

U. S. COMMISSION OF FISH AND FISHERIES,

JOHN J. BRICE, Commissioner.

REPORT

OF THE

REPRESENTATIVE OF THE U. S. FISH COMMISSION

AT THE

COTTON STATES AND INTERNATIONAL EXPOSITION
AT ATLANTA, GEORGIA, IN 1895.

BY

W. DEC. RAVENEL.

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Plates 11 to 21.

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UNITED STATES GOVERNMENT BUILDING, ATLANTA EXPOSITION.

1.—REPORT OF THE REPRESENTATIVE OF THE UNITED STATES FISH COMMISSION AT THE COTTON STATES AND INTERNATIONAL EXPOSITION AT ATLANTA, GEORGIA, IN 1895.

BY W. DE C. RAVENEL.

Under the act of Congress approved August 18, 1894, providing for the participation of the Executive Departments, the Smithsonian Institution, the National Museum, and the Fish Commission in the Cotton States and International Exposition at Atlanta, Ga., for the purpose of illustrating the functions of the several Departments and Bureaus, the Commissioner designated Dr. Tarleton H. Bean, assistant in charge of the division of fish-culture, as the representative of the Commission on the board of management. Upon the resignation of Dr. Bean, May 23, 1895, to accept the position of superintendent of the aquarium at Castle Garden, New York, W. de C. Ravenel was designated as his successor.

PLAN AND SCOPE OF THE EXHIBIT.

The plan of the exhibit, as laid out by the representative and approved by the Commissioner, was as follows:

(1) The scientific investigation of the Commission to be illustrated by models of the vessels employed, with full-sized forms of the apparatus used; by charts illustrating the results obtained and publications covering the different investigations; by casts of fish colored from life; collections of sponges, corals, oysters, and other shellfish, crabs, lobsters, sea lilies, sea-pens, and various other material obtained by dredging and trawling apparatus.

(2) The fish-cultural operations to be shown by models and photographs of hatching stations; models and full-size specimens of apparatus used in the collection, transportation, and hatching of eggs; apparatus used in the transportation of fish; charts showing a summary of work done since the organization of the Commission; results obtained with reference to special fisheries and results at the different stations of the Commission during the fiscal year 1894-95; also by the practical hatching of eggs of the salmon, whitefish, and trouts.

(3) Methods and statistics of the fisheries, to be illustrated by models of vessels and boats used in the fisheries of the United States, with special reference to the South Atlantic and Gulf regions; models and full-size specimens of seines, gill nets, pound nets, lines, trawls, spears, and accessories; charts showing the extent and value of the fishing

industry, besides illustrations of the various fisheries by means of photographs, oil paintings, etchings, etc.

(4) An aquarium for showing the economic food and game fishes of the South Atlantic and Gulf States and the fishes reared by the United States Fish Commission at its various stations, including some of the ornamental fishes and other marine life of the Gulf of Mexico.

PREPARATIONS FOR THE EXHIBIT.

As soon as practicable after the formal organization of the board and allotment of funds and space had been made, steps were taken to prepare the plans for the aquarium, which was the most difficult and expensive part of the exhibit. Mr. H. Von Bayer, the architect of the Commission, was detailed to assist the representative, but owing to pressure of other duties he was unable to give his time to the work and it became necessary to employ L. F. Græther as architect. He, with the assistance of Mr. Von Bayer, prepared the plans, which were approved May 1, 1895.

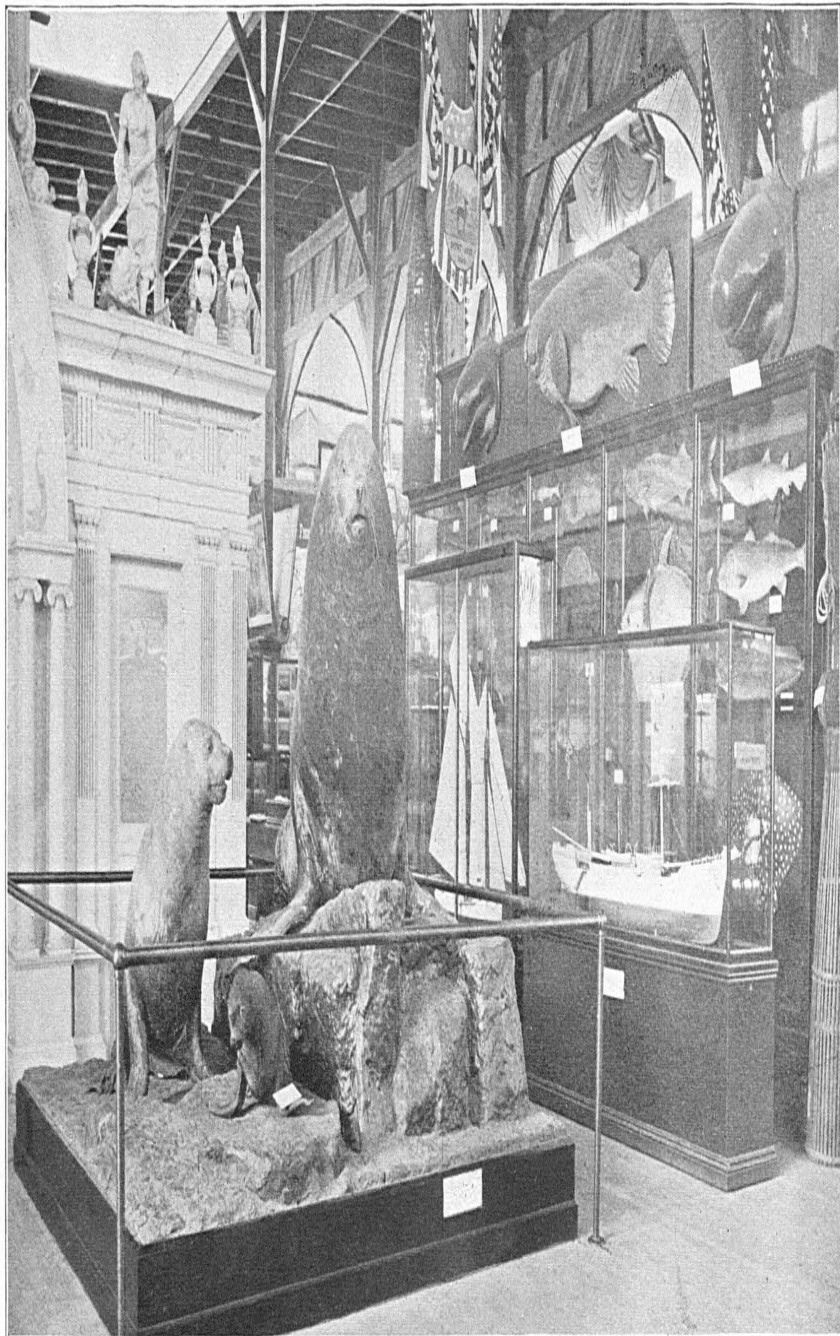
In April the work of collecting, preparing, and packing the material for the exhibit was begun, and a building was rented as a temporary workshop and storehouse. Mr. W. P. Sauerhoff, fish-culturist, was detailed to take charge of the preparation of fish-cultural material and the packing of the exhibit, and by the end of July most of it had been prepared and shipped to Atlanta.

The material for illustrating the scientific investigations of the Commission was designated by Mr. Richard Rathbun, assistant in charge of the division of scientific inquiry, and prepared for exhibit by Mr. James E. Benedict.

Dr. Hugh M. Smith, assistant in charge of the division of statistics and methods of the fisheries, assisted by Mr. W. H. Abbott, designated and prepared the material illustrating the methods and statistics of the fisheries.

INSTALLATION.

Messrs. W. P. Sauerhoff and John L. Leary left Washington for Atlanta on August 11 for the purpose of unpacking the material and placing the cases in position. On September 1 the representative arrived and commenced the installation, with the assistance of W. H. Abbott, to whose ingenuity and skill in exposition work much of the success attained is due. The total space allotted to the Commission was 8,000 square feet in the southwest corner of the Government building. Two-thirds of this was occupied by the aquarium and the balance by fish-cultural apparatus and material illustrating scientific investigation and methods of the fisheries, as shown by accompanying floor plan. It was not deemed necessary to prepare a complete descriptive catalogue of the material exhibited, as it is described in the various publications of the Commission, but the plan and scope of the several sections are shown by the following synopsis:



SEA LIONS, LOOKING FROM SOUTH AISLE.

SYNOPSIS OF THE FISH COMMISSION EXHIBIT.

SCIENTIFIC INQUIRY SECTION.

1. *Laboratories for marine exploration:*
Illustrations of zoological stations: Laboratory at Woods Hole, Mass. (two views).
2. *Exploring vessels:*
Models: Steamer Albatross. Steamer Fish Hawk. Schooner Grampus.
Illustrations: Steamer Albatross. Steamer Fish Hawk. Schooner Grampus.
3. *Collecting apparatus:*
Nets: Seines. Beam trawls. Towing nets.
Dredges: Naturalists' deep-sea dredge. Naturalists' boat dredge. Chester rake dredge. Oyster dredge.
Tangles.
4. *Accessories for dredging and trawling:*
Dredge rope: Steel-wire dredge rope. Splices in dredge rope.
Weights for beam trawl.
5. *Apparatus for assorting collections:*
Sieves: Table sieves. Hand sieves.
6. *Apparatus for preserving collections:*
Tanks, jars, etc.
7. *Apparatus for deep-sea sounding:*
Sounding machine: Tanner sounding machine. Tanner intermediate towing net.
8. *Apparatus for physical observations:*
Thermometers: Deck thermometer. Professor Baird's protected thermometer. Miller-Casella deep-sea thermometer. Negretti & Zambra thermometer.
Thermometer cases and accessories: Wooden cases. Brass cases.
Salinometers: Hilgard salinometer.
9. *Results of explorations:*
Charts.
Collections.
 - (1) Marine animals in alcohol:
 - (a) Deep-sea animals: Crinoids, corals, crabs, sea-pens, starfish, sea-urchin, etc.
 - (b) Surface animals: Entomostraca, etc., forming food of fish.
 - (c) Shallow-water animals: Mollusks, crustaceans, etc.
 - (2) Marine animals, dry: Foraminifera. Sponges. Corals. Mollusks, etc.

DIVISION OF FISH-CULTURE.

10. *Transportation apparatus:*
Apparatus for collecting and carrying eggs: Models and specimens: Wroten bucket, improved. Collins's can. McDonald crate. Atkins's egg box. Clark's egg case. Clark's whitefish crate. Clark's foreign egg case. Mather transportation can. Trout boxes used in 1872.
11. *Apparatus for transporting fry:*
Models and full-sized apparatus:
 - (a) Models: Car No. 1.
 - (b) Specimens: Stone's transportation can. Automatic transportation can. McDonald trout can. Carp transportation pail. Carp transportation kettle. Wood-bound can, full size. Messenger's complete outfit. Bucksport transportation can. Ferguson's transportation can. Fish Commission transportation can. Stranahan's transportation keg. Box for native food-fishes.
 - (c) Accessories: Siphon strainer. Siphon tube, bag, and cage. Dip nets of various sizes. Water bucket.

12. *Hatching apparatus:*

Models and specimens:

- (a) For floating eggs: Chester cod box. McDonald cod box. McDonald hatching bucket. Ferguson's submerged bucket.
- (b) For semibuoyant eggs: Wroten's bucket. Green's shad box. Brackett's shad box. Ferguson's submerged bucket. Bell-Mather shad cone. Models of cones and buckets. Chase's whitefish jar. McDonald jar, old style. McDonald universal hatching jar. Clark's jar.
- (c) For heavy eggs: Garlick's hatching box. Stone's charred trough. Cost's hatching grills. Stone's salmon basket. Bucksport hatching trough. Holton's hatching box. Clark's hatching trough. Mather's hatching trays. Atkins's hatching crate.
- (d) Working models:
 - Whitefish table, 8 feet long, 3 feet wide, and 3 feet high, fitted with 12 McDonald hatching jars for hatching whitefish eggs.
 - Two hatching troughs, 8 feet long, 12 inches wide, and 8 inches deep, equipped for hatching quinnat-salmon and lake-trout eggs.
- (e) Accessories: Spawning pans. Spawning buckets. Page's egg scale. Egg funnels for whitefish and shad. Series of nets from Central Station, Washington, D. C. Series of nets from Northville Station, Michigan. Series of nets from Battery Station, Maryland. Nippers, brass and wood. Dippers. Strainer dippers. Humo's spawning box. Pan for washing eggs. Salmon dip net. Tray for washing eggs. Siphon bags. Siphon cages. Siphon tubes. Aquaria.

13. *Hatching and rearing establishments:*

Models of hatching establishments—

- (a) Hatching houses at Put-in Bay, Leadville, and Havre de Grace.
- (b) Floating hatchery. Hatching barge.

Illustrations of hatching stations, showing buildings, exterior and interior, methods employed in collecting, hatching, rearing, and distributing fish, fry, and eggs.

- (a) Green Lake. Grand Lake Stream. Bucksport and Craig Brook, Maine. Gloucester cod station and Woods Hole, Mass. Central Station and Fish Commission fish ponds, Washington, D. C. Battery Station, Havre de Grace, Md. Bryan Point shad station, Md. Wytheville Station, Va. Duluth Station, Minn. Alpena and Northville stations, Mich. Put-in Bay Station, Ohio. Quincy Station, Ill. Neosho Station, Mo. Leadville Station, Colo. Fort Gaston, McCloud, and Baird stations, Cal. Clackamas Station, Oreg.
- (b) Floating stations: Hatching barge. Steamer *Fish Hawk*.

14. *Methods and results of fish-culture:*

Models—

- (a) Lay figure illustrating method of taking salmon eggs.

Charts—

- (a) Giving names and locations of stations and output of each for the fiscal year 1894-95.
- (b) Showing work of the Commission from 1872 to 1892.
- (c) Showing effect of fish-culture on the shad fishery.

Painted casts of fishes reared by the Fish Commission—

- (a) Brook trout one, two, three, and four years old; Von Behr trout one, two, three, and five years old; Loch Leven trout one, two, three, and six years old; lake trout one and two years old; landlocked salmon one year old; rainbow trout one and four years old; whitefish five years old; carp, tench, goldfish, black bass, etc.



ENTRANCE TO GROTTA FROM WEST AISLE.

FISHERIES SECTION.

15. *Objects of the Fisheries:*

Mammals—

(1) Sirenians. Manatee (cast).

(2) Cetaceans.

(a) Dolphins: Blackfish (cast), head. Grampus (cast), head. Harbor porpoise (casts), young.

(b) Sperm whales: Sperm whale (models).

(3) Carnivores:

(a) Earless seals: Harbor seal (mounted group).

(b) Eared seals: Northern fur-seal (mounted group). Steller's sea-lion (mounted group).

Batrachians—

Frogs: Bullfrog (cast). Green frog (cast). Pickerel frog (cast).

Fish—

Casts of 150 species of marine and fresh-water food-fishes.

Drawings of and notes on the important fishes of the Southern States.

Living marine and fresh-water fish in aquarium.

Invertebrates—

Living sea-anemones, starfish, crabs, lobsters, mollusks, algae, etc., in aquarium.

16. *Fishery apparatus:*

Vessels—

(1) Series of models showing the development of fishing vessels from settlement of America to the present time.

(2) Models of vessels used in the important fisheries of the South Atlantic and Gulf States.

(3) Pictures of vessels.

Boats: Models of types used in important commercial fisheries.

Canoes: Skin kyak from Alaska used in capture of seals, sea-lions, etc.

Nets: Pounds. Weirs. Pots. Seines. Castnets. Dip nets. Trawls. Dredges.

Lines: Trawl lines. Hand lines.

Accessories: Disgorgers, hook extractors, etc.

Appliances for seizing: Rakes for oysters and clams. Tongs. Hooks for sponge. Mackerel and squid jigs.

Accessories: Water glass used in sponge fishery.

Appliances for striking: Spears.

17. *Illustrations of fisheries.*

Fishermen. Fishermen's dwellings. Fishing towns.

Special fisheries: Mammals. Reptiles. Fishes. Mollusks. Crustaceans. Sponges.

18. *Statistics of fisheries of the United States.*

CONSTRUCTION OF AQUARIUM.

Proposals for the construction of the aquarium were solicited by advertising in newspapers published in Washington, New York, Atlanta, and Savannah, but when the bids were opened on May 15 they were found to be too high and were all rejected. This was due chiefly to the fact that the class of work required was unusual and not understood by the firms making the bids. As the time was getting short and there was no reasonable hope of getting satisfactory bids by further advertisement, contracts were made with the following parties for the construction of certain portions of the aquarium: Peters & Pahl,

of Washington, D. C., for the construction of the wood, mason, and iron work; Koppe Bros. & Steinichen, of Atlanta, for the stuccowork and figures; O. Pause, of Atlanta, for the painting and decoration of grotto. All of the work was to be done under the direction of L. F. Graether and in accordance with accompanying plans and specifications. The contracts provided for the completion of the work by August 10, 1895, but owing to delay in completing the Government building and the difficulty experienced by the contractors in obtaining proper material in the vicinity of Atlanta, they were unable to finish it in the time specified, and it was necessary to extend their contracts. Mr. Graether continued to supervise the work until August 23, when he resigned and was succeeded by Mr. Von Bayer, who remained in charge until its completion.

The machinery and piping for circulating the salt water and air and for filtering the fresh water were put in under the direction of I. S. K. Reeves, passed assistant engineer, U. S. N., who arrived in Atlanta August 4, 1895, and remained until that portion of the plant was completed. Mr. L. G. Harron, superintendent of the aquarium at Central Station, having been detailed by the Commissioner to assist in connection with the exhibit, was ordered to Atlanta on August 6 to assume the superintendency of the aquarium and to arrange for the interior decoration of the tanks and the preliminary installation of salt water, plants, etc. Notwithstanding the numerous delays and difficulties encountered in the construction of the aquarium, it was complete and thoroughly stocked with salt and fresh water fishes and other animals by September 18, when the Exposition was opened.

The space occupied by the aquarium was L shaped, 28 feet wide and 150 feet long. Arched grottoes were constructed the whole length, and a rotunda with a dome connected the two arms of the L. Twenty-eight aquaria were placed in this grotto, 14 for salt-water fish and 14 for fresh-water fish, the sizes being as follows: Two 14 feet long, 3 feet high, and 5 feet across the top; fourteen 7 feet by 30 feet by 5 feet, and twelve 5 feet by 3 feet by 5 feet. The main wall of the Exposition building formed one side of the grotto construction, and the exterior of the other consisted of a handsomely paneled wood partition, separating the grotto from the general Exposition hall.

All light entering the grottoes had to pass through the aquaria tanks, except what little entered through the open end doorways. The main passage in the grotto was 12 feet wide, and between the rear of the aquaria and the exterior of the grotto was a passageway for the use of the attendants to the aquaria. The faces of the tanks were of polished French-plate glass 3 by 7 feet and 1 inch thick, and they were decorated on the inside with white sand, rocks, and aquatic plants.

The exterior partition facing the general Exposition hall was arranged so that it could be used as a picture gallery. Its architecture was of the early renaissance style, constructed as a pilaster treatment,



ENTRANCE TO GROTTTO FROM SOUTH AISLE.

finished at the top throughout its entire length with a delicately conceived entablature bearing a series of urns. The frieze of this entablature was divided by triglyphs into ornamental panels, in which were inserted bas-reliefs representing aquatic life. Two semicircular archways, one on the south, the other on the west, gave admittance to the grotto. These entrances were flanked on each side by Ionic colonnades and surrounded by paneled and ornamented arches and soffits. The keys to the arches formed a group representing a youthful Poseidon taming an aquatic monster, and the whole was finished at each end above the entablature by statuary representing a fisherman gathering fish and a fisher-maid planting fry in the waters of the country. An ornamental net gracefully suspended between the urns above the entablature spanned the entire front and sides of the grotto, giving final finish to the outside of the structure. The whole of the outside was finished in ivory white and gold.

On entering the doorways a series of grottoes could be seen, forming a passage to the rotunda. The ceilings of these grottoes were formed by groined fan or funnel arches, supported by romanesque columns, pedestals, and brackets. The space between each pair of columns formed a bay for one tank. The bases and sides of these bays were treated in rusticated stonework. The ribs and spandrels of the ceiling were tinted, those of the arched ceiling being blended from a sky blue above to a sea green below. The spandrels formed on the walls were embellished by paintings of aquatic animal and plant life.

The columns, caps, and bases were made of imitation Numidian marble, and the rustic work in imitation of natural stone. The caps to the columns were carved differently, and represented fish, lobster, and other aquatic animals. Over each tank was a semicircular sash containing ornamental cathedral glass of various shades, which permitted only subdued light to enter the grottoes.

The passageway through the grotto led to a large circular rotunda surmounted by a semicircular dome, the soffit of which was embellished throughout with cassettes graduated from the springer line to the eye of the dome. The motive chosen for the ornamented parts of the cassettes was the water lily. A few of the panels were glazed for the purpose of securing a more brilliant light effect on the interior of the dome and the waters of the cascade, and the sides of the rotunda were wainscoted with a richly ornamented pilaster treatment.

The dome contained a large, horseshoe-shaped basin, surmounted in the rear by an imposing arch with relief shell work, from the center of which a cascade issued. The sides of this basin represented regular rustic stonework, and the coping of the basin walls consisted of a bronze cast-iron capping ornamented in water lilies. The cascade was enriched by an arrangement of natural rock and plants, and by artistic representations of manatees, otter, sea gulls, etc., executed in natural size.

One of the important problems in the construction of an aquarium is to arrange so that it will not become overcrowded. Profiting by our experience at Chicago, a passageway 12 feet wide was provided, but people coming in from both ends soon packed it, and it was almost impossible to move either way. This was largely due to the fact that there were fish on both sides of the grotto, and visitors going down one side returned on the other instead of going out. This might have been avoided by placing a partition down the center of the aisle, but it would have marred the architectural effect of the grotto, which was much admired.

FRESH-WATER SUPPLY.

The water for the fresh-water side of the aquarium was supplied from one of the three mains laid to the Government building and connected with the city water supply, which is taken from the Chattahoochee River. Before entering the aquarium this water was passed through a pressure filter of the Jewell pattern, having a capacity of 20,000 gallons per hour, but as it had already been filtered at the city waterworks by the alum coagulated process, it was unnecessary to use the alum provided by the Jewell filter. After passing through the filter the water was conducted to the aquaria through 1½-inch galvanized-iron pipes fitted with ¼-inch brass jet cocks and arranged horizontally above them. The waste water was carried off by means of an overflow pipe placed in the end of the aquaria near the top, and discharged into a trough emptying into a manhole connected with one of the sewers.

SALT-WATER SUPPLY.

The salt water for the aquarium was obtained at Morehead City, N. C., and transported in three tank cars loaned by the Standard Oil Company. It reached Atlanta August 23, and was unloaded as soon as possible and placed in a large tank constructed for it under the aquarium. Its density when shipped was 1.021, temperature 80°; five or six days later its density remained the same, but the temperature had fallen to 78°, and the water was in excellent condition.

SALT-WATER CIRCULATION.

The two pumps used for circulating the water were of the Erwin-Welch pattern, having a power cylinder 4 inches in diameter; pump cylinder, 5 inches; stroke, 6½ inches; suction inlet to pump, 2 inches in diameter; discharge, 1½ inches. The power ends were of brass and the pumping ends of block tin hardened. They were built to operate under a minimum water pressure of 50 pounds, and were so designed as to lift the water through their suction a distance of 10 feet and deliver it to a tank 30 feet above, each pump delivering 900 gallons per hour. The pumps could be operated together or singly, but better results were obtained by operating them together. The water for running them was taken from the main located under the Government building, the average pressure being about 80 pounds per square inch, though it

was often as low as 60 pounds and sometimes went as high as 125 pounds.

The salt water was forced from the large reservoir below the floor, by means of the pumps, into the distributing tank located in the south-west tower of the main building 25 feet above the aquaria, from which point it was distributed by gravity through asphalt-lined iron piping fitted with $\frac{1}{4}$ -inch hard-rubber jet cocks. The water was fed into the aquaria through $\frac{1}{8}$ -inch glass nozzles attached to rubber hose leading from the rubber cocks, which delivered it at the surface and forced air in with it. In addition to the surface supplies, each aquarium was arranged so that water could be introduced at the bottom with $\frac{1}{2}$ -inch hose.

The overflow was the same as on the fresh-water side, except that it emptied into a filter box connected with the reservoir tank, and was thus filtered over and over again.

The filter was a pine box 7 feet 6 inches long, 3 feet 10 inches wide, and 16 inches deep, filled with gravel of different sizes, varying from 2 inches to $\frac{1}{4}$ inch in diameter, laid in courses, and covered with 2 inches of clean sand. The capacity of this filter was 1,400 gallons per hour.

HEATER.

In November, finding that the temperature of the water was getting too low for the salt-water fishes from the Gulf, a heater was made for regulating it. This was 8 feet long and made of 2-inch galvanized-iron pipe, arranged like the ordinary return-bend steam heater. Under each section of the pipe 16 gas jets were placed, and the entire apparatus was encased in a steel box. The heater was placed in the tower and so connected that all of the salt water could be passed through it before entering the supply tank. By this means there was no difficulty in keeping the water at an even temperature of from 60° to 63° when the air temperature was below the freezing point.

AIR CIRCULATION.

In order to provide the necessary amount of air to the aquarium a vertical hydraulic air-pump or compressor, of the Bishop & Babcock pattern, was erected between two of the aquaria on the salt-water side. The water-power cylinder of this pump is 4 $\frac{1}{2}$ inches in diameter, the air cylinder (situated above the water cylinder) 6 inches, and the stroke 8 inches. The pumps deliver the air into the galvanized-iron cylinder, where a pressure of about 7 pounds per square inch is maintained, and from there it is fed through a $\frac{3}{8}$ -inch pipe along the backs of the aquaria. At the back of each one the pipe is connected with rubber tubing, which passes down the back to the bottom of the tank. At the end of the tubing is a hard-rubber cylinder into which wooden liberators are introduced for forcing the air into the water in minute globules. The air and water circulating plants were so arranged as to be entirely independent of each other, so that in case of the water supply being cut off it was possible to maintain the air circulation.

EMPLOYEES.

In addition to the superintendent, there were employed in connection with the aquarium a machinist to look after the pumps, filters, etc., 2 night watchmen, and 2 laborers to clean the aquaria, wash sand in filter, prepare food for the fishes, etc.

CARE OF THE AQUARIUM.

The aquaria tanks were thoroughly cleaned once a week, Sunday being selected, as no visitors were allowed in the building on that day. In the fresh-water tanks a perforated galvanized iron funnel attached to a rubber siphon was used to draw the waste food and sediment from the bottoms, and about a gallon of Turks Island salt was distributed in each aquarium once a week as a disinfectant, 60 bushels being used for this purpose during the Exposition. In the salt-water aquaria the sediment and other deleterious matter was caught and held in suspension by the sand filter.

The losses of fresh and salt water fishes were very small after the opening day, when a very heavy loss occurred, owing to the high temperature of the water and the insufficient supply, caused by opening up all of the fountains on the grounds.

The heaviest losses of salt-water fishes usually occurred just after their arrival, and were caused, apparently, by bruises received in transportation, though many specimens that were received in a badly bruised condition recovered entirely and were alive when the aquarium was closed on December 31. A sudden fall of temperature from 65° to 52° in the latter part of October caused the loss of all the pompano and a number of red snappers, spade-fishes and cow-fishes. This defect in the aquarium was cured by the fitting up of the heater.

COLLECTION OF FISHES FOR THE AQUARIUM.

Marine fishes.—The primary object being to show the commercial fishes of the South, the collecting points chosen were Morehead City, N. C., and Pensacola, Fla., as they are important commercial fishing centers and accessible by rail. Mr. F. P. Hagan, who had had a valuable experience in the collection and transportation of fishes for the World's Columbian Exposition, Chicago, Ill., made the collections at Morehead City and transported successfully all the specimens secured at that point and at Pensacola. Lieut. Franklin Swift, U. S. N., in command of the United States Fish Commission steamer *Fish Hawk*, furnished two excellent loads from Pensacola. Arrangements were also made for securing supplies of anemone, lobsters, starfish, and other marine life from Woods Hole and Gloucester, through the superintendents of the stations at those points. These were shipped by express, carefully packed in seaweed or moss, and arrived in fairly good condition, considering the temperature existing at the time of shipment and the length of time they were en route—from four to six days.

Fresh-water fishes.—The majority of the fresh-water fishes were furnished from the U. S. Fish Commission stations at Quincy, Ill., and



VIEW FROM WEST AISLE.

Wytheville, Va., and from the fish ponds at Washington, D. C. Collections were also made from the Neuse River at Newbern, N. C., and from the Chattahoochee River in the vicinity of Atlanta. Hon. John D. Edmundson, superintendent of the fisheries of Georgia, also furnished specimens from a lake near Luluton, Ga. Fungus developed on those obtained from the Neuse and Chattahoochee Rivers very shortly after their arrival, and most of them died in a few days.

Following is a list of fishes and other aquatic animals collected and exhibited during the Exposition.

Species.	Number.	Species.	Number.
Fresh-water fish:		Salt-water fish—continued.	
Black bass.....	156	Striped mullet.....	34
Crappie.....	70	Kingfish.....	9
Warmouth bass.....	60	Cavally.....	43
Rock bass.....	70	Pompano.....	36
Sunfish.....	67	Lizard-fish.....	11
Yellow perch.....	61	Tautog.....	3
White perch.....	22	Remora.....	1
White bass.....	10	Spadefish.....	29
Pike.....	35	Flounder.....	27
Brook trout.....	50	Hog-choker.....	4
Rainbow trout.....	28	Tongue solo.....	3
Black-spotted trout.....	18	Mummichog.....	180
Landlocked salmon.....	106	Sea-robin.....	8
Grayling.....	5	Sea-raven.....	13
Suckers.....	83	Toadfish.....	23
Carp.....	75	Swolfish.....	10
Golden ide.....	17	Burfish.....	44
Goldfish.....	328	Fllofish.....	14
Common tench.....	140	Trigger-fish.....	18
Golden tench.....	18	Cowfish.....	23
Dogfish.....	21	Batfish.....	1
Catfish.....	67	Salt-water catfish.....	13
Gar pike.....	60	Stingray.....	7
Total.....	1,573	Skato.....	1
Salt-water fish:		Total.....	
Red drum.....	15	1,085	
Black drum.....	1	Reptiles, crustaceans, etc.:	
Croaker.....	75	Alligator.....	1
Spot.....	50	Green turtle.....	1
Spotted sea-trout.....	11	Soft-shell turtle.....	2
Sheepshead.....	45	Snapping turtle.....	1
Pinfish.....	68	Terrapin.....	7
Seup.....	1	Lobster.....	18
Pigfish.....	68	King-crab.....	9
Red snapper.....	37	Hermit-crab.....	90
Pensacola snapper.....	1	Blue crab.....	42
Mangrove snapper.....	2	Spider-crab.....	3
Sea bass.....	102	Conch.....	25
Red grouper.....	34	Starfish.....	20
Black grouper.....	17	Sea-anemone.....	102
Squirrel-fish.....	3	Total.....	321
		Grand total.....	2,070

From time to time supplies of fish were brought in from the stations of the Commission and the field-collecting stations, so that there was no perceptible change, except that as the water became cooler the supply and varieties of trouts were largely increased.

The average temperatures of salt and fresh water for September, October, November, and December are given in the following table:

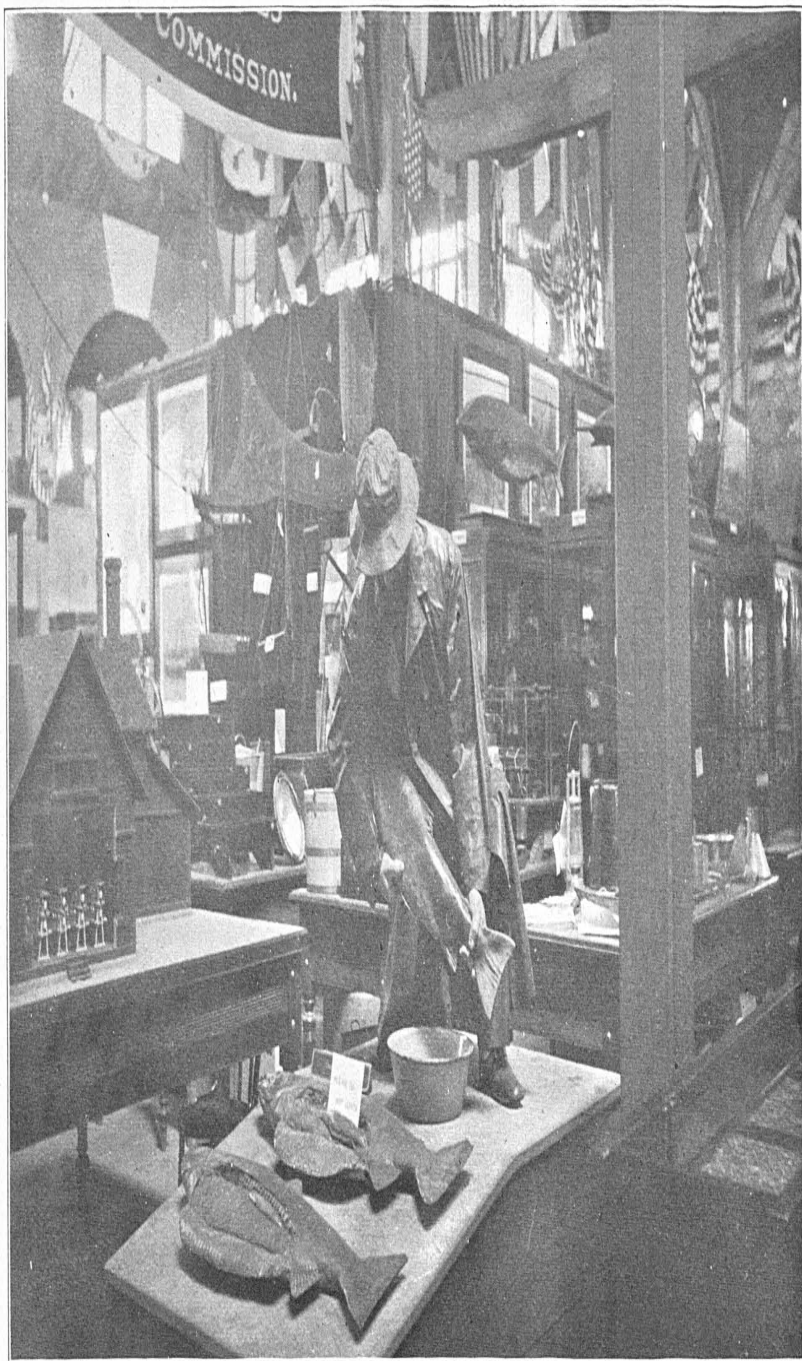
Month.	Salt.			Fresh.		
	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.
September	75	65	70	81	77	79
October	63	53	58	76	63	60.5
November	63	53	58	62	50	50
December	63	58	60.5	56	48	52

FOOD.

The food used was round beefsteak, beef livers, clams, and fiddler-crabs. The beef and liver were cut into small pieces and care was taken to remove all of the fat and sinews. All of the marine species except the trigger-fishes and file-fishes took the beef readily, especially if it was slightly salted. The trigger-fishes and file-fishes were fed entirely on clams. The fiddler-crabs intended for food were shipped by express from Pensacola by Lieutenant Swift from time to time as they were needed, and no difficulty was experienced in keeping them for an indefinite period in a box of slightly moistened sand. The fish were fed regularly once a day, except Sunday, and seemed to thrive after they became accustomed to confinement.

PRACTICAL FISH-CULTURE.

To illustrate practically the methods employed at the various stations of the Commission, two hatching troughs were fitted up, one with gravel for the hatching and rearing of trout, one with trays for salmon, and a table with 8 McDonald jars for whitefish and other similar eggs. It was hoped that it would be possible to do practical work throughout the Exposition, but owing to the high temperature of the water all the eggs shipped to Atlanta previous to December 4 died after being in the troughs and jars from 2 to 6 days. A consignment of 10,000 lake-trout eggs received on that date from Alpena, Mich., hatched on the 15th, with a loss of only 300, thus showing that the previous losses had been due to the temperature of the water and not to the use of alum in its filtration. The water temperature was 54° on the day they were received, but it fell to 45° by the time they had finished hatching. The fry resulting from the eggs were held until the sac was absorbed and then planted in a pond near Atlanta, belonging to Mr. T. J. Barnard. A shipment of 10,000 quinnat salmon eggs received from Baird, Cal., on the 10th



SPAWN-TAKER STRIPPING SALMON.

attracted a great deal of attention during the closing days of the Exposition, and added greatly to this feature of the exhibit. The fry hatched from them were planted in Clara Meer, a lake in the Exposition grounds, about 30 acres in area.

The following statement shows the numbers and kinds of eggs received and the results obtained from them:

Date.	Source of supply.	Species.	Number of eggs received.	Water temperature when received.	Number of eggs and fry lost.	Number of eggs hatched.	Remarks.
Sept. 22	Baird	Salmon	10,000	Deg. 81			Sept. 23; all dead.
Oct. 7	do	do	5,000	73			Nov. 8; all dead.
Oct. 21	Alpena	Lake trout.	10,000	66			Nov. 10; all dead.
Nov. 1	do	do	10,000	62			Nov. 15; all dead.
Nov. 15	do	Whitefish.	800,000	60			Nov. 10; all dead.
Dec. 4	do	Lake trout.	10,000	54	1,000	*9,700	Dec. 15; hatched.
Dec. 10	Baird	Salmon	10,000	51	429	†9,771	Jan. 1; hatched.

* Nine thousand fry delivered to Mr. Barnard. † Fry planted in lake at Piedmont Park.

CLOSING OF THE EXPOSITION.

At the close of the Exposition the fresh-water fishes were planted in public and private waters in the vicinity of Atlanta; the majority of the salt-water fishes were transferred to Washington and exhibited in the aquarium at Central Station. No attempt was made to remove the grotto, as it would have been seriously damaged in taking apart and transporting; besides this, the Commission had no facilities for storing it in Washington. The aquaria, pumps, piping, supply, and reservoir tanks, were taken down and shipped to Washington, and afterwards turned over by the Acting Commissioner to the Commissioners of the Zoological Park. As soon as arrangements were completed for the disposition of the aquarium, the representative returned to Washington, leaving W. P. Sauerhoff in charge of the packing and reshipment of all exhibits. This was completed in February, and all material borrowed from the Smithsonian Institution was returned in good condition.

The aquarium proved the most important and attractive exhibit on the grounds, and was always crowded to its fullest capacity, even when the attendance at the Exposition was small.

ACKNOWLEDGMENTS.

To the diligence, intelligence, and experience of the employees of the Commission detailed to assist at Atlanta, the Commission owes much of its success, especially to Mr. L. G. Harron, who was in general charge of the exhibit during the absence of the representative, and Mr. W. P. Sauerhoff, who had charge of fish-cultural work and who superintended the packing and shipping of all material exhibited.

The Commission is indebted to the Secretary of the Smithsonian Institution for loan of material and cases forming part of its exhibit; also to the following parties, who contributed largely toward its success:

Hon. J. D. Edmundson, superintendent of fisheries for Georgia, for assistance rendered in collection of fishes for the aquarium.

Col. R. H. Payne, secretary Union Tank Line Company, for loan of tank cars for hauling salt water from Morehead City to the Exposition.

Judge Hillyer, president Atlanta Water Works, for permission to take fish from lake controlled by his company, and for aid in keeping a uniform pressure of water for operating the pumps.

Capt. E. L. Tyler, chief of transportation, for loan of water carts for hauling salt water.

M. M. Sullivan & Son, Savannah, Ga., for assistance in collecting fishes and gift of turtle.

To the director general and supervising architect of the Cotton States and International Exposition, for assistance rendered in connection with the installation of the aquarium.

W. H. Baldwin, jr., second vice-president Southern Railroad Company, for free transportation of tank cars containing salt water, and special facilities provided for their movement without delay; also for free transportation of U. S. Fish Commission Car No. 4, and crew from Washington to Goldsboro, N. C., thence to Atlanta and return.

Gen. George C. Smith, president and general manager of the Alabama, Atlanta and West Point Railway, for hauling car and crew from Atlanta to Montgomery and return, two trips.

Hon. Milton H. Smith, president Louisville and Nashville Railroad Company, for hauling car from Montgomery to Pensacola and return, two trips.

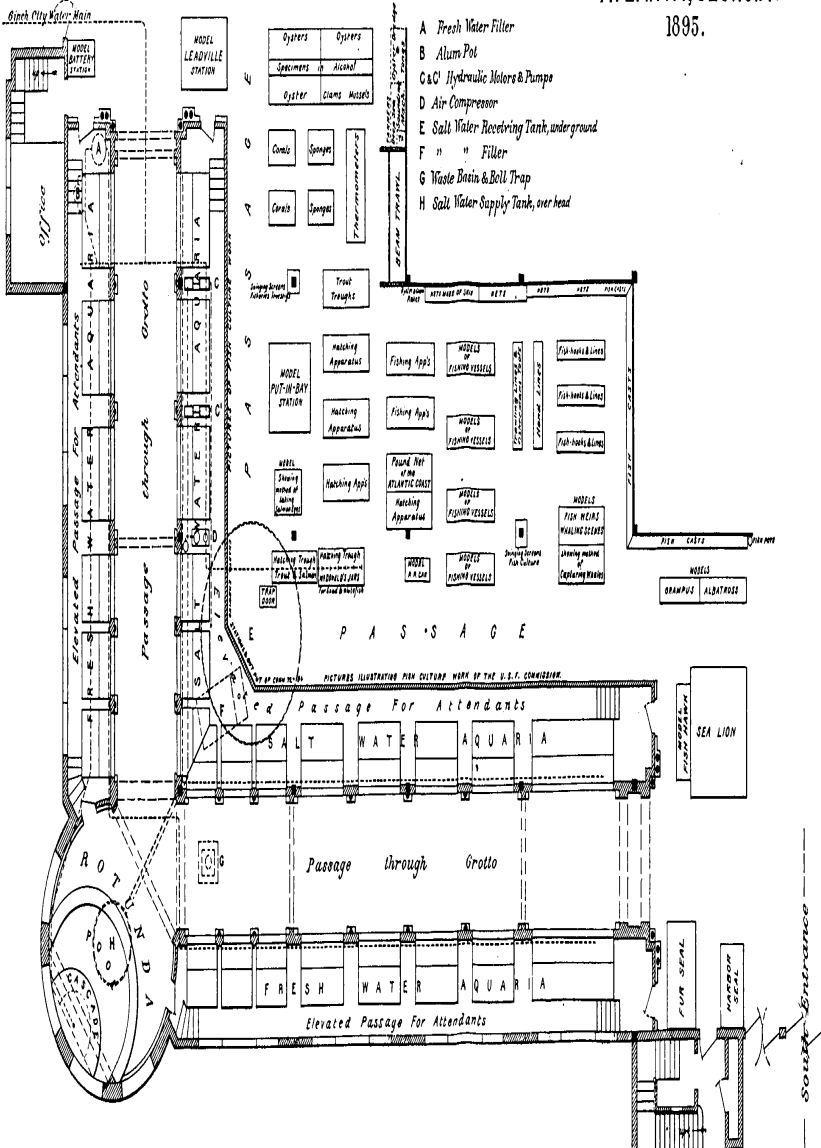
The South Carolina Railroad Company, for free transportation over its line to Branchville, S. C., and return.

Mr. F. J. Jette, superintendent of transportation, Central Railroad of Georgia, for transportation of car and crew from Atlanta to Albany, Ga., and return.

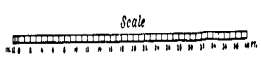
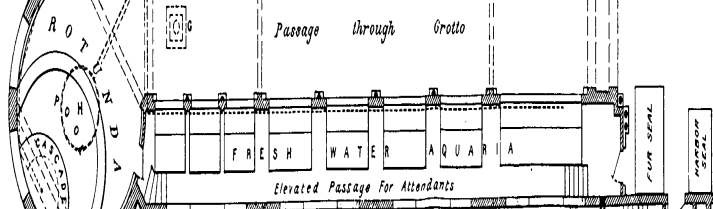
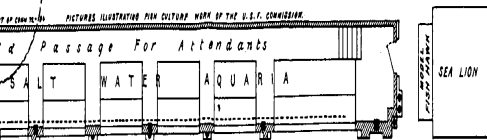
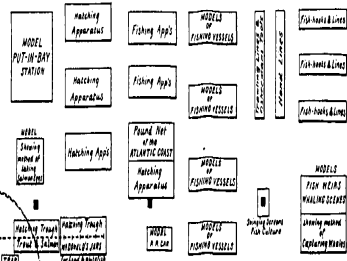
The total cost of preparation, maintenance, and return of the exhibits of the Commission, including the aquarium, was \$20,689.80. The following statement shows the objects for which the money was expended:

Items.	Amounts.
Exhibits and furniture	\$605. 12
Transportation.....	2, 475. 05
Installation and maintenance.....	1, 367. 48
Packing and repacking	1, 935. 22
Miscellaneous expenses.....	191. 52
Construction of aquarium	10, 898. 78
Installation and maintenance of aquarium.....	2, 372. 35
Stocking of aquarium.....	843. 38
Total.....	20, 689. 80

DIAGRAM
U.S. Fish Commission Exhibit
 IN THE U.S. GOVERNMENT BUILDING
 at the
COTTON STATES & INTERNATIONAL EXPOSITION
ATLANTA, GEORGIA.
 1895.



- A Fresh Water Filler
- B Alum Pot
- C & C' Hydraulic Motors & Pumps
- D Air Compressor
- E Salt Water Receiving Tank, underground
- F " " Filler
- G Waste Basin & Bell Trap
- H Salt Water Supply Tank, over head



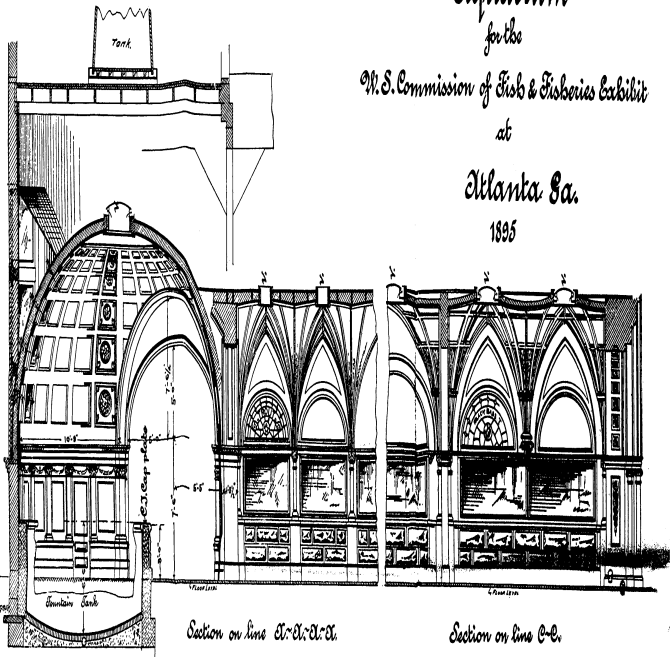
Aquarium for the

U. S. Commission of Fish & Fisheries Exhibit

at

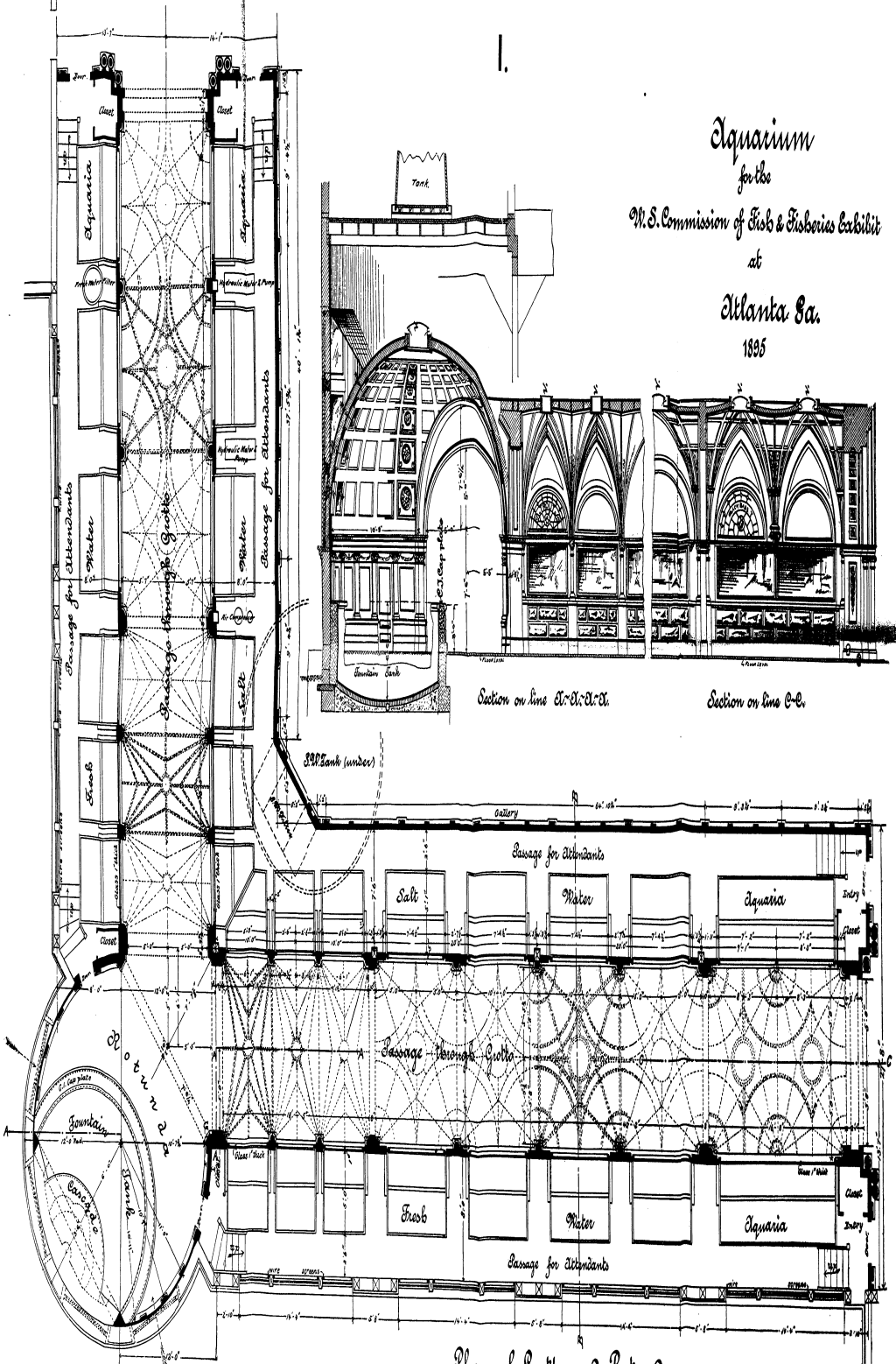
Atlanta Ga.

1895



Section on line A-A-A-A

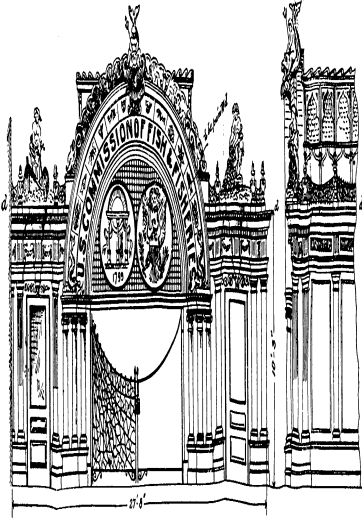
Section on line C-C



Plan of Grotto and Rotunda.

Scale
1" = 10'

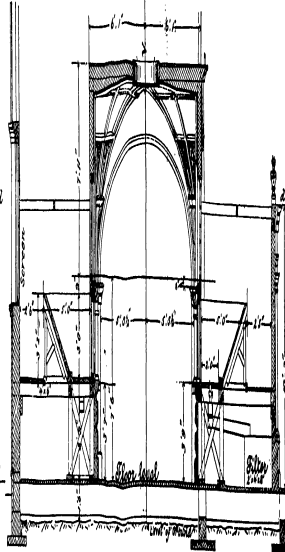
2.



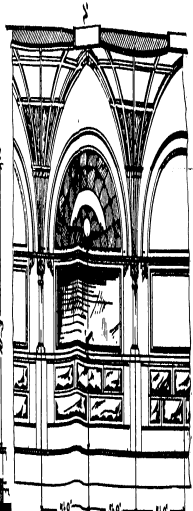
East Entrance

N.E. part of gallery

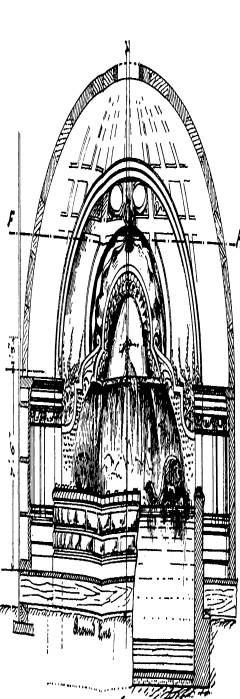
North entrance to be accurately the same, with the exception of the Mchellions, these to show the reverse side of coats of arms



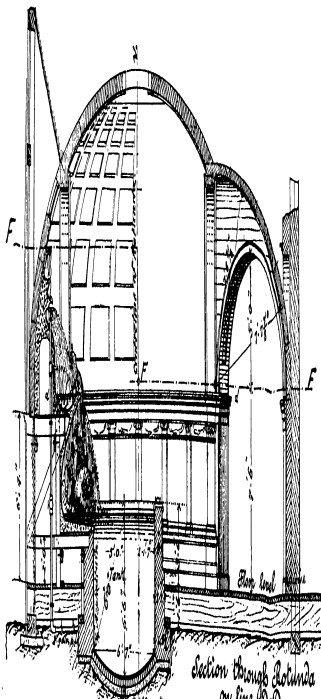
Cross Section on line B-B



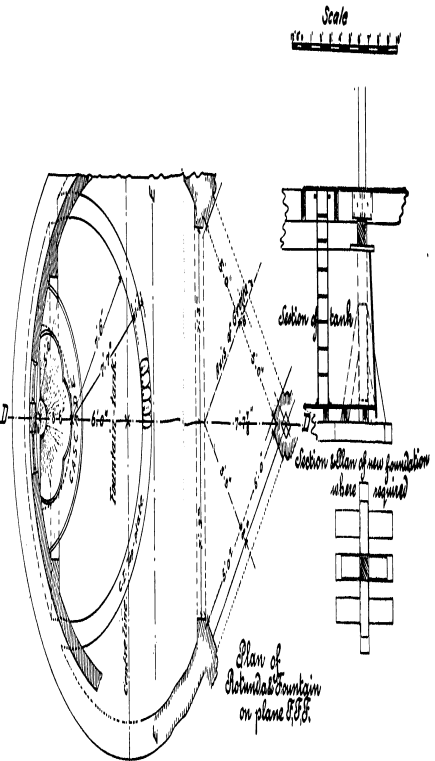
East of longitudinal section on line A-A



Section through Rotunda on line C-C



Section through Rotunda on line D-D



Plan of Rotunda on plane C-C

SPECIFICATIONS FOR CONSTRUCTING THE AQUARIUM.

DESCRIPTION.

The construction of the aquarium herein specified consists of the following principal parts: An arched grotto containing thirty aquaria, two entrances thereto; a rotunda with dome, containing a fountain; an extensive gallery in panelwork, and all other minor details, as shown on the drawings.

Excavation, removal of earth, etc.—Excavate the ground for the salt-water tank, tank for fountain, for laying sewer and other pipes, and for new foundations under main posts of Exposition building, etc., and do all other excavation required by the drawings and as directed by architect in charge and required to complete the work.

Remove all surplus earth and rubbish off the premises to places designated by the superintendent, and level off as will be directed.

MASON WORK, ETC.

Concrete.—Prepare and lay for foundation walls and bottom of fountain tank and waste basin a bed of concrete 6 inches thick, and fill between the walls of salt-water tank and ground with concrete made of best native Portland cement and clean, sharp, grit sand and broken limestone (stone to pass a ring of 2 inches diameter in clear) in parts: 1, cement; 2, sand, and, 3, broken stones, properly mixed and laid in the best manner. Do all other concreting required by the drawings and necessary to complete the job.

Brickwork.—The tanks for fountain and waste basin, as shown, to have their walls and bottoms built with best hard-burnt brick laid in best hydraulic (Portland) cement mortar; except where otherwise specified the joints to be completely filled with mortar throughout and thoroughly grouted.

Asphaltum.—The inner linings of the aforesaid tank and basin, and also the bottom of the same, to be built with brick boiled in best Trinidad asphaltum, laid while hot, and properly bonded with the other brickwork; the bottom of the tank to have the bricks set on edge, laid in herring-bone fashion, as per design, to have a pitch so as to drain toward sewer inlet; the entire sides and bottoms of the tank and basin to be lined with pure Trinidad asphaltum $\frac{1}{2}$ inch thick throughout.

The aquaria (30 in number), as shown on plans, to have $\frac{1}{2}$ inch best asphalt coating throughout their inside surfaces, as will be directed; all metals, pipes, bolts, nuts, etc., coming in contact with salt water to be also thoroughly coated with asphaltum while hot. All this work must be done as directed by the architect in charge.

Do all other mason work required to complete the job and as directed by the architect in charge.

Carpenters' and cabinet-makers' work.—The materials used throughout to be of good merchantable quality, free of any defects, rot, knots, etc., and to be well seasoned throughout. The workmanship must be the best of its kind throughout; the general drawings and details furnished and directions given by the architect in charge must be strictly followed, and the whole work must be constructed and put up in a substantial and careful manner.

The framing of the entire structure is to be done with good quality of native (Georgia) pine, free of any defects; the timber must be sawed square, straight, and true, and to be thoroughly framed together as shown and directed.

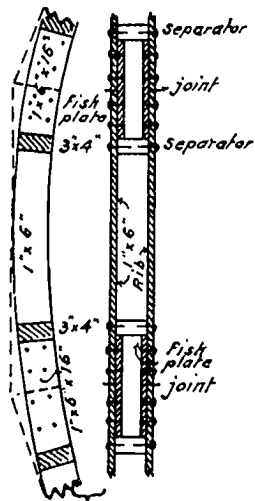
The foundation for main posts of Exposition building shall be carefully lowered to such a depth and in a manner as and where shown on drawings. The gallery partitions are to be made in sections of 3 panel widths, mortised and tenoned together, and to be securely framed together as shown, put up in sections, so that they can be easily taken down, sections to be screwed together in a substantial manner and as directed; the grotto and rotunda walls and partitions to be framed together and substantially spiked, braced, and nailed; all partitions to have 3" x 4" studs, 16 inches on centers, framed to 3" x 4" top and bottom plates, to be held

together on top with 2" x 6" ceiling joists, four to each bay, with 2" x 4" diagonals, all thoroughly toenailed, etc., all complete.

Groined ceilings of arches *a* and *b* and *c* each to have an eye at the apex, made with a circular drum in two sections of four pieces each, of 1" x 10" boards, joints framed and toenailed to curved ribs as shown; the curved ribs for groins to be made in two sections of 1' x 4" each, sawed to shape, joints broken, all thoroughly nailed with steel wire nails.

The curved main ribs to be spiked to 3½-inch turned uprights, around which plaster columns are built, extending from floor to ceiling, and to circular drums; to have horizontal and other curved ribs cut between as shown; the ribs to be well braced to uprights.

The curved ribs of the rotunda and the arches of entrances to be constructed of 1" x 8" boards, cut to shape in four sections (see diagram) to each rib, nailed to 1" x 6" x 16" fish plates, and separated by blocks of 3" x 4" stuff, nailed with 10-penny steel-wire nails, clinched on the inside, 8 nails to each joint, all as shown; the ribs to be toenailed to curb plate and eye drum of dome, the drum, to be made, in a similar manner as specified above, of 2 circular sections, each section to be of 4 pieces of 1" x 10" stuff, joints broken; the horizontal ribs to be made in a similar manner and cut between main ribs, etc., all complete, and all nailed with 10-penny steel-wire nails.



The platform supporting the aquaria to be constructed as shown, well braced, braces to be bolted to the uprights and horizontal pieces, etc., as directed, all complete.

The foundations for salt-water tank, filters, and pumps to be made as shown; parts of the flooring and floor joists of Exposition building floor are to be cut and taken up, these parts to be relaid in a proper manner, as directed.

The frames for the front entrances to be made, as shown, of substantial construction, similar to the other vaulting.

The carpenter is to do all cutting for other craftsmen, is to provide centers for vaulting and arches, scaffolding, and is to do all furring required to complete the job.

Front entrances, gallery, and rotunda walls to be faced from floor up to a line *d d d* (top of entablature) with ¾-inch dressed best white poplar (*Liriodendron tulipifera*) or canoe wood, as shown and according to details; the pedestals, bases, columns, pilasters, panels, and entablatures to be

faithfully carried out according to design; all to be fastened with screws to the studding so that they can be easily removed when desired; the caps of columns and pilasters, ornamental friezes and panels, and all others up to lines *d d d* to be made of composition material (such as "Decoreo" or similar good compositions), according to details furnished or selections made from catalogues; the network and vases, etc., above entablature, as shown, to be also made of aforesaid composition material. The statuary and arches, including their ornamentation, will be of stucco, as specified below. All this work must be perfectly smooth, sandpapered to a proper surface, and made ready for a No. 1 ivory and gold finish.

The outside walls of the grottoes, seen from the interior of the Exposition building, shall be ceiled, shingled, and trimmed as shown on drawings, and finished for an ivory or white-zinc finish, as directed.

Flooring of ¾ inch by 6 inch joined, square edge and milled stuff, to be laid on floor joists of aquaria passages and between aquaria, as shown; portions of said floors to be left loose, as directed. Do all other flooring required to complete the job.

Closets in aquaria passages to be made of one-inch milled stuff, tongued and grooved, one battened door to each, hung with substantial hinges and provided with

substantial and neat closet rim lock and keys; the closets to have shelves and hooks, as directed.

Doors for front entrance and rotunda to be of white poplar $1\frac{1}{4}$ inches thick, hung to proper frames, to be made as shown, to have wired ground glass in the upper panels. Hang each with two loose-joint butts and fasten with 3-inch mortise lock, brass escutcheons, and knobs. These doors must be prepared to receive best ivory finish.

Semicircular windows to grottoes.—Frames to be made similar to ribs of groined vaulting, to be rabbeted to receive sash. Semicircular sash to be of $1\frac{1}{4}$ -inch poplar, ogee molded. All these sash to have central molded frames and sash for inscriptions, etc., as shown. The central segment sash to be made and fastened so that it can be removed at any time. The windows shall be glazed with domestic cathedral glass of different tints, as per designs, laid in flat lead. The windows in dome of rotunda to have ogee molded $1\frac{1}{4}$ -inch sash, glazed with ornamental ground glass, one plate to each; sash to be set in rabbeted and molded frames.

Screens of close-wired netting to be set to all outside windows; sash to be molded on the outside, etc., all as shown.

The roof of rotunda and extrados of entrance arches where exposed to the eye and as directed to be prepared for plastering.

Ventilators "V" of galvanized iron and of ornamental pattern to be put to all vaulting, rotunda, etc.

Semicircular grill, with medallions in tympana over main entrances.—Provide proper rabbeted frames for 2' x 3' semicircular molded sash made as shown, sash to be grooved to fasten $\frac{3}{16}$ wire grill-

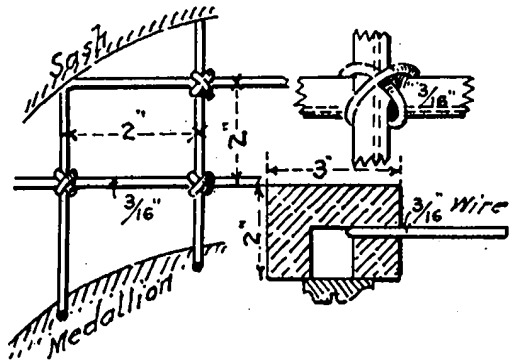
work of 2" mesh thereto, wires to pass through suitable rings, 2 rings to each crossing, thus:

The medallions to be of No. 30 sheet iron, 11 oz. per square foot, and must have neatly molded frames, to which the sheet iron and vertical and horizontal wires are fastened, etc., complete in every particular, made ready for the painter.

The aquaria to be made as per details; sides, bottoms, and ends to be of a clear 2" dressed cypress; the several pieces must be bolted together with 1" wrought-iron bolts, as shown in details, the whole to be put together with white-lead joints and to have $\frac{1}{4}$ -inch coat of best Trinidad asphaltum in the best manner. The fronts of the aquaria, of the best polished plate glass, 1" in thickness, will be furnished by the U. S. Government and delivered in the Exposition building at Atlanta. The glass is to be set in a rolled steel frame, constructed of Carnegie "Z" bars, No. 19, $4\frac{1}{2}$ lbs. to the foot, riveted together, countersunk to sides and bottom of aquarium and packed with two layers of $\frac{1}{4}$ -inch thick vulcanized rubber between said steel frames and glass. The double aquaria will have at their centers, where the two plate-glass fronts meet, a mullion of rolled steel "T" bar, Carnegie's No. 69, 10.9 lbs. to the foot, and to be properly connected to the "Z" frames.

Eighteen plates are required, each 3' 0" by 7' 0", and 12 plates each 3' 0" by 5' 0".

These aquaria to be provided with overflow and waste, etc., etc., as directed. The aquaria must be very carefully set up, warranted water-tight, and the glass must be protected during the progress of the work in a thorough manner, and the whole must be done according to details furnished and directions given. A neat ornamental frame of thin sheet iron is to be fastened around each glass front, as shown. Build frame for cascade, as shown, in a substantial manner.



The carpenter is to do all other carpenter work, such as bracketing for stucco and cement work, etc., required by the drawings and as directed by the architect in charge, and is required to complete the job.

CEMENT AND STUCCO WORK, WIRE LATH, ETC.

Wire lathing.—The walls of the grottoes, rotunda, and arches over entrances and all such parts of the walls not ceiled to be covered with good wire lathing in a thorough, workmanlike manner. Do all wire lathing for groins, cornices, ribs, and cassettes in rotunda, etc., all complete. The extrados of dome of rotunda is to be lathed with sound lath, properly nailed to top of ribs, to receive two coats of plain plastering.

CEMENT AND STUCCO WORK.

Slate.—The base in grottoes to be throughout 1½-inch rubbed gray slate, 12 inches high, square finished; back up with plaster and properly fasten to framework.

Keen's cement and stucco.—From base up to springer line throughout put to a brown coat one good coat of pure Keen's cement, and from springer line up put one coat of finish, composed of one part of Keen's cement and three parts of best plaster of paris; all put to a well-floated brown coat. The stucco and cement putty for the walls and spandrels, also for the ribs of vaulting and ribs of cassettes of rotunda, for soffits and moldings of archivolt and stucco ornaments, caps, etc., are to be colored in mixing the various tints as directed by the architect in charge.

The molded work must be executed in artistic and first-class manner, sharp and true. All ornamental work and other enrichments must be of a high, artistic grade and of bold and realistic character. Models of clay of the various ornaments, statuary, etc., must be submitted for approval to the architect in charge before they can be executed.

The archivolt, moldings, and various ornamentations of the main entrances to be also executed in stucco, of the same material, and finished as grotto and rotunda, etc. The statuary, as shown, to be also of stucco; to be of a highly artistic finish and bold execution.

The several bidders are required to submit with their estimate a sample of stucco finish, about 6 inches square.

Portland cement work.—The cascade and fountain to be executed in best English Portland cement mortar (one part of cement and three parts of sand), according to designs. The exterior face of wall of fountain tank to be made in imitation of stone, as shown. The figures representing manatees and otter and other ornaments, rock, basins, etc., shall all be executed in cement after the models have been approved.

A model representing one of the bays of the vaulting can be seen at the United States Fish Commission office, in Washington.

All imperfections, either in execution of the designs and workmanship or damages from whatever cause, must be remedied and made good to the entire satisfaction of the architect in charge before the work will be considered complete.

Ironwork.—Provide rolled-iron T and Z bars, bolts, nuts, as shown on details for aquaria. Over large 14-foot aquaria provide and hang beams, where shown, to roof timbers, with 1-inch diameter wrought-iron rod, substantially put up, etc., all complete.

Provide substantial spikes, bolts, clamps, etc., wherever required to complete job. Semicircular transoms of main entrances to be wired with medallions of No. 30 galvanized sheet iron, inserted as shown.

The doors for main entrances to be grill work of very light construction, as per design, representing network, etc., to be hung to jambs, with substantial brass butts fastened with neat locks and furnished with brass knobs, etc., all complete.

A cast-iron cap plate to be put to top of wall around tank for fountain in six sections, ½-inch metal, firmly bolted with three ½-inch expansion bolts, 8 inches long, to each section, to be of ornamental design, "Bower Barff" process (motive water lilies),

as shown. See also diagram. Rosettes of cast iron representing water lilies, to be fastened, as shown, to top of cap.

A rail made of 2-inch gas pipe to be built around gallery, as shown, substantially made and fastened to floor, etc. This rail to be bronzed by painter.

Painting.—The painter's work will be executed in the very best manner and must be of a high artistic grade. The woodwork for gallery, main entrances, rotunda, etc., will receive a pure-white ivory color, semi-glossy, finished as follows: One coat of liquid filler as a primer, all imperfections filled with white-lead putty, then given two coats of French zinc-white, thinned with half and half boiled oil and turpentine, with patent drier to harden; the last coat to be smoothed up with sandpaper and the work brought up with two coats of flake white, ground in japan, thinned with Damar varnish. Three days must be allowed between the last two coats and four days after the last coat before rubbing. This work must be rubbed with pumice stone and water, left with a clean, fine surface.



The network on top of cornice, the several ornaments, caps, statuary, etc., to be picked out with gold-leaf gilding. The panels of the doors and moldings around panels and architraves to have a $\frac{1}{4}$ -inch strip of gold-leaf gilding. The ornamentation of the archivolt of the main entrances and rotunda, the caps of columns, the vases, statuary, etc., will be picked out in gold, as directed by the architect in charge. Put to the facade of the archivolt of main entrances flat ornaments, in colors and designs as chosen by the architect.

The medallions on entrances shall be emblazoned in a highly finished manner with the obverse and reverse coats of arms of the United States and the State of Georgia, as directed. The statuary will be painted in delicate tints and in such a manner as will be directed.

Grottoes.—The spandrils of the groined arches will be enriched with such ornaments and tints as to give a marine effect, etc. The dome of the rotunda and the cascade to have the cassettes, ribs, etc., tinted in different colors, as will be directed. The spandrils of the archivolt in the rotunda and panels will be painted so as to represent still-life scenery.

Do all other painting requisite to finish the work complete in every particular.

Final.—All plumbing for the aforesaid aquarium forms no part of this contract.

Specifications of material to be provided and of work to be done for and in the construction of an aquarium for the United States Commission of Fish and Fisheries exhibit at Atlanta, Ga.

The whole is to be done in accordance with these specifications and accompanying plans, prepared under the architect of the United States Fish Commission, and no deviation therefrom will be permitted unless authority in writing is first obtained from the representative of the United States Commission of Fish and Fisheries.

Any change of plans, etc., involving any difference in cost from that proposed by the contract must be agreed upon by the parties to this contract, with statement in writing as to the difference in price from that originally agreed upon.

Should it be deemed desirable during the construction of the proposed aquarium to make any additions to it or to do any extra work not contemplated or provided for by these plans and specifications, an agreement in writing, stating the nature and cost of such additional or extra work, must be entered into between the representative of the United States Commission of Fish and Fisheries and the contractor before such work is commenced. No claim for extra work or materials, excepting as above specified, will be considered.

Should it be deemed desirable to make any change from the plans and specifications during the progress of the work, which does not involve any additional expense to the contractor for labor and material, he will be expected to make such change without extra charge.

The work will be under the direction of the architect or other duly appointed agent of the board of management, United States Government exhibit, and in case any disagreement should arise between the agent in charge and the contractor as to the meaning or intention of any portion of these plans and specifications, the decision of the representative of the United States Commission of Fish and Fisheries upon said disputed point or points will be final.

The work is to be commenced within ten days after signing of contract and is to be carried forward at such rate as shall insure its completion on or before August 10, 1895.

And it is understood and agreed by and between the parties hereto that if the contractor shall fail to comply with the terms of this contract which relate to the time within which said work is to be completed, the said contractor shall be subject to forfeit of fifty dollars per day for each and every day thereafter until the completion of the work by him, enforcement of the same to be made in the discretion of the representative of the Commission of Fish and Fisheries, which sum shall be deducted from any amounts which may be due the contractor; and if amount due contractor be not sufficient to meet the forfeit, then contractor to pay the difference or the money to be retained out of the bond given by the said contractor and his bondsmen.

Any failure to commence work within the specified time or to prosecute it thereafter at the rate and in the manner required will be considered as allowing the United States to annul the contract and declare a forfeiture of all reserved percentages and other dues or as allowing the United States, at the option of the representative of the United States Commission of Fish and Fisheries, to carry on the work at the expense of the contractor and as rendering him and his bondsmen liable for any increase of cost over that proposed and agreed upon.

In case the lowest price be named by two or more bidders, these bidders must agree between themselves, within twenty-four hours after notification, as to who shall have the award. If the question be not settled within the time stated, and the representative of the Commission of Fish and Fisheries so informed, he may select either of them to do the work at his discretion at said price.

Payment for the work will be made as follows, viz: After the end of each month, if the progress of the work is satisfactory, part payments will be made upon the written certificate of the agent in charge, reserving twenty per centum of the amount due, which will be retained until the final completion and acceptance of the work by the representative of the United States Commission of Fish and Fisheries. Within thirty days thereafter final payment for the work will be made.

The "instructions for bidders," as far as they may be applicable, are to be considered essential parts of these specifications.

The tools, scaffolding, etc., used by the contractor must be suitable for the work and satisfactory to the agent in charge. The scaffolding will be left in place until a written order for its removal is given by the agent in charge.

The contractor will protect the work and materials from damage during the progress of operations, and will clear, from time to time, as may be necessary, all dirt and rubbish resulting from the work. On completion, he will thoroughly clean all floors and windows, remove all débris, and have the premises in good order,

ready for use, and satisfactory in every respect to the superintending Government officer, to whom he will then turn over the entire aquarium.

The contractor shall furnish all necessary plants, materials, and labor. He shall allow agent of Fish Commission in charge of the work full access to all parts of the work at all times, and shall give the agent any and all assistance which he may need.

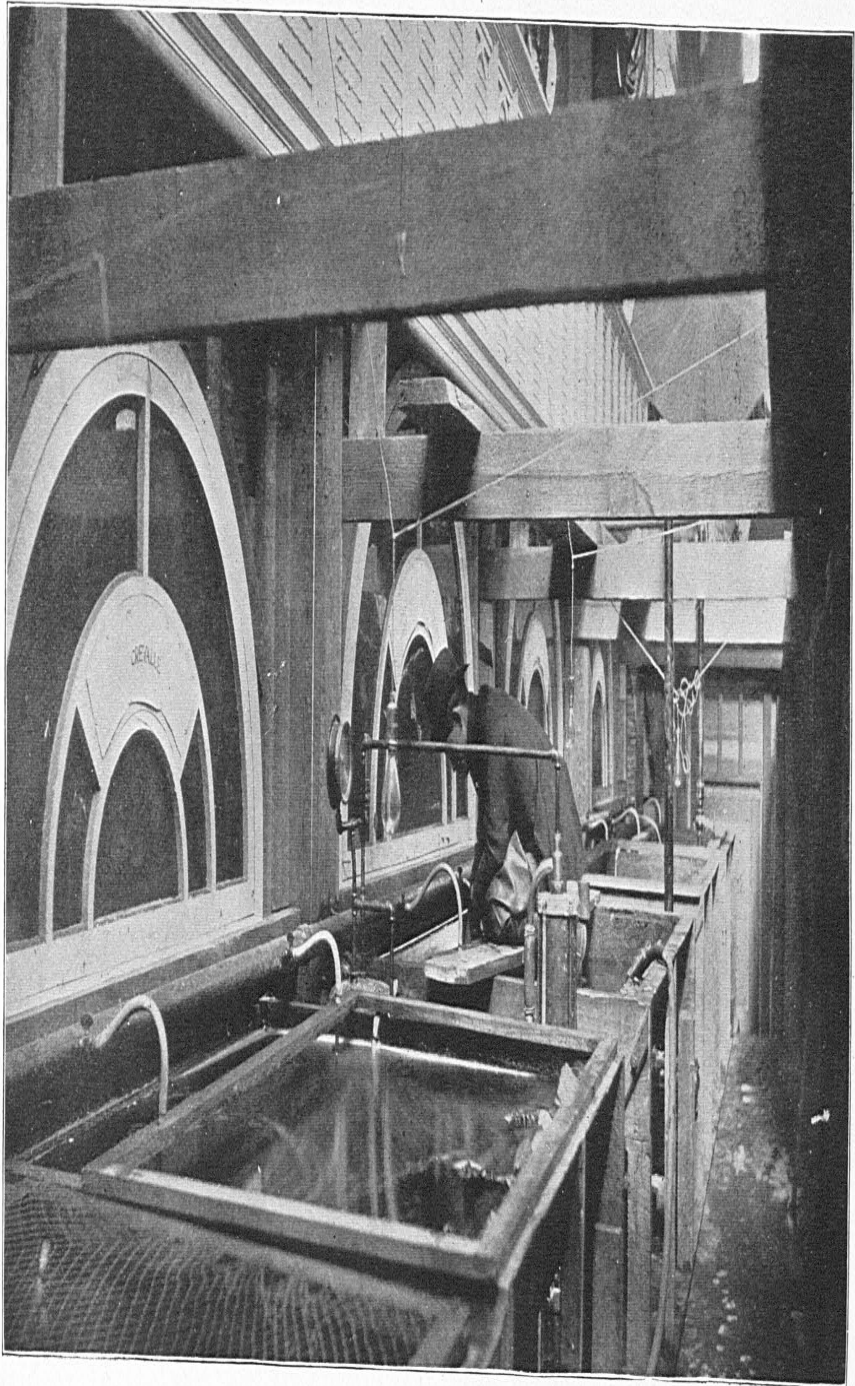
All materials furnished for the work must be first class of their kind and satisfactory to the agent in charge. Any materials not satisfactory will be condemned, and must be removed from the location of the work and not be again brought upon the ground.

All workmanship must be first class, and any work not so must be corrected immediately upon the request of the Government agent in charge.

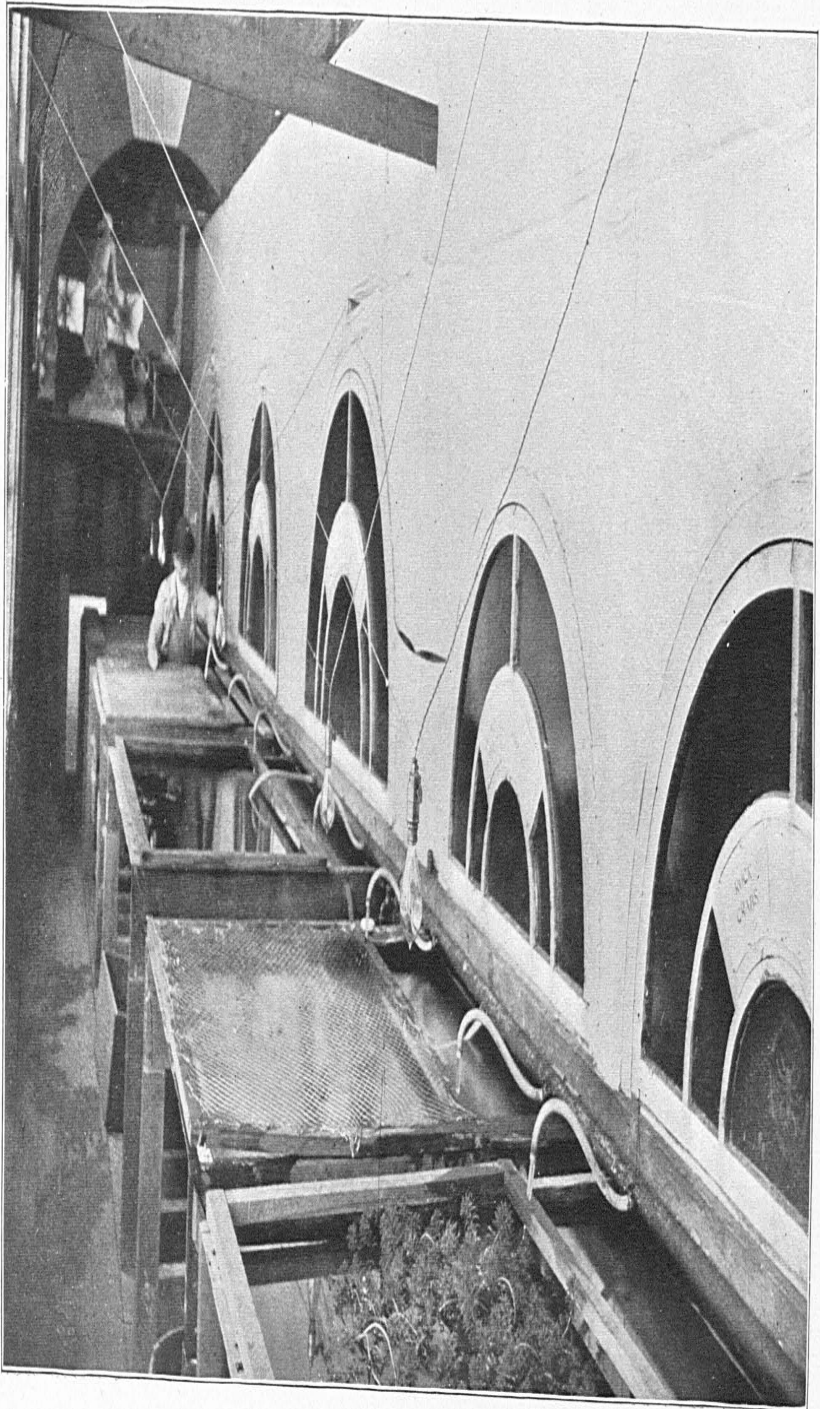
Except when otherwise specified, the lumber and timber used will be well seasoned and of the best kind and quality used for similar purposes at or near the locality where the aquarium is to be built, all subject to approval of superintending officer.

Where figures are given in the drawings they will be followed; otherwise scale dimensions will be the guide.

The contractor shall, in the fulfillment of this contract, take no advantage of any omission or incompleteness in these specifications or in the accompanying plans, as full explanations and detail drawings will be furnished him when required.



BACK VIEW OF SALT-WATER AQUARIA, SHOWING AIR-PUMP, ETC.



BACK VIEW OF FRESH-WATER AQUARIA.