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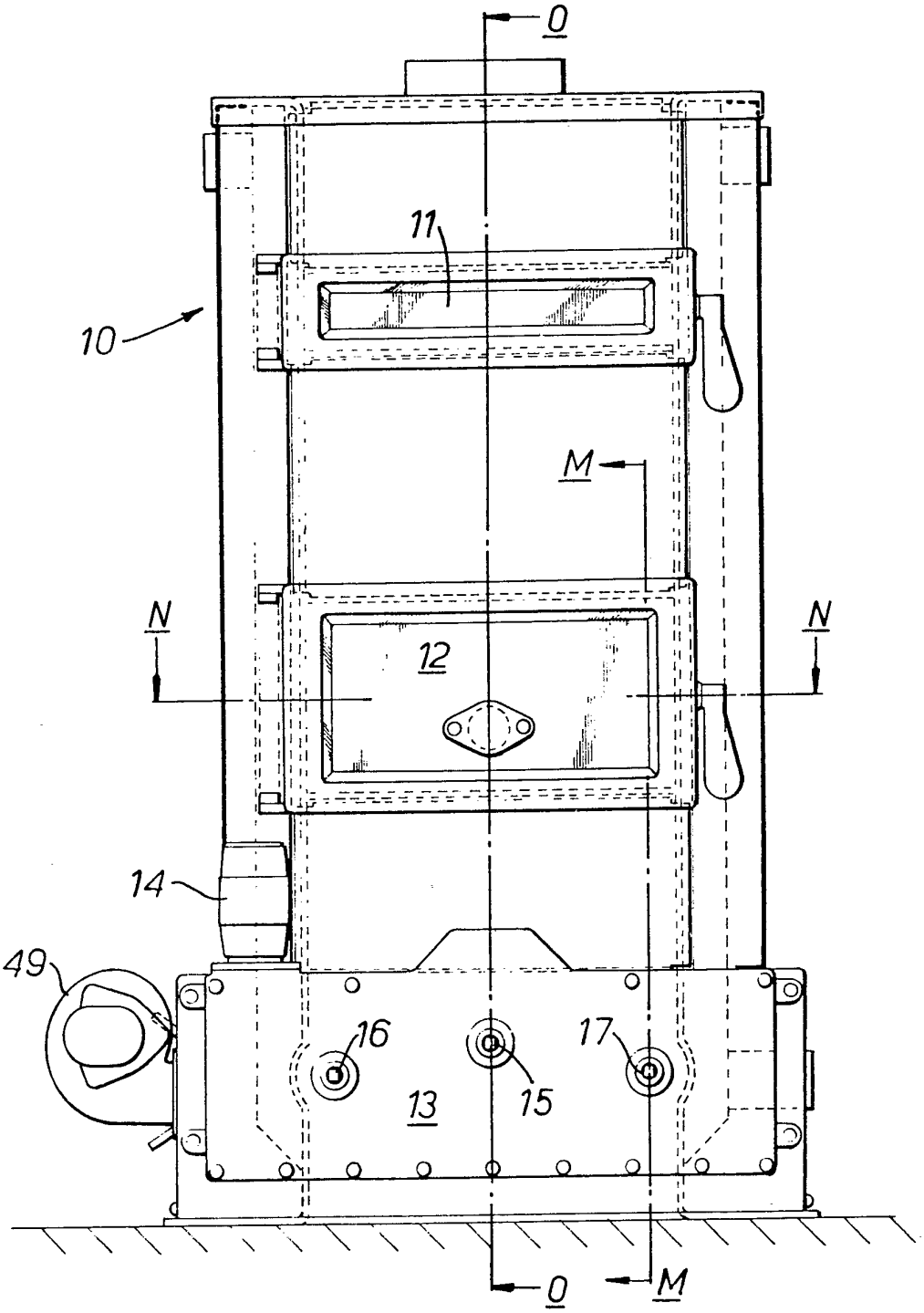

FIG. 1.

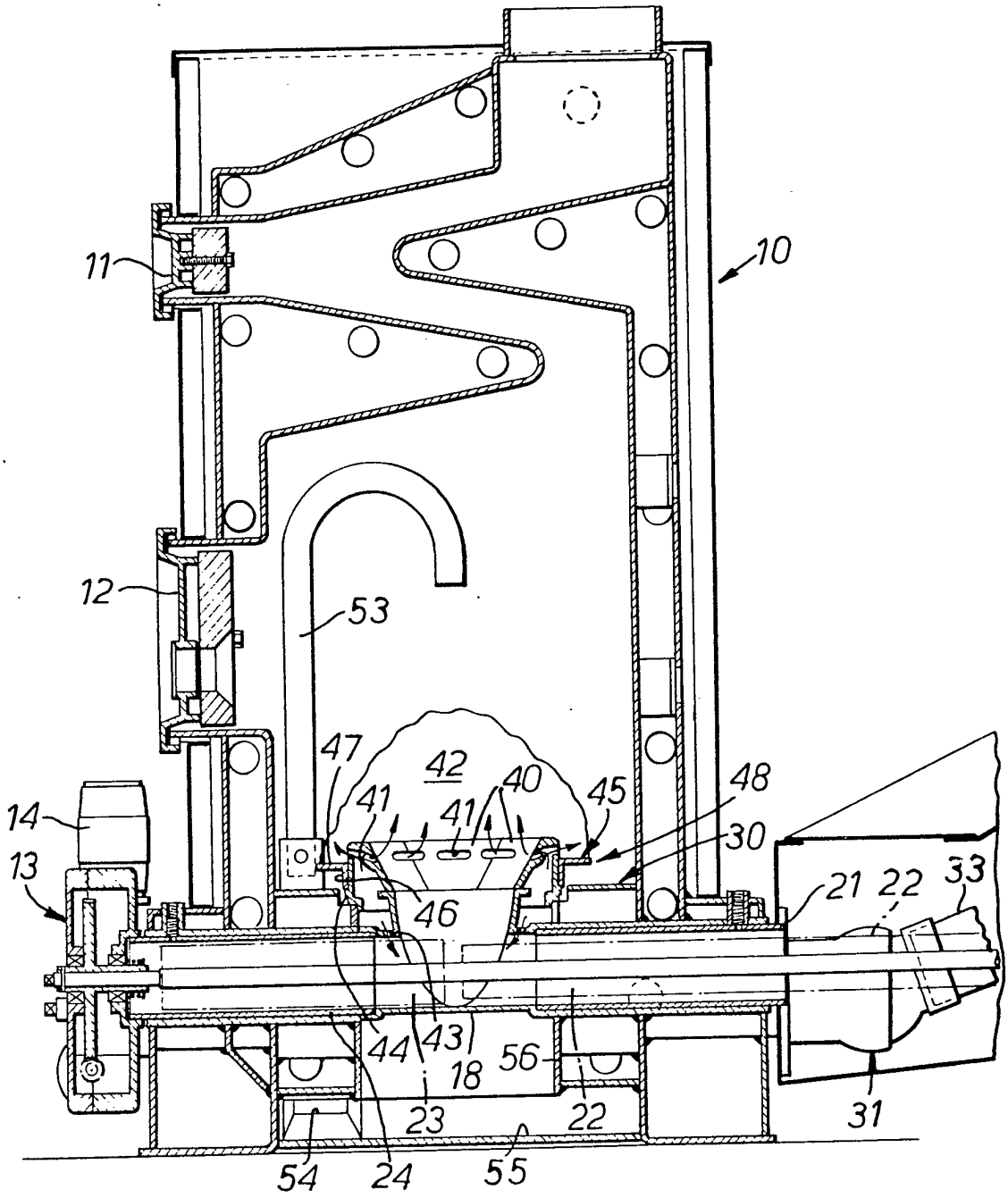
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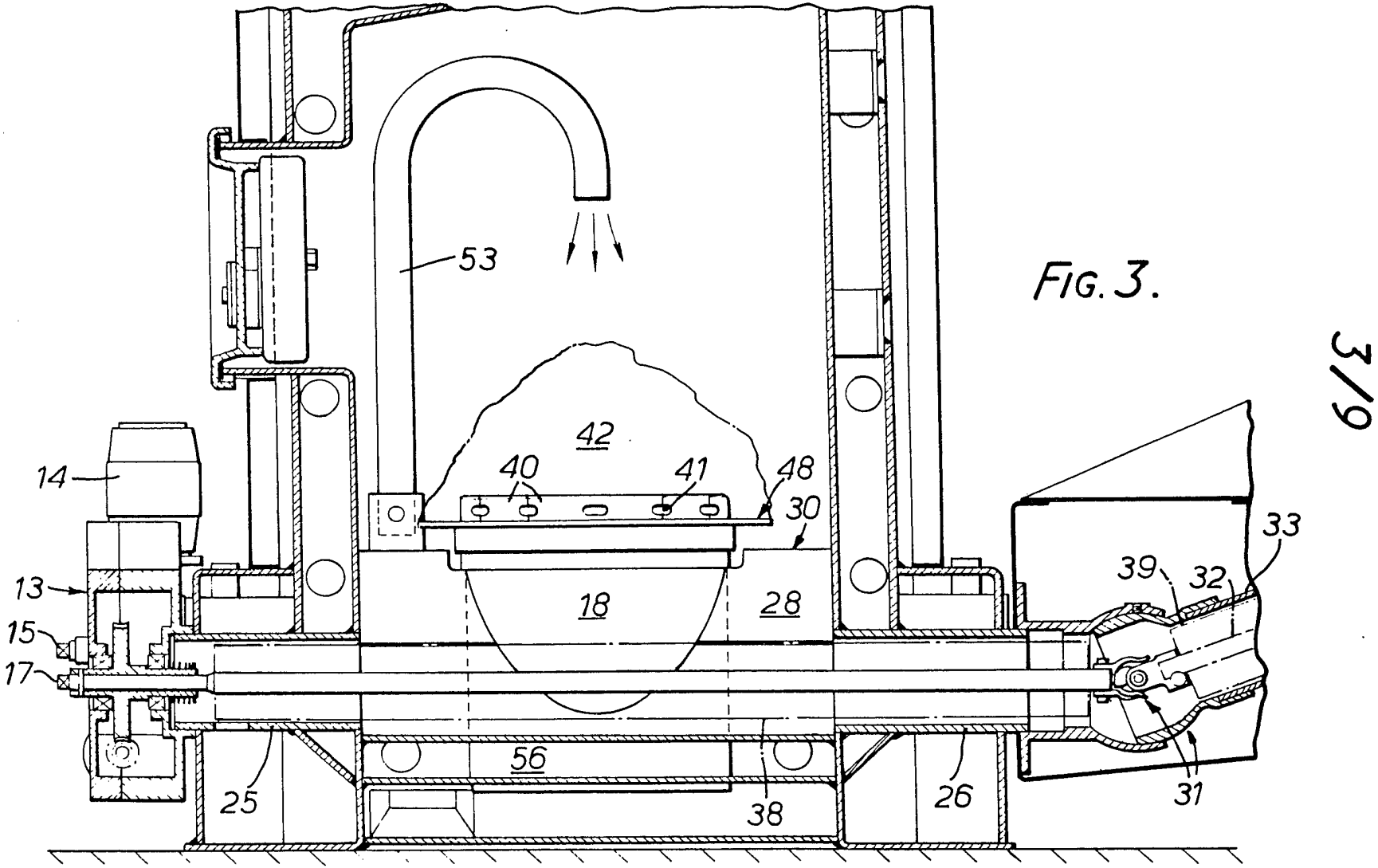
FIG. 2.



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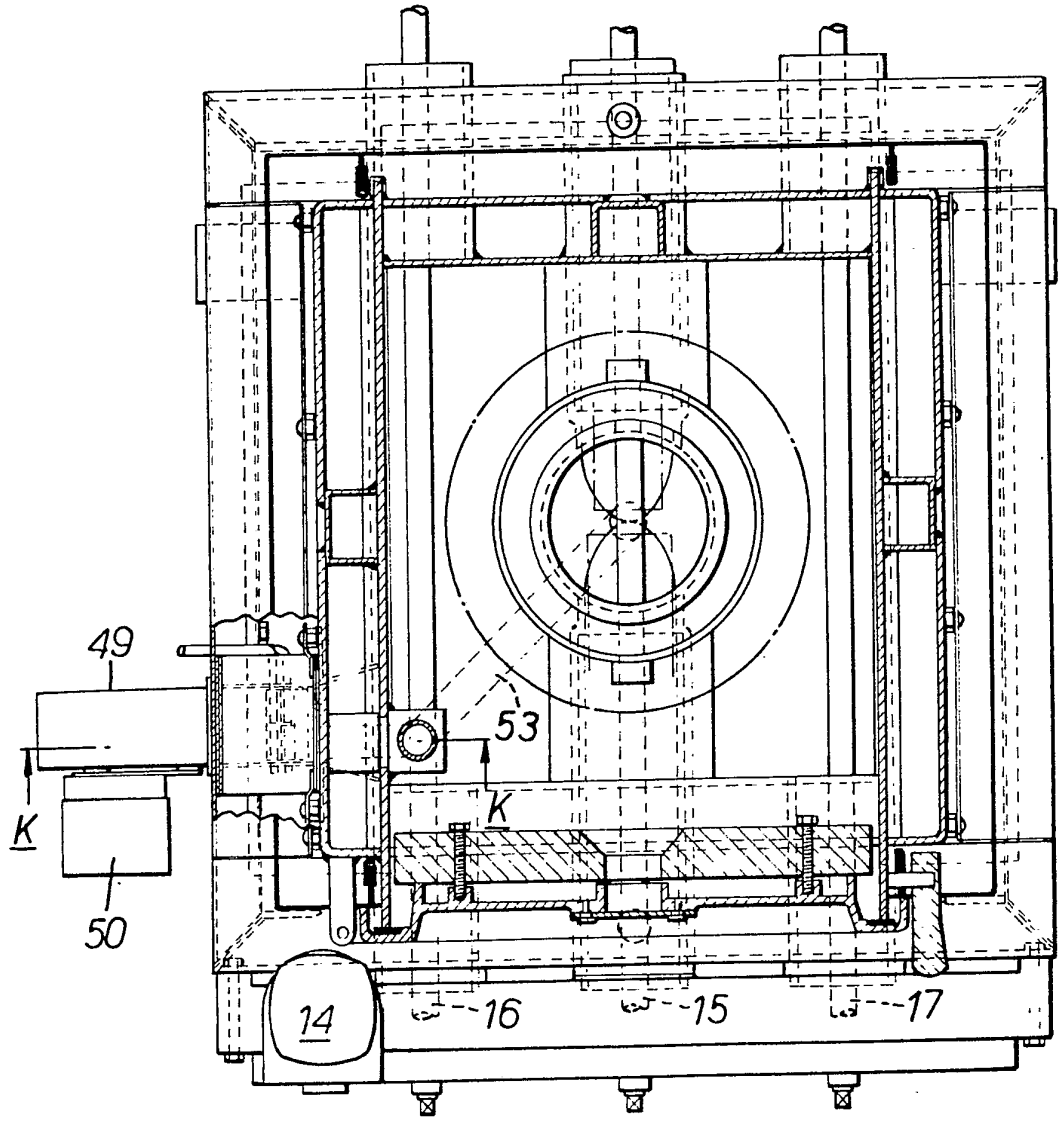

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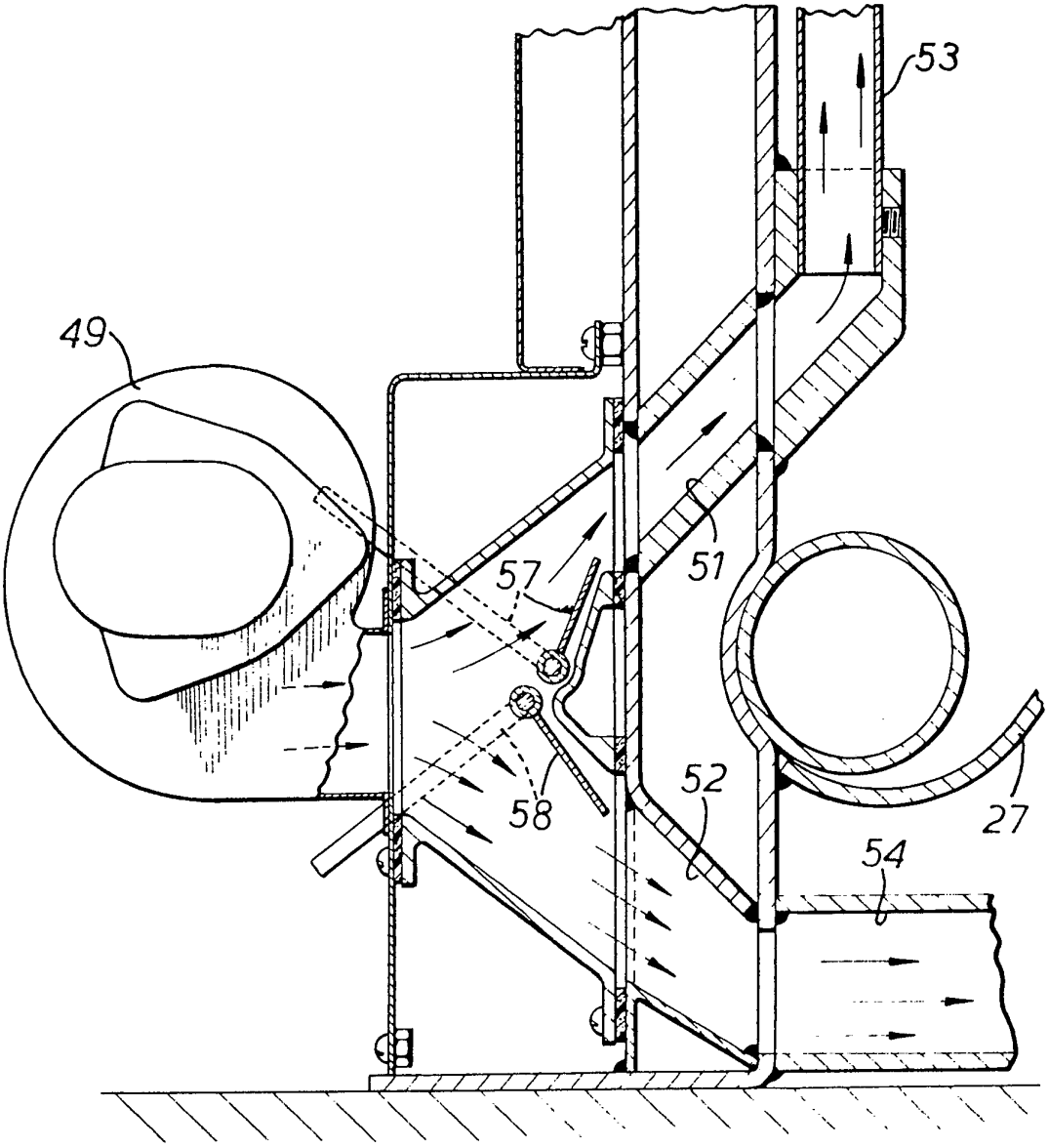

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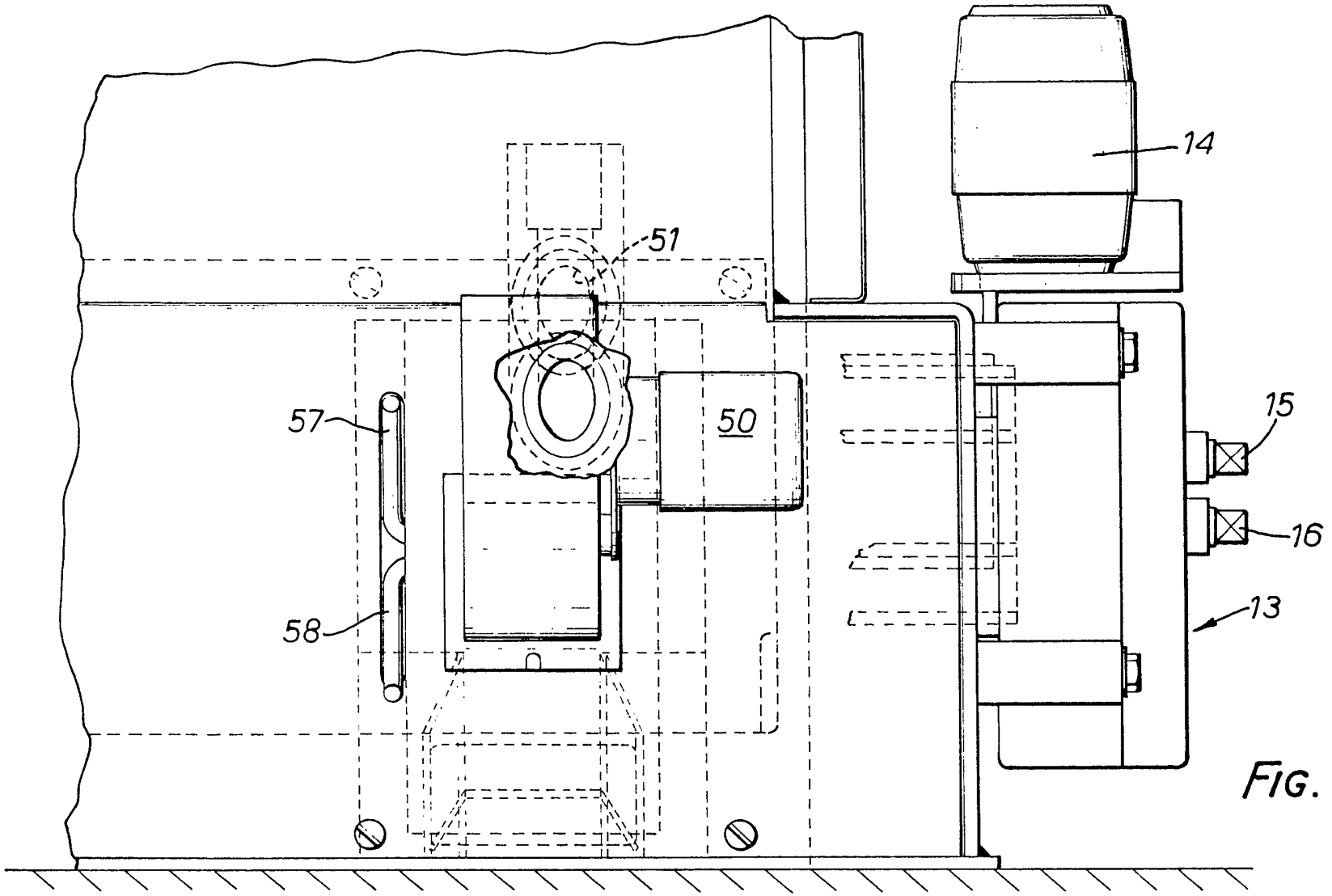

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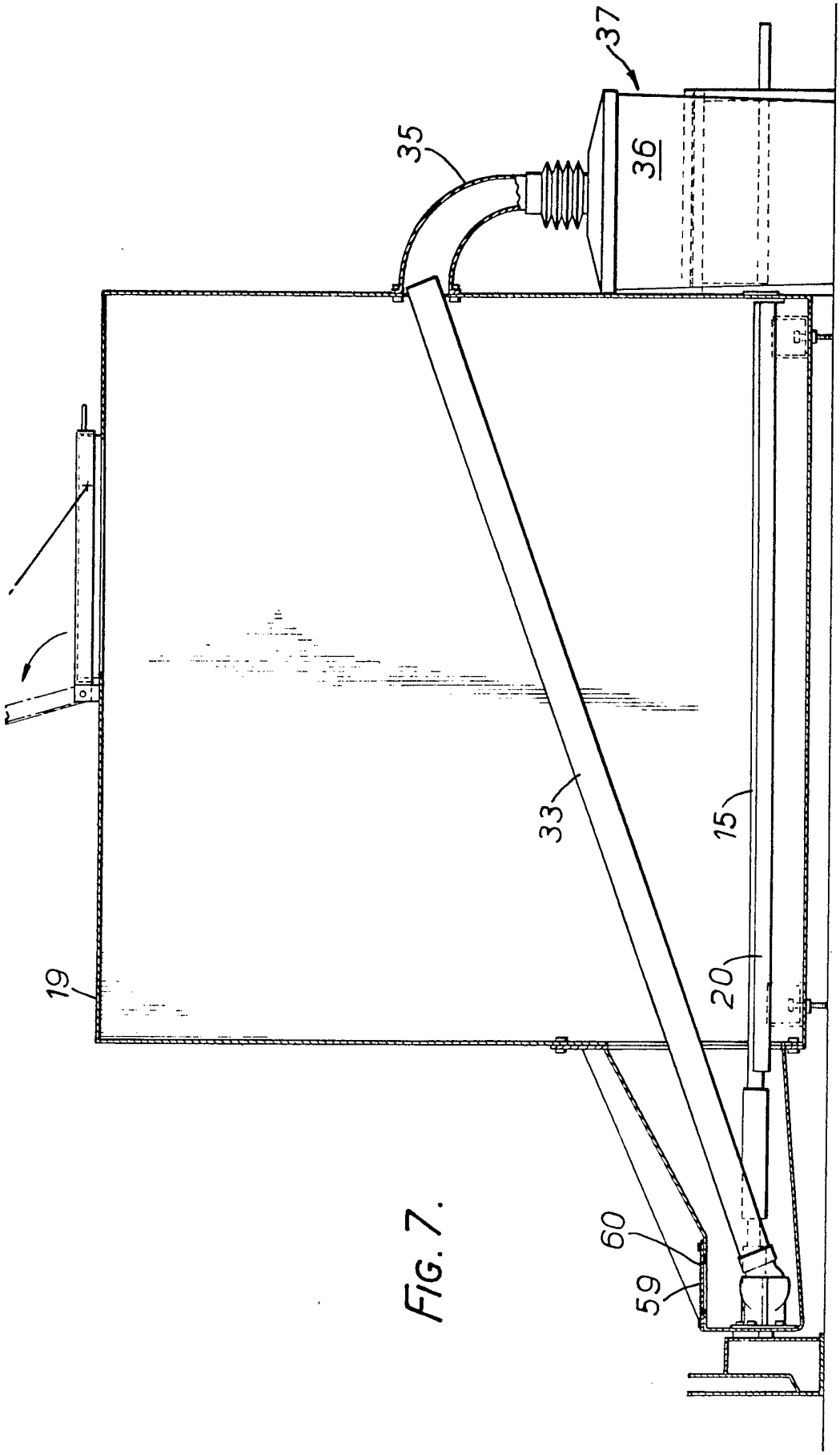


FIG. 7.

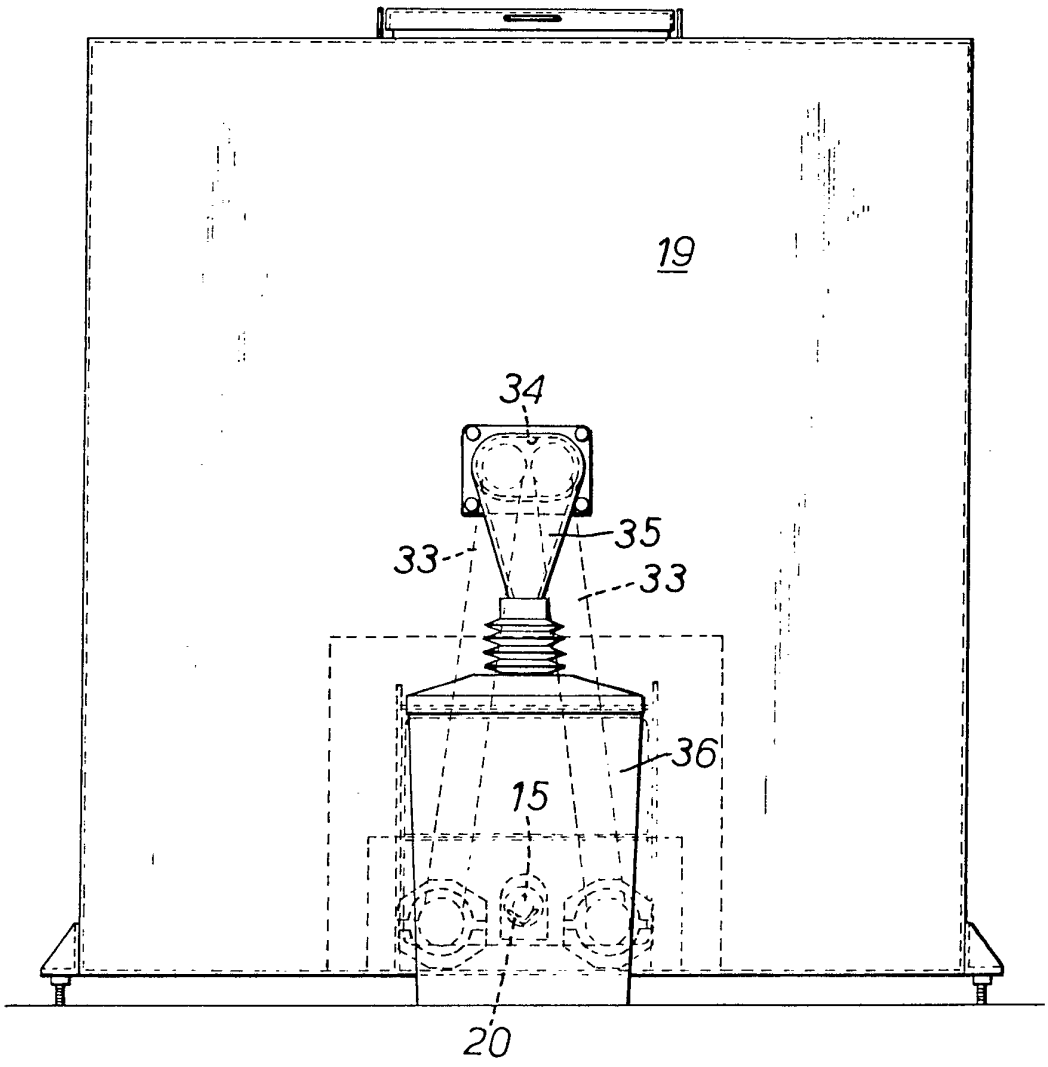
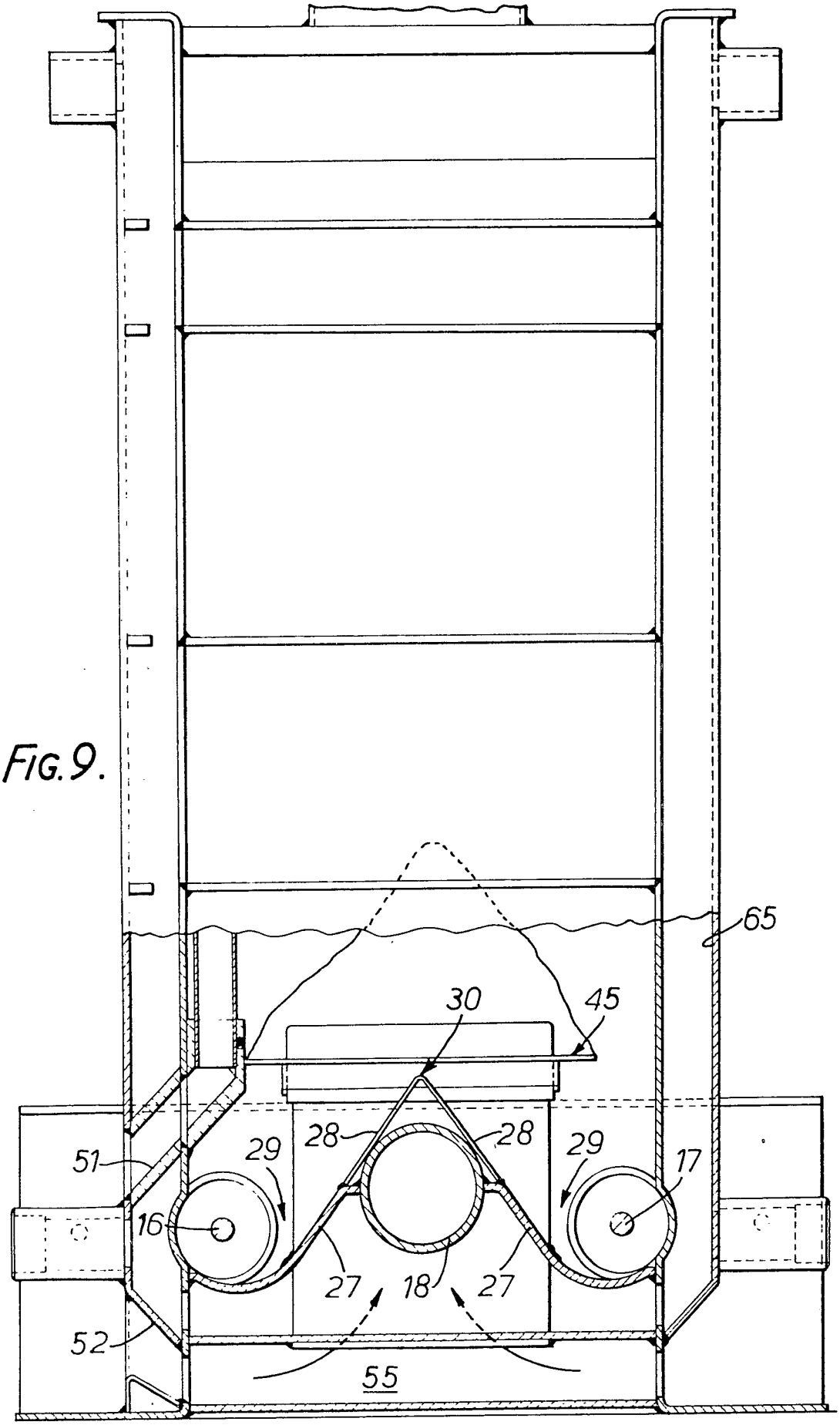


FIG. 8.

FIG. 9.



SPECIFICATION

Ash/Clinker discharge means for a coal-fired boiler system

This invention relates to a coal-fired boiler system.

A coal-fired boiler (for example, for domestic use) is known which comprises a feed screw which, when rotated, feeds coal from a bunker into and through a tube into a retort around which these is disposed an air chamber which is connected to a conduit along which air is forced by a fan. The retort is so shaped that the coal being forced along the tube in a generally horizontal direction is forced to change direction and move upwardly. The retort itself is either surmounted by detachable tuyeres or is suitably apertured so as to provide air holes equivalent to the detachable tuyeres, Once ignited, the fuel bed burns continuously with unburnt coal being supplied from beneath the incandescent part of the fire, the ash and clinker spreading out substantially radially from the fire. The feed screw rotating in the tube constitutes an underfeed stoker of the pot type.

In said known boiler, which has been marketed in the United Kingdom, one failure of the device was in connection with the removal of the minimal quantities of ash and of the clinker. The tuyeres were encircled by a refractory hearth which was supported upon the top of the plenum chamber and the ash and clinker, where it spread radially beyond the tuyeres themselves, simply piled up on the hearth and over the fire bed. The boiler was provided with an openable door through which the clinker could be extracted but that is a time-consuming and unpleasant job; the clinker tends to be kept at a very high temperature by the fuel bed and has to be picked up by special tongs and can easily be dropped. Ash and clinker removal is also unpleasant and dirty to have to attend to because, unlike the automatic supply of coal from the bunker to the boiler for burning, the ashes and clinker have to be manually deposited in a dustbin (preferably of metal), the resultant dust settling all over everything.

Moreover, ash and clinker were inclined to build up over the fuel bed itself because they had nowhere to which to disperse. This had the effect of clogging the fuel bed and damping the fire.

The principal object of the present invention is to improve this known system by providing means which will enable all ash and clinker to be discharged from the boiler automatically, even into a combustible container such as a plastics dustbin or bag.

Accordingly the present invention consists in a coal-fired boiler system which has a pot type underfeed stoker and which comprises a rotatable conveyer screw driven to feed coal along a tube to a retort surmounted by tuyeres, said tuyeres being connected by way of a plenum chamber to means operable to produce a forced draught and also supporting and being encircled by a device having a periphery which acts as a weir by permitting continuously produced ash and clinker to fall off the device into an ash removal system, said removal system including at least one coneyor screw rotatable to crush any clinker which may be produced and to convey said crushed clinker and ash, said at least one conveyor screw conveying said ash/crushed clinker along a bent path to an elevated discharge location.

Said bent path consists of a first generally horizontal portion followed by a second upwardly inclined portion in the case where there is only one conveyor screw dealing with the ash/crushed clinker.

In the case where there are two conveyor screws dealing with said ash/crushed clinker, said bent path consists for each conveyor screw of a first generally horizontal portion following by a second upwardly inclined portion, said upwardly inclined portions of the two conveyor screws converging to be closely adjacent to one another at their upper ends.

The first generally horizontal portion and the second upwardly inclined portion of the or each conveyor screw are connected to one another by a universal joint.

In every case, said second upwardly inclined portion extends through a tank or bunker containing the store of coal which is to be fed by said stoker into the retort. This distance through which the ash/crushed clinker is conveyed before it is discharged into a bin or sack ensures that said ash/crushed clinker is quite cold when so discharged.

A preferred exemplary embodiment of a coal-fired boiler system in accordance with the present invention will now be more particularly described with reference to the accompanying drawings, in which :-

Figure 1 is a view of the front of the boiler;

Figure 2 is a vertical section on the median plan 0-0 of the boiler shown in Figure 1;

Figure 3 is a section on the line M-M in Figure 1;

Figure 4 is a section taken on the line N-N in Figure 1;

Figure 5 is a section taken on the line K-K in Figure 4;

Figure 6 is a scrap view looking in the direction indicated by the arrow L in Figure 4, part of the respective cover having been removed to show a porting arrangement for secondary air;

Figures 7 and *8* are two views (side and front) of a fuel tank which forms part of the boiler system; and

Figure 9 is a section showuing the ash/clinker removal system in front of the retort.

Referring to the drawings, a boiler 10, having the usual flue cleaning door 11 and an inspection door 12, has a D.C. motor 14 driving three conveyor screws by way of a gear box which is indicated generally by the reference numeral 13.

The shafts of the three conveyor screws are indicated in Figure 4 by the reference numerals 15, 16 and 17. The middle shaft 15 is the shaft of the coal-feed conveyor screw and the shafts 16, 17 are the shafts of the ash/clinker-crushing coneyor screws.

The shaft 15 extends from the gear box 13 through a retort 18 (Figure 2) and out through the back of the boiler into a coal bunker or tank 19 (Figure 7) in which it is supported for rotation in a V-shaped supporting channel 20. Said shaft 15 carries a small diameter helical flight or screw (not illustrated) whose function is simply to ensure that coal is fed or propelled towards the location at which the coal is

constrained to enter a tube 21 mounted in the back of the boiler and connected at its front end to the retort 18. Said shaft 15 also carries a helical flight or screw 22 which is of a larger diameter than the first-mentioned helical flight or screw, the function of the screw 22 being to force the coal into the tube 21 and along said tube into the retort 18. Lastly, the shaft 15 also carries a helical flight or screw 23 of hand opposite to that of the screw 22. The screw 23 is located within tube 24 whose front end is mounted in the front of the boiler and whose rear end is connected to the retort 18. The screw 23 ensures that coal is not fed beyond the retort 18 along the tube 24 and into the gear box 13. The coal is therefore fed to the retort 18 from the tank 19 in a horizontal direction, and at the retort the coal moves in a generally upwards direction.

The shafts 16, 17 will now be described with reference to Figure 3 which illustrates the shaft 17; except as specified, the two shafts 16, 17 are identical in construction and operation and what is described in relation to shaft 17 is true for shaft 16. Thus, the shaft 17 extends through two tubess 25, 26 of which the tube 25 is mounted forwardly of the retort 18 and of which the tube 26 is mounted rearwardly of said retort. The rear end of the tube 25 and the front end of the tube 26 are in communication with an open trough which is of a configuration which can be determined by studying Figures 3 and 9 in conjunction with one another. A curved plate 27 is mounted in a sealed manner (e.g. by welding) on the respective parts of the boiler including the retort 18, and another plate 28 is mounted on said plate 27 and extends in a generally upwards direction therefrom. In fact, the two plates 27 and the two plates 28 together form the horizontally spaced troughs 29, the two plates 28 being joined to one another at their upper ends as indicated by the reference numeral 30. Thus, the two inclined and conjoined plates 28 constitute a chute leading downwardly into the respective troughs 29 for purpose to be described hereinafter. At the rear of the boiler, the shaft 17 emerges from the tube 26 and is connected by a suitable form of universal joint (indicated by the reference numeral 31) to one end of n upwardly inclined shaft 32 (see Figures 2, 3, 7 and 8) which therefore acts as an extension of said shaft 17. The shaft 32 is enclosed within a tube 33 which extends upwardly through the fuel tank 19 to an appropriately dimensioned aperture 34 which is formed in that wall (the front wall) of the tank 19 which is farther away from the boiler. A chute 35 has one end thereof connected to said front wall covering said aperture and has the other end thereof connected in a releasable manner to a bin 36 or to a bag 37.

The shafts 16, 17 are parallel to one another and to the shaft 15 until they reach the respective universal joins 31; thereafter the shafts 32 and their enclosing tubes 33 converge until their upper ends are close together at the aperture 34. The shafts 16, 17 are provided with helical flights or screws 38 (Figure 3) which feed ash/clinker from the respective troughs 29 into the respective tubes 26, rotation of the shafts 16, 17 and of the respective extension shafts 32 (which are provided with helical flights or screws 39) causing any clinker to be crushed into a fine condition and to be fed with any ash upwardly to the aperture 34, the chute 35 and bin 36 or bag 37.

The upper end of the retort 18 is surmounted by a plurality of separate tuyere elements 40 which are arranged in the form of a ring (see Figures 2 and 3) so shaped and constructed as to provide tuyeres 41 by way of which air is blown into the fuel bed which is indicated by the reference numeral 42. The retort 18 also has ports 43 through which blown air reaches the heated coal immediately under the incandescent part of the fire. Each tuuyere element 40 has a radially outward projecting boss 44 integral therewith and a weir device 45, circular in plan configuration, sits on said bosses. The device 45 consists of a right cylindrical sleeve 46 connected to a horizontally disposed flange 47 which extends radially outwardly away from the elements 40 which it encircles. Minimal quantities of ash and the clinker which is formed by an underfeed stoker system are progressively pushed upwardly or outwardly until they fall off the edge 48; in doing so, said ash and clinker fall into the troughs 29 or onto one of the sloping plates 28 and thence into the respective trough 29.

A fan 49 driven by motor 50 supplies air to each of two ducts 51, 52. The duct 51 has a pipe 53 whose upper end is bent over so as to direct so-called secondary air downwardly towards the fire 42 in order to burn whatever carbon monoxide might be given off. The duct 52 is in communication with one end of a duct 54 which at its other end opens into a plenum chamber or wind box 55 which, in turn, communicates with a duct 56 by way of which ascending blown primary air reaches the ports 43 and the hollow elements 40 and the tuyeres 41. Manually operable air-control flaps or dampers 57, 58 are provided near the fan; these are adjustable to regulate the draught.

The remainder of the boiler is of a construction which need not be described in detail. Suffice it to say that it has a two-pass heat exchanger, adjustable thermostat and any other desirable controls, safety devices and so on.

The motor 14 is reversible for the purpose of being able to clear any jams which may occur, such jams being possible in the feed of coal to the retort. The tank 19 is provided with a hatch 59 which covers an access aperture 60 through which the jamming may be cleared.

The universal joints 31 will facilitate the fitting of the shafts 32 and their enclosing tubes 33 in a brick-built or block-built fuel bunker if the buyer of the boiler system were to prefer such a bunker instead of a metal tank 19. Also, of course, the universal joints make it possible for said shafts/tubes 32, 33 to be upwardly inclined and convergent.

The extension of said shafts/tubes 32, 33 through the tank 19 or equivalent bunker ensures that all ash/clinker dust is completely cold by the time it reaches the upper ends of said tubes 33 and falls into the bin/sack 36, 37. In view of this, a dustbin of plastics material could be used or sacks of plastics material could be used or multi-wall paper sacks could be used. If any type of sack were to be used

instead of a bin, the means of attachment of the neck of the sack to the lower end of the chute 35 could be made such (namely, of such strength) that the sack will simply drop off when it contains a predetermined weight of ash/clinker dust.

The screws 38 will crush any clinker into particles fine enough to be fed continuously along the tubes 26 and up the tubes 33.

The outside diameter of the device 45 (i.e. the distance between diametrically opposite points on the edge 48 of said device) will determine the efficiency with which ash/clinker removal is carried out. Thus, a number of different sizes of device 45 can be provided, the smaller the outside diameter thereof the earlier the ash/clinker will fall off the weir. If it is found that the clinker pieces are prevented by their sizes from falling off the weir where said edge 48 is nearest to the boiler sides or where said edge is near to the pipe 53, the device 45 can be replaced by one of smaller diameter.

The shafts 16, 17 are contra-rotating in order to convey the ash/crushed clinker in the same direction.

The fan motor 50 may be a D.C. motor but, of course, both the motor 14 and the motor 50 could be A.C.

The weir device 45 need not be of the shape and configuration described herein and illustrated in the drawings. The weir device may be made of any suitable heat-resistant material (for example, of metal, of ceramic material, of cast iron), and it could be made so as to be of basically triangular section in any part thereof as distinct from the angle section shape shown in the drawings.

Water is circulated in the region of the shafts 16, 17 and respective troughs. This is best shown in Figure 9 in which the water jacket indicated by the reference numeral 65 will be seen to have been continued under the conveyer screws 16, 15, 17; therefore, the whole space beneath the plates 27 and the retort 18 and above the chamber 55 is colled and the heat therefrom is utilised. Alternatively, that space could be filled with a refractory material instead of with water.

It will be noted that it is an important feature of the boiler system described above that the conveyor screws are supported within the various tubes of the ash removal system by the ash/crushed clinker. There are no bearings for the shafts 16, 17, 32 which are located within their respective tubes 26,33; the packed ash/crushed clinker supports those shafts.

CLAIMS (Filed 26 Jan 1982)

1. A coal-fired boiler system which has a pot type underfeed stoker and which comprises a rotatable conveyor screw driven to feed coal along a tube to a retort surmounted by tuyeres, said tuyeres being connected by way of a plenum chamber to means operable to produce a forced draught and also supporting and being encircled by a device having a periphery which acts as a weir by permitting continuously produced ash and clinker to fall off the device into an ash removal system, said removal system including at least one conveyor screw rotatable to crush any clinker which may be produced and to convey said crushed clinker and ash, said at least one conveyor screw conveying said ash/crushed clinker along a bent path to an elevated discharge location.

2. A system as claimed in Claim 1, wherein there is only one conveyor screw and wherein said bent path consists of a first generally horizontal portion followed by a second upwardly inclined portion.

3. A system as claimed in Claim 1, wherein there are two conveyor screws and wherein said bent path consists for each conveyor screw of a first generally horizontal portion followed by a second upwardly inclined portion, said upwardly inclined portions of the two conveyor screws converging to be closely adjacent to one another at their upper ends.

4. A system as claimed in Claim 2 or Claim 3, wherein the first generally horizontal portion and the second upwardly inclined portion of the or each conveyor screw are connected to one another by a universal joint.

5. A system as claimed in Claim 2 or Claim 3 or Claim 4, wherein the or each second upwardly inclined portion extends through a tank or bunker containing the store of coal which is to be fed by said stoker into the retort.

6. Any features of novelty, taken singly or in combination, of the embodiments of the invention hereinbefore described with reference to the accompanying drawings.

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