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COAL BURNING APPARATUS

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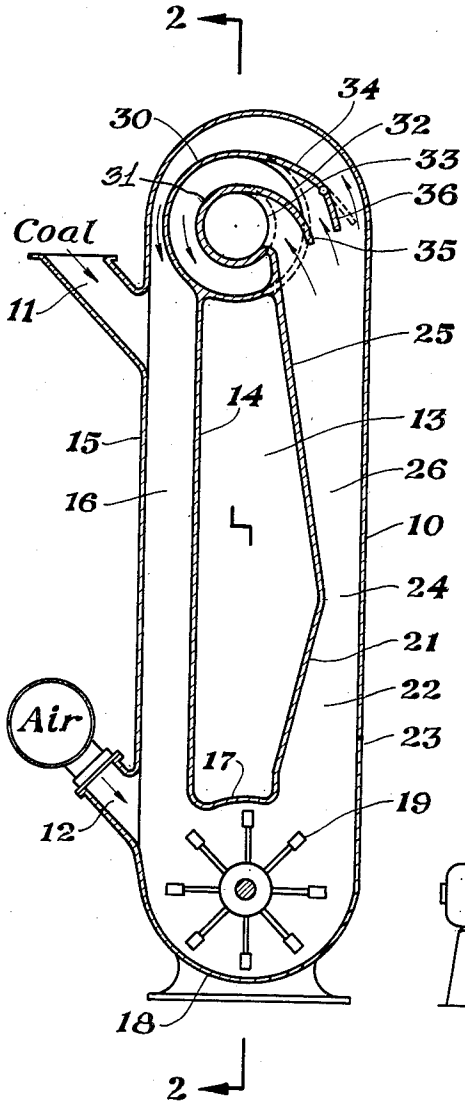


Fig. 1

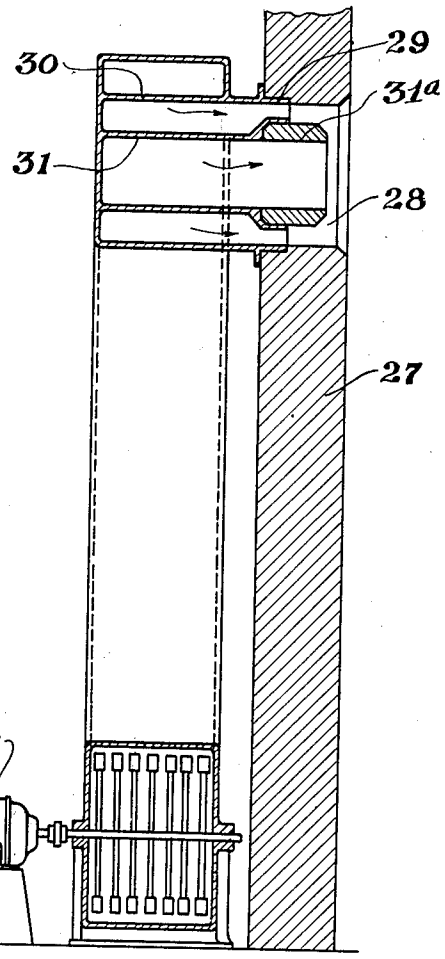


Fig. 2

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COAL BURNING APPARATUS

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13 Claims. (Cl. 110—104)

The present invention relates to coal burning apparatus.

More particularly the present invention relates to improvements in apparatus for burning coal in pulverized condition. It is, of course, desirable in coal burning apparatus of the kind referred to to reduce the coal to sufficiently fine particles to permit the efficient burning thereof, but it is uneconomical to pulverize beyond the necessary degree of fineness.

The present invention has for one of its objects the provision of means for controlling the fineness of the particles of coal delivered to a furnace.

A further object is to provide improved coal burning apparatus involving simple mechanism for grading the particles of coal delivered to the furnace.

Further objects will appear as the description proceeds.

Referring to the drawing—

Figure 1 is a more or less diagrammatic view showing in vertical section one embodiment of the present invention; and

Figure 2 is a sectional view taken along the planes indicated by the arrows 2—2 of Figure 1.

The numeral 10 indicates an elongated casing, and communicating therewith at one side adjacent to the top is the chute 11 for the delivery of coal or the like. Communicating with the casing 10, near the bottom thereof and at the same side as the coal chute 11, is the air duct 12. Air will be delivered under pressure from the air duct 12, and of course the coal chute 11 will be provided with means for preventing undue escape of air outwardly through said coal chute. Means for this purpose are well known to those skilled in the art and need not be described herein.

Disposed within the casing 10 is the inner casing 13 having a wall 14 cooperating with the adjacent wall 15 of the casing 10 to provide a vertical passageway 16 for permitting the dropping of coal therethrough. The bottom wall of the inner casing 13, which bottom wall is indicated by the numeral 17, is curved upwardly. The bottom portion 18 of the casing 10 is also curved, and in the space between the bottom wall 17 of the inner casing 13 and the bottom portion 18 of the casing 10 is the set of rotating hammers or pulverizers 19 adapted to be driven by the motor 20. The hammers or pulverizers 19, in cooperation with the walls 17 and 18, comprise a pulverizing mill for the coal which is dropped through the passageway 16. Such mills are well known to those skilled in the art.

Extending upwardly from the wall 17 is the wall 21, which provides a gradually contracting throat 22 with the adjacent wall 23 of the casing 10. Said throat 22 reaches its narrowest dimension at the region indicated by the numeral 24, from which region a wall 25 extends upwardly as a continuation of the wall 21. Said wall 25 provides a gradually expanding throat 26 with the adjacent wall 23 of the casing 10. The adjacent wall of the casing 10 is substantially straight.

The casing 10 is mounted adjacent to the wall 27 of a furnace or the like having an opening 28. The casing 10 has a laterally extending burner, indicated by the numeral 29, for directing a mixture of pulverized coal and air through said opening 28. Said burner 29 includes the substantially cylindrical portion 30 extending across the casing 10 adjacent to the top thereof, which cylindrical portion 30 forms part of the outer wall of the burner 29. Disposed coaxially with respect to the cylindrical portion 30 and the outer wall of the burner 29 is the cylindrical duct 31 having the end portion 31*a* extending into the opening 28 of the furnace 27.

As shown in Figure 1, the cylindrical portion 30 of the burner 29 forms the upper wall of the inner casing 13. Said cylindrical portion 30 is open throughout a part of its circumference, as indicated by the numeral 32, and has communication with the throat 26 within the casing 10. The inner duct 31 of the burner 29 has an opening, indicated by the numeral 33, in generally symmetrical relationship with the opening 32. The upper side of the opening 32 is defined by the vane 34 extending out into the throat 26, whereby to be adapted to deflect a portion of the material passing through said throat 26 into the annular space between the cylindrical portion 30 and the duct 31 of the burner 29. The upper portion of the opening 33 in the duct 31 is defined by the vane 35, which also extends out into the throat 26 and serves to deflect a portion of the particles within said throat 26 into the duct 31.

Pivotally mounted at the outer side of the vane 34 is the adjustable vane 36, which may be swung through a range of movement from the adjacent wall of the casing 10 to the vane 35.

In operation it will be understood that coal will be delivered through the chute 11, dropping down through the passageway 16. Said coal, mixed with air from the air duct 12, will be pul-

verized in the mill 19 and will be shot upwardly through the gradually contracting throat 22. By reason of the fact that the throat 22 is gradually contracting, the particles of coal will be increased in speed, and by reason of the fact that the wall 21 converges toward the vertical wall 23, said heavier particles will be crowded to the outside of the casing. The difference in speed between the air and the coal particles in the throat 22 will tend to separate the lighter particles from the heavier particles, and the separation of the particles will result in efficient drying thereof. The contracted portion 24 of the throat 22 will help to prevent the heavy particles from flying back to the mill at the bottom of the casing 10. The increase of speed of the heavy particles in the region 24 of the throat 22 will increase the centrifugal action in the top portion of the casing 10.

By reason of the fact that the heavier particles are thrown toward the outside of the casing 10, the result follows that the finest of the particles are deflected by the vane 35 into the duct 31 of the burner 29. The finer of the heavier particles will be deflected by means of the adjustable vane 36 and the vane 34 into the annular space between the duct 31 and the cylindrical portion 30 of the burner 29. By adjustment of the adjustable vane 36 it is readily possible to select the proportions of the heavy particles which are deflected into the annular space between the duct 31 and the cylindrical portion 30 of the burner. The heaviest particles will follow around the outer wall of the casing 10 and will again drop through the passageway 16 to the mill at the bottom of the casing 10. Under certain conditions the adjustable vane 36 will be moved to its limit in a clockwise direction as the parts are viewed in Figure 1, whereby none of the relatively heavy particles are admitted to the burner but all are carried around for further treatment in the mill at the bottom of the casing 10. Under other conditions the adjustable vane 36 will be moved in a counter-clockwise direction to a selected position in which a certain proportion of the relatively heavy particles are deflected into the annular space between the duct 31 and cylindrical portion 30 of the burner. By manipulation of the adjustable vane 36, the selection of the relatively heavy particles may be varied as desired.

Though a preferred embodiment of the present invention has been described in detail, many modifications will occur to those skilled in the art. It is intended to cover all such modifications that fall within the scope of the appended claims.

What is claimed is—

1. Coal burning apparatus comprising, in combination, means for pulverizing coal, means for conducting pulverized fuel from said pulverizing means, said conducting means comprising a throat portion gradually contracting to a region of minimum cross-section, a burner including a central duct and an outer duct surrounding said central duct, said conducting means including an expanding throat portion increasing progressively in cross-sectional area from said region of minimum cross-section to and communicating with said burner, said coal burning apparatus providing a passageway around the outside of said burner and communicating with said conducting means for returning relatively heavy particles to said pulverizing means, and a vane in said conducting means for predetermining the portion of the relatively heavy particles of said pulverized fuel which shall be returned to said pulverizing means.

2. In coal burning apparatus, in combination, an elongated casing, means for admitting coal thereto, means for admitting air thereto, a mill communicating with said admitting means for pulverizing said coal while intermixed with said air, conducting means for delivering pulverized fuel from said mill, said conducting means including a wall for directing said pulverized fuel to the outer portion of said casing, said conducting means including an expanding throat for delivery of said pulverized fuel, a burner including a central duct and an outer duct surrounding said central duct, a vane cooperating with said central duct for deflecting relatively fine pulverized fuel from said directing means into said central duct, and another vane for directing coarser particles of said pulverized fuel into said outer duct, said casing providing a passageway for conducting relatively coarse pulverized fuel from said conducting means back to said mill.

3. In coal burning apparatus, in combination, an elongated casing, means for admitting coal thereto, means for admitting air thereto, a mill communicating with said admitting means for pulverizing said coal while intermixed with said air, conducting means for delivering pulverized fuel from said mill, said conducting means including a wall for directing said pulverized fuel to the outer portion of said casing, said conducting means including an expanding throat for delivery of said pulverized fuel, a burner including a central duct and an outer duct surrounding said central duct, a vane cooperating with said central duct for deflecting relatively fine pulverized fuel from said directing means into said central duct, and another vane for directing coarser particles of said pulverized fuel into said outer duct, said casing providing a passageway for conducting relatively coarse pulverized fuel from said conducting means back to said mill, said last mentioned vane having adjustable means cooperating therewith for predetermining the proportions of the relatively coarse pulverized fuel which shall be directed to said outer duct or back to said mill.

4. In coal burning apparatus, in combination, an elongated outer casing, an inner casing disposed therein, said inner casing defining with said outer casing a passageway for the admission of coal, a mill between said casings for pulverizing said coal, said inner casing defining with said outer casing a progressively contracting throat for the delivery of pulverized fuel from said mill and also a gradually expanding throat from the narrowest portion of said contracting throat, the walls of said casing being positioned relative to one another to operate to throw relatively heavy particles of pulverized fuel to the outer portions of said outer casing, a burner connected and communicating with the larger region of said progressively expanding throat, said burner having an inner duct positioned to receive the finer particles delivered through said progressively expanding throat, said burner having an outer duct surrounding said inner duct and positioned to receive a portion of the coarser particles delivered through said progressively expanding throat, said burner and said inner casing being positioned relative to said outer casing to provide a passageway for the coarsest of the particles of said pulverized fuel from said progressively expanding throat back to said mill.

5. In coal burning apparatus, in combination, an elongated outer casing, an inner casing dis-

posed therein, said inner casing defining with said outer casing a passageway for the admission of coal, a mill between said casings for pulverizing said coal, means for admitting air to said mill, said inner casing defining with said outer casing a progressively contracting throat for the delivery of pulverized fuel from said mill and also providing a gradually expanding throat from the narrowest portion of said contracting throat, the walls of said casing being positioned relative to one another to operate to throw relatively heavy particles of pulverized fuel to the outer portions of said outer casing, a burner connected and communicating with the larger region of said progressively expanding throat, said burner having an inner duct positioned to receive the finer particles delivered through said progressively expanding throat, said burner having an outer duct surrounding said inner duct positioned to receive a portion of the coarser particles delivered through said progressively expanding throat, said burner and said inner casing being positioned relative to said outer casing to provide a passageway for the coarsest of the particles of said pulverized fuel from said progressively expanding throat back to said mill, and adjustable means for selectively controlling the delivery of pulverized fuel to said outer duct or back to said mill.

6. In coal burning apparatus, in combination, means for pulverizing fuel, means for delivering air to said fuel to set up a velocity therein, delivery means for said pulverized fuel including deflecting means for segregating the coarser particles of said pulverized fuel from the finer particles thereof, a burner having a duct positioned to receive said finer particles, said burner having another duct positioned to receive coarser particles deflected by said deflecting means, said apparatus providing a passageway past said burner for delivering relatively coarse particles from said delivering means back to said mill.

7. In coal burning apparatus, in combination, means for pulverizing fuel, means for delivering air to said fuel to set up a velocity therein, delivery means for said pulverized fuel including deflecting means for segregating the coarser particles of said pulverized fuel from the finer particles thereof, a burner having a duct positioned to receive said finer particles, said burner having another duct positioned to receive coarser particles deflected by said deflecting means, said apparatus providing a passageway past said burner for delivering relatively coarse particles from said delivering means back to said mill, and adjustable dividing means for predetermining the portions of said coarser particles which shall be delivered to said other duct or back to said mill.

8. In coal burning apparatus, in combination, an outer casing, means within said casing providing a passageway for coal, a mill for receiving coal from said passageway, means for admitting air to the coal within said mill to set up a turbulence therein, conducting means for conducting pulverized fuel from said mill, said conducting means including a wall providing with said outer casing a progressively contracting throat, said wall being positioned to direct relatively heavy particles of said pulverized fuel toward the outer region within said casing, a burner for receiving said pulverized fuel, said burner having a duct positioned to receive the finer particles of said pulverized fuel, said burner having another duct positioned to receive a portion of the coarser particles of said pulverized fuel, said apparatus providing a passageway for the coarsest particles of said pulverized fuel back to said mill.

9. In coal burning apparatus, in combination, an outer casing, means within said casing providing a passageway for coal, a mill for receiving coal from said passageway, means for admitting air to the coal within said mill to set up a turbulence therein, conducting means for conducting pulverized fuel from said mill, said conducting means including a wall providing with said outer casing a progressively contracting throat, said wall being positioned to direct relatively heavy particles of said pulverized fuel toward the outer region within said casing, a burner for receiving said pulverized fuel, said burner having a duct positioned to receive the finer particles of said pulverized fuel, said burner having another duct positioned to receive a portion of the coarser particles of said pulverized fuel, said apparatus providing a passageway for the coarsest particles of said pulverized fuel back to said mill, and dividing means for predetermining the proportions of said coarser particles which shall be delivered to said other duct or back to said mill.

10. Coal burning apparatus comprising, in combination, means for pulverizing coal, means for conducting pulverized fuel from said pulverizing means, said conducting means comprising a throat portion gradually contracting to a region of minimum cross section, and a burner, said conducting means including an expanding throat portion increasing progressively in cross sectional area from said region of minimum cross section to and communicating with the interior of said burner, said coal burning apparatus providing a passageway around the outside of said burner and communicating with said conducting means for returning relatively heavy particles of fuel to said pulverizing means.

11. Coal burning apparatus comprising, in combination, means for pulverizing coal, means for conducting pulverized fuel from said pulverizing means, said conducting means comprising a throat portion gradually contracting to a region of minimum cross section, a burner, said conducting means including an expanding throat portion increasing progressively in cross sectional area from said region of minimum cross section to and communicating with the interior of said burner, said coal burning apparatus providing a passageway around the outside of said burner and communicating with said conducting means for returning relatively heavy particles of fuel to said pulverizing means, and a movable vane in said conducting means for predetermining the portion of the relatively heavy particles of said pulverized fuel which shall be returned to said pulverizing means.

12. In coal burning apparatus, in combination, an elongated outer casing, an inner casing disposed therein, said inner casing defining with said outer casing a passageway for the admission of coal, a mill between said casings for pulverizing said coal, means for admitting air to said mill, said inner casing defining with said outer casing a progressively contracting throat for the delivery of the pulverized fuel from said mill and also a gradually expanding throat from the narrowest portion of said contracting throat, the walls of said casing being positioned relative to one another to operate to throw relatively heavy particles of pulverized fuel to the outer portions of said outer casing, and a burner connected to and communicating with the larger

region of said progressively expanding throat, said burner having an opening positioned to receive the finer particles of fuel delivered through said progressively expanding throat, said burner and said inner casing being positioned relative to said outer casing to provide a passageway for the coarsest of the particles of said pulverized fuel from said progressively expanding throat back to said mill.

13. In coal burning apparatus, in combination, an elongated outer casing, an inner casing disposed therein, said inner casing defining with said outer casing a passageway for the admission of coal, a mill between said casings for pulverizing said coal, means for admitting air to said mill, said inner casing defining with said outer casing a progressively contracting throat for the delivery of the pulverized fuel from said mill and also a gradually expanding throat from the narrowest portion of said contracting throat, the walls of said casing being positioned relative to one another to operate to throw relatively heavy particles of pulverized fuel to the outer portions of said outer casing, a burner connected to and communicating with the larger region of said progressively expanding throat, said burner having an opening positioned to receive the finer particles of fuel delivered through said progressively expanding throat, said burner and said inner casing being positioned relative to said outer casing to provide a passageway for the coarsest of the particles of said pulverized fuel through said progressively expanding throat back to said mill, and adjustable means for predetermining the proportion of the coarser particles of said fuel which shall be delivered back to said mill.

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