water over the standard weir, through the canal, and over the experimental models was regulated by gates at the head and foot of canal. By the manipulation of these gates various discharges, submergences, and heads on the experimental weir models were secured. The upstream head was measured in the flume with a plumb-bob attached to steel tape at a point about 25.5 feet above the upstream edge of crest of flat weir, while the downstream head was measured in the same way in still water behind the flume on both sides and about 16.6 feet downstream from the upstream edge of crest of flat weir. The longitudinal water surface curve over the weir was determined for all models under various conditions of flow. The flow of water over these experimental models varied between 27.6 and 203.2 second-feet, equivalent to 6.87 and 50.75 c.f.s. per linear foot of weir, respectively. The upstream heads on the weir varied between 1.66 and 6.35 feet and the ratio of submergences between 0 and 95. The experimental coefficients as derived are based upon the submerged weir formula $D = cF^{\frac{1}{2}}\left(H + \frac{d}{2}\right)$, where D = discharge per linear foot of crest, H = upstream head, d = downstream head, F = fall or upstream head minus downstream head, c = experimental coefficient. The weir coefficients for the flat-crest models are given in Table II. and are shown in Fig. 3.

Table No. II.—Weir Coefficients, Flat-top Model.

Weir condition	Average minimum river flow per linear foot of weir	Co-efficient	Average mean river flow per linear foot of weir	Co-efficient	Average maximum river flow per linear foot of weir	Co-efficient
	C.f.s.		*C.f.s.*		*C.f.s.*	
Free	18.00	3.120	25.00	3.160	45.00	3.260
0.1 submergence	18.00	3.145	25.00	3.190	45.00	3.300
0.2 submergence	18.00	3.195	25.00	3.245	45.00	3.345
0.3 submergence	18.00	3.260	25.00	3.308	45.00	3.419
0.4 submergence	18.00	3.340	25.00	3.397	45.00	3.500
0.5 submergence	18.00	3.480	25.00	3.540	45.00	3.655
0.6 submergence	18.00	3.720	25.00	3.780	45 00	3.900
0.7 submergence	18.00	4.125	25.00	4.190	45.00	4.320
0.8 submergence	18.00	4.850	25.00	4 910	45.00	5.060
0.9 submergence	18.00	5.930	25.00	8.025	45.00	6.210

The weir coefficients of the rounded-crest models were about 5 per cent. greater than those of flat-crest models, but the coefficient increment was about the same for each type within the limits for river conditions. The flat-crest model was therefore adopted on account of the easier construction, inspection, and repair.

The committee does not wish it understood that the type of weir here proposed is the most desirable one for the purpose. The experiments made were by no means sufficient to settle this question. It is very probable that further experiments would reveal a still better type. The one proposed does demonstrate, however, that the project is feasible.

SILICON STEEL FOR ELECTRICAL PURPOSES

The results of extended experiments shows that silicon steel is to be preferred to manganese steel for electrical purposes on account of its superior magnetic properties is the statement made by F. Goltzè in a paper read before the German Foundrymen's Association, Berlin. Annealing improves the structure and the mechanical properties, and has considerable effect on the magnetic properties, at 750° C. reducing them slightly and at 1,000° C. establishing a marked improvement, while at 900° C. it has a decidedly adverse influence. Coarseness of grain and good magnetic properties were found to go hand in hand. The addition of aluminum to cast-iron was also found to increase the magnetic properties of the iron.

BASIC OPEN-HEARTH STEEL CASTINGS.*

By H. F. Miller.

FOR some years the prejudice against basic open-hearth steel for castings has been gradually decreasing. Acid steel has been used for this purpose much longer than basic steel; and the melters in acid practice had it well in hand when basic steel was first tried. Then the necessity of learning a new set of laws for the production of satisfactory basic open-hearth steel for castings became evident. The first of these laws has to do with the furnace construction. The charge should be melted down as speedily as possible to prevent excessive oxidation.

Furnace Hearth.—The hearth of the furnace is a decisive factor in the production of solid castings. The manufacturer should know the size of the heats he intends to make constantly, and should have his furnace built for that size of heat. The hearth should differ in dimensions from that of a furnace making ingot steel. That is, the bath should be deeper and should have less surface area. A shallow bath permits the slag to come out soon after the steel commences to flow, and thus prevents the additions from going into the steel, or from becoming uniformly distributed should they be put in hurriedly.

Under this head comes the very poor practice of making small heats in hearths of a much larger capacity. If into a 25- or 30-ton furnace only 12 or 15 tons of metal is charged per heat, the proportion of heats that will be wild or show signs of wildness at some time during the pouring will be comparatively large; whereas, if the hearth is charged to capacity, a heat showing signs of wildness will be a rare occurrence.

Influence of Slag.—The nature and action of the slag is an important factor in the manufacture of quiet steel. Slags are usually roughly classified by the melter according to physical appearance, as follows:—

(1) The dry, heavy slag occurring when there is very little silica present. This is a dangerous slag if not carefully worked. The burning of many furnaces is due to reflection of the heat to the roof by this slag. Another danger is that the melter, deceived by the physical appearance of the slag, may add an excessive amount of fluorspar. This results in the ladle being badly cut and the stopper rod burned off. These disasters can be prevented by a gradual addition of spar until a "wet" slag is created, after which the heat may be worked down as usual. With natural gas the heat will form for some time.

(2) A wet but lumpy slag is a good slag with which to work. The lumps of limestone should be broken up with a rod, so that a rocky bottom may be avoided. Otherwise an unbroken lump will choke the tap-hole, so that the flow of the slag being stopped, the steel is left uncovered until the tap-hole can be freed. A large amount of heat is lost from the steel thereby. A lumpy slag can be avoided by charging small-sized limestone.

(3) A third slag is the very watery variety, usually occurring when heats melt at high temperature, by reason of the presence of an excessive amount of silica. This slag should have burned dolomite or raw limestone added until a thick slag is made. When the slag is too thin, it will mix with the steel in tapping and a wild steel will be the product. The ladle and stopper rod will be badly

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