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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No. 2778.	Press Mis.
204-5.	
Dated 10-9-	1867.

Not to be folded or roughly handled*By*

No. 204. Read the following Despatch from the Right Honorable the Secretary of State for India, (Public Works,) to His Excellency the Right Honorable the Governor in Council, Fort St. George, dated India Office, London, 9th July 1867, No. 20:—

On receipt of your despatch No. 10, of 5th March last, relative to a project prepared by Dr. Wyndowe and Captain Goddard for improving and extending the Gas Works in Fort St. George, I caused all the correspondence on the subject to be placed in the hands of Colonel Robertson, whose opinion has recently been taken with respect to a similar project for lighting the Cantonment at Rawul Pindee, and who is believed to be specially acquainted with the practical working of gas in India.

* Dated 14th June 1867.

2. From the enclosed copy of Colonel Robertson's Report,*(accompanied by a sketch,) it will be seen that he recommends certain alterations in the plans prepared by the local Officers, especially as regards the machinery and apparatus. I would suggest that Colonel Robertson's Report be forwarded to Dr. Wyndowe and Captain Goddard, with a view to their embodying in an amended project such of the proposals contained in it as, after mature consideration, may seem applicable to the circumstances of the case. When such an amended project has been approved by your Excellency, an Indent for the whole of the apparatus, pipes, and fittings which may be required, should be transmitted to this Office in the usual manner.

3. I have desired that the specimens of coal, burners, pendants, pipes, and gas fittings referred to in the concluding paragraph of Colonel Robertson's Report should be sent out without delay for the assistance of the local Officers in making revised arrangements.

From Colonel A. ROBERTSON, to the Director General of Stores, Cannon Row, dated Lundin Links, Largo, Fifeshire, 14th June 1867.

1. In accordance with the instructions contained in your letter of the 20th ultimo, I have the honor to submit my report upon the project for the extension of the Gas Works at Fort St. George.

2. I fear the time occupied in the preparation of this report may appear long, and that the report itself so short and simple will add to this conviction, but it requires much time and consideration to go fully into a project such as this, and to understand fully what has been done and what is contemplated. The papers have all been returned by Railway Parcel Department by Great Northern Railway.

Report upon the project for lighting Fort St. George with Gas, prepared agreeably to instructions conveyed in letter of the 20th May from the Director General of Stores.

1. In dealing with the subject of the gas scheme, present and proposed, for Fort St. George, it appears convenient to divide the subject into four heads, Machinery, Manufacture, Distribution, and Interior fittings.

2. The existing apparatus appears to have been entirely got up at Madras, and does great credit to the science, ingenuity, and skill of all concerned.

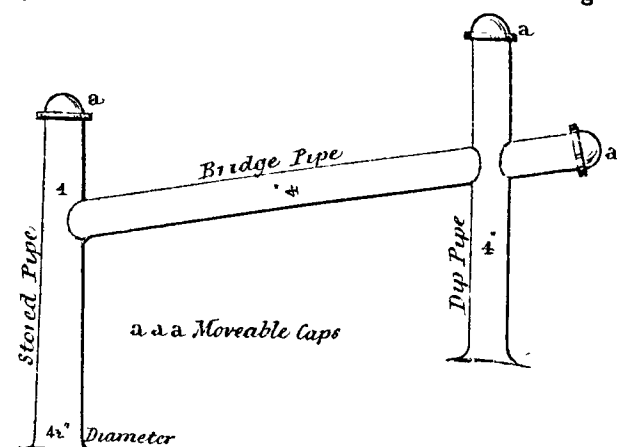
Machinery.

3. Of the Machinery for the production of the gas, the retorts and ovens seem satisfactory. The stand-pipes or pipes ascending from the retorts to the hydraulic main are, in my opinion,

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too small, the practice on this point is very varied, but from 3 to 4 inches diameter are the usual sizes, and I think the latter is to be preferred, as there is much fouling. The stand-pipe is frequently made of a larger diameter at the mouth piece, and tapered to a smaller size at the top, as it facilitates cleaning, and I would recommend $4\frac{1}{2}$ inches at the mouth piece and 4 inches above at the bridge. The bridge and dip pipes are formed in various ways, but in all cases the pipes are carried up beyond the bend, and have a movable cap to allow the clearing of the pipes.

4. The best form seems this—



The capacity of the hydraulic main might, with advantage, be slightly increased.

5. Several tar cisterns are employed, and of small capacity; it is usual to have one of full capacity placed in a situation below all the apparatus, and carry all overflow pipes to it, sealing the ends by a seal cap, that is allowing the ends to dip into a small vessel which remains full and closes them though the main cistern be emptied. In the proposed apparatus all the purifiers, &c., are in duplicate: this is always advisable, and valves and connexions should be added, to admit of any vessel being shut off for repair or renewal of material without interfering with the process of manufacture, such valves may be contemplated, but I do not see them provided in the estimates, or indicated in the plan. All the connecting pipes in the apparatus as proposed, should not be less than 4 inch diameter; that is the pipes connecting the different purifying vessels.

6. The condenser, as proposed with seven pairs of pipes, seems sufficient; but I would recommend the annular form, with say, internal pipes $2\frac{1}{2}$ inches and external 7 inches, interior diameter, a current of air passing through the inner pipes, the gas in the annular space, and the outer pipe enveloped in straw, and a shower of water directed on it, from wrought-iron pipes properly arranged for the purpose to carry this out effectually. A cistern should be provided, raised on columns, and a pump worked by power for filling it.

7. For the quantity of gas proposed it would probably be advisable to add a third lime purifier, so that the gas might always be passed through two, while the third was being cleaned and renewed.

8. It is usual to arrange the inlet and outlet pipes from the gas holder in a syphon box, so as to collect any liquid, and a fixed pump is provided for pumping off the liquid.

9. The retorts proposed, worked night and day, and with six hour charges, should produce each from 2,000 to 2,400 cubic feet, or for each bench of two say 4,500 cubic feet in the twenty-four hours; so that in general three sets of two retorts will be sufficient for the supply, but to allow for repair, &c., the five pairs are not more than sufficient.

10. Looking to the estimates of cost, I consider the whole apparatus required could be obtained much more economically from home.

11. The gas holder proposed is stated to be 35×17 . It is generally preferred to keep gas holders as low as possible, and I would suggest 40×12 as a better proportion.

12. Considering the whole of Dr. Wyndowe's report, I am led to the conclusion that the distillation of the coal is carried too far; the data is insufficient for me to conclusively to assert this, as no detail of the process is given, but Dr. Wyndowe states the poverty of the gas, and from the other details its low specific gravity is to be inferred.

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13. The coal used I suppose to be the ordinary English export coal, and all coal deteriorates much from exposure to the atmosphere and high temperature; yet from the tables of consumption of coal, and production of gas, appended to Report 65 of the 4th December 1865, and after deducting the full bulk of the oil gas due to the oil used, (though this is not exactly correct,) I find the quantity of gas per ton of coal to exceed 9,000 cubic feet, which is much beyond what should be drawn from such coal as I suppose to be used: and would fully account for the poverty, low specific gravity, and want of illuminating power, which necessitates the admixture of oil gas.

14. The distillation should not be carried beyond five or six hours, at a cherry red-heat, after this the specific gravity rapidly diminishes, and little else but hydrogen and other light gases with little illuminating power pass over; by continuing the distillation to ten and twelve hours the bulk of gas goes on increasing, but at the complete sacrifice of the illuminating power. Oil at Madras is very expensive, and I would strongly advise the discontinuance of its use, and the improvement of the quality of the gas, by a distillation not exceeding six hours, and by the use of a superior gas coal, imported for the purpose.

15. I attach a statement of the prices and quantities of gas coal, showing the yield of gas per ton and the specific gravity, and I need hardly state that the specific gravity of the gas is the best index of the illuminating power. I would recommend the importation of one of the moderately priced Cannel coals, such as the Wigan, Capledray, or Lothian, at about £1-0-8 per ton, and including freight it should be delivered at Madras at about Rupees 32 to 34 a ton, and it must be borne in mind, that the freight of the most inferior coal and the finest gas coal is the same, so that it is bad economy to use an inferior coal.

16. From such Cannel coal as I recommend, a rich gas requiring no addition of oil gas, would be produced, and with Fish Tail or Union burners, consuming from 2 to $2\frac{1}{2}$ cubic feet of gas per hour, yield a full and satisfactory light.

17. In the Reports and statements furnished, there is a difficulty in arriving at any conclusions regarding the results attained and anticipated: as comparisons are made by lights, without defining what a light means. The usual comparison is by the standard sperm candle, and lights are stated to be equal to so many of these as tested by the Photometer, and hence a comparison is possible.

18. It is stated in one Report that the consumption of mixed gas in a burner in the men's Barracks for twelve hours was 8 cubic feet, and it is difficult to estimate what the light could have been: even with pure oil gas 1 to $1\frac{1}{2}$ cubic feet per hour is required to produce a fair light; but of the mixed gas $\frac{2}{3}$ cubic feet per hour must give a light totally inadequate to the purpose. I find from the statements of the expenditure, that the cost of the mixed gas is Rupees 9-1-9 per 1,000 cubic feet, and that the waste by condensation, leakage, &c., was 11 2 per cent.; the cost of the oil gas was Rupees 32-10-9 per 1,000, and the waste 18 86 per cent. The yield from the oil is about 100 cubic feet per gallon is a very good result. The usual allowance for waste is 15 per cent, and so that the result in the mixed gases is very good. With good Cannel coal at 34 Rupees a ton, and producing (allowing for deterioration from climate and exposure) only 10,000 cubic feet of gas per ton (according to the rate of wages given for the mixed gas) the cost per 1,000 cubic feet should not exceed Rupees 7, and 2 cubic feet of such gas per hour should give a light with a No. 2 Fish Tail burner equal to fourteen or fifteen standard candles.

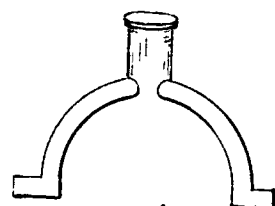
Distribution.

• Marked A.

19. The mains in many places appear larger than necessary. I attach a rough tracing* of what I would propose, which, while securing efficiency, will much reduce the cost.

20. I would add that wrought-iron pipes, if possible, should not be used under ground, except for the actual connexions of the building with the main; and for all detached single, or lights up to ten, cast-iron 1 inch pipe should be used. The wrought-iron pipe corroding rapidly under ground.

21. The introduction of junction pieces in the mains for ordinary service pipes seems unnecessary. The usual practice is when the service is of moderate size and the main also, say 1 inch service, on a 4 inch main, the service is simply screwed into the main; where the main is small compared with the service, a saddle is used, that is a socket for the branch or service is cast in a half round piece of metal to fit the main (a strap securing it to the main with screw bolts) and is fitted on with red-lead, and then the main bored and the service secured in the usual way: this is more convenient, and saves much expense in inserting junction pieces, which may be never used,



and are often found when required not to be in the place where wanted. The service pipes appear in some cases unnecessarily large, and several laid to one building, in general one pipe to each building is sufficient. A wrought-iron service pipe of 1½ diameter will supply lights consuming 150 cubic feet per hour; 1½ inch, 100 cubic feet; 1 inch, 60 cubic feet; ¾ inch, 40 cubic feet; and ½ inch, 25 cubic feet; and this is on the most liberal scale and allowing for considerable distances, and in ordinary cases an addition to these quantities may be made. But I will notice this subject further under the head of interior fittings. Cocks or mains are seldom used above 1½ inches, above that dimension either hydraulic or slide valves are used. The hydraulic valve, it is almost needless to remark, is a rod passing through a stuffing box, and raising or lowering a cup containing liquid which closes or unseals the mouth of the pipe, or the case is reversed and the liquid is in the fixed vessel, and the cup or chamber is raised or depressed in it, and opens or closes the communication between the pipes. The slides are of the ordinary construction and worked by screws. The masonry cess pools provided are supposed to be in lieu of syphons, it is feared there would be much leakage in the masonry, and the number seems unnecessarily large; the ordinary cast-iron syphons are quite cheap and are preferable; one at each change of gradient is sufficient, they are fitted with an emptying pipe, covered with a hinge trap of cast-iron. In many cases a governor would be necessary, but in Fort St. George there is so little change of level, that I don't think one is required.

Interior Fittings

22. The first remark I have to make on this head is regarding the use of copper pipes and fittings, it is remarked by Drs. Edmund Renalds and Thomas Richardson in their work on the application of Chemistry to the Arts, "Copper pipes are dangerous on account of the production of a peculiar pulverulent deposit formed by a combination of the metal with some of the ingredients of the gas which takes fire spontaneously in the air."

23. By War Office Regulations all interior pipes should be of wrought-iron, and this should not, I think, be deviated from in India, except in small connecting pipes of short length, in the roofs, entirely out of reach of injury, and in this case tin and not composition pipe should be used, as much more safe and lasting. All cocks and small fittings should be of brass, they can be obtained much cheaper at Home than in India. The arrangements at Madras, as far as can be gathered from the Reports sent, differ from that in the Punjab, &c. It appears that at Madras, in the men's Barracks, the lights are all burned throughout the night.

24. Her Majesty's Regulations provide for all lights being extinguished in quarters occupied by the men and families at Tattoo Roll-call, and in family quarters only one light is allowed. In India it appears necessary for many reasons that a light should be burned in each ward of the men's Barracks during the night, but it is certainly unnecessary that more than one should be so burned, and is decidedly objectionable as increasing the heat in buildings already overheated, nor does it seem necessary in married quarters, if allowed it should only be a burner turned down to the lowest, and consuming say ½ a cubic foot of gas per hour.

25. The allowance of gas for Barracks, by Her Majesty's Regulations, is 1 cubic foot of gas per 1,000 cubic feet of space, in burners consuming 5 cubic feet each burner per hour; this

allows for an inferior quality of gas, and an equivalent light would be given by 2½ to 3 feet of good Cannel coal gas, and it may be taken as one light to every 5,000 cubic feet of space. The plans sent do not show the distribution in the men's Barracks, Privies, &c., &c., so I am unable to state in detail what I would propose, but I will state generally what has been arranged for to state in detail what I would propose, but I will state generally what has been arranged for the service pipe conveys the gas from the main, the pipe is carried up the wall of the main ward to the roof about 3½ feet above the floor, a stop cock is placed enclosed in a locked box, for shutting off the gas throughout the building: for the main lights, the 1 inch pipe is carried along the roof just under the beams the whole length of the building, and branches taken off to pendants at proper intervals; when the building is long the pipe is diminished to ¾ inch diameter at half length.

26. Just under the shut-off cock, on the first service, a ½ inch pipe is connected and also furnished with a cock and lock-box, this pipe is carried up to the roof and along the building parallel and along side the other, and from it the night lights one to each ward are supplied. At Tattoo Roll-call, or 9 o'clock, the ordinary lights are extinguished, and the cock on the 1 inch pipe shut off, leaving the night light controlled by the cock on the ½ inch pipe.

27. For privies, urinaries, &c., a small burner consuming 1 cubic foot of gas per hour is provided and controlled by a separate cock. By War Office Rules, all pendants for Barrack-rooms should be of wrought iron pipe and without roof joints, but with strong roof plates; should the rule as to extinguishing a large portion of the burners at 9 P.M. be carried out, it will materially modify the requirements in the way of gas.

28. For the supply of the various buildings, when of any size, I observe by the plans that several service pipes are taken from the main; for instance, for the Government Offices, eight service pipes are shown of 1 inch each, the usual practice is to have only one service pipe of suitable size connected with a metre to check the consumption of gas and carrying the necessary pipes from it to the different parts of the building. For the Government Offices I would propose to place a metre in some convenient place near the centre of the building and take a service pipe of 2 inches wrought-iron from the main, which, as the distance is short, would be amply sufficient for the supply of the whole building, from the metre a 1½ inch pipe on each side would convey sufficient gas to each wing, the size of the pipe being diminished as the lights were supplied. In the same way for the Church, a 1½ inch or 1½ inch pipe would be sufficient. Of the pendants, &c., I can say nothing, as the mere description, Patent pendant is not understood, but for ordinary purposes the simple double pendant, that is, a single descending pipe of 1½ inch wrought-iron fixed to a roof-plate and having two arms about 2 feet long of ¾th inch iron pipe with L cocks and screwed jets sockets is a good description. The Union or Fish Tail jet is the one most approved of, and is generally preferred to the Bat wing. The Argand is a very expensive light, consuming a large quantity of gas in proportion to the light; as a general rule, Scotch Unions No. 0, 1, 2, and 3, will be found suitable for all purposes. For Rawulpindee the L cocks have galleries lined with wire gauge, glass globes, and punkah tops of wire gauge, to protect the lights from currents of air. For the Church the amount of light appears small.

Recommendations

29. Having completed the duty assigned me in reporting upon the project generally, I would venture to add a few recommendations—

1st—I would recommend that an early opportunity be taken of sending out to Madras 10 or 15 tons of moderately priced Cannel coal, such as the Wigan, Capledray, or Lothian, from £1-0-8 to £1-0-10. The apparatus at Madras is in working order, and they would at once be able to test what I have stated regarding the discontinuance of oil, &c., and arrange accordingly for the extension.

2nd.—It seems doubtful whether the burners are what they should be, it would, therefore, be advisable to send out, say a gross of No. 2 and a gross of No. 3 Scotch Union or Fish Tail burners screwed, the oil gas burners which they have will supply the place of No. 0 and 1, though a few of each might also be sent.

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3rd.—It is doubtful what description of pendant are in use, and I think it would be an advantage to send out one double pendant (as arranged for Rawulpindee, and according to War Office Regulations) for the men's Barracks, with globes, &c., complete, and cost, so that they may compare it with what they have in use.

4th.—A specimen of cast-iron 1 inch and 1½-inch pipes, with turned and bored joints, one or two lengths of each might be sent out.

5th.—Specimens, say one of each minor gas fittings, with cost.

List of several Cannel Coals.

Cannel or Parols Coals.	Cubic feet of gas per ton.	Illuminat- ing power.	Specific gravity.	Price	Where delivered.
				£. s. d.	
Wigan Cannel	11,400	20.00	.528	0 17 0	At Liverpool.
Boghead	15,000	37.75	.752	2 15 0	„ Leith.
Capledray not	14,000	19.75	.577	1 8 6	„ Burntisland.
Telmahogo	13,000	27.10	.642	1 12 6	„ Glasgow.
Wemyss	11,300	21.50	.580	1 0 0	„ Leith.

14th June 1867.

(Signed) A. ROBERTSON, Colonel.

No. 205. ORDER THEREON, 10th September 1867, No. 2,778.

CIVIL WORKS, No. 23.

1. Communicated to the Superintending Engineer of the 4th Division in continuation of G. O. No. 662, dated 5th March 1867, and with a request that Captain Goddard may be directed to prepare and submit an amended project for improving and extending the Gas works in the Fort with reference to the suggestions offered by Colonel Robertson.

2. The articles referred to in paragraph 3 will be forwarded on receipt.

(True Extract.)

(Signed) CHARLES A. ORR, Colonel, R. E.,
Secretary to Government.

To the Superintending Engineer, 4th Division, with a copy of the Sketch Plan.

„ Public Department.

„ Military Department.

„ *Sup^t of Govt Gas Works*

Exd S. T. Augustin.

Public Works Dept.

2778

*Proceedings of the Madras Government
Under date the 10th September 1867.
Read the following*

*From the Right Honble the
Secretary of State for India
(Here enter 9th July 1867
2720)*

*Communicated to the
Supy Engr of the 4th Div in
Continuation of G. O. No. 662
of 5th March 1867, and with
a request that Capt Goddard
may be directed to prepare
and submit an amended
project for improving and
extending the Gas works in
the Fort with reference to
the suggestions offered by Col.
Robertson*

*The articles referred to in
Para 3 will be
forwarded on receipt*

*To
The 1 Engr 4 Div with a copy of the
Sketch Plan
„ Public Dept
„ Mil Dept
„ Sup^t of Govt Gas Works*

Recd 17/9/67

204 8215

P. W. 1867. Department.

Proc. of Govt. for September
No. 2778

PROCEEDINGS OF GOVERNMENT

Madras

Dated 10th September 1867

Instructing the Supg.
Engr. of the 1st Division to
submit an unimproved project
for the extension of Gas Works
in Fort Saint George.