Feb. 13, 1968 R. E. LAWRENCE 3,368,506

STACK SECTIONS WITH EXPANSION MEANS

Filed Sept. 16, 1966 2 Sheets-Sheet 1

Fig. 2.

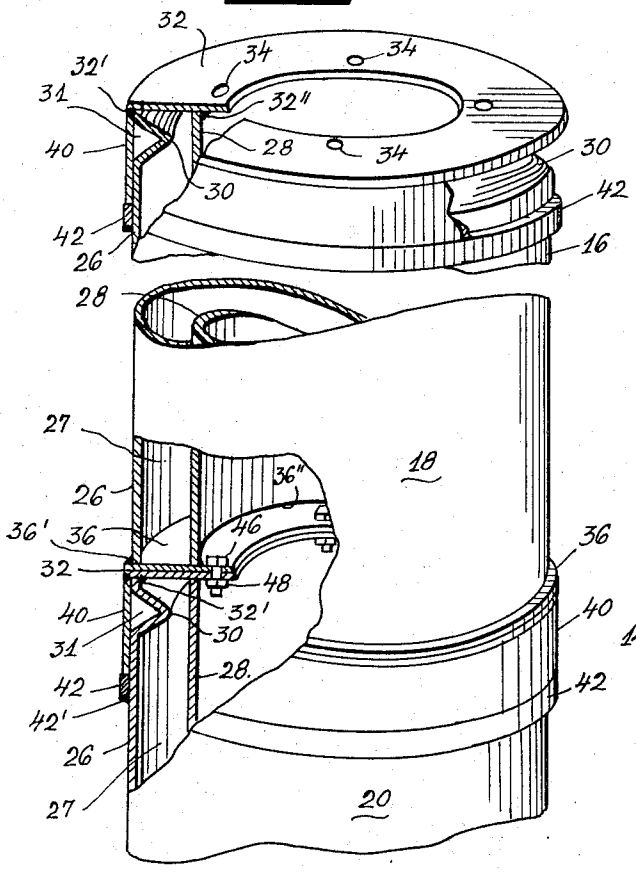


Fig. 1.

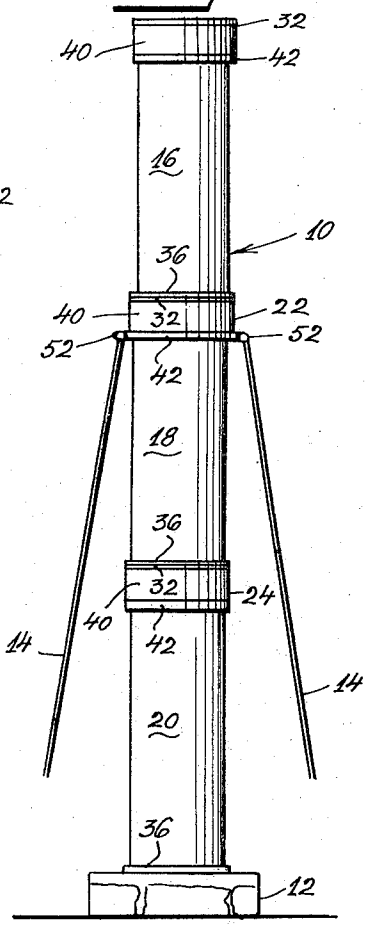


Fig. 4.

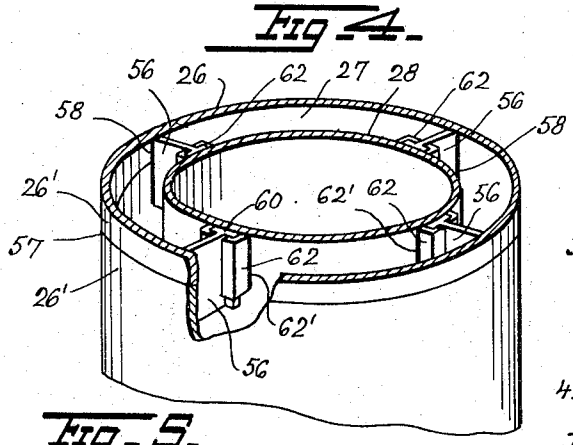


Fig. 5.

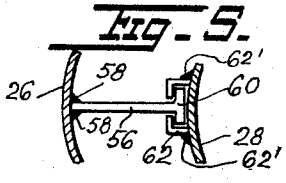
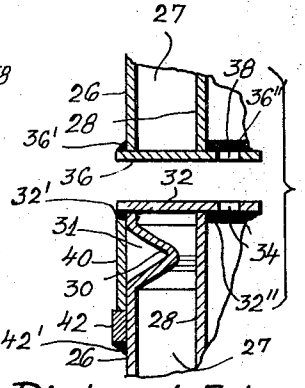


Fig. 3.



INVENTOR

Richard E. Lawrence

BY Polachek & Saulsbury

ATTORNEYS

Feb. 13, 1968 R. E. LAWRENCE 3,368,506

STACK SECTIONS WITH EXPANSION MEANS

Filed Sept. 16, 1966 2 Sheets-Sheet 2

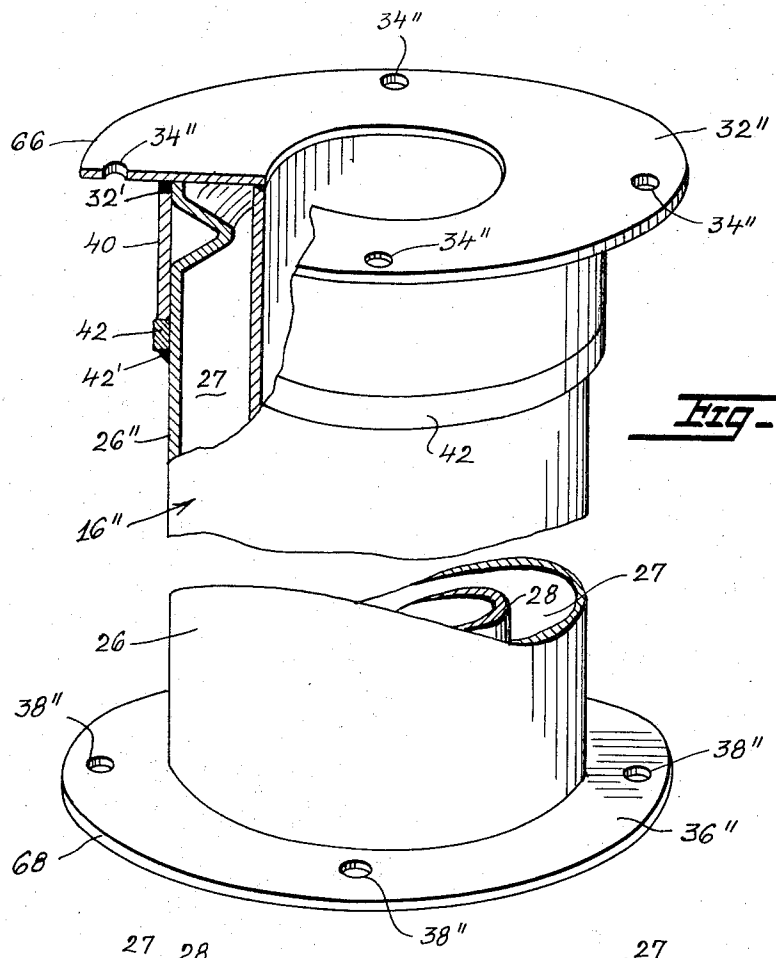


Fig-6-

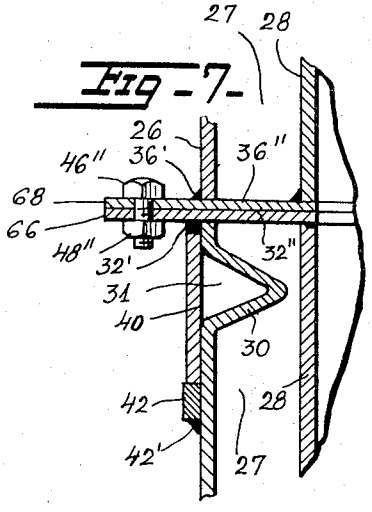


Fig-7-

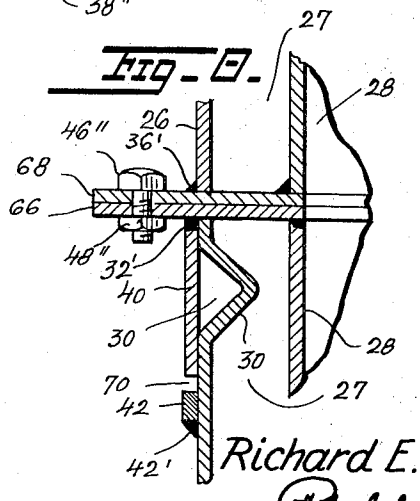


Fig-8-

INVENTOR

Richard E. Lawrence

BY Polachek & Saulsbury

ATTORNEYS

United States Patent Office 3,368,506 Patented Feb. 13, 1968

3,368,506

STACK SECTIONS WITH EXPANSION MEANS

Richard E. Lawrence, 50—25 71st St.,
Woodside, N.Y. 11377

Filed Sept. 16, 1966, Ser. No. 579,938
5 Claims. (Cl. 110—184)

ABSTRACT OF THE DISCLOSURE

A smokestack for the conveyance of hot gases having a sectional body formed of superposed tubes, each section including outer and inner spaced tubular walls, the hot gases adapted to pass through the inner wall, the space between the outer and inner wall defining a dead air space, means for securing the superposed sections to each other, and means in the dead air space to accommodate for the difference in thermal expansion between the outer and inner walls thereof in a direction of their length. Such means constituted by an annular accordion-like fold in one form and a T-shaped plate in another form.

This invention relates to a steel smokestack construction, and particularly to a smokestack construction which will effectively eliminate the condensation which causes destructive corrosion of most steel stacks and is an improvement over the smokestack construction disclosed in my co-pending application Ser. No. 462,555, filed June 9, 1965, now Patent No. 3,302,599.

Condensation occurs within most steel smokestacks, because of the temperature differential that exists between the hot gases flowing along the internal surface and the cooler ambient air. Because of this temperature differential, there is a liquid condensate having sulphurous components that attacks steel and eventually will cause structural failure within a short period of time.

The novel structure disclosed herein, substantially eliminates the formation of this corrosive condensate upon the internal surface of the smokestack. This is done by insulating the inner surface of the stack from the outer surface, and providing a dead air space therebetween. In so doing, the quick reduction of temperature of the hot gases is prevented and the gases are allowed to flow hot and rapidly out of the stack. The insulation is provided by a hermetically air-sealed, double wall structure which is fabricated in a novel and efficient manner without increasing the cost or weight of material involved and to accommodate for the difference in expansion between the inner and outer walls.

It is, therefore, the principal object of this invention to provide an insulated steel smokestack construction which will prevent the formation of corrosive condensate on the internal surface and reduce the corrosion that normally readily takes place with steel stacks.

Another object of the invention is to provide a double walled steel smokestack with means for permitting thermal expansion between the outer and inner walls in the direction of their length.

Still another object of this invention is to provide a double walled steel stack construction which utilizes hermetically sealed air insulation between the interior and exterior surfaces of the stack.

A further object of this invention is to provide a double-walled stack construction with a hermetically air-sealed pocket between the walls that will be structurally reinforced at appropriate points throughout the height of the stack.

A further object of this invention is to provide a double-walled steel smokestack construction which can be fabricated in sections that can be conveniently transported

from the point of fabrication to the location where the smokestack is to be erected.

A still further object of the invention is to provide a smokestack of this kind that presents longer resistance to corrosion, that is inexpensive to manufacture and maintain and is more efficient in use than the previously constructed single and double wall smokestacks.

For further comprehension of the invention and other objects and advantages thereof, reference may be had to the following description taken in connection with the accompanying drawings and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings,

FIGURE 1 is a side elevational view of a smokestack embodying one form of the invention shown mounted on a stone base.

FIG. 2 is an enlarged fragmentary top perspective view of sections of the smokestack, parts being shown broken away to show the construction thereof.

FIG. 3 is an enlarged vertical disassembled sectional view of a joint between fragments of the sections of the smokestack.

FIG. 4 is an enlarged cross-sectional and perspective view taken through a joint, where the cylindrical portions making up the sections of the smokestack are welded together, and the bracers are disposed between the walls of the stack, to hold them in spaced relationship.

FIG. 5 is a top plan view of one of the bracers shown in FIG. 4.

FIG. 6 is a top fragmentary perspective view similar to FIG. 2 of a modified stack section in which the assembly of the stack is effected from the exterior thereof.

FIG. 7 is a fragmentary vertical sectional view of the modified sections of FIG. 6 assembled together showing the inner and outer walls in unexpanded condition, and

FIG. 8 is a similar view to FIG. 7 but showing the walls in an expanded condition.

Referring particularly to the form of the invention shown in FIGS. 1 to 5, a smokestack made in accordance with the present invention is shown generally at **10**. This smokestack **10** may be mounted on stone or concrete base **12** and held securely by stay wires **14** that will be anchored to the ground or a nearby building structure.

This smokestack is generally made up of three steel cylindrical or tubular doubled wall sections **16**, **18** and **20**, with assembled joint structures **22** and **24** between sections **16–18** and **18–20**, respectively, thereby providing a typical smokestack **10** that is adapted for easy field erection from prefabricated doubled walled sections.

Each of the body sections **16**, **18** and **20** comprises an expansible metal outer wall **26** and an inner wall **28** that is concentrically spaced therefrom to provide a dead air space **27** therebetween. At the top end of the section as viewed in FIGS. 1 and 2, the outer wall **26** is bent into a circumferential accordian-like fold **30** extending inwardly of the wall, and providing a collapsed groove **31** thereabout. An annular plate **32** is welded to the top edge of the fold **30** at **32'** and serves for connecting the top of one section to the bottom of the section thereabove. The plate **32** is welded to the inner wall **28** at **32''**. Holes **34** are struck in the annular plate **32** adjacent to its inner periphery. At the bottom end of the section, another annular plate **36** is welded respectively at **36'** and **36''** to the bottom edges of the respective outer and inner walls **26** and **28**. Holes **38** similar to holes **34** are formed in the lower plate **36** in line with the holes **34** of the upper plate. The inner wall **28** will be expanded from the heat of the hot gases flowing out of the stack while the outer wall **26** being relatively cold will through differential thermal expansion between the walls be permitted to expand in the

direction of its length by virtue of the provision of the accordian-like fold 30 thereof.

A metal web ring apron 40 surrounds the outer wall 26, encircling the groove 31 and fold 30 to cover the same and hold its shape. The top edge of this ring 40 as viewed in FIG. 2 is welded to the under surface of the periphery of the top annular plate 32 at 32'. The ring 40 is not attached to the outer wall and can be lifted with the outer wall along the outer surface thereof. Another narrower metal stop band 42 is welded to the outer wall 26 below the lower edge of the ring or in the line of movement of said ring 42 to limit its downward movement. The fold 30 of the outer wall will permit the outer wall 26 to be expanded with inner wall 28. The stop band 42 is welded to the outer wall 26 at 42'.

In assembling and mounting the smokestack, the bottom plate 36 of one body section is superimposed on the top annular plate 32 of the next adjacent body section and bolts 46 mounted in the aligned holes 34 and 38 of the plates as shown in FIG. 2 and secured by nuts 48. This secures the body sections to each other in vertical alignment. The bottom plate 36 of the bottom body section 20 may rest on top of a stone or concrete base 12 or other support and is secured thereto by stay bolts, not shown, driven into or embedded in the top surfaces of the base 12. The stay wires 14, 14 are fixed at their upper ends to perforated lugs 52 affixed to the annular stop band 42 of one of the stack sections, for example, section 18, the other ends of the stay wires 14 being affixed to the ground or building in any suitable manner.

In place of the accordian-like fold 30 to form the dead air space 27 shown in the smokestack 10 of FIGS. 1 and 2, the expansion of the outer and inner walls 26 and 28, respectively, of the smokestack 10 may be provided by the T-section vertical brace plate 56 welded along one long edge to the inner surface of the outer wall 26 of each section as indicated at 58. A crosshead 60 at the other long edge of the plate 56 is slidably fitted into an elongated split socket 62 welded or otherwise secured to the outer surface of the inner wall 28 at 62' as best shown in FIGS. 4 and 5. These braces or stiffeners 56 while holding the stack walls 26 and 28 in concentric relationship permit relative vertical expansion or movement of the stack walls relative to each other.

The outer wall 26 may be made up of several adjoining cylindrical wall portions 26' to form one stack section, the number of portions depending upon the length of the section desired and butt welded to one another at 57. The T-section plates 56 are welded across the line 57 and will thereby strengthen the weld of the portions to one another and these plates 56 may even eliminate the need for so welding of the portions 26' together. The inner wall 28 may be similarly constructed from cylindrical portions and retained by the split socket pieces 62.

In FIGURES 6 to 8, inclusive, there is illustrated another form of a section for the smokestack. Section 16'' differs from sections 16, 18 and 20 of the smokestack of FIGS. 1 to 5 in that the outer periphery 66 of top annular plate 32'' and the outer periphery 68 of the bottom annular plate 36'' both extend beyond the outer wall 26'', and the holes 34'' and 38'' instead of being adjacent the inner peripheries of the plates 32'' and 36'' are adjacent the outer peripheries thereof. When the modified sections are stacked as shown in FIGS. 7 and 8, the holes are in alignment and the sections secured to each other by the bolts 46'' and nuts 48'', whereby the stack sections can be bolted to one another from the exterior of the stack as when the stacks are of small diameter and would not allow for the lowering of a builder into the stack to do the bolting assembly; of similar showings in the first form, the same numerals apply in the showings of this second form.

When the inner wall 28 will have been heated and elongated thereby, the accordian fold 30 will open as best shown in FIG. 8 to accommodate the outer wall 26 to amount of expansion of the inner wall 28 and take with it the apron ring 40 which confines and maintains the shape of the upper end of the outer wall about fold 30, the apron ring rising a distance indicated at 70.

It shall be understood that an expansion fold may be made as well in the inner wall 28 where the expansion of the stack may be too great for the outer wall 26 to be accommodated by the accordian-like fold 30.

While the stack sections are assembled by bolts and nuts, the individual sections are fabricated from pieces of steel and appropriately welded in the place indicated by weld indications shown through the drawings, making for rigid fully welded sections that can be delivered to the stack site and readily assembled one upon the other with derrick equipment.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and that various detail changes and modifications may be made within the scope of the invention as defined in the appended claims.

What is claimed is:

1. A smokestack for the conveyance of hot gases comprising a sectional body composed of superposed tubular sections, each section including concentrically arranged outer and inner tubular walls, the outer wall surrounding the inner wall through which the hot gases pass and providing therebetween a dead air space between the two walls, and annular accordian-like fold means in the dead air space on one of the tubular walls of each section to accommodate for the difference in thermal expansion between the outer and inner walls thereof in a direction of their length, and the accordian-like fold expansion means including an annular fold in one end of the outer wall of each section, forming a groove therein, said fold adapted to be expanded, an annular plate secured at its outer periphery to the folded end of the outer tubular wall, a ring apron depending from the outer periphery of the plate and secured thereto around the groove in said outer wall, the outer wall being in slidable engagement with the ring apron, an annular plate supported on the other edges of the outer and inner walls of an adjacent section, the annular plate on the folded end of the first-named section adapted to seat on the last-named annular plate, and means for fastening the plates to each other.

2. A smokestack for the conveyance of hot gases as defined in claim 1 herein the plates have aligned spaced holes along the inner peripheries thereof, and said fastening means including bolts extending through said aligned holes and nuts on the protruding ends of the bolts for securing the sections to each other.

3. A smokestack for the conveyance of hot gases as defined in claim 1 and a narrow band on the outer tubular wall of each section engageable by the lower edge of the ring apron for limiting downward movement thereof and the collapse of the accordian-like fold.

4. A smokestack for the conveyance of hot gases comprising a sectional body composed of superposed tubular sections, each section including concentrically arranged outer and inner tubular walls, the outer wall surrounding the inner wall through which the hot gases pass and providing therebetween a dead air space between the two walls, means for securing said superposed sections to each other, and annular accordian-like fold means in the dead air space on one of the tubular walls of each section to accommodate for the difference in thermal expansion between the outer and inner walls thereof in a direction of their length, said expansion means including annularly spaced T-section vertically extending plates on the inner surfaces at the outer walls, and split tubular sockets on the outer surface of the inner tubular wall opposite the T-section plates and open at the top to slidably receive the T-head of said T-section plates.

5. A smokestack for the conveyance of hot gases comprising a sectional body composed of superposed tubular sections, each section including concentrically arranged

outer and inner tubular walls, the outer wall surrounding the inner wall through which the hot gases pass and providing therebetween a dead air space between the two walls, means for securing said superposed sections to each other, and annular accordian-like fold means in the dead air space on one of the tubular walls of each section to accommodate for the difference in thermal expansion between the outer and inner walls thereof in a direction of their length, the means for securing the superposed sections to each other comprising a joint including an annular plate at one end of the walls, extending outwardly of the outer tubular wall and secured inwardly of the outer periphery thereof to the folded end of the outer tubular wall, said plate having spaced holes along its outer periphery, another annular plate supported on the other end edges of the walls, said other plate having spaced holes along the outer periphery thereof, the first-named plate adapted to seat on the annular plate on the other

end of the walls of the adjacent section, with the holes in alignment, and bolt and nut means extending through said aligned holes for securing the sections to each other.

References Cited

UNITED STATES PATENTS

153,776	8/1874	Mason	165—83
1,009,085	11/1911	Mersereau	126—307
3,232,642	2/1966	Cleff et al.	285—226 X
3,302,599	2/1967	Lawrence	110—184

FOREIGN PATENTS

942,002	11/1963	Great Britain.

FREDERICK L. MATTESON, JR., *Primary Examiner.*

H. B. RAMEY, *Assistant Examiner.*