

APPLICATION FILED APR. 5, 1906. RENEWED APR. 26, 1910.

Patented Oct. 4, 1910.

A schematic diagram of a cross-section of a composite material. It shows a central core with a vertical layer labeled h and a horizontal layer labeled h^{22} . To the left of the core is a layer labeled h^{33} , and to the right is a layer labeled h^{44} . A curved line on the right side is labeled h^{55} . A dimension line on the left indicates a thickness of 7 .

A diagram of a four-lobed cross. The top and bottom lobes are labeled h^{22} . The central rectangle is divided into three vertical sections labeled h^{44} , h^{55} , and h^{44} from left to right.

A cross-sectional diagram of a composite material. It shows a central layer with diagonal hatching, labeled with γ on the left and γ^{22} below. Above this central layer is a layer labeled γ^{33} on the left and γ^{22} in the middle. To the right of the γ^{22} layer is a thin layer labeled γ^{55} above and γ^{44} on the right. The top of the diagram is labeled H .

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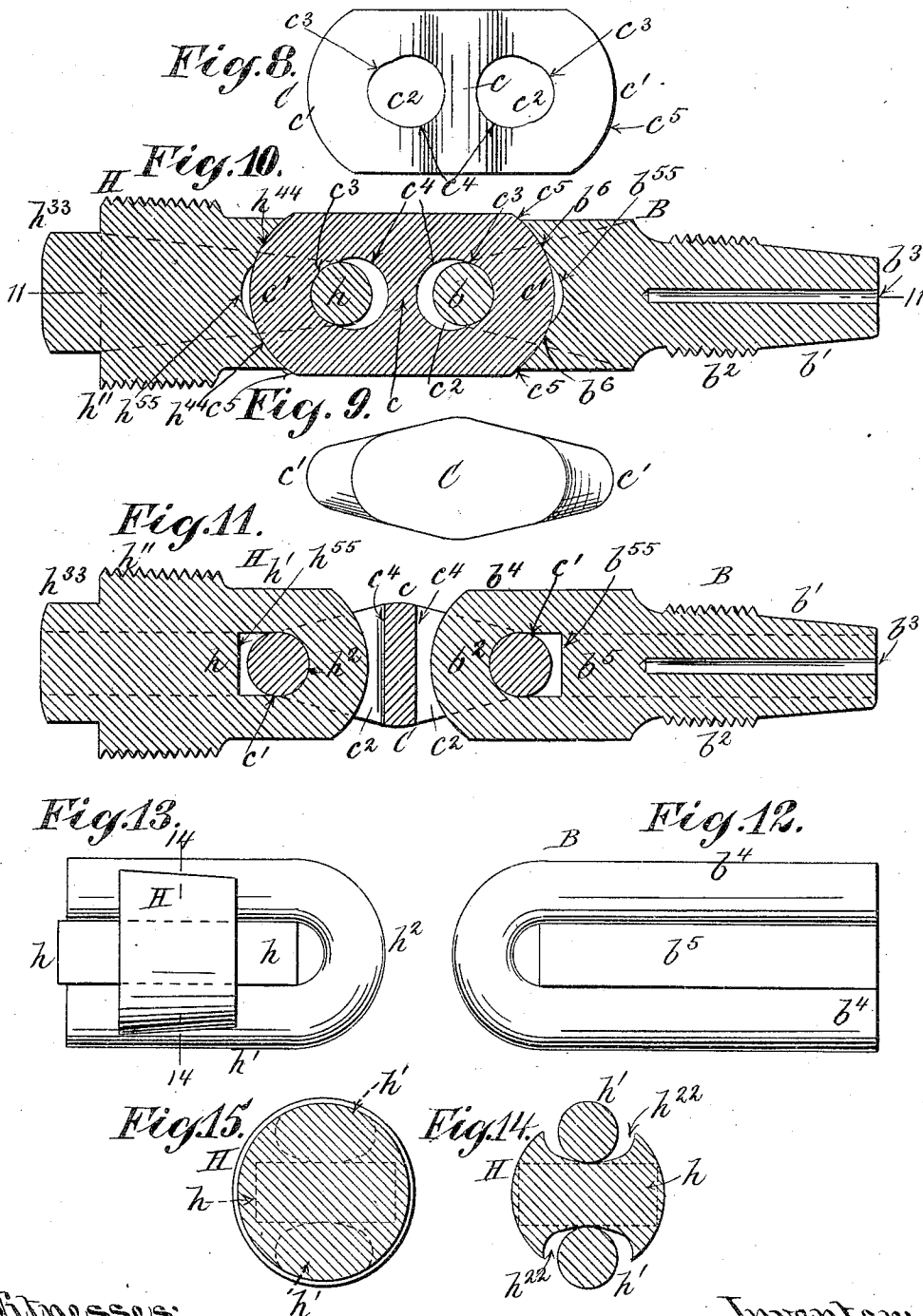
G. S. THOMPSON.
MANUFACTURE OF STAY BOLTS.

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971,805.

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2 SHEETS-SHEET 2.



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UNITED STATES PATENT OFFICE.

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MANUFACTURE OF STAY-BOLTS.

971,805.

Specification of Letters Patent.

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Original application filed October 7, 1905, Serial No. 281,841. Divided and this application filed April 5, 1906, Serial No. 310,002. Renewed April 26, 1910. Serial No. 557,825.

To all whom it may concern:

Be it known that I, GEORGE S. THOMPSON, a citizen of the United States, residing at Hockessin, Newcastle county, and State of Delaware, have invented certain new and useful Improvements in the Manufacture of Stay-Bolts, of which the following is a specification.

My present application is a sub-division of that filed by me October 7th, 1905 Serial No. 281,841 and relates to the manufacture of the articulated stay bolts therein described and claimed, as well as those of the character disclosed in Letters Patent No. 792,863 issued to me June 20th, 1905, the present invention being directed to the method pursued in the production of stay bolts such as described in my aforesaid application Serial No. 281,841.

While my articulated bolt is applicable for various other uses, it is intended particularly for use in steam generators, especially locomotives, between the outer shell and the fire box shell.

The main object set forth in my aforesaid application, Serial No. 281,841 is to attain a three part, articulated stay bolt which while capable of lateral flexure by reason of its joints, shall at the same time be practically unyielding axially or longitudinally, so as to hold the boiler and fire box firmly and rigidly in position with relation to each other,—all looseness or play lengthwise of the bolt being obviated by the peculiar construction of the joints between the parts as hereinafter more fully described.

As in my patent hereinbefore referred to No. 792,863 I attain a maximum of strength for a given size and thickness of bolt, and prolong its life and usefulness, by relieving the weaker parts of all excessive pressure, and distributing and neutralizing the strain, both of tension and compression, on the parts generally, both during manufacture, application and use. I also in my said application, Serial No. 281,841 aim to preserve the flexibility of the stay bolt as a whole by preventing the accumulation or lodgment of sediment between the articulated parts or joints, thus obviating lateral strain that might otherwise result from impaired flexibility.

Another feature of the invention of my said application, Serial No. 281,841 is a

structure designed to afford prompt evidence of any break or fracture from any cause occurring at the weaker part of the stay bolt, which is adjacent to its connection with the fire box plate,—not because this bolt is weakened in any particular, but because the other or outer end of the bolt, which was formerly the weaker end, has been materially strengthened.

A distinguishing feature of the stay bolt of my said application, Serial No. 281,841 consists in the use of a central coupling link made in one piece without joint or weld, which I accomplish by forming the loops of both the eye bolt and the eye head of straps which are passed through the link and then bent over and welded to central fillers, the welded portions being then shaped and threaded for engagement with the boiler and fire box plates.

An advantage of my construction of three part stay bolt is that both eye bolt and eye head may be screwed home simultaneously in the plates to which they are applied, the bolt as a whole being particularly rigid and as of one piece when supported and driven longitudinally, since there is no looseness between the parts, the articulating bearing surfaces being locked in intimate contact with each other, also preventing the independent rotation of either part upon the other.

In this connection a feature of my invention consists in forming the eye bolt with a nose of less diameter than the threaded portion of the eye bolt, to facilitate the entrance and connection of the male screw thread on the eye bolt with the female screw thread formed for its reception in the fire box plate.

The severest strain to which the bolt is subjected being that of compression by reason of the unequal expansion of the plates to which it is attached, since the fire box plate is exposed to a higher temperature than the boiler shell, I so arrange and construct my parts that the force of compression is met and expended upon the external surface of the coupling link, the eyes of which are protected by central depressions in the opposed concentric bearing surface of the eye head and eye bolt, so that the pressure is transmitted to and through the longitudinal sides of the link as hereinafter shown.

My said invention also includes certain other features in the construction and arrangement of parts hereinafter described.

In the accompanying drawings, Figure 1, 5 is an elevation of my improved articulated stay bolt applied to and between a boiler shell and a furnace plate; Fig. 2, is an elevation of the bolt before application, the view being taken at right angles to Fig. 1; 10 Fig. 3, is a side elevation of the filler used in the formation of the eye head; Fig. 4, an edge view of the same at right angles to Fig. 3; Fig. 5 is a face end view of the filler; Fig. 6, is a rear view of the filler; 15 Fig. 7, is a section taken upon plane of line 7—7—Fig. 3; Fig. 8, is a side elevation of the coupling link; Fig. 9, an edge view of the coupling link; Fig. 10, is a central longitudinal section upon plane of line 10—10— 20 Fig. 2; Fig. 11 a similar section of the whole bolt taken upon plane of line 11—11—Fig. 10; Fig. 12, is a detail view illustrating the construction of the eye bolt; Fig. 13, is a similar view illustrating the construction of the eye head; Fig. 14, is a transverse section 25 taken upon plane of line 14—14—Fig. 13; Fig. 15, is a section taken upon the same plane after the welding together of filler and strap has been effected.

30 My improved articulated stay bolt consists of a central coupling link C, an eye head H and an eye bolt B. The coupling link is formed preferably of a single piece 35 of metal either cast or drop forged without weld or joint. I thus attain a coupling of uniform texture and strength, which latter is further enhanced by forming the link with a broad central web c , from which the 40 body of the link tapers in either direction to merge into the knuckles c' , c' , which are circular in cross section, as will be seen more particularly by reference to Fig. 11. The 45 eyes c^2 , c^2 , are formed with concave seats c^3 , c^3 , of the same radius as that of the knuckle b , on the eye head H, and the knuckle b , on the eye bolt B, both of which 50 knuckles are circular in cross section as will be seen by reference to Fig. 10. Back of the seats c^3 , c^3 , the eyes are enlarged to form eccentric spaces c^4 , c^4 , for the purpose not 55 only of facilitating the insertion as hereinafter described of the cylindrical strap rods for the eye bolt B, and eye head H, during the manufacture of the bolt, but also for a 60 more important purpose, that of avoiding contact between the internal surfaces of the eyes and the external convex surfaces of the loops of the eye bolt and stay bolt, as will 65 be seen by reference to Figs. 1, 10 and 11, of the drawings; and also for the purpose of avoiding the lodgment of sediment as hereinafter set forth.

The eye bolt B may be constructed in substantially the same manner as set forth in 65 my Letters Patent 792,863 hereinbefore re-

ferred to, but in the present case the eye bolt B is formed with an extension or nose b' , beyond the threaded portion b^2 of the shank, and is also formed with an internal recess or bore b^3 , extending from the end of the nose 70 b' , preferably through and beyond the said threaded portion b^2 , of the eye bolt, as will be seen by reference to Figs. 10 and 11. That is to say, in the formation of the eye 75 bolt B a cylindrical rod b^4 , is passed through one of the eyes c^2 , of the coupling link C, and bent over to form the loop of the eye bolt, a central filler b^5 , being then inserted between the ends of the rod which ends are then flattened and welded to the filler, after 80 which the welded portions of the eye bolt are shaped and threaded as shown by well known means. As heretofore the inner end of the filler b^5 , is formed with concave bearing surfaces b^6 , b^6 , with a central depression 85 $b^{6'}$, between them, the said concave bearing surfaces b^6 , b^6 , being concentric with the knuckles b , the inner convex surface of which fits in the opposed concave seat c^3 , in the 90 coupling link C, as clearly shown in Fig. 10, by reference to which it will also be seen that the concave bearing surfaces b^6 , b^6 , of the eye bolt engage with the opposed concentric convex surface c^3 , of the link knuckle. Thus 95 the articulation of the parts is provided for without looseness or longitudinal play, the knuckles fitting each other snugly, and being held to their respective seats by the concave bearing surfaces b^6 , b^6 , which however do 100 not interfere with the pivotal or lateral flexure of the parts upon each other within ample limits.

The nose b' , of the eye bolt B, is reduced 105 in diameter to less than that of the threaded portion b^2 , of the eye bolt, and is preferably tapered toward the end also to facilitate its introduction into the tapped hole in the fire box plate F, the nose thus acting as a guide 110 and centralizer for the threaded portion b^2 , of the shank, so that the engagement between the male and female screw threads is easily 115 effected during the operation of applying the stay bolt as a whole to and between the boiler shell S and the fire box plate F. When thus applied the tell tale bore b^3 , will, 120 in case of rupture of the threaded shank, open into the fire chamber, and water or steam from the space between the shell S and plate F, thus admitted to the fire box, will direct attention to the defect. I thus 125 protect the eye bolt because it is necessarily the weaker part of the bolt, relatively speaking, not because it has been weakened, but because the other parts of the stay bolt, the coupling link C, and the eye head H, have 130 been materially strengthened by my structure of stay bolt, and also because the stay bolt is necessarily subjected to the greatest degree of strain or compression at its junction with the fire box plate owing to the

high degree of temperature and hence to the extremes of expansion and contraction, to which the plate is subjected.

The eye head H is likewise formed from a central filler h , and a strap h' , consisting of a cylindrical rod, the rod being bent to form the knuckle h^2 , and the filler h , being inserted between the ends of the rod, which are then flattened and welded to the filler, the welded portions being then shaped externally. In order to afford the required thickness of metal to form the head h' , and to facilitate the formation of the head, the filler is made with lateral extensions forming recesses or grooves h^{22} , h^{22} , for the reception of the ends of the strap h' . This is illustrated in Fig. 14. Fig. 15 shows the parts after the ends of the strap h' have been flattened and welded. The dotted ovals h' of this figure indicate approximately the line of weld. The dotted rectangle h indicates the outline of the part of the filler which is not provided with the lateral extensions.

The finished head h'' , is preferably in the form of a conic frustum peripherally threaded for engagement with a hole tapped for its reception in the boiler shell S; and the base of this conic section is formed with an extension h^{33} , which is polygonal in cross section, or otherwise so formed as to provide for the simultaneous rotation of the eye head and link C, and eye bolt B upon their common longitudinal axes for which purposes various well known mechanical expedients may be resorted to if the polygonal extension h^{33} , is not desired.

The inner end or face of the filler is formed with the concave bearing surfaces h^{44} , h^{44} , with a central depression or space h^{55} , between them, said concave bearing surfaces h^{44} , h^{44} , being concentric to the knuckle h^2 , and bearing against the opposed convex concentric surface c^5 , of the coupling link, as will be seen by reference to Fig. 10. Thus as in the case of the articulation of the eye bolt B, the parts are held in intimate engagement with each other, and no longitudinal looseness or play is possible in either direction, the stay bolt being maintained at a prescribed length when the parts are extended with their longitudinal axes in alignment, so that considered axially the stay bolt is practically unyielding and rigid, in the transmission of longitudinal strain or compression, while flexible transversely to adapt the parts to lateral strain. In this connection the coupling link C is of special importance since it readily adapts itself to, and compensates, for any lack of perfect axial alignment, from any cause, between the eye head H and the eye bolt B.

The recesses or depressions h^{55} , and b^{55} , in the inner faces of the eye head H and eye bolt B, respectively, are of importance in that they relieve the central portions of the

knuckles c' , c' , of the coupling link from compression, transferring the pressure to the sides of the link where it can do no possible harm.

The concave bearing surfaces b and h^{44} , with their intermediate recesses b^{55} , and h^{55} , are stamped by means of suitable dies used in the formation of the fillers b^5 and h .

The eccentric extensions c^3 , c^3 , of the eyes c^2 , c^2 , of the coupling link C, not only obviate contact with the convex external surfaces of the eye head H and eye bolt B, thereby protecting the knuckles of said parts against the force of compression during use, but they also perform another important function in that they protect the knuckles against injury during the upsetting of the metal in the manufacture of the bolt, and thereby preserve smooth, even peripheral surfaces upon which sediment can find no resting place,—the collection of sediment between the joints having a tendency to impair the usefulness and strength of the stay bolt.

By my construction of eye head the outer end of the stay bolt is rendered much more substantial and durable than heretofore; the setting of the fiber of the metallic strap by compression so that resilience and stretch is eliminated &c., as set forth in my said Letters Patent in connection with the description of the formation of my special form of eye bolt, being advantages inherent in the present structure of both eye head and eye bolt, so that they do not need to be recapitulated herein.

Having now described in detail a stay-bolt which may be constructed by the method which forms my present invention, I direct attention to the method itself. It consists in or is characterized by looping the strap which forms the knuckle of the bolt or head member, as the case may be (which strap as above described is preferably formed of bar iron circular in cross section), through the eye of the corresponding part of the structure, which is in this case the coupling link C, bending the strap until its ends lie in parallel position upon opposite sides of the interposed filler, which filler is preferably grooved to receive it, and then welding the ends of the strap and the body of the filler together. A word more may be said regarding the shaping of the filler. The filler for the eye bolt B as above described is a flat-sided filler rectangular in cross section; the filler for the eye head H on the other side is a filler which is corrugated or grooved along its sides for the reception of the ends of the strap when bent to position to engage it. It is of course understood that the filler may in either case be made corrugated or grooved. The corrugation of the filler is advantageous, both because the shaping of the assembled parts is more easily accomplished, and because the

groove in the filler serves to hold the strap in position relative to it during the welding operation. In case a flat-sided filler is employed, the welding operation becomes much
5 more difficult and expensive. It is of course to be understood that with the structure particularly described above, the filler employed for the eye bolt B will be smaller than the filler employed for the eye head H.

10 What I claim as my invention and desire to secure by Letters Patent is,

1. The method herein set forth of manufacturing an articulated stay bolt consisting in looping a strap cylindrical in cross section into the eye of the part to which the
15 head is coupled, bending said cylindrical strap to form the eye of the head, and weld-

ing the ends of said strap to the opposite sides of a central filler throughout the length thereof, substantially in the manner 20 and for the purpose described.

2. The method herein set forth of manufacturing an articulated stay bolt which consists in looping a strap of metal into the eye of a bolt member, bending the ends of 25 said strap to substantially parallel position, upon opposite sides of a grooved filler inserted between them, and welding together such strap ends and filler.

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