Aug. 10, 1954 A. M. SCHLICK 2,685,853

FURNACE ASH CONVEYER AND DISPOSAL MECHANISM

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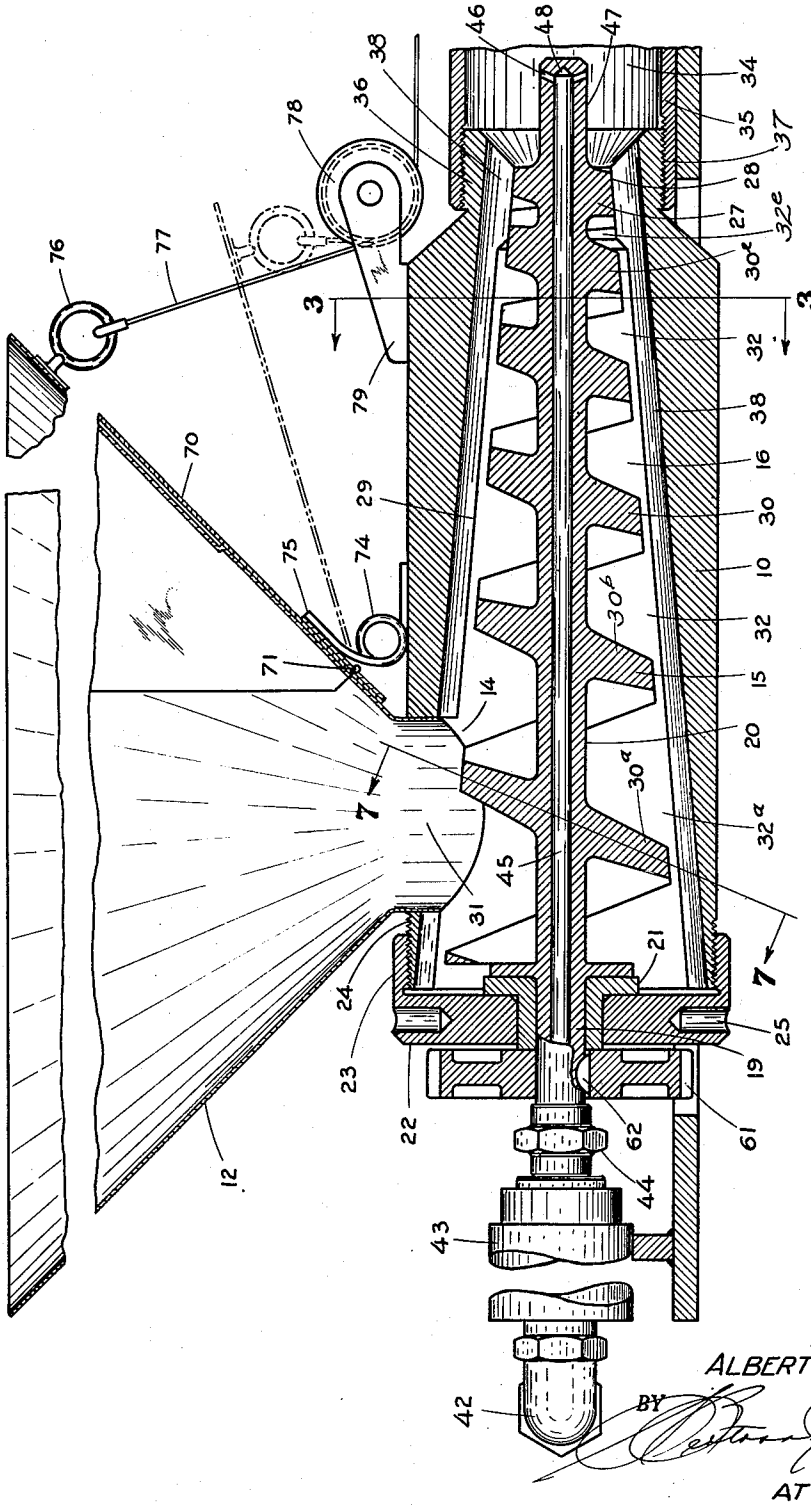


Fig. 1

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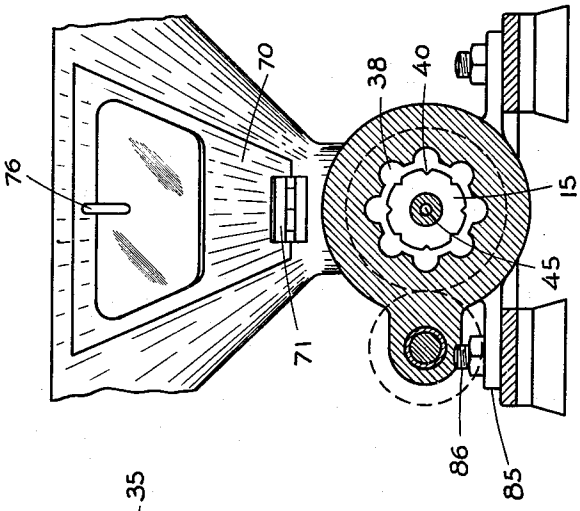


Fig. 3

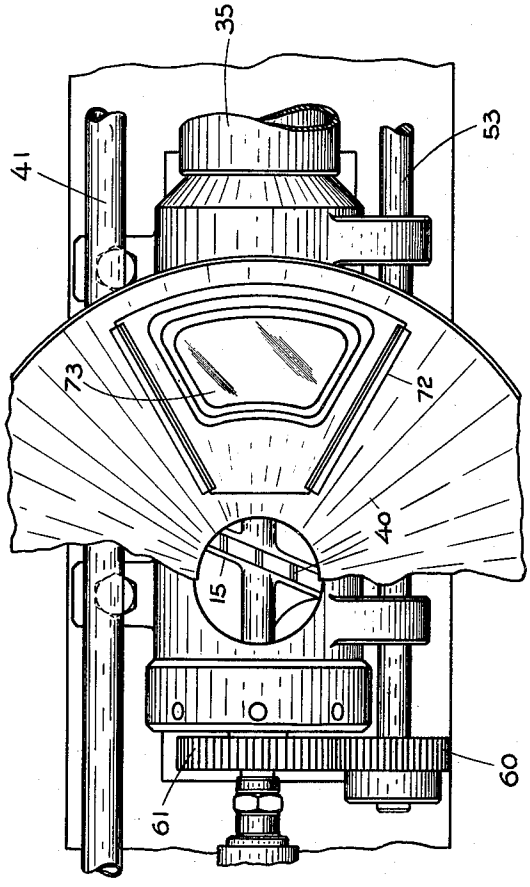


Fig. 2

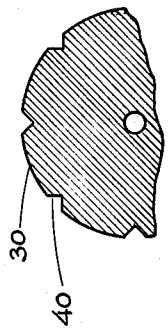


Fig. 7

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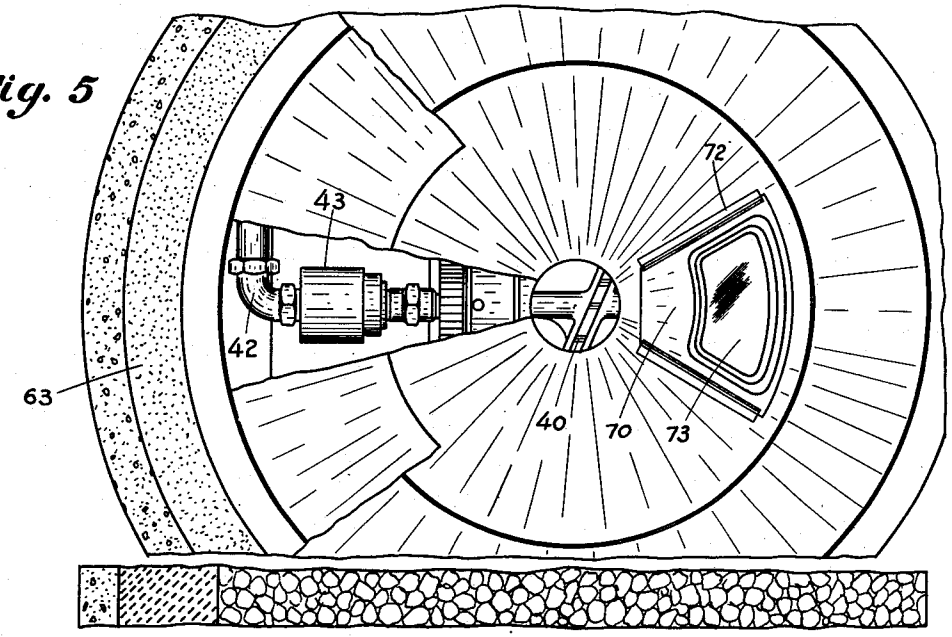
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FURNACE ASH CONVEYER AND DISPOSAL MECHANISM

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Fig. 5



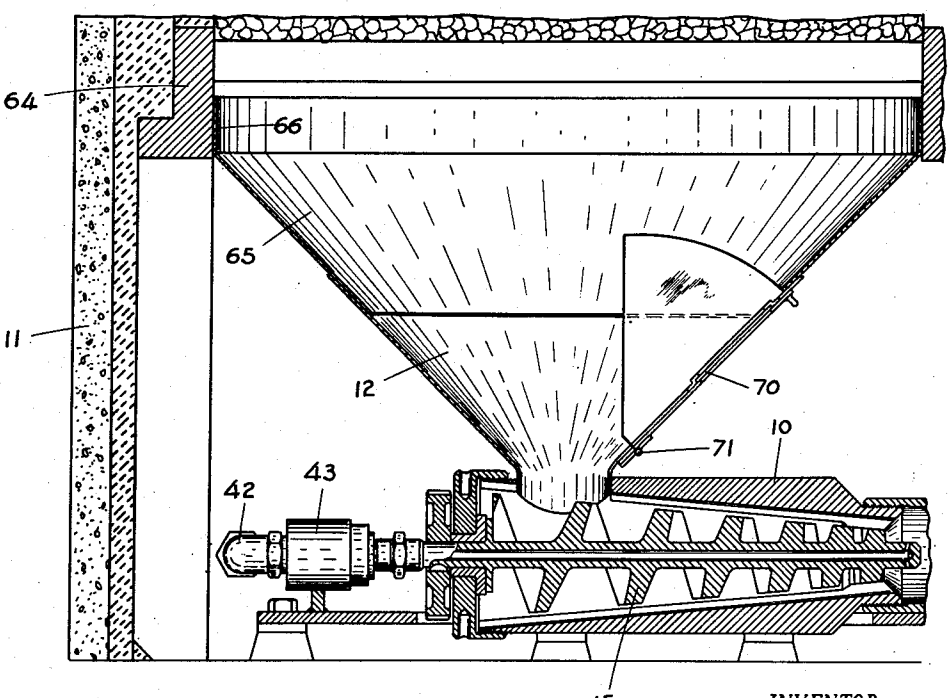


Fig. 4

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FURNACE ASH CONVEYER AND DISPOSAL MECHANISM

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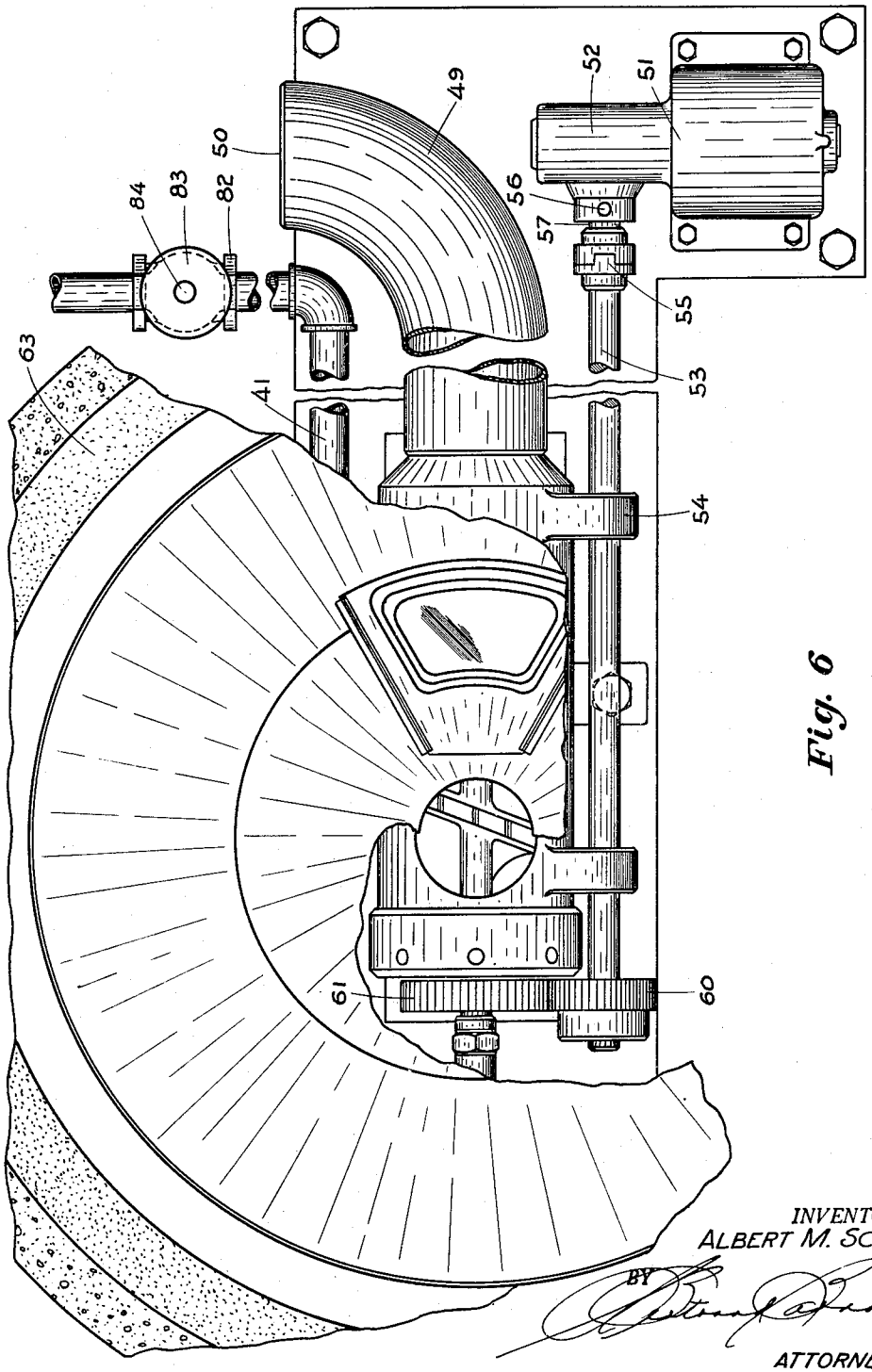


Fig. 6

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Patented Aug. 10, 1954 2,685,853

UNITED STATES PATENT OFFICE

2,685,853

FURNACE ASH CONVEYER AND DISPOSAL MECHANISM

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Application August 25, 1949, Serial No. 112,250

6 Claims. (Cl. 110—165)

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This invention relates to an ash conveyor, processing and disposal unit, suitable for mounting in the pit of a furnace, to remove the ashes from the furnace, and transfer them to the sewage system, or some external point, and simultaneously break up any large chunks or clinkers which may be present, a spray of water being utilized to sluice the ashes through the pipes leading to the sewer or other outlet.

The unit may be mounted in a furnace, with the hopper mounted below the grates, to receive the ashes.

The removal of ashes from furnaces, and particularly the smaller home-heating furnaces has always been a troublesome problem.

When the ashes are removed by hand, frequent shoveling is necessary. The shoveling of ashes is a laborious operation, and tends to raise dust which gets into the air and spreads through the house, and unless extreme care is taken, spreads over the furnace room floor, necessitating frequent cleaning.

The primary object of my invention is to provide an ash conveyor and disposal unit which will remove the ashes from the furnace, break up any large chunks or clinkers, which may be present, and sluice the ashes through an outlet pipe, into the sewage system, or other disposal repository.

A further object is to provide a relatively simple ash conveyor mechanism, which will force the ashes through an outlet pipe, under pressure, and simultaneously subject them to a water spray, which will sluice the ashes through the outlet pipe.

A major object is to provide an ash conveyor and disposal mechanism, which can be produced and installed in the furnace, at relatively low cost, and can be operated, maintained and serviced by relatively unskilled persons, over sustained periods.

The accompanying drawings, illustrative of one embodiment of my invention, together with the description of the construction and the method of installation, and operation thereof, will serve to clarify further objects and advantages of my invention.

In the drawings:

Fig. 1 represents a vertical section through the assembled ash conveyor, processing unit, and disposal mechanism.

Fig. 2 is a plan view of the assembled unit of Fig. 1.

Fig. 3 is a cross-section through the spiral conveyor, processing unit, and housing, taken at 3—3, Fig. 1, and a partial side elevation of the unit.

Fig. 4 represents a vertical section through a

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furnace, with the ash conveyor and processing mechanism installed.

Fig. 5 is a partial cross-section through the furnace, of Fig. 4, and a plan view of the ash conveyor and processing mechanism.

Fig. 6 is a plan view of the conveyor mechanism and furnace, similar to Fig. 5, showing the conveyor drive motor and drive shafts.

Fig. 7 is a cross-section through one of the blades of the spiral rotor, taken at 7—7, Fig. 1.

It will be understood that the following description of the construction, installation, and operation of the furnace ash conveyor and disposal mechanism, is intended as explanatory of the invention and not restrictive thereof.

In the drawings, the same reference numerals designate the same parts throughout the various views, except where otherwise indicated.

The ash conveyor unit, as indicated in Figs. 1, 2 and 4, is mounted in a cast housing 10, which may be located in the ash-pit of a furnace 11, a hopper 12 guiding the ashes from the grate, through an opening 14, in the housing, to a rotary spiral conveyor 15 and processing unit, supported in a substantially frusto-conical opening 16, formed in the housing. The spiral conveyor could be cast of steel, bronze or other high-strength material.

The extension end 19, of a long tubular shaft 20, formed integral with, or attached to the spiral conveyor, may be trunnioned in a shouldered bushing 21, fitted to the rear wall 22, of a cap 23, threadably attached to the rear end of the housing, by means of internal threads formed in the cap, which fit the external threads 24, formed in the tubular end of the housing, as indicated in Fig. 1. A plurality of substantially radial holes 25, may be provided around the outer circumference of the cap, the holes receiving pins of a conventional type of spanner wrench, to tighten or adjust the cap.

In place of the radial openings 25, a plurality of flats may be formed around the outer circumference, or the contour of the rear wall 22, of the cap, may be made in the form of a hexagon, or of other suitable contour to fit the opening in the conventional type of wrench.

The front spiral blade 27, of the spiral conveyor, may be supported by the frustum conical edge of the wall 28, of the housing, at the forward end, the entire rear portion of the housing interior being enlarged to form a frusto-conical area, the sides 29 of the frusto-conical area clearing the balance of the spiral blades 30, in the conveyor unit.

The ashes which are dropped from the furnace grate are directed by the sloping walls of the

hopper 12, to a central opening 31, formed in the hopper, in communication with the space surrounding the rear blade 30a of the conveyor.

The diameter of the spiral blades 30 is progressively reduced from the rear blades 30a to the front bearing tooth 27, the pitch of the blades being progressively, simultaneously reduced from rear to front.

This progressively reduces the space 32, between the blades, from the space 32a, between the two rear blades, and the space 32e, between the front blade 30e, and the front bearing blade 27, the blade breaking the ashes up into smaller particles, and simultaneously compressing the ashes into a smaller volume, thereby increasing the velocity of the ashes as they leave the front blade and enter an opening 34, formed in a tubular connection 35, threadably attached to a tubular extension 36, formed integral with the forward end of the housing, by means of the external threads 37, cut in the housing extension, which fit the internal threads of the tubular connection.

A plurality of long grooves 38, of semi-circular or other suitable cross-section, may be formed around the opening in the housing wall, as indicated in Fig. 4, the grooves coacting with a series of V-shaped, or other suitable form of notches 40, cut in the circumference of the spiral blades, as indicated in Figs. 6 and 7, to break up any large chunks, or clinkers, formed on the grate, and mixed with the ashes, when the rotor is revolved, the movement of the blades, and the progressively reduced space between them, breaking the ashes up into smaller particles.

Water may be fed through a long pipe 41, which is connected by a fitting 42, to a Swivlex or other suitable form of flexible coupling 43, the opposite end of which may be threadably attached to the end of the shaft extension by means of a coupling 44, the water being fed through a cylindrical passage 45, formed in the tubular shaft 20 of the conveyor, to a plurality of small, substantially radial angular openings, or nozzles 46, formed in the outer wall of the forward extension 47, of the shaft, the wall 48, formed at the forward end of the shaft extension, sealing the passage 45, and directing the flow of water through the small radial openings 46. Where additional water volume is required, an additional small opening may be formed in the wall 48, of the shaft extension, in substantial alignment with the central passage 45.

The angular openings 46, located at the end of the shaft extension, act as nozzles in deflecting the water from the central passage 45. The combined area of the openings 46 would be less than that of the passage 45, at the center of the shaft extension, thus increasing the velocity of the water stream, as it leaves the angular nozzle openings.

The pressure of the water stream in striking the small radial openings 46 in the shaft extension, forms a fine, substantially conical spray, which contacts the ash stream, as it passes from the outlet blade 27, of the spiral conveyor, to the tubular connection 35.

The velocity of the water spray, at the outlet openings, combined with the velocity of the ash stream, as it leaves the spiral conveyor, under pressure, sluices the mixture of water and ashes through the tubular connection 35, thence through an opening in a pipe 49, Fig. 6, the outlet end 50, of which, may be connected to the sewage system of the house, or to some other point for storage or removal, where the ashes are to be used as fill, or for other purposes.

If at any time, the water supply is temporarily shut off, the pressure on the ash stream, generated by the spiral conveyor blades, and the velocity imparted by the pressure, would force the ash stream through the outlet pipe over a sustained period, without assistance from the water stream.

The spiral conveyor 15 may be driven by an electric motor 51, having a built-in reduction gear 52, incorporated therewith, the motor reduction gear being connected to a long shaft 53, trunnioned in a pair of brackets 54, formed integral with, or attached to, the housing 10, by a coupling 55, a shear pin 56, or other suitable type of torque-limiting device being provided on the motor shaft extension 57, to limit the load which may be imposed on the motor, should the conveyor be stopped by chunks of coal or other obstructions lodging in the grooves 38, formed in the housing, and the notches 40 formed in the spiral blades, as indicated in Fig. 7.

A spur, helical or other suitable form of pinion 60, mounted at the opposite end of the shaft 53, drives a mating gear 61, mounted on the extension end 19, of the spiral conveyor shaft, a Woodruff key 62, or other suitable type of key or locking device, being used to connect the gear to the shaft.

As indicated in Figs. 4, 5 and 6, the entire unit may be mounted in the ash-pit of a furnace, the walls 63, of which, are of circular or other form of cross-section.

The hopper 12 may be located in substantial alignment with a circular or other form of ring 64, mounted in the furnace wall, below the grate bars, an auxiliary extension hopper 65, of frusto-conical outline, fitting into the upper end of the hopper 12.

A substantially circular ring 66, formed integral with the upper end of the extension hopper may be attached to the furnace ring 64 to support the extension hopper.

An opening may be formed in the wall of the hopper 12, at the front end of the hopper, in substantial alignment with the furnace door, as indicated in Figs. 1, 2 and 4, a flap or door 70, attached to the hopper by means of a hinge 71, being mounted between a pair of side guides 72, attached to the hopper wall, as indicated in Figs. 4 and 5.

A window 73, made of mica or other fire-resistant, transparent material may be mounted in a frame formed in the upper portion of the flap 70.

Under normal conditions the flap is held in the closed position, shown in Fig. 1, by a coiled torsion spring 74, or other type of closing device, the upper arm 75 of the spring pressing against the flap.

A hook or loop 76, or other suitable form of connection, may be provided at the upper end of the hopper door 70, a flexible cable 77, which passes over a grooved pulley 78, rotatably supported on the housing 10, by a bracket 79, being utilized to manually open the hopper door.

A latch (not shown) may be provided at the upper end of the flap 70, to retain the flap in the closed position, after it is closed by the spring 74. Where a latch is used, the control knob of the latch may be connected, by means of a cable extension, to the upper end of the cable 77, an additional pulley, rotatably attached to the hopper, being provided to guide the auxiliary cable, in opening the latch.

The flow of water through the passage **45**, in the conveyor shaft, may be started or stopped by a valve **82**, connected into the feed pipe line **41**, the opening and closing of the valve being controlled by an electrically-operated solenoid **83**, mounted on the valve housing, the solenoid opening the valve either directly by means of a rod **84**, mounted in the center of the solenoid coil, or through a linkage mounted within the valve housing, when the solenoid is energized.

The flow of current to the solenoid may be controlled by the controller or starter of the motor **51**, which actuates a switch (not shown), which in turn, controls the flow of current to the solenoid, thus opening the water supply valve simultaneously with the starting of the conveyor drive motor **51**.

The unit while shown in a furnace of circular cross-section may be adapted for use in any other type of furnace.

The auxiliary hopper **65**, shown in Figs. 4 and 5, may be constructed to fit furnaces of square, rectangular or any other cross-section, the lower end of the auxiliary hopper being of frusto-conical form to fit the hopper **12**, of the ash-disposal unit.

Where the unit is mounted in a furnace of square, rectangular or other polygonal cross-section, the hopper **12** may be made of similar cross-section, instead of circular, as indicated in Figs. 4 and 5.

The housing **10** may be attached to the bed of the furnace by a plurality of legs **85**, attached to or formed integral with the housing, the legs being bolted to the furnace bed by a plurality of bolts **86**, or attached thereto by other suitable means.

The diameter and spacing of the blades of the spiral conveyor and processing unit, may be varied to suit the requirements of a particular application, the size and spacing depending upon the speed of rotation of the conveyor, the pressure and velocity required in the ash stream, and the amount of ashes to be removed in a given time interval.

The form, size and number of grooves **38**, formed in the housing wall, may be varied depending upon the type of grate, the type of furnace used, and the size of the clinkers or other large chunks, which may come into the ash pit with the ashes.

The number, size and form of the V-notches formed around the blades of the spiral conveyor may also be varied considerably to suit the requirements of a particular application, or installation.

The notches may be formed in all of the blades of the spiral conveyor or confined to the rear blades **30***a* and **30***b*, of the conveyor, the outer contour of the other conveyor blades being left smooth.

The hopper door or flap may be made of substantially trapezoidal contour, as indicated in Fig. 3, or of any other suitable contour, depending upon the size of the opening in the hopper, the size and form of the flap, and the method of attaching the flap to the hopper.

The motor, may be fitted with a built-in reduction gear, or a motor, driving a separate reduction gear unit, may be substituted therefor.

Where a slow-speed motor is used the reduction gear may be eliminated entirely, the pinion and gear between the motor shaft and the shaft of the spiral conveyor, reducing the conveyor shaft speed.

It will be apparent to those skilled in the art that my present invention is not limited to the specific details described above and shown in the drawings, and that various further modifications are possible in carrying out the features of the invention without departing from the spirit and scope of the appended claims.

What I claim is:

1. An apparatus for progressively breaking up, compressing and conveying solid materials of irregular form, comprising a tubular housing, the interior of said housing being of substantially frusto-conical form, said housing having an opening through one side thereof, a hopper fitted to said housing opening, feeding the solid materials therethrough, the interior of said housing having a plurality of longitudinal grooves of arcuate cross-section therein, a conveyor rotatably mounted in said housing, the conveyor having a plurality of narrow edged spiral blades of progressively reduced diameter formed along the longitudinal axis thereof, each blade of said conveyor having a plurality of substantially radial V-notches cut across the outer circumference thereof, each notch cutting entirely through the blade edge, said conveyor being adapted to receive the solid materials through the housing opening, the conveyor blade notches being operative to coact with the housing grooves to simultaneously break the solid materials up into smaller particles, the conveyor blades being operative to compress the solid materials, and deliver the materials through an outlet opening formed in said housing, an outlet conduit attached to said housing, said spiral conveyor having a longitudinal passage formed therethrough, with a plurality of angular openings communicating with said longitudinal passage, and means supplying a stream of water through said openings, the rotary spray from said angular openings sluicing the broken material stream along the conduit.

2. An apparatus for progressively breaking up, compressing and conveying ashes of irregular form from a furnace, comprising a tubular housing, the interior of said housing being of substantially frusto-conical form, the interior of said housing having a plurality of longitudinal grooves of substantially semi-circular cross-section therein, a spiral conveyor rotatably mounted in said housing, said conveyor having spiral blades of progressively reduced diameter formed along the axis thereof, the diameter and pitch of the blades of said conveyor being progressively reduced from the inlet end to the outlet, each of said conveyor blades having a plurality of substantially radial V-notches cut across the outer circumference thereof, the V-notches being cut in a direction perpendicular to the longitudinal conveyor axis, the notches in the blades of the conveyor coacting with the grooves in the housing wall to break the ashes up into smaller particles, the reduced space between the conveyor blades, compressing the ashes, the blades at the reduced diameter of the conveyor delivering the ash stream through an outlet opening formed in the housing, an outlet conduit connected to said opening, and means for supplying and directing a water spray into said conduit, the water spray coacting with the conveyor blades to sluice the ashes from the conveyor outlet along the conduit.

3. An apparatus for progressively breaking up, compressing and conveying ashes of irregular form from a furnace, comprising a tubular housing, the interior of said housing being of substantially frusto-conical form, the interior of said

housing having a plurality of longitudinal grooves of substantially semi-circular cross-section therein, a spiral conveyor rotatably supported by said housing, said conveyor having spiral blades of progressively reduced diameter formed along the axis thereof, a shaft formed integral with said conveyor, each of said conveyor blades having a plurality of V-notches cut through the outer circumference thereof, the V-notches being cut in a direction perpendicular to the longitudinal conveyor axis, a motor for driving said conveyor shaft, means operatively connecting the motor to the conveyor shaft, means reducing the speed of said motor, the notches of the blades in the conveyor coacting with the grooves in the housing wall to break the ashes up into smaller particles, said conveyor being adapted to simultaneously compress the ashes, and deliver the ashes through an outlet opening formed in the housing, a hopper adapted to receive the ashes and direct them toward the conveyor, an outlet conduit connected to said housing opening, said conveyor shaft having a longitudinal passage formed therethrough, with a plurality of nozzle openings in communication with said passage, formed in the outlet end of said shaft, means supplying a stream of water through said openings, means flexibly connecting the supply source to the conveyor shaft, and means starting and shutting off the water supply, the rotary spray from said openings coacting with the conveyor blades to sluice the ash stream from the conveyor outlet along the conduit.

4. An apparatus for progressively breaking up, compressing and conveying solid materials of irregular form, comprising a tubular housing, the interior of said housing being of substantially frusto-conical form, a spiral conveyor of frusto-conical form, having spiral blades of progressively reduced diameter formed along the axis thereof, rotatably supported in said housing, the wall of said housing, around the conveyor, having a plurality of substantially radial, longitudinal grooves formed therein, the blades of said conveyor having a plurality of radial V-shaped notches formed through the outer circumference thereof, said V-shaped notches coacting with the grooves in the housing to break the solid materials up into smaller particles, said conveyor being adapted to simultaneously compress the solid materials, and deliver the broken materials, through an outlet opening formed in the housing, a hopper adapted to collect the solid materials, and direct them toward the conveyor blades, one wall of said hopper having an opening formed therethrough, means closing said opening pivotally attached to the hopper, means retaining said closing means in the closed position, and an outlet conduit attached to the housing in communication with the housing opening, said solid material stream passing from the conveyor through the outlet opening, thence through the conduit, the progressively reduced diameter of the conveyor blades being operative to force the broken material stream from the conveyor outlet through the conduit.

5. An apparatus for progressively breaking up, compressing and conveying ashes of irregular form from a furnace, comprising a tubular housing, the interior of said housing being of substantially frusto-conical form, the interior of said housing having a plurality of longitudinal grooves of substantially semi-circular cross-section therein, a spiral conveyor of frusto-conical contour rotatably mounted within the housing, said conveyor having spiral blades of progressively reduced diameter formed along the axis thereof, a shaft formed integral with said conveyor, a motor adapted to drive said conveyor shaft, means operatively connecting the motor shaft to the conveyor shaft, means reducing the speed of said motor, the pitch of the blades of said conveyor being progressively reduced from the inlet end to the outlet end, each of said conveyor blades having a plurality of V-notches cut through the outer circumference thereof, the V-notches being located in a direction perpendicular to the longitudinal blade axis, the blade V-notches being operative to coact with the longitudinal housing grooves to break the ashes up into smaller particles, a substantially cylindrical shaft formed integral with said conveyor, said conveyor blades compressing the ashes into the reduced space between the blades, the ashes being delivered at the outlet end of said conveyor through an opening formed in the housing, a hopper attached to said housing, said hopper receiving the ashes and directing them toward the inlet end of the conveyor, a conduit attached to the housing in communication with said housing opening, said conveyor shaft having a longitudinal passage formed therethrough, with a plurality of substantially radial openings in communication with the longitudinal passage, formed adjacent the end of the shaft, means directing a liquid stream through said openings, means flexibly connecting the liquid supply line to the conveyor shaft, the rotary spray from said openings, coacting with the conveyor blades to sluice the ash stream from the conveyor outlet along the conduit.

6. An apparatus for progressively breaking up, compressing and conveying solid materials of irregular form, comprising a tubular housing, with a liquid supply line connected to the housing, the interior of said housing being of substantially frusto-conical form, the frusto-conical interior of said housing having a plurality of longitudinal grooves of substantially semi-circular cross-section therein, a spiral conveyor of frusto-conical contour rotatably mounted in the interior of the housing, said conveyor having a plurality of relatively narrow edged blades of progressively reduced diameter formed along the axis thereof, the pitch of the blades being progressively reduced from the inlet to the outlet end, each of said conveyor blades having a plurality of V-notches cut through the outer circumference thereof, the V-notches being cut in a direction perpendicular to the longitudinal conveyor axis, a shaft formed integral with said conveyor blades, the conveyor blade notches being operative to coact with the housing grooves to break the solid materials up into smaller particles, said blades simultaneously compressing the material into the reduced space between the blades, and delivering the material at the outlet end, through an opening formed in the housing interior, a conduit attached to the outlet end of the housing, in communication with the interior thereof, said conveyor shaft having a longitudinal passage formed therethrough, with a plurality of substantially radial openings in communication with the longitudinal passage, formed adjacent the end of the shaft, means directing a stream of water through said openings, means flexibly connecting the liquid supply line to the conveyor shaft, the rotary spray from said openings coacting with the conveyor blades to force

the material from the conveyor outlet, through the conduit.

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