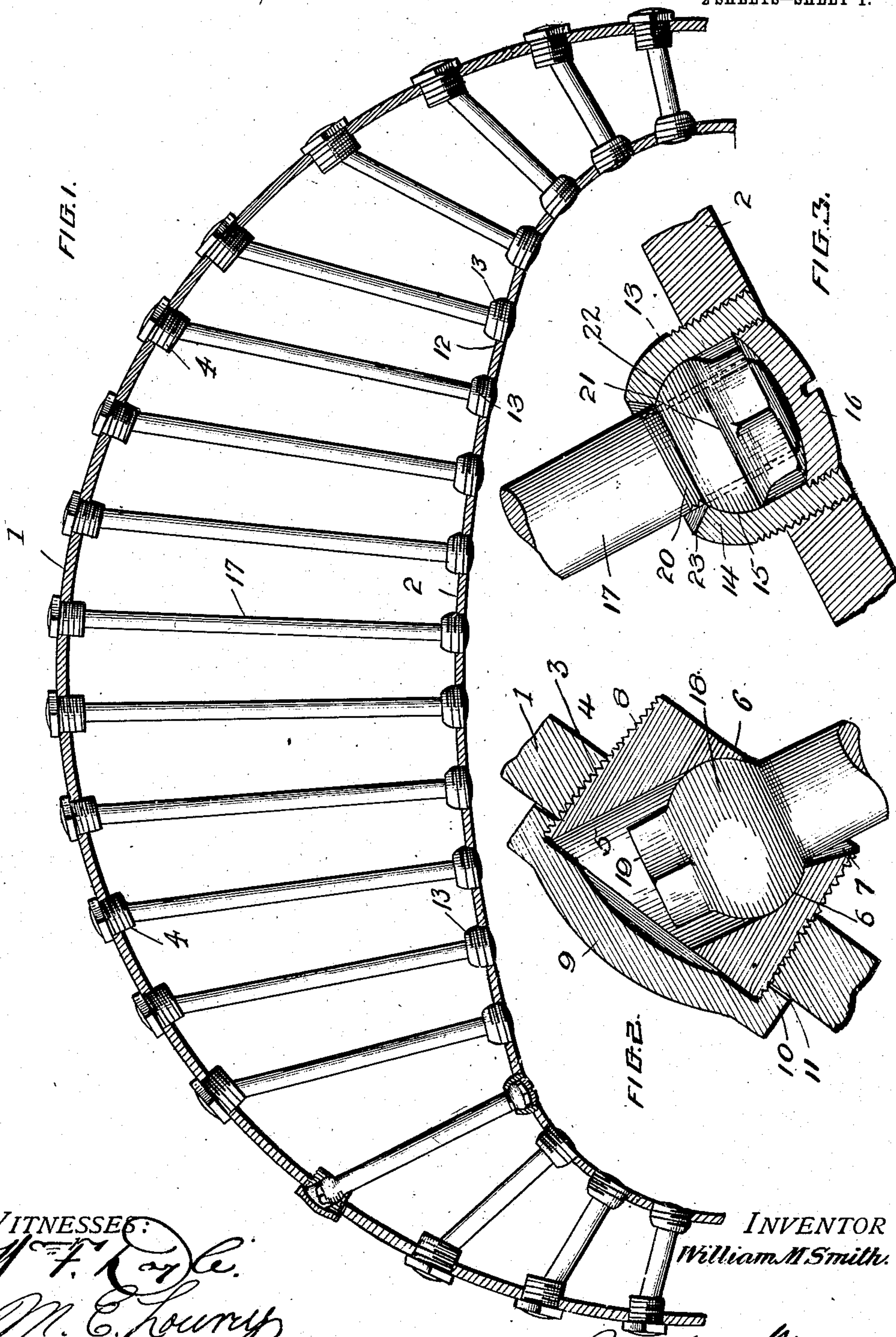


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APPLICATION FILED FEB. 20, 1909.

930,809.

Patented Aug. 10, 1909.

2 SHEETS—SHEET 1.



WITNESSES:

*H. F. Rayle.*  
*M. E. Lowry*

INVENTOR

*William M. Smith.*

*By A. M. Wilson*  
Attorney

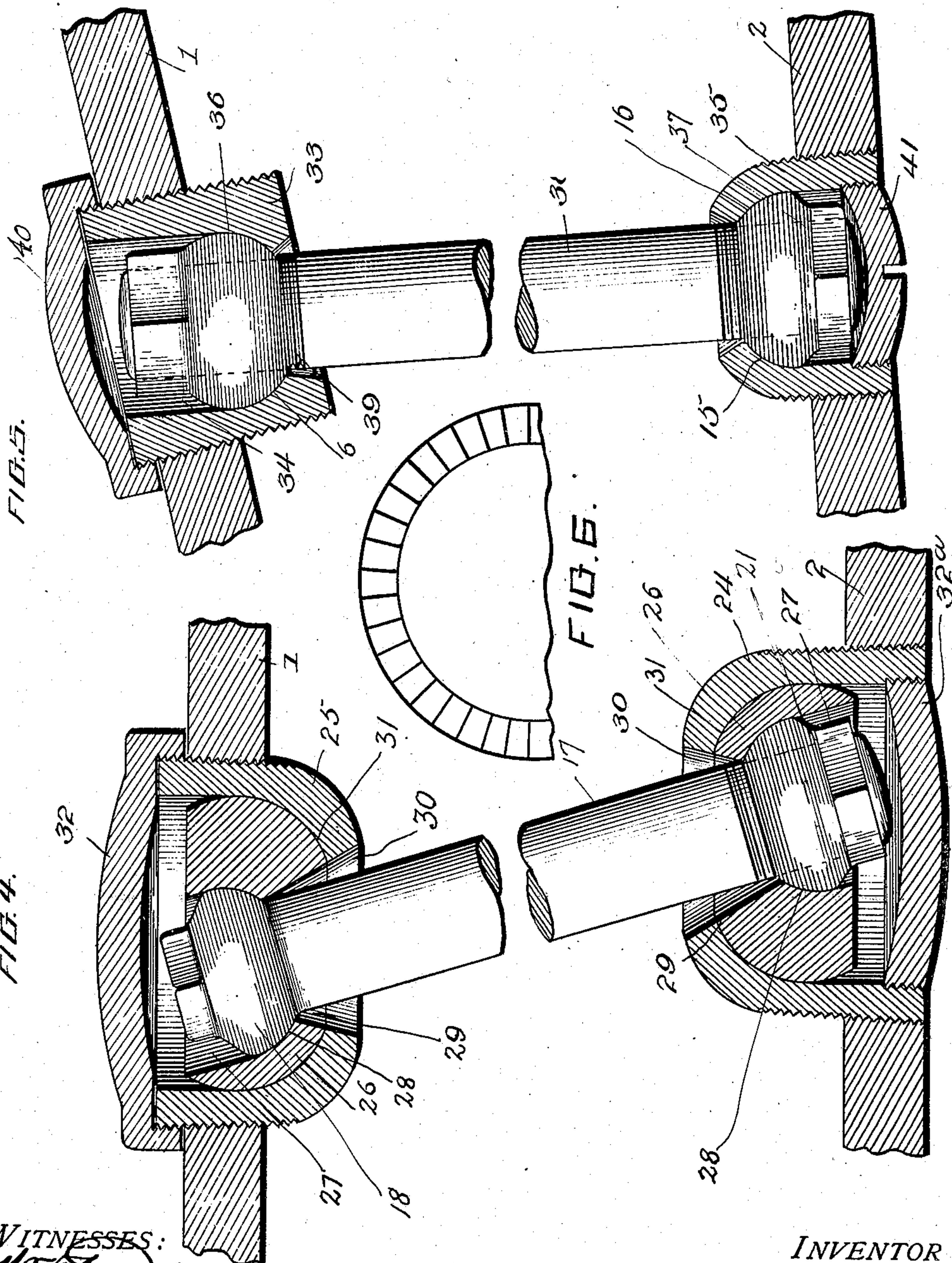


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WITNESSES:  
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# UNITED STATES PATENT OFFICE.

WILLIAM M. SMITH, OF TURTLE CREEK, PENNSYLVANIA.

## FLEXIBLE STAY-BOLT.

No. 930,809.

Specification of Letters Patent.

Patented Aug. 10, 1909.

Application filed February 20, 1909. Serial No. 479,166.

*To all whom it may concern:*

Be it known that I, WILLIAM M. SMITH, a citizen of the United States, residing at Turtle Creek, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Flexible Stay-Bolts, of which the following in a specification.

This invention relates to flexible stay-bolts and the object thereof is to provide means in a manner as hereinafter set forth for bracing the roof and crown sheets of boiler fire boxes, that will allow for, and accommodate the forces of expansion and contraction on lines of least resistance, that will permit of material movement of the complete fire box under expansion and contraction without imparting twisting or bending strains to the stay-bolts or the sheets to which the stay-bolts are attached and further that will enable to conveniently position and secure the stay-bolt at any angle desired with respect to the boiler sheets without the addition of providing the roof sheets with coupling devices or pads attached to the inner face thereof.

Further objects of the invention are to provide in a manner as hereinafter set forth a flexible stay-bolt capable of being conveniently positioned at the desired angle with respect to the boiler sheets, which shall be strong, durable, efficient in its use, and inexpensive to manufacture.

With the foregoing and other objects in view the invention consists of the novel construction, combination and arrangement of parts hereinafter more specifically described and illustrated in the accompanying drawings, wherein is shown the preferred embodiment of the invention, but it is to be understood that changes, variations and modifications can be resorted to which come within the scope of the claims hereunto appended.

In describing the invention in detail, reference is had to the accompanying drawings wherein like reference characters denote corresponding parts throughout the several views, in which—

Figure 1 is a view in section through the roof sheet of a boiler and crown sheet of a fire box showing the adaptation therewith of flexible stay-bolts in accordance with this invention, Fig. 2 is a sectional detail

showing the roof sheet and coupling means carried thereby for one end of the bolt, Fig. 3 is a detail view in section of a portion of the crown sheet showing the coupling means employed for connecting the other end of the bolt in position, Fig. 4 is a sectional view in elevation of a modified form of flexible stay-bolt in accordance with this invention, and Fig. 5 is a like view of another modified form, and Fig. 6 is a detail illustrating the teeth upon the rim of the cap.

Referring to the drawings in detail, 1 denotes the roof sheet of the boiler and 2 the crown sheet of the fire box. The sheet 1 is formed with a series of openings 3 having the walls thereof provided with threads to which is attached coupling plugs referred to generally by the reference character 4. The plugs 4 not only constitute a means for coupling the outer ends of the stay-bolt to the roof sheet 1, but further provide means whereby the outer end of the stay-bolt can be angularly adjusted so that the proper inclination of the bolts will be had with respect to the coupling plugs 4 carried by the roof sheet 1. The coupling plugs 4 are positioned at an inclination with respect to the stay bolts to be presently referred to and are also radially disposed throughout the sheet 1. Each of the plugs 4 is formed with a bore 5, the latter being inclined with respect to the axis of the plug, the direction of inclination of the bore however is opposite with respect to the direction of inclination of the plug when mounted in the sheet 1. The wall of the bore 5 is shouldered, the shoulder being rounded and the said shoulder provides a seat 6 for the outer head of a stay bolt to be presently referred to. The seat 6 extends at an inclination, the inclination of the seat being upwardly from the inner end of the bore 5. The lower portion of the bore, that is, that portion below the seat 6 is beveled as at 7, the height of said beveled portion gradually decreasing from one side of the bore to the other. The plug 4 has its periphery provided with threads 8 which as before stated engage with the threads of the opening 3. The plugs 4 are so positioned within the roof sheet 1 that the bores will project from the inner as well as the outer faces of the said sheet 1. Secured to the outer projecting portions of the plugs 4 are the



closure caps 9 provided with threaded rims 10 which engage with the peripheral threads of the plugs. The edge of the rim 10 is serrated for engagement with the outer face of the roof sheet 1 whereby the plugs will be prevented from moving or shifting, as the serrations form the edges of the rims 10 with sharp teeth which bite into the roof sheet 1. The crown sheet 2 is formed with a series of openings 12, the walls of which are threaded and engaging with the said threads are the hollow coupling plugs 13, these latter being provided with peripheral threads for engagement with the threads of the openings 12. The coupling plugs 13 are of a length as to project from the inner face of the sheet 2 and have their inner ends intumed as at 14 to provide the seats 15 for the inner end of the stay-bolts to be presently referred to. The plugs 13 are closed by caps 16.

The form of stay-bolt shown in Figs. 1, 2 and 3 consists of a shank 17 having the outer end thereof enlarged as at 18 to constitute a head, the head at its outer terminus being squared as at 19 for the reception of a tool to manipulate the bolt when desired. The enlarged head 18 is rounded so that its inner portion will constitute a bearing surface which is mounted against the seat 6 formed on the wall of the bore 5. The shank 17 at its inner end is threaded as at 20 and engaging the said threads 20 is a removable head 21, the latter being provided with interior threads for engagement with the threads 20 and is furthermore provided with a rounded enlargement 22, the periphery of which constitutes a bearing surface for engagement with the seat 15 of the inner coupling plug. The centers of the inner plugs 13 are always on a line with the axes of the bores 5 of the outer plugs whereby the bolts can always be set at the desired inclination. The removable or adjustable head 21 provides means whereby that portion of the shank of the bolt which is arranged between the sheets 1 and 2 can have its length increased or diminished as desired. By setting up the outer coupling plugs 4 in the manner as stated, that is to say, with the inclined bore 5, it does not necessitate the angularly disposing of the openings with respect to the coupling plugs 4 so that the bolts can be properly positioned. The openings upon one side of the sheet 1 or upon the other side of the sheet 1 can be disposed at a different angle to that of the inclination of the inner coupling plugs 13, yet the stay-bolts can be set up at the proper angle. This provision is made owing to the inclined bore 5 and the shifting of the heads 21 and 18 upon the seats 15 and 6 so that the bolts can be readily positioned at the desired inclination and at the same time the necessary degree of flexibility is obtained for the bolt

to prevent breakage thereof during the contraction and expansion of the sheets.

By providing the outer coupling plugs 4 in the manner as stated it is readily apparent that no difficulty is presented when setting up the bolts at varying inclinations as the plugs can be readily turned to position the bore 5 to extend in the direction desired, the bolt with head 21 removed, inserted into the plug, the threaded end of the shank extended into the plug 13 and the head 21 mounted upon the shank 1, which maintains the bolt in position and in connection with the plugs 4 and 13 the bolts are coupled to the sheets 1 and 2. Prior to the positioning of the head 21, the shank of the bolt is shifted to the desired inclination, the rounded head 18, seat 16, and beveled end of the wall of the bore 5 allowing for such adjustment. The beveled end of the wall of the bore 5 as well as the beveled end 23 of the coupling plug 13 allows of the shank 17 of the bolt to be shifted when the heads move upon their seats due to the contraction and expansion of the sheets, such arrangement affording the necessary flexibility, but preventing the breaking of the bolts.

In the modified form illustrated in Fig. 4 the inner coupling plug is indicated by the reference character 24 and the outer plug by the reference character 25. Within each of said plugs is mounted a shiftable bearing member 26 provided with a bore 27 which extends at an inclination, the wall of the bore 27 at a point intermediate its ends is rounded to provide a seat 28 and the wall of the bore 27 which extends from said seat 28 is beveled as at 29, said beveled portion gradually decreasing in height from one side to the other and registering with the beveled wall 30 of the opening at the inner end of a plug. Each of the plugs 24 and 25 is intumed in a rounded manner to provide a seat 31 for its respective bearing member 26. The plug 24 is secured to the crown sheet 2 and the plug 25 to the roof sheet 1, openings being provided for the reception of the plugs. The outer plug is closed by means of the cap 32 which engages with the periphery of the plug, the plug projecting outwardly from the outer face of the sheet 1 for the reception of the cap, the plug 24 is closed by means of the plug 32<sup>a</sup>, the plugs projecting inwardly from the inner faces of the sheets. The differences between the construction shown in Figs. 2 and 3 is that, in lieu of shifting the plug to have the inclined opening extend in the desired direction, the bearing member 26 is shifted. The construction of bolt employed in Fig. 4 is similar to that shown in Fig. 3 like reference characters being applied.

In the construction shown in Fig. 5 the outer plug which is indicated by the refer-



ence character 33 is of less diameter than the plug 4. The plug 33 is provided with a bore 34, the bore extends at an inclination, but its inclination is less than that of the bore 5. Otherwise than as stated the construction of the plug 33 is similar to that of plug 4, like reference characters being employed. The inner plug shown in Fig. 5 and which is indicated by the reference character 25 is similar in construction and arrangement as the inner plug 13, like reference characters being employed to indicate the parts. The bolt as shown in Fig. 5 is provided with two removable heads which are indicated by the reference characters 36 and 37, the shank of the bolt is indicated by the reference character 38 and is formed at each end with threads 39 for the reception of the heads 36 and 37. The head 36 has its inner portion rounded to provide a bearing surface which engages the seat 6 and the head 37 has its inner portion rounded to form a bearing surface which engages the seat 16. The plug 33 is closed by a cap 40 and the plug 37 by the cap 41. The manner of setting up the form of stay-bolt shown in Fig. 5 is similar to that shown in Figs. 1, 2 and 3.

By setting up the stay-bolts in the manner as heretofore set forth it is evident that no difficulty is presented in adapting them to portions of the roof sheets and crown sheets where the coupling plugs which are secured into the curved roof sheet will extend at an angle with respect to the bolt as it is obvious that the plugs can be readily connected to the roof sheet, adjusted if necessary, and the bolts inserted and conveniently positioned to the desired angle, owing to the fact that the bolts will automatically adjust themselves to the angle as the bolts can turn and shift upon their seats.

What I claim is:—

1. The combination with a roof sheet of a boiler and the crown sheet of a fire box, of coupling plugs secured in the roof sheet at an inclination and each provided with a bore extending at an inclination with respect to the axis of the plug, the direction of inclination of the bore being opposite with respect to the direction of inclination of the plug, the wall of each of said bores provided with annular seat, coupling plugs secured to the crown sheet and provided with seats, and stay-bolts having heads at each end provided with bearing surfaces engaging the seats of the plugs whereby the bolts are flexibly connected with the said sheets by said coupling plugs.

2. The combination with a roof sheet, of a boiler and the crown sheet of a fire box, of coupling plugs secured in the roof sheet at an inclination and each provided with a bore extending at an inclination with respect to the axis of the plug, the direction of inclina-

tion of the bore being opposite with respect to the direction of inclination of the plug, the wall of each of said bores provided with annular seat, coupling plugs secured to the crown sheet and provided with seats, and stay-bolts having heads at each end provided with bearing surfaces engaging the seats of the plugs whereby the bolts are flexibly connected with the said sheets by said coupling plugs, one of the heads at one end of each of said bolts being adjustably connected to its respective bolt.

3. In combination, a coupling plug extending at an inclination and having an inclined bore with the wall thereof formed with a seat, said bore extending in an opposite direction with respect to the inclination of the plug, a coupling plug provided with a seat, a stay-bolt embodying a shank, and a pair of heads provided with bearing surfaces, said bearing surfaces engaging said seats said bore inclined at an angle with respect to the axis of the plug and said plug extending at an inclination with respect to the bolt.

4. In combination, a coupling plug extending at an inclination and having an inclined bore with the wall thereof formed with a seat, said bore extending in an opposite direction with respect to the inclination of the plug, a coupling plug provided with a seat, a stay-bolt embodying a shank, and a pair of heads provided with bearing surfaces, said bearing surfaces engaging said seats, said bore extending at an inclination with respect to the axis of the plug and said plug extending at an inclination with respect to the bolt, one of the heads of said bolts being adjustably connected to the shank of the bolt.

5. The combination with the roof sheet of a boiler and the crown sheet of a fire box, each of said sheets provided with screw threaded openings, and plugs secured in said openings and projecting from the inner face of each of said sheets, said plugs secured to said roof sheet and extending at an inclination and having bores inclined oppositely with respect to the inclination of the plug, said bore having a rounded seat at a point removed from its inner end, said plugs secured to said crown sheet and provided with curved seats, said plugs extending at an inclination with respect to said bolt and said bores inclining at an angle with respect to the axes of the plugs and bolts having each end provided with a head having a rounded bearing surface, said bearing surface engaging the seats of the plugs and capable of shifting on said seats, whereby the bolts are flexibly connected to said sheets by said plug.

6. In combination, an adjustable plug provided with a bore having said wall formed with an upwardly inclined annular seat at a point removed from its inner end, a plug



having a rounded seat, and a bolt having a head at each end provided with a bearing surface, said bearing surface mounted against said seats and capable of shifting thereon.

7. In combination, an adjustable plug provided with a bore having the wall of this bore formed with an upwardly inclined annular seat at a point removed from its inner end, a plug having a rounded seat, and a bolt having a head at each end provided with a bearing surface, said bearing surface mounted against said seats and capable of shifting thereon, the inner end of the wall of said bore being beveled and the inner end of said second mentioned plug being beveled whereby the shank of the bolt at each end thereof is allowed to shift when said bearing surfaces move upon said seats.

8. In combination, an adjustable coupling means provided with a seat at a point removed from its inner end, a coupling means provided with a seat, a bolt having a head at each end formed with a rounded bearing surface, said surfaces engaging said seats and capable of being shifted thereon, each of said coupling means having a beveled inner end to allow of the shank at each end of the bolt shifting when the bearing surfaces move upon their seats.

9. In combination, an adjustable coupling means provided with a bore inclining at an angle with respect to the axis of said coupling means, said bore having the wall thereof formed with an inclined annular seat, a coupling means provided with a seat, and a stay-bolt having a head at each end, said heads engaging and shiftable upon said seats.

10. In combination, an adjustable coupling means provided with an inclined bore, having the wall thereof formed with an inclined annular seat, a coupling means provided with a seat, and a stay-bolt having a head at each end, said heads engaging and shiftable upon said seats, one of said heads being adjustable.

11. In combination, an adjustable plug provided with a bore inclining at an angle with respect to the axis of the plug and having the wall thereof formed with an upwardly inclined seat at a point removed from its inner end, a plug having a rounded seat, and a bolt having a head at each end provided with a bearing surface, said bearing surface mounted against said seats and capable of shifting thereon, the inner end of the wall of said bore being beveled and the inner end of said second mentioned plug being beveled whereby the shank of the bolt at each end thereof is allowed to shift when said bearing surfaces move upon said seats, said adjustable coupling means providing for the adjusting of the bolt at varying inclinations.

12. In combination, an adjustable coupling

means provided with a seat at a point removed from its inner end, a coupling means provided with a seat, a bolt having a head at each end formed with a rounded bearing surface, said surfaces engaging said seats and capable of being shifted thereon, each of said coupling means having a beveled inner end to allow of the shank at each end of the bolt shifting when the bearing surfaces move upon their seats, said adjustable coupling means providing for the adjusting of the bolt at varying inclinations.

13. In combination, an adjustable coupling means provided with a bore, at an angle with respect to the axis of said coupling means, said bore having the wall thereof formed with an inclined rounded seat, a coupling means provided with a seat, and a stay-bolt having a head at each end, said heads engaging and shiftable upon seats, said adjustable coupling means providing for the adjusting of the bolt at varying inclinations.

14. In combination, an adjustable coupling means provided with a bore, at an angle with respect to the axis of said coupling means, said bore having the wall thereof formed with an inclined rounded seat, a coupling means provided with a seat, and a stay-bolt having a head at each end, said heads engaging and shiftable upon said seats, one of said heads being adjustable, said adjustable coupling means providing for the adjusting of the bolt at varying inclinations.

15. In a stay means for boiler sheets, a plug having a bore inclined at an angle with respect to the axis of the plug, the wall of said bore having offset to provide a seat.

16. In a stay means for boiler sheets, a plug having a bore inclined at an angle with respect to the axis of the plug, the wall of said bore having offset to provide a seat, said seat being positioned at a point removed from the inner end of the bore.

17. In a stay means for boiler sheets, a plug having a bore inclined at an angle with respect to the axis of the plug, the wall of said bore having offset to provide a seat, said seat being positioned at a point removed from the inner end of the bore, that portion of the wall of the bore below the seat being beveled.

18. In combination, two oppositely opposed boiler sheets upon different arcs, plugs arranged in each sheet each having a bore, the plugs being of different inclinations, the bore of the plugs of one sheet axially aligned with respect to the bore of the opposing sheet.

19. The combination with the roof sheet and the crown sheet of a boiler arranged on different arcs, of a plug in each sheet, the plugs in each sheet disposed to aline with the axis of a circle of which the arc of the sheet



forms a part, each plug having a bore and the bore of the plug in the roof sheet disposed with respect to its plug so as to axially align with the bore of the plug in the crown sheet.

20. In combination a plug extending at an inclination, said plug having a bore extending at an angle with respect to the axis thereof, the direction of the inclination of the bore being opposite with respect to the inclination of the plug, said plug provided with an annular seat.

21. In a stay means for boiler sheets, a plug having a bore extending at an inclination with respect to the axis of the plug,

said plug further provided with an annular seat.

22. In a stay means for boiler sheets, a plug having a bore extending at an inclination with respect to the axis of the plug, said plug further provided with an annular seat, said seat inclining upwardly with respect to the inner terminus of the bore.

In testimony whereof I affix my signature, in presence of two witnesses.

WILLIAM M. SMITH.

Witnesses:

A. M. WILSON,  
N. LOUIS BOGAN.