April 5, 1932. W. H. ARMACOST ET AL 1,852,279

MEANS FOR SECURING TUBES TO HEADERS

Filed May 16, 1929 2 Sheets-Sheet 1

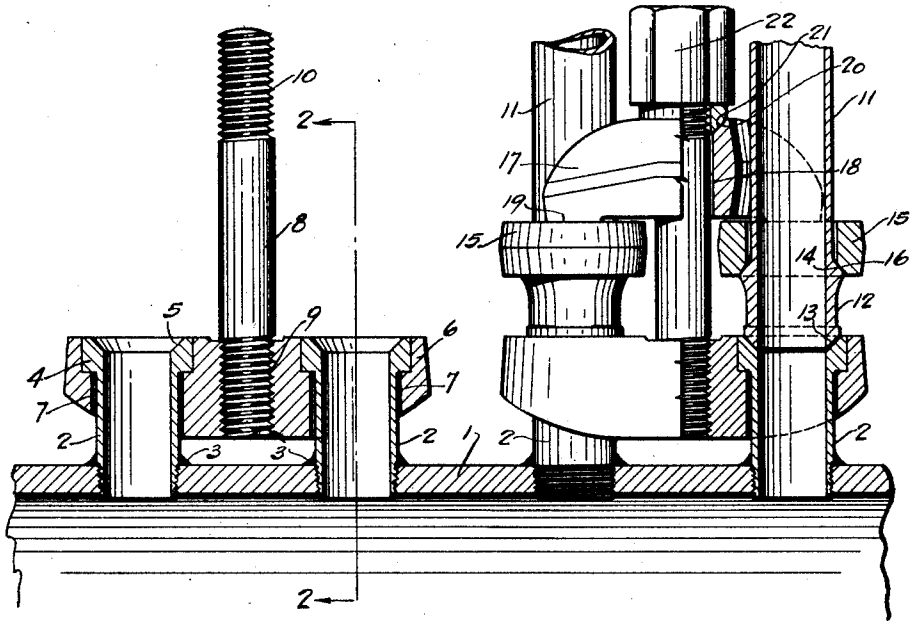

Fig. 1.

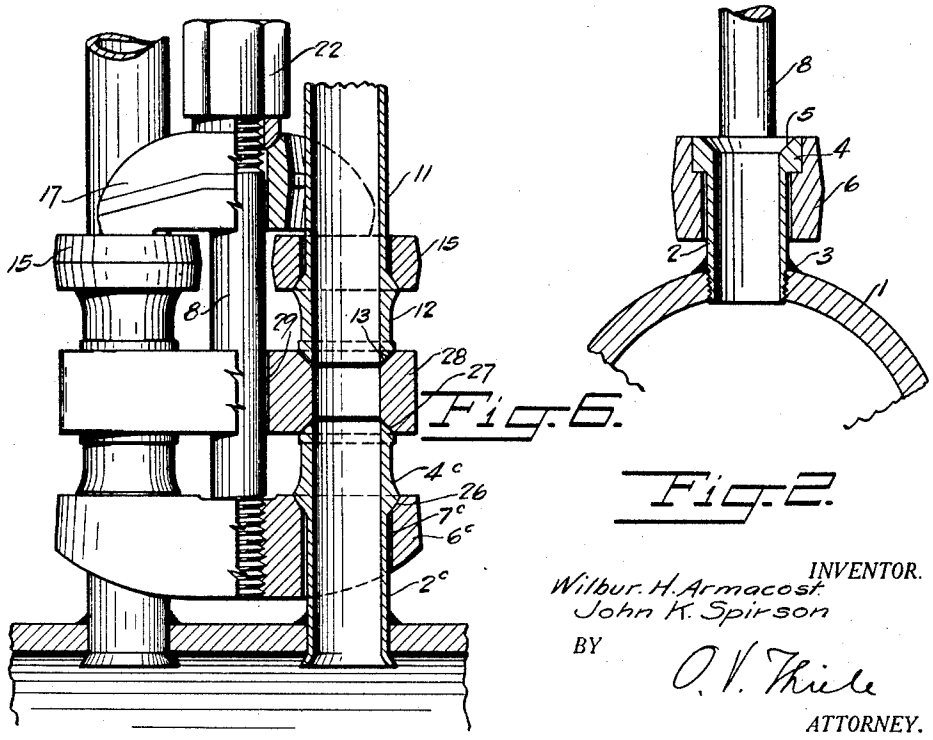

Fig. 6.

Fig. 2.

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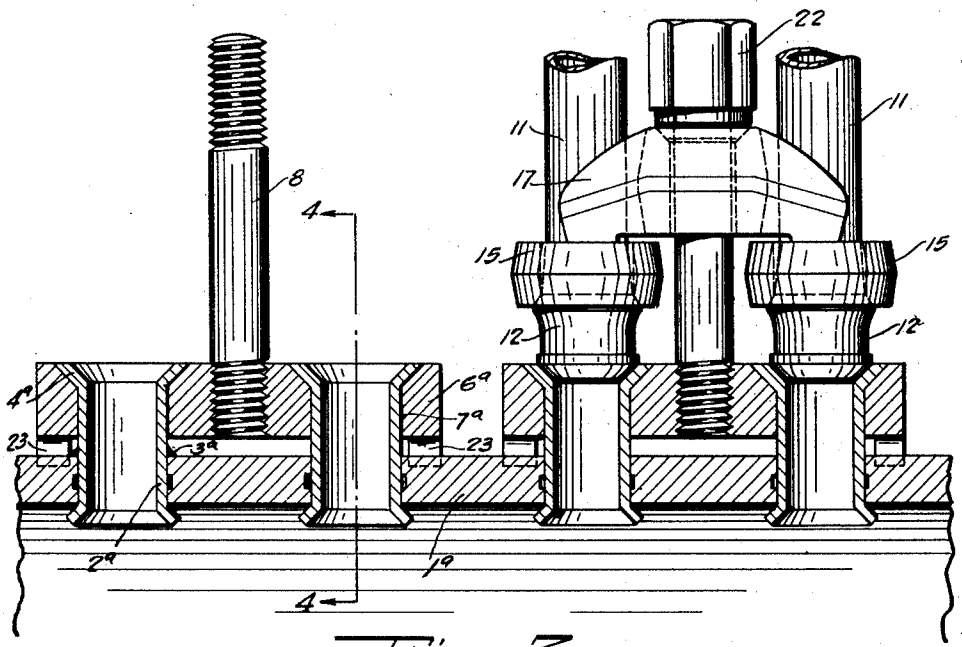


Fig. 3.

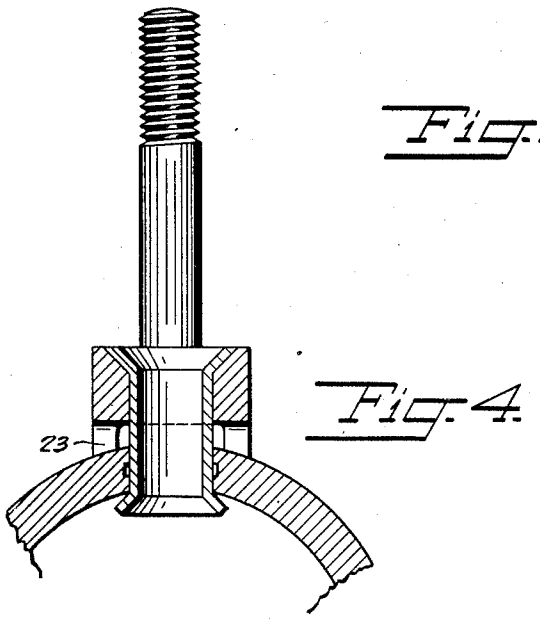
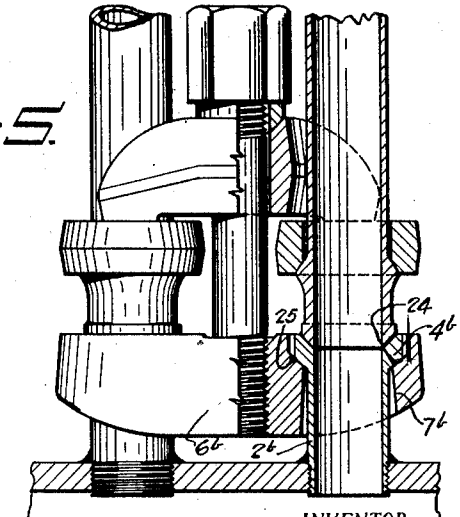


Fig. 4.

Fig. 5.



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UNITED STATES PATENT OFFICE

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MEANS FOR SECURING TUBES TO HEADERS

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The present invention relates to means for securing tubes to headers or the like and has particular reference to structures such as steam superheaters or the like in which a number of tubular elements conveying fluid under pressure are detachably secured at their ends to distributing or collecting headers.

Heretofore tubular elements of this character have been detachably connected to headers through the medium of releasable clamping means holding the ends of the elments in contact with seats located in the header walls and with the clamping means anchored in the header wall or some reinforcing element associated therewith.

The use of much higher steam pressures in structures of this nature has rendered the forms of joints heretofore employed unsatisfactory, due to the distortion occuring in the header and joint structure because of the extreme pressure employed, such distortion causing difficulty in maintaining pressure tight joints.

The principal purpose of the present invention is the provision of an improved form of structure by means of which the above difficulty may be eliminated and also by means of which the advantages of a detachable connection between header and tubes may be retained while at the same time employing a lighter header than would otherwise be possible.

The manner in which the purpose of the invention is carried into effect may best be understood from a consideration of the ensuing description of the embodiments thereof shown in the accompanying drawings in which Fig. 1 is a fragmentary elevation, partly in section, of a header and tube assembly embodying the invention; Fig. 2 is a fragmentary section taken on the line 2—2 of Fig. 1; Fig. 3 is a view similar to Fig. 1 showing another form of the invention; Fig. 4 is a section taken on the line 4—4 of Fig. 3, and Figs. 5 and 6 are views similar to Fig. 1 showing still other forms of the invention. Referring now to Figs. 1 and 2, the header is shown at 1 and while for purposes of illustration a cylindrical header has been shown, it will be readily apparent as the description proceeds that the invention is equally well applicable to headers having other cross sectional forms.

The header wall is suitably perforated to receive a member of relatively short nipples 2 placed in suitably spaced relation and permanently secured to the header. As shown in the figures, the nipples 2 are threaded through the header wall and sealed against leakage by means of the welds 3. Other methods of securing the nipples may obviously be employed.

The outer ends of the nipples are upset to form shouldered heads 4 and internal conical seats 5 are provided in these heads. A bar 6 having suitably spaced counter-bored apertures 7 therethrough is fitted over each pair of nipples so that the upset heads 4 of the nipples lie within the counter-bored portions of the apertures 7. The main portions of the bores of the latter are preferably slightly larger in diameter than the normal diameter of the nipples 2. Between the apertures, through which the nipples pass, the clamping bolt 8 is secured to bar 6. In the form illustrated the bolt 8 is in the form of a stud threaded through a centrally located threaded hole 9 in bar 6, and the upper end of the bolt is threaded as at 10 for a purpose to be described later. Equivalent means of securing a clamping bolt to bar 6 may be employed. The tubular elements 11 are each formed with an enlarged head 12, said heads being formed with two external spherically contoured seats 13 and 14, these surfaces being struck from a common center. A washer 15 having a bore slightly larger than the external diameter of the tubular element 11 is placed around each of the elements, said washer being countersunk at 16 to provide a conical bearing surface adapted to contact with the spherical surface 14 of the element head 12. A yoke 17 having a central bore 18 slightly larger than bolt 8 is fitted over the extended end of the latter, said yoke being bifurcated at its ends to form bearing surfaces or feet 19 acting on opposite sides of each of a pair of washers 15. The upper end of bore 18 is countersunk as at 20 to provide a conical bearing surface against which the

spherical surface of washer 21 bears. The latter has a plane upper surface engaged by the nut 22 screwed on the threaded end 10 of the clamp bolt.

In assembling the structure above described, nipples 2 are first inserted through the apertures in bar 6 and are then screwed and welded in place in the header wall 1. Stud 8 may be assembled either before or after the nipples are secured in the header. Washers 15 are slipped over the ends of the tubular elements 11 before the upset heads of the latter are formed, unless the opposite ends of these elements are secured by means of a joint which does not require enlargement of the external diameter of the elements. The elements are then placed with the seats 13 engaging seats 5 of the nipples; the yoke 17 is placed in position and the elements drawn into fluid pressure tight engagement with the nipples by means of the nut 22.

As will be obvious, a line contact will result between surfaces 13 and 5 and also between surfaces 14 and 16 and because of the common center from which surfaces 13 and 14 are generated, it will be apparent that a certain degree of universal motion is possible for the elements 11 without in any way affecting the joint between the elements and the nipples. Also because of this form of construction the yoke 17 can adjust itself to slight inequalities such as variation in the thickness of washers 15, so that the pressure exerted thereby is evenly distributed to the two element heads held by the yoke.

Turning now to Figs. 3 and 4; another form of joint is shown in which the nipples 2—*a* are expanded into the header wall 1—*a* to form a permanent joint which may also be further sealed by means of the circumferential welds 3—*a*. The bar 6—*a* instead of being counter-bored as in the form shown in Fig. 1 is countersunk, and enlarged heads 4—*a* of the nipples are formed by expanding the walls of the nipples against the conical seats formed by countersinking the apertures 7—*a* in the bar. This expanding of the nipples is preferably accomplished by a rolling process which obviously will tend to force the bar 6—*a* toward the wall of the header. A number of lugs or feet 23 are preferably provided on the under side of bar 6—*a* to form a support for the latter so that the major portion of the bar is spaced a short distance from the header for a purpose which will appear later. As in the form previously described, the clamp bolt 8 is in the form of a stud centrally located in the bar 6—*a*, and the heads 12 of the elements 11 are secured to the nipples 2—*a* in the same manner as that previously described by means of washers 15, yoke 17 and nut 22.

In Fig. 5, another form of joint is shown in which the enlarged heads 4—*b* of nipples 2—*b* are formed with external spherical bearing surfaces 24 which engage the conical surfaces 25 formed by countersinking the apertures 7—*b* in the bar 6—*b*. In this connection it is to be noted that a clearance is provided between the nipples 2—*b* and the apertures 7—*b* to allow the bar 6—*b* to align itself. The remainder of the clamping means is the same as that already described.

In the form shown in Fig. 6 the enlarged outer ends or heads 4—*c* of nipples 2—*c* are formed in the same manner as the heads 12 of the elements 11, that is, with two spherical seats 26 and 27 struck from a common center. The surfaces 26 engage conical bearing surfaces formed by countersinking the apertures 7—*c* in bar 6—*c*, this construction being similar to that shown in Fig. 5. Instead, however, of having the element heads 12 seated directly against the nipples, an intermediate bar 28 is provided having suitably spaced bores therethrough, each of said bores being countersunk at both ends to form conical bearing surfaces against which the bearing surfaces 27 of the nipples 2—*c* and 13 of the element heads 12 seat. Bar 28 is also provided with a central bore 29 through which the clamp bolt 8 passes and the usual washers 15, clamp 17 and nut 22 are employed to draw the heads 4—*c* and 12 into pressure tight engagement with their respective seats in the bar 28.

In the several forms hereinbefore described, it will be apparent that the joints provided between the nipples and the elements will not be subject to distortion such as would be the case if the seats against which the element heads bear were formed in the wall of the header or an element integrally connected therewith.

In order to maintain pressure tight joints of the character hereinbefore described it is necessary from time to time to regrind the bearing surfaces, and where such surfaces form a portion of the header the seats may be reground only a limited number of times before the removal of metal by the regrinding process causes undesirable weakening of the header wall. By means of the present invention the permissible number of regrindings of the seats is substantially unlimited, as the nipples which may have been reduced in thickness to an undesirable degree by regrinding operations may be readily replaced at small expense by new ones. As will be readily apparent, it is a relatively simple matter to cut worn out nipples from the header and re-thread or re-expand new nipples in place, sealing them by means of new welds. In this connection it is to be noted that because of the relatively short length of the nipples provided, they may be readily expanded into the header wall by means of an expander operating through the open ends of the nipples so that hand hole plates in the header opposite the nipples are not required.

It is for the purpose of facilitating renewals of nipples that the feet 23 are provided on the bar 6—*a*, shown in Fig. 3, these feet giving a clearance between the header and the bar which permits the sealing of replacement nipples in the header by means of new welds 3—*a*.

Obviously the arrangement of the elements 11 with respect to the header or headers is subject to wide variation as are also the details of construction of the joints, and the invention is therefore not to be considered as limited to the illustrative forms herein disclosed, but is to be considered as embracing all such changes and modifications as may fall within the scope of the appended claims.

We claim:

1. Apparatus of the class described, comprising a header wall, a pair of spaced nipples permanently secured in said wall, the outer end of each nipple being enlarged and having an annular seat formed thereon, a pair of tubular elements each formed with an enlarged head having an annular seat thereon, and releasable clamping means for holding each of said nipples in fluid pressure tight communication with one of said elements, said means comprising a bar acting under the enlarged heads of the nipples, an apertured yoke acting over the element head, a bolt engaging said bar between said nipples and extending through the aperture in said yoke, and a nut on the extended end of the bolt for drawing said yoke and bar together.

2. Apparatus of the class described comprising a header wall, a pair of spaced nipples permanently secured in said wall the outer end of each nipple being enlarged and having an annular seat formed thereon, a pair of tubular elements each formed with an enlarged head having an annular seat thereon engaging one of said first named seats, and releasable clamping means engaging the enlarged ends of the nipples and the heads of the elements to hold the nipples and elements in pressure tight engagement.

3. Apparatus of the class described, comprising the combination of a header wall, a pair of spaced nipples permanently secured in said wall, the outer end of each nipple being enlarged and having an internal conical seat formed thereon, a pair of tubular elements each formed with an enlarged head having an external spherical seat thereon engaging one of said conical seats, and releasable clamping means engaging the enlarged ends of the nipples and the heads of the elements to hold the nipples and elements in pressure tight engagement.

4. Apparatus of the class described, comprising the combination of a header wall, a pair of spaced nipples permanently secured in said wall, a bar having counterbored apertures therethrough through which said nipples pass, the outer ends of said nipples being enlarged to provide shouldered heads seating in said counterbores and having internal conical seats, a bolt engaging said bar between said apertures, a pair of tubular elements each formed with an enlarged head having an external spherical seat engaging one of said conical seats, and means engaging said stud and said element heads for holding the latter in pressure tight engagement with the nipples.

5. Apparatus of the class described, comprising the combination of a header wall, a pair of spaced nipples permanently secured in said wall, a bar having countersunk apertures therethrough through which said nipples loosely pass, the outer ends of said nipples being enlarged to form heads having internal conical seats and external spherical surfaces engaging the countersunk portions of said apertures, a bolt engaging said bar between said apertures, a pair of tubular elements each formed with an enlarged head having an external spherical seat engaging one of said conical seats, and means engaging said stud and said element heads for holding the latter in pressure tight engagement with the nipples.

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