Commissioners Light Houses.

1857.

MEMORANDUM
CONCERNING
LIGHTHOUSES
& LIGHT VESSELS
REQUIRED IN
THE COLONIES

H. Campbell
January 1859

MEMORANDUM

CONCERNING

LIGHTHOUSES AND LIGHT VESSELS

REQUIRED IN

THE COLONIES,

TOGETHER WITH

INSTRUCTIONS TO LIGHTKEEPERS, AND OTHER PAPERS ON THE SUBJECT OF LIGHTHOUSES AND LIGHT VESSELS.

PREPARED BY THE BOARD OF TRADE,

WITH

THE ASSISTANCE OF THE TRINITY HOUSE.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
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FOR HER MAJESTY'S STATIONERY OFFICE.

1855.

MEMORANDUM

TO

ACCOMPANY A CIRCULAR FROM THE COLONIAL OFFICE TO THE GOVERNORS OF COLONIES, ON THE SUBJECT OF LIGHTHOUSES REQUIRED IN THE COLONIES.

When the Authorities in a Colony are desirous of applying to the Mother Country for assistance in the construction of any Lighthouse or Light Vessel, application should be made to the Colonial Office, and a copy of the printed Form annexed, marked A, should be carefully filled up, with complete answers to all the questions, and sent with the application.

The Colonial Authorities should at the same time name some person in London as an Agent, who is to be the party responsible for all payments, and who will for that purpose give such orders and make such contracts as may be necessary, and who will in so doing be guided by the advice and direction of the Board of Trade. The Board of Trade will confine themselves strictly to the function of giving such advice and direction as may be necessary for procuring the proper execution of the works required by the Colonial Authorities, but they will not open any account, or make themselves responsible for any payments whatever.

In giving instructions to the Agent, it must be understood by the Colonial Authorities, that as it will be necessary for the Board of Trade to employ an engineer and other professional men, their expenses are to be included with those of the works, and paid by the Agent accordingly.

If it is the desire of the Colonial Authorities that the materials should be shipped or forwarded by any particular vessel, special directions are to be given to the Agent, who should also be directed to effect the necessary insurances, should they be determined upon.

As considerable care in the management of Lighthouses and Light Vessels, and in the economy of the oil and wicks, the cleanliness of the reflectors, burners, glasses, &c., is requisite, the directions which the Trinity House have issued for the guidance of their own Light Keepers are herewith annexed, that Colonial Authorities may have the advantage of their long experience, and adopt them in the management of the Colonial Lighthouses, if they should think fit; and as the Colonial Authorities may have occasion to construct Light Vessels, there are annexed to this Memorandum the dimensions of the Light Vessels used in this country, and all other particulars necessary for the building of such vessels, and for tendering for contracts to build them, and for their equipment

and maintenance. Should it be necessary to apply to England for the lanterns and lighting apparatus, the dimensions given in the annexed paper will be strictly adhered to, so that the construction and fitting of the vessel may all go forward in the Colony, and the vessel be ready to receive the lanterns by the time they arrive.

FORM A.

PARTICULARS to be sent from the Colonies when ASSISTANCE is required in the CONSTRUCTION of a LIGHTHOUSE.

Questions.	Answers.
1. State the geographical position of the light required.	
2. Describe the nature of the foundation on which the tower is to be erected. Send a specimen if of rock; and if of sand or marshy ground a sketch of the borings.	
3. The elevation of the site above high-water mark. (If possible, send a ground plan and elevation of the site of the tower.) A contour plan is the best if it can be procured.	
4. Are there materials on the spot, or in the Colony, from which the tower and buildings may be constructed? What are they, and how far from the site? At what price per ton could they be conveyed there, or should all the materials be sent from England? Are there facilities for land-	

Questions.	Answers.
ing stores and other materials near the site?	
5. If labourers are to be had in the Colony, state the daily wages of masons, bricklayers, carpenters, smiths, and day labourers.	
6. Can fresh water be had at the proposed site of the lighthouse; or how far will it require to be conveyed if it be found at a distance?	
7. Will any Engineer or Workmen be required to be sent from England to erect the buildings or fix the lantern and apparatus?	
8. State the purpose for which the light is wanted, whether for a harbour or a sea light, and the distance at which the light should be visible, and the area over which the light is required to be exhibited.	
9. Is there any light within fifty miles of either side of the proposed light, and what is its character, fixed, revolving, bright, or coloured, or other characteristic?	
10. Is there any contiguous hill over which the light will be required to be seen, and if so, state its height above that of the site of the	

Questions.	Answers.
proposed tower and its distance off it ?	
11. What oil is intended to be used, and from what source will the supply be derived ?*	
12. What provisions with regard to wicks for the burners should be made for the present and future use ?	
13. Will any trained Light Keepers be required ?	
14. Is there any particular vessel or conveyance by which the Colony wish these materials should be sent out ?	
15. State the name and address of the Agent in London who is to be responsible for the payments, and all expenses incurred in carrying out the application from the Colony.	
16. State any other particulars that may seem to be necessary.	
17. If a Light Vessel be required, say in what water she will ride; and answer the beforegoing questions so far as they can be applicable to a Light Vessel.	

* It is of importance that the oil or other material proposed to be used in the lamps should be of that description which can with certainty be procured at all times in the locality; the point is one which should be considered and determined in the first instance, as the description of lamp and other apparatus to be used in the lighthouse necessarily depend upon the nature of the material from which the light is to be obtained.

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LIGHTHOUSE KEEPERS.

(WITH APPENDIX.)

INSTRUCTIONS

TO

LIGHTHOUSE KEEPERS.

(WITH APPENDIX.)

ISSUED BY THE CORPORATION OF TRINITY HOUSE OF DEPTFORD STROND.

GENERAL DUTIES.

Times at which the lamps are to be lighted and extinguished.

1. THE lamps are to be lighted every evening at sun-setting, and to be kept constantly burning bright and clear till sun-rising. (See also paragraph 17.)

Perpetual watch throughout the night.

2. In order to ensure the perfect fulfilment of the foregoing paragraph, a perpetual watch is to be maintained throughout the night; and, in this respect, the Principal is to take equal duty with the Assistant Keeper. He whose watch is about to end, is to trim the lamps and leave them burning, in perfect order, before he quits the lantern and calls the succeeding watch; and he who has the watch at sun-rise is then to extinguish the lamps, and commence all necessary preparations for the exhibition of the light at the ensuing sun-set.

How often lamps to be trimmed.

3. In order to maintain the greatest degree of light the wicks are to be trimmed every three hours,* and especial care taken that their tops are cut exactly even. (See also paragraphs 18 and 30.)

Beds, &c. not allowed in the lantern or watch-room.

4. No bed, sofa, or other article on which to recline can be permitted either in the lantern or in the apartment under the lantern, known as the watch-room.

Lamps and reflectors to be cleaned every morning.

5. Care is to be taken that the lamps and reflectors, or other lighting apparatus, are cleaned and polished every morning, using for that purpose the polishing powder and leathers provided by the Corporation, and no other means; the glazing of the lantern is also to be constantly kept, both internally and externally, in the cleanest possible condition.

Precautions to be taken against fire.

6. Especial care is to be taken that neither lamps, candles, coals, or any other article, be left burning anywhere so as to endanger fire.

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* This was adapted for the use of sperm oil; with rape seed oil now consumed, the wicks do not require trimming so frequently.

Economy in stores and good management to be at all times observed.

7. None of the oil, stores, goods, or materials are to be allowed to be wasted, embezzled, or stolen, and all economy and good management, consistently with the maintenance of a perfectly good light, are to be in every respect, and at all times, observed.

Damage through carelessness, &c., to be made good.

8. If any of the lamps, reflectors, or windows are broken, or other damage be done to the Lighthouse, through carelessness or negligence of the Light Keepers, the repair thereof is to be paid for by the person through whose carelessness or negligence the damage occurred.

No alteration in lighthouses, &c. to be made without the sanction of the Trinity House.

9. The erection of any outbuildings is strictly forbidden, as is also any alteration of the Lighthouse, premises, or fences, without the sanction of the Board has first been obtained.

Account of stores, &c. to be kept.

Forms (L.H. 1) and (L. H. 2) and (L. H. 3.) in Appendix.

10. The principal Light Keeper is charged with the custody of the oil and stores of every description ;—he is therefore to keep an exact account of the quantities thereof received from time to time, and of the deliveries for the necessary purposes of the establishment,—also an accurate account of the nightly consumption of oil, on the Forms provided for that purpose, and to deliver the same, together with the other accounts for which Forms are furnished, to the Agent at the regulated periods for transmission to this House.

Journal.

Form (L.H. 4.) in Appendix.

11. The Principal Light Keeper is also to keep a journal of all occurrences and observations, and to be particular in describing all circumstances attending them, and to communicate the same on the Form provided for that purpose, once a quarter, or oftener, if necessary. (See Paragraphs 39 to 47 " Meteorology.")

Visitors.

12. The Light Keepers are to exercise a proper discretion in the admission of visitors to view the establishment, conducting themselves with civility to strangers and other persons upon all occasions, and observing that no person is, on any account, to be permitted to inspect the interior of the lantern unattended by one of the Light Keepers, and they are held responsible that no damage is thereby occasioned to the lighting apparatus, or disfigurement to any part of the premises.

Religious duties.

13. The Keepers are to attend a place of worship upon each Sunday in turn, and where this rule shall, by reason of distance, be incompatible with the performance of the Lighthouse service, the Principal Light Keeper shall, at least once in every Sunday, assemble his own family and his assistants and their families, in his own dwelling or other convenient place, and there read to them throughout the Church Service for the day ; also a sermon or homily from the volume provided by the Corporation for this purpose.

Retention and promotion of Light Keepers depends upon

14. The Light Keepers, both Principal and Assistants, are cautioned that their retention or promotion in the service depends upon their strict adherence to the rules laid down for their guid-

ance; and also on the constant habit of cleanliness and good order in their own persons, and the preservation thereof in every part of the Lighthouse, lantern, and other premises; and they are enjoined to the invariable exercise of temperance and morality in all their habits and proceedings, so that by their example they may enforce, as far as lies in their power, the observance of the same laudable conduct by their wives and families. their observance of these rules.

15. The Principal Light Keeper is held responsible for the execution of the duties of the establishment, and the observance of the foregoing regulations. Principal Light-keeper responsible for execution of duties.

16. All orders given by Visiting Committees at Lighthouses when in addition to, or differing from the report of works, are to be entered in the order books at those establishments, with the signature of the Chairman affixed; and also the principal or assistant keepers are to keep an account of work done, either by labourers or mechanics, stating daily the number of men and time employed, to be entered in the blank leaves of the oil books. Entry of orders of Visiting Committees and of work done by labourers, &c.

MANAGEMENT OF THE DIOPTRIC LIGHT AND HYDRAULIC LAMP.

17. The light is to be extinguished at sun-rising, and the flow of oil stopped by raising the regulating balance ball of the supplying cistern B, and the curtains are then to be put up round the lantern. (For sketch of lamp, see Form (L. H. 5), in Appendix.) As soon after which as practicable the Light Keepers will commence the daily process of trimming the lamp, and cleaning the refractors and mirrors, observing strictly the following directions :— When process of cleaning is to commence. Form (L. H. 5) in Appendix.

To trim the Hydraulic Lamp.

18. The flow of oil having been previously stopped when the light was extinguished, as above directed, the reservoir A may be filled, observing exactly the quantity of oil required, as it will give the consumption of the previous night. Cleanse the burner thoroughly in every part, observe that all the union joints are secure, and put in fresh cotton wicks, if required, taking care always to cut them quite even at the top; the oil in the chamber for overflow C, may be drawn off at any time, and put into the reservoir A for the following evening, or used in the house lamps. General directions.

19. When the internal parts of the lamp and cisterns require cleansing, the burner and the union joints must be unscrewed; the whole may then be thoroughly cleaned by means of the elastic brushes provided for that purpose. This will probably be required about once in six months. To clean internal part of the lamp.

To clean external parts.

20. The lamp being ready for lighting, then clean the outsides of the copper cistern and reservoir; for which purpose mix a small quantity of prepared Tripoli powder with waste oil, and having wetted a piece of the woollen cloth with it, rub the copper till it becomes bright, after which clean it off with a dry woollen cloth, and dry powder; when it is not much tarnished, the dry cloth and powder will be sufficient.

Management of regulating ball.

21. Half an hour before sun-setting, the regulating ball in the supplying cistern must be lowered, care being taken that its previous level be preserved, as any alteration of it will either increase or diminish the proper flow of oil to the burner.

To clean the Refractors and Mirrors.

What materials to be used.

22. The materials supplied from London must be used, and *no others*.

To clean the frames of the refractors.

23. First clean and polish the brass frames of the refractors:—mix a small quantity of the prepared powder with a little waste oil on a woollen cloth, and rub the brass all over till the tarnish disappears, then polish it off with a dry woollen cloth and some of the dry powder, till quite bright and clean, and take off all the dust with the brushes provided for that purpose. If the frames are not much tarnished, they may be cleaned with the dry woollen cloth, and dry powder only.

To clean the mirrors and refractors.

24. Mix a small quantity of the rouge powder with the rectified spirits of wine, not more than sufficient for a day's use, and having wetted a soft sponge with it, wash the mirrors and refractors, and clean it off before it dries with a fine soft dry leather and some of the dry rouge powder, until the whole are quite clean and brilliant, using a clean dry soft brush in the recesses of the refractors where the leather will not penetrate. The rouge powder will not be required more than once a week; at other times the rectified spirits of wine, and occasionally the dry soft leather only will be sufficient. When the refractors and mirrors are perfectly clean, cover the fronts of the refractors with the Holland covering provided to prevent the effect of the sun upon them. They may be dusted with the feather brushes at any time.

Leathers, &c. to be kept free from dust.

25. The leathers and polishing powders must be kept in the store cases free from dust, taking care that no grit or hard substance adheres to them to scratch or injure the polish of the refractors or mirrors, and no leather which has been washed or wetted with water must on any account be made use of for them.

Floor, &c. to be cleaned with water where requisite.

26. When all are completed ready for lighting, the lantern floor and platform must be cleaned with water where requisite, care being taken that no dust is allowed to settle on the refractors or

mirrors after they have been polished. If the roof, uprights, or other parts of the lantern require washing, it should be done early in the day, before the refractors are cleaned, that the whole may be thoroughly dry before the evening.

Fire to be kept during the winter.

27. During the winter season a fire must be maintained in the stove at the discretion of the Principal Light Keeper, sufficient to keep the oil in the lamp in a liquid state; but the temperature of the lantern should not be raised above the external air more than is absolutely necessary for the purpose.

General direction as to lighting and trimming lamps.

28. Preparatory to lighting the lamp at sun-setting, the curtains are to be taken down and put away; in cold weather the glass cylinder should be warmed before it is placed on the lamp, and at all times the flame must be increased very gradually; the best height is *two inches and a quarter*, and not exceeding *two inches and a half*, and it should be frequently attended to and kept free from smoky points by moving the throttle valve of the iron damper. While the lamp is being trimmed, the regulating ball should be raised, if required, to prevent the overflow and wasting of the oil.

MANAGEMENT OF THE REFLECTING LIGHTS.

When process to commence.

29. When the lamps are extinguished at sun-rising, the curtains are to be put up round the lantern, and as soon as practicable afterwards, the Light Keepers will commence the daily process of trimming the lamps, and cleaning the reflectors, observing strictly the following directions.

To trim the Lamps.

General Directions.

30. Cleanse them thoroughly in every part, occasionally rinsing out the reservoirs and tubes with hot oil; the glass cylinders must be made perfectly clean and free from stains; fill the reservoirs with oil, and put in fresh cotton wicks if required, taking care always to cut them quite even at the top.

To clean and polish the Reflectors.

What materia to be used.

31. The materials supplied from London must be used, and *no others*.

To clean the backs of the reflectors.

32. Remove the reflectors one at a time from the frame, and carry them carefully into the room next below the lantern, and if the back or copper side be tarnished, place them on the table or stand provided for that purpose, with that side uppermost; mix a little of the prepared Tripoli powder in some waste oil, and apply it with a woollen rubber, rubbing smartly till the

tarnish is removed, then clean it off with some dry powder and another rubber; this will be required twice or three times a week, according to the weather and state of the lantern.

To clean the face of the reflectors.

33. The reflector must then be placed in the stand with the face or silver side upwards, and polished with the utmost care, as upon this the brilliancy and efficiency of the light materially depend:—having taken off the dust or burnt particles of cotton wick with a reflector cloth, moisten a small quantity of the rouge powder with the rectified spirits of wine,* not more than sufficient for a day's use, and apply it with a soft leather to the silver, rubbing it all over in right lines up and down with its apparent grain, and before it is dry, polish it off with a dry leather and a little dry rouge powder, rubbing it briskly till it becomes brilliant and perfectly free from tarnish or stains. This will probably be required about once in a week; at other times when the silver is not much discoloured, it will be sufficient to apply a little dry rouge powder in a soft bag lightly, breathing on it at the same time, and then to polish it off with a clean dry leather.

Care to be taken in using the leathers, &c.

34. The leathers and polishing powders are to be kept in the store cases, free from damp or dust; in using the leathers great care must be taken to fold them smooth, without crease or uneven surface, and that no grit or hard substance adheres to them to scratch or injure the surface of the silver, and no leather which has been washed or wetted with water must, on any account, be made use of for the reflectors.

Lantern floor, &c. to be cleaned with water when necessary.

35. When all are completed ready for lighting, the lantern floor and platform must be cleaned with water where requisite, care being taken that no dust is allowed to settle on the reflectors after they are polished. If the roof, uprights, or other parts of the lantern require washing, it should be done early in the day before the reflectors are cleaned, that the whole may be thoroughly dry before the evening.

Fire to be kept up during the winter.

36. During the winter season the stove must be lighted at the discretion of the Principal Keeper, and sufficient fire maintained to keep the oil of the lamps in a liquid state, but the temperature of the lantern should not be raised above the external air more than is absolutely necessary for that purpose.

General directions as to lighting and trimming lamps.

37. Preparatory to lighting at sun-setting, the curtains are to be taken down and put away. In cold weather the glass cylinders should be warmed before they are placed on the lamps, and at all times the flame must be increased *very gradually*. The best

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* The use of spirits of wine for the above-mentioned purpose is discontinued.

height for the flame is *one inch and a quarter*, and not exceeding *one inch and a half*, and it should be frequently attended to, and kept free from smoky points.

Apparatus provided for trimming the Lamps.

38. The girdle, leather case, and tin box, have been provided, in order to prevent the breakage of cylinders, and to promote cleanliness: the Light Keepers are therefore especially directed to make use thereof at all times, and in the manner following, previously observing to cover the cylinder tongs with leather, viz :—

Apparatus provided by Trinity House to be used at all times.

(*a.*) The belt is to be strapped round the body.

(*b.*) The cylinder, when taken from the lamp for the purpose of snuffing, is to be *immediately* deposited in the leather case.

(*c.*) The snuff, when taken from the wick of the lamp is to be put in the tin box, (in which a little damp sand is to be kept,) and the sponge at the opening is intended to cleanse the scissors from the snuff.

(*d.*) The cylinder, tongs, and scissors are to be put on the hooks affixed to the belt as occasion requires.

DIRECTIONS FOR KEEPING THE METEOROLOGICAL REGISTER.

(SUGGESTED BY THE BOARD OF TRADE.)

39. The time to be used in recording the observations is to be *civil time*, which supposes the day to begin and end at midnight.

Time.

40. Such observations as are made, whether few or many, are to be entered as made at the hour nearest to their time, and no alteration is to be made except to correct an accidental error.

Time when observations are to be entered.

The months are to be indicated by the Roman numerals I. to XII., beginning with January.

The observer should be careful, before he begins his register, to note in the respective columns the *numbers* of the instruments by which they are distinguished, and whenever one is broken, or another substituted for the previous one, the number is to be carefully recorded and the change noted in the remark column.

41. Observations, however numerous, unless carefully made and recorded, can only mislead, and their relative value will entirely depend upon the truthfulness and systematic care bestowed upon them. With this view the hours of record are printed in large and small type, to suit the convenience of various observers. The larger figures, are intended for the hours of record of such

All observations to be made and entered systematically.

officers as can only give a small portion of their time to this pursuit, and the whole have been inserted for those who are at liberty to co-operate largely in the undertaking.

The columns are numbered to correspond with the numbers settled by the Brussels Conference in 1853. It is manifest that what is done should be done well and efficiently; as in proportion to the extent and carefulness of the observations rendered, will be the degree of merit which will attach to the results.

Hour.—Col. 3. **42.** This column contains all the even hours of the day, and in addition 9 A.M. and 3 P.M.

It is desirable that the meteorological observations should be made at the two-hourly intervals, but in case this should be departed from, the hours of 4 A.M., 9 A.M., NOON, 3 P.M., and 8 P.M., are printed in larger type, as those at which the observations should be made.

Barometer.—Cols. 4 and 5. **43.** The barometer, if not recorded at the two-hourly periods, should be noted at 4, 9, 12, 3, 8; and it is indispensable that the thermometer attached to it be noted at the same time.

When read off, the barometer should have the light, or a piece of white paper as a reflector, placed behind it, and the vernier should be gently moved down towards the surface of the mercury by the screw until the thread of light is just shut out; the light should then be removed, and turned on the vernier.

But independent of these hours, should any unusual fluctuations of the barometer appear, such as during hurricanes or earthquakes, or should the mercury fall unusually low, and alter rapidly, the minimum altitude and the changes should be recorded with the time in the remark column.

The barometer should be suspended in a place where it is not likely to be removed, and should have the 30 inches line on a level with the eye of an ordinary observer, the usual height of the cistern above the level of the sea being noted. If its position be at any time changed, this fact should be stated, and its height above the level of the sea should be again ascertained.

Care should be taken in placing the barometer and in using the thermometer, that no temporary cause, such as the sun's rays, the heat of a fire, or the warmth of any body, affect the instrument, which should not, on any account, be placed in the lantern of a Lighthouse.

Thermometer. Cols. 6 and 7. **44.** When provided for ascertaining the moisture of the air, the dry and wet bulb thermometers should be observed at the same hours as the barometer. If it rains at the time of observation of the wet bulb, put the letter R after the temperature. It should be borne in mind that it will always be an advantage if, in addition, the maximum and minimum of temperature during the day be re-

corded in the remark column. These usually occur about an hour or two after noon, and about an hour before sunrise and after sunset. Great care should be taken in making observations on the temperature that the situation is in an exposed place, where the heated air of the structure cannot influence the result, and where the sun has no effect upon the instrument; and if there is any spray or other moisture on the bulb of the dry thermometer, it must be wiped off before the observations are made: when observed at night, care must be taken that the heat of the lamp does not affect it. The wet-bulb thermometer will have a light linen covering drawn over the bulb, and if not kept in a constant moisture by its cistern, should be moistened with fresh water three to five minutes before the observation is made, and registered as the last drop falls off the rag; it should also be dipped in fresh water very frequently, to cleanse it from the salt which may settle upon it, and it should not be placed in a strong current of air when the observations are made. Precautions for special cases.

45. The direction of the wind entered should be that which has been the most prevalent during the preceding four hours. The force is to be indicated by figures. Wind.—Cols. 8 and 9.

46. The number of hours of fog, rain, snow, hail, &c. in the four preceding hours should be entered with the letters given for the purpose. Weather.—Col. 13.

Strokes of the pen, or bars, placed under the number of hours signify degree, as 3r means three hours of light rain; 3r rain; 3r heavy rain.

47. It is desirable to obtain information on any of the following points, viz.;— Supplementary information.

Tempests, Tornadoes, Cyclones, Whirlwinds, Typhoons, or Hurricanes.

Every circumstance connected with these should be stated in detail; the different changes of the wind, the appearance of the sky and the clouds, of the sea, and electrical appearances, rain, hail, &c. The height of the mercury in the barometer should be frequently noted, at least as often as there is a change of a tenth of an inch; and, when not at one of the hours given in the register, the time should be stated.

Waterspouts.

The time of their duration, their successive appearances, their formation, direction of their revolving movement, and breaking up should be described.

Tidal Observations.

In a place where the establishment (or time of high water at the full and change of the moon) is not well known, the times of high and low water should be observed ; also the rate and direction of the tidal stream, the time and duration of slack water on flood and ebb, and the rise vertically.

Occasionally hourly meteorological observations, especially at the times of the equinoxes and solstices, would be very valuable.

In addition to the observations mentioned above, it is desirable that each Light Keeper should write at the end of the Register any general remarks which his experience and knowledge of the weather may suggest.

APPENDIX.

FORM (L. H. 1.)—See paragraph 10.

MONTHLY ACCOUNT OF OIL.

ACCOUNT of OIL consumed at the LIGHT in the Month of 185 ; also the Time (in Hours and Minutes) of lighting, extinguishing, and exhibiting the Light; with the Number of Cylinders broken, and Cotton Wicks consumed each Night; the State of the Weather, &c.; an Account of all which is *directed* to be accurately kept, and carefully inserted.

Days of the Month.	Time of lighting.		Time of extinguishing the Light.		How long exhibited.		Oil consumed.					Cylinders broken.	Cotton Wicks consumed.	Thermometer in Lantern.			Wind.		State of the Weather.
	Hour.	Min.	Hour.	Min.	Hour.	Min.	Gallons.	Quarts.	Pints.	Half Pints.	Gills.			Lighting.	Midnight.	Extinguishing.	Lighting.	Extinguishing.	
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2																			
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30																			
31																			
Total quantity consumed in the exhibition of the Light																			
*Total quantity consumed this Month for use in the Dwelling House - -																			
Total in this Month - -																			

Light Keeper.

* The Account of the quantity of Oil consumed in the Dwelling House must be kept wholly distinct, and *cannot* be *allowed* in *any way* to interfere with the statement of the quantity consumed in the exhibition of the Light.

FORM (L. H. 1.)—*continued.*

Light Keeper's Account of Receipt and Expenditure of Oil.

	Gallons.	Quarts.	Pints.	Half Pints.	Gills.		Gallons.	Quarts.	Pints.	Half Pints.	Gills.
To Oil remaining at the Lighthouse the 1st of this Month -						By Oil consumed this Month - - -					
To Oil received at the Lighthouse this Month - - -						By Oil returned -					
						By Oil remaining at the Lighthouse -					
Galls. -						Galls. -					

Agent's Account of Receipt, &c.

	Gallons.	Quarts.	Pints.	Half Pints.	Gills.		Gallons.	Quarts.	Pints.	Half Pints.	Gills.
To Oil in Store in the Warehouse 1st of this Month - -						By Oil sent to the Lighthouse -					
						By thick Oil returned -					
To Oil received - -						By Oil remaining in Store* - - -					
Galls. -						Galls. -					

LIST OF STORES WANTING.

* I have personally inspected and ascertained the accuracy of the quantities of Oil stated to be remaining prior to affixing my signature hereto.

_____ *Agent.*

FORM (L. H. 2.)—See paragraph 10. FORM OF STORE ACCOUNT FOR DIOPTRIC LIGHTS.

ACCOUNT of STORES received, expended, and remaining in Store, at the LIGHT, in the Quarter ending .

	Concentric Cotton Wicks.	Argand Cotton Wicks.	Balls of Cotton.	Large Cylinders.	Polishing Powder for Lenses.	Cleaning Cloths for Lenses.	Cleaning Cloths for Plate Glass.	Skins.	Tow.	Powder for Copper Work.	Powder for Brass Work.	Curved Trimming Scissors.	Spirits of Wine.	Sponge.	Woollen Rubbers for Copper Work.	Woollen Rubbers for Brass Work.	Flexible Brushes.	Curved Brushes for Lenses.
	Yds.	*Doz.*	*No.*	*Doz.*	*Oz.*	*Yds.*	*Yds.*	*No.*	*lbs.*	*lbs.*	*lbs.*	*No.*	*Qts.*	*No.*	*No.*	*No.*	*No.*	*No.*
In Store per last Return - -																		
Received in this Quarter - -																		
Total - -																		
Expended this Quarter - - -																		
Remaining in Store* - - -																		
Stores requested for the supply of the ensuing Quarter - -																		

* It is particularly requested that the Agent will personally inspect, and ascertain the accuracy of the Quantities of each Article stated to be in Store, prior to affixing his signature hereto

(Signed)_____

Agent.

FORM (L. H. 3.)—See paragraph 10.

FORM OF STORE ACCOUNT FOR REFLECTING LIGHTS.

ACCOUNT of STORES received, expended, and remaining in Store, at the LIGHT,
in the Quarter ending

	Cotton Wicks.	Balls of Cotton.	Cylinders.	Polishing Powder.	Cleaning Cloths for Reflectors.	Cleaning Cloths for Plate Glass.	Skins.	Tow.	Wick Holders.	Trimming Scissors.	Powder for Copper Work.	Powder for Brass Work.	Woollen Rubbers for Copper Work.	Woollen Rubbers for Brass Work.	Bags of Polishing Powder.	Flexible Brushes.
	Doz.	*No.*	*Doz.*	*Oz.*	*Yds.*	*Yds.*	*No.*	*lbs.*	*No.*	*No.*	*lbs.*	*lbs.*	*No.*	*No.*	*No.*	*No.*
In Store per last Return - -																
Received in this Quarter - -																
Total - -																
Expended this Quarter - - -																
Remaining in Store* - - -																
Stores requested for the supply of the ensuing Quarter - -																

* It is particularly requested that the Agent will personally inspect, and ascertain the accuracy of the quantities of each Article stated to be in Store, prior to affixing his signature hereto.

(Signed) _____

Agent.

FORM (L. H. 4.)—See paragraph 11. FORM OF OIL

ACCOUNT of OIL consumed at the LIGHT, in the Month of 185 ; also the Time (in Hours and Minutes) of lighting, extinguishing, and exhibiting the Light; with the Number of Cylinders broken, and Cotton Wicks consumed each Night; the State of the Weather, &c.; an Account of all which is *directed* to be accurately kept, and carefully inserted.

Days of the Month.	Time of lighting.		Time of extinguishing the Light.		How long exhibited.		Oil consumed.					Cylinders broken.	Cotton Wicks consumed.	Thermometer in Lantern.			WIND.	
	Hour.	Min.	Hour.	Min.	Hour.	Min.	Gallons.	Quarts.	Pints.	Half Pints.	Gills.			Lighting.	Midnight.	Extinguishing.	Lighting.	Extinguishing.
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Total quantity consumed in the exhibition of the Light																		
* Total quantity consumed this Month for use in the Dwelling House - -																		
Total in this Month - -																		

Light Keeper.

* The Account of the quantity of Oil consumed in the Dwelling House must be kept wholly distinct, and *cannot* be *allowed* in *any way* to interfere with the statement of the quantity consumed in the exhibition of the Light.

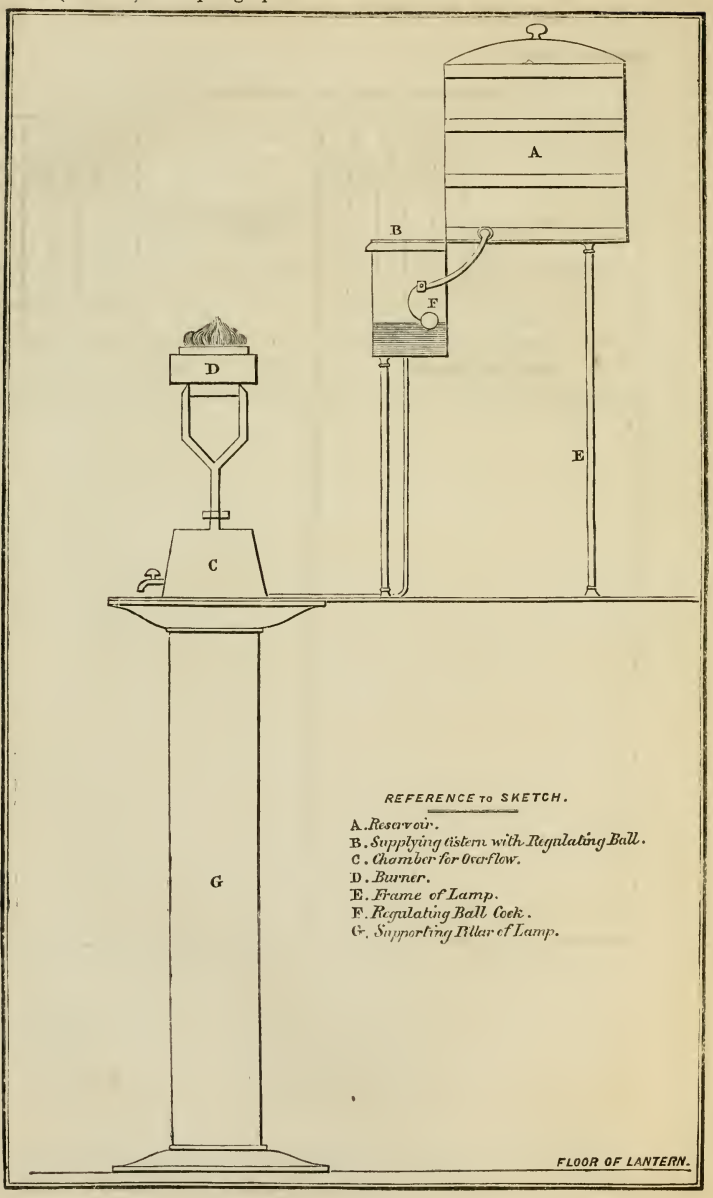
ACCOUNT BOOK.

Account of Receipt and Expenditure of Oil.

	Gallons.	Quarts.	Pints.	Half Pints.	Gills.		Gallons.	Quarts.	Pints.	Half Pints.	Gills.
To Oil remaining on the 1st of this Month						By Oil consumed this Month - -					
To Oil received this Month - -						By Oil returned -					
Galls. -						Galls. -					

State of the Weather.	REMARKS.

FORM (L. H. 5.)—See paragraph 17.



FORM (L. H. 6.)—See paragraphs 39 to 47.

METEOROLOGICAL REGISTER.

Letters to indicate the State of the Weather and Figures to denote the Force of the Wind.

b Blue sky.
c Clouds detached.
d Drizzling rain.
f Foggy.
g Gloomy dark weather.
h Hail.
l Lightning.
m Misty, hazy atmosphere.
o Overcast.
p Passing (temporary) showers.
q Squally.
r Rain continued.
s Snow.
t Thunder.
u Ugly weather, threatening appearance.
v Visibility of objects. Clear atmosphere.
w Wet, dew.

The strength of the wind is to be denoted by a number less than 14; 13 being supposed to represent a violent hurricane, and 1 the highest breeze.

Instruments used.

BAROMETER*

No. — Index error _____ Capacity _____ Capillary attraction _____ Height of cistern _____ — Compared at _____ by _____ Date _____

No. — Index error _____ Capacity _____ Capillary attraction _____ Height of cistern _____ — Compared at _____ by _____ Date _____

THERMOMETERS

No. _____ Error _____ Compared at _____
No. _____ „ _____
No. _____ „ _____ by _____
No. _____ „ _____
No. _____ „ _____ Date _____
No. _____ „ _____ Compared at _____
No. _____ „ _____
No. _____ „ _____ by _____
No. _____ „ _____
No. _____ „ _____ Date _____

* The corrections for capacity and capillary attraction are marked on the Instruments, or are to be allowed for in gross as the Index error.

FORM (L. H. 6) *continued.*—See paragraphs 39 to 47.

Year 185 .

METEOROLOGICAL REGISTER kept at the LIGHTHOUSE

DATE.		Hour.	BAROMETER. No.		THERMOMETER.		WINDS.		WEATHER.	WATER.	
Month.	Day.		Height.	Attd. Therm.	Wet Bulb. No. .	Dry Bulb. No. .	Direction.	Force.	Fog, Rain, Snow, Hail, Thunder, Lightning.	State of the Sea.	Temp. at Surface. No. .
1	2	3	4	5	6	7	8	9	13	14	16
		2							‡		
		4									
		6									
		8									
		9									
		10									
	NOON	**12**									
		2									
		3									
		4									
		6									
		8									
		10									
	MIDT.	12									
		2									
		4									
		6									
		8									
		9									
		10									
	NOON	**12**									
		2									
		3									
		4									
		6									
		8									
		10									
	MIDT.	12									

at_____ from_____ to_____.

REMARKS.

INSTRUCTIONS

TO

MASTERS AND MATES OF LIGHT VESSELS,

(WITH APPENDIX.)

INSTRUCTIONS

TO THE

MASTERS AND MATES OF LIGHT VESSELS,

(WITH APPENDIX.)

ISSUED BY THE CORPORATION OF THE TRINITY HOUSE OF DEPTFORD STROND.

PRELIMINARY.

48. The word Master must be read as applying to the Master during his period of duty; but at all other times it is intended to apply to the Mate or Officer in charge. — To whom instructions to apply.

GENERAL DUTIES.

49. The lamps are to be lighted every evening at sun-setting, and to be kept constantly burning bright and clear till sun-rising. — Time of lighting and extinguishing lamps.

50. In order to maintain the greatest degree of light, the wicks are to be trimmed every three hours*, and especial care taken that their tops are cut exactly even. (See paragraph 75.) — Trimming lamps.

51. The lamps and reflectors are to be cleaned and polished every morning, using for that purpose the polishing powder and leathers provided by the Corporation, and no other means; the glazing of the lantern is also to be constantly kept, both internally and externally, in the cleanest possible condition; and it is further required that cleanliness be constantly preserved throughout the Vessel, and also in the persons of the Master and Crew. — Cleaning lamps, &c.

52. Especial care is to be taken that neither lamps, candles, coals, or any other article, be left burning anywhere so as to endanger fire. — Precautions against fire.

53. The oil is always to be emptied into the cisterns as soon as received on board, and none of the oil, stores, goods, or materials, whether appertaining to the Light or to the Vessel, are to be wasted, embezzled, or stolen, and all economy and good management, consistently with the maintenance of a perfectly good light, are to be in every respect, and at all times, observed. — No waste to be allowed.

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* This paragraph is adapted for the use of sperm oil; with the rape-seed oil now consumed the wicks do not require trimming so frequently.

Inventory of stores.

Form (L.V. 1.) in Appendix.

54. An inventory (in the Form marked (L. V. 1.) in the Appendix) is to be taken by the Master, at the time of his appointment, of all anchors, cables, sails, and all other stores, materials, and furniture in the Light Vessel. At the termination of each half year a similar inventory is to be made out, in order to its transmission through the proper channel to the Trinity House, that the Corporation may be acquainted with those articles which have been expended.

Account of lighting stores.

Forms (L. V. 2 and 3) in Appendix.

55. An exact account is to be kept of the quantity of oil and lighting stores received on board, from time to time, and the nightly consumption of the former is to be entered in the Form provided for that purpose (marked L. V. 3. in the Appendix), and the same is to be sent, with a statement of the quantity remaining on board, to the Agent, at the end of every month; at the end of each quarter, an account of all stores expended, with the quantities then remaining, is also to be furnished in the Form marked (L. V. 2), in the Appendix.

Oil Account Book.

Form (L.V. 4.) in Appendix.

56. A specimen of the *Oil Account Book* is given in the Appendix, and is there marked (L. V. 4.) In this Form must be entered *for each night* the amount of oil consumed, the time of lighting and extinguishing the lights, the number of cylinders broken, and the number of cotton wicks consumed, the state of the weather, and such other remarks as are directed by these instructions.

Wages and provisions.

Form (L. V. 5.) in Appendix.

57. At the end of every quarter, an account is to be made out of all expenses for wages and provisions then due, at the allowances stated in Form (L.V. 5.), for Master and Crew, and the same is to be sent to the Agent, who will pay the amount thereof when approved.

Embezzlement, causing loss to Owners or Crown.

58. Neither the Master nor any of the Crew are to be concerned themselves in running any goods out of any ship, vessel, or boat, or in aiding or assisting others to do so to the prejudice of Her Majesty's Revenue; neither are they to suffer any kind of goods to be brought on board the Light Vessel from any ships or vessels, except those in distress, and in that case care is to be taken that there be no embezzlement or damage, or practices whatever, that may prejudice either the Owners or the Crown.

Relief of duty.

59. The Master is to remain on board the Vessel, at her Station, for one calendar month, at the end of which he is to be relieved by the Mate, who is to take charge during the succeeding calendar month, so that either the Master or the Mate is to remain on board the Light Vessel, at her Station, every alternate month throughout the year; and the reliefs, both of the Master and of the Crew, are regulated as follows, viz.:—On the 1st day of each month (wind and weather permitting), the Master or Mate, one

lamplighter, and two seamen, (carpenter always reckoned as one,) are to be relieved and taken on shore; and seven of the crew, consisting of the Master or Mate, two lamplighters, and four seamen, are to remain constantly on board.

Master and crew not to be absent from district without leave.

60. During the periods of the Master's turn to remain on shore, he is not to absent himself, nor suffer the seamen whose turn it is to be on shore to be absent from the neighbourhood of their Station without special permission from the Corporation; but they are always to remain ready to render their services in navigating the Tender, or in executing such Buoy Service as shall attach to the district; they are also to be watchful, to proceed to the Light Vessel with such seamen at the appointed periods of relief, and also at other times to afford every assistance to the Light Vessel that may be requisite; and particularly in the event of any accident, or of the Light Vessel breaking from her moorings, the Master and the seamen on shore are, as early as possible, to join the Vessel, and not quit her again until she shall be safely brought back, and replaced at her station; and this regulation is to apply in like manner to the Mate, during the period of his turn on shore.

Watch to be increased in bad weather;

61. In unsettled or tempestuous weather the number of the watch is to be increased, the Master going upon deck frequently, and vigilantly superintending the said increased watch; and thus ascertaining that strict attention is given to the safe riding of the Light Vessel at her moorings.

and deep-sea lead to be kept overboard.

62. On such occasions constant attention is to be given to the deep-sea lead, which is to be kept overboard; and to such further proceedings, either by taking bearings, or otherwise, as shall best enable the Master, at all times, to determine whether the Vessel retains her proper situation.

Vessel to be hove short up on the lowest ebb of every spring tide.

63. In those cases in which the Light Vessel is moored with a span and bridle, the ring of the ground-chain is, upon the lowest ebb of every spring tide, to be hove up to the bows of the Light Vessel. And in those cases in which the moorings consist of a single mushroom and chain, the cable is to be shortened, inasmuch as the depth of water may render prudent, at which times the lead is to be attended to, and the marks for the Vessel's position carefully noted. If, from the state of the weather, it may be found impracticable to perform this service upon the lowest tide, it shall be done upon the first succeeding low water upon which it may be possible to effect this duty; and, in either case, its execution shall be noted in the log-book; and if not done upon the first-named occasion, the reason of its non-performance. A specimen of the log-book is given at Form (L. V. 7.) in the Appendix.

Form (L.V. 7.) in Appendix.

In tempestuous weather bower anchor to be kept ready and watch to be increased.

64. It being of essential importance that in cases in which the Vessel may, by parting her moorings, or other unlooked-for circumstance, be forced from the station, that she should be brought up by her anchor as soon thereafter as shall be consistent with the safety of the Vessel, it is to be observed that, in tempestuous weather, the bower anchor is to be kept in all respects ready for letting go, that a strict and sufficient watch on deck be maintained, and attention given to the use of the deep-sea lead, as directed in paragraph No. 62 above; by a due regard to which precautions it is considered a vessel can drive but a very short distance before she may be brought up by her anchor; and any neglect herein will subject the officer in charge at the time to the severest displeasure of the Board.

Steps to be taken in case of Vessel parting from her moorings.

65. In the event of any Light Vessel being driven from her station, the master or mate, whichever be in charge, is carefully to consider whether she has driven to such a distance, or in such a direction, as to make it dangerous to shipping to continue to show her lights.

(*a.*) If the distance or direction be not such as to endanger the safety of vessels running on their course, the *lights and balls* are to be continued in the usual manner.

(*b.*) But should the Light Vessel have driven so as to be of no use as a guide to Shipping, the *usual lights and balls* are, in that case, to be *discontinued*, and *two red lights substituted*—one at the end of the davit forward, the other on a stanchion beside the ensign staff; and a *red flare light* shown every quarter of an hour during the night.

Watch to be kept on deck by day and night; and sails to be kept bent at certain periods.

66. It is strictly enjoined upon the officer in charge to take care that a watch, of at least two persons, is constantly kept upon the deck of the Vessel, by day and by night. And in addition thereto, that the sails of the Vessel are to be kept bent at all times between the 1st October and the 1st April; and also, upon all occasions of tempestuous weather, in other parts of the year.

Assistance to vessels in distress.

67. When Vessels are observed from a Light Vessel to be in distress, or to require assistance, the following directions are to be attended to:—

(*a*). *If in the day time*, two guns are to be fired on board such Light Vessel, each at an interval of five minutes, and repeated every half hour until assistance be observed approaching.

(*b.*) *If in the night time*, two guns are to be fired on board such Light Vessel, at similar intervals, each followed by a white rocket thrown in the direction of the Vessel in distress, and these signals are to be continued until the required assistance has been rendered.

Journal. Form (L. V. 4.) in Appendix.

68. A journal is to be kept in duplicate upon the Form provided in books for this purpose of all occurrences and observations, and particular care is to be taken in describing all circumstances attending them, especially the precise time at which the lamps are trimmed during the night, the length of time which intervenes between the lowering of the lantern and again hoisting the same after the lamps are trimmed; also the times at which it may be necessary to increase the watch upon deck, stating the period when such additional watch comes on duty, and how long continued.

Direction and force of the wind.

69. The direction and strength of wind, and the state of the weather, are to be noted in the log-book, at 4 A.M.—9 A.M.—3 P.M.—8 P.M.—and such other times as may be required. The direction of the wind is to be given by compass, and its strength denoted by a number less than 14; 13 being supposed to represent a violent hurricane, and 1 the lightest breeze. (*See further on the subject of meteorology, paragraphs* 83. *to* 91.)

Rise of each tide to be registered.

70. Each time of high water, and each time of low water, the rise of tide (perpendicularly), and the times of slack water and of changes in the direction of the stream, are to be registered as often, and as accurately, as may be practicable.

Time for observations how to be ascertained.

71. Time for the several observations may be obtained by watches frequently set by the sun, when on the meridian, or when rising or setting. This will, of course, be apparent time; and, in the register, it should be noted whether apparent or mean time is used.

Religious duties.

72. The officer in charge is once, at least, on every Sunday, to assemble the Crew, with the exception of the watch upon deck, either in his own cabin or other convenient place, and there read to them the Church Service for the day throughout, and also a sermon or homily from the volume provided by the Corporation for this purpose.

Entry of orders of Visiting Committees, and of work done by labourers, &c.

73. All orders given by Visiting Committees on board Light Vessels, when in addition to or differing from the Report of Works, are to be entered in the Order Books at those establishments, with the signature of the Chairman affixed; and also the Masters or Mates of Light Vessels are to keep an account of work done, either by labourers or mechanics, stating daily the number of men and time employed. This account is to be entered in the Log Book or Journal.

MANAGEMENT OF THE REFLECTING LIGHTS ON BOARD THE LIGHT VESSELS.

Time of trimming.

74. When the lamps are extinguished at sun-rising, the lanterns are to be lowered down immediately; and as soon as practicable afterwards, the lamplighters will commence the daily process of trimming the lamps and cleaning the reflectors, observing strictly the following directions:—

To trim the Lamps.

Lamps to be thoroughly cleansed.

75. Cleanse them thoroughly in every part, occasionally rinsing out the reservoirs and tubes with hot oil: the glass cylinders must be made perfectly clean, and free from stains. Fill the reservoirs with oil, and put in fresh cotton wicks if required, taking care always to cut them quite even at the top. The gimble work must be kept perfectly bright and free from rust.

To clean and polish the Reflectors.

What materials to be used.

76. The materials supplied from London must be used, and *no others.*

To clean the backs of the reflectors.

77. Remove the reflectors carefully from the frame into the tin boxes, and carry them into the oil room. If the back or copper side be tarnished, place them on the table or stand provided for that purpose with that side uppermost; mix a little of the prepared Tripoli powder in some waste oil, and apply it with a woollen rubber, rubbing smartly till the tarnish is removed, then clean it off with some dry powder and another rubber: this will be required twice or three times a week, according to the weather and state of the lantern.

To clean the face of the reflectors.

78. The reflector must then be placed in the stand with the face or silver side upwards, and polished with the utmost care, as upon this the brilliancy and efficiency of the light materially depend:—having taken off the dust or burnt particles of cotton wick with a reflector cloth, moisten a small quantity of the rouge powder with the rectified spirits of wine,* not more than sufficient for a day's use, and apply it with a soft leather to the silver, rubbing it all over in right lines up and down with its apparent grain, and before it is dry polish it off with a dry leather and a little dry rouge powder, rubbing it briskly till it becomes brilliant, and perfectly free from tarnish or stains. This will probably be required about once in a week; at other times when the silver is not much discoloured, it will be sufficient to apply a little dry rouge powder in a soft bag lightly, breathing on it at the same time, and then to polish it off with a clean dry leather.

* The use of spirits of wine for the above-mentioned purpose is discontinued.

79. The leathers and polishing powders are to be kept in the store cases, free from damp and dust. In using the leathers great care must be taken to fold them smooth, without crease or uneven surface, and that no grit or hard substance adheres to them to scratch or injure the surface of the silver; and no leather which has been washed or wetted with water must on any account be made use of for the reflectors. Care to be taken of polishing apparatus.

80. When all are completed ready for lighting, the lantern must be cleansed with water where requisite, care being taken that no dust is allowed to settle on the reflectors after they are polished. If the roof, or other internal parts of the lantern, require washing, it should be done early in the day, that they may be thoroughly dry before the evening. Care to be taken to prevent dust or damp.

81. In cold weather the oil must be kept warm below, and only put into the lamps immediately before sunset, that it may be in a sufficiently liquid state: the glass cylinders also should be warmed before they are placed on the lamps, and at all times the flame must be increased *very gradually*. Oil and glass cylinders to be warmed in cold weather.

82. The best height for the flame is *one inch and a quarter*, and not exceeding *one inch and a half;* and it should be frequently attended to, and kept free from smoky points. The ventilators of the lantern must be made use of at the discretion of the officer in charge, and the lamplighter. Height of flame.

DIRECTIONS FOR KEEPING THE METEOROLOGICAL REGISTER.

(SUGGESTED BY THE BOARD OF TRADE.)

83. The time to be used in recording the observations is to be *civil time*, which supposes the day to begin and end at midnight. Time.

84. Such observations as are made, whether few or many, are to be entered as made at the hour nearest to their time, and no alteration is to be made, except to correct an accidental error. Time when observations are to be entered.

The months are to be indicated by the Roman numerals I. to XII., beginning with January.

The observer should be careful before he begins his register, to note in the respective columns the *numbers* of the instruments by which they are distinguished, and whenever one is broken, or another substituted for the previous one, the number is to be carefully recorded and the change noted in the remark column.

85. Observations, however numerous, unless carefully made and recorded, can only mislead, and their relative value will entirely depend upon the truthfulness and systematic care bestowed upon them. With this view the hours of record are printed in large and small type, to suit the convenience of various observers. The larger figures are intended for the hours of record of such All observations to be made and entered systematically.

officers as can only give a small portion of their time to this pursuit, and the whole have been inserted for those who are at liberty to co-operate largely in the undertaking.

The columns are numbered to correspond with the numbers settled by the Brussels Conference in 1853. It is manifest that what is done should be done well and efficiently ; as in proportion to the extent and carefulness of the observations rendered, will be the degree of merit which will attach to the results.

Hours.—Col. 3. **86.** This column contains all the even hours of the day, and in addition 9 A.M. and 3 P.M.

It is desirable that the meteorological observations should be made at the two-hourly intervals, but in case this should be departed from, the hours of 4 A.M., 9 A.M., NOON, 3 P.M., and 8 P.M., are printed in larger type, as those at which the observations should be made.

Barometer—Cols. 4 and 5. **87.** The barometer, if not recorded at the two-hourly periods, should be noted at 4, 9, 12, 3, 8 ; and it is indispensable that the thermometer attached to it be noted at the same time.

When read off, the barometer should have the light, or a piece of white paper as a reflector, placed behind it, and the vernier should be gently moved down towards the surface of the mercury by the screw until the thread of light is just shut out ; the light should then be removed, and turned on the vernier.

But independent of these hours, should any unusual fluctuations of the barometer appear, such as during hurricanes or earthquakes, or should the mercury fall unusually low, and alter rapidly, the minimum altitude and the changes should be recorded with the time in the remark column.

The barometer should be suspended in a place where it is not likely to be removed, and should have the 30 inches line on a level with the eye of an ordinary observer, the usual height of the cistern above the level of the sea being noted. If its position be at any time changed, this fact should be stated, and its height above the level of the sea should be again ascertained.

Care should be taken in placing the barometer and in using the thermometer, that no temporary cause, such as the sun's rays, the heat of a fire, or the warmth of any body, affect the instrument.

Thermometer.—Cols. 6 and 7. **88.** When provided for ascertaining the moisture of the air, the dry and wet bulb thermometers should be observed at the same hours as the barometer. If it rains at the time of observation of the wet bulb, put the letter R after the temperature. It should be borne in mind that it will always be an advantage if, in addition, the maximum and minimum of temperature during the day be recorded in the remark column. These usually occur about an hour or two after noon, and about an hour before sunrise and after

sunset. Great care should be taken in making observations on the temperature that the situation is in an exposed place, where the heated air of the structure cannot influence the result, and where the sun has no effect upon the instrument; and if there is any spray or other moisture on the bulb of the dry thermometer, it must be wiped off before the observations are made: when observed at night, care must be taken that the heat of the lamp does not affect it. The wet-bulb thermometer will have a light linen covering drawn over the bulb, and if not kept in a constant moisture by its cistern, should be moistened with fresh water three to five minutes before the observation is made, and registered as the last drop falls off the rag; it should also be dipped in fresh water very frequently, to cleanse it from the salt which may settle upon it, and it should not be placed in a strong current of air when the observations are made. Precautions for special cases.

89. The direction of the wind entered should be that which has been the most prevalent during the preceding four hours. The force is to be indicated by figures. Wind.—Cols. 8 and 9.

90. The number of hours of fog, rain, snow, hail, &c. in the four preceding hours should be entered with the letters given for the purpose. Weather.—Col. 13.

Strokes of the pen, or bars, placed under the number of hours signify degree, as 3r means three hours of light rain; 3r rain; 3r heavy rain.

91. It is desirable to obtain information on any of the following points, viz.;— Supplementary information.

Tempests, Tornadoes, Cyclones, Whirlwinds, Typhoons, or Hurricanes.

Every circumstance connected with these should be stated in detail; the different changes of the wind, the appearance of the sky and the clouds, of the sea, and electrical appearances, rain, hail, &c. The height of the mercury in the barometer should be frequently noted, at least as often as there is a change of a tenth of an inch; and, when not at one of the hours given in the register, the time should be stated.

Waterspouts.

The time of their duration, their successive appearances, their formation, direction of their revolving movement, apparent dimensions of the column, and breaking up should be described.

Tidal Observations.

In a place where the establishment (or time of high water at the full and change of the moon) is not well known, the times of

high and low water should be observed; also the rate and direction of the tidal stream, the time and duration of slack water on flood and ebb, and the rise vertically.

Occasionally hourly meteorological observations, especially at the times of the equinoxes and solstices, would be very valuable.

In addition to the observations mentioned above, it is desirable that each Light Keeper should write at the end of the Register any general remarks which his experience and knowledge of the weather may suggest.

APPENDIX

TO

INSTRUCTIONS TO MASTERS AND MATES OF LIGHT VESSELS.

FORM (L. V. 1.)—See paragraph 54.

FORM OF INVENTORY OF STORES FOR A LIGHT VESSEL.

Now on board the_____

No._____

MAST MAKER.

Main-mast, $15\frac{3}{8}$ inches diameter, 69 feet long, with oak battens, and 18-feet mast head, with lightning conductor complete.
1 Lug-yard, 24 feet long, at the out-stations.
1 Ensign staff, 17 feet long.
2 Vane staffs, 10 feet long.
Mast for long-boat, 18 feet long.
Yard for do. 11 do.

(If more than one mast.)

Fore-mast, $15\frac{3}{8}$ inches diameter.
Mizen-mast, $15\frac{3}{8}$ inches diameter.

6 16-feet ash oars.
4 12-feet do.
4 Boat-hooks, 2 of 12 feet, and 2 of 10 feet.
3 Boat-scoops.
6 Hickory handspikes, 6 feet long.
1 Lignum vitæ fid for splicing.
1 Serving-mallet.
1 Deep-sea reel.
1 Log-reel and 2 current logships.

BLOCK MAKER.

Stamp—TRINITY HOUSE.

		Diameter of sheaves. *Inches.*
1	Threefold purchase block	10
2	Double cat blocks	7
2	Double fish-tackle blocks	8
1	Snatch block	6
2	Staysail halyard blocks	5
2	Do. sheet do.	5
1	Do. downhaul block	$3\frac{3}{4}$
2	Double luff tackle do.	$5\frac{1}{4}$
2	Single do. do.	5
3	Single Burton blocks	5
4	Single rudder pendant blocks	$4\frac{1}{2}$
2	Single tiller rope do.	$3\frac{3}{4}$
4	Single gun tackle do.	$3\frac{3}{4}$
6	Double boat's davit tackle blocks	5
2	Single do. do.	$4\frac{1}{2}$
4	Single do. guy do.	3
2	Spare double blocks	5
2	Do. single do.	5
2	Do. single do.	$3\frac{3}{4}$
1	Single signal halyard block	$2\frac{1}{2}$
1	Deep-sea line snatch do.	

(For each mast.)

2	Lantern preventer tye blocks	5

ANCHOR SMITH.

Stamp—TRINITY HOUSE.

		Cwt.
1	Bower anchor, stock included	20
1	Spare ditto	14
1	Kedge	2
1	Smaller kedge	1
1	Creeper	$\frac{1}{4}$
1	Boat's anchor	$\frac{1}{4}$

MOORINGS AS REQUIRED.

	Mushrooms	32
	One-arm anchors	

CABLES $1\frac{1}{2}$ INCH.

		Fathoms
1	Bridle or riding chain	
1	Bower do.	
2	Cable claw hooks.	
6	Connecting shackles, $1\frac{1}{2}$ inch.	
1	Fish-hook.	
2	Shank painters, 13 feet 6 inches long $\frac{1}{2}$-inch tapered.	
2	Stoppers do. do.	
12	Chain hand-hooks.	
1	Large 2-feet wrench hammer.	
1	Small 18-inch do.	
2	Starting hammers.	
2	Clench do.	
1	Double-headed maul.	
6	Cold chisels.	
6	Chain punches.	
12	Spare cable pins.	

CHAINS AND GEAR FOR EACH MAST.

6 Shrouds, $\frac{5}{8}$-inch, with screws for setting up.
1 Forestay, do. do.
1 Backstay, do. do.
1 Triangle block, with a $6\frac{1}{2}$ in. sheave by $2\frac{1}{4}$.
1 Pair iron cheek blocks, 6-in. sheaves by $2\frac{1}{2}$
2 Lantern tyes, $\frac{1}{2}$-inch.
1 Ditto fall, $\frac{5}{8}$ or $\frac{1}{2}$ inch.
2 Jacob's ladders.
2 Spare shrouds, $\frac{5}{8}$-inch
2 Do. lantern tyes, $\frac{1}{2}$-inch.
1 Do. do. fall, $\frac{5}{8}$ or $\frac{1}{2}$ incl..
12 Clasp-connecting shackles for tyes.
1 Wooden globe in two halves, with hanging-hooks and staple-plates.
1 Spare collapsing do. do.
6 Chain boat's davit guys, $\frac{1}{4}$-inch.
2 Composition rudder chains, $\frac{5}{8}$-in , 8ft. long.

ROPE MAKER.

1 5-inch hawser.
1 $3\frac{1}{4}$-inch warp.
1 Buoy rope, 25 fath. 5-inch water laid rope.
1 Hawling line for boats, 120 faths. 2 in.
1 *Coir* do. $3\frac{3}{4}$-in. at the out-stations.
$\frac{1}{4}$ Coil of 5-in. rope for stoppers, pendants, &c.
$\frac{1}{4}$ Do. $3\frac{1}{2}$ do. for rudder and fish pendants.
1 Do. 3 do. for purchase falls, preventer tyes, &c.
1 Do. $2\frac{1}{2}$ do. for boat and luff tackle falls, &c.
1 Do. $2\frac{1}{4}$ do. for small boat's falls.
1 Do. 2 do. for preventer falls, stay-sail halyards, &c.
1 Do. $1\frac{1}{2}$ do. for staysail sheets down-hauls, &c.
$\frac{1}{2}$ Do. 12 threads, rudder, pendant, falls, &c.
$\frac{1}{2}$ Do. 6 do. for signal halyards.
56 lbs. of spunyarn.
2 Hand lead-lines, 20 fathoms long.
1 Deep-sea lead-line, 120 do.
6 Log-lines.
2 lbs. of sewing and 2 lbs. of whipping twine.

SAIL MAKER.

Stamp—TRINITY HOUSE.

1 Lug-sail and cover, at the out-stations.
1 Fore-staysail.
1 Long-boat's lug-sail.
Awnings complete.
1 Windsail.
18 Hammocks.
6 Duck table-cloths.
25 Coal-bags.
2 Cork fenders.
20 Yards new canvass, No.
40 do. old do.
1 Collapsing globe-cover.
1 Skylight-cover for each skylight.
1 Winch-cover for each winch.
1 Gong-cover.

BOAT BUILDER.

1 Long-boat, copper fastened, 20 feet long, 6 ft. 9 in. broad and 2 ft. 8 in. deep, clinch built, with stern davit, rudder, tiller, complete.
1 Double headed boat, copper fastened, 16 ft. long, 6 ft. 3 in. broad, and 2 ft. 2in. deep, with rudder, &c. complete.

COOPER.

Stamp—TRINITY HOUSE.

4 Harness casks, with locks and keys.
2 Bread casks, 1 cwt. each, with do.
1 Flour do.
1 Pea do.
30 Water do. to contain 9 gallons each.
1 Wash deck tub.
8 Buckets.
2 Wash kids.
2 Bread-kids.
2 Water-funnels, with iron pipes.
1 Oil-funnel, lined with lead, and long lead pipe.
1 Small wood nun buoy.

LIGHT APPARATUS AND STORES.

Stamp—TRINITY HOUSE.

1 Lantern complete for each mast, with lamps and reflectors, according to the character of the light.
Spare lamps and reflectors as required, with brackets or cups.
Spare rack wickholders, pinions, and wrench.
4 Oil cisterns, to contain 122 gallons each.
8 Oil drippers.
1 Set of copper oil-measures, 1 gall. to 1 gill.
1 $\frac{1}{2}$-gallon copper oil-feeder.
1 Pint do.
1 Pint copper funnel.
1 Copper trimming tray.
2 Lighting torches.
1 Galley-lamp, with gimble.
1 Cabin do. do.
1 Oil room lamp do.
1 Binnacle do.
1 Spare do.
1 Copper stand for binnacle.
1 Copper lantern.
1 Copper reflector box.
2 Japanned boxes.
1 Cylinder-box for each lantern.
2 Pair trimming scissors.

2 Mandrills.
Spanners.
Cylinder wires.
Wick-holders.
Trimming wires.
Rape oil.
Glass cylinders.
Cotton wicks.
Balls of cotton.
Reflector cloths.
Glass do.
Leathers.
Woollen rubbers.
Tow.
Cotton wipings.
Polishing powder for reflectors.
Do. for copper.
Do. for brass.
Bags for polishing powder.
Flexible brushes.
1 Plough diamond.
2 Spare squares of glass for lantern.
2 do. for doors of do.
14 lbs. of cement for plate glass.
2 Putty-knives.
1 Hand-vice.
1 Screw driver.
1 Flat file.
1 Round file.
1 Half-round file.
1 Pair of soldering irons.
7 lbs. of solder.
¼ Pint of spirit of salts.

WATER TANKS.

8 Wrought-iron, connected by leaden pipes with brass screws, to contain 1,700 galls.

IRONMONGER.

Stamp—TRINITY HOUSE.

2 12-lb. carronades.
1 Copper powder magazine.
1 do. do. measure.
1 do. do. primer.
A crane for each mast.
1 Long japanned speaking-trumpet.
1 Short do.
1 Iron anchor buoy.
1 Branding-iron, with number of vessel.
18 Hanks for stay, 4 inches in the clear.
2 Dozen hooks and thimbles.
1 do. welded thimbles.
4 Tin paint-pots.
4 Marline-spikes.
1 Pitch-pot and ladle.
1 Small chopper.
2 Crowbars.
2 Ballast-shovels.
6 Scrapers.
Set of carpenter's tools, as per list.
6 Pair of brass butt hinges and screws.
6 Pair of H. do.

1,000 4*d.* clasp-nails.
1,000 6*d.* do.
1,000 10*d.* do.
1,000 20*d.* do.
1,000 Pump-tacks.
1,000 Brads (assorted).
1,000 1½-inch boat nails.
1,000 ⅝ do. copper tacks.
250 Batten nails.
250 Copper rooves.
250 Iron screws (assorted).
250 Copper do.
28 lbs. spike-nails (assorted).
56 lbs. of 4 lb. sheet-lead.

GALLEY.

1 Cook's hearth, with cheeks, copper funnel with T top, tormentors, ladle, poker, rake, shovel, hanging-plate, and steamer.
1 Coal-hod, and 1 pair of bellows.
1 Iron tea-kettle.
1 Coffee-pot.
2 Tin baking-pans.
3 Oval tin dishes.
9 Metal mess-plates.
9 Round mess-tins.
9 Hook-pots.
1 Hook for warming pot.
9 Pannikins.
9 Iron spoons, and 1 salt cellar.
1 Oval iron saucepan.
1 Round do.
1 Frying-pan, and 1 gridiron.
1 Pair of brass steelyards.
1 Set of weights and scales.
The weights from 2 oz. to 14 lbs.
1 Bread Sieve.
2 Brass beer-taps.
1 Meat-saw, and 1 hand-saw.
1 Meat-chopper, and 1 cook's axe.
1 Tinder-box.

CABIN.

1 Cabin stove complete, copper funnel for do. and T top, copper ash-pan, and wire guard.
1 Set of fire-irons.
1 Coal-hod.
1 Metal tea-pot and 1 coffee-pot.
3 Knives and forks.
1 Carving knife and fork.
3 Of each, metal table and tea spoons.
1 Small metal tureen and ladle.
1 Set of cruets.
1 Salt-cellar and 1 sugar-box.
1 Tea-cannister.
1 Bread-tray.
1 Pint black-jack.
2 Metal wash-hand basins and 2 ewers.
1 Dust-pan.

SHIP CHANDLER.

Stamp—TRINITY HOUSE.

1 Rammer and sponge for 12-lb. carronade.
1 Ladle and worm do.
100 Flannel cartridges filled.
Gunpowder.
1 Powder-horn.
1 Trinity ensign, 3½ yards.
1 Set of signal-flags.
2 Deep-sea leads, 28 lbs. and 36 lbs.
2 Hand do. 11 lbs.
1 Grindstone and trough.
4 Paint-work scrubbers.
4 Long-handle deck do.
2 Long-handle tar brushes.
2 Short do.
4 Paint-brushes.
2 Tools.
4 Mops.
2 Long-handle hair brooms.
2 Dozen heath brooms.
2 Banister brushes.
1 Set of black-lead brushes.
6 Hand scrubbing-brushes.
9 Yards of Dwilling.
6 Holy stones.
2 Bath-bricks.
2 Yards red bunting.
3 Yards green baize.
25 Sail needles.
25 Sewing do.
¼ lb. mixed thread.
1 Palm.
6 lbs. pump-leather.
½ A tanned hide.
2 lbs. thrums for pitch-mops.
7 lbs. resin.
2 Gallons Stockholm tar.

CABIN.

3 Cups and saucers.
3 Soup-plates.
3 Flat do.
2 Dishes, 10 and 12 inches.
3 Tumblers.
3 Wine-glasses.
1 Green baize table-cover.

STATIONERY.

1 Log-book.
2 Half-yearly journals.
1 Tidal journal.
Almanac for the year.
Oil and light store accounts.
1 Store expenditure book.
Framed instructions for masters and mates.
2 Framed lists of rations.
1 Framed list of books.
11 Bibles and prayer books.
Library, containing 18 volumes.
1 Signal book.
1 Chart of the station.
1 Log-slate.
1 Inkstand, marked Trinity House.
1 Pair parallel rulers, 18 in. do.
1 2-feet ruler do.
1 Gunter scale do.
1 Pair of dividers. do.
1 Portfolio and stationery.
1 Package of slate-pencils.

CABIN FURNITURE.

1 Oak table.
3 Chairs.
1 Looking-glass, 14 in. by 12, in a black frame.

COMPASSES.

1 Brass steering compass.
1 Wooden box do.
1 Brass-hanging do. for cabin.
1 Medicine-chest.
1 Time-piece and hood.
1 Aneroid barometer, with a thermometer.
2 28-second log-glasses.
1 Spyglass, marked Trinity House.
1 Gong and sticks.
1 Life-buoy.

PAINT STORES.

3 cwt. of red lead and venetian, in powder, mixed in the proportion of two of red lead to one of venetian.
2 do. stone colour.
1½ do. white lead.
¼ do. black paint.
7 Lbs, litharge and 7 of copperas, for driers.
18 Gallons of boiled oil.
18 do. raw oil.
6 do. turpentine.
28 lbs. of tallow.
56 do. soap.
6 Gallons black varnish.
6 do. bright do.

FORM (L. V. 2.)—See paragraph 55.

ACCOUNT of STORES received, expended, and remaining in Store, at the LIGHT,
in the Quarter ending .

	Cotton Wicks.	Balls of Cotton.	Cylinders.	Polishing Powder.	Cleaning Cloths for Reflectors.	Cleaning Cloths for Plate Glass.	Skins.	Tow.	Cotton Waste.	Wick Holders.	Trimming Scissors.	Powder for Copper Work.	Powder for Brass Work.	Woollen Rubbers for Copper Work.	Woollen Rubbers for Brass Work.	Bags of Polishing Powder.	Flexible Brushes.
	Doz.	*No.*	*Doz.*	*Oz.*	*Yds.*	*Yds.*	*No.*	*lbs.*	*lbs.*	*No.*	*No.*	*lbs.*	*lbs.*	*No.*	*No.*	*No.*	*No.*
In Store per last Return -																	
Received in this Quarter -																	
Total - -																	
Expended this Quarter -																	
Remaining in Store* - -																	
Stores requested for the supply of the ensuing Quarter																	

* It is particularly requested that the Agent will personally inspect, and ascertain the accuracy of the quantities of each Article stated to be in Store, prior to affixing his signature hereto.

(Signed) _____

Agent.

FORM (L.V. 3.)—See paragraph 55.

ACCOUNT of OIL consumed at the FLOATING LIGHT in the Month of 185 ; also the Time (in Hours and Minutes) of lighting, extinguishing, and exhibiting the Light; with the Number of Cylinders broken, and Cotton Wicks consumed each Night: the State of the Weather, &c.; an Account of all which is *directed* to be accurately kept, and carefully inserted.

Days of the Month.	Time of Lighting.		Time of extinguishing the Light.		How long exhibited.		Oil consumed.					Cylinders broken.	Cotton Wicks consumed.	State of the Weather and other Observations.
	Hour.	Min.	Hour.	Min.	Hour.	Min.	Gallons.	Quarts.	Pints.	Half Pints.	Gills.			
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
Total quantity consumed in the exhibition of the Light														
* Total quantity consumed this Month, for purposes not connected with the exhibition of the light -														
Total in this Month - -														

Master.

Mate.

* The quantity of Oil consumed in the Vessel for uses *not* connected with exhibition of the Light must be kept wholly distinct, and *cannot* be *allowed* in *any way* to interfere with the statement of the quantity consumed for that purpose.

FORM (L. V. 3.)—*continued.*

Master or Mate's Account of Receipt and Expenditure of Oil.

	Gallons.	Quarts.	Pints.	Half Pints.	Gills.		Gallons.	Quarts.	Pints.	Half Pints.	Gills.
To Oil remaining on board the 1st of this month - - -						By Oil consumed this month - -					
						By Oil returned -					
To Oil received on board this month - -						By Oil remaining on board - - -					
Galls. - -						Galls. - -					

Agent's Account of Receipt, &c.

	Gallons.	Quarts.	Pints.	Half Pints.	Gills.		Gallons.	Quarts.	Pints.	Half Pints.	Gills.
To Oil in store in the warehouse 1st of this month - - -						By Oil sent on board the Light Vessel -					
						By thick Oil returned					
To Oil received - -						By Oil remaining in store* - - -					
Galls. - -						Galls. - -					

LIST OF STORES WANTING.

* I have personally inspected and ascertained the accuracy of the quantities of Oil stated to be remaining prior to affixing my signature hereto.

_____ *Agent.*

FORM (L. V. 4.)—See paragraph 56. FORM OF OIL

ACCOUNT of OIL consumed at the FLOATING LIGHT in the Month of 185 ; also the Time (in Hours and Minutes) of lighting, extinguishing, and exhibiting the Light; with the Number of Cylinders broken, and Cotton Wicks consumed each Night: the State of the Weather, &c.; an Account of all which is *directed* to be accurately kept, and carefully inserted.

Days of the Month.	Time of lighting.		Time of extinguishing the Light.		How long exhibited.		Oil consumed.					Cylinders broken.	Cotton Wicks consumed.	Thermometer in Lantern.			Wind.	
	Hour.	Min.	Hour.	Min.	Hour.	Min.	Gallons.	Quarts.	Pints.	Half Pints.	Gills.			Lighting.	Midnight.	Extinguishing.	Lighting.	Extinguishing.
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
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24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Total quantity consumed in the exhibition of the Light																		
* Total quantity consumed this Month for purposes not connected with the exhibition of the Light.																		
Total in this Month - -																		

Master.

Mate.

* The account of the quantity of Oil consumed in the Vessel, for uses *not* connected with the exhibition of the Light, must be kept wholly distinct, and *cannot* be *allowed* in *any way* to interfere with the statement of the quantity consumed in the exhibition of the Light.

ACCOUNT BOOK.

ACCOUNT of Receipt and Expenditure of OIL.

	Gallons.	Quarts.	Pints.	Half Pints.	Gills.		Gallons.	Quarts.	Pints.	Half Pints.	Gills.
To Oil remaining on the 1st of this month						By Oil consumed this month - -					
To Oil received this month - - -						By Oil returned -					
Galls. -						Galls. -					

State of the Weather.	REMARKS.

FORM (L. V. 5.)—See paragraph 57.

ORDERED,

That the under-mentioned Rations, when afloat, and money in lieu thereof when on shore, be allowed to the Crew of each Light Vessel belonging to this Corporation, viz. :—

WHEN AFLOAT:

Meat	10 lb.	per week each man.
Bread	7 lb.	,,
Flour	2 lb.	,,
Peas	1 pint	,,
Potatoes	7 lb.	,,
Suet	½ lb.	,,
Tea	2 oz.	,,
Sugar	¾ lb.	,,
Beer	3 gallons	,,

WHEN ON SHORE:

One shilling and threepence per day each man, in money, in lieu of provisions.

ORDERED,

That a copy hereof be fixed up in the cabin and galley of each Light Vessel.

ORDERED ALSO,

That no provisions whatever be removed from the Vessel.

BY ORDER OF THE BOARD,

Trinity House, London,
1st January 1845.

FORM (L. V. 6.)—See paragraphs (83 to 91.)

METEOROLOGICAL REGISTER.

Letters to indicate the State of the Weather, and Figures to denote the Force of the Wind.

b Blue sky.
c Clouds detached.
d Drizzling rain.
f Foggy.
g Gloomy dark weather.
h Hail.
l Lightning.
m Misty, hazy atmosphere.
o Overcast.
p Passing (temporary) showers.
q Squally.
r Rain continued.
s Snow.
t Thunder.
u Ugly weather, threatening appearance.
v Visibility of objects. Clear atmosphere.
w Wet, dew.

The strength of the wind is to be denoted by a number less than 14; 13 being supposed to represent a violent hurricane, and 1 the highest breeze.

Instruments used.

*BAROMETER

No. Index error _____ Capacity _____ Capillary attraction _____ Height of cistern _____ — Compared at _____ by _____ Date _____

No. Index error _____ Capacity _____ Capillary attraction _____ Height of cistern _____ — Compared at _____ by _____ Date _____

THERMOMETERS

No. _____ Error _____
No. _____ „ _____
No. _____ „ _____
No. _____ „ _____
No. _____ „ _____
No. _____ „ _____ — Compared at _____ by _____ Date _____

No. _____ „ _____
No. _____ „ _____
No. _____ „ _____
No. _____ „ _____
No. _____ „ _____
No. _____ „ _____ — Compared at _____ by _____ Date _____

* NOTE.—The corrections for capacity and capillary attraction are marked on the instruments, or are to be allowed for in gross as the Index Error.

FORM (L. V. 6.) *continued.*—See paragraphs 83 to 91.

Year 185 .

METEOROLOGICAL REGISTER kept at_____

DATE.		Hour.	BAROMETER, No. .		THERMOMETER.		WINDS.		WEATHER.	WATER.	
Month.	Day.		Height.	Attd. Therm.	Wet Bulb. No. .	Dry Bulb. No. .	Direction.	Force.	Fog, Rain, Snow, Hail, Thunder, Lightning.	State of the Sea.	Temp. at Surface. No. .
1	2	3	4	5	6	7	8	9	13.	14.	15.
		2									
		4									
		6									
		8									
		9									
		10									
	NOON	12									
		2									
		3									
		4									
		6									
		8									
		10									
	MIDT.	12									
		2									
		4									
		6									
		8									
		9									
		10									
	NOON	12									
		2									
		3									
		4									
		6									
		8									
		10									
	MIDT.	12									

at_____ from_____ to_____.

REMARKS.

FORM (L. V. 7.)—See paragraph 63.

JOURNAL of the Light Vessel.

Day of the Week and Month.		WINDS, WEATHER, OCCURRENCES, &c.

MISCELLANEOUS MEMORANDA

ON THE SUBJECT OF

LIGHTHOUSES AND LIGHT VESSELS.

MISCELLANEOUS MEMORANDA

ON THE SUBJECT OF

LIGHTHOUSES AND LIGHT VESSELS.

I. On the System pursued by the Corporation in the Instruction of Candidates for the Situation of Light Keepers.

Candidates undergo instruction before they are admitted into the service.

92. Candidates who have been approved for admission to the service are placed at the Trinity Buoy-Wharf, Blackwall, and are instructed in the duties of a Light Keeper, prior to their appointment to Lighthouse Stations as Assistants in the first instance. Opportunities also occasionally offer for their further instruction, by their being required after they have attained sufficient competency to be so employed, to take the place temporarily of Keepers who are unable, by reason of illness or absence, to perform the duty.

II. Concerning the Oil submitted by parties tendering for Contracts.

Duplicate sample retained for testing.

93. The oil so submitted is tested by burning at the Trinity House both before the contract is taken, and frequently during the year; a duplicate sample being retained specially for that purpose. It is burned for a certain space of time in similar lamps placed together upon a frame. Mr. Faraday observes, that "there is not "any mode of analysis or chemical treatment that will serve as a "test beforehand of the purity of the oil or its fitness for burning," and therefore its quality is ascertained as stated.

Skeleton form of contract for the supply of rape-seed oil.

94. ARTICLES of AGREEMENT and CONTRACT indented, made, and concluded this day of in the year of our Lord , between of the one part, and of the other part.

Whereas the said have made a tender for supplying to the said pure refined rape-seed oil, of the finest quality, upon the terms and conditions hereunder written, and to perform the several matters and things in relation thereto herein-after expressed, and the said tender hath been accepted by the said :

Now these presents witness, and the said do hereby jointly for themselves, their heirs, executors, and administrators, and each of them severally doth hereby for himself, his heirs, executors, and administrators, covenant, promise, and agree to and with the

said and their successors in manner following, (that is to say,) that they the said , in consideration of the sum of of lawful money of Great Britain per imperial gallon (estimated at pounds weight per gallon), to be paid in manner herein-after expressed, shall and will deliver to the said at , tuns or gallons (estimated as aforesaid) of pure refined rape-seed oil, of the finest quality, to be approved of by the said , and submitted, if required, either wholly or partially, in any quantity or quantities, to such test or tests, by scientific and practical processes for ascertaining the quality thereof, as and by such person or persons as the said shall from time to time order, direct, and appoint for that purpose, and the oil (if any) which may not be approved of by the said shall be returned to the said , who shall substitute at their expense other oil in lieu thereof, to be approved of and tested in like manner as aforesaid. That the whole of such oil shall be delivered to the said at aforesaid, in the quantities and at the times following, (that is to say,) tuns, part of the said tuns, on or before the day of next, other tuns, further part thereof, on or before the day of next, other tuns, further part thereof, on or before the day of next, and the rest of the said tuns of oil on or before the day of now next ensuing. That a receipt for each quantity so delivered to the said at as aforesaid shall be attached to the bill of parcels thereof, and forthwith sent to the said , addressed to . And the said for themselves and their successors do hereby covenant, promise, and agree to and with the said that in consideration of the said , their executors or administrators, supplying and delivering such oil in manner aforesaid, they the said , or their successors, upon receiving from the said , their executors or administrators, on the first day of every month after the supply and delivery of any oil to the said at the place and in manner aforesaid, an abstract or account of all bills of parcels of the oil which shall have been delivered in performance of this contract during the preceding month, they they said shall and will, after examination and approval thereof by such person or persons as the said shall direct to

examine the same, pay to the said , their executors, administrators, or assigns, the amount of such abstract or account, free from discount, on or before the last day of the month in which such abstract or account shall have been sent. And it is hereby lastly agreed by and between the said parties hereto that the said , with two good and sufficient sureties, to be approved by the said , shall enter into a bond or obligation in a sufficient penalty for the due observance and performance of these presents, and the articles, matters, and things herein expressed and agreed, and that the expense attending the preparation and completion of these presents, and of a copy thereof for the said , shall be borne and paid by the said ; but if the said shall require a duplicate of these presents, the same shall be at their costs and charges. In witness, &c.

Signed, &c.

III. On the Ventilation and Warming of and Prevention of Damp or Moisture in the Lanterns, &c.

Ventilators how to be placed.

95. " Ventilators are in many cases put round a lantern opening from the outside;* they can be opened or closed at pleasure, and are very well fitted for the purpose of admitting air. They should be so placed that rain could not drive into them; and if the openings are in stone or brick work, the passages should be *lined* with metal tube to prevent the communication of moisture to the entering air. No anxiety need be entertained about the supply of air to the lamp, for if enough air (which is easily supplied) enters the lantern the lamp is sure to be supplied, and its ventilation will take care of itself.

* * * * * *

Where the lighthouse has no house fires or flues in it.

96. " Where the tower of a Lighthouse is uninhabited, having neither house fires in it nor flues in use, it should not be aerially connected with the lantern. The following general plan is recommended for adoption (with more or less modification according to peculiar localities or circumstances). The watch-room to be dry. The lantern and watch-room to be cut off from the tower by a door, and these, as to warming and ventilation, to be considered virtually as one chamber. The ventilation as to entering air to be effected by means of four windows in the watch-room, each to be 45 inches wide, and the sashes to open from above, any one of which (according to the wind) will, when open an inch or two, be sufficient for the purpose. If the windward window be opened only one inch, it offers a passage to air having an area of 45 square inches ; and as an equal aperture

* These now fitted open from the *inside*.

" is opened between the upper and lower sashes by the same act, " 90 square inches of sectional area, or of air passage, is thus at " once obtained. This air to be heated by a stove standing " (unless there be special reasons) in the middle of the watch- " room. The stove not to be jacketed or double, or, if it be, both " the top and bottom part to be removed. The space between " the ceiling of the watch-room and the floor of the lantern, which " are supported by the cross-beams upon which the lamp, &c. " stands, to be made a hot-air passage, by opening the centre of " the ceiling of the watch-room for a diameter of five feet, covering " the space with a light grate, or a screen of trellis wire-work, " and opening also the floor of the lantern all round for a distance " of two feet, or, perhaps, 18 inches from the wall. The watch- " room and the lantern to be separated by a door on the stairs, " for the sake of precaution, which may, however, finally not be " needed. The chimney of the stove to be of copper, to pass " through the ceiling and floor, to any convenient side of the " lantern, according to the nature and position of the latter, but " to be within the lantern in its ascent, and, if manageable, on " the coldest side. The usual ventilators in the sides of the " lantern may not be required if the foregoing arrangement be " adopted.

Mode of obviating the injurious effects of the condensation of the moisture produced by combustion.

97. " The injurious effects of the condensation of the moisture " produced by the combustion of the oil, upon the glass of the " lanterns, have been obviated by a ventilating tube, which is " placed over the flame of the lamp, according to a method sug- " gested by Professor Faraday, whereby the elements for such " condensation are conveyed direct to the exterior of the lantern."

NOTE.—*The preceding memorandum is drawn up from Reports from time to time received from Professor Faraday upon the subject to which it relates.*

IV. On the Application of Lightning Conductors.

Principles upon which the lightning conductors are fitted to Lighthouses under the management of the Trinity House.

98. The following are the conclusions of Professor Faraday, as to the circumstances under which Lighthouses are placed as respects lightning, as stated in a Report dated 25th September 1843; and the Corporation of Trinity House have caused all conductors put up at their light establishments to be fitted upon the improved principles therein expressed, viz.:

(*a.*) That Lighthouses should be well defended from the top to the bottom.

(*b.*) That, as respects the top, the metal of the lantern and upwards is sufficient to meet every need, and satisfy every desire and fear.

(*c.*) That, for the rest of the course down the tower, a copper rod three-fourths of an inch in diameter is quite and more than sufficient.

(*d.*) That, at the bottom, where the rod enters the earth, it is desirable at its termination to connect it metallically with a sheet of copper 3 or 4 feet long by 2 feet or more wide.

(*e.*) The latter to be buried in the earth, so as to give extensive contact with it.

(*f.*) That glass repellers are in every case useless.

(*g.*) That glass thimbles are not needed, but do no harm.

(*h.*) That if the repeller be removed, and the point on the vane be terminated as the lightning rods usually are, and then the metal of the lantern be strongly attached to and connected with the upper end of the copper rod, and the rod continued down the tower to the earth, and the sheet of copper buried in it, such a system will be an effectual and perfectly safe lightning conductor.

(*i.*) That then there need be no rod end rising by the side of and above the lantern.

(*k.*) That the rod may (if required on other accounts) come down on the inside of the building, or in a groove in the wall, but should not be unnecessarily removed from observation and inspection.

(*l.*) That all large metallic arrangements in the stonework or other non-metallic parts of the tower of the Lighthouse, such as tying bars, metal flues, &c., should be well connected by copper with the conductor.

(*m.*) That the vicinity of two metallic masses, without contact or metallic communication, is to be avoided.

(*n.*) That it is important—casual arrangements should never be depended upon for lightning conductors, but a copper rod be established for the especial purpose.

V. On the Necessity of preserving the Water intended for domestic purposes from Impurities.

99. It is essentially requisite, and care should be taken,—

Rules to be observed in the construction, &c. of water tanks.

(*a.*) That at every light establishment the tanks or reservoirs for receiving the rain-water; from which source the Keepers and their families chiefly obtain the supply, be so constructed, as to site and security, that the spray from the sea cannot enter.

(*b.*) That no paint be used on those parts of the buildings over which the rain-water flows, and that, in its course, it does not come in contact with copper or other metal surfaces.

(*c.*) Further, it is important that no water gathered from lead and copper roofs and galleries exposed to the action of the spray should be used for drinking or culinary purposes.

Slate tanks.

100. Slate tanks are considered preferable, and have been provided at some stations in substitution for leaden cisterns; although the former are liable, in very severe weather, to be injured by the effects of the frost.

VI. Statement respecting a Trinity Light Vessel.

Principal dimensions, &c.

101. A floating Light Vessel for the exhibition of one light, as built for the Corporation's service, is of about 158 tons register, and the principal dimensions are as follows, viz:

Length from the fore part of the main stem to the after part of the taffrail - - - - 85 feet.

Breadth at the broadest part above the main wales - 21 feet.

Full details as regards the other dimensions and particulars of construction are given in the printed "Specification for building a Light Vessel (see page below);" all the Light Vessels of the Corporation are of wood, round-sterned, have no galleries and no head.

Mast.

102. The mast (a Riga spar) is $15\frac{3}{8}$ inches diameter, parallel up to the hounds, its extreme length 69 feet, with oak battens and 18 feet mast-head, fitted with a copper lightning-rod or conductor, as described in the "Specification."

Rigging.

103. The rigging consists of three chain shrouds $\frac{5}{8}$ths of an inch, set up with screws on each side of the mast, which is further secured by a forestay and backstay, and is surmounted by an open globe or ball (to be taken down when the vessel is out of position), made of truss-hoops of 6 feet diameter.

Oil cisterns.

104. The oil cisterns, four in number, are of iron, and are calculated to contain 122 gallons each, and the wrought iron water tanks, which are connected by leaden pipes with brass screws, to hold 1,700 gallons.

Construction and fastenings. Form (L. V. 1.) in Appendix to Masters and Mates of Light Vessels.

105. For the description of the other appurtenances and inboard works, a reference should be made to the "Specification" and "Inventory" (see Form L. V. 1.) No essential alteration or improvement has been made, for some years past, in the build or fittings of the vessels in question, but it has been thought desirable to substitute Indian teak for African oak in their construction, and to introduce copper fastenings and metal dumps in lieu of trenails.

Moorings.

106. The moorings are of two kinds, consisting either of a single cable-chain and mushroom anchor, or of span (or ground) moorings; the former, in general, have 210 fathoms of $1\frac{1}{2}$ inch chain,

the latter, a bridle, or riding chain, 150 fathoms in length, and of similar diameter, shackled to the swivel which connects either arm of the span, each arm being 105 fathoms long, and $1\frac{1}{2}$ inch; the mushroom anchors from 30 to 40 cwt.—except in some protected situations in-shore, when the moorings are of a lighter character,—the chains being smaller and the anchors of less weight.

107. Spare gear is provided for the mast, as also for use in case of necessity, spare mooring cables and bower anchors. Spare gear.

108. A red light, instead of the usual light, is shown from the bow and from the stern, on occasions of the Vessel getting adrift or being away from her Station, and other signals displayed.* Lights when adrift.

109. The fixed lights have eight lamps and reflectors. The lights, which are visible at a distance of 9 or 10 English miles, burn at an elevation of 38 feet above the surface of the sea, which is the greatest height to which the lanterns are raised above high water. Spare lighting apparatus is kept on board, as specified in the following estimate. Number and height of lamps in fixed lights.

110. The expense of a Light Vessel, with one lantern complete in every respect, is estimated at about 5,000*l.*, and the annual charges of maintenance, comprising agency, wages to crew, provisions, oil and stores, at about 1,100*l.* The separate cost of a lighting apparatus and lantern, with the tackle, &c. for hoisting and lowering the same, may be estimated, at present prices, as under :— General estimate of cost of a light vessel with one lantern.

	£	s.	d.
A copper lantern glazed with plate glass complete	235	1	6
Parabolic reflectors and patent lamps	68	10	6
Gimble work mounted to the lamps and reflectors	50	7	7
Traversing frame and metal table to facilitate trimming	16	0	0
Tackle, &c., consisting of a winch and chain	11	15	2
Extra lamps, reflector, and gimble work, as spare apparatus	24	5	3
	£406	0	0

* The intention here is, that when a Light Vessel breaks adrift she should show some lights unlike those which she carries when at her station, and that should also distinguish her from other vessels.

VII. Specification for building a Light Vessel for the Service of the Corporation of Trinity House of Deptford Strond.

Dimensions.

111. Length extreme - - - - - 80 feet.
Breadth to a 3 inch plank - - - - - 21 feet.
Depth in the hold, from the strake next the limbers to the upper side of lower deck beams, as per drawing at the Trinity Buoy Wharf; to have a round stern, and to be filled up inside with 2 inch oak plank from stem to abreast of windlass ends on both sides on the upper deck.

	Feet.	In.
Depth of Hold abreast of *foremast* from strake of ceiling next the limbers to upper side of lower deck beams - - - - - - - - - -	3	5
Depth of Hold abreast of *mainmast* from strake of ceiling next the limbers to upper side of lower deck beams - - - - - - - - - -	3	7
Depth of Hold abreast of *mizenmast* from strake of ceiling next the limbers to upper side of lower deck beams - - - - - - - - - -	3	1
Depth between Decks abreast of *foremast* from the upper side of lower deck beams to the upper side of the upper deck beams *amidships* - - - - -	7	2
Depth between Decks abreast of the *mainmast* from the upper side of the lower deck beams to the upper side of the upper deck beams *amidships* - - -	7	5
Depth between Decks abreast of the *mizenmast* from the upper side of the lower deck beams to the upper side of the upper deck beams *amidships* - - -	7	2

Scantling, &c.

112. Keel.—To be English elm, in three pieces, sided 11 inches by 13 inches; scarphs, 5 feet long, laid with flannel or felt, bolted with six copper bolts of 1 inch diameter, $2\frac{1}{2}$ inches left above the rabbet.

Keelson.—To be Indian teak, sided 11 inches, moulded 13 inches; to be bolted through every floor timber by copper bolts of $\frac{7}{8}$ inch diameter on copper rings; two $1\frac{1}{4}$ inch iron eye-bolts to be driven through from side to side, and clenched on rings to secure the ends of chain cables. Scarphs 4 feet 6 inches, with two copper bolts in the lip, $\frac{3}{4}$ inch in diameter.

False Keel.—To be English elm, 3 inches. Builder to find and fit all copper fastenings for the same.

Stem.—To be in one piece, English oak, sided 11 inches at the head, and 10 inches at lower end, moulded 12 inches, to have a good knee to connect lower end to dead wood, to run from the

lower breast hook to step of foremast, bolted with 1 inch copper bolts every 18 inches, to have 3 inches wood abaft the rabbet.

Apron.—To be sided as the stem, of English oak.

Stern Post.—To be English oak or Indian teak, sided 11 inches, at the lower end as the keel; moulded according to the draft, the main post to have 3 inches wood before the rabbet.

Dead Wood.—To have sufficient dead wood forward and aft, with a good English oak knee; the upper arm to run up the stern post to the lower deck; the lower arm not less than 7 feet, bolted with copper bolts of 1 inch diameter every two feet; also two wooden crutches of sufficient length, under the lower deck, securely bolted with copper bolts of 1 inch diameter.

Room and Space—To be two feet.

Floor Timbers.—To be English oak, sided midships $10\frac{1}{2}$ inches, forward and aft $9\frac{1}{2}$ inches, depth on the keel 11 inches, moulded at heads $8\frac{1}{2}$ inches, to be bolted with copper bolts of 1 inch diameter.

First Futtocks.—To be English oak, sided in midships 9 inches, diminishing to $8\frac{1}{2}$ inches and 8 inches forward and aft, to run down to within 6 inches of the keel solid, moulded at the heads $7\frac{1}{2}$ inches in midships, the lower ends not champered off, and then made up square by pieces scarphed and trenailed on, and the heads and heels of all timbers where they abut on each other to have a dog of sufficient size driven to keep them in contact.

Second Futtocks.—To be English oak, sided in midships 8 inches, forward and aft $7\frac{1}{2}$ inches, moulded at the heads $6\frac{1}{2}$ inches.

Top Timbers.—To be English oak, sided $7\frac{1}{2}$ inches at the heels, at the heads 7 inches, moulded at the heads 5 inches, to be built in frame, and bolted with $\frac{3}{4}$ inch iron bolts, and to come up within one inch under covering board, shifts of timber not less than 4 feet 6 inches; the round stern to be framed similar to the drawing at the Trinity Buoy Wharf.

Main Wales.—To be in three strakes of $4\frac{1}{2}$ inches Indian teak plank, in long lengths, 8 inches broad amidships, round the bow and stern, English oak of same dimensions; 1 strake of 3 inches, Indian teak to be worked above the wales abreast of foremast and mainmast, but round the bow and stern, English oak of same dimensions: the upper and lower edge of the wales with a bead on the edge.

Bottom.—To have two strakes of four inch Indian teak plank at the floor heads, the remainder of the plank to be 3 inches English oak or Indian teak plank, except the flat of the floor below the thick strakes, which is to be of 3 inch English elm.

Top Sides.—Two strakes of $2\frac{1}{2}$ inches Indian teak plank.

Sheer Strake.—To be 3 inches Indian teak, to receive upper deck fastenings, and to be worked round the stern; shifts of plank to be 6 feet shifts, and not less than 3 strakes between them.

Inside Plank.—To have two strakes of 3 inches, wrought next the timbers, three strakes of 3 inches at floor heads; ceiling to be of $2\frac{1}{2}$ inches to two strakes above the floor heads; the remainder to be 2 inches, and the three clamps under shelf piece of upper deck 3 inches, and to come down to lower end of the short hanging knees, all of Indian teak. All the planks, both inside and outside, to be of the *full* size specified after they are worked and planned on the vessel.

Air Openings.—Three openings to be left, each 4 inches wide fore and aft in the ceiling, one above the thick strakes at floor heads, one at 16 inches above the lower deck, and one three feet below the upper deck; the latter one to have flaps about every foot apart throughout of fir in the living room and cabins, to hang with brass butt hinges, to fall down with buttons and knobs, to open and shut; flaps to be 4 feet 6 inches in length.

Breast Hooks.—To have 4 below the upper deck, of English oak, the deck hook 14 feet long, sided 11 inches, and bolted with 13 through copper bolts of 1 inch diameter; the three lower hooks 12 feet long, sided 9 inches, bolted with 10 through copper bolts each of $\frac{7}{8}$ inch diameter; the deck hook and lower breast hooks are to be of one piece of timber, except a piece as a filling chock amidships; an iron hook 10 feet long to be fixed and fitted above the deck hawse holes, bolted with $9\frac{3}{4}$-inch through copper bolts.

Steps.—To have three steps of sufficient size securely bolted to the keelson, with mortice in each for masts, and to find and fix proper mast partners, carlings, combings, and wedges on both decks for 3 masts. Mainmast to be placed at the midship section, and the fore and mizen masts 20 feet distant before and abaft it.

Lower Deck Beams.—To be of English oak or Indian teak, sided 8 inches, moulded 7 inches, three feet apart—to rest upon a teak shelf 9 inches by 5 inches, properly bolted fore and aft; round the bow and stern English oak of same dimensions, every other beam to have 2 lodging knees of English oak, from beam to beam.

Upper Deck Beams.—To be of English oak, or Indian teak, sided 11 inches in the way of bitts, and 10 inches in the way of hatchways,—the others sided 9 inches, moulded in middles 8 inches, at the ends 7 inches—not exceeding 4 feet apart, every beam to be scored 1 inch and dowelled into a shelf of Indian teak, $6\frac{1}{2}$ inches by $10\frac{1}{2}$ inches, to run fore and aft and round the stern,

bolted through every other timber, and clenched on the timber, each beam abreast of windlass and riding bitts, also the second beam from forewards and the second beam from aft of the upper deck to be secured at each end by a strong hanging iron knee, the lower arms of which are to be 6 feet long, and the upper 3 feet, bolted with 1 inch copper bolts 1 foot apart, all the other beams by hanging knees, the lower arms to be 3 feet 7 inches long from the under part of the beam, and bolted with 4 through 1 inch copper bolts below the shelf piece, the upper 3 feet long, to be bolted with through copper bolts 1 inch in diameter, 12 inches apart, the beam bolts to be clenched on a copper ring on the beam, the deck to be framed abreast of the companion, the beams to be planed smooth, and to be beaded at the lower edges fore and aft; each beam to have an inch score up and down, each end rounded top and bottom, weight of the small knees 3 qrs. 10 lbs., weight of large knees 4 qrs. 14 lbs., *forged to fit close into the shelf piece.*

Waterways.—To be of Indian teak in midships of one length 12 inches square; the round on both sides from the foremast forward, and from the mizen mast aft, to be of English oak, with horizontal scarphs not less than 3 feet long, each scarph to have three through copper bolts, and to be clenched both forward and aft—8 scupper holes, 6 inches by 3 inches, to be cut four on each side, to be carried under the waterways without cutting them.

Upper Deck.—To be of 3 inch Dantzic deal, except one strake 25 feet long of English oak or Indian teak on each side, to receive 4 deck stopper bolts—bolts to be of $1\frac{1}{4}$ inch iron, clenched to under side of the beam, with rings 4 inches in the clear—to find and fix eight deck lights 10 inches long, the edges to be coppered, to fix a large bull's eye, if required, and to find and fix iron bars or gratings to protect the same.

Lower Deck.—To be of 2 inch yellow Baltic pine; to find and fix six gratings of teak, 4 feet long by 2 feet wide, the carlings of which to be flush with the lower deck, and rest upon the lower beams; four to be placed in the wings, one forward, and one in the cabin; to find and fix two oak plank stanchions, 10 inches wide, $2\frac{1}{2}$ inches thick, to reach from lower deck beams to upper deck, each stanchion to have two iron clamps, with bolts, pins, and chains, to steady the chain cables. To find and fix twenty-four copper-plates of $\frac{1}{4}$ inch copper, 6 inches by 4 inches, each plate to have a hole to receive an iron key; the plates to be screwed to openings in the deck, each with four copper screws of $1\frac{1}{2}$ inch long; to find twelve iron hand keys for the same plates.

Shoot.—To find and fix two Indian teak shoots, the bottom to be 4 inches thick from the fore part of the windlass to the inner

edge of the long hawse pipes, with proper stanchions to support their after ends, and cleats forward; to line the same with iron plates screwed in the plank.

Plank Sheers.—To be of 3 inch Indian teak or English oak, of sufficient width to allow of $1\frac{1}{2}$ inch moulding outside the sheer strake; to cut holes, and to find and fix twelve 4 inch brass screw ventilators with leather washers, six on each side, in the plank sheer. Timber heads to run through as per drawing, viz., three on each side above the rail forward, and two on each side above the plank sheer aft.

Rough Tree Rail.—To be of English oak, fore and aft, 6 inches by 4 inches, with moulding on both sides; to be secured to each timber with copper saucer-head rail dogs, and copper screws, and to be 2 feet 6 inches from the upper part of covering board to the top of rail, with two gangways cut in it as may be directed.

Windlass.—To find, and fit, and properly fix a windlass of English oak, 18 inches diameter, with a spindle of $3\frac{3}{4}$ inches diameter, to run into the body 24 inches at each end, bolted through with four bolts; to find and fix two circular ends to windlass, each 14 inches long by 12 inches diameter, the spindles to go 10 inches into each end, and to be bolted through; to find and fix proper pawl and carrick bitts to windlass, carrick bitts at upper deck 22 inches broad, at lower deck 17 inches, to bolt to lower deck beams, to be properly knee'd on upper deck; the knee to take two beams; to fit riding chock and wedges complete; to find and fix Tyzack and Dobinson's, or any other patent pawls, and machinery for the same, complete, as may be directed by the Corporation; to find and fix an iron gong stand on the pawl bitt; to line each side of the windlass with 5 inch Indian teak, and iron plates at each angle, of $\frac{1}{2}$ inch thick and 4 inches broad, hollowed down in the centre for chain cables; to find and fix cross pieces from carrick to pawl bitts with iron strong back, stanchions, hooks, and bolts on both sides.

Riding Bitts.—To have one pair of riding bitts of Indian teak or English oak, 14 inches by 15 inches fore and aft, of proper length, the lower ends to go down to and morticed to the floor timbers, and bolted through the lower deck beam, with a cross piece of 13 inches square, each bitt to have a wood knee of sufficient length on deck to take two beams on upper deck, properly bolted into beams and carling below. The upper end of each bitt to have four hoops of $\frac{3}{8}$ inch iron, 3 inches wide, driven on hot above the cross piece; 3 similar sized hoops to be driven on each end of cross pieces, the upper, under, and after side of the cross piece on both sides to have a plate of $\frac{3}{8}$ inch iron, 18 inches long, secured by 3 inch screws inside, and joining the cross piece hoops.

Pumps.—To find and fix two good iron pumps of such make as the Corporation may direct, with proper partners, wedges, &c., to be placed where directed, and enclosed within an oak well of 2 inch plank, with oak stanchions below the lower deck, pumps to have brass chambers, if required, with two complete sets of gear, viz., spears, stanchions, brakes, and lower boxes, with proper bolts and nuts; two covers to be fitted to pumps, with chain and eye-bolts to fix them on the deck.

Bilge Pieces.—To find and fit four bilge pieces of English or American elm, 50 feet long, 16 inches in and 12 inches out, 10 inches broad at the timbers, to be worked outside, on the timbers as per drawing; each bilge piece to be bolted through every timber with a $\frac{7}{8}$ inch copper bolt, and all the bolts to be clenched on copper rings on the thick stuff inside; each bilge piece to have four composition knees 12 inches by 24 inches, $1\frac{1}{4}$ inch at the throats, and $\frac{3}{4}$ of an inch at the ends, secured to the bilge pieces outside, and to the bottom, by two through copper bolts at the throat, one through the bottom, and one through the bilge piece, with three butt bolts of $\frac{3}{4}$ inch copper.

Hatchways.—To find and fix proper combings, frames, and ledges for four skylights, and proper companion of Indian teak, each combing to be one foot above the deck, companion stanchions to be of 4 inch Indian teak, to frame deck abaft the rudder. To provide and fix one privy where directed, bottom to be lined with 6 lb. lead, to overlap the deck 2 inches all round. To find and fix stands for beer and provision casks, hammock racks, boats' chocks, iron tables and stanchions for lantern, anchor cushions, cleats and belaying pins, where required, of all descriptions.

Hawse Pipes.—To find and fix two hawse pipes of 1 inch iron, lower lips to be 4 inches thick, to be properly lined with 4 lb. lead, chocked, wedged, and bolted above the upper deck; to find and fix 2 long hawse pipes to go through the upper deck, under the deck hook, of 1 inch iron, 4 inches at the lower lip, flanged off, flush with the deck, to be properly cushioned, chocked, wedged, bolted, and leaded, to be cased in with 4 inch oak plank, from the hawse hole to deck, the case to be properly bolted, caulked, and made water-tight; also, one long hawse plug and one short plug.

Chain Plates.—To find and fix sixteen chain plates of $\frac{1}{2}$ inch galvanized iron, 4 inches wide, with strong eye at the upper ends, some of them to come up above the covering board, and others to upper part of rough tree rail as directed, to receive the rigging, lower ends to bolt into thick strake above the wales, each plate to have five through copper bolts clenched on copper rings; to find and fix sixteen copper lightning conductors of $\frac{1}{4}$ inch copper, 2 inches broad, upper end to join the chain plates, the lower ends

to reach to the 6 feet water line, each plate to be properly secured with countersunk copper screws 8 inches apart.

Davits.—To find and fix a davit of English oak, 14 feet long, 12 inches square, with three bushed sheaves at the outer end, with an English oak knee, 5 feet arms under, bolted with inch copper bolts 8 inches apart; to find and fix an iron strap to davit head, with iron roller of $\frac{3}{4}$ inch iron, to rake to main-mast head, the roller to be 3 inches by 2 inches diameter, strap $\frac{1}{2}$ inch, to have three lugs; also one large cheek block on starboard side of davit well secured with iron roller and iron pin of 2 inches diameter, sufficient to take a mooring chain; to find and fix secure two pair of iron davits of $2\frac{7}{8}$ths inch iron, with iron steps for same on the plank sheer, with clamps on rough tree rail—upper ends to be 6 feet 6 inches above the rail; each davit to be fitted with an iron double swivel block to take a $2\frac{1}{2}$ inch rope, to be secured with screws and nuts to davit heads complete. The whole of the iron and iron work to be galvanized; with $\frac{3}{8}$ chain guys for davits.

Catheads.—To be 10 inches square, each to have three bushed sheaves at the head, to take a 3 inch rope, with proper pins and thumb cleats of iron, to be bolted to the side of each for stoppers; each cathead to be hooped at the outer end with $\frac{1}{2}$ inch iron hoop, and to have an English oak knee, each arm 2 feet long, plated, and bolted securely to timbers.

Pillars.—To fit pillars of English oak under every beam 6 inches square at top and bottom, to be properly morticed and tenanted, to be turned and moulded between each square, and to have one pillar under each long hawse pipe.

Rudder.—To fit a rudder, 2 feet broad up to the 8 feet water mark, and then tapered to a round head, with 3 pair of composition pintles and gudgeons; pintles to be 3 inches diameter; to fix a spider hoop with 3 lugs round the rudder head, each lug 3 feet long, and screwed to the deck, with hoop on rudder head, tiller, norman, and chocks complete; to have two iron plates let in, one on each side the tiller hole, bolted with four bolts; two $\frac{1}{2}$ inch iron hoops to be driven on the head, and an inch composition strap with eyes to be secured on the back of rudder to receive shackles, with 8 feet of $\frac{3}{4}$ inch composition chain; the inner end of chain to have rings and thimbles attached of sufficient size to receive a 3 inch rope; the rudder trunk to be of 3 inch Dantzic deal, caulked and pitched, the whole of the trunk to be lined with 6 lb. lead, to overlap 4 inches above and below, and nailed with copper nails of 1 inch.

Cushions.—To find and fix cushions for anchors, with all stanchions, cants for water tanks, and bulkheads in the hold, where required. To find two long and two short hawse pipe

moulds complete, which are to be returned to the Trinity Wharf.

Iron Work.—To find and fix the following: two iron knees 3 inches broad, abreast of each mast over the waterways, the lower arm to be 3 feet long, and to have 4 copper bolts through, and clenched under the beam; the upper arm to reach the rail, and to have four copper bolts through the timber and clenched or rivetted on copper rings outside. Eye and ring bolts to secure cook's hearth and cabin stove, $\frac{1}{2}$ inch ring bolts to four stanchions for two guns; an A iron plate of $\frac{3}{4}$ inch flat iron, 3 inches wide, with an eye to receive a backstay above the taffrail; the legs to be 3 feet long, to be secured by $\frac{1}{2}$ inch copper bolts to stern frame. Two strong iron rollers 12 inches by 5 inches diameter, with pins of 2 inch wrought iron outside the knight heads, and between the next timber head, next to them above the rail. Four gangway stanchions with plates and sockets, and 12 awning stanchions with ditto if required; a hand rail, with plates and screws to companion ladder, iron gratings $\frac{3}{4}$ inch iron over skylights, with bars and bolts for cap scuttles of $\frac{1}{2}$ inch iron, 2 inches broad; four iron brackets in the berthing forward for windlass and winch handles. One inch bolts, screws, and nuts to secure three A cranes to the deck through beams, carlings or ledges; to make six iron shouldered normans, of 2 inch bolt iron, iron plates on riding bitts, and into windlass for normans, 1 inch iron hoops and eyes for strong back, all needful eye bolts, ring bolts, staples, screws, nails, and nuts, in and about the vessel; two cast-iron scuttles for chain cables, two stout short iron knees to main lantern house, as fenders, two $1\frac{1}{4}$ inch eye bolts and short chains for shank painters, and stoppers of $\frac{1}{2}$ inch chains on both sides, plates for 2 dog vane staves, with tumbler step and clamp for ensign staff, 2 pump hooks for each pump, and two 2 feet sounding rods, marked to inches; also a pair of gangway sheers, or gallows, of $1\frac{1}{2}$ inch iron, to stand 4 feet above the roughtree rails, with becket or loop in the under part, to hook tackle hook into, and with square iron sockets upon gangway stanchions to ship the legs into. Lumber or spar irons, for boat's masts and oars, to be placed where directed. All the iron work to be galvanized.

Joiners.—To find and fit waist and quarter boards of 1 inch fir, to be rabbeted and beaded fore and aft, boards to be 9 inches wide, lower board to be hung with long copper hinges from forward to aft, with copper plates and hooks to close the flaps; to fit proper companion with half doors on each side, top to open on both sides, connected and secured by two pair of double-jointed brass hinges, to be secured with copper screws; to find and fix a proper companion ladder, with brackets for telescope

inside companion ; to find and fix four skylights as per drawing, to be glazed with plate glass $\frac{1}{8}$ inch thick, with cap scuttles for each of 1 inch stuff, to make a binnacle with funnel with two panes of plate glass ; to fit all bulkheads in the hold and between decks ; to form cabin, oil-room, and steerage. *Dimensions of Master's cabin.*—From the front of the after-cabin lockers to the after part of the cant, of the thwartship bulkhead, 9 feet 9 inches. *Dimensions of oil-room.*—From the fore part of the cant of the master's cabin to the after part of the cant in the fore part of the oil-room, length 11 feet 4 inches. *Dimensions of chain-room.*—From the fore part of the cant of the oil-room bulkhead to the after part of the cant of the galley bulkhead, 14 feet 5 inches. *Dimensions of galley.*—From the forepart of the cant at the after part of the galley to the harness cask or stand, 26 feet 11 inches. To fit after-cabin with two state rooms, pantry, book-case, and drawers, with wash-hand stands in Master's and Mate's berths, with drawers under bed berths ; to fit oil-room with shelves, lockers, oil cistern stands, sinks for water and trimming lamps, with hanging covers to ditto ; to fit bread and potatoe lockers in the wing, to be lined with tin, covers to be hung with brass butt hinges ; to fit and fix four store rooms with shelves and lockers, and doors ; to fit seamen's lockers, mess tables, and forms for seamen ; all lockers and doors to have brass hinges, knobs, locks, and handles ; to find and fix chain cable lockers with thwartship and fore and aft bulkheads in the hold as required ; to cover and cap in all connecting pipes to and from the water tanks with one-inch deal, doors and after-cabin to be panelled ; to find all nails, screws, hasps, nuts, knobs, hinges, of brass or copper, for all the work complete ; to cut berthing for anchors ; to find and fix cases for reflector boxes in the oil-room ; to find and fix a proper panelled privy abaft, with one seat, and door hung with brass butt hinges, knobs, buttons, and latches complete. One port on each side with doors for gun, with brass hinges and bolts, and cap scuttles or shutters as may be required.

Stern Frame.—To be framed, dowelled, chocked, and bolted as the body ; to have four fashion pieces, one on the elbow or knuckle of each quarter, and one on each side of rudder trunk (*vide* Mr. Pitcher's present plan and drawings) 18 inches above the lower deck, bolted with ten 1 inch through copper bolts, clenched on copper rings, size of transom 14 feet long, sided 11 inches, of English oak, bolted with 13 through copper bolts of 1 inch diameter ; stern frame to be secured abaft the rudder by an iron strap or truss, 5 inches broad amidships by 1 one thick, worked towards the ends to 4 inches broad by $\frac{3}{4}$ inch thick ; the ends to extend forward midway between the second and third

beams, to be properly fayed to the skin parallel with upper deck, and bolted with $\frac{3}{4}$ inch through copper bolts, clenched on copper rings; an iron deck transom knee on each side aft, close up to the deck, to unite the transom and shelf together, with two arms 4 feet long each, and of proper thickness, to be bolted through the upper transom and shelf, with 1 inch copper bolts clenched through the shelf, the bolts, 1 foot apart: scarphs on shelf and waterways to be secured as per drawing.

PLUMBERS.—To find and fit with composition nails, eight stout leaden scuppers, 6 inches by 4 inches through the sides, under the waterways and above the shelf piece; also to find and fix four copper valves 2 inches in the clear, on the deck over oil cisterns; with two similar copper valves in the deck, connected with pipes of 2 inches in the clear from the deck to water tanks, with a hand pump and pipes leading from tanks to sink in lower deck; to find, connect, and secure such pipes with a proper head pump and pipes with gratings below, also two sets of gear for each pump; to lead galley and cabin platform, galley and cabin bulkheads from deck to deck; to lead cants round galley and cabin funnels and mast holes, sinks in oil room and between decks, inside of binnacle; to find and properly fit one funnel through stern frame for privy, and to cover the top of round house or privy with marine metal secured with copper tacks; to find four copper turnkeys for air valves; all hawse pipes to be leaded with 4 lb. lead under.

PAINTERS.—To paint the vessel inside and out three times in oil throughout, *and a fourth coat if required*, and complete with every article on, in, and appertaining to both decks; including guns and carriages, windlass handles, provision casks, deck tubs, buckets, masts, flagstaff and mast-heads, globes, globe covers, small and large boat, boat's masts, oars, rudders, tillers, &c. To write name on both sides, and number, grain, and varnish cabin; all sky-light, gong, crane, and sail covers to be painted, wales to be black varnished.

FASTENINGS.—The vessel to be completely copper-fastened throughout from keel to gunwale, the decks to be copper or composition nailed; all the butts of the bottom to be bolted with $\frac{7}{8}$ inch copper bolts, and $\frac{3}{4}$ inch dumps, all the bolts of every description to be clenched on copper rings, all rings and starts to be of copper; proper and substantial composition dove-tail plates to be fixed on after part of the stern post, and a good stout composition horse-shoe plate on the gripe; the vessel to be thoroughly caulked all over fit for sea; the bottom to be felted with patent felt, and coppered, both at the builder's expense, the Corporation finding copper or metal sheathing and plates for stem only. *No trenails to be used in the vessel.* At every butt,

a $\frac{7}{8}$ inch in diameter through copper bolt at the upper edge of butt, and a three-quarter inch composition dump bolt at lower edge of butt, a through copper bolt in every third timber, $\frac{7}{8}$ inch in diameter, either at the upper or lower edge of plank. The dump bolts to be used of the following dimensions:—In plank of 3 inches thick, 7 inches long, $\frac{1}{2}$ inch in diameter—in plank of 4 inches thick, 9 inches long, $\frac{5}{8}$ inch in diameter; and when the plank is thicker than this, the dump to be $\frac{3}{4}$ inch in diameter, and proportionably long. The ends of the dump to be ragged; where any internal fastenings come through the outside plank, then those bolts may be brought in as one of the through bolts. Where practicable, all the through bolts of the outside planking to be clenched on the inside plank.

Timber.—All timber, plank, knees, crutches, breast-hooks, transoms, pointers, riders, and shelves, with the whole frame, to be free from sap, or any other defects whatever, to be of the best English oak or Indian teak, as specified. All futtocks and timbers to be put together in frame, with square heads and heels dowelled together, with square connecting bolts, except the top timbers, which are to be scarphed to the heads of the second and third futtocks. N.B. The lower ends of first futtocks must be square and solid.

Boats.—To build two boats of oak, one 20 feet clench-built, copper-fastened throughout, with thwarts, bottom boards, rudder, tiller, davit, four ash oars, two boat hooks and staves, and mast with step and clamp to each, each to have stem plate and stout band of iron to be screwed to keel; boat and all her gear to have three coats of paint in oil. The other, 16 feet, double-headed, clench-built, and copper-fastened, with rudder, tiller, thwarts, and four oars, two boat hooks and staves, and to have three coats of paint.

Lantern House.—To build, fit, and fix upon the deck a house similar in every respect to the middle house in the Light Vessel at Blackwall, with all necessary fastenings, knees, doors, slides, plate glass windows with brass guards; the house to have three coats of colour in oil, inside white, outside and top red, with the mast within the house; the top to be covered with marine metal secured with copper tacks.

Fire.—The builder to insure the said vessel from fire during the time she is building, and until she is launched and delivered complete to the officers of the Corporation.

Overseer.—The work to be subject at all times to the inspection of such person or persons as the Corporation may appoint from time to time during its progress.

Extra Work.—No charge will be allowed for any extra work

that may be required until the sanction and agreement for such work be had and obtained, in writing, from the Corporation.

LAUNCH.—The vessel to be completed in every respect according to the foregoing specification ; to be launched and delivered up to the Corporation's officers, on or before the .

PAYMENTS.—To be made at five different periods as the work advances, as follow, videlicet :—

1st. On signing the contract.

2nd. When the floors are all crossed and stem and stern post up.

3rd. When framed and the wales are wrought all round.

4th. When the whole plank is wrought inside and outside, and the decks laid and caulked.

5th. The balance when the said vessel is finished in every respect according to the Specification, and delivered to the officers of the Corporation.

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