This invention relates to improvements in stokers of underfeed type, and more particularly to improvements in burner structures for stokers of the domestic type, wherein provision is made for collecting and returning to the fuel bed in the burner, all particles or ruddles of fuel and fine material which may pass through the combustion air openings or tuyères in the burner grate, and fall into the air supply chamber about the grate.

Accordingly, the object of the invention is to provide in combination in a burner assembly for domestic stokers and the like, material collecting and conveying mechanism serving to return to the fuel bed in the burner, such fine particles of fuel and material as may drop through the grate tuyères, into the combustion air supply chamber about the grate. The mechanism for accomplishing this purpose, includes rotatable means for collecting and localizing the fuel particles in a manner to facilitate positive return thereof to the burner fuel bed.

Other objects and advantages will appear readily from the following description of a preferred embodiment of the invention, as illustrated in the accompanying drawings, in which:

Fig. 1 is an assembly elevation of a domestic stoker to which the present invention is applied, certain parts of the assembly being illustrated in diagrammatic manner and others thereof having portions broken away to disclose operating elements of the assembly; Fig. 2 is an enlarged sectional elevation of the burner apparatus of the stoker, illustrating details of the invention; Fig. 3 is a similar sectional elevation of the burner, but taken at a right angle to the view of Fig. 2, as viewed from line 3—3 in Fig. 1; Fig. 4 is a greatly enlarged view in perspective, of the burner, shown with the grate structure thereof removed and placed to one side; Fig. 5 is a view in plan, of a material sweeper member forming an element of the invention, and Fig. 6 is a fragmentary sectional elevation of the burner and sweeper member, the sectional view relative to the sweeper member being taken along line 5—5 in Fig. 5.

Referring to the drawings by suitable characters of reference, the stoker assembly illustrated generally, in Fig. 1, includes a burner 10 and a housing 14 spaced from the burner and containing, as shown in broken lines, a stoker operating motor 12 connected as by a suitable belt or chain 14, to a reduction-gear unit 15. Although not shown, the housing may enclose a fuel bin or hopper, providing a supply of fuel for the burner, and connecting the hopper with the burner is a fuel conduit 16 through which extends a rotary conveyor 18 which may be comprised of a shaft 19 having a helical conveyor flight 20 thereon. The conveyor is by preference, driven from the hopper end 22 of its shaft 19, as by the chain or belt 23 between the shaft end 22 and the motor driven gear unit 15. As indicated in Fig. 1, the fuel conduit 16 may be located within a larger conduit 24, the latter conduit providing for the delivery of combustion air to the burner, as from a suitable blower (not shown) which may be arranged within the housing 11 for driven connection with the motor 12 therein.

Ash removing facilities for the burner, may be provided by an ash conveyor of helical or screw flight type, comprised of a shaft 26 and a helical flight 27 thereon, operating in a conduit structure 28 extending from the ash-pit zone 29 which extends about the housing 11, to the housing 11. The burner end 30 of the ash conduit is of open, trough-like form, to expose the corresponding end portion 31 of the ash conveyor flight, to the ashes piling up within the ash-pit zone, for removal of the ashes therefrom. The ash conveyor and its conduit preferably extend into the housing for operative association with an ash elevator 32 therein, providing for the discharge of the ashes into suitable containers (not shown).

Then end 33 of shaft 26 is projected beyond the end of the conduit 28 which is within the housing 11, for operative connection to the gear unit 15, as by the chain or belt drive connection 34. Thus as now described, both the fuel and ash conveyors are driven from the stoker motor, through the reduction-gear unit 15. Moreover, it is to be noted although not shown, that the ash elevator may be operated by the motor 12 in any suitable manner.

As appears in the sectional elevations of the burner, Figs. 2 and 3, the structure thereof includes a burner base 35 of hollow construction, having a conduit-neck portion 36 projected laterally from one side, for connection with the burner end 38 of the conduit 24, as by the flanged-bolted joint 39. The upper open end 40 of the base is substantially circular (Fig. 4) and is formed to provide inwardly and outwardly directed flanges 42 and 43 respectively, and a top horizontal surface 44 of annular extent, providing a bearing seat for a rotatable grate assembly 45 later to be described. Suitably spaced, inwardly of the hollow burner base 35, is a retort base or burner pot 47 opening upwardly, and outwardly flanged at its upper end 48, as at 50. The flange 50 which is annular in extent, provides an additional bearing seat for the rotatable grate assem-
bly 46, as will hereinafter more fully appear. Projected laterally of the burner pot is a conduit-neck 61 which, in the stoker assembly, registers and joins with the burner end 62 of the fuel conduit 18 (Fig. 2). Located diametrically opposite the conduit-neck 61 is a conduit section 64 preferably of lesser diameter and closed at its outer end 55, providing a pocket or recess 66 therein. As shown in Fig. 2, the burner end 62 of the fuel conveyor shaft 14 extends through the conduit-neck 61 and the conduit section 64 and terminates within the recess 66, while the conveyor flight 20 thereon, terminates at a point on the shaft below the upwardly opening end 48 of the pot 47. Arranged on the terminal portion of the shaft end 68 located within the recess 56 is a helical conveyor section 69 having its flight pitched oppositely to the fuel conveying flight 20, so that it may operate to prevent entrance into the recess 56, of fuel delivered to the burner pot by conveyor 26, and will serve also, to convey to the burner pot, material delivered to the recess 56 as will hereinafter appear. The diameter of the flight 69 is determined by the diameter of the recess 56, and is preferably such as to provide for an appreciable operating clearance relative to the walls of the conduit section 64 defining the recess 56.

The burner grate structure is comprised of an upwardly opening, circular casing 60 having a horizontal, annular wall 62 directed inwardly thereof, at the lower end of the casing. Supported by and suitably secured to the casing, are a plurality of plate-segments 63 which cooperate to form a grate surface for the fuel in the burner; the plates extending in an upward and outwardly flaring manner, between the inner edge 64 of the casing wall 62 and the rim 66 of the casing. The plates and casing in this arrangement, are relatively spaced to provide a combustion air supply chamber 67 extending annularly about the grate-plates, from which air for combustion is delivered to the fuel bed through tuyère-forming passages 68 in the plate 63. Air is supplied to chamber 67 from the blower, in a manner later appearing.

In the assembly position of the grate structure on the burner base, the casing wall 62 engages and rotatively journals upon the bearing surface 44 of the burner base and the flange-seat 60 of the burner pot (Figs. 2 and 3), thereby spanning the annular opening 10 between the upper ends of the burner base and pot. In order to prevent displacement of the grate assembly, laterally of the burner base, rollers 71 are carried by the casing wall 62, in circumferentially spaced relation therebelow and in position to engage the internal flange 42 at the upper end of the burner base (Fig. 2). Rotation of the grate structure may be effected in any well known manner, or as preferred and illustrated herein, by a suitable drive connection with the ash conveyor. Accordingly, a ring member 72 surrounds the upper end 40 of the burner base and is removably secured to the grate casing 60 by upstanding, slotted lugs 74, on the ring engaging pins 75 projecting radially from the grate casing. The ring 72 is provided with a plurality of equally spaced, radially projecting arms or teeth elements 76, which in the operative assembly of the burner, are engaged successively, by the exposed flights 31 of the ash conveyor (Figs. 3 and 4). The relative arrangement of the ring lugs 74 and casing pins 75 is such that through rotation of the ring in one direction (clockwise, as shown in Fig. 4) as determined by the direction of ash conveyor rotation, these elements will cooperate to drive the grate structure, but upon a reverse rotation of the ring, the slotted lugs thereof will become disengaged from the pins, thereby to permit ready removal of the ring.

As appears particularly in Figs. 3 and 4, the wall 62 of the grate casing 60 is provided with a number of openings 78 each of arcuate extent and provided for the passage of combustion air from the air-receiving chamber 79 in the burner base 85, to the air chamber 67 formed in the grate assembly.

During operation of the burner, some of the finer particles of fuel and other foreign matter which may be contained in the fuel as delivered to the fuel bed in the grate structure, may drop or pass through the tuyère openings 88 in the grate plate 63, into the air chamber 67. From this chamber, the greater portion of such fine material or ruddlings will ultimately, fall through the openings 78, and unless provision be made for collecting the material as its falls therethrough, will accumulate in the air chamber 79 in the burner base 85. The fine siftings of fuel and other material, if permitted to accumulate in the chamber 79 over an extended period of burner operation, may offer increasing resistance to the flow of combustion air therethrough, and it is conceivable that after so long a time, the chamber may become so clogged as to preclude delivery of combustion air to the fuel bed, in the volume or at the rate necessary to effect efficient combustion of the fuel therein. Accordingly, provision is made by the present invention, to collect and localize all such siftings or ruddlings of fuel material, and to convey the same from the zone of localization to the burner pot for return to the fuel bed and ultimate consumption therein.

Spaced inwardly from the wall of the burner base 85, near its upper end 40, is a horizontal plate or deck element 86 which surrounds the upwardly directed portion of the burner pot 47, and preferably, is so disposed as to lie in a plane through the uppermost wall portion of the conduit neck 61 projecting from the pot. The outer edge of the plate is provided a turned rim or flange 82 which cooperates with the plate and the burner pot surrounded thereby, to form an annular channel 83 which underlies the air openings 78 in the casing wall 62 of the grate structure (Fig. 3). The flanged rim of the plate 80 is supported from the wall of the burner base, as by a plurality of connecting elements or webs 84 which bridge the annular space 86 between the plate flange 82 and the wall of the burner base near the upper end 40 thereof. The space 85 is effected necessarily, to provide for the passage of combustion air from the burner base chamber 79, upwardly about the channel-forming plate 80 and through the openings 78 into the grate air chamber 61. But at the same time, the channel-plate 80 below the openings 78 serves to receive all siftings of fuel and other matter dropping through such openings, whereby to preclude accumulation therein, and to collect the same in the base chamber 79. It is to be noted here that the burner base assembly, including the burner pot and its conduit-neck elements, the flanged plate 80 and the plate-supporting elements 84, may be a unitary structure, formed by a single casing. In this manner the base 80 integrally united with the burner pot and also,
with the wall of the burner base through the elements 84, serves through the latter elements, to support in part, the burner pot in spaced position within the burner base.

The channel discharge opening 87 is provided in that portion 88 of the plate 80 which overlies the pocket-forming conduit 54 projecting from the burner pot 47. Communication between the opening 87 and the recess 56 formed by conduit 54, is effected by a passage 89, defined by wall elements 91 extending between the opening 87 and a similar opening 92 in the upper wall portion of the conduit 54. Thus fuel siftings collecting in the channel 83, may be discharged through opening 87 into the recess 56, and the conveyor 93 operating therein, may then convey the material outwardly of the recess and into the lower portion of the burner pot, for re-delivery to the fuel bed.

Operating in the channel 83 are a plurality of conveying or material sweeper elements 94, which serve to collect the material siftings in the channel and to convey them to the channel-opening 87, for discharge therethrough as above described. The sweeper or scraper elements 94 which preferably, are of plate-like form, are carried by a ring member 95, each element having a bent-over portion engaging the ring and secured thereto, as by welding.

Engaging the bent portion 96 of certain of the scrapers, are ring securing lugs 98 preferably welded thereto and projecting radially, relative to the ring, to provide means for mounting the ring to the wall 92 of the grate casing 80. The projecting portion of each lug is provided with an aperture 99, to receive a mounting element, as a screw or threaded stud 100 which threaded engages the wall 82 (Fig. 4). Thus, during rotation of the burner grate structure, the ring and its sweepers will be rotated thereby, in the channel 83. The elements 94 riding over the surface of the plate 80, although preferably out of actual sliding contact therewith, will effectively sweep the material in the channel, to the channel opening 87 for discharge therethrough.

It is to be noted as a preference in the present exemplary embodiment of the invention, that the sweeper elements are directed forwardly at an acute angle to the ring (Fig. 5), in the direction of ring rotation. The purpose for this arrangement is to effect thereby and as the sweepers operate in the channel, a diversion of the fuel siftings from the zone of the channel flange 82, to and into the wedge-shape area 102 (Fig. 5) between each sweeper and the ring. It is quite probable that if during sweeper conveyance of the material in the channel, a portion thereof were allowed to collect and pile up in the zone of the channel flange, some of the siftings would spill over the flange and drop into the air chamber 79 in the burner base. Hence, by so directing the sweeper or scraper elements, as described, any tendency for the fuel siftings to pile up at the channel flange, is thereby effectively reduced or precluded.

The presently preferred embodiment of the invention as now described and as illustrated in the drawings, fully attains the purpose therefor, while materially improving the function of the burner apparatus. It is to be understood, however, that the form and arrangement of the exemplary embodiment herein detailed, may be altered or modified without departing from the spirit and intended scope of the invention, as defined by the appended claim.

I claim:

In a burner of the character described, a stationary casing open at its upper end, a burner pot in said casing having its upper open end inwardly spaced from the upper open end of the casing, a rotatable casing above the stationary casing and provided at its lower end with a substantially horizontal, inwardly directed flange spanning the spaced open ends of the burner pot and stationary casing, and seating thereupon in assembly, said flange having openings therethrough, a grate carried by said rotatable casing and having its lower end in registry with the upper open end of the burner pot, said grate having tuyère openings for the passage of combustion air to the fuel on the grate, said casings and grate cooperating in assembly, to form an air supply chamber communicating with said tuyère openings, a peripherally flanged channel member supported by and extending about said burner pot below said rotatable casing flange and in substantial registry with the openings in the latter flange, said channel member serving to receive therein particles of fuel and ash dropping through said grate tuyère openings and through said rotatable casing flange openings, said channel member being provided with a discharge opening, a sweeper supporting member secured to the flange of said rotatable casing for rotation therewith, sweeper elements on said supporting member for operation in said channel member to convey fuel and ash particles collecting in the channel, to said channel discharge opening, each of said sweeper elements being directed forwardly in the direction of sweeper rotation, whereby to deflect the fuel and ash particles inwardly away from the flanged periphery of the channel member, passage-means connecting said discharge opening with the interior of said burner pot, and a conveyor in said passage-means, operable to convey the fuel and ash particles delivered thereinto, to the interior of the burner pot.

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