

Design, Construction and Inspection of Locomotive Boilers.

Following is the conclusion of the American Master Mechanics Association Committee's report on this subject, the first portions of which were published in Canadian Railway and Marine World for September and October:

KELLEY METHOD OF STAYING FLUE SHEETS.—Twelve members advise that they have had no experience with this method. Two members that have used this method advise that no advantage was found and have removed the same. Another member reports that he used five stays in small

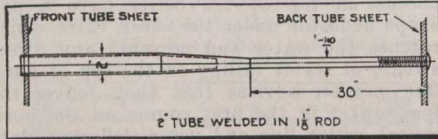


Fig. 27.—Method of Staying Flue Sheets.

boilers containing about 200 flues, and three stays in larger boilers, and believes that it is good practice and tends to prevent flues leaking. Another member is experimenting, as shown in fig. 27, but cannot give any information as regards the performance.

TUBE.—It is the consensus of opinion of those reporting that 2 in. tubes are preferred, until the length of tube exceeds 16 ft., when 2 1/4 in. tubes are preferred.

Taking into consideration that a 2 in. tube will give a greater amount of tube heating surface, and the cost of maintenance is less, and less damage is done to the tube sheets in working over flues, your committee suggests that further consideration be given to the use of 2 in. tubes in lengths greater than 16 ft.

THICKNESS OF FRONT TUBE SHEET.—Half inch and 5/8 in. being used by the majority of the members who replied to the circular. One member uses 9-16 in. and another uses 3/4 in.

THICKNESS OF BACK TUBE SHEET.—One half in. tube sheets are being used by 16 of the members. Two members use 9-16 in. and one uses 5/8 in. All but three report having more or less trouble with flue sheets working up on account of frequently working on the flues, causing the flue sheets to crack across the top of the flange of the sheet.

WIDTH OF BRIDGE in the front tube sheet varies from 1/2 to 15-16 in.; 3/4 in. is used by the majority of members. Width of bridge in the back tube sheet varies from 11-16 to 15-16 in.; 3/4 in. is used by the majority of the members.

FLUE SETTING.—Two members advise that they had tried soft iron ferrules with very little success. One member advises that they had a limited experience trying to set flues in the back flue sheet without any coppers, but found that it did not work satisfactorily, and that they are now experimenting with a combined copper and iron ferrule, but have not had these under test long enough to make any report. One member advises that they use soft iron shims on the front flues to avoid excessive expanding.

SETTING OF FLUES IN THE FRONT Tube Sheet.—The consensus of opinion of the roads reporting is that tubes should be rolled in the front tube sheet without any ferrules, and 10% of the flues, equally distributed, should be beaded with a beading tool.

TUBE SETTING IN BACK SHEET.—Figs. 28, 29 and 30 show the practice followed out by some of the members in setting the tubes, which are giving good results. Fig. 31 shows application, maintenance and removal of flues in locomotive boiler

as used by three members. Tube setting of this kind gives a large bridge, good circulation of water at the back tube sheet and at the same time the inside of the flue is reduced at the end so that any cinders which will pass through the swaged end will not clog the flues. The instructions in connection with this plate are as follows:

PREPARING FLUE SHEETS.—Holes in new firebox flue sheet shall be 1 3/8 in. diameter. Holes in new smokebox flue sheet shall be 2 1-32 in. diameter. Holes in old flue sheet more than 1-32 in. out of round must be reamed, reamer A, fig. 31. Inside and outside edges of flue holes in both sheets must be slightly rounded to remove sharp edges.

TABULAR STATEMENT OF FLUE Setting Method.—

Back End.	Front End.
Operation.	Shim.
Expand copper ferrules.	Roll.
Drive in flues.	Dudgeon roller by air.
Roll.	
Bead and caulk.	
Expand.	

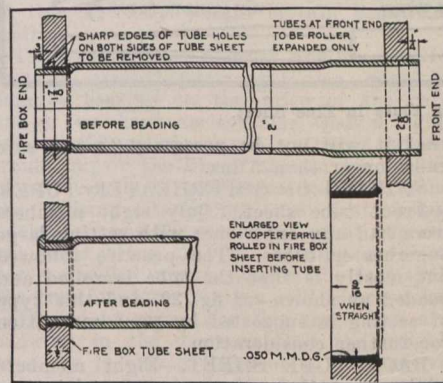


Fig. 28.—Method of Setting Flues in Flue Sheet.

Tool Used.
Prosser expander.
Sledge and pin with collar.
Dudgeon roller by small air motor.
Beading tool in air hammer.
Prosser expander.

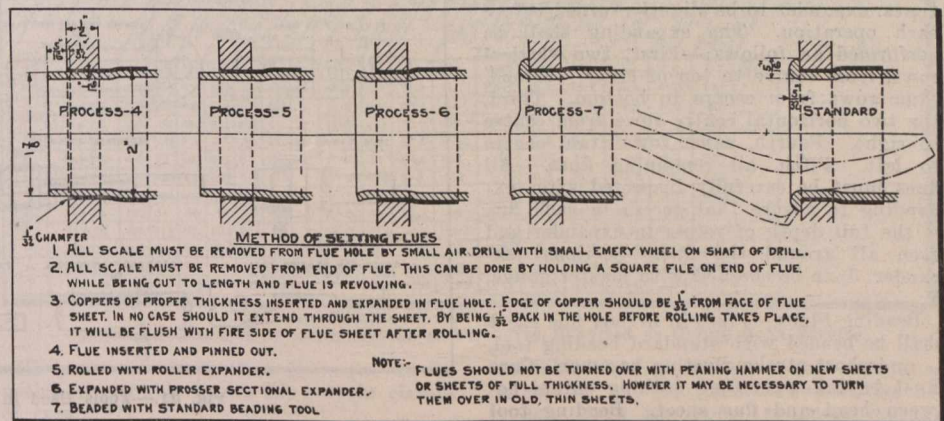


Fig. 29.—Method of Setting Flues in Flue Sheet.

Flue sheet holes (A, fig. 30).—Care should be taken that holes in flue sheet are true, smooth and free from burrs and sharp edges. It is desirable that the flue hole have a fillet especially on the water side, of about 1-32 in. radius. A sharp edge around the hole often cuts the ferrule in two, even cutting into the flue. The diameter of the flue hole should be the same as outside diameter of flue plus 1-32 in.

Copper ferrule (B).—For New York this should not be far different from no. 16 b.w.g. In old flue sheets when the flue

holes are large it is desirable to use enough heavier ferrules to bring the internal diameter of ferrule when expanded into flue sheet to 1/8 in. less than flue diameter. The ferrule should be set into flue hole flush with fireside and expanded into place with Prosser expander (C).

Swaging Flue (D).—Great care should be taken to give the swage the right length and to have it terminate in as abrupt a shoulder as possible. The flue, after it is swaged, should be annealed and the scale removed from the portion entering the sheet. Grinding this scale off by machine is desirable, but in the absence of a grinder the removal of the scale with a file will answer. The flue when driven into the sheet (E) should extend 3-16 in. through the sheet on the fire side.

Rollings (F).—The front end of the flues having been shimmed, when necessary, both the back and front ends are rolled with the dudgeon or other suitable roller, with proper appliances they may be safely and economically rolled by air; the rolling of the back ends must be done by an experienced boilermaker, and the motor must not be larger than a Thor no. 22 or its equivalent.

Beading (G).—This may now be done with a beading tool in an air hammer. Do as little hammering with the beading tool as possible, and do not work bead to a feather edge, but leave as much metal as possible for future caulking.

Expanding (H).—Particular stress should be placed upon this, the most important step in the flue-setting process. Care should be taken that the flue shoulder when heavily expanded bears snugly and firmly against the flue sheet. Hammer not to exceed 4 lbs. after prossering the front ends then bead a sufficient number for safety which finishes the flue setting.

Back ends of flues or safe ends when used in back flue sheet must be cut off square in pipe machine and burr removed by reamer.

Wheel-flue cutters must not be used on account of leaving a heavy burr which splits when beading over.

Air motor and roller are only to be used on initial setting. In reworking flues, the Prosser expander only is to be used, and rollers must not be used, as they force the

bead away from the sheet.

Applying Copper Ferrules.—Copper ferrules 1 3/4 in. inside diameter, 1/2 in. long, .095 in. in thickness shall be used in firebox flue sheet only. Ferrules shall be secured in place with straight expander, B, fig. 31, taking care that shoulder of expander is tight against flue sheet, which shall bring edge of ferrule 1-32 in. from fire side of sheet.

Preparing Flues.—Flue safe ends should be 5 ins. long, except that new iron flues shall have safe ends 4 ins. long, and when