U. S. LIGHT-HOUSE ESTABLISHMENT.

SPECIFICATIONS

FOR

THE IRON-WORK

OF THE

HILTON HEAD RANGE LIGHT-HOUSES, SOUTH CAROLINA.

DECEMBER, 1877.

PETER C. HAINS,
Engineer Secretary.

SPECIFICATIONS

FOR THE

IRON-WORK OF THE HILTON HEAD RANGE LIGHT-HOUSES, SOUTH CAROLINA.

REAR LIGHT-HOUSE.

GENERAL DESCRIPTION.

The light-house will be a skeleton structure, made up of five series of iron columns, braced and tied by means of beams and tie-bars, and together forming the outline of a regular hexagonal pyramid, with a central stair-cylinder enclosing the axes of the pyramid. The first series of columns, provided with tenons at their lower ends, will fit into hubs on the foundation-disks, and will be bolted to the same.

The foundation-disks will rest on and be bolted to the concrete foundation-piers by six (6) anchor-bolts each. The form, dimensions, and character of this foundation will be determined by the district engineer.

The tops of the columns of the 1st, 2d, 3d, and 4th series, will form sockets for the tenons provided at the lower ends of the series, above; they will be bolted together through horizontal flanges.

At the top, these columns will be provided with radial flanges, to which the diagonal perimeter tension-bars will be attached. Similar flanges will be provided at the lower parts, for the attachment of channel-iron beams connecting the columns.

The radial tension-bars will be attached to cast-iron rings, which will form part of the stair-cylinder. The upper ends of the fifth series of columns will enter the hubs provided on the corners of the architrave castings. They will have flanges for the attachment of the upper series of perimeter tension-bars.

The architrave will consist of six (6) castings, the inside edge of which will conform to the stair-cylinder. The frieze will consist of six castings, and will have raised surfaces for the attachment of the watch-room-gallery brackets.

The watch-room floor will consist of eight (8) castings, bolted to the frieze by $\frac{3}{4}$-inch bolts. The watch-room side-walls will be made of wood,

and will be secured to the watch-room floor, frieze, and architrave by twenty-four ¾-inch bolts. The room will have two windows, and a door leading out on the gallery.

The lantern will be of wood covered with a tin roof, and will be held to the watch-room by sixteen ¾-inch bolts. It will have one window, consisting of a single pane of glass, on the side toward the front light-house. It will be provided with a ventilator, ball, and pinnacle, and will be reached from the watch-room, through a trap-door.

DETAILS.

METAL WORK.

Foundation-disks.—The six (6) cast-iron foundation-disks, (shown on Plate 2, Figures 1 and 2,) will have central inclined hubs to receive the tenons of the columns of the first series, and will be bored out to insure a perfect fit. At the upper ends, and perpendicular to the axes of the hubs, there will be flanges, to which the corresponding flanges of the first series of columns will be bolted.

Anchor-bolts.—The anchor-bolts (six to each foundation-disk) will be of wrought iron, six (6) feet three (3) inches between the nuts and heads.

Anchor-plates.—There will be one cast-iron anchor-plate to each bolt, stiffened by ribs, as shown on the drawings, (Plate 2, Figures 46 and 47.)

Columns.—There will be five (5) series of cast-iron columns of the forms and dimensions shown on Plate 2, Figures 19 to 39, each series consisting of six (6) columns. The flanges on the ends of the columns by which they are to be bolted together, end to end, will be at right angles to the axis, and strengthened by ribs, as shown on drawings. The upper end of each will be bored to proper dimensions to receive the turned tenons of the columns above.

The upper part of the fifth (5th) series will be provided with tenons, as shown in Figures 36 to 39.

Ribs at the top and bottom of the columns will be provided for the attachment of the perimeter tie-bars and channel-irons.

Near the lower end of each column, shoulder-bosses will be provided for the tension-bars.

The holes through the columns for the tension-bars may be cored, but of dimensions to accommodate the tie-bars passing through them.

Architrave.—The architrave (Plate 3, Figures 43 to 47) will consist of six (6) castings, bolted together by ¾-inch bolts. The corner-castings will be provided with hubs into which the tenons of the columns of the fifth series will fit. When bolted together, the inner portion of the

architrave will form a ring for the attachment of the outside lining of the stair-cylinder. The castings will be provided with side and top-flanges for joining them together and to the frieze above.

The flanges between the hub and lower part of architrave will strengthen the casting and serve for the attachment of the tie-bars connecting the corner-castings to the columns of the fifth series.

The frieze will consist of six (6) castings, bolted together and to the architrave and watch-room floor by ¾-inch bolts. The castings will be provided with top and side-flanges, as shown on Plate 3, Figures 51 to 54, and at their vertical surfaces they will have raised faces for the attachment of the cast-iron gallery-brackets, (Plate 3, Figures 48 to 50.)

The brackets will be bolted to the frieze by ¾-inch bolts. They will have bosses through which the lower parts of the railing-standards will be passed and be secured by nuts.

Watch-room floor.—The watch-room floor will consist of eight (8) castings, of which the six (6) outer ones will be of one pattern, as shown on Plate 3, Figures 39 to 42. The two (2) inner castings will be of the same pattern (as shown) as the stair-landings, with the rising flange on the top surface and the ribs *O*, *O*, (Plate 3, Figure 22,) omitted. The six outer castings will be provided with flanges, and will be bolted together by ¾-inch bolts, three to each joint.

Shoulders will be provided for the centre castings, to be fitted to the same. Bosses will be provided, four to each casting, through which the bolts will pass to secure the watch-room. These bolts will be ¾ inch diameter, and will pass through both flanges of the frieze and the top flange of the architrave, where they will be secured by nuts.

Watch-room-gallery railing.—The outer perimeter of the watch-room gallery will have a wrought-iron railing (Plate 3, Figures 1 to 10) in six (6) sections. In the centre of the panels there will be uprights, provided with collars and screw-threads, which will pass through the top and lower rails and through the diagonal braces, as shown on Plate 3, Figure 1. The upper, middle, and lower rails will be scarfed at the corners, and supported by pieces of gas-pipe. The lower parts of the top rail will receive the heads of the standards, and will be covered by the hand-rail, which will be riveted thereto. Each of the standards will be surmounted by a cast-iron washer and tapped ball.

Lantern-gallery railing.—The lantern-gallery will be guarded by a wrought-iron railing, in six (6) sections. The twelve (12) standards will have collars and screw-threads at their lower ends.

The screw part will pass through the wooden joists, and will be secured by nuts and washers underneath.

The standards will taper upwards. and be provided with collars and screw-threads. The lower portion of the standards will be the same as those of the watch-room-gallery railing. There will be a top and a lower rail, scarfed at the corners. The upper rail will rest against shoulders provided on the standards, and will have a rolled-iron hand-rail riveted to it. It will be firmly held in position by cast-iron washers and balls, similar to those of the watch-room-gallery railing.

Foundation-castings for stair-cylinder.—The foundation-casting of the stair-cylinder will be in six parts, bolted together by one and one-quarter ($1\frac{1}{4}$) inch bolts through side-flanges, as shown on Plate 2, Figures 3 and 5. It will be provided with a bottom, and vertical flanges.

The section below the door will be three (3) inches less in height than the rest.

The radial upright flanges at the inner side of the casting will stop three (3) inches from the top of the same, to receive the platform at the foot of the stairs. Radial flanges will also be provided on the outside of the casting, as shown on the drawings.

Foundation-disk for newel.—A foundation-disk will be cast with a hub to receive the tenon of the lower part of the newel-pipe. It will be provided with radial flanges, and of the form and dimensions shown on Plate 2, Figures 3 and 5.

Door-steps.—The steps, shown on Plate 2, Figures 6 to 10, will be of cast-iron, and will have their surfaces provided with diamond checkers. They will be fastened to the carriers by one-half ($\frac{1}{2}$) inch tap-bolts. The carriers will be fastened and fitted to the foundation-casting of the stair-cylinder.

Hand-rail.—The stairs will have a wrought-iron hand-rail, one (1) inch in diameter. It will commence at the first flight, and terminate at the head of the fifth. The railing will be continued at the landings and will run horizontally around the same. It will be riveted to wrought-iron arms attached to the inner wooden lining of the cylinder. (Plate 3, Figure 38.)

Struts.—The perimeter struts of the 2d, 3d, 4th, and 5th series of columns, will consist of channel-irons bolted to the radial flanges on the lower part of the respective columns. Those of the second series will be eight (8) inches high, not exceeding in weight 75 pounds per yard; those of the third series will be seven (7) inches high, 60 pounds to the yard; those of the fourth will be six (6) inches high, and weigh 50 pounds per yard. They will be fitted at the shop.

Tension-bolts.—The tension-bolts are shown on Plate 2, Figures 41 to 43. Their dimensions are given in a schedule on the same Plate. They

must be of the best bar-iron, with eyes forged on one end; the other will be forged round, and a screw-thread chased on the same. The diameter D, (Figures 40 and 41,) as given in schedule, does not include the projection of the screw-threads.

The perimeter tension-bars will be fork-shaped, to fit the flanges on the columns. The radial bars will be plain where the eyes will be forged to enter the sockets of the cylinder-rings.

The pins for the tension-bars (Plate 2, Figures 44 and 45) will be forged rough and drilled for the insertion of the split-pins. Their dimensions are given on a schedule on the same Plate.

Stair-cylinder.—The stairs leading to the watch-room will be enclosed in a cylindrical wrought-iron boiler-plate mantle, $\frac{1}{4}$ inch thick, (Plate 3, Figure 32.) The mantle will be formed in fifteen sections. Each entire section will consist of six (6) segmental plates riveted to each other, and to adjoining sections, cylinder-rings, window and door-frames, architrave-ring, and foundation-casting, by single lines of rivets $\frac{1}{2}$ inch diameter and $2\frac{1}{4}$ inches from centre to centre. The sections of the mantle will overlap each other $1\frac{1}{4}$ inches from the centre of the line of rivets.

WOOD-WORK.

The interior of the staircase enclosure will be lined with narrow tongued and grooved yellow-pine boards, one (1) inch thick, nailed against 3 by $4\frac{3}{4}$-inch studs. The lining will be circular, and will have a clear diameter of six (6) feet. The top of the lining will be finished by a moulding to correspond to the moulding of the inner semicircular casting in the centre of the watch-room floor.

The hexagonal watch-room will be seven (7) feet high in the clear, and will have an inside diameter of nine (9) feet. It will be made of sills, plates, studs, and diagonal cross-pieces, all to be 4 by 4 inches.

The lantern floor will be framed of radial joists 3 by 8 inches, and floor-joists 2 by 8 inches. A suitable opening will be framed, through which the lantern may be reached. The joists of this floor will be notched one inch over the plates of the watch-room enclosure, and will be supported in the centre by a post which will be extended from the stair-newel to this level.

The lantern-gallery will be covered with tin, having soldered joints, the tin to be turned up ten (10) inches under the weather-boarding.

The lantern will be made of sills, plates, and studs, all to be 4 by 4 inches. It will be covered with a tin roof, and provided with a ventilator-ball and pinnacle.

The sides of the watch-room and lantern will be covered with one (1) inch sheathing, nailed on diagonally, over which tarred roofing-paper will be tacked. On the outside there will be nailed rustic horizontal weather-boarding. A water-table will be fastened to the watch-room and lantern. The walls and ceiling of the watch-room and the lantern will be covered with narrow tongued and grooved and beaded pine boards, $\frac{7}{8}$ inch thick. Furring-strips of 2 by 2-inch stuff to be let flush into the studding, to which the siding will be nailed. The washboards will be eight (8) inches high, plain bevelled.

A cove moulding will be run on all the walls near the ceiling.

The lantern-floor and gallery will be laid with a single thickness of 1-inch best yellow-pine flooring, tongued and grooved.

One and three-eighths ($1\frac{3}{8}$) inch facia-boards will cover the heads of rafters and lantern deck-beams.

The underside of the projecting rafters of the lantern-gallery will be ceiled with narrow tongued and grooved boards, showing the planed side.

The lantern-roof will be covered with one (1) inch sheathing, over which tar paper will be tacked, and covered with the best quality I. C. charcoal tin with standing joints; the tinning to extend under the base of the ventilator-ball and over the edges of the rafters, forming a moulding for the lantern-roof, and fastened to the walls of the lantern.

The windows of the stair-cylinder and watch-room, six (6) in number, will have two panes of glass 12 by 18 inches. The sashes will be $1\frac{3}{8}$ inches thick, hung with two (2) wrought-iron butt-hinges, and will swing to the outside. The glass will be of the best quality, (American double-thick.) The windows will be provided with suitable sash-fastenings.

The stationary transom above the door will be made similar to the stair-windows, and will be bolted to the door-frame. There will be four (4) doors—two (2) at the entrance to the cylinder, one leading to the watch-room gallery, and one to the lantern-gallery. They will be of the heights and widths shown on the drawings, $1\frac{3}{8}$ inches thick, hung with strong wrought-iron slip butt-hinges and provided with one-inch rim-locks, with brown porcelain knobs, and black japanned furniture. The door-openings of the watch-room and the inner side of the stair-cylinder will be trimmed with beaded casings.

In the lantern-floor there will be a trap-door, provided with lifting-ring and hook, and hung with wrought-iron strap-hinges.

The iron watch-room-gallery brackets will have furring-strips, 2 by 4 inches, bolted to them, to which the gallery-floor slats (2 by 4 inches) will be nailed. The furring-strips and floor-strips to be of clear, heart, yellow pine.

A step-ladder will be provided to reach the lantern from the watch-room. The rise of the steps will be 10 inches.

The stringers will be 2 by 5 inches, and the steps will be $\frac{7}{8}$ inch thick, yellow, heart pine, housed and glued into the stringers.

The wood-work, inside and outside of tower, will be painted four coats of the best white-lead and linseed-oil paint, of such tints as will be directed.

LANTERN FOR FRONT LIGHT-HOUSE.

The lantern, with its details, is shown on the drawing.

Lantern-sill.—The lantern-sill will be made in four (4) castings, of the form and dimensions shown on the drawing. The castings will have raised shoulders for the reception of the lantern-posts, which will be bolted to the same. The surfaces of contact between the adjoining parts of metal and glass will be planed and turned.

Anchor-bolts.—There will be sixteen anchor-bolts to secure the lantern to the wood-work below, as shown on the drawings.

Air-registers.—There will be four air-registers of cast-iron, of the form and dimensions shown on the drawings. The revolving disk, with handle, will be of brass, neatly finished.

Lantern-posts.—The eight lantern-posts will be of cast-iron, with square double flanges at top and bottom for the attachment to the sill and the cornice by two $\frac{3}{4}$-inch bolts each. The surfaces of contact will be planed as well as the rebate faces, for the glass.

Glass stops.—The glass stops will be made of finished bronze. They will be flat bars, bevelled for the sill and soffits. They will be fastened with $\frac{1}{4}$-inch bronze tap-bolts.

Cornice.—The cast-iron cornice will be in eight pieces. The joints will be in the middle of the sides, with planed flanges, through which they will be bolted together with $\frac{1}{2}$-inch bolts. In the corners there will be ribs for the attachment of the rafters. The soffit portion will be shaped exactly like the sill. The lantern-posts will be bolted to the same, and it will be planed in the rebate and on the joint with the posts.

Rafters.—The eight rafters will be of wrought iron, of the shape shown on the drawings. They will be bolted to the angle-flanges by two $\frac{1}{2}$-inch bolts each. There will be one tier of wrought-iron purline-strips, fastened to the rafters with palms by $\frac{3}{8}$-inch bolts.

The rafters will be bolted on top to the flange of the cast-iron ventilator-pipe by a $\frac{1}{2}$-inch bolt each. This pipe will be cut above and below for the insertion of a wrought-iron yoke, through which the pin-

nacle will be held. The pinnacle will be of wrought iron, secured with a nut below. It will have a shoulder above, to rest on the upper yoke. The upper portion will be finished with a platinum point, of a quality approved by the Engineer.

Copper roof.—The lantern-roof will be made of $\frac{1}{32}$-inch copper, in eight sections. The joints will be made in the manner shown on the drawings, and will be brazed. On top, the roof will be bolted to the flange of the ventilator-pipe and to the purlines by $\frac{1}{4}$-inch brass tap-bolts, the heads of which will be soldered to the copper surface. The roof will be bolted to the cornice by $\frac{3}{8}$-inch brass tap-bolts, six (6) inches apart, through a bronze strip. The ventilator-ball and neck will be made of $\frac{1}{16}$-inch copper. The ball will be terminated with a brass collar soldered on to the same, through which the pinnacle will pass, forming a cup which will be filled with solder.

The interior of the lantern-roof, from the ventilator-pipe to the soffit-flange of the cornice, will be lined with $\frac{1}{32}$-inch sheet-zinc, fastened to the rafters by $\frac{1}{4}$-inch tap-bolts, six inches pitch, and to the ventilator-pipe and soffit by $\frac{1}{4}$-inch tap-bolts, about the same pitch, through wrought-iron strips.

MISCELLANEOUS.

Bolts.—The contractor for the iron-work will furnish all the bolts required for connection of the different parts of the metal-work.

Joints.—The surfaces of contact between the different parts of the work will be finished, in all cases, by planing, turning, or boring.

All the forgings must be made of first-quality charcoal-iron, thoroughly welded, and free from all imperfections.

All the materials and workmanship must be of the best quality.

Oiling and painting.—All the iron-work of the structure will receive one coat of hot linseed oil at the shops. Before oiling or painting, the surfaces of all the metal-work must be thoroughly cleansed by the removal of rust, &c.

All sockets of castings not accessible after erection will be similarly treated. After the application of the linseed oil the surfaces of all iron-work, excepting bolted and finished surfaces, will receive two coats of red-lead ground in oil, applied at the workshops, and left to dry for some days before shipment. Each coat must be perfectly dry before the next shall be applied.

Bolted joints, &c.—All bolted, planed, and turned surfaces will receive a coat of white-lead and tallow before shipment.

Marking.—All the pieces will be marked before shipment, according to some uniform system, which will be prescribed by the agent of the

Light-house Board, in order to expedite the erection and prevent all delay and inconvenience at the site.

If any omission of details be discovered, either in the drawings or in these specifications, the contractors shall not take advantage of it, but will be expected to refer for information to the agent of the Light-house Board, the Board claiming the right to order any details to be provided without additional cost to the Government, should it become evident that such details were originally intended, or that they will be essential to the proper construction of the work.

Full explanations and complete detail drawings will be furnished for any parts of the work not sufficiently shown or understood.

o

SPECIFICATIONS FOR THE FOUNDATION OF THE IRON TOWER AT HILTON HEAD RANGE LIGHTS, SOUTH CAROLINA.

EXCAVATION AND GRADING.

The ground to be excavated for a depth of six (6) feet over a circle of forty-three (43) feet diameter, and the bottom well rammed down.

The sides of the excavation to be rivetted with one and one-half ($1\frac{1}{2}$) inch planking for a height of four (4) feet.

The excavated materials to be removed to a place designated by the Light-house Engineer until required for use.

After the foundation is completed and is, in the opinion of the Light-house Engineer, or of his agent, sufficiently dry, the rivetting planks will be removed and the earth filled in around the concrete and well rammed. The surface will be graded to shed the water from all sides.

CONCRETE FOUNDATION.

The concrete to be composed of English Portland cement, broken granite or other hard stone of approved quality, and clean, sharp, fresh-water river sand, mixed with fresh water in the following proportions, viz:

One (1) measure of Portland cement.

Two (2) measures of clean, sharp, fresh-water river sand.

Five (5) measures of broken stone.

The cement and sand will be made into a thin paste before the stone is added, and the whole thoroughly incorporated and placed quickly in the work, where it will be well rammed.

None of the excavated material will be permitted to be used for making the concrete.

The base of the foundation will be a cylinder forty-two and one-half ($42\frac{1}{2}$) feet in diameter, reduced by one (1) offset course of twelve (12) inches to a surface diameter of forty and one-half ($40\frac{1}{2}$) feet, and four (4) feet in thickness over the entire surface. Above this will be built six (6) concrete piers to receive the iron foundation disks of the columns, and one (1) central pier for the foundation disk of the stair cylinder.

The piers will be hexagonal in plan for a height of two (2) feet, and above that level will be cylindrical for a height of eighteen (18) inches. The piers for the columns will be eight (8) feet in diameter at the base, and

reduced by one (1) offset course of twelve (12) inches to a surface diameter of six (6) feet. The central pier will be ten (10) feet at the base, reduced by one offset course of twelve (12) inches to a surface diameter of eight (8) feet. The circular portions of the piers will be smooth finished by coating the inside of the wooden form into which they will be built with pure cement-mortar one (1) inch in thickness just before filling in the concrete.

The surface of the central pier will be recessed for the reception of the foundation disk, as shown on the drawings. Plate 1.

The anchor bolts of the foundation disks of the columns, thirty-six (36) in number, will be built into the concrete, and must be accurately placed by the use of template holed to correspond with the bolt-holes in the iron disks.

○