rived at the present condition in every direction in which human industry has been exerted, — a graphic history of the development of the human culture and civilization."

These are Mr. Goode's own declarations of what seem to be the vital intentions of his scheme; and it is therefore a serious error, both practically and theoretically, when he places the natural history of man, including his psychology and individual manifestations, at the head of his scheme, in place of making this department the terminal one, to be viewed by visitors only after they had gone through with all the other departments.

The author has arranged the sections and sixty-four topics according to a system which is artificial, and irreconcilable with his intentions and his general objects, and shows this in the place assigned to mankind. Man is essentially the product of the forces which have acted upon this earth. Without going into the question of whether these forces were divine or material, which is of no value in such a technical discussion, it is certainly very illogical to place the conclusion before the beginning, the consequent before the antecedent, man before the earth. This may be very satisfactory to those who need, or think they need, to perpetually swing the censer before the old idol of man's supremacy in the universe; but it is none the less unnatural and illogical to have one mode of arrangement for the parts of a great collection, and another for the whole.

In a future number we shall consider some of the minor features of this elaborate scheme.

LIST OF TWENTY-THREE NEW DOUBLE STARS, DISCOVERED AT CAROLINE ISLAND, SOUTH PACIFIC OCEAN, BETWEEN APRIL 27 AND MAY 7, 1883, BY E. S. HOLDEN AND C. S. HASTINGS.

Star.	α, 1880.0.	δ, 1880.0.	p.	s.	Mags.	Observer.	Date.
	h. *m.* *s.*						
Stone, 5791	10 28 35	−54° 46′	250°	2″	8.5 – 9	Holden	May 1.
Anon.	11 31 28	−60 14	350	1½	8.5 – 9.5	Holden	April 28.
Lac., 4936	11 48 58	−55 25	230	2	7.5 – 8	Holden	May 1.
Anon.	11 57 40	−57 5	240	1½	8.5 – 9.5	Holden	May 4.
Lac., 5223	12 31 24	−55 16	205	1½	7.3 – 9.3	Holden	May 1.
Anon.	13 1 16	−52 5	200	1¼	9.5 – 9.5	Holden	May 4.
Lac., 5434	13 6 59	−62 57	40	1½	7.5 –10	Holden	May 6.
Lac., 5738	13 48 28	−53 33	330	2	6.5 – 8.5	Russell	A. B.
			290	25	6 5 –13	Holden	May 2, A. C.
Lac., 5817	13 59 56	−49 18	30	¾	7.5 – 7.5	Hastings	May 1.
Lac., 5844	14 6 14	−61 9	180	3½	7 – 9	Hastings	May 2.
Lac., 6066	14 41 16	−72 42	90	1½	6 – 8	Hastings	May 2.
Lac., 6136	14 50 35	−67 30	0	5	7 –10	Hastings	April 27.
Anon.	15 2 18	−40 31	70	4	7 – 8	Hastings	May 4.
Stone, 8250	15 3 33	−51 38	220	3	7.5 – 9	Holden	May 2.
Lac., 6259	15 6 36	−60 27	300	12	6.5 –13	Hastings	April 27.
Anon.	15 7 20	−68 8	0	1¾	7.5 – 9	Hastings	May 2.
Anon.	15 8 40	−53 50	170	3	8 –10	Hastings	May 1.
Stone, 8348	15 14 18	−47 29	225	1½	8.0 – 8.5	Hastings	May 1.
ϵ Lupi	15 14 32	−44 15	175	¾	3 – 6	Hastings	April 27.
Lac., 6488	15 36 11	−50 24	210	2	7 – 9	Holden	May 4.
Lac., 6540	15 44 44	−60 23	85	1	6 5 – 9	Hastings	May 2.
Stone, 9221	16 50 15	−56 25	125	2	7.5 –10	Holden	May 7.
Lac., 7315	17 23 16	−40 57	95	1	8.0 – 8.5	Holden	May 7.

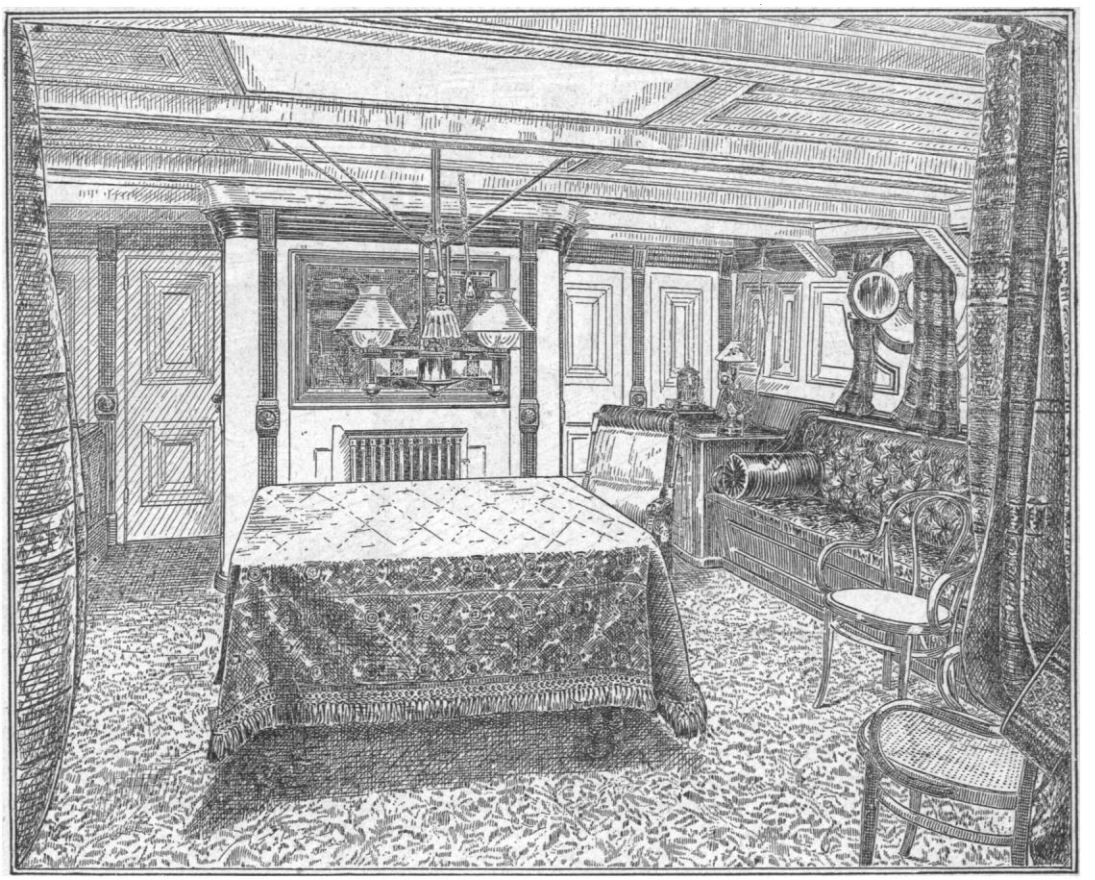
THE UNITED STATES FISH-COMMISSION STEAMER ALBATROSS.[1] — II.

THE fitting-up of a small floating scientific laboratory, which might remain at sea for a month or more at a time, and yet include every necessary convenience, was a somewhat novel problem, and required a considerable amount of planning, based mainly upon past experiences of the fish-commission. The general arrangements are now, for the most part, complete, but they are subject to alteration and improvement.

The main laboratory (see figures, pp. 68, 69) is twenty feet long, twenty-six feet wide, and nearly eight feet high. The forward-end of the room is devoted to storage, and the sides and

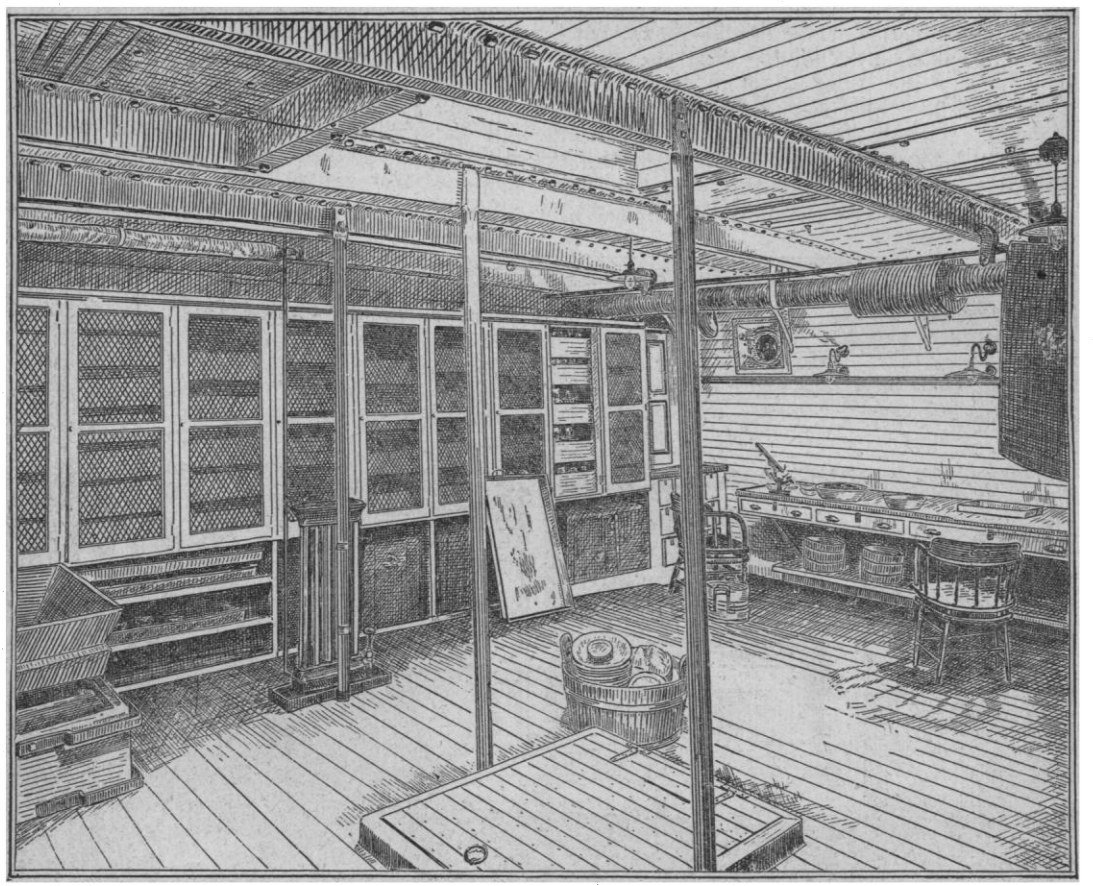
[1] Concluded from No. 22.

after-end to work-tables. The storage-case consists of a series of six double racks, with wire doors in front for holding the trays of bottles and jars, the trays being all of the same size, so as to fit any part of the case. Under the racks are six large bins for the tanks of alcohol in use, the large fish-pans, dishes, and other heavy laboratory utensils, and at either side is a small case for chemicals and preservatives. In one of the after-corners is a photographic dark room, and opposite to it the sink and water-supply. The remainder of the space on each side is occupied by a sorting-table, one being at the proper height to work while standing, the other while sitting. The after-bulkhead contains the arrangements for chemical and physical investigations, consisting of a broad table, with drawers and cupboards underneath, and racks above.



CAPTAIN'S CABIN.

The storeroom is of about the same size as the general laboratory, though of less height, and is entirely fitted up for the storage of jars, bottles, tanks, alcohol, zoölogical specimens, and the lighter kinds of collecting apparatus. A single series of bins on a level with the floor extends around the entire room, excepting in front of the stairway, and serves as compartments for the copper tanks of alcohol, which are contained in uniform-sized boxes. In these bins there is room for fifty tank-boxes, each with a capacity of sixteen gallons, making a total of eight hundred gallons of alcohol which it is possible to carry in this way. Against the fore and after bulkheads, above the bins, are two sets of racks for bottle-trays, similar to those in the general laboratory. They are intended for the storage of the main supply of bottles and jars; and, as rapidly as those in the laboratory become filled with specimens, they are carried below, and their places supplied



MAIN LABORATORY, FORWARD-END.

with empty ones, without the necessity of removing any from the trays. On the two sides of the storeroom are large, deep bins for nets and other light appliances, the dredges and trawls being stored elsewhere.

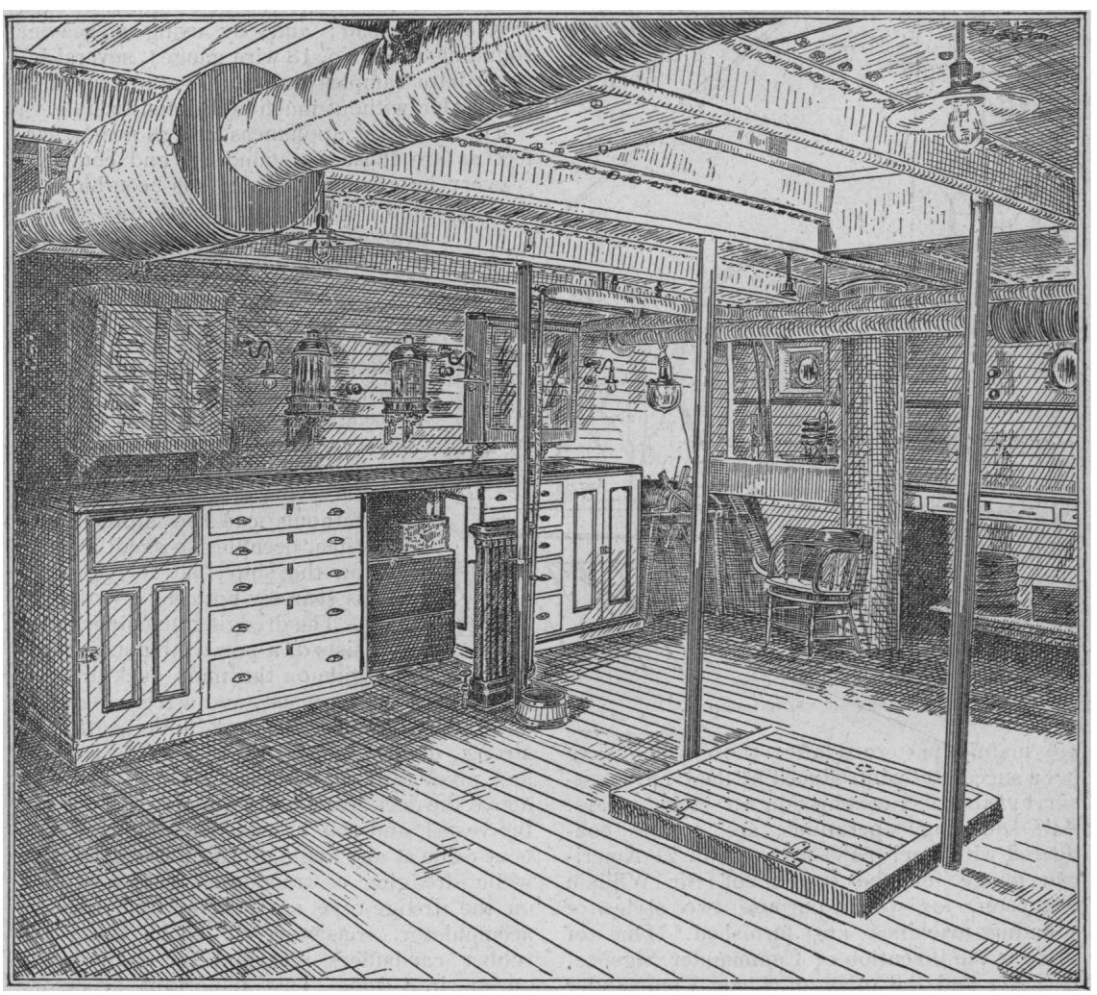
The deck-laboratory, which receives the greatest amount of light, is more especially arranged for study. The after-end is occupied by a bookcase, with a cupboard for the physical apparatus on one side; and the forward-end, by the medical case, and stairway to the lower laboratory. A large square table, with accommodations for four persons, stands in the centre of the room, under the skylight. Under one window is the sink, and beside it two upright cylindrical tanks for sea-water and alcohol which empty by means of faucets. The other window-spaces are supplied with folding tables, which, when not in use, can be shut down against the wall. Arrangements are yet to be made in this room for small working-aquaria, where the living forms and colors of delicate marine animals can be studied and pictured. They will probably be modelled after the new style of hatching-jars, recently introduced at Washington, for the propagation of shad and salmon.

The Albatross is furnished with two propeller-screws instead of the usual number, one, to enable her to execute more readily the various manoeuvres demanded by the peculiar character of her work. They are right and left handed, — one being placed under each counter, — and measure nine feet in diameter. By their means the steamer can be turned completely around almost within her own length, and placed in position for dredging and sounding without the delays incidental to most exploring steamers. The motive power is furnished by two compound engines, with

two cylinders each, — one of high, the other of low pressure, — the stroke of piston being thirty inches. The engines are slightly inclined, the upper ends of the cylinders being drawn inboard over the condenser, which is common to both engines, and forms their framing. The boilers are two in number, of the overhead return-flue pattern, and measure twenty-one feet and a half in length by eight feet and a half in diameter.

The proper ventilation of all parts of the ship was carefully considered during her construction, and the plan adopted has given the greatest satisfaction. It consists simply in withdrawing the foul air from the lower parts of each room through small ventilators, by means of a Sturtevant exhaust-fan with Wise's steam-motor attachment. The influx of air is from above, through open doors or ports; and a constant circulation is maintained, even in the lowest inhabited portions of the ship.

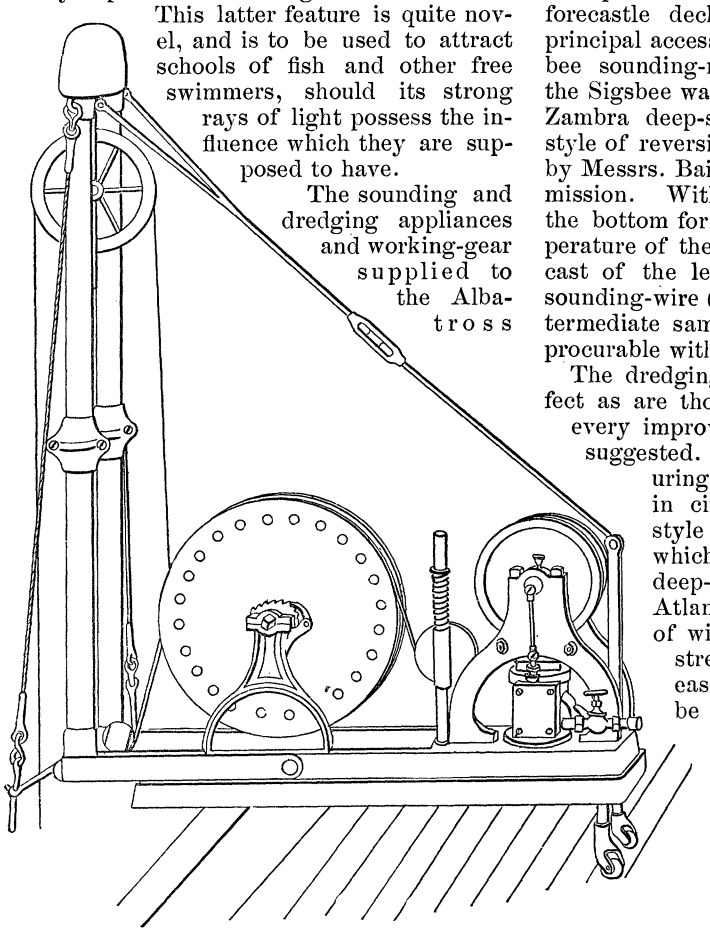
One of the most interesting features of the Albatross is the system of electric lighting, which has already been referred to. Some such method of replacing the dingy lamps common to most ocean vessels was rendered imperative from the fact that this steamer is supposed to continue her observations as regularly through the night as through the day, and the surrounding surface of the sea must also be lighted. To accomplish this, a hundred and twenty eight-candle B lamps of the Edison incandescent system are distributed through the ship; every portion, including the



MAIN LABORATORY, AFTER END.

holds, storerooms, and open decks, having its share. They are controlled by a Z dynamo, driven by an Armington and Sim's high-speed engine. An arc-lamp of great power, designed by Dr. O. A. Moses, and intended for illuminating the surface of the water, works in circuit with the same system; and there is also a powerful submarine lamp which can be lowered to any depth not exceeding a thousand feet. This latter feature is quite novel, and is to be used to attract schools of fish and other free swimmers, should its strong rays of light possess the influence which they are supposed to have.

The sounding and dredging appliances and working-gear supplied to the Albatross



THE SIGSBEE SOUNDING-MACHINE.

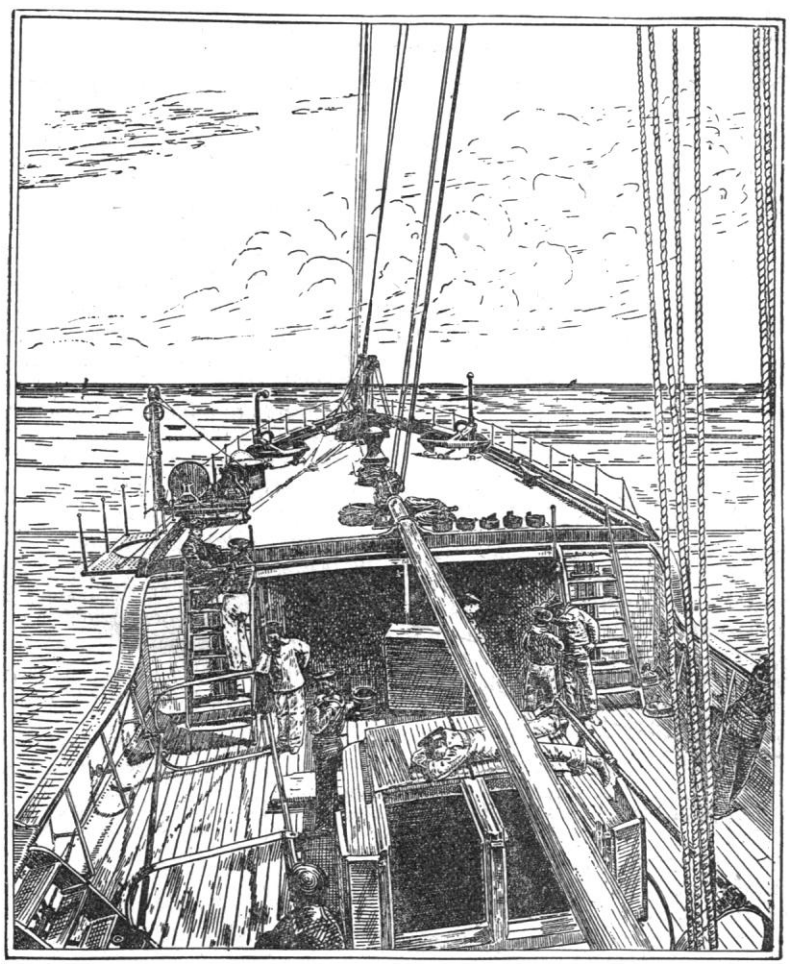
are mainly patterned after those which have been successfully introduced by the U. S. coast-survey and fish-commission in recent years. All sounding operations are to be conducted with steel piano-wire of No. 21 American gauge, on the system of Sir William Thomson, for which purpose two styles of sounding-machines are furnished. One of these is the invention of Commander Sigsbee, U.S.N., and the other of Lieut.-Commander Tanner, U.S.N. The Tanner machine, in which the reeling-in is accomplished by hand, is extremely simple in its workings, and is intended for moderate depths of water only. It is attached to the rail on the port side of the main deck, forward of the pilot-house. The Sigsbee machine can be used in all depths of water, down to the deepest parts of the ocean, and is worked by steam. It occupies a prominent position on the port side of the top-gallant forecastle deck (see opposite page). The principal accessories to sounding are the Sigsbee sounding-rod, with detachable weights; the Sigsbee water-cup; and the Negretti and Zambra deep-sea thermometer, with a new style of reversible metal case recently devised by Messrs. Bailie and Tanner of the fish-commission. With these appliances, samples of the bottom formation and water, and the temperature of the latter, can be obtained at each cast of the lead; and, by using a heavier sounding-wire (No. 18 wire gauge), several intermediate samples and temperatures are also procurable without much additional trouble.

The dredging appliances are as nearly perfect as are those for sounding, and comprise every improvement which has been hitherto suggested. Steel-wire dredge-rope measuring only an inch and an eighth in circumference replaces the old style of three-inch hempen rope, which is no longer recognized by deep-sea dredgers on this side of the Atlantic. The principal advantages of wire rope are its compactness, strength, and durability, and the ease and speed with which it can be handled. The working-reel of the Albatross, on which 4,000 fathoms can be stored at a time, occupies so small a space on the ship that its presence is scarcely noticeable.

The dredging machinery consists of a powerful hoisting-engine on the main deck directly in front of the foremast, and a reeling-engine and reel on the berth-deck underneath. A strong dredging-boom, thirty-six feet long, and pivoted to the foremast about seven feet above the deck, carries the dredge-rope clear of the vessel, and can be raised and lowered, or bent aside at any angle, to suit the convenience while dredging or trawling. Sudden strains on the dredge-rope are relieved by a Sigsbee accumulator, consisting of about thirty-five rubber car-buffers arranged for compression on an iron rod. This important accessory hangs suspended from the masthead above the

hoisting-machine. The course taken by the dredge-rope while in use is as follows: starting from the reel on which it is contained, it passes through a pulley on the berth-deck to the drum of the hoisting-engine, thence up to and through an iron block at the lower end of the accumulator, and down again through a sheave in the heel of the boom, from which it extends to the outer end of the boom, where there is another large pulley. The free end of the rope is spliced into the eye of a set of safety-hooks, to which the dredge or trawl is fastened, and which are so arranged as to open and release the apparatus, should the strain, by reason of fouling on the bottom, exceed a certain amount. These hooks can be adjusted to detach at any point between three thousand and six thousand pounds, which is less than the tensile strength of the rope they are intended to secure from breakage. The amount of rope out at all times is recorded by a register attached to the sheave in the heel of the boom, the sheave measuring just half a fathom in circumference.

In preparing for work, the dredging-boom is topped up at the requisite angle over the starboard bow, and the loaded dredge or trawl is hoisted above the deck, on which stands the sieve or tubs ready to receive its contents. Two methods of sifting or washing the materials are followed. For the trawls, which generally bring up a heavy load, a large and deep, square sieve, standing upon legs at a convenient height for working, is used. As the tail of the trawl is lifted above the deck,



FORWARD DECK.

the sieve is shoved under it, and the contents of the former are released. In case no washing is necessary, the specimens are rapidly transferred to their proper receptacles; but if, as usually happens, the load consists mainly of mud or sand, a stream of water from a hose is turned upon it, and it is thoroughly washed down. A nest of three or four small circular sieves, each having a different mesh, is generally employed for washing the contents of the dredges.

To describe the various appliances of research belonging to the outfit of the Albatross would carry us beyond the proper limits of this article: suffice it to say, that every method of obtaining results known to the fishermen and marine zoölogist will be tried. The scientific apparatus is mainly such as has already been thoroughly tested by American expeditions, and much of it has been described in published reports. There are many additional features, however, which have been lately added. The fisherman's outfit is complete, and comprises all kinds of seines and gill-nets, line-trawls, and hooks and line. The principal appliances for deep-sea research will be the dredges and beam-trawls, both in their original and modified forms; and, in connection with the latter, two large towing-nets will always be used. They are fastened, one at either side of the trawl, in the shape of wings, which name they now bear in the dredger's vocabulary. They were introduced as an experiment two years ago by the fish-commission; and, proving an invaluable adjunct to the trawl, they soon became a permanent fixture. The simple open towing-nets are to skim the surface of the sea at all times, when the speed of the vessel will permit; and occasional trials will be made with the Sigsbee trap for ascertaining the amount of animal life within any prescribed area below the surface.

The chemical department has not yet been completely furnished, but all the more important apparatus for making the principal tests, and glassware for saving water-samples, have been supplied. The photographic section has, however, been placed in perfect running-order, and affords the means of illustrating all sorts of objects, whether large or microscopic. It also contains improved appliances for registering the intensity of light at different depths.

Among the small boats with which the Albatross is liberally provided are two steam launches of the Herreschoff pattern for use in setting and hauling nets, and in spearing porpoises and large fish which cannot be reached from the high deck of the steamer.

From the above brief account, it may be rightly assumed that this new addition to our coast-marine is the most perfect floating workshop and laboratory for scientific purposes ever constructed. Its first cruise, during which it encountered severe winds, gave proof of its superior sailing qualities; and, judging of its outfit from past experiences, we are justified in predicting for it a long life of usefulness to science and the fishing interests. RICHARD RATHBUN.

SUN-SPOT OBSERVATIONS.

THE U. S. signal-service has published month by month since June, 1877, observations of sun-spots, made by Prof. D. P. Todd (now of Amherst college) with a telescope less than three inches aperture.

As a maximum of solar spottedness seems to have passed, it has been thought wise to collate these observations in the accompanying table, and present them for comparison and study.

In this table the Roman figures are the actual observed values, and interpolated values in Italic type are added for the sake of completeness.

The observations for August, 1878, were made by the Signal-service at Fort Whipple, Va. The mean monthly results combine both actual and interpolated values, and show that the last minimum epoch was at 1878.9, and the last maximum was at 1882.4.

Professor Fritz of Zurich gives the following table of maxima and minima of sun-spots for the present century to 1878. These agree in the main with the results of other researches.

Epochs of maximum and minimum sun-spots of the nineteenth century.

Maximum.	Period.	Minimum.	Period.
1804.2		1810.6	
	12.2		12.7
1816.4		1823.3	
	13.5		10.6
1829.9		1833.9	
	7.3		9.6
1837.2		1843.5	
	10.9		12.5
1848.1		1856.0	
	12.0		11.2
1860.1		1867.2	
	10.5		11.7
1870.6		1878.9	
	11.8		
1882.4			
Mean	11.2	Mean	11.4

Taking the mean of each twelve months, we have mean yearly numbers, in 1878, 2.2; 1879, 2.0; 1880, 14.3; 1881, 26.7; and, in 1882, 28.3. The last two agree with the observations of Tacchini in Rome.