Oct. 31, 1950 L. R. PYLE 2,528,287

LOCOMOTIVE FRONT END

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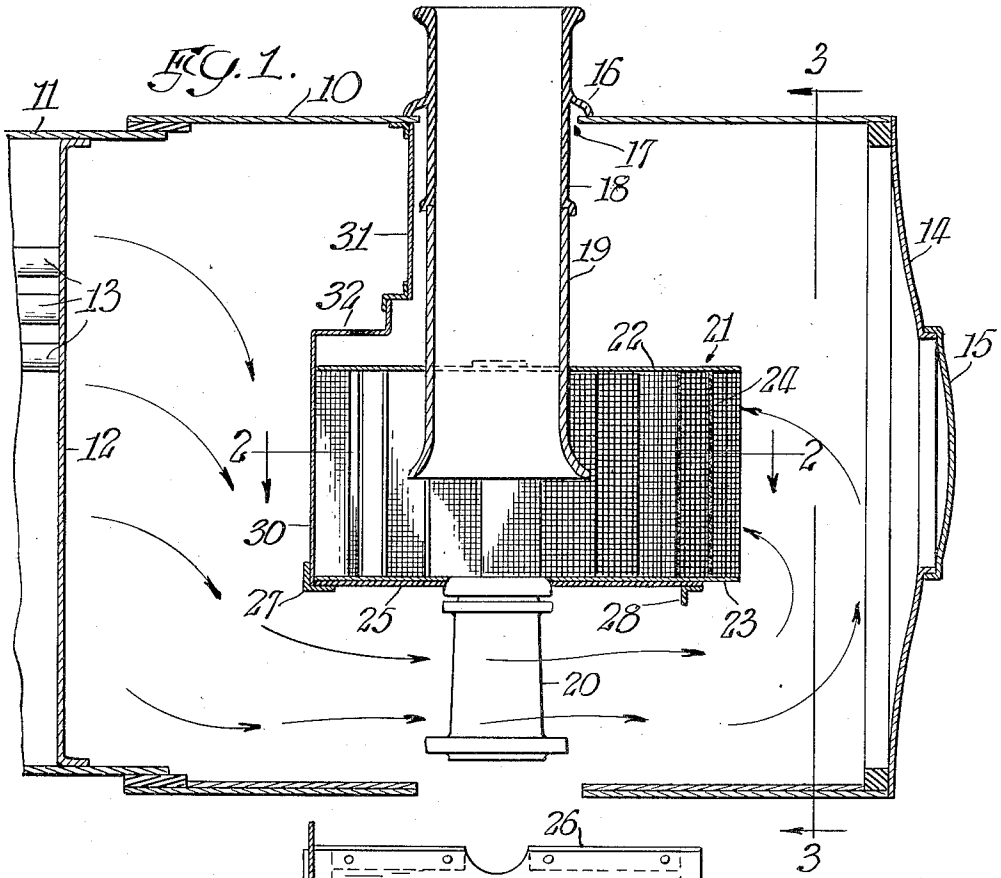
FIG. 1.



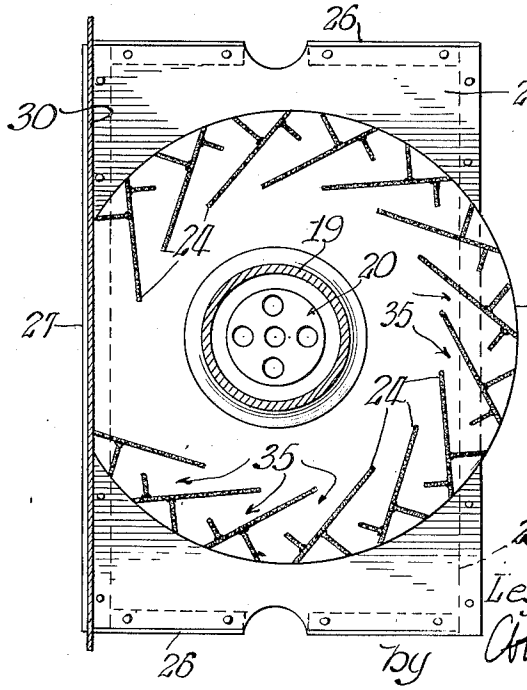


FIG. 2.

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FIG. 3.

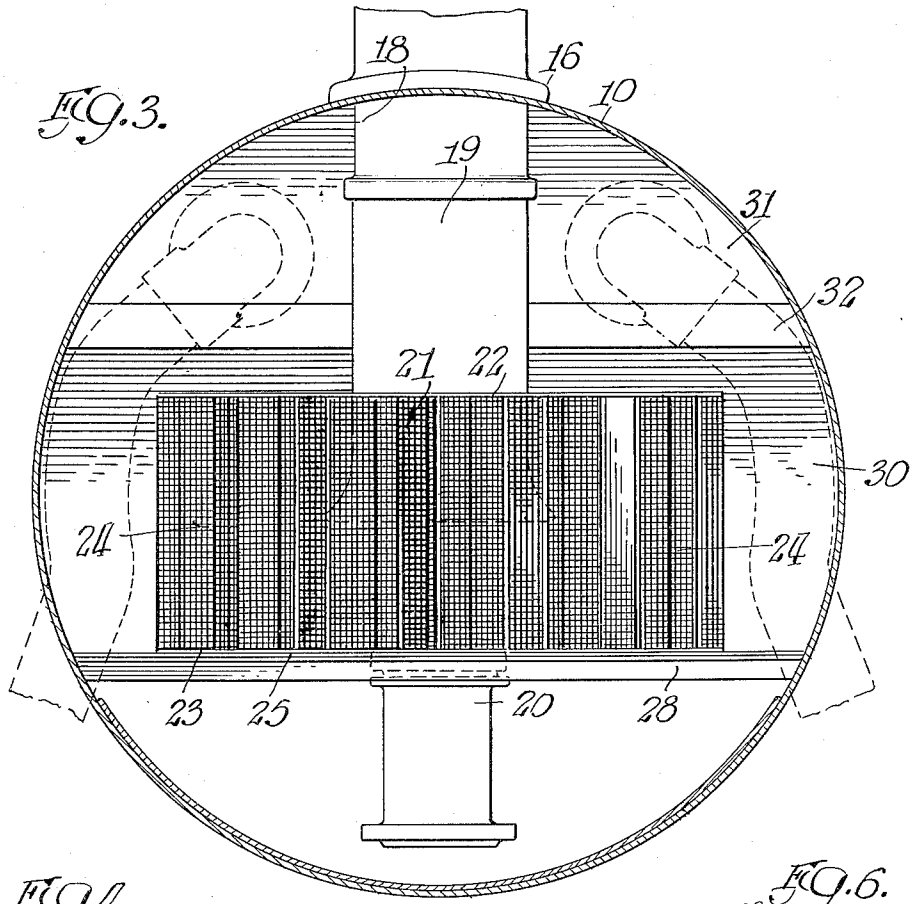


FIG. 4.

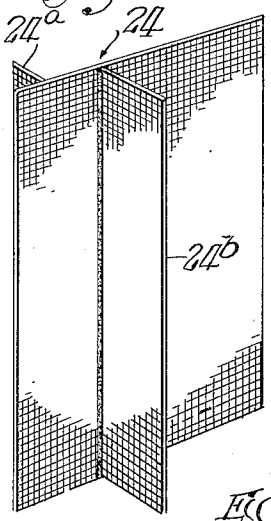


FIG. 5.

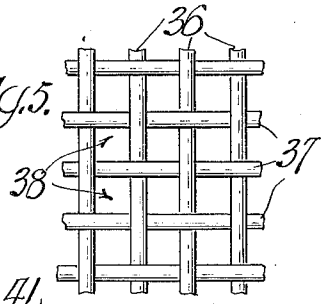


FIG. 6.

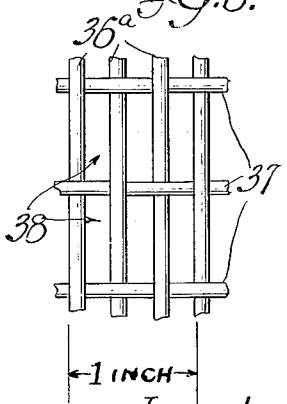
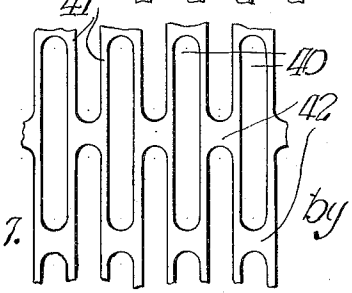


FIG. 7.



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UNITED STATES PATENT OFFICE

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LOCOMOTIVE FRONT END

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Application April 14, 1949, Serial No. 87,519

3 Claims. (Cl. 183—90)

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This invention relates to improvements in locomotive front ends and it consists of the matters hereinafter described and more particularly pointed out in the appended claims.

The invention is more especially concerned with a locomotive front end of the kind that includes a centrifugal spark arrester, which is peripherally open, at least in part, and has between the top and bottom plates thereof, a series of inwardly extending deflectors or vanes between which are spaces for the passage of the products of combustion from the interior of the smoke box shell into the arrested for entrainment and discharge up the stack under the action of steam blasts from the exhaust nozzles.

Heretofore such deflectors or vanes, along with their auxiliary wings were constituted by imperforate sheet metal plates. Because of their being imperforate, along with their arrangement relative to each other, they induced a high velocity whirling movement of the products of combustion entering the arrester through the spaces between said vanes. This movement of said products causes the large particles thereof, such as cinders, to impinge against the vanes and their wings with an abrasive action or effect, and cause a quick wearing out of the same. Some of the cinders are ground down to smaller particles so as to be extinguished and then be airborne for entrainment into the stack assembly with a whirling motion along with the remaining large particles. These remaining larger particles, as they pass up the stack with said whirling motion, impinge and rub against the inner surfaces of the stack assembly with a similar abrasive effect or action and this to such an extent that the stack assembly rapidly deteriorates and wears out.

This wearing away of the vanes of the arrester and of the stack assembly soon produces holes therein with a resulting loss in locomotive operating efficiency, and requires renewal of the parts and a lay up of the locomotive at a considerable expense.

While it might be possible to reduce the abrasive actions or effects mentioned by reducing draft action, this is not at all practical as the same would reduce operating efficiency of the locomotive and increase operating costs.

One of the objects of the present invention is to produce a novel spark arrester structure for a locomotive front end, which overcomes to a great extent, the disadvantages above mentioned and inherent in such arresters as heretofore made and whereby the velocity of the products of combustion is materially reduced as they enter the interior of the arrester, without disturbing draft action.

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Another object of the invention is to provide in the arrester for a locomotive front end, a novel structure in the deflector vanes, whereby the products of combustion are better and more evenly distributed for passage through the spaces between the vanes and whereby a greater percentage of the larger particles of such products are reduced in mass and extinguished and cooled before they are entrained for passage up the stack for discharge, thus reducing the abrasive action upon the vanes and stack so that they have a greater period of usefulness without repair of replacements.

Furthermore, it is an object of the invention to provide in connection with the foraminous vanes, a novel arrangement of table and baffle plates which cause the products of combustion to be directed in a definite path, under the arrester so as to then be capable of entering the arrester from the front and sides thereof, thus assuring that said products be acted upon by the arrester for a greater length of time and broken up into smaller extinguished particles for a better entrainment up the stack with a greatly reduced brasive action thereon.

The above mentioned objects of the invention along with their advantages thereof will more fully appear as the specification proceeds.

In the drawings:

Fig. 1 is a longitudinal vertical sectional view through a locomotive front end embodying the preferred form of the invention.

Fig. 2 is a horizontal sectional view through the spark arrester portion of the front end structure appearing in Fig. 1, as taken on the line 2—2 thereof.

Fig. 3 is a transverse vertical sectional view through a part of the front end, in advance of the spark arrester thereof, as taken on the line 3—3 and on a scale greater than that of Fig. 1.

Fig. 4 is a perspective view of one of the improved deflectors or vanes in the spark arrester of the front end and which will be more fully referred to later.

Fig. 5 is a detail view in elevation of a metallic wire netting from which the vane of Fig. 4 may be made.

Fig. 6 is a view similar to Fig. 5 showing a modified form of wire netting from which said vane of Fig. 4 may be made.

Fig. 7 is a view in elevation showing a frag-

ment of a perforated sheet metal plate from which said vane of Fig. 4 may also be made.

In general, the improved front end includes a centrifugal spark arrester that is open about most of its periphery and which is supported in the smoke box shell in operative relation to the bottom end of the stack assembly and the top end of the aligned exhaust nozzle by means of a table plate.

The table plate is supported at its opposite sides by portions of the smoke box shell and the front and rear edges thereof are spaced longitudinally from the smoke box shell door and the front flue sheet of the boiler shell and to which the smoke box shell is operatively attached.

The spark arrester includes top and bottom substantially circular plates, each having openings therein to accommodate the bottom end of the stack assembly and the top end of the exhaust nozzle respectively. Between said plates are upright deflectors or vanes arranged tangentially to the axis of the arrester as a whole and they may or may not include lateral wings near their periphery to produce a tortuous passage for the products of combustion as they enter the spaces between the deflectors or vanes.

The deflectors or vanes are made of a novel material and instead of being imperforate plates, as heretofore, they are provided throughout with evenly spaced openings and the combined area of said openings preferably approximates substantially half the area of the deflector or vane.

In association with the table plate, there are baffle plates that close off the smoke box shell above the rear edge of the table plate so that the products of combustion entering the smoke box shell are caused to take a path under the table plate, to enter the spark arrester from the front and the sides thereof. As these products enter the outer ends of the spaces between the deflectors or vanes, under the draft action of the stack and nozzle, instead of passing through said space with a velocity abrasive action, parts of such products pass through the openings in the deflectors or vanes and this reduces the velocity of such products. Also, because of the many surfaces presented by said openings, such products are better broken up into smaller particles and extinguished before they are entrained into the exhaust blast for passage up the stack. Thus the velocity of such products entering the interior of the arrester is reduced without unduly reducing the draft action and the resulting steaming action of the boiler.

In the passage of said part of the products of combustion through said openings in the deflectors, some may momentarily lodge therein, but other and succeeding products will impinge thereagainst and break the same to smaller sizes or otherwise wear them down to extinguished dust-like parts. Thus such particles are not heavy enough nor is the velocity high enough to be carried through the blast to be deposited upon the bottom of the arrester and upon the table plate, but on the contrary they are entrained in a fine extinguished condition before they enter the stack. Thus the abrasive wear on the stack is reduced, possibility of wayside fires, due to live cinder discharge up the stack, is eliminated and the tendency of cinders to accumulate in the bottom of the smoke box shell is avoided, and which therefore remains cleaner for longer periods of time.

Referring now in detail to that embodiment of the invention illustrated in Figs. 1, 2, 3 and 4 of the accompanying drawings, 10 indicates the body of a locomotive smoke box shell, which is operatively connected at its rear end to the front end of the boiler shell 11 of the locomotive in any suitable manner. The smoke box shell is separated from the water space of the boiler by the flue sheet 12. The front ends of flues 13 are secured in the flue sheet to open into the smoke box shell, so as to deliver thereinto the products of combustion from the firebox of the locomotive. 14 indicates a front for the smoke box shell, which front has the usual door 15 therein.

16 indicates the flanged base for the smoke stack, which is directly secured to the top of the smoke box shell about an opening 17 therein. The base carries a tubular depending stack portion 18 that depends into the interior of the shell 10 and has an extension 19 attached to its bottom end.

The steam or exhaust pipe or stand, which is indicated at 20, is disposed in the bottom of the smoke box shell 10 in axial alignment with the stack 18 and its extension 19.

In the central portion of the smoke box shell 10 is located a spark arrester of the so-called circumferentially open type and the same is indicated as a whole at 21 in Fig. 1. This arrester, which is substantially cylindrical in shape, has its vertical axis arranged slightly forwardly of the stack 18 and its extension 19 and the exhaust nozzle 20. It embodies therein top and bottom vertically spaced plates 22 and 23 respectively and perpendicular vanes or deflector members 24 attached in a suitable manner at their top and bottom ends to said plates and one of these vanes appears in perspective in Fig. 4. The structure of said vanes or deflector members will be mentioned in more detail later.

The top plate 22 of the spark arrester, which is substantially circular, has a circular opening which receives the body of the stack extension 19, the bottom flared end of which is disposed in a plane about midway between the plates 22 and 23.

The bottom plate 23 of the spark arrester is engaged in supporting relation upon a table plate 25 disposed substantially in the plane of the top end of the exhaust stand or pipe 20. Said table plate which engages at its oppoiste margins in supporting relation upon opposite side portions of the smoke box shell below its axis, has its front and rear edges spaced from the door 14 and flue sheet 12, before mentioned. The table plate 25 and the bottom plate 23 of the arrester have aligned openings therein to receive the top end of the exhaust stand, which discharges exhaust steam into the central portion of the arrester and into the bottom end of the stack extension, whereby draft action is induced for the products of combustion from the flues 13 to the stack 18 for a discharge out through the top of said stack.

The side and the front margins of the table plate are suitably stiffened by angle bars 26—26 and 27 and 28 respectively, which best appear in Fig. 2, and these bars support the entire assembly.

The rear margin of the top and bottom plates 22—23 of the arrester are cut off on a straight line coincident with the rear edge of the table plate while the front margin of the bottom plate projects a short distance forwardly of the front edge of the table plate, as best appears in Figs. 1 and 2.

Rising from the rear edge of the table plate 25 and extending to an elevation above the top plate 22 of the arrester, is an upright imperforate

baffle plate 30, the side margins of which engage the inner surfaces of side portions of the smoke box shell. To the rear of the stack 18 and its extension 19, but forwardly of the baffle plate 30, is a second and imperforate baffle plate 31 which closes off the upper portion of the smoke box shell. The upper end of the baffle plate 30 and the lower end of the baffle plate 31 are connected together by a stepped baffle portion 32. These plates 30—31 and portion 32 close off the entire upper portion of the smoke box shell above the table plate and to the rear of the stack, its extension and the spark arrester, so that the products of combustion must take a path from the flues 13 which passes under the table plate to enter the front and side peripheral portions of the arrester. This path is best indicated by the arrows appearing in Fig. 1.

The vanes, as best shown in Fig. 2, are disposed tangentially to the axis of the arrester as a whole and extend inwardly from the periphery of the top and bottom plates 22—23 to terminate at the inner ends in a circle of a diameter greater than that of the flared bottom end of the stack extension as best appears in Fig. 2. With this arrangement of vanes or deflector plates there is formed therebetween spaces 35 through which products of combustion tangentially enter the arrester to take on a whirling motion within the central portion for entrainment up the stack under the action of the steam blasts discharged from the exhaust stand.

Each vane or deflector member 24 may include, near its outer end, right angled wing extensions 24*a* and 25*a*, but these are not essential so far as the present invention is concerned. Heretofore such vanes or deflector members were made of imperforate sheet metal plates, which were open to the objection previously set forth herein.

To overcome said objections, the said vanes or members are formed with openings therein which are spaced evenly or in regular order and are of such size as to collectively amount to approximately one-half the area of said vanes or members and this is so whether said vanes or members include the wing extensions mentioned.

In Fig. 5 there is illustrated on a full size scale (see scale adjacent Fig. 6), a fragment of wire netting or mesh which will serve the purpose and which includes interlaced right angled, vertical and horizontal wires 36 and 37 approximating ⅛'' in diameter and so spaced apart as to define in the netting square openings 38 each having a dimension slightly over a quarter inch square. The collective area of said openings approximates 44% of the total area of the vane.

In Fig. 6 is illustrated on a full size scale (see scale adjacent Fig. 6), a fragment of a modified form of wire netting which also well serves the purpose. Such netting includes interlaced, right angled, vertical and horizontal wires 36*a* and 37*a* respectively, approximating ⅛'' in diameter and so spaced apart as to define vertically elongated rectangular openings 38*a*. The openings are about $\frac{3}{16}$'' x ¾'' wide and long and approximate collectively 49% of the tota larea of the vane or member.

In Fig. 7 is illustrated on a full size scale (see scale opposite Fig. 6), a fragment of a perforated sheet metal plate having rows of elongated openings 40—40 each about $\frac{3}{16}$ of an inch wide and 1½'' long, openings in one row being offset from those in adjacent rows by a narrow portion 41. The spacing between adjacent sides of the openings in adjacent rows, as provided by the portions 41, is about $\frac{1}{16}$ of an inch. The spacing between adjacent ends of the openings in the same row is provided by portion 42 about $\frac{3}{16}$ of an inch in length. In such a perforated plate the collective area of the openings relative to the area of the vane is somewhat more than one-half the area of the vane.

When the vanes are made of the netting described and are provided with the extension wings, such wings are welded to the vane as shown in Fig. 4. This is also true when the vanes and their wings are made of the perforated sheet metal appearing in Fig. 7.

When the vanes are made of the material just above described, it is obvious that the relative large cinders of fire carrying mass in the products of combustion, entering the spark arrester will impinge against the edges of the opening and will be broken up thereby and that such products as can pass through the openings in one vane, impinge against the edges of the openings in the next vane to be further broken up thereby into such small particles that burn themselves out and are cooled off before they are entrained into the stack for discharge.

It should be understood that the open mesh vanes are not applied for the purpose of having cinders or solids pass through the mesh. The open mesh vanes act to guide the cinders through the intake area so that they are carried across the inside of the arrester in a tangential direction and have to be picked up and carried into the stack in another movement. As before explained, it is possible certain of the cinders and solids may engage the edges defining the open spaces of the vanes, but they are quickly broken up and dislodged by the following products. The main purpose of the netting, however, is to reduce the centrifugal action.

Thus, as such particles are broken into smaller sizes and as the velocity thereof is reduced, their abrasive action on the vanes are likewise reduced so that wear becomes very little indeed and this without seriously affecting the draft action of the locomotive of which the front end forms a part. The cinder cutting action on the stack and the stack extension are also greatly reduced. Hence the maintenance cost of the arrester, stack and stack extension is greatly reduced.

While the open area of the deflector wing may vary, it has been found that the best results are obtained when such open area is from 35 to 50%.

While in describing the invention I have referred in detail to the form, construction and arrangement of the parts embodied in the improved front end structure, the same is to be considered only in the illustrative sense and therefore I do not wish to be limited thereto except as may be specifically set forth in the appended claims.

I claim as my invention:

1. A locomotive front end embodying therein a smoke box shell having a horizontal axis and including a vertically disposed smoke stack and exhaust steam nozzle arranged to discharge into the stack, a spark arrester in said shell and comprising a table plate disposed below the axis of said shell and extending from side to side of the shell and having front and rear ends spaced from the front and rear ends of the shell, there being an opening in said table plate occupied by an upper portion of the nozzle, a top plate spaced above said axis of the shell and having an opening therein through which a bottom portion of the stack extends, a bottom plate engaged on

said table plate, said bottom plate and said table plate having openings therein for the top end of the nozzle, and a plurality of deflector members disposed between said top and bottom plates and extending inwardly from the periphery thereof and stopping short of the bottom of the stack and providing spaces therebetween for the passage of the products entering the arrester from the smoke box shell, at least certain of said members having openings therethrough, which act to reduce the velocity of said products as they enter the interior of the arrester, and means providing a baffle closing off the smoke box shell and a part of the arrester above the table plate to the rear of the stack.

2. A locomotive front end embodying therein a smoke box shell having a horizontal axis and including a vertically disposed smoke stack and exhaust steam nozzle arranged to discharge into the stack, a spark arrester in said shell and comprising a table plate disposed below the axis of said shell and extending from side to side of the shell and having front and rear ends spaced from the front and rear ends of the shell, there being an opening in said table plate occupied by an upper portion of the nozzle, a top plate spaced above said axis of the shell and having an opening therein through which a bottom portion of the stack extends, a bottom plate engaged on said table plate, said bottom plate and said table plate having openings therein for the top end of the nozzle, and a plurality of deflector members disposed between said top and bottom plates and extending inwardly from the periphery thereof and stopping short of the bottom of the stack and providing spaces therebetween for the passage of the products entering the arrester from the smoke box shell, each member being constituted by a woven wire netting, the open area of which constitutes from thirty-five to fifty per cent of the area of said member, and means providing a baffle closing off the smoke box shell and a part of the arrester above the table plate to the rear of the stack.

3. A locomotive front end embodying therein a smoke box shell having a horizontal axis and including a vertically disposed smoke stack and exhaust steam nozzle arranged to discharge into the stack, a spark arrester in said shell and comprising a table plate disposed below the axis of said shell and extending from side to side of the shell and having front and rear ends spaced from the front and rear ends of the shell, there being an opening in said table plate occupied by an upper portion of the nozzle, a top plate spaced above said axis of the shell and having an opening therein through which a bottom portion of the stack extends, a bottom plate engaged on the table plate, said bottom plate and said table plate having openings therein for the top end of the nozzle, and a plurality of deflector members disposed between said top and bottom plates and extending inwardly from the periphery thereof and stopping short of the bottom of the stack and providing spaces therebetween for the passage of the products entering the arrester from the smoke box shell, each member being constituted by a woven wire netting, the open area of which constitutes from thirty-five to fifty per cent of the area of said member, a wing carried by each member and extending outwardly therefrom at an angle and constituted by similar wire netting, and means providing a baffle closing off the smoke box shell and a part of the arrester above the table plate to the rear of the stack.

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