Archives I—10,006—16-8-77.

(1) Number of pages 54

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(3) Initials of the Referencer Lang

TAMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

P.W.D DEPARTMENT

G.O. No. / B.P. No.	1628 - W 1629 - W	Press. / Mis.
Dated	28-6-1882	197 .

Not to be folded or roughly handled

A. Allan

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 187.

READ—the following letter from the Assistant Secretary to the Chief Commissioner, Public Works Department, Central Provinces, to the Chief Engineer and Secretary to Government, Public Works Department, dated Nagpur, 31st May 1882, No. 4078 :—

Letter No. 2453 M.W., dated 17th December 1881, from the Manager, Wardha Coal State Railway, with enclosure.
Letter No. 2182 M., dated 15th May 1882, from the Manager, Wardha Coal State Railway, with enclosures.

I am desired to forward, with Colonel Mayne's compliments, copies of the documents noted on the margin regarding experiments made for the manufacture of coke from coal obtained in these Provinces.

Copy of letter from the Manager, Wardha Coal State Railway, to the Secretary to Chief Commissioner, Public Works Department, Central Provinces, dated 17th December 1881, No. 2453 M.W.

With reference to your No. 7983, dated 7th October 1881, I have the honor to submit a copy of the Assistant Manager's No. 8907, dated 2nd December 1881, and enclosure.

2. I also send the keg alluded to in paragraph 4, and also the coal referred to in paragraph 5.

3. In consequence of the large amount of important work to be done at Warora, I have directed the Assistant Manager not to continue the experiment. I am, however, having some trials made at Nagpur both with Warora and Chindwara coal, and when they are completed I will report.

Copy of a letter from the Assistant Manager, Wardha Coal State Railway, to the Manager, Wardha Coal State Railway, dated 2nd December 1881, No. 8907.

Dr. Stanbrough's Coke Kiln.

I have the honor to state as follows regarding the above.

2. The kiln was built as you yourself saw on your recent visit here, and for record the drawing of it as built and approved of verbally by you is enclosed.

3. It was charged and lighted on the morning of 26th by noon. On the morning of 29th, about 10 A.M., I applied water as directed, with no resulting ebullition of steam.

4. I then threw water over the top of the coal, put out the fire, and opened it out. I send you herewith a railway receipt for the keg containing some of the coal more nearly approaching to coke that was obtained. I should mention that the kiln was charged with slack coal and some little admixture of larger pieces.

5. In the burning of the coal in the kiln the want of air under the fire was very marked, the slack only smouldering and no brisk fire consuming the whole mass as is anticipated by Dr. Stanbrough in his specification when he writes of the ebullition of steam following on the application of water. On examination of the small piece of semi-burnt coal I send you in

a box will prove to you, I imagine, as it conclusively proves to me, that this coal will not coke as I pointed out before this experiment.

I shall be glad to hear what the cost of this experiment is to be charged to.

Copy of a letter from the Manager, Nagpur and Chhattisgarh State Railway, to the Secretary to Chief Commissioner, Public Works Department, Central Provinces, dated Nagpur, the 15th May 1882, No. 2182 M.

With reference to this office No. 2453 M.W., dated 17th December 1881, I have the honor to submit a copy of a report on some experiments made by the Locomotive Superintendent of this Railway with Dr. Stanbrough's coke kilns.

2. With my letter above quoted I submitted a report on this subject by the Assistant Manager of the Wardha Coal State Railway, who had also made experiments with the result, I think, of clearly showing that this coal would not coke.

3. The experiments made by the Locomotive Superintendent have been made on a more extensive scale, and with better means for applying the water than were available at Warora.

4. Two different experiments have been made with Warora coal, and one with Chhindwara coal, the first being carried out in a kiln on Dr. Stanbrough's design, measuring 58 feet long by 12 feet wide by 3 feet deep, containing 33½ tons of coal, and with water at pressure due to a head of 30 feet laid on in abundance.

5. It will be seen that the kiln was charged and burnt for twenty-six hours, and that water was then allowed to run into it for 20 minutes, and the result was an outturn of about 22¾ tons of coke.

6. The second experiment was made in a kiln, also of Dr. Stanbrough's design, but of proportions different to that used for the first experiment, in its internal dimensions being 20 feet by 12 feet by 7 feet high; into this 33½ tons of Warora coal were charged and about 22½ tons of coke received from it, being about the same ratio of [illegible]ge to outturn as was reported from the first experiment.

The coke, such as it was, was however of very inferior quality, and when tried in a smith's fire was practically useless.

7. When ordered by you to have these experiments made I thought it would be an advantage to have some made with the same coal as that Dr. Stanbrough had used, and at my request the Deputy Commissioner of Chhindwara sent me about 4 tons of coal from Barkoi.

It was with this coal that the third of the experiments in the report now submitted was carried out; there being no Railway communication with Barkoi and no good roads, it was not possible to obtain any large quantity of this coal, and a smaller kiln measuring 6 feet 6 inches by 4 feet by 5 feet was made and charged with 3¼ tons of coal, and the result was an outturn of 2 tons of coke of rather better quality than that got from the Warora coal, but still of a very poor kind.

8. The conclusions to be drawn from these experiments agree practically with those arrived at by the Assistant Manager at Warora as previously reported, for although the experiment with the Barkoi coal from the Chhindwara seam yielded a small amount of coke, it was worthless for any practical purpose; while from the Warora coal the so-called coke received could not be used for any work, as it had no heating properties left.

9. The result of the experiment agrees with a report on coke made from Chhindwara coal in 1867, submitted by Mr. Sopwith (Coal Engineer) to G. Berkley, Esq., Consulting Engineer, Great Indian Peninsula Railway, a copy of which is attached, and from which it will be seen that the coke made at that time was "comparatively worthless."

10. I regret that such a length of time has been allowed to pass since orders were issued for a report on this subject. I however considered it advisable to make experiments and reports which would prove what all who have experience of the coal knew before, viz., that it will not coke, and to do this during the busy season and with new appliances took longer than I anticipated.

11. I would ask your orders with reference to the continuance of these experiments, and also as to how the charges are to be adjusted.

Copy of extract from the report of Mr. SOPWITH (Coal Engineer) to G. BERKLEY, Esq., Consulting Engineer, Great Indian Peninsula Railway, *re* Dr. Stanbrough's Coke, dated 3rd April 1867.

The coke which has been made at Barkoi, and which, from what I have said respecting the similarity of the seams, may be taken as representative of the coke that may be made from any other seam in the district, is comparatively worthless. The proportion of the coke made from

the Barkoi coal by Dr. Stanbrough is about 60 to 65 per cent., but very little that I saw was fully burnt, and 60 per cent. is therefore a fair percentage to take.

As all the dirty or shally matter is, of course, retained in the coke, there is at least from 30 to 35 per cent. of ash in the latter, a quantity which entirely counterbalances the fact of the remainder being fixed carbon.

It is only by selecting the coal that there is any possibility of making fair coke, but the working of a large quantity to supply sufficient clean coal, and the latter not giving very probably more than 40 per cent. of coke, make the prospect of obtaining a fair coke from these seams very improbable.

Copy of a letter from the Locomotive Superintendent, Nagpur and Chhattisgarh State Railway, to the Manager, Nagpur and Chhattisgarh State Railway, dated 10th May 1882, No. 1421.

Dr. Stanbrough's Coke Process and Kiln.

Report called for.—In reply to your letters marginally quoted, I have the honor to submit my report on the above.

No. 3638 M. of 16th November 1882.
" 794 M. of 25th March 1882.

2. *Documents supplied, descriptions of process and kiln.*—Under the former of these letters you forwarded me copy of a demi-official letter from General Hyde, Inspecting Engineer for State Railways, India Office, to the Chief Commissioner of the Central Provinces. This demi-official letter was accompanied by a copy of an extract from Dr. Stanbrough's specification of his process, together with a couple of sketches of the kilns used by him, of which, however, no description is given beyond the bare dimensions of one stated to have been successful. As this was insufficient to guide me definitely in constructing a kiln, I applied to you personally for further instructions. You then handed me for perusal the file of papers on the same subject in your Wardha Coal State Railway Office containing a copy of Dr. Stanbrough's patent specification forwarded to you by the Secretary to Chief Commissioner in his No. 7983 of 7th October 1881. This patent specification does not, however, include the "extract of specification" referred to above, and, though not contradictory, the two appear to have been written on different occasions, and it is scarcely possible to understand the whole process of coking and construction of kilns patented by Dr. Stanbrough without reading the two together carefully.

3. *General principles of the process and kilns.*—From these documents I glean—

(1) that Dr. Stanbrough's patent consists of two distinct inventions, viz., a process for coking and a particular form of kiln said to be well suited for carrying out that process;

(2) that the employment of the process is not limited to its use with the particular form of kiln patented and described by him;

(3) that Dr. Stanbrough himself describes no less than four different kinds of kiln employed by him for carrying out his process, viz.:—

I. A circular mound of coal carefully built up around a chimney with air passages through it and covered with small slack and clay, with some means, not described, of introducing water beneath the mound when required after firing.

II. A hole excavated in the bank of nala with channels leading down its sides from earthen water pots set on its brink.

III. A brick-built kiln 20 feet long by 12 feet wide by 7 feet high, with channels in its walls for conveying water down beneath the coal in the kiln.

IV. A brick or rubble-built kiln 58 feet long by 12 feet wide and 3 feet deep, with its walls hollow and filled with sand, in which pipes or hollow bamboos can be easily fixed at any desired positions.

(4) that all the four kinds of kiln described have obviously been designed to suit the circumstances of working in the jungle at a distance from more mechanical conveniences that might otherwise be employed.

(5) that the various arrangements of channels in the sides or walls for carrying water down, as described above, are obviously intended for giving the water a certain amount of head to insure its entering the bottom of the kiln with some force and simultaneously in the different channels.

(6) that independently of the type of kiln employed, the essential features of the process appear to be the burning of coal in a kiln with a free admission of air until the whole mass is white hot throughout, when by *any* suitable means water is injected *beneath* the whole of this mass of live coal simultaneously, causing a violent explosion of steam which, as Dr. Stanbrough states, drives out all ash and desulphurizes the residual "coke" at one and the same time.

4. *Exact type of Stanbrough's kiln not necessary where there is good water-supply under pressure.*—In making the experiments here it was decided that as we had an abundant supply of water in the workshop yard, where the experimental kilns were erected, the water having a head of some 30 feet, there would be no difficulty in arranging for a simultaneous injection of

water to the bottom of the kiln without going to the expense of building kilns with channels in the walls. The experiments were, therefore, with a view to economy, conducted in kilns built of brick and mud with a water-supply as will be described below.

5. *First experiment with Warora Coal.*—The first experiment was with best-selected Warora coal. The dimensions of kiln adopted were the same as of that described above in paragraph 3 as No. IV, with the exception of the length which was cut down to 25 feet from 58 feet for the simple reason that to charge a kiln of the latter size would have cost a very large sum of money. The kiln was built and 33½ tons of coal charged carefully in accordance with Dr. Stanbrough's description. Instead, however, of tubs of water and channels in the walls, a trough was built all round the kiln about 18″ deep and 9″ wide. Into this trough were led four pipes 3½″ diameter taken off a main 6″ diameter provided with a sluice valve. The four pipes entered the trough at equal distances apart, one on each side of the kiln. From the bottom of this trough were numerous openings, 3″ square, into the bottom of the kiln, which was sloped towards the centre and supplied with small channels as described by Dr. Stanbrough. The kiln was fired and allowed to burn for 26 hours as recommended in the "Extract of Specification." By that time the coal in some few parts of the kiln was reduced almost entirely to ash, while the other parts had scarcely ignited and only smouldered, and all endeavours to get these parts to burn brisker failed. The sluice valve was then rapidly opened, the trough immediately filled, and water entered the bottom of the kiln at all openings simultaneously. Yet there was not any *violent explosion* as described by Dr. Stanbrough, but only a deep internal rumbling. Not so much as one piece of coal was disturbed, and there was none of the expected shower of ashes. Immense volumes of steam, however, rose out of the kiln, and the flames which had entirely subsided hours before again leapt up to a great height, caused no doubt by the decomposition of steam on the burning carbon and liberation of hydrogen according to the well-known chemical formula—

$$2\,H_2O + C = 2\,H_2 + CO_2.$$

At the same time, also, it was impossible to stand on the leeward side of the kiln without being suffocated on account of the large quantities of sulphurous anhydride (SO_2) passing off. This gas, it would seem, is formed during the combustion of the coal, but remains occluded in it until driven out by the so-called explosion. It is questionable, however, whether this result takes place in the upper part of the kiln remote from the explosion. Water was allowed to flow freely into the kiln for the space of 20 minutes, when the kiln became flooded with it 18 inches deep and the walls commenced to leak badly. It was then shut off. At that time, however, the upper portion of the coal, with the exception of the dead parts referred to above, was still burning nearly as briskly as ever, there being a good deal of wind. Water was therefore "sprinkled" over it as alluded to in the "Extract of specification." This "sprinkling," however, consisted in half a dozen coolies fetching water in pots and throwing it on the burning mass in constant succession. This "sprinkling," I may add, causes far more "explosion" than the admission of water beneath. After thoroughly drenching it, the residue was left (as described in the patent specification) for an hour or two and then smothered with a layer of sand. It was, however, so hot that it was not till four days after that it was found possible to clear the kiln. It was then found that of what remained a large quantity, by measurement, was ash, and that the remainder was a mixture of cindery half-burnt coal with pieces of coal scarcely ignited; it was clear that the kiln had not had sufficient draught, although fully supplied with the proper apertures and passages, which result might have been anticipated from its small height of 3 feet. That there had been an ample supply of water was clearly shown by the bottom portions being soaking wet. The outturn of "coke" was about 22¼ tons. The ratio of outturn to charge may therefore be said to be $\frac{2}{3}$.

6. *Second experiment with Warora Coal.*—I next tried a kiln of the dimensions of the one described above in paragraph 3 as No. III, which was charged with 33⅛ tons of Warora coal. The arrangements for water injection were the same as before. This kiln drew air famously, and the coal burnt equally throughout it. When water was injected there ensued a number of little explosions all over the kiln, causing a rumbling, crackling noise. In no sense of the word was there any violent explosion, nor were any ashes driven away. Plenty of sulphurous anhydride, however, was evolved as before. It was found necessary as before to drench the surface of the ignited coal in order to extinguish the kiln, and it was again some days before it was possible for men to rake it out. The products of this experiment were very much like those of the preceding experiment, but there was no unburnt coal, and the cinder was much more charred than in the previous experiment. The outturn of "coke" was about the same as in the previous experiment, viz., 22¼ tons. The ratio, therefore, of outturn to charge was again $\frac{2}{3}$.

7. *Third experiment with Barkoi Coal.*—The third and last experiment was tried with a small quantity (3½ tons) of the Barkoi coal from the Chhindwara District, which you obtained through the Deputy Commissioner of that district from the same pit that Dr. Stanbrough formerly worked. The kiln used was 6 feet 6 inches long, 4 feet wide by 5 feet high. Being so small, it was considered sufficient to let water into it by two pipes only direct from the main and built in the end walls, which worked quite satisfactorily. After firing, the kiln was allowed to burn 15 hours, when the whole of its contents came to a white heat. Water was then turned on with pretty much the same result as before, though the so-called explosion was perhaps rather more forcible

than on either previous occasion. The water was allowed to rush with great force into the burning mass, until in a few minutes it swamped the kiln to a height of 18 inches from the floor. Even then the upper portion continued to burn fiercely. No flight of ashes was occasioned, and what is a very curious fact there was not a trace of sulphurous anhydride to be perceived. This, I say, is curious, as it is the very and only coal with which Dr. Stanbrough ever experimented. As it apparently contains no sulphur, it is difficult to understand how he was able to so confidently predict the action of his process in driving off sulphur which, from the preceding experiments on Warora coal, it certainly does do.

It was found necessary to extinguish the kiln as in preceding experiments.

The outturn of "coke" was 2 tons. The ratio of outturn to charge in this experiment was therefore rather smaller than in the case of Warora coal, but the "coke" was of much better quality. Still, whatever ashes were produced were left in the kiln quite undisturbed by the so-called explosion.

8. *The Coke or Cinder very like Scotch Char.*—This "coke" or "cinder" is very like what in Scotland is known as "char," a kind of coky cinder made in engineering works for smithy use from an inferior coking coal known technically as "smithy coal" by smothered combustion in heaps. Observing this I have had it tried for smithy purposes. It makes a nice, clean, bright fire, but does not give any great heat; with a newly-made fire it is possible to make a new weld for light work, but the fire rapidly gets choked and clinkered up, so that the operation cannot be repeated without entirely renewing the fire on the hearth, while for a heavy heat the fire gets clinkered up before this is complete. It is, therefore, useless for smithy work. "Scotch char" burns away to a clean ash without clinkering.

On account of this clinkering I have no hesitation in saying it would be useless for cupola work in a foundry, as it would at once gob up the twyers. I also fancy it would not develop sufficient heat even under a strong blast. Not having a cupola here I have been unable to test this; but there is really no need for a test, as its clinkering tendency precludes it from foundry use altogether. As an example of its very poor heating power it was found impossible to keep steam with it in the boilers of the shop portable engines, while it clinkered up the fire-bars terribly. I may add that the char made from Barkoi coal in these experiments proved itself far superior to that from Warora coal, which was anticipated from its appearance as described in paragraph 7. Both clinkers are about 20 per cent. of the coke burnt.

9. *General conclusions deducible from experiments.*—The conclusion that may be drawn from the experiments are—

(1) that Dr. Stanbrough's patent process of admitting water beneath the burning coal is utterly worthless, as it does not effect what it pretends to do, that is to say, it does not drive off the ashes, while for driving off sulphur it is not only partially successful, which would be done far better by flooding the kiln with water from above than from below which, as noted in paragraph 5, produces much more of an explosion;

(2) that in attempting to coke either Warora or Barkoi coal the principal result is to drive away by destructive distillation the gases forming the chief constituents of those coals, while the earthy matters that cause the clinkering so far from being removed by the process appear to be entirely retained, and are consequently present in the residue in a much larger proportion than in the original unburnt coal;

(3) that until some means for eliminating these clinkering matters are devised, the so-called coke or char is worthless for any purpose;

(4) that recollecting the fact, well known from experience gained in using Warora coal for locomotive purposes, that it rapidly deteriorates and loses its steaming qualities by exposure to the atmosphere for any length of time, a very fair inference may be drawn that the coal owes its heating power principally to carburetted gases which become disengaged by exposure and not to fixed carbon. Therefore any attempts made to use it economically in manufacturing iron should rather be directed towards making gas from it for use in Sieman's or other recuperative gas furnaces.

10. *Samples forwarded.*—I forward three boxes containing samples of the so-called coke derived from the three experiments respectively; also two others containing specimens of the clinker formed in burning the coke as described in paragraph 8.

11. *Cost of experiments and estimate for the same.*—The cost of these experiments has been hitherto approximately as follows:—

	Rs.
Cost of building kilns	340
Do. fuel for charging	600
Total ...	940

This, however, does not include the cost of the Barkoi coal and its carriage from Chhindwara, which I believe was disbursed in your office, and which should be notified to me. Further, a slight

expenditure will be necessary for dismantling the small kiln still standing, taking up the water pipes, &c. Orders are now solicited as to what head of accounts these experiments will be debited to enable me to prepare a regular estimate for sanction; meanwhile, for convenience sake, the expenditure incurred has been debited to Workshop Manufacture Suspense Account.

12. *Further experiments with Mohpain Coal.*—Until receipt of further orders I shall not dismantle the small kiln, as shortly before Colonel Mayne, R.E., Secretary to Chief Commissioner, left Nagpur, he mentioned to me one morning when coming in from Kanhan Workshops that he contemplated an experiment with Mohpain coal. As the kilns stand in the way of completing the roads in Nagpur Workshop yard, I would solicit early orders on this point; if this extra experiment be made, I should like to know the cost of coal (say 5 tons) and its carriage here so as to include it all in one estimate.

No. 188.

ORDER—dated 28th June 1882, No. 1628 W., Public Works.

Ordered that this correspondence be recorded, and its receipt acknowledged.

(Here enter No. 1629 W., dated 28th June 1882.)

(True Extract.)

Under Secy. to Govt., P.W.D.,
Irrigation Branch.

To the Consulting Engineer for Railways.
" Superintending Engineer, First Circle.
" " " Second Circle.

Exd. A. F. Goodall.
Spare Copies

BUILDINGS AND ROADS
CIVIL WORKS.

Govt. of {1882} Madras.

PUBLIC WORKS.

Dated June, 15th.

Read.

Encl.

28th June 1882, No. 1628 W.

JUNE.

Nos. 187—188.

Coal.

Manufacture of coke from — obtained in the Central Provinces.—Correspondence received from the Chief Commissioner, Central Provinces, regarding experiments for the —, recorded.

1628W-28/6

P1

PUBLIC WORKS SECRETARIAT, C. P.

No. 4078 Nagpur, 31st May 1882. 1628

From Asstt.

The SECRETARY to CHIEF COMMISSIONER,

Public Works Department,

Central Provinces.

To Colonel Sankey R.E.

Chief Engineer & Secretary P.W.D.

Madras

Sir,

I am desired to forward, with Colonel Haynes' compliments, Copies of the documents noted on the margin, regarding Experiments made for the manufacture of Coke from Coal obtained in these Provinces.—

Letter No 2463/M.W. of 17th December 1881, from the Manager, G.I.P. Ry, with Enclosures.
Letter No 2152 M. of 15th May 1882. from the Manager, Nag.pur Chh. Ry, with Enclosures.

I have the honor to be,
Sir,
Your most Obt Servant.—

W Hunter

Asstt Secy to Chief Comr C.P.

Encl

P.W.D. No 4078

Copy of letter No 2453 M.W. dated 17th December 1881, from the Manager, Wardha Coal State Rly: to the Secretary to Chief Commr. P.W.D., &c.

With reference to your No 7980 D/7th Octr. 1881, I have the honor to submit a copy of the Asstt: Manager's No 8907 D/2nd Decr: 1881 and enclosure.

2. I also send the Keg alluded to in para 4 and also the coal referred to in para 5.

3. In consequence of the large amount of important work to be done at Warora, I have directed the Asstt: Manager not to continue the experiment. I am, however, having some trials made at Nagpur both with Warora and Chhindwara coal and when they are completed I will report.

Copy of a letter No 8907 D/2nd Decr: 1881 from the Assistant Manager, Wardha Coal St. Rly to the Manager, Wardha Coal State Railway.

I have the honor to state as follows regarding

P.W.D. 11/6
C.E. 9.6 R 24/6

regarding the above.

2. The kiln was built as you yourself saw on your recent visit here and for record the drawing of it as built and approved of verbally by you is enclosed.

3. It was charged and lighted on the morning of 26th by noon. On the morning of 29th about 10 A.M. I applied water as directed with no resulting ebullition of steam.

4. I then threw water over the top of the coal put out the fire and opened it out - I send you herewith a railway receipt for the Keg containing some of the coal more nearly approaching to coke that was obtained. I should mention that the kiln was charged with slack coal and some little admixture of larger pieces.

5. In the burning of the coal in the kiln the want of air under the fire was very marked the slack only smouldering and no brisk fire consuming the whole mass as is anticipated by Dr Stanbrough in his

steam following on the application of water On examination of the small piece of semi-burnt coal, I send you in a box, will prove to you I imagine as it conclusively proves to me that this coal will not coke as I pointed out before this experiment.

I shall be glad to hear what the cost of this experiment is to be charged to.

1628
2 NP 4

Copy of a letter No. 2102 M. dated Nagpur the 15th May 1902, from the Manager, Nagpur and Chhattisgarh State Railway, to the Secretary to Chief Commissioner, P. W. D., Central Provinces.

With reference to this Office No. 2453 M. W. dated 17th December 1901 I have the honor to submit a copy of a report on some experiment made by the Locomotive Superintendent of this Railway with Dr. Stanbroughs Coke Kilns.

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it internal dimensions being 20 feet × 12 feet × 7' high - into this 33½ tons of Warora Coal were charged and about 22½ tons of Coke resulted from it, being about the same ratio of Charge to outturn as was reported from the first experiment

The Coke such as it was, however was of very inferior quality and when tried in a smiths fire was practically useless.

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It was with this Coal that the third of the experiments in the report now submitted was carried out there being no Railway Communication with Barkoi and no good roads it

was

Coke

was not possible to obtain any large quantity of this Coal, and a small coke kiln measuring 6' 6" by 4' by 5' feet was made and charged with 3¼ tons of coal and the result was an outturn of 2 tons of Coke of rather better quality than that got from the Warora Coal but still of a very poor kind.

8. The conclusions to be drawn from these experiments agree practically with those arrived at by the Assistant Manager at Warora as previously reported for although the experiment with the Bankui Coal from the Chandwara seam yielded a small ammount of Coke, it was worthless for any pratical purpose; while from the Warora Coal the so called coke received could not be used for any work as it had no heating properties left.

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how the charges are to be adjusted.

1179

Copy of Extract from the report of Mr Sopwith (Coal Engineer) to G. Berkley Esquire, Consulting Engineer G. I. P. Railway re- Dr Stanborough's Coke dated 3rd April 1867 -

A2

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Coke

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It is only by selecting the coal that there is any possibility of making fair coke, but the working of a large quantity to supply sufficient clean coal, and the latter not giving very probably more than 40 per cent of coke make the prospect of obtaining a fair coke from these seams very improbable.

WP

0178

Copy of a letter No. 1421 D/ 10th May 1882 from the Locomotive Superintendent, Nagpur and Chhattisgarh State Railway, to the Manager, Nagpur and Chhattisgarh State Railway.

Doctor Stanbroughs coke Process and Kiln.

In reply to your letters marginally quoted I have the honor to submit my report on the above.

No 3638 M of 16-11-82.
No 794 M of 25-3-82.

2. Under the former of these letters you forwarded me copy of a D.O. letter from General Hyde, Inspecting Engineer for State Railways, India office, to the Chief Commissioner of the C.P. This D.O. letter was accompanied by a copy of an extract from Dr Stanbroughs specification of his process together with a couple of sketches of the kilns used by him, of which however no description is given beyond the bare dimensions of one stated to have been successful. As this was insufficient to guide me definitely in constructing a kiln, I applied to you personally for further instructions. You then

then handed me for perusal the file of papers on the same subject in your Wardha Coal State Railway office containing a copy of Dr Stanbroughs Patent specification forwarded to you by the Secretary to Chief Commissioner in his No 7903 of 7th October 1881. This Patent specification does not, however, include the "extract of specification" referred to above and, though not contradictory, the two appear to have been written on different occasions, and it is scarcely possible to understand the whole process of coking and construction of kilns patented by Dr Stanbrough without reading the two together carefully.

3. From these documents I glean

(1). that Dr Stanbroughs patent consists of two distinct inventions - namely a process for coking and a particular form of kiln said to be well suited for carrying out that process.

(2). that the employment of the process is not limited to its use with the particular form of kiln patented and described by him

(3)

(3). that Dr Stanbrough himself describes no less than 4 different kinds of kiln employed by him for carrying out his process, namely -

I. A circular mound of coal carefully built up around a chimney with air passages through it and covered with small slack and clay, with some means, not described, of introducing water beneath the mound when required after firing.

II. A hole excavated in the bank of nala with channels leading down its sides from earthen water pots set on its brink.

III. A brick built kiln 20' long by 12' wide x 7' high with channels in its walls for conveying water down beneath the coal in the kiln.

IV. A brick or rubble built kiln 58' long by 12' wide and 3' deep with its walls hollow and filled with sand in which pipes or hollow bamboos can be easily fixed at any

any desired positions

4. That all the 4 kinds of kilns described have obviously been designed to suit the circumstances of working in the Jungle at a distance from more mechanical conveniences that might otherwise be employed.

5. That the various arrangements of channels in the sides or walls for carrying water down, as described above, are obviously intended for giving the water a certain amount of head to insure its entering the bottom of the kiln with some force and simultaneously in the different channels.

6. That independently of the type of kiln employed, the essential features of the process appear to be the burning of coal in a kiln with a free admission of air until the whole mass is white-hot throughout, when by any suitable means water is injected beneath the whole of this mass of live coal simultaneously, causing a violent explosion of steam which, as Dr. Staubrough states, drives out all ash and desulphurizes the residual "Coke" at one and the same time.

4. In making the experiments here it was decided that as we had an abundant supply of water in the workshop yard where the experimental kilns were erected, the water having a head of some 30 feet, there would be no difficulty in arranging for a simultaneous injection of water to the bottom of the kiln without going to the expense of building kilns with channels in the walls. The experiments were therefore with a view to economy conducted in kilns built of brick and mud with a water supply as will be described below.

5. The first experiment was with best selected Warora coal. The dimensions of kiln adopted were the same as of that described above in para 3 as No. IV, with the exception of the length which was cut down to 25 feet from 50 feet for the simple reason that to charge a kiln of the latter size would have cost a very large sum of money. The kiln was built and 33½ tons of coal charged carefully in accordance with Dr. Staubroughs description. Instead, however, of tubs of water and channels in the walls, a trough was built

all

all round the kiln about 18" feet deep and 9" wide. Into this trough were led 4 pipes 3½" diar. taken off a main 6" diar: provided with a sluice valve. The 4 pipes entered the trough at equal distances apart, one on each side of the kiln. From the bottom of this trough were numerous openings 3" square into the bottom of the kiln which was sloped towards the centre and supplied with small channels as described by Dr Staubrough. The kiln was fired and allowed to burn for 26 hours as recommended in the "Extract of Specification". By that time the coal in some few parts of the kiln was reduced almost entirely to ash while the other parts had scarcely ignited and only smouldered, and all endeavours to get these parts to burn briskly failed. The sluice valve was then rapidly opened the trough immediately filled and water entered the bottom of the kiln at all openings simultaneously. Yet there was not any violent explosion as described by Dr Staubrough but only a deep internal rumbling. Not so much as one piece of coal was disturbed and there was none of the

the expected shower of ashes. Immense volumes of steam however rose out of the kiln and the flames which had entirely subsided hours before again leapt up to a great height, caused no doubt by the decomposition of steam on the burning carbon and liberation of hydrogen according to the well known chemical formula

$$2H_2O + C = 2H_2 + CO_2$$

At the same time also it was impossible to stand on the leeward side of the kiln without being suffocated on account of the large quantities of sulphurous anhydride (SO_2) passing off. This gas it would seem is formed during the combustion of the Coal but remains occluded in it until driven out by the so called explosion. It is questionable, however, whether this result takes place in the upper part of the kiln remote from the explosion. Water was allowed to flow freely into the kiln for the space of 20 minutes when the kiln became flooded with it 18" deep and the walls commenced to leak badly. It was then shut off. At that time however, the upper portion of the Coal with

the

the exception of the dead parts referred to above was still burning nearly as briskly as ever, there being a good deal of wind. Water was therefore "sprinkled" over it as alluded to in the "Extract of specification". This "sprinkling" however consisted in a half dozen coolies fetching water in pots & throwing it on the burning mass in constant succession. This "sprinkling" I may add causes far more "explosion" than the admission of water beneath. After thoroughly drenching it, the residue was left (as described in the patent specification) for an hour or two and then smothered with a layer of sand. It was however so hot that it was not till four days after that it was found possible to clear the kiln. It was then found that of what remained a large quantity, by measurement, was ash, and that the remainder was a mixture of cinders, half burnt coal with pieces of coal scarcely ignited; it was clear that the kiln had not had sufficient draught although fully supplied with the proper apertures and passages which result might have been anticipated from its small height of 3 feet.

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That there had been an ample supply of water was clearly shown by the bottom portions being soaking wet. The out turn of "Coke" was about 22½ tons. The ratio of out-turn to charge may therefore be said to be ⅔.

6. I next tried a kiln of the dimensions of the one described above in para 3 as No. III which was charged with 33½ tons of Warora coal. The arrangements for water injection were the same as before. This kiln drew air famously and the coal burnt equally throughout it. When water was injected there ensued a number of little explosions all over the kiln, causing a rumbling crackling noise. In no sense of the word was there any violent explosion nor were any ashes driven away. Plenty of sulphurous anhydride however was evolved as before. It was found necessary as before to drench the surface of the ignited coal in order to extinguish the kiln, and it was again some days before it was possible for men to take it out. The products of this experiment were very much like those of the preceding experiment, but there was no

unburnt

unburnt coal, and the cinder was much more charred than in the previous experiment. The out-turn of "coke" was about the same as in the previous experiment, viz: 22½ tons. The ratio therefore of out-turn to charge was again ⅔.

7. The third and last experiment was tried with a small quantity (3½ tons) of the Barkoi coal from the Chhindwara District which you obtained through the Deputy Commissioner of that district from the same pit that Dr Stanbrough formerly worked. The kiln used was 6'6" long 4' wide by 5' high. Being so small it was considered sufficient to let water into it by 2 pipes only direct from the main and built in the end walls, which worked quite satisfactorily. After firing, the kiln was allowed to burn 15 hours when the whole of its contents came to a white heat. Water was then turned on with pretty much the same result as before, though the so called explosion was perhaps rather more forcible than on either previous occasion. The water was allowed to rush with great force into the burning mass, until in a few minutes it swamped the kiln to a height of 18" from the floor. Even then the upper portion continued to burn fiercely. No flight of ashes was occasioned, and what is a very curious fact there was not a trace of sulphurous anhydride to be perceived. This, I say, is curious as it is the very and only coal with which Dr Stanbrough ever experimented. As it apparently contains no sulphur, it is difficult to understand how he was able to so confidently predict the action of his process in driving off sulphur which from the preceding experiments on Warora Coal it certainly does do.

It was found necessary to extinguish the kiln as in preceding experiments.

The out-turn of "coke" was 2 tons. The ratio of out-turn to charge in this experiment was therefore rather smaller than in the case of Warora coal; but the "coke" was of much better quality. Still whatever ashes were produced were left in the kiln quite undisturbed by the so called explosion.

8. This "Coke" or "Cinder" is very like what in Scotland is known as "char" a kind of coky

Cinder

Cinder made in Engineering works for smithy use from an inferior coking coal known technically as "smithy coal" by smothered combustion in heaps. Observing this I have had it tried for smithy purposes. It makes a nice clean bright fire but does not give any great heat; with a newly made fire it is possible to make a nice weld for light work; but the fire rapidly gets choked and clinkered up, so that the operation cannot be repeated without entirely renewing the fire on the hearth while for a heavy heat the fire gets clinkered up before this is com-plete. It is, therefore, useless for smithy work. "Scotch" "char" burns away to a clean ash without clinkering.

On account of this clinkering, I have no hesitation in saying it would be useless for Cupola work in a foundry as it would at once gob up the tuyeres. I also fancy it would not develope sufficient heat even under a strong blast. Not having a cupola here I have been unable to test this; but there is really no need for a test as to clinkering

tendency

tendency precludes it from foundry use altogether. As an example of its very poor heating power it was found impossible to keep steam with it in the boilers of the shop portable Engines, while it clin-kered up the fire-bars terribly; I may add that the char made from Barkoi coal in these experiments proved itself far superior to that from Warora coal, which was anticipated from its appearance as described in para 7. Both clinkers are about 20 per cent of the coke burnt.

9. The conclusion that may be drawn from the experiments are that,

(1). that Dr. Stanbroughs patent process of admitting water beneath the burning coal is utterly worthless as it does not effect what it pretends to do. that is to say it does not drive off the ashes, while for driving off sulphur it is not only partially successful which would be done far better by flooding the kiln with water from above than from below which, as noted in para 5, produces much more of an explosion.

(2)

(2) that in attempting to Coke either Warora or Barkoi Coal the principal result is to drive away by destructive distillation the gases forming the chief Constituents of those Coals, while the earthy matter that cause the clinkering so far from being removed by the process appear to be entirely retained and are consequently present in the residue in a much larger proportion than in the original ambient Coal.

(3) that until some means for eliminating these clinkering matters are devised, the so called coke or char is worthless for any purpose.

(4) that recollecting the fact, well known from experience gained in using Warora Coal for Locomotive purposes, that it rapidly deteriorates and loses its steaming qualities by exposure to the Atmosphere for any length of time, a very fair inference may be drawn that the Coal owes its heating power principally to carburetted gases which become disengaged by exposure

exposure, and not to fixed carbon - Therefore any attempts made to use it economically in manufacturing iron should rather be directed towards making gas from it for use in Siemans or other recuperative gas furnaces.

10. I forward 3 boxes containing samples of the so called coke derived from the 3 experiments respectively; also two others containing specimens of the clinker formed in burning the coke as described in para 8.

11. The cost of these experiments has been hitherto approximately as follows.

Cost of building Kilns	Rupees	340-0-0
—"— "— fuel for charging	"	600-0-0
	Total Rs	940-0-0

This, however, does not include the cost of the Barkoi Coal and its carriage from Chhindwara which I believe was disbursed in your office and which should be notified to me. Further a slight expenditure will be necessary for dismantling the small kiln still standing, taking up the water pipes &c. Orders are now solicited as to what head of Accounts these

These experiments will be debited to enable me to prepare a regular estimate for sanction; meanwhile, for convenience sake, the expenditure incurred has been debited to workshop Manufacture Suspense Account.

12. Until receipt of further orders, I shall not dismantle the small kiln as shortly before Coll. Mayne, R.E., Secretary to Chief Commissioner left Nagpur he mentioned to me one morning when coming in from Kamhan Workshops that he contemplated an experiment with Mohpani coal. As the kilns stand in the way of completing the roads in Nagpur Workshop yard, I would solicit early orders on this point: if this extra experiment be made I should like to know the cost of coal (say 6 tons) and its carriage here so as to include it all in one Estimate.

"True Copies"

Clinton Ast. Clerk.

1628/20

C Rly

No need to re-circulate this volume to H.E.'s number as the above question will be dealt with

24/6

The H.E. the Governor
Rt. Hon'ble Governor

For information

The persons mentioned circulated reporting the failure to obtain Coke from the Central Provinces Coals under Dr. Strangways patent (now expired) have no further interest in this Presidency that it would now seem extremely improbable that a good workable Coke can be produced from the various ashy Coals procurable from the Singareni field, and Dale has in the much poorer material likely to be turned out from the Godavari Seams on the Nizam's side of the river

As the Submit- Peter Coal resources of this Presidency will ever be submitted to Prof. on a professional- me by

Cir: 19.6. R 24/6

Permit Absolgarth
which I have forwarded
for remarks to the
Supt. Geological Survey
of India at Calcutta
it is needless for me to
say more on the subject
which as matters stand
is of more immediate
concern to Hyderabad
and the Central Provinces
under the Cotton Admin-
istration particularly efforts
were for years made by
Mr. Ness, a thorough mining
Expert, to manufacture
Coke from the Warora
Coal without success and
this second failure
must be a disappointing
This Coke is said to be
made from the Barakur
coal, but the experiments
made with Samples sent
to our P.W. Workshops
proved a failure
I append a note from Mr. King which may
be interesting

19.6.82

Extract of a demi-official from Mr. King
to Col. Sankey, R.E., of Quilon January 15th
1880.

× × × × ×

About Starborough's patent, I do not
feel myself qualified to give an opinion, except
in this way:—

Nearly all the coals in the Central Provinces
are ill fitted for coking on account of
the large percentage of ash and water in most
and the poor percentage of volatile matter
in others.—

However Starborough proposes to get over
the difficulty of the ashy constitution—
by that blowing up of the contents
of the kiln by water admitted into the
bottom at a certain period of the process.
If this be so then it is a question whether
the resulting amount of coke, and the difficulty

of clearing away the ash would counter-
balance the expense of coking. Also,
I question whether the resulting coke would
be hard enough for the uses to which
coke is put. In any case, this ought
to be pure evidence, or information, as to
the amount of coke obtained from a
certain quantity of coal on which
reliance can be placed. Ness* must have
heard of this process from the authorities
in Central Provinces, and he is such
a thoroughly practical man that I am
sure he would have tested the process
in some way. — [illegible]

* The Engineer who for some years has been working the Warora coal field under the C.P. Administration. A.H.

× × × × ×

At present however, I do not see that
Starborough's process would be of any use to
the Madras Govt, for we have no coal that
appears to be good enough for coking. If
it be worth anything anywhere, then it
would be best developed in Bengal. The
(Geological?)
correspondence might be sent to our
Department Agent for information.

The coal question all round in the
Madras Presidency is a very gloomy one.
As far as we can see, the coal on the
British side of the Godavari is poor
and the quantity does not appear to be
very large. But as the pit is being
carried on and is apparently to be
continued until more is known, there
is a possibility that we might get
coal like that of Singareni which

is the best coal on this side of the country. If you get a good seam of such coal, then it ought to be sold at the pits mouth for less than 5 Rs a ton from which place it is I think fairly clear that you ought to get it to Madras by river and canal for sale 7 Rs more. However I have no hope that you will get as good coal as that of Singareni.

So, Singareni is the only field to which you can look for fairly good coal.

Now all the calculations on the produce of this field are based on faulty data. No body for certain would take coal from a place where colliery works are not in operation — as it is monstrous to write of coal costing Rs 8·8·2 a ton. With a colliery properly carried out, coal ought to be laid at the pits' mouth for less than Rs 5 per ton.

But there is the road; well a line of rails must be laid to Bezwada. Of course it could be worked on the Nizam to enable him to do this! But if we want the coal, we ought to do it; or else, which would be better, there ought to be a line of rail from Hyderabad, passing within easy distance of Singareni, to the Kistnah district. It will come to that in time: but in the meantime we must go back to the Godavari field, and the more so because a pit is being made "will ye will ye!" and see what can be made of the coal there. If we get tolerable coal there, it should be brought to Madras under the 17 Rs rate given by the Loco: Supt: and you may be sure on this that the Nizam's Govt will set to work on the other side of the river

where there ought to be a far larger
quantity. And, they'll sell it just
as cheap as we can do it, for coal
(Indian) drawn to a pits' mouth
must be sold and quickly too, or it
will spoil immediately.

The whole coal question for the
Madras Presidency hangs on the fact that
a pit is being made below Badrachellum,
and let us hope the coal got may
not be stuff" fit only for the
workshops at Dowlaishwaram,

No 1628 W. B.P.C. 6 Jun 82

PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 28th June 1882

Read the following—

1628/26

From

The Secy. to Chief Comr. C.P. Dept. Central Provinces } (No. 4078 of 31st May 1882)

Ordered that this correspondence be recorded, and its receipt acknowledged.

No. 1629 W. of 28th June 1882

To, The Chief Comr.
Central Provinces.

Sir,

I am directed to acknowledge the receipt of your Public Works Secretary's letter No. 4078 of 31st May 1882, and to

I should like before I say to have any Coal or other Mineral resources more carefully examined

MDD June 3/82

Com: Engr. for Rys. ✓
Supg Engr. First Circle ✓
— " — Second Circle.

pgW 8/7

Convey the thanks of
His Excellency the Governor
in Council for the interest-
ing reports therewith trans-
mitted regarding experiments
for the manufacture of
Coke from Coal obtained
in the Central Provinces.

R.S.
Secy
27/7

1.8.82

Ext Ind Cir: 10/6 R 11/6

A

Govt. of (1882) Madras.

PUBLIC WORKS.

Price 30/6

C.O. 28 June 1878
1879 to

Coal.

On manufacture of coke from — obtained in the Central Provinces. Correspondence received from the Chief Commr Central Provinces regarding Experiments for the — recorded.

30/6