

tion of flow and as nearly level as possible. It is packed firmly with sods in order that no leakage may occur and that the full discharge of the stream flows over its crest. When the stream has adjusted itself to the change in slope due to the presence of the weir, the head of water is taken by means of an engineer's level. The rod is held on the crest of the weir and also at water level beyond the velocity of approach (approximately six feet above, for a 15" weir), the readings being subtracted to give the head on the weir.

Current Meter Measurements.—As described under the previous heading, the cross-section is divided into elementary strips. The mean velocity, area and discharge are determined separately for each strip; the total discharge and area are found by summing those for the various strips; and the mean velocity is found by dividing the



Fig. 9.—Left frame at Pendant d'Oreill. Height, 17 feet.

total discharge by the total area.

Weir Measurements.—A rectangular, sharp-crested weir, having complete end contractions, was used in all cases of weir measurement. The Francis formula, $Q = 3.33 (L - 2H) H^{3/2}$, was used in the computation. This formula neglects the velocity of approach the percentage of error resulting being so small that it is practically negligible.

The office work of plotting cross-section and discharge rating curves for the streams of the Maple Creek district shows that in the majority of cases the beds of the streams shift more or less during flood stages. Hence, whenever a change occurs, a new rating curve must be plotted and sufficient measurements must be made in the field while conditions remain unchanged in order that a rating curve may be plotted which will cover the range of daily gauge heights obtained during this time. Another condition affecting the accuracy of records is that, with few exceptions, the gauge heights are read to the nearest tenth or half-tenth of a foot

This is due to the difficulty in explaining the decimal marking of the gauges. For this reason approximate results only are obtainable in the case of very small streams.

As soon as funds were available, Mr. F. H. Peters, C.E., was deputed to enquire into the water rights on St. Mary and Milk Rivers.

The Milk River rises on the eastern slope of the foothills in the Blackfoot Indian Reserve in the United States. Its headwaters run down in two main streams which are known, after entering Canada, as the north and south branches. The north branch runs in a north-easterly direction through the Blackfoot Reserve for a distance of about 15 miles, and then enters Canada near the south-east corner of the south-west quarter of Section 3, Township 1, Range 23, west of 4th Meridian. From the international boundary the stream continues in a north-easterly direction for about nine miles when it bends to the east and runs in an easterly direction through the second tier of townships to its junction with the south branch at the south-west corner of the north-east quarter of Section 20, Township 2, Range 18, west of the 4th Meridian.

The south branch runs to the south and east of, and parallels the north branch for a distance of about 48 miles, as the crow flies, through the Blackfoot Reserve and then enters Canada near the south-east corner of the south-west quarter of Section 1, Township 1, Range 20, west of the 4th Meridian. From the international boundary it runs in a north-easterly direction to its junction with the north branch. From the junction of the two branches the Milk River runs in an easterly direction through the second tier of townships in Canada to the east boundary of Range 7. From this point the river runs in a south-easterly direction to its first point of crossing the international boundary in the United States. The first point of crossing is near the south-west corner of the south-east quarter of Section 5, Township 1, Range 5, west of the 4th Meridian. The river runs for a distance of about 1,540 feet (mid-stream measurement) through the United States, then crosses back into Canada and runs in an easterly direction about one-quarter of a mile north of the international boundary to a point near the south-west corner of the south-east quarter of Section 3, Township 1, Range 5, west of the 4th Meridian, where it crosses again into the United States. The river runs for a distance of about 2,440 feet (mid-stream measurement) through the United States and then crosses back into Canada. From this point the river meanders in an easterly direction through Canada to a point on the international boundary about 900 feet west of the east boundary of Section 1, Township 1, Range 5, west of the 4th Meridian, where it finally crosses into the United States. This point is known as the "Eastern Crossing." The length of the course of Milk River in Canada from the western crossing of the north branch to the eastern crossing is 179 miles. The length of the course of the south branch in Canada is 20 miles.

Throughout its course in Canada from the western crossing of the north branch to the eastern crossing the Milk River runs through a well defined valley bordered on each side by a range of hills. The whole of its water-shed in Canada is bald prairie land. The river receives a number of small tributary creeks along its course, all of which discharge a considerable volume of water during the spring freshets; they all dry up by July 1st, (about) and have no considerable discharge again until late in the fall when some of them have a small flow for perhaps a month before they freeze up. The same remarks apply to the south branch in its course through Canada.

The general conditions of flow in the river are such as