

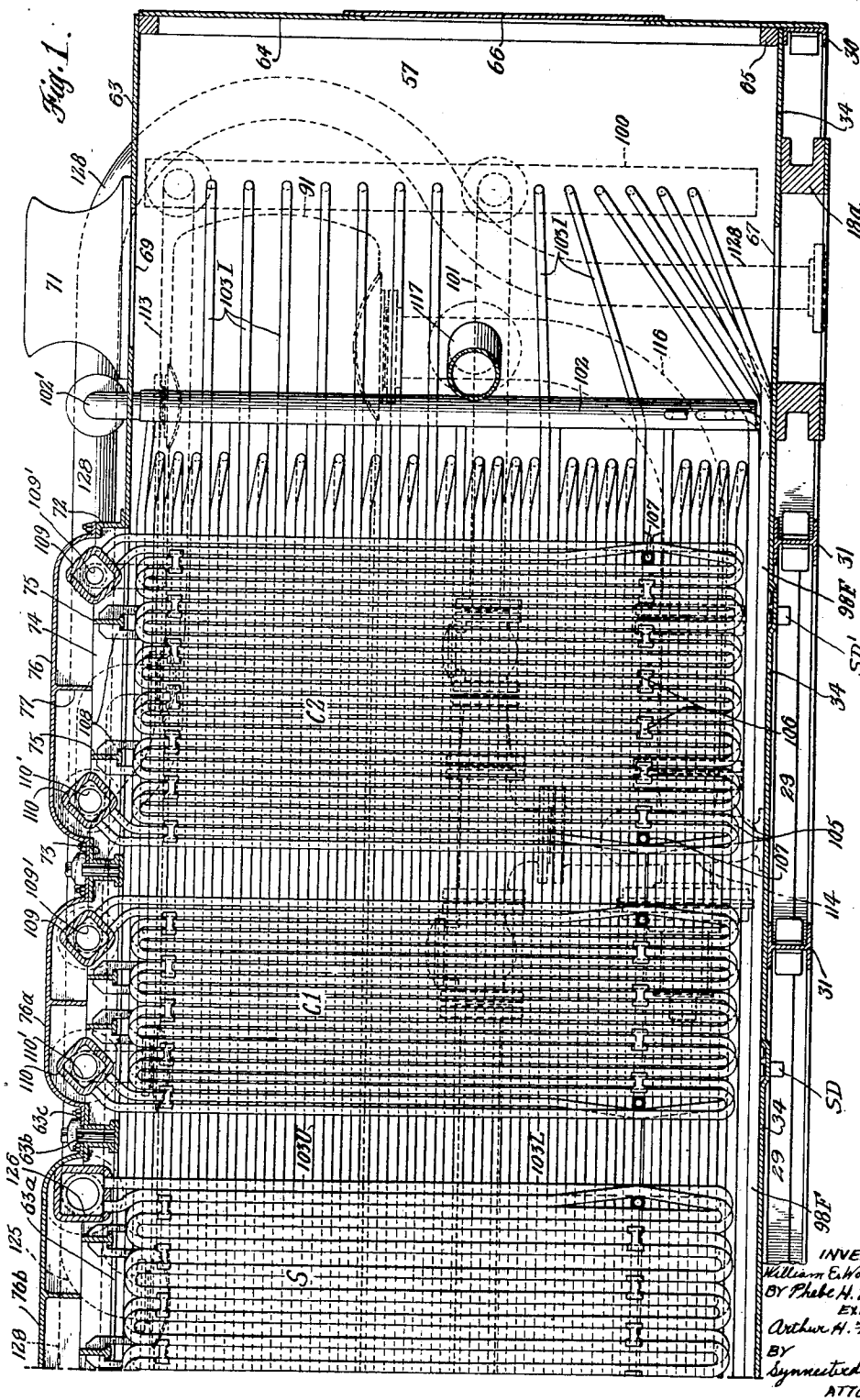
May 10, 1949.

W. E. WOODARD ET AL
TUBE SECURING MEANS FOR LOCOMOTIVE
AND OTHER BOILERS

2,469,487

Filed Aug. 25, 1942

3 Sheets-Sheet 1



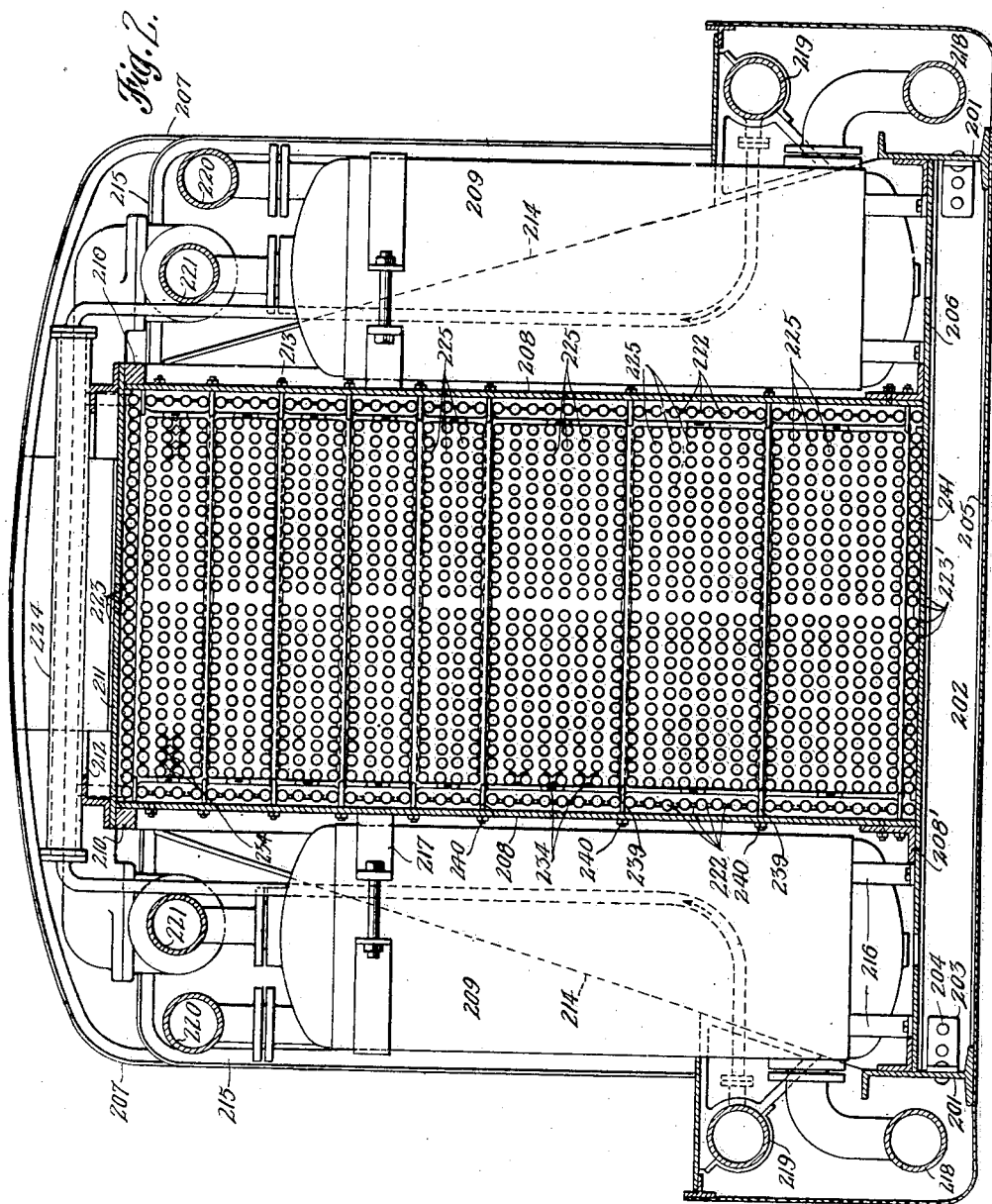
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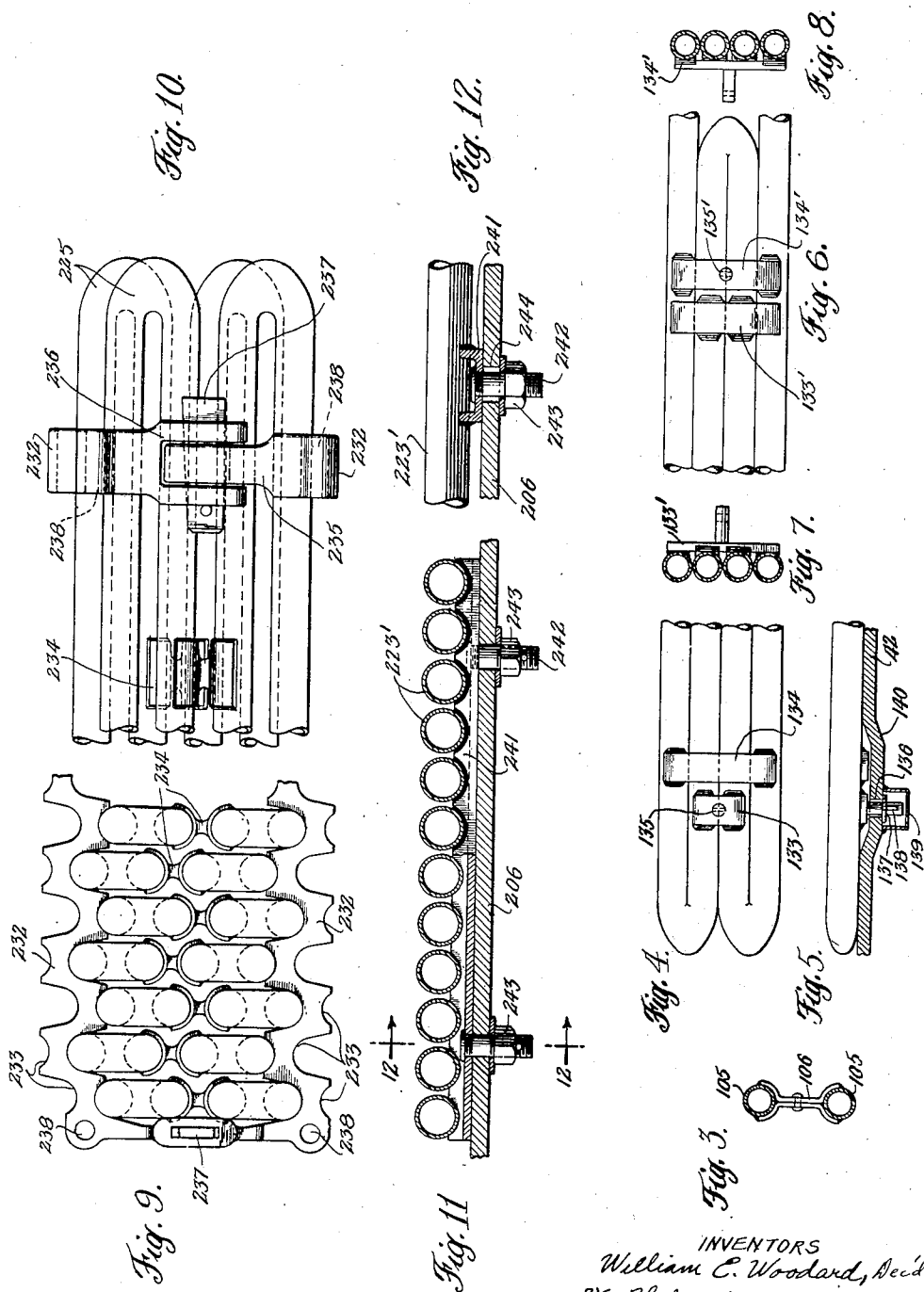
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UNITED STATES PATENT OFFICE

2,469,487

TUBE SECURING MEANS FOR LOCOMOTIVE
AND OTHER BOILERS

William E. Woodard, deceased, late of Forest Hills, N. Y., by Phebe H. Woodard, executrix, Forest Hills, N. Y., and Arthur H. Filander, Baltimore, Md.; said Filander assignor to Lima-Hamilton Corporation, a corporation of Virginia, and said Phebe H. Woodard assignor to Phebe H. Woodard

Application August 25, 1942, Serial No. 456,010

5 Claims. (Cl. 122—6)

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This invention relates to steam boiler construction, being chiefly adapted to water-tube locomotive boilers and the like, especially such boilers as employ forced-circulation boiler elements housed within a shell which is wholly or in large part free of the boiler pressure; and the invention is more particularly directed to the tube-securing means in such boilers. Locomotives having such types of boiler are disclosed in our copending applications, No. 223,528 filed August 6, 1938, and No. 379,772 filed February 20, 1941, which applications include the feature of utilizing the pressure-free shell as a major element of strength and stiffness of the locomotive foundation. The present specification consists of portions of the disclosures of said two prior applications and portions of the disclosure of copending application No. 406,962 filed August 15, 1941. Said three applications have issued respectively as Patents 2,318,040, 2,346,715, and 2,346,716.

In general, one of the primary purposes of the present invention is to make feasible the utilization on a large scale of water-tube evaporating surfaces in locomotive boilers and the like, whereby to secure substantial improvements in economy, efficiency and steaming capacity within given limitations of space, weight, safety, first cost and maintenance.

A further object of the invention is to render the boiler design more flexibly adaptable to existing limitations of proportion and size and also to the preferred design criteria of the locomotive chassis and other parts.

More specifically, it is an object of the invention to simplify and lower the cost of first construction, maintenance and repair of locomotives of the water-tube type, and especially of the type having forced-circulation water-tube coils constituting all or a major part of the radiant and convection heating surfaces of the boiler; and to improve the arrangement and location of boiler elements with relation to each other and to the shell, for the sake of convenience, compactness, ruggedness, safety and economy—especially in a boiler wherein the evaporating surface is subdivided into a plurality of units which are preferably coupled to headers or the like and are individually removable and replaceable.

Still further, since one of the problems standing in the way of the accomplishment of the foregoing and related objects has been the difficulty of firmly securing the boiler elements (including water tubes, superheater elements, headers, and other parts) while accommodating thermal expansion and contraction—a problem which is es-

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pecially severe in the locomotive field because of the severe shocks and vibrations in service—the present invention is specifically directed to accomplishing said objects by improving and simplifying the mounting, support and retention of the elements of the boiler (particularly the tube coils) in relation to the enclosing shell, while at the same time simplifying the separate and independent removal and replacement of individual tube coils or banks of tubes.

Still further, the invention contemplates the attainment of the foregoing and other objects and advantages by the features and details of construction and arrangement hereinafter fully described with reference to the accompanying drawings.

Figure 1 is a vertical longitudinal mid-section through the forward portion of a locomotive boiler and associated parts, showing the grouping of various internal boiler elements, the association of the tube coils with the headers, and the positioning and support of the parts, in accordance with one embodiment of the present invention.

Figure 2 is a transverse vertical section taken through the main part of the boiler (of a modified form of locomotive) showing in elevation one of the water and steam drums at each side, and illustrating the mounting and support within the shell of a plurality of banks of longitudinally-extending tubes, in accordance with an alternative embodiment of the present invention.

Figure 3 is a detail, taken in section through two adjacent water-tube elements of the boiler of Figure 1, and showing in elevation an inter-connecting positioning clamp or saddle device welded to said elements.

Figure 4 is a fragmentary elevational view of the looped ends of two adjacent water-tube elements, and illustrating a pair of positioning or saddle devices, constituting a feature of the invention, adapted to relatively position and to secure said elements.

Figure 5 is an edge elevation of the assembly of Figure 4, in association with securing means located at a wall of the shell structure, the wall being shown in section, illustrating how the securing means is arranged to accommodate relative longitudinal expansion and contraction between the shell and the adjacent tubes.

Figure 6 is a view similar to Figure 4 but showing a modified pair of positioning devices.

Figure 7 is a left-hand view of the assembly of Figure 6, with the tube elements shown in section.

Figure 8 is a right-hand view of the assembly

of Figure 6, with the tube elements shown in section.

Figure 9 is a fragmentary and elevational view of a typical bank of boiler tubes and tube-supporting and clamping means such as employed in the boiler shown in Figure 2, but illustrating a staggered arrangement of adjacent tube units as a modification of the straight row arrangement shown in Figure 2.

Figure 10 is a fragmentary enlarged side elevational view of the structure of Figure 9, viewed from the left of that figure.

Figure 11 is a sectional detail through one of the walls of the structural casing or shell for the boiler of Fig. 2, showing the closely spaced water wall tubes of the boiler positioned in juxtaposition to the inner face of said shell, and illustrating the means of securing said tubes to the shell.

Figure 12 is a fragmentary section on the line 12-12 of Figure 11, illustrating means for accommodating relative longitudinal expansion and contraction between the shell and the adjacent tubes.

By reference first to Figure 1, it will be seen that a typical locomotive embodying the invention comprises a longitudinally-extending pressure-free shell, adapted to be superimposed on the main framing of the locomotive. The usual locomotive saddle and cylinder structure (not shown) may be employed to securely interconnect the front end of the locomotive frame and the pressure-free boiler shell. The shell itself has at its front end a heavy bracing casting 13a adapted to cooperate with the locomotive saddle casting. The remaining points of interconnection between the shell and the locomotive main frame may consist of flexible or movable joints (in the manner fully disclosed in our said copending applications) whereby to accommodate longitudinal expansion and contraction of the shell relative to the frame while maintaining joint solidity of these structures in transverse directions.

As in the case of said copending applications, the shell in its preferred form is a major structural element of the locomotive foundation, and as it is free of the burden of withstanding the boiler pressure its construction can be designed primarily from the standpoint of securing rigidity of the locomotive in all transverse directions.

The base of the shell, from the front end rearwardly to a point adjacent the front of the fire-box region (not shown), comprises longitudinal beams, some of which may conveniently be formed of pairs of angle bars 29; the longitudinal beams being interconnected by transverse channel and I-beams 30 and 31; and a deck plate 34 being secured to the longitudinal and transverse beams, in position to form a floor or bottom wall for the enclosed space of the shell. Wall sheets 42 (a fragment of one of which is seen in section in Figure 5) extend upwardly from the base of the shell; and these, together with the deck plate 34 and the top or roof construction hereinafter described, largely define the gas passageway for the products of combustion from the region of combustion to the region of discharge of said products, the latter region being designed as a smoke-box 57.

In the region of the smoke-box the enclosure is completed by a roof plate 63, an apertured front plate 64 with reinforcing 65, and front smoke-box cover 66. The base plate 34 is apertured at 67 to pass the exhaust nozzle (not shown) and the smoke-box roof 63 is apertured at 69 to pass the usual internal extension (not shown) of the smoke stack 71.

In the intermediate region between the smoke-box and the fire-box, the roof plate is largely cut away as indicated at 63a to form openings for the tube coils. There is a series of tube coil supporting frames, each composed of heavily-flanged front, rear and side members 72, 73, 74 and 74, having supplemental transverse members 75 to which the tube coils are secured. Substantially dished cover plates 76, 76a and 76b, having internal reinforcing webs 77, cooperate with the rectangular frames just described, to form composite beams for the firm support of the tube coils from the main side structure of the shell. Stud 63b detachably secure the framing and cover plates or lids to the roof sheet 63a. Bolts or studs 63c, in turn, detachably secure the lids 76, 76a, 76b to their frames. These parts will again be referred to, when we come to the description of the tube coils and their mounting.

The structural shell which has just been described preferably receives its protection from the heat of combustion by being lined, through most of the shell, with water-circulating tubes or coils which constitute water-heating and steam-generating elements of the boiler. According to the present invention, these elements are arranged in a substantially improved manner, whereby the number of coil patterns required to complete the lining is materially reduced, the making of joints to the headers is simplified, the firm securing of the elements while maintaining freedom for expansion and contraction is improved, and the replacing of elements is made easier.

The floor protecting elements of the boiler comprise sinuous tube coils 98F, the various passes of which extend longitudinally, in side-by-side relation, to form the floor lining of the main deck 34 within the gas passageway extending forwardly toward the smoke-box. The inlet ends of the elements 98F are coupled to the vertical delivery headers 100 which receive water from the forwardly extending pump delivery lines 101. The outlet ends of these coils 98F are coupled to the vertical header pipes 102, which at the top have transverse connection pipes 102' coupled directly to the drums 91. While only one drum and one of each of said headers is illustrated, it will be understood that these parts are duplicated at each side of the locomotive (in accordance with the disclosure of our copending application No. 379,772). Most of these parts are located outside of the shell, at each side of the locomotive, although the vertical outlet headers 102 are positioned within the shell.

Turning now to the lining for the side walls of the main body of the shell, it will be seen that this comprises two groups of tube elements 103L and 103U. The side wall tube coils 103L have their rear end loops adjacent the front of the fire-box (not shown); i. e. they extend back only to the rear end of the side walls of the main gas passageway. The upper side wall tube coils 103U, however, preferably extend back into the fire-box, and these coils therefore, being longer, are made with fewer passes, as will be evident from Figure 1. At the front, the inlet ends 103I of all these tubes are connected into the vertical delivery headers 100, while their outlet or discharge ends are connected into the vertical discharge headers 102.

Turning now to the main body of convection heating surface, it will be seen that this takes the form of bundles of tube coils, indicated generally at C1 and C2. Although these two groups are of different size, they are otherwise similar, and a detailed description of one will suffice.

The tube coil units 105 are of sinuous formation with their passes running vertically. Each unit lies in a single vertical longitudinal plane, and laterally adjacent units are in abutting relation, but their passes and bends are staggered, as shown, so that the gases passing toward the smoke-box take sinuous paths between the individual elements of the tubes. Adjacent loops of each unit are secured together as by welding to double-seated brackets or saddles 106. The detail of this is seen in Figure 3.

At their lower ends, the front and rear elements of alternate units are respectively bent out of line to permit the passing of water-cooled positioning tubes 107 transversely through the entire bank. At their upper ends there are two means of support and positioning for the tubes (in addition to the inter-tube clamps 108). First, there are L-shaped lugs or hangers 108 welded to the upper loops of the tube units and hooked onto the flanges of the transverse beams 75, with freedom for sliding thereon if necessary. Second, the transverse delivery and discharge headers 109 and 110, to which the inlet and outlet ends of the tube units are connected, are seated in the side frame members 74 and thus also serve as tube supports.

These headers are formed to a square cross-section to facilitate the making of numerous tube connections thereto. In addition, they are set with their flat sides at such angles as to accommodate two rows of tube connections at one header face, with a minimum of bending of the tube ends. The seating of the headers in the side frame members 74 is preferably by means of round inlet and output pipes 109', 110', which in turn are coupled to the delivery and discharge lines. The delivery lines receive their circulation from pipes 113 which are connected into the upper ends of the front vertical headers 100, and the discharge lines are connected directly into the drums 91 (as seen in dotted lines).

The foregoing arrangement of the main transverse headers 109 and 110 has the further advantage of providing a series of cross-connections between the circulating system on the right side of the locomotive and the circulating system on the left side, each side being provided with a circulating pump 114 (one of which is shown in Figure 1) so that, if one pump fails the complete boiler will still be served by the other pump, as is the case in both of our copending applications referred to. Each pump takes water from a drum 91 through a main intake pipe 116. These two pipes are cross-connected as shown at 117.

From the pump delivery pipe on one side of the locomotive, water may be taken by any suitable connections (such as those described in our copending application No. 379,772) and delivered into the transverse supporting pipes 107, which latter aid in positioning the convection heating units and the superheater. All these transverse supporting pipes may have their discharge outlets on the opposite side of the locomotive, where they may be connected by a similar series of pipe connections into the intake side of one of the pumps.

The foregoing description gives enough of the major elements of the water-circulating system for the purposes of the present case.

Steam is taken from the top of the drums 91 by means of steam pipes such as that indicated at 125, each of which is coupled to an end of the transverse steam inlet header 126 of the superheater unit S. Since this unit, in its general con-

struction, arrangement, and support, is similar to the evaporating units C1 and C2, it need not be described in detail. Its outlet header (not shown) preferably contains the locomotive throttle, and from same the steam pipes 128 extend forwardly at each side of the locomotive, and these at their front ends are bent downwardly for coupling to the steam chests for the cylinders.

As before stated, Figure 3 shows one of the securing brackets or interpositioning saddles 106 between two tube elements 105, as already described with reference to one of the banks of convection tubes. It will be noted that similar interpositioning members are used in the superheater bank. Likewise, the lower portions of the outermost passes of alternate superheater elements are bent slightly to provide clearance for transverse water-cooled positioning tubes similar to the tubes 107 used in positioning the lower ends of the convection tube banks. Similarly, the superheater elements making up the bank are hung by hook-like devices from cross members of the framing which cooperates with the superheater header 126 and the cover member 166.

It will be apparent that by the beam-like cover plate and associated framing, together with the rigid cross-headers, all these banks of tubes are firmly supported from their upper ends; and they, with their headers, are in turn so closely associated with the cover structure as to provide considerable protection for the latter against the heat of the products of combustion, particularly since the cover structure is outside of the direct path of the flowing gas stream. At the same time, the tubes because of their sinuous arrangement and their free suspension at the lower ends, can readily accommodate expansion and contraction longitudinally, under thermal change; and yet the interpositioning saddles and the transverse positioning tubes 107 prevent undue displacement and vibration of the tubes collectively or individually.

We turn now to the securing means for the lining tubes which lie against the main wall surfaces of the shell. These securing devices (indicated in general at SD and SD' in Fig. 1) take a couple of forms, although their general arrangement and appearance are similar. One form is shown in Figures 4 and 5, and another form in Figures 6 to 8.

Figures 4 and 5 show in detail the preferred method of securing in place the loop ends of one of the multi-pass tube-coil units. The securing unit comprises a pair of saddles or straps 133 and 134, one short and one long, the first of which is welded to the inner or adjacent tube elements of two abutting tube loops, the other being welded to the outer or non-adjacent elements. Although they lie on the same side of the tube coil, the arrangement will readily be seen to be such as to prevent relative disalignment of the two loops in either direction from their common plane. At the same time, these devices permit free longitudinal expansion and contraction of the coil elements. One of the straps (in this case, the short one) carries a stud 135 which extends loosely through an aperture 136 in the shell wall in a manner to accommodate thermal expansion, and is there secured by means of a washer 137 and a key 138. A closure cap 139 can be welded in place over this assembly, to prevent ingress of air or egress of gases. The shell wall is dented or humped outwardly at 140 to form a pocket to accommodate the straps, whereby the tube coil lies flat against the shell wall 42.

In the form of securing arrangement for the opposite end of the tube coil, as shown in Figures 6, 7 and 8, similar elements are employed, except that the straps 133' and 134' are both long enough to underlie four tube elements, and the stud is secured to the one which is fastened to the outermost elements of the group. At this end of the coil, the outermost tube elements are adapted to be connected to their inlet and discharge headers (not shown in the detail figures) which fix said connected ends of the tube, and these ends may thus be conveniently joined by the strap 134' carrying the securing stud 135'; whereas the two parts forming the central loop are joined by the strap 133', which, however, has a relative sliding engagement with the outermost elements of the coil, to permit expansion and contraction of the central loop of the coil toward and away from the headers. Thus, expansion and contraction of the coil relative to the wall of the shell, and also contractions and expansions of different parts of the coil relative to each other, can take place, without putting a strain upon the coil or its joints with the headers; while at the same time each element of each tube coil is maintained in protective juxtaposition to the shell wall, and is held as against vibration, which would otherwise cause excessive wear.

Reference will now be made to the alternative embodiment of the invention, as illustrated in Figures 2 and 9 to 12.

Figure 2 is a transverse section through a pressure-free boiler shell generally similar to that of Figure 1, but in which the main banks of convection heating surfaces run longitudinally instead of vertically. The base of the shell is formed of main longitudinal girders 201, of considerable vertical depth, which may extend substantially throughout the length of the locomotive, one such girder being adjacent each side, and the two girders being interconnected at intervals by means of transverse I-beams or other structural members 202, the joining of the structural parts being by any suitable means such as angle members 203 and rivets 204. The longitudinal girders are interconnected by a bottom plate 205 and a deck plate 206, the plate 206 serving as the bottom wall of the passageway for the products of combustion, in other words as the bottom wall of the metallic shell which encloses the evaporating means.

The major part of the metallic shell is built up upon the base just described, and is preferably formed of steel sheeting. In the region of the fire-box, the width is as indicated by the external reinforcing angle bars 207, but in the region from thence forwardly to the smoke-box the overall width between the side walls 208 of the shell is considerably reduced. This not only results in a reduction in the cross-sectional area of the passage for the products of combustion which are cooled during their progress from the fire-box to the smoke-box, but also provides the necessary space exteriorly of the shell, at each side, for a longitudinally-extending row of upright water and steam drums 209.

The side walls 208 of the gas passageway are secured to the base by longitudinal angle bars 208' and are reinforced along their upper edges, as by the reinforcing bars 210; and the roof or top wall is made up of a removable cover plate 211 which has reinforcing flanges or framing 212. The side walls 208 are additionally braced by vertical flange members 213 and flanged triangular bracing sheets 214. Additional flanges 215 may extend outwardly from the side walls

and down to the base, and may be used for the added function of supporting an enclosing sheath adapted to house thermal insulating material. In addition, the steam and water collecting and storing means, preferably in the form of the vertical drums 209 above mentioned, serve to add to the strength and stiffness of the shell, by being mounted rigidly, as by the base brackets 216, upon the lateral extensions of the base of the shell, and by being secured firmly to the side walls of the shell as at 217.

Figure 2 also illustrates some of the essentials of the circulating system, such as the main pump intake lines 218, pump delivery lines 219, discharge lines 220 from the water-tube banks to the drums, and the steam take-off lines 221 from the drums to the superheater header; but details of this are not necessary to the present case, and can in any event be had by reference to our copending parent application No. 223,528.

Turning now to the convection heating tubes within the shell, it will be observed that the side walls 208 are protected by finned tubes 222 which extend longitudinally. These may consist of sinuous tube coils, with return bends, and having their terminal points connected to vertically disposed inlet and outlet headers (not shown) which may be similar to those illustrated in Figure 1.

The roof tubes 223 lie close to the inner face of the cover plate 211, and also extend longitudinally. Thus the roof has separate protection in this form, instead of being protected by the main tube banks (such as C1 and C2 in the first form). The roof tubing 223 has inlet and outlet connections extending upwardly, as shown, for coupling to transverse headers, one of which is shown at 224, so that the roof, the roof coils and their headers are removable as a unit, upon uncoupling of the pipe line connections to the headers.

The main bulk of the convection surface of the steam-generating means is in this embodiment composed of longitudinally-extending tubing, arranged in bundles 225, which may have their inlet and discharge ends coupled to headers in the smoke-box (not shown).

Just as in the first embodiment, it is important that the tubes be held as against vibration, kept in their proper spacing, and arranged for convenient removal and replacement as unitary bundles. Suitable apparatus for accomplishing these purposes is indicated fragmentarily in Figure 2, and in detail in Figures 9 to 12 inclusive.

Although the tubes in Figures 9 and 10 are shown in staggered relation, it will be understood that the tube clamps 232 shown therein may readily be configured with their curved tube seats 233 either in staggered relation or in straight rows as indicated in Figure 2. A plurality of tube units, or a plurality of passes of the same tube unit, are positioned in superimposed relation by means of the double-ended saddle members 234, which may if desired be welded to the adjacent tubes. Any suitable number of the tube units are then clamped together between two of the members 232, which have complementary tongues and forks 235, 236, apertured to receive a wedging key 237. At the corners of the assembled bundle, the clamping members 232 have holes 238, adapted to be slid onto and retained by hooked bolts 239 (see Fig. 2) which pass through the walls of the shell and are there secured as by nuts 240. The accommodation for expansion and contraction may be between the bolts 239 and the bores or holes 238, or between the hooked ends of said

bolts and the apertures in the shell wall through which they extend.

A suitable fastening for the floor, wall and roof tubes (for example the floor tubes 223' of Figure 2) is shown in Figures 11 and 12, wherein it will be seen that saddle strips 241 extend at right angles to the axes of the tubes, the tubes being welded in said saddles. Studs 242 pass out through the wall 206 of the shell, and are secured as by suitable nuts 243. In order to allow for relative longitudinal expansion between the tubes and the shell structure, holes 244 through which the studs pass may be made elongated in the direction of the tube length, as shown in Figure 12.

An additional means of securing tubes in place, particularly in cases where tubes are positioned to extend in a direction perpendicular to the length of the shell, may consist of lugs or studs integral with the bent ends of the tube units, such lugs being in turn secured to the shell as by passing through apertures similar to those already described. This arrangement is not illustrated in the embodiment of Fig. 2, but it will be readily understood that hanger lugs such as those numbered 108 in Figure 1 could be adapted to this purpose, by forming them as studs and fitting them loosely through the roof plate of the shell, for example.

It will now be observed that in both embodiments of the invention, the tubes are disposed primarily for convenience of installation and removal, for ready accommodation to thermal changes, and for ease of making external connection to the internally housed tubes, rather than to facilitate natural circulation. In fact, with the sinuous tubes herein disclosed, effective natural circulation would be impossible. However, the forced-feed water circulation employed, which is adapted to circulate water at a rate substantially in excess of the steaming rate, protects not only the tubes and the shell but also the tube securing arrangements herein described.

As to both embodiments of the invention, the horizontal disposition of the side wall tubes in the main gas passageway to the smoke-box permits the use of long-coil units here as well as at the floor, which not only simplifies their installation, but also simplifies their connection to headers at the front end. The fastening means for the lining tubes are such as to assure close and secure positioning of said tubes against the inside surfaces of the shell, which also avoids short-circuiting of the gases behind the tubes, while at the same time providing the necessary freedom for expansion and contraction of the tubes relative to the shell.

The main banks of convection tubes, whether running vertically as in the first embodiment, or horizontally as in the second, are firmly supported from the pressure-free shell (which is stiff enough to take their weight), and held as against excessive vibration, although permitted to expand and contract in a direction longitudinally to the tubes, both with relation to the shell, and as between different tube units.

Where the main convection banks of water tubes, and/or the superheater, are arranged vertically (as in Fig. 2), we secure greater ease of individual removal and replacement. This arrangement also permits the use of sufficient cross-ties at various points along the top of the shell so as to increase the strength and stiffness of the latter. The support of these tubes against vibration and consequent loosening and wear is also thereby improved. Further, the headers can

serve the additional combined functions of cross-connections for the parallel circulating systems connected to the duplicate pumps, and of supporting means for the tube bundles and bracing means for the shell. These headers are clamped between the mounting frames and the cover plates, and the frames in turn are secured over the openings in the top of the shell, so that each bank of tubes with its headers, supporting frame and cover plate, can be handled as a unit. By withdrawing the transverse positioning tubes near the bottom of the unit, disconnecting the header couplings, and unscrewing the fastening studs at the top, the complete unit can be lifted right out of the shell, which is of value not only in connection with repair or replacement, but also for the purpose of cleaning. On the other hand, the fastening means for the cover plates may be loosened, and the plates removed separately, for purposes of inspection.

From the foregoing description it will now be readily understood how we achieve the objects and advantages set out at the beginning of the specification. Several forms of tube securing arrangements, characterized by firm interpositioning of the tubes by various saddle devices, and fastening means accommodating longitudinal expansion and contraction, have been illustrated and described, and it will be evident to those skilled in the art that still other forms may be adopted without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. In a locomotive, a bundle of looped water tube elements the loops of which are supported as against displacement out of a plane containing the axes of the tube elements but have freedom for limited movement in said plane, together with means providing the support defined, said means including a pair of saddle members fixedly secured to a tube loop, one of said saddle members being positioned to straddle a pair of tube lengths across the loop connecting them, and the other being positioned between the same tube lengths at the opposite end of the bundle; said means also including, for at least one of the saddle members, a fastener extending at right angles to the axis of the tube bundle and engaging a support with limited freedom to move bodily with the tube.

2. The combination, with a plurality of elements of a tube coil of sinuous configuration, of a pair of interpositioning saddles lying on one face of a group of elements spaced apart longitudinally of said elements, one of said saddles being fixedly secured to a pair of non-adjacent elements but slidable relative to other elements of said group, and the other being fixedly secured to a pair of elements between said non-adjacent elements, a fastening device on one of said saddles, a support, and means of interconnection between said fastening device and said support including a sliding connection configured to accommodate relative movement in a direction longitudinally of said elements, whereby relative movement of different pairs of said group may occur with differences in thermal expansion.

3. Positioning means for water tubes or the like, comprising, in combination with a plurality of elements of a tube coil of sinuous configuration, a pair of straps spaced apart longitudinally of said elements lying on one face of a group of elements crosswise thereof, one of said straps being fixedly secured to a pair of non-adjacent

elements, said non-adjacent elements being slidable relative to other elements of said group, and the other being fixedly secured to a pair of elements between said non-adjacent elements, and at least the first mentioned strap being extended to overlie all four of them although being fixed to only two of them, so that relative movement of said two pairs of said group may occur with differences in thermal expansion.

4. The construction of claim 3 with a fastening device on one of said straps having a sliding connection with an adjoining support.

5. The construction of claim 4, in which the adjoining support is a wall plate having a recess within which said straps lie.

PHEBE H. WOODARD,

*Executrix of the Estate of William E. Woodard,
Deceased.*

ARTHUR H. FILANDER.

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