

riveting through both straps and the web. When the flue is large enough to admit of it, the joint should be caulked both inside and out, as indicated in the cut. If the flue is too small for this, there is no necessity of having the abutting ends of the flue as far apart as they are shown in the cut. T-shaped wrought-iron rings, similar to that shown in the figure, and made in halves, are sometimes riveted directly to the flue, midway between the joints, when the flue, either through age, through increase of pressure or through faulty design, requires more stiffening than the builder has given it. Rings of angle-iron are also used for this purpose.

Fig. 3 shows a ring of steel, hoop-shaped in section, which is sometimes used in building up flues in the place of the T-iron

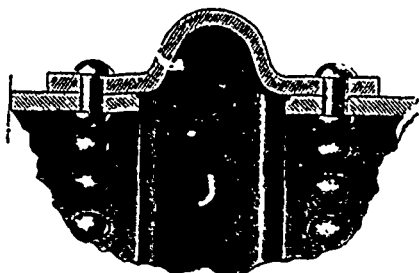
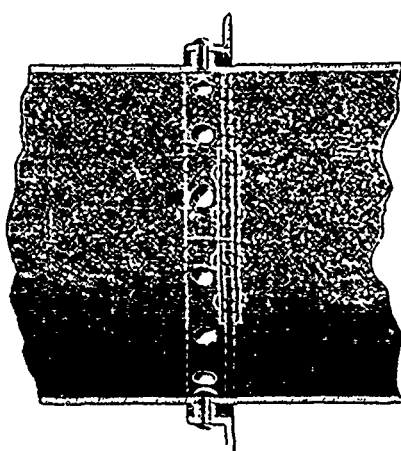
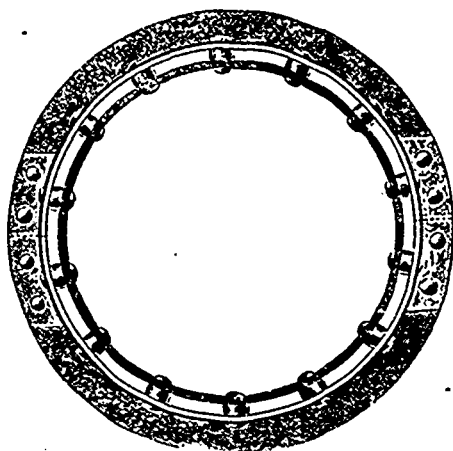


FIG. 3.—STEEL HOOP.

ring illustrated in Fig. 2. The advantage claimed for this form of joint is that it has a certain amount of elasticity, and that it yields sufficiently to prevent any very severe strain from unequal expansion and contraction in the flue and boiler. This form of ring should be made in one piece and be shrunk on, and then riveted. It should be caulked on the outside, and on the inside also, if the flue is large enough to admit of it.

At the present time, flues are rolled of all lengths up to 18 feet. If a longer boiler is required 21 feet long for example, it is customary to use a rolled flue 18 feet long, pieced out with an additional section three feet in length. The joint where the flue sections come together gives stiffness enough, ordinarily, to prevent the collapse of the shorter segment; but the long section should be supported by some additional means. Rings of angle-iron, or T-iron, like that shown in Fig. 2 may be riveted around the flue at intervals of from 3 to 5 feet, to give the necessary stiffness, or the device shown in figures 4 and 5 may be



FIGS. 4 AND 5.—RING OF ANGLE-IRON, WITH THIMBLES.

adopted. There is some liability to overheating when the angle-iron is riveted directly to the flue, yet this is often done without giving rise to any such trouble. The ring shown in Figs. 4 and 5 seems superior to the plain ring, however, because water can circulate freely between the rivets, cooling both the rivets and the flue, and greatly lessening the likelihood of overheating. It consists of a ring of angle-iron or U-iron made in halves, with the ends riveted together in a double-strap, as indicated in the cuts. There is a free space of about one inch between the ring and the flue, all around, and the two are kept apart by thimbles that are spaced 5 or 6 inches apart. The ring and the flue are secured to one another by rivets which pass through the thimbles, as shown, and are headed over inside of the flue and outside of the angle-iron or U-iron. These rings are used in England much more than in this country, because flue boilers are much more common there than here. It will be interesting, therefore, to quote the opinion of Mr. Henry Miller, Chief En-

gineer of the National Boiler Insurance Company, with regard to them, as he is thoroughly familiar with the best English practice. "The angle-iron," he says, "should not be less than 3 in. x 3 in. x 9-16 in. The ferrules between the hoop and the plate should be about one inch thick, [*i. e.*, one inch long], and the rivets should be spaced about six inches apart. With the exception of the part that requires riveting over, the rivet should be as cool as possible when it is inserted, as otherwise the excessive contraction in so long a rivet will be likely to induce such a strain as to fracture the head. The ferrules should fit tightly between the hoop and the flue, and the rivets should fill the ferrules." These rings are made in halves, as explained above, and the ends of the halves are made to butt together and are secured by securely riveting a double strap to the web of the ring where the joint comes, in the manner indicated in the cuts.

Mr. Miller does not recommend this form of ring for new boilers, nor do we, unless there is some special reason for it. It is often serviceable, however, when the flues of a boiler were originally made too weak for the pressure it is desired to carry. For new work we strongly recommend Mr. Adamson's joint, shown in Fig. 1, or the steel hoop shown in Fig. 3. A few years ago a ferry boat plying about New York City was built with rings of this sort around her flues, except that in place of the angle-iron shown in Figs. 4 and 5, half round iron 2½ inches wide and 1½ inches high was used. The rings were placed along the flues at intervals of about twenty inches, and the rivets were spaced 8 inches apart. This stiffening proved insufficient, and a vast amount of trouble resulted. In our opinion the rings used in this case were much too small, and were weak in shape. The flue was 36 inches in diameter, and in this form no strengthening ring was to be used at all, a heavy ring of angle-iron should have been employed in the place of the weak, half-round strips. If we remember rightly, the trouble was removed by the substitution of corrugated flues for the plain ones.

It may be well to say in this place that we do not approve of flue boilers as a general rule. There seems to be no especial advantage in them and they are inherently weaker than the tubular form. We believe that greater safety and economy, and more general satisfaction, can be had from tubular boilers than from any other form. Flue boilers are used in some parts of the country in sawmills, where refuse is burned for fuel; and we have known the owners of these mills to object to tubular boilers because they were economical. It was necessary, they said, to burn all their refuse, and if the boiler wouldn't do it, it was necessary to have separate furnaces constructed for the purpose. Nowadays, when all things are put to use and the word "waste" is nearly obsolete, we seldom hear this objection urged.

There are other points that should be mentioned in connection with flues, and we shall return to the subject in a later issue.—*The Locomotive*.

EXTENSION OF THE BELL TELEPHONE SYSTEM.

THE trunk lines of the Bell Telephone system were largely extended in Ontario during the last year, and greater extensions and improvements are projected for the coming year. New metallic through wires and wires for way stations are to be erected from Toronto to Barrie, Orangeville, London via Guelph and Stratford; from Chatham to Windsor, and from Hamilton to Niagara Falls, to complete the line from Detroit and Windsor through London and Hamilton to Niagara Falls and Buffalo, and thence to all points in New York and the adjacent States; also from Port Hope to Kingston, to put that city, with Belleville and the neighboring towns, in communication with subscribers in Toronto and points farther west. The new pole routes will all be of the most substantial construction, and the wires of copper and doubled in all cases, so that the annoying effects of induction from electric railway and electric light currents will be done away with and the company able to offer to its subscribers who have metallic circuits to their exchanges perfectly silent lines.

The Bell Telephone Company at Buffalo, with its numerous connecting lines, will meet the Canadian company at the Falls, thus preparing the means for conversation between Toronto and New York and other American cities.