

other. Further, the water and steam must be inclosed in a chamber capable of standing the pressures which will be developed. Again, the fire must be inclosed in a suitable chamber or volume, so that the hot gases may be led along and brought into contact with the heating surface, and finally conducted to the stack. These requirements are fulfilled in various ways, according to the type of boiler. In the fire-tube boiler the gases are subdivided by being passed through a large number of comparatively small tubes, the water being on the outside of them. The result of this is that no particle of either gas or water is far from the heating surface, the vital point being the subdivision, rendering possible the ready transfer and absorption of the largest amount of heat in the smallest space and time. In the water-tube boiler, the water is subdivided by being passed through the tubes, and the hot gas is subdivided, so to speak, by having the tubes passed through it. As before, the important point is the subdivision, the objects to be kept in view being the keeping of the necessary amount of surface for the efficient abstraction of the heat from the gas, and subdivision sufficiently minute so that the various particles of water and gas will readily find their way to the heating surface, the one to give, the other to receive. In the fire-tube boiler we necessarily must have, surrounding the water, steam, and fire tubes, a shell, water and steam tight, and of strength sufficient to withstand the internal fluid pressure. In the case of the water-tube boiler we must have a space wherein may occur the efficient separation of the water and steam, but no all-embracing water-tight shell is required, as in the other case. Instead, however, provision must be made for the proper retention of the hot gases on their way to the stack.

#### "GROOVING" IN BOILERS.

An engineer of an English boiler insurance company, speaking of the various forms in which corrosion goes on, says that grooving or channeling is one of the most frequent. It usually occurs at the joints of the plates, and is due to the fact that the stress is not transmitted directly, and consequently a bending action is set up close to the lap of the seam. Sometimes the grooving is of a much more acute form than this, being very deep and narrow, and like a fine fracture. It sometimes occurs in cases where the water does not appear to be of a particularly corrosive nature, and is probably due to straining of the plates during construction. Locomotive boilers (in which this kind of grooving usually occurs), are often made with the rivet holes in the shell plate punched before the plates are bent. When this is done, it is difficult to avoid undue bending, and distress being caused near the line of rivet holes when rolling the plate to form, and, in some instances, the final bending of the plate near the edges has been done by means of a sledge hammer. Considering the high pressure made use of in locomotive boilers, and the great degree of straining to which they are subjected in the ordinary course of their work, it is not surprising that defects should soon appear, unless in their construction the best workmanship and greatest care have been exercised. Another form of grooving is that which sometimes occurs at the vertical seams; and it should always be remembered that it is much more dangerous at these parts, especially low down where damp ashes may be lying, than near the centre of the

plate. Internal grooving at longitudinal and ring seams may be ascribed usually to corrosion localized near the joint, caused by slight bending to and fro at this part. The same mechanical action which results in grooving in the first instance tends to accentuate and cause it to be more acute near the lap of the plate afterward. In determining the weakening effect of grooving, therefore, the strength of the grooved plate to resist this bending action must be taken into account, and in this connection it must be remembered that, generally speaking, the resistance of a plate to bending varies with the square of the thickness. It must usually be considered, therefore, in such cases, that the ultimate resistance of the plate is reduced by grooving in a much greater ratio than is indicated by the ratio of the wasted thickness to the original thickness. In many cases the water used for the boilers contains various minerals, rendering it violently corrosive, and quite unfit for use. There are many instances also in which the danger arising from this cause has been much increased by the wasting having been concealed by means of new plates bolted over the defective parts. This has often led to a wrong estimate of the boiler's strength, and subsequently to disastrous explosions. When the feed water is found to be corrosive, an endeavor should be made to procure a better supply, or if this is not possible, steps should be immediately taken to neutralize its acid properties.

J. B. GRIFFITH succeeds the late T. B. Griffith as manager of the Hamilton Electric Ry.

THE Pembroke Electric Light Co. have removed their plant to their new station. They will soon begin to run all night.

THE Truro town council are considering an offer to provide the town with more electric lights, and also an electric fire alarm system.

ON a motion in the Supreme Court, R. L. Borden has been appointed trustee of the Halifax Illuminating and Motor Company. The trustees till now were the National Trust Company of Boston.

LEWIS ABBEY, engineer for the Moose Jaw, N.W.T., electric light company, was accidentally drowned last month. He was once an engineer on the Regina section of the C.P.R., and leaves a wife and five children.

THE Chaudiere Electric Company, of Ottawa, has closed arrangements to expend \$50,000 on a supplementary steam plant to arrive for their water power. The new chimney will be 120 feet high. They have now some 20,000 incandescent lights in the city.

PROF. C. A. CARUS-WILSON, M.A., Professor of Electrical Engineering at McGill College, has gone to England to marry Miss Mary Louisa Georgina Petrie, B.A., eldest daughter of the late Colonel Martin Petrie, of Hanover Lodge, Kensington Park. The marriage takes place at the end of August, previous to his return to Montreal to resume his duties at McGill.

THE Edmonton *Bulletin* gives a full report of a public meeting in that town to consider an electric street railway. A resolution, moved by N. D. Beck, was carried to the effect that the town council obtain legislation for the establishment of an electric railway system in Edmonton and vicinity, one branch of which should be to the railway station, and providing for the operation of the system by the municipality or by a company as should be afterwards decided.