froze on decks and rigging, had resulted in keeping many vessels in port. In consequence, but few lives were lost at sea.

Bulletin No. 3, by S. P. Fergusson, is entitled *Progress of Experiments with Kites during 1897–98 at Blue Hill Observatory*, and presents an admirable summary of this work. Both Bulletins are abundantly illustrated.

SNOW ROLLERS.

THE March number of *Climate and Crops: New England Section* notes the occurrence of 'Snow Rollers' at Grafton, N. H., on March 16th, last. This is an interesting but comparatively rare phenomenon, occasionally observed in the winter season when freshly fallen snow is rolled into balls or cylinders by the wind. At Grafton these are stated to have been rolled up in countless numbers. Some of the rollers were as large as a barrel, and the fields and hills were covered with them. Other occurrences of the same phenomenon have been noted, within recent years, at Spokane, Wash., in December, 1895; at Hartford, Conn., on February 19, 1896, and in Saline county, Kan., on January 14, 1898. At Spokane there were 'hundreds of snow cylinders of uniform size, and as perfectly formed as though they had been cast in a mould.' The rollers were from 12 to 16 inches long, and from 6 to 10 inches in diameter. At Hartford some of the rollers measured 8 inches in diameter. In the Kansas case the size varied from that of base-balls to that of half-a-bushel measures. The uniform size, often noted, may be explained by the fact that the wind rolls the cylinders of snow along the ground until they become too heavy to be moved farther. If the velocity of the wind continues about the same it is likely, other things being equal, that the rollers will have about the same size.

A COURSE IN METEOROLOGY AT OHIO STATE UNIVERSITY.

IT is a pleasure to note the establishment of a new course in meteorology at the Ohio State University, Columbus, Ohio. This course, which is being given by Mr. J. Warren Smith, Section Director of the U. S. Weather Bureau at Columbus, is required in the junior year in the course in agriculture and horticulture, and is elective in the courses in arts, philosophy and science. It is also open to all teachers. Lectures began on March 29th, and are given twice a week during a term of ten weeks. The object of the course, as stated in the prospectus, is 'to open and outline a rational and systematic line of study of the leading facts concerning our atmosphere, and of the methods of observing and investigating the daily weather changes, and of the physical laws underlying these changes.' Davis's 'Elementary Meteorology' is used as a text-book. The lectures are illustrated by means of lantern views, and the 'laboratory work' includes the use of the ordinary instruments and practice in the construction of weather maps.

CLIMATE OF THE CONGO FREE STATE.

THERE has recently been published an admirable little pamphlet on the climate of the Congo Free State, by M. Lancaster, Director of the Meteorological Service of Belgium (*Court Aperçu du Climat du Congo*, 12mo., Brussels, 1899, pp. 43). This is a summary, in a very convenient form, of the meteorological portion of the volume on the climate, soils and hygiene of the Congo Free State, noticed in SCIENCE for January 13, 1899, p. 72, and is reprinted from the *Annuaire de l'Observatoire royal de Belgique pour* 1899.

R. DEC. WARD.

HARVARD UNIVERSITY

A NEW MARINE BIOLOGICAL LABORATORY.

AMERICAN biologists will doubtless be gratified to learn that the United States Fish Commission will maintain a marine biological laboratory at Beaufort, N. C., during the coming summer, and will probably undertake to establish a permanent laboratory at that place. The station will be fully equipped for a limited number of investigators and be ready for occupancy by June 1st. There will be one building devoted to laboratory purposes and another affording sleeping accommodations.

Dr. H. V. Wilson, professor of biology in the University of North Carolina, has been asked to become the director of the laboratory. Dr. Wilson was associated with the Commission at its Woods Holl laboratory for several years

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.