The auxiliary machinery consists of a steam windlass (Clarke, Chapman & Company); steam and hand steering gear by John Hastie & Company, and a refrigerating engine of the No. 3 single vertical marine type by J. & E. Hall, Limited, of Dartford, Kent. There is steam heating throughout the vessel, and in all rooms and toilets, with the exception of those under the forecastle, are steam radiators, each having 25 sq. ft. heating surface for each thousand feet. As the vessel will be required to work in extremes of temperature, an elaborate system of ventilation has been introduced. The electric lighting equipment, which was fitted by the Wallsend staff of Messrs. Swan, Hunter & Wigham Richardson, Limited, includes a searchlight on the bridge, and the accumulators are arranged in the tunnel space between the propelling shafts. In shallow water, the staff of the Cartier will leave the steamer and conduct survey in launches and boats, afterwards returning to the vessel to work up their observations. Accordingly the outfit of the Cartier comprises two gasoline launches, each 27 ft. x 6 ft. 7 in. x 3 ft., as also two gigs, 27 ft. x 6 ft. x 2 ft. 5 in., and one dinghy, 18 ft. x 5 ft. 4 in. x 2 ft. 2 in. The steam winches, provided for the hoisting of the boats, are arranged with special leading blocks, so that they may be used for hoisting any one of the four boats. Included in the special outfit of the Cartier is a standard compass of the Lord Kelvin Navy pattern, whilst the steering compasses include a Ritchie standard compass, and a Wilson & Gillie compass. It is understood that the vessel is required for survey work on the Eastern side of Canada, and in its design consideration was paid to the fact that the vessel would be absent for long periods on surveying work.

MARCH LAKE LEVELS

The United States Lake Survey reports the stages of the Great Lakes for the month of March, 1910, as follows:—

Lakes.	Ft. above tide-water, New York.
Superior	601.54
Michigan-Huron	580.00
Erie	571.68
Ontario	245.75

Lake Superior is 0.19 foot lower than last month, 0.19 foot higher than a year ago, 0.45 foot below the average stage of March of the last ten years, 0.74 foot below the high stage of March, 1901, and 0.53 foot above the low stage of March, 1892. It will probably remain about stationary in April.

Lakes Michigan-Huron are 0.04 foot higher than last month, 0.06 foot lower than a year ago, 0.15 foot below the average stage of March of the last ten years, 2.95 feet below the high stage of March, 1886, and 0.89 foot above the low stage of March, 1896. They will probably rise about 0.4 foot in April.

Lake Erie is 0.49 foot higher than last month, 0.10 foot lower than a year ago, 0.11 foot above the average stage of March of the last ten years, 2.17 feet below the high stage of March, 1887, and 0.85 foot above the low stage of March, 1896. It will probably rise about 0.8 foot in April.

Lake Ontario is 0.72 foot higher than last month, 0.05 foot higher than a year ago, 0.32 foot higher than the average stage of March of the last ten years, 2.06 feet below the high stage of March, 1886, and 1.45 feet above the low stage of March, 1897. It will probably rise about 0.9 foot in April.

RAILWAY SIGNALLING.

V. I. Smart, B.A., Professor of Railway Engineering, McGill.

The most important department of railroading is that which deals with the movement of trains. This must be done with a maximum of safety and expedition to be economical. The important thing to be determined is what is the method to be used that will give the greatest safety, utilizing the track to its fullest capacity, and at a minimum of cost.

There are two general methods of controlling train movement. First by means of a time table, in which all the regular movements are scheduled, irregular movements being made under the direction of a dispatcher, who issues train orders to the conductor and engineman of the train about to make this irregular movement, not provided for in the time table. The necessity for these irregular movements occurs when a train is run that is not scheduled, or when a scheduled train is late or has to meet a late train.

Second, by means of signals, in which the line is divided into sections, the number and length of which is determined by the density of the traffic, the entrance to each section is controlled by a signal, the trains being advanced from section to section by means of the signals. Only one train being admitted to the section at any one time. Meeting points being made when the necessity arises, by refusing admittance of one train to a section and advancing the other up to the same point, where one of the trains is passed round the other.

We might perhaps add a third method, which is a combination of the first two. As for instance, where automatic block signals are used, the introduction of the automatic does not permit of the discontinuance of the train order system.

The first and third methods are employed in America, the second is employed to a small extent in America, but is the method used in Great Gritain, Europe generally, South Africa, India, and Australia.

I believe that in America we are suffering from the fact, that we have not recognized that every department of a railroad, with the possible exception of that department engaged in the collection, and care of passengers and freight, involves principles of engineering. The whole machine from its inception, its construction, its operation, and its maintenance is as truly a question of engineering, as is the permanent way, or the power and equipment. Unfortunately we have relegated the engineer to position of simply taking care of the machine, instead of both taking care of it and running it. It is very much like a manufacturing concern employing engineers to maintain the buildings and machinery, but having nothing whatever to do with the production of the product of manufacture. The engineering features of any business will be worked out on a more consistent and economical basis, by the trained man, than they will by one who has not had a scientific education.

In every operation there must be some principle involved, depending on some natural law, otherwise it becomes inconsistent, unsafe, and uneconomical. If we build a bridge, disregarding the principles of the strength of materials, and the theory of structures, we would either have it too strong, therefore uneconomical, or too weak, therefore unsafe, necessitating the use of props to keep it up. The maintenance of which would again be uneconomical.

This is equally true of train operation. There is a principle on which it is based. It is the neglect of this which leads to the use of numerous rules and regulations, to act as props, which are inconsistent, detracting from safety, and adding expense. If we do not recognize, and follow the