Jan. 11, 1938. LE ROY THOMPSON 2,104,958

SMOKE BOX STRUCTURE

Filed Feb. 10, 1937 3 Sheets-Sheet 1

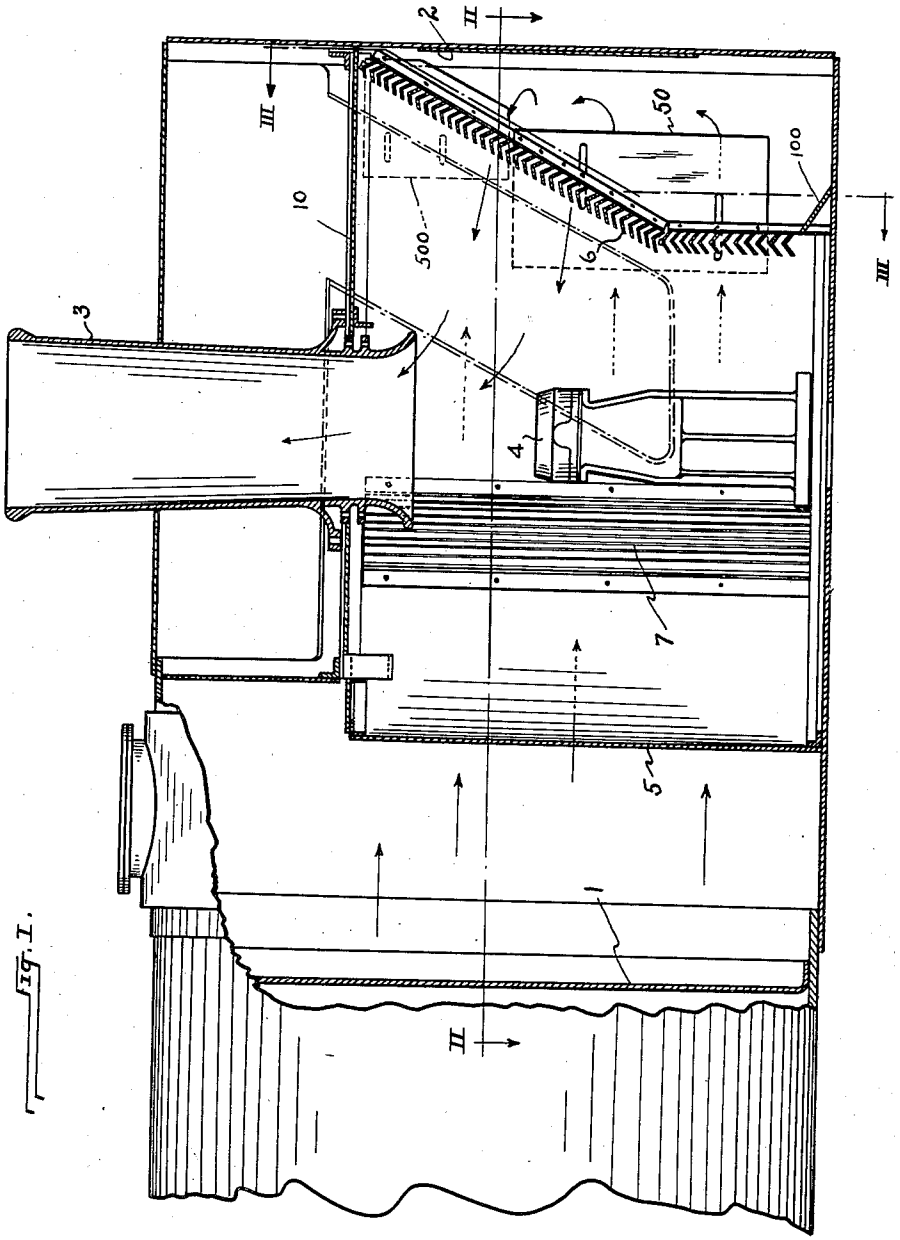


Fig. 1.

INVENTOR
Le Roy Thompson
BY
Christy and Wharton
ATTORNEYS

Jan. 11, 1938. LE ROY THOMPSON 2,104,958

SMOKE BOX STRUCTURE

Filed Feb. 10, 1937 3 Sheets-Sheet 2

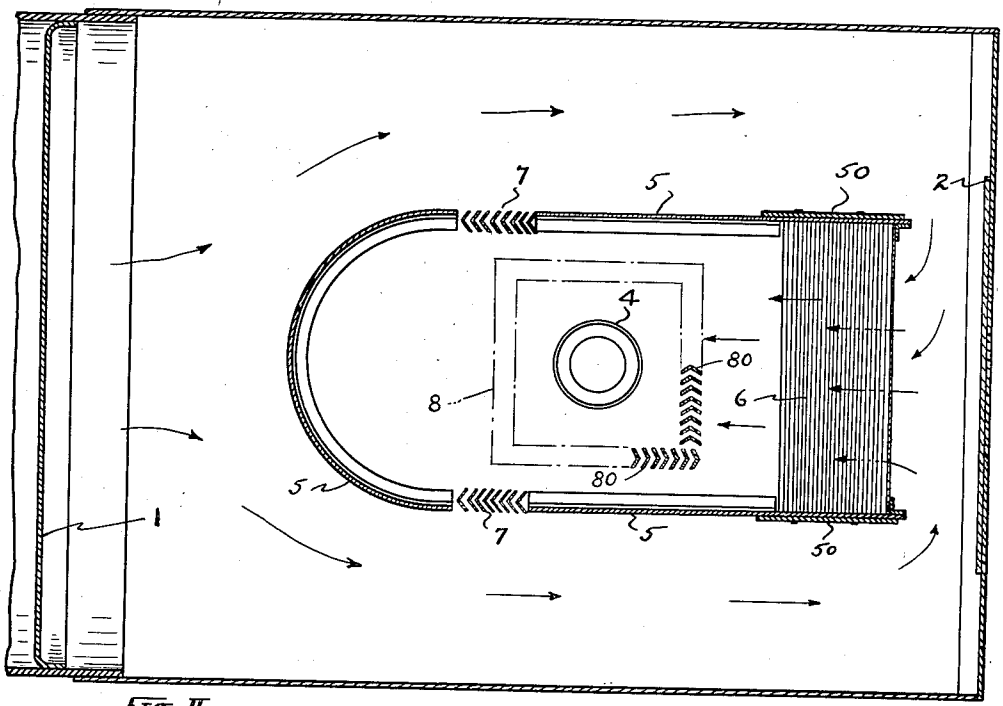


Fig. II.

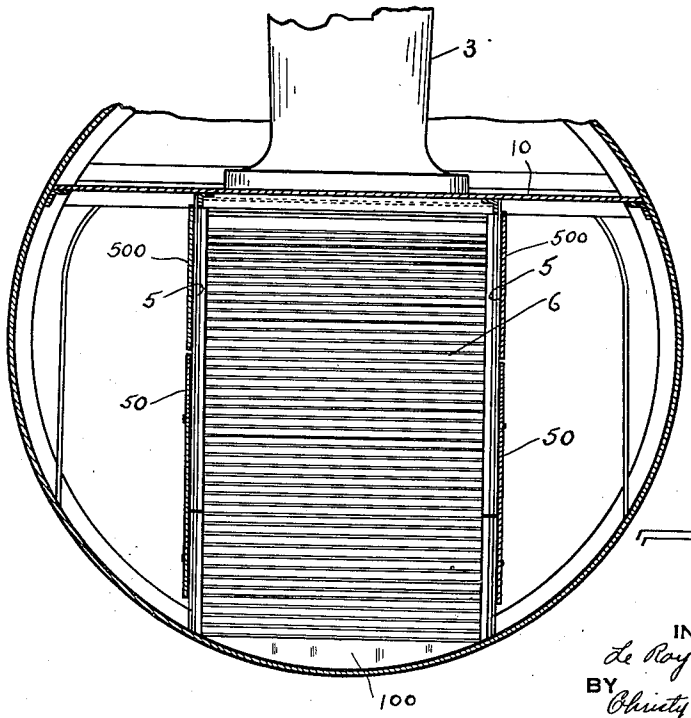


Fig. III.

INVENTOR
Le Roy Thompson
BY Christy and Wharton
ATTORNEYS

Jan. 11, 1938. LE ROY THOMPSON 2,104,958

SMOKE BOX STRUCTURE

Filed Feb. 10, 1937 3 Sheets-Sheet 3

Fig. IV.

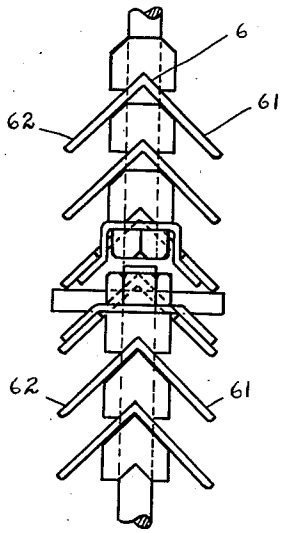
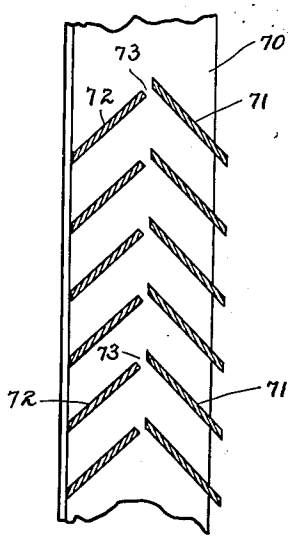


Fig. V.



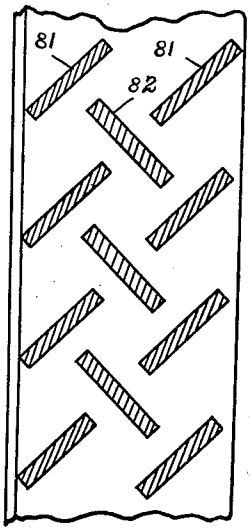


Fig. VI.

INVENTOR
Le Roy Thompson
BY
Christy and Wharton.
ATTORNEYS

Patented Jan. 11, 1938 2,104,958

UNITED STATES PATENT OFFICE

2,104,958

SMOKE BOX STRUCTURE

Le Roy Thompson, Blakely, Ga.

Application February 10, 1937, Serial No. 125,030

3 Claims. (Cl. 230—97)

This invention relates to locomotive structure, and particularly to the structure of the smoke-box that is arranged, as ordinarily is the case, in the forward end of the locomotive. The object in view is the elimination of incandescent cinders from the discharge of the smoke-stack, and the consequent removal of fire hazard without in any way impairing the efficiency of the locomotive.

An embodiment of the invention is illustrated in the accompanying drawings. Fig. I is a view, partly in section and partly in side elevation, of the forward portion of a locomotive, showing in entirety the smoke-box; Fig. II is a horizontal section, on the plane indicated by the line II—II, Fig. I; Fig. III is a vertical section on the line III—III, Fig. I; Fig. IV is a fragmentary view to larger scale, showing in elevation a louvre plate assembly; and Figs. V and VI are views in vertical section, illustrating modifications in the louvre-plate structure.

The smoke-box is essentially a cylindrical, horizontally extending continuation of the boiler wall. The boiler flues open to the smoke-box from the rear of the smoke-box forwardly. The smoke-box extends (Fig. I) from a rear plate 1, to the left of which the boiler lies and through which the boiler flues extend, to a front wall 2. A smoke-stack 3 and an injection nozzle 4 are arranged in vertical alignment in the top and bottom of the smoke-box, and at an interval rearward from the forward end of the smoke-box. A bifurcated, vertically extending partition 5 (cf. Fig. II) extends from the rear and on opposite sides of the aligned steam-nozzle and smoke-stack, toward the forward end of the smoke-box, and terminates at an interval from the forward wall of the smoke-box. This partition extends between the bottom of the smoke-box and a properly disposed upper plate and forms with the side walls of the smoke-box a passageway for the stream of the products of combustion forward from the rear end of the smoke-box in bifurcated course adjacent the side walls of the smoke-box to the forward edges of the said partition. At the forward ends of the partition, the passageway is continued, its branches merged in a central united passageway that extends rearward again between the two branches of the partition wall 5 to the ejector that is constituted by the nozzle 4 and the smoke-stack 3. A jet of spent steam under pressure, delivered from nozzle 4 axially upward through the smoke-stack, sweeps the stream of the products of combustion out through the smoke-stack, and is cooperative in establishing draft conditions from fire-box to smoke-stack. Such a general arrangement will be found illustrated in Letters Patent of the United States No. 1,683,455, granted to Guy T. Foster on September 4, 1928; and in Letters Patent of the United States No. 1,331,845, granted to the said Foster on February 24, 1920, will be found a partition plate more closely approximating the partition plate 5 of the drawings of this application, although in the patent last named a feed-water heater is arranged in the smoke-box, and with a feed-water heater this invention is not now directly concerned.

A bank of horizontal louvre plates 6 is arranged athwart the passageway beneath plate 10, immediately to rearward of the forward edges of the bifurcated plate 5, and between the two bifurcations, so that it is the united stream flowing from front toward the rear that passes through the bank of louvre plates. And the interval between the curved bottom wall of the smoke-box and the bottom of the bank of louvre plates is closed by a segmental plate 100. The louvre plates are formed as shown. Each plate individually is formed of a section of angle-iron arranged angle upward and with the two flanges 61 and 62 spreading downwardly and outwardly; and the assembly is such as is shown in Fig. IV; so that, in vertical succession, the forward, downwardly extending flange 61 of each superior louvre plate overlaps the upper edge of the corresponding flange of the next lower louvre plate. In consequence, the stream of products of combustion does not find at any point a straight-away course through the bank of louvre plates, but must on every line of flow be directed against a louvre-plate face. Furthermore, the downward and forward flange of each louvre plate cooperates with the downward and rearward extending flange of the next superior louvre plate, in that the portion of the stream that may be deflected upward by the upper face of the forward flange of the lower louvre plate will be directed against the nether surface of the rearward flange of the superior louvre plate. The bank of louvre plates is preferably arranged in the oblique position shown in Fig. I, to the end that it shall stand in approximately perpendicular position with respect to stream flow, considering the facts that the passageway around the front of the bifurcated partition is of diminishing width upwardly, and that the sweep of the stream (subject to the ejector action through the smoke-stack) is obliquely upward in this portion of the line of flow. Near the bottom, however, accommodation is made for a more nearly horizontal rearward flow there, by disposing that portion of the bank of louvre plates

in vertical position, and forming in the bank a bend not far above the bottom of the passageway. This is clearly illustrated in Fig. I, and requires no further description. Even though there be a dislocation of the individual louvre plates at the point where the bend is effected, the dislocation will not be such as to disturb the general arrangement and cooperation that have been described.

The proportions of the passageway thus formed for the flow of the products of combustion is such that a constriction is formed at a point where the branches of the stream turn around the forward edges of the bifurcated plate **5**, and unite to flow rearwardly through the bank of louvre plates. I give actual figures of a specific illustration: The net area of the passageway from the boiler flues to the smoke-box is 1292 square inches; the net cross-sectional area of the bifurcated passageway from the rear to the front of the smoke-box is 1268 square inches; the net area of the two passageways taken together through which the branches of the bifurcated stream advance to reunion around the forward ends of the bifurcated partition is 819 square inches; and the net cross-sectional area of the openings through the louvre plate is 1145 square inches. It will be understood that the ejector effect of the steam nozzle cooperating with the smoke-stack is to exert suction, and to cause the stream to flow in the course described from the boiler flues to the smoke-stack. And it will be understood that contraction in the cross-sectional area of the passageway means acceleration in rate of flow. In the organization described, the bank of louvre plates stands immediately beyond, that is to say, in advance of (so far as concerns stream flow), the contraction in the passageway.

The problem is the elimination of incandescent cinders. The stream of the products of combustion carries with it from the fire-box cinders that are incandescent, and that, but for preventive measures, may sweep through boiler flue, smoke-box, and stack, and be thrown out and become a fire hazard to inflammable material adjacent the roadway. Considering the stream of products of combustion as it swirls around the forward edges of the bifurcated partition within the smoke-box, it will be perceived that it is caused to flow at definitely accelerated speed, and then immediately meets the louvre plates. Under such conditions a maximum momentum has been imparted to the cinders themselves that are small, solid lumps of carbon in incandescent condition; that relatively high momentum thus imparted to these cinders will not have spent itself, but will cause the cinders to be projected with substantially undiminished momentum against the surfaces of the louvre plates; and the fact that the cross-sectional area of the passageway is at this point somewhat increased has the advantageous effect of diminishing the pull of stream-flow upon the particles of carbon. Thus, maximum impact is effected. Impact has effect in the crushing of the cinders—the breaking of them up into small particles—and these small particles caught up by the stream that still flows at high speed are swept on through the passageway and out of the smoke-stack. However, in consequence of impact and crushing, the heat dissipation to which the incandescent carbon particles is subject is greatly increased, with the consequence and effect that the condition of incandescence rapidly passes away; and these same particles, when at length they emerge from the smoke-stack, are no longer incandescent; and both because of their heat dissipation and relative smallness they are rendered innocuous—they no longer constitute a fire hazard. It is not necessary to repeat, but it suffices to note, that the louvre plates with their double flanges cooperate more effectively to accomplish such breaking up of the cinder particles because they present double surfaces of impact; and it is practically impossible for any cinder of dangerous mass to pass entirely through the bank of louvre plates without fracturing impingement upon the upper surface of a forward flange or a nether surface of a rearward flange—forward and rearward here being used with respect to the locomotive structure itself, and not with respect to the stream flow, for with respect to stream flow the terms forward and rearward must be used in inverse sense, and have already so been used in this specification.

It remains only to say that the effective area of the divided passageway around the forward edges of the bifurcated plate **5** may be varied by providing at that point adjustable plates **50**. These plates are separate from the plate **5** itself. They are provided with elongate slots, and through those elongate slots they are bolted to the plate **5**, as is clearly shown in Fig. I, being adjusted to the required position determinative of the effective area of the passageway and then secured by the bolts.

I have given actual dimensions of an actual installation; these are exemplary merely, and by no means limiting. The only limitation is the relative one: that the passageway shall be of minimum cross-sectional area at the turn of the stream, and that, in the direction of stream flow, the bank of louvre plates shall be situated immediately forward from that point of minimum cross-sectional area.

It may be that in particular installations the proportions will be such as to create a too intense rate of stream flow, and in such case openings may be made in the partition **5**, and these openings may be protected by banks of louvre plates, as indicated at **7**. Through these openings it will be perceived that a portion of the stream flow may be shunted along more direct course to the smoke-stack, and in this case also the louvre plates will serve, in the manner described, to break up cinders and eliminate fire hazard.

In further elaboration the injection nozzle **4** and lower end of smoke-stack **3** may be enclosed within a secondary louvre assembly. This secondary louvre assembly consists in rectangular cage **8**, as shown in Fig. II, formed of four banks of louvre plates **80** that extend vertically from the bottom wall of the smoke-box to the upper horizontal plate (the plate **10** of Fig. III) and arranged between the parallel walls of the bifurcated plate **5**. Thus, in particular cases additional provision may be made against the discharge of incandescent cinders.

Fig. V illustrates that the louvre assembly, instead of being formed of angle-irons, may be made up of plates **71** and **72**, secured at their opposite ends, say by welding, to supporting angle-irons **70**. The plates **71** and **72** are arranged in pairs, with the plates of each pair inclined substantially as the flanges **61** and **62** of the louvre plates **6** of Fig. IV are inclined. The top edges of the plates **71** and **72** of each pair need not meet, but the intervals **73** between such edges are sufficiently narrow to prevent large cinders from passing through, so that in practical effect the streaming products of combustion do not find at any point in the bank of louvres a

straightaway course of flow. Fig. VI illustrates still another arrangement of louvre plates. In this case too the louvre plates, 81 and 82, are so arranged that on every line of flow the streaming gases are directed against a louvre-plate face; and each subdivision of the stream, deflected by one plate, is directed against the face of a succeeding plate.

I claim as my invention:

1. In a locomotive structure, a smoke-box, a smoke-stack and an injection nozzle arranged in vertical alignment in the top and bottom of the smoke-box and spaced intermediately in the longitudinal extent of the smoke-box, partition walls within the smoke-box defining a passageway for products of combustion from the rear to the front end of the smoke-box and thence rearwardly again to the smoke-stack, such passageway being of reduced cross-sectional area at the point where it turns rearwardly, and a bank of horizontally extending cinder-crushing louvre plates arranged athwart the passageway immediately to rearward of such point of reduced cross-sectional area and beyond such point of reduced cross-sectional area, so far as concerns the direction of stream-flow, the lower edge of each superior louvre plate overlapping the upper edge of the next lower louvre plate, whereby cinders borne on the stream of products of combustion are caused when traveling at maximum speed to impinge upon the surfaces of the louvre plates and the broken particles are borne thence at diminished speed.

2. In a locomotive structure, a cylindrical, horizontally extending smoke-box structure, a smoke-stack and an injection nozzle arranged in vertical axial alignment in the top and bottom of the smoke-box and spaced rearwardly from the forward end of the smoke-box, a bifurcated, vertically extending partition arranged within the smoke-box and extending from the rear and on opposite sides of the axis of steam-nozzle and smoke-stack alignment in bifurcated form toward the forward end of the smoke-box and terminating short of the forward wall of the smoke-box, and affording passageway for the stream of products of combustion forwardly from the rear in bifurcated course adjacent the side walls of the smoke-box to the forward end of said partition and then rearwardly in united course at the centre of the smoke-box toward the axis of steam-nozzle and smoke-stack alignment, and a bank of cinder-crushing louvre plates arranged athwart the passageway for the united and rearwardly flowing stream immediately within the forward edges of the bifurcated partition, the lower edge of each superior louvre plate overlapping the upper edge of the next lower louvre plate, the cross-sectional area of the passageway through the smoke-box being of minimum size between the forward edges of the bifurcated partition and the front wall of the smoke-box and of increasing size from such point rearwardly toward the smoke-stack, whereby under the suction created in the smoke-stack cinders carried by the stream of products of combustion make impact under maximum momentum upon the louvre plates.

3. The structure of claim 1, the said partition being vertical in its extent and of bifurcated form and being additionally provided intermediate the extent of its bifurcations with openings, affording by-passes from the rear end of the smoke-box to the smoke-stack, and a bank of louvre plates set in each such opening.

LE ROY THOMPSON.