In streams of the kind mentioned, however, the ice problem is not the only one involved in intakes, for it is equally difficult to contend with sand, gravel, and floating and submerged driftwood. During high water driftwood lodges against trash racks, as commonly placed, finer materials are then caught, and, with sand and silt, often make an almost watertight dam; sometimes it is as difficult to keep such racks clear, as when there are ice formations. Sand and gravel, washing into intakes and thence down the canal or pipe line, cause much damage to water-wheels, or they clog the canal and are not easily prevented. It is evident that sub-diversion channels are likely to be easily filled in by the river drift in times of high water, even in large, slowly moving streams; it is absolutely sure that the swiftly flowing streams common to the mountains would either fill them up or that they would serve to divert the sand and gravel—carried in great quantities by the torrential flows—into the intake; a condition it is desirable to avoid.

Perhaps it is unfair to discuss conditions differing so much from those assumed in the paper, as do the usual mountain streams, but the excuse is in the great interest and importance of the matter under all conditions. The writer submits plans (Fig. 1) showing an intake designed for an irrigation and power canal, where it was very difficult to deal with the ice in winter and the floating drift, sand, and gravel in summer. This intake was not built just as shown on the plans, and does not now give the best results. Had it been built as designed, it would surely have done the work in the best possible manner.

The plans show a movable dam across the stream, operated from a service bridge above it. In place of the usual trash rack, there is a vertical diaphragm of wood fastened to steel beams extending between undercut concrete piers and reaching in a straight line up and down stream and nearly parallel to it. This diaphragm is set above the middle of a concrete channel, with side-walls flush with the bottom of the river. The water is discharged below the dam, the flow through the concrete channel being controlled by a wooden gate. The diaphragm wards off all floating materials, and the space under it allows the water to pass to the intake. The channel or trough of concrete catches all sand and gravel washed down by the current, and the rush of the current of water through it removes all such material and prevents clogging; the channel has been given a heavy fall in order to accomplish this.

Below the diaphragm, and some distance away, there are two Tainter gates, each 18 ft. wide and 13 ft. high. Between the gates and the diaphragm, and on the river side, there are five wooden gates which serve as relief gates for the pool of water that the Tainter gates may be made to form. In the bottom, and leading to these five gates, there are some channels extending diagonally across and below the floor of the intake, and these catch and remove the sand which passes the diaphragm channel; the pool above the Tainter gates acts in some degree as a settling basin. The five wooden gates serve only to close the side of the channel and provide an overflow, but are arranged so as to operate the sand trap, being left up a short distance when there is water enough to waste, or are raised occasionally for flushing out the sand.

The arrangements to care for all conditions of flood or frost, and to remove the sand and gravel entering the intake are complete, and, provided there is sufficient fall to the location, cannot fail to do good work. The arrangement would need modification where the fall is light, but the general idea could be preserved. From the plans the design may be easily understood. It it not reasonable to regard a deflecting diaphragm, as shown here, with a subsurface intake entry, as promising better results under all conditions, and more logical to adopt in place of the usual rack so easily clogged either by trash or ice?

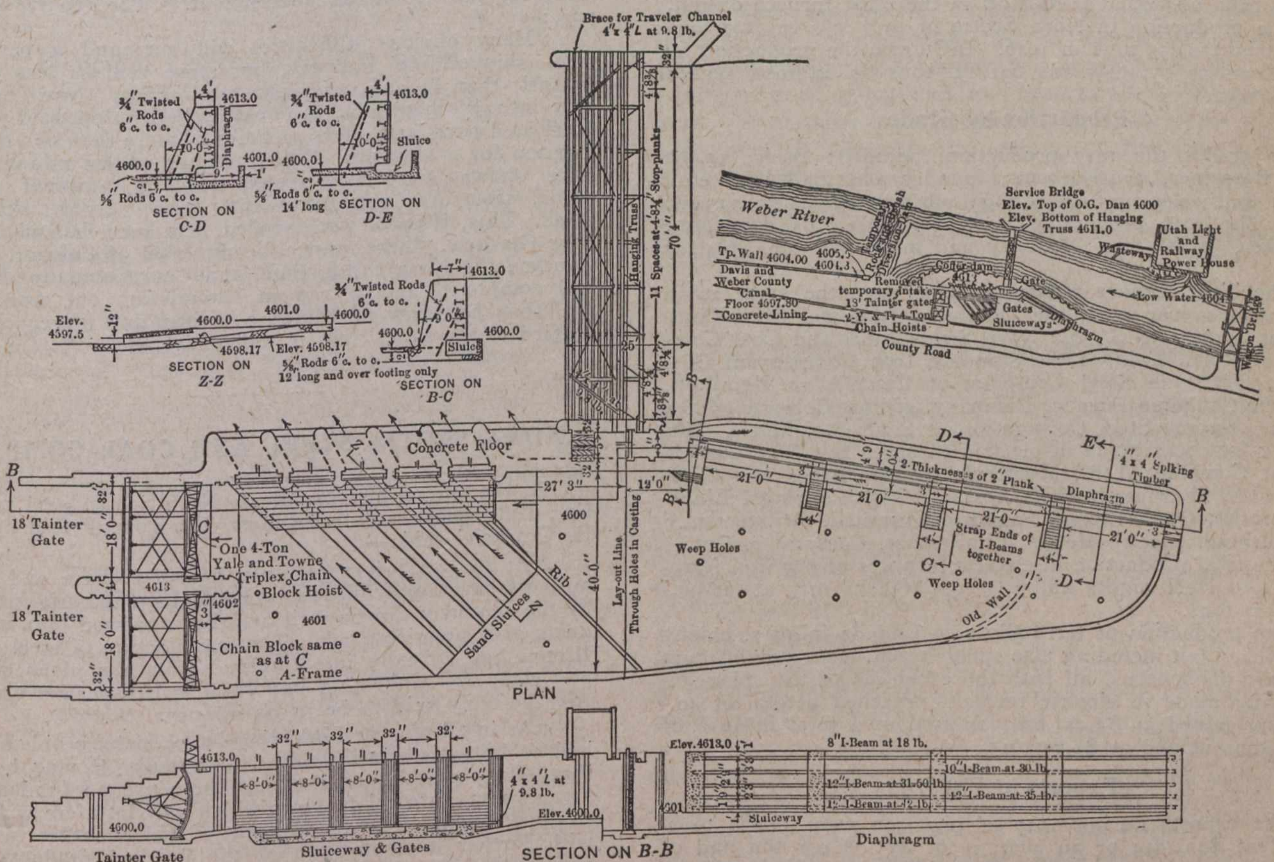

Fig. 1—Main Canal Headworks of the Davis and Weber Counties Canal Company.