Oct. 17, 1933. C. S. TURNER 1,930,782

SOOT BLOWER CONSTRUCTION FOR SUPERHEATER TUBES

Filed April 16, 1931 2 Sheets-Sheet 1

Fig. 1.

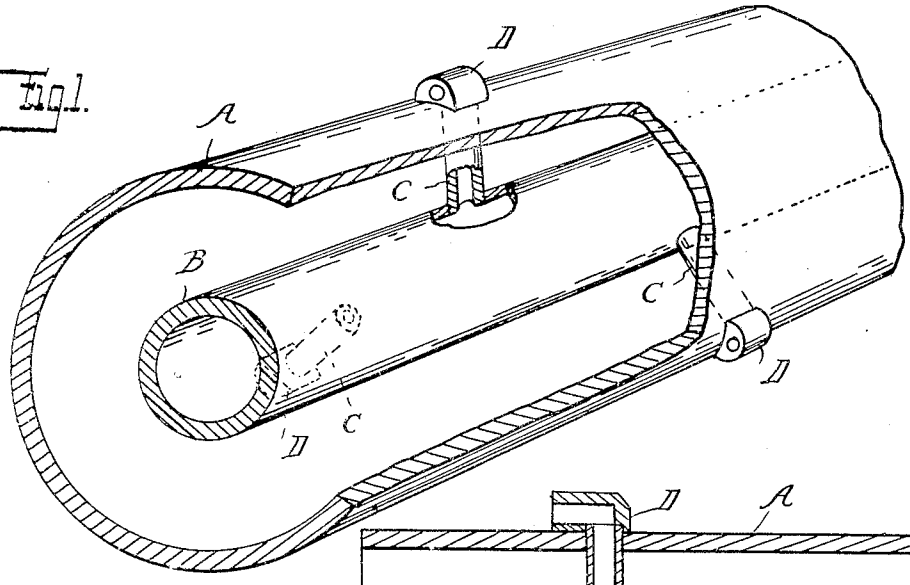


Fig. 4.

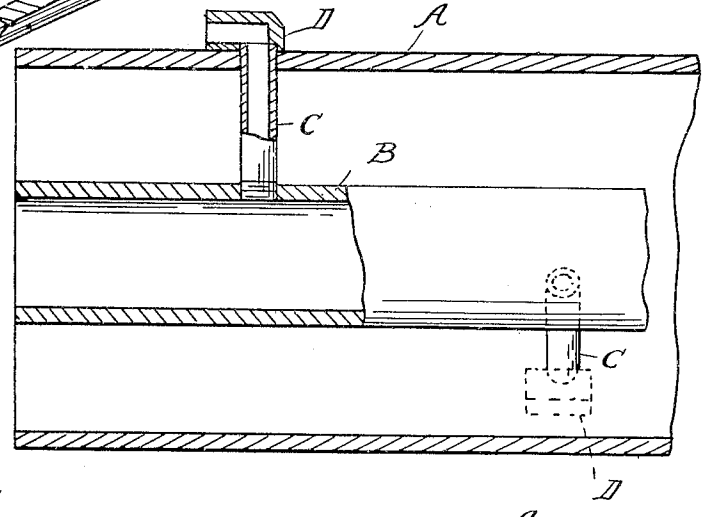


Fig. 2.

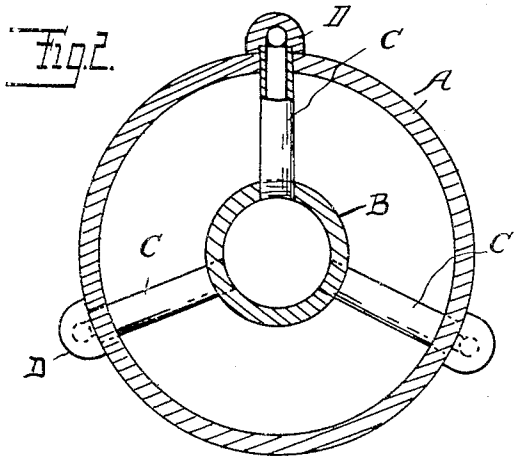
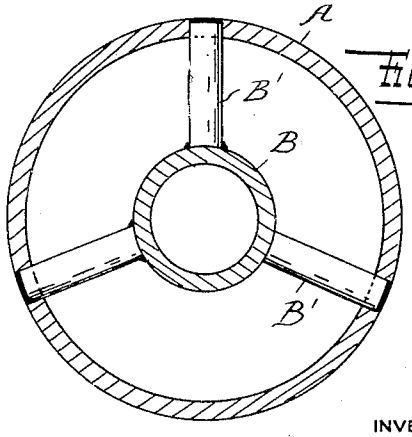


Fig. 3.



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Filed April 16, 1931 2 Sheets-Sheet 2

Fig.5.

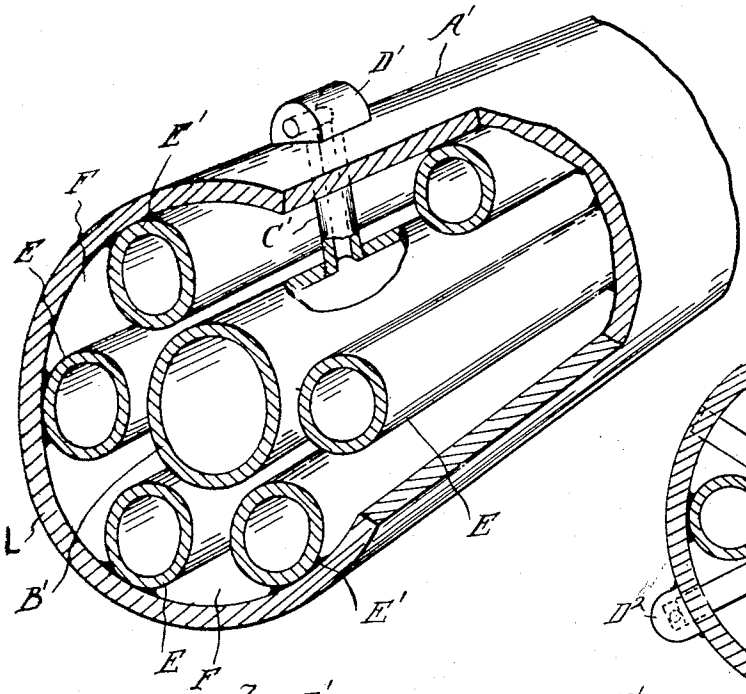


Fig.9.

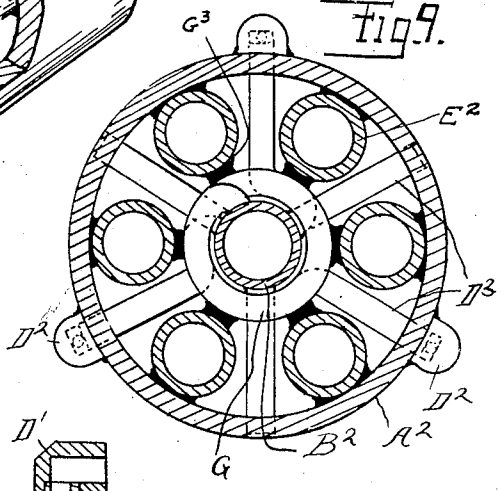
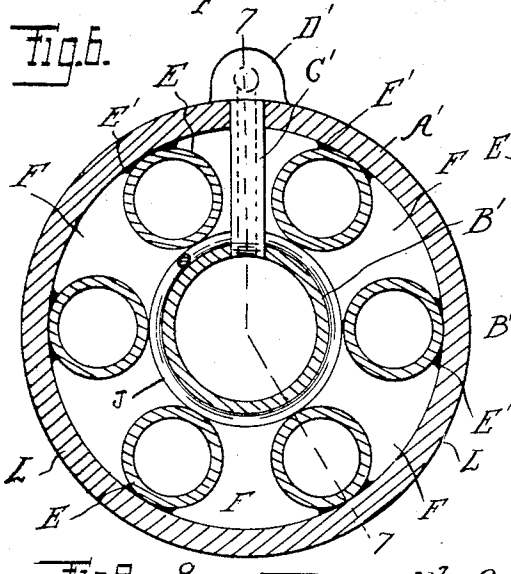


Fig.6.



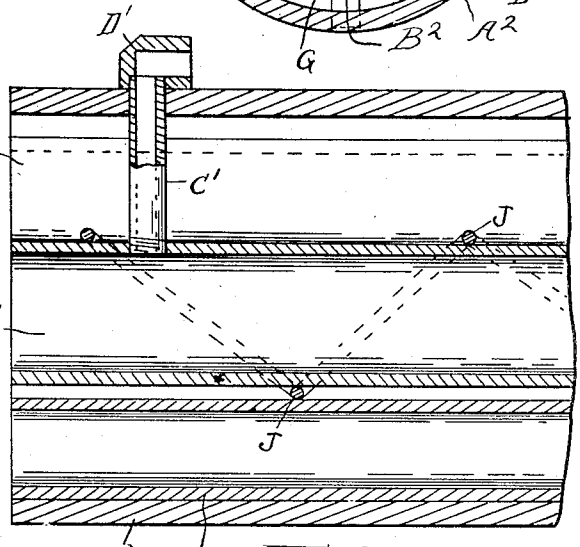
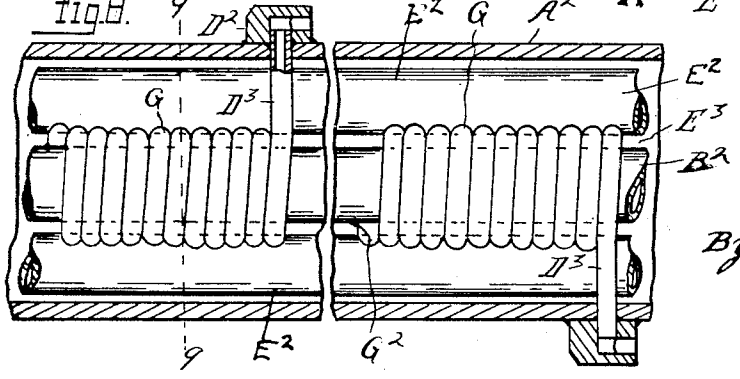


Fig.7.

Fig.8.



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SOOT BLOWER CONSTRUCTION FOR SUPERHEATER TUBES

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Application April 16, 1931. Serial No. 530,544

12 Claims. (Cl. 122—392)

This invention relates to an improved sleeve or protective tubular construction adapted especially for boiler superheater installations, wherein it is desirable, while the unit is in active operation, to clear portions at least of the exterior of the tubes of soot and similar accumulations. The difficulty of doing this with an ordinary externally-applied soot blower mechanism is the tendency to rapid burning out, and similar metallurgical impairment of the soot blower tubes if alone and unprotected, due to the intense heat which the generation of superheated steam involves, or to the intense heat prevailing about the tubes.

So far as I am aware, the only method of cleaning the exterior surfaces of boiler superheater tubes now known or practiced involves the temporary insertion between and among the tubes of a hand-operated or "lance" terminal of a blower pipe connected with a suitable air or steam source. By the use of my improved organization of parts I am enabled to partake of all the advantages attendant upon the maintenance of the tube surfaces relatively clear from soot accumulations, while at the same time affording adequate protection to the soot blower parts as such, except of course the exposed nozzle, which can be prepared from adequately hard or specially treated metal accordingly.

In the drawings:

Figure 1 is a partly broken-away perspective of the simplest form of my invention, wherein the blower pipe, whose protection from the superheating conditions to which the superheater pipes themselves are purposely exposed, is spacedly supported within the tube, either by plain brackets or spiders which project radially at suitable intervals, or by the radial nozzle projections, through whose terminals air or steam is blown upon the exterior surface of the superheater tubes.

Figure 2 is a cross sectional view of the construction shown in Figure 1.

Figure 3 is a similar cross-sectional view, whose purpose is to suggest the possible terminal support of the superheater tubes by means of plain spider members located at or adjacent the ends of such tubes which lead into headers.

Figure 4 is a side elevational view partly in section, further bringing out this spider support for the pipe.

Figure 5 is a partly broken-away perspective showing a modification from the construction shown in Figures 1 to 4 inclusive, in that a series of cooling-fluid pipes is located about the central blower tube in the annular space between it and the superheater tube wall.

Figure 6 is a cross sectional view of the modified form of construction shown in Figure 5.

Figure 7 is a fragmentary sectional elevation taken along the line 7—7 of Figure 6 and looking crosswise of the tube, designed to bring out still further the relation of the blower tube and nozzle to the other elements.

Figure 8 is a fragmentary side elevational view, partly in section, showing a still further modification of the blower nozzle construction and its connection with the central blower tube.

Figure 9 is a cross sectional view of the construction shown in Figure 8, taken along the line 9—9 thereof.

Referring first to the form of construction illustrated in Figures 1 and 2, A indicates a superheater pipe or tube of any desired form which is designed to be exposed to such high degrees of heat incident to its use that no permanent blower tube installation for effecting the pneumatically or steam-induced cleansing of the outer walls thereof can be thought of, for the reason that such tubes would quickly warp and deteriorate because of the heat. The present tendency in superheater installations toward locating the several tubes directly in the heat path renders the degree and probability of rapid soot accumulation upon the outer surface thereof such that unless they be frequently and adequately cleaned, a pronounced impairment of their operative efficiency results. As already stated, this cleaning can be to a degree and rather inconveniently effected by the temporary insertion of hand-held blower nozzles; and it is the purpose of this invention to offer such an organization of parts as will permit the permanent and continuingly-operative presence of an adequate blower system, which is protected from direct access to it of the heat conditions to which the boiler superheater tubes are subjected.

To this end I position within the several superheater tubes A a blower tube B, which is preferably, though not necessarily, held about centrally thereof either by suitable supports as spider members at the ends thereof, as shown at B' in Figure 3, where the superheater tubes connect with the headers, or by means of the generally radial take-off branches C, which, passing through the walls of the superheater tubes have their ends D formed as blower nozzles, through which a cleansing stream of air or steam can be directed upon the superheater tube surface. These blower nozzles may extend at selected in-

tervals all in the same radial direction toward the outside of the superheater tube A, in which case an accordingly limited portion of the tube would be cleansed by the blasts therefrom, or they may extend in radially different directions, as brought out in Figures 2 and 3, thus cross-sectionally of the entire pipe and tube length as such in effect functioning as a spider, which indeed the showing in Figure 2 suggests. Since, however, in some superheater installations it is not necessary that the blower tube B be maintained with any exactness in the center of the tube A, I have shown cross-sectionally in Figure 3 a superheater tube and a contained blower tube, which, except for the radially outward extent of such nozzles as may be used, need not necessarily result in the presence of such spacing or spider members, except near the ends of the blower pipes, where they emerge into the headers. This would sometimes result in the blower tube being not exactly centrally located within the superheater tube if the length of any superheater tube between headers were not perfectly straight, so that if no centrally-spacing spider were employed, the superheater tube walls and the included blower tube walls would touch at one or more points. This construction would not, I believe, function as efficiently as a more nearly centrally-spaced blower tube installation does, but under some circumstances could be used entirely satisfactorily, the main objection to such an arrangement being the operative requirement that the inner tube be rigidly held within the outer tube so that it will not vibrate or rattle under the influence of gases rapidly passing therethrough.

In any event and as to any of the forms of construction herein dealt with, the blower nozzle itself and particularly its exposed terminal being preferably made of steel, can reasonably be expected to withstand the high heat conditions to which that part which extends outside of the superheater tube wall is subjected.

In the form of construction illustrated in Figures 5 to 8 inclusively, in place of the aerially-protected positioning of the blower tube within the superheater tube, I position at spaced intervals, each extending lengthwise of the superheater tube A', a plurality of fluid-conducting tubes, as E, the peripheral portion of each of which is preferably welded, as at E', to the interior surface of the shell or superheater tube A', so that for all purposes of thermal interconduction the several fluid-conducting tubes E and the outer or superheater tube A' are unitary. Through these tubes E columns of cooling fluid may be passed, which will exert their influence by mural conduction upon the steam which passes through those portions of the spaces within the shell A', as F, which, surrounding the centrally positioned blower tube B', space the several tubes E from one another. Or this condition may be reversed, steam passing through the tubes E and the cooling fluid through the spaces F.

As in the case of the construction shown in Figures 1 to 4 inclusive, there extend radially at desired intervals, from the central blower tube B', a series of take-off branches C' whose nozzles D' are located just outside of and in operative relation to the exterior surface of the superheater tube A, thus, similarly to the construction shown particularly in Figure 1, serving to effectively clear the exterior surface of the latter, while the blower tube B' is adequately protected against the direct access of the superheater influence.

If the smaller tube elements E be made to serve as the containers for cooling columns, their welded attachment to the inner surface of the outer shell A of course results in the absorption by them and their contained water column of a certain proportion of heat units transmitted thereto through the outer wall along the lines of welding, and in turn the heat units thus absorbed by these tubes E and their contained water columns are conductively transmitted to the steam in the adjacent alternated surfaces F. If, on the other hand, the tubes E be made to serve as steam-conducting elements with the spaces F serving as media for the passage of a cooling fluid, the wall spaces L of the superheater tube A located between the lines of welding serve to transmit to the cooling columns the heat units to which these several sections are subjected from without, but not sufficiently to impair to an objectionable degree the cooling influence exerted upon the steam in the tubes E, due to the fact that, except along their lines of welding, they are surrounded by these cooling columns. And in any event the interiorly located blower pipe B' is prevented from attaining anything like a distorting or similarly impairing temperature, regardless of the degree of heat which may be prevailing about the outside of the superheater tube A'. A spacing wire J is shown wrapped about the blower tube B' and engaging both it and the tubes E, thus positively positioning the blower tube and preventing rattling.

The modified forms of construction illustrated in Figures 6, 7, and 8, while partaking of the protective and operative features already discussed, are designed to counteract the effect of a tendency toward "creeping" of one pipe, as for example, the superheater tube A' relatively to the blower pipe B', or vice versa, under the influence of heat, which in the case of long tube assemblies, and where relatively short take-off blower branches C are employed to conduct the steam or air to the exterior nozzle portions H, might result in a shearing off of the latter. In this modified construction I arrange the relative cross-sectional size and spacing of the several tubes, superheater A^2, cooling E^2, and blower B^2, so that there is normally left between the cooling tubes, as E^2, and the blower tube, as B^2, a space sufficient to permit the positioning therebetween of a plurality of coiled take-off branches, as G, the inner end of each of which is welded, as at G^2, in an aperture in the wall of the blower pipe B^2. The radial part, as D^3 of each take-off tube, being immobile relatively to the superheater wall A^2 by reason of its extent therethrough, cannot, of course, move axially lengthwise of the superheater tube under the expansive influence of heat, but such movement of the outer tube wall is rendered harmless to the take-off tubes by the spiral winding of the latter. At selected points along the spirally-wound portions of the take-off pipes G, preferably near the point where their radially extending portions begin, the outer surface of each is welded to certain ones, or, if desired, all, of the cooler pipes E^2 as indicated at G^3, thus permitting lengthwise movement with these latter without danger of shearing the radial portions D^3, which fixedly extend through the superheater tube wall A^2, due to the resiliency of the wound-about portion of the take-off tube G. Whether this construction be used, and if used, what length of spiraling is

necessary, is of course dependent upon the expected degree of heat conditions to which the apparatus is designed to be subjected.

In any of the forms, however, it will be noted that, except as to the hardened nozzle D, the entire blower system is protected from access of an impairing degree of heat, and that this may be built in as a permanent part of the superheater installation to be supplied as desired with air or steam from a suitable external source, the flow from which may be regulated as desired by intermediate valves.

What I claim is:

1. A superheater tube construction adapted to conduce to the pneumatic cleansing of its exposed exterior surface, comprising in combination a plurality of spacedly disposed fluid-conducting elements positioned in substantially axial parallelism about a common center, an exterior heat-receiving wall with corresponding adjacent portions of which the several fluid conducting elements are intimately united, a central steam-conducting tube about which said fluid-conducting elements are spacedly positioned, and radially projecting blower jet extensions from said steam-conducting tube having exteriorly extending discharge nozzles positioned to direct cleaning fluid upon tube surface portions adjacent the nozzles.

2. A combined superheater and blower tube construction, comprising a centrally positioned tube connectible with an external fluid pressure source, radially extending branches projecting at intervals therefrom, the ends of said branches being connected to blower nozzles, a heat-exposed outer tubular wall positioned spacedly about said central tube and through which the nozzled ends of said radial branches extend, and are provided with jet apertures through which a cleansing fluid blast may be discharged, and a plurality of fluid-conducting tubes arranged within the outer wall and outside said centrally positioned tube, each being intimately united with an adjacent interior surface portion of the tubular wall, whereby heat interchange between them is aided, said fluid-conducting tubes and said tubular wall in turn protecting the centrally positioned tube against heat impairment.

3. A protective construction for soot blower elements, comprising, in combination with a fluid conduit pipe, an enclosing shell adapted for direct exposure to heating influence, a plurality of parallel extending tubes spacedly arranged about said conduit pipe and similarly within said enclosing shell, each being in intimate contact with the interior surface thereof, and nozzle outlet elements leading at spaced intervals from said conduit pipe to the exterior of said enclosing shell in position to direct soot-removing jets upon the adjacent surface thereof.

4. In combination with an enclosing shell adapted to be directly exposed to heating influence, a plurality of fluid-conducting pipes structurally united with the interior surface of said enclosing shell in spaced relation to one another, and a fluid conduit pipe positioned within the space surrounded by said fluid-conducting pipes, said fluid conduit pipe being provided with radially extending blower jets extending from the exterior of said enclosing shell and positioned to direct cleansing fluid upon tube surface portions adjacent the nozzles.

5. The combination, with a pneumatic conduit tube provided with spacedly disposed radially extending nozzle terminals, of a heat-protective construction therefor adapted to serve as well as superheater units, comprising an outer shell adapted to be exposed to direct heating influence within which said pneumatic conduit tube is spacedly positioned and through whose wall said nozzle terminals extend, and a plurality of fluid-conducting tubes positioned within said outer shell in spaced relation to one another and to said pneumatic conduit tube, said fluid-conducting tubes having those lengthwise portions of their walls adjacent the interior surface of said outer shell welded thereto for facilitating the interchange of heat units between their contents and that of the intervening spaces within said outer shell.

6. In combination with an outer shell exposed to direct heating influence, a plurality of fluid-conducting tubes arranged in spaced relation from one another about the interior surface of said outer shell, being welded thereto along their several lines of contact therewith, a fluid conduit tube positioned within said outer shell in substantially coaxial relation thereto and within the positions of the several fluid-conducting tubes, and outwardly extending nozzle members leading at spaced intervals from said fluid conduit tube through said outer shell to positions of potential blowing influence upon adjacent surface portions.

7. In a combined blower and superheater tube construction, in combination with a pair of spacedly interfitted tubes, the inner one of which is connectible with an external source of fluid and the outer one of which is adapted to be exposed to heating influence, a plurality of blower nozzles extending from connection with selected points along said inner tube and through the walls of said outer tube, the adjacent exterior surface portions of which latter are within the range of cleansing blasts directed upon them by said nozzles, the inner ends of which, adjacent their several points of connection with said inner tube are helically disposed thereabout to permit thermally induced relative movement of said inner tube and said outer tube non-injuriously of the inner tube positioning joints afforded by the extent of said nozzles through the walls of the outer tube.

8. In combination with an outer tube adapted for exposure to superheating influence, an inner tube positioned spacedly therewithin and connectible at one of its ends with an external source of fluid pressure, a plurality of fluid-conducting tubes located within said outer tube, spaced from one another and surroundingly of said inner tube, and limitedly resilient blower nozzle elements connected at their inner ends with selected points along said inner tube, about which they are plurally coiled, the outer ends of said blower nozzle elements being extended through the wall of the outer tube to positions of cleansing fluid-projection against adjacent surfaces, and the coiled portions thereof serving to resiliently yield under thermally induced relative movement of said inner and outer tubes without impairment of the relative rigidity of the joints constituted by the passage of the outer ends of said blower nozzles through the wall of the outer tube.

9. In combination with a boiler superheater tube, a soot blowing construction incorporated therewith and comprising a tube extending longitudinally of and within the superheater tube, a plurality of nozzles projecting from the sur-

face of the superheater tube, and means including a bent tube connecting the inner tube and the nozzles but yieldable under relative axial movement of the inner and outer tubes.

10. In a boiler superheater tube construction, a tube for superheating steam, and a soot-blower incorporated therewith comprising an inner tube extending longitudinally of and within the first, a plurality of nozzles carried by the outer tube, and means including a curved tube connecting the inner tube and the nozzles, but yieldable in a direction axially of the tubes.

11. In a boiler superheater construction, an outer tube through which steam to be superheated may be passed, a plurality of temperature control tubes extending through and welded to the inner surface of the outer tube, a soot blower tube extending substantially axially through the assembly, jet tubes connected to the central tube and extending spirally about its surface and thence outwardly between the temperature control tubes and to an aperture in the outer tube.

12. In a boiler superheater construction, an outer tube through which steam to be superheated may be passed, a plurality of temperature control tubes extending through and welded to the inner surface of the outer tube, a soot blower tube extending substantially axially through the assembly, jet tubes connected to the central tube and extending spirally about its surface and thence outwardly between the temperature control tubes and to an aperture in the outer tube, said jet tube having a portion welded to a temperature control tube.

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