to insure perfect holding qualities. This is difficult to secure. Their use in columns for buildings is objectionable, as they rust badly under certain conditions; columns, therefore, should be without rivets, and the beam-bearing bracket shelf on cast iron columns should be cast in one piece with the column. It is generally supposed, and frequently stated, that there is a great difference between the expansion of iron and masonry by heat. This is not the case. For example, the length of a bar which at 32 degs. is represented by 1, at 212 degs. would be represented as follows:

Cast-iron	1.0011
Wrought iron	1.0012
Cement	1.0014
Granite	1.0007
Marble	1.0011
Sandstone	1.0017
Brick	1.0005½
Fire-brick	1.0005

In the "fire proof" building of the Western Union Telegraph Company, in New York, some years ago, a heavy brick pier, 7 or 8 feet in diameter, adjoined the wall of the boiler furnaces. The difference in expansion in the brickwork next to this furnace wall as compared with that of the remaining brickwork of the pier was so great as to produce a crushing of the material from top to bottom of the pier for a depth of several inches, and it was found necessary to change the furnace wall and leave an air space between it and the pier.

While the difference in expansion between masonry and iron incorporated with it is less per running foot than is generally supposed, and while the difference in expansion between a cubic foot of iron and that of a cubic foot of masonry would hardly be noticeable, especially if the iron were covered on all four sides, yet in stretches of 50 feet or more, as in the case of iron I-beams and girders, the cumulative effect of expansion in uncovered iron might be a serious matter—quite sufficient with the rises of temperature due to a burning building to push out the bearing walls and wreck the building. Especially is this true of temperatures higher than 500 degs. It is unnecessary to suggest that metal differs from masonry in the important respect that heat does not travel throughout the entire length of the latter, while it does in the case of metal. In other words, while the difference between the expansion of a lineal foot of iron as compared with a lineal foot of masonry, marble, brick, etc., is very slight, the difference in conductivity is very great. The conducting power of silver, for example, being represented by 1, copper would be .845, cast iron .359, gold .981, marble .024, and brick .01—an important fact to be considered in the construction of buildings. Brickwork raised to a white heat would not raise the temperature of other masonry in the same wall a few feet away, but one end of an iron I-beam could not be raised to a white heat without raising the temperature of the beam for its entire length.

Where iron beams and girders are inserted in walls without sufficient space left for their expansion under heat they are almost certain to overthrow the bearing walls by their expansion thrust. A large warehouse in Vienna in which such provision had been contemplated by the architect was totally destroyed, with its contents, by reason of the fact that an officious subordinate, discovering the space in the wall purposely left at the end of each beam, deliberately poured liquid cement therein, which, having set, effectually thwarted the well-meant intention of the architect, and resulted in the destruction of the building. The expansion thrust of iron beams may be computed upon the following factor of expansion: Rolled iron of a length of 1,562 feet will expand one-eighth of an inch for every degree of temperature. The heat of a burning building as already stated is enormous—sufficient to fuse most known materials; it may safely be estimated to be at least 1,000 degs.; therefore a length of rolled iron of 1,562 feet at 1,000 degs. of temperature would expand about 125 inches and a 50 foot length of iron girder would expand between 4 and 5 inches, showing that there should be a play at each end of at least 2 inches if the iron is not fire-proofed. Inasmuch as in iron construction the iron beams and girders are usually anchored to the walls to steady them, space should be left and the tie to the anchor should be by a movable hinge joint, which would be of the same strength with an inflexible anchor for all tying purposes, but would yield under the thrust pressure like an elbow and allow play of the beam, or stiff anchors should have elongated holes to allow expansion when beams are of great length. Girders are seldom over 25 feet long, but if bolted together, as is frequently the case, they may be 120 feet or more long, and a line of columns from cellar to roof of a building may easily have one continuous iron structure of two hundred or more feet. It should be remembered, however, that this danger from the expansion of iron may be almost wholly counteracted by protecting it from exposure to fire through the use of non-conducting material. It is more important to protect girders than beams.

The mistaken pride with which the owners of some buildings point to exposed iron beams in ceilings as evidence that the floors are "fire-proof," actually justifying the supposition that they are left exposed for such display, would be ludicrous if it were not serious. In buildings occupied for offices or dwellings, where there is not sufficient combustible material to endanger the beams, it is not so objectionable; but in warehouses and stores, filled with merchandise, such construction is dangerous; and if one of the upper floors should give way it would come hammering down to carry all below and thoroughly wreck the structure. In this connection it is well to say that combustible merchandise should never be stored 100 feet above the street grade even in a "fire-proof" building, since the average fire department cannot reach it at that height.

The roof, that portion of a building which ought to be most carefully watched during construction, is often the most neglected, woodwork entering into the composition, as in the case of the Horne building, at Pittsburgh, where the cornice was supported on wooden outriggers.

Partitions.—These should not be erected upon wooden sills, as is sometimes the case—only, however, with ignorant and inexperienced architects, who suppose that it is necessary to use wood in order to nail baseboards and other trim at the bottom of the partition. Porous terra-cotta will hold nails and should be used in preference to wood, which, as soon as it burns out, will let down the entire partition.

(To be continued).

—At a meeting of the Board of Governors of McGill University, held July 28, Ernest Rutherford, M.A., B.Sc., Trinity College, Cambridge, was appointed W. C. McDonald Professor of Physics, and Dr. James Wallace Walker, of University College, London, was appointed W. C. McDonald Professor of Organic Chemistry. Both the new professors have had most successful careers hitherto, and we hope they will add to their laurels while at McGill.