scorified, and usually some tons of steel will go into the pit by reason of a burned-off stopper rod.

The ideal slag is heavy and wet with no large lumps. This slag makes an easy heat to work and gives a steel low in phosphorus and sulphur. It requires but a small amount of fluorspar to put this slag in shape for the ladle. A heavy slag of this nature will not mix with the steel, and will generally stay in the furnace until the steel is nearly all in the ladle. It also has the good quality of cutting neither the stopper rod nor the ladle brick. The only objection is that it causes a dirty bottom, and unless a washout is made after each heat the bottom will rise to the sill-plate level after a few heats. This result shows very poor practice. No time is ultimately gained by charging up without the usual washout. If a washout from 20 to 30 min. is made after each heat, the furnace will work fast for a much longer time. Moreover, the holes that occur in a high bottom will be largely avoided, if the bottom is kept low and clean.

Tap-Hole.—The tap-hole should be kept large and low. The quicker steel gets into the ladle, the more heat is retained. The shorter a spout the better, for the same reason. Moreover, a large tap-hole will not clog up easily if rabbling has to be done; and few hard taps will occur. For shutting up the tap-hole magnesite is best, because it does not burn together and make a hard tap, nor does magnesite boil out, as may happen when a tap-hole is closed with green dolomite. Burned dolomite, however, may be safely used, the only drawback being an occasional hard tap, due to the burning together of the material.

The foregoing facts are probably known to most smelters; but unless vigilance is constant, one factor is apt to be overlooked. The bottom may be low and the tap-hole all right; but the spout if not smooth at the end may cause the stream to spray over the ladle, thus losing much heat and causing a skull and, perhaps, some misrun castings, all of which could be avoided with a carefully made up spout.

Alloys.—The addition of alloys may be made in the bath or in the ladle. By putting them into the bath, much heat is saved. This is a valuable method where a furnace is working cold or a heat has melted low and there is difficulty in getting it hot. The advantage is that the additions are made while the flame is still on the bath, and the loss of the heat in the bath caused by dissolving the alloys can be regained. The objections are:—(1) That a large amount of each alloy must be added, since in this method from 15 to 30 per cent. goes into the slag; (2) that the silicon, reacting, will throw back the phosphorus into the steel. Putting the additions into the steel as it goes into the ladle is the better method. A uniform distribution of alloys is obtained by shovelling the alloys in gradually. If the alloys are added to the ladle, the steel will be helped greatly by first raising them to red heat, especially in winter.

After the heat has melted down and the limestone has boiled up, the charge will be benefited by allowing it to "soak" from 15 to 30 min. This will allow any contained slag to rise and also much of the gases. Ore may then be fed if necessary or, if the heat has come ready, it remains only to get the steel hot. Sometimes heats will melt low, and if only small ladles are available or there are no heavy castings to pour, it is best to get the heat ready by using manganese. This will not add much metal to the bath, and it is a good substitute for pig-iron.

With large ladles, working the heats with both pig-iron and manganese is recommended. Very little, if any, ferro-silicon should be used instead of manganese, since the silicon mixes with the slag and cuts the stopper rod off while the heat is being poured. Hot metal is preferable to cold additions, as the bath is not then chilled by the additions.

If the slag comes too quickly and all the additions have to be made to the first part of the heat, an even distribution can be obtained by rabbling the heat. If some of the additions are lost in the slag, or if insufficient has been put in, the heat showing signs of wildness, a simple remedy is to take a number of sticks of aluminium, bend a tapping rod around them, thrust them to the bottom of the ladle, stir the bath with them and rabble it afterwards if necessary. There is hardly a heat that cannot be made absolutely quiet by this means. But it is curative treatment, and a good preventive is always better.

The time consumed in pouring is a factor in determining the size of the heat. Good practice demands that a heat of steel should be poured in less than 60 minutes; the faster the better. The high temperature required to pour steel from 1 to 2 hours causes a great increase in occluded gases and necessitates an increase of about 30 per cent. of ferro-silicon to make it as quiet as when poured at a lower temperature.

The use of fluorspar seems also to make the steel less responsive to the quieting action of silicon, since the fluorine appears to be absorbed by the steel. I have noticed when pouring a test that after much spar has been used the steel gives off a smoky gas of the same appearance as when fluorspar is added to the bath. If this is true, the action of fluorspar cannot be beneficial to steel when added in large quantities. Good basic steel is harder to make than good acid steel; but if the practice outlined is followed, the steel produced will be as quiet while molten and as solid afterwards as acid open-hearth steel —and tougher.

FORCE EXERTED BY EXPANSION OF WOOD.

The great pressure exerted by the expansion of wood when soaked with water has been illustrated during the flood at Dayton, Ohio. A quantity of oak dashes veneered with maple was stacked to within one inch of a reinforced concrete girder in the basement of a factory. This girder had a cross-section of 12 by 19 inches and supported a 6-inch reinforced concrete floor. The basement was flooded, and after the water receded it was found that the girder, together with the concrete floor which it supported, had been lifted 3 inches. Ten weeks after the flood the girder still rested on the dashes, but it had settled about ¾ inch. Large cracks developed in this girder, starting at the edge of the pile of dashes and extending upward and outward. These cracks extended from the bottom to the top of the section at an angle of about 30 degrees with the horizontal. It was necessary to replace this girder and a section of the floor.

In these days, when hydro-electric power is becoming so important a factor in industry, it is of interest to note that in the Western Provinces there are vast possibilities in this regard. In Manitoba there is water power which would produce 7,000,000 horse-power, and only 78,000 horse-power is being utilized. This is at Winnipeg, which has a municipally-owned hydro-electric plant, supplying light and power to consumers at cost.