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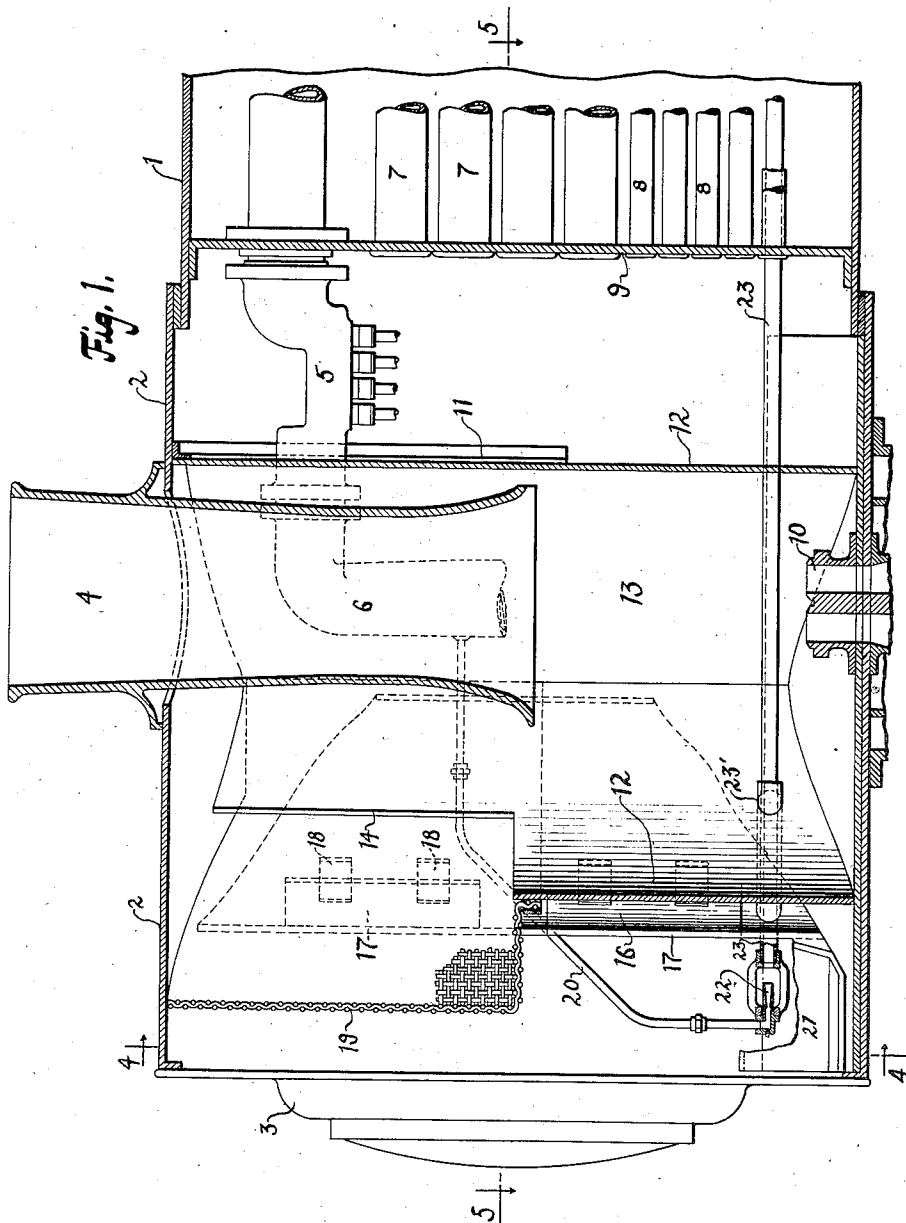
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LOCOMOTIVE

Filed May 20, 1930

5 Sheets-Sheet 1



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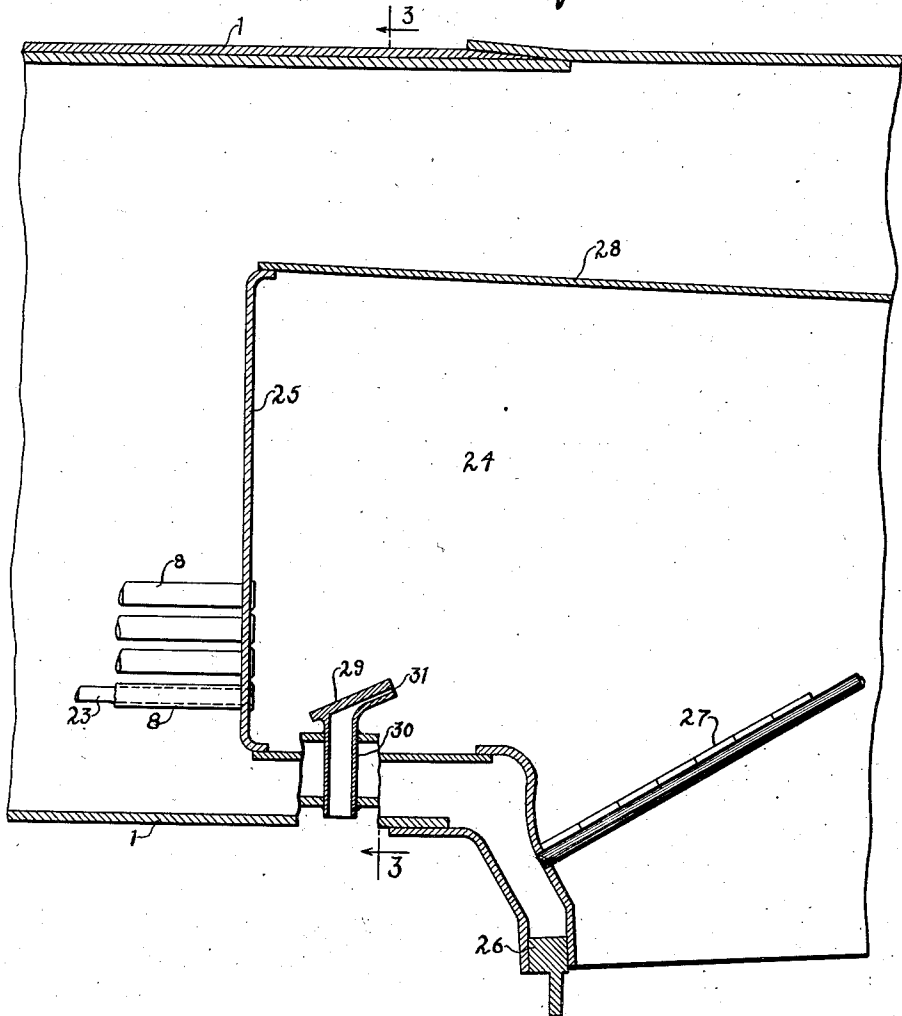
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Fig. 2.



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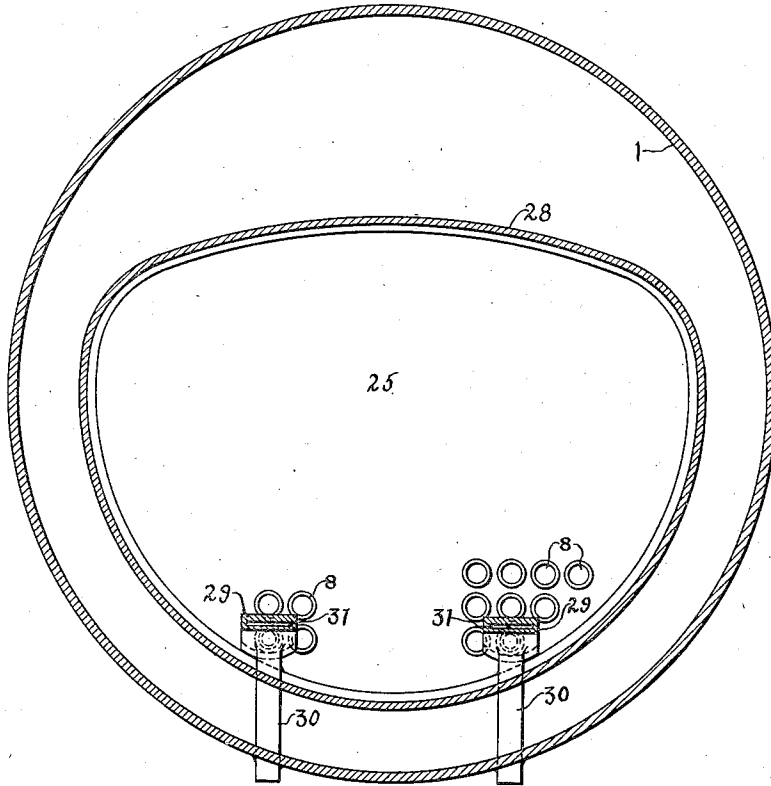
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Fig. 3.



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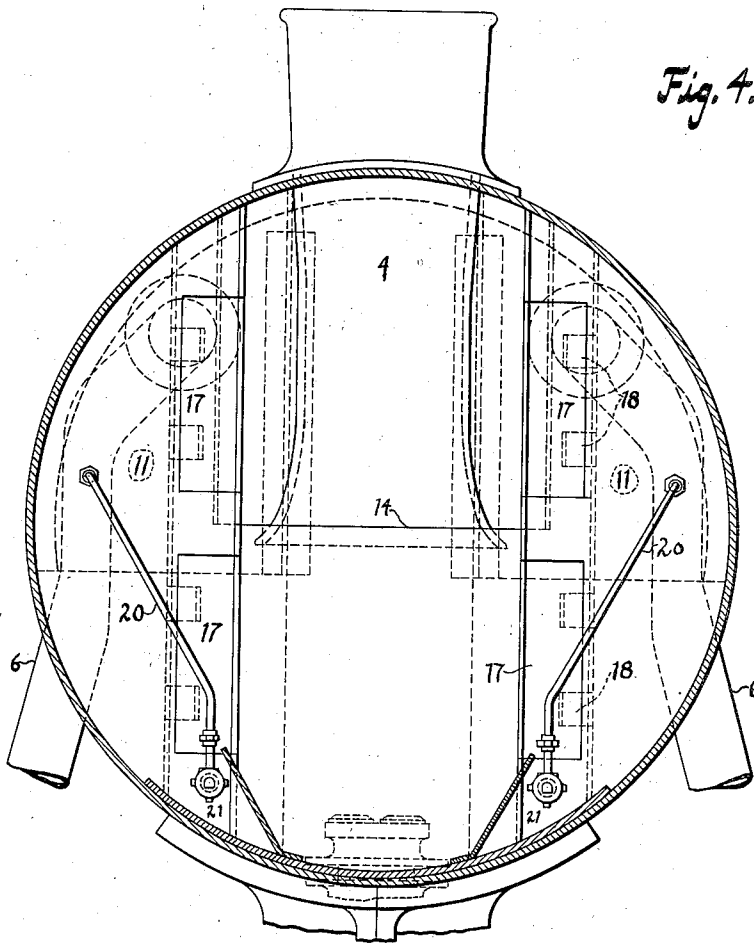


Fig. 4.

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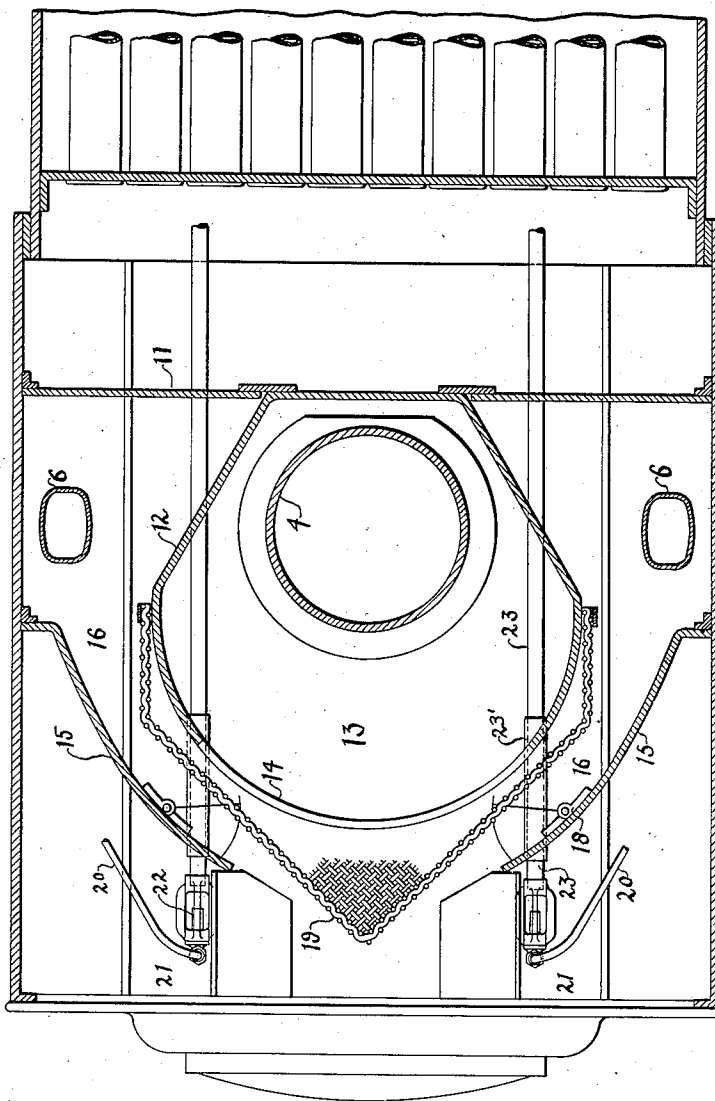
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5 Sheets-Sheet 5

Fig. 5.



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# UNITED STATES PATENT OFFICE

1,997,751

## LOCOMOTIVE

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Application May 20, 1930, Serial No. 454,020

12 Claims. (Cl. 110—123)

This invention relates to locomotives, and is primarily concerned with the separation of cinders and other solids from the flue gases, the disposal of the separated solids, and the provision of simple and rugged structure, readily applied to existing equipment, which will accomplish these functions in such manner as to enhance the efficiency of the draft and of the locomotive as a whole.

One object of this invention is to remove the solids completely from the exhaust gases before they reach the zone of greatest draft, even when low grade fuels, such as lignite, are used. A further object is to provide structure for accomplishing these ends which can be installed in present locomotives without making any substantial change in them, and which will not require much power to operate or much care to maintain.

More specifically, this invention contemplates the provision of partitions and baffles in the locomotive smoke box, the arrangement of these being such as to cause the exhaust gases en route to the stack first to traverse a circular path at high velocity, and then abruptly to change direction, so that centrifugal force and momentum operate to separate the entrained cinders therefrom. The separated cinders fall into pockets in the front of the smoke box, where jets blow them through pipes to the fire box.

It is also a purpose of this invention to provide means for varying the contour and effective area of the exhaust gas passages to obtain maximum efficiency in cinder separation.

Still another object of the invention is to provide, in association with an improved centrifugal type of cinder separating apparatus, a simple and effective spark arresting arrangement.

How the foregoing, together with such other objects and advantages as may hereinafter appear, or may occur to those skilled in the art, are attained, will be apparent from the following description, which, together with the accompanying drawings, presents a preferred embodiment of this invention.

In the drawings:

Fig. 1 is a vertical longitudinal section through a locomotive front end construction embodying my invention, certain of the parts being shown in elevation.

Fig. 2 is a similar view, though somewhat diagrammatic, through the front of the fire box, and rear tube sheet of the same locomotive, and showing a distributor plate with means for ad-

mitting air into the fire box under the action of the draft.

Fig. 3 is a section on the line 3—3 of Fig. 2 showing a plurality of such distributor plates.

Fig. 4 is a transverse vertical section on the line 4—4 of Fig. 1, with a part thereof omitted for the sake of clarity, and

Fig. 5 is a transverse horizontal section on the line 5—5 of Fig. 1.

Fig. 1 shows the front end construction of a locomotive having a boiler 1, smoke box 2, smoke box cover 3, stack 4, superheater header 5, dry pipe 6, flues 7, fire tubes 8, forward flue sheet 9, and exhaust nozzle 10. Between the flue sheet 9 and the stack 4, wing partitions 11 extend partially across the upper half of the smoke box (see also Figs. 4 and 5). Between the inner ends of these wing partitions, is the rear wall of a shell 12, extending from top to bottom of the smoke box. This shell forms an inner draft chamber 13 around the exhaust nozzle 10 and the stack 4. An opening 14 is provided in the forward, upper section of the shell 12, the bottom of this opening being at a higher level than the bottom of the stack.

Forward of the wing partitions 11, baffle walls 15 are mounted on either side of the smoke box, extending forwardly and toward but not to the center of the smoke box. These baffle or guide walls 15 are curved from side to side (see Fig. 5) and are spaced from the shell 12 in such manner as to provide channels 16 around both sides of the shell. Preferably, these channels diminish in cross-sectional area from back to front.

To provide for further diminution of the effective area of these channels or passages, portions 17 of the walls 15 may be cut out and provided with hinges 18, so that they may be swung inwardly.

A spark screen 19 is fixed to the shell 12, completely covering the opening 14. Preferably, this screen is attached to the sides of the shell in such manner as not to block the entrances of the passages 16, but it lies in said passages and extends forwardly and inwardly through and beyond them, so that its sides meet in a point, as clearly shown in Fig. 5, at the center line and near the front of the smoke box. The screen 19 is omitted in Fig. 4 in order to show the relation of the parts behind it.

Pipes 20 are tapped into the dry pipe at either side of the smoke box, and extend forwardly and downwardly to cinder-receiving pockets or hoppers 21, and open into nozzles 22. Opposite these nozzles are pipes, 23, each of which extends in a

straight line from the cinder pocket through one of the fire tubes 8, to the fire box 24 (see Fig. 2). These pipes pass through the lower part of the passages 16, and, to protect them from the scouring action of the cinder-laden exhaust gases at these points, are covered with sleeves 23'. A straight pipe is provided from cinder pocket to fire box, without turns or curves, so that the scouring action of the cinders passing through it will be reduced to a minimum.

Figs. 2 and 3 show the rear end construction, including fire box 24, rear tube sheet 25, mud ring 26, fire arch 27, and crown sheet 28. The rear end of pipe 23 in fire tube 8 is shown in Fig. 2. Mounted in the fire box, between the tube sheet 25 and the arch 27, are the distributor plates 29, one opposite the end of each cinder-carrying pipe 23. The supports for these plates are tubular members 30, which may be cast integral with said plates or may be fastened thereto in any suitable manner. Slot-like channels 31 are formed in the plates 29, communicating with channels in the tubular supports 30. It will be noted that the supports 30 project through the outer boiler shell 1, and are open to the atmosphere. The cinder return mechanism and fire box or rear end construction are not specifically claimed herein, as claims directed thereto have been made part of the subject matter of application Serial No. 619,458, filed June 27th, 1932, which application is in part a continuation of this case.

In operation, the gases from the fire box pass through the fire tubes to the smoke box, thru the spaces to right and left of shell 12 below wing baffles 11, into passages 16, along and through the screen 19, through opening 14, into the inner draft chamber 13 and out through the stack. In traversing the passages 16, the gases and entrained cinders attain a high velocity. On reaching a point opposite the opening 14, the gases immediately and abruptly change direction, due to the suction created within the chamber 13 by the exhaust through the nozzle 10. The entrained cinders, on the other hand, are prevented by centrifugal force, momentum, and by the screen 19, from following the gases, and are separated therefrom, falling to the bottom of the smoke box and into the pockets 21.

The velocity of the gases in passages 16 may be varied by varying the effective cross-sectional area of said passages, and I provide the adjustable sections 17 in the front baffles 15 to accomplish this.

It will be understood that it may be advisable to vary the velocity of said gases to meet varying conditions of service, as, for example, as between freight and express service, or as between anthracite and lignite-burning locomotives.

When the locomotive is working, the cinders in pockets 21 are blown by steam jets (supplied with steam preferably from the dry pipe 6) from the nozzles 22, into and through pipes 23 back to the fire box 24. Here they are discharged upon the distributor plates 29, from which they fly off into the flame. The channels 31 serve a double purpose; first, that of cooling the plates, second, that of supplying a certain amount of additional air to assist in burning the combustible elements of the cinders. Since distributor plates are located forward of the arch, and the discharged cinders strike them at an angle and are deflected upwardly against the direction of flow of the burning gases, any trouble that might be caused from the cinders being blown directly back below the arch and through the fire door if it should be open, is avoided.

It will be seen that the novel form and location of the screen 19 co-operate to minimize the danger of its being clogged by cinders, for centrifugal force will operate to drive most of the cinders against the baffle walls 15, and such cinders as do contact with the screen will be carried along instead of directly against it and will be prevented from lodging in the interstices by the vertical position of the screen and by the scouring action of the gases. Although the screen may be omitted entirely under some conditions, its use is particularly advantageous in territories where low-grade fuels, such as lignite, are burned.

From the foregoing it will be seen that I have provided apparatus which is simple, rugged, easily maintained and unlikely to get out of order, and that by this apparatus I am able completely to separate cinders and other foreign solids from the exhaust gases without impairing the effectiveness of the exhaust. It will also be noted that provision is made for adjusting the apparatus to meet varying conditions of service, and that the separated cinders are automatically and positively discharged into the fire box, in such a way moreover as to prevent them from being blown back through the fire door under any circumstances.

I claim:—

1. In a locomotive, cinder separating apparatus including a smoke box and a stack having a portion extended downwardly into said smoke box, an exhaust nozzle located adjacent the bottom of the smoke box and positioned in substantially axial alignment with the stack, partition means around the extended portion of the stack and said nozzle and spaced peripherally therefrom in a location to shield the same against direct forcible impingement of the products of combustion entering the smoke box, said partition means being apertured in front of said extended portion of the stack, baffle means exterior of the partition means providing a passage for the products of combustion exterior of said partition means and in peripheral relation to the nozzle and to said extended portion of the stack and communicating with said aperture, and means for varying the effective capacity of said passage.

2. In a locomotive, cinder separating means including a smoke box and a stack having a portion extended downwardly into said smoke box, partition means around the extended portion of the stack and spaced peripherally therefrom in a position to block direct flow of the products of combustion from the rear portion of the smoke box to the stack but apertured in front of the stack, baffle means exterior of said partition means providing a passage for the products of combustion exterior of said partition means and in peripheral relation to said extended portion of the stack, and means forming a part of said baffle means to vary the effective capacity of said passage.

3. In a locomotive, cinder separating means including a smoke box and a stack having a portion extended downwardly into said smoke box, partition means around the extended portion of the stack, and spaced peripherally therefrom in a position to block direct flow of the products of combustion from the rear portion of the smoke box to the stack but apertured in front of the stack, baffle means exterior of said partition means providing a passage for the products of combustion exterior of said partition means and in peripheral relation to said extended portion

of the stack, and adjustable vanes for varying the effective capacity of said passage.

4. In a locomotive, cinder separating apparatus including a smoke box and a stack having a portion extended downwardly into said smoke box, an exhaust nozzle located adjacent the bottom of the smoke box and positioned in substantially axial alignment with the stack, partition means around the extended portion of the stack and the nozzle and spaced peripherally therefrom in a position to shield the same against forcible impingement of the products of combustion entering the smoke box, said partition means being apertured in front of said extended portion of the stack, baffle means exterior of the said partition means providing a passage for the products of combustion exterior of said partition means and in peripheral relation to the nozzle and to said extended portion of the stack and communicating with said aperture, and means for varying the contour of said passage.

5. In a locomotive having a smoke box and stack extending thereinto, partition means in the smoke box around the stack positioned to block direct flow of products of combustion from the rear of the smoke box to the stack, said partition means having an opening in an upper part thereof, forward of said stack and above the level of the bottom of the same, and a screen across said opening.

6. In a locomotive having a smoke box and stack extending thereinto, partition means in the smoke box around the stack positioned to block direct flow of products of combustion from the rear of the smoke box to the stack, said partition means having an opening in an upper part thereof, forward of said stack and above the level of the bottom of the same, and a wedge shaped screen member mounted on said partition means and surrounding said opening.

7. In a locomotive having a smoke box and stack extending thereinto, cinder separating means including partition means in the smoke box and around said stack but spaced from the latter and positioned to block direct flow of products of combustion from the rear of the smoke box into the same, said partition means having an opening therethrough forward of said stack, a screen across said opening, baffle means surrounding said partition means and peripherally spaced therefrom, and adjustable means for varying the gas flow area of the space between the partition and baffle means.

8. In a locomotive, cinder separating means including a smoke box, a smoke stack having an extension into the smoke box, generally upright partition means located in the smoke box around said stack extension and spaced peripherally from said extension, said partition means having curved walls at each side of the stack extension which define passageways open at one end to receive products of combustion, the passageways being in peripheral relationship to said stack extension and being in communication with the stack at the other end, and means for varying the cross-sectional flow area of said passageways.

9. In a locomotive having a smoke box and stack extending thereinto and flues delivering thereto, means in the smoke box forming a draft

chamber surrounding said stack, cinder collecting means also in the smoke box outside of said chamber, means forming an elongated exhaust gas passageway interposed between the zone of said flue delivery and the zone of said collecting means, the passageway being curved around said chamber and having a communication therewith in an upper part thereof and further communicating with said cinder collecting means, and a screen in the communication between the passageway and the draft chamber.

10. In a locomotive, a smoke box, a smoke stack communicating therewith, an exhauster positioned to induce a draft through said stack, a fire box, flues connecting the fire box and smoke box, means including curved walls in the smoke box positioned to form curved passageways around the stack and open at one end to receive the products of combustion entering the smoke box, an outer wall of the passageways being apertured to provide for centrifugal projection of solid products of combustion there-through, an inner wall of the passageways being apertured to provide for gas-flow from said passageway to the stack, means for admitting air to the fire box under the induced action of the draft, and pivoted baffle means in the smoke box for varying the flow area of said passageways whereby the induced draft action on the air admission means and the centrifugal separating action on the solids are conjointly varied.

11. In a locomotive having a smoke box and stack extending thereinto, partition means in the smoke box around the stack positioned to block direct flow of products of combustion from the rear of the smoke box to the stack, said partition means having an opening in an upper part thereof in front of the stack to admit smoke and gases to the stack, laterally spaced-apart baffle walls adjacent said partition means located peripherally outward therefrom in positions to form therewith restrictive passageways for the products of combustion, there being a gap between the baffle walls at their forward ends providing an exit for the forward expulsion of the cinders under the influence of the velocity imparted to them during their traverse through the passageways, and screening lying substantially edgewise to the flow of the products of combustion as they pass between said baffle walls and the partition means, said screening being positioned to enclose the opening in the front of the partition means.

12. In a locomotive having forwardly extending flues, a smoke box, a stack with an inlet communicating therewith and a draft creating nozzle, means for centrifugal separation of cinders from flue gases, comprising wall-like partitioning in the smoke box positioned to form a forwardly extending open-ended channel for gases and cinders, part of said partitioning having an aperture therein forward of the stack, through which aperture gases are drawn abruptly rearwardly by the draft, whereby cinders are projected forwardly out of the open-ended channel, and screen means surrounding the said aperture and lying in a plane roughly parallel to the path of the cinders through the outlet end of said channel.

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