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COAL DUST FEEDER.

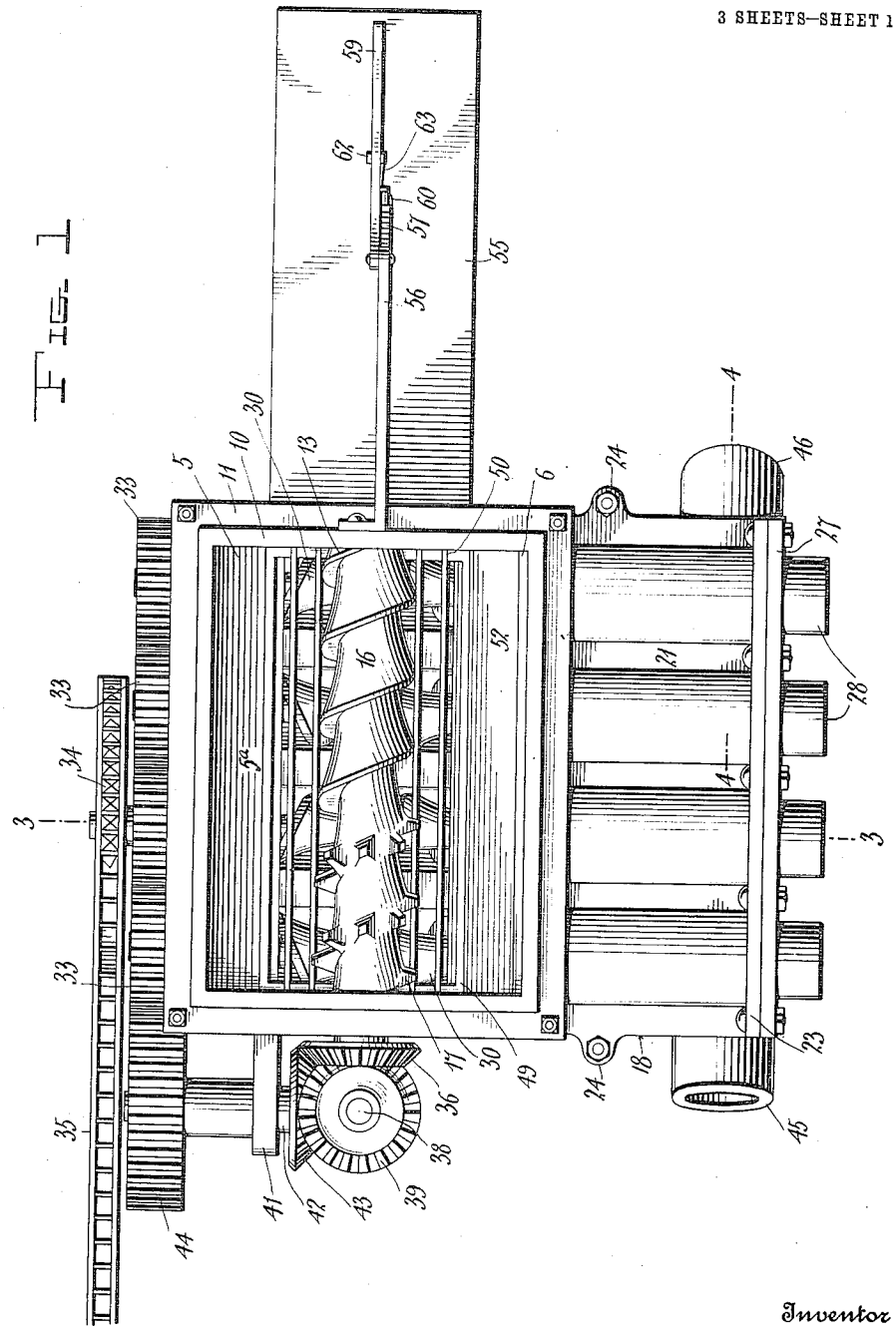
APPLICATION FILED NOV. 23, 1909. RENEWED JAN. 5, 1911.

986,259.

Patented Mar. 7, 1911.

3 SHEETS—SHEET 1.

FIG. 1



Witnesses

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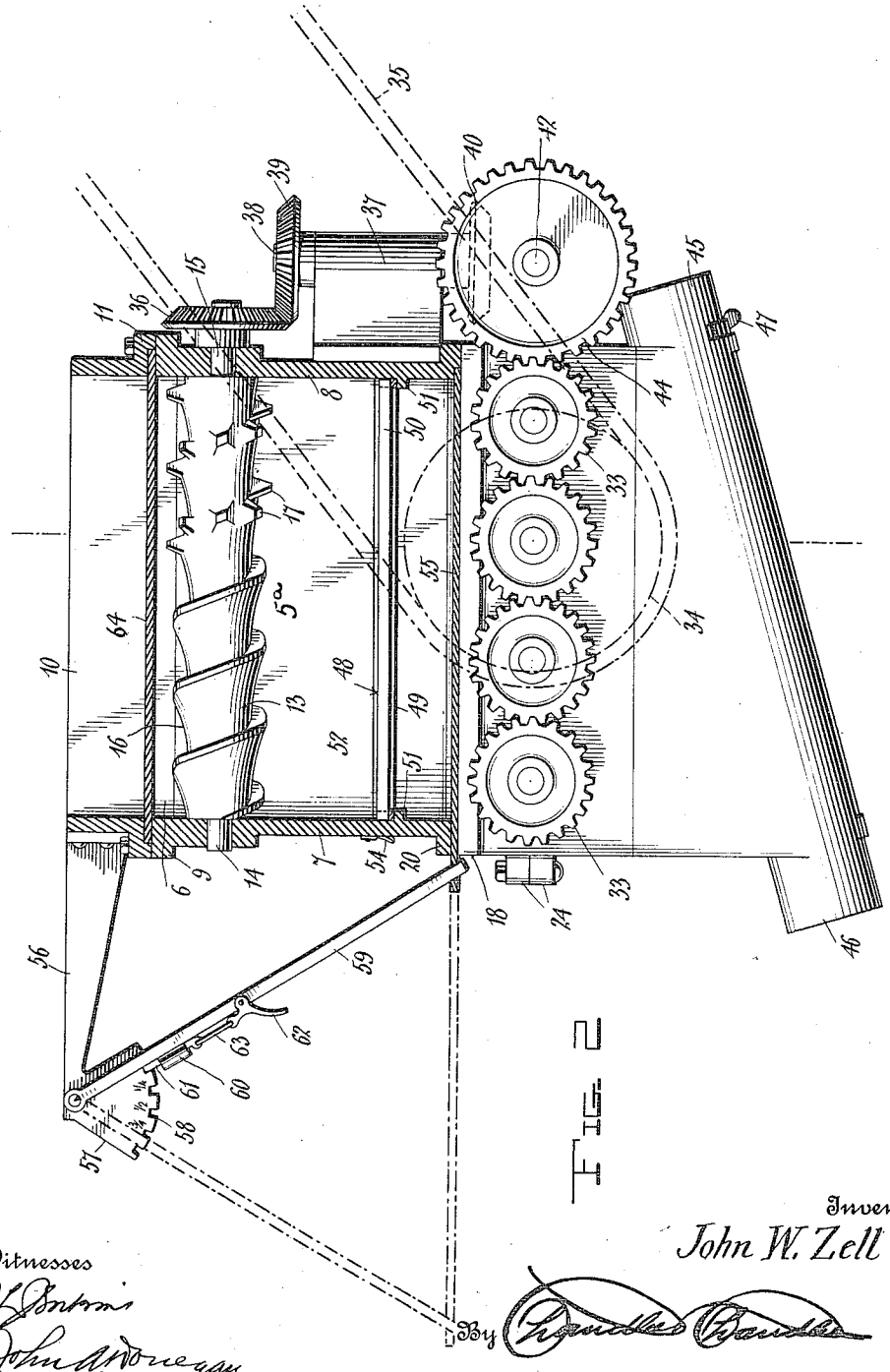

FIG. 2

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3 SHEETS—SHEET 3.

FIG. 3

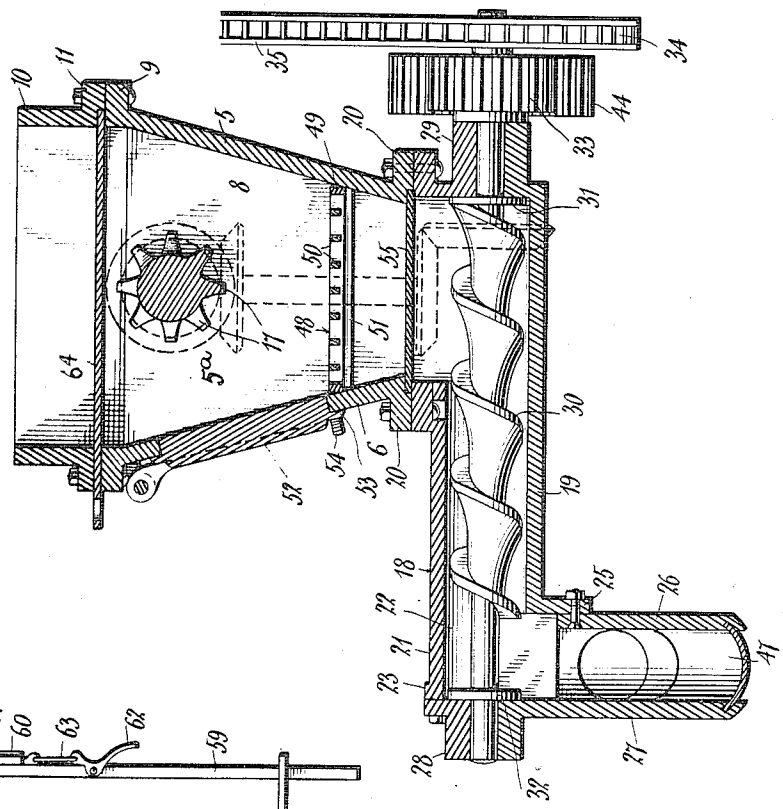
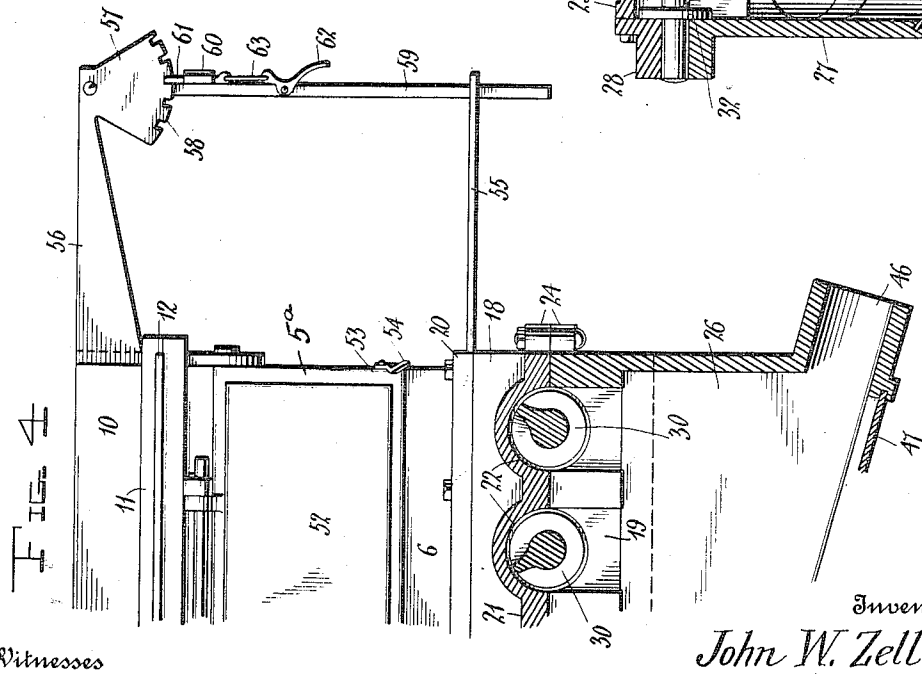


FIG. 4



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COAL-DUST FEEDER.

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Application filed November 23, 1909, Serial No. 529,636. Renewed January 5, 1911. Serial No. 600,289.

To all whom it may concern:

Be it known that I, JOHN W. ZELL, a citizen of the United States, residing at Duncannon, in the county of Perry, State of Pennsylvania, have invented certain new and useful Improvements in Coal-Dust Feeders; and I do hereby declare the following to be 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.

This invention relates to improvements in that class of feeders designed to feed powdered fuel to a furnace.

The device is intended, primarily, for use with an ore melting furnace wherein a mixture of air and dust are blasted into the combustion chamber. It has been found in practice that the usual coal dust feeders do not produce the required result for the reason that little or no provision is made for regulating the supply of coal dust to mix with a proper quantity of air.

The present invention therefore has for one of its objects the provision of a feeder provided with a means for regulating the flow of coal dust into the path of the blast so that a desired admixture of coal dust and air may be delivered to the combustion chamber of the furnace.

Another object is the provision of a feeder provided with a plurality of conveyer screws and a feed screw and a screen interposed between the feed and conveyer screws so that the admission of relatively large foreign bodies, which would have a tendency to choke or break the conveyer screws, will be prevented.

A further object is the provision of a feeder including a hopper and a door connected with the hopper and so positioned that it may be readily opened and the interior of the feed and conveyer apparatus examined and foreign objects which are sometimes mixed with the coal removed.

A still further object is the provision of a feed screw provided at one end portion with a plurality of breaker teeth designed to reduce to the proper size relatively large lumps of coal and to break up cakes of coal dust. And a still further object is the provision of a geared connection between the feed and conveyer screws, whereby the latter will be rotated at a greater speed than the former.

With these and other objects in view as will more fully hereinafter appear, the present invention consists in certain novel details of construction and arrangement of parts, hereinafter fully described, illustrated in the accompanying drawings and more particularly pointed out in the appended claims; it being understood that various changes in the form, proportion, size and minor details of the device may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings forming part of the specification:—Figure 1 is a plan view of the device and showing the feed regulating slide open. Fig. 2 is a view showing the conveyer tubes and chute in front elevation and the hopper in vertical section. Fig. 3 is a transverse vertical sectional view approximately on the line 3—3 of Fig. 1. Fig. 4 is a fragmentary sectional end view approximately on the line 4—4 of Fig. 1 and also showing one end portion of the hopper in front elevation.

Similar numerals of reference are employed to designate corresponding parts throughout.

The hopper 5^a is of the usual flared type and comprises the side walls 5 and 6, and the end walls 7 and 8. The upper and lower edges of these walls are provided with outwardly extending lateral flanges 9. A sleeve is designated by the numeral 10, and corresponds in contour and area to the mouth of the hopper. The lower edges of the side and end walls of the sleeve are provided with outwardly extending lateral flanges 11, corresponding in width to the width of the flanges 9, and designed to bear upon the latter, the said flanges being provided with alining openings which receive clamping bolts or nuts by means of which the sleeve is secured to the hopper. A portion of the lower face of one of the flanges 11 is cut away and the flange directly opposite has a portion on its lower face likewise cut away, whereby a space is provided which receives

a manually operated sliding door 12, which serves, when closed, to prevent the entrance of coal dust into the hopper.

What will subsequently be termed a feed screw is designated by the numeral 13. This member is provided at either end with reduced extensions constituting trunnions 14 and 15, the said trunnions being journaled in openings formed in the medial portions and adjacent the upper ends of the end walls 7 and 8 of the hopper. The feed screw 13 is of peculiar construction inasmuch as the groove which forms the spiral instead of being cut so that its opposite sides will be of equal width on the contrary is so cut that one of its sides slants outwardly and is considerably wider than the opposite sides as shown at 16. With this construction it is evident that the groove will be deeper on the face of one thread than on the opposed faces of the next succeeding thread, whereby the pushing or advance of a large cake of dust or lump of coal will be performed by one face of the spiral. The spiral extends from one end of the screw to a point adjacent the opposite end where it terminates in a plurality of spaced breaker teeth 17. The teeth 17 project beyond the plane of the periphery of the spiral and are arranged in staggered relation, the said teeth following the curve of the spiral to the opposite end of the screw.

With this construction it is manifest that a relatively large cake of dust or lump of coal falling on that end of the feeder remote from the teeth will be advanced through the coöperation of the spiral and side walls of the hopper to the teeth 17, and since the space between the extremities of these teeth and side walls of the hopper is less than the distance between the periphery of the spiral and said side walls, the teeth 17 will crush the cake or lump to the required size to be fed through the blast pipe and into the furnace.

The conveying mechanism which carries the coal dust from the hopper to the blast which directs the said coal dust into the furnace will now be described.

Secured to the bottom of the hopper is a boxing comprising upper and lower plates 18 and 19. The upper plate 18 corresponds in width to the length of the hopper and is preferably formed of a single casting and is bolted to lateral flanges 20, extending outwardly from the lower ends of the end and side walls of the hopper. The length of the upper plate 18 is considerably greater than the width of the lower or contracted end of the hopper and when in position as shown in Figs. 1 and 3, that is with its rear end in alinement with the rear end of the hopper, the forward end of said plate will extend for a considerable distance in advance of the front side of the hopper. That portion of the upper plate lying below the hopper is open while the outer end of the portion extending in advance of the front of the hopper is covered as shown at 21. The covered portion 21 is provided on its lower face with a plurality of concaved depressions 22, which extend in the direction of the length of the plate and terminate in an upwardly extending flange 23, at the free or outer end of the plate. The lower plate 19 is somewhat less in length than the upper plate 18 and is positioned so that its rear end is in alinement with the rear end of the top plate 18 while its forward end terminates at a point adjacent the forward end of the upper plate 18. The plates 18 and 19 are provided on their opposite sides with lateral flanges 24, having openings for the reception of clamping bolts by means of which the plates are united. The lower plate 19 is provided on its inner face with a plurality of spaced concaved depressions, which are parallel with the depressions 22, in the upper plate, these depressions forming circular openings and by virtue of the plates bearing one upon the other the sides of these depressions will likewise bear, whereby the tubes or openings formed by the depressions will be out of communication with each other.

As before stated, the forward end of the lower plate 19 terminates at a point adjacent the forward end of the upper plate 18, and this terminal of the lower plate is provided with a depending flange 25, as clearly shown in Fig. 3. Riveted or otherwise secured to the flange 25 and depending from the latter is a plate 26, corresponding in length to the length of the flange 25, and the lower side of which inclines upwardly as shown in Figs. 2 and 4. Depending from the forward end of the top plate 18 is a plate 27, the lower side of which is in a plane with the lower side of the plate 26, and like the latter inclines upwardly from one end. The plates 26 and 27 form the sides of a chute into which the coal dust falls from the conveyer tubes.

By reference now to Figs. 1 and 3, it will be seen that the outer face of the plate 27 is provided with a plurality of bushings 28, having bores which are in axial alinement with the conveyer tubes and it will be further observed that the rear ends of the upper and lower plates are provided on their outer faces with semi-cylindrical boxings 29 bearing one upon the other, and the bearing surfaces of which are provided with semi-circular grooves which coöperate to form circular openings in axial alinement with the bores of the boxings 28 and conveyer tubes.

The conveyer screws are designated by the numeral 30. In the present instance four of these members are employed; it must be understood however, that I am not to be limited to this specific number since it will be

understood, from what will appear, how a greater or less number might be equally as well employed without departing from the spirit of the invention. The screws are positioned in the tubes and have their opposite ends journaled in the bushings 28 and boxings 29. It will be further observed that the spiral or thread of each screw extends from a point adjacent the boxing 29 to the forward end of the lower or shorter plate 19 and formed integral or otherwise secured to the shaft of each screw are bearing collars 31 and 32, which bear on the inner faces of the bushings and boxings and prevent the entrance of dust into the latter. The conveyer screws conform to the construction of the feed screw, before described, and their rear ends or those extending through the boxings 29 have keyed or otherwise secured thereto a plurality of meshing gears 33. As shown in Fig. 1 the rear end of the shaft of one of the screws projects considerably in advance of the shafts of the other screws and in addition to being provided with the gear which meshes with the adjacent gears is also provided with a pulley 34. The pulley 34 is driven by a belt 35, the latter in turn being driven by a motor (not shown).

With the construction thus described it is evident, owing to the gearing connection between the screws, that each pair will turn in opposite directions therefore in order to accomplish the result of conveying the coal dust after it falls from the hopper it is evident that the thread or spiral on one screw of each pair will extend opposite to the thread or spiral of its mate.

In order to connect the feed screw 13 with the conveyer screws the following construction is employed:—By reference now to Fig. 2 it will be seen that the trunnion 15 extends through the end plate 8 of the hopper and is provided with a beveled gear 36, and extending in advance of the end plate 8 and secured to the outer face of the latter is a bracket 37 in which is journaled a vertically disposed shaft 38. Keyed to the upper end of the shaft 38 is a beveled gear 39, the teeth of which mesh with the teeth of the beveled gear 36 and keyed to the lower end of the shaft 38 is a beveled gear 40, in a plane with the lower end of the hopper, or substantially so. Projecting laterally from the rear end portions of the top and bottom plates is a bracket 41, having a transverse opening in which is journaled one end portion of a shaft 42. Keyed to one end of the shaft 42 is a beveled gear 43, the teeth of which mesh with the beveled gear 40, at the lower end of the shaft 38. The opposite end of the shaft 42 is provided with a crown gear 44, the teeth of which mesh with the crown gear of the adjacent conveyer screw. The gearing between the conveyer and feed screws is so proportioned that the conveyer screws will rotate at a greater speed than the feed screw.

By reference now to Figs. 1, 2 and 4, it will be seen that the opposite ends of the chute formed by the depending plates 26 and 27 are provided with sleeves 45 and 46, the upper of these sleeves receiving one end of a tube (not shown) extending from a fan blower (not shown). The lower sleeve 46 receives one end of a tube (not shown) which connects the chute with the apparatus wherein the coal dust is mixed with the blast of air and delivered to the furnace.

Thus it will be seen with the construction described when coal dust is fed into the hopper 5^a and passes the feed screw 13 it will fall into the conveyer pockets and be from thence moved to the chute by the screws 30. It will be seen that the chute is provided with a slide bottom 47, the opposite sides of which enter into inclined grooves formed on the inner faces of the plates 26 and 27 and adjacent the lower edges thereof. By providing a sliding bottom for the chute the latter may be removed whenever desired and the forward ends of the screws inspected or cleaned.

In order to prevent the entrance of foreign substances such as pieces of iron or the like into the conveyer pockets a screen 48 is provided. This member comprises a rectangular frame 49, to the opposite ends of which are secured a plurality of metallic strips 50, spaced apart sufficiently far to permit coal dust to pass therebetween but prevent the passage of relatively large objects. The screen is positioned between the feed screw and conveyer screws and is located directly above the outlet end of the hopper and is supported by a plurality of spaced lugs 51, secured to the inner faces of the side and end walls of the hopper.

In order that the matter caught by the screen may be removed therefrom without the necessity of placing the hand into the mouth of the hopper an opening is formed in the front side wall 6 of the hopper, the lower side of this opening extending to a point in a plane with the screen. Hingedly secured to the upper side of the opening is a door 52, of a size to nicely seal the opening in the front side wall 6. The lower corners of the door 52 are provided with lateral keepers 53, and projecting forwardly from the end walls 7 and 8 are a pair of resilient latches 54. The latches 54 are in a plane with the keepers 53 and their free end portions are bent laterally so that when the door is moved to closed position the keepers 53 will bear on the inclined ends of the latches 54 and move the same farther outward until the door is completely seated in the opening of the front side wall when the intermediate portions of the latches will bear

on the keepers and prevent outward movement of the door.

As before stated, a portion of the lower edges of the side and end walls of the hopper is removed to provide a space and slidingly fitted in this space is a slide 55, located between the screen and conveyer tubes. The slide 55 is preferably formed of a single piece of sheet metal and when in closed position as shown in Fig. 2, its outer end will extend a trifle in advance of the end wall 7, of the hopper. Projecting in advance of the end wall 7 of the hopper and secured to the sleeve 10, is a bracket arm 56, the free end of which is provided with a depending rack 57. The rack 57 conforms approximately to the shape of a sector and its convexed edge is provided with a plurality of teeth 58. Fulcrumed at the outer end of the bracket 56 is one end of a lever 59, the lower or free end of which is loosely fitted in an opening formed in the projecting end of the slide 55. The lever 59 is provided, at a point adjacent the teeth of the rack 57, with a sleeve 60, in which is slidingly fitted a bolt 61, adapted to engage with the spaces between the teeth 58. The bolt 60 is spring pressed and normally held in one of the spaces between the teeth. An operating lever for the bolt is shown at 62, and is pivoted to the lever 59, and has one end connected with the bolt 61, by means of a link 63.

It is manifest that the function of the lever is to move the slide 55 to a position to cut off communication between the hopper and conveyer tubes as shown in Fig. 1 and to move the said slide outwardly as shown in Fig. 4, whereby communication is established between the hopper and as many of the conveyer tubes as desired. It has been found in practice that the best results are obtained when the amount of coal dust entering the furnace can be regulated without in any way reducing the power which drives the feeder. Thus it can be seen when the character of the fuel which is being used demands that a comparatively small amount shall enter the furnace, this amount can be regulated by moving the lever 59 outwardly from the position shown in Fig. 1 until one or more of the tubes are placed in communication with the hopper. For convenience in determining the number of tubes in communication with the hopper a scale is provided on the outer face of the rack. This scale will indicate the whole or fractional part of the opening exposed for the admission of coal dust from the hopper into the conveyer tubes since it can be readily seen when the parts are in position as shown in Fig. 2 that by moving the lever outwardly to the middle of the rack the said lever will aline with the marking "one half" on the scale which will indicate that the slide is half opened.

When for any reason it is desired to cut off communication between the hopper and the receptacle containing the coal dust a slide 64 is provided. This member is located between the feed screw 13 and upper end of the hopper and is operated manually and of a size to completely seal the upper end of the hopper.

From the foregoing it can be seen that I have provided a device which is exceedingly simple in structure and comparatively inexpensive to manufacture, embodying few parts and these so arranged that the danger of derangement will be reduced to a minimum.

What is claimed as new, is:—

1. A coal dust feeder comprising a hopper having a screen in its lower portion, a feed element mounted for rotation in its upper portion and having a spiral feed flange, a boxing having one end below the hopper, said boxing being provided with a plurality of passages each of which communicates at one end with the throat of the hopper, conveyer screws mounted for rotation in said passages, and an inclined chute into which the rear ends of the conveyer passages discharge.

2. A coal dust feeder comprising a hopper having a screen in its lower portion, a feed element mounted for rotation in its upper portion, and having a spiral feed flange, a boxing having one end below the hopper, said boxing being provided with a plurality of passages each of which communicates at one end with the throat of the hopper, conveyer screws mounted for rotation in said passages, an inclined chute into which the rear ends of the conveyer passages discharge, and means to establish and cut off communication between the hopper and conveyer passages.

3. A coal dust feeder comprising a hopper having a screen in its lower portion, a feed element mounted for rotation in its upper portion, and having a spiral feed flange, a boxing having one end below the hopper, said boxing being provided with a plurality of passages each of which communicates at one end with the throat of the hopper, conveyer screws mounted for rotation in said passages, and an inclined chute into which the rear ends of the conveyer passages discharge, said chute being open at its upper and lower ends.

4. A coal dust feeder comprising a hopper having a screen in its lower portion, a feed element mounted for rotation in its upper portion, and having a spiral feed flange, a boxing having one end below the hopper, said boxing being provided with a plurality of passages each of which communicates at

one end with the throat of the hopper, conveyer screws mounted for rotation in said passages, an inclined chute into which the rear ends of the conveyer passages discharge, said chute being provided in its lower side at a point below the discharge ends of said conveyer passages, with an opening affording access to the said conveyer screws, and a closure for the said openings.

5. In a coal dust feeder, a hopper having a sleeve at its upper end, a slide to cut off or establish communication between said sleeve and hopper, a screen in the lower portion of the hopper, a feed element mounted for rotation in the upper portion of the hopper and having a spiral feed flange, a boxing having one end below the hopper, said boxing being provided with a plurality of passages, each of which communicates at one end on its upper side with the throat of the hopper, conveyer screws mounted for rotation in said passages, a slide in the throat of the hopper below the said screen, to establish or cut off communication between the hopper and the said passages, and a chute into which said passages discharge.

In testimony whereof, I affix my signature, in presence of two witnesses.

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