

No. 640,661.

Patented Jan. 2, 1900.

F. W. JOHNSTONE.
STAY BOLT FOR STEAM BOILERS.

(Application filed June 12, 1899.)

(No Model.)

Fig. 3.

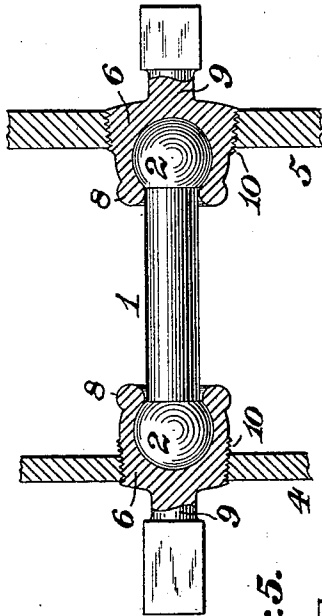


Fig. 4.

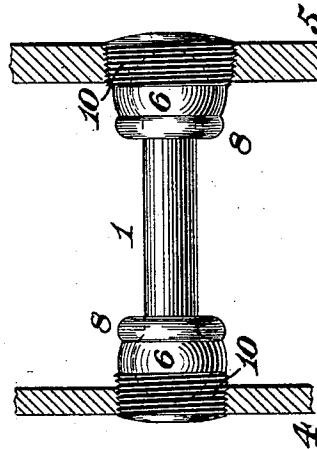


Fig. 5.

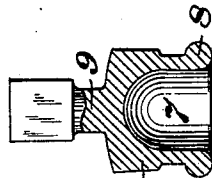


Fig. 6.

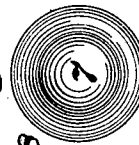


Fig. 1.

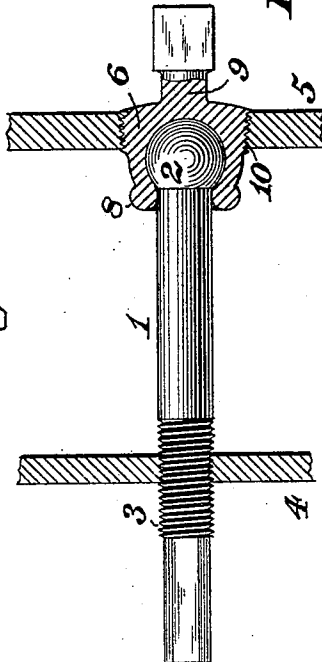
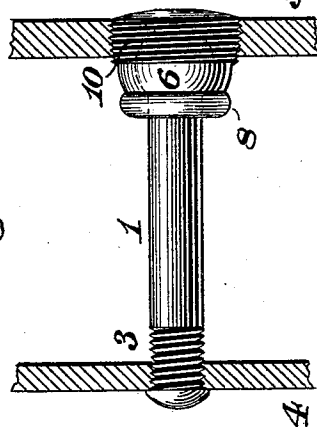


Fig. 2.



WITNESSES:

James C. Heron.
S. R. Bell.

INVENTOR,

F. W. Johnstone,
by J. Snowden Bell, Att'y.

UNITED STATES PATENT OFFICE.

FRANCIS W. JOHNSTONE, OF MEXICO, MEXICO.

STAY-BOLT FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 640,661, dated January 2, 1900.

Application filed June 12, 1899. Serial No. 720,313. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS W. JOHNSTONE, a citizen of the United States, residing at the city of Mexico, in the Republic of Mexico, have invented a certain new and useful Improvement in Stay-Bolts for Steam-Boilers, of which improvement the following is a specification.

My invention relates to the staying of sheets of locomotive and other steam boilers for the purpose of opposing proper and sufficient resistance to the exertion of internal pressure; and its object is to enable this result to be effectively attained, more particularly in boilers working under comparatively high pressures, in such manner and by such means as will be readily and desirably applicable in connection with steam-boilers of various designs known in the art and will in practice afford a substantial safeguard against the breakage of stay-bolts by the expansion of the sheets in which they are secured.

To this end my invention, generally stated, consists in the combination, in a flexible stay-bolt, of a stem or body, a spherical head formed thereon, a correspondingly-socketed plug embracing the head, and screw-threads for connecting the stem and plug to an inner and an outer sheet of a steam-boiler.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a transverse section through the water-space of a steam-boiler, illustrating a flexible stay-bolt embodying my invention as preliminarily connected to the boiler-sheets; Fig. 2, a similar section showing the stay-bolt as finally secured in operative condition to the sheets; Fig. 3, a similar section illustrating a stay-bolt having the capacity of flexibility at each of its ends as preliminarily connected to the boiler-sheets; Fig. 4, a similar section showing the stay-bolt of Fig. 3 as finally secured in operative condition to the sheets; Fig. 5, a longitudinal central section through the socketed plug in its original condition, and Fig. 6 an end view of the same.

The loss of life and destruction of property occasioned by explosions of locomotive-boilers have been recognized as being largely due to the breakage of stay-bolts, the liability to which is materially increased by reason of the

adoption of high steam-pressures in the operation of locomotive-engines of the later and approved types which are now in general use on the railroads of the United States and other countries. Notwithstanding careful and frequent inspections the risk of explosions from broken stay-bolts continues to be a serious and a dangerous one, and it is of material importance in the operation of railroads that this risk should be minimized by the adoption of such safeguards as may be produced and be found effective to that end, as well as by the employment of material and workmanship of the highest grade obtainable. Experience has shown that in the great majority of instances breakage of stay-bolts occurs near the inside of the outer sheet, and it is clearly due to the fact that the rigid connection of the stay-bolt to the outer sheet prevents it from yielding or moving relatively to the sheet in accordance with the movements of the latter under the expansive action of applied heat. My invention provides a yielding or flexible connection of the stay-bolt with the outer sheet, as well as with the inner sheet, if desired, and the strains which are exerted upon stay-bolts of the ordinary construction by the expansion of the sheet or sheets are thereby avoided.

The construction and manner of application of my invention render it advantageously adaptable, without material increase of cost or modification of other structural elements, to use in locomotive and other steam boilers of any of the standard types of present practice.

Referring first to Figs. 1, 2, 5, and 6, in the practice of my invention I provide a stay-bolt having a cylindrical stem or body 1, corresponding in diameter with stay-bolts of the ordinary construction, upon one end of which is formed what is ordinarily termed a "spherical" head 2 or, in exact terms, one which varies from a true sphere only in so far as is due to its junction with the cylindrical body of the bolt throughout the full transverse area thereof. The outer end of the body 1 is squared for a sufficient distance to afford proper bearing for a wrench, and a screw-thread 3 is cut upon the body for a sufficient distance to engage the inner sheet 4 of the water space or other portion of a boiler in which the stay-bolt is to be used. The length

of the body is such that when the screw-thread 3 is engaged with the inner sheet 4 and a sufficient length of the thread projects beyond the outer side of said sheet to be riveted over thereon a portion of the head 2 of the bolt will stand within an opening in the outer sheet 5, which receives a socketed plug 6, by which the bolt is connected to said outer sheet. The plug 6, which is preferably made of cast-steel, is reamed out to provide a socket 7, within which the head 2 can neatly fit, and is slightly tapered or in the form of a frustum of a cone, the lesser diameter of which is next the open end of the socket 7. A bead or strengthening-lip 8 is formed around the end of the socket, and a central stem 9, having a squared end portion to receive a wrench, is formed on the opposite end of the plug.

The bolt 1 and plug 6 are connected one to the other and secured to the boiler-sheets 4 5 in the following manner: The plug 6 having been heated to a degree proper to enable it to be worked, the head 2 of the stay-bolt 1 is inserted in the socket 7 and the shell surrounding the socket is closed down upon the head by a hammer and suitable dies, the bolt being thus held in and spherically jointed to the plug. A screw-thread 10 is then cut upon the tapered portion of the periphery of the plug and is engaged with a corresponding internal thread in the outer boiler-sheet 5, the thread 3 of the stay-bolt being engaged with an internal thread cut in the inner sheet 4. Fig. 1 shows the bolt and plug as thus preliminarily connected to the sheets. The stem 9 of the plug and nearly all of the body 1 of the stay-bolt which projects beyond the outer side of the inner sheet 4 are then cut off, and the body 1 and plug 6 are riveted over on the sheets 4 and 5, respectively, and their connection therewith completed, as shown in Fig. 2. It will be seen that relative movement of the outer sheet 5 and the stay-bolt body 1, including rotation of the head in the socket, is freely permitted by reason of the connection of the sheet and stay-bolt through a true universal joint, and the sheets are at the same time held together with the same resistance to internal pressure as if an ordinary stay-bolt rigidly connected to each of them were employed.

I have ascertained by experimental test that a seven-eighths-inch stay-bolt will break under a sufficient applied strain without being pulled out of a plug to which it is connected in the manner above described.

Under certain conditions of service it may be found desirable and advantageous to provide a stay-bolt each end of which is connected flexibly or through a universal joint with the adjacent boiler-sheet, and my invention may, as shown in Figs. 3 and 4, be so applied without departure from its essential and governing features. To this end a spherical head 2 is formed upon each end of the body 1 of the stay-bolt, and a socketed plug 6 is connected to each of the heads in the manner

above described. The plugs 6 6 are preliminarily connected to the boiler-sheets 4 5 by the engagement of their screw-threads 10 with corresponding internal threads in the sheets, as shown in Fig. 3, and the stems 9 of the plugs are then cut off and the plugs riveted over on the sheets, completing their connection therewith, as shown in Fig. 4. As in the instance first described, each end of the stay-bolt is secured to the adjacent boiler-sheet by screw-thread connections and the same universal-joint device is employed, this being in the instance last described applied similarly at the connection of the bolt with each of the sheets.

It will be obvious that while I have herein set forth the application of my invention in connection with steam-boilers, for which it is primarily and chiefly designed, it is equally adaptable to use in the construction of tanks, reservoirs, or other structures in which metal sheets are employed, forming the walls of spaces within which pressure is or may be exerted and which are subject to deformation or change of relative position due to contraction and expansion or to any other cause.

I am aware that a stay-bolt has been heretofore proposed having an angular head projecting beyond the outer sheet of a boiler and fitting in a closed cap in which it is held without the capacity of rotation, the cap being connected to the sheet by screw-threads surrounding a tapered central passage which incloses a portion of the body of the stay-bolt. Inasmuch as this construction may afford a certain degree of flexibility, although failing to provide a truly universal joint, I hereby disclaim, broadly, a stay-bolt which is flexibly connected or jointed to a boiler-sheet.

I claim as my invention and desire to secure by Letters Patent—

1. The combination of a stay-bolt having a stem or body and a spherical head, a plug having a correspondingly-formed socket embracing the head of the stay-bolt, and screw-threads for connecting the stay-bolt and the socketed plug to an inner and an outer sheet of a steam-boiler.

2. The combination of a stay-bolt having a stem or body with a spherical head at one end and an external screw-thread adjoining its opposite end, and a plug having a spherical socket embracing the head of the stay-bolt, and having an external screw-thread on its body surrounding a portion of the socket thereof.

3. The combination of a stay-bolt having a stem or body with a spherical head at one end, a squared projection at the opposite end, and an external screw-thread adjoining said squared projection, and a plug having a spherical socket embracing the head of the stay-bolt, and having an external screw-thread on its body surrounding a portion of the socket thereof and a central squared projection on its end farther from the socket.

4. The combination of a stay-bolt having a

stem or body, a spherical head at one end and
an external screw-thread adjoining its oppo-
site end, a plug having a spherical socket em-
bracing the head of the stay-bolt and having
5 an external screw-thread on its body sur-
rounding a portion of the socket thereof, and
an inner and an outer steam-boiler sheet
having internal screw-threads engaging the
threads of the stay-bolt and of the plug, re-
10 spectively.

5. A plug for receiving and connecting a

flexible stay-bolt to a boiler-sheet, having a
cylindrical socket with a hemispherical bot-
tom, the open end of said plug being adapted
to be closed down upon a spherical head on a 15
stay-bolt, and a central projection on its end
farther from the opening of the socket.

FRANCIS W. JOHNSTONE.

Witnesses:

LOUIS P. SCHAEFER,
WM. S. HARRIS.