

No. 698,449.

Patented Apr. 29, 1902.

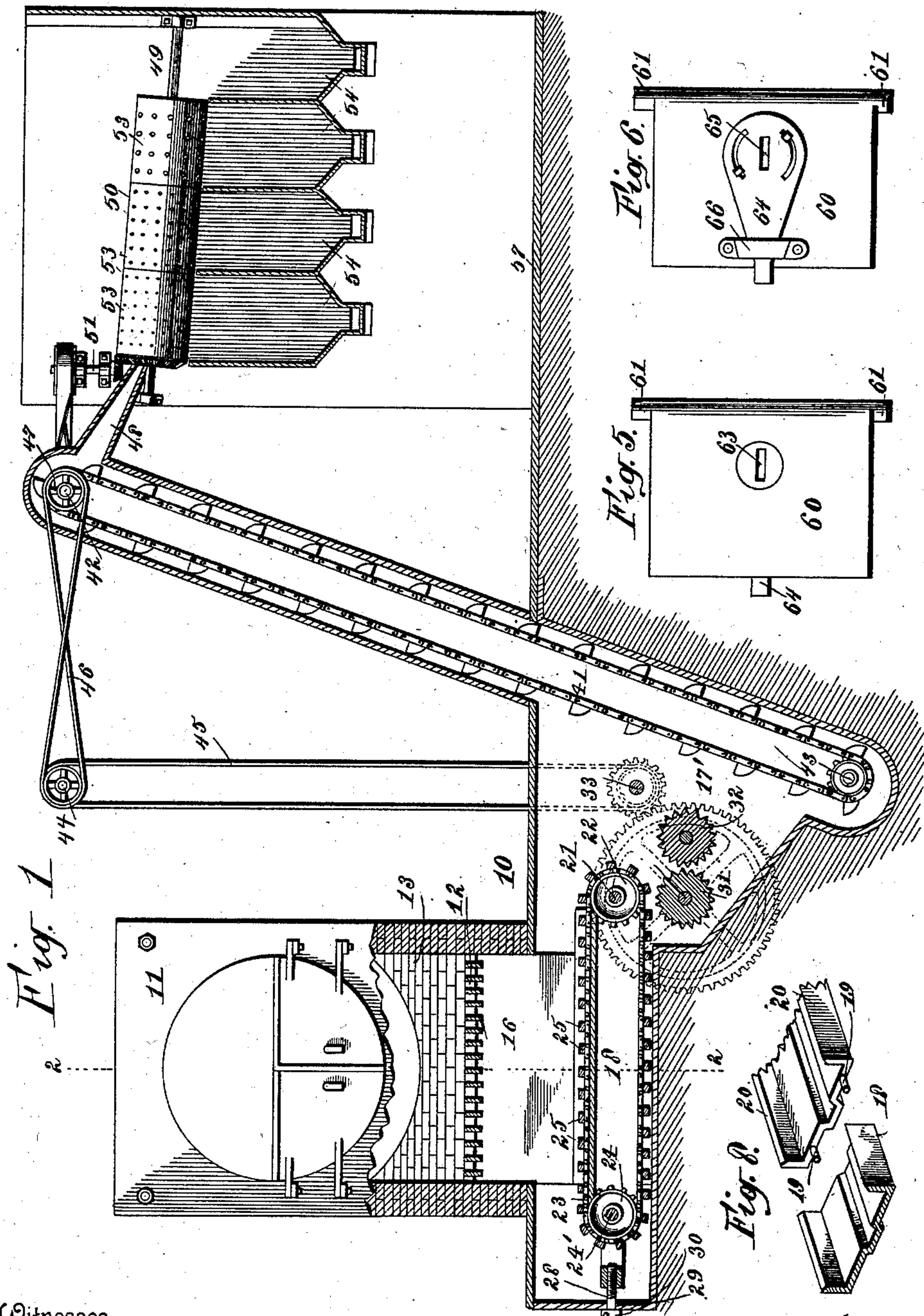
D. CAMPBELL.

ASH REMOVER FOR BOILER FURNACES.

(Application filed Nov. 16, 1900.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses:

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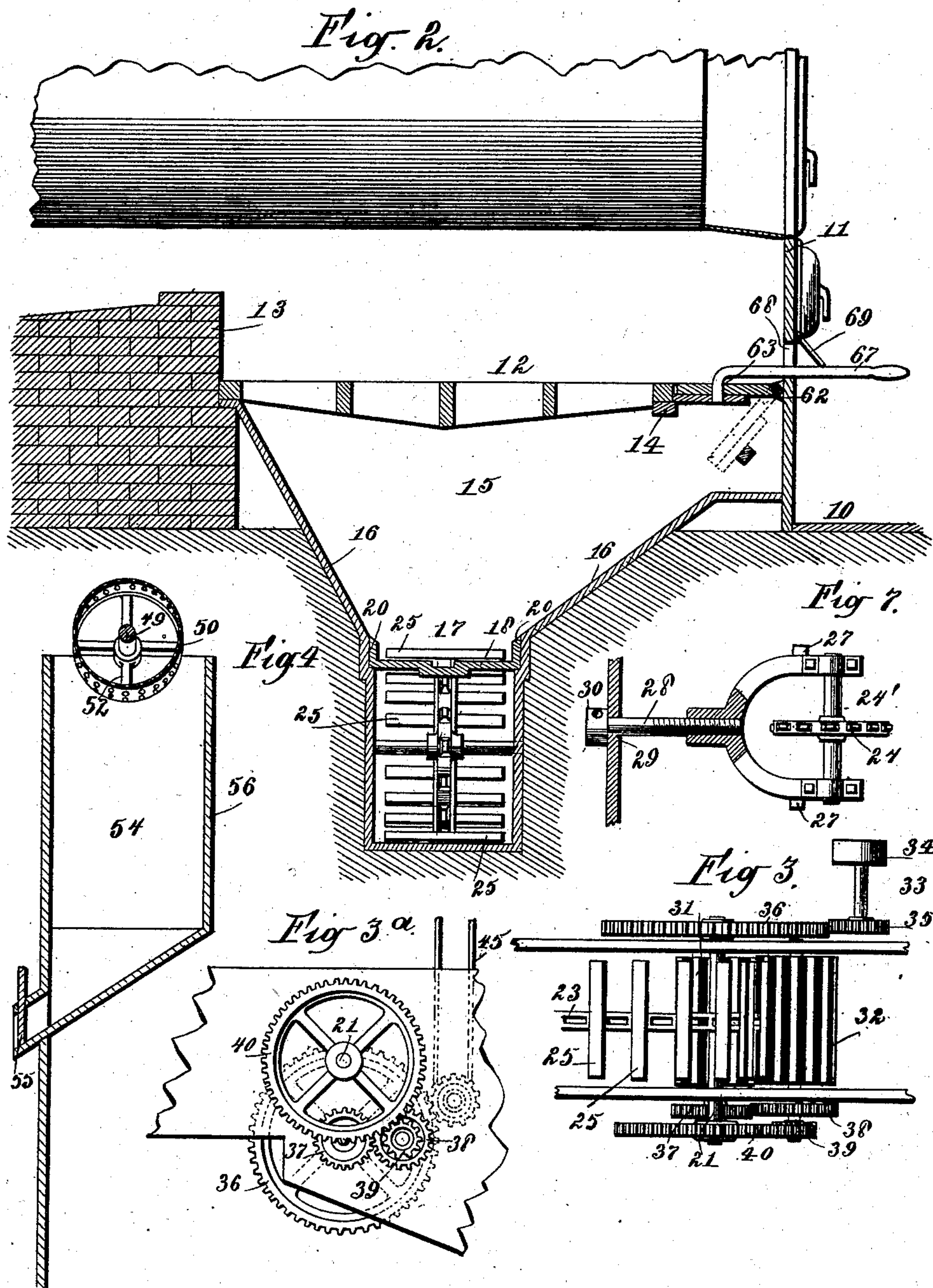
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(No Model.)

4 Sheets—Sheet 2.



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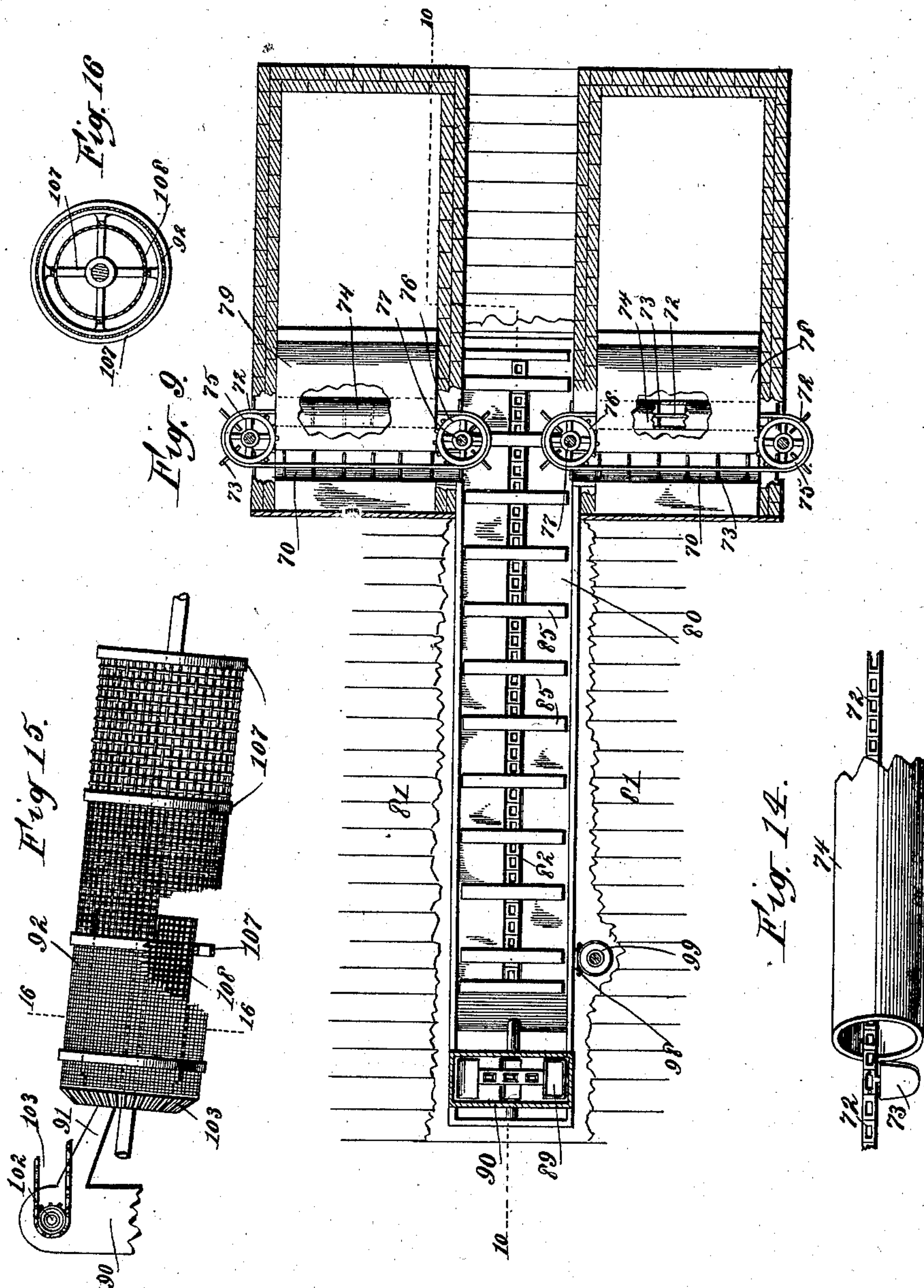
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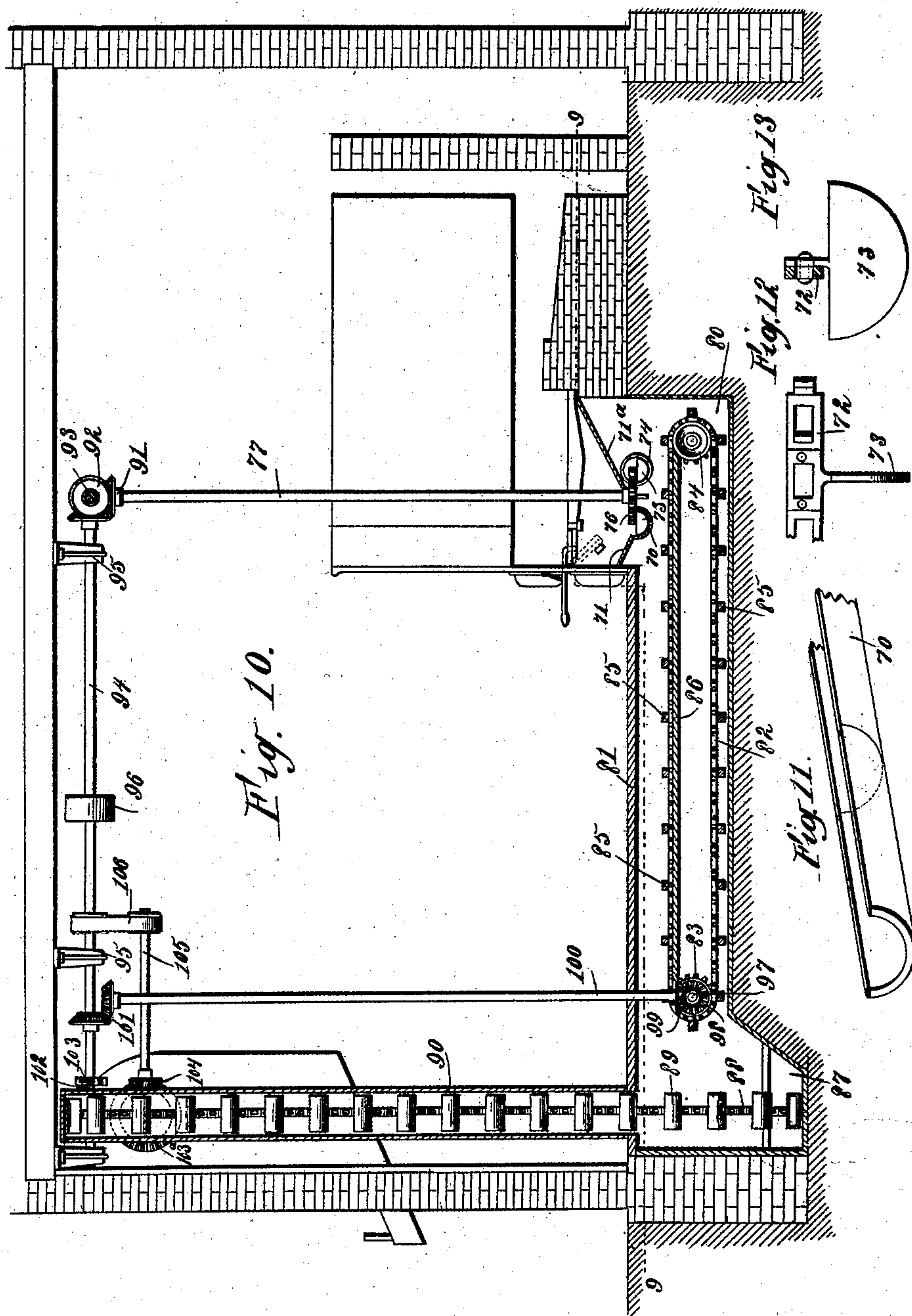
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4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

DANIEL CAMPBELL, OF FAIRVILLE, CANADA.

ASH-REMOVER FOR BOILER-FURNACES.

SPECIFICATION forming part of Letters Patent No. 698,449, dated April 29, 1902.

Application filed November 16, 1900. Serial No. 36,680. (No model.)

To all whom it may concern:

Be it known that I, DANIEL CAMPBELL, a subject of Her Majesty the Queen of Great Britain, residing at Fairville, county of St. John, Province of New Brunswick, Canada, have invented certain new and useful Improvements in Ash-Removers for Boiler-Furnaces; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an apparatus for removing ashes from boiler-furnaces; and one object in view is to provide mechanism for automatically and mechanically carrying away the ashes from the ash-pit, thus dispensing with a part of the disagreeable duties of the fireman and preventing the loose particles of ash-dust from escaping into the air of the engine-room.

A further object is to provide means for sifting and assorting the ashes into different grades to render the refuse of factories and mills available as commercial products, because the fine ashes may be used as fertilizer or the clinkers may be employed to form pavements.

A further object is to provide a dead-plate arranged to deflect the clinkers raked out of the fire on the grate into the conveyer for discharging the refuse from the ash-pit, thus overcoming the necessity of throwing out the clinkers into the engine-room, said dead-plate having a latch mechanism which is easily manipulated.

Further objects and advantages of the invention will appear in the course of the subjoined description, and the novelty in the combination of mechanisms and in the construction and arrangement of parts will be defined by the claims.

In the accompanying drawings, forming a part of this specification, Figure 1 is a sectional elevation through a part of the boiler-furnace and showing my apparatus for removing the ashes therefrom and for treating the ashes to secure commercial products. Fig. 2 is a vertical sectional elevation in the plane of the dotted line 2 2 on Fig. 1. Fig. 3 is a detail plan view of the clinker-crushing mechanism and a part of the ash-conveyer. Fig. 3^a is a side elevation of the construction shown by

Fig. 3. Fig. 4 is a detail view of the sifter and grading mechanism. Figs. 5 and 6 are detail views of the dead-plate and its latch. Fig. 7 is a detail view of one of the chain-tighteners for the ash-conveyer. Fig. 8 is a detail perspective view of a part of the ash-pit lining. Fig. 9 is a sectional plan view in the plane of the dotted line 9 9 on Fig. 10, illustrating the application of my improvements to a battery of boilers and in operative relation to a secondary mechanism, the latter arranged to discharge to an elevator mechanism. Fig. 10 is a longitudinal sectional elevation in the plane of the dotted line 10 10 on Fig. 9. Fig. 11 is a detail view in perspective of a portion of an ash-conveyer trough. Figs. 12 and 13 are detail views of another form of ash-conveyer mechanism adapted for use in connection with the trough of Fig. 11. Fig. 14 is a detail view in perspective, illustrating the adaptation of the conveyer mechanism of Figs. 12 and 13 to a return-tube. Figs. 15 and 16 are views in side elevation and in transverse section, respectively, of a sifter-cylinder embodying an internal brace-cylinder adapted to withstand the weight of a large quantity of ashes which may be supplied thereto.

The same numerals of reference are used to indicate like parts in each of the several figures of the drawings.

10 designates the line of the boiler, 11 the front plate thereof, 12 the grate, 13 the bridge-wall, and 14 the rail of the front grate-support, all these parts being ordinary in the art.

15 designates the usual chamber below the grate, said chamber having the sloping walls 16, which converge, so as to form the ash-pit proper, 17. This ash-pit according to my invention extends transversely across the grate, and said ash-pit is provided with a metallic lining 18. This lining is made in sections, each of which is cast in a single piece of metal, and the sections are provided with the dowels 19 and the side flanges 20, the latter extending upwardly from the flat or horizontal plates of the sections. These sections fit snugly between the vertical walls of the ash-pit, and the dowels thereof connect the sections, so as to make close joints and hold the parts firmly in position.

The driving-shaft of the ash-conveyer is

indicated by the numeral 21 as being located, preferably, outside of the line of the boiler-furnace, and this shaft is provided with a series (two or more) of sprocket-gears 22. The
 5 ash-conveyer is preferably embodied as an endless conveyer having the chains 23, which engage with the sprockets 22 on said shaft 21. These sprocket-chains also engage with the idle sprocket-gears 24, and said chains carry
 10 the metallic slats 25, the latter being secured at suitable intervals to the chains and arranged thereon in parallel relation to each other. The idle sprockets 24 of the endless ash-conveyer are preferably supported on
 15 short shafts 24', which are individually mounted in yokes of tightener devices. One of these yokes is shown by Fig. 7 of the drawings as being slidably confined in suitable guides 27, and with this yoke engages a screw-
 20 spindle 28, the latter being loosely mounted in a bearing 29, and said screw-spindle being provided with a suitable means for turning the same, said means being shown as a perforated head 30, adapted to receive a pin or bar
 25 which is manipulated by hand.

The endless ash-conveyer extends longitudinally in the ash-pit 17, and it is propelled by its shaft 21 to travel in a path substantially at right angles to the line of the grate 12.
 30 The sloping walls 16 of the chamber 15 direct the ashes which pass through the grate into the ash-pit 17, so that the ashes will lodge upon the metallic lining 18. The endless ash-conveyer is arranged over this lining in
 35 a manner for its metallic slats 25, on the lower side thereof, to sweep close to this metallic lining and to travel between the upstanding flanges 20 thereof, whereby the ash-conveyer is adapted to operate efficiently in forcing the
 40 ashes through the pit 17.

It is well known to those skilled in the art that the ashes removed from a boiler-furnace contain clinkers, and to utilize these clinkers or make them available as a commercial
 45 product I have equipped my apparatus with means for mechanically reducing said clinkers and for separating the same from the ashes. A clinker-crushing mechanism is arranged in a subchamber 17' of the ash-pit, which sub-
 50 chamber is below the floor-line of the furnace and in a vertical position at one side of the boiler-furnace. (See Fig. 1.) Said crushing mechanism embodies a pair of coacting corrugated rolls 31 32, which are mounted in
 55 parallel relation to each other, and said crushing-rolls are driven from a roll-driving shaft 33, the latter having a pulley 34. Said shaft 33 is also provided with a gear-pinion 35, which meshes with a large gear 36, which is
 60 fast with the shaft of the roll 31. The shafts of the two crushing-rolls are provided with the gear-pinions 37 38, arranged to intermesh and cause the rolls to rotate in opposite directions simultaneously, whereby the roll 31
 65 is driven from the shaft 33, and it in turn rotates the roll 32. The shaft of said roll 32

has a gear-pinion 39, which meshes with a large gear 40 on the drive-shaft 21 of the endless ash-conveyer, thus propelling the latter from a roll-shaft of the clinker-crushing mechanism. 70

41 designates an endless bucket elevator, which may be of any suitable construction known to the art. Said bucket elevator is disposed in an inclined position, with its foot 75 or lower end disposed within the subchamber of the ash-pit, while its upper end discharges to a chute 48, which delivers the load of the elevator to the screening and grading mechanism presently described. The upper part 80 of this bucket elevator is engaged with an elevator-driving shaft 42, while the lower or foot end of the elevator engages an idle shaft 43, the latter being supported below the rolls of the clinker-crushing mechanism. It will 85 be observed that in the operation of my apparatus the endless ash-conveyer carries the ashes and clinkers from the ash-pit to the crushing mechanism. The ashes are free to pass between or around the rolls, while the 90 clinkers are detained and crushed by the rolls, whereby the ashes and the crushed clinkers are deposited in the subchamber 17'. The bucket elevator is loaded by its buckets traveling through the ashes and clinkers that accumulate in the subchamber, and this elevator discharges its load upon the chute 48. 95

The main driving-shaft 44 of the apparatus is connected by a belt 45 to the pulley 34 on the shaft 33, that propels the clinker-crushing 100 mechanism and the ash-conveyer, and this main shaft is also connected by a belt 46 to the pulley 47 on the shaft 42, which drives the bucket elevator.

The screening and grading mechanism that 105 I employ consists of a rotary cylinder 50, which is carried by a longitudinal shaft 49, the latter being propelled from a cylinder-driving shaft 51, which is geared to the shaft 42 of the bucket elevator in any way preferred by the skilled constructor. This rotary 110 cylinder has a series of heads or spiders 52 secured to the shaft 49 and supporting a plurality of screen-sections 53, the latter having meshes of different sizes. I prefer to employ 115 a cylinder having three sections made of wire fabric or other foraminous material, which may be designated as "fine," "medium," and "coarse," in order to correspondingly grade the ashes that are adapted to pass there- 120 through while the clinkers and coarse matter are discharged from the end of the screen. Said cylinder is arranged in an inclined position for the chute 48 to extend into the fine section 53 thereof, and said screen-cylinder is 125 disposed over a series of bins 54, the latter being made of metal or other fireproof material and suspended above the floor-line or a platform 57. Each bin is provided at its bottom with a gate-valve 55, which may be 130 opened for emptying the contents of the bin into a cart or other receptacle adapted to

travel on the platform 57. All the parts of the screening and grading mechanism are contained in a suitable housing 56.

The clinkers are adapted to be raked by a
5 suitable implement from the bed of incandescent fuel on the grate 12, and in my invention I have provided novel means by which these clinkers may be directed to the endless
10 ash-conveyer to be removed by the latter from the furnace, thus overcoming the objection of drawing the hot clinkers out of the furnace into the engine-room and obviating one of the disagreeable duties of the fireman. A plate 60, which I term a "dead-plate," is
15 provided at one edge with trunnions 61, loosely mounted in lugs 62, which are secured to the boiler-front 11 in the horizontal plane of the grate 12. This plate is arranged to normally lie in a horizontal position between the front
20 edge of the grate and the boiler-front, and it is sustained in this position by a suitable form of latch 64, the latter being disposed on the under side of the dead-plate and connected pivotally thereto in any suitable way.
25 The dead-plate is provided with a transverse aperture 63, and the latch has a socket 65. The free end of the latch works or plays in a keeper 66, which is bolted or otherwise fastened on the under side of the dead-plate,
30 said end of the latch arranged to rest upon the rail 14 of the front grate-support, whereby the latch sustains the free edge of the dead-plate, and the latter is supported in the horizontal plane of the grate. A lever or bar 67,
35 having a downturned end, is adapted to be thrust through the aperture 63 of the dead-plate and to be fitted in the socket 65 of the latch. This lever may be operated in a hole 68, provided in the boiler-front, and when the
40 lever is removed or withdrawn the hole 68 is closed by a hinged door 69. Said lever or bar may be engaged with the latch and be manipulated by hand to withdraw the free extremity of the latch from the rail 14, thus
45 permitting the dead-plate to drop to the inclined position shown by dotted lines in Fig. 2 of the drawings. The clinkers raked from the fire lodge upon the dead-plate, which deflects said clinkers into the ash-pit 17, from
50 which the clinkers are removed by the operation of the ash-conveyer, as hereinbefore described.

I prefer to employ crushing-rolls each having a continuous series of sharpened or
55 pointed teeth arranged to pass each other and to operate efficiently in crushing the hard clinkers, while at the same time providing for proper clearance of the crushed clinkers.

60 Although I have shown and described the boiler-front as provided with an extra opening closed by a door on a plane above that of the grate, I do not limit myself to the use of such extra door, because the usual fuel-door
65 may be formed with a slot or opening adapted to permit the handle-bar to pass therethrough

for engagement with the latch of the dead-plate.

Many modifications may be made in the apparatus heretofore described in applying or
70 adapting the conveyer mechanism to different kinds of boiler-settings. I have experienced difficulty in the installation of a conveyer mechanism to boiler-settings having concrete or stone floors, because the proprie-
75 tor of the plant or factory objects to cutting the foundation, and besides this there is considerable amount of labor involved in making the necessary excavation. To overcome these objections, as well as various others from
80 practical standpoints, I contemplate the employment of the construction shown by Figs. 9 to 14, inclusive. In this embodiment of the invention I contemplate the use of a trough
85 70, which is installed above the bed or floor of the boiler-setting below the grate and to extend from side to side of the furnace, substantially as shown by Figs. 9 and 10. In
90 conjunction with this trough, which is open at its upper side, the inclined plates or other surfaces 71 71^a are employed, said surfaces converging toward the trough for the delivery thereto of any ashes or clinkers that may be
95 deposited upon the inclined surfaces. The employment of this trough, which constitutes the equivalent for the lining-plate heretofore described, necessitates the use of an endless
100 conveyer mechanism having driving and idler sprockets which are arranged in horizontal positions and turn on vertical axes. The form of flight for this endless conveyer mechanism is modified in accordance with the cross-
105 sectional shape of the trough, as represented by Figs. 12 to 14, inclusive. The endless chain 72 of the conveyer mechanism has certain of its links equipped with the flights 73,
110 which are provided with curved lower edges adapted to snugly fit in the trough 70. The endless chain of the mechanism is disposed in a horizontal plane, so as to have one lead or length thereof extend lengthwise of and
115 over the trough, (see Figs. 9 and 10,) and the other lead of this endless chain is arranged to travel in a return tube or conduit 74, the latter being disposed in rear of the trough and parallel therewith. The trough and the
120 return-tube may be placed in position beneath the boiler-grate without excavating the floor of the setting in any manner whatever, thereby facilitating the installation of the ash-remover system. The trough 70 is preferably made in sections, assembled in endwise
125 abutting relation, as more clearly indicated by Fig. 11, the meeting ends of the sections being joined together by a lap-joint or by the dowel connection illustrated in conjunction
130 with the lining-plate for the ash-remover conveyer heretofore described. The outer or rear end of the ash-conveyer is maintained in position by an idler-sprocket 75, which is mounted in any suitable way, while the inner or opposite end of said conveyer passes around a

driving-sprocket 76, both of said sprockets turning on vertical axes. The driving-sprocket is on a vertical shaft 77, which is supported in any suitable way adjacent to the boiler and which is driven from an overhead shaft through suitable bevel-gearing, as will presently appear.

The construction just described is especially well adapted for use in an ash-removing system which may be employed in connection with a battery of boilers, as represented by Figs. 9 and 10, the furnaces of the battery being indicated by the numerals 78 79. The transversely-operable ash-conveyers are installed below the boiler-grates, substantially as hereinbefore indicated, and they are arranged to be driven in opposite directions, so that the different conveyers will discharge the ashes to a common conveyer-pit 80, the bottom of this pit being on a level considerably below the horizontal plane of the ash-conveyer troughs 70. This conveyer-pit 80 is arranged for its longitudinal axis to lie at right angles to the major axes of the two ash-conveyers, and, furthermore, the conveyer-pit extends for a considerable distance beyond the line of the battery and is provided below the floor 81 of the boiler-house in which the plant is installed. The conveyer-pit accommodates a secondary conveyer mechanism, which is preferably of the endless variety, in that it consists of a chain 82, which passes around the driving and idler sprockets 83 84, said sprockets being carried by horizontal shafts, which are suitably mounted in the conveyer-pit. The chain of the secondary conveyer mechanism is provided with a series of flights 85, and below its upper lead there is supported a continuous false bottom 86, the latter arranged below the adjacent discharge ends of the conveyer-troughs 70, so that the ashes from the furnaces of the boiler-battery will be discharged by the operation of the transversely-movable conveyer mechanisms upon said false bottom 86.

The conveyer-pit is arranged in communication with a deeper elevator-pit 87, the latter being provided, preferably, below the boiler-house floor and adjacent to an end wall of the house. In this elevator-pit operates the foot end of an endless chain 88 of elevator-buckets 89, said endless elevator being housed within a boot or casing 90, the whole erected in an upright position adjacent to an end wall of the house. Said elevator-boot is equipped with a spout 91, which is arranged to discharge its contents into a sifter-cylinder 92, as shown by Fig. 15. Any suitable mechanism may be adopted for driving the transversely-movable ash-conveyers, the secondary conveyer mechanism, the elevator mechanism, and the sifter-cylinder; but as one means for attaining this end I have provided the vertical shafts 77 for independently operating the individual ash-conveyers, the upper

ends of said shafts 77 being provided with the bevel-gears 91, which have intermeshing engagement with similar gears 92 on a counter-shaft 93, the latter being driven by suitable gearing from the prime shaft 94. Said prime shaft is arranged in an overhead position, being mounted, preferably, in the hangers 95, and, furthermore, the shaft has a power-pulley 96, adapted to be driven from a motor of any suitable kind. The driving-sprocket 83 for the secondary conveyer mechanism, which operates in the conveyer-pit, is on a shaft 97, having a bevel-gear 98, the latter intermeshing with a similar gear 99 on a vertical shaft 100, the latter being geared at 101 to the prime shaft 94. The upper end of the endless elevator 88 is supported by a sprocket on a shaft 102, which is geared at 103 to the prime shaft 94. Finally, the sifter-cylinder 92 is equipped with a bevel-gear 103, that meshes with a bevel-pinion 104 on a shaft 105, which is belted at 106 to the prime shaft 104.

The sifter-cylinder 92 is constructed with a series of annular bands or spiders 107, which are suitably attached to the cylinder-shaft and which serve to properly support the meshed screens, which are of different grades of fineness, as clearly shown by Fig. 15. This sifter-cylinder is housed or contained in a compartment which is subdivided to form a series of bins that are disposed to receive different grades of ashes, which are separated by the various screens of the sifter-cylinder, each bin provided with an offstanding chute adapted to deliver the sifted ashes to the outside of the boiler-house. (See Fig. 10.)

In the construction of the sifter-cylinder shown by Figs. 15 and 16 I equip the receiving end thereof with an interior supplementary screen 108, the latter being of a mesh corresponding to the mesh of the medium or second screen of the cylinder. This supplementary screen is arranged within the fine screen at the receiving end of the cylinder, and into the supplementary screen are discharged the ashes and clinkers from the spout of the elevator-boot, whereby the supplementary screen relieves the finest screen of the sifter-cylinder from the weight of the heavy clinkers and the mass of ashes lifted by the elevator mechanism.

In the embodiment of the invention shown by Figs. 9 and 10 I have not represented the clinker-crushing mechanism, because I wish to be understood that my invention is not restricted to the use of such crushing mechanism in connection with an ash-conveyer. It is perfectly obvious, however, that the crushing mechanism can be arranged adjacent to the delivery end of the secondary conveyer mechanism, which operates in the conveyer-pit, or it can be arranged at any other convenient point.

Changes within the scope of the appended claims may be made in the form and proportion of some of the parts, while their essen-

tial features are retained and the spirit of the invention is embodied. Hence I do not desire to be limited to the precise form of all the parts as shown, reserving the right to vary therefrom.

I claim—

1. In a boiler-furnace, the combination of an ash-pit having the converging walls below the grate, an endless conveyer arranged within the ash-pit below the plane of the converging walls thereof, means for supporting and driving said conveyer to impel it in a horizontal path, an ash-plate supported between the upper and lower leads of the conveyer and close to the upper lead thereof, and scraper-bars attached to the conveyer and arranged to sweep close to the ash-pit, substantially as and for the purposes described.

2. In a boiler-furnace, the combination of an ash-pit having converging walls which are arranged transversely to the line of the boiler-grate, a metallic ash-plate supported below the converging walls of the ash-pit and having the upstanding flanges, an endless conveyer arranged for its upper lead to travel over and close to the ash-plate, and slats attached to the conveyer and arranged to travel between said flanges and to sweep close to the ash-plate, substantially as described.

3. In a boiler-furnace, the combination of an ash-pit having converging walls which are arranged transversely to the line of the boiler-grate, a metallic ash-plate supported below the converging walls of the ash-pit and consisting of the flanged sections having detachable interlocking engagement one with the other, and an endless conveyer arranged below said ash-pit and having slats adapted to sweep close to said ash-plate, substantially as and for the purposes described.

4. A boiler-furnace comprising an ash-pit having the downwardly-converging walls and a conveyer-pit at the intersection of said walls, a horizontally-disposed conveyer mechanism operatively arranged within said conveyer-pit, a grate immediately above the conveyer mechanism, and a dead-plate disposed in the plane of the furnace-grate and hinged to drop downward to an inclined position toward one of the walls of the ash-pit and the conveyer mechanism, the space between said dead-plate and the conveyer-pit being unobstructed and permitting the free passage of clinkers and ashes which may be raked from the grate directly to the conveyer mechanism, substantially as and for the purposes described.

5. A boiler-furnace comprising an ash-pit having the downwardly - converging walls meeting in a subjacent conveyer-pit, a clinker-crushing mechanism situated externally to the furnace, a horizontally-traveling ash-conveyer mechanism operatively arranged in the conveyer-pit and having its discharge end terminating at said clinker-crushing mechanism, a grate over the conveyer mechanism, and a

clinker-collector plate disposed in the same plane as the grate and arranged to drop down below the grate and to be inclined toward one of the walls of the ash-pit and the conveyer mechanism therein, whereby the clinkers and ashes will be delivered by the collector-plate to the conveyer and by the latter to the crushing mechanism, substantially as described.

6. A boiler-furnace comprising an ash-pit having the downwardly - converging walls meeting in a subjacent conveyer-pit, a subchamber situated at a point outside of the limits of the furnace, a clinker-crushing mechanism in said subchamber, a horizontally-movable ash-conveyer within said conveyer-pit and arranged to travel across the furnace and to deliver to the clinker-crushing mechanism, a grate over the conveyer mechanism, a clinker-collector plate mounted in the plane of the boiler-grate and adapted to drop below the same to assume a lowered position inclined toward the ash - conveyer, and an elevator mechanism taking its load from the subchamber of said ash-pit, substantially as described.

7. A boiler-furnace comprising an ash-pit having the downwardly - converging walls meeting in a subjacent conveyer-pit, a subchamber outside of the furnace, a set of inter-gearied clinker-crushing rolls situated within said subchamber, means for driving one of the rolls of said set of crushing-rolls, a conveyer-driving shaft geared to one of the rolls of the set, and a horizontally-movable ash-conveyer disposed within the conveyer-pit and engaging with the conveyer-driving shaft, said conveyer being movable in a path transversely across the furnace and said set of rolls and the conveyer being driven in series from a common source of power, substantially as described.

8. A boiler-furnace comprising an ash-pit having the downwardly - converging walls meeting in a subjacent conveyer-pit, an endless conveyer having the parallel chains and the cross-flights arranged to move in a horizontal path through the conveyer-pit and transversely across the furnace, a conveyer-driving shaft engaging with said chains, the individually-supported idler-sprockets engaging with the other end of the conveyer-chains, a subchamber disposed outside of the furnace, the yokes and screws for adjusting said idler-sprockets and the chains of the endless conveyer individually, a set of clinker-crushing rollers disposed in the subchamber and below the drive-shaft of said endless conveyer which has its delivery end overhanging said crushing mechanism, and gear connections between the conveyer-drive shaft and one roller of the crushing mechanism, substantially as described.

9. A boiler-furnace comprising a grate, an ash-conveyer disposed below the same, a dead-plate hinged in the horizontal plane of the grate and adjustable to a sloping position below the grate and inclined toward the ash-

conveyer, a latch mounted on the dead-plate and arranged to engage with the grate to normally sustain said dead-plate in the same plane as the grate, and means for operating the latch mechanism, substantially as described.

10. A boiler-furnace comprising a grate, an ash-conveyer disposed below the same, a hinged dead-plate adjustable to a sloping position below the grate and inclined toward the ash-conveyer, a latch pivoted to the under side of said dead-plate and arranged to engage the grate and to support the dead-plate in the plane thereof, and a handle or lever connected detachably with said latch, as and for the purposes described.

11. A boiler-furnace comprising a grate, an ash-conveyer disposed beneath the same, a hinged dead-plate adjustable to a sloping position below the grate and inclined toward the ash-conveyer, a latch pivoted on the under side of the dead-plate, a keeper attached to the dead-plate and loosely embracing the latch, and a handle or lever connected detachably to the latch, substantially as described.

12. In a boiler-furnace, the combination with a grate, and a boiler-front having an opening or doorway in the horizontal plane of said grate, a dead-plate hinged to the boiler-front in the horizontal plane of the grate and of said opening, a door hinged in a position to close said opening, a latch on said plate, a handle-bar adapted to be thrust through the opening and adjusted to engage with the latch, and an ash-conveyer below the grate, substantially as described.

13. In a boiler-furnace, the combination of an ash-pit provided with the downwardly-converging walls, a conveyer arranged to join the converging walls of said ash-pit, a boiler-grate, a horizontal return tube or conduit ad-

jacent to said conveyer-pit and substantially in the same plane therewith, an endless conveyer having its active and return leads disposed in a horizontal plane below the ash-pit and arranged to travel in the conveyer-pit and the return-conduit respectively, and blades carried by the conveyer and active in the conveyer-pit only, substantially as described.

14. In a boiler-furnace, the combination of an ash-pit provided with the downwardly-converging walls, a conveyer-pit which joins said converging walls of the ash-pit below the boiler-grate, a horizontal return-conduit adjacent to said conveyer-pit, an endless conveyer having its active and return leads operatively disposed in the conveyer-pit and the conduit respectively and each lead arranged to pursue a horizontal path, gear elements mounted to turn on vertical axes and sustaining the conveyer, and scrapers on said conveyer, substantially as described.

15. In a boiler-furnace, the combination of an ash-pit provided with the downwardly-converging walls, a conveyer-pit joining the converging walls of said ash-pit below the boiler-grate, a return-conduit adjacent to said conveyer-pit, an endless conveyer having the active and return leads thereof movable in a horizontal path through the conveyer-pit and the conduit respectively, and flights which conform to the conveyer-pit and carried by the conveyer to sweep close to the surface of the same, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

DANIEL CAMPBELL.

Witnesses:

H. H. PICKETT,
M. D. BROWN.