Removable liners on locomotive and tender truck pedestals makes it easy to take up wear and reduce pedestal renewals. To prevent rapid wear between wheel hub liner face and driving box sufficient provision for lubrication should be made.

Shoes and wedges should be so designed that wear can be easily reduced and wedges kept in their proper place with a minimum of labor. Improperly maintained shoes and wedges soon result in increased maintenance of boxes, rods, pins, etc.

Pilots made of scrap boiler flues cost less to maintain than those of wood.

All oiling points should be made as accessible as possible. Handholds or small steps, properly located, to make some oiling points accessible, will soon pay for themselves. Lubricator chokes should be placed in proper position and located as near to the cylinder, or steam chest, as possible. Proper inspection and maintenance of chokes has been found the key to many lubrication troubles. The location of the lubricator in the cab where the feeds may easily be seen and adjusted will result in better lubrication. When located close to the front of the cab, or where the light is poor, proper adjustment is exceedingly difficult.

Four-pane cab side windows are easier and cheaper to maintain than those containing one large pane.

Boiler jacketing should be applied in sections so that panels can be removed with a minimum of labor.

The foregoing are but a few of the multitudinous details which merit most careful thought. But little mention has been made of the possibilities of simplified design by the use of cast steel. It is felt that with the development of the cast steel industry and the production of castings which are practically equivalent to wrought iron, locomotive construction in the future may be greatly simplified. We are to-day using castings that ten years ago would have been deemed impossible to successfully cast. For example, one-piece locomotive frames are now under consideration and will soon be in experimental service. These consist of the two main frames and all cross-braces cast in one piece. This is an indication of the degree of simplification that may be obtained. The maintenance of such parts has in turn been made possible by the development of the art of electric and acetylene welding.

The foregoing are simply a few indications of the importance of design in its relation to maintenance. To mention all the points that merit attention and to discuss them in detail would be far beyond the scope of this paper. Good and far-reaching results can be obtained by inviting criticism and suggestions from those directly responsible for construction and maintenance. Simplicity, correlated with efficiency, should be one of the key-notes of locomotive design. This principle, which in other words is simply good judgment, will make for that degree of efficiency which will be reflected, not only in reduced maintenance costs, but also in the increased capacity of the locomotive plant as a whole.

A recent report issued by the American Highway Association states that the new highway laws of Indiana provide for a penalty of $5 to $25 for blocking the drainage of roads at the entrances to farms, and that if this law is enforced it will gradually do away with one of the greatest troubles experienced in maintaining country roads, as it is impossible to keep a road in good condition unless the roadbed is well drained, and it is impossible to keep the roadbed drained unless the ditches are kept clear.

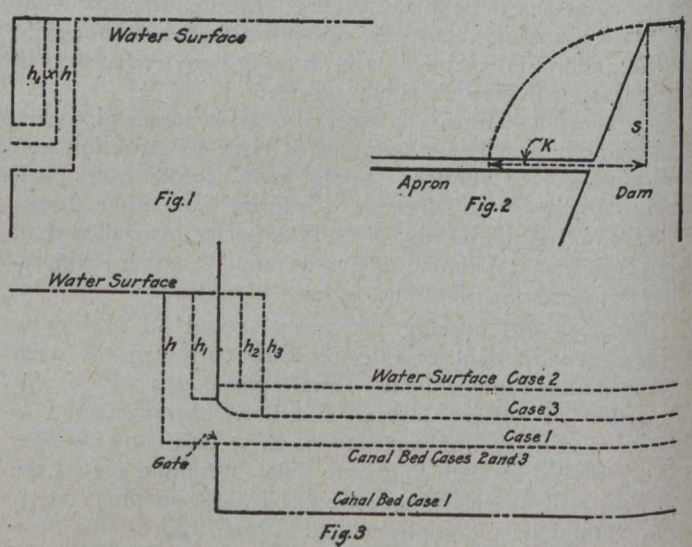
CALCULATIONS FOR DESIGN OF IRRIGATION STRUCTURES*

By Chas. W. Helmick.

IN designing headworks for irrigating canals it is frequently necessary to construct a low diversion dam across the channel of the river furnishing the water supply, not for the purpose of an impounding reservoir, but merely to divert the water to the intake canal.

If the dam be a low one, raising the water but a few feet above the general river bed, and the waste weir extend over the greater part of the channel, the drop from the crest of the weir to an apron below may be made in one step so as to break the fall, or the drop may be into a water cushion, which is preferable when such can be economically constructed.

The crest of the weir should be at the height that the water should stand above the gates of the intake canal to provide the maximum volume that the intake canal is to carry to the impounding reservoir or to the lands to be irrigated, for in many cases the low water flow will be found to have been acquired by prior appropriators, and only the flood waters, supplemented by what water can be obtained from the river when its water is not otherwise



Figs. 1-3.—Diagrams for Flow Calculations

being used, will be found to be available for the new project.

The prior rights will therefore necessarily have to be first provided for, and gates of ample capacity leading downstream must be provided for all such whose diversion lie below the diversion weir, and as it will generally be found to be more economical to construct the headworks to the intake canal and the gates for prior appropriations in one structure, and in the location of the canal, this idea should be given due consideration.

The quantity of water required for the prior rights taken below the diversion, together with the maximum as wanted through the intake canal, will determine both the number and dimensions of the gates when the head upon the same shall have been determined. Flashboards may, however, be used to increase this head, but they are difficult to operate, and the preferable plan will be found to be to increase the number of gates rather than to be troubled with their continued operation.

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*Extracts from article in "Transit."