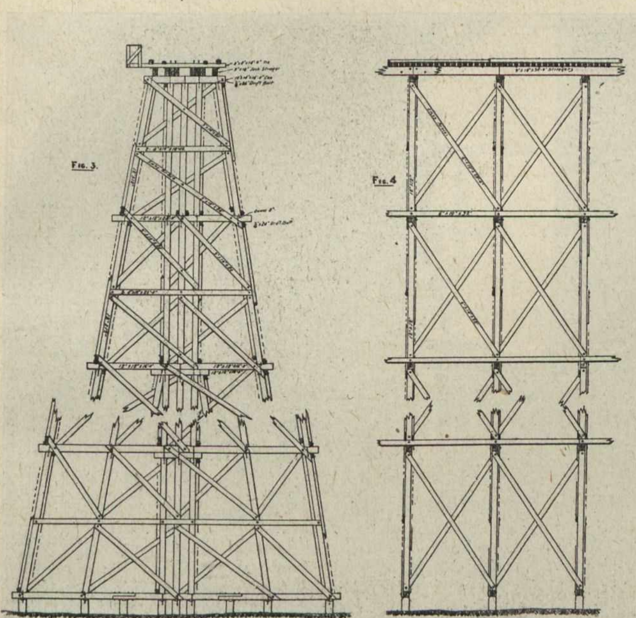
mixture such as the United States Government use in their lighthouses.

From personal observation during an experience of thirty-five years, the writer has come to the conclusion that the safe working load, sidewise on hard pine, should be taken at one hundred pounds per square inch, in a moist climate, and varying in proportion to the dryness of the climate from that to two hundred pounds, or even two hundred and fifty pounds per square inch, in very dry countries.

In actual practice the strain is often five hundred to one thousand pounds per square inch. An important consideration is facilities for renewals, the bridge should be designed with sufficient strength so that the pieces in each bent can be removed one at a time and another substituted, without interrupting traffic.

Figs. 1 and 2 are submitted as general plans for trestles up to or over one hundred feet in height. According to this plan there are no stresses on the side wood great enough to destroy the fibre. It is so designed that it can be removed piece by piece and it is intended that all the timber on the structure shall be planed and painted.

Fig. 3 represents a general plan of a wooden trestle as generally built. This style has a batter of two inches to the foot (one in six). It has intermediate cap sills and sill. Notwithstanding that this plan is faulty in many details, it has the approval of two great corporations in Canada. It has not



Front Elevation. Side Elevation.

sufficient spread to carry the great loads that are expected to go over it. Locomotives weighing one hundred tons, and with a high centre of gravity, are expected to run over these structures at fifty miles an hour. The swaying or oscillation of these locomotives on a trestle one hundred feet in height will be terrific, owing to the peculiar design of the structure. The strain on the side wood of the sills and the cap sills will be sufficient to crush the life out of the wood between the upper and lower posts, owing to the shrinkage and swelling of the cap sills in wet and dry weather, as explained above.

Fig. 1 shows a side view of the proposed bents in the writer's design up to one hundred feet in height. The size of the posts are to be 6 x 12 inches, and the longitudinal wales (end view—shown in Fig. 1 in detail A) should be 8 x 10 inches and thirty-two feet long. Where two pieces of the posts butt on to each other, two dowels ¾ x 4 inches are used (see detail A and B), and a piece of black sheet iron of about 24 B. W. gauge, cut 6 x 12 inches and inserted between the ends of the two pieces of the posts. Detail C shows a corbel under the cap to which the posts are fastened, and also a cast steel bed plate on which the steel girder rests. Detail D shows splicing of the cross-wales when they become too long to be furnished in the complete length.

Fig. 2 shows a side view of tower to carry steel girders with 9 x 18-inch stringers over the tower. The tower braces are to be 6 x 12 inches throughout until the tower exceeds one hundred feet, and the longitudinal wales to be 8 x 10 inches. The ties on this plan are shown 8 x 12 inches, but if greater economy is desired the 9 x 18-inch stringers over the tower might be kept four inches higher, and 8 x 12-inch ties used over the steel girder.

The Department of Railways and Canals of Canada issues specifications for steel and iron bridges, but I do not know of any specification governing timber trestles, although nearly all our western railways are carried over gulches on timber trestles when the railways are first built.

As the Government of Canada contributes generously to the construction of railways, and as the safety of the public patronizing them is in the care of this Department, it appears of the first importance that stringent specifications should be adopted in regard to the style of the structure, as well as the material used therein. Canadian railway development is only in its infancy, and as there is an abundance of timber, undoubtedly in the development of railway systems a great amount of timber will be consumed both for temporary and permanent use, and whereas timber can be procured quickly; and to secure steel involves great delay, there is no doubt that timber will be the material largely used for many years to come.

It appears desirable that plans of trestle bents with all their bracing and foundations, and superstructure whether of wood or steel should be prepared by the Department of Railways and Canals, and it should be made imperative that all railways receiving Government assistance should follow these plans.

MACHINERY INDUSTRY IN JAPAN.

A tabulated statement, prepared by the Japan Chronicle, and incorporated in the report of the commercial agent for that country, shows the growth of the machinery industry in that country since 1896. The table* follows:—

	Steam Engines.	Electric Dynamos.	Locomotive Engines.
1896	818,241	14,094	1,620,768
1897	1,308,173	167,628	4,235,617
1898	697,173	91,414	4,282,502
1899	327,144	12,566	1,968,374
1900	773,255	309,195	1,089,209
1901	1,095,906	388,716	1,749,408
1902		473,084	12,114,323
1903	989,873	836,653	2,267,472
1904	1,710,914	1,266,186	2,291,327
1905	2,633,033	2,455,424	2,466,561
1906	2,162,123	1,408,315	1,659,951

	Lathes.	Others and Total.
1896	73,538	12,944,669
1897	192,672	22,347,432
1898	243,863	21,114,104
1899	331,070	9,561,246
1900	231,405	13,930,302
1901	709,103	16,738,947
1902	473,084	12,114,325
1903	178,109	13,213,072
1904	827,615	14,757,884
1905	3,349,617	27,954,226
1906	1,120,405	27,040,554

At the end of 1900 246,000 was the aggregate horse-power industrially employed, and, according to the commercial agent, it is now about 300,000. This figure is not very large, but the amount of power used has quadrupled during the past ten years, and it is expected that the ratio of increase will continue.

* The figures are given in yens, the unit being equal to 49.8 cents.