

Aug. 16, 1938.

F. HOGG

2,126,776

FUEL PULVERIZER AND FEEDER

Filed Oct. 6, 1933

4 Sheets-Sheet 1

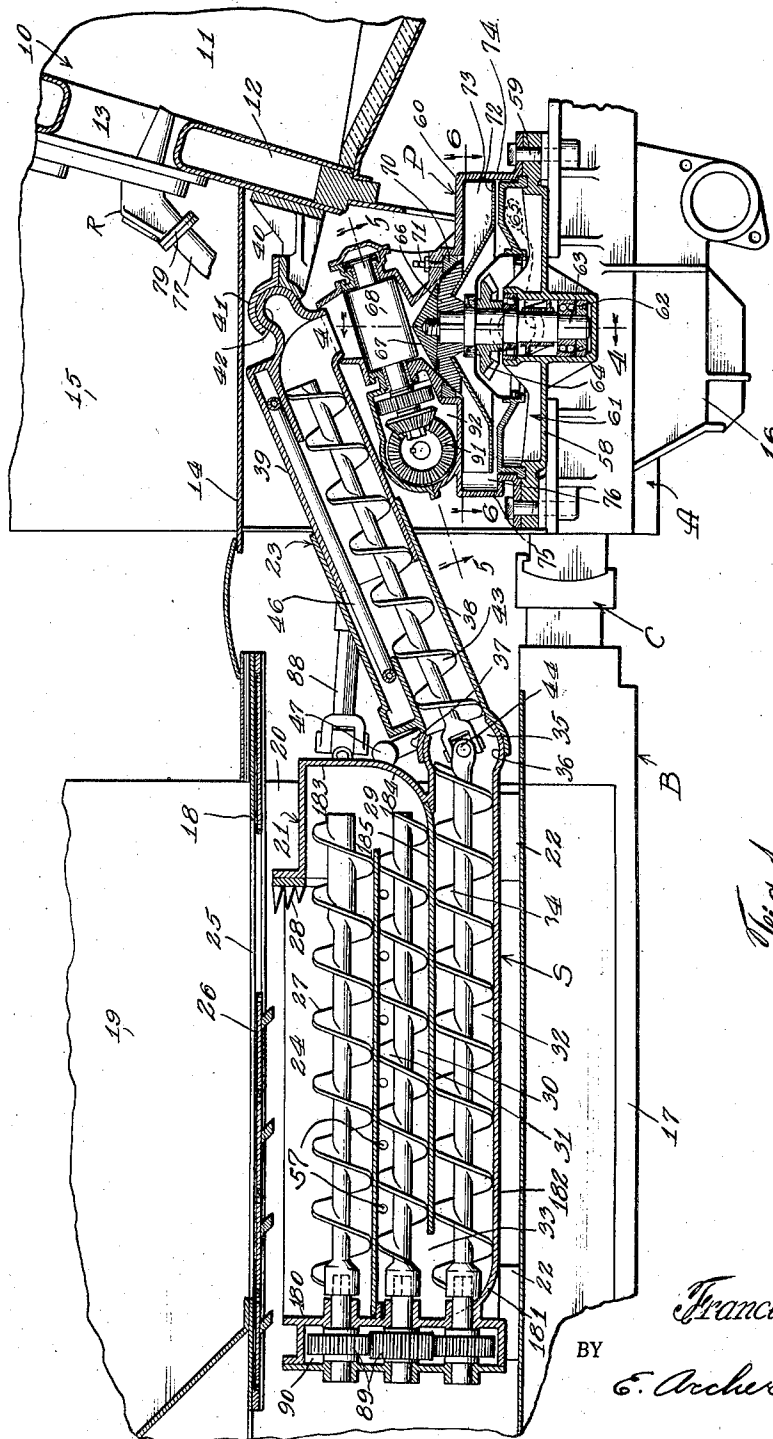


Fig. 1

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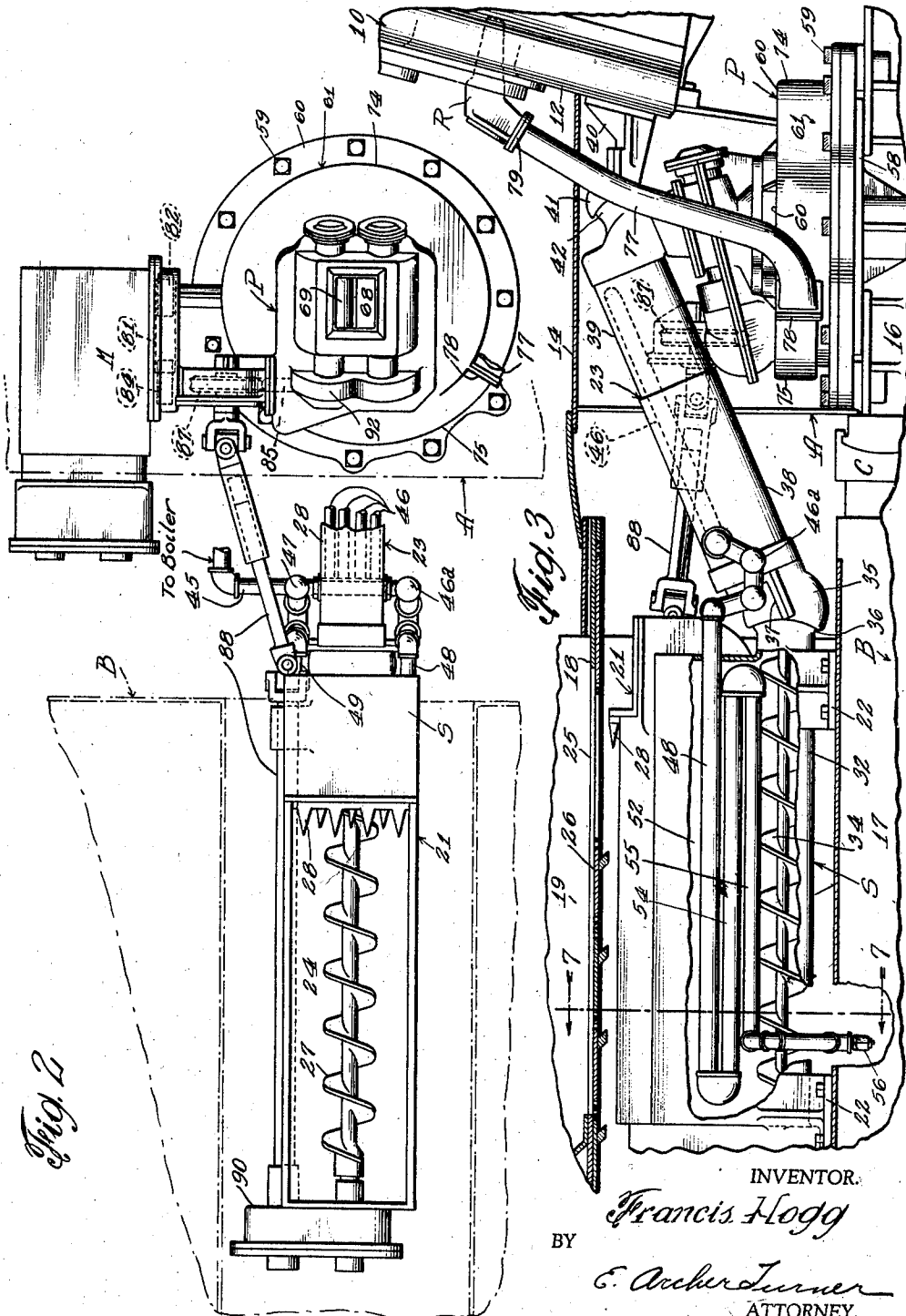
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4 Sheets-Sheet 2



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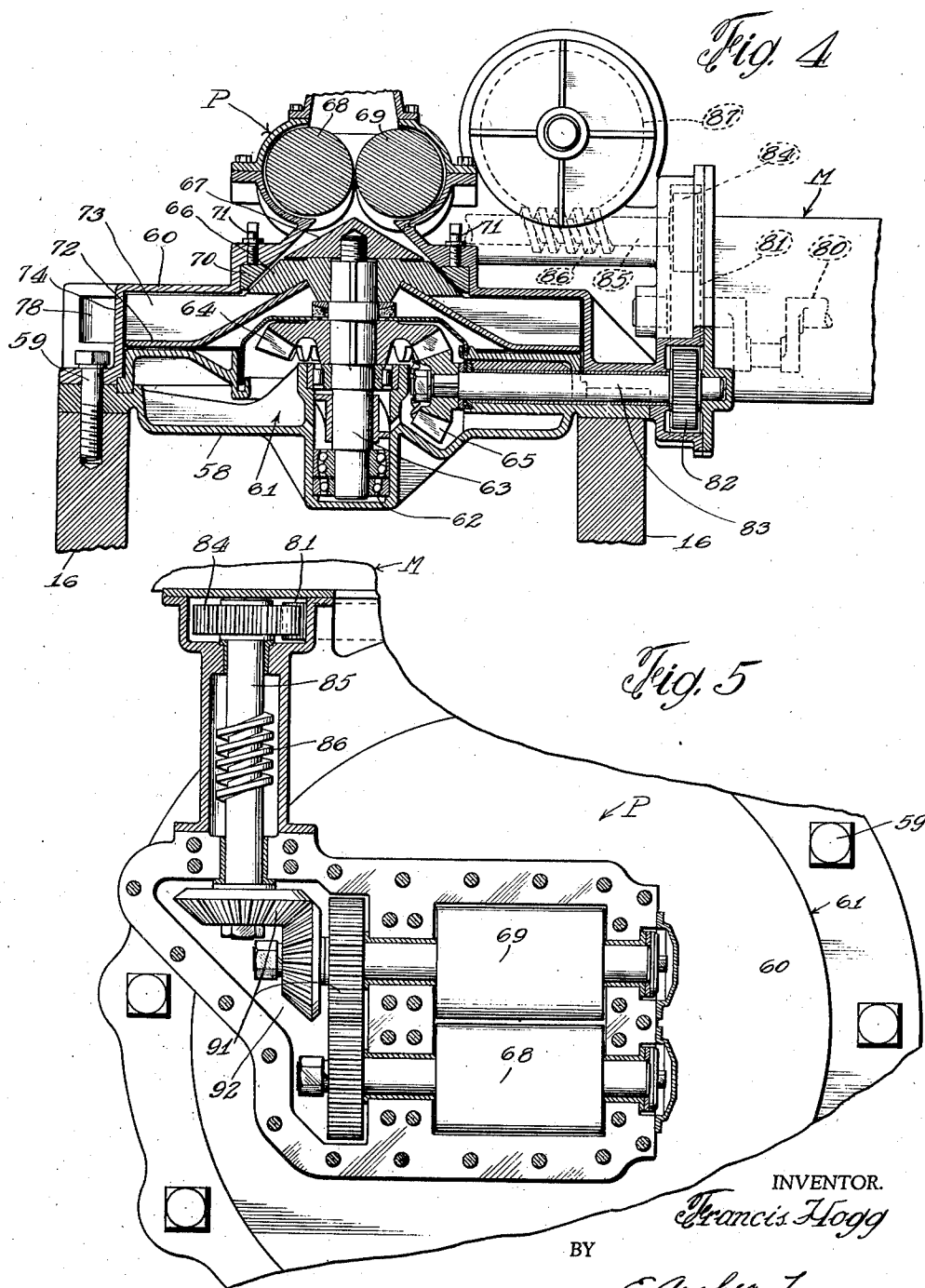
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FUEL PULVERIZER AND FEEDER

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4 Sheets-Sheet 3



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FUEL PULVERIZER AND FEEDER

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4 Sheets-Sheet 4

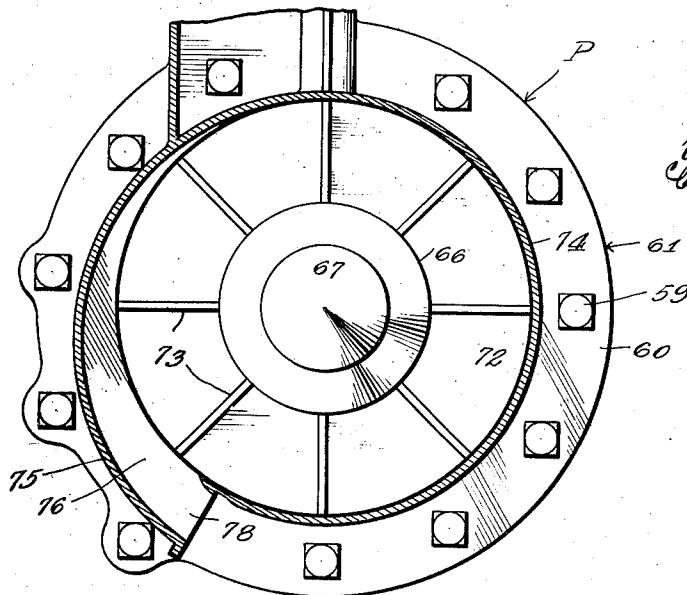


Fig. 6

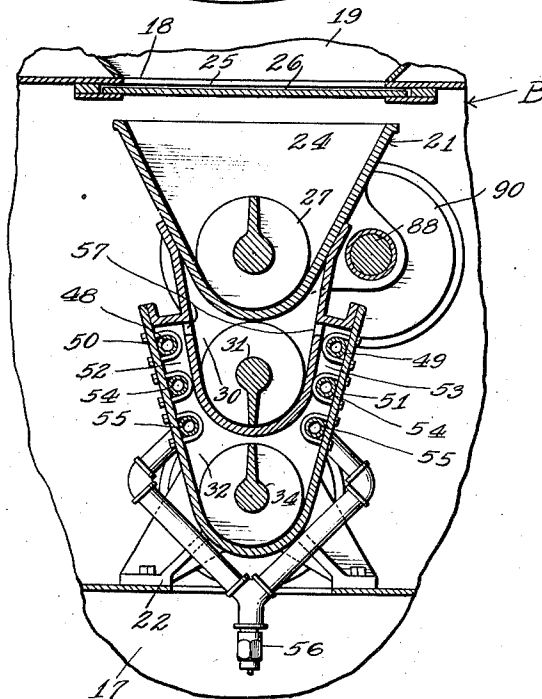


Fig. 7

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UNITED STATES PATENT OFFICE

2,126,776

FUEL PULVERIZER AND FEEDER

Francis Hogg, Wesleyville, Pa., assignor, by mesne assignments, to The Standard Stoker Company, Inc. (1922), New York, N. Y., a corporation of Delaware

Application October 6, 1933, Serial No. 692,385

6 Claims. (Cl. 110-106)

The present invention relates to certain novel improvements in apparatus for pulverizing and feeding fuel to a furnace of any known construction, although primarily the improvements which I have devised are productive of an apparatus particularly adaptable for use on steam locomotives and their tenders.

Foremost of the objects of this invention is the provision of such improved apparatus, which comprises a conveying system receiving run-of-mine coal from a fuel bin, crushing means for reducing the coal to a suitable size for delivery to a pulverizing unit, and a heating or drying means which thoroughly dries the coal in its transit through the conveying system whereby a more friable fuel is introduced to the pulverizing unit.

Another object of this invention is the provision of a novel conveying system which includes a plurality of fuel conduits arranged in a labyrinth-like formation and having suitable conveying mechanism therein whereby the coal received from the fuel bin is urged through this labyrinth conduit formation in order that the heating or drying process may be effectively carried out and also so that a further reduction in the size of the coal may be produced by this prolonged conveyance.

In one of its broader phases, the present invention also contemplates the provision of a stoker conduit which is provided with a heating or drying unit for driving off the excess moisture in the fuel.

It is also an object of this invention to provide a fuel pulverizing unit which is especially adaptable for installation on a locomotive and which is of a simple and durable construction.

These and other objects and advantages will be fully described in the following specification which is accompanied by the drawings illustrating the invention, and in which

Figure 1 is a central vertical longitudinal section through adjacent portions of a locomotive and tender with the fuel pulverizer and feeder shown in similar section and a portion of the burner in elevation;

Figure 2 is a plan view of the invention illustrated in Figure 1 with parts thereof removed or broken away and the locomotive and tender indicated by conventional lines;

Figure 3 is a central vertical longitudinal section through adjacent portions of the locomotive and tender, showing the fuel pulverizer and feeder in side elevation with parts broken away to illustrate the fuel heating or drying system;

Figure 4 is a sectional view taken on the line 4-4 of Figure 1;

Figure 5 is a view taken on the line 5-5 of Figure 1;

Figure 6 is a view taken on the line 6-6 of Figure 1 with parts being shown in plan; and

Figure 7 is a transverse cross sectional view taken on the line 7-7 of Figure 3.

On these drawings, the locomotive is shown at A, the tender at B and the coupling member connecting these vehicles at C. The locomotive A includes a boiler 10 and the firebox 11 having a hollow backwall 12 with an opening 13 there-through. Extending rearwardly from the backwall 12 is a floor 14 which forms a deck for the cab 15. The cab 15 and the firebox 11 are supported in a well known manner from the frames 16, which also carry the locomotive running gear (not shown). The tender B includes the underframe 17 and a floor 18 above said underframe which forms the bottom of a fuel bin 19. The space between the floor 18 and the underframe 17 constitutes a compartment 20 in which the conveying system S is supported.

The conveying system S includes the fuel transfer conveyor casing 21 which is preferably rigidly secured to the underframe 17 as by means of bolts passing through the supports 22, and a conduit 23 which leads forwardly toward the locomotive. In order that certain of the objects of this invention may be carried out, I have made the fuel transfer conveyor casing 21 of a novel construction and it includes the open mouth trough 24 which receives coal from the bin 19 through an aperture 25 in the floor 18. This aperture 25 is closed by the slidable plates 26 which may be moved from their covering position to form a relatively small opening in the floor 18 through which coal falls by gravity into the trough 24. A conveyor screw 27 is rotatably mounted in the trough 24 and urges the coal forwardly, oversize lumps being reduced by the crusher 28, and the coal thus reduced passes through the opening 29 into the conduit 30 wherein a conveyor screw 31 transfers the coal from the front toward the rear of the transfer conveyor casing 21. Another conduit 32 is offset downwardly from the conduit 30 and receives coal therefrom through an opening 33 at the rear of the transfer conveyor casing 21 and remote from the opening 29. In like manner, a conveyor screw 34 urges the coal through the conduit 32 forwardly toward the locomotive. It will, of course, be understood that the crusher 28 may be of any known construction so as to

reduce the coal to the required size and likewise, any number of conduits such as 30, 32 may be employed so that the crushed coal may be conveyed through the labyrinth-like transfer conveyor casing 21 whereby the further reduction in size of the coal, and its heating and drying, hereinafter to be fully described, may be effectively accomplished.

The conduit 23 preferably is universally connected to the forward end of the transfer conveyor casing 21 as at 35, and in the present instance, a spherical flange 36 is formed with the forward end of the conduit 32 to which is connected the conduit 23 by means of a ball and socket clamp 37. The conduit 23 is composed of the telescopic sections 38 and 39, the rearward section 38 being universally connected to the transfer conveyor casing 21 while the forward section 39 is universally carried by the locomotive as by means of the bracket 40 which carries the spherical clamp 41 for supporting the ball member 42 of the front section 39. A conveyor screw 43 is housed within the conduit 23 and it is universally connected as at 44 to the screw 34 of the conduit 32. The conveyor screw 43 receives fuel from the transfer conveyor casing 21 and urges it forwardly to the locomotive and delivers the same into a pulverizer P which is mounted on the frames 16 of the locomotive.

In order that the conveyor screws may be readily reversed, the rear wall 180 of the transfer conveyor casing 21 is provided with a curved portion 181 which merges into the bottom wall 182 of the conduit 32. Likewise, the front wall 183 is curved as at 184 so as to merge with the bottom wall 185 of the conduit 30. Thus, when the conveyor screws are reversed in order to release a clog in the conveying system, the fuel will not be packed against flat walls at either end of the transfer conveyor, but will instead be guided upwardly along the curved walls 181, 184 and thence toward the adjacent conduit, as clearly shown in Figure 1 of the drawings.

In order that the coal delivered to the pulverizer P from the bin 19 be free from moisture, provision has been made for heating and drying the coal during its transit through the conveying system S. Leading from the locomotive boiler is a main heater steam pipe 45 which passes through the rearward section 38 of the conduit 23. A plurality of pipes such as 46 branch from the main steam heater pipe and extend longitudinally within the conduit 23. Adjacent each exterior side of the conduit 23, flexible connections such as 46a, 47 connect the heater pipes 48, 49 respectively, each of which extends longitudinally within the transfer conveyor casing 21. Preferably, the bottom conduit 32 is provided with sides 50, 51 which extend above and are in spaced relation with the lower portion of the intermediate conduit 30, forming therewith pockets 52, 53. The heater pipes 48, 49 pass through these pockets and are provided with return bends such as 54, 55, the ends of the lowermost return bends 55 extend exteriorly through the sides 50, 51 and then extend inwardly to form a Y which is provided with a drain valve 56.

When steam is admitted to the pipe 45, it will be seen that the longitudinal pipes 46 in the conduit 23 and the heater pipes 48, 49, 54 and 55 of the transfer conveyor casing 21 will become filled with steam, thereby increasing the temperature in the adjacent fuel conduits. The intermediate conduit 30 is provided with a plurality of apertures 57, whereby circulation of the warm air

currents is increased. Condensation in the heating system will pass through a drain valve such as 56, of which there may be several. It will of course be understood that exhaust steam could be entrained through the heating system, and in this event drain valves would not be used and the exhaust steam could be introduced into the water tank of the tender increasing the temperature of the water therein. Any number of return bends could be used, depending upon the temperature at which it is desired to dry the coal and if it were desirable to heat the coal to a degree higher than that usually reached during the drying process, it is within the scope of this invention to accomplish this.

The coal having been crushed to the desired size and dried or heated to the desired extent is then delivered by the conveying system S into the pulverizer P, which is of a novel construction. The pulverizer P includes the base 58 which is secured to the frames 16 as by means of the bolts 59 passing through this base and the housing cover 60 which, together with the base 58 forms a casing 61 for maintaining the parts of the pulverizer in operative relation. Suitably journaled in bearings such as 62 is the upright shaft 63 on which is mounted a gear 64 meshing with the pinion 65 for transmitting power to the upright shaft 63. The upright shaft 63 carries a rotor 66 which is in the form of a truncated cone and immediately thereabove is a conic disc 67, also rotatably mounted with the upright shaft 63.

Crushed coal which is delivered to the pulverizer P is first introduced between the rollers 68, 69 which rotate inwardly when viewed from above and are disposed slightly above the apex of the conic disc 67. These rollers 68, 69 grind the crushed coal which is then dropped over the revolving conic disc 67 and then passes between the closely adjacent faces of the rotor 66 and a bull-ring 70 for pulverization. The bull-ring 70 is movable vertically as by means of the adjusting bolts 71 whereby any degree of fineness in the pulverized coal may be attained. After the coal has been pulverized to the desired degree, it drops onto a fan 72 which is in assembled relation with the rotor 66. The fan 72 is provided with a plurality of blades such as 73 and fits closely adjacent the major portion of the side wall 74 of the housing cover 60. A portion of this side wall 74 is in the form of a volute curve 75 forming a space 76 between the periphery of the fan 72 and the side wall 74. The fan blades 73 impel the pulverized coal through this space 76 and through a tube 77 connecting the discharge end 78 of the pulverizer P and the intake end 79 of the burner R. In the present instance, the burner R enters the firebox 11 through the firing opening 13, although it will be appreciated that the pulverized fuel may be introduced into the furnace in any other convenient manner.

The conveying system S and the pulverizer P are driven in the following manner. A motor M constitutes the prime mover and has a crank or power shaft 80, one end of which carries a gear 81. The gear 81 meshes with a pinion 82 on one end of the shaft 83 which shaft also carries the pinion 85 on its opposite end for driving the rotor 66 and the fan 72. Another pinion 84 also meshes with the gear 81 and it in turn drives a worm shaft 85. This worm shaft 85 is provided with a worm gear 86 which engages the worm wheel 87 for driving the conveying system S, as will presently appear. Operatively connected to the worm wheel 87 is the shafting 88 which ex-

tends to the rear of the conveying system S and drives the connected gearing 89 housed in the gear casing 90. The gearing 89 is operatively connected to the rearward ends of the conveyor screws 27, 31, 34 and in this manner transmits power thereto. At its end remote from the pinion 84, the worm shaft 85 is operatively connected to the gearing 91 disposed in the housing 92 and operatively connected to the crushing rollers 68, 69. In this manner a single motor M is utilized for driving the conveying system S and the pulverizer P, although if found desirable, a separate motor can be used for each unit.

I claim the following structures to be within the scope of this invention.

1. In combination with a locomotive and a tender, the former being provided with a firebox and the latter having a fuel bin, a fuel conveying system including a transfer conveyor mounted on the tender beneath said fuel bin, said transfer conveyor including a trough in open communication with said bin, a conduit beneath said trough and communicating therewith through a common opening at the forward end of said transfer conveyor, a conveyor for advancing fuel to said common opening and delivering the same into the conduit therebeneath, a conduit beneath the first named conduit and communicating therewith through a common opening at the rear of said transfer conveyor, a conveyor in the first named conduit receiving fuel delivered thereinto by the conveyor in said trough, said second named conveyor advancing fuel to the opening communicating with the second named conduit, and a conveyor screw in the second named conduit receiving the fuel delivered into the second named conduit and advancing it toward the forward end of said transfer conveyor, a conduit flexibly related with said transfer conveyor and arranged to receive fuel therefrom, said flexibly related conduit leading forwardly toward the firebox and being flexibly connected with respect thereto, a conveyor for advancing fuel through said flexibly related conduit, a heating device for said conveying system, said heating device including a plurality of tubular members extending interiorly of said transfer conveyor and a plurality of tubular members extending interiorly of said flexibly related conveyor, a flexible connection between the tubular members of said transfer conveyor and the tubular members of said flexibly related conveyor adjacent the flexible connection between said conveyors, means for supplying a heating fluid to such tubular members and means for introducing the fuel into the firebox.

2. In a locomotive having a firebox and a cab deck and a tender for said locomotive having a fuel bin, a fuel casing below the tender floor arranged to receive lump fuel from said bin, screw conveying means mounted in said fuel casing for conveying fuel therethrough, means in said fuel casing for granulating said lump fuel, a pulverizer mounted on the locomotive beneath the deck thereof, conveying means for delivering fuel from said fuel casing to said pulverizer, said conveying means being flexibly related with said fuel casing and said pulverizer providing for movement of said conveying means as relative movement between the locomotive and tender occurs, a heating device including a plurality of tubular members extending into said conveying means longitudinally thereof arranged for movement with said conveying means, means for supplying a heated fluid to said tubular members, a conduit communicating with said pulverizer and de-

livering to the firebox and a blower mounted on the locomotive beneath the deck thereof for blowing the pulverized fuel through said conduit into the firebox.

3. In a locomotive having a firebox and a cab deck and a tender for said locomotive having a fuel bin, a fuel casing mounted on the tender beneath and in communication with said fuel bin, means in said casing for conveying fuel therethrough, means associated therewith for granulating the lump fuel, a fuel pulverizer mounted on the locomotive beneath the cab deck thereof, a transfer conduit communicating with and extending forwardly from said tender casing and at its forward end opening downwardly to said pulverizer for delivering granulated fuel thereto, said transfer conduit being flexibly connected with said tender casing and said pulverizer providing for movement of said transfer conduit as relative movement between the locomotive and tender occurs, a heating device for said tender casing and transfer conduit including a plurality of tubular members, a flexible connection between the tubular members of said tender casing and said transfer conduit adjacent the flexible connection between said tender casing and said transfer conduit, means for supplying a heating fluid to said tubular members, a conduit communicating with said pulverizer and delivering to the firebox and a blower mounted on the locomotive beneath the deck thereof for blowing pulverized fuel through said last named conduit into the firebox.

4. In a locomotive having a firebox and a cab deck and a tender for said locomotive having a fuel bin, a conveyor casing mounted on the tender beneath said bin, said conveyor casing including a plurality of conduits, said conduits being approximately U-shaped in cross section, the straight sides thereof flaring laterally, said U-shaped conduits being offset one above the other and each being received between the side walls of the conduit immediately therebeneath, one of said conduits receiving fuel from said bin and arranged to communicate with an adjacent conduit through a common opening, a conveyor for advancing fuel in the first named conduit toward said opening, a conveyor in the adjacent conduit receiving fuel from said opening for advancing the fuel in a direction opposite to the advance of the fuel by said first named conveyor, means associated with said casing for granulating the lump fuel, a fuel pulverizer mounted on the locomotive beneath the cab deck thereof, a transfer conduit communicating with and extending forwardly from said conveyor casing and at its forward end communicating with said pulverizer for delivering granulated fuel thereto, a heating device for said tender casing and said transfer conduit including a plurality of tubular members, means for supplying a heating fluid to said tubular members, a conduit communicating with said pulverizer and delivering to the firebox and a blower mounted on the locomotive beneath the deck thereof for blowing pulverized fuel through said last named conduit into the firebox.

5. In a fuel conveying system, the combination of a source of fuel supply, a transfer conveyor receiving fuel from the source of supply, said transfer conveyor comprising a plurality of conduits approximately U-shaped in cross section, one above and partially fitting within the other to provide a common wall between said conduits, a plurality of longitudinally extending tubular members within a lower conduit, means for supplying a heating fluid to said tubular mem-

bers, a plurality of apertures in the sides of the common wall between the said lower conduit and the conduit immediately thereabove to permit a circulation of heat from the lower conduit into the conduit immediately thereabove, an opening in the bottom of the common wall between the lower conduit and the conduit immediately thereabove, a fuel conveyor in said upper conduit arranged for advancing fuel toward said opening for delivering fuel to said lower conduit, and a fuel conveyor in said lower conduit.

6. In combination with a locomotive and a tender, the former being provided with a firebox and the latter having a fuel bin, a fuel conveying system including a transfer conveyor mounted on the tender and receiving fuel therefrom and advancing it toward the locomotive and a conveyor flexibly connected with said transfer conveyor and

arranged to receive fuel therefrom, said flexibly connected conveyor leading forwardly toward the firebox and being flexibly connected with respect thereto, fuel crushing means in said transfer conveyor, a heating device for said conveying system, said heating device including a plurality of tubular members extending interiorly of said transfer conveyor and a plurality of tubular members extending interiorly of said flexibly related conveyor, a flexible connection between the tubular members of said transfer conveyor and the tubular members of said flexibly related conveyor adjacent the flexible connection between said conveyors, means for supplying a heating fluid to such tubular members and means for introducing the fuel into the firebox.

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