Letter to the Editor

HALIFAX DIVING BELL

Sir,—In the November 21st, 1918, issue of *The Canadian Engineer,* I note a reply from Mr. MacDonald to my letter which appeared in the October 31st, 1918, issue, with reference to the caisson or diving bell used at Halifax Harbor. It would be interesting to know the name of the individual who actually originated the idea of using the outfit of the type employed, and whether the design of the walls was prepared having in view the use of a caisson of the particular type used.

Mr. MacDonald asserts that the device used by me in Hamilton was lacking in novelty, so far as the regulation of draft is concerned. In making this statement, Mr. MacDonald must be speaking without information as to the actual facts. The device, as used by me here, was capable of being used in depths of water varying between 1 ft. 6 ins. and 7 ft., and with slight structural modifications, not affecting the principle of the apparatus, this depth could have been increased.

The method of obtaining this difference in draft is not in any way fundamentally different from that used in the Halifax outfit. Mr. MacDonald calls the outfit used here simply a scow with a bottomless central well for working about 3 ft. below the surface, and asserts that any change in draft was impossible. This is not the case. The fact that the Halifax device rested on the bottom when working has nothing whatever to do with the buoyancy and water ballasting principles of the apparatus, except in so far as it aids in maintaining the equilibrium of the apparatus when in operation.

The principle of the bottomless central well is inseparable from diving bells or caissons in any form used in construction work. As a matter of fact, the long air shaft as applied to Mr. MacDonald's device for use in deep water, is not at all original as applied to deep water marine work, and the form of the lower part of the caisson is of the general type used on bridge pier foundations. The only part of the device apparently for which Mr. MacDonald claims originality, are the buoyancy and water ballast chambers. The use of such chambers was made by me on the device used here for floating and moving the outfit when required, and for carrying water ballast to increase the dead weight of the apparatus and for regulating the draft of the caisson, or bell, when in operation.

The matter of the exact name, or names, which are applied to the device does not alter their functions in any way, and whether Mr. MacDonald calls his device a mobile, pneumatic caisson, or a diving bell, or simply a plain, floating caisson, as the writer prefers, does not matter and does not affect the fundamental principle in any way. Strictly speaking, the word "bell" should not be applied to the device. The diving bell proper, so called from its approximate similarity in outline to a bell, has no air lock or shaft, and depends for its ballast on its own dead weight, being suspended in the water from suitable hoisting and lowering apparatus placed above water.

As Mr. MacDonald refers to European practice, it is relevant that I should refer to it also, from personal experience in my own particular case. Probably the most extensive recent work carried out by the diving bell type of this device was the construction of the breakwaters at the Dover Naval Harbor by the contractors, S. Pearson & Son, of London. The principles of its operation are too well known to require explanation here.

Another device of the type of caisson proper with a shaft and air lock was that used at Plymouth Harbor by the contractors for the removal of a large rocky shoal there, for the Admiralty. The writer was at one time a member of the staff of the company carrying out this work, so does not need to generalize or use text book information. In this particular outfit, the air shaft passed through a well in the centre of a large steel scow, which was fitted with air compressors, etc., and the air driven rock drills were carried on a track in the working chamber, which was larger than in the Halifax outfit. This particular device, however, was ballasted by the dead weight of the scow. When it was desired to float the caisson, the ballast connections between the scow and caisson were liberated, and the air pressure in the caisson brought it towards the surface. This device was simple and stable in all conditions, and was able to withstand quite a heavy sea, but did not depend for its ballast on excess dead weight or water ballast, there being no buoyancy or water ballast chambers attached.

The caissons used in dock walls at Antwerp and other ports are of the type which became a part of the permanent structure and are not, strictly speaking, part of the construction machinery or plant.

The writer is quite familiar with the use of ballast and buoyancy chambers as applied to sliding gates for dry docks, etc., but this device is not adapted for construction purposes, and is not generally movable beyond the limits of its berth. The water is simply expelled from a section of the gate, which is built much of the same shape as a ship's hull, in sufficient quantity to permit the gate to lift slightly clear of the sill and float to one side endwise,—not at all an intricate device fundamentally. Mr. MacDonald apparently overlooked the application of ballast and buoyancy chambers to our late friends, the "U"-Boats.

The writer would be interested in knowing of a case where this principle is applied to scows carrying construction plant in tidal waters, as Mr. MacDonald states, and what purpose this is supposed to serve. The writer is aware of a self-dumping deck scow of Norwegian origin, which unloads its deck cargo by alternately flooding and unwatering portions of the subdivided hull, but this has no bottomless central well, and he fails to see where the flooding and emptying of the hull of an ordinary scow, or use of a bottomless central well, presumably for the purpose of turning air in it, serves any purpose.

Mr. MacDonald states that the problem of flotational stability while in a submerged condition was entirely absent, etc. A little superficial examination will correct this statement. Has Mr. MacDonald made any actual calculations in support of this statement, or is this merely an unsupported assertion?

As a matter of fact, the question at issue between the device used at Halifax and that used at Hamilton is, which had priority of design, construction and operation? and whether the principle of attaching compartments to a self-contained movable caisson, or as Mr. MacDonald also calls it, "bell," to be used for construction purposes under water, and on which the compartments referred to can be loaded with water to provide additional ballast, or emptied by any suitable means to provide buoyancy or maintain equilibrium in a floating condition, is the exclusive monopoly of either apparatus, or is common to both?

The exact shape of the caisson or the compartments or the position of the latter relative to the working chamber does not affect the principle of the device. Mr. MacDonald says the use of water ballast was not an essential principle of the device used here. Water ballast, as a matter of fact, was a prime necessity, when in operation. A heavier scow, as Mr. MacDonald asserts, would not have served the purpose. The *use* of water ballast did not regulate the draft so that it could pass over the piling, as Mr. MacDonald asserts, but rather the *absence* of water ballast permitted this to be done.

Mr. MacDonald makes this statement: "In order to float the Halifax caisson when it was required to be moved, the buoyancy chamber was added and this was its only function."

Does this mean that the buoyancy chamber shown in figure 5 of Mr. MacDonald's article is not also used as a ballast chamber by the admission of water into it? and is it not the case that the ballast chamber, as indicated in the same drawing, is also, when required, used as a buoyancy