Feb. 5, 1957 R. A. BANCK 2,780,205

TUBE SUPPORTED WALL

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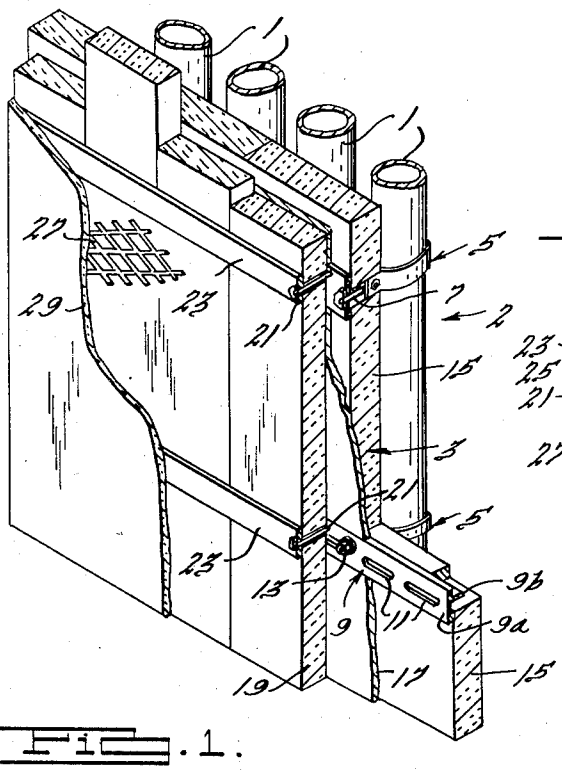


Fig. 1.

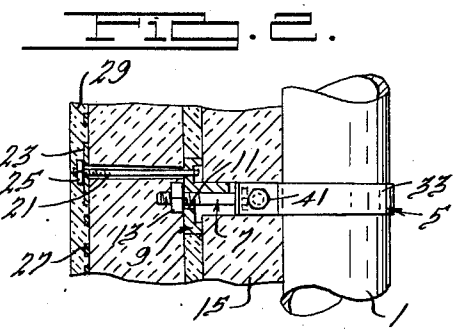


Fig. 2.

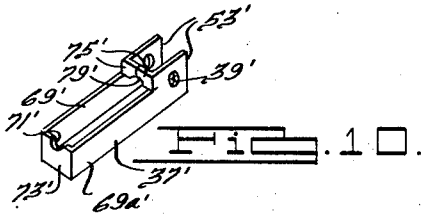


Fig. 10.

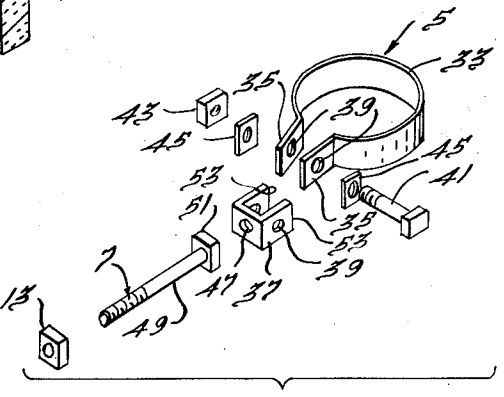


Fig. 3.

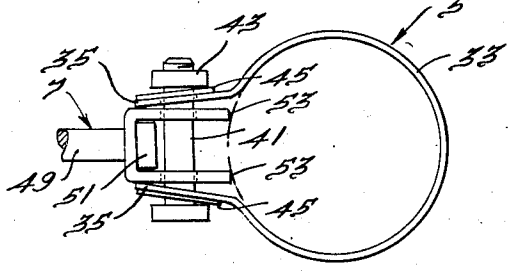


Fig. 4.

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Fig. 5.

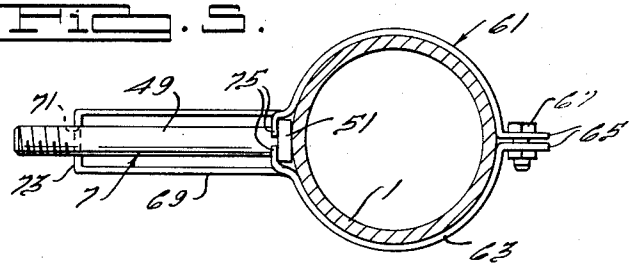
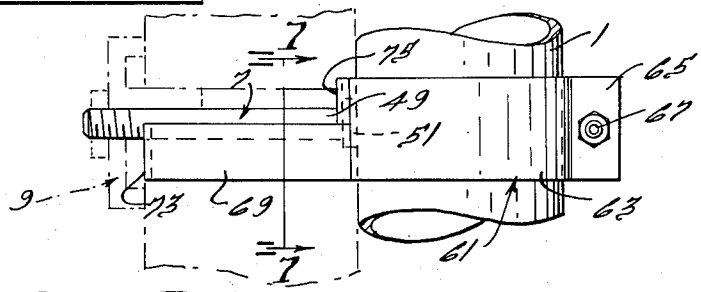
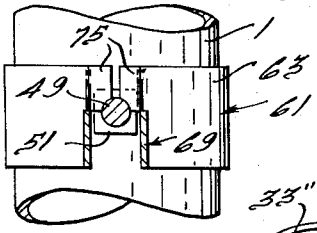


Fig. 6.





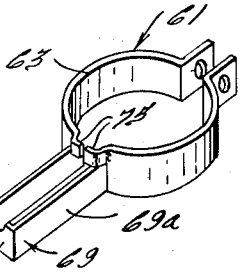


Fig. 7.

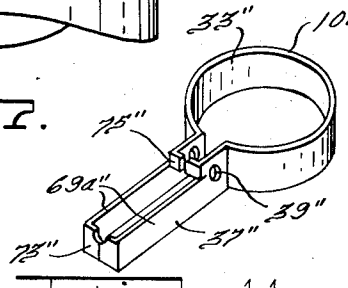


Fig. 8.

Fig. 11.

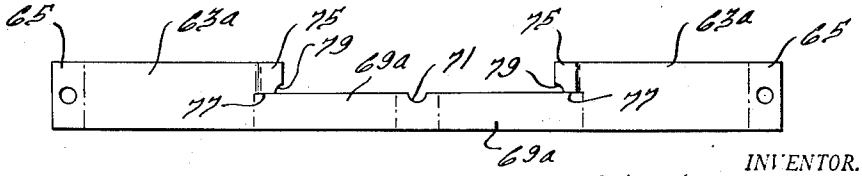


Fig. 9.

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TUBE SUPPORTED WALL

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Application November 17, 1952, Serial No. 320,998

1 Claim. (Cl. 122—6)

This invention relates to industrial boiler constructions and in particular to their enclosures.

It is an object of this invention to provide improved means for supporting the enclosing wall of an industrial boiler and, more particularly, it is an object of this invention to provide means for supporting an enclosing wall upon the tubes of the boiler.

The invention accomplishes these objects by means of a wall supporting device that may be clamped to tubes of the boiler. A multiplicity of these devices are used and they serve to transmit the weight of the enclosing wall to the boiler tubes. The devices, being clamped to the tubes, expand and contract with them and thus substantially eliminate relative movement between the tubes and the walls. Also, the wall construction may be unit-suspended on the supporting devices so that cumulative loading of the refractory is eliminated. As a consequence of these two features, the loads on the enclosure wall are substantially reduced, and, consequently, it is possible to very materially decrease the amount of structural steel framework needed to support the enclosing wall. This substitution of the boiler tubes for conventional framework as a support for the wall reduces initial cost and simplifies contouring of the wall around the furnace.

The devices which are used to support the wall each preferably comprise a contractable circular clamping section which can embrace the boiler tube and which is suitably adapted to support a stud extending transversely of the tube to which the device is clamped. The stud is connected to the enclosing wall structure in a suitable manner and supports it by transmitting its weight to the tube.

Other objectives, features, and advantages of the invention will become apparent upon consideration of the accompanying drawings in which:

Fig. 1 is a perspective view of a portion of a tube-supported boiler wall;

Fig. 2 is a partial side view of the structure shown in Fig. 1 as taken from portion 2 in Fig. 1;

Fig. 3 is an exploded perspective view of the wall supporting device of this invention;

Fig. 4 is a plan view of the device of this invention in a loosely assembled condition;

Fig. 5 is a plan view of a modified form of the invention shown secured to a boiler tube;

Fig. 6 is a side elevation of the modified form of the invention shown in Fig. 5;

Fig. 7 is a section taken along the line 7—7 of Fig. 6;

Fig. 8 is a perspective view of the modified form of wall supporting device;

Fig. 9 is a plan view of the blank which may be used to form the construction shown in Fig. 8.

Fig. 10 is a perspective view of a modified form; and

Fig. 11 is a perspective view of a further modification.

Referring first to Figs. 1 and 2 of the drawings, a series of rather closely spaced water tubes 1 form a part of a conventional boiler (not shown) and located adjacent

to them is an enclosing wall structure 3 which is mounted upon the tubes 1 by means of the wall supporting devices 5 of the invention. Each device 5 supports a stud 7 that projects transversely of the boiler tube 1 to which it is attached. The wall brackets 9 are suspended from the studs 7. The brackets 9 are preferably horizontally extending and parallel to the tubes 1 and are spaced vertically from one another at suitable intervals, approximately 18 inch spacing being found to be satisfactory for the installation illustrated. The brackets 9 are preferably cast from heat resistant alloy and may be of any desired construction which is adapted for suspension on and connection to the studs 7. The bracket 9 which is illustrated is of roughly T shape and is provided with apertures or slots 11 in its vertical side 9*a* which receive the studs 7 that extend through them and have nuts 13 threaded on their ends to bear against the vertical face of the bracket and draw it toward the tubes 1. By locating the apertures 11 below the horizontal side 9*b* of the bracket 9, the brackets may be rested on the studs as clearly revealed in Fig. 2. The horizontal spacing of the studs 7 and devices is determined principally by the requirements of the individual installation. With the construction illustrated the tubes 1 are of about 3 inch diameter and located on 6 inch centers with a device 5 on every other tube, i. e., 12 inch horizontal spacing.

It will be seen that the brackets 9 act in effect as shelves to carry the material which is used to form the walls. They are thus admirably adapted to the unit-suspending type of wall design. Thus, the innermost layer 15 of refractory material may comprise tile blocks of suitable size and shape that rest on the horizontal sides 9*b* of the brackets 9. On the outer face of the refractory tile layer 15 is preferably laid one-half inch or so of plastic insulation 17. Outside of the plastic layer 17 may be placed a layer of block insulation 19. This is ordinarily very light and can be supported adequately by means of J hooks 21 which have their rebent ends hooked into suitable apertures or lugs in the bracket 9 and their shanks extending transversely of the tubes and through batten bars 23. Nuts 25 are threaded on the ends of J hooks 21 and shoulder against the outside faces of the batten bars 23 so that the block insulation 19 may be drawn up tightly against the layer 17. Some metal lathe 27 may be laid beneath the batten bars 23 and used to help support a layer of insulating cement 29. The layer 29 is next to the outermost layer, the outermost layer not being shown in the drawings. It preferably comprises a fabric adhesive finish, known under the trademark TEXAD, and described and claimed in my co-pending application, Serial No. 172,347, filed July 6, 1950, now abandoned and replaced by Serial No. 373,865, filed August 12, 1953; however, conventional boiler plate casings can be used if desired.

Referring now more particularly to the wall supporting device 5, it will be seen from Figs. 3 and 4 that it comprises a contractable clamping member 33 of circular shape to embrace a tube 1. The member 33 has a pair of bent ends or flanges 35 that are circumferentially spaced from each other to define a mouth that will receive a U-shaped stud carrying member 37. The flanges 35 and the sides of the member 37 have aligned apertures 39 through which a bolt 41 is passed. Upon tightening of the nut 43 on the bolt, the member 37 will be clamped tightly between the flanges 35. In order to resist loosening of the nut 43 the flanges 35 are preferably slightly tapered toward each other in their unstressed condition, as shown in Fig. 4, so that on tightening of the nut 43 on the bolt 41 they will exert an expanding pressure creating friction in the engaging threads of the nut and bolt. In order to minimize attrition and provide maximum stress distribution, square or rectangular washers

45 are used between the head of the bolt 41 and the flange 35 and between the interface of the nut 43 and the flange 35.

The member 37 has an aperture 47 in its bight through which the shank 49 of the stud 7 extends, the head 51 of the stud being located inside of the member 37 and between the bight and the shank of the bolt 41. The nut 13 threads on the end of the shank 49 and shoulders against the outer face of the bracket 9 as already described.

In attaching the wall supporting device 5 to a tube 1, the stud 7 may be first placed inside of the U-shaped member 37. The mouth of the clamping member 33 can be expanded to the diameter of the tube and the clamp 33 pushed over the tube with the flanges 35 pointing outwardly toward the wall. The combined member 37 and stud 7 are then placed between the flanges 35 and the washers 45, bolt 41, and nut 43 assembled and tightened up, resulting in secure attachment of the stud 7 to the tube 1. The vertical edges 53 of the legs of the member 37 are preferably located so that they will engage the outer periphery of tube 1 and it will be seen that this engagement will prevent pivoting or angular movement of the member 37 and stud 7 about the axis of the bolt 41. The flanges 35 are received in suitable apertures in the tile layer 15 and the balance of the wall structure 3 may be mounted on the studs 7 in the manner indicated above.

Referring now to the modified form of the invention shown in Figs. 5–9, the device 61 of these Figs. is made of a single piece of sheet metal, the blank form being shown in Fig. 9. The device 61 includes a clamping portion 63 that has flanges 65 located on the rear side to define a mouth that may be opened to permit the device to be passed over a tube 1 and clamped tightly to the tube by means of the bolt and nut 67. Projecting forwardly from the front of the clamping portion 63 is a cradle portion 69 that is U-shaped in plan view and which has a semi-circular recess 71 in which the stud 7 may lie. The end 73 of the cradle portion 69 is located near the end of the stud shank but is spaced inwardly from the end of the stud by a sufficient distance to permit the bracket 9 to fit on the end of the stud. The clamping portion 63 has a pair of ears 75 formed in alignment with the cradle 69 and located to engage the top of the shank adjacent the head 51 of stud 7. The ears 75 are jogged or offset radially of the major portion of the clamping section 63 so that the stud head 51 may fit between them and the periphery of tube 1.

It will be seen from Fig. 9 that the clamping device 61 can be readily made by bending a blank of the type illustrated, the blank being symmetrical about its mid-plane containing the center of the recess 71. The side legs 69*a* of the cradle 69 extend outwardly from the mid-plane and into the wider portions 63*a* which will be bent into circular form to provide the clamping section 63, the ends of the blank providing the flanges 65. The ears 75 are formed by slitting the legs 69*a* for a short distance beyond their junction with the portions 63*a* as shown at 77 and circular quadrants 79 are preferably formed in the bottoms of the ears 75 to define a recess that is complemental to the recess 71 and thus engageable with the top of the stud shank 49.

As indicated in Fig. 6, the load transmitted to the studs 7 by the wall brackets 9 is downward and located close to the outer ends of the studs. It therefore produces a moment on each stud 7 tending to pivot the threaded stud end on the cradle end 73 in a downward direction and the head 51 in an upward direction. It will be seen, however, that this tendency of the stud 7 to pivot about the wall of the recess 71 is resisted by the ears 75 and that the studs therefore are capable of transmitting the weight of the wall 3 directly to the tubes 1 without undesired displacement.

The modification of the invention shown in Figs. 5–9 is thus of simple construction and simple to use since it is

not necessary to bolt the stud 7 to it. Like the first modification, a standard or conventional type of stud can be used. In attaching the supporting device 61 to a tube, the stud 7 is first laid in place with its head behind the ears 75 and the shank end resting on cradle end 73 in the recess 71 and then the mouth of the clamp is opened by spreading the flanges 65 and the device slipped over the tube 1. If desired, tangs (not shown) may be formed in the legs 69*a* below the ears 75 to engage the underside of the shank 49 and prevent the stud 7 from dropping out prior to assembly on the tube 1. The device 61 is clamped in place by the bolt and nut 67. The brackets 9 and other wall structure 3 may then be mounted on the stud and cradle 69 in the manner already indicated.

A further modification of the invention is shown in Fig. 10 and combines features of the previous two modifications, similar structural features being given the same reference numerals primed. This form of the invention resides in a stud support 37′ that is adapted for use with clamp 33 in place of the member 37. The support 37′ is the same as device 61 with the clamping section 63 removed and holes 39′ added whereby bolt 41 may be used to secure it to clamp 33. The support 37′ has a stud cradle portion 69′ with the recess 71′ in its end 73′ for the stud 7. The ears 75′ are turned in above legs 69*a*′ and spaced outwardly of the holes 39′ by a sufficient distance to allow the stud head 51 to fit in place behind the ears and ahead of the bolt 41 and the shank to pass through cutouts 79′, the head 51 being, of course, too wide to rotate between the sides 69*a*′ as it is too wide to rotate between the sides of member 37. It is obvious that the piece 37′ may be formed from a single piece of metal, similar to the blank of Fig. 9, and that its edges 53′ can abut the tube to prevent tilting thereof relative to the tube about bolt 41. The particular advantage of this modification as compared with the device 61 of Figs. 5–9 is that it has the clamping stud 41 on the outside of the tubes rather than on the inside as is bolt 67.

It is evident that the clamp 33″ and support 37″ could be combined and formed from a single piece of metal 100 (Fig. 11) by putting the parting line in end face 73″ so that it would form opposite ends of the blank whereas the clamp 33″ would be in the center of the blank. The sides 69*a*″ of the device would be spread apart to allow it to be passed radially over the tube and then clamped together by bolt 41 through holes 39″. It will thus be seen that the device 100 is very similar to the device 61 of Fig. 8 but that the bolt 41 will be on the outside of the tube.

Those in the art will now appreciate the advantages associated with use of the present invention. An important benefit is that it is especially well adapted for a unit-suspended wall design. It also reduces the cost of erection and maintenance and eliminates much steel that was necessary in prior constructions. Expansion problems are minimized because the wall and tubes act as a unit. The invention permits great flexibility in wall design and reduction in its weight as well as elimination of cumulative refractory loading or expansion conditions. It also permits a stable wall to be erected wherein each unit of refractory is positively supported.

These and other advantages of the invention can be obtained even though modifications of the precise constructions shown herein are used; hence, it is not intended to limit the invention to the details which have been described for purposes of illustrating the principles and spirit of the invention.

What is claimed is:

In a wall supporting structure for boilers with vertical tubes, means for securing a headed stud to a vertical tube so that it projects radially of the tube comprising an expansible aperture clamp adapted to encircle the tube, said means including a stud supporting section carried by the clamp and projecting radially therefrom, means holding said section in a rigid radial position, said section having a surface spaced a substantial distance radially of the clamp aperture and engageable with the underside of the

stud to hold it in a position normal to the clamp aperture, said means having a surface carried by the clamp and extending parallel to the clamp aperture and spaced radially from the aperture and engageable with the head of the stud to prevent its movement radially away from the aperture, a stud supported by said means, wall forming means supported by said stud, said section being U-shaped when viewed from a plane parallel to the clamp aperture with the legs of the U pointing toward the clamp aperture and the bight of the U spaced radially therefrom and provided with said stud supporting surface, said section being provided by a separate U-shaped member, said head engaging surface comprising the wall of an aperture in the bight of said member, said member having its legs interfitted with a pair of radial flanges formed on the clamp, said legs and flange having aligned apertures therein, said legs fitting inside said flanges and said flanges tapering toward each other in relaxed condition so that in clamped condition with said member between them they tend to expand and exert tension on the bolt means, bolt and nut means clamping the legs and flanges together including a bolt in said aligned apertures extending through said legs and flanges.

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