

caring for ice. At least twice this will be required at times, but for periods too short to justify so much reduction in installation. During the war, when viewpoints are barricaded, travel discouraged and resources husbanded, maintenance for scenic effect is ill-timed; but in the transition period at the end of the war, and later, this latter 40,000 s.f., equitably distributed, will not only improve the present and former scenic effect, but—by throwing the heaviest flow over the margins—will stop and tend to remedy the increasing self-defacement of the

tary diversion, etc., and 56,000 s.f. beside. Hence, at least 60,000 s.f., in round numbers, should be deducted for existing canals, plants, etc. Deducting from the useful flow, taken as 200,000 s.f., the minimum installation allowance for ice, etc., and for installations now operating, a total of 100,000 s.f., we have the other 100,000 s.f. remaining. The fall, about 160 feet, means approximately 1,800,000 horse-power.

Another condition essential to a clear grasp of the situation is the treaty with the United States, which, in effect, forbids further developments of boundary waters until after a year's notice of its abrogation, unless, of course, this be waived by mutual agreement.

The proposed developments of the rapids below the falls by tunnel, long penstock or dam, are not quick enough to make them of any war value, for so much labor will have to be put into them that the war may be over before it could be gotten back by the added force and efficiency given to other labor. There is nowhere else so quick and cheap a way to get vast power in the heart of the market as to apply machinery to the dam which nature has already installed at Niagara!

Plan for Rapid Development

Almost every way conceivable for partial peace-time development has been studied or suggested, but no plan for complete development except the following, which was proposed by the writer at a meeting of engineers in January and brought to the attention of those in touch with the engineers of both governments during the following month. It is at least better than no development at all, and has been definitely set forth to meet such a catastrophe as the termination of nitrate shipments would produce, or as really now exists, could the people but realize the importance of the manufacturing emergency.

As a minor example of one method, were it desired to develop five or ten thousand horse-power,

it would be no feat to block the channel between Luna and Goat Islands—not fifty feet wide nor two deep—install penstocks, etc., on or near the face of Luna Fall, and then remove the obstructions. This might temporarily murder the scenery, but things far more precious are being murdered for the lack of power. If more power were wanted, nobody could gainsay the feasibility of stopping the inter-island escape channels and diverting to the Luna Channel all the water flowing between Green and Goat Islands.

Similarly, the American channel passes but a twentieth to a thirtieth of the total river flow and is under 170 yards wide and but little over three feet in mean depth near the head of Goat Island. Here it would be no great feat to hold about 170 cubic yards of obstructions of an easily re-



Plan of Niagara Falls, U.S. Geological Survey—A, G and C Indicate Littoral Penstock Installations Proposed by Mr. Young; D, Vertically Controlled Deflector; S, S, Temporary Emergency Main Spillway Section

Horseshoe, where what may occur is exemplified by what appears at the next bend below, where the river turned a similar angle and narrowed itself from the wide whirlpool section to form a series of rapids but three or four hundred feet wide. Into such a narrow self-dug gorge the Horseshoe seems, with increasing rapidity, to be surely disappearing.

Most of the main existing plants at Niagara Falls require tunnels or canals through town,—valuable for scenic preservation or economic use of head, but too slow in construction for war development, which must be almost instant to serve at all. We, therefore, are not further concerned with them except to deduct the sum of existing plant and canal diversions to get the net flow of the river for our problem. The treaty allows some canal and sani-