March 26, 1935. M. B. MORROW 1,995,745

CINDER COLLECTING AND DELIVERY DEVICE

Filed Jan. 16, 1933 3 Sheets-Sheet 1

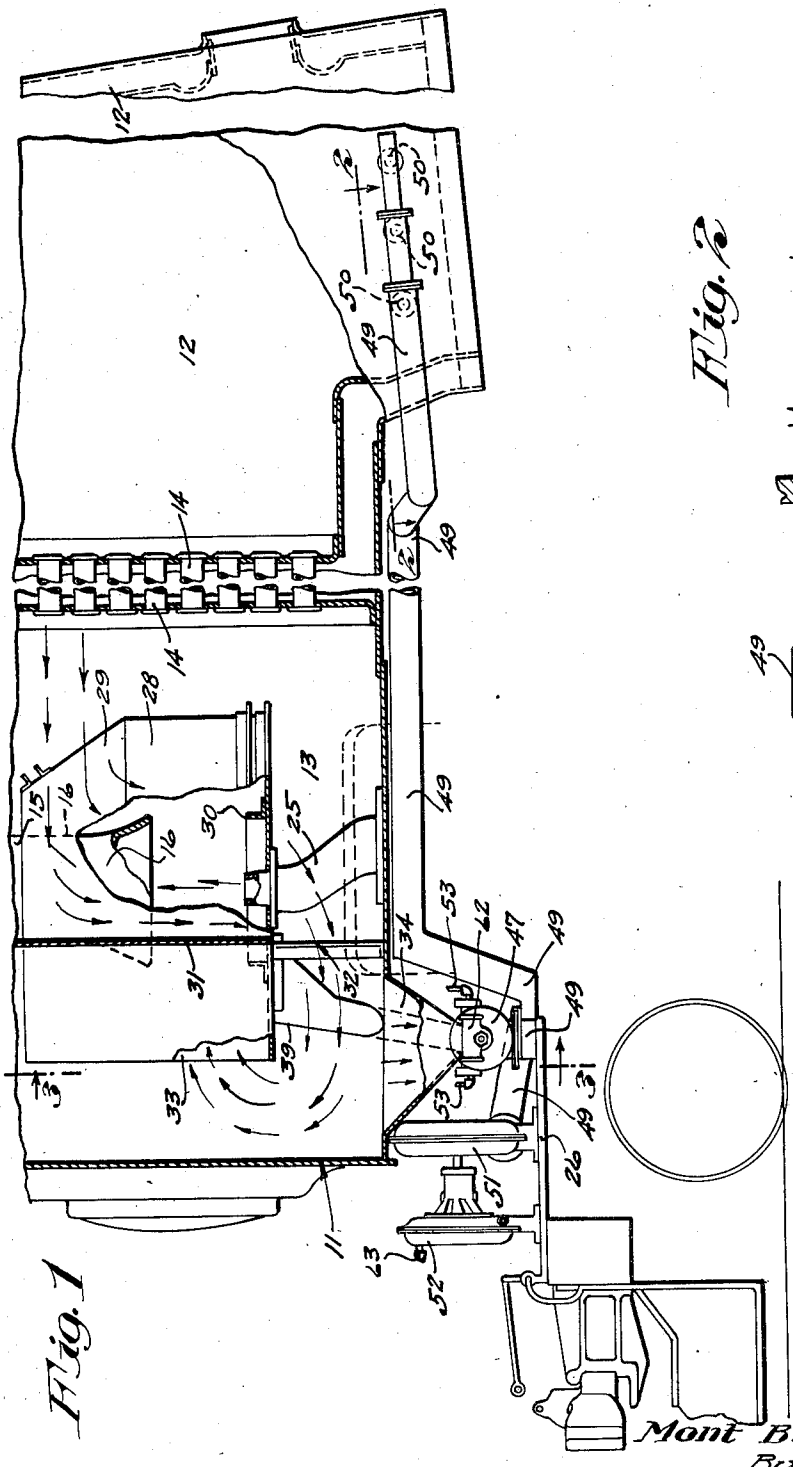


Fig. 1

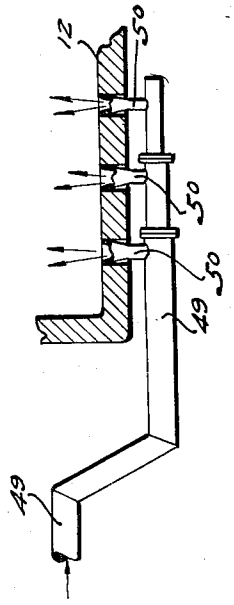


Fig. 2

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CINDER COLLECTING AND DELIVERY DEVICE

Filed Jan. 16, 1933 3 Sheets-Sheet 2

Fig. 5

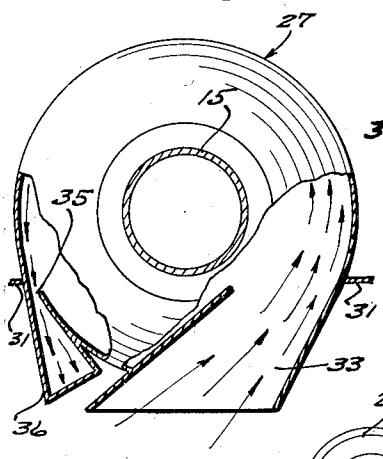


Fig. 3

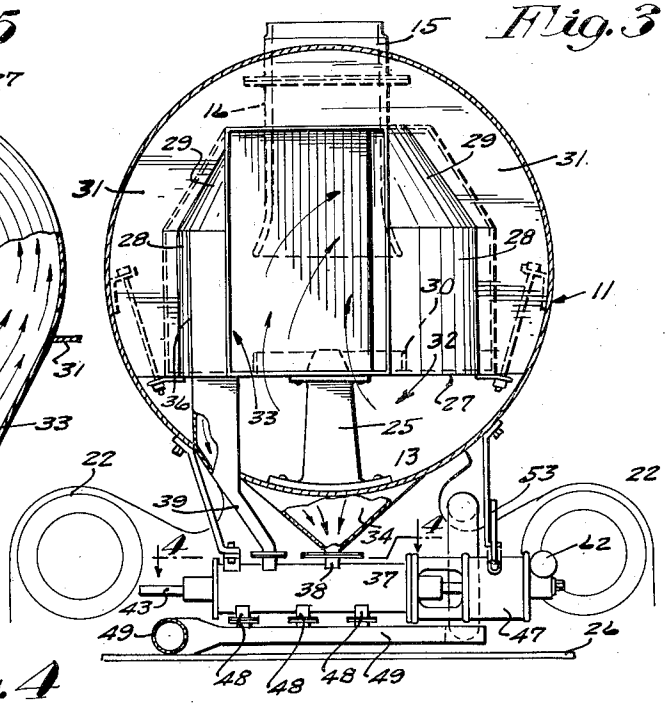


Fig. 4

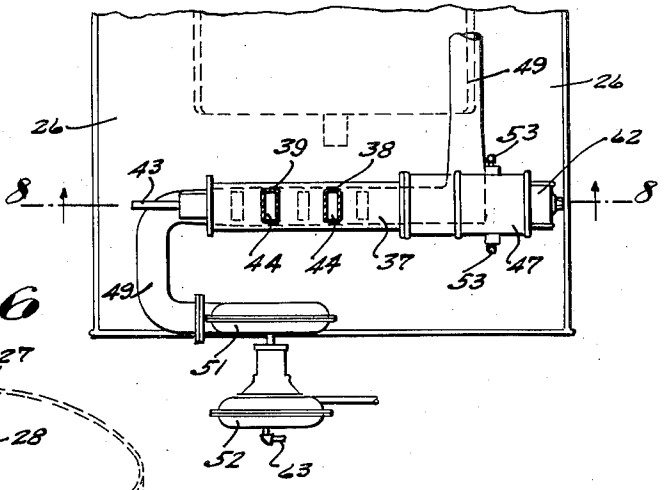
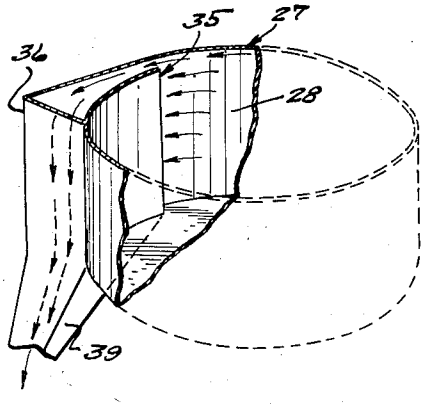


Fig. 6



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CINDER COLLECTING AND DELIVERY DEVICE

Filed Jan. 16, 1933 3 Sheets-Sheet 3

Fig. 7

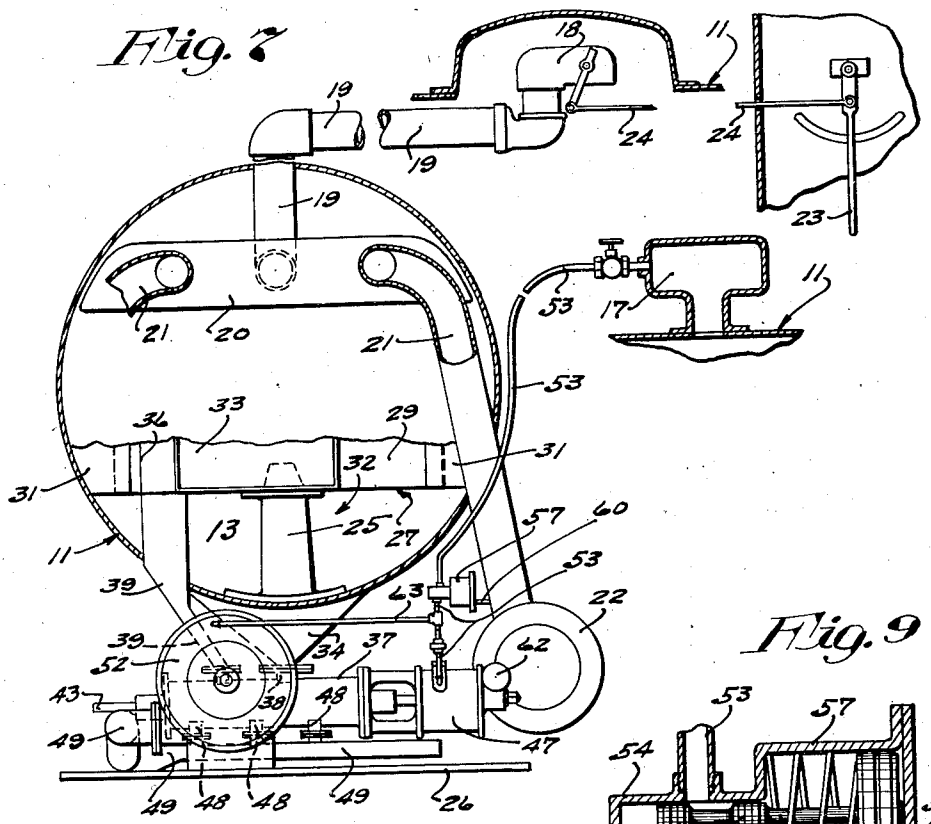


Fig. 9

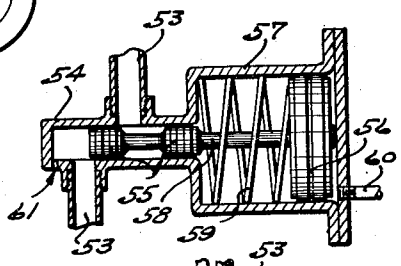
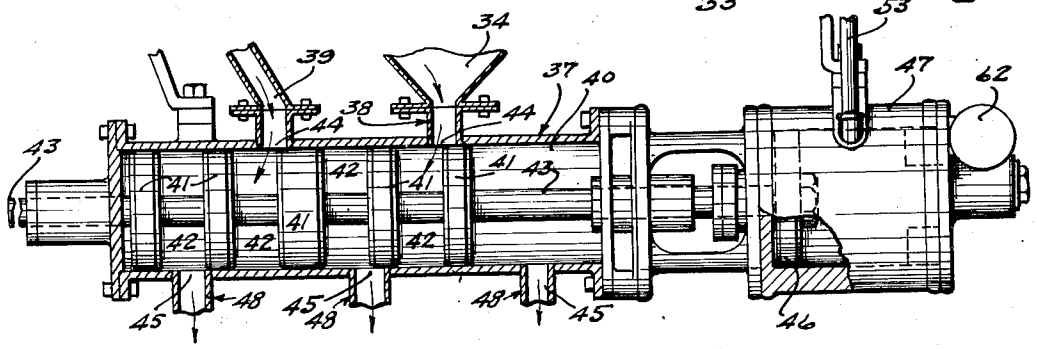


Fig. 8



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UNITED STATES PATENT OFFICE

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CINDER-COLLECTING AND DELIVERY DEVICE

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Application January 16, 1933, Serial No. 651,942

16 Claims. (Cl. 110—120)

My invention has for its object the provision of simple and highly efficient means for collecting cinders and other solids in a steam locomotive, after they have been separated from the gases during the travel of the products of combustion to the stack, and for delivering the same to a distant point or, more particularly, to the fire box of the locomotive for incineration.

To the above end, generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

In the accompanying drawings, which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a fragmentary view of a steam locomotive, partly in left side elevation and partly in central vertical section, having the invention embodied therein;

Fig. 2 is a fragmentary view partly in plan and partly in horizontal section taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary view partly in front elevation and partly in transverse vertical section taken on the line 3—3 of Fig. 1;

Fig. 4 is a plan view partly in diagram and partly in section taken on the line 4—4 of Fig. 3;

Fig. 5 is a plan view of the spark arrester removed from the locomotive, some parts being broken away and sectioned;

Fig. 6 is a fragmentary perspective view of the spark arrester in horizontal section taken substantially just below its frusto-conical portion;

Fig. 7 is a diagrammatic perspective view partly in front elevation and partly in transverse section, except the steam dome, throttle valve equipped pipe, and throttle lever which are shown partly in side elevation and longitudinal vertical section;

Fig. 8 is a detail view partly in front elevation and partly in vertical section taken on the line 8—8 of Fig. 4, on an enlarged scale; and

Fig. 9 is a detail view of the automatic valve partly in side elevation and partly in central vertical section.

The invention, as illustrated, is embodied in a standard type of steam locomotive equipped with a spark arrester known to the trade as the "cyclone" and disclosed in United States Letters Patent No. 1,875,846, issued September 6, 1932, to Martin F. Brown.

Of the parts of the steam locomotive illustrated, it is important to note the boiler 11, the fire box 12, the smoke box 13, the flues 14, the smoke stack 15 and its depending extension 16, the fountain 17, the throttle valve 18, the steam pipe 19 leading from said valve to the steam head 20, the steam pipes 21 leading from the steam head 20 to the steam chests 22, the throttle lever 23 connected by a link 24 to the throttle valve 18, the exhaust nozzle 25, and platform 26 under the front end portion of the boiler 11.

The spark arrester is mounted in the smoke box 13 and its separator 27 consists of a vertically disposed cylindrical body or lower portion 28 and a frusto-conical upper portion 29. This separator 27 is between the smoke pipe 15 and the exhaust nozzle 25, which are axially aligned and axially spaced and said separator is in axial alignment therewith. It will be noted that the pipe extension 16 extends completely and axially through the upper portion 29 of the separator 27 and slightly into the lower portion 28 thereof and that the exhaust nozzle 25 extends into said separator through its closed bottom.

On the bottom of the separator 27 and surrounding the exhaust nozzle 25 is a concentric collar 30 and the space between this collar and the lower end of the stack extension 16 affords a passageway for the gases from the spark arrester to the stack 15. The smoke box 13 is divided into two compartments by a transverse vertical partition 31 which extends from side to side of said smoke box and from the top thereof downwardly and includes the separator 27. It is important to note that the lower edge of the partition 31 is substantially at the bottom of the separator 27 leaving a draft passage 32 under said separator and partition.

The products of combustion, including cinders and other solids entering the smoke box 13 from the flues 14, pass under the separator 27 and the partition 31 and travel to the front end of said separator where said products of combustion are deflected into the separator 27 through a forwardly projecting tangential intake conduit 33. This conduit 33 has converging vertical walls that extend from the top to the bottom of the separator 27, at the front thereof, and directs the products of combustion into the separator 27 in a definite tangential direction.

The products of combustion are delivered into the separator 27 from the contracted portion of the conduit 33 which causes the same, upon entering said separator, to gyrate at high velocity with the result that the cinders and other solids, in the products of combustion, are thrown outwardly with considerable force against the

periphery or internal walls of the separator 27. My invention provides for the collection of the cinders or other solids, as will hereinafter appear.

The cinder-free gases during whirling in the separator 27 come within the zone of influence of the draft and are drawn through the passageway, between the stack extension 16 and the collar 30, upward through the stack 15.

The parts of the steam locomotive and the spark arrester, heretofore designated, are all of standard and well-known construction.

Referring now in detail to my invention, means is provided for collecting cinders precipitated onto the bottom of the smoke box 13, after having passed under the partition 31 and into the forward section of said smoke box, and for the collection of cinders in the spark arrester, separated from the gases by centrifugal force, and for the return of the collected cinders to the fire box 12.

In the bottom of the smoke box 13, forward of the partition 31, is a depending open hopper 34 into which a portion of the cinders are precipitated during the eddying of the products of combustion prior to their entrance into the spark arrester. All cinders, thrown by centrifugal force against the periphery or internal walls of the separator 27 from the whirling products of combustion in the separator 27 during their circumferential travel on said walls, escape through a vertical outlet slot 35 in said separator. From this outlet slot 35 the cinders enter a collecting chamber 36 the outer vertical wall of which is tangential to the shell of the separator 27 at said slot, see Fig. 5. This slot 35 is relatively narrow, extends from the top to the bottom of the spark arrester, and the vertical sides of the chamber 36 are in outwardly diverging relation or, in other words, the transverse width of the chamber 36 progressively increases from the slot 35 and thereby slows up the travel of the cinders from the separator 27 which strike the outer wall of the chamber 36 as a baffle.

Cinders collected in the hopper 34 and the chamber 36 gravitate into an ejector trap 37 from the former through a short depending conduit 38 and from the latter through a conduit 39 leading from the open bottom of the chamber 36. Said trap 37 comprises, as shown, a cylinder 40 and cooperating piston-like gates 41. These gates are axially spaced and form transverse compartments 42 in the cylinder 40. The cylinder 40 extends transversely under the smoke box 12, forward of its partition 31, and the gates 41 are fixed, at their axes, to a common shaft 43. The end portions of the shaft 43 work in boxes on the heads of the cylinder 40. The conduits 38 and 39 are secured to the cylinder 40, at the top thereof, and empty into the compartments 42 through two inlet openings 44 in the top of said cylinder and spaced longitudinally thereof.

In the bottom of the cylinder 40 are three outlet openings 45 spaced longitudinally thereof and staggered with respect to the inlet openings 44, whereby the gates 41 always cut off a direct opening through the cylinder 40 between the inlet openings 44 and the outlet openings 45.

Without this trap 37 or other cut-off device it would be impossible for the cinders to gravitate from the smoke box 13 and the spark arrester for the reason that a partial vacuum is produced by the draft to the stack 15 and of such force as to prevent precipitation of the cinders.

The gates 41 are reciprocated at the desired speed by a piston 46, on the left hand end of the shaft 43, mounted in a cooperating steam cylinder 47 fixed to the adjacent head of the cylinder 40. Cinders precipitated into the compartments 42 are scraped by the gates 41 into the outlet openings 45 where they gravitate through short pipes 48 into a long horizontal conduit 49. This conduit 49 extends longitudinally under the trap 37 and from thence rearwardly on the left hand side of the boiler 11. From the conduit 49 cinders are discharged transversely into the fire box 12 through a plurality of nozzles 50; as shown, three.

Cinders gravitated into the conduit 49 from the trap 37 are caught by a blast of air from a fan 51 and carried through said conduit to the nozzles 50 where they are discharged into the fire box 12. By reference to Fig. 2, it will be noted that the nozzles 50 flare toward their discharge ends and thereby separate and spread the discharged cinders over the fire in the fire box 12 to facilitate the burning thereof. It will be noted that the short sections of the conduit 49, for the last two nozzles 50, have a reduced conducting capacity, whereby the cinders will be substantially evenly distributed to the nozzles 50. The fan 51 is driven by a steam turbine 52, which together with said fan, is mounted on the platform 26.

Live steam is supplied to the cylinder 47 from the fountain 17 through a pipe 53 in which is interposed the casing 54 of a duplex slide valve 55. This valve 55 is reciprocated by an attached piston 56 mounted in a cooperating steam cylinder 57 and which piston is secured to the stem 58 of said valve. By reference to Fig. 9, it will be noted that the steam intake and the steam outlet in the casing 54 are spaced longitudinally from each other, whereby when the valve 55 is reciprocated its outer part alternately opens and closes the passageway through the casing 54 between said intake and outlet. The other or inner portion of the valve 55 closes the passageway between the casing 54 and the cylinder 57 in all positions of said valve.

The steam pipe 53 is normally closed by the valve 55 which is held retracted by a coiled spring 59, encircling the stem 58 and compressed between the inner head of the cylinder 57 and the piston 56. Live steam is introduced into the cylinder 57, on the opposite side of the piston 56 from the spring 59, when the throttle valve 18 is open, from a branch pipe 60 which leads from the left hand steam pipe 21. When the piston 56 is in its projected position the valve 55 is positioned to open the steam pipe 53 and said valve will be held open as long as the throttle valve 18 is open but when said throttle valve is closed the spring 59 will become active and retract the piston 56 which closes the valve 55. Formed in the casing 54, close to its outer head, is an open air port 61.

Live steam from the pipe 53 is discharged into the cylinder 47 alternately on opposite sides of the piston 46 by ports and valve mechanism, not shown, except the valve casing 62 on the outer head of the cylinder 47. Live steam is supplied to the turbine 52 through a branch pipe 63 which leads from the steam pipe 53 on the discharge side of the valve casing 54. It will thus be seen that when the throttle valve 18 is closed the valve 55 will be closed, and hence the steam supply to the cylinder 47 and to the turbine 52 will be cut-off.

From the above description it is evident that when the throttle lever 23 is operated to open the throttle valve 18, live steam in the pipe 60 from the left-hand steam pipe 21, will automatically

open the valve 55 by pressure on the piston 56, and admit steam to the cylinder 47 for reciprocating the gates 41 and also admit steam to the turbine 52 for operating the fan 51. When the throttle valve 18 is closed the reciprocation of the gates 41 and the driving of the turbine 52 will be automatically stopped. It will thus be seen that the operations for trapping the cinders and for returning the same to the fire box 12 take place only when the throttle valve 18 is open, which is correct for the reason that no cinders are in motion when the throttle valve 18 is closed.

The stack draft produces a partial vacuum in the smoke box which would tend to cause an upward flow from trap 37, and the blast of air being forced through the conduit 49 from the fan 51 would tend to cause an upward flow of air to trap 37, it is therefore evident that except for the sealing effect of gates 41, the gas flow would be upward through trap 37, and thus prevent any gravitation of cinders from the smoke box through trap 37 into the conduit 49.

The word "cinders" is herein used in a broad sense to cover solids and other precipitable matter in products of combustion.

What I claim is:

1. The combination with an engine having a fire box, a steam supply and a throttle valve equipped steam pipe leading from the steam supply, of means for collecting cinders from the fire box, means for returning the collected cinders to the fire box, a cinder trap having a compartment and an intake through which collected cinders are discharged into the compartment, said trap also having an outlet through which cinders are discharged from the compartment to the cinder-returning means, said trap also having gates for alternately opening and closing the outlet and the inlet to the compartment, means actuated by steam from the steam supply for operating the gates, and a normally closed valve for the steam supply to the gate-operating means, and means controlled by the opening of the throttle valve for opening the normally closed valve.

2. In combination with a stack extension and an associated nozzle aligned therewith but spaced below the same for discharging a draft inducing column up said stack extension, a cylindrical separator casing surrounding the associated ends of said stack extension and nozzle, means providing an inlet opening for said casing with its bottom end extending into a plane below that of said stack extension for directing the incoming products of combustion tangentially toward one side of the casing in a path outside the draft inducing column discharged by the nozzle, and means providing an outlet opening for said casing for directing the cinders tangentially from the casing, said intake and outlet openings being on the same side of a line extending through the casing at the center thereof.

3. The combination with a steam engine having a steam supply, a main steam line leading from the steam supply and a throttle valve in said line, of a cinder trap having an intake opening and an outlet opening offset, the one from the other, said trap also having gates arranged to form a compartment in the trap and cut off a passageway through the compartment from the intake opening to the outlet opening, said gates being operable to position the compartment to alternately receive cinders from the intake opening and discharge cinders through the outlet opening, and automatic means controlled by the opening of the throttle valve for operating the gates and for stopping the operation of the gates when the throttle valve is closed.

4. The combination with a steam engine having a steam supply, a main steam line leading from the steam supply and a throttle valve in said line, of a cinder trap having an intake opening and an outlet opening offset, the one from the other, said trap also having gates arranged to form a compartment in the trap and cut off a passageway through the compartment from the intake opening to the outlet opening, said gates being operable to position the compartment to alternately receive cinders from the intake opening and discharge cinders through the outlet opening, and means actuated by steam from the steam supply for operating the gates, a valve normally closing the steam supply to the gate actuating means, and means controlled by the opening of the throttle valve for opening the normally closed valve.

5. The combination with a steam engine having a steam supply, a main steam line leading from the steam supply and a throttle valve in said line, of a cinder trap having an intake opening and an outlet opening offset, the one from the other, said trap also having gates arranged to form a compartment in the trap and cut off a passageway through the compartment from the intake opening to the outlet opening, said gates being operable to position the compartment to alternately receive cinders from the intake opening and discharge cinders through the outlet opening, a steam cylinder and cooperating piston for operating the gates, an auxiliary steam line leading from the steam supply to the cylinder, a normally closed valve in the auxiliary steam line, and automatic means for opening the normally closed valve when the throttle valve is opened.

6. The combination with a steam engine having a steam supply, a main steam line leading from the steam supply and a throttle valve in said line, of a cinder trap having an intake opening and an outlet opening offset, the one from the other, said trap also having gates arranged to form a compartment in the trap and cut off a passageway through the compartment from the intake opening to the outlet opening, said gates being operable to position the compartment to alternately receive cinders from the intake opening and discharge cinders through the outlet opening, a cylinder and piston steam engine for operating the gates, an auxiliary steam line leading from the steam supply to the cylinder of the last noted engine, a normally closed valve in the auxiliary steam supply, a steam cylinder and cooperating piston for operating the normally closed valve, means for supplying steam to the steam cylinder from the steam supply for opening the normally closed valve when the throttle valve is opened, and automatic means for closing the normally closed valve when the throttle valve is closed.

7. The combination with a steam engine having a fire box, a steam supply, a main steam line leading from the steam supply and a throttle valve in said line, of means for collecting cinders from the fire box, an ejector for the collected cinders, a conveyor arranged to receive cinders from the ejector, steam actuated means for operating the ejector, other steam actuated means for operating the conveyor, means for supplying steam to the two steam actuating means from the steam supply including a nor-

mally closed valve, and means controlled by the opening of the throttle valve for opening the normally closed valve.

8. The combination with a steam engine having a fire box, a steam supply, a main steam line leading from the steam supply and a throttle valve in said line, of means for collecting cinders from the fire box, an ejector for the collected cinders, a conveyor arranged to receive cinders from the ejector, a steam cylinder and piston engine for operating the ejector, a steam turbine for operating the conveyor, means for conveying steam from the steam supply to the cylinder and piston and to the turbine including a normally closed valve, and means controlled by the opening of the throttle valve for opening the normally closed valve.

9. The combination with a steam engine having a fire box, a steam supply, a main driving cylinder, a main steam line leading from the steam supply to the main driving cylinder, and a throttle valve in the steam main line, of valve controlled means for handling cinders from the fire box and which means is actuated by live steam when and only when steam is admitted to the main driving cylinder by the opening of the throttle valve, said means being independent of pressure variations in the main steam line.

10. The combination with a steam engine having a fire box, a steam supply, a main driving cylinder, a main steam line leading from the steam supply to the main driving cylinder, and a throttle valve in the steam main line, of means for handling cinders from the fire box, steam-actuated means for operating the cinder-handling means, an auxiliary steam line leading from the steam supply to said steam-actuated means, a normally closed valve in the auxiliary steam line, and steam-actuated means operable when and only when steam is admitted to the main driving cylinder by the opening of the throttle valve for opening the normally closed valve.

11. The structure defined in claim 10 which further includes automatic means for closing the normally closed valve when and only when steam is cut off from the main driving cylinder by the closing of the throttle valve.

12. The combination with a steam engine having a fire box, a main steam supply line, and a throttle valve in said line, of a trap in which cinders from the fire box are collected, said trap having a movable element, and means controlled by live steam when admitted to said supply line, by the opening of the throttle valve, for operating the movable element of the trap to discharge cinders collected in the trap.

13. The structure defined in claim 12 which further includes additional means controlled by the opening of the throttle valve for delivering cinders discharged from the trap to the fire box.

14. The combination with a steam engine having a fire box, a steam supply, a main steam line leading from the steam supply, and a throttle valve in said line, of means having an ejector in which cinders from the fire box are collected, means actuated by steam from the steam supply for operating the ejector, a valve normally closing the steam supply to the ejector, and means controlled by the opening of the throttle valve for opening the normally closed valve.

15. The combination with an engine having a fire box, a steam supply, a main steam line leading from the steam supply, and a throttle valve in said line, of means having an ejector in which cinders from the fire box are collected, a secondary steam line leading from the steam supply, means actuated by steam from the auxiliary line for operating the ejector, a normally closed valve in the auxiliary steam line, and means controlled by the throttle valve for opening the valve in the auxiliary steam line.

16. A spark arrester including a cylindrical casing having an intake conduit and an outlet conduit, both of which extend outwardly of the casing in converging relation on the same side of said casing, the outer side of each conduit being substantially tangential to the cylindrical shell of the casing, the two sides of the intake conduit being in inwardly converging relation.

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