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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No. 1112	Press
284-85	Mis.
Dated 20-14	(S.M.)

Not to be folded or roughly handled

*Proceedings of the Madras Government, Public Works Department,
20th April 1871.*

No. 284. Read the following Proceedings of the Government of India in the Public Works Department, (Railway,) dated Fort William, 29th March 1871, No. 561-R:—

Proceedings of Railway Conference on rolling stock and the method of working the traffic of Indian Railways.

Read again—

Public Works Department Resolution Nos. 1,634—G-R, dated the 26th September 1870.

Read also—

Letter from the Government of Bengal in the Public Works Department, Railway Branch, No. 156-G, dated the 24th January 1871, and enclosure.

ORDER.—Ordered, that these papers be forwarded to the Governments and

Madras. | Bengal.
Bombay. | Punjab.
Oudh.

Administrations named in the margin,
for communication to the Agents of the
several Railway Companies, with the

request that they will favour the Government with any remarks they may desire to offer on the points discussed after due official consideration of them. Also, if the proposal to hold an annual Conference to discuss Railway questions of general interest is regarded with favour, that they will record in some detail their views as to the best manner of giving effect to it. Also, that the Local Governments and Administrations named be invited to express their opinions on the subjects discussed.

(Signed) E. C. S. WILLIAMS, Major, R.E.,
Deputy Secy. to the Govt. of India.

No. 285.

ORDER THEREON, 20th April 1871, No. 1,112.

RAILWAY, No. 42.

COMMUNICATED to the Consulting
Engineer for Railways with a view to
the Agents of the Railways in this Pre-

sidency being invited to submit such observations as they may desire to offer on the points discussed in the accompanying papers regarding rolling stock and the method of working the traffic on Indian Railways.

2. In submitting the reports of the Agents Major Prendergast will express his own opinion on the questions which are considered in those papers.

(True Extract.)

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

To the Acting Consulting Engineer for Railways, with ten copies of the Enclosure.

Ed. S. T. Augustin.

all communications
should be addressed
to the Secretary.

No. 557 R.

GOVERNMENT OF INDIA.
PUBLIC WORKS DEPARTMENT.
RAILWAY.

FORT WILLIAM, MARCH 29, 1871.

*Proceedings of Railway Conference on rolling-stock and the method of
working the traffic of Indian Railways.*

Read again—

Public Works Department Resolution Nos. 1634—6 R, dated the 26th September 1870.

Read also—

Letter from the Government of Bengal in the Public Works Department, Railway
Branch, No. 156 G, dated the 24th January 1871, and enclosure.

ORDER.—Ordered, that these papers be forwarded to the Govern-
ments and Administrations named in the margin, for

Madras. Bengal.
Bombay. Punjab.
Oudh.

communication to the Agents of the several Railway
Companies, with the request that they will favour the
Government with any remarks they may desire to offer on the points
discussed after due official consideration of them. Also, if the pro-
posal to hold an annual Conference to discuss Railway questions of
general interest is regarded with favour, that they will record in some
detail their views as to the best manner of giving effect to it. Also,
that the Local Governments and Administrations named be invited to
express their opinions on the subjects discussed.

Major R. E.,

Deputy Secretary.

To
The Secretary to the Govt. of India
Public Works Dept. (R)

PUR

To

No. R.

Dated March 29, 1871.

Received 18 April

*Proceedings of Railway Conference on
rolling-stock and method of working the
traffic of Indian Railways.*

P. W. D. Press—29-3-71—104.

Enclosure to Public Works Department No. 561—5 R of 1871.

No. 156 G, dated 24th January, 1871.

*From—MAJOR F. S. TAYLOR, R. E., Joint Secy. to the Govt. of Bengal, in the P. W. Dept.,
Railway Branch,*

To—Secretary to the Government of India, P. W. Dept.

I have the honor to report that the Railway Conference convened in terms of Resolution No. 1635R, dated 26th September 1870, duly met in Calcutta between the 11th and 14th January, and the minutes of its proceedings are herewith forwarded for submission to His Excellency the Governor General in Council.

2. Anticipating great difficulty in obtaining a consensus of opinions on the subject of the best form for carriage stock, I considered it expedient to recommend the Conference to confine the discussion on this occasion to the question of the improvement of existing vehicles. A great deal of valuable information has been recorded under this head, and an opening has been made which will, I hope, lead to further practical results.

3. The general opinion of the Conference is, it will be seen, in favor of four classes of passenger accommodation, but the 4th class is recommended for short or coolie traffic only, and the fare of this class should obviously be below the Government maximum for the lowest class. I recommend, therefore, that the sanctioned maximum rates should include 1st, 2nd, 3rd classes only, and that it should be made compulsory on all Railway Companies to run carriages of these three classes on all trains.

The intermediate class advocated by the East Indian Railway is, strictly speaking, a lower 2nd class, and the accommodation now given is obviously insufficient for the fare charged, but an improvement in this respect can easily be arranged for by a composite 2nd class carriage on the through trains; in the local trains on which seatless 4th class carriages are now run, the classes of accommodation on the East Indian Railway are now precisely the same as those of the Great Indian Peninsula Railway. Both intermediate and 4th class fares should be a reduction on the 2nd and 3rd class maxima, and the precise rate per mile may be left to the discretion of the Company concerned, under the existing rules.

I attach much importance to the authoritative introduction of a common class nomenclature and a uniform scale of accommodation on all the trunk lines, and I trust that His Excellency the Governor General in Council will be moved to issue a regulation on the subject.

4. The Conference commended the strength and efficiency for general use of Mr. Pearce's model (composite iron and wood) wagon, but practical experience appears to show that it is not in the direction of increased cubical capacity that reform is needed. In the wagon described by Mr. Conder, the decrease in dead-weight is due probably to the use of a lighter description of timber, and it is a question whether strength has not been sacrificed; if, however, Mr. Prestage's expectations are realised, there would seem to be no reason why equally good results in iron could not be obtained from rectangular wagons.

5. As respects the precautions necessary for safe working, the "line clear" system, alluded to at the Conference, must be understood to mean that guards and drivers will wait at each station for permission to proceed; the written line clear message generally used in India is not absolutely necessary under this system, but it is obviously the only efficient check over the working staff.

On all lengths, such as inclines, requiring careful working, or where there is a very heavy traffic, the adoption of the block system in its integrity should, I think, be insisted on. The crossing of irregular trains on the single line is managed in India in a way very similar to that practised in the United States, only experienced Station Masters being authorised to pass trains out of course.

6. On the subject of the classes of goods accommodation, the minutes of the Conference will be found to give all necessary information.

7. In addition to the business indicated in the Resolution convening the Conference, I have obtained a general opinion on the subjects of the communication between passengers and guards, and the locking of carriage doors. I recommend that all Railway Companies be invited to take action on both these subjects.

8. The concluding clause of the minutes will be found to embody the recommendations of the Conference on the question of future meetings.

Proceedings of the Railway Conference composed as under which assembled at Calcutta on the 11th, 12th, 13th, and 14th January 1871.

PRESIDENT:

MAJOR F. S. TAYLOR, R. E., *Consgr. Engr. to Govt. of Bengal.*

MEMBERS:

MR. INBRIE MILLER, *Supdg. Engr., State Railways* | MR. J. C. BATCHELOR, *Traffic Manager,*
CAPTAIN R. DEBOURBEL, R. E., *Consgr. Engr. to* | *E. I. Railway,*
the Oudh Govt. | R. W. PEARCE, *Carriage Supdt. E. I.*
MR. F. PRESTAGE, *Agent, E. B. Railway Co.* | *Railway.*
" H. CONDER, *Genl. Traffic Manager, G. I. P.* | *Railway.*
" J. G. COOKE, *Locomotive Supdt.*
Oudh and Rohilkhand Railways.

The Government of India Resolution No. 1635 B. of 26th September, convening the Conference, and subsequent correspondence (*Appendix A*), together with a Memorandum by the President and his Circular letters to the Members (*Appendix B*), having been laid on the table, the following papers were then read and discussed:—

- 1.—Memorandum by Mr. Cooke
 - 2.—" " " Conder
 - 3.—" " " Pearce
 - 4.—Note by Lieut. Firebrace, R. E.
- (*Appendix C.*)

The Conference after having inspected specimens of the various descriptions of rolling-stock in use and under construction on the Eastern Bengal and East Indian Railways, and having examined the full set of detailed drawings of American palace cars, the ordinary 1st class carriage, the different styles of goods wagoons, and two styles of American locomotives with bogie trucks, submitted by Mr. Miller, as well as designs and sketches put forward by various members, decided on recording the following expression of their views upon the various matters indicated in the above-mentioned Resolution, as well as upon other similar subjects connected therewith:—

I.—CARRIAGE STOCK.

The discussion on carriage stock resulted in an unanimous opinion in favour of a joint passenger stock for the through fast service on all trunk lines; but as a large saloon carriage, built expressly for the East Indian Railway, to accommodate 16 persons, and fitted with all the latest improvements, is shortly expected from England, the further consideration of the question of a new joint-stock had better, in the opinion of the Conference, be deferred until some experience of the working of this carriage has been gained.

2. With regard to the existing stock now running, and the best mode of improving it—

The 1st and 2nd class carriages referred to in Mr. Conder's Memorandum as having been lately sent out from England for the Great Indian Peninsula Railway, drawings Nos. 1 and 2 are generally approved of by the Conference, one member, Mr. Miller, dissenting; but it is considered that they are susceptible of certain improvements which may be pointed out in the event of the construction of a joint-stock being decided upon for the through service.

It was agreed that the best mode of adapting the East Indian Railway 1st and 2nd class (old pattern, 20 feet) carriages to the requirements of the through service is that shown in the drawings Nos. 3 and 4. In the 1st class carriage, the end-doors, the easy conversion of the transverse seats into longitudinal sleeping berths, the lowering of the window openings, and the increased height of the carriage, were generally approved of, but it was considered that the form of sky-light roof (omnibus) had not been sufficiently tried to warrant a decided opinion being expressed as to its suitability for India. Mr. Miller pointed out, and the Conference agreed, that an improvement would be effected by making the ventilating windows in the roof to move on vertical instead of horizontal pivots for the purpose of more effectually keeping out the dust; and as dust is one of the greatest inconveniences which travellers by Indian Railways suffer from, it was decided to recommend the trial of the simple expedient of having a screen of canvas or of some inflammable material stretched between each pair of carriages just above the buffers, so as to keep the dust rising from the road from entering by the end-doors or windows.

3. The question of carrying 1st and 2nd class passengers' luggage in the same carriage with "through" passengers, was discussed; but as the views of the members were divided on the subject, no recommendation was agreed to; it was however decided to append a drawing (No. 5) to the Proceedings showing a design by Mr. Cooke for effecting this object.

4. As regards 3rd class sleeping carriages for the through service, the Conference was doubtful whether such accommodation is required by the public. A general opinion was expressed in favour of recommending the fitting up of a carriage on the plan proposed by Major Taylor as an experiment (drawing No. 6). Messrs. Conder and Miller considered that the experiment was unnecessary.

5. The ordinary 3rd class carriages on the East Indian Railway, with venetian openings at the ends to promote the free circulation of air, and divided into lateral compartments separated by iron bars to prevent overcrowding, are considered to be the most suitable existing form of carriage for general use, but the Conference would recommend that in all new stock of this class, the compartments should be made not less than 4 feet 4 inches in clear width.

6. On the general question of end or side-door for passenger carriages, the opinion of the Conference was in favour of the former; Mr. Conder dissenting.

II.—CLASSES OF PASSENGER ACCOMMODATION.

The general opinion of the Conference was in favour of having four classes of accommodation in passenger vehicles; the 4th class to be without seats for use on short distances, and for local or coolie traffic; further that three classes of accommodation are sufficient for through trains. Mr. Batchelor advocated running four classes of carriages on all trains, and would confine the use of the seatless carriages to local traffic. The following are the particulars of the present practice on each of the under-mentioned lines of Railway:—

2. On the Great Indian Peninsula Railway, the 4th class carriages are without seats, and are run on the mixed and coolie trains only. On the East Indian Railway, intermediate and 3rd class passengers are carried in the same description of carriage by all trains, and a seatless 3rd class carriage is run on the local trains between Calcutta and Raneegunge; Mr. Batchelor would slightly increase the accommodation of the intermediate class and call it 3rd class, and reduce the present 3rd to 4th class. On the Eastern Bengal Railway, the 4th class carriages are without seats, and are run upon all trains. On the Oudh and Rohilkhand Railway there are at present three classes, 1st, 2nd and 3rd, some of the last being carriages without seats, which are generally reserved for women; but it has been settled as an experiment to have only two classes of passenger carriages on this line, with facilities for obtaining reserved accommodation in each.

Tabular Statement of accommodation now given.

RAILWAY.	DESCRIPTION OF CARRIAGE.	NUMBER OF SEATS BY DAY.	NUMBER OF SLEEPING-BERTHS BY NIGHT.	REMARKS.
EAST INDIAN RAILWAY.	1st Class, old style, 3 compartments ...	24	12	No retiring accommodation.
	" altered, 2 " " ...	16	8	Furnished with two retiring-rooms.
	2nd Class, altered, 2 " " ...	26	10	One compartment of four sleeping-berths "for ladies only." A retiring-room for each compartment.
	3rd Class, old style, 5 compartments ...	50	...	The intermediate and 3rd class carriages are precisely the same.
GREAT INDIAN PENINSULA.	" new " 7 " " ...	70	...	
	" seatless, 2 " " ...	50	...	
	1st Class, new pattern, 2 saloons ...	24	12	A retiring-room to each compartment.
	2nd " " " 2 " " ...	38	14	Ditto ditto.
EASTERN BENGAL RAILWAY.	3rd " " " 4 compartments ...	40	...	
	4th " seatless, 4 " " ...	40	...	
	1st Class, ordinary, 3 compartments ...	24	12	No retiring accommodation.
	" saloons ...	24	...	
OUDH AND ROHILKHAND RAILWAY.	2nd Class, 4 compartments ...	40	...	
	3rd " 5 " " ...	50	...	
	4th " seatless " ...	75	...	
	1st Class, 4 compartments ...	32	...	Retiring accommodation to each compartment.
	2nd " 5 " " ...	50	...	No retiring accommodation.
	1st } Class, composite, 4 compartments,	32	...	Retiring-rooms in the centre of the carriage for the 1st class only.
	2nd } 2 first and 2 second class.			
	3rd Class, 6 compartments ...	60	...	
	The above stock is now under construction for this line.			

III.—Goods Stock.

Regarding the best form of existing goods wagons, the general opinion of the Conference was in favour of the latest improved covered goods wagon constructed by Mr. Pearce,* weighing 5½ tons, and capable of carrying 9½ tons. Mr. Conder considered that the wagon now partially in use on the Great Indian Peninsula Railway, weighing 5 tons, and carrying 7 to 8 tons, was best suited for general traffic in India.

Messrs. Conder and Batchelor stated that the average load of wagons on the Great Indian Peninsula and East Indian Railways was about 5 tons, and that there was little prospect of better results being obtained. Mr. Prestage stated from the experience of the Eastern Bengal Railway, that a locomotive was found to labour as heavily under a train of 45 empty wagons, as with a train of 35 loaded wagons.

2. With respect to the new cylindrical iron goods wagons adopted by the Eastern Bengal Railway, the Conference considered that their shape was not suited for general use, and that a further expression of opinion had better be deferred until some experience of their working had been gained.

3. Mr. Prestage wished to record his opinion that, however well-suited wagons with rectangular bodies may be for carrying rectangular packages, they were ill-suited for carrying packages approaching a cylindrical form—such as bales of loose cotton, or demas of jute—as it had been proved by actual experiment that a cylindrical wagon having a capacity of 1,575 cubic feet could carry 3 tons 8 cwt. 2 quarters of loose cotton, or 9 tons of loose jute, whilst a rectangular body having a capacity of 1,069 cubic feet carried only 2 tons, 2 cwt. 3 quarters of loose cotton, or 4 tons 15 cwt. of jute.

4. Mr. Prestage further stated that he hoped by the time the Conference next meet to submit the results of the working of a cylindrical wagon designed to carry 12 tons of grain, seed, salt or coal, and having a dead load of only 4 tons.

IV.—WORKING.

With reference to the precautions to be observed in working trains, Mr. Conder stated that the Martin's block system was in force throughout the double line on the Great Indian Peninsula Railway, and that he was an advocate for its introduction on both single and double lines. Mr. Batchelor stated that the block system was not in force on the East Indian Railway, but that he advocated its introduction on all lengths, such as inclines, whether single or double, which required careful working.

2. The general opinion of the Conference was in favour of the "line-clear" system, as an additional precaution on both single and double lines. Mr. Miller stated that neither of the above-mentioned precautions were used in the United States, and that they were not required with the American system of working. Mr. Prestage stated that neither precaution was used in its integrity on the Eastern Bengal Railway, and that he considered the written line-clear message an obstruction to working as long as trains kept to their schedule time.

3. Regarding the speed of trains, the Conference was unanimously of opinion that the speed of ordinary passenger and mail trains should be limited to 20 miles an hour, including all stoppages.

V.—CLASSES OF GOODS ACCOMMODATION.

As respects two classes of goods traffic, fast and slow, the general opinion of the Conference is, that two classes of service at different rates are not necessary.

2. Mr. Conder states that the practice on the Great Indian Peninsula Railway as respects the mixed trains, is to run a slow cooly train, to which goods wagons for intermediate local stations are attached. These trains run by day only, and are not used for through goods. Mr. Batchelor states that the practice on the East Indian Railway is to run "through" mixed trains carrying "through" goods only as far as possible. Goods for local stations are carried by a pick-up train.

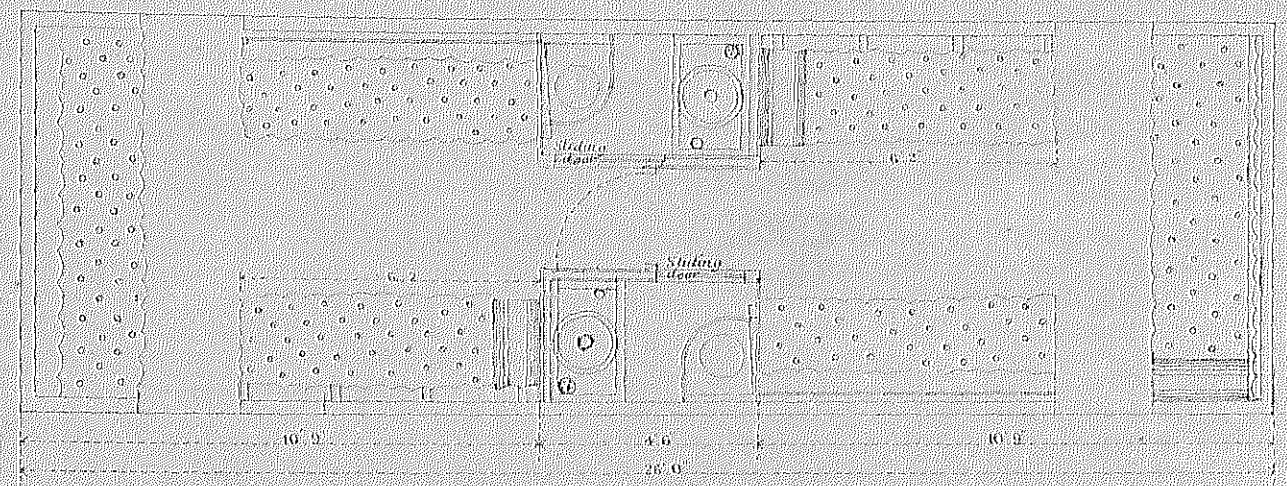
3. In the opinion of the Conference, the arrangement of mixed trains will always be dependent on local circumstances, and that uniformity in this respect is not possible.

VI.—COMMUNICATION BETWEEN PASSENGERS AND GUARDS.

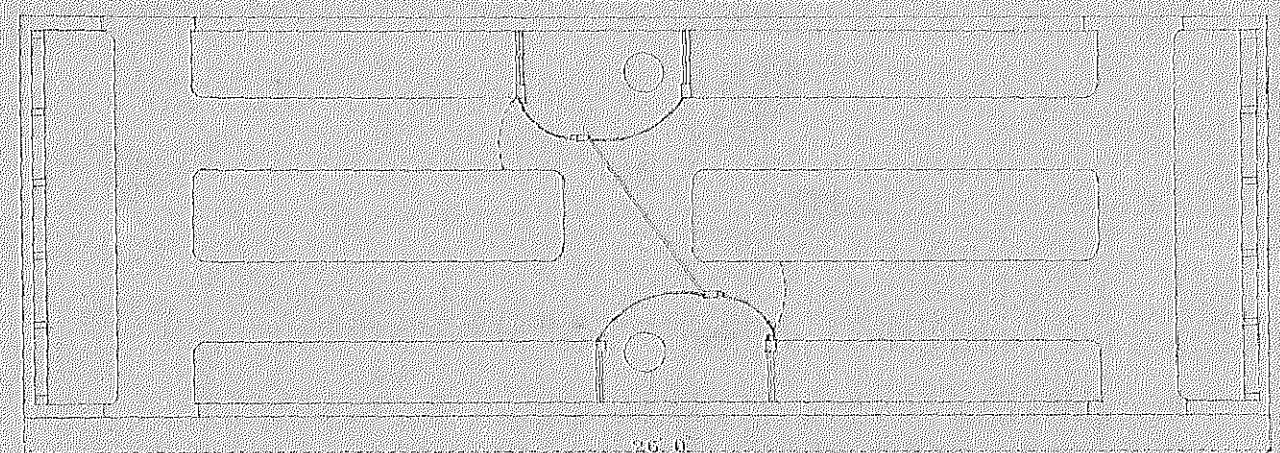
With regard to the communication cord, Mr. Conder states that it is not in use on the Great Indian Peninsula Railway, but that application had been made to England for the apparatus lately approved by the General Managers of the English Railways. In his opinion, however, a communication is not necessary under the existing arrangements on the Great Indian Peninsula Railway. Mr. Miller considers a good communication, such as is used in America, indispensable if trains are worked without line-clear messages on the American system.

2. The general opinion of the Conference is, that the communication cord at present adopted on the East Indian Railway is of no practical use.

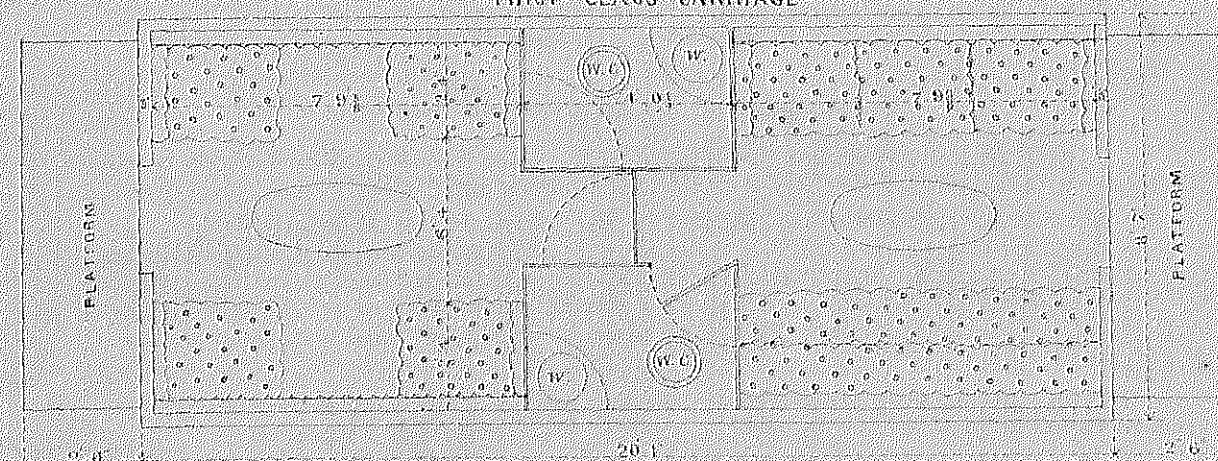
Nº 1.
G.I.P.R.
FIRST CLASS CARRIAGE



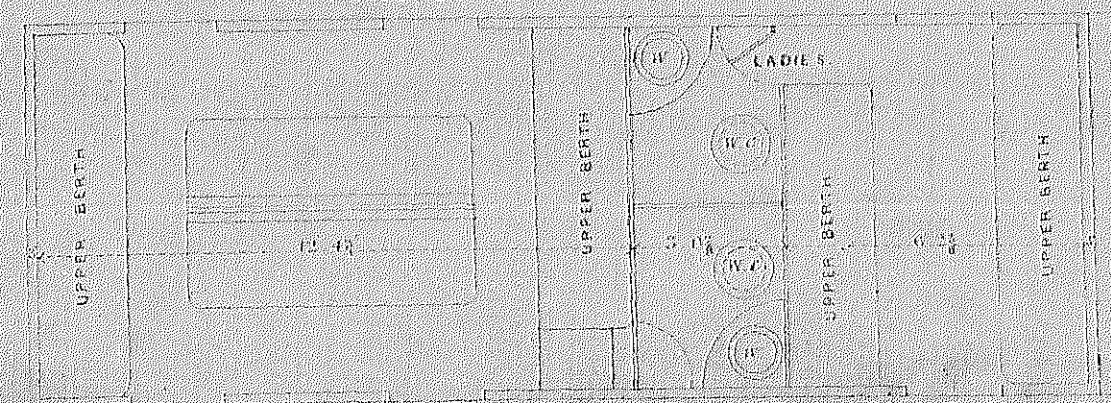
Nº 2.
G.I.P.R.
SECOND CLASS CARRIAGE



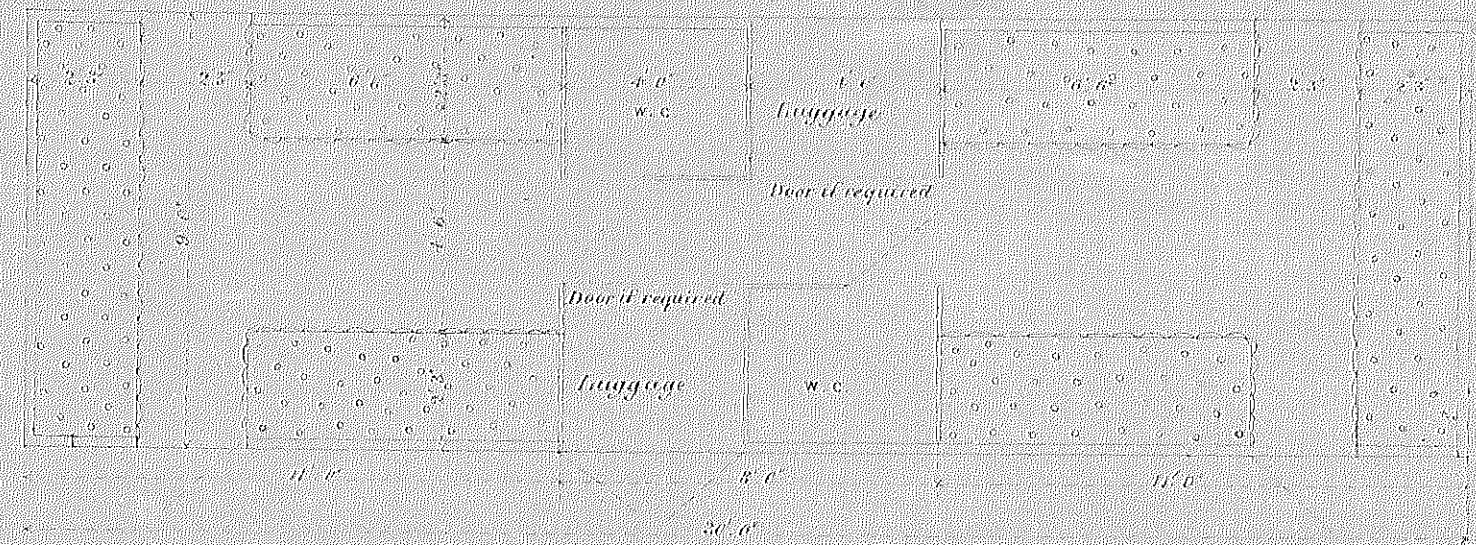
Nº 3.
E.I.R.
FIRST CLASS CARRIAGE



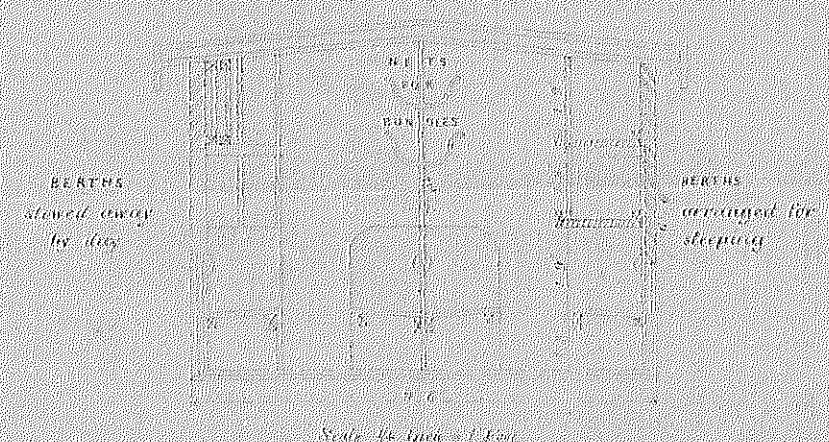
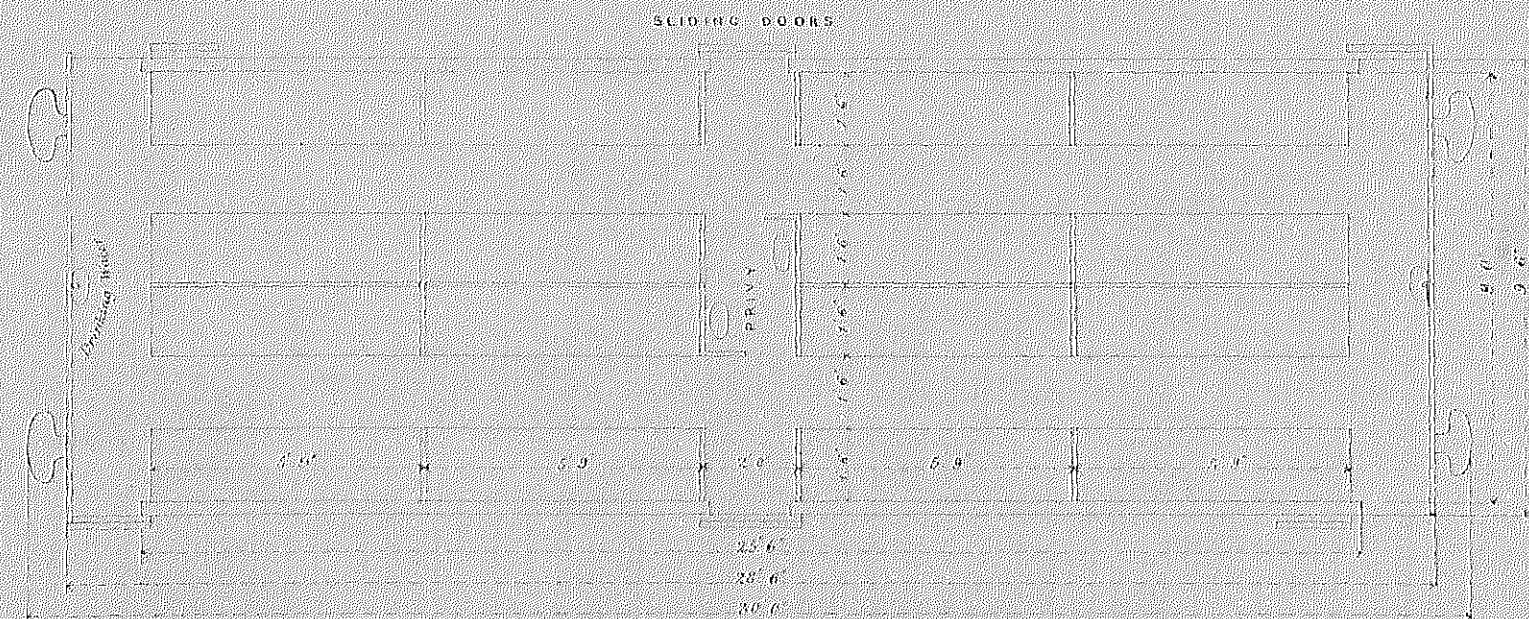
Nº 4.
E.I.R.
SECOND CLASS CARRIAGE



Nº 5
 PROPOSED FIRST CLASS SLEEPING CARRIAGE
 FOR 12 PERSONS AND THEIR LUGGAGE



Nº 6
 PROPOSED 3rd CLASS SLEEPING CARRIAGE
 48 SEATS BY DAY, 24 SEATS AND 24 SLEEPING BERTHS BY NIGHT.



VII.—LOCKING CARRIAGE DOORS.

On the question of locking carriage doors, the general opinion of the Conference is that the doors of carriages ought not to be locked, except within station limits for the convenience of collecting tickets, or to prevent passengers getting out on the wrong side.

VIII.—CONCLUSION.

2. As it appeared, when the members met for the final settlement of the minutes, that Mr. Miller had prepared a paper giving his views upon the several questions referred to the Conference by the Government Resolution, but which was not ready at the commencement of the proceedings, and had not been read, it was agreed this paper should be printed and attached to the minutes (*Appendix D.*)

3. With reference to the proposal for future Conferences, the general opinion was to the effect that much good might result from a more regular intercourse of members interested in Railway improvement, and it was suggested that all the Railway Companies in India should be invited to send delegates to an annual Congress to be convened by the Supreme Government, it being settled at each meeting of such Conference where and when the next meeting shall be held.

4. The Conference then closed with a vote of thanks to Lieutenant W. Wallace, R. E., who had acted as Secretary.

F. S. TAYLOR.
H. CONDER.
R. W. PEARCE.
J. G. COOKE.
J. C. BATCHELOR.
DE BOURBEL.
J. IMBRIE MILLER.
F. PRESTAGE.

APPENDIX A.

No. 1635 R, dated 26th September, 1870.

RESOLUTION,—By the Govt. of India, P. W. Dept.

Read again :—

Public Works Department	Circular No. 9 R, dated 2nd September 1867.
" " "	Resolution No. 648—52 R, dated 15th June 1868.
" " "	" " 1309—13 R, " 5th November 1868.
" " "	Letter " 1314 R of 5th November 1868, to Government of Madras.
" " "	" " 103—6 R, dated 29th January 1869, to Local Governments.
" " "	" " 107 R, dated 29th January 1869, to Government of Bombay.
" " "	" " 10 R, dated 31st May 1869.
Despatch to Secretary of State,	" 50 of 1869.
From Government of Bengal,	" 1018 G, dated 17th May 1869.
Despatch to Secretary of State,	" 51 of 1869.
from " "	" 53 of 1869.
Public Works Department Circular	" 1 R of 11th January 1870.
Despatch from Secretary of State,	" 43 of 1870.
Public Works Department	" 1393 R, dated 8th August 1870, to the Government of Bengal.

Read also :—

From Government of Bengal, Public Works Department, Railway Branch, No. 594 G, dated 11th March 1870.

Note by Consulting Engineer to the Government of Bengal, dated 2nd May 1870, with Appendix (received with letter from Government of Bengal, No. 1067 G, dated 18th May 1870).

From Government of Bengal, No. 1250 G, dated 14th June 1870.

" Oudh Administration, " 1217 R, " 6th July "

" " " " 1319 R, " 19th " "

" " " " 1338 R, " 21st " "

Public Works Department " 1417 R, " 13th August " to the Oudh Administration.

RESOLUTION.—The general form of vehicle stock in use, and the mode of working traffic in force on English Railways, have been accepted and extended to India, apparently without any special local enquiry, though many adaptations to

suit local peculiarities have doubtless been made. Much experience has now been gained by those connected with the working and control of Railways in India, of the special requirements of the traffic and of the climate, and it is of the highest importance, not merely with reference to the large extension of the Railway system by Guaranteed Companies and the State, both decided upon and contemplated, but also to the future requirements of the existing Guaranteed Companies, that this experience should be taken the fullest advantage of. This may probably best be done by assembling a body of competent Officers, who shall confer on the important matters under consideration, and review them in the light of the experience they may have gained both in this country and elsewhere, and of the information they may possess, or be able to ascertain of the specialities obtaining in other countries.

2. The particular points which appear to call for consideration may be grouped under four heads (as follow), but it will be open to the Conference to extend the scope of their enquiry, if they should think that the general object in view is likely to be furthered thereby :—

1st.—The form of construction and the internal arrangements suitable for passenger carriages. The classes into which passenger traffic should be divided, with which is intimately connected the facilities for obtaining reserved accommodation.

2nd.—The kind of wagon best suited for merchandise traffic, and the varieties in capacity in case it may be thought desirable to have wagons differing much in size either on the same or on different Railways.

3rd.—The system of working the traffic. This will constitute a somewhat wide field of enquiry. By the system generally, but not universally, in vogue in England and India, the transit of trains is regulated by clerks in charge of local stations, who endeavour to conform to the times printed in the time-bills, and this system may usefully be contrasted with the results where the traffic is regulated from a Central Office, and where the authority of the station clerks is reduced.

4th.—The advantage of having two classes of goods service (fast and slow), and the question of introducing a differential scale of charges for the same. In connection with this, the expediency of a mixed (passenger and goods) service may also be considered.

3. In order to obtain a result valuable alike to the undertakings they represent, and to the State, the Governor General in Council necessarily looks to the Agents of the Guaranteed Companies to further the end in view by making available the service of some of their Officers to attend the Conference. It is proposed that the Conference shall be held in Calcutta about the end of the year, if that time should prove generally convenient, and the gentlemen whose special experience and qualifications at present suggest to the Government of India for nomination are—Mr. Conder, of the Great Indian Peninsula Railway, Mr. Cooke, of the Oudh and Rohilkhand Railway, Mr. Batchelor and Mr. Pearce, of the East Indian Railway, and Mr. Prestage, of the Eastern Bengal Railway. With these gentlemen would be associated Mr. Imbrie Miller, who will be able to give information regarding Railways in the United States, Captain deBourbel, R. E., and Major F. S. Taylor, R. E., who will preside.

4. The Conference should draw up a formal report of their deliberations to be submitted by the President to the Public Works Department of the Government of India. The precise time of meeting should be arranged by Major Taylor in communication with the members after it has been ascertained by the Government of India that their services can be made available somewhat about the time indicated.

5. The Governor General in Council is inclined to think that very great advantage would accrue to Railway administration generally, if an annual Congress were held at some convenient station, not necessarily always the same, to discuss Railway questions of common interest. Highly useful results might be looked for from the deliberations of such a Congress if attended by delegates from different Railways and by Government Officers

connected therewith, and His Excellency in Council would wish the manner of giving practical effect to this idea to be considered at the ensuing Conference before it separates.

ORDER.—Ordered, that this Resolution be communicated to the Governments of Bombay and Bengal, and to the Chief Commissioner of Oudh, with a request that it may be reported whether the services of the gentlemen named can be made available for the purpose indicated about the time mentioned.

No. 2073 G, dated 18th October, 1870.

Endorsed by the Govt. of Bengal, in the P. W. Dept., Railway Branch.

Copy of the above forwarded to the Chairman, Board of Agency, East Indian Railway, with the request that the services of the Officers named may be made available at the proposed Conference.

No. 2074 G.

Copy of the above forwarded to the Agent, Eastern Bengal Railway Company, with the request that the services of the Officers named may be made available at the proposed Conference.

No. 586 G, dated 31st October, 1870.

From—C. STEPHENSON, Esq., for Chairman, Board of Agency, E. I. Railway,

To—Consulting Engineer to the Government of Bengal, Railway Dept.

I have the honor to acknowledge Joint-Secretary's docket No. 2073 G of 18th instant, transmitting copy of Resolution No. 1635 R, dated 26th ultimo, by the Government of India in the Public Works Department, proposing a Conference of certain Officers to assemble in Calcutta about the end of the year to discuss the question of the general form of vehicle stock for India, and the system of working the traffic, and nominating certain Railway and Government Officers to be present at the Meeting.

In reference to the request of the Government, that Messrs. Batchelor and Pearce may be invited to attend on behalf of this Company, the Agency have no objection to their services being made available for the purpose about the time decided, if they are willing to serve, but on the distinct understanding that they are not delegates representing the East Indian Railway, but record only their own individual opinions.

As it is presumed that the object of the Meeting is to elicit full information, it would be advisable to nominate the Traffic Manager, Locomotive Superintendent, and Carriage and Wagon Superintendent of each Railway, instead of selecting individuals on no apparent principle. In any case, the Punjab Railway should be represented in any such Conference on this side of India.

No. 2174 G, dated 8th November, 1870.

From—MAJOR F. S. TAYLOR, R. E., Joint Secy. to the Govt. of Bengal, in the P. W. Dept., Railway Branch,

To—Officiating Secretary to the Government of India, P. W. Dept.

With reference to Public Works Department No. 1635 R, dated 26th September last, I am directed to forward, for such consideration as it may deserve, a copy of letter No. 586, dated 31st October, from the Chairman, Board of Agency, East Indian Railway, on the subject of the proposed Congress for the discussion of certain questions relating to Railway working, and to express a hope that the Congress may arrive at a practical conclusion on one or more of the points raised. The services of the Consulting Engineer will, I am to state, be made available on the date which may be finally fixed.

No. 1803 R, dated 18th November, 1870.

From—MAJOR E. C. S. WILLIAMS, R. E., Depy. Secy. to the Govt. of India, P. W. Dept.,
To—Joint Secretary to the Government of Bengal, in the P. W. Dept., Railway Branch.

I am directed to acknowledge the receipt of your letter No. 2174 G of the 8th November 1870, submitting copy of a letter from the Board of Agency, East Indian Railway, on the subject of the proposed Conference at the end of the year for the discussion of questions relative to the pattern and description of

vehicle stock best suited to Indian Railways, and other matters connected with the working of the traffic.

2. The services of Mr. Conder, of the Great Indian Peninsula Railway, will be available for the Conference, and I am to enclose copy of a letter received on the subject from the Government of Bombay for communication to Major Taylor, who should communicate the exact date (when decided) of meeting to the several members of the Committee.

3. I am to take this opportunity of requesting that Major Taylor may be informed that the papers read at the head of Public Works Department Resolution Nos. 1634-6 R of 26th September 1870, should be placed before the Conference, and if any of these papers are not now with him, they will be supplied on his application.

4. Mr. Imbrie Miller has been requested to lay before the Conference plans of the American carriages, and Mr. Kline has also been directed to attend the Meeting to afford any information in his possession on the subjects to be considered, on being summoned to do so by the President.

No. 1479, dated 3rd November, 1870.

From—The Secy. to the Govt. of Bombay, in the P. W. Dept., Railway Branch,
To—Secretary to the Government of India, P. W. Dept.

In reply to your letter No. 1634 R of the 26th September, I am directed to state that Mr. Conder's services can be spared for attendance at the proposed Conference in Calcutta at the end of the year.

No. 2326 G, dated 28th November, 1870.

From—MAJOR F. S. TAYLOR, R. E., Joint Secy. to the Govt. of Bengal, in the P. W. Dept., Railway Branch,
To—Officiating Secretary to the Government of India, P. W. Dept.

With reference to your letter No. 1803 R, dated 18th instant, on the subject of the proposed Conference for the discussion of certain Railway questions of common interest, I am directed to enquire whether the Government of India has any objection to include an Officer of the Delhi Railway Company, and to suggest that the Lieutenant Governor of the Punjab may be requested to name a member for the Conference.

No. 2010 R, dated 13th December, 1870.

From—MAJOR E. C. S. WILLIAMS, R. E., Depy. Secy. to the Govt. of India, P. W. Dept.,
To—Joint Secy. to the Govt. of Bengal, in the P. W. Dept., Railway Branch.

In reply to your letter No. 2326 G of the 28th November 1870, proposing that a member of the staff of the Sindh, Punjab and Delhi Railway Company should be requested to join the forthcoming Conference on certain Railway matters, I am directed to state that it is deemed inexpedient to increase the number of Officers (already eight) invited to attend. Special questions are to be considered, and the Officers who have been selected are well-fitted by the variety of their experience to discuss them. Should, however, the Lieutenant Governor of the Punjab desire that the views on the particular subjects to be considered, which may be held either by the Railway Officers of His Honor's Government, or by the Company in the Punjab, should be placed before the Conference, Major Taylor will be at liberty to submit them on being placed in possession of those views.

No. 2517 G, dated 29th December, 1870.

From—MAJOR F. S. TAYLOR, R. E., Joint Secy. to the Govt. of Bengal, in the P. W. Dept., Railway Branch,
To—Officiating Secretary to the Government of India, P. W. Dept.

With reference to this Office letter No. 2174 G, dated 8th November, and subsequent correspondence on the subject of the Railway Conference convened by the Governor General in Council, I am directed to forward for the information of the Government of India, a copy of a

letter No. 2380, dated 6th December, to the Chairman, Board of Agency, East Indian Railway, and of its enclosures, and to state that the difficulty has been removed, and the date of Meeting definitely fixed for the 11th January.

2. I am at the same time to enquire whether the Government of India has considered the question of remunerating the non-official members of the Conference. Under the circumstances, the Lieutenant Governor would suggest that the actual travelling expenses of the non-official members, with Rs. 15 per diem for the three days the Conference will sit in Calcutta, may be allowed to them.

No. 2380, dated 6th December, 1870.

From—MAJOR F. S. TAYLOR, R. E., Consq. Engr. to the Govt. of Bengal, Railway Dept.,
To—Chairman, Board of Agency, East Indian Railway.

With reference to your letter No. 5869, dated 31st October, on the subject of the Conference convened by the Government of India for the consideration of certain Railway questions of common interest, I have the honor to invite your attention to the enclosed letter No. 685 G—O, dated 1st December, from Mr. Batchelor to my address, in which he states that he considers it useless for him to attend after this expression of the views of the Board of Agency.

2. As, however, His Excellency the Governor General in Council has been pleased to nominate the members of the Conference, instead of inviting the Railway Companies concerned to send representatives, I infer that members will attend as professional advisers of Government, and I shall feel obliged by your pointing this out to Mr. Batchelor, at the same time satisfying him (as I trust is the case) that the Board of Agency had no intention of throwing any obstacle in the way of the Conference.

3. I have also to invite your attention to the enclosed letter No. 10808 B, dated 5th December, from Mr. Pearce to my address.

No. 685 G—O, dated 1st December, 1870.

From—J. C. BATCHELOR, Esq., Traffic Manager, E. I. Railway,
To—Consulting Engineer to the Government of Bengal, Railway Dept.

I beg to acknowledge the receipt of your letter of the 25th ultimo, and enclosure, in reference to which, I regret I cannot attend the Meeting you refer to, as my doing so would be useless under Agency letter No. 5869 of 31st October to your address, seeing that to effect the object you have in view, and in which I wish you every success, unanimity and cordial co-operation between representatives of the leading Companies appear to be absolutely necessary.

No. 10808 B, dated 5th December, 1870.

From—R. W. PEARCE, Esq., Carriage and Wagon Supdt., E. I. Railway,
To—Consulting Engineer to the Government of Bengal, Railway Dept.

I beg to acknowledge the receipt of your Circular No. 2319 of 25th ultimo, and beg to inform you that I have as yet received no instructions from the Board of Agency on the subject.

APPENDIX B.

Nos. 2316-22 G, dated 25th November, 1870.

From—MAJOR F. S. TAYLOR, R. E., Joint Secy. to the Govt. of Bengal, in the P. W. Dept., Railway Branch,

To—F. PRESTAGE, Esq.

H. CONDER, Esq.

J. C. BATCHELOR, Esq.

R. W. PEARCE, Esq.

J. G. COOKE, Esq.

IMBRIE MILLER, Esq.

CAPTAIN R. DEBOURBEL, R. E.

As I have been instructed to preside at the Conference which His Excellency the Governor General in Council has convened for the discussion of certain Railway subjects of common interest, I have the honour to suggest

that each member should prepare beforehand a memorandum explanatory of the arrangements in force on the Railway with which he is connected (illustrated with sketches of the interior arrangements of carriages) and embodying his own views on the several points indicated in Resolution No. 635R, dated 26th September, a copy of which is circulated herewith.

2. These memoranda should, I propose, be read and explained in succession prior to the general discussion, and by this means the points on which the greatest dissimilarity of opinion now exists will be at once indicated, and a basis for further argument obtained in the shortest possible time.

3. I also take this opportunity to name 11 A. M. on Monday, the 11th December, as the date of Meeting, and my Office, No. 21, Dalhousie Square, Calcutta, as the place, and shall be glad to learn by telegraph, if necessary, whether the engagements of members will allow of their attendance on that and the two following days, as I propose that the deliberations should, if necessary, be allowed to extend over two clear days, leaving the third for the confirmation of the proceedings.

Nos. 2496-2502G, dated 27th December, 1870.

From—MAJOR F. S. TAYLOR, R. E., Joint Secy. to the Govt. of Bengal, in the P. W. Dept., Railway Branch.

To—F. PRESTAGE, Esq.

H. CONDER, Esq.

J. C. BATCHELOR, Esq.

R. W. PEARCE, Esq.

J. G. COOKE, Esq.

IMBRIE MILLER, Esq.

CAPTAIN R. DEBOURBEL, R. E.

With reference to my letter of the 25th November 1870, on the subject of the approaching Conference for the discussion of certain Railway subjects, I have now the honour to inform you that the date of Meeting has been definitely fixed for Wednesday, the 11th January, the place and hour remaining as before.

2. I also take this opportunity to circulate a memorandum prepared in the hope that, by defining the scope of the discussion more precisely, the sittings of the Conference may be readily curtailed within the limits assigned in my previous letter, and so far as the views expressed by me on the several subjects commend themselves to the judgment of members, I venture to solicit their co-operation.

3. I will also suggest that the Memoranda of members, if printed, should be of a uniform shape and be submitted with 75 spare copies for embodiment in the proceedings of the Conference.

Memorandum on matters for discussion at the Railway Conference, by

MAJOR F. S. TAYLOR, R. E.

PART I.

Passenger Carriages.

Until quite recently, the English pattern of both passenger and goods vehicles has been reproduced in India as a matter of course, and all the older railways are already fully stocked; the concessions to the climate have for passengers taken the shape of an increased allowance of sitting space and double roofs, and (in first class carriages only) sleeping berths; for goods, the use of covered wagons is now almost universal; the original dimensions have been somewhat enlarged, and stronger axles are being gradually substituted where necessary.

In first class carriages on the East Indian Railway, four passengers are now generally considered the full load of a compartment for long distances; in second class carriages, the actual average load is really less than four, owing to the paucity of applicants, but the full load is still supposed to be ten to a compartment; in third class carriages, ten passengers are now, I believe, considered the maximum for an ordinary compartment. All three classes of carriages are built strictly on English models, but the seats and venetians have been taken out of some third class carriages on both the East Indian and Eastern Bengal Railways to produce an inferior 3rd class, the total load remaining about the same; by this means, an intermediate class has been established on local trains to meet the wants of the better class of Natives, for which a higher fare is charged.

As a rule, the first class fare is double the second, and the intermediate double the third.

In England, long experience seems to have established the fact, that the public fully appreciates the advantage of three classes of accommodation, and that, with good management, trains can always be fairly filled at existing fares.

In America, one class is found to be sufficient for the general public, but a reserved carriage fitted up specially for long journeys has recently been introduced with success.

In India, the public has clearly not yet settled down into the groove prepared for it by Railway Companies, and it is lamentable to see an amount of accommodation wasted, which, if distributed more equally, would enable everybody to travel with comfort. The evil here noticed, instead of diminishing as additional lines of railway are opened for traffic, appears to be increasing, as all the endeavours to meet the difficulty have hitherto taken the shape of a further sub-division of classes, thereby throwing additional loss on the Company, and leading up to an increase of fares.

Against this tendency it is clearly advisable to struggle in the interests both of the public and the Railway Companies, and if the Conference can throw any fresh light on the subject, or can indicate the proper course to pursue, its labours will not be thrown away.

It seems to me that the principle followed by Railway Companies in the United States is a judicious one, and may serve as a guide for India. In America, the unit of charge has been reduced to a minimum, and all share alike; practically, the standard of comfort is far higher than in England, and the system thus tends obviously to encourage traffic.

In India there are, of course, the two races, European and Native, to be provided for, and two distinct classes of accommodation are indispensably necessary. In point of fact, two classes (and two classes only) of carriages are now running, and the sub-division is one of name and fare only.

Exigencies of the climate loudly demand the improvement of the first class stock running on the through mail trains, and concessions in this direction will, it may be hoped, by developing the long traffic, well pay the Companies, but the old first class carriage may still be accepted as well suited for the UPPER CLASS on ordinary trains. The LOWER CLASS is, in my opinion, suitably represented by the old third class carriage on the East Indian Railway,—a vehicle divided into a number of separate compartments to prevent over-crowding, and adapted for carrying as many passengers as possible with a due regard to their health. If the unit of charge for these two classes is reduced to a minimum, there can be little doubt they will carry the great bulk of the passenger traffic.

Any further provision that the Railway Companies undertake to make in addition to the two main classes is, I think, of the nature of reserved accommodation, and the use of such special carriages may, therefore, be regulated strictly by the demand.

By the fast mail train there is a steady demand for the very best accommodation, and it is to meet this requirement that I have recommended the construction of a Grand Saloon to be run in connection with the Ocean steamers,

and am also advocating the re-fitting of an adequate number of the old first class carriages on the East Indian Railway; application in advance for this reserved accommodation should, I think, be encouraged. By all trains there will, in addition to the above, be a limited class of Europeans and Natives, whose main object is economy, but who are ready and willing to pay for separation from the masses, and the question is—how best to meet this requirement. The old second class carriage is open from end to end, and is utterly unsuited for the accommodation of a heterogeneous freight; Military Officers with their families, and Railway employés, now almost monopolise the vehicles of this class, on this side of India at all events, and they are consequently run at a dead loss to the Companies. To render this class of carriage at all suited for the purpose of segregation, it should be suitably divided by bulk-heads. If this is done, it would be ridiculous to retain the present rate of fare, for the only inducement to use it was contingent on its comparative emptiness; but at a fare of $4\frac{1}{2}$ pie it would, I am inclined to think, fill fairly certain trains and meet the wants of the better class of Natives. Nor must it be forgotten that a Railway Company is in a position to encourage the use of its special class carriages by offering, on previous application, to reserve one or more entire compartments on liberal terms.

But not only has a Railway Company in India to meet the requirements of two distinct races, it is further necessary to protect the public from the rudeness of a small number of uneducated Europeans, to which class many of their own servants unfortunately belong; to meet this difficulty, I would suggest that one of the two brake-vans attached to every passenger train might be fitted up to carry a limited number of poor European passengers at a reduced rate, and the lower orders of Company's servants, who would thus be under the eye of the guard and out of the way of the better disposed classes of travellers.

The views here expressed seem to point to a conclusion in favour of four classes of accommodation—

Upper and lower first,
" and " third;

but I do not think the necessity could arise for having more than three classes of carriages on any one train, so that the designation 1st, 2nd and 3rd classes as used in England may remain unchanged. I would leave it to the Railway Companies to regulate the fares to suit particular times and rates of speed, provided the lower carriages of each class formed the nucleus of every train, and on the understanding that the maximum fare of these two classes is to be determined by Government.

By way of illustration, the fast mail train might comprise upper and lower first, and lower third; the local and slow passenger trains, lower first, upper and lower third. The fares being for Bengal—

A. P.		
1	6	per mile upper first
0	9	" lower "
0	$4\frac{1}{2}$	" upper third
0	3	" lower "

These recommendations are, I must add, made with the view of making the most of existing carriages, as the principal lines in India are already well stocked, and as it is obviously advisable that all additions to interchangeable carriages should be of the common pattern; and I suggest, therefore, that the Conference (on the present occasion at all events), should confine the discussion to the subject of the improvement of existing carriages, and the introduction of a common class nomenclature, and a uniform scale of accommodation.

PART II.

Goods Wagons.

As respects goods wagons, there can, I think, be little doubt that a medium sized water-tight and securely fastened wagon on two pair of wheels is the form best suited to India; many experiments have been made in the

direction of improved carrying capacity, and it now seems advisable that the maximum dimensions, and the limit of weight on axles, should be determined authoritatively. For interchangeable stock, a uniform pattern seems absolutely necessary, and wagons built expressly for any particular description of merchandise must, I think, be reserved for it alone; I suggest, therefore, that the discussion should, here also for the present, be confined to the subject of the improvement of existing wagon stock.

PART III.

Working.

In discussing the system of working, it will, I think, be the proper course to contrast the English "block system" with the American system, under which the trains are controlled by a train despatcher operating by telegraph from a Central Office.

The former is, doubtless, almost perfection when combined with perfect machinery for working the signals and points, and an intelligent staff of operators; the latter answers almost as perfectly under the very different conditions attending Railway traffic in the United States.

In India it must, I fear, be admitted that there is at present no system at all. The original rules and regulations sanctioned by Government are entirely obsolete, and each Railway Company is working on its own responsibility, and on rules framed to meet the special requirements of its traffic.

The peculiar conditions of traffic out of which the English block system has been elaborated will never, probably, be re-produced in India. I should be glad even to see the running speed of passenger trains limited to 25 miles an hour between stations, and 8 miles within distance signals, and then the necessity for its general introduction could, I think, never arise.

The precautions to be observed require to be determined authoritatively, and to this subject I invite the attention of the Conference. On a single line, the driver's "line-clear" message seems an absolutely necessary precaution, but it may be safely used in the more scientific way adopted in America, where a competent Officer in a Central Office is held responsible for the passing of the trains, and the time-table itself is the line-clear message for all drivers and guards to whom it is issued, provided they can keep their time after they have been started.

The economy of the American system (which dispenses with Station Masters, pointsmen, and signals), for lines which have not sufficient traffic to earn a dividend, should be its chief recommendation. I have myself, without any practical experience, introduced it on the Calcutta and South-Eastern (State) Railway with complete success, and the line now, in face of every possible disadvantage, pays its working expenses. For branch lines it would save almost the whole of the cost of the terminal establishment.

PART IV.

Mixed Trains.

The advantage of having a fast service for goods is not, I believe, appreciated in India, and the staples of traffic are not of a class requiring speedy handling; cheap carriage is the main *desideratum* on long lines, and any concessions the Companies can afford ought, I think, to take the shape of a rebate according to distance. I would suggest this, and the question of differential rates generally, as the subjects for discussion on the present occasion. A system of mixed trains, which may mean either the completion of a passenger train with goods wagons to obtain a full load, or the attachment of one or more passenger carriages to a goods train to meet the requirements of local traffic, is one of too obvious advantage to need, I think, special discussion.

E. S. TAYLOR, Major, R. E.

FORT WILLIAM, }
The 1st December 1870. }

Supplementary Memorandum for discussion at the Railway Conference,
by MAJOR F. S. TAYLOR, R. E.

The attention of members is solicited to the annexed letters on the subject of the communication between passengers and guards on trains in motion, and I would suggest that the Conference record an opinion on the questions raised by Government and the East Indian Railway Company.

Extract from the General Rules and Regulations.

"Section I, Clause 6.—To enable the guard to call the attention of the driver, on some convenient part of each tender shall be suspended a bell with a lever arm, to which shall be attached a cord, passing through spring brackets fixed on the top or along the sides of all the carriages in the train and terminating in the guard's van. No carriage, truck or horse-box shall be attached to a passenger train unless it be provided with brackets to carry the cord above-mentioned. When the guard may have occasion to call the attention of the engine-driver, he will pull the cord and sound the bell."

No. 673 R, dated 7th June, 1869.

From—MAJOR E. C. S. WILLIAMS, R. E., *Under Secy. to the Govt. of India, P. W. Dept.*,
To—*Offg. Joint Secy. to the Govt. of Bengal, in the P. W. Dept., Railway Branch.*

Referring to the question of communication between guard and engine and passengers while a train is in motion, I am directed to bring to the notice of the Government of Bengal, that the question has been recently disposed of in England, on the majority of the lines for the north of England, by a rope in the old way, but hung over instead of below the door of the carriage as formerly, so that the passengers can get to it as well as the guard at the end of the train.

2. Until something better is devised, this simple expedient should be adopted on the Railways under the control of the Government of Bengal.

No. 663 G, dated 19th December, 1870.

From—E. PALMER, Esq., *Chairman, Board of Agency, E. I. Railway*,
To—*Consulting Engineer to the Government of Bengal, Railway Dept.*

The Agency have the honour to request that the Government will sanction the discontinuance of the use of the communication-cord on the slow passenger (mixed) trains.

They understand that its use is not imperative on the Great Indian Peninsula Railway, and although it has now been applied to this Company's trains for a long time, it does not appear that it has ever once been employed.

The Superintendent of the Carriage and Wagon Department speaks of it as a costly and troublesome arrangement.

Supplementary Memorandum for discussion at the Railway Conference,
by MAJOR F. S. TAYLOR, R. E.

The attention of the members is solicited to the annexed papers on the subject of the locking of the doors of passenger carriages of trains in motion, and I would suggest that the Conference record an opinion as to the proper course to be adopted.

No. 17 R, dated 3rd October, 1866.

From—LIEUT.-COL. C. H. DICKENS, R. A., *Secy. to the Govt. of India, P. W. Dept.*,
To—*Joint Secretary to the Government of Bengal, in the P. W. Dept., Ry. Branch.*

With Public Works Department Resolution Nos. 383—GR of the 24th April 1866, an extract of a Despatch from the Secretary of State for India, to the Government of Bombay, was communicated, and opinions were invited on the advisability and necessity of locking the doors of passenger carriages of trains in motion. I am now directed to forward an abstract of the replies which have been received, and in observing that the balance of opinion is in favour of locking the doors of 1st and 2nd class passenger carriages on one

side only, to state that while the Government of India adopt that opinion, they consider that it may properly be left to each Government concerned to determine the practice on the Railways under their control as respects all classes of carriages.

Extract from a Despatch from the Secretary of State for India, to the Government of Bombay, No. 48, dated 24th December, 1866.

PARA. 15.—"With regard to locking doors of Railway passenger carriages, I think with you, that the several Local Governments had better be left to select, each for itself, what may be deemed the most suitable practice for the Railways under its control. At the same time, however, the custom which prevails on the Madras Railway, of securing carriage doors by a bar and catch that can be opened without much difficulty, seems preferable to locking them."

APPENDIX C.

Memorandum by MR. J. G. COOKE, Locomotive Superintendent of the Oudh and Rohilkhand Railway, for the Conference called under the Government of India Resolution No. 1635R of 26th September 1870, Public Works Department.

Major Taylor observes with respect to India, that the public has clearly not settled down into the groove prepared for it by Railway Companies, and he deplores the waste of accommodation which undoubtedly exists. In this I concur, and I also think that the endeavours to meet the difficulty by further sub-division of classes is disadvantageous to the Companies. The suggestions contained in Major General Beadle's Note, to have only two classes, appear to me to solve this problem. The upper class affords comfortable accommodation for Europeans at a moderate cost, and places reserved compartments within the means of many who could not afford to take four first class seats at the 1½ anna rate. By placing the upper and lower classes in one vehicle, and arranging the space allotted to the lower class so that when filled it will a little more than cover the cost of running, the earnings of the upper compartments will be clear profit. It will only be necessary to have a few composite carriages, because lower class passengers far outnumber the others; and the lower class compartments of the composite will be mostly kept as reserved compartments to be filled accordingly. The proportion of upper to lower class compartments has to be decided; but I do not think that any proportion could, with advantage, be definitely fixed at present, as it must depend upon the character of the passenger traffic.

The American system of carriage, if used in this country, would not be as convenient as the English form, with separate compartments and side doors; and it would be necessary to have special carriages for reserved accommodation. One of the great advantages of a long carriage is to have a clear passage down the centre, so that the Conductor may pass from end to end of the train for the purpose of collecting tickets, and that the seats may be arranged to seat the passengers with their backs or faces to the engine at pleasure. I will suppose an upper and lower composite carriage so constructed: it will then be necessary to divide the two by a bulk-head, and the centre passage is at once lost. Again, as the entrances are at the ends, there could be no reserved compartment without the passengers passing through the other portion of the carriage to get at it; so that in the case of reserved accommodation, you would have to break through the plan and have a portion partitioned off in the centre, with side doors, or have a separate carriage. The two classes on the English or present system avoid the special vehicle, and offer greater facilities to passengers for stowing the baggage they take with them in the carriage.

I am not averse to the American system in America or in Mexico (where I had many carriages of the kind) because the people understand them, and do not mind being together. But in India, where there are Europeans and Natives of various ranks and castes, it would not be found to answer.

Still, I think there is no reason why the American pattern should not be used in India for special purposes. Take, for instance, the movement of troops,—would it not answer for the Government to have carriages built specially for troops, to be maintained by Government, and used only for that purpose, paying the Railway Companies so much per vehicle for passing over their lines? Carriages thus applied might be fitted up to supply camp and kitchen on a long journey, and transhipment would thus be avoided.

Major Taylor's roof and sleeping carriages for troops would answer admirably, and render the carriages habitable, with ordinary cooling appliances, even in the hottest weather.

GOODS WAGONS.

Covered wagons are, in my opinion, best suited for this part of India. The under-frames should be wide and strongly built, with the superstructure as light as is consistent with stability; but the axles and springs should be strong enough to carry at least twice the weight of the entire wagon. The length should not be greater than necessary for a capacity for twice its own weight. Axles should be parallel, and not be reduced in the centre, which is too frequently done. The journals being outside the wheels, cause the axles to bend when weakened in the centre. I look upon this as a great cause for friction, and altogether an error in the construction of wagon axles.

Timber trucks require improvements. A double bogie truck with lower centre of gravity might be an improvement.

WORKING.

The line-clear message for a single line is good and simple. Why should it not be used on a double line, each line of which can be worked so that no two trains are between stations on the same line at one time? The American system leaves the stations short-handed, and, in the event of the Telegraph getting out of order, would, in this country, cause confusion and uncertainty.

In America, the operator in the Central Office has a wooden diagram of the whole line with the stations marked. The line is represented by a groove in the wooden diagram, in which slide small numbered buttons to represent the trains. These buttons are moved on from station to station on the diagram as the train progresses on its journey. By looking at the diagram, the operator at once knows the position of all trains. I look upon the wooden diagram as a most important feature in this system.

TIME.

To run trains correctly to time, and to prevent difference of clocks, I propose the following system:—That every driver and guard, when on duty, be provided with a watch, locked up in a small brass case, which should fit on to a hook on the engine and in the van.

These watches are to be corrected, wound up, and locked into the case before the starting of each train, and each station clock along the line set by the watch of the guard. In this way, the same time is kept at all stations, and the guard's and driver's time always agreed. The standard time will be kept at the Central Station, where there should be a responsible person to look after it and to correct the watches.

Suppose, for example, that a guard and driver run from Lucknow to Aekburpoor; they have their watches corrected before starting and locked, so that they cannot possibly alter them. When they get to Aekburpoor, they report the correct time to the person in charge, and he again corrects the watches of the men who continue the journey to Benares. In the same case, and above the watch, I would place a small box with a glass front, which contains cards with time-tables for each train printed plainly on them. The driver places the one he requires in front, and so has his time-table and watch before him without putting his hand in his pocket. I may add that the watches rest on a soft India-rubber cushion to prevent the vibration from deranging their movements.

LUCKNOW:
The 5th January 1871. }

J. G. COOKE,
Locomotive Superintendent.

Memorandum by MR. H. CONDER, General Traffic Manager of the Great Indian Peninsula Railway, for the Conference called under the Government of India Resolution, No. 1635 R of 26th September 1870, Public Works Department.

The second paragraph of the Resolution specifically mentions four questions for discussion, and I take each one separately:—

1st.—Passenger carriages, and the classes into which passenger traffic should be divided.

The forms of passenger carriage which appear to be most useful, and which, at any rate, are most in demand upon this Railway, are those which provide a compartment suited for a small party, with easy access to the necessary washing and water-closet accommodation, and carriages are being provided for such a party at moderate cost. A number of new first class have sleeping accommodation for twelve persons, six in each half, with separate arrangements for washing, &c., for each half (a drawing of these carriages is attached). They can be reserved, either the whole or half only, upon twelve or six tickets respectively being taken.

Some new second class carriages are being provided (of which some are now running) of similar construction, and provided with water-closet accommodation for each half. They can be reserved, either the whole or half separately, by taking ten tickets for each half (a drawing is attached).

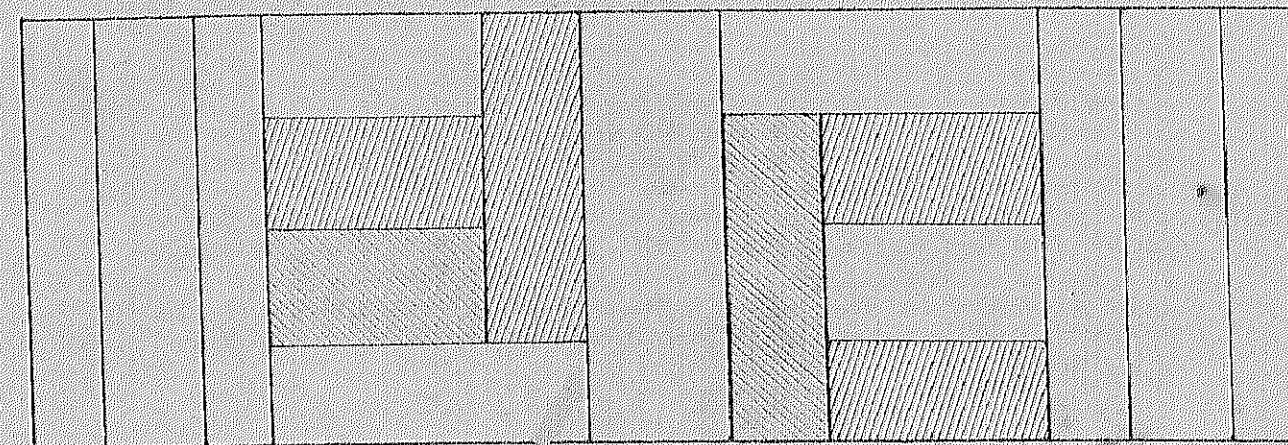
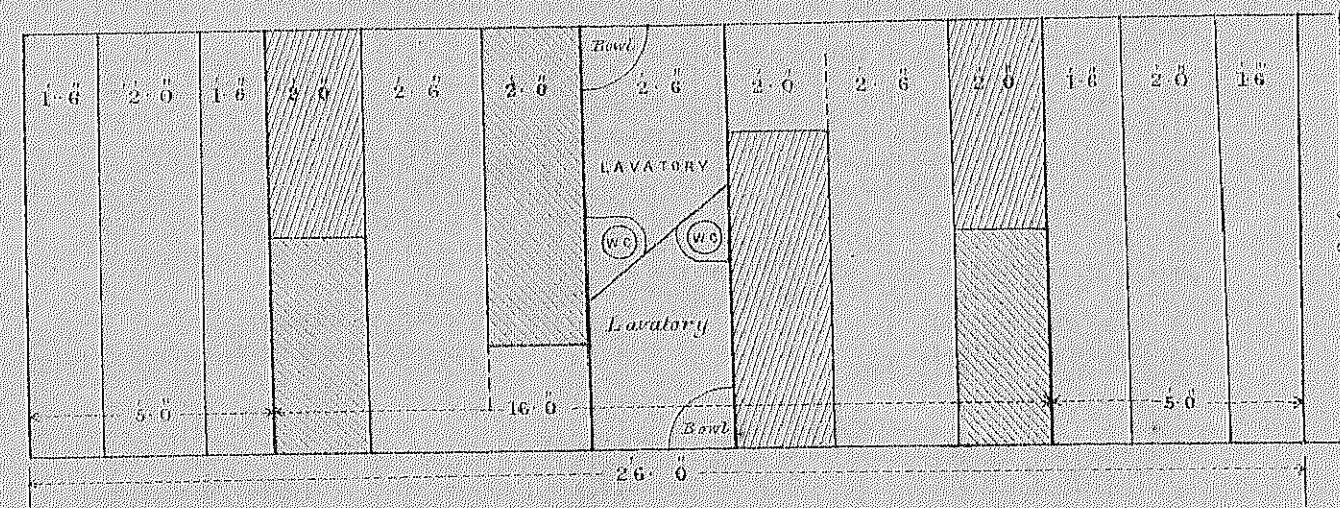
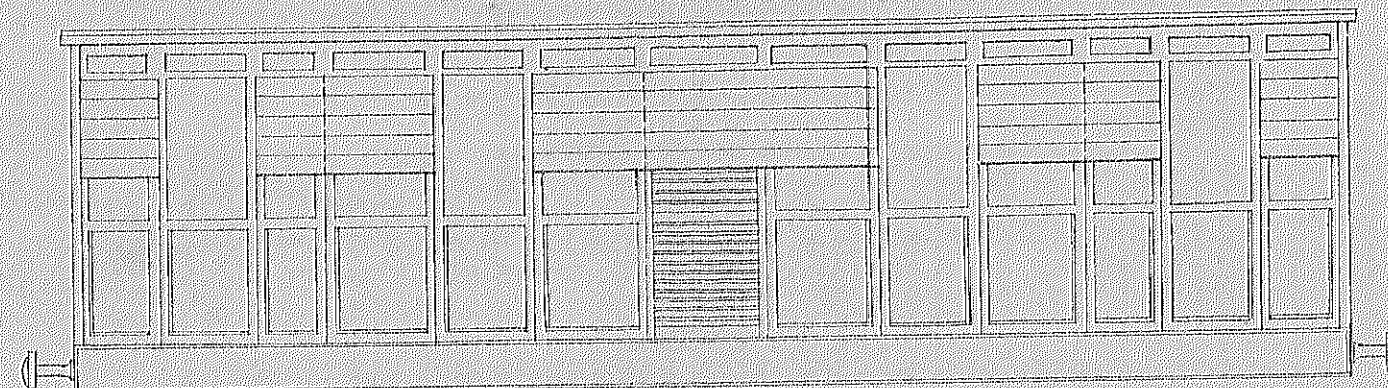
O. & R. R.

PLAN

OF

PROPOSED UPPER CLASS

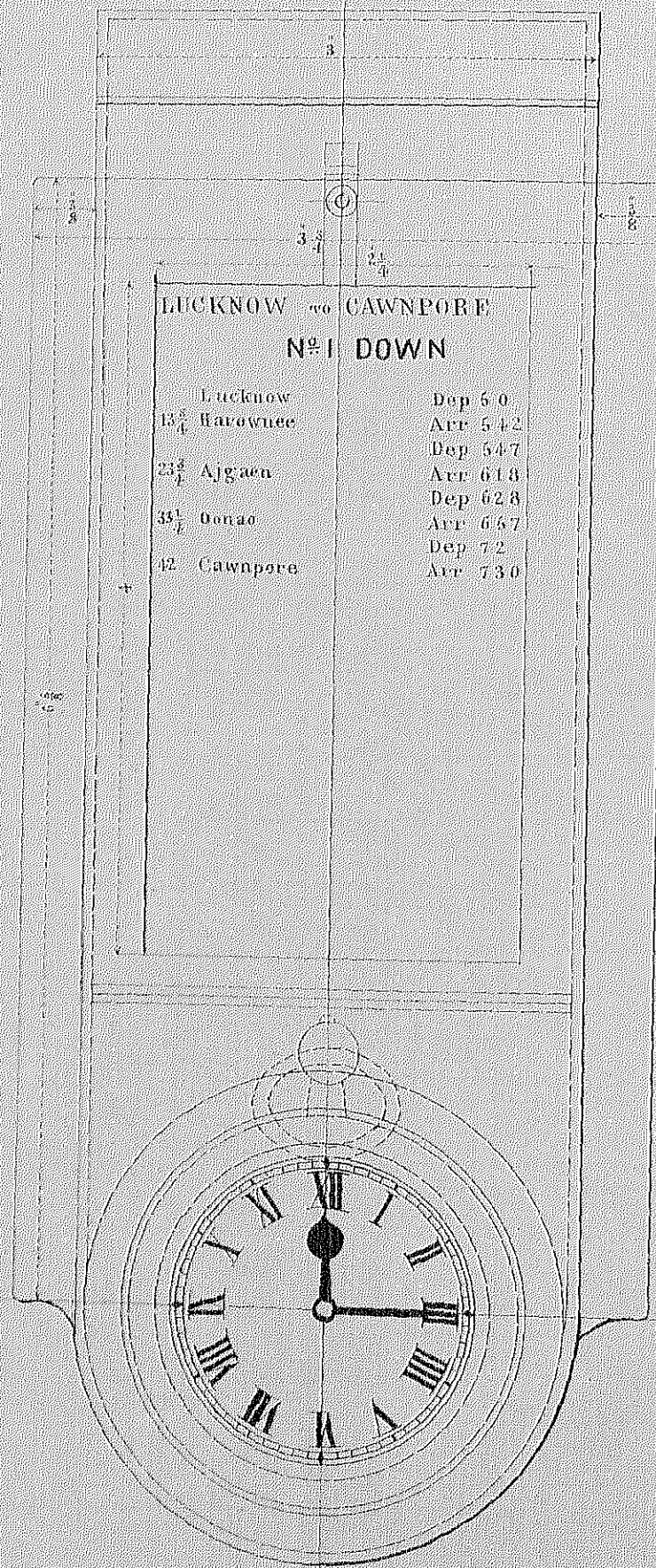
COMPOSITE CARRIAGE.

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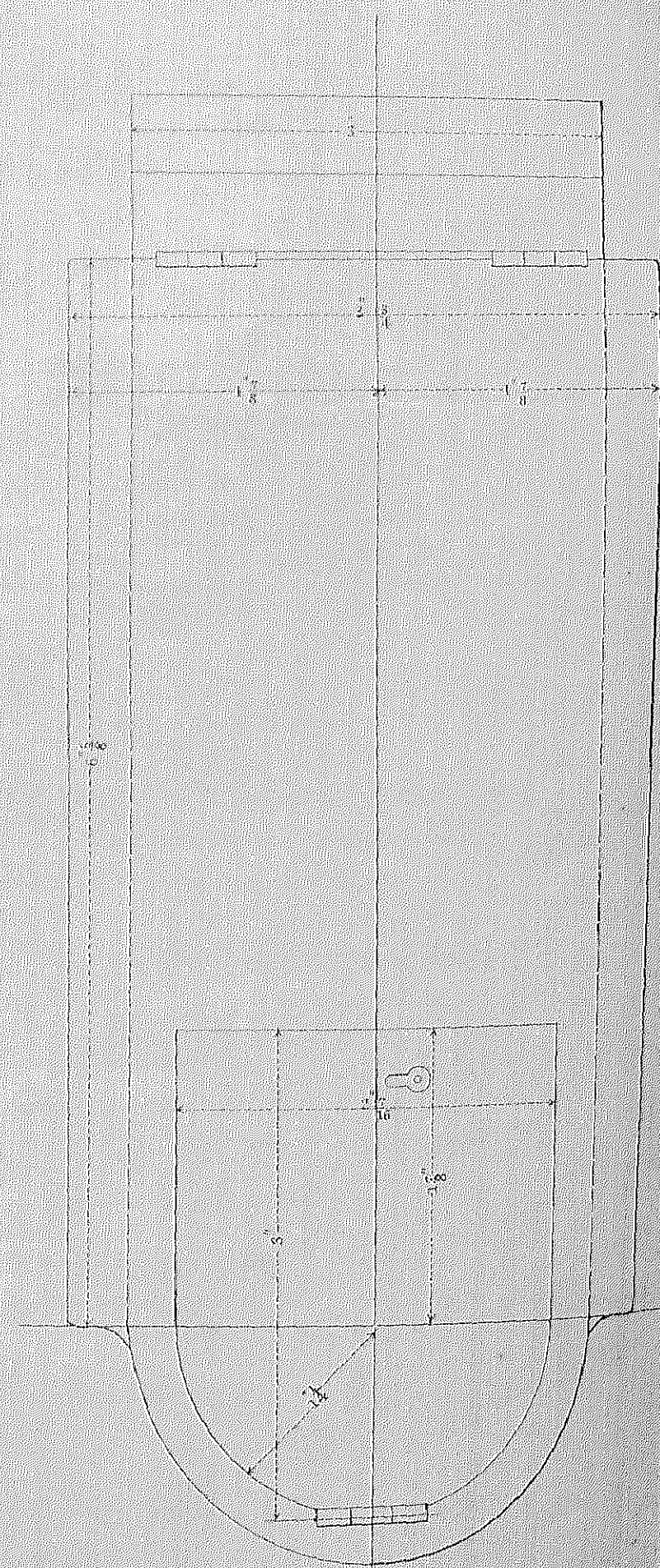
The long seat in the upper class compartment is to be made in two halves each of which is to be round forming a longitudinal couch to be placed either in the centre or at the sides as may be agreeable.

O. & R. R.
LOCK UP WATCH CASE
 For Engines & Brakevans

Nº 91



Full Size



For first and second class carriages I consider that in all essential respects these are the most convenient and most suitable form of carriages yet produced for India. They are very much in request for the long through traffic between the East Indian and Great Indian Peninsula Railways, and are very much liked by the public.

In connection with this matter, although not a question directly referred to this Conference, I may add that we are very anxious to introduce the plan, adopted to a very large extent in England, of through carriages, the joint property of the Railways forming the through route between Calcutta and Bombay, and between Madras and Bombay, paid for in proportion to the mileage of the Railways respectively forming the through routes, and to be kept for use on the through mail trains. I mentioned this matter to the East Indian Board of Agency in December 1869, and to the Madras Company's Agent in November last. The through route, Calcutta to Bombay, was not then open, but I hope that now some steps may be taken to carry out the suggestion as respects that route, and that the matter will be considered by the Madras Railway, the route from Bombay to Madras being near completion.

For third class passengers a carriage to carry 40 passengers is in use on the Great Indian Peninsula Railway. They are without the division into compartments with which those of the East Indian are provided. The division enables the East Indian to get 50 in the carriage, or ten in each of five compartments, and I think it is in many respects an improvement. The Great Indian Peninsula third class carriages are reserved on payment of 40 third class fares.

Some fourth class carriages are running on the cooly mixed (passenger and goods) trains on the Great Indian Peninsula Railway. The fare charged is $2\frac{1}{2}$ pies per mile. The carriages are without seats, and 40 or 50 passengers are carried in them.

I do not see the necessity for any alteration of the classes into which passenger traffic is divided. As a matter of practice, the present division is found to suit all sections of passengers on the Bombay side of India.

Reserved accommodation is often asked for in third as well as first and second class carriages, and there is no difficulty in procuring it. Neither is there any difficulty in providing separate accommodation for Natives and Europeans, or for men and women passengers. The limited first and second class traffic on Indian Railways does not make these matters points which require very elaborate arrangements to be made to meet them. Each Company is, I imagine, in a position to do all that is necessary with their ordinary carriages, and with the present division of classes.

2nd.—Goods vehicles.

I agree with those who have said that a wagon with four wheels weighing about five tons, and capable of carrying seven or eight tons, is the most convenient and economical one for India.

I have had the average load per wagon throughout the Great Indian Peninsula Railway taken out. That line is divided into four districts. The average load in two districts for eleven months was a little over 127 maunds; in another for eleven months it was slightly over 118 maunds; and in the fourth for nine months it was over 122 maunds per wagon. The averages are greatly reduced by light goods, such as docra cotton, of which only $2\frac{1}{2}$ tons can be put in our large cotton wagons. Some districts send sheep in large numbers to Bombay, and they are included in these loads, and tend to reduce the average. Hay and grass are sent in large quantities, and are of comparatively light weight. Other things also reduce the average, and at small stations small quantities of bulky goods which it is not desirable to keep on hand, tend in the same direction. But I think an average of nearly five tons does not leave much to complain of with respect to the loads, and, practically, I believe it may be taken as about the ruling average load for goods traffic for the Great Indian Peninsula Line, whatever the carrying capacity of the wagons may be.

A dead weight of 5 tons to a paying load of 7 or $7\frac{1}{2}$ tons is, it appears to me, a fair proportion; and I do not think that lighter wagons to carry the same or heavier loads would be an economical or desirable class of vehicle. Such lighter wagons would be very greatly depreciated by the wear and tear to which they are exposed, and would not so well bear the strain upon them which their use in this country especially involves.

Two classes of wagons kept exclusively for through and local traffic are not, I consider, either desirable or economical. They would involve a great deal of extra running of wagons, and therefore of extra expense. The large traffic in docra cotton on the Great Indian Peninsula Line made it necessary to provide wagons of light construction capable of containing bulky but light loads. That is, however, exceptional, and can hardly be called a rule for general application, besides which it is found in practice on that line better to use these lighter wagons for general purposes rather than restrict their use to that class of cotton alone.

I do not see the need for a uniform style, either in design or capacity, of goods wagons for through traffic. The classes of traffic on different lines and different parts of India must always require to some extent diversity in these respects, but a vehicle of 5 tons weight to carry 7 to 8 tons of goods will, I believe, be found the most generally useful, and it must not be forgotten that the special wagons for any special traffic of either line are capable of general use on other lines.

3rd.—Method of working the traffic.

There will doubtless be information given at the Conference as to the American system.

It appears to me, however, that it cannot be an economical plan to have a highly paid man at head-quarters to arrange the crossing of trains under the circumstances of Indian Railways. So far as the Great Indian Peninsula Railway is concerned, the present staff do all that is necessary, and if they were relieved of crossing trains, they could not be reduced either in number or pay. At all stations, even the smallest, opened only as crossing stations at first, passengers are booked and the receipts in almost every case exceed the expenses. These small places are being gradually opened as goods stations, and in every case earn quite sufficient to justify the expense incurred in providing a siding, very little, if any, extra staff being required: so that it would not be good policy to abolish these crossing stations. They are placed at varying distances of from eight to ten miles throughout the line. The value of the crossing stations being thus established, no good would be gained by abolishing the present system. The Station Masters at large stations are specially authorized to cross trains at other than the regularly appointed places specified in the Working Timetables. They have always been found quite competent to exercise judiciously the discretion in this respect vested in them. I am not aware of any single accident or mishap having arisen from our plan, and when it is known that we do not pay more than Rs. 250 per month to any Station Master on the Great Indian Peninsula Railway, and that there are not more than about a dozen who are paid more than Rs. 150 per month, it will readily be believed that no alteration could result in reduction of expense. I consider, however, that our experience shows that the plan now in force provides quite as much security as any other system of crossing the trains.

A large part of the Great Indian Peninsula Railway is worked upon the block system, and the extension of that plan throughout the whole line is, I consider, essential to the safety of the public. I hope at no distant date to see it carried out. It may be remarked that there is no extra expense involved in working it, and that it reduces very considerably the chances of accident. It does not, however, affect the question of the plan of crossing the trains.

4th.—The two classes of goods trains, and differential rates for goods.

From papers I have seen, the terms fast and slow goods train service are, I am led to believe, understood to mean not fast or slow as regards speed per mile, but direct and stopping, in the sense of one service running through without detention, and the other, in the sense of wagons with partial loads being left at intermediate stations, for the load to be completed, or, if fully loaded, being left for some time in order that goods may accumulate so as to form a full train load, the charges being higher or lower according to the service.

In either case, I am of opinion that no difference of rate or train service is necessary. At large stations where many wagons are loaded each day, it is only natural that a full train should be made up and despatched to destination with little or no detentions. In this country, however, it is not often or every day that a train load would be consigned from one station to another, except, of course, with special descriptions of traffic. It is, moreover, to the interest of the Railway to get rid of goods with the least practicable delay; the longer they are in the Company's hands, the more risks there are of damage and loss. The system of road vans in which small consignments may be loaded, practically enables a Company to have most of the wagons pretty nearly loaded up to their proper carrying capacity. The mixed passenger and goods trains which the Great Indian Peninsula, and most of the other Companies in India, run, provide the means of avoiding the running of trains with only partial loads. During some parts of the year, and at some places, the mixed is the only regular daily train, and it enables us to clear traffic from small stations, leaving the goods trains themselves to be made up to full train loads at starting, or at large stations on the road.

Under the circumstances of the Great Indian Peninsula Railway, it would be impossible to put goods on to the mail and passenger trains. The loads of those trains are, in almost all cases, made up to the maximum. Our great difficulty is to reduce the load down to the maximum rather than the reverse, and our maximum loads will always, in consequence of our severe gradients, be lower than on other lines.

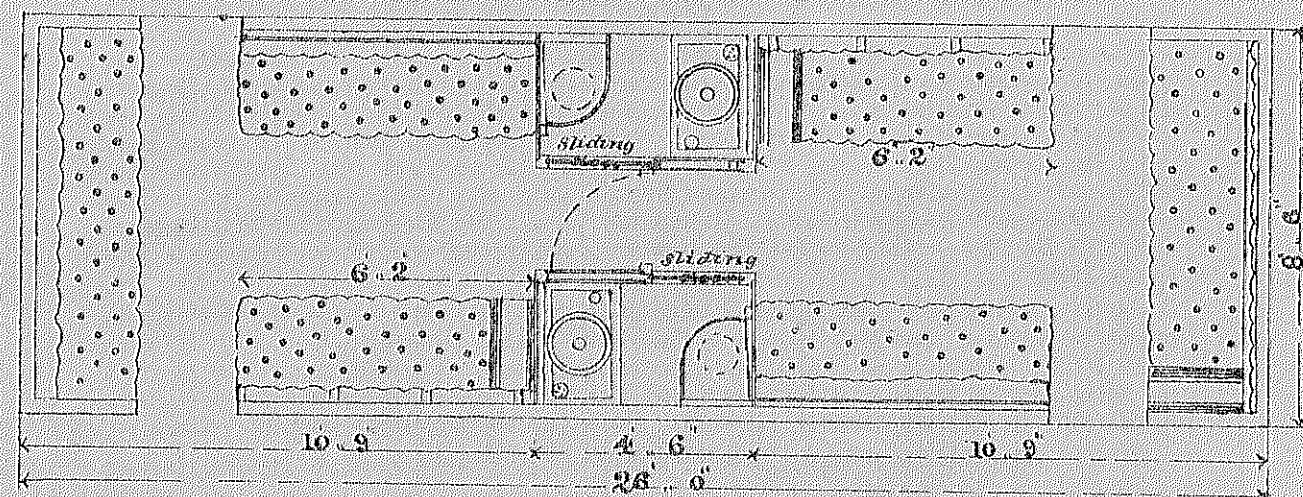
An average speed of 12 miles an hour, including stoppages, is, I consider, sufficient to meet all reasonable requirements of goods traffic; and 20 miles an hour, including stoppages, for mail and passenger trains ought to be accepted as quite high speeds, enough for this country, especially when it is borne in mind that the higher the speed, the greater the expense of working, of engine power, and of maintenance of stock and road, as well as, to some extent, increase of danger also.

With respect to para. 5 of the Resolution, I think an annual Conference for the discussion of matters of general interest to the Railways of India would be useful, if constituted under proper regulations and with clear and definite instructions, and a judicious selection of gentlemen from each Railway in the country to attend it. The place of meeting should, I think, vary, as suggested in the para. of the Resolution, it being settled at each Meeting where the next one should be held.

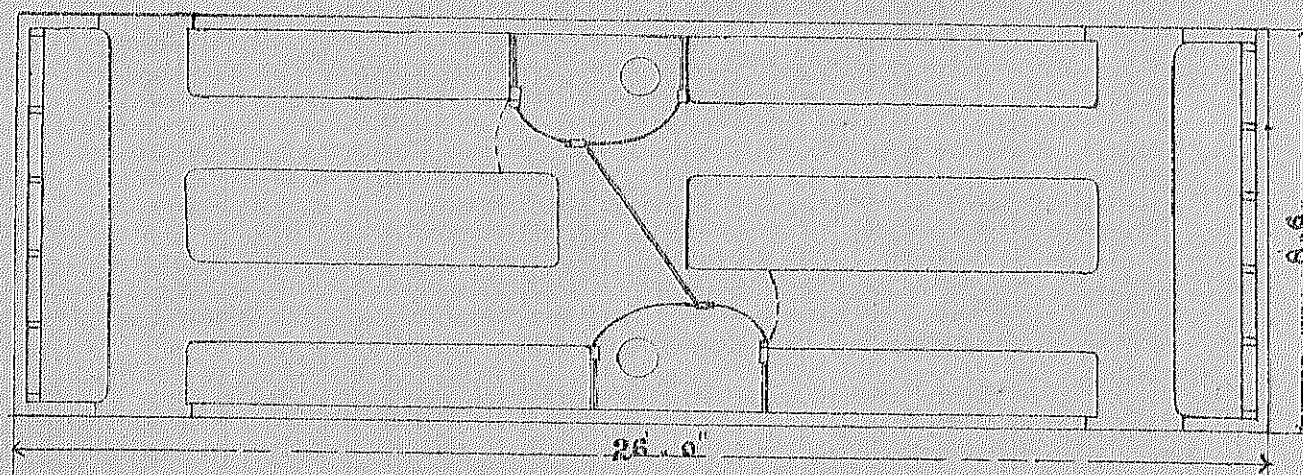
The 5th January, 1871.

H. CONDER.

C.I.P.R.
FIRST CLASS CARRIAGE



C.I.P.R.
SECOND CLASS CARRIAGE



Scale $\frac{1}{4}$ in = 1 Foot

Memorandum by Mr. R. W. PEARCE, Carriage Superintendent, East Indian Railway, for the Conference called under the Government of India Resolution No. 1635 R of 26th September 1870, Public Works Department.

Passenger Carriages.—The pattern vehicles sent out from England some fifteen or sixteen years ago were of the English type, but with double roofs, the bodies 19' 6" x 7' 5", and 7' 6" high inside measure, the seats all transverse; the

1st class	had 3 compartments	to hold 24 passengers	or 4 on a seat.
2nd ..	4 ..	40 ..	or 5 ..
3rd ..	5 ..	60 ..	or 6 ..

and when the East Indian Railway was opened a short distance only, this style answered very well, indeed, the only fault was the height of windows, they being no less than 3 feet 3 inches from the floor, or 1 foot 9 inches from the top of seat to window opening.

The 1st class even had elbows to divide the passengers off into four per seat.

As the line opened out, the elbows were removed in order to allow a passenger to lie down, provided the carriage was not full.

Then the back of seat was made to lift up, so as to form an upper sleeping-berth; commodes were fixed under the seat, and the number of passengers fixed per carriage at twelve, or a reduction of 50 per cent.

The next improvement consisted in dividing off one compartment for ladies exclusively, giving with the ladies' compartment a retiring-room with wash-hand basin, &c., see *Figure 1*.

Several other plans also have been tried, namely, the carriage divided into four longitudinal compartments with longitudinal seats and upper sleeping-berths, and a separate retiring-room to each compartment, see *Figure 2*. This carriage was afterwards re-converted, it not having sufficient ventilation, and being too confined. Another plan tried was a carriage divided into five coupé compartments with upper berths to accommodate ten passengers sleeping, having a longitudinal passage on one side communicating with each compartment (see *Figure 3*), with a water-closet at one end and a wash-hand basin at the other. This plan was also abandoned.

Again, another plan, *Figure No. 4*, a carriage divided into five coupé compartments with a separate retiring-room to each compartment. This carriage is still running, but not liked, being too close.

Many other plans have also been tried, but without success.

One of the most important and recent changes consists in dividing off the old English type three-compartment carriage into two compartments only, carrying four passengers in each compartment, or eight to the whole carriage, and having a separate retiring-room to each compartment, the seats transversely placed (see *Figure 5*). This was a ready and economical method of altering the old style of carriage, and one that is very much sought after by the travelling public; it is a reduction from twenty-four passengers, as in the original first class, to eight only, or 66 per cent.

The great improvement to be effected is in lowering the side windows. This has been and is now being done, although at a great cost and involving almost entirely new side-framing and windows, &c., reducing the height of windows 3 feet 3 inches from the floor, as in the original carriage, to 2 feet 7 inches only, or 8 inches lower. All the windows should be made so as the passengers can be able to put up the glasses and venetians at the same time. A few have been fitted in this way, which is considered a great improvement. A number of carriages are now being converted similar to the Agency carriage (*Figure No 6*), being on the American plan, with a platform at each end and a passage through the centre of body (see *Figure 7*), the seats being arranged longitudinally, divided into two compartments with a separate retiring-room to each compartment and a door-way in centre of carriage, which can be closed at pleasure, should it be found desirable to the passengers to separate one compartment from the other. These carriages are fitted with upper berths made to fold knapsack-fashion in the day time, or when not required, up above the

heads of the passengers and out of the way. The longitudinal side seats are also fitted with hinge flaps and movable cushions, so that the passengers can sit with their backs or faces or sides to the engine as they may wish. In carrying out this change, the dimensions of the old body have been preserved, and by bolting on new side-frames, increasing the width from 8 feet to 8 feet 7 inches, the old body is 20 feet long. New sole bars have been added, and the under-frame increased in length from 20 to 24 feet over head stocks, the body is thus the old length of 20 feet with a platform of 2 feet 6 inches wide at each end, or 25 feet over platforms, each platform projecting 6 inches over the buffers at each end. To give greater longitudinal stability to the carriage, the centres of wheels have been augmented from 11 to 14 feet.

It is well known that the greatest amount of lateral oscillation is experienced at the ends of carriages, the centre part being therefore best, and by lengthening the wheel-base this motion is to a great extent obviated.

There is some difference of opinion as to transverse seats *versus* longitudinal seats. The majority of persons I have consulted on this matter are in favour of longitudinal, and from my own experience I must say, after many years of travelling, I prefer the longitudinal sleeping berth. The carriage (Figure No. 7) I therefore prefer and recommend for the Indian first class travelling public for long distances, is the longitudinal berth carriage.

Second Class.—For short journeys and local traffic, the ordinary English type with low side-windows is all that can be desired; but for long through journeys, I recommend as the best Figure No. 8, which has a ladies' compartment at one end with a separate retiring-room, and a saloon at the other end, with also a separate retiring-room. Common cushions may also be added as now adopted on English and Continental Railways, if this is found not to draw the passengers from the 1st class carriages.

Third Class.—For this class of traffic I do not think anything can be better than what we have now, which is the old lateral seat compartment four feet from centre to centre of partition, and doors to each side of each compartment, and each compartment separated by divisions of iron bars to prevent over-crowding, to give more space to the passengers. The distance from centre to centre of partition may be increased to five feet instead of four, or, if other plans are adopted, say American, the males to be separated from the females, and a separate retiring-room for each.

Wagon Stock.—For this I do not advocate too many classes of wagons, as a general rule, for Indian Railways; the classification should not consist of more than—

Covered goods,
Open side,
Timber-trucks,
Cattle wagons,
Powder vans,

and coal hopper wagons only where coal jetties are in use.

The best style of covered goods wagon I know of are the re-built ones on the East Indian Railway (see *Tracing No. 19.*)

The length of the wagon is 18 feet, width 8 feet 6 inches, height from floor to top of door-way 5 feet 6 inches, equal to 841½ cubic feet capacity, and carrying 9 tons, or at the rate of 93½ cubic feet per ton, mounted on four wheels, axles 4½ diameter in the middle, and journals 9 × 3½.

The wagon built of teak-wood framing, galvanized sheet-iron panels, and corrugated iron-roof weighs only 5½ tons, and as I have fixed the gross load of a pair of axles 4½ diameter at 15 tons, including wheels, the wagon consequently carries 9½ tons.

This wagon is capable of carrying its full load of very nearly every kind of merchandize on the East Indian Railway.

By the introduction of falling flap-doors on the sides will carry coal, seeds, &c., &c. Nine tons of coal at 45 feet per ton just loads the wagon up to 2 feet 7½ inches from floor.

Six-wheeled wagons, I am of opinion, are a great mistake.

Open-side Wagons should be made 21 feet long, 8 feet wide, and 2 feet deep inside. This gives 336 cubic feet, and will carry 7 tons coal strike load, or with piling 10 tons easily; the centres of wheel base 12 feet (I say 12 feet to suit the present turn-tables and weigh-bridges, otherwise I would have 14 feet), and the under-frame well stayed and strutted for carrying rails. It is lamentable to see a 16-foot wagon carrying 24 feet rails overhanging each end 8 to 9 feet, all the weight borne by ends, and the wagon hogged in consequence from 1 to 2 inches.

Timber Trucks, Cattle Wagons and Powder Vans do not require any special remarks.

Timber versus iron or steel as materials for building wagons.

It does not appear to me that the substitution of iron or steel for timber would be attended by any advantage either as to saving dead weight or first cost, when we consider that a piece of teak-wood of equal length and weight with a piece of iron, and subjected to a tensile strain, is about 2½ times the strength of iron, to a transverse strain is about equal strength, and under a direct strain of compression is about three times as strong as iron.

No doubt iron admits of greater change in form and section and manipulation than timber.

I am afraid the trouble would be great in repairing iron-wagons in this country damaged by collision, accident, getting off the road, drawing out a headstock, &c., &c.

Probably the best is a judicious distribution of wood and iron together.

Notwithstanding my opinions as expressed on this matter, I have some time ago recommended our Board to send out to this country ten iron-built covered goods wagons as an experiment; these wagons will be about the same capacity and weight as the composite wagon I have already alluded to.

Axles, Wheels, Tyres, Axle-boxes, and Screw Couplings.

Axles.—This is the most important matter connected with the carrying capacity of any Railway, as the strength of the axles and size of journal define the carrying power of any vehicle, no matter what its shape or size may be.

An axle may be considered as a beam supported at two points some distance from the middle, and loaded at each end; when the load is sufficient to deflect the beam in the middle, the fibres of the metal at the upper part of beam are extended, while those of the bottom are compressed, and at 30 miles per hour (3-6 wheel), this change of alternate tension and compression takes place at all points of the circumference of the axle 240 times per minute.

It is a fact that an axle subjected to these conditions, it is only a matter of time for the nature of the iron to become changed from that of the fibrous to crystalline, and consequently useless.

In 1866 I made a series of experiments on the strength of axles (5' 6" gauge) with a view to the reduction in dead weight of rolling-stock, and to decide the weights to be safely borne by various sized axles. The results I give tabulated as follows:—

Abstract of experiments 3' 6" diameter wheels.

Size of axle in inches.	Journal.	GROSS LOAD IN TONS INCLUDING 2 AXLES AND 4 WHEELS.										
		Deflection of axle at middle in inches.					Alteration in gauge at bottom in inches.					
		12	13	14	15	16	12	13	14	15	16	
1	9 × 3½	085	090	100	110	110	200	210	215	230	250	4½ through nave.
1½	9 × 3½	050	055	065	075	085	145	150	155	185	200	4½ " "
2	9 × 3½	035	035	040	040	045	130	140	150	155	165	Iron 4½ " "
2½	9 × 3½	035	040	040	050	055	065	080	080	120	125	Bessemer steel 5 " "
3	10 × 4	035	035	035	040	040	085	090	100	110	115	Iron 5½ " "

I consider the 4-inch axle unsafe with any load above 12 tons; in fact, it is overstrained at that load.

These experiments were most carefully conducted.

Covered goods wagons were weighed and run over wedges $1\frac{1}{4}$ inches high between each test.

The deflection of axles was measured from a steel straight edge 5' 0" long between the naves of wheels; the deflection measured to centres of journals 7' 3" would be more than the figures given.

Alteration or diminution of gauge of wheels was measured between the backs of tyres at bottom.

For 3' 9" diameter wheels the alteration of gauge would be still greater, some of our 3' 9" wheels 4-inch axles with a gross load of 12 tons, spring $\frac{1}{16}$ of an inch out of gauge.

From these tests I fixed the gross loads for each size of axle, viz. :—

2	4-inch axles	12 tons.
2	4 $\frac{1}{4}$ " "	13 "
2	4 $\frac{1}{2}$ " "	15 "
3	4 $\frac{3}{4}$ " "	18 "

The weight borne by each journal is therefore—

4	Wheel wagon 4" axles, weighing gross	...	...	T. cwt. lbs.
	Deduct wheels	...	...	12 0 0
		...	...	1 12 0
		4)	10 8 0	
	Weight borne per journal	...	...	2 12 0

6	Wheel 4" axles, gross weight	...	...	T. cwt. lbs.
	Deduct wheels	...	...	18 0 0
		...	...	2 8 0
		6)	15 12 0	
	Per journal	...	...	2 12 0

4	Wheel 4 $\frac{1}{4}$ " axles, gross weight	...	...	T. cwt. lbs.
	Deduct wheels	...	...	13 0 0
		...	...	1 13 0
		4)	11 7 0	
	Per journal	...	...	2 16 84

4	Wheel 4 $\frac{3}{4}$ " axles, gross weight	...	...	T. cwt. lbs.
	Deduct wheels	...	...	15 0 0
		...	...	1 14 0
		...	...	13 6 0
	Per journal	...	...	3 6 56

In the substitution of larger axles for small ones on the East Indian Railway, the maximum dimension was determined by the size through nave; it was found the old wheels would not bear boring out to more than 5 inches, and practical experience has proved the part through nave should be proportionately larger than at the middle; the dimensions fixed is, therefore, 5 inches through nave, 5 $\frac{1}{2}$ inches at back of nave, and 4 $\frac{3}{4}$ inches in middle of axle.

The journal has also been increased from 3 $\frac{1}{4}$ inch to 3 $\frac{1}{2}$ inch diameter—all that the present axle-boxes would admit of.

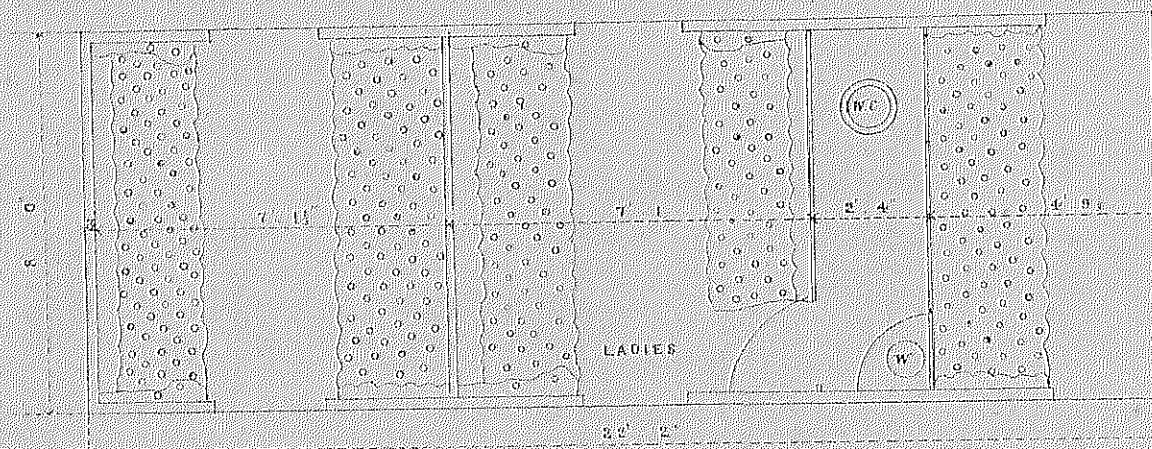
I am of opinion the greatest load we can run (even with oil) on a journal $9 \times 3\frac{1}{2}$, is 3 tons 7 cwt., the amount fixed.

Figure 9 and 9* is a sketch of the old 4-inch axle.

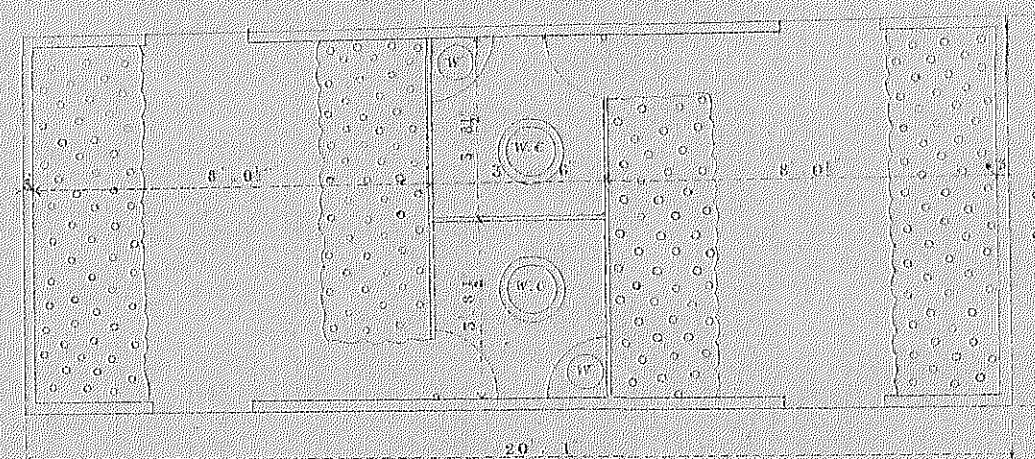
„ 10 „ „ 4 $\frac{1}{4}$ -inch „

„ 11 a sketch of the 4 $\frac{3}{4}$ -inch axle 5-inch through nave.

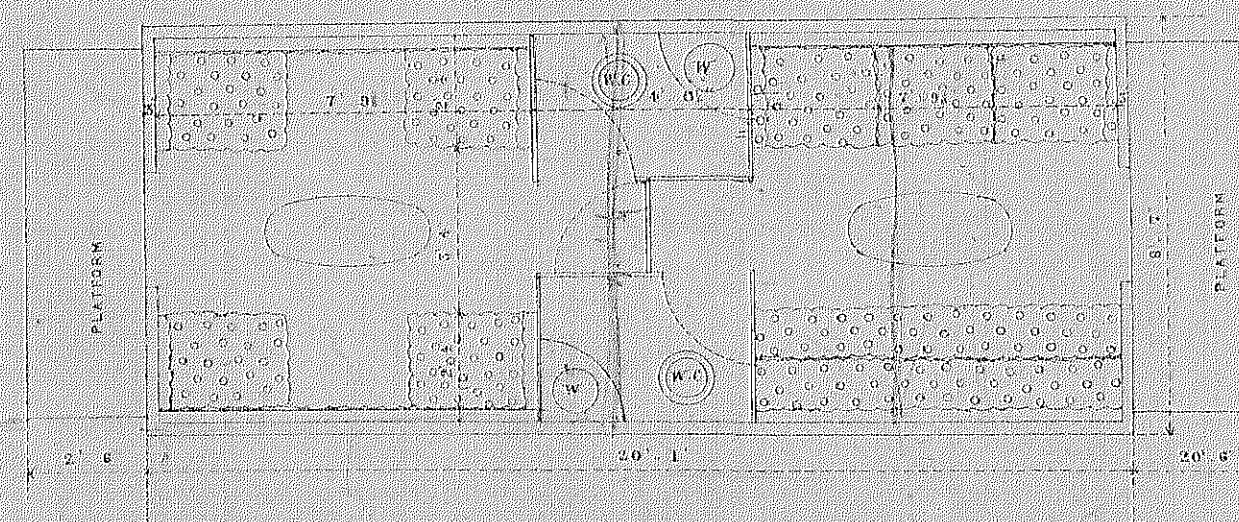
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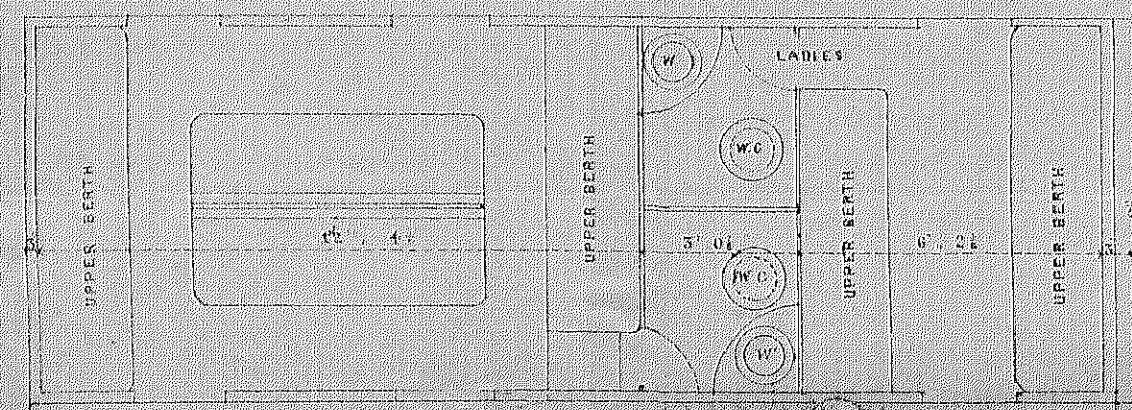
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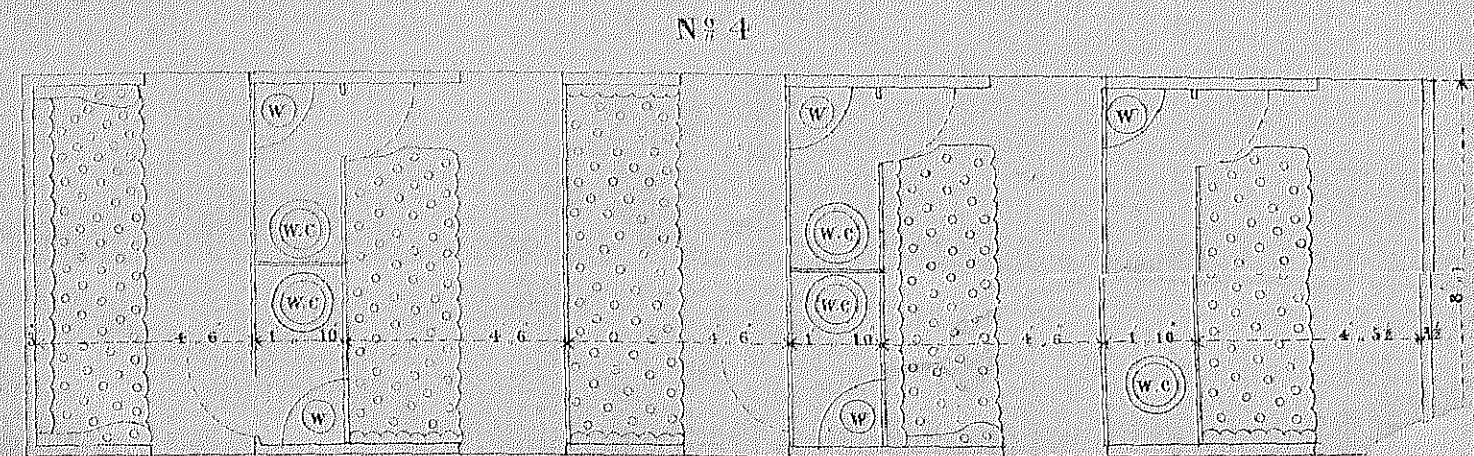
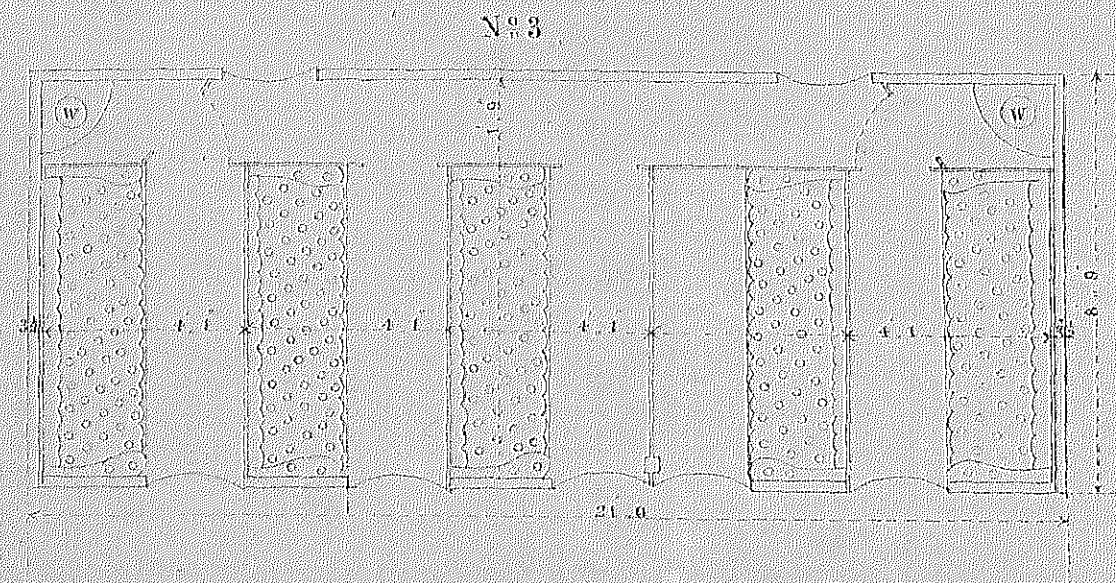
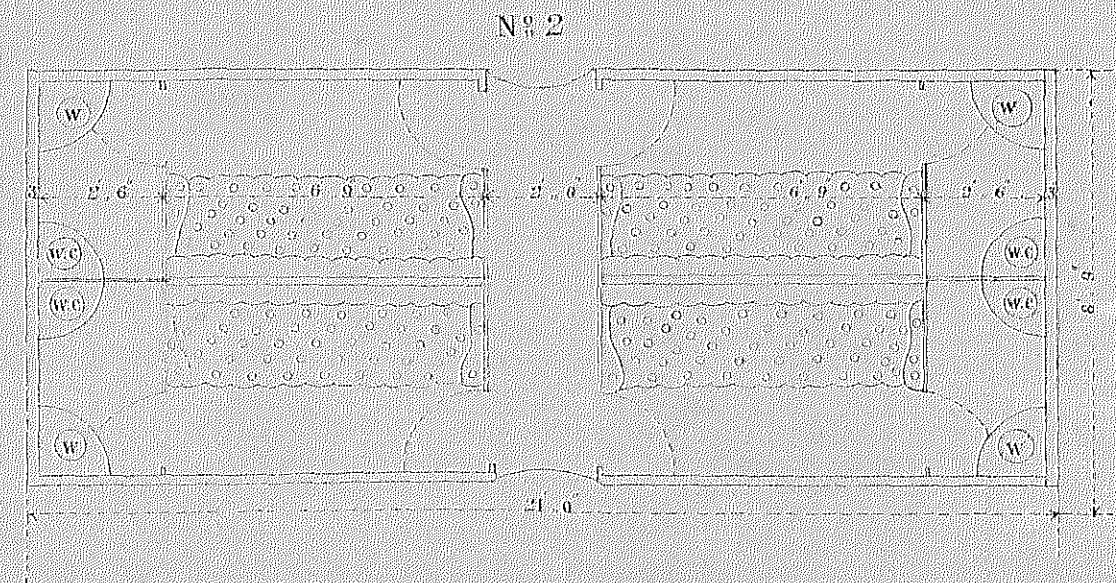
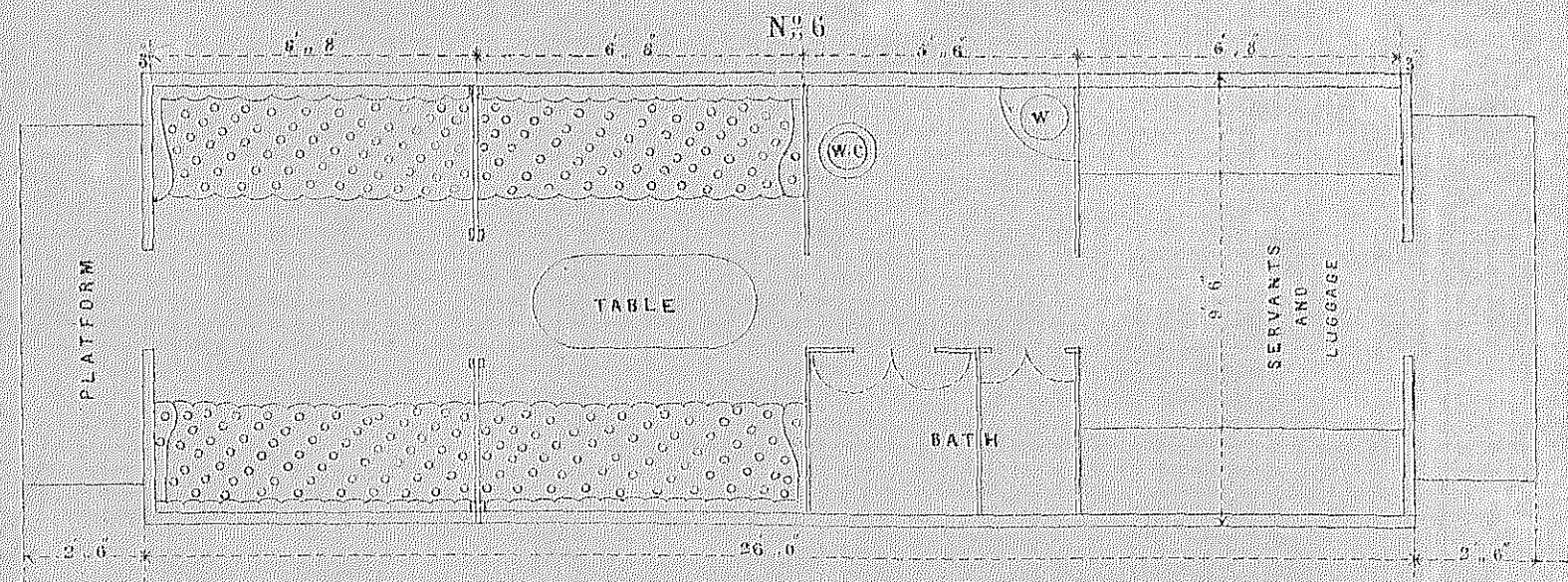


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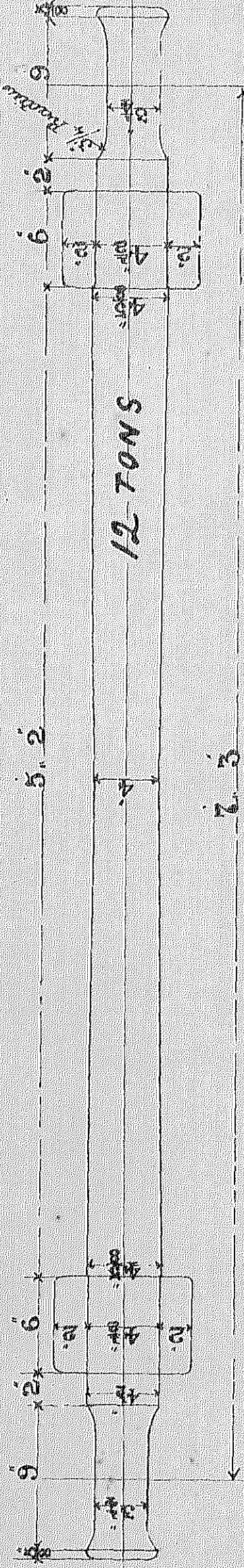


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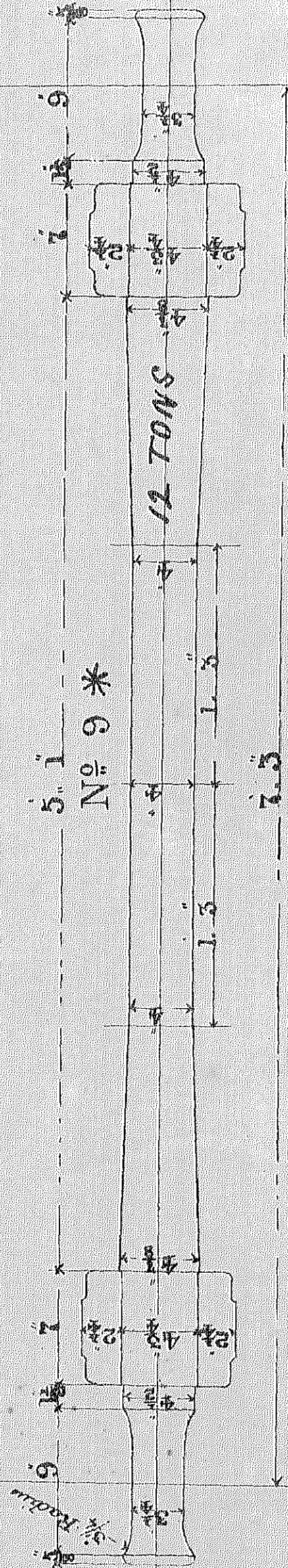




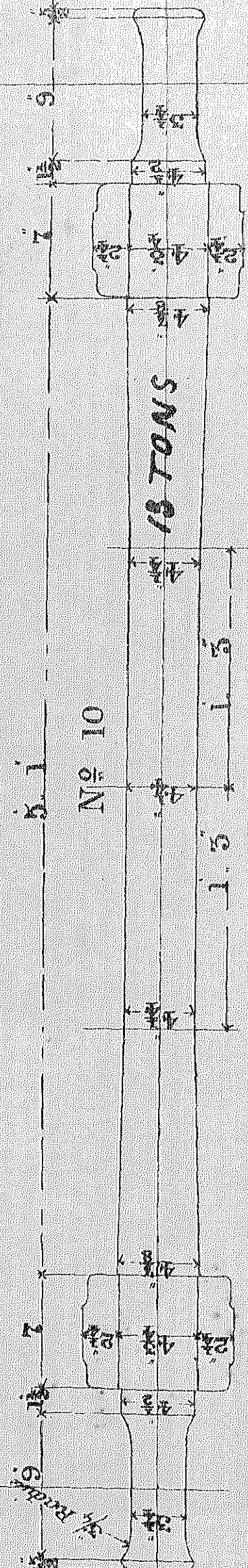
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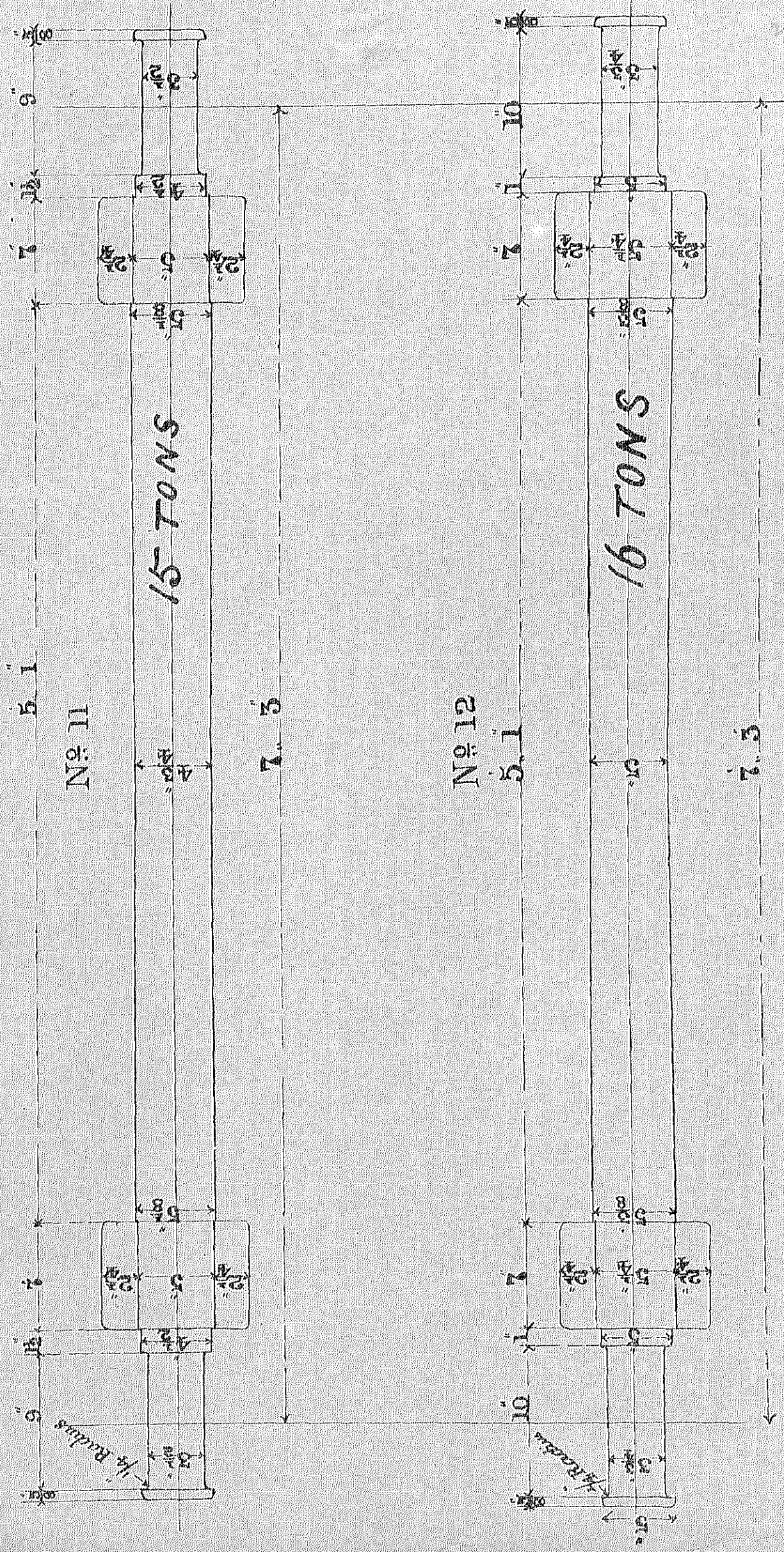


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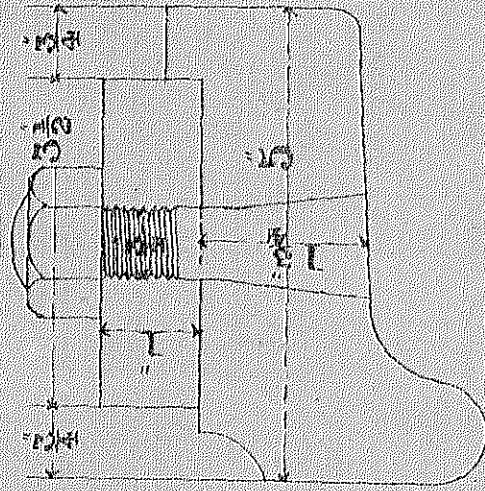
No 10



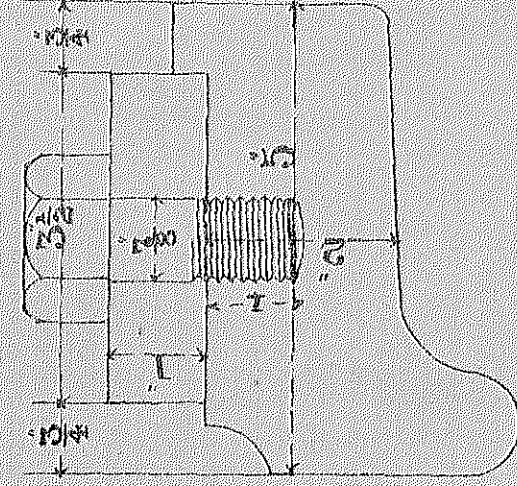


Scale $1\frac{1}{2} in = 1 Foot$

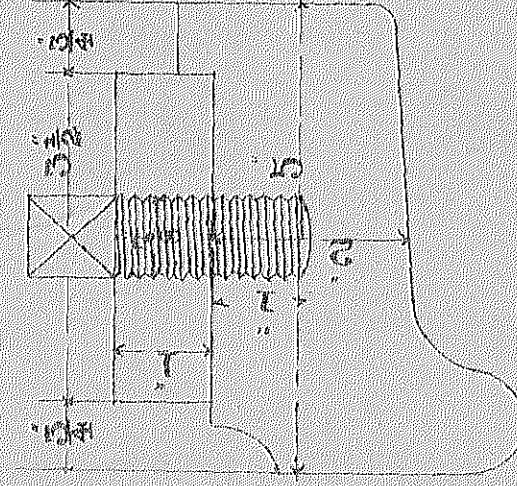
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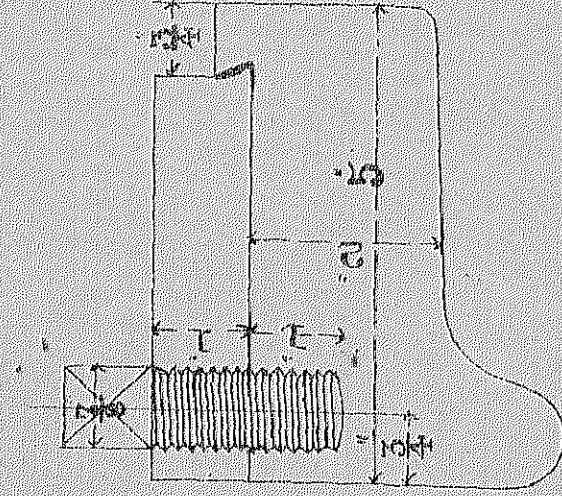
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№ 15



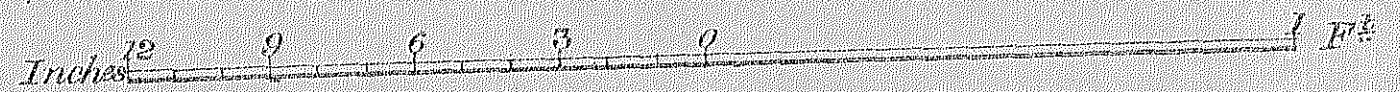
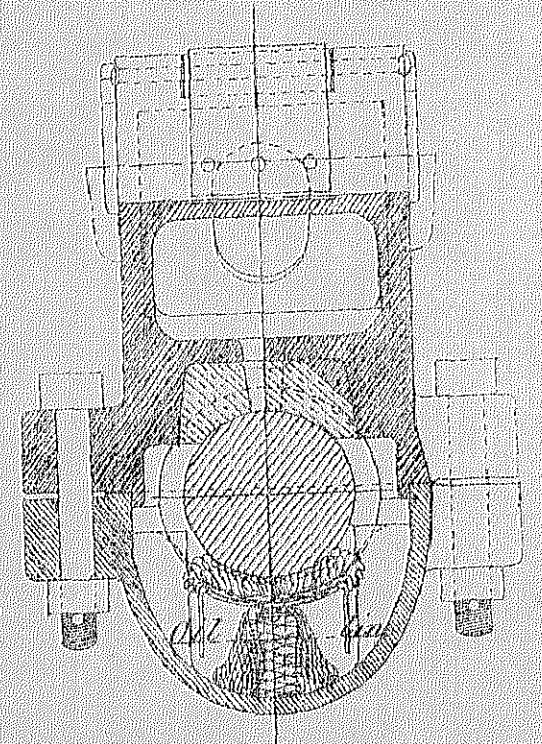
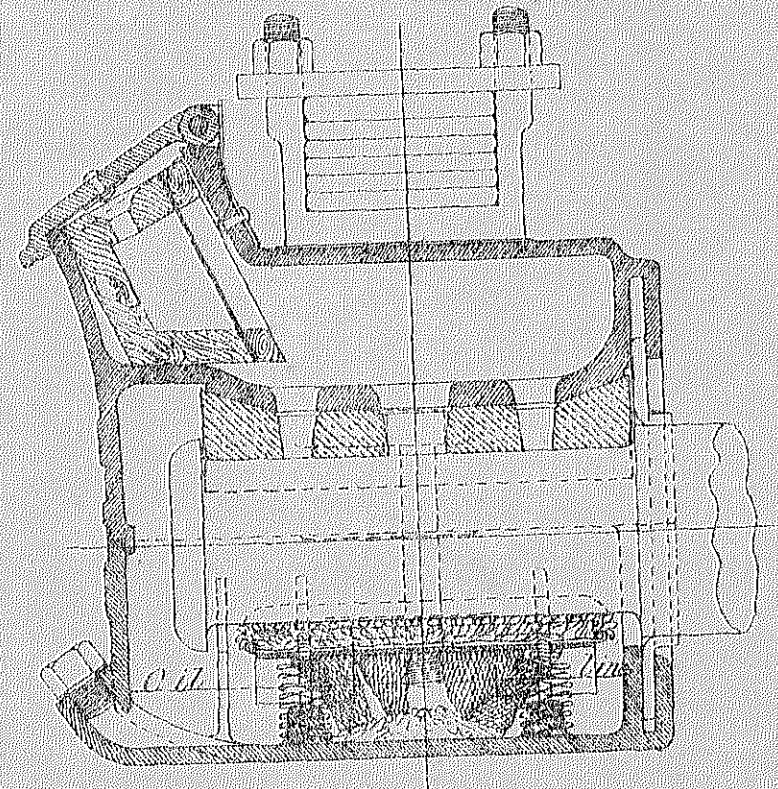
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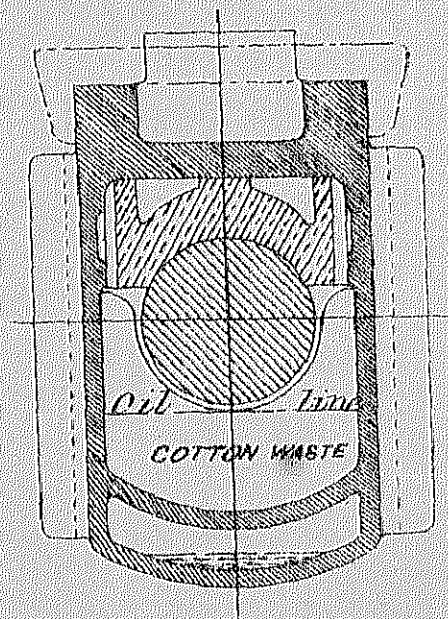
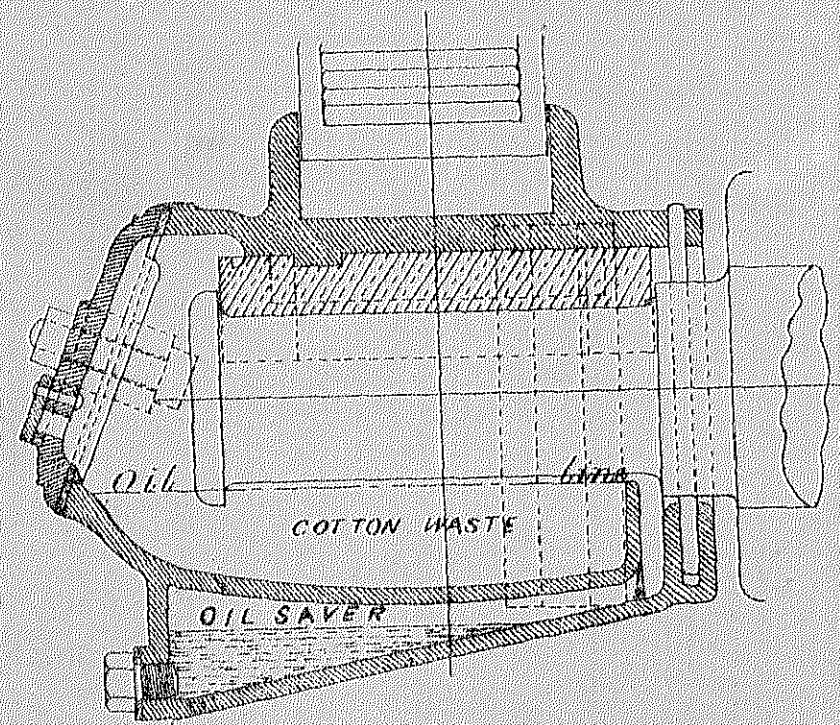
Half Size

OIL AXLEBOXES.

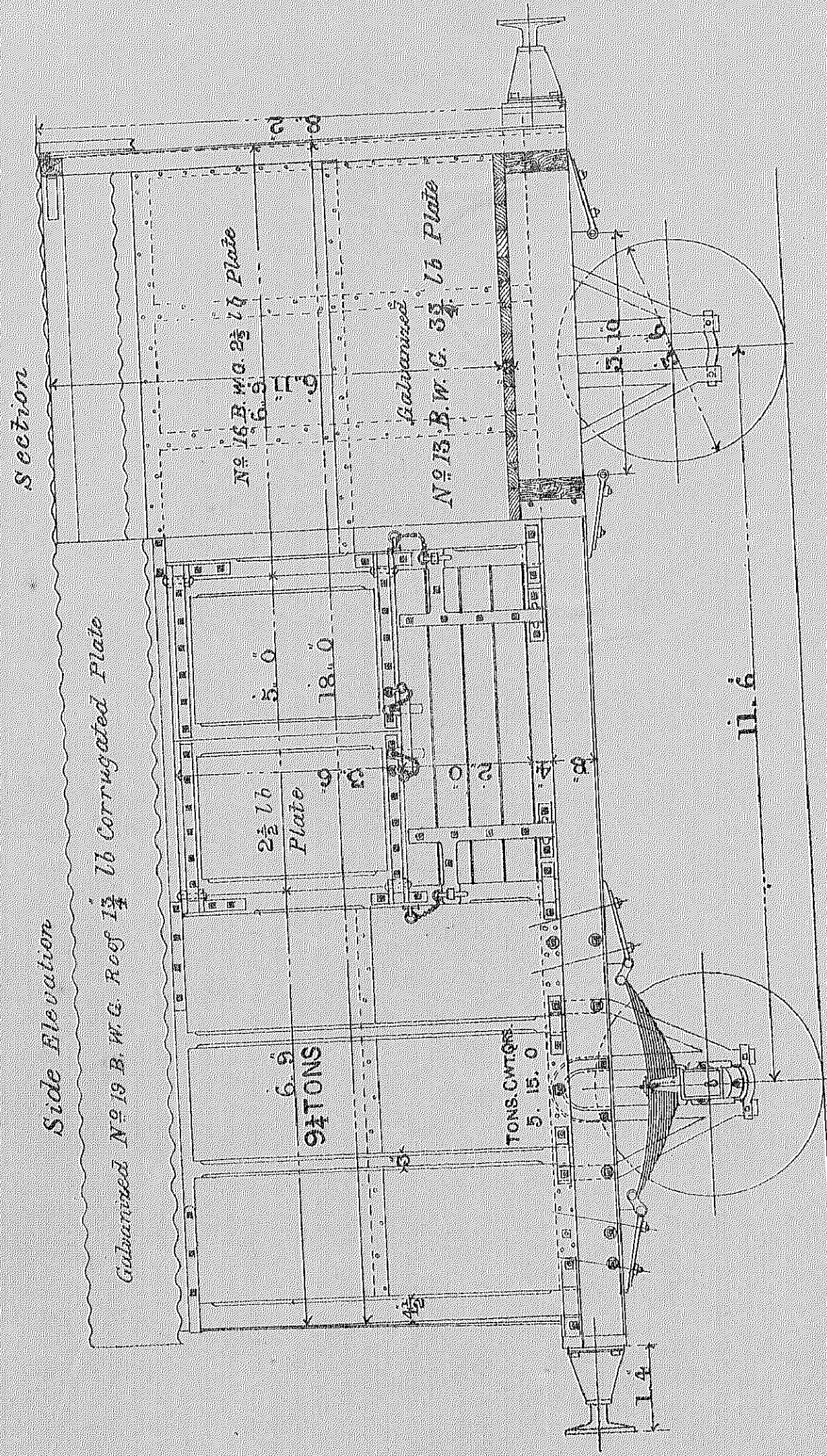
Nº 17



Nº 18



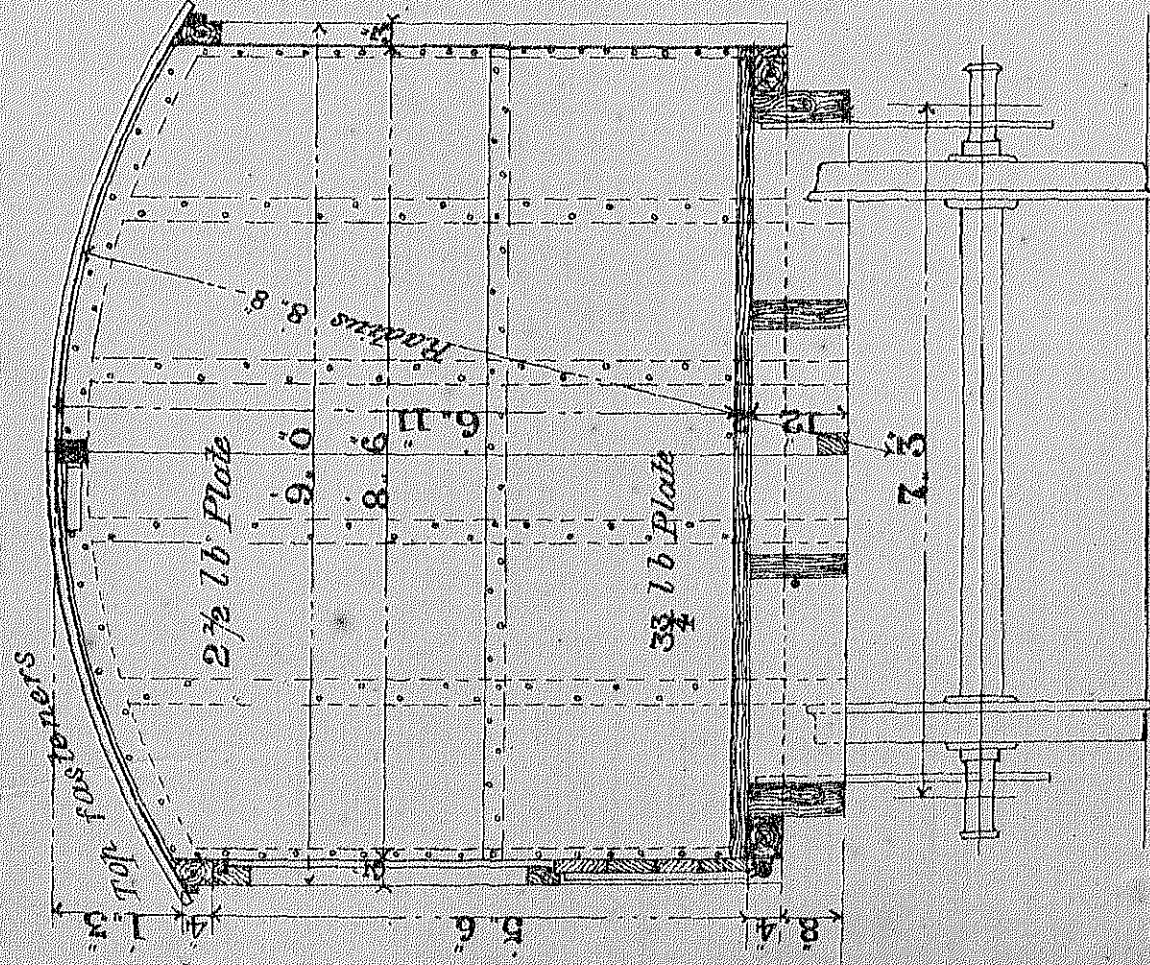
COVERED GOODS WAGON No 19



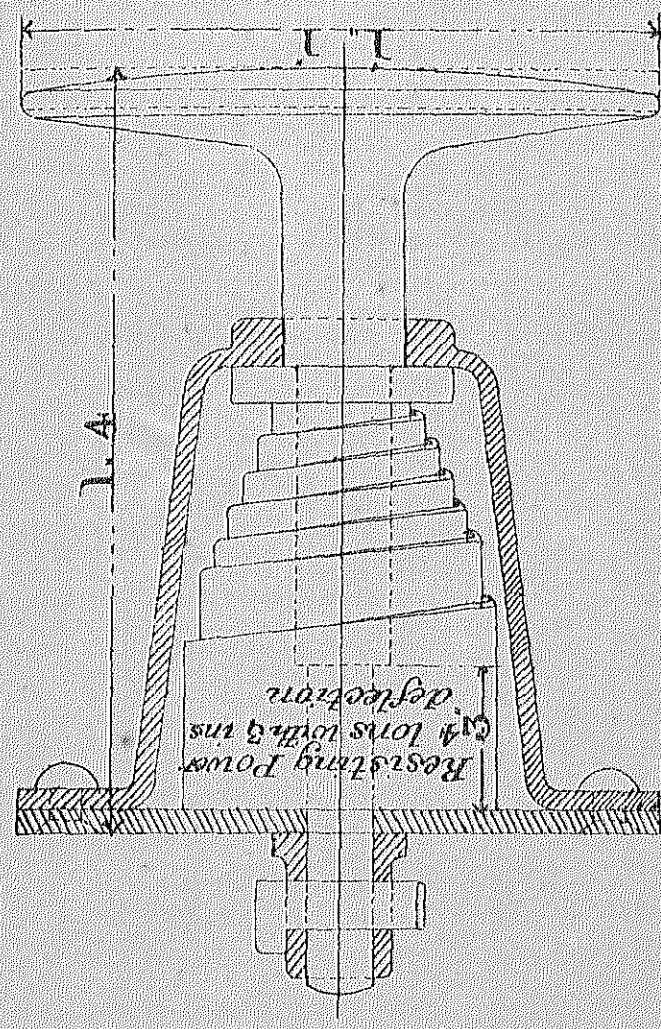
COVERED GOODS WAGON

No 19

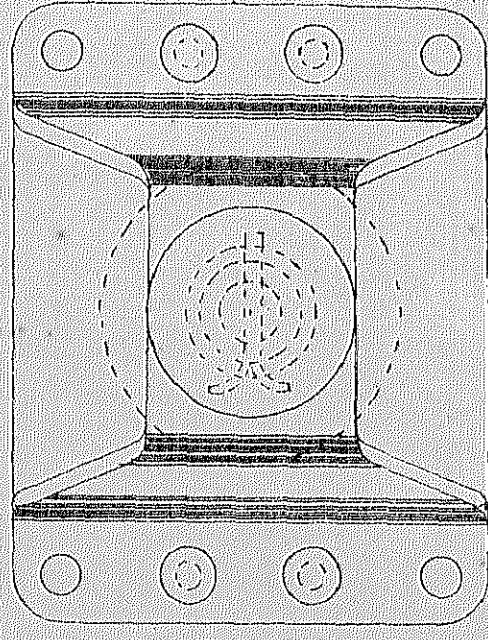
Cross Section



WROUGHT IRON VOLUTE SPRING BUFFER



weight of wrought iron buffer without Spring 102 lbs



Scale 1/2 in = 1 Foot

Scale 3 in = 1 Ft

Figure 12 an axle I would propose for new Indian Railways, or where new wheels and axle-boxes have to be ordered. This is 5 inches in the middle, $5\frac{1}{4}$ through nave, and journal $10 \times 3\frac{3}{4}$; I would fix the gross load (2 axles) at 16 tons. This would give a load of $10\frac{1}{2}$ tons in a covered, and 11 tons in an open wagon, at this rate would be a safe axle, and the the larger journal would run cool and economically in this country.

I may mention that the substitution of large axles for small ones on the East Indian Railway will increase the capacity of the wagon-stock by 18,000 tons, or equal to building 2,800 new wagons, or a saving to capital of £380,000.

I have not had sufficient experience to recommend steel-axles in preference to really good faggotted iron ones.

For tyres, steel certainly is the best, and should be adopted everywhere.

Figures 13, 14, 15 and 16 show methods adopted on the East Indian Railway for securing tyres; No. 13 is an old, barbarous and now exploded plan; No. 14 is not a bad plan; No. 15 is better; and No. 16 the best of all.

Skeletons of wheels are best made of wrought-iron welded in one solid piece, and either 8 Losli's double spokes, or 9 solid engine spokes; 2 inch thickness, is sufficient for the metal in boss round the axle, and the keys cast-steel $1\frac{1}{2} \times \frac{1}{2}$.

Axle-boxes.—Oil as a lubricator is fast superseding grease on Railways; the difficulty has been adapting the old grease boxes to oil; this has been done on the East Indian Railway by substituting a new keep and a woollen wiper underneath the journal, and is found to answer well (*see Plan No. 17*).

The simplest and best plan I know of for oil where new boxes entirely are required, is one patented by an American gentleman, Mr. Hodge, about twenty years ago, and is almost the only axle-box in use in America to this day (*see Plan No. 18*). It consists in surrounding the underside of journal with cotton waste well saturated with oil and packed in moderately tight from the opening in front.

Screw couplings.—It is to be hoped, on the East Indian Railway during the next six months, these will be generally adopted for all trains—passenger and goods—and the old common chain for wagons done away with, and there is no doubt this measure will effect an immense saving in the wear and tear of our stock, and their lives lengthened accordingly.

The screw should not be less than 2 inch diameter, shackles $1\frac{1}{2}$ inch diameter, $\frac{1}{2}$ pitch of thread, and of the round and hollow pattern being much stronger and less liable to give way with a jerk than either the V or square threaded screw.

The 11th January, 1871.

ROBT. W. PEARCE,

Carriage and Wagon Supdt.,

E. I. Railway.

Note by LIEUTENANT E. FIREBRACE, R. E., *Manager of the Calcutta and South-Eastern (State) Railway, on the Passenger Traffic of the Line.*

Some Railway authorities are understood to assert that Natives when travelling by rail prefer carriages without seats to those in which seats are provided, so that if two carriages, one with, and one without seats, are provided to accommodate equal numbers and at the same fare, the Native passenger would prefer to travel in the seatless carriage. The experience gained during the last 10 months on the Calcutta and South-Eastern Railway is quite opposed to this idea.

Originally there were three classes for passengers on the State Railway. A lower class, the fourth, was afterwards added, and to this class the majority of passengers at once resorted. These 4th class carriages were simply 3rd class carriages with the seats removed. The fare charged for a seat in these carriages was 3 pies per mile, the 3rd class having been raised to $4\frac{1}{2}$ pies; these classes, accommodation and fares originated with, and still exist on, the Eastern Bengal Railway, where it is also noticed that the great majority of passengers travel in the lower class.

When Government took the management of the Calcutta and South-Eastern (State) Railway out of the hands of the Eastern Bengal Railway Company, who had been working it for about 18 months, the Consulting Engineer decided to reduce the classes to two, at 9 pies and 3 pies per mile. The number of passenger carriages on the line being small, for some time both third and fourth class carriages were run, the fare being the same for both, viz., 3 pies per mile. A great rush was always made towards the carriages with seats, and these

carriages were always filled before many passengers would go into the seatless carriages. A similar tendency was observed in the upper class carriages; so long as there was room in a first class carriage, passengers preferred crowding in that class to having ample room by distributing themselves through the first and second class carriages.

In the trains now running, although, generally speaking, ample accommodation is provided for the lower class passengers in carriages with seats, a seatless carriage (sometimes two) is usually attached, and it is found that the few passengers using it are either of very low caste, or else Railway servants, the latter being restricted to that carriage.

The majority of Native passengers by the local trains on all the Calcutta Railways are Baboos (Clerks in the various Calcutta Offices), and field labourers. The Baboo must ride in a carriage with seats if he wishes to keep his clothes clean, and it seems a mockery to take advantage of his necessities to raise his fare; the ordinary Native passenger will always elect to travel in the lowest class and put up with any amount of inconvenience, and is thus also made to suffer in the attempt to extract a higher fare from his richer fellow-countrymen.

The following table will show the great exodus from the third into fourth class when the class was first instituted on this Railway:—

		No. of Passengers.	
		3rd Class.	4th Class.
1st-half of 1867		1,67,191	
2nd " "		1,35,452	
1st " 1868		1,52,345	
2nd " "		20,187½	93,364½
1st " 1869		24,486	1,09,694
2nd " "		19,813	88,291½

The numbers of passengers in the different classes on the Eastern Bengal Railway show the same result. I feel certain that if I were to attach ballast trucks to the passenger trains and allow passengers to travel in them at 2 pies per mile, the majority of the present travellers would ride in the trucks and put up with every inconvenience in order to save themselves the extra pie per mile.

It seems, perhaps, natural for a Native to sit in a Railway carriage in the same manner as he sits in his own house, but observation on this Railway goes to show that he will always choose a carriage with seats, provided always that the fare is the same. Something, however, is due to the fact that carriages with seats are considered by English people to be of a higher class than those without seats; the Native, aware of this, considers it derogatory to his dignity to travel in a carriage lower by estimation than another in which he can travel for the same fare.

The following table shows the result of reducing the classes to two, viz., upper and lower, and for comparison, the results of the corresponding 10 months of 1869 are placed side by side. A small decrease is visible in the upper class passengers, but this can be wholly attributed to the very small number of Europeans who now make use of the Railway; the increase in the lower class passengers is, however, most marked, and gives every appearance of being permanent:—

	1869.				1870.			
	1ST AND 2ND CLASSES.		3RD AND 4TH CLASSES.		UPPER CLASSES.		LOWER CLASSES.	
	Nos.	Receipts.*	Nos.	Receipts.*	Nos.	Receipts.	Nos.	Receipts.
		Rs. As. P.		Rs. As. P.		Rs. As. P.		Rs. As. P.
March	549	557 13 6	23,134	4,479 2 0	569	463 2 9	24,337	4,248 8 9
April	477	392 9 9	21,800½	3,863 14 9	438½	343 10 6	22,022½	3,670 4 0
May	359½	278 0 9	19,145½	3,889 5 9	427	312 4 6	23,271½	3,817 10 9
June	494½	382 3 0	24,979½	4,414 13 9	446½	347 9 6	28,666	4,635 15 6
July	508½	411 2 9	18,936	3,381 8 6	455	321 12 3	22,946	3,474 14 9
August	405	329 7 3	17,410	3,138 13 0	270	199 11 6	20,779	2,999 13 3
September	437	304 15 3	16,709½	2,907 12 3	335	279 0 6	21,994	3,222 11 9
October	415	334 8 3	18,101	3,121 6 6	329	252 12 0	17,294½	3,156 1 9
November	383	309 12 3	19,019½	3,339 15 9	414	267 1 6	24,530½	3,713 9 3
December	487½	297 2 0	19,014	3,547 7 0	394	332 15 9	30,634½	4,290 9 0

* These amounts show the total receipts taken from the passengers; they are subject to a reduction due to the circumstance, that the Eastern Bengal Railway Company were allowed to charge for an extra mile of distance for the privilege of receiving into their terminal station, which extra fares went wholly to that Company.

The 14th January, 1871.

F. FIREBRACE, Lieut., R. E.

APPENDIX D.

Note by Mr. IMBRIE MILLER, Superintending Engineer, State Railways, read at the close of the Conference called under the Government of India Resolution No. 1635 R of 26th September 1870, Public Works Department.

There are two distinct interests that we are called upon to harmonize when deciding upon a standard plan for Railway carriages, namely, that of the passenger asking the greatest amount of comfort possible; and that of the Company demanding the greatest economy of space and load, consistent with the requirements of the service.

After carefully examining all the plans for carriages submitted, I still remain decidedly of the opinion, that the greatest comfort and convenience to the upper class passengers can be economically arranged *only* by adopting some modification of the palace sleeping car.

I consider it desirable that for future plans for new stock of *this kind*, the following details should be recommended.

Long carriages on bogie trucks, with longitudinal passage and openings at both ends, arranged so that tatties can be used when desirable, with box wind-sails to deflect the currents of air upon them.

Bath-rooms and water closets easily accessible to all the passengers.

Wide longitudinal sleeping berths for each person, capable of being converted into lateral seats at pleasure, so that *all* the passengers can use the side windows conveniently.

Sky-light and double roofs to all the carriages, the upper windows in pairs, hung vertically (and opening alternately, in opposite ways according to the direction of travel), so as to exclude the smoke and dust.

Such an arrangement of the compartments that a limited amount of private reserved accommodation can be secured by payment of not exceeding four first class fares.

Long carriages on bogie trucks travel much more quietly and with less jolting than the short Indian stock with rigidly framed wheels, but if very long cars are preferred, the side doors must be abandoned, as they weaken the framing.

Short carriages without longitudinal passages require separate bath-rooms and closets for every compartment, and as the single transverse compartments are not sufficiently ventilated for this climate, the result is, that for the sake of health and economy, the compartments on short carriages will have to be made so large as to render private accommodation beyond the reach of nearly all the passengers.

With a longitudinal passage closed by a door in the centre, some of the bath-rooms can be dispensed with, and one comfortable dressing-room at each end of the open passage made to answer the requirements of 12 double compartments.

Comfortable rest cannot be obtained while lying across the direction in which the train is moving, and unless space is wasted in the carriage, some of the berths must be placed this way when all the entrances are at the sides.

Passengers will never be satisfied to sit with their backs to the windows, as the journey is made more tedious by confining the prospect to the inside of the carriage.

Both of the last two defects are fully disposed of in the detailed drawings of the palace car submitted herewith, and both are obviated in the car No. 7, recommended to the Conference by Mr. Pearce, and which I consider as the best model proposed for re-fitting the short stock now in use on the East Indian Rail road.

There is usually but one class of passengers carried on regular trains in the United States, and through fare for long distances averages about 1 anna per mile.

In some parts of the country the fare is higher than that named, but tickets per fast express across the Continent (including the separate cost of the whole of a private State room on one of the palace cars) cost 1 anna and 7 pies per mile travelled.

The charge for the special accommodation included in the above is independent of the charge for passage, and amounts to about three rupees per night for each of the two berths in each compartment, all amounting to the sum named per mile; this includes also the use of clean towels, bedding and attendance.

Although difficult to ventilate any kind of sleeping carriage sufficiently for this climate when full of passengers, the cars described are better off in this respect than any style now in use here, each compartment being furnished with two windows on a side with air traps over them, two dust-proof ventilators in the roof, and a front of six feet, that can be opened or closed upon the general passage through the car, with doors at both ends.

If tatties were arranged over the end doors of the long passage, with wind-sails to deflect the air against them, a considerable reduction could be effected in the temperature at a small cost per passenger.

Each private compartment contains one upper and one under berth, 3 feet wide; the first can be folded up above the windows, and the lower one opened in the middle so as to form two comfortable seats, facing each other, and that every one can look out of the windows conveniently.

It is sometimes the practice to attach dining cars to the western trains for the convenience of passengers; but this is quite an exceptional arrangement only suitable to special cases.

The lower employes of the Company ride in the leading carriage, which is a very plainly furnished day saloon with two rows of seats with reversible backs, and passengers are allowed to go into this car when they wish to smoke.

About 1 maund of luggage is carried free for each party, who receives a brass-ticket, numbered and with the destination of the party plainly stamped on it. An exact duplicate check is strapped to the box, which, at the journey's end, is delivered to any porter who can produce the original ticket.

Brake-vans are dispensed with, as cars of every description have connected brakes attached, acting at a moment's notice, on the whole, or any number of the wheels of the train.

In Mr. Pearce's plan for the conversion of old 20-foot stock, I have suggested a few slight modifications of minor details which are usual on American cars, and necessary when end openings and omnibus roofs are adopted.

When end doors are used over brick ballast, a canvas curtain should be extended across the short space below the platforms, and when windows are placed in the roof, they should be hung vertically and in pairs, so that whichever way the train is moving they can be set to exclude the smoke and cinders. It must be remembered that these windows are not for the admission of air, but to carry off foul air and to give a cheerful but subdued light to the saloon through the stained glass above.

The objection I make to some new saloon carriages lately introduced on one of our lines, in seating the passengers with their backs to the windows, is a defect that has been overcome by Mr. Pearce's adaptation of the American changeable seats.

For new first class stock, my opinion is in favour of long cars with bogie trucks whenever 12 passengers can be relied on to travel in them; otherwise, I of course prefer a lighter and shorter carriage, and would propose a frame much like the Agent's carriage on the East Indian Rail-road.

Twenty-six feet length of frame to end of platforms, divided into two compartments, with closing door between, one for four, and the saloon for eight passengers.

Two separate bath-rooms in centre of car, and all the berths longitudinal and seats changeable.

End doors with tatties, and anti-dust omnibus roof.

This will, I think, prove a more comfortable arrangement than any style of carriage in use here, and will accommodate 12 passengers with one private compartment for four.

In regard to the low-priced Native transportation, great economy seems to be preferable to any high degree of luxury, and I think that if the compartments are increased to 4 feet 4 inches in the clear, as proposed by the Committee, separated by bulk-heads to prevent over-crowding and make reserved accommodation attainable, besides being furnished with wide seats, the special requirements of this traffic will be fully met.

I am not convinced of the desirability of supplying horizontal sleeping accommodation to any of the low-paying passengers at an increased expense to the Railway Companies, and consequently to themselves, as, for this traffic, it is necessary that the minimum cost of transportation should be adopted.

For the same reason, I think that the bulk of the lowest grade should be hauled on slow trains, as it is more expensive to carry them rapidly than otherwise.

I have expressed my opinions about goods wagons for India already, and have only to add that those designed for special freight should be constructed so as to answer for ordinary merchandize when making return trips, or when ever not employed on the special service intended.

J. IMBRIE MILLER.

No 1632

P. H. Dept
No 1112
Proceedings of the Madras Government
Under date the 20 April 1871
Read the following
from the Government of India S. E. No 561 R of 29 March 1871.

Communicated
to the Consulting En-
gineer for Railways
with a view to the Agents
of the Railways in this
Presidency being invited
to submit such observa-
tions as they may
desire to offer on the
points discussed in
the accompanying
papers regarding rolling
stock and the method
of working the traffic
on Indian Railways

In submitting the
reports of the Agents
Major Pendreget
will express his own
opinion on the question
which are considered
in those papers -

W. B.

The Cong. Engrs
for Railways & canals
ten copies of the publication
by 3-depts of the
P. C. -

Book of 1871-1872

PUBLIC WORKS.

Chief Consulting Engineer
for Railways

Date

Ref

20 April 1112.

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