and needs no introduction to the scientific world.

Beaufort is situated near one of the great ocean inlets, and the waters of the harbor and adjacent sounds are remarkably well supplied with fishes and invertebrates. The advantages this locality affords for biological research are well known, as many naturalists have from time to time resorted thereto for the study of special problems.

In the early fall Beaufort will be made the headquarters of the steamer *Fish-Hawk* during a biological and topographical survey of the oyster grounds of the State which the Commission will conduct at the request of Professor J. A. Holmes, director of the North Carolina Natural History and Geological Survey, and other State officials.

HUGH M. SMITH.

U. S. COMMISSION OF FISH AND FISHERIES.

THEORY OF THE STEAM ENGINE.

M. NADAL, in a very extended review of the recognized 'Principles of the Mathematical Theory of the Steam Engine,' in recent issues of the *Revue de Mécanique*, discusses the theory of heat-exchanges between working fluid and cylinder-walls, the influence of the duration of the admission period, that of the compression and of the velocity of operation of the motor; touching upon the experimental work of Dwelshauvers-Dery. His principal conclusions are the following: *

1. The absorptive power of the metal in contact with the vapor is finite, and variable as a function of time. It is more considerable than the emissive power. The variation of this absorbing power is a function of the amount of liquid deposited upon the wall, and that amount has been shown by Donkin to vary, in the cases reported by him, from 20 calories per square meter per unit difference of temperature between metal and vapor, per second, and, at the time of admission, down to 12 during expansion and lower, and to 2 during the period of re evaporation and of emission, and to even less values as exhaust becomes complete; although this re-evaporation may be exceedingly rapid at the moment of opening the eduction port.

2. In the case of the unjacketed cylinder the mean temperature of the wall is equal or superior to that of the vapor in contact with it.

3. The heat surrendered by the vapor at induction increases less rapidly than does the period of action, that of induction. The indications are that the range of temperature during expansion mainly affects the quantity of the heat-exchange and that the total temperature-range does not measure the waste, which is contrary to general opinion among engineers and physicists.

4. Compression in the clearance or 'dead spaces' is not always advantageous.

M. Nadal shows that the moisture on the wall plays an important part, augmenting the quantity of heat-waste as superheating diminishes it. It is found that the variation of the magnitude of heat-exchanges during the forward and the return stroke accounts largely for the well-established, and often large, gains due to the use of the steam-jacket; since that accessory may communicate heat rapidly and effectively during the earlier portion of the cycle, while the sluggish transfer of heat out of the cylinder wall during the period of low pressure and temperature checks the wastes that would otherwise then occur, and more extensively than in the earlier period. Thus this variation of transferring power of the wall acts as a sort of 'check-valve' for the heat received from the jacket, permitting it to act efficiently, where most needed and preventing loss of heat where its transfer could do no good and would be purely a waste. Thus the jacket, also, is most economical in those engines which would be most economical without it, those in which the interior walls of the cylinder are dry during exhaust.

R. H. THURSTON.

THE PHILADELPHIA EXPOSITION OF 1900.

WE have received from the officers of the Philadelphia Exposition of 1900 details in regard to their plans. It is their purpose to exhibit every kind of manufactured products of the United States especially suitable for export. Such exhibits will form the principal depart-

* Revue de Mécanique, 1898–9.