tures on one hand and of riveted structures on the other has scarcely yet died out as far as bridges of moderate span are concerned, although some agreement has been reached with reference to long spans. For the latter, the excessive vibration which sometimes characterizes smaller pin-connected structures, disappears, and the advantage of easy erection is afforded, which is of considerable importance where spans of four or five hundred feet length must be placed across streams in which a rise of twenty or thirty feet may occur in a few hours. Many British engineers now admit the especial advantage of pin-connections under such conditions. For crossings which present no particular difficulty as far as erection is concerned, however, riveted spans are coming into great favor. A few railroads, such

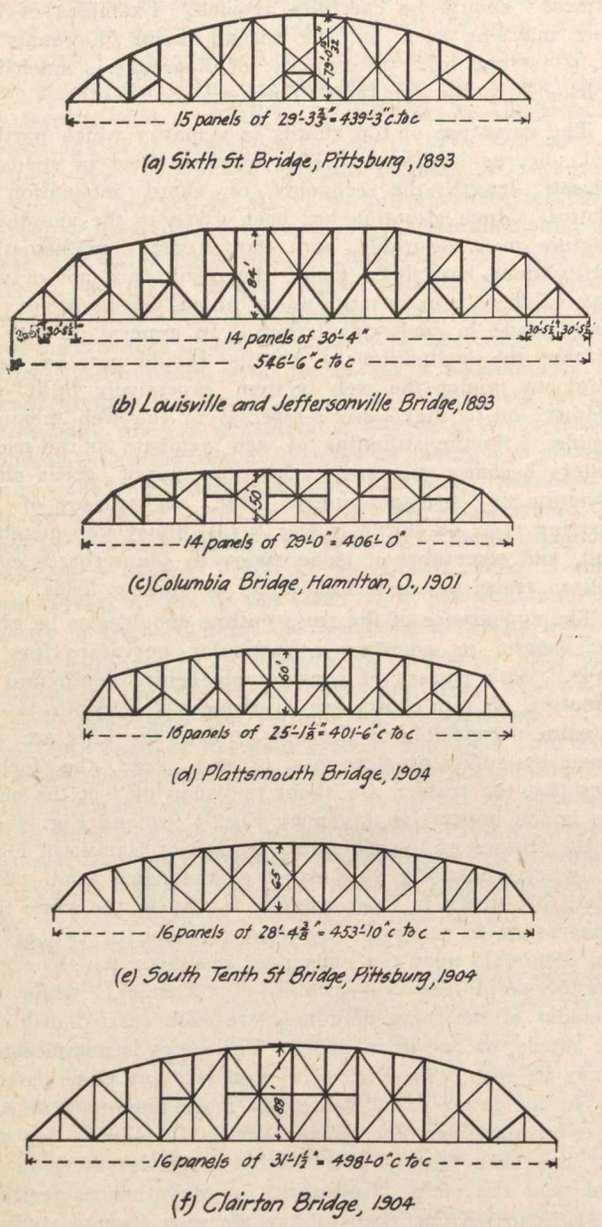

Fig. 5 - Petit Trusses

as the New York Central and Hudson River are adopting this type of construction very extensively, and particularly in Canada is this tendency apparent. Among railroad structures may be mentioned the 296 ft. ½ in. Pickerel River span for the Canadian Northern Ontario Railway, now being erected, and the 412 ft. 8 in. span over the French River, built in 1907 for the Toronto-Sudbury Division of the Canadian Pacific Railway. This latter, it is believed, is the longest riveted simple truss span in America. It was designed to be converted into a draw-span without adding to the truss members. The outline closely resembles that given in Fig. 5 (f). Highway riveted spans have been built of considerable length in Canada, the Richmond Bridge, the trusses of which are shown in outline in Fig. 2 (c), being, as has been stated already, probably the longest riveted highway span on the continent.

That the limit of 546½ ft. in the length of simple truss spans set by the Louisville and Jeffersonville Bridge eighteen years ago will be considerably surpassed is not at all improbable. When some of the energy which has heretofore been directed towards the development of the cantilever for moderate spans is turned to the perfection of simple truss structures of long span, we may expect spans of 700 or 800 feet in length. The necessary conditions of this development are easy and safe methods of erecting such large structures and the economical design of the long, heavy compression chords. With an extension of the present practice of building stiff bottom chords in the end panels, it is not unlikely that many simple truss spans will be easily erected over rapid streams and deep gorges by the cantilever method. At the same time the investigation of the resistance of full-sized compression members which is sure to follow the lamentable collapse of the Quebec Bridge will render the design of all the truss members in large structures uniformly safe and economical.

STEEL RAILS.

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A great deal has been said regarding the steel rail question within the last four or five years, in connection with the wrecks which have occurred throughout Canada and the United States. In every instance where wrecks are mentioned, the first supposition is that it is a broken rail, and while we must admit that in a large percentage of these wrecks broken rails are sometimes discovered—yet, I hardly think that the rail in itself was responsible for the wreck in every case without some undue force causing breakage. We are apt to blame the manufacturer possibly for a poor class of material, and frequently broken specimens of rail taken from these various wrecks are hurried to the chemical laboratory for microscopical determinations. In a number of cases the chemical determinations turn out to be in full accordance with the specifications under which the rails were ordered—why then is it that having fulfilled the specification regarding chemical composition the particular rail examined failed in service? A microscopical examination has also shown in a number of instances some of these rails were split, possibly produced by what is commonly termed piping.

On reading an article in connection with the general discussion on rails before the American Society of Testing Materials, given by Professor Dudley of the Pennsylvania Railroad, the assertion is made that the consumers, or rather the Railroad Company think the principal fault in the breakage of rails is due to the poor quality, and just as naturally the producers think that the principal fault is in the condition of service—pointing out the increased wheel loads, also speeds, and where the attention has been drawn that if a rail is to be made to sustain these conditions that the section should be modified and also the specifications revised. We must admit that there may be some truth in this, as only two weeks ago, in reading over one of our daily papers I came across an item where it stated that railroads throughout the United States are becoming alarmed over the rapidly increasing number of broken car-wheels which are the frequent cause of disastrous wrecks, and to demonstrate this it has been shown by the fact that the Pennsylvania Railroad on its lines east of Pittsburg removed during the year 1907 a total of 79,000 wheels, and that this was an increase of over 50 per cent. in a few years, and it was stated that the added expense of car-wheel removal was becoming a serious item in the operating column, on account of rolling stock being taken out of service.

This would also seem to indicate that these breakages were caused by the increased weight of rolling stock and the high speed of train travel. Formerly, when the lighter rails were in use, the capacity of cars ranged from 30,000 to 60,000 lbs., while at the present day the capacity of cars is 80,000

* Paper read before the Engineers' Club, Toronto.