Sept. 6, 1932. M. F. BROWN 1,875,846

SPARK ARRESTER FOR LOCOMOTIVES

Filed May 21, 1930 2 Sheets-Sheet 1

FIG. 1

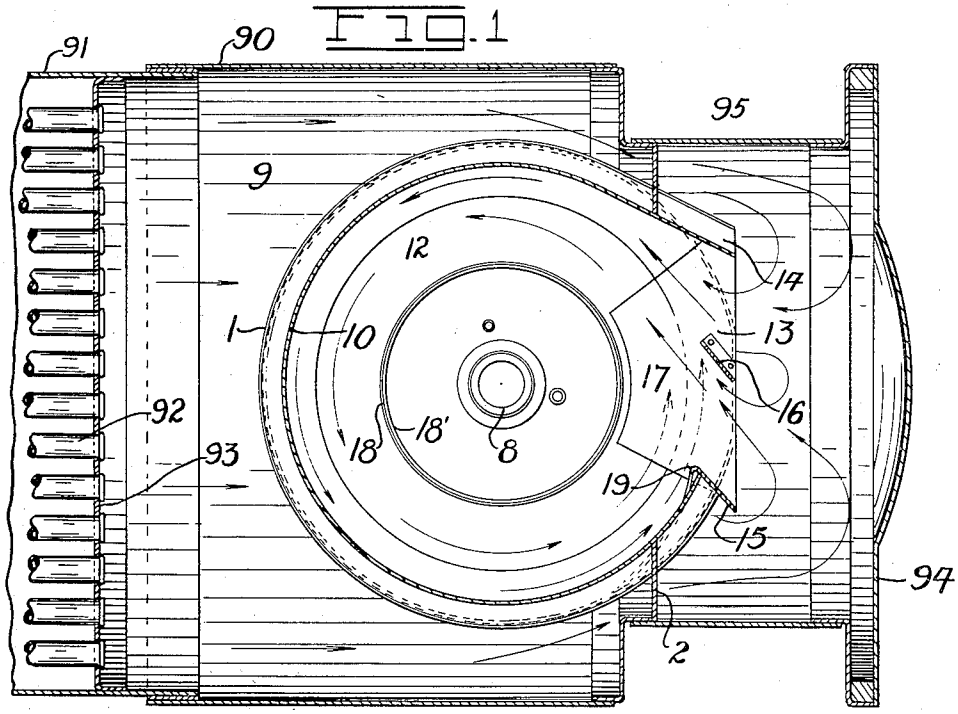
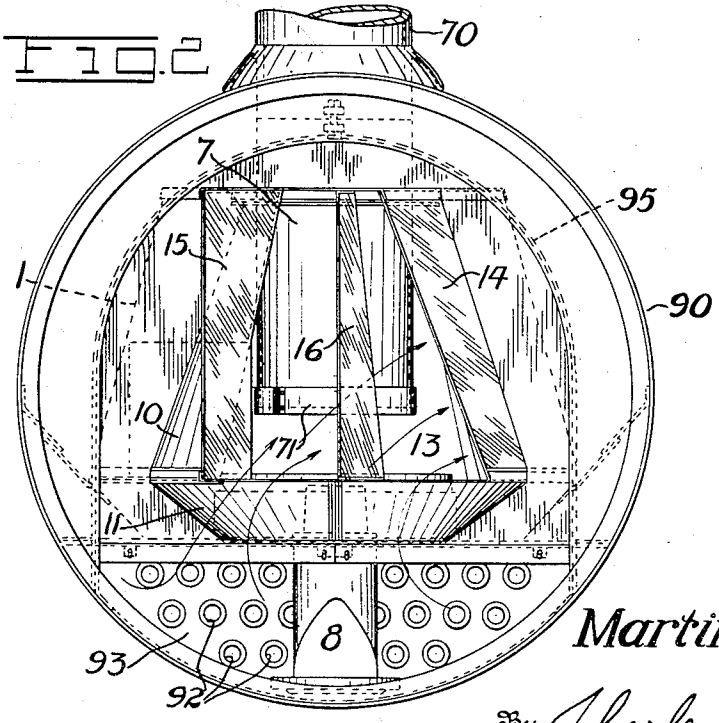


FIG. 2



Inventor
Martin F. Brown
By Charles L. Reynolds
Attorney

Sept. 6, 1932. M. F. BROWN 1,875,846

SPARK ARRESTER FOR LOCOMOTIVES

Filed May 21, 1930 2 Sheets-Sheet 2

FIG. 3

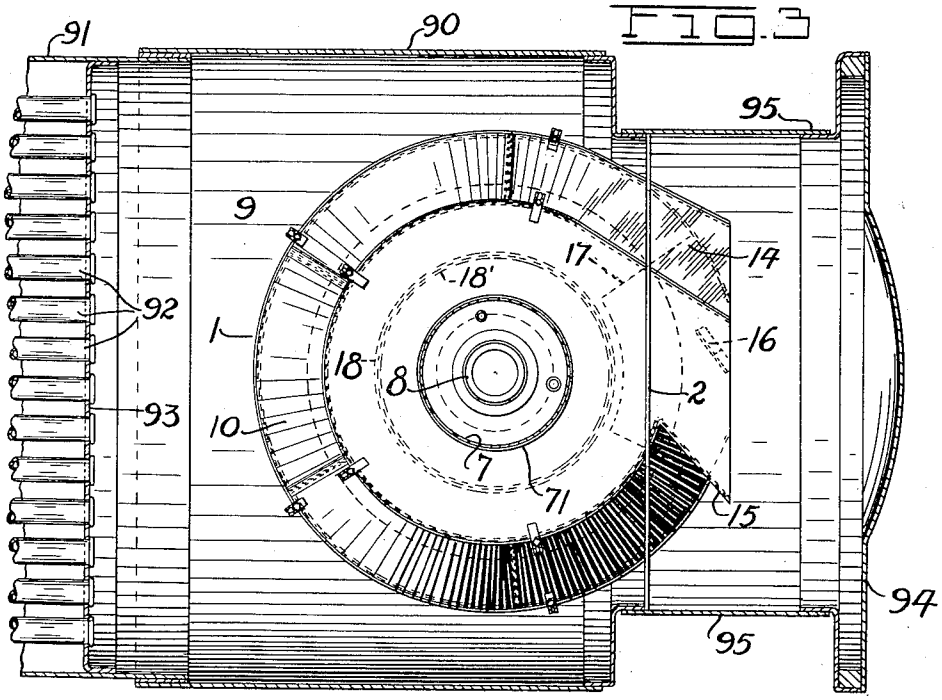
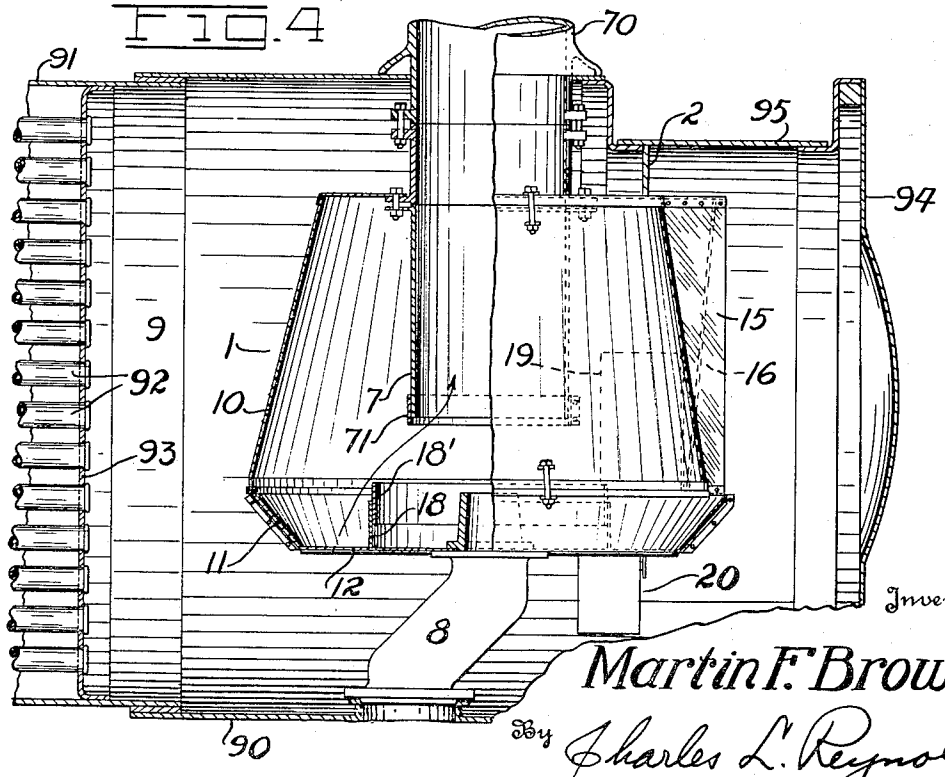


FIG. 4



Inventor

Martin F. Brown

By Charles L. Reynolds

Attorney

Patented Sept. 6, 1932 1,875,846

UNITED STATES PATENT OFFICE

MARTIN F. BROWN, OF ST. PAUL, MINNESOTA

SPARK ARRESTER FOR LOCOMOTIVES

Application filed May 21, 1930. Serial No. 454,339.

My invention relates to an improvement in what are generally termed spark arresters, for use on steam locomotives. I have found that glowing cinders, if properly handled and separated from the draft, may be quenched, and then may be permitted to be discharged from the stack, having been ground up in the separator into fine particles, which are usually completely extinguished, and which, if not extinguished, will not have the capacity to start a fire upon their being discharged.

It is the object of my present invention, then, to provide a spark arrester or separator which will automatically cause the sparks to be first separated from the draft, to be held adjacent the zone of influence of the draft, then ground into fine particles and forced within the influence of the draft, and then discharged from the stack, thus automatically keeping the separator cleaned out, and obviating any possibility of failure due to inability or failure of the clean-out mechanism to discharge the cinders from the separator.

Another object is to provide means whereby a tangential movement of the draft and cinders within the separator is insured, and whereby reverse tangential movement is prevented.

Another object is to provide means whereby the area of the draft opening beneath the lower end of the stack extension may be adjusted, and whereby its height with respect to the bottom of the separator chamber may be varied.

A further object is to insure the separation of the cinders being whirled around within the separator from the fresh gases entering the separator.

Other objects, and especially such as relate more particularly to mechanical details and arrangements, may be discovered from a study of the attached drawings, wherein my invention is embodied in a preferred form, of this specification, and of the claims which terminate the same, wherein are defined those points of novelty which are embodied in the present invention.

Figure 1 is a section on a horizontal plane through a locomotive smoke box and my separator installed therein, taken at about the axis of the boiler.

Figure 2 is a front elevation of the smoke box and my separator in a typical installation, the front end being removed.

Figure 3 is a plan view of my device, the smoke box being shown in section.

Figure 4 is a part elevation and part axial section through the separator, the smoke box being shown in section.

The design of the boiler and smoke box, with accessory parts, is largely immaterial, and I have therefore shown the same in association with a typical installation, wherein the smoke box 9 is defined by a cylindrical plate 90 secured to the front end of the boiler 91, the tubes 92, received in the tube plate 93, admitting the products of combustion into the smoke box 9, the front end of which is closed by a plate 94. In the particular smoke box illustrated, the plate 90 is reduced at the top and both sides, as indicated by the saddle 95, and in this particular installation, a feed-water heater (not shown) is seated in this saddle. This arrangement, of course, has no essential connection with my separator, but illustrates how a separator of sufficient capacity may be incorporated in a smoke box thus restricted in available volume.

Discharging within the smoke box 9 is an exhaust nozzle 8, and axially aligned therewith is a downward extension 7 forming, in effect, part of the smoke discharge stack 70; for a purpose which will appear hereafter, a sleeve 71 is secured upon the lower end of the extension 7, and is adjustable vertically thereon.

Surrounding the extension 7 and the end

of the nozzle 8, and enclosing both, is a separator, generally designated by the numeral 1, and consisting of a frusto-conical upper portion 10, and a similar inverted frusto-conical lower portion 11. The upper portion is relatively high and the lower portion shallow, and differs from ordinary separators in that it is formed with a shallow or flat bottom 12. The slope of the wall of the lower portion 11 is quite pronounced, and at the joint between the upper and lower portions of the separator 1 there is a line of greatest diameter, spaced somewhat above the bottom wall 12 and at about the upper end of the nozzle 8, but below the lower end of the stack extension 7.

At its forward end the separator is provided with an inlet opening 13; I prefer that this inlet be located wholly in the upper portion 10. To assist in defining this opening, and in starting the draft thereinto in a tangential direction, I prefer that the walls leading to and defining the inlet 13 may be extended outwardly, as is indicated at 14 and 15, to provide a tangential inlet conduit. To prevent the draft from starting in the opposite direction, and to deflect all drafts in the proper direction, I may provide a baffle or baffles 16 between the two sides 14 and 15, this baffle being placed edgewise to the proper direction of the draft, so as to impede it the least, yet to prevent any cross or counter draft. I may also provide an apron 17 extending inwardly from the outer end of the inlet conduit 13 towards the center of the separator 1, and over the lower portion thereof at the inlet.

Between the end of the nozzle 8 and the sidewall 11, and projecting upwardly from the bottom 12 of the lower portion is a two-part collar 18 and 18′. The portion 18′ is adjustable relative to the portion 18 to vary the combined height thereof, and to cooperate with the collar 71 previously mentioned, in varying the height and area of the space between, through which the draft passes to reach the stack 70.

Since the extension wall 15, at the leading side of the inlet opening 13, is necessarily short, I prefer that an extension 19 of somewhat greater curvature than the side wall 10 of the separator be provided at the junction of this baffle 15 with the side wall, this portion 19 serving to deflect the gases slightly inwardly from the inlet opening, to prevent their passing out therefrom, and to provide an eddy or suction which assists in drawing the gases into the inlet opening 13 at this point.

The separator is supported in any suitable way, as from the stack extension 7, for instance. The smoke box 9 is divided into two portions by a transverse vertical partition 2, which extends from side to side of the smoke box and from the top down to and including the separator 1, but preferably not materially therebeneath. There is thus left a draft opening 20 beneath the lower edge of the partition 2, through which the draft must pass to reach the forwardly directed inlet opening 13 of the separator. This partition 2 may assist in supporting the separator, as may also the exhaust nozzle 8.

The draft from the flues 92, with the entrained cinders and glowing coals, passes into the smoke box 9 and thence through the opening 20 beneath and around the separator 1, until it reaches the front end of the smoke box and is deflected to enter the inlet 13 of the separator. Entering the separator, it is given a definite tangential direction by the inlet conduit consisting of the walls 14 and 15, and by the baffle 16. Being at high velocity, it throws the entrained cinders, coals and other particles, with considerable force against the walls of the separator and against each other. They whirl around rapidly within the separator chamber, the heavier particles moving to the outside, and seeking the line of greatest diameter. They are rapidly ground into small particles by this abrasive action, and slip down over the inclined side 11 and the shallow bottom 12, being assisted in this movement by gravity and by the pressure of fresh masses of larger particles, until they finally come within the zone of influence of the draft, which passes between the collars 71 and 18′ and up the stack extension 7. The larger particles, being farther out from the opening than the smaller ground-up particles, and being of greater mass, are not within the influence of this draft, and consequently, are not expelled through the stack, but the smaller particles, moving inwardly toward the center of the separator over the shallow bottom, come within the zone of influence of the draft, and are removed continuously and automatically through the stack.

By this time, however, the coals have been largely extinguished, partly by reason of the abrasive action and partly by reason of the time they have been in the separator, and have been partially consumed. They are largely dead when they pass out of the stack, so that they can cause no harm, but if occasionally a live spark passes out at the top of the stack, it is of such small mass that it will either be extinguished before it strikes the ground or will be of such slight mass and low temperature that it will not have the capacity to start fires, even in extremely dry weather and under most favorable conditions.

By regulation of the distances between the collars 71 and 18′, and by regulation of the height of this draft opening between them above the bottom 12, the zone of influence of the draft through this opening may be controlled and varied, and in this way the de-

gree of extinguishment of sparks and the size of the particles to be expelled may, to a certain extent, be controlled.

What I claim as my invention is:—

1. 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 separator casing surrounding the associated ends of said stack extension and nozzle, and 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.

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 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 the 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 a deflector disposed in said inlet opening for assisting in directing said incoming products of combustion toward said side of the casing.

3. 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 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 the 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 supported from the casing for determining the spacing between said nozzle and stack extension and the axial length of the effective zone of draft with respect to said inlet.

4. In combination with a stack extension and an associated nozzle aligned therewith but spaced below the same for discharging a draft inducing column up the stack extension, a separator casing surrounding said stack extension and nozzle, said casing having a diameter greater than the said stack extension so that it is spaced therefrom, and means providing an inlet opening for said casing arranged tangentially with respect to the axis of the stack extension and having its bottom end extending into a plane below that of said stack extension for directing the incoming products of combustion toward one side of the casing in a path passing outside said draft inducing column.

5. In combination with a smoke box shell, a smoke stack extension and an associated nozzle arranged in said shell for discharging a draft inducing column up the stack extension, a separator casing in said shell and surrounding portions of said extension and nozzle disposed within the shell, means providing an inlet opening at the front of the casing with its bottom end extending into a plane below that of said stack extension for directing the incoming products of combustion toward one side of said casing in a path passing outside the draft inducing column discharged by the nozzle, and a baffle disposed between said shell and casing to the rear of said inlet opening, said baffle terminating short of the bottom of the shell.

6. 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 separator casing surrounding the associated ends of said stack extension and nozzle, and which casing comprises top and bottom oppositely disposed truncated casing parts connected together at their ends of greatest diameter, and means associated with the top truncated casing part and extending the full axial length of said casing part for directing the incoming products of combustion toward one side of the casing in a path outside the draft inducing column discharged by the nozzle, the bottom end of said inlet opening extending into a plane below that of the bottom of the stack extension.

7. 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 separator casing surrounding the associated ends of said stack extension and nozzle, and which casing comprises top and bottom oppositely disposed truncated casing parts connected together at their ends of greatest diameter, means associated with the top truncated casing part and extending substantially the full axial length thereof providing an inlet opening for said casing for directing the incoming products of combustion toward one side of the casing in a path outside the draft inducing column discharged by the nozzle, and means supported from the bottom truncated part of the casing for determining the axial length of the effective zone of draft caused by said column discharged by the nozzle.

8. In combination with the exhaust nozzle of a locomotive and a downward extension of the stack aligned therewith, a separator casing having a top portion with its walls disposed in the surface of a conical frustum, and a like bottom portion joined to the top portion along a line of greatest diameter near

the bottom wall of the separator, said separator enclosing the bottom end of the stack extension and the top of the exhaust nozzle and the gap therebetween, and said separator having a tangentially disposed side inlet, the walls of the upper and lower portions of the casing being continuous except for the inlet opening and a collar upstanding from the bottom wall of the separator, between its outer wall and the exhaust nozzle, to about the level of the line of greatest diameter, but spaced from the end of the stack extension.

9. In combination with the exhaust nozzle of a locomotive and a downward extension of the stack aligned therewith, a separator casing having a top portion with its walls disposed in the surface of a conical frustum, and a like bottom portion joined to the top portion along a line of greatest diameter near the bottom wall of the separator, said separator enclosing the bottom end of the stack extension and the top of the exhaust nozzle and the gap therebetween, and said separator having a tangentially disposed side inlet, the walls of the upper and lower portions of the casing being continuous except for the inlet opening, and a baffle between the sides of the inlet opening, and placed edgewise to the tangentially entering draft.

10. In combination with the exhaust nozzle of a locomotive and a downward extension of the stack aligned therewith, a separator casing having a top portion with its walls disposed in the surface of a conical frustum, and a like bottom portion joined to the top portion along a line of greatest diameter near the bottom wall of the separator, said separator enclosing the bottom end of the stack extension and the top of the exhaust nozzle and the gap therebetween, and said separator having a tangentially disposed side inlet, the walls of the upper and lower portions of the casing being continuous except for the inlet opening and external baffles defining a tangential inlet conduit leading to said side opening.

11. In combination with the exhaust nozzle of a locomotive and a downward extension of the stack aligned therewith, a separator casing having a top portion with its walls disposed in the surface of a conical frustum, and a like bottom portion joined to the top portion along a line of greatest diameter near the bottom wall of the separator, said separator enclosing the bottom end of the stack extension and the top of the exhaust nozzle and the gap therebetween, and said separator having a tangentially disposed side inlet, the walls of the upper and lower portions of the casing being continuous except for the inlet opening and external baffles defining a tangential inlet conduit leading to said side opening, and an internal baffle curved inwardly from the general curvature of the separator walls, from a point adjacent the leading edge of the inlet opening, to such opening.

12. In combination with the exhaust nozzle of a locomotive and a downward extension of the stack aligned therewith and spaced therefrom to leave a draft gap, a continuous casing surrounding the nozzle and stack extension and having a shallow bottom disposed sufficiently close to the gap mentioned to be within the zone of influence of draft therethrough, and said casing having an entrance opening only, means to initiate a whirling movement of gases within the casing, the gases and cinders, when the latter are small enough to be entrained in the draft up the stack, being discharged through the stack, and a circular collar spaced from and surrounding the nozzle, and extending upward from the bottom of the casing to a point within the zone of influence of the draft up the stack, the collar being of greater diameter than the stack extension, and terminating therebelow.

13. In combination with the exhaust nozzle of a locomotive and a downward extension of the stack aligned therewith and spaced therefrom to leave a draft gap, a continuous casing surrounding the nozzle and stack extension and having a shallow bottom disposed sufficiently close to the gap mentioned to be within the zone of influence of draft therethrough, and said casing having an entrance opening only, means to initiate a whirling movement of gases within the casing, the gases and cinders, when the latter are small enough to be entrained in the draft up the stack, being discharged through the stack, a circular collar spaced from and surrounding the nozzle, and extending upward from the bottom of the casing to a point within the zone of influence of the draft up the stack, the collar being of greater diameter than the stack extension, and terminating therebelow, and means for adjusting the height of the space therebetween relative to the separator bottom.

14. In combination with the exhaust nozzle of a locomotive and a downward extension of the stack aligned therewith and spaced therefrom to leave a draft gap, a substantially continuous casing surrounding the nozzle and stack extension and having a bottom portion disposed sufficiently close to the gap mentioned to be within the zone of influence of the draft therethrough, said casing having a relatively large entrance opening, means to initiate a whirling movement of the gases and cinders within the casing whereby the cinders are thrown out toward the casing wall for disintegration to such small size that they are entrained in the draft up the stack and discharged therethrough.

15. A spark arrester adapted for disposition within the smoke box of a locomotive and comprising a casing having a substan-

tially continuous wall of generally annular character disposed with its axis vertical and adapted to surround the gap between the lower end of the stack and the upper end of the exhaust nozzle, said casing being formed with inlet means disposed to initiate whirling of the gases and entrained cinders, said parts being formed and positioned to arrest the downward movement of the cinders at a point within the influence of the draft adjacent said gap whereby the cinders will be continuously discharged through the stack.

Signed at St. Paul, Ramsey County, Minnesota, this 19th day of May, 1930.

MARTIN F. BROWN.