

form a full bead. The bottom of bead should stand 1-16 in. clear of the sheet.

MAINTENANCE OF ARCH TUBES.—Tubes should be thoroughly examined and cleaned at each washout of the boiler. At the least indication of scale formation in the tubes the pneumatic tube cleaner must be used. The tube cleaner is secured to a length of $\frac{1}{2}$ in. air hose, to which is attached another $\frac{1}{2}$ in. hose for supplying water while cleaning. Care must be taken so as not to break the cleaning cutters by

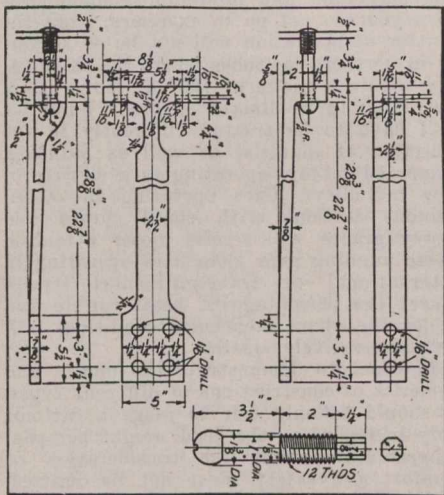


Fig. 21.—Two Methods of Throat Sheet Belly Brace.

allowing cleaner to be pushed through opposite end of tube. Stop must be provided on hose set at proper length for this purpose. Tube cleaner must be lubricated with signal oil fed through a lubricator in air supply pipe, 30 drops a minute. After cleaning, tubes must be inspected by holding a light at opposite end of tube to make sure that tubes are thoroughly cleaned and free from scale.

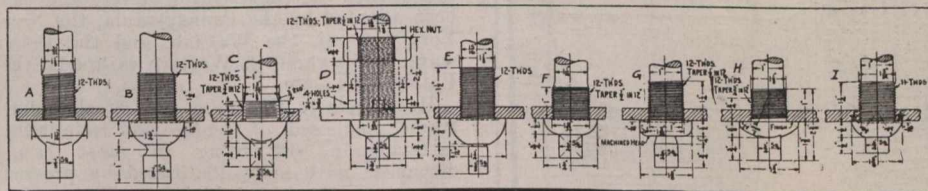


Fig. 22.—Different Styles of Buttonhead Staybolts.

Leaky tubes must be stopped from leaking by rolling with expander, A, fig. 19. Before rolling tube ends must be thoroughly cleaned from scale.

Your committee has been unable to get any information in regard to which type of flue setting gives the best service, therefore are unable to make a recommendation as to which type we would recommend as standard practice.

RADIUS OF FLANGE IN BACK TUBE SHEET.—Replies received in regard to the radius in the back tube sheet where it connects to the crown sheets. Recommendations were made from $\frac{1}{2}$ in. up to 2 ins. Some members had trouble with cracked sheets and leaky seams with large radius; others had trouble with the small radius. One member advises that he is now experimenting with a 4 in. radius and it seems to give good satisfaction, but it has not been in use a sufficient length of time to give a complete report. Two members increased the radius from $\frac{3}{8}$ in. to 2 ins. and had considerable trouble with flue sheet working up and the flanges cracking. Two-inch radius has been discarded and they are now using $\frac{7}{8}$ in., which improves the con-

dition but does not eliminate the difficulty entirely.

DISTANCE FROM INSIDE OF FLANGE OF BACK FLUE SHEET TO EDGE OF FLUE HOLES.—Your committee recommends that the distance from the inside of the back flue sheet to the edge of the nearest flue hole be ample to prevent the flue sheet cracking through the flange. This distance will vary, depending on the radius of the flange of the tube sheet. In tube sheets with $\frac{7}{8}$ in. radius, this distance should be at least 2 ins. at the top, $\frac{7}{8}$ in. on the side. In sheets with 2 in. radius, the distance should be at least $2\frac{1}{2}$ ins. at the top.

THROAT SHEET BRACE.—Your committee had the members submit designs of throat-sheet belly brace used and fig. 20 shows 12 styles of braces, the design of brace for this location to be such as to avoid any mud pockets and so as to allow for proper circulation of water.

METHOD OF SUPPORTING GRATE SIDE FRAMES.—Your committee recommends the grate side frames to be supported from studs in the mud ring or brackets fastened to the under side of the mud ring, the latter forming a pocket for the grate side frame to fit into.

SLOPING BACK HEADS are used by practically all of the members who replied to the circular. The slope varies from 8 to 20 degrees, making an average slope of 12 degrees. Sloping of back heads gives additional room in the cab, reduces the weight of the boiler and gives a maximum length of firebox, and still remains within a reasonable limit for hand firing.

STAYBOLTS.—Uniform spacing of all staybolts in all parts of the firebox is recommended by your committee. The majority of the members reported the use of button head crown stays for the six to nine centre rows of the crown sheet the entire length; two members use hammered heads for the first four or five rows from the flue sheet. The different forms of button heads are shown by fig. 22, on which you

will note that there are nine different designs shown. The member that uses style D advises that they are having some difficulty keeping the button heads tight.

Your committee favors the use of button

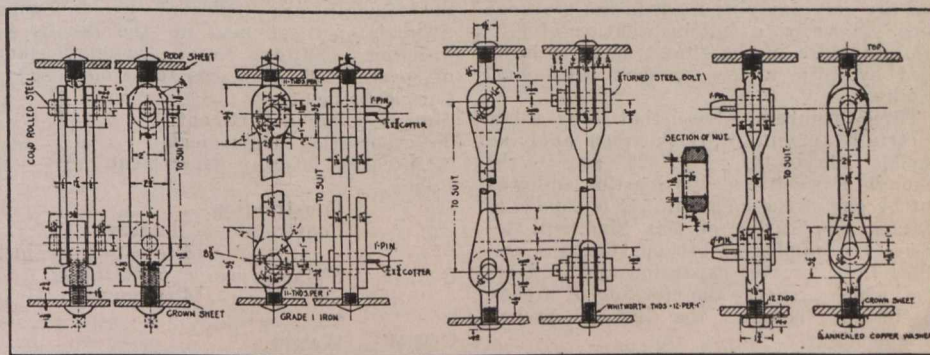


Fig. 23.—Four Types of Sling Stays.

heads on as many rows as the design of firebox will permit, but recommends for the consideration of members the practice of using hammered heads on the first four or five rows back from the flue sheet.

SLING STAYS.—Figs. 23 and 24 show the various types of sling stays in use by the different members and no difficulty with any of these types has been reported. Three members use a special flexible staybolt on all new equipment, as shown by fig. 25, and the use of this type of sling stay is also favored by, but not used by, another member. Sling stays are used to the extent of two, three and four rows back

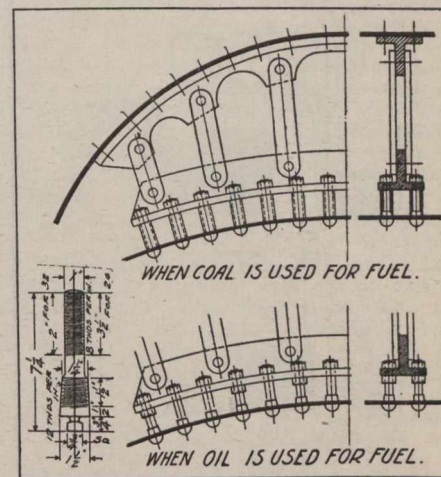


Fig. 24.—Two Types of Sling Stays.

from the tube sheet on boiler with combustion chamber.

FLEXIBLE STAYBOLTS.—Of the members who have replied, all except one member use flexible staybolts. Most of the members apply these in the breakage zone. Five members are making full installation of flexible staybolts on boilers with wide fireboxes. One member reports: "In Feb., 1907, locomotive received new firebox with full installation of flexible staybolts, with the exception of 4 bolts under the auxiliary dome and 4 under the steam turret; also 8 which go on top of same at back head. Feb., 1908, the locomotive received general repairs and firebox was in good condition. All caps were removed from flexible staybolts and they were found to be o.k. April, 1909, it was found necessary to patch the top of the back tube sheet on account of sheet cracking from the hole around the flange; this was done in the engine house. Oct., 1909, locomotive was given general repairs, and by this time the top of back tube sheet had given out in two more places, but as the sheet was in good condition otherwise it was patched. Three of the mudring corners also had to have small patches applied. After rattling scale from firebox sheets with large hammer, it was found that 40 of the flexible

sleeves had cracked outside of the sheet, and on being taken out they were found to be crystallized, but no broken bolts were found. In 1911 the locomotive was again in the shop for general repairs and had all