

Standardized Electrical
Wiring and Fixtures for use
in Seacoast Defense

Corps of Engineers

1909-1915

WAR DEPARTMENT
 UNITED STATES ENGINEER OFFICE
 Second District, New York City
 Room 707, Army Building, 39 Whitehall St.
 New York, N.Y.

EDA/TMM

April 28, 1915.

From: The Board on Standardization of Electrical Wiring and Fixtures for Seacoast Defenses.

To: The Chief of Engineers, U.S. Army.

Subject: Submits report.

1. The following report, superseding that rendered October 3, 1911, is submitted.

2. The Board was constituted by the following order:

"Special Orders)
 No. 56)

War Department,
 Office of the Chief of Engineers,
 Washington, October 11, 1909.

In order to standardize electrical wiring and fixtures in Seacoast Defenses, a Board of Officers of the Corps of Engineers is hereby constituted by the authority of the Secretary of War to meet at the call of the Senior Member at such point as may be selected by him and prepare detailed instructions and specifications for all wiring and fixtures for use in the batteries.

Detail for the Board

Colonel Solomon W. Roessler
 Lieutenant Colonel Edward Burr
 Lieutenant Colonel Harry Taylor
 Captain Hubert L. Wigmore, Recorder.

Upon the completion of the duty assigned them the members of the Board will return to their proper stations.

The travel directed is necessary in the military service.

By command of the Chief of Engineers:

Frederic V. Abbot,
 Colonel, Corps of Engineers."

3. The first meeting was held on December 21, 1909. Notice of this meeting had been given to prominent firms in the vicinity of New York City who were known to be engaged in the manufacture of such articles as the Board had been directed to consider, with an invitation to be represented at the hearing and to be prepared to submit verbally or in writing any views they desired to express upon the subjects under consideration. A number of firms responded to this invitation, and by verbal statements followed by communications in writing, gave the Board the benefit of their experience in their special lines of work. After the hearing the Board canvassed the information which it had obtained at the hearing and from communications from other district officers, and decided upon the particular articles and material which should be considered under the terms of the convening order. After agreeing upon a subdivision of the labor among the individual members, the Board adjourned to meet at some future date.

4. The next meeting was held on June 14, 1910, by which date samples of some of the electric fixtures had been obtained upon which it was necessary that the full Board should pass.

5. The third meeting was held on December 17, 1910. This was intended to be a final meeting, but owing to defects which had been discovered in some of the designs and samples submitted, and to the omission of the important platform light fixture which is intended to replace the temporary fixtures which have been erected at a number of points, a fourth meeting held on May 6, 1911, was necessary. At this last meeting complete drawings and specifications were submitted by the individual members and tentatively adopted by the full Board. Since that date some changes have been made in the plugging-in device. A new design of the emplacement panel box has been prepared so as to permit the use of commercial sizes of panel switches. On October 3, 1911, detail drawings in 36 sheets, were submitted to the Chief of Engineers, and have since been issued to District Engineer Officers (E.D.73171, February 26, 1914). Large quantities of the fixtures adopted by the Board have been purchased since the above date, and from time to time slight modifications in design have been made. The following additional drawings are forwarded herewith, viz:

Additional sheet 37: Lighting of Range-Data Boards.
" " 38: Half shade for niche lights on gun platforms.
" " 39: Plug for type X outlets.

On February 16, 1915, a tracing was submitted to the Chief of Engineers, showing an adapter coupling for type X outlets; this tracing is numbered: "Additional Sheet 13X." The above four additional sheets, together with the 36 sheets referred to above, form the complete set of detail drawings to accompany this report, and it is recommended that they be adopted as standard for use in all sea-coast fortifications.

6. The drawings which form part of this report (forty in number) detail only those parts which are of special design. Commercial articles are designated by catalogue number or are otherwise indicated with sufficient clearness to avoid misunderstanding. The drawings are designed to be complete working drawings of the several articles shown upon them. It is intended that the sheets for any specified article should be sent with the specifications calling for proposals for that article.

7. If purchases are made separately by district offices a large number of prints will be required. If the purchases are made through some one office centrally located, the number of prints required will be very greatly reduced. It is the opinion of the Board that it would be advantageous and economical to make all purchases for a particular class of material through the agency of one office. Circular letter of February 26, 1914 (E.D. 73171) states that the fixtures described herein will be purchased by the Engineer Depot, Washington Barracks, D. C., for issue to District Engineer Officers. A complete set of limit gauges for all screwed parts of fixtures, to insure perfect interchangeability of all similar parts, has been purchased and is in the custody of the District Engineer Officer, SECOND DISTRICT, New York City. These gauges are for the use of Engineer Department inspectors, and are not to be loaned to manufacturers. Without such limit gauges it is practically impossible even with manufacturers of undoubted repute to secure perfect fit. The value of such gauges will be more apparent when it is desired to renew worn or broken parts of fixtures in place.

8. The subject matter under consideration is divided into four topics, marked respectively "A," "B," "C," and "D."

"A"

SPECIAL RULES FOR DISTRIBUTION OF LIGHT AND POWER

IN NEW AND REPAIR WORK

(1) In the construction of new and rewiring of old batteries, the mains for each battery should be led to a central feeder panel or switch-board.

- (2) In constructing new and rewiring old batteries feeder panels for distributing light and power should be installed at, or close to, each battery, and should be placed in the most convenient location, having in mind the possible future installation of reserve generating sets.
- (3) In rewiring old emplacements and constructing new batteries, the general scheme of light and power distribution shown diagrammatically on Sheet 35, and the detailed layout for a twelve-inch emplacement given on Sheet 36 should be followed as closely as practicable. In rewiring old batteries of all calibres and of varying designs, the general idea to be followed can be inferred by the local officer from the Sheets 35 and 36.
- (4) Conduits should not be used for local distribution in emplacements where they can be avoided.
- (5) All wires leading out from the emplacement switchboard should be exposed as far as possible.
- (6) Armored cable should be used for all exposed wiring and lead covered cable for conduits.
- (7) All lighting wires for emplacement distribution will be of No. 12 B. and S. gauge (81 mils).
- (8) Exposed wires will be held from ceilings or walls by cable hangers, to permit the application of preservative coatings.
- (9) Snap switch and plugging-in boxes introduce more points where grounds may occur and should be used only where they cannot well be dispensed with.
- (10) Each emplacement should have its own switch panel box. Two boxes may be used when the number of circuits exceeds the number of switches in the largest box shown on drawings (sheets 1 to 4).
- (11) A single branch lighting circuit may have as much as a 6-ampere load, but not more.
- (12) All fixtures for inside or outside lighting about emplacements should be of the approved standard watertight types.
- (13) Sheet 34 shows a type plan for the distribution of power to the several groups of batteries from a central plant as a guide to district officers in planning a suitable layout for any particular locality. Searchlights may be connected with the central plant when the conditions are favorable, and minor units under favorable conditions may be connected direct to the central plant instead of through the switch-board of a major unit.

"B"

LAMP FIXTURES AND THEIR ACCESSORIES

and

EMPLACEMENT PANEL BOXES

In designing the lamp fixtures and their connecting parts, the members of the Board have had the benefit of their own recent experience on fortification work and of suggestions from other district officers as well as from firms engaged in the manufacture of similar articles. The designs are simple and substantial in construction and generous in dimensions as experience has dictated, but not costly. Some parts of the fixtures are commercial articles and as many

such as possible have been used, special designs being limited to those parts for which commercial designs were not deemed suitable.

The lamp boxes and other bronze castings in this class of material are to be made of a composition metal, as follows:

Copper	not less than	84%
Tin	" " "	3%
Lead	" " "	1.3%
Balance - zinc.		

The exact proportions of the ingredients, subject to the above inferior limits, being left to the discretion of the manufacturer.

This composition makes a smooth, tough casting, machines easily and takes a clean thread. Castings purchased under these specifications have been satisfactory.

The parts included under the above heading are more specifically described as follows:

CEILING LAMP FIXTURE

The assembled parts are shown on Sheet 5. The complete fixture consists of lamp receptacle and lamp (Sheet 5); box (Sheet 6); cover (Sheet 7); guard (Sheet 8); globe (Sheet 9); gaskets (Sheet 10) and from one to four type "X" outlet couplings (Sheet 13).

WALL LAMP FIXTURE

The box for the wall fixture is shown on Sheet 29. The parts required to complete the fixture are the same as for the ceiling fixture and are shown on Sheets 5, 7, 8, 9 and 10.

PLATFORM LIGHT FIXTURE

Sheets 30 to 33 inclusive show the details of the special parts of a platform light fixture which is designed to be placed under the hand rail along the rear of loading platforms of 8", 10", 12" and 14" gun emplacements. Sufficient amount of light will be obtained by three such fixtures for the 8", 10" and 12" emplacements of the older type, and by four fixtures for the 12" and 14" emplacements of the latest type. The parts required to complete the lamp fixture proper are shown on Sheets 5, 7, 8, 9 and 10.

PORTABLE HAND LAMP

Sheets 27 and 28 illustrate the handle, hood and guard of a portable hand lamp, which with the other parts indicated on Sheet 27 make the complete lamp. A plug and box cover of the type shown on Sheet 15 are used with this lamp.

PLUGGING-IN BOX

It includes the standard box (Sheet 6); cover gasket (Sheet 10); type "X" outlet couplings; special cover, receptacle, and plug as illustrated on Sheet 15. The plug and receptacle are controlled by patent and are manufactured by the Conlan Electric Company, 43 Murray Street, New York. This Company does not furnish the standard box (Sheet 6) as a part of its device. This fixture is likely to collect moisture as are other types designed for a like use, and should be used only where necessary.

JUNCTION BOX

The complete fixture includes the standard box (Sheet 6); cover gasket (Sheet 10); cover as shown on Sheet 12; and one to four Type "X" outlet couplings (Sheet 13).

SNAP SWITCH BOX

All emplacement lights should be controlled as far as practicable by the switches in the emplacement panel box. In exceptional cases it may be desirable to control special lights from some other point. To provide for this, the switch box with double pole snap switch, illustrated on Sheet 11, may be used. It consists of the standard box (Sheet 6), cover gasket (Sheet 10), the special parts shown on Sheet 11 and the necessary type "X" outlet couplings. The use of this fixture should be restricted to special cases, where it can not well be dispensed with.

TYPE "X" OUTLET COUPLING

Sheet 13 illustrates the several parts of this coupling. The soft rubber gasket is of the same shape and dimensions as "Type B," shown in General Electric Company's Bulletin No. 4670. The diameter of the hole through the gasket should be such as to fit snugly over the lead sheathing of the cable. As the diameter of the lead sheathing varies slightly between different manufacturers even under the same specifications, that diameter should be ascertained before specifying the diameter of the hole in the gasket. The threads of the coupling should be coated with red lead when they are inserted in the fixtures.

WATERTIGHT SERVICE BOXES WITH FUSES

Two sizes are illustrated on Sheets 17 and 18. They are intended to be inserted in certain lighting and power mains in order to protect the systems against the grounds which frequently occur on the gun carriage. They should be inserted in the lighting and power mains at a point of convenient access and as close to the gun carriage as possible but not in the gun well. They may be advantageously used at other points where protection against probable grounds is desirable. The box shown in the drawings is manufactured by the H. W. Johns-Manville Co., of New York City, and is cheaper than the regular subway types of equal capacities, but is suitable for use in gun emplacements.

TYPE "Y" OUTLET COUPLING

This coupling shown on Sheet 14 is used on the 61-100 ampere Watertight Service Fuse Box (Sheet 18), and on the emplacement panel box when armored feeder cable is used. The rubber gasket is a commercial article, the shape and dimensions being those of General Electric Company's "Type G." See remarks as to diameter of gasket for type "X" outlet couplings.

CABLE HANGER

The galvanizing of the steel wire armor of the cable protects the steel from rust only a very short time. Sooner or later the armor must be painted and in order that this may be thoroughly done, it is necessary to hold the cable a short distance from the wall or ceiling. This is done by means of the cable hanger, illustrated on Sheet 16. The dimensions of the hanger may be varied to suit different size cables. The hanger may be secured to a lead plug which is firmly driven into a hole drilled in the concrete. Scrap lead may be used for making the lead plugs by moulding to the proper diameter and in convenient lengths and then cutting into the particular lengths required to fill the holes as drilled. After the plug is firmly driven into the hole in the wall or ceiling, a starting hole for the brass screw is drilled in the plug. Instead of the lead plugs, expansion shields may be found more satisfactory; especially where the concrete has been made with Rosendale cement. The hangers should be spaced about two feet centers, but may be placed closer together if necessary to prevent sagging in the cable.

PANEL BOX FOR EMPLACEMENT LIGHT DISTRIBUTION

The Type box is illustrated on Sheets 1, 2, 3 and 4. The drawings show details for four, six and eight-circuit panel boxes. Sheet 4 shows the outside dimensions of a four, six and eight-circuit panel. So far as practicable, selection should be made from one of these three sizes. Not more than a six-ampere load should be placed on any one lighting circuit.

The lugs by which the box is secured to the vertical face of a concrete wall are designed to hold the back of the box one inch from the concrete surface so as to permit a free circulation of air all around it and allow the metal to take up more readily the temperature of the surrounding air, thereby reducing and possibly preventing the condensation of moisture on the interior of the box at certain times of the year.

Type "X" outlet couplings will be used for branch circuits leading out from the panel boxes.

The bottom of the box is provided with a large boss which may be tapped for a type Y coupling, when armored feeder cable is used, or for an iron pipe through which the feeder cable is brought into the box, when unarmored cable is used. A satisfactory method of bringing in an unarmored feeder cable is as follows: Provide a 1-1/2" pipe long enough to extend from the box down to a level of six inches below the top of the manhole or hand-hole directly under the box, and screw this pipe into the bottom of the box. Carry the unarmored cable from the manhole through the iron pipe to the box. Pack the space around the cable inside the pipe with a ring of Oakum or cotton waste about six inches below the box and then pour over this packing a hot insulating compound until the compound comes up flush with the inside bottom of the box. A loop about twelve inches long should be left in each conductor of the feeder cable inside the box.

"C"

GENERATOR AND FEEDER PANELS FOR LIGHT AND POWER DISTRIBUTION

The panels described below and illustrated on the accompanying drawings were designed with special reference to the requirements of installations including 25 Kw. Gas Motor Sets, but their application is not limited to such installations. They provide a generator panel for each generating set and as many feeder panels as may be necessary to give room for the required circuit breakers and switches. Panels of the size shown form convenient units for switch board construction, are less likely to be broken in transportation, are easier to install, and permit extensions of any board to be made by the addition of more panels when necessary, better than panels of larger size.

The circuit breaker on each generator panel includes a reverse current feature even when a single panel only is used, as the extra cost of this type of breaker is small, and it provides for future extensions of the board by the addition of other generator panels when necessary to operate sets in parallel without change in the type of the circuit breaker.

Motor circuits are protected by circuit breakers on the feeder panels, while light circuits are protected by fuses only; as the motor circuits may be frequently subjected to heavy momentary overloads due to conditions which automatically readjust themselves, while overloads on light circuits are usually the result of a short circuit or some condition which must be remedied before the current can be safely thrown on the circuit again.

A large number of panels have been purchased in accordance with these specifications, for installation with the 25 Kw. Gas Motor Sets and have been found satisfactory.

Sheet 19 shows a generator panel with feeder panel attached for use with one 25 Kw. Gas Motor Set for emplacement service. The standard generator panel without feeder panel may be used to operate one searchlight.

Sheet 20 illustrates two standard generator panels and one feeder panel to be used when two 25 Kw. Gas Motor Sets are installed together, permitting the parallel operation of both Sets or the individual operation of either.

Sheet 21 illustrates two generator panels for use with two searchlights when two 25 Kw. Gas Motor Sets are installed in the same power house. Either searchlight may be operated from two Sets working in parallel, or from either Set singly; but two searchlights cannot be connected to one Set.

Sheet 22, Sketch A, shows a single generator panel for insular possessions (export), the board being made in three sections to minimize breakage in transit. It may be used without feeder panel for single searchlight.

Sheet 22, Sketch B, shows a single generator panel for use in the United States (domestic), the board being made in two sections. It may be used without feeder panel for single searchlight.

Sheet 22, Sketches C and D, show single feeder panels to be used in emplacements where 25 Kw. Gas Motor Sets have not yet been installed, and where there are no motor circuits. The boards have switches only and no ammeters are provided. When a 25 Kw. Gas Motor Set is installed a standard generator panel may be added to either of these feeder panels.

Sketch C shows a three-section board for export.

Sheet 23, Sketches E, F, G and H, illustrate single standard generator panels with feeder panels for use in emplacements where there are no motor circuits. Switches only are provided on the feeder panels, the size, number and arrangement varying to suit requirements. Board so arranged may be used in six-inch gun, or mortar batteries where there are no motor circuits.

Sheet 24, Sketches J, K and L, show single standard generator panels and feeder panels with switches for lights and circuit breakers for motors. Boards K and L have ammeters on the feeder panel to measure the total motor load. Board J has four circuit breakers and can be installed in a two-gun battery with ammunition hoists (two circuits) and with retracting motors on the gun carriages (two circuits). Boards K and L are used where there are only two motor circuits instead of four. The ammeter on the feeder panel is optional. Its omission provides space for three more 50-ampere switches.

Sheet 25 -- Sketch M shows two standard generator panels and one feeder panel for lighting circuits only. This is suitable for two 25 Kw. Gas Motor Sets operating in parallel.

Sketch N shows two generator panels and one feeder panel supplying light and power to motors. This is suitable for two 25 Kw. Gas Motor Sets operated in parallel.

Sheet 26, Sketches O and P, show two generator panels and two feeder panels supplying light and power to motors. These are suitable for two 25 Kw. Gas Motor Sets operating in parallel. This board may be installed in three-gun batteries where more than four motor circuits are required. One ammeter on one feeder panel may be used to indicate the current used by the retracting motors and the other to indicate the current used by the ammunition hoists.

"D"

INSULATED CABLES

The accompanying specifications are based upon those published in Engineer Mimeograph No. 110, with such modifications as recent experience in the purchase of cable and conferences and correspondence with cable manufacturers suggest to be desirable. One of the principal changes is the incorporation in paragraph 8a, Class 1, and paragraph 8a, Class 2, of a provision under which consideration can be given to an insulating compound which contains no mineral ingredients. Under the specifications given in Mimeograph No. 110 it has not been practicable to entertain proposals for cable whose insulation was of this type. In paragraph 3 the quality of rubber called for has been designated by the trade name so as to remove any doubt as to whether the best quality was called for or not. The same paragraph excludes reclaimed rubber from the balance of the ingredients.

Other changes are such as have been suggested by experience in recent purchases, and do not need special mention here.

S. W. ROESLER

Colonel, Corps of Engineers.

Colonel, Corps of Engineers.

Colonel, Corps of Engineers.

Incls. accomp.

Specification for Rubber Compound (printed booklet)
Specifications, Watertight Lamp Fixtures, etc.
" Standard Generator and Feeder Panels
" Lead Covered Armored Cable
" Flexible Covered Armored Cable
36 tracings (forwarded October 3, 1911).
1 tracing (forwarded February 16, 1915).
3 tracings (herewith)

1198

73171

73171.

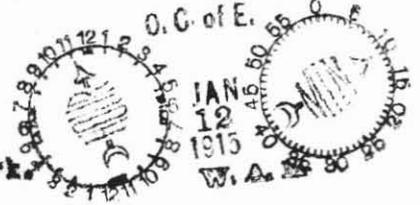
WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
WASHINGTON.

EEW/JVC

January 12, 1915.

From: The Chief of Engineers.

To: District Engineer Officers in Charge of Fortification Work.



Subject: Electric wiring and fixtures for seacoast batteries.

CIRCULAR LETTER:

1. On February 29, 1914, a circular letter was sent to district Engineer officers having charge of fortification work containing a general description and accompanied by drawings of the standard fixtures proposed for seacoast emplacements.

2. It is proposed to give consideration to any modifications that may be necessary, and all officers are therefore requested to submit within ten days after the receipt of this letter any criticisms they may have to make as to the fixtures themselves, the material from which they are made, or the method of installing them, shown on the drawings.

By command of the Chief of Engineers:

Lieut. Col., Corps of Engineers.

Above letter to:

- The District Engineer Officer,
- Portland, Me.,
- Boston, Mass.,
- Newport, R. I.,
- New London, Conn.,
- SECOND DIST., New York City.
- Philadelp. Pa.,
- Baltimore, Md.,
- Washington, D. C.,
- Norfolk, Va.,
- Wilmington, N.C.,
- Charleston, S.C.,
- Savannah, Ga.,
- Jack sonville, Fla.,
- Montgomery, Ala.,
- Mobile, Ala.,

- New Orleans, La.,
- Galveston, Tex.,
- Los Angeles, Cal.,
- Second District, San Francisco, Cal.,
- Second District, Portland, Ore.,
- Seattle, Wash.,
- Engineer Depot, Washington Barracks, D.C.,
- The General Purchasing Officer, Isthmian Canal Commission, Washington, D.C.,
- The Division Engineer,
- Northeast Division, New York City,
- Eastern Division, New York City,
- Southeast Division, Savannah, Ga.,
- Gulf Division, Baltimore, Md.,
- Pacific Division, San Francisco, Cal.,

Circ.Letter - 2.

Northern Pacific Division,
~~San Francisco, Cal.~~ *Portland Oregon.*
The Senior Member,
The Board of Engineers,
New York City.
Lieut. George R. Coethals,
West Point, N.Y.

Copy furnished to:
Chief Clerk, O. C. of E.,
Mr. Van Brakle,
Digest Clerk.

73171

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
WASHINGTON.

ARR-FB

May 7, 1915.

From: The Chief of Engineers.
To: The Officer in Charge, Engineer Depot,
WASHINGTON BARRACKS, D. C.
Subject: Standard fixtures and methods of wiring in seacoast defenses.



1. There is transmitted herewith the final report of the Board of Officers of the Corps of Engineers convened by S. O. No. 56, O. C. of E. 1909.

2. This report had been practically completed in 1911, but due to minor modifications in the design of certain of the fixtures proposed by the Board, to delays in completing specifications for cable, and to additional work placed on the Board, its final submission has been prevented until the present time. The designs for the Standard Fixtures, etc., proposed by the Board had however been made available in 1911, and considerable quantities have already been purchased and distributed to District Engineer Officers, and by circular letter of this office of February 26, 1914, (E. D. 73171), the substance of the Board's report, accompanied by prints of the Board's drawings, were sent to all District Officers in charge of fortification work, and the Engineer Depot at Washington Barracks made the purchasing and distributing agency for these fixtures and for all cables required for battery wiring and power distribution at seacoast defenses.

3. As numerous minor modifications in the design of standard fixtures and methods of wiring are now desirable as a result of experience with these fixtures in the past few years, and as occasional modifications will be required from time to time, it is intended that the Engineer Depot will now undertake and continue the work of the design and modifications in the design of standard fixtures and methods of wiring for seacoast defenses.

4. On January 12, 1915, a circular letter was addressed to District Officers who had had experience with the standard fixtures of the Board's design, requesting the submission of criticisms on the fixtures, or on the methods of installation. The criticisms received are transmitted herewith for consideration by the Depot in connection with the duty imposed upon it in paragraph 3 above.

5. From these criticisms and others which have been advanced, it appears that special consideration should be given to the following:

Junction Box. Providing a lip around the top of the present box so that the covers may be set in flush with the top of the box. Lugs in the back to be made thicker so as to hold the box further out from the surface to which attached. In this connection, attention is invited to the accompanying criticism of the Ordnance Department and drawing submitted by that Department showing its suggestion as to improvement, (E. D. 43814/215).

Wall Lamp Fixture. Same as for Junction Box.

Type X Outlets and Couplings. The use of pipe thread instead of special thread in type X outlets and outlet couplings.

Snap Switch. The addition of a small bead of metal around the edge of the stuffing box in the cover.

Platform Lights. Fixtures similar to those designed for the Defenses of the Panama Canal are considered preferable to those designed by the Board.

Watertight Service Boxes. Omission of the fuse carrier hooks, operating handle, etc.

Cable Hangers. The use of straps in lieu of the standard hanger when several cables are run paralleling each other with small intervals between centers.

Switch Panel Boxes. The use of cast iron, instead of composition metal for these boxes, and also the design of a door which, while watertight, can be opened quicker and more easily.

Switches. That snap switches will be necessary for the several lights around the loading platform so that they may be turned on or off at will. This also includes the portable lights on gun and mortar carriages now provided by the Engineer Department.

6. With these exceptions, the fixtures and the method of their installation, as proposed by the Board, seems to be generally satisfactory and have the approval of this office as is also the case with the fixture submitted by the Depot under date of January 21, 1915, for use with a Helophane shade in plotting rooms or other localities where maximum illumination is desirable but where dampness is not serious.

7. In the work of designing or modifying the design of fixtures and methods of wiring for seacoast defenses, it is desired that as far as possible drawings be made of a uniform size and style, with a view, as indicated hereafter, to their ultimate publication when deemed desirable. All new designs or changes in design of fixtures and methods of wiring will moreover be submitted to this office for approval prior to adoption.

8. It is further desired that the Depot take up the work of preparation of a manuscript embodying the substance of the Board's report, and descriptions of the several standard fixtures finally decided on, together with other appropriate data relative to wiring at seacoast defenses, with a view to its publication in a suitable printed pamphlet for the information and guidance of constructing officers. It is contemplated that this pamphlet will contain all data on the subject of wiring, etc., at seacoast defenses that is now contained in the E. D. file of Mimeographs and their Supplements, and which has not become obsolete, and that this pamphlet will then take the place of these Mimeographs. In this publication, the several fixtures and

their use, as well as typical methods of wiring should be illustrated by line cuts and half tones or both, and the necessary drawings or photographs for this purpose should be provided. In view of the fact that the duty of purchasing practically electrical equipment and materials for seacoast defenses is now made through or by the Engineer Depot, Washington Barracks, D. C., there is no necessity for including in this publication the detailed specifications for the standard fixtures, cables, and other articles of electrical equipment. The manuscript, when completed, should be forwarded to this office for approval. In this connection, attention is invited to the accompanying copy of E. D. 43814/198 relative to portable lights in 2-inch batteries and to the accompanying copy of circular letter of this office dated April 20, 1915, (E. D. 41420) on the subject of lighting and firing circuits for mortar carriages.

9. The Board under date of February 16, 1915, submitted a design for an adapter so as to permit the use of pipe conduit with type X outlets, (E. D. 73171/182), but if, as understood above, pipe threads are adopted for the outlets, there will be no necessity for this adapter. The papers are however transmitted herewith for use in connection with the consideration of this general subject.

10. The Board with its final report submits drawings on additional sheets as follows:

No. 37 Lighting of Range-Data Boards.

No. 38 Half shade for niche lights on gun platforms.

No. 39 Plug for type X outlets.

Of these, No. 38 is hardly believed to be necessary should the several platform lights be provided with snap switches.

11. In addition to the drawings referred to above accompanying the report of the Board, there is transmitted herewith Sheets 1-18 and 27-33 of the Board's drawings, and from the records of this office it appears that Sheets 19-26 and 34-36 were sent informally to the Depot under date of April 14, 1915. The District Engineer Officer, 2nd District, New York City, has been instructed to send all records pertaining to the Board, now in his office, to this office and on their receipt they will be forwarded to the Depot for its files.

By command of the Chief of Engineers:

Incls. 115, 116, 118-120, 127-132, Lieut. Col., Corps of Engineers.
169-172, 174-183, 188, 190-197, 204-206,
photostat copy of 43814/198, and copy of
circular letter of April 20, 1915, ee 41420,
and 43814/216 and drawing (unmarked), and
Standardization Board Drawings 1-18 and 27-33 accomp.

Gr 27-51

UNITED STATES ENGINEER OFFICE

NEWPORT

December 8, 1913.

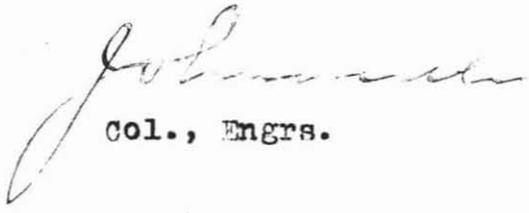
From: District Engineer Officer.

To: The Chief of Engineers.

Subject: Standardization Board lighting fixture specifications and drawings.

1. Reference, letter from this office Oct. 14, 1913, to Officer in Charge, Engineer Depot, Washington Barracks, forwarded to the Chief of Engineers Oct. 20, 1913 (Gr. 27-44). Drawings and specifications, if available, are desired of the form of lighting fixtures designed by the Standardization Board for use in connection with the lighting to be installed on the widened platforms at Battery Hale, Fort Greble, R. I.

NHB-


Col., Engrs.

73171/88

1st ind.

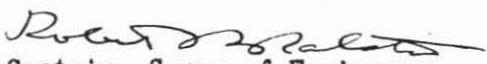
RRR/BHB

Office C. of E., December 13, 1913 - To the District Engineer Officer,
NEWPORT, R. I.

With negatives of the drawings requested. The matter of the purchases should be taken up with the Engineer Depot, Washington Barracks, D. C.

By order of the Acting Chief of Engineers:

Negatives of sheets 5-7, 9, 10,
12, 13, 30, 31 & 33 designed by
Stand. Board in sep. roll.


Captain, Corps of Engineers.

Rec'd back U.S. Engr. Office, Newport R. I. DEC 14 1913

TMM

7/20/30

SPECIFICATIONS
for
WATERTIGHT LAMP FIXTURES AND THEIR ACCESSORIES,
and
EMPLACEMENT PANEL BOXES

(To the form of advertisement and general specifications No. 41, War Department, Office of the Chief of Engineers, U.S. Army, or to other general specifications which may be used if an informal agreement for furnishing the material is to be entered into, should be added the following paragraphs:)

GENERAL SPECIFICATIONS

MATERIAL TO BE FURNISHED. The material to be furnished under these specifications is described in the DETAILED SPECIFICATIONS FOR FIXTURES herewith, and is listed by items in the form of proposal hereto attached.

QUALITY OF MATERIAL. Only articles of the best material and workmanship will be accepted under these specifications.

GUARANTEE. The contractor shall guarantee the workmanship and the quality of all material furnished by him, and shall replace free of expense to the United States, including transportation charges, any part which within one year after delivery shall fail, due to defective workmanship or material.

INSPECTION. The material to be furnished will be subject to inspection by inspectors appointed by the contracting (or purchasing) officer, and these inspectors shall be allowed access to the work at all times and shall be given every possible facility for inspecting the material to be furnished. They will decide all questions connected with the work, but in case of a dispute between the manufacturer and the inspector an appeal will be made to the contracting (or purchasing) officer, whose decision shall be final. The object of the inspection is to ascertain that the material to be furnished is in accordance with the specifications and that it is thoroughly able to perform the work for which it is intended. At the discretion of the contracting (or purchasing) officer inspections will be made during the progress of the work, or a single and final inspection will be made, upon notification by the bidder that the material is completed and ready for such final inspection.

DETAILED SPECIFICATIONS FOR FIXTURES

DESCRIPTION OF MATERIAL. The different styles of fixtures are described below and are shown on the blue prints forming a part of these specifications.

<u>Item</u>	<u>Quantity</u>	<u>Articles</u>
1	_____	<p>Ceiling Lamp Fixtures, complete, shown on Sheets 5, 6, 7, 8, 9 and 10.</p> <p>Bosses will be tapped as follows:</p> <p>One boss on _____ boxes</p> <p>Opposite bosses on _____ boxes</p> <p>Two bosses at 90° _____ boxes</p> <p>Three bosses on _____ boxes</p> <p>Four bosses on _____ boxes</p>
2	_____	<p>Wall Lamp Fixtures, complete, shown on Sheets 5, 7, 8, 9, 10 and 29.</p> <p>Viewed from the front with the lamp downwards, bosses on the box will be tapped as follows:</p> <p>Right hand boss on _____ boxes</p> <p>Left hand boss on _____ boxes</p> <p>Both bosses on _____ boxes</p>
3	_____	<p>Platform Light Fixtures. The complete fixture is shown on Sheets 30 to 33 inclusive. The parts to be furnished for each fixture under these specifications are One box (Sheet 30), two reflectors (Sheets 31 and 32), two covers (Sheet 7) two guards (Sheet 8), two globes (Sheet 9), two globe and two cover gaskets (Sheet 10), two lamp receptacles (Sheet 5) and one steel top plate for regular (or alternate) position (Sheet 32). Galvanized pipe, pipe fittings, straps, braces, bolts and lead washers not to be furnished under these specifications.</p>
4	_____	<p>Portable Hand Lamps, complete, shown on Sheets 27, 28, 5, 7, 8, 9 and 10 with (or without) half shades.</p>
5	_____	<p>Plugging-in Devices, parts shown on Sheet 15, consisting of receptacle, plug, and box cover, patented and manufactured by the Conlan Electric Company, New York City. Diameter of hole through gasket to be _____ inch.</p>
6	_____	<p>Boxes for Plugging-in devices, shown on Sheet 6; with cover gasket, Sheet 10.</p>

<u>Item</u>	<u>Quantity</u>	<u>Articles</u>
7	_____	<p>Junction Boxes, complete, shown on Sheets 6, 10 and 12.</p> <p>Bosses will be tapped as follows:</p> <p>One boss on _____ boxes</p> <p>Opposite bosses on _____ boxes</p> <p>Two bosses at 90° _____ boxes</p> <p>Three bosses on _____ boxes</p> <p>Four bosses on _____ boxes</p>
8	_____	<p>Snap Switch Boxes, complete, shown on Sheets 6, 10 and 11.</p> <p>Bosses will be tapped as follows:</p> <p>One boss on _____ boxes</p> <p>Opposite bosses on _____ boxes</p> <p>Two bosses at 90° _____ boxes</p> <p>Three bosses on _____ boxes</p> <p>Four bosses on _____ boxes</p>
9	_____	<p>Type X Outlet Couplings, complete, shown on Sheet 13.</p> <p>Diameter of hole through gasket to be _____ inch.</p>
10	_____	<p>Type Y Outlet Couplings, complete, shown on Sheet 14.</p> <p>Diameter of hole through gasket to be _____ inch.</p>
11	_____	<p>Watertight Service Box with Fuses, 0 to 30 ampe., of pattern shown on Sheet 17, or its equal.</p> <p>Two _____ ampere fuses to be placed in, and two extra fuses to be furnished with each box.</p>
12	_____	<p>Watertight Service Box with fuses, 61 to 100 ampe., of pattern shown on Sheet 18, or its equal.</p> <p>Two _____ ampere fuses to be placed in, and two extra fuses to be furnished with each box.</p>
13	_____	<p>Cable Hangers, with screws, shown on Sheet 16, with diameter of hole to fit cable of _____ inch diameter over armor.</p>
14	_____	<p>Switch Panel Boxes, complete, with panels, switches and fuses as shown on Sheets 1, 2, 3 and 4.</p> <p>_____ boxes to have four circuits.</p> <p>_____ boxes to have six circuits.</p> <p>_____ boxes to have eight circuits.</p> <p><u>Note:</u> Plug fuse switch panels of equal quality may be substituted for that shown on Sheet 4, if approved by the purchasing officer.</p>
15	_____	<p>Adapter couplings, shown on Sheet 13X, female end tapped for _____ inch pipe.</p>
16	_____	<p>Half shades for niche lights shown on Sheet 36.</p>
17	_____	<p>Plugs for type X outlets, shown on Sheet 40.</p>

DIMENSIONS. Dimensions and other specifications noted on the drawings are to be considered a part of these specifications, and must be closely followed.

COMPOSITION. The composition from which the bronze castings are made is to be as follows:

Copper	not less than	84%
Tin	" " "	3%
Lead	" " "	1.3%
Balance	Zinc.	

Subject to the above inferior limits, the exact proportions of the ingredients are left to the discretion of the contractor.

GASKETS. The rubber used for all gaskets shall be equal to U.S. Navy standard, specification 33 R1a, containing 45% Para rubber.

GAUGES. Screw holes must be carefully spaced and all threaded parts must be made to gauges, so as to insure perfect interchangeability between all similar parts. Threaded portions of globes, globe guards, lamp fixture covers, outlet couplings, adapters, portable hand lamp outlet, switch box cover and outlets for types X and Y couplings, must pass the U. S. Engineer Department Limit Gauges for lighting fixtures, as indicated on the drawings.

These gauges may be inspected at the U.S. Engineer Office, Room 707, Army Building, New York City, but will not be loaned to manufacturers.

SAMPLES. As soon as practicable after receipt of the award the contractor shall make a sample of each item to be furnished, complete (except panel box), and express it prepaid to the address given in the advertisement above for the inspection and approval of the purchasing officer. The finish and workmanship and fit of the balance of each item shall be equal in every respect to the sample submitted. It is suggested that samples be submitted before completing the items which they represent.

PATENTED ARTICLES. The United States will not be responsible for the use of any patented article, process or appliance.

ASSEMBLY. Before shipment, each fixture shall be assembled complete in order to insure perfect interchangeability of similar parts and to permit the removal of any minor defects that may be found to exist.

PACKING. The material shall be packed in good boxes bound with strap iron. Globes may be shipped in barrels bound in a similar manner. (If for export, all boxes shall be new boxes of not less than 3/4 in. stock, reinforced at ends and bound with strap iron.)

P R O P O S A L

_____.
(Place)

_____.
(Date)

(Purchasing Officer)

(Address)

Sir:

In accordance with your advertisement of _____, inviting proposals for furnishing watertight fixtures and accessories, and subject to all the conditions and requirements thereof, and of your specifications of same date, copies of both of which are hereto attached, and, so far as they relate to this proposal, are made a part of it, we (or) I propose to furnish:

<u>Item</u>	<u>Quantity</u>	<u>Article</u>	<u>Unit Price</u>	<u>Total</u>
1 (a)	_____	Ceiling Lamp Fixtures; one outlet	\$ _____	\$ _____
(b)	_____	" " " ; opposite outlets	_____	_____
(c)	_____	" " " ; two outlets at 90°...	_____	_____
(d)	_____	" " " ; three outlets	_____	_____
(e)	_____	" " " ; four outlets	_____	_____
2 (a)	_____	Wall Lamp Fixtures; right hand outlet	_____	_____
(b)	_____	" " " ; left hand outlet	_____	_____
(c)	_____	" " " ; two outlets	_____	_____
3	_____	Platform Light Fixtures	_____	_____
4	_____	Portable Hand Lamps	_____	_____
5	_____	Plugging-in Devices	_____	_____
6 (a)	_____	Boxes for Plugging-in Devices; one outlet ...	_____	_____
(b)	_____	" " " " ; opposite outlets	_____	_____
(c)	_____	" " " " ; two outlets, 90°	_____	_____
(d)	_____	" " " " ; three outlets..	_____	_____
(e)	_____	" " " " ; four outlets ..	_____	_____
7 (a)	_____	Junction Boxes; one outlet	_____	_____
(b)	_____	" " " ; opposite outlets	_____	_____
(c)	_____	" " " ; two outlets, 90°.....	_____	_____
(d)	_____	" " " ; three outlets	_____	_____
(e)	_____	" " " ; four outlets	_____	_____

<u>Item</u>	<u>Quantity</u>	<u>Article</u>	<u>Unit Price</u>	<u>Total</u>
8 (a)	_____	Snap Switch Boxes; one outlet.....	€ _____	\$ _____
(b)	_____	" " " ; opposite outlets	_____	_____
(c)	_____	" " " ; two outlets, 90°.....	_____	_____
(d)	_____	" " " ; three outlets	_____	_____
(e)	_____	" " " ; four outlets	_____	_____
9	_____	Type X Outlet Couplings	_____	_____
10	_____	Type Y " "	_____	_____
11	_____	Watertight Service Boxes (small size); with fuses, and two extra fuses	_____	_____
12	_____	Watertight Service Boxes (large size); with fuses, and two extra fuses	_____	_____
13	_____	Cable Hangers, with screws	_____	_____
14 (a)	_____	Switch Panel Boxes; with fuses; four circuit	_____	_____
(b)	_____	" " " ; " " ; six "	_____	_____
(c)	_____	" " " ; " " ; eight "	_____	_____
15	_____	Adapter Couplings	_____	_____
16	_____	Half Shades	_____	_____
17	_____	Plugs for Type X Outlets	_____	_____

Aggregate € \$

Material will be manufactured at _____.
 Material will be delivered f.o.b. (f.a.s.) at _____.
 We (or) I make this proposal, etc.

(Signature) _____
 (By) _____
 (Address) _____

SEP 13 1918

File 76680/1
In 5 sheets (#1)WAR DEPARTMENT
GENERAL ENGINEER DEPOT
SEACOAST PURCHASING DEPARTMENT
U. S. ARMY.

1438 U St., N. W., Washington, D. C.

(Date) August 26th, 1918.

ENGINEERING ADVICE #6.

SUBJECT:- Engineer Department Standard Lighting Fixtures for Seacoast Fortifications.

1. Following is a list of Part Numbers which has been assigned to the various Standard Engineer Department Fixtures.

2. It is requested that the part numbers be used on all requisitions calling for the fixtures and that all depot records have this number recorded.

3. In submitting requisitions for parts S.F. #1 to #4 inc. and #8 to #10. inc., the number of outlets and thread (if special) should be specified. If the thread is not specified the boxes will be considered drilled and tapped for Type X outlet coupling (S.F. 16).

The location and sizes of the main outlet and the number of branch circuits and outlets should be stated for Switch Panel Boxes (S.F. 13.) Example - For 6 - Ceiling Lamp Fixtures with guards drilled and tapped, 2-way with outlets at 90° for Type X Couplings,

Specify:- 6 - S.F. 1 - 2-way 90°.

For 1 - Switch Panel Box with 10 circuit panel and main outlet drilled and tapped for Type Y Outlet Coupling.

Specify:- 1 - S.F. 13 - 10 circuit, main D&T for S.F. 17.

<u>Part No.</u>	<u>Description</u>	<u>Shown on</u>
S.F. 1	Ceiling Lamp Fixture, with guard.	Sheet 5
S.F. 2	Ceiling Lamp Fixture, with shade.	A-137
S.F. 3	Wall Lamp Fixture, with guard.	-
S.F. 4	Wall Lamp Fixture, with shade.	-
S.F. 5	Platform Light Fixture.	Sheets 32 & 33
S.F. 5a	Platform Light Fixture (hand rail offset).	Sheets 32 & 33
S.F. 6	Combined Lamp and Switch Fixture.	179-C
S.F. 7	Portable Hand Lamp.	Sheet 27
S.F. 8	Snap Switch Box.	Sheet 11
S.F. 9	Junction Box.	Sheet 6
S.F. 10	Plugging-in-Box, complete with plug.	Sheet 15
S.F. 11	Plug, complete for plugging-in-box.	Sheet 15
S.F. 12	Receptacle complete for plugging-in-box.	Sheet 15
S.F. 13	Switch Panel Box, complete with Panel etc.	Sheets 1 to 4
S.F. 14	Service Box, Type X.	Sheet 17
S.F. 15	Service Box, Type Y.	Sheet 18
S.F. 16	Coupling Outlet, Type X.	Sheet 13
S.F. 17	Coupling Outlet, Type Y.	Sheet 14
S.F. 18	Adapter Coupling for Type X Outlet.	Sheet 13X

E. A. #6.

<u>Part No.</u>	<u>Description</u>	<u>Shown on</u>
S.F. 19	Plugs, Brass, for Type X Outlets.	Sheet 39
S.F. 20	Half Shade	Sheet 38
S.F. 101	Box for S.F. 1,2,8,9 and 10.	Sheet 6
S.F. 102	Cover for S.F. 1 to 5a inc., 6 and 7	Sheet 7
S.F. 103	Screws, Cover, for 102 (4 per) (#8-32, 5/8 F.H. Br.)	Sheet 7
S.F. 104	Guard, Globe, for S.F. 1, 3, 5, 5a, 6.	Sheet 8
S.F. 105	Globe for S.F. 1, 3, 5, 5a, 6.	Sheet 9
S.F. 106	Gasket, Cover, for S. F. 102.	Sheet 10
S.F. 107	Gasket, Globe, for S. F. 105	Sheet 10
S.F. 108	Receptacle, Lamp, for F. S. 1 to 7 inc.	Sheet 5
S.F. 109	Screws, for S. F. 108 (2 per) (#8-32, 7/8" R.H. Br.)	Sheet 5
S.F. 201	Shade Holder for S. F. 2,4.	Dr. 137
S.F. 202	Shade for S.F. 2,4.	B-370-1
S.F. 301	Box for S.F. 3,4.	Sheet 29
S.F. 501	Box for S.F. 5.	Sheet 30
S.F. 502	Reflector for S. F. 5.	Sheet 31
S.F. 503	Plate, Top, for S. F. 5 (10" x 21").	Sheet 32
S.F. 504	Plate, Top, for S.F. 5a (9" x 21").	Sheet 32
S.F. 505	Bolts, Br., Hex. Head and Nut, (12 per) (1/4"x1-1/2" for S.F. 5 and 5a).	Sheet 32
S.F. 506	Bolts, Tap, 3/8" x 3/4" for S. F. 5 and 5a.	Sheet 32
S.F. 507	Bolts, 3/8" x 1-1/4" with nuts for S.F. 5 and 5a.	Sheet 32
S.F. 508	Washers, lead, for S.F. 5 and 5a.	Sheet 32
S.F. 601	Box for S.F. 6.	181-B.
S.F. 602	Cover, Switch, for S.F. 601.	182-B
S.F. 603	Gasket for S.F. 602.	183-B
S.F. 604	Cover Blank for S.F. 6,9.	Sheet 12
S.F. 605	Screws for S.F. 604, (4 per) (#8-32, 1/2" Rd. Hd. Br.)	Sheet 12
S.F. 606	Switch for S.F. 6.	181-B
S.F. 607	Mica for S.F. 606.	181-B
S.F. 608	Screws for S.F. 605 (#8-32, 3/4" R.H. Br.)	181-B
S.F. 609	Handle Switch for S.F. 606.	182-B
S.F. 610	Screw Plug for S.F. 609.	182-B
S.F. 611	Gasket for S.F. 609.	182-B
S.F. 612	Washer, Brass for S.F. 611.	182-B
S.F. 613	Reflector for S.F. 6.	184-B
S.F. 614	Hook Bolt for S.F. 613.	184-B
S.F. 615	Wing Nut for S.F. 614.	184-B

E.A. #6.

<u>Part No.</u>	<u>Description</u>	<u>Shown on</u>
S.F. 701	Handle for S. F. 7.	Sheet 27
S.F. 702	Cap for S. F. 701.	Sheet 27
S.F. 703	Washer for S.F. 701.	Sheet 27
S.F. 704	Gasket for S.F. 701.	Sheet 27
S.F. 705	Hood for S. F. 701.	Sheet 27
S.F. 706	Screws for S. F. 701, (4 per) (#8-32, 1/2" F.H.Brass).	Sheet 27
S.F. 707	Screws for S.F. 705 (2 per) (#8-32, 1/4" F.H. Brass).	Sheet 11
S.F. 708	Screws, Set, for S.F. 705 (3/8" diam. x 3/4").	Sheet 11
S.F. 709	Gasket for S. F. #705.	Sheet 11
S.F. 710	Guard, Globe, with one half shade for S. F. 7.	Sheet 28
S.F. 801	Cover for S. F. 8.	Sheet 11
S.F. 802	Handle Switch S. F. 8.	Sheet 11
S.F. 1101	Body, Bronze, for S.F. 11.	Sheet 15
S.F. 1102	Nut, for gasket, for S.F. 11.	Sheet 15
S.F. 1103	Washer, friction, for S. F. 11.	Sheet 15
S.F. 1104	Gasket, cable, for S.F. 11.	Sheet 15
S.F. 1105	Interior Fitting, S. F. 11.	Sheet 15
S.F. 1106	Gasket, Sheet Rubber, S.F. 11.	Sheet 15
S.F. 1107	Rubber Ring, Soft Rubber, S.F. 11.	Sheet 15
S.F. 1108	Screws, Brass, #6-32, R.H.	Sheet 15
S.F. 1109	Screws, Brass, #8-32.	Sheet 15
S.F. 1110	Screws, Brass, #6-32.	Sheet 15
S.F. 1201	Cover for S.F. 12.	Sheet 15
S.F. 1202	Valve with rawhide packing ring for S.F. 12.	Sheet 15
S.F. 1203	Spring Coil for S. F. 12.	Sheet 15
S.F. 1204	Mica Ring for S.F. 12.	Sheet 15
S.F. 1205	Interior Fitting, complete, for S.F. 12.	Sheet 15
S.F. 1206	Strap Supporting for S.F. 12.	Sheet 15
S.F. 1207	Screws, Brass (#8-32) for S.F. 12.	Sheet 15
S.F. 1208	Screws, Brass (#10-32) for S.F. 12.	Sheet 15
S.F. 1209	Screws, Brass (#8-32) for S. F. 12.	Sheet 15
S.F. 1301	Box for S.F. 13.	Sheet 2
S.F. 1302	Cover for S. F. 13.	Sheet 2
S.F. 1303	Padlock for S. F. 1301.	Sheet 1
S.F. 1304	Wing Nuts for S.F. 1301.	Sheet 1
S.F. 1305	Gasket for S. F. 1301.	Sheet 3
S.F. 1306	Panel Board for S. F. 13.	Sheet 4
S.F. 1307	Fuses for S. F. 1306.	Sheet 4
S.F. 1308	Receptacles, fuse, for S. F. 1307.	Sheet 4
S.F. 1309	Switches for S. F. 1306.	Sheet 4
S.F. 1310	Terminal Nuts for S.F. 1308.	Sheet 4
S.F. 1311	Screws, Supporting, for S.F. 1306 #18-18, 1-3/8" R.H. with brass washer 1/16" x 3/4")	Sheet 4

E. A. #6

<u>Part No.</u>	<u>Description</u>	<u>Shown on</u>
S.F. 1401	Box Cover and Gasket, complete for S.F. 14.	Sheet 17
S.F. 1402	Fuse Block, porcelain, for S.F. 14.	Sheet 17
S.F. 1403	Scrows for mounting S.F. 1402.	Sheet 17
S.F. 1404	Terminal Scrows for S.F. 1404.	Sheet 17
S.F. 1405	Fuses, enclosed, for S.F. 1402.	Sheet 17
S.F. 1501	Box, cover and gasket, complete, for S.F. 15.	Sheet 18
S.F. 1502	Fittings, Conduit, for S.F. 15.	Sheet 18
S.F. 1503	Gasket Rubber for S.F. 1502.	Sheet 18
S.F. 1504	Scrows for S.F. 1502 (8-#12-24 x 5/8", R.H., Brass)	Sheet 18
S.F. 1505	Fuse Block, porcelain, for S.F. 15.	Sheet 18
S.F. 1506	Scrows for mounting S.F. 1505 in box.	Sheet 18
S.F. 1507	Fuses, enclosed, for S.F. 1505.	Sheet 18
S.F. 1601	Nipple for S.F. 16.	Sheet 13
S.F. 1602	Cap for S.F. 16.	Sheet 13
S.F. 1603	Washer, Brass, for S.F. 16	Sheet 13
S.F. 1604	Gasket, Rubber, 5/8" hole, for S.F. 16.	Sheet 13
S.F. 1605	Washer, Lead, for S.F. 16.	Sheet 13
S.F. 1701	Nipple for S.F. 17.	Sheet 14
S.F. 1702	Cap for S.F. 17.	Sheet 14
S.F. 1703	Washer, Brass, for S.F. 17.	Sheet 14
S.F. 1704	Gasket, Cable, for S.F. 17.	Sheet 14

4. Sizes of Cable Hangers for Armored Cable is shown on G.E.D. drawing No. 168-C. These hangers should be specified by number shown in second column.

Following are the sizes of cable when manufactured under standard specifications that the hangers ordinarily will take:

<u>Hanger No.</u>	<u>Size of Cable B&S</u>		<u>Gauges, Inches</u>	
	<u>Single</u>	<u>Duplex</u>	<u>Maximum</u>	<u>Minimum</u>
0	-	12	31/32	29/32
1	-	10	1-1/8	1
2	1/0	8	1-1/4	1-1/8
3	-	-	1-3/8	1-1/4
4	3/0	6	1-1/2	1-3/8
5	4/0	4 to 2	1-3/8	1-1/2
6	-	-	1-3/4	1-5/8
7	-	1/0	1-7/8	1-3/4
8	-	2/0	2	1-7/8
9	-	-	2-1/8	2

File 76680/1
In 5 sheets (#5)

E. A. #6

By direction of General Engineer Depot Officer:

N. B. KEELER,
Captain, Engineers, U. S. A.

Copies in duplicate to:

Engineer Depot #1
Seacoast Accounting Department.
District Engineers in charge of
Fortification Works (together
with one copy of standard
drawings of fixtures and one
copy of "Specifications on
Watertight Lighting Fixtures
and Accessories No. 1, G.E.D.,
June 1918").

FIG. 3

Proposed modification of out of coupling cover and removal of rubber gasket



FIG. 2

Proposed modification of out of coupling cover and removal of rubber gasket

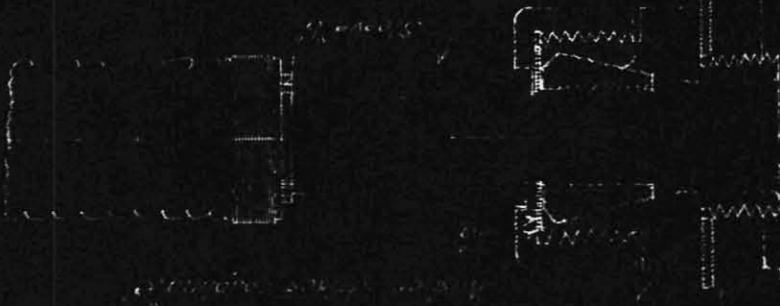
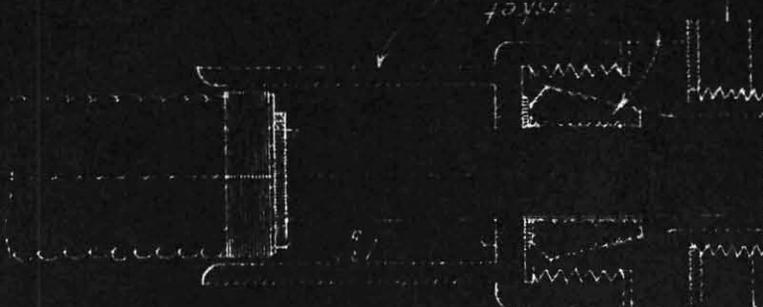


FIG. 1

Proposed modification of out of coupling cover and removal of rubber gasket



Wrapper on E.D. 38963/80

CHIEF OF ENGINEERS

38963

SEP 13 1910

WAR DEPARTMENT

1st

WAR DEPARTMENT

OFFICE OF THE

August 27, 1910.

Respectfully referred to Colonel S. W. Roessler, Corps of Engineers, senior member, Board on wiring and fixtures for seacoast batteries, with request for remark as to the wiring proposed.

By command

[Signature]

Major

38963/80-82 accomp.

38963

80-82

and 12 addl

incs. (bps) accpy

[Signature]

F

SWR/D 2nd indorsement.

UNITED STATES ENGINEER OFFICE,

Room 707, Army Building,

NEW YORK CITY. Sept. 2, 1910.

1. Respectfully returned to the Chief of Engineers, U.S.A.

2. While lead-covered cable is most suitable for drawing into conduits, it is not equally adapted to the interior exposed wiring of batteries; for the latter, an iron armored cable is recommended, and for the smaller batteries at Fort Dade a #14 wire will be large enough. #14 iron armored cable can be purchased in the market at \$150 per 1000 ft.

3. As regards fixtures: It is suggested that those that have been tentatively developed under the direction of the Board for standardizing electrical fixtures be used. Here with are 12 blue-prints showing the fixtures so far as they have been developed in this office, along the lines indicated by the Standardization Board. The details have not been passed upon and approved by the Board as yet. An order for a number of fixtures has been placed by this office and to be filled in the near future, with a view to developing any possible defects in design before calling the Standardization Board in further meeting. Should the fixtures of the type indicated herein be purchased they will be conformable to, or will not dif-

fer far from those the Board is likely to adopt. Complete lighting fixtures from the plans indicated, can be purchased, delivered in New York, at about \$2.75 each.

4. The use of snap or base switches has been considered by the Board which has recommended, in a preliminary report, that no switches of that kind be used unless absolutely necessary, a distributing panel box with branch leads to several groups of lights being preferred.

[Signature]

Colonel, Corps of Engineers.

1 inclos. herewith;
2 b.pts. returned;
12 addl. b.pts.)
sep. roll.

UNITED STATES ENGINEER OFFICE

SECOND DISTRICT

321 CUSTOM HOUSE
PORTLAND, OREGON

Def. 760/652.

JFMc-LEA

April 28, 1913.

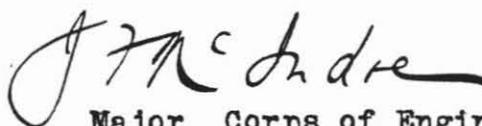
From: The District Engineer Officer,
SECOND DISTRICT, PORTLAND, OREGON.

To: The Chief of Engineers, U. S. Army,
Washington, D. C.

Subject: New type of Cable Hanger.

1. In reply to Circular Letter from the Office of the Chief of Engineers dated April 19, 1913 (E. D. 73171), I have to report that no record can be found in this office of any type of cable hanger having been recommended by the Board on Standardization of Electrical Fixtures or supplied for use in the fortifications of this district.

2. A type of cable hangers that has given satisfactory service in this district is shown in James B. Clow & Sons Catalogue (C) as No. B-528. These hangers are fastened to the concrete wall or ceiling with ~~*~~ flat head wood screws turned into ~~*~~ lead composition expansion shields.



Major, Corps of Engineers.

ENGINEER DEPOT
UNITED STATES ARMY
WASHINGTON BARRACKS, D. C. Nov. 1, 1913.

From: The Officer in Charge, Engineer Depot.

To: The Chief of Engineers, U. S. Army.

Subject: Furnishing of standard lighting and wiring fixtures for fortifications.

1. Some time ago the F. H. Lovell & Company furnished a number of standard fixtures for fortifications. Some of these were ordered by Colonel Roessler's office, some by the Engineer Depot. The Engineer Depot requested Colonel Roessler to inspect their fixtures, knowing that his man was to make a similar inspection. This inspector applied to the material a set of gauges in the possession of the New York office. The result of the inspection was a large number of rejections. This caused the President of the F. H. Lovell Company to try to find some way whereby his factory could build the material according to specifications at a reasonable figure. Early last month the inclosed letter with its inclosures was received from Mr. Callender. In addition Mr. Callender called at the Depot a few days ago and discussed the matter.

2. In Colonel Roessler's letter to the F. H. Lovell Company he states:

"In a circular letter recently received from the Chief of Engineers it appears that future purchases of the fixtures in question will be made by the "Engineer Depot, Washington Barracks, D.C." and from there distributed to the various Engineer Districts throughout the country."

This evidently refers to circular letter from the Chief of Engineers dated September 18, 1913, on the subject "Issues to the Artillery on requisitions." In paragraph eight of this letter, sub-head (e), appears "Standard lighting and wiring fixtures for fortifications". Although the circular letter in which the quoted words appear refers only to Artillery requisitions, the use of such words justifies the assumption which Colonel Roessler has apparently made. On the other hand, no directions or instructions have been issued as far as is known to this office, which directs District Engineer Officers to obtain material for standard lighting and wiring fixtures for fortifications through the Engineer Depot.

3. It is only by one office making all the purchases of such material that the difficulties pointed out by Mr. Callender can be overcome. Such a policy apparently is not followed, for in talking with Mr. Callender he referred to an incident which occurred within the last two or three months where a certain manufacturer offered to supply the Philadelphia office with a panel

box for some \$37.00, which panel box Mr. Callender claimed should cost over \$75.00, as it was absolutely impossible to manufacture it in accordance with the standard drawings for anything near \$37.00. This indicates that one District Officer at least is purchasing material in piecemeal. It is not known whether the Philadelphia office will call upon the New York office to make the inspection, but unless the inspection is made by the New York office, it is more than likely that the box furnished by the unfortunate bidder will not be of the same standard as the Standardization Board's drawings call for.

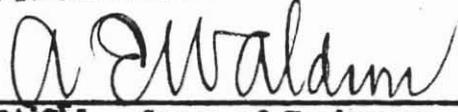
4. There is no doubt that all purchases of standard material should be made by one office and each purchase should be made in sufficient quantities to justify the cost of proper inspection. The results of improper inspection are not always evident or noticeable. The Depot, however, has recently had such experience. It has been called upon to buy cable in piecemeal lots. The amount of cable on individual orders would not be sufficient to justify the maintaining of an inspector at the factory; so, to keep down the expense, inspection either has been waived and the manufacturer required to give an affidavit as to composition of compound, etc., or only some special point has been inspected, such as witnessing the mixing of the rubber compound. In all of this action, which had for one of its objects that of keeping the manufacturer guessing as to what process of manufacture would be inspected, the Depot never thought of inspecting the completed cable for the purpose of observing the manner in which the armor was placed. In the case where some cable was delivered to the Depot recently, during a casual examination it was noticed that the armor wires were very loosely applied. In fact, so loosely that the value of the armor was entirely lost. The incident only shows the necessity of keeping close watch on the manufacturer.

5. To get back to the question of gauges, it seems that the best way to handle this matter would be to purchase in one lot a sufficient amount of material, possibly \$10,000.00 worth, which would justify the manufacturer in purchasing a set of gauges. As Colonel Roessler states, the only set of gauges in the Government's possession should not be loaned to the manufacturer. The possession by the Government of a duplicate set of gauges would be unsatisfactory, for in the competition for business two or three manufacturers of fixtures may be filling orders for the Government at the same time, and each would want the duplicate set in his possession. The manufacturer who had the duplicate set would find all the excuses he could for ^{not} relinquishing the possession of the set, if for no other reason than to incommode his competitor. The Depot is of the opinion that purchases of spare fixtures and cable to be used about a fortification, whether it be supplied to fill Artillery requisitions, or whether it is to be used in new constructions, should be purchased by one office. It is believed that the Depot, especially the Seacoast Defense Section thereof, is the natural office to make such purchases. The inspector employed on this class of work by Colonel Roessler, as well as the set of gauges in his possession, should be transferred to the Depot. It is also believed that New York City is the proper locality from which to make such purchases and inspections.

6. The Depot recommends that, if it can possibly be arranged, the next purchase of standard fixtures be in large quantities, totaling perhaps \$10,000.00, and all purchases thereafter be in similar quantities, so that the manufacturer can spread the cost of his gauges over a large number of fixtures. If such a

course is followed the manufacturer who obtained the first business would have a slight advantage over other manufacturers in subsequent business, but that advantage would not be so great as to destroy serious competition. The situation would in a way be advantageous to the Government, for it would be more probable that the same quality or standard of material would be furnished in filling future orders.

FOR & IN THE ABSENCE OF LT. COL. JOSEPH E. KUHN, CORPS OF ENGINEERS.


Maj. Gen., Corps of Engineers.

3 incls.

73171/82

1st ind.

RRR/BHB

Office C. of E., March 11, 1914 - To the Engineer Depot, WASHINGTON BARRACKS, D.C.

1. By the 21st Supplement to Mimeograph No. 50 (Serial No. 501), Par. 3, the duty of procuring the fixtures, cables, etc., to complete the wiring under G.O. No. 1, W. D., 1913, was assigned to the Depot.

2. By Circular letter of September 18, 1913 (E.D. 88612), standard lighting and wiring fixtures requisitioned by the Artillery are to be furnished by the Depot.

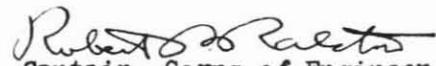
3. By Circular letter of February 26, 1914 (E.D. 73171) standard fixtures and cables for wiring new or requiring old batteries will be procured by District Officers through the Engineer Depot.

4. This office concurs in the desirability of making purchases of standard fixtures, etc., for stock in large lots, but the quantities that can be purchased at any one time, being dependent on the availability of funds may often, of necessity, fall considerably below the \$10,000 worth recommended in Paragraph 6 of the foregoing communication.

5. The statement in Par. 5 of the foregoing letter to the effect that the inspector employed by Colonel Roessler, and the set of gauges in his possession, should be transferred to the Depot, and that New York City is the proper locality to make purchases, etc., are not understood.

By command of the Chief of Engineers:

Incls. 83-85 accomp.


Captain, Corps of Engineers.

MAR 12 1914 S. O. S., Eng. Depot, Wash. Bks., D. C.

Engineer Depot, Washington Barracks, D.C., March 18, 1914 - To Chief of Engineers

1. As bearing upon this subject, a letter received from Colonel Roessler is quoted below:

"From: The District Engineer Officer, SECOND DISTRICT, New York City.

To: The Officer in Charge, Engineer Depot, Washington Barracks, D.C.

Subject: Six-circuit panel box, Engineer Dept. standard.

1. Your letter of the 3rd inst. relating to the above, received.

2. This matter was taken up with a member of the firm of Russell & Stoll, who is at present furnishing a large order of Engineer standard lighting fixtures for Battery Merritt and he states that under the existing method of purchasing these fixtures in small lots at varying intervals of time, it is not possible for manufacturers to furnish them at lower prices and in the case of the one panel box with cable couplings, in question, there are numerous reasons for the high price, some of which are:

a. A special composition of metal is required, such as is not used for ordinary commercial work; this requires extra work in the foundry consisting of the cleaning of a furnace and special care to guard against a defective casting, all of which increases the cost of the casting per pound.

b. The casting of say six boxes would take but little more time than for one and the time of the furnace and men would be distributed over the larger number of boxes; this also applies to the cost of the pattern.

c. The possibility of a mistake in machining or assembling which would cause rejection of the finished box and the consequent loss therefrom must be considered.

d. The cost of routing an order for one box through a shop would be practically the same as for a quantity.

e. The cost of the panel is a very small part of the whole and no substantial saving would be affected by purchasing them separately.

f. A box made of cast iron would cost about 20% less than bronze but if made of the former the box would need to be of thicker metal; this saving might be worth considering on a quantity of boxes.

3. It is not thought advisable for the Department to own the patterns for any of the fixtures, as they would be a constant source of trouble and expense.

4. The couplings, lock and panel for this box will cost about \$20.00, the pattern \$10.00 (this seems a low figure), the casting about \$15.00, leaving \$77.00 for machining, assembling and shipping; this is an unreasonable proportion but is explained by par. 5.

5. As all material of this class is to be purchased by the Engineer Depot it is suggested that a solution of the matter lies in the making of a yearly contract, after advertising, stating a minimum quantity to be purchased and reserving the right to increase the quantity. This method of purchasing would probably secure greater competition in bidding and lower prices.

It also seems advisable to have the limit gauges for these fixtures transferred to the custody of the Depot.

S. W. ROESSLER,
Colonel, Corps of Engineers."

2. The only way in which the inconsistency noticed in paragraph 5 of the preceding indorsement can be removed, is to assume that a somewhat indirect recommendation was made to move the Seacoast Defense Section of the Depot to New York. This was the intention of the party composing the letter.

aw
3 inclos.

Joseph O. Kubu
Lt. Col., Corps of Engineers.

~~ENGR. OFFICE CHIEF OF ENGINEERS~~ MAR 20 1914

73171/82

3d Ind.

EB-FF

Office C. of E., March 23, 1914 - To the Engineer Depot, WASHINGTON BARRACKS, D. C.

1. The matter of the most economical method of making purchases of these fixtures should be brought up in connection with the submission of the project called for by letter of this office of February 13, 1914 (E.D.91372).

2. Recommendations are requested in reference to the transfer of the set of limit gauges to the Engineer Depot.

3. It is not intended to transfer the Seacoast Defense Section of the Depot to New York.

By command of the Chief of Engineers:

MAR 25 1914 S. O. S., Eng. Depot, Wash. Bks., D. C.

Inclos. 83-85 accomp.



Tim R...
Colonel, Corps of Engineers.

Engineer Depot, Washington Bks., D.C., Mar. 30, 1914 -To the Chief of Engineers.

1. The data called for by E.D. 91372, dated February 13, 1914, can be best prepared by one individual connected with the Seacoast Defense Section of the Engineer Depot. The lists called for will be furnished as soon as practicable under the circumstances. When furnished, a recommendation will be made as to the size of lots in which purchases should be made.

2. In connection with the transfer of the gauges from New York to the Engineer Depot, Colonel Roessler was advised, in reply to the letter quoted in the second indorsement, as follows:

"4. In reference to the last sentence of your letter it would seem that as long as the usual successful bidders for standard fixtures remain those whose places of manufacture are in the near vicinity of New York, the gauges should remain in New York. For even if an inspector from the Depot made the inspections it would not appear advisable to transport the gauges back and forth between New York and Washington. Then too, unless the practice is becoming objectionable to you, the Depot would much prefer to have Mr. Letts continue to make these inspections, as he has done exceedingly well in the past."

to which Colonel Roessler as replied as follows:

"3. If inspections are to be made by this office, limit gauges should remain here; provided the gauges are here more accessible to successful bidders. At present this office seems to be the better place, as the fixtures are being made closer to New York than to Washington. If a firm at another place is the successful bidder, the gauges should be sent to the Engineer Office nearest that point.

4. With the small drafting force here the inspections for the Engineer Depot breaks in considerably on our regular work. This applies as well to Isthmian Canal inspections. But the officer will always make desired inspections if possible, and I see no reason why we should not respond in the future as we have done in the past."

Until manufacturers other than those in the near vicinity of New York bid on this material, it is thought advisable to keep the gauges in the New York office.

AW
3 inclos.


Lt. Col., Corps of Engineers.

September 3rd, 1912.

Colonel John Millis,
Corps of Engineers, U.S. Army,
Newport, R.I.

Colonel:-

Referring to your letter of the 30th ultimo relative to the form of lighting fixtures designed by the Standardization Board for platform lighting, I have the honor to advise you that the type of fixture which has been tentatively adopted by the Board is shown on negatives 7-10, incl., and 30-33, incl., which are being sent you in a separate roll.

The material shown on sheets 7-10, incl., 30 and 31 and the top plate shown on sheet 32 (and no pipe and fittings) have been purchased by this office from F. H. Lovell & Co., Arlington, N.J., for \$5.40 each FOB Arlington. The Russell & Stoll Co., 48 Cliff Street, New York, and also the Universal Standard Electric Company, 90 Verona Street, Brooklyn, N.Y., can supply the material. All these manufacturers have copies of the specifications under which similar material has been purchased.

The early return of the negatives is requested as the routine work of this office requires frequent reference to them.

Very respectfully,

1 pck. sep.

M/T

Captain, Corps of Engineer.

DISTRICT No. 2
FORTIFICATIONS

United States Engineer Office

ROOM 414 U. S. CUSTOM HOUSE

FORTS 67/534

SAN FRANCISCO, CAL., May 5, 1913.

FROM: The District Engineer Officer, Second District.

TO: The Chief of Engineers, U.S. Army, Washington, D. C.

SUBJECT: New type of cable hanger.

1. Referring to E. D. circular letter dated April 19, 1913 (73171):

2. None of the new type of cable hanger recommended by the Board of Standardization of Electrical Fixtures have been received by this office.

2. There is inclosed herewith a blue print showing a type of hanger that has been used in connection with the fortifications in this district since 1910 and has been found satisfactory. The head is snipped off of a common wood screw and the screw is then cast into the base of the hanger, the upper end first being flattened to afford a better bond. The hanger is then secured in holes drilled in concrete walls, ceilings, etc., by means of ordinary expansion shields, or shields improvised from the lead covering on scraps of electric cable remaining on hand after completion of fire-control and electric power installations.

4. The hanger was designed in this office and is manufactured locally from patterns belonging to the Engineer Department. The number used and the prices paid are as follows:

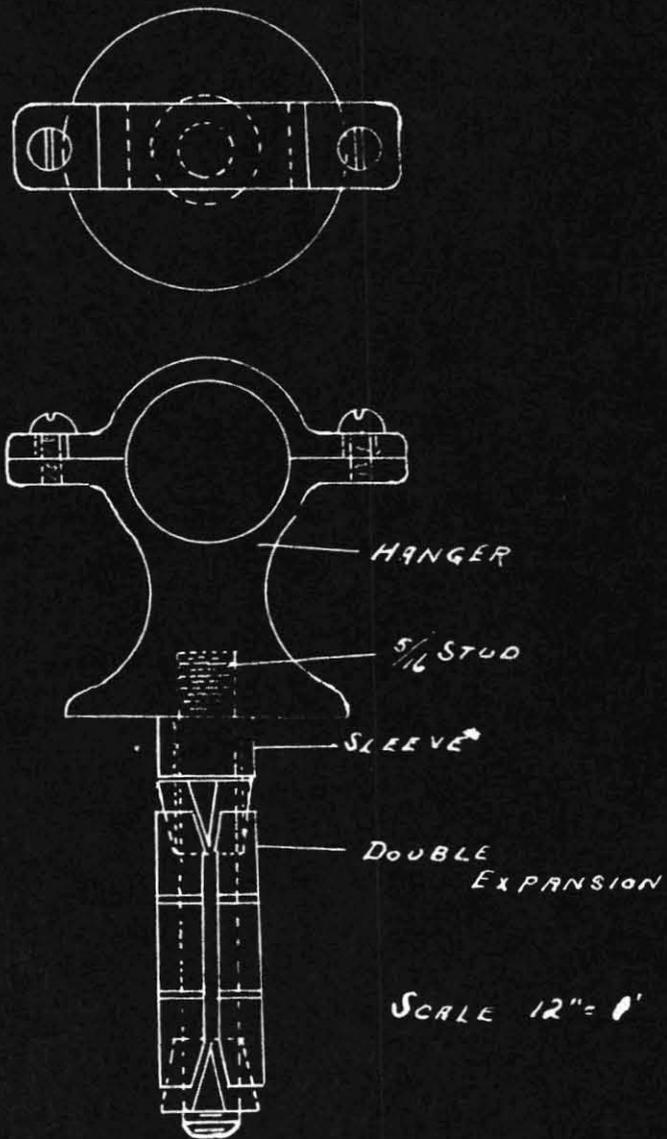
<u>Date.</u>	<u>Number ordered.</u>	<u>Price each.</u>
February 1910	5,000	9.9¢
June 1910	1,800	12.0¢
August 1910	450	12.0¢
October 1910	2,600	12.0¢
October 1911	600	15.0¢



Lieut. Col., Corps of Engineers.

1 inclosure.

SKETCH OF PIPE HANGER USED FOR SUPPORTING
LEAD COVERED ARMORED CABLE IN
EMPLACEMENT WIRING



MAY

WAR DEPARTMENT

73171/6675

U.S. ARMY

NEW YORK DISTRICT NO. 2

RECEIVED 26 231

File
over

UNITED STATES ENGINEER OFFICE
MCCANDLESS BUILDING

HONOLULU, T. H. May 7, 1913.

The District Engineer Officer, Honolulu, Hawaii.
From: ~~Major W. B. Wooster, Corps of Engineers~~

To: **The Chief of Engineers,**
U. S. Army.

Subject: **New type of cable hanger (Cir. Lett., O.C.E., April 19,
1913, E.D.73171)**

The accompanying blue print shows cable hangers which have been used in wiring the fortifications in the Hawaiian Islands. Brass has been used exclusively in their manufacture, and they have given perfect satisfaction.

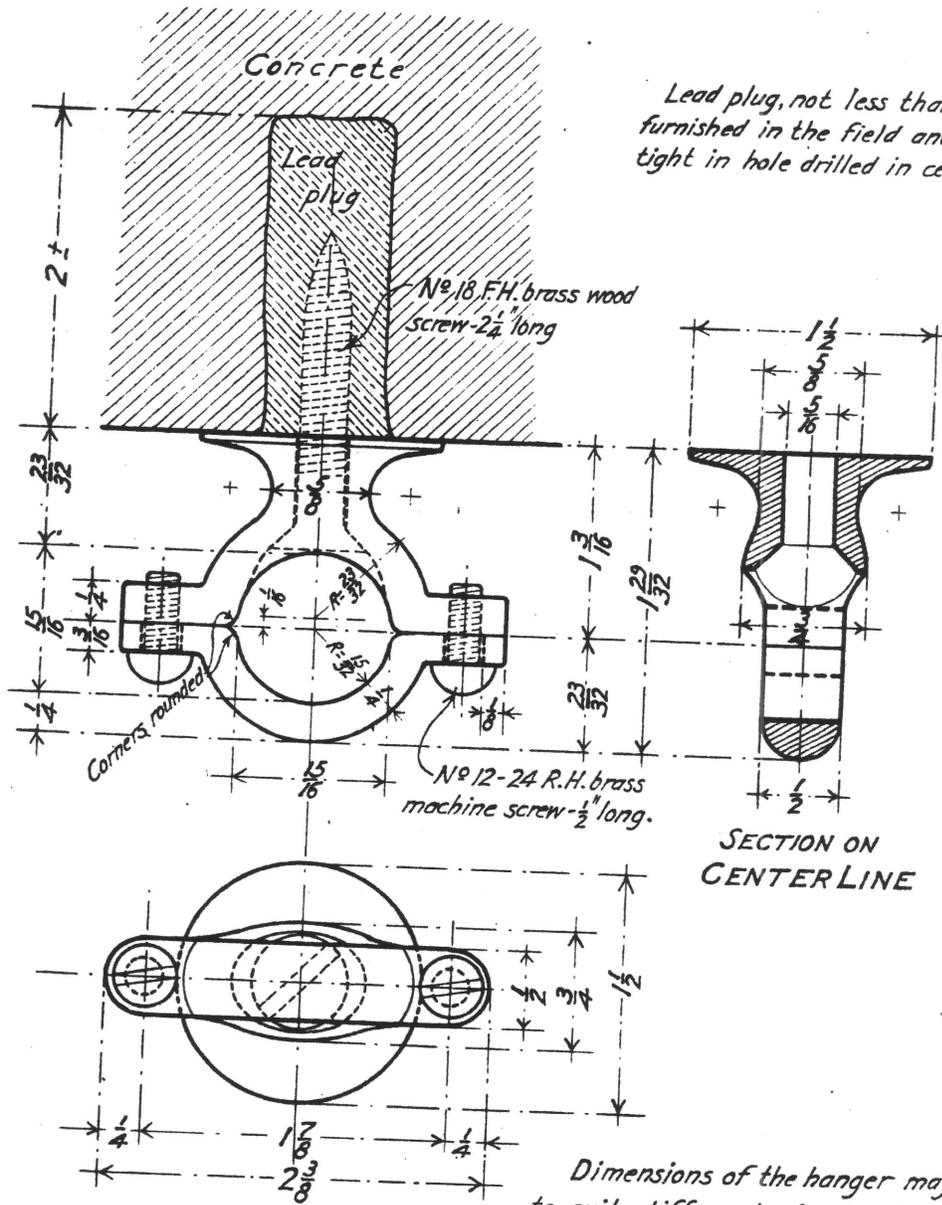
The type of cable hanger referred to ^{in the circular letter} ~~within~~ has never been used in this district, although it is understood that a supply had been shipped, and will shortly be received.

W. B. Wooster,
Major, Corps of Engineers.

1 incl. (blue print)

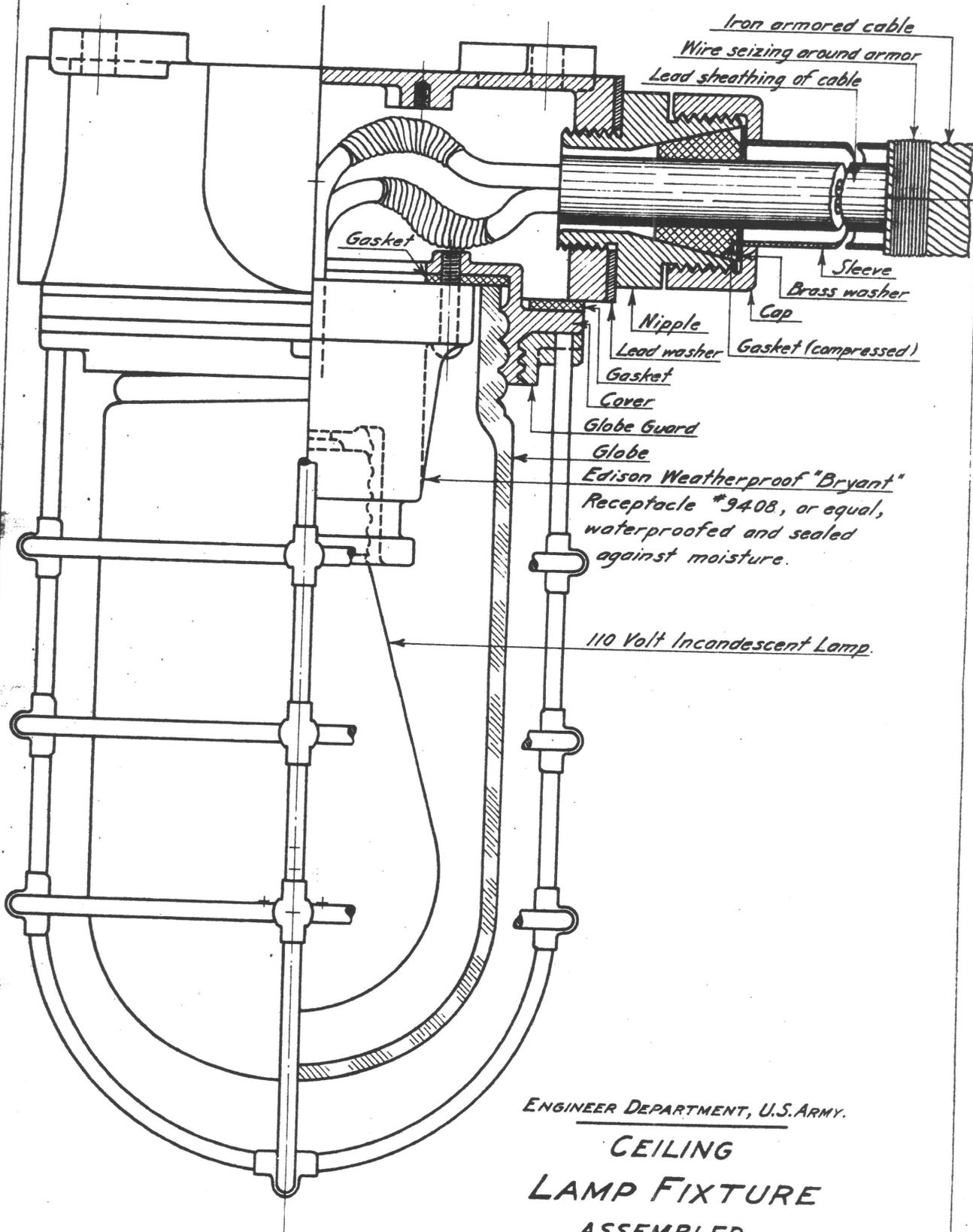
OFFICE, CHIEF OF ENGINEERS
WAR DEPARTMENT
23171
900

RECORDED
INDEXED



ENGINEER DEPARTMENT, U.S. ARMY.
**GALVANIZED IRON
 CABLE HANGER.**
 Full Size.

APPROVED. May 6, 1911.
 FOR THE BOARD:
S. W. Koessler
 Colonel, Corps of Engineers, U.S.A.
 Senior Member



ENGINEER DEPARTMENT, U.S. ARMY.

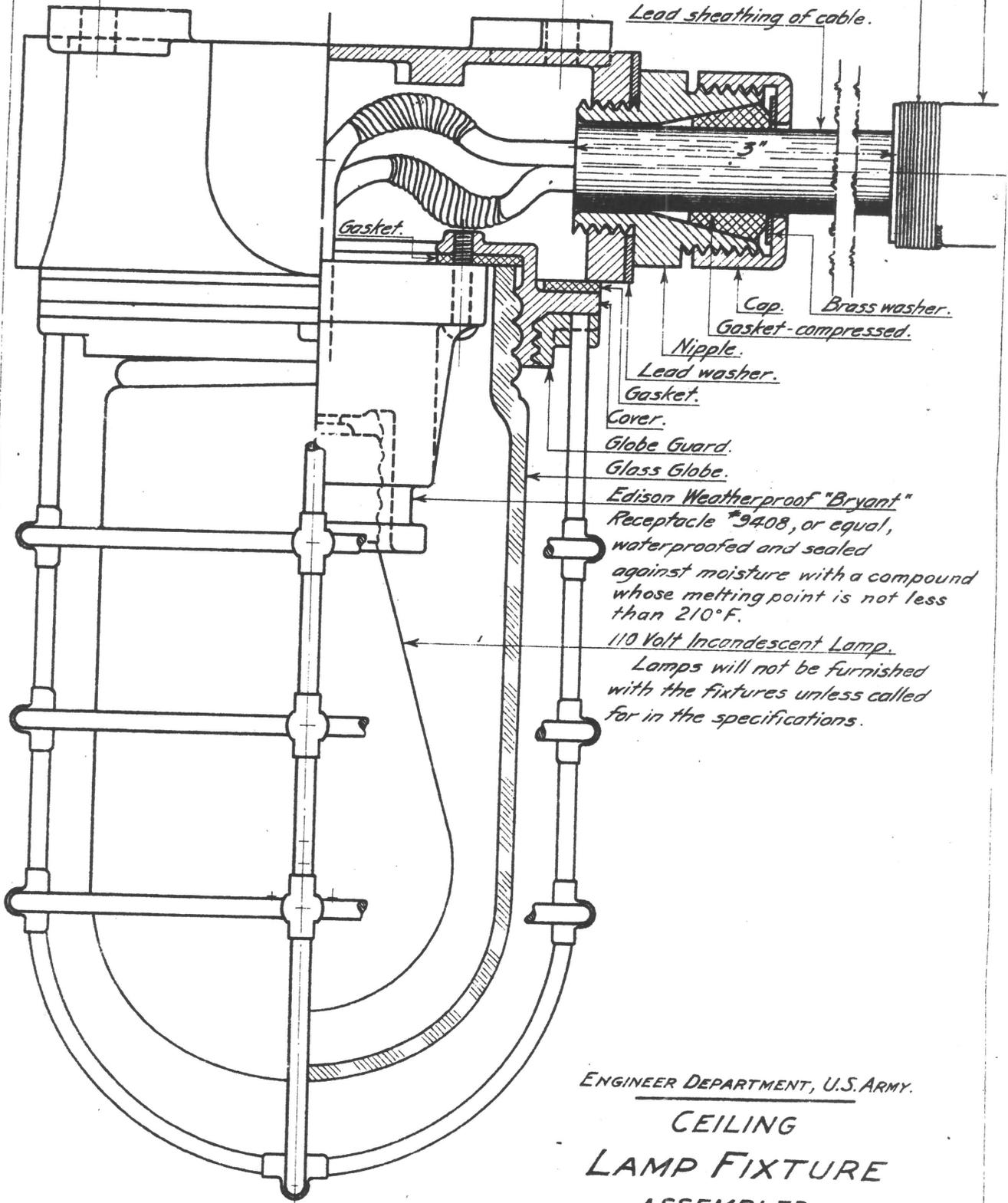
CEILING
LAMP FIXTURE
ASSEMBLED.
Full Size.

APPROVED. May 6, 1911.

FOR THE BOARD:

S. W. Raessler
Colonel, Corps of Engineers, U.S.A.
Senior Member

Two layers of jute yarn over cable armor.
Seizing of #18 B&S. tinned copper wire.
Lead sheathing of cable.



Cap.
Brass washer.
Gasket-compressed.
Nipple.
Lead washer.
Gasket.
Cover.
Globe Guard.
Glass Globe.
Edison Weatherproof "Bryant"
Receptacle #9408, or equal,
waterproofed and sealed
against moisture with a compound
whose melting point is not less
than 210°F.
110 Volt Incandescent Lamp.
Lamps will not be furnished
with the fixtures unless called
for in the specifications.

ENGINEER DEPARTMENT, U.S. ARMY.

CEILING
LAMP FIXTURE
ASSEMBLED.
Full Size.

APPROVED. January 31, 1913.

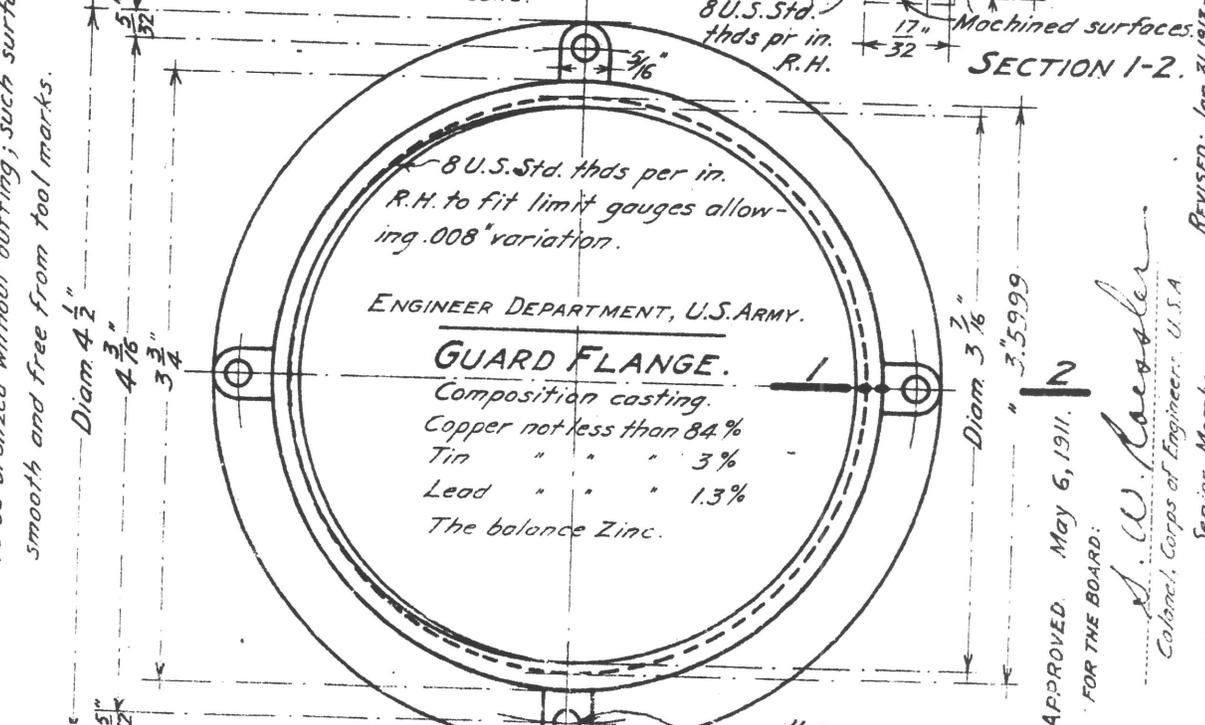
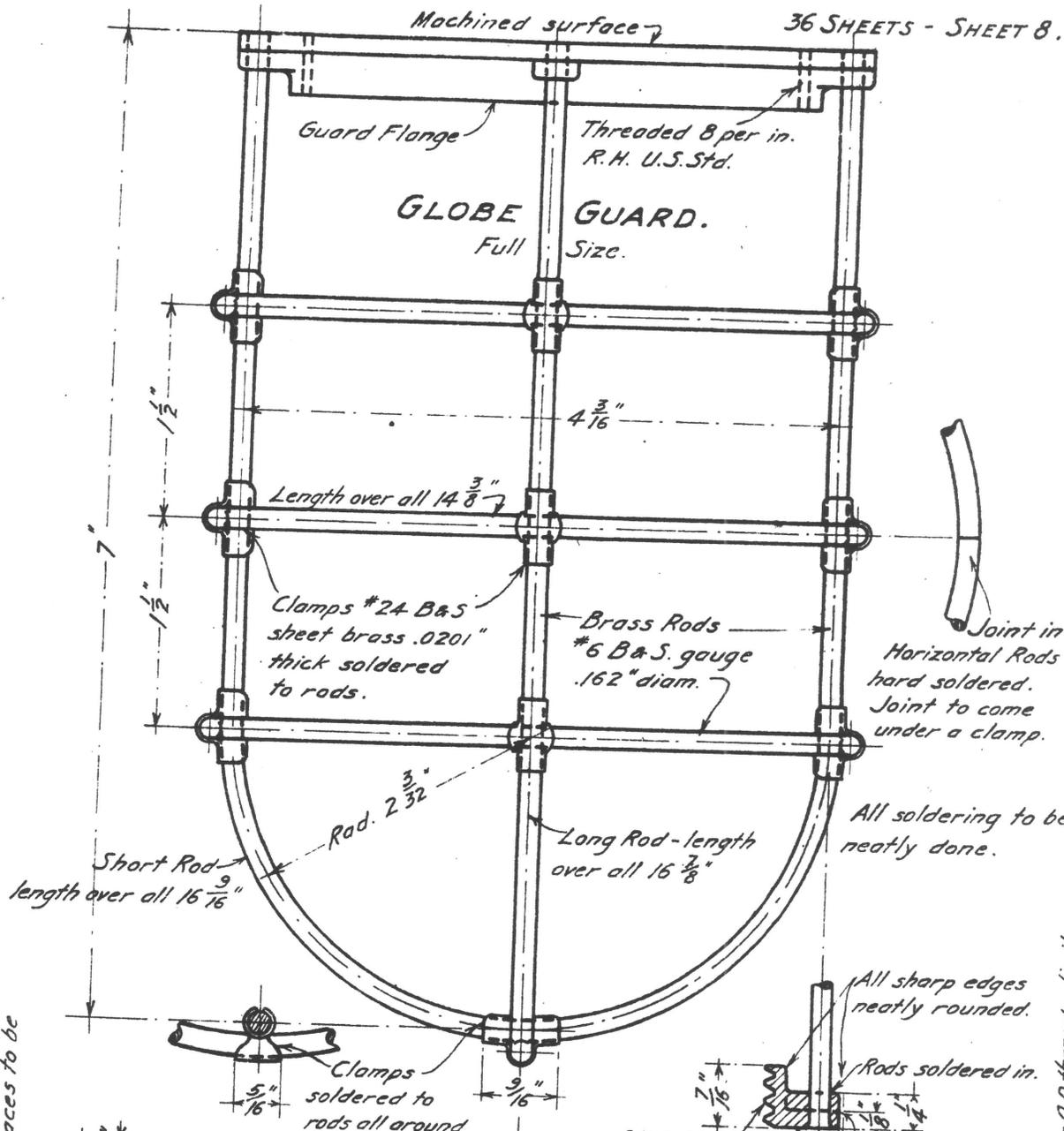
FOR THE BOARD:

S. W. Roessler

Colonel, Corps of Engineers, U.S.A.

Senior Member.

REVISED: Oct. 9, 1913, Cap of outlet coupling.



FINISH: All parts to have dark bronze finish. Machined surfaces to be bronzed without buffing; such surfaces to be smooth and free from tool marks.

All soldering to be neatly done.

All sharp edges neatly rounded.

Rods soldered in.

Machined surfaces.

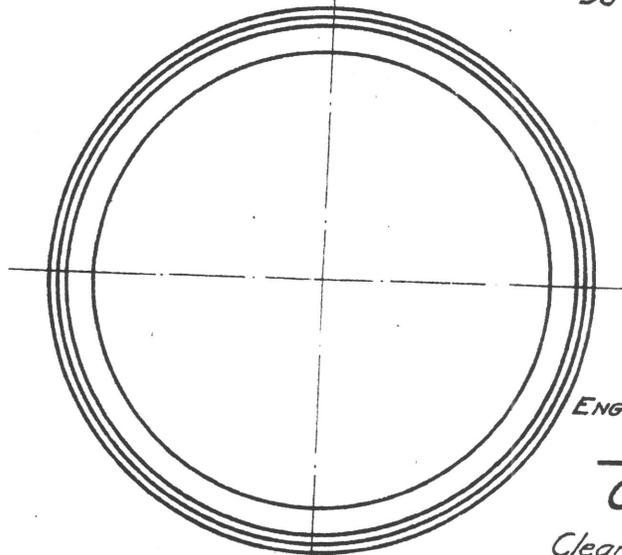
SECTION 1-2.

APPROVED. May 6, 1911.

FOR THE BOARD:

A. W. Cassler
 Colonel, Corps of Engineers, U.S.A.
 Senior Member.

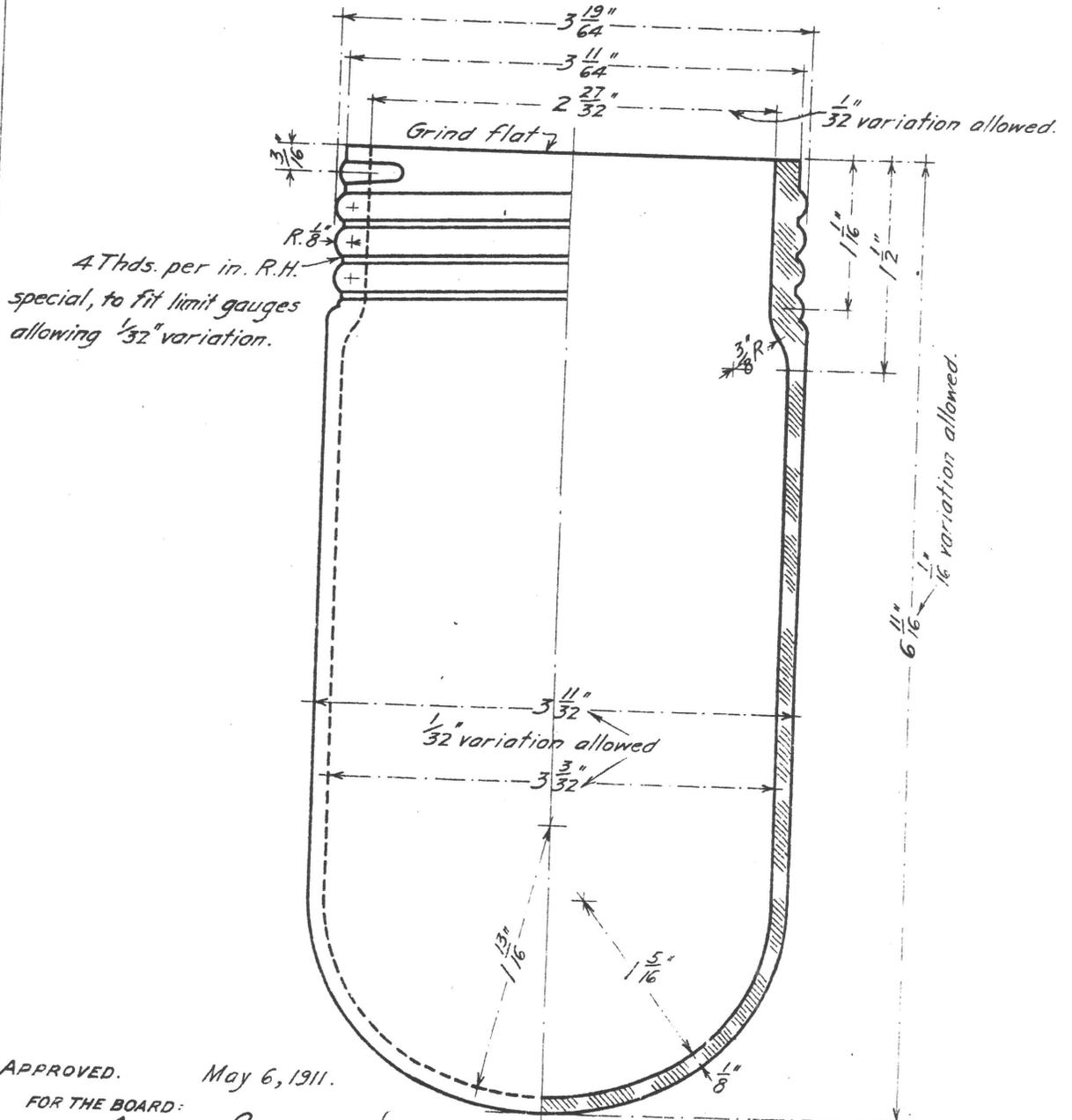
REVISED: Jan. 31, 1913 - O.D. threads; limit gauges; edge of flange machined.



ENGINEER DEPARTMENT,
U.S. ARMY.

GLOBE.

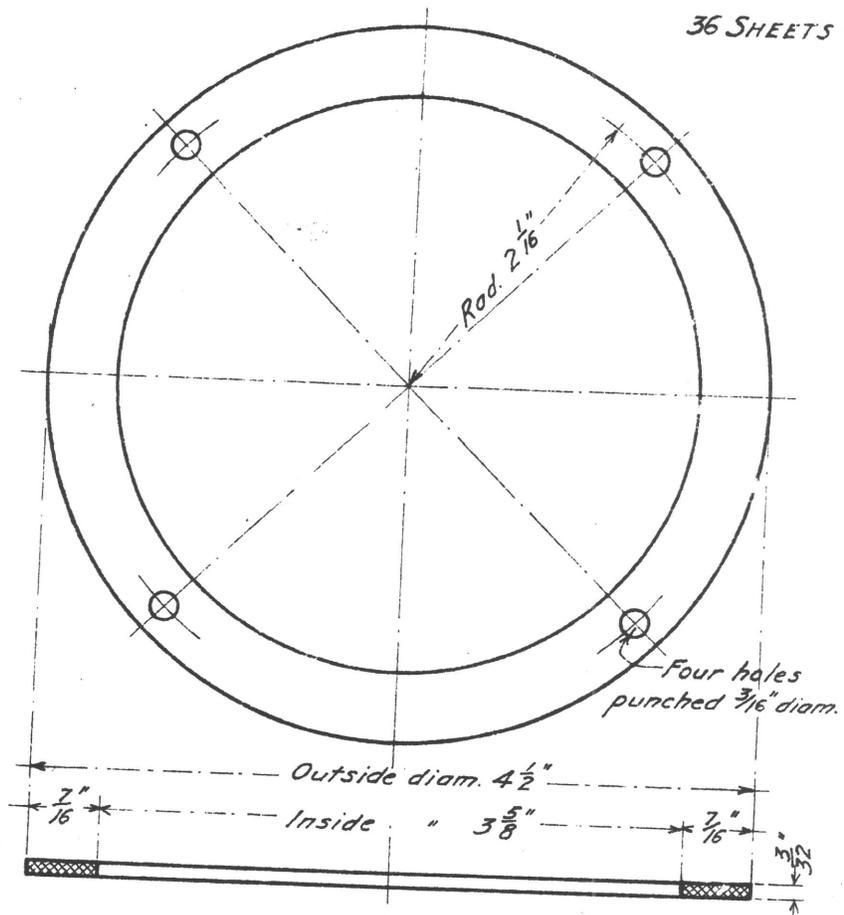
Clear Flint Glass.
Full Size.



APPROVED. May 6, 1911.

FOR THE BOARD:

S. W. Roessler
Colonel, Corps of Engineers



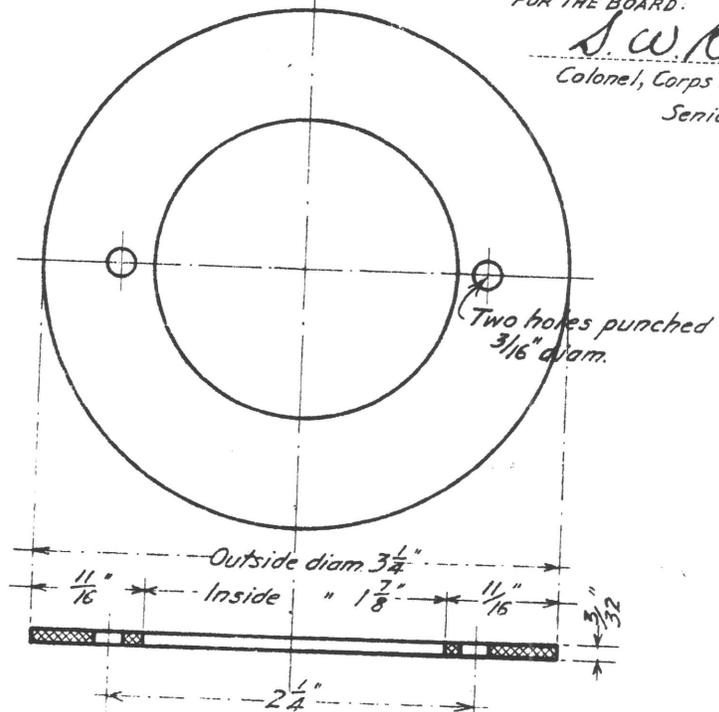
COVER GASKET.
Sheet rubber packing,
without cloth insertion.
Full Size.

ENGINEER DEPARTMENT,
U.S. ARMY.

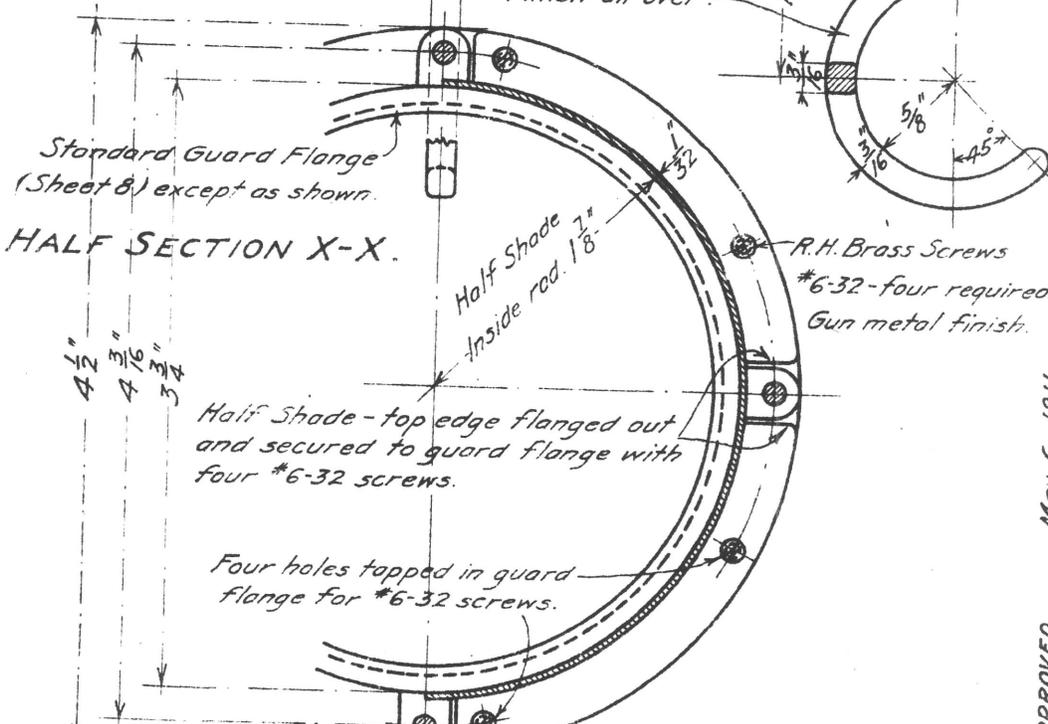
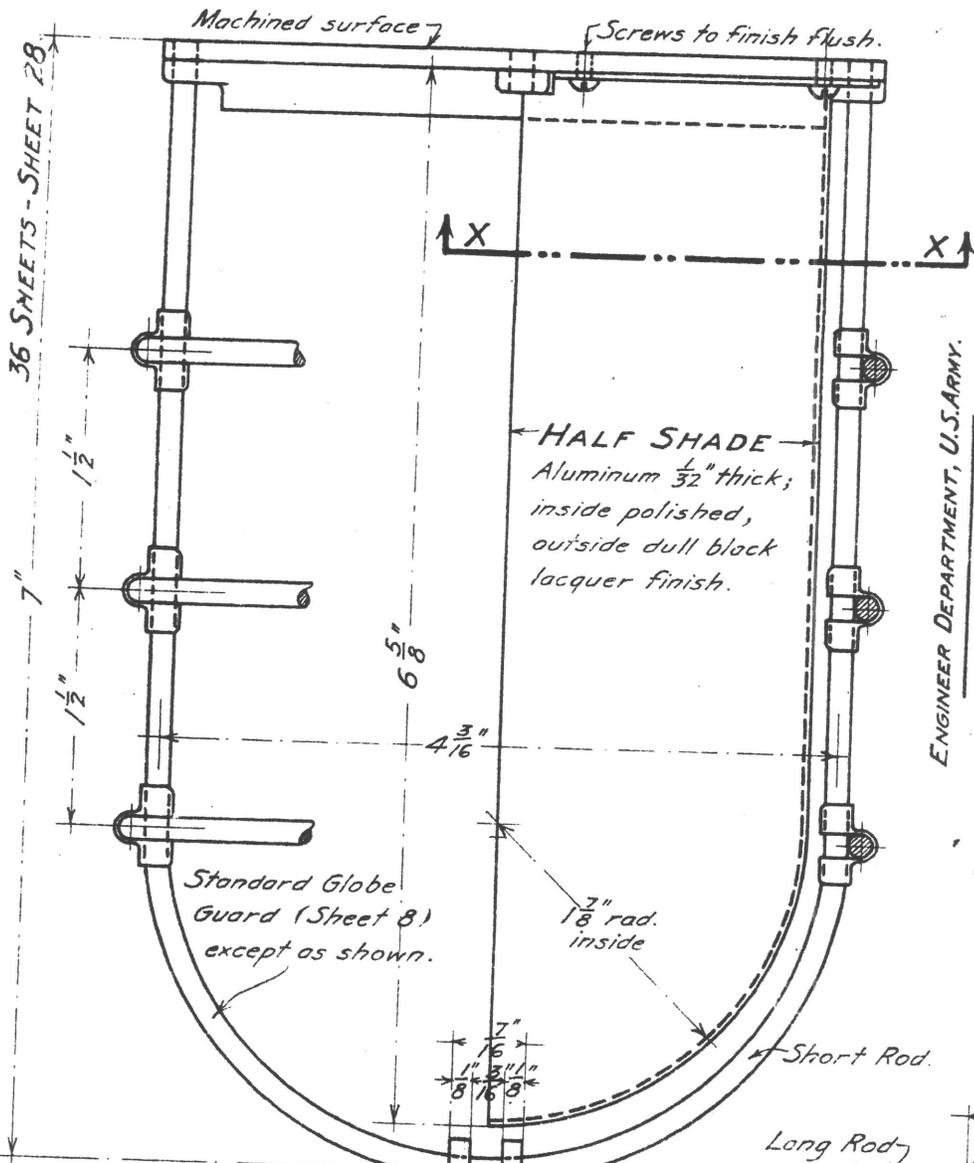
APPROVED. May 6, 1911.

FOR THE BOARD.

S. W. Raessler
Colonel, Corps of Engineers, U.S. A.
Senior Member.



GLOBE GASKET.
Sheet rubber packing,
without cloth insertion.
Full Size.



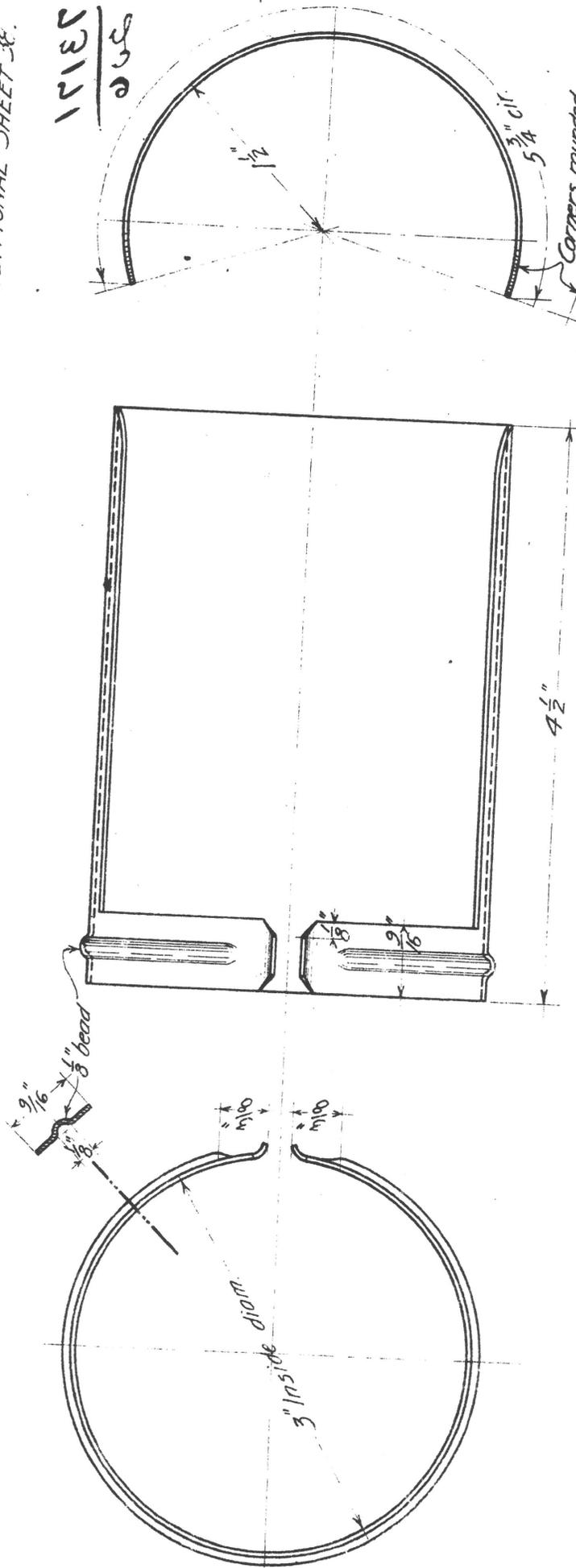
ENGINEER DEPARTMENT, U.S. ARMY.
GLOBE GUARD AND HALF SHADE
FOR PORTABLE HAND LAMP.

The half shade will be furnished only when specified.
 See Sheet 27 for further details of this fixture.
 Full Size.

APPROVED. May 6, 1911.
 FOR THE BOARD:
 S. W. Rowley
 Colonel, Corps of Engineers, U.S.A.
 Senior Member.

36 ORIGINAL SHEETS.
 ADDITIONAL SHEET 38.

17183
 065



The shade is designed to fit over glass
 globes 3" to 3 1/32" outside diameter.

Shade to have dark bronze or gun metal finish.

APPROVED:
 FOR THE BOARD:

April 28, 1915.

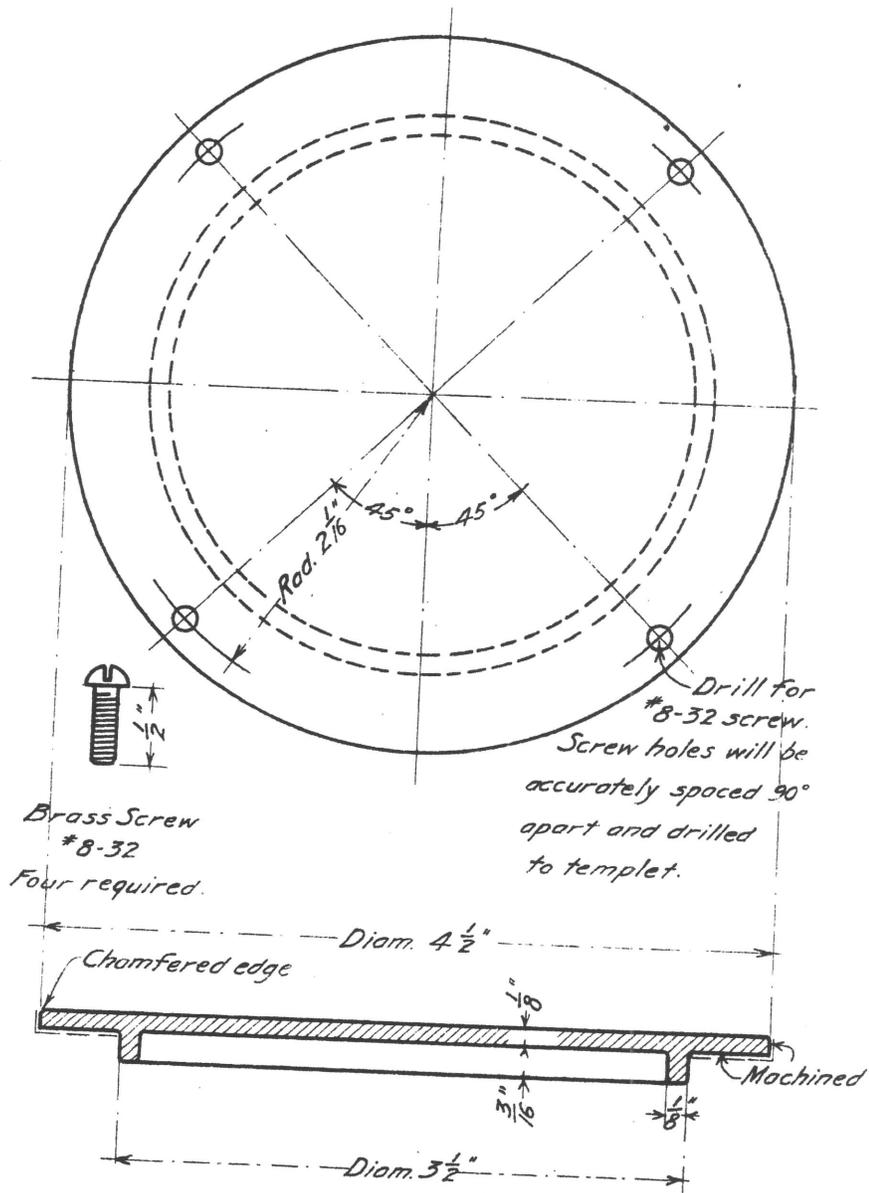
D.W. Roosevelt
 Colonel, Corps of Engineers, U.S.A.
 Senior Member.

ENGINEER DEPARTMENT, U.S. ARMY.

HALF SHADE

FOR NICHE LIGHTS ON GUN PLATFORMS
 Full size.

Make from sheet brass No. 18 B & S gauge, 4 1/2" x 9 1/2".



Brass Screw
#8-32
Four required.

Drill for #8-32 screw. Screw holes will be accurately spaced 90° apart and drilled to templet.

Use cover gasket as shown for lamp fixture and switch box.

ENGINEER DEPARTMENT, U.S. ARMY.

COVER FOR BOX

Full Size.

WHEN USED AS JUNCTION BOX.

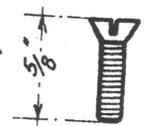
Composition casting.
Copper not less than 84 %
Tin " " " 3 %
Lead " " " 1.3 %
The balance Zinc.

FINISH: All parts to have dark bronze finish.
Machined surfaces to be bronzed without buffing; such surfaces to be smooth and free from tool marks.

APPROVED. May 6, 1911.

FOR THE BOARD:

S. W. Roessler
Colonel, Corps of Engineers, U. S. A.



Brass Screw #8-32.
Four required.

Screw holes will be spaced 90° apart and drilled to templet.

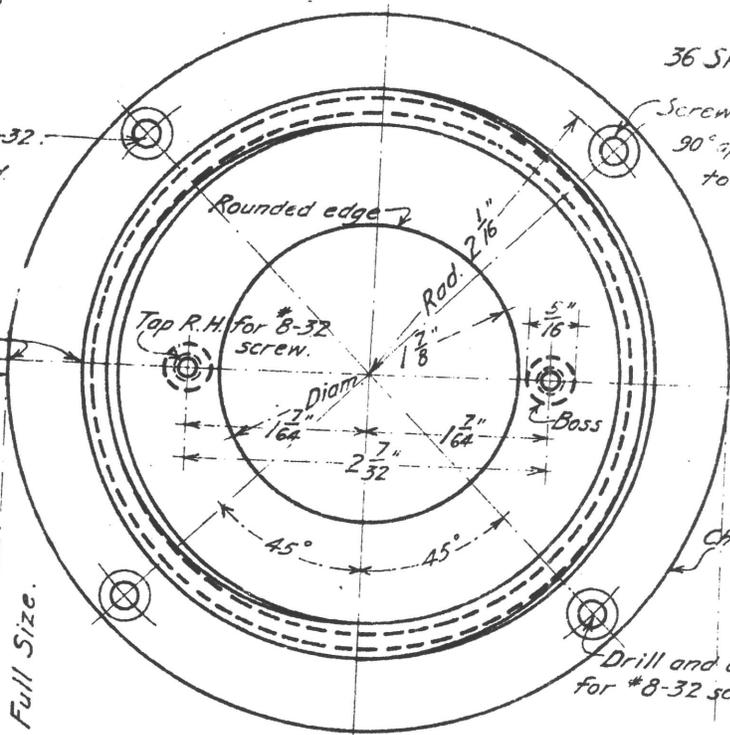
Machined surface

Full Size.

COVER FOR BOX
WHEN USED AS LAMP FIXTURE

Composition casting
Copper not less than 84%
Tin " " " 3%
Lead " " " 1.3%
The balance Zinc.

ENGINEER DEPARTMENT, U.S. ARMY.

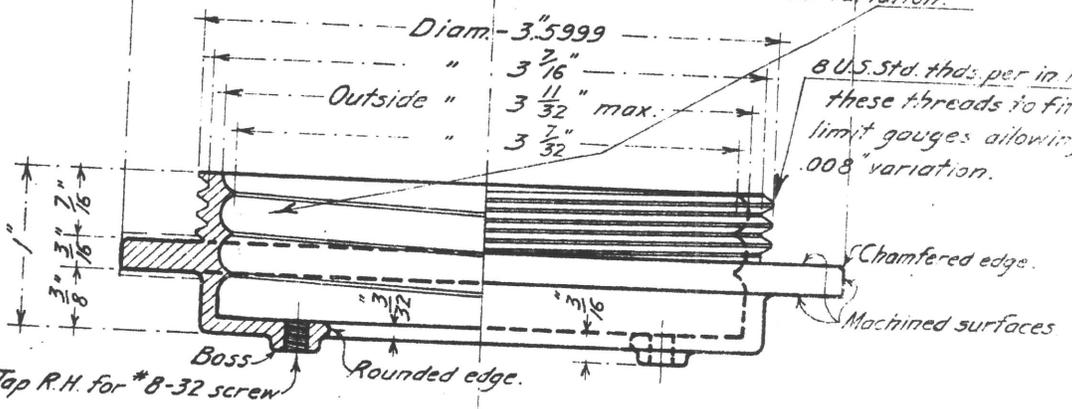


Drill and csk. for #8-32 screw.

Outside diam. 4 1/2"

TOP.

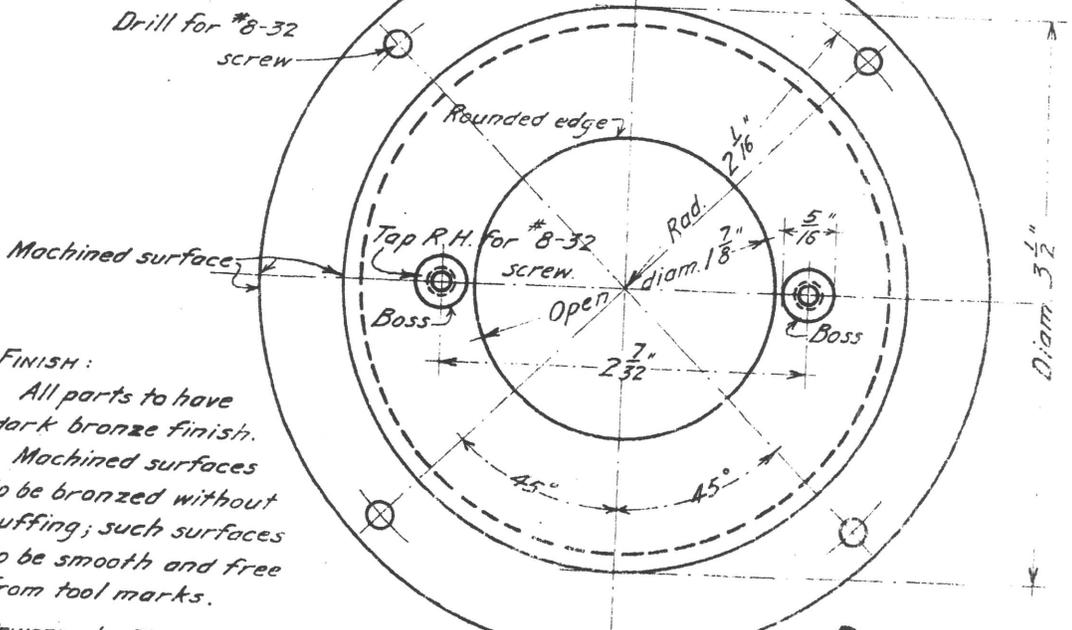
4 thds. per inch R.H., special, to fit limit gauges allowing .008" variation.



8 U.S. Std. thds. per in R.H. these threads to fit limit gauges allowing .008" variation.

HALF SECTION.

HALF ELEVATION.

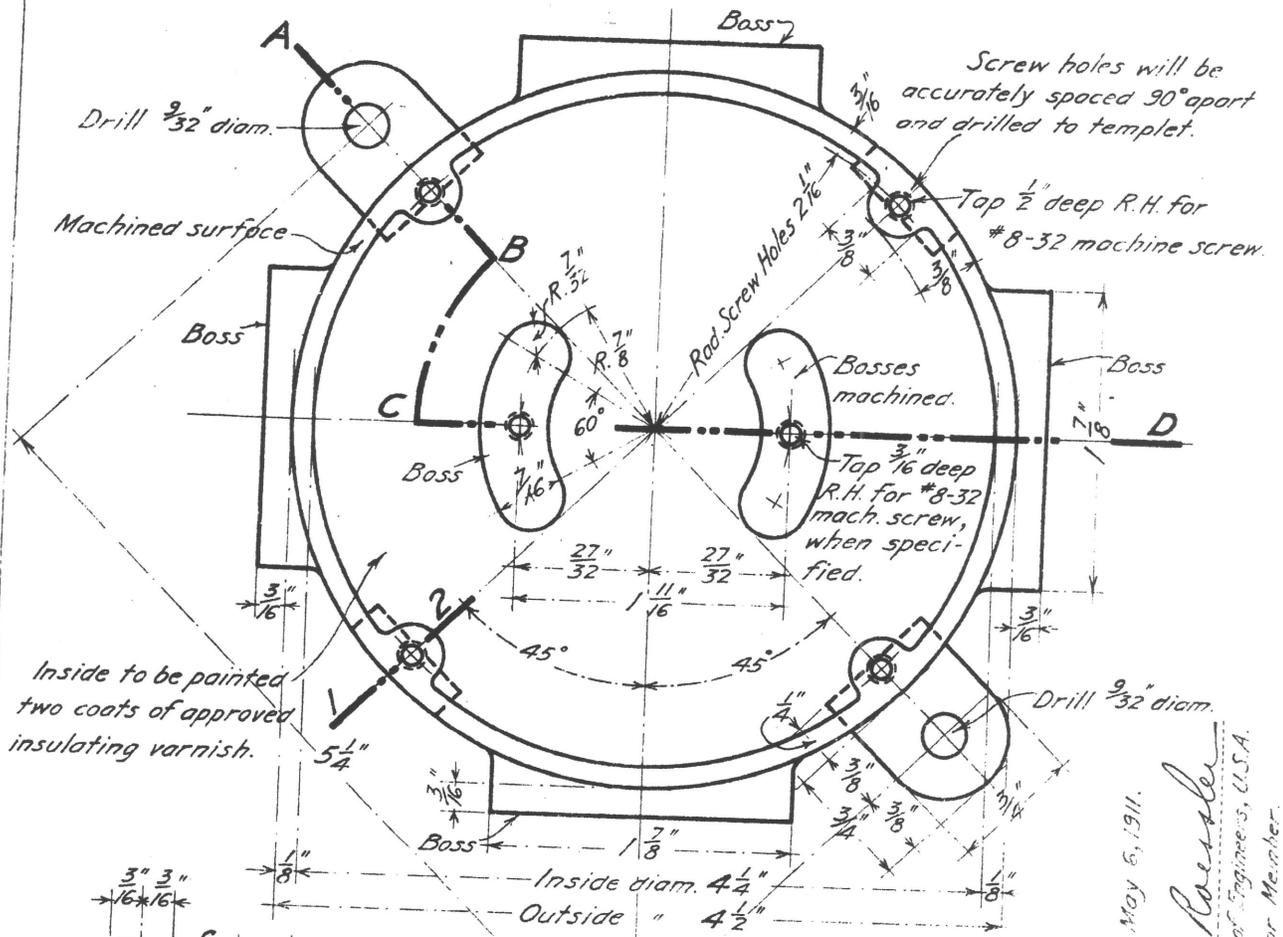


FINISH:
All parts to have dark bronze finish.
Machined surfaces to be bronzed without buffing; such surfaces to be smooth and free from tool marks.

APPROVED May 6, 1911

FOR THE BOARD:

A. W. Roe
Colonel, Corps of Engineers, U.S.A.
Senior Member.



Inside to be painted two coats of approved insulating varnish.

Screw holes will be accurately spaced 90° apart and drilled to templet.

PLAN. Full Size.

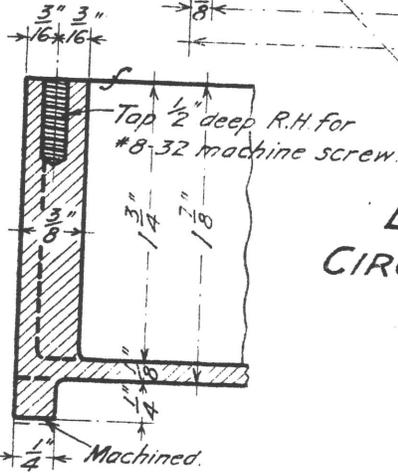
ENGINEER DEPARTMENT, U.S. ARMY.

BOX FOR LAMP FIXTURE, CIRCUIT SWITCH, JUNCTION BOX, AND PLUGGING IN BOX.

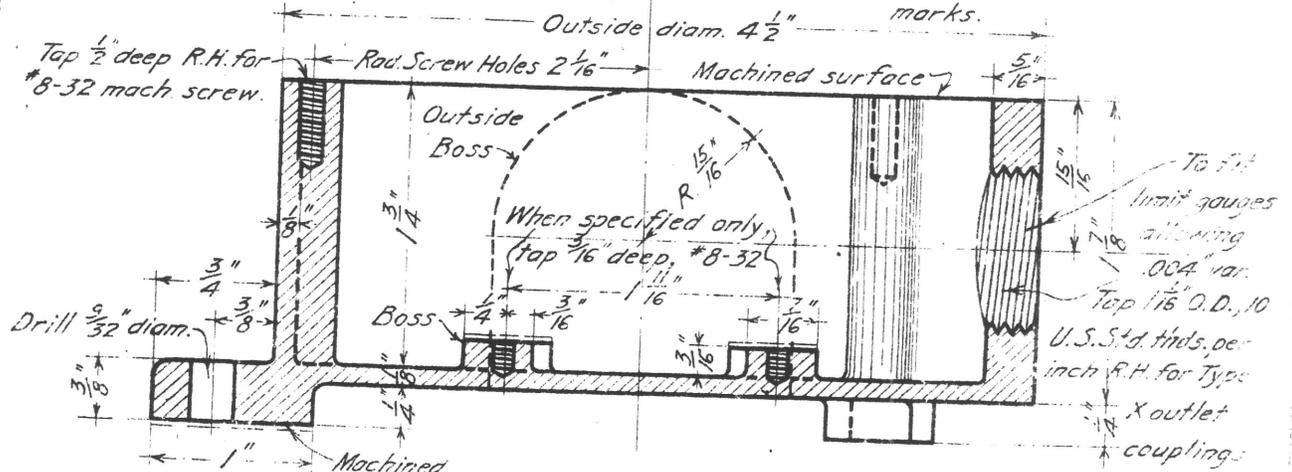
Composition Casting.

Copper not less than 84%
 Tin " " " 3%
 Lead " " " 1.3%
 The balance Zinc.

FINISH
 All parts to have dark bronze or gun metal finish. Machined surfaces to be bronzed without buffing; such surfaces to be smooth and free from tool marks.

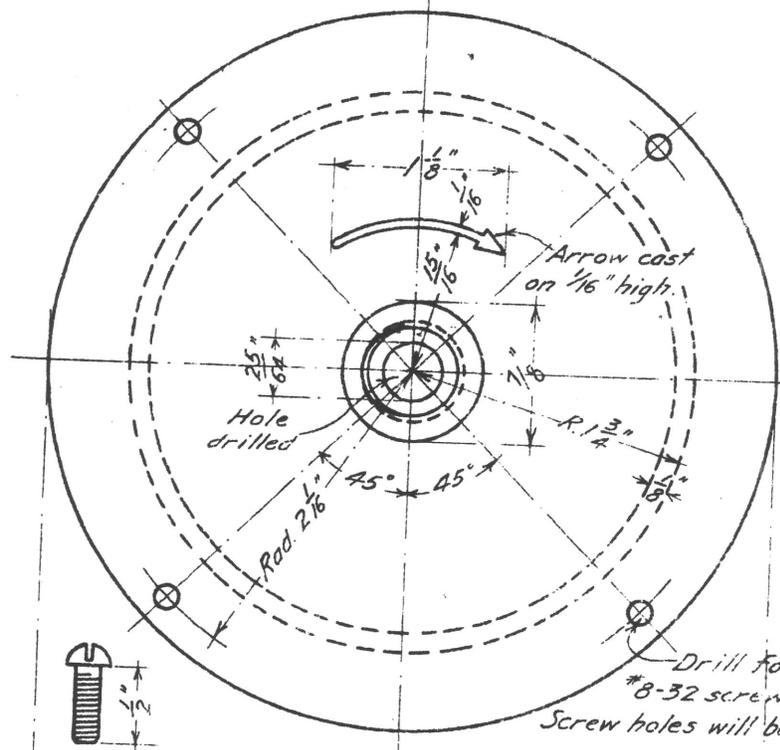


SECTION 1-2.



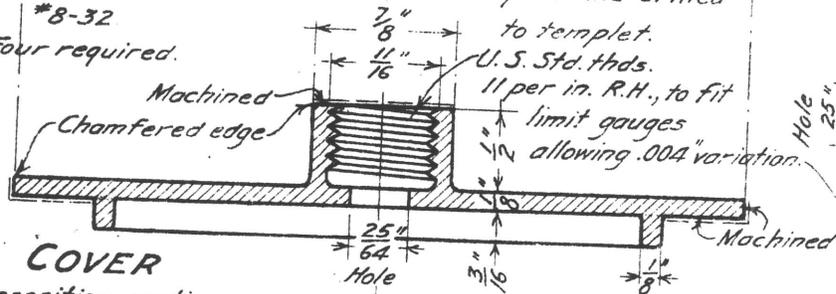
SECTION A-B-C-D. The number and position of bosses to be tapped to be

APPROVED FOR THE BOARD.
 May 6, 1911.
 S.W. Ressler
 Chief, Dept. of Engineers, U.S.A.
 Senior Member.



Drill for #8-32 screw. Screw holes will be accurately spaced 90° apart and drilled to templet.

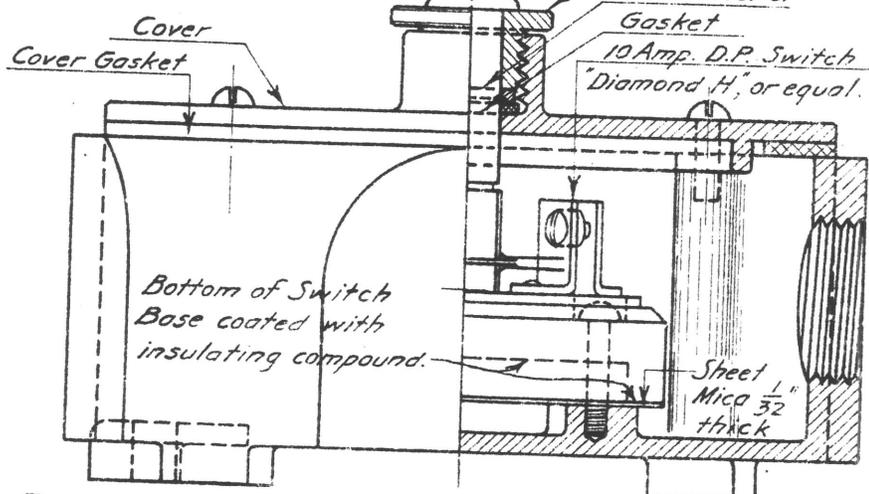
Brass Screw #8-32 Four required.



COVER

Composition casting.
Copper not less than 84%
Tin " " " 3%
Lead " " " 1.3%
The balance Zinc.

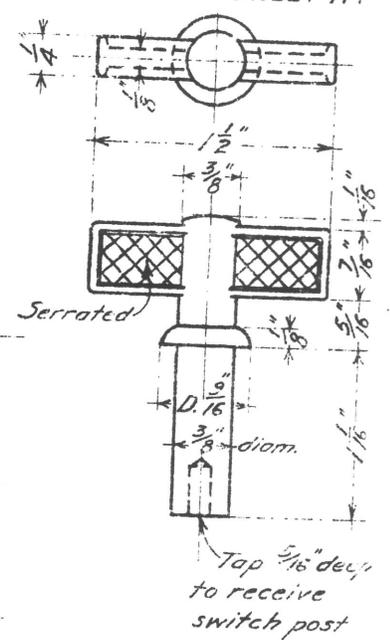
SWITCH-BOX ASSEMBLED.



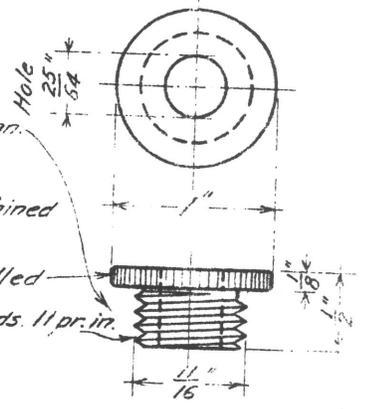
FINISH: All parts to have dark bronze finish. Machined surfaces to be bronzed without buffing; such surfaces to be smooth and free

APPROVED. May 6, 1911.

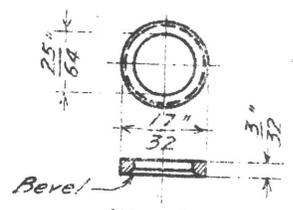
FOR THE BOARD:
S. W. Roessler



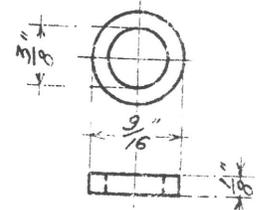
Switch Handle
Composition casting.
Finish all over.



Screw Plug
Composition.
(Or brass rod.)



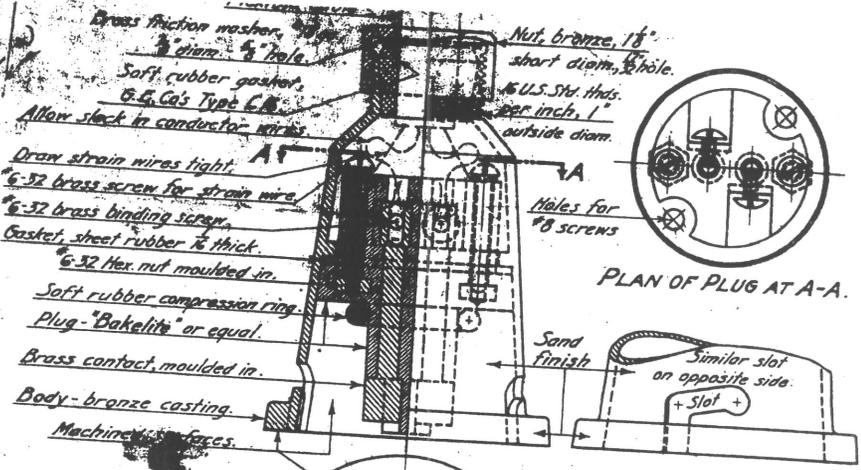
Washer
Sheet brass
F.A.O.



Gasket

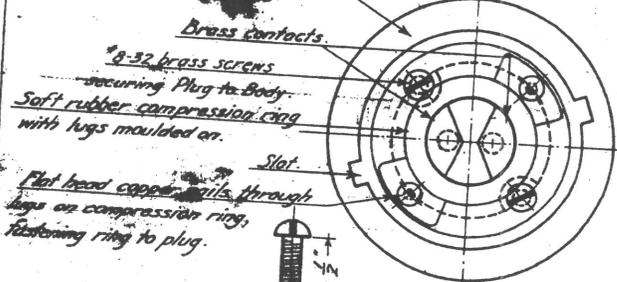
REVISED: Jan. 31, 1913 Limit gauges.

36 SHEETS - SHEET 11



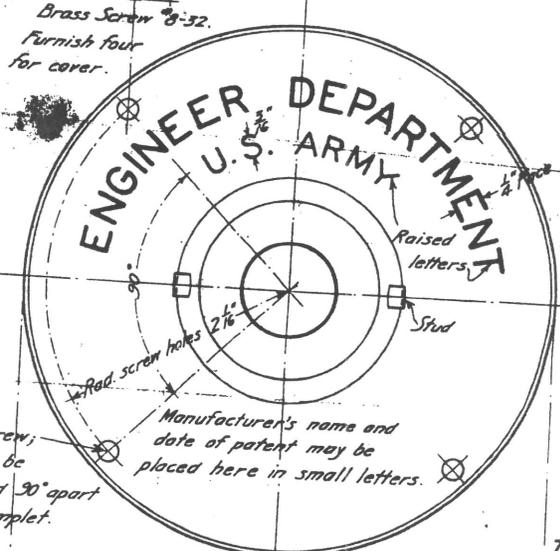
PLAN OF PLUG AT A-A.

PART ELEVATION OF BODY
Showing slots to engage projecting studs on cover.

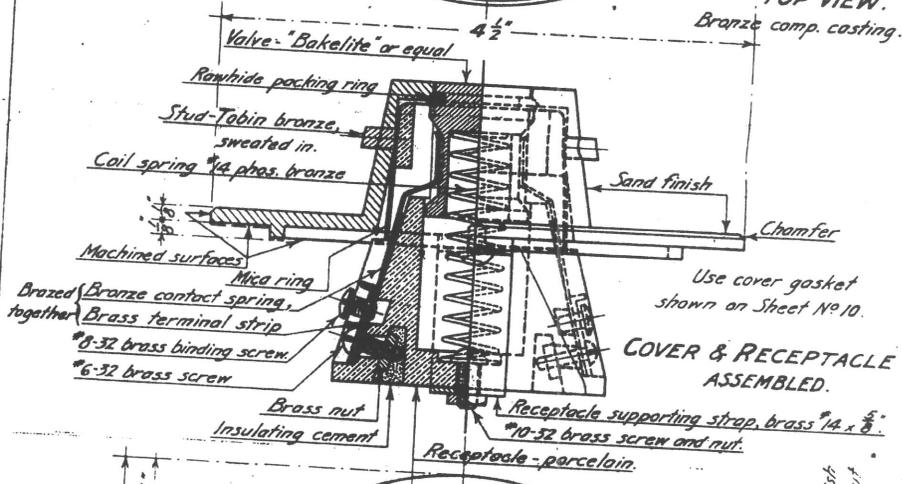


PLUG AND BODY ASSEMBLED.

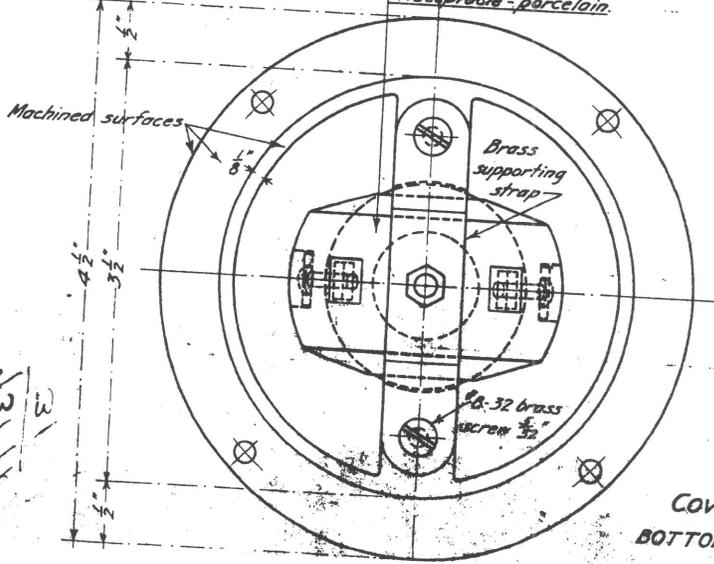
COVER AND PLUG FOR PLUGGING-IN BOX Full Size



COVER TOP VIEW.
Brass comp. casting.



COVER & RECEPTACLE ASSEMBLED.



COVER BOTTOM VIEW.

ENGINEER DEPARTMENT, U.S. ARMY.
APPROVED: May 15, 1912.
FOR THE BOARD.

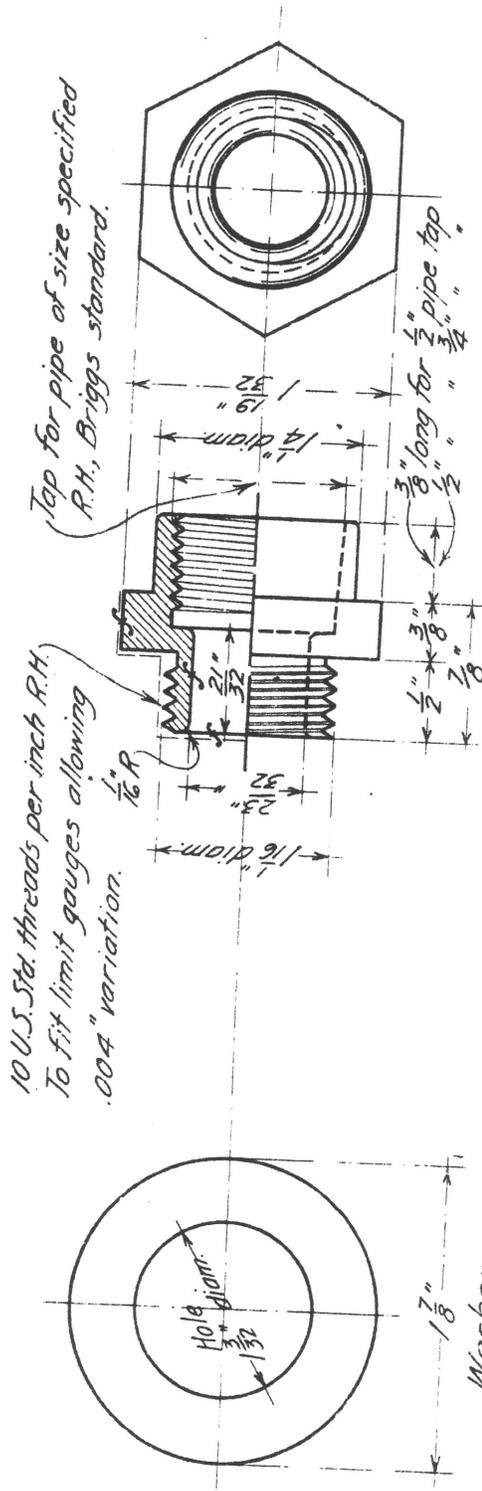
S. W. Rowley
Colonel, Corps of Engineers, U.S.A.
Senior Member.

REVISION: Apr 21, 1913 - Compression ring.

FINISH: Cover, cover screws, plug body and nut to have dark bronze or gun metal finish. Machined surfaces to be bronzed without buffing; such surfaces to be smooth and free from tool marks.

36 SHEETS - SHEET 11

681



10 U.S. Std. threads per inch R.H.
 To fit limit gauges allowing
 .004" variation.

Tap for pipe of size specified
 R.H., Briggs standard.

Adapter
 Composition casting or brass rod.

COMPOSITION CASTINGS.
 Copper not less than 84 %
 Tin " " " 3 %
 Lead " " " 1.3 %
 The balance Zinc.

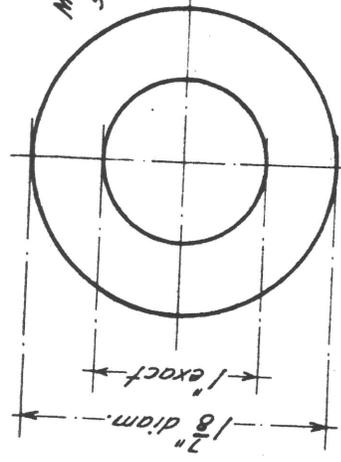
FINISH:
 All parts to have dark bronze or
 gun metal finish; machined surfaces
 to be bronzed without buffing, such
 surfaces to be smooth and free from
 tool marks; all fins and burrs to be
 removed.

APPROVED:
 FEBRUARY 16, 1915.

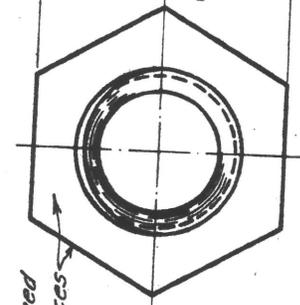
FOR THE BOARD:

A. W. Raper
 Colonel, Corps of Engineers, U.S.A.
 Senior Member.

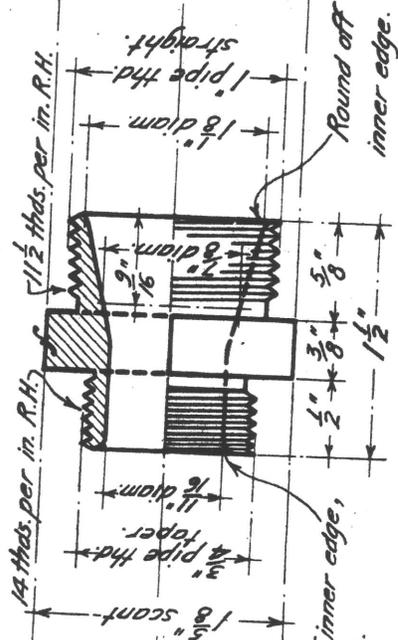
ENGINEER DEPARTMENT, U.S. ARMY.
ADAPTER COUPLING
FOR TYPE X OUTLETS
 For use where pipe conduit is used
 instead of armored cable.
 Full Size.



Washer
Sheet lead $\frac{1}{16}$ " thick.

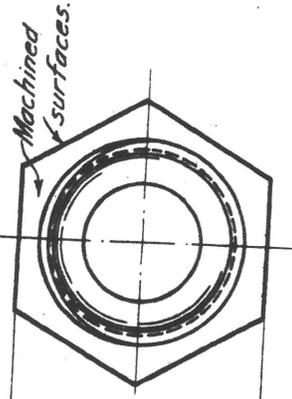


Gasket
Soft rubber.
Gen. Elec. Co. Type B

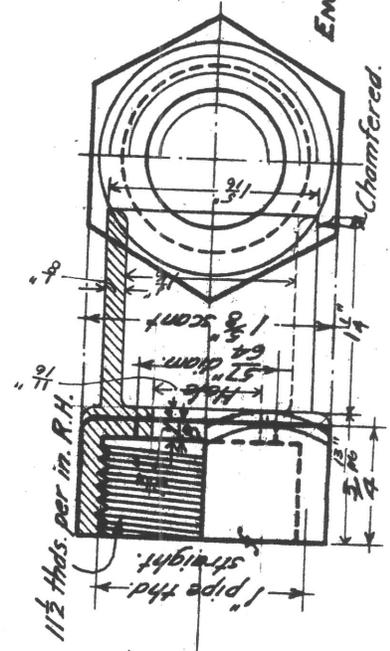


Nipple
Composition casting,
or brass rod.

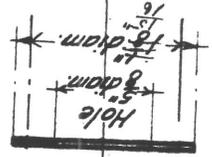
FINISH: All parts to have dark bronze or gun metal finish; machined surfaces to be bronzed without buffing, such surfaces to be smooth and free from tool marks; all fins and burrs to be removed.



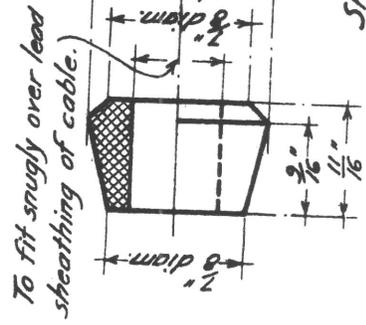
Cap
Composition casting,
or brass rod.
Finish all over.



Sleeve
Brass tubing
#10 B&S gauge.



Washer
Sheet brass
#18 B&S gauge,
.04" thick.



To fit snugly over lead sheathing of cable.

COMPOSITION CASTINGS:
Copper not less than 84%
Tin " " " 3%
Lead " " " 1.3%
The balance Zinc.

APPROVED. May 6, 1911.
FOR THE BOARD:

S. W. Raper
Colonel, Corps of Engineers, U.S.A.
Senior Member.

ENGINEER DEPARTMENT, U.S. ARMY.

TYPE X
OUTLET COUPLING

For boxes requiring conductors not larger than #10 B&S gauge. Full Size.

Medified Detail.

18181

21

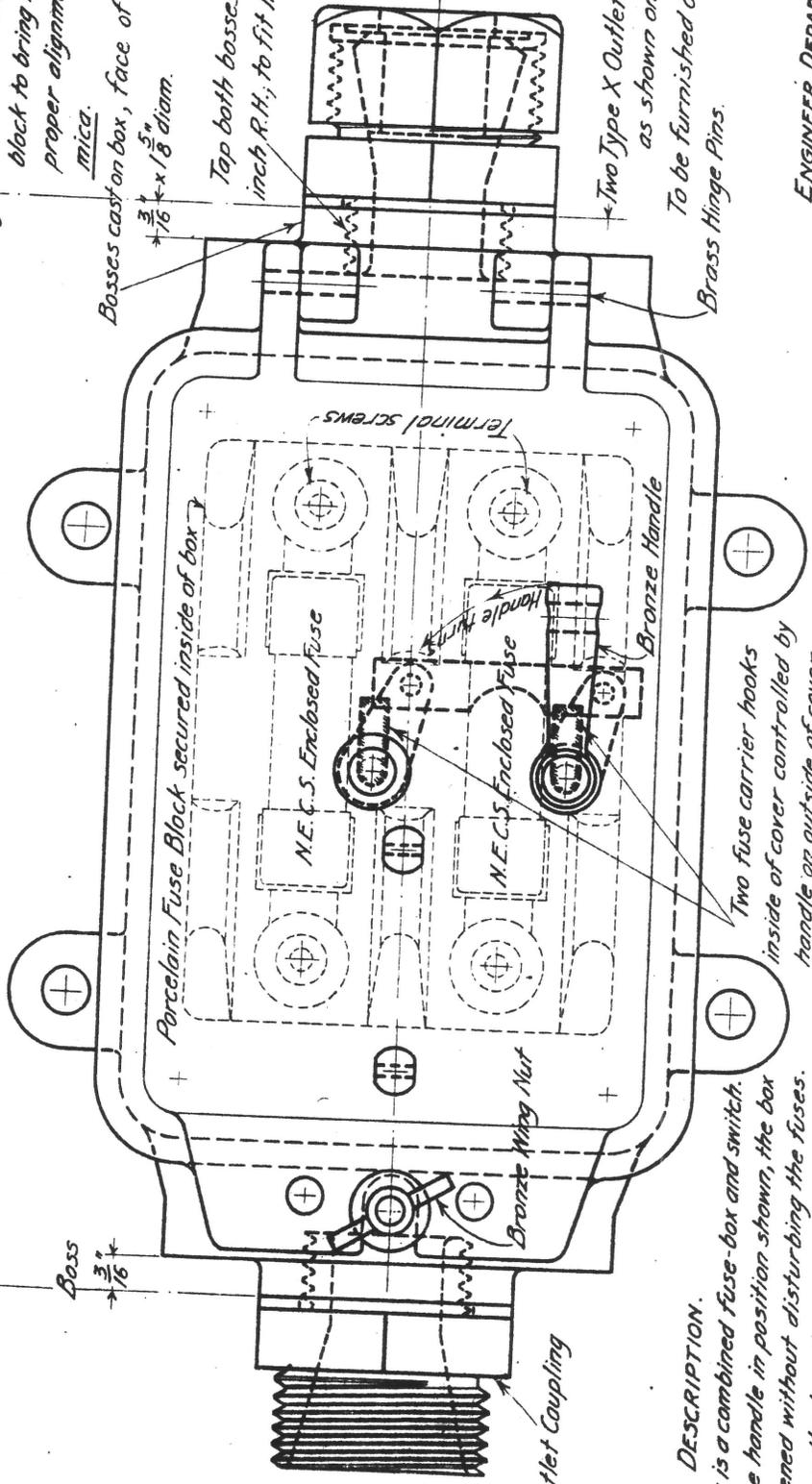
36 SHEETS - SHEET 17.

Watertight Service Box, Mark #3828, or equal, 0-30 amps, two poles, complete with fuse block and fuses; modified to receive U.S. Engr. Dept. outlet couplings, Type X.

SPECIAL NOTE TO CONTRACTOR.
When assembling the box and fuse block, it is found necessary to place shims under the block to bring the fuses and carrier hooks in proper alignment, such shims shall be of sheet mica.

Bosses cast on box, face of bosses to be finished $\frac{3}{16} \times \frac{5}{8}$ diam.
Tap both bosses $\frac{1}{16}$ O.D. 10 U.S. Std. thds. per inch R.H.; to fit limit gauges allowing .004 var.

Two Type X Outlet Couplings complete as shown on Sheet 13.
To be furnished only when specified.
Brass Hinge Pins.



DESCRIPTION.

The box is a combined fuse-box and switch. With the handle in position shown, the box may be opened without disturbing the fuses. By giving the handle a quarter turn in the direction indicated, the carrier hooks engage the fuses; if the box cover is then pulled open the fuses are withdrawn, breaking the circuit; pushing the cover again replaces the fuses in their fuse clips.

APPROVED. January 16, 1913.
FOR THE BOARD:

A. W. Roessler
Colonel, Corps of Engineers, U.S.A.
Senior Member.

REVISED: Oct. 9, 1913 - Type X coupling cap. July 1914 - Machined bosses.

ENGINEER DEPARTMENT, U.S. ARMY.
WATERTIGHT SERVICE BOX
MODIFIED TO RECEIVE
TYPE X OUTLET COUPLINGS.
Full Size.

NOTE: This drawing supersedes all previous designs for this type of fixture.

Watertight Service Box, Mark 3678, or equal, 61-100 amps, two poles; complete with fuse block, fuses and porcelain bushings.

SPECIAL NOTE TO CONTRACTOR.
When assembling the box and fuse block if it is found necessary to place shims under the block to bring the fuses and carrier hooks in proper alignment, such shims shall be of sheet mica.

Two Type Y Outlet Couplings complete as shown on Sheet 1A.
To be furnished only when specified.

Gasket $\frac{1}{8}$ " thick, sheet rubber without cloth insertion.
Two Straight-away Conduit Fittings, topped $1\frac{1}{2}$ " iron pipe size, $1\frac{1}{2}$ " threads per inch R.H., to fit Briggs' Std. pipe thread gauge.

FIELD NOTE.
These threads shall be painted with red lead when coupling is screwed into conduit fitting.

24
Eight #12-24 brass screws
 $\frac{5}{8}$ " long.

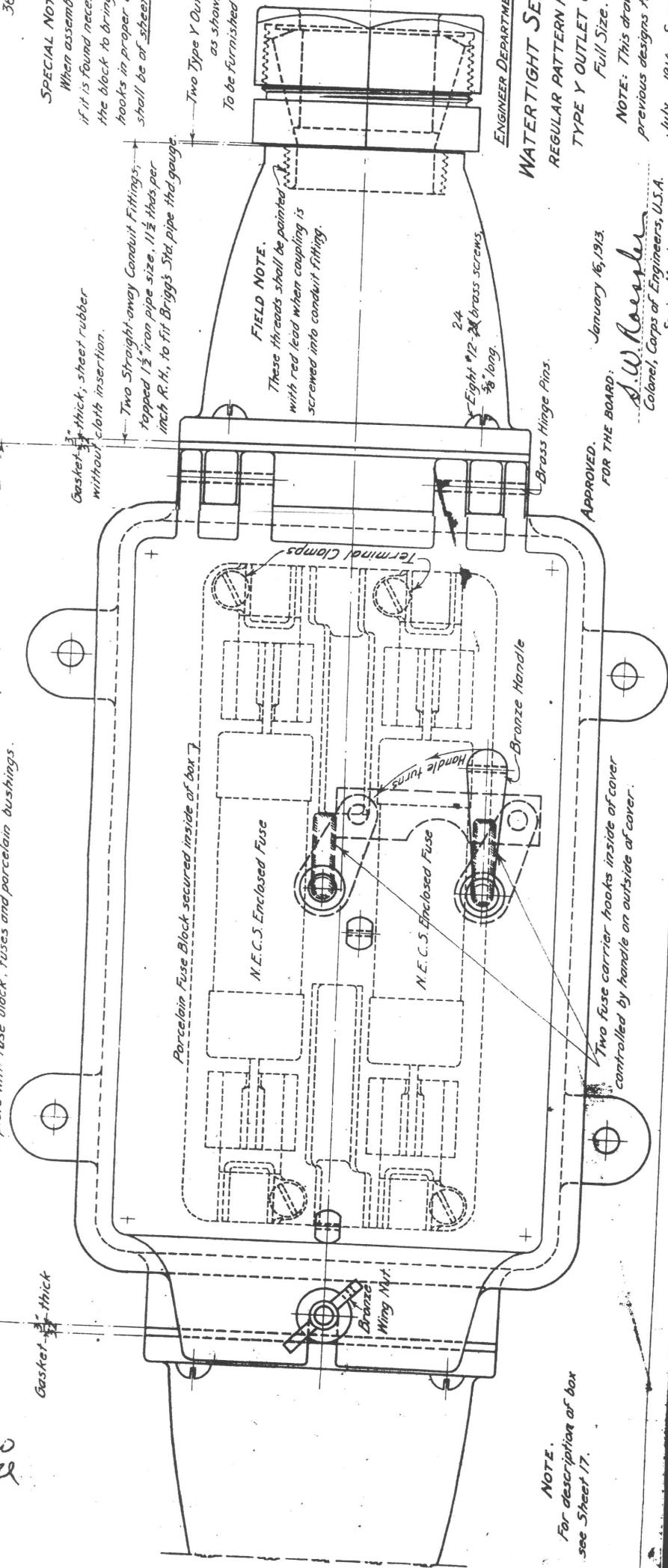
ENGINEER DEPARTMENT, U.S. ARMY.

WATERTIGHT SERVICE BOX
REGULAR PATTERN FITTED WITH TYPE Y OUTLET COUPLINGS.
Full Size.

NOTE: This drawing supercedes all previous designs for this type of fixture.
July 1914 - Screws for conduit fitting
REVISED: Oct. 9, 1913 - Type Y coupling.

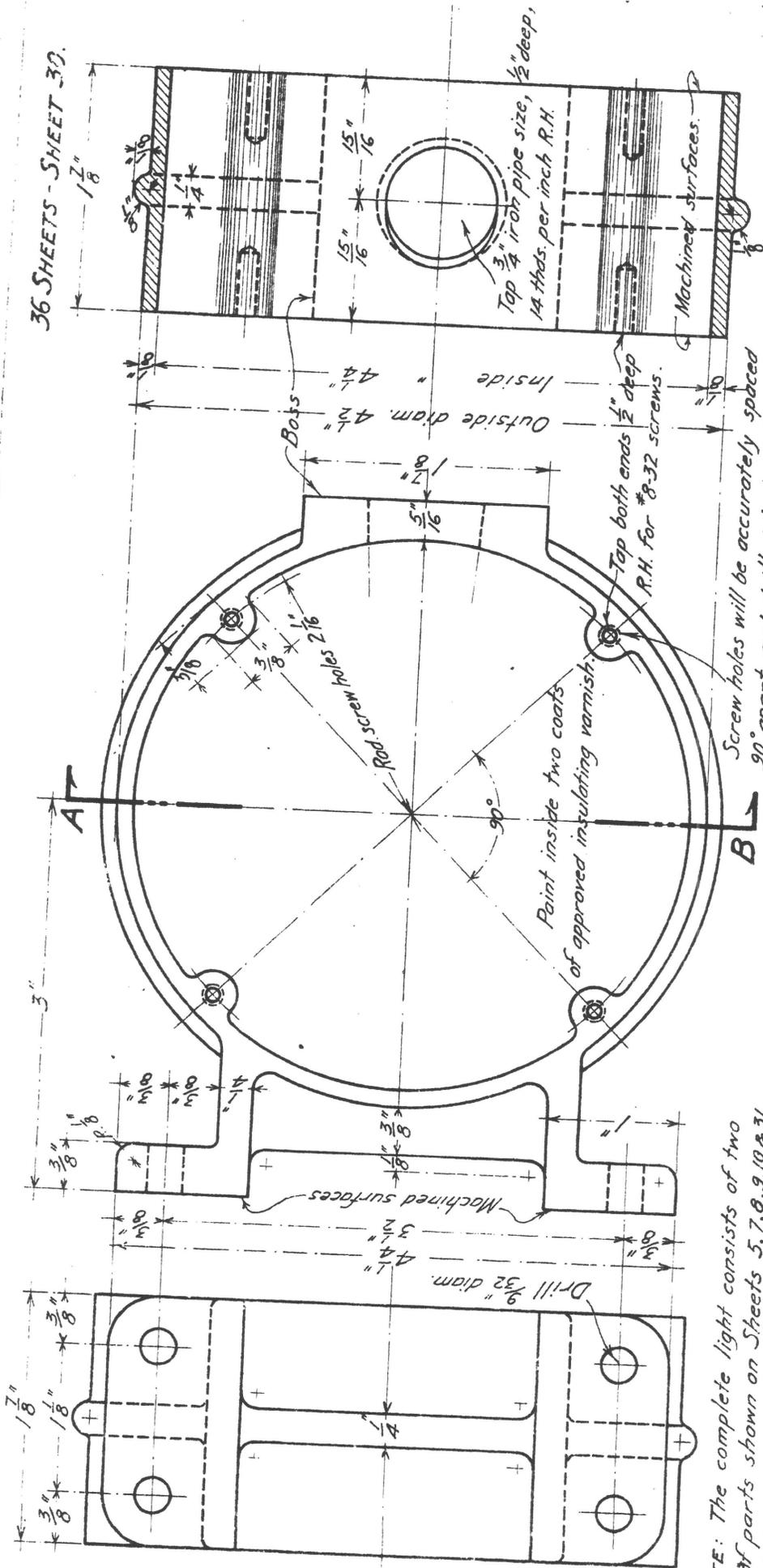
APPROVED, FOR THE BOARD:
January 16, 1913.

S. W. Roessler
Colonel, Corps of Engineers, U.S.A.
Senior Member.



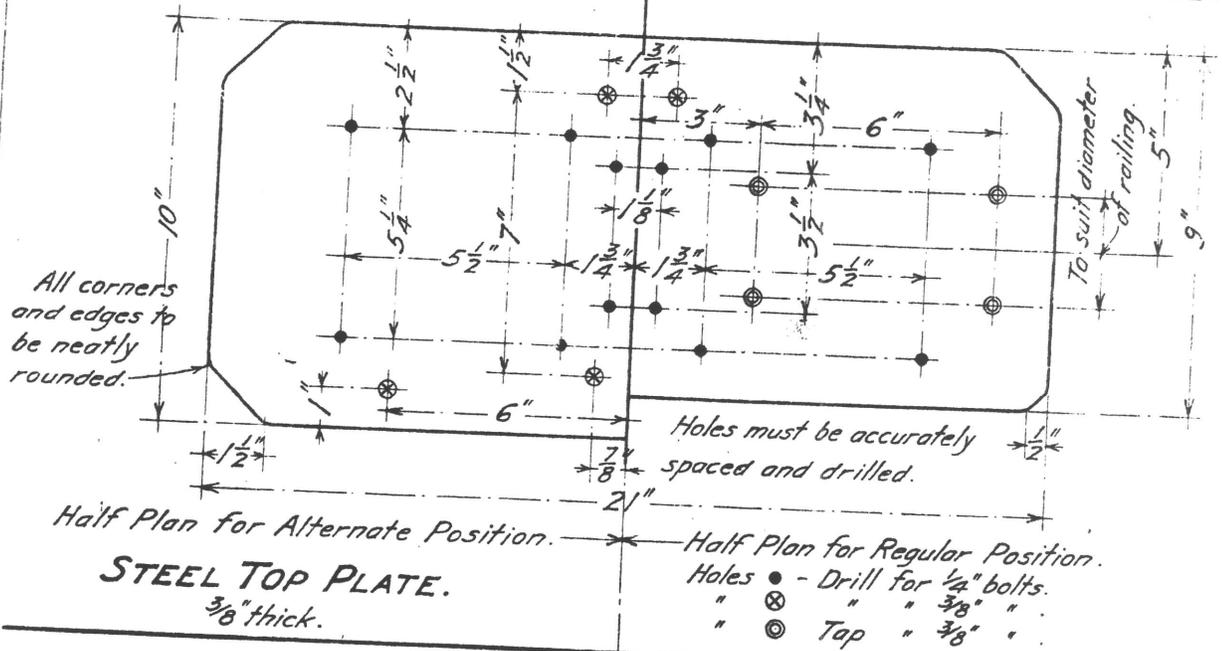
NOTE.
For description of box see Sheet 17.

17114
SC

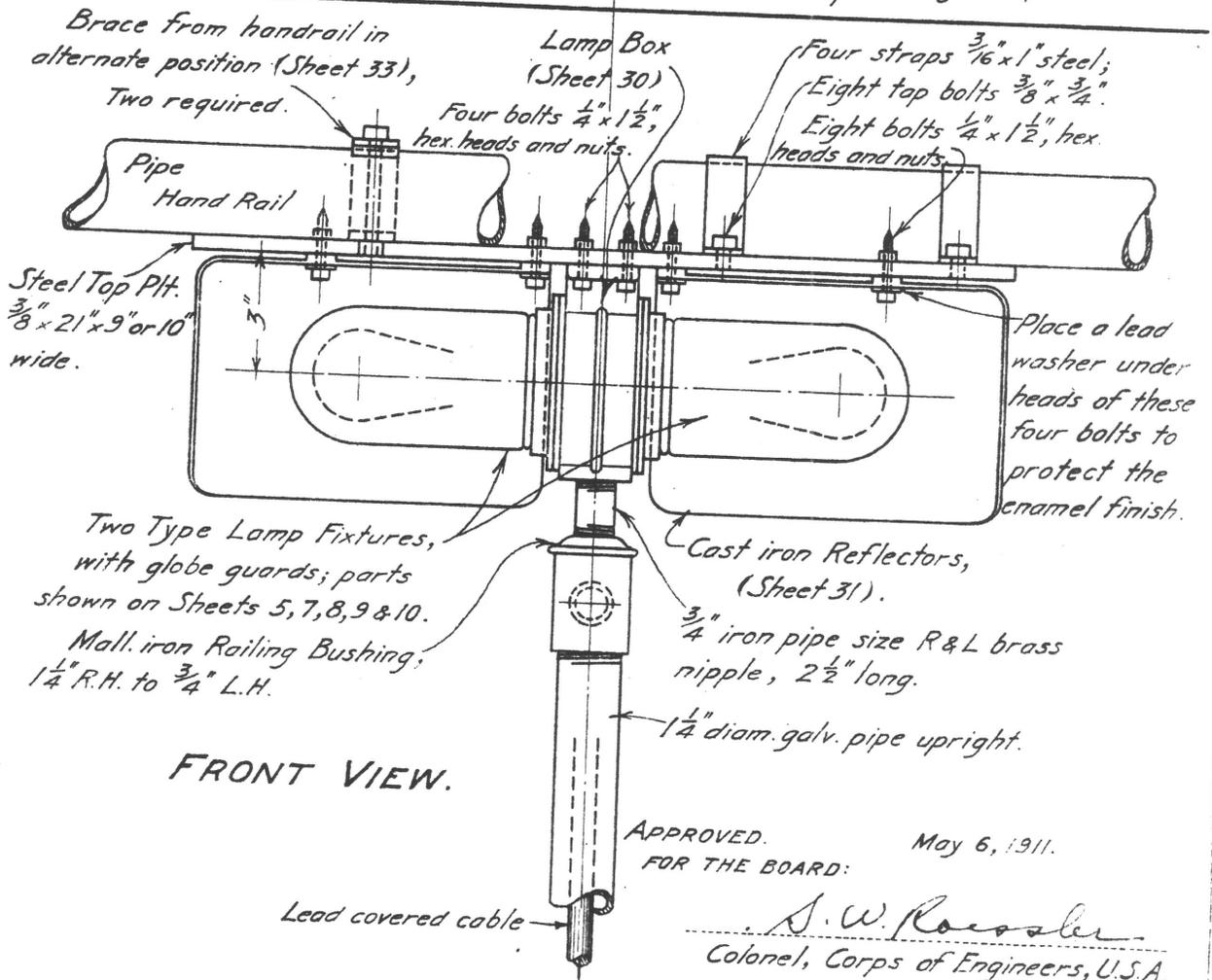


Plates are symmetrical about ϕ .

36 SHEETS - SHEET 32.



STEEL TOP PLATE.
 $\frac{3}{8}$ " thick.



FRONT VIEW.

APPROVED. May 6, 1911.
FOR THE BOARD:

S. W. Roessler
Colonel, Corps of Engineers, U.S.A.
Senior Member.

ENGINEER DEPARTMENT, U.S. ARMY.

**DETAILS OF
FIXTURE FOR PLATFORM LIGHT.**

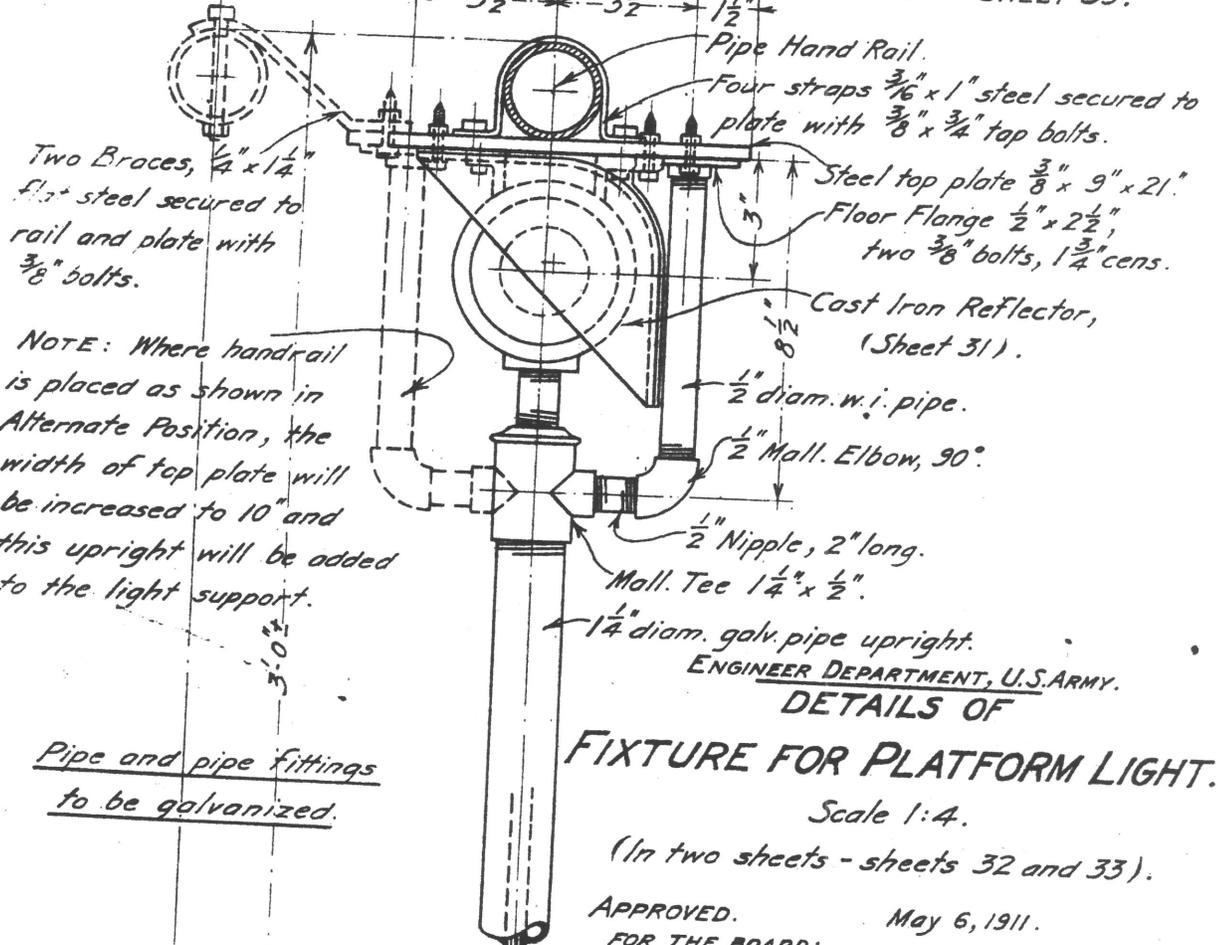
Scale 1:4.

(In two sheets - sheets 32 and 33).

REVISED:
Jan 31, 1913 - Globe guards added.

ALTERNATE POSITION
OF HAND RAIL.

36 SHEETS-SHEET 33.



ENGINEER DEPARTMENT, U.S. ARMY.

DETAILS OF
FIXTURE FOR PLATFORM LIGHT.

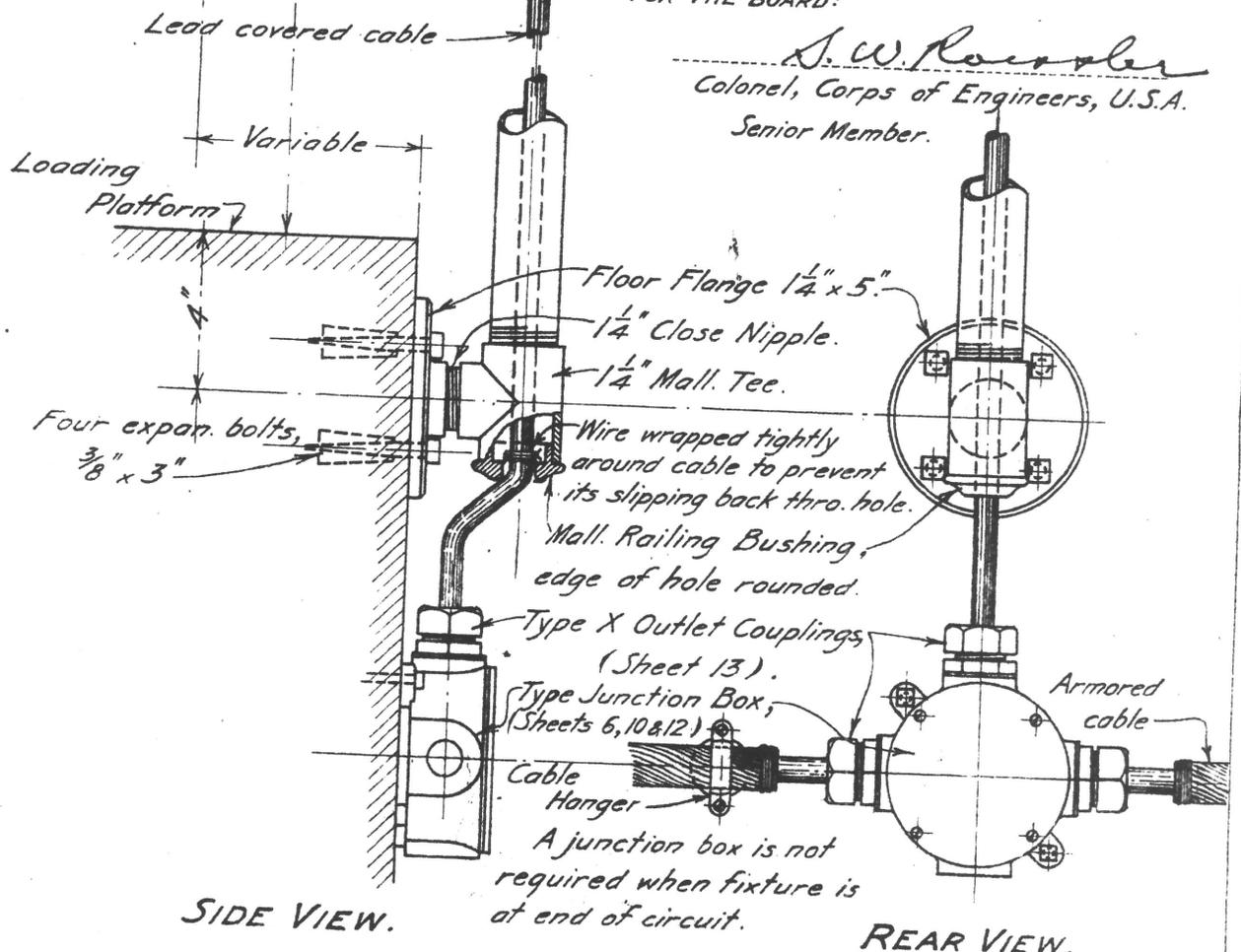
Scale 1:4.

(In two sheets - sheets 32 and 33).

APPROVED. May 6, 1911.
FOR THE BOARD:

S. W. Rowler
Colonel, Corps of Engineers, U.S.A.
Senior Member.

Pipe and pipe fittings to be galvanized.



SIDE VIEW.

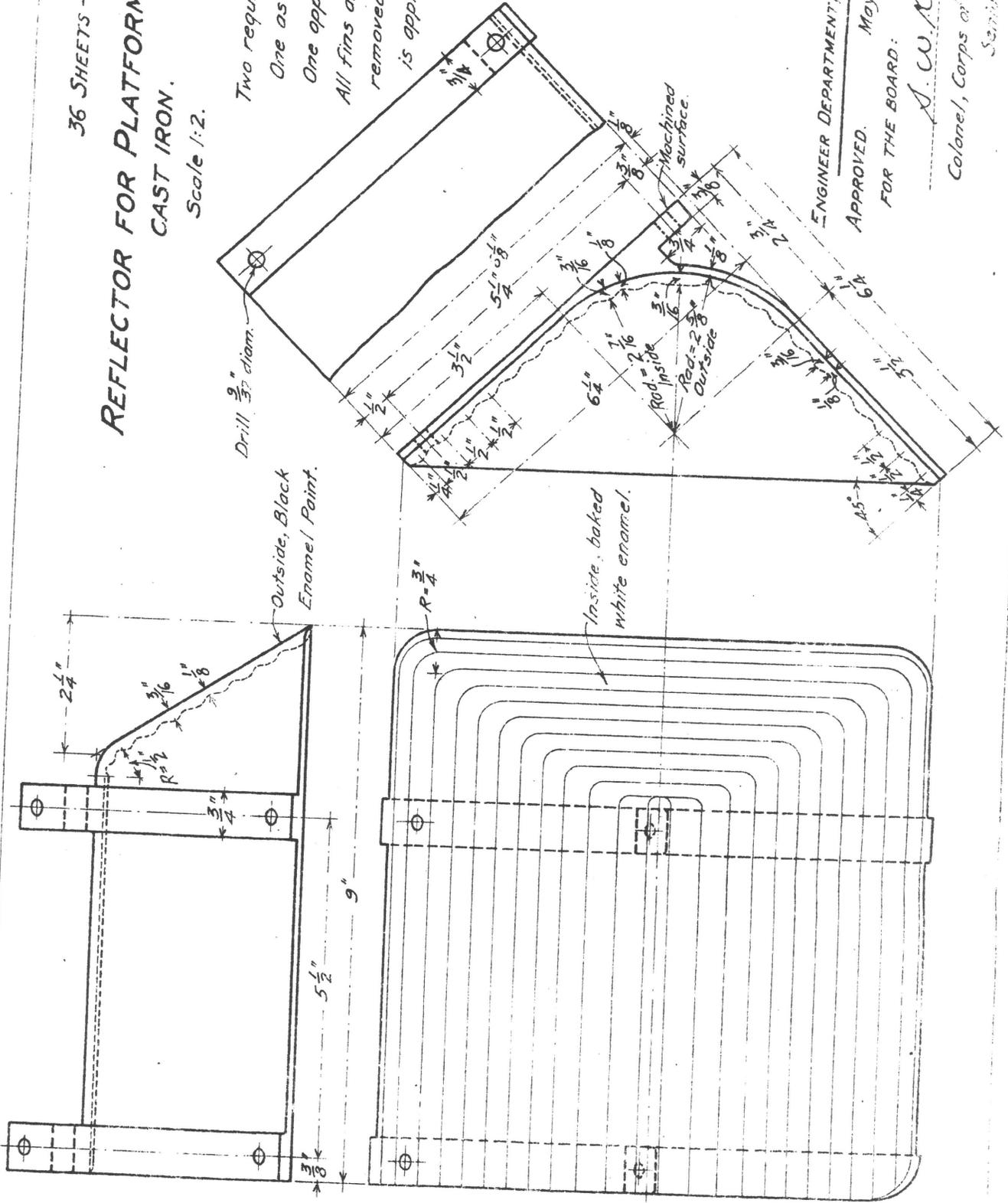
REAR VIEW.

36 SHEETS - SHEET 31.

REFLECTOR FOR PLATFORM LIGHT. CAST IRON.

Scale 1:2.

Two required for each light,
One as drawn,
One opposite hand.
All fins and burrs to be
removed before enamel
is applied.



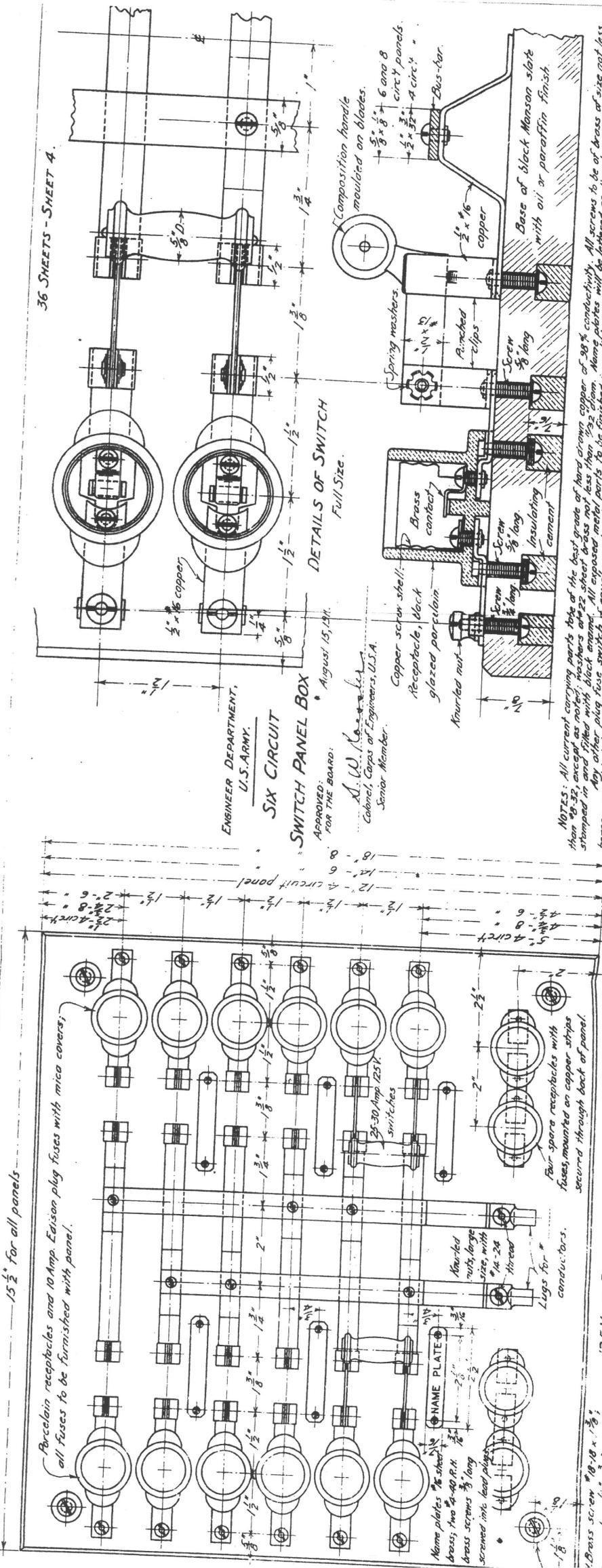
ENGINEER DEPARTMENT, U.S. ARMY.

APPROVED. May 6, 1911.

FOR THE BOARD:

A. W. K...

Colonel, Corps of Engineers, U.S.A.
Senior Member.



ENGINEER DEPARTMENT,
U.S. ARMY.

SIX CIRCUIT
SWITCH PANEL BOX

APPROVED:
FOR THE BOARD:
August 15, 1917.
A. W. [Signature]
Colonel, Corps of Engineers, U.S.A.
Senior Member.

DETAILS OF SWITCH
Full Size.

NOTES: All current carrying parts like of the best grade of hard drawing copper of 98% conductivity. All screws to be of brass of size not less than #8-32, except as noted; washers and nuts sheet brass not less than #22 gage. Name plates will be further polished copper, lacquered to be stamped in and filled with black enamel. All exposed metal parts to be finished in polished copper, lacquered. Any other plug fuse switch or other construction may be used if approved by the purchasing officer, but the clearances herein prohibited inside of box must not be reduced.

12.5 VOLT PANEL BOARD.

Scale 1:2.

REVISED: Jan 31, 1917 - Larger nuts for main terminals.

15 1/2" for all panels

Porcelain receptacles and 10 Amp Edison plug fuses with mica covers; all fuses to be furnished with panel.

Name plates 1/4" x 1 1/2" x 1/8" brass; two #4-40 R.H. brass screws 3/8" long screwed into base plate.

Maulled nuts, large size, with #14-24 threads.

Lugs for conductors.

Four spare receptacles with fuses, mounted on copper strips secured through back of panel.

Brass screw #10-18 x 1 1/8";
SST washer 1/8" x 3/4"

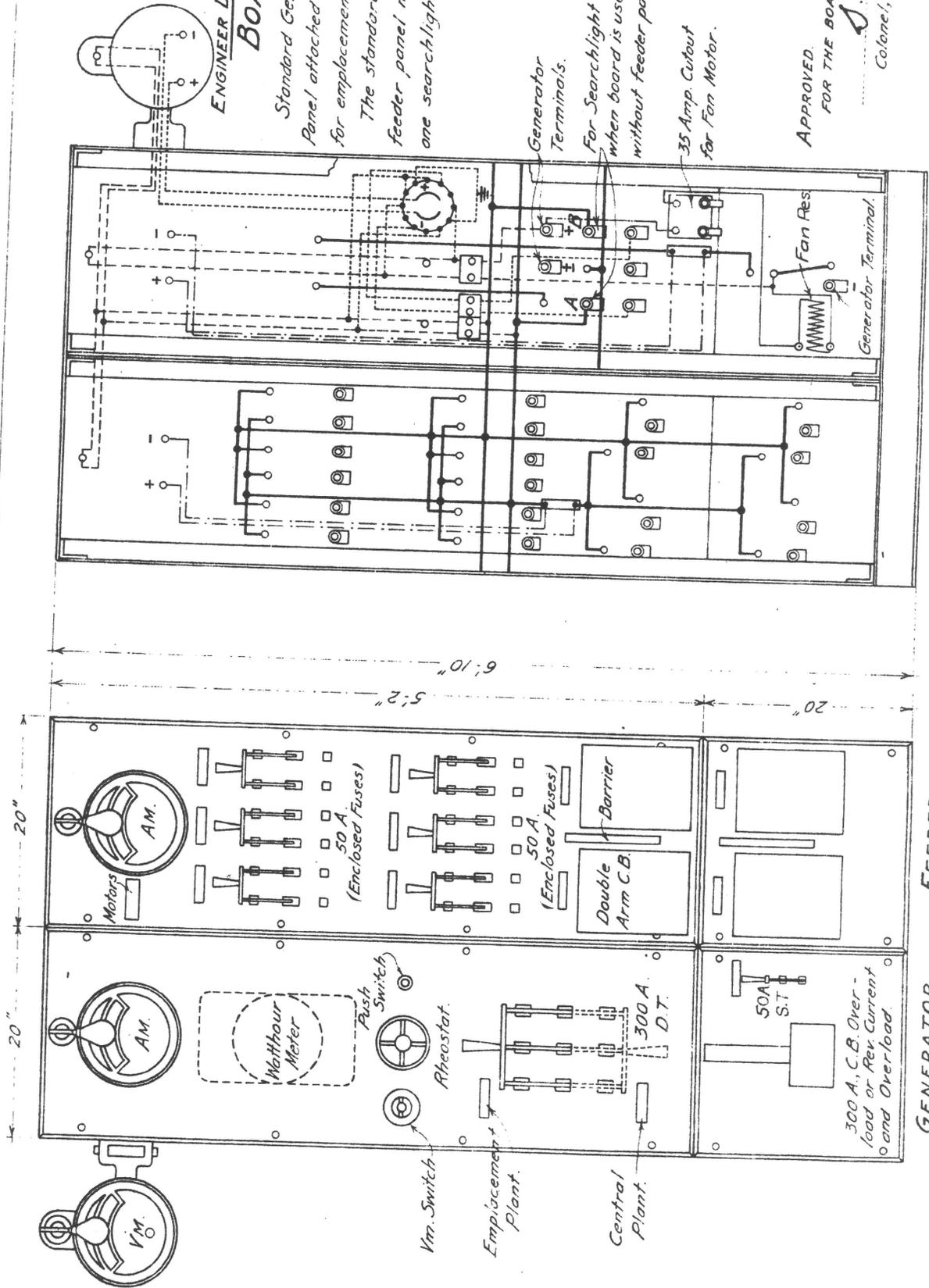
ENGINEER DEPARTMENT, U.S. ARMY.
BOARD No. 1.

Standard Generator Panel with Feeder
 Panel attached for use with one Generator,
 for emplacement service.

The standard generator panel without
 feeder panel may be used to operate
 one searchlight.

APPROVED FOR THE BOARD:
 May 6, 1911.

S. W. Roessler
 Colonel, Corps of Engineers, U.S.A.
 Senior Member.



GENERATOR PANEL.

FEEDER PANEL.

Scale.

D. Jan. 31, 1913 - Pilot lamp circuit on Gen. Panel changed. Nov. 3, 1914. Fan resistance and short-circuit switch added.

BOARD NO. 3.

Two Standard Generator Panels for use with two searchlights when two generating sets are installed in the same searchlight power house.

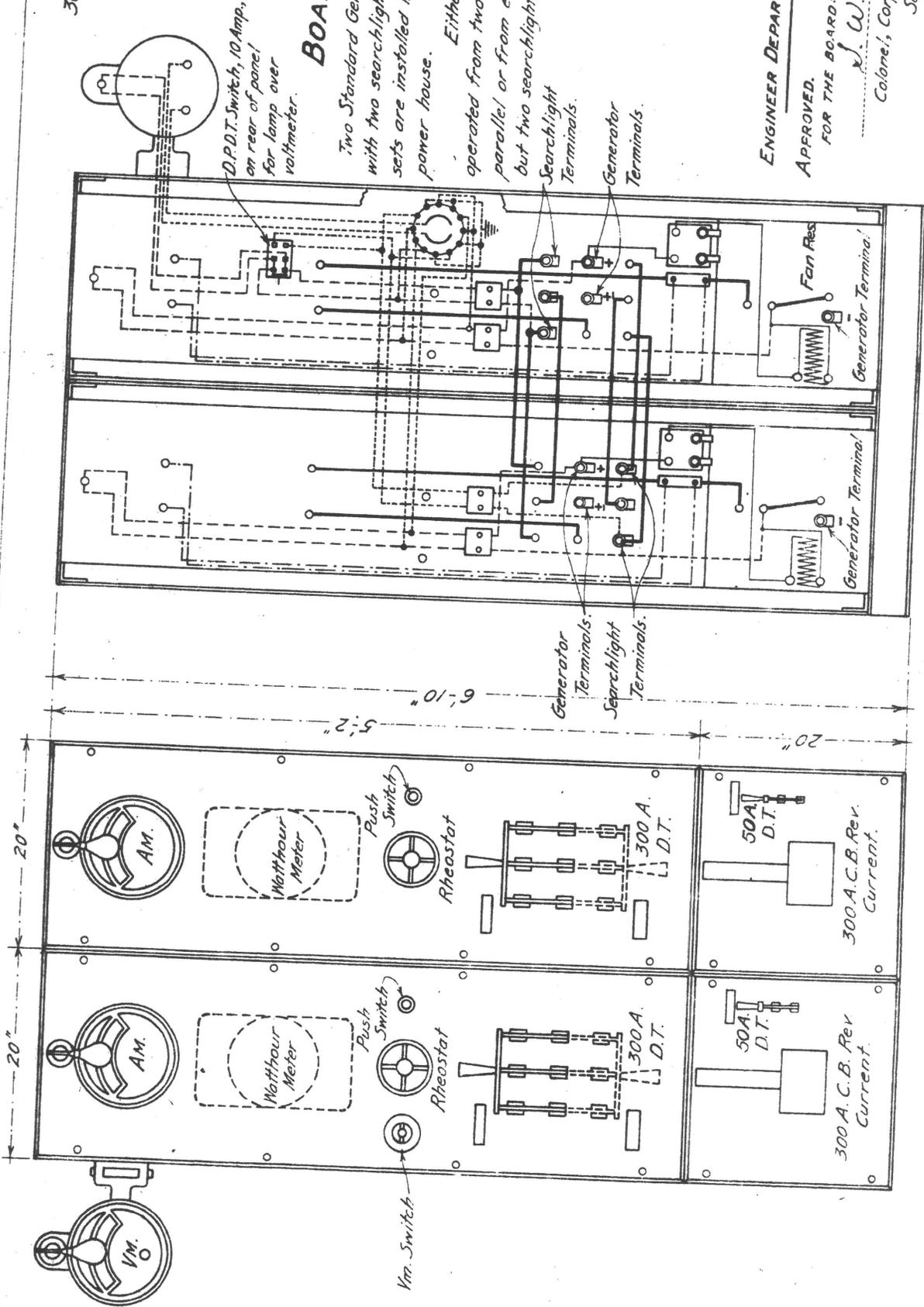
Either searchlight may be operated from two engines working in parallel or from either engine singly, but two searchlights cannot be connected to one engine.

ENGINEER DEPARTMENT, U.S. ARMY.

APPROVED FOR THE BOARD: May 6, 1911.

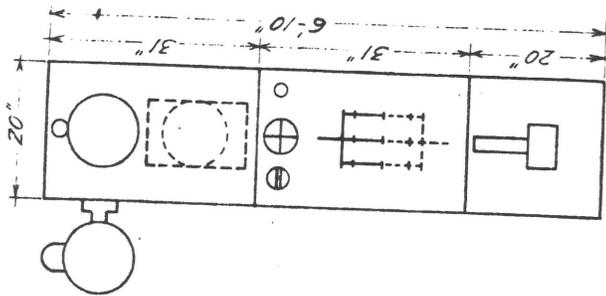
J. W. Rowland

Colonel, Corps of Engineers, U.S.A.
Senior Member.

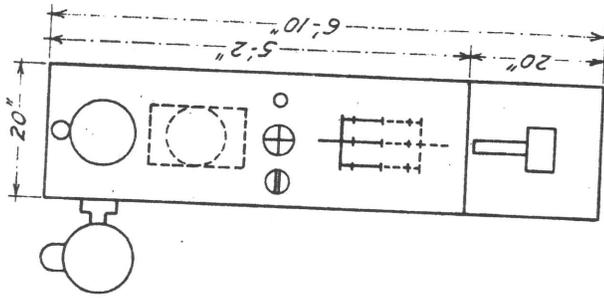


Scale. 12" 0 1 2 3 Ft.
Nov. 3, 1914. Fan resistance and short-circuit switch added.

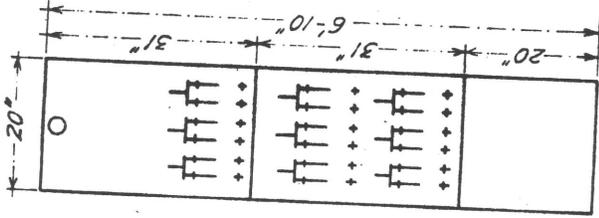
Jan. 31, 1913. Pilot lamp circuit changed.



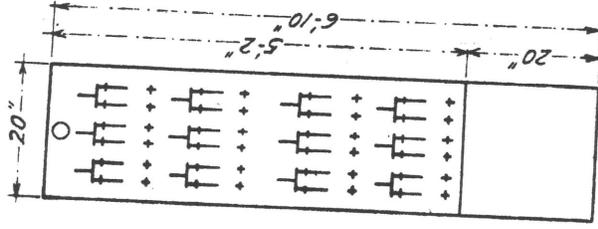
A. Single Generator Panel for Insular Sessions (export), the board being in three sections to minimize breakage in transit, may be used without order panel for single searchlight.



B. Single Generator Panel for use in the United States (domestic), the board being in two sections; may be used without feeder panel for single searchlight.



C. Single Feeder Panels to be used in installations where generating sets have not been installed and where there are no motor circuits. The boards have switches only and ammeters are not provided. When a generating set is installed, a standard generator panel may be added to either of these feeder panels. Sketch C shows a three-section board for export.



D. Single Feeder Panels to be used in installations where generating sets have not been installed and where there are no motor circuits. The boards have switches only and ammeters are not provided. When a generating set is installed, a standard generator panel may be added to either of these feeder panels. Sketch C shows a three-section board for export.

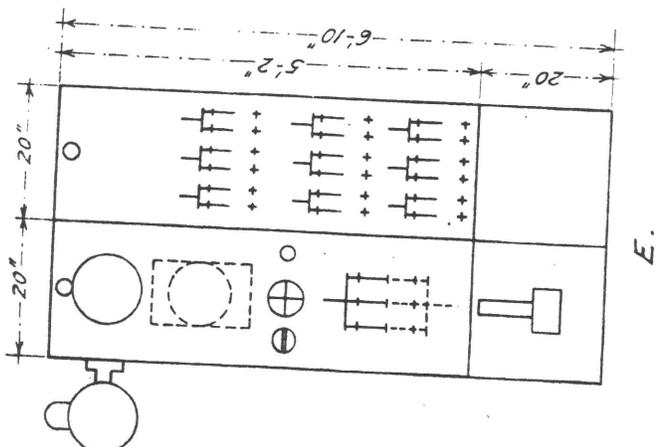
ENGINEER DEPARTMENT, U.S. ARMY.

SWITCHBOARDS.
TYPES A, B, C & D.

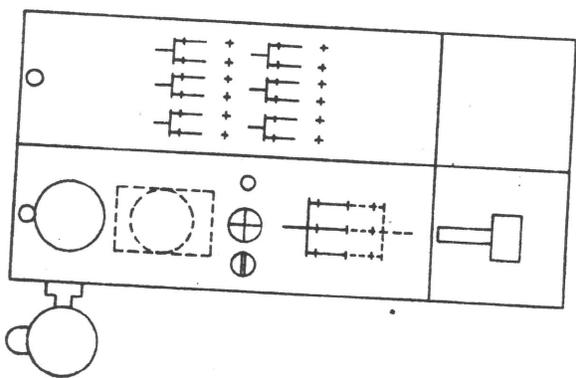
APPROVED.
FOR THE BOARD:

May 6, 1911.

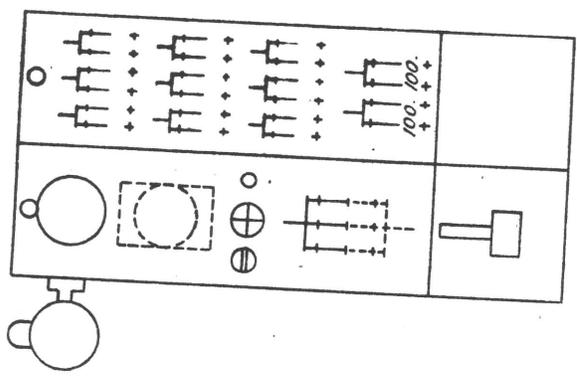
A. W. Ransome
Colonel, Corps of Engineers, U.S.A.
Senior Member.



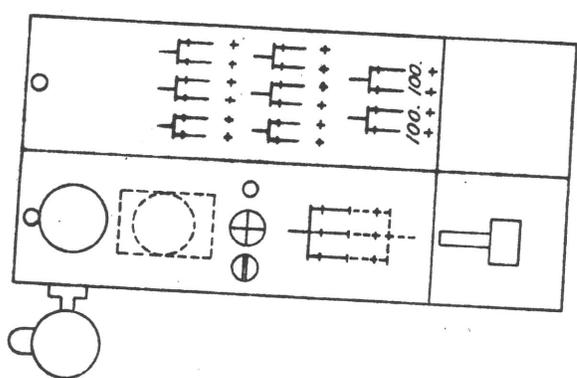
E.



F.



G.



H.

ENGINEER DEPARTMENT, U.S. ARMY.

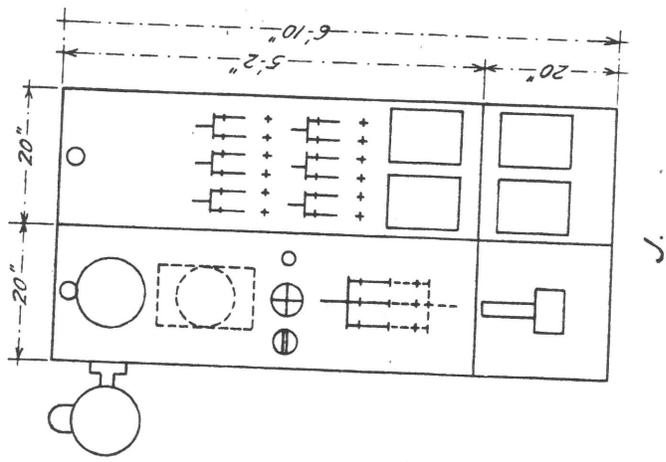
SWITCHBOARDS.

TYPES E, F, G & H.

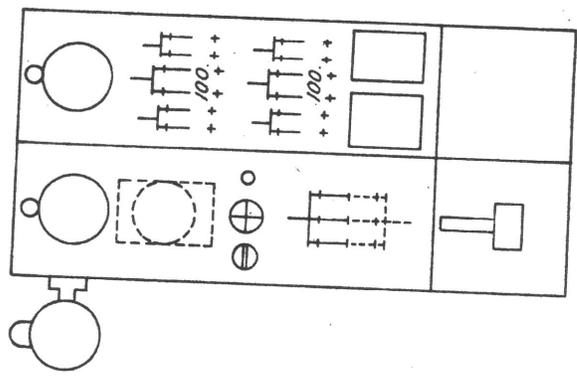
Single Generator Panels with Feeder Panels for use in emplacements where there are no motor circuits. Switches only are provided on the feeder panels, the size, number and arrangement varying with conditions. Boards so arranged may be used in 6-inch or mortar batteries where there are no motor circuits.

APPROVED. May 6, 1911.
FOR THE BOARD:

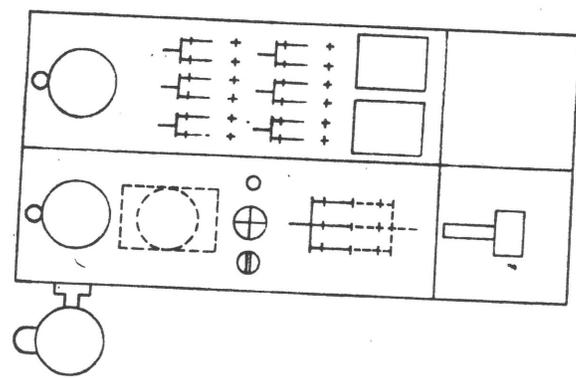
N. W. Rowland
Colonel, Corps of Engineers, U.S.A.
Senior Member



J.



K.



L.

SWITCHBOARDS.

TYPES J, K & L.

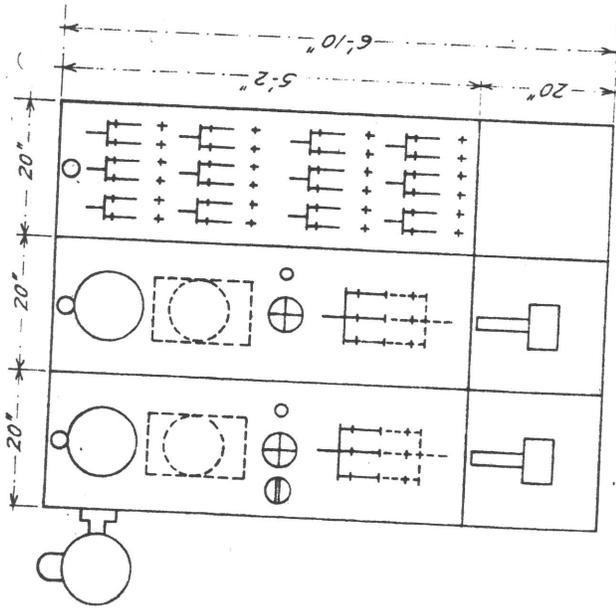
Single Generator Panels and Feeder Panels with switches for lights and circuit breakers for motors. Boards K and L have ammeters on the feeder panel to measure the total motor load. Board J has four circuit breakers and may be installed in a two-gun battery with ammunition hoists (2 circuits) and with retracting motors on the gun carriages (2 circuits). Boards K and L are used where there are only two motor circuits instead of four. The ammeter on the feeder panel is optional. Its omission provides space for three more 50-Amp switches.

ENGINEER DEPARTMENT, U.S. ARMY.

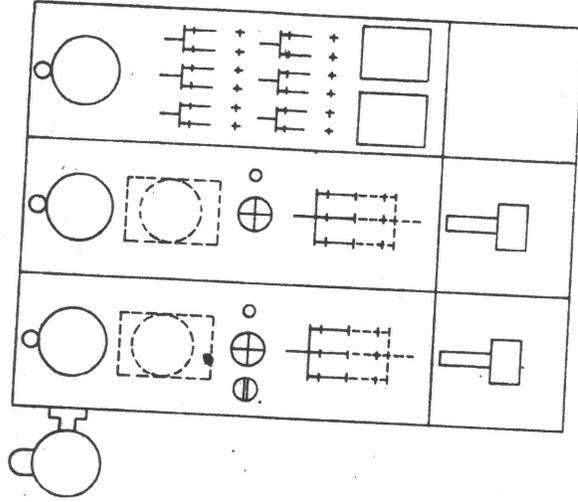
APPROVED.
FOR THE BOARD:

May 6, 1911.

A. W. Rowland
Colonel, Corps of Engineers, U.S.A.
Senior Member.



M.
Two Generator Panels and one Feeder Panel for lighting circuits only; for two generators operating in parallel.



N.
Two Generator Panels and one Feeder Panel supplying light, and power to motors; for two generators operating in parallel.

ENGINEER DEPARTMENT, U.S. ARMY.

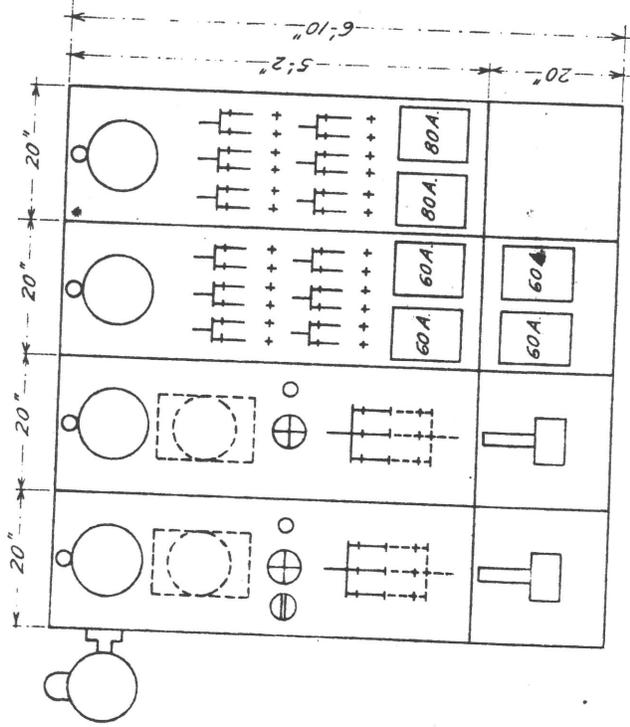
SWITCHBOARDS.

TYPES M & N.

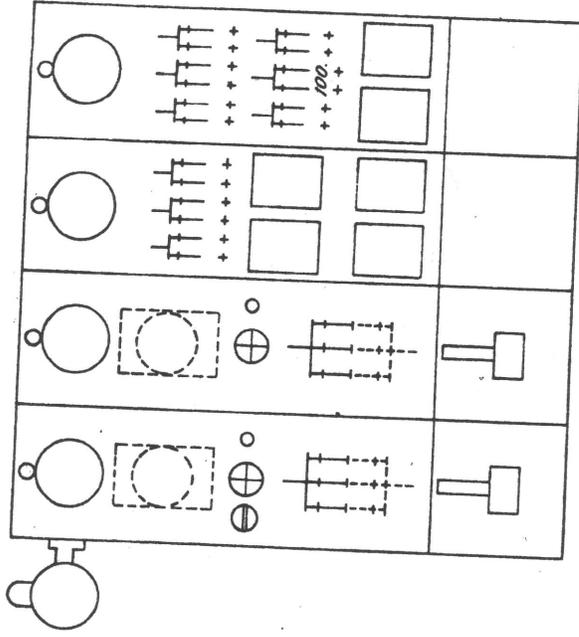
APPROVED FOR THE BOARD:

May 6, 1911.

J. W. K...
Colonel, Corps of Engineers, U.S.A.
Senior Member.



O.



P.

ENGINEER DEPARTMENT, U.S. ARMY.

SWITCHBOARDS.

TYPES O & P.

Two Generator and two Feeder Panels supplying light, and power to motors; for two generators operating in parallel.

This board may be installed in a three-gun battery where more than four motor circuits are required; one ammeter on one feeder panel may be used to indicate the current used by the retracting motors and the other to indicate the current used by the ammunition hoists.

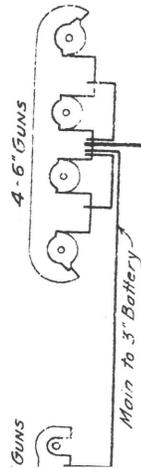
APPROVED.

FOR THE BOARD:

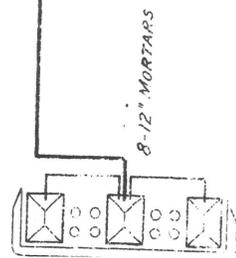
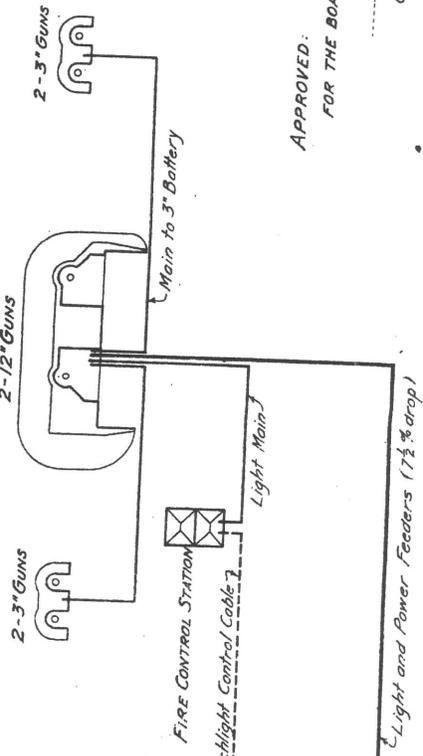
May 6, 1911.

S. W. Rowlee
Colonel, Corps of Engineers, U.S.A.
Senior Member.

GROUP No 2.



GROUP No 3.



GROUP No 1.

APPROVED: FOR THE BOARD: May 6, 1911.

S. W. Rowland
Colonel, Corps of Engineers, U.S.A.
Senior Member.

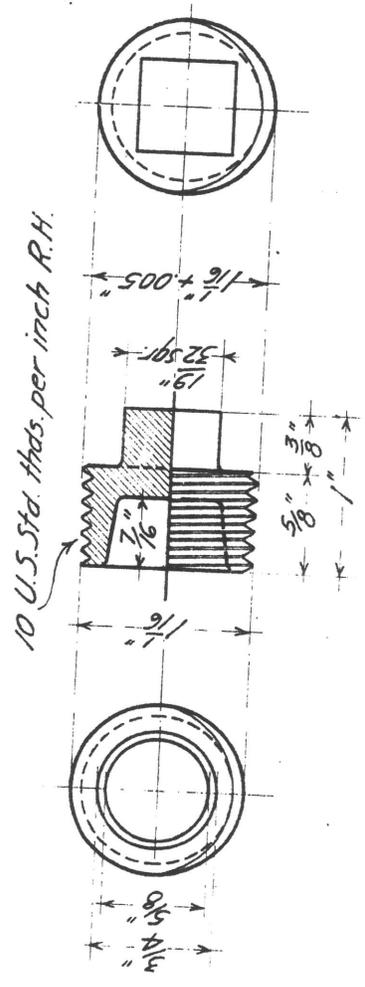
ENGINEER DEPARTMENT, U.S. ARMY.

TYPE PLAN OF

POWER DISTRIBUTION
FROM A CENTRAL POWER PLANT
AT SEACOAST FORTIFICATIONS.

36 ORIGINAL SHEETS.
 ADDITIONAL SHEET 39

17187
 208



COMPOSITION CASTING.
 Copper not less than 84%
 Tin " " " 3%
 Lead " " " 1.5%
 The balance Zinc.

Plug to have dark bronze or gun metal finish.

ENGINEER DEPARTMENT, U.S. ARMY.
PLUG FOR TYPE X OUTLET
 Full size.

APPROVED:
 FOR THE BOARD:
 April 28, 1915.

A. W. Rawler
 Colonel, Corps of Engineers, U.S.A.
 Senior Member

ENGINEER DEPARTMENT, U.S. ARMY.

BOARD No 2.

Two Standard Generator Panels and one Feeder Panel, to be used when two generators are installed together permitting the parallel operation of both generators or the individual operation of either.

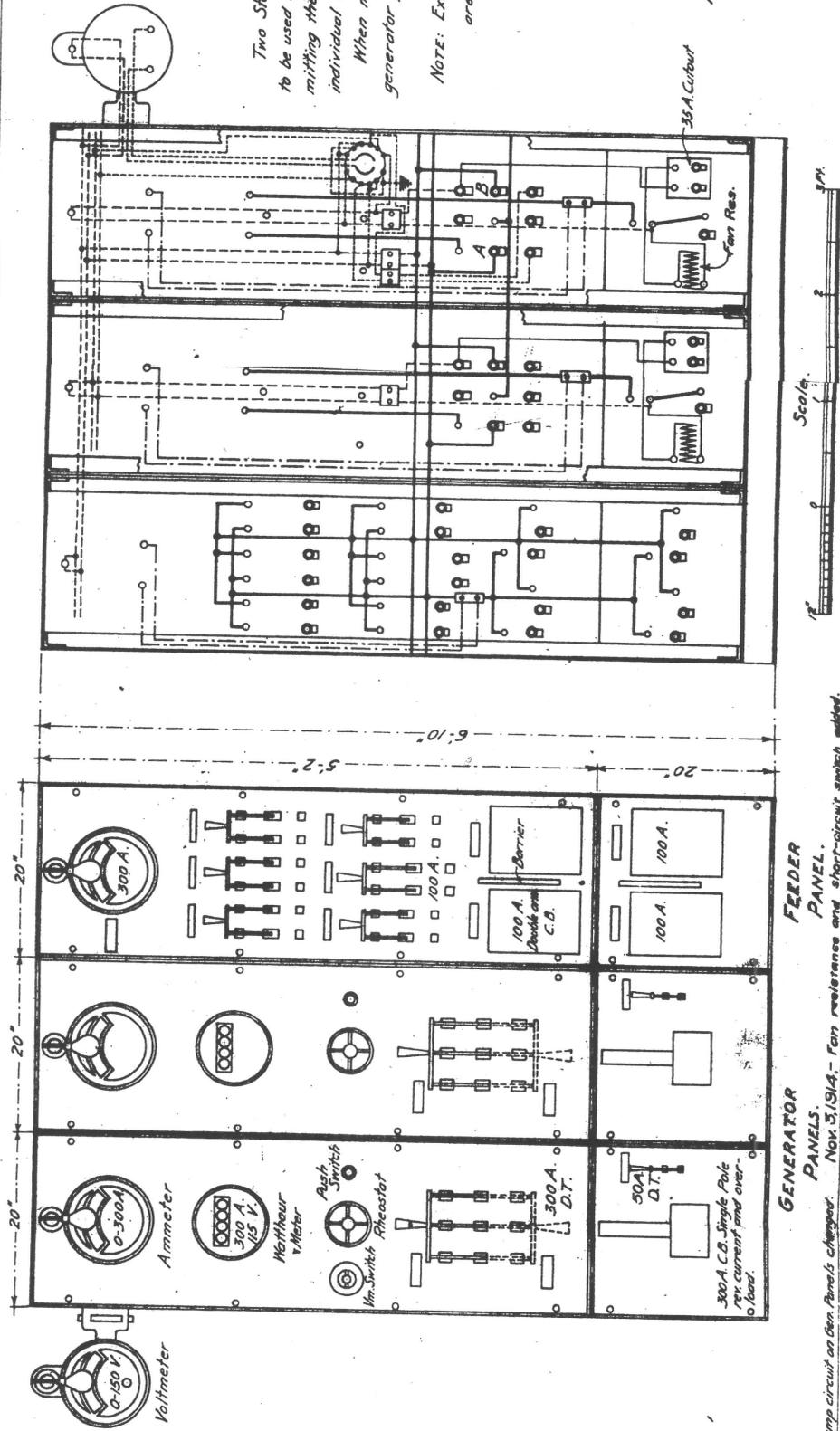
When more than two generators are installed additional generator panels may be added.

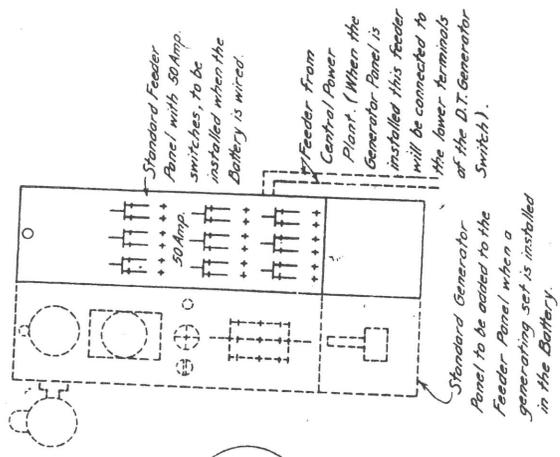
NOTE: Except where otherwise indicated, Feeder switches are 50 Amp capacity.

APPROVED. May 6, 1911.

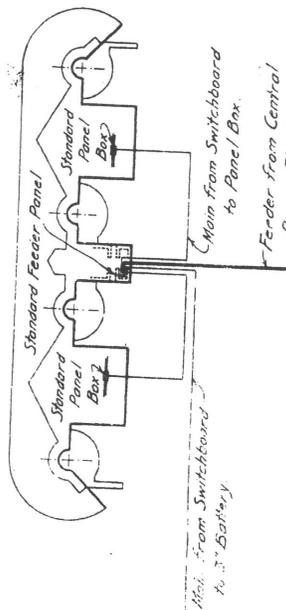
FOR THE BOARD:

D. W. Rose
Colonel, Corps of Engineers, U.S.A.
Senior Member.

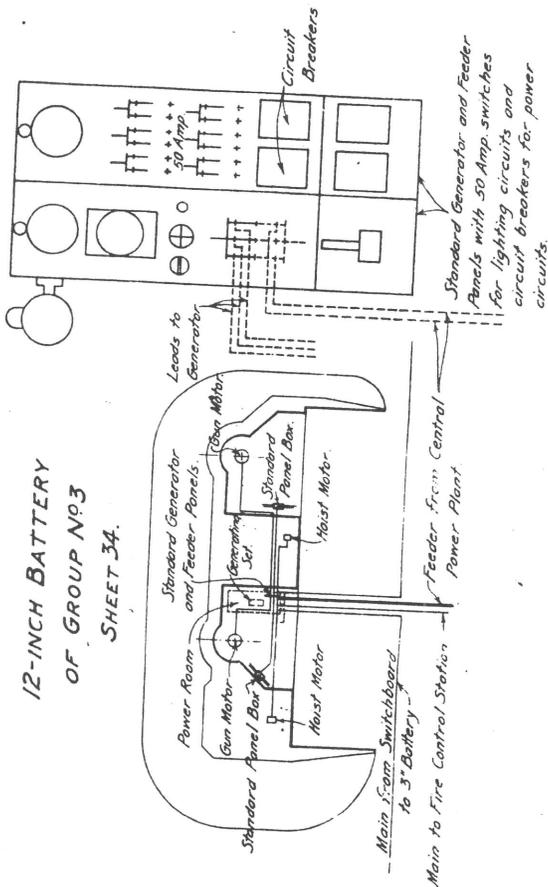




6-INCH BATTERY OF GROUP NO 2 SHEET 34.



12-INCH BATTERY OF GROUP NO 3 SHEET 34.



ENGINEER DEPARTMENT, U.S. ARMY.

TYPE PLANS SHOWING DISTRIBUTION OF POWER FROM SWITCH-BOARDS IN SEACOAST BATTERIES.

APPROVED: May 6, 1911.
FOR THE BOARD:

S. W. Kowalek
Colonel, Corps of Engineers, U.S.A.
Senior Member.

NOTE.
 In emplacements with low parapets the height of the Time-Range board may be reduced
 and the canopy over the board sloped in the opposite direction.

3/8 ORIGINAL SHEETS.
 ADDITIONAL SHEET 31.

15125
 7068

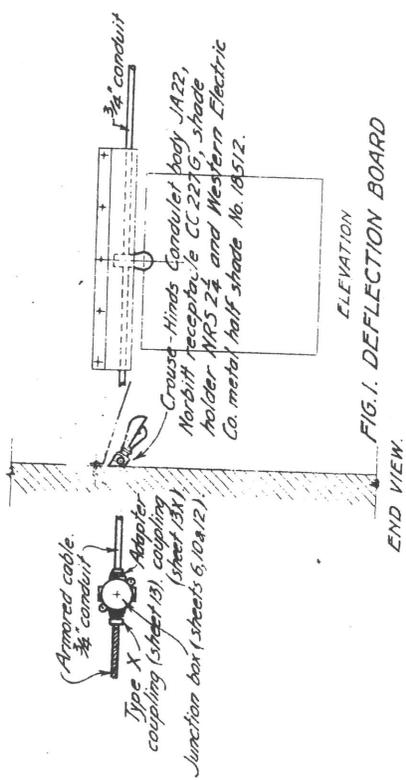


FIG. 1. DEFLECTION BOARD
 ELEVATION
 END VIEW.

ENGINEER DEPARTMENT, U.S. ARMY.
 LIGHTING OF
 RANGE DATA BOARDS
 AT GUN EMPLACEMENTS
 Scale 3/8 in. = 1 ft.

APPROVED:
 FOR THE BOARD. April 28, 1915.
 J. W. Rowden
 Colonel, Corps of Engineers, U.S.A.
 Senior Member.

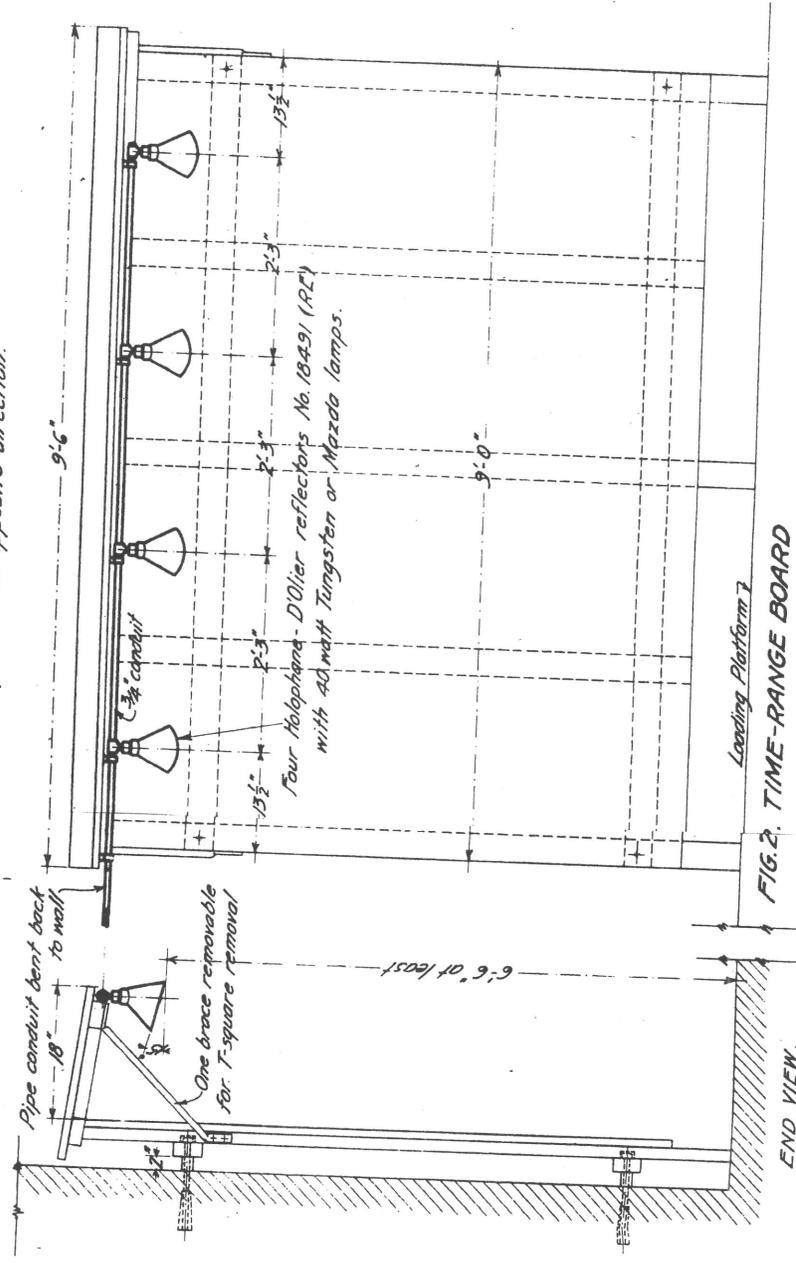
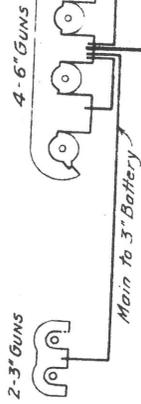
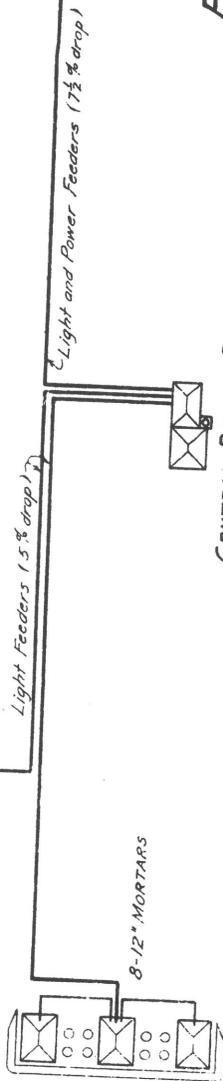
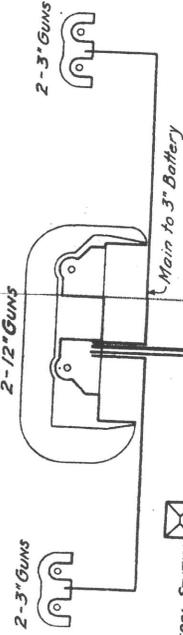


FIG. 2. TIME-RANGE BOARD
 ELEVATION.
 END VIEW.

GROUP NO. 2.



GROUP NO. 3.



APPROVED FOR THE BOARD:

May 6, 1911.

D. W. Rowland

Captain, Corps of Engineers, U.S.A.

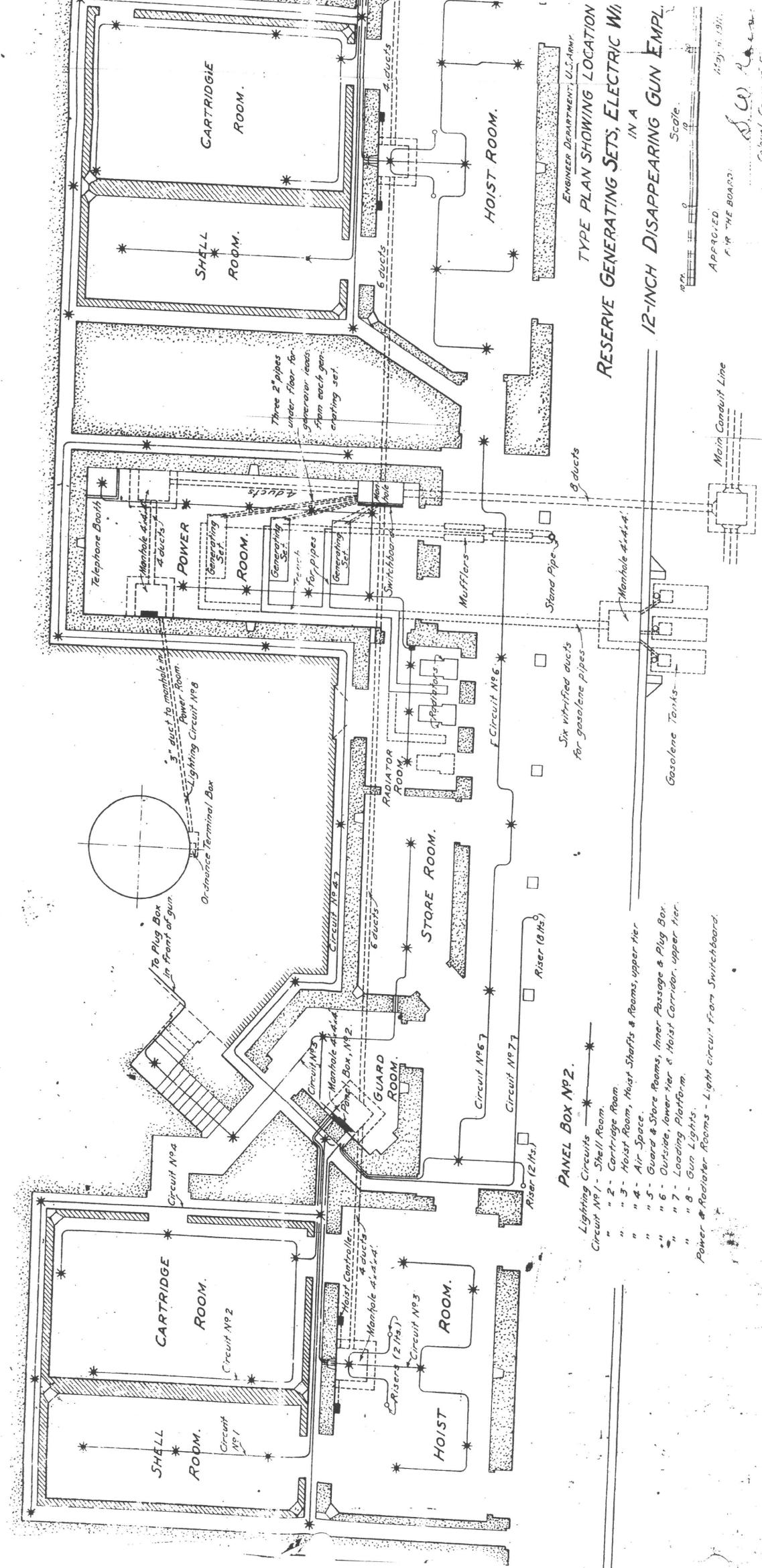
Senior Member.

ENGINEER DEPARTMENT, U.S. ARMY.

TYPE PLAN OF

POWER DISTRIBUTION

FROM A CENTRAL POWER PLANT
AT SEACOAST FORTIFICATIONS.

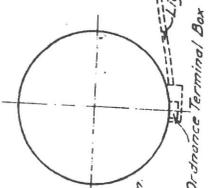


ENGINEER DEPARTMENT, U.S. ARMY
**TYPE PLAN SHOWING LOCATION
 IN A
 RESERVE GENERATING SETS, ELECTRIC WINCH
 12-INCH DISAPPEARING GUN EMPL.**

APPROVED FOR THE BOARD:
 Major H. 1911
 Colonel, Corps of Engineers
 Station, Fort

- PANEL BOX NO 2.**
- Lighting Circuits
 - Circuit No 1 - Shell Room.
 - " " 2 - Cartridge Room.
 - " " 3 - Hoist Room, Hoist Shafts & Rooms, upper tier.
 - " " 4 - Air Space.
 - " " 5 - Guard & Store Rooms, Inner Passage & Plug Box.
 - " " 6 - Outside, lower tier & Hoist Corridor, upper tier.
 - " " 7 - Loading Platform.
 - " " 8 - Gun Lights.
- Power & Radiator Rooms - Light circuit from Switchboard.

Telephone Booth
 Manhole 4"x4"
 POWER ROOM
 Generating Set
 For pipes
 Generating Set
 Switchboard
 Mufflers
 Stone Pipe
 Manhole 4"x4"
 Main Conduit Line
 Gasolene Tanks
 Six vitrified ducts for gasolene pipes
 Radiator Room
 Store Room
 GUARD ROOM
 Hoist Room
 Shell Room
 Cartridge Room
 Hoist Room
 Cartridge Room
 Shell Room



Scale: 1" = 10'