Improvements in Locomotive Boilers.

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(CONTINUED FROM SEPTEMBER ISSUE.)

STAYBOLTS.—In Canada and the U.S. are universally of wrought iron, generally 1 in. in diameter although sizes from ⅞ to 1⅛ ins. are used to a certain extent. The outer ends are usually drilled with a 3-16 in. hole 1¼ ins. deep, for the purpose of indicating by the escape of water any breakage that might occur. In place of the rigid bolt various types of flexible bolts are frequently substituted, and fig. 28, shows a flexible bolt which is in common use, while fig. 29, shows a patented type of flexible bolt called the Tate which is also used by a number of administrations replying. The latter possesses the advantage that deposits of scale cannot interfere with its flexibility. Flexible bolts of whatever type are usually applied to fire-boxes at the points where the amount of breakage of staybolts experienced is large. Fig. 30, shows a representative application in which the flexible bolts are disposed along the edges and corners of the fire-box sheets, which are the points where breakage most frequently occurs, and the number of flexible bolts is usually about 30 to 40 of the entire number of staybolts in the fire-box. On Wooten fire-boxes the breakage occurs in a different location. viz., for about 2 ft. above the mud ring throughout the entire length of the side sheets, and roads on which this type of boiler is used apply flexible staybolts in that location. While not common practice certain administrations have largely extended the use of this type of bolt. It has given exceedingly good satisfaction so far as freedom from breakages is concerned but on account of its increased cost the question of determining to what extent it is economical to apply them is largely dependent on the service obtained from the ordinary type of bolt. This has been considerably improved by the increase that has taken place in the water space around the fire-box and recent indications would appear to show that while the use of a certain number of flexible staybolts is advisable that the number employed will not be largely increased. In South America where copper fire-boxes are used copper staybolts are alone employed and flexible bolts are consequently not used.

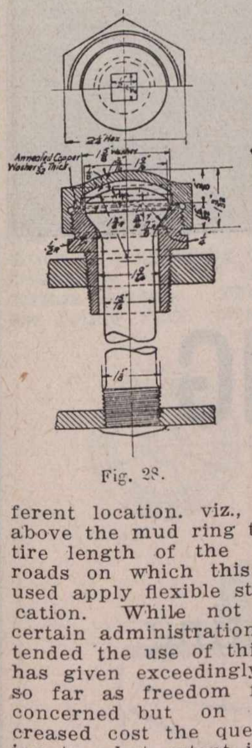

Fig. 28.

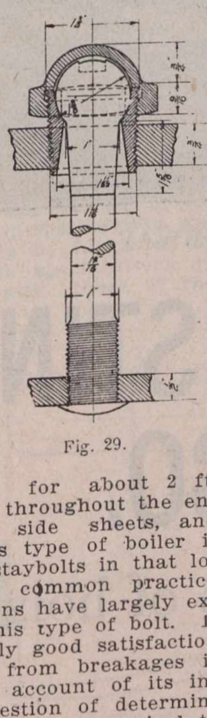

Fig. 29.

TUBES are usually 2 ins. in diameter although some administrations use 2¼ in. tubes on large engines while others use 2¼ ins. when tubes are over 15 to 18 ft. in length. Replies would indicate that the use of 2¼ in. tubes is usual on long boilers, but that 2 in. tubes have been found satisfactory for lengths of 18 to 20 ft. The tubes are usually 0.12 ins. in thickness but a number of administrations report using tubes 0.11 ins. in thickness with satisfactory results. The usual spacing center to center for a 2 in. tube is 2¾ ins. and for 2¼ in. flues 3 ins. A number of administrations, especially those operating in districts where the water is not good, have increased the spacing to 2⅞ ins. for 2 in. and 3⅛ in. for 2¾ ins., and report better circulation and improved results. In the front tube sheet the spacing is usually 2 11-16 to 2¾ ins. for the 2 in. tubes, and a corresponding distance for 2¼ in. tubes. No difficulty is experienced with smaller spacing in the front tube sheet, and the weight of the boiler can evidently be somewhat reduced. The tubes are usually disposed in rows that are vertical and incline at 30 deg. to the horizontal. Occasionally two vertical rows of tubes are used in the center, and one administration is using three vertical rows in the center, and three horizontal rows about the middle of the sheet. A few administrations use vertical and horizontal rows only and while these roads are comparatively few in number this arrangement is claimed to give better circulation and tend to keep the tubes cleaner.

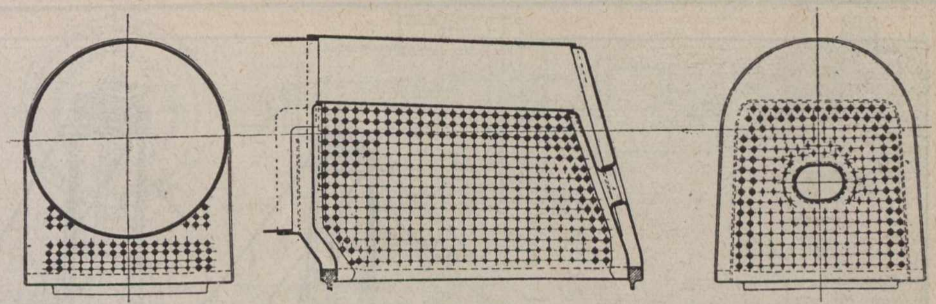

Fig. 30.

Apart from the South American administrations which are using brass tubes the invariable practice is to cut out the tube when the end has been damaged by continual tightening, and subject it to what is termed rattling by rolling it with other tubes in a machine which removes the scale. A piece about 7 ins. long is then welded on the original tube to restore it to its proper length. This process is termed safe-ending and is illustrated in fig. 31. It will be seen that the body of the tube is expanded to taper from the inside outwards, while the safe end is tapered from the outside to the inner edge. The safe end is then welded to the body of the tube and the opposite end of the original tube cut off to length. The hole in the tube sheet is usually made of the same diameter as the tube, viz., 2 ins. for 2 in. tubes. The end of the tube is reduced in diameter to 1⅞ ins. and a copper ferrule 1-16 in. or less in thickness and the same width as the thickness of the tube sheet is placed in the hole in the tube sheet with its edge about 1-16 in. below the back surface of the sheet. The ferrule is slightly rolled to hold it in place and the tube inserted until its end projects 3-16 ins. beyond the sheet within the fire-box. The tube is then rolled in place and its appearance at this stage is shown in fig. 32. The roller expander used is shown in fig. 33 of what is frequently termed the Dudgeon type. The tube end is next expanded with what is termed a Prosser expander, which expands the tube slightly on both sides of the tube sheet driving the projecting end outward and pinching the tube tightly against the sheet on both outside and inside. Its appearance when this operation is completed is shown in fig. 34. The tool which does this work is made in sections which are expanded by the driving in of a tapered pin and is called the Prosser expander after its inventor. It is shown in fig. 35. The end of the tube is next beaded over and its appearance when this is completed is shown in fig. 36, which also shows the action of the beading tool. This is shown in detail in fig. 37, and the gauge by which the tool is maintained in its proper shape is shown in fig. 38. The process illustrated while varying slightly in detail is practically in universal use throughout the U.S. The inside shape of the Prosser expander and of the beading tool vary somewhat with different administrations. but with each, the shape of these tools is maintained with the greatest care, as any variation in their form or dimensions, at the various points at which this work is done, will cause serious damage to the ends of the tubes through reducing their thickness unevenly and will materially affect the service they give. At the front end of the boiler no copper ferrules are used. The hole is usually ⅛ in. larger than the actual diameter of the tube, and the tube is slightly enlarged before being put in, and expanded into the sheet by a roller expander. Some administrations depend entirely upon rolling in the front sheet, others bead 20% of the flues in the front sheet while some bead

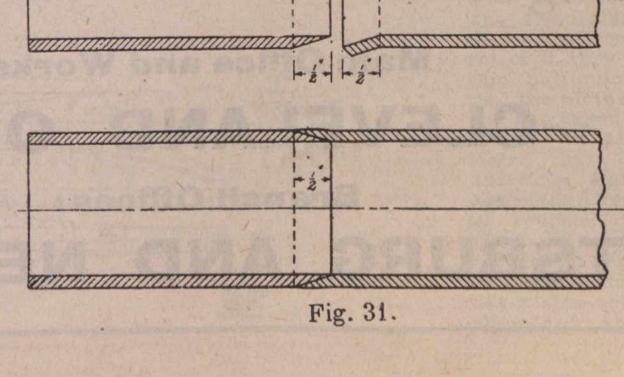

Fig. 31.

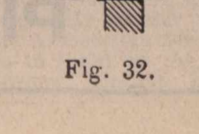

Fig. 32.