

and the present excellent product was the result of a great deal of investigation. They commenced with the addition of 2 per cent. manganese, and increased this to 7 per cent., at which point they found the metal very brittle and experiments ceased. Later on, however, they were again taken up, and more by accident than otherwise higher percentages were used, namely, from 10 to 30 per cent. At 10 per cent. the metal began to recover its toughness and held this property until near 20 per cent., when brittleness became apparent again, and further investigation proved the best percentage to be between 10 and 15; the exact amount depending upon

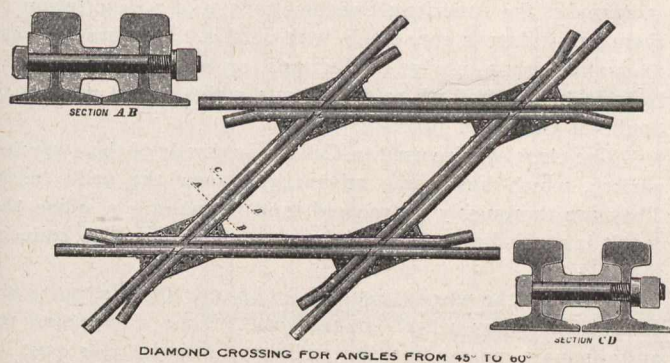


Fig. 3.

the particular use intended. A manganese diamond is cast in complete sections, and on account of its great hardness the only machine work that can be done on it is grinding. It is quite brittle after removal from the sand, and it acquires its final properties by being heated in a special gas furnace to a very high and exact temperature. That they are im-

the frog points of an ordinary diamond is so great that the wheel is unprotected to a dangerous degree. This method consists of two sets of short switch points placed face to face between two bent rails. They are moved in opposite directions at the same time, either by direct connection with a double-throwing stand, or by a "T," or oppositely-acting bell cranks connecting with an ordinary stand, or with interlocking apparatus. Fig. 4 shows this arrangement for the crossing of the Canadian Northern Railway and Grand Trunk Railway, at Rockland, Ont. The angle of this crossing was 9 degrees and 46 minutes, which would have allowed 28 inches between frog points of the ordinary diamond, and the liability to derailment was in such a case obviously too great. This crossing cost \$160 installed, and is giving perfect satisfaction.

Signal Tower.

The central machine controlling the interlocking is situated in a tower built usually 9 feet clear of the nearest rail, or with 22 feet clearance, when a second track is to be provided for, in the angle of the diamond affording the best view of the tracks for the operator. The size of these cabins depends, of course, on the size of the machine installed, but the standard for single track installation is 12 feet by 14 feet.

One feature of the design of a tower may be questioned, and that is the location of the stairway. In countries of mild climate throughout the year there is little doubt that an outside stairway is preferable. However, in a climate such as we have in Canada, the inside stairway has decided advantages. The danger and difficulty of snow on the stairway is removed, and, having the heater on the ground floor, the operator

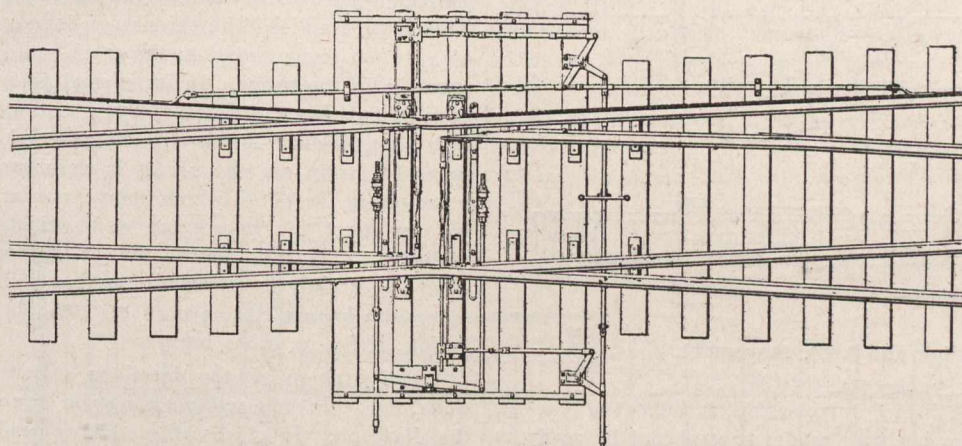


Fig. 4.

provement on the ordinary type there can be little doubt, as they are more compact with fewer plates and bolts. The wearing capacity of a manganese diamond, **if placed on good foundation**, compared with the ordinary type, is about 5 to 1, and sometimes more. They cost, at present quotations about \$550 for angles from 60 degrees to 90 degrees, and compared with the cost of the ordinary type, namely, \$350, they are desirable from all points of view. Perhaps the only drawback manganese diamonds have on the Canadian market is the length of time necessary to supply them, running from one to three months, and it is frequently necessary to obtain the diamond without such delay. One of these diamonds was installed in the tracks of the Canadian Northern Ontario Railway, and the Toronto Street Railway at Queen Street East, in January, 1908, and has given perfect satisfaction. It is absolutely necessary to have a perfectly solid foundation for these diamonds, and as such is the exception of new construction, it has been found advisable to put in a built-up diamond for a sufficient period to guard against any settlement in the grade and then the renewal diamond may be ordered of the manganese type.

In cases where the angle of the crossing is less than 15 degrees, it is sometimes desirable to put in a movable point frog, Fig. 4. With such a small angle, the distance between

must pass it sufficiently to keep it in order and prevent the danger arising from an overheated stove. A strong argument against the inside idea is that it necessitates a trap door in the floor, but if this is properly counterbalanced, little danger can be met with if ordinary care is exercised on the part of those whose business necessitates them using the cabin.

The cost of the signal cabin will vary according to its location, as in some parts of the country lumber can be purchased cheaper than in others. The average price of seven of these towers, built within the past two years, was found to be \$508, and it is quite a fair price to assume.

Semaphores and Connections.

The semaphore signal was introduced on railways in England about 1841, by Mr. C. H. Gregory. Numerous other forms of fixed signals were used before its introduction and are still being used, but the semaphore is fast superseding all the others, and will undoubtedly become practically the standard and consists of a vertical post from 30 to 40 feet in height, only form in use. It is the recognized signal in use in Canada and consists of a movable arm pivoted near the top of the post. This arm is usually capable of being moved through an arc of about 70 degrees, but sometimes moves as much as 90 degrees, and is the means adopted of communicating with the