for supplying the tuyère.

13. The combination with a heating boiler or furnace having a base portion and a combustion chamber above the base portion, of an air duct in said base portion, a tuyère supported by the top wall of the air duct to open outwardly into said combustion chamber and inwardly into the air duct, a retort supported in the air duct and communicating with the interior of the tuyère, a fuel tube connected to the retort and extending to a source of supply located exteriorly of the boiler or furnace, fuel feeding means extending the length of the fuel tube for delivering fuel to the retort, a prime mover in said air duct for driving the fuel feeding means, and means driven by the prime mover for delivering combustion air to the interior of the air duct to supply the tuyère.

14. The combination with a heating boiler or furnace having a base portion and a combustion chamber above the base portion, of an air duct in said base portion and having an inlet for air opening through a wall of the base portion, a tuyère supported by the top wall of the air duct to open outwardly into the said combustion chamber and inwardly into the air duct, a retort supported in the air duct and communicating with the interior of the tuyère, a fuel tube connected to the retort and extending to a source of supply located exteriorly of the boiler or furnace, fuel feeding means extending the length of the fuel tube for delivering fuel to the retort, a prime mover in said air duct for driving the fuel feeding means, a fan driven by the prime mover for delivering combustion air to the interior of the air duct through its inlet opening, and shutter mechanism for controlling the combustion air delivered by the fan.

15. The combination with a heating boiler or furnace having a base portion and a combustion chamber above the base portion, of an air duct in said base portion, a tuyère supported by the top wall of the air duct to open outwardly into the said combustion chamber and inwardly into the air duct, a retort supported in the air duct and communicating with the interior of the tuyère, a fuel tube connected to the retort and extending to a source of supply located exteriorly of the boiler or furnace, fuel feeding means extending the length of the fuel tube and through the retort to have a driving end project into the air duct, a prime mover in the air duct for driving the projecting end of the fuel feeding means, and means driven by the prime mover for delivering combustion air to the interior of the air duct to supply the tuyère.

16. The combination with a heating boiler or furnace having a base portion and a combustion chamber above the base portion, of an air duct in said base portion having an inlet for air opening through a wall of the base portion, a tuyère supported by the top wall of the air duct to open outwardly into the said combustion chamber and inwardly into the air duct, a retort supported in the air duct and communicating with the interior of the tuyère, a fuel tube connected to the retort and extending to a source of supply located exteriorly of the boiler or furnace, fuel feeding means extending the length of the fuel tube and through the retort to have a driving end project into the air duct, a prime mover in the air duct for driving the projecting end of the fuel feeding means, a fan driven by the prime mover for delivering air to the interior of the air duct through its inlet opening, and shutter mechanism for controlling the combustion air delivered by the fan.

17. The combination with a heating boiler or furnace having a base compartment provided with two openings in its side walls, a combustion chamber above the compartment, and a partition, having an opening, separating the compartment from the chamber, of a retort positioned in the base compartment, a tuyère communicating with the retort and communicating with the combustion chamber through the opening in the partition, a conveyor for delivering fuel to the retort extending through one of the side wall openings of the base compartment from an exterior source of supply, a combustion air supply fan registering with the second side wall opening of the base compartment, shutter mechanism for controlling the flow of air through the fan, means for conducting the combustion air from the fan to the tuyère, and a prime mover in the base compartment for driving the fuel conveyor and the fan.

18. A fuel burner comprising an air duct, a tuyère supported by the top wall of the air duct to open outwardly of and to communicate with the interior of the air duct, a retort supported in the air duct and communicating with the interior of the tuyère, a conveyor for delivering fuel to the retort from a source of supply exterior of the air duct, a prime mover in the air duct for driving the conveyor, and means driven by the prime mover for delivering combustion air to the interior of the air duct for supplying the tuyère.

19. A fuel burner comprising an air duct, a tuyère supported by the top wall of the air duct to open outwardly of and to communicate with the interior of the air duct, a retort supported in the air duct and communicating with the interior of the tuyère, a conveyor for delivering

fuel to the retort from a source of supply exterior of the air duct, a speed reducer unit in the air duct and drivingly connected to the fuel conveyor, a prime mover in the air duct for driving the speed reducer unit, and means located in the air duct and driven by the prime mover for drawing combustion air into the air duct to supply the tuyère.

20. A fuel burner comprising an air duct, a tuyère supported by the top wall of the air duct to open outwardly of and to communicate with the interior of the air duct, a retort supported in the air duct and communicating with the interior of the tuyère, a fuel tube connected to the retort and extending to a source of supply exterior of the air duct, a feed screw extending the length of the feed tube for delivering fuel to the retort and having a driving end projecting into the air duct, a speed reducer unit located in the air duct and drivingly connected to the projecting end of the feed screw, a prime mover located in the air duct for driving the speed reducer unit, and means driven by the prime mover and located in the air duct for supplying the latter with combustion air for the tuyère.

21. In combination, a heating furnace or boiler, a basic-stoker assembly located in the base of the furnace or boiler, and fuel conveyor mechanism for the basic-stoker assembly extending outside of the base of the furnace or boiler, said basic-stoker assembly comprising a retort to receive the fuel from the conveyor mechanism, a tuyère for the retort, a prime mover for driving the conveyor mechanism, a combustion air delivering fan to be driven by the prime mover, and means for enclosing all of the above parts of the basic-stoker assembly but the tuyère and for conducting the combustion air from the fan to the tuyère.

ROBERT W. SUMAN.