fine particles of ballast dropping down between the slabs onto the upper flanges of the girders there would be some deterioration of the girders. However, a recent examination of one of the earliest structures of this type which has been in service for seven years, failed to reveal grounds for any serious fear from this source. Another problem which has been given attention has been the tendency for the individual slabs to creep or move longitudinally along the structure. While this movement has been minor, it has been noticed in several structures. To prevent this, a recent design of the St. Paul provides for a spacing angle to be riveted to the upper flange of the girder in the field with one leg extending between the adjacent slabs. These, however, are minor details of design which do not affect the practicability of the solid floor deck as a whole.

Several advantages are derived from this type of construction. Probably the most important is that of economy in maintenance cost. With the open floor replaced by the standard ballasted track construction, it is estimated that the cost of maintenance per foot of track on the bridges is reduced one-half. At the same time, a better line and a uniform riding track are secured, while the more or less pronounced jar resulting from passing from one form of track construction to another at the ends of open floor bridges is eliminated. Also, a ballasted deck rides as quietly as the adjacent embankment, while the track may be maintained by the regular track forces without the necessity of calling a bridge gang from time to time. A further advantage which may be considered sentimental, but which is present, nevertheless, is the appearance of added strength which the solid floor gives to the layman.

WORLD'S COPPER PRODUCTION, 1845-1914.

The production of copper in the world for the 69 years from 1845 to 1914 is given in the following table. The figures are in long tons of 2,240 lbs.:—

Year.	Production.	Year.	Production.
1845-1879	1,587,540	1897	398,955
1880	153,959	1898	429,156
1881	163,369	1899	469,309
1882	181,622	1900	487,331
1883	199,406	1901	511,279
1884	220,249	1902	542,293
1885	225,592	1903	589,628
1886	217,986	1904	650,474
1887	223,798	1905	701,252
1888	258,026	1906	712,000
1889	261,205	1907	710,000
1890	269,615	1908	727,321
1891	278,917	1909	825,178
1892	310,683	1910	855,000
1893	303,250	1911	895,150
1894	321,163	1912	1,010,725
1895	334,565	1913	1,003,227
1896	373,361	1914	917,131

For the past 20 years the United States has furnished about 55 per cent. of this production.

MAGNETIC PROPERTIES OF ALLOY STEELS.

In the proceedings of the American Society for Testing Materials appears a paper by J. A. Matthews, in which it is shown that the magnetic properties of hardened alloy steels vary with the physical characteristics of the metal. Alloys hardened by quenching in oil give a lower permeability and residual magnetism but a higher coercive force than those quenched in water. The size of the cross-section of the metal also has an influence, varying according to the hardness of the metal.

GOVERNMENT WHARF AT VANCOUVER.

THE Department of Public Works, Canada, has under construction at Vancouver a wharf, some of the details of which are illustrated and described below. The works in connection with its construction include lines of timber cribs, sheathed with reinforced concrete, and filled with stone ballast. The superstructure is of concrete. Its length is 800 ft. and its width 300 ft. At the shore end of the wharf are two bulkheads of timber cribwork similarly faced with reinforced concrete, and supporting a mass concrete superstructure. The cribs will be placed upon a foundation consisting of layers of rubble and broken stone and the two lines of cribs will be filled in to the level of the coping of the concrete superstructure, and at the back of the bulkheads to the railway right-of-way, as shown in Fig. 1. The work involves excavation in earth and rock to a depth of 36 ft. over the area covered by the cribs, and to a depth of 35 ft. over the slips at each side of the wharf. The total quantity of

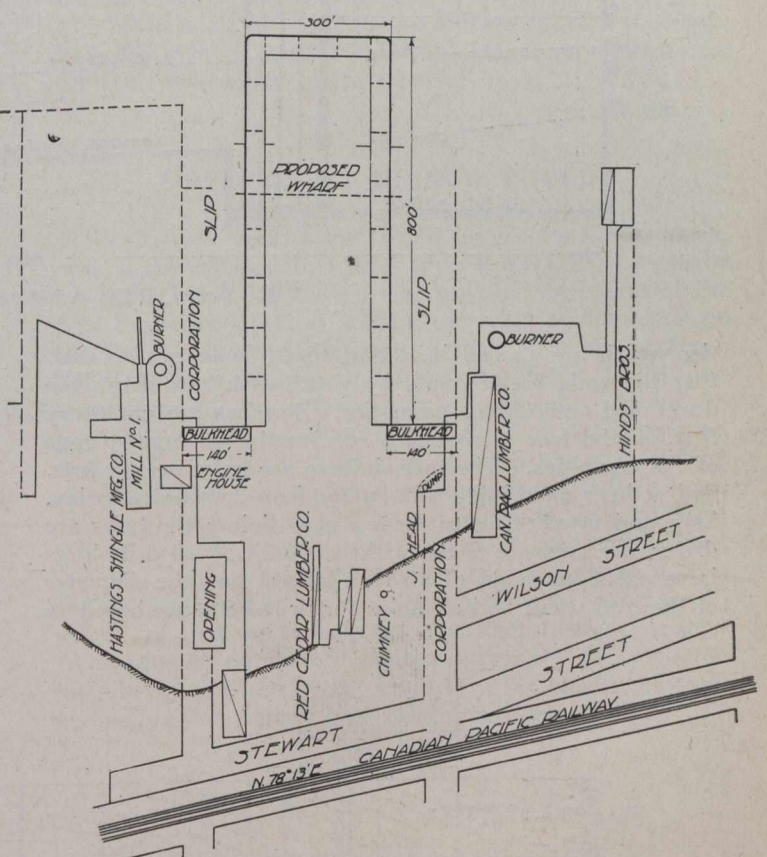

Fig. 1.—Location of New Wharf and Bulkheads.

rock excavation is approximately 108,000 cu. yds. Of this quantity about 100,000 cu. yds. will be used as ballast for cribs and foundations. When completed, the coping of the wharf will be 22 ft. above datum.

The sides and outer end of the wharf are built of timber cribs, each about 100 ft. long, 37 ft. wide and 39 ft. high, so that, after sinking, their top will be 4 ft. above low water spring tide. The specifications recommend their construction in a floating dry dock, or a scow without deck, to such a height that they may be launched and floated. When fully constructed to a height of 10 ft. with the concrete sheathing, it is estimated that the cribs will draw about 7 ft. of water, ballasted to float level. It is intended that one or two chambers of the cribs be left empty to permit dewatering, should conditions necessitate.