No. 475. Read the following letter from Lieutenant-Colonel J. H. M. SHAW-STEWART, R.E., Consulting Engineer for Railways, to Colonel G. W. WALKER, R.E., Secretary to Government, Public Works Department, Fort St. George, dated Madras, 19th March 1875, No. 160 :—

ADVERTING to the Proceedings of Government, under date the 6th instant, No. 647, I have the honor to report that I have lately had an opportunity of closely examining the action of the pneumatic apparatus which has been tried upon several of the cylinders at the bridge under construction over the Huggry. I regret to say that in every case the apparatus has proved a failure, owing to the leakage of air through the joints and bolt-holes in the cylinders. At the Huggry the same precautions were taken in caulking the joints which had been successful in rendering them water-tight at the Kuddulhoondy Bridge, where cylinders of the same description were used. It is clear, however, that they are not air-tight, a defect which has arisen from the fact that the use of the pneumatic apparatus was not foreseen when the cylinders were put together in the first instance; and the depth to which the cylinders have been sunk places this defect beyond the reach of remedy, so far as the use of the pneumatic apparatus in the case of those cylinders is concerned. The same remarks are applicable to the cylinders at the Cheyair Bridge; and it appears that the only cases in which the apparatus in question can now be successfully applied are at the nine western piers of the Huggry Bridge, from which the screw piles have been removed, and where the sinking of the cylinders has not yet begun. I have no doubt that in these cases it will be possible to render the joints air-tight.

2. The enclosed* letter from the Agent of the Madras Railway, with accompanying report from the Chief Engineer, will show that the Directors have been telegraphed to, in order that the execution of the indent for two additional sets of the pneumatic apparatus may be suspended. It will now be necessary to use the diving apparatus in preparing the foundations of the cylinders both at the Huggry and the Cheyair Bridges; and the Agent has accordingly submitted an indent† for three sets of diving apparatus, of which there is at present only one available between two men. In order to avoid delay, I have authorized the immediate transmission to England of the indent in question, in anticipation of sanction.

* No. 284, 18th March 1875.

† No. 144, herewith enclosed.

3. Mr. Going in his report makes mention also of the fact that it has been ascertained by the European Divers that, in the case of three cylinders, the lowest sections have been fractured on coming into contact with the solid rock. The cylinders in question are at the east end of the bridge, and before reaching hard rock were sunk through depths varying from 38 feet to 53 feet. The stability of the piers will not, in my opinion, be affected by these casualties; but, as observed by Mr. Going, the necessity of embedding every cylinder in the solid rock, whatever the depth may be at which it is reached, should be fairly considered. It will be observed that this question is to be referred for the opinion of the Company's Consulting Engineer, Sir John Hawkshaw, who it is understood has hitherto been in favor of sinking every cylinder into the solid rock. After careful consideration of the subject I agree with Mr. Going that, when a cylinder has reached a hard substratum immediately overlying solid rock, at a depth of not less than 40 feet below the river bed, such

cylinder may be held to be perfectly safe provided that it is able to sustain a weight of 120 tons.

From R. B. ELWIN, Esq., Agent and Manager of the Madras Railway Company, to Lieutenant-Colonel J. H. M. SHAW-STEWART, R.E., Consulting Engineer for Railways, dated Madras, 18th March 1875, No. 284.

In forwarding, for your information, a copy of the Acting Chief Engineer's letter of the 17th instant, No. 215, I have the honor to request that you will be so good as to let me know whether you concur in the opinion arrived at by Mr. Going, that the pneumatic apparatus cannot be applied to the preparation of the foundations of the Cheyair Bridge.

2. If you do concur in that opinion I shall be glad if you will communicate sanction for the transmission to England of the accompanying indent* for three sets of diving apparatus. I have already requested the Board by telegraph to suspend the execution of the order for the two additional sets of pneumatic apparatus.

*No. 144, in triplicate.

From T. H. GOING, Esq., Acting Chief Engineer, to R. B. ELWIN, Esq., Agent and Manager of the Madras Railway, dated Madras, 17th March 1875, No. 215.

You will have observed that in my half-yearly report furnished on the 5th instant I promised a special report on the Huggry Bridge after having paid a visit to the works.

2. My inspection has since been made in company with the Government Consulting Engineer, and we gave our particular attention, when at the bridge on 11th instant, to the experiences which had been developed in working the pneumatic apparatus. My telegram requesting you to suspend execution of my indent of 27th January for an additional pair of these machines for Cheyair, was the result, and I now wish to explain my reasons for having come to the conclusion (in which I believe Colonel Shaw-Stewart agrees) that the pneumatic apparatus cannot be applied to the preparation of foundations in Cheyair Bridge.

3. It has been tried on five of the cylinders sunk in the Huggry river, and has failed owing to the impossibility of rendering the joints air-tight. This might have been effected in the first instance, when putting the cylinders together before sinking them, had it been anticipated that the pneumatic process would be necessary and that air-tight joints would be required. In our former experiences with cast-iron cylinder piers all that had been aimed at was the securing water-tight joints, and this was perfectly attained by means of the caulking materials sent out with the cylinders from England.

4. The Huggry cylinder joints were thus caulked, and so were those of the Cheyair. On applying the pneumatic apparatus to these cylinders it proves that joints so caulked, though perfectly water-tight, are not air-tight. Leakage occurs through the bolt holes. This might, as I before observed, have been remedied in the first instance by a special method of caulking when putting the cylinders together, but now there appears no way of effecting it, as the cylinders are sunk to considerable depths and cannot be withdrawn. There is then no means of reaching the joints so as to caulk them more effectually, and I fear the only piers to which it will be possible to apply the pneumatic process are the nine western ones of the Huggry Bridge which have not yet been commenced. The other piers of this bridge, as well as all those of the Cheyair Bridge, must, so far as we can now judge, have their foundations levelled by means of the ordinary diving apparatus. I have accordingly prepared an indent for three additional sets of these.

5. I have instructed the Resident Engineer to apply the pneumatic apparatus to one or two more of the cylinders in Huggry Bridge, but have very little hope that the results will be more favorable than those already obtained.

6. In the meantime the two Divers who came out from England with the apparatus have been at work in the single diving dress at present in our possession, and have prepared level rock foundations at the bottom of some of the cylinders.

Proceedings of the Madras Government, Public Works Department,
19*th April* 1875.

7. Another fact in connection with the sinking of these cast-iron cylinders has recently come to light and must be reported here as demanding serious consideration.

It has been ascertained by the Divers that three of the cylinders have been fractured in their bottom sections.

Others may have suffered in the same way. One of the cylinders thus found fractured had passed through 30 feet of sand, then 18 feet of clay and at last into 4½ feet soft rock. Its final descent of 1½ feet was made under a load of 158 tons which brought it in contact with solid rock and caused fracture in two segments of the bottom section. The cases of the other two fractured cylinders were very similar. In each the injury was caused by a short final descent under considerable weight through the bed overlying solid rock, the contact with the surface of which latter stratum caused fracture.

8. These results bring us back to a re-consideration of the views expressed in my letters marginally quoted, wherein it was proposed to found the deep cylinders of the Cheyair and Huggry Bridges not directly on rock but in the hard stratum which overlies it. It is to be now decided whether we shall force the cylinders through this hard stratum at the risk of fracturing them, or whether we shall rest satisfied with sound cylinders resting at great depths in a hard stratum which is yet not rock but overlying it.

No. 123 of 3rd Feb. 1874.
" 335 of 21st May "

9. Perhaps the question may be best disposed of by fixing a limit of weight beyond which it shall be considered unnecessary to load the cylinders in sinking them.

The greatest weight which any of these cylinders will be called on to bear in the bridge as completed is 102 tons. To withstand this there will be the frictional resistance of the cylinder surface added to the direct resistance of the column of concrete at its base.

In sinking the cylinders we have to overcome the former of these resistances alone.

Will it not, therefore, be sufficient if a limit be fixed of say 120 tons as the maximum load to be placed on each cylinder in sinking when it is known that rock lies at a short distance below its base, the latter being not less than 40 feet below the river bed?

I shall feel obliged if this question is referred to Sir John Hawkshaw.

No. 476. ORDER THEREON, 19th April 1875, No. 1,090.

RAILWAY, No. 56.

His Excellency the Governor in Council regrets the ill-success which has attended the trial of pneumatic apparatus in levelling rock foundations for bridges on the Madras Railway. A copy of these papers will be submitted for the information of the Government of India, who will, under the circumstances, be requested to confirm the sanction accorded for the transmission home of the indent for three sets of diving apparatus, in supersession of that for two additional sets of pneumatic apparatus now under provision.

2. The opinion of the Company's Consulting Engineer on the question of embedding every new cylinder in the solid rock should be reported for information when ascertained.

(Here enter No. 1,091, dated 19th April 1875.)

(True Extract.)

(Signed) G. W. WALKER, Colonel, R.E.,
Secretary to Government.

To the Consulting Engineer for Railways.

Fxd. E. C. Shunker.
Spare Copies

PUBLIC WORKS DEPARTMENT,
FORT ST. GEORGE, 19*th April* 1875.

No. 477.

No. 1,091.

FROM

COLONEL G. W. WALKER, R.E.,
Secretary to the Govcrnment of Madras,
Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
Public Works Department.

RAILWAY, No. 57.

SIR,—Adverting to my letter, No. 648, dated 6th March 1875, in which was reported the transmission home of an indent for two additional sets of pneumatic apparatus for levelling rock foundations for bridges on the Madras Railway, I am now directed to submit the accompanying correspondence, from which it will be observed that the trial with the existing apparatus has proved unsuccessful, and in consequence the indent in question has been superseded by that which I am now to submit for three sets of diving apparatus. The causes of the failure are stated by the Chief Engineer of the Company to be due to the leakage of air through the joints and bolt holes in the cylinders, which were not prepared in the first instance with a view to operations with pneumatic apparatus. This defect is reported to be irremediable. Under the circumstances, there seems no alternative but to continue the work by Divers, in the case of cylinders already sunk; and the Consulting Engineer has, in anticipation of sanction, authorized the provision of three sets of diving apparatus. I am to request confirmation of this proceeding.

2. It is also reported that the lower sections of some of the cylinders have been fractured on coming into contact with solid rock, but the Consulting Engineer is of opinion that this circumstance will not affect the stability of the piers. The question of embedding the cylinders in the solid rock in all cases will now be re-considered, and the opinion of the Company's Consulting Engineer on the subject elicited. This will, on receipt, be laid before the Government of India.

I have the honor to be,
Sir,
Your most obedient servant,
(Signed) G. W. WALKER, Colonel, R.E.,
Secretary to Government.

Exd. W. J. Lewis.

Spare Copies.

Railway Department. CONSULTING ENGINEER'S OFFICE.

No. 160

From

LIEUT.-COLONEL J H. M. SHAW STEWART, R.E.,

Consulting Engineer for Railways,

To

COLONEL G. W. WALKER, R.E.,

Secretary to Government,

Public Works Department,

Fort Saint George.

SIR,

Adverting to the Proceedings of Government under date the 6 instant, No 647, I have the honour to report that I have lately had an opportunity of closely examining the action of the pneumatic apparatus which has been tried upon several of the cylinders at the bridge under construction over the Muggy. I regret to say that in every case the apparatus has proved a failure, owing to the leakage of air through the joints and bolt-holes in the

the cylinders. At the Huggry the same precautions were taken in caulking the joints which had been successful in rendering them water-light at the Kuddilhoondy bridge, where cylinders of the same description were used. It is clear however that they are not airtight, a defect which has arisen from the fact that the use of the pneumatic apparatus was not foreseen when the cylinders were put together in the first instance, and the depth to which the cylinders have been sunk places this defect beyond the reach of remedy, so far as the use of the pneumatic apparatus in the case of those cylinders is concerned. The same remarks are

are applicable to the cylinders at the Cheyair bridge; and it appears that the only cases in which the apparatus in question can now be successfully applied are at the nine western piers of the Huggry bridge, from which the screw piles have been removed, and where the sinking of the cylinders has not yet begun. I have no doubt that in these cases it will be possible to render the joints airtight.

2. The enclosed letter

*No 284
18 March 75. from the Agent of the Madras Railway, with accompanying report from the Chief Engineer, will show that the Directors have been telegraphed to, in order that the execution of the indent for two additional sets of the pneumatic apparatus may be suspended.

If

It will now be necessary to use the diving apparatus in preparing the foundations of the cylinders both at the Nuggey and the Cheyair bridges; and the Agent has accordingly submitted an indent* for three sets of diving apparatus, of which there is at present only one available between the two rivers. In order to avoid delay, I have authorised the immediate transmission to England of the indent in question, in anticipation of sanction.

*No 144 herewith enclosed

3.

Mr. Going in his report makes mention also of the fact that it has been ascertained by the European divers that, in the case of three cylinders, the lowest

lowest sections have been fractured on coming into contact with the solid rock. The cylinders in question are at the east end of the bridge, and before reaching hard rock were sunk through depths varying from 38 feet to 53 feet. The stability of the piers will not, in my opinion, be affected by these casualties; but, as observed by Mr. Going, the necessity of embedding every cylinder in the solid rock, whatever the depth may be at which it is reached, should be fully considered. It will be observed that this question is to be referred for the opinion of the Company's Consulting Engineer, Sir John Hawkshaw, who it is understood has hitherto been in favour of sinking

sinking every cylinder into the solid rock. After careful consideration of the subject I agree with Mr Going that, when a cylinder has reached a hard substratum immediately overlying solid rock, at a depth of not less than 40 feet below the river bed, such cylinder may be held to be perfectly safe provided that it is able to sustain a weight of 120 tons.

I have the honour to be

Sir

Your Most obedt servt

W Mountstuart Lt Col R.E.

Mr Rao

19 March

1875

Cons: Engineer for Railways

& Bench

No. 284

MADRAS RAILWAY.

AGENT AND MANAGER'S OFFICE.

Madras, 18th March 1875

From

R. B. Elwin Esqre,

Agent and Manager of the M R Co

To

Lieut Col J Hills Thaw Stewart, R E

Consulting Engineer for Railways.

Sir,

In forwarding for your information a Copy of the acting Chief Engineer's letter of the 17th instant, No 215, I have the honour to request that you will be so good as to let me know whether you concur in the opinion arrived at by Mr Going, that the Pneumatic apparatus cannot be applied to the preparation of the foundations of the Cheyaur Bridge.

2. If you do concur in that opinion I shall be glad if you will communicate sanction for the transmission to England of the accompanying Indent for three sets of Diving apparatus. I have already requested the Board by telegraph to suspend the execution of the order for the two additional sets of pneumatic apparatus.

No 1144 in Triplicate

I have the honour to be

Sir

your most obedient servant

R B Elwin

Agent & Manager

MADRAS RAILWAY.

From

The Agent and Manager.

To

The Consulting Engineer

for Railways.

Dated 18 March 1875

Recd. 19 [illegible]

No. 284

Requesting to communicate sanction for the transmission to England of Indent for 144 for 3 sets of Driving apparatus.

[illegible] 2/5

occurs through the bolt holes. This might, as I before observed, have been remedied in the first instance by a special method of caulking when putting the Cylinders together, but now there appears no way of effecting it, as the Cylinders are sunk to considerable depths and cannot be withdrawn. There is then no means of reaching the joints so as to caulk them more effectually and I fear the only Piers to which it will be possible to apply the Pneumatic process are the 9 western ones of the Buggrey Bridge which have not yet been commenced. The other Piers of this Bridge as well as all those of the Cheejaw Bridge must, so far as we can now judge, have their foundations levelled by means of the ordinary Diving Apparatus. I have accordingly prepared an Indent for three additional sets of these.

5 I have instructed the Resident Engineer to apply the Pneumatic Apparatus to one or two more of the Cylinders in Buggrey Bridge, but have very little hope that the results will be more favourable than those already obtained.

6 In the meantime the two Divers who came out from England with the Apparatus have been at work in the single Diving Dress at present in our possession and have prepared level Rock foundations at the bottom of some of the Cylinders.

7 Another fact in connection with the sinking of these Cast Iron Cylinders has recently come to light and must be reported here as demanding serious consideration.

It has been ascertained by the Divers that three of the Cylinders have been fractured in their bottom sections.

Others may have suffered in the same way. One of the Cylinders thus found fractured had passed through 30 ft of sand, then 18 ft of clay and at last into 4½ ft soft rock. Its final descent of 15 ft was made under a load of 158 tons which brought it in contact with solid rock and caused fracture in 2 segments of the bottom section. The cases of the other two fractured Cylinders were very similar. In each the injury was caused by a short final descent under considerable weight through the bed overlying solid Rock, the contact with the surface of which latter stratum caused fracture.

8 These results bring us back to a reconsideration of the views expressed in my letters marginally quoted wherein it was proposed to found the deep cylinders of the Cheejaw and Buggrey Bridges not directly on Rock but on the hard stratum which overlies it. It is to be now decided whether we shall force the Cylinders through this hard stratum at the risk of fracturing them or whether we shall rest satisfied with sound Cylinders resting at great depths on a hard stratum which is yet not rock but overlying it.

№ 123 of 3rd Feby 1874
„ 335 of 21st May „

9 Perhaps the question may be best disposed of by fixing a limit of weight beyond which it shall be considered unnecessary to load the Cylinders in sinking them.

The greatest weight which any of these Cylinders will be called on to bear in the Bridge as completed is 102 Tons. To withstand this there will be the frictional resistance of the Cylinder surface added to the direct resistance of the Column of concrete at its base.

In sinking the Cylinders we have to overcome the former of these resistances alone.

Will it not therefore be sufficient if a limit be fixed of say 120 Tons as the maximum load to be placed on each Cylinder in sinking when it is known that Rock lies at a short distance below its base, the latter being not less than 40 feet below the River bed?

I shall feel obliged if this question is referred to Sir John Hawkshaw.

I have &c.

(Signed) J. W. Lowe
Agent and Manager

/ True Copy /
J. W. Lowe
Agent and Manager

Yours faithfully
(Signed) J. W. Long
Ag. Chief Engineer

P. W. 1875 Dept
No. 185 (5) 1875.

From

The Consulting Engineer for Railways

No.

To

The Secretary to Govt
P. W. Department
Fort St. George

Dated 19 March 1875
Rec'd 22nd March 1875
E. 2 No 160

Submitting Lr and
No 1446 for 3 sets of
Diving apparatus required for Chegam and
Bridge Jetties
G. O. No 1091 14-4-76

606 Mar/75 No. 647 6 18 173-176
" 21st Mar/74 " 1363
" 8 Apl/ " 924

No 475

623-3-75

Public Works Department.

PROCEEDINGS of the MADRAS GOVERNMENT.

Under date the

READ the following :—

From,

The Cons. Engineer for Railways } (M. E. Lr No 160 of 19th March 1875.)

1090

His Excellency the Governor in Council regrets the ill-success which has attended the trial of pneumatic apparatus in levelling rock foundations for Bridges on the Madras Railway - A copy of these papers will be submitted for the information of the Government of India, who will, under the circumstances, be requested to confirm

the

of the Company blue due to the leakage of air through the joints and bolt-holes in the Cylinders, which were not prepared in the first instance with a view to operations with Pneumatic Apparatus. This defect is reported to be irremediable. Under the circumstances there seems no alternative but to continue the work by Divers, in the case of Cylinders already sunk; and the Consulting Engineer has in anticipation of sanction authorized the provision of 3 sets of Diving apparatus. I am to request confirmation

of this proceeding.

It is also reported that the lower sections of some of the Cylinders have been fractured on coming into contact with solid rock, but the Consulting Engineer is of opinion that this circumstance will not affect the stability of the piers. The question of embedding the cylinders in the solid rock in all cases will now be reconsidered, and the opinion of the Company's Consulting Engineer on the subject elicited. This will on receipt be laid before the

Govt.

Government of India

Desp with Enclosure
7 Copies 10903/15

No 475-477

1857

V

Govt. of {1875} Madras.

PUBLIC WORKS.

To Civil Engineer
Mr. Pullbrey
Fort St. George

Dated Madras

Read. Read

G. O. 19th June 1875. No. 1090

Nos. 475-477.

Forwarding correspondence regarding the failure of the Pneumatic Apparatus and requesting confirmation to the sanction accorded for the transmission home of the indent for 3 sets of diving Apparatus for the Madras Ry.

Nos 475-477

Indent (M. Ry). The Confirmation of the Govt of India requested to the sanction accorded for the transmission home of the — for 3 sets of diving Apparatus. The opinion of the Comptr. Con. Engr on the question of embedding every new cylinder in the solid rock to be reported for information when ascertained.