M.R.O. 1—77,006—8-6-37.

(1) Number of pages 14

(2) Date of repair

(3) Initials of the Referencer

MADRAS RECORD OFFICE.

Government of Madras.

Public works DEPARTMENT.

G.O. No. 217 Press Mis.

440-41

Dated 25 1 1871.

Not to be folded or roughly handled

Proceedings of the Madras Government, Public Works Department,
25th January 1871.

No. 440. Read the following Circular from the Government of India, Public Works Department, (Railway,) to the Governments of Madras, Bombay, Bengal, the North-Western Provinces and the Punjab; the Chief Commissioner of Oudh; the Resident at Hyderabad; and the Agent to the Governor-General in Central India, in the Public Works Department, Railway Branch, dated Fort William, 10th December 1870, No. 21-R.:—

In continuation of Circular, No. 24-R. of 1869, the undersigned is directed to forward for information copies of the further papers enumerated in the margin,* on the subject of communication between the passengers, guards, and drivers of trains in motion, and to refer to the publications also noted in the margin† for further information on the subject.

* Letter from the Board of Trade, to the Under-Secretary of State for India, dated 2nd September 1869.
Rules of the London and South-Eastern Railway.
An illustrative drawing.
Report by Col. W. Yolland, dated 21st Feb. 1868.

† Papers read before the Institution of Civil Engineers on 11th December 1866.
"Preece on communication in trains."
Pamphlet by Latimer Clarke, M. I. C. E., on pneumatic communication, etc., London, E. and F. N. Spon, 1868.

(Signed) E. C. S. WILLIAMS, Major, R.E.,
Deputy Secretary.

No. 441. ORDER THEREON, 25th January 1871, No. 217.

RAILWAY, No. 52.

COMMUNICATED to the Consulting Engineer for Railways in continuation of G. O., No. 3,529, dated 4th November 1869.

(True Extract.)

Colonel, R.E.,
Secretary to Government.

To the Acting Consulting Engineer for Railways, with 7 Copies of the Enclosure to address

Exd. E. C. Shunker.

Enclosure to Circular No. 21 Railway.

Dated 2nd September, 1869.

From—T. GRAY, Esq., *Secy., Board of Trade, (Railway Department),*

To—The Under Secretary of State for India.

In further reference to the request contained in your letter of the 10th ultimo, for information as to the means adopted on English Railways for effecting communication between Passengers, Guards, and Drivers, I am directed by the Board of Trade now to transmit to you the following particulars:—

Four systems of communication between passengers and the Guards and Drivers of Railway trains have been sanctioned by the Board of Trade, on the application of various Companies, under the provisions of the 22nd Section of the Regulation of Railways Act, 1868, Cap. 119. In three of these the communication is effected by means of a cord or rope, and in the remaining one by electricity.

1.—*System approved for the Midland Railway and most of the principal Companies.*

The rope-system adopted by the great majority of the Companies (on the recommendation of a Committee of Managers, of which Mr. Allport of the Midland Company was the Chairman) is known as Harrison's system, having been arranged by Mr. Thomas Harrison, the Engineer to the North-Eastern Railway Company.

This apparatus consists of a cord passing in an easy accessible situation, under the eaves of the carriage roofs, over friction rollers, from the rear van to the engine. It is wound round a drum in the Guard's van, and is kept in a state of tension by a weight. On the edge of the drum is a movable catch, which is adjusted at starting by means of thumb-screws, according to the length of the train and the amount of slack which has to be taken up. When the cord is pulled this catch strikes a bell, which continues ringing by clock-work in the rear van till stopped by the Guard, whilst at the same time a whistle is sounded on the engine by means of a spring which closes the whistle when the cord is released. Outside each compartment can be fitted a "detector," which is thrown out by the pressure on the cord in the action of pulling, and cannot be replaced by the passengers. At present, however this detector has not been brought into use.

2.—*London, Brighton, and South Coast Railway Company.*

The London, Brighton, and South Coast Railway Company, with a view to saving expense in fitting up their rolling-stock, have obtained the approval of the Board of Trade to a means of communication effected by a cord passing through the *commode* handles on the off side of the carriages, instead of under the eaves of the roof. The last van of the express trains is fitted with a continuous cord wound round a drum, and paid out and passed through the handles when the train is made up, and connected with a bell on the tender of the engine. The Guard adjusts the rope according to the length of the train, allowing about two inches of slack for each carriage, to allow for going round curves, and then secures the drum by screwing up the handle, when the apparatus is ready for use.

3.—*London, Chatham, and Dover Railway Company.*

In the case of the London, Chatham, and Dover Railway Company, another form of rope-communication has been adopted, the invention of Mr. John Edwards. Each carriage carries its own length of rope, fitted with a simple hook-and-eye coupling, and running through the centre of the train on the floor, inside the carriages, the slack being taken up by a weight at each end. A passenger, by pulling in one foot of rope, alarms the Engine-Driver and the front Guard, and by pulling in a few inches more, he signals to Guard at the rear of the train as well.

4.—South-Eastern Railway Company.

The South-Eastern is the only Company that has adopted an electrical communication, which has been approved by the Board of Trade, on the understanding that when the rolling-stock of the Company forms part of a train in which there is also rolling-stock belonging to another Company, the cord system approved for use by the majority of the principal Companies must be used.

The South-Eastern system is the invention of Mr. Walker, the Electrical Engineer of the Company, and consists of an electrical apparatus with batteries in the Guard's van, enabling passengers to communicate with Guards, Guard with Guard, and Driver with Guard, respectively

The passenger effects the communication by drawing out a wooden-plug (one of such plugs being placed inside each compartment), which, when withdrawn, sets the bells in the Guard's van ringing till the train is stopped.

The passenger cannot replace the plug, and a disc springs out from the side of the compartment on the signal being given, which also cannot be replaced by the passenger. The current is conveyed along gutta-percha-covered wires, which are connected by metal hooks between each carriage.

This system has been in operation on some of the Company's trains since July 1866, and is said to have worked very well.

Drawings and descriptions of the various systems sanctioned by the Board of Trade, and numbered 1, 2, 3 and 4, are appended.

SOUTH-EASTERN RAILWAY.

COMMUNICATION BETWEEN PASSENGERS, GUARDS, AND DRIVER.

To all Officers and servants of the Company concerned.

TRAINS FITTED WITH ELECTRIC COMMUNICATION BETWEEN PASSENGERS, GUARDS, AND DRIVER.

Commencing Thursday, July 1st, the following Trains will be fitted with the Telegraph apparatus for each journey:—

DOWN.	UP.
The 7-40 a. m. Dover Mail.	The 1-40 a. m. Dover Mail.
„ Tidal Train.	„ 4-15 a. m. „
„ 8-45 a. m. Ramsgate and Margate.	„ 8-20 a. m. Dover Express.
„ 12-15 p. m. „ „ „	„ 8-35 a. m. Hastings „
„ 2-15 p. m. „ „ „	„ 11-25 a. m. Ramsgate and Margate.
„ 4-5 Hastings Express.	„ 12-0 noon Dover Express.
„ 4-48 p. m. Dover Express.	„ 3-30 p. m. Margate and Ramsgate.
„ 8-45 p. m. „ Mail.	„ 3-45 p. m. Dover Mail.
„ 8-50 Dover Fast.	„ 7-40 p. m. Margate and Ramsgate.
„ 2-30 p. m. Hastings } *Saturdays only.*	„ Tidal Train.
„ 3-5 p. m. Ramsgate and Margate. } *Saturdays only.*	„ 7-30 a. m. Margate and Ramsgate. } *Mondays only.*
	„ 7-50 a. m. Hastings } *Mondays only.*

NOTE.—When heavy traffic requires a Train to be divided, both Trains are to be fitted.

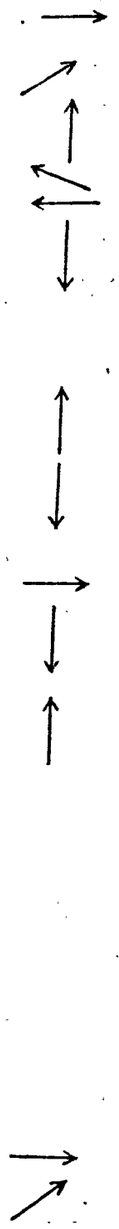
Printed Instructions have been affixed to the apparatus in each Guard's van, explaining how to use it; and Guards are required to work the bells in accordance with the following Codes and Instructions:—

CODES.

I.—One blow on bell ... ... Line not clear.
II.—Two blows on bell ... ... Line clear.
III.—Three or more blows on bell ... ... Testing.

*** The above Signals are to be acknowledged by repeating them.

IV.—Continuous ringing .. .. (implies) Danger or distress.



The Engine is taken to be to the right of the arrows shown in these instructions.

USE OF THE SWITCH.

FRONT VAN.

1. ORDINARY POSITION.—No Signals reach Engine.
2. All Signals reach Engine, and ring its bell.
   a Passengers and rear or intermediate Guards ring bells *only*.
   b Front Guard (using his plunger) rings bells, and also raises Semaphore Arm at each Signal.
3. To ring Guards' and Engine bells continuously, and permanently raise Semaphore Arm on Engine, when PASSENGER has NOT rung bell.
4. } To ring all bells and raise Semaphore Arm permanently, when
5. } PASSENGER has rung bell.
6. *(a)* When Engine is not fitted; *(b)* or when fitted or unfitted Carriages are between front Van and Engine, whether fitted or not. In these cases Engine must not be coupled up.

*** Nos. 3, 4, and 5 give continuous ringing WITHOUT using the plunger. Either is the Signal for STOPPING THE TRAIN.
Nos. 1, 2, and 6 give Code Signals by using the plunger.

INTERMEDIATE VAN.

3. When Van is without a Guard.
6. ORDINARY POSITION.—Code Signals are to be made with plunger.

} But, as a rule, apparatus should not be placed in intermediate vans.

REAR VAN.

1. To produce continuous ringing.

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6. ORDINARY POSITION.—Code Signals are to be made with plunger.
3. At the end of a journey, and when not at work, all Indexes must be set *upward*.

The Passenger Signal is continuous, and the disc opens and indicates the compartment. Guards can quiet their bells by setting Index upward. Each Guard to carry a key for closing discs and restoring bell-pulls.

When a Guard gives the Danger or Distress Signal, he should exhibit his red flag or lamp.

SIGNALS TO THE DRIVER.

Two blows on bell	TO START TRAIN.
Three or more blows on bell	TESTING.
Continuous ringing, Arm down	ATTENTION.
Continuous ringing, Arm up	STOP TRAIN.

THE STARTING SIGNAL, WHEN USED, IS

1. Two blows rear to front Guard.
2. Two blows front to rear Guard, in reply.
3. Two short whistles from Driver.

*** The Arrows for the starting Signal refer to front Van, and are so arranged that REPLY Signal only reaches the Engine.

NOTE.—When Vans work on unfitted Trains, the apparatus is to be removed, and given into the Telegraph Office.

NOTE.—The index is in all cases to be BOLTED in position.

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1. When a Danger or Distress Signal is made to Guards or Driver, they are immediately to look carefully along each side of the Train, and in case of any occurrence of a serious character—say violent oscillation, carriage on fire, &c.—the Train is to be stopped as quickly as possible; and when stopped, the Train protected in accordance with the usual regulations. If there is nothing to indicate need for the Train to be brought to an immediate stand-still, it must stop at the next Station in advance.

2. When a Passenger Alarm Signal is given, the Head Guard is at once to proceed to the compartment from which the signal is received, and ascertain the cause, and should there not be any justifiable reason for giving the Alarm Signal, the name and address of the person or persons offending is to be taken and reported in the usual way.

3. The Bell-pull and Disc must be re-placed before the Train is again started.

4. Shunters or Porters who couple and uncouple the carriages must also couple and uncouple the electric couplings, and will be held responsible for any damage that may occur through neglect of this order.

5. Careful attention is to be given to the unhooking of the electric couplings when carriages are detached from Trains in speed.

6. All Junction and other Stations affected by these regulations will be furnished with the necessary couplings and spare wire, to be used in case of its being absolutely necessary to attach an unfitted vehicle.

7. The Head Guard working in charge of the Trains specified, must carry with him spare couplings and some coils of wire to re-place any that may be damaged on the journey, or may be required for unfitted vehicles.

8. The couplings at the end of journey are to be collected from the Train and kept in the place appointed for them.

9. A special coupling is provided for coupling the Tender to the Trains, and is always to remain with the Engine Driver.

10. Each Terminal and other Stations making up Trains, attaching or detaching vehicles, will be held responsible that the portion of the Train with which they are concerned is properly furnished with the necessary apparatus for guards' vans, couplings, &c.

11. Guards are responsible for seeing their Trains are properly connected up, all outside discs closed, and to test the communication before the Train is ready to start. The test must also be made at all places where vehicles are attached or detached on the journey: also occasionally when the Train is in motion throughout the journey.

12. The Head Guards of Trains supplied with this communication are to make out a report of the working throughout the journey upon the usual Train Report. Should any defect occur in Engine apparatus, the Driver is to report to the Guard.

13. At Dover, Folkestone Harbour, Ramsgate, Ashford, and Tunbridge, the Chief Telegraph Clerk will see that the apparatus in Trains working to those stations is in good order and rectify ordinary faults. They have apparatus in reserve for contingencies.

14. At Bricklayers' Arms an Inspector will look after all the fitted stock and apparatus, and will be responsible that the apparatus is in good order; he will also have charge of the reserved apparatus, to re-place *and make good any defect that may be discovered.*

15. The vehicles fitted for the above-mentioned Trains, are not to work in Ordinary Trains. Should it be absolutely necessary to place a fitted vehicle in an unfitted Train, it must be taken out at the Terminal Station, and worked back to London as soon as possible.

16. The Guards' instructions furnished to each Van are to be strictly carried out, particularly the note referring to the apparatus being removed and handed over to Telegraph Office and in such case the Clerk to advise Mr. Walker, Tunbridge, by Telegraph.

17. Station Masters and others will please note that no Train must run a distance exceeding 20 miles without stoppage, unless fitted with the communication between passenger and guard. Any infringement of this regulation may lead to serious consequences.

18. The boxes containing apparatus for Guards' Vans also contain liquid; and, to prevent leakage, they must not be turned upside down or laid on their sides. Should any person be found deviating from this rule, he will be severely dealt with. The boxes have to be handled with the greatest care, to avoid damage to the contents. The "Set" is to be carried with care, when removed from a van.

19. Several cases have occurred where the Telegraph apparatus has been wilfully damaged, bells broken, &c., and particularly couplings lost or mislaid, and in a recent instance the gutta-percha covering of wires has been cut about by some mischievous person; damage of this sort can only be caused by Company's servants, who are hereby warned that such cases will be strictly enquired into, and the offending party severely dealt with.

(By Order)

C. W. EBORALL,
General Manager.
W. COCKBURN,
Out-door Supdt.

SUPERINTENDENT'S OFFICE,
LONDON BRIDGE STATION;
Dated 31st July, 1869.

Dated 21st February, 1868.

Report made by COLONEL W. YOLLAND, *to the Board of Trade, on experiments recently made on various Lines of Railway on which some of the Trains have been run wholly or partially fitted with different systems of electrical communication between passengers and the servants of Railway Companies in charge of those Trains.*

I have the honour to state, for the information of the Board of Trade, in obedience to your Minute of the 21st November last, the results of the experiments which have been made since that date, on various lines of Railway on which regular trains have been run, wholly or partially fitted with different systems of electrical communication between passengers and the servants of Railway Companies in charge of those trains.

These experiments have been made on the London and North-Western, London and South-Western, Midland, and South-Eastern Railways, and they have all been conducted, the better to test the working of the communication, under instructions that the guards at the rear of the trains shall give the starting signals from the terminal, and at all events at some of the intermediate stations, by means of the electrical communication running through the whole length of the train. I shall proceed to give the results.

The London and North-Western Railway Company fitted up the express train that runs from London to Wolverhampton (125¾ miles) and back during each week day, with Mr. Martin's electrical apparatus (which had previously been used on the Royal Train), and the experiments commenced on the 8th January, and I have been furnished with the results for about 25 days. The train generally consisted of about nine vehicles, including vans at each end, but independent of the engine and tender. On several occasions extra carriages were introduced into the train, not regularly fitted with the electrical communication, but provided for by spare couplings, usually carried in the guards' vans, and conducting wire-ropes, stretched alongside the carriages.

These trains have been started by ringing the electric bell in the front van, by the action of the guard in the rear van, from 10 stations in each journey, the guard in the leading van then giving the usual signal to the driver, the electric communication not extending to the engine. I am informed that although this communication has been made use of about 500 times, it has only failed upon three occasions, in consequence of the conducting wire having been unnecessarily twisted and broken by porters in the act of taking off the electrical coupling wires.

On two occasions the communication was made use of by passengers out of curiosity. In neither case could the engine-driver or guard perceive that there was anything wrong with the train, and in consequence, acting properly in obedience to their instructions, they did not stop the train until they got under the protection of the fixed signals at the next station. The apparatus enabled the guards to ascertain who had given the electric signals from the carriages. I think the experiments on this train furnish satisfactory results.

2. The London and South-Western Railway Company commenced to make similar experiments with their Exeter express train on the 2nd December last, instructions having been given that the trains were to be started from the terminal stations in London and Bideford (219¾ miles apart), and also at Basingstoke, Salisbury, Yeovil junction, Honiton, Exeter, and Barnstaple, by the head guard riding in the rear van, ringing an electrical bell placed on the engine: the electrical apparatus employed being that invented by Mr. W. H. Preece, which has now been long in use on this line (since May 1865). The usual number of vehicles, exclusive of engine and tender, in the train was seven, but there are many instances in which additional carriages were added, and in some the number was increased to 14. Among the usual number of seven, there was generally one not fitted up with the electrical apparatus, but spare couplings and conducting wire-ropes were provided to maintain the circuit. I have been furnished with the original guards' reports, and Mr. Preece informs me that, out of 714 starting signals given on 48 days by the rear guard, only seven have failed to be acknowledged; of these, two are accounted for by the electric bell being placed on the tender, instead of on the engine, and being prevented from being heard by the engine blowing off steam; four occurred at Exeter Station, in consequence of the train standing on the line in which turn-tables are placed, and the platelayers having disturbed the wire which had been carried round the turn-table, in order to connect the rails electrically, and thus complete what is termed the earth circuit; and in the seventh instance the starting signal was not received at Basingstoke on the 7th December, it is supposed, in consequence of its not having been properly made by the guard, as the train was stopped by the lineman at Whitchurch, and it was then found to work correctly, both in the front van and on the engine. Various experiments were also made from compartments in the different carriages, by Mr. Preece's assistants, but the electrical communication does not appear to have been used by the public either from necessity or out of curiosity. I travelled by this train on the 19th instant, and found the communication complete to the guard; but the connexion with the engine no longer existed, and the electric bells continued to ring all the way to Axminster (where I left the train), in conse-

quence of the guard not having a proper key to unlock the handle in the commutator in the carriage in which I rode. I think these experiments must also be regarded as satisfactory.

3. The Midland Railway Company also fitted up an express train that runs from London to Leeds (201 miles) and back on Mr. Preece's system, and commenced to run it under the same instructions as to the starting of trains on the 30th December last, and I have received reports respecting it up to and including the 6th instant. This train, when it left King's Cross Station, consisted of five composite carriages, two vans and the engine fitted with the apparatus, and one composite which was not fitted, but had a wire-rope carried round to maintain the electric circuit. It ran in this state as far as Trent Station, where the train was broken up and divided for Manchester, Nottingham, and Leeds, the portion for Leeds consisting of two fitted and one unfitted composite carriage, with a wire-rope carried ronnd it to maintain the circuit. At Chesterfield two unfitted carriages, with wire ropes carried round them, were attached to the train. At Normanton an unfitted composite was taken off for York, and the train then proceeded to Leeds with two fitted and two unfitted composites, two vans, and the engine fitted. The train was appointed apparently to stop at six intermediate Stations on the down, and ten on the up journey, with the right to be stopped at two additional stations on the down journey by signal, to take up passengers for certain districts. The engine was not fitted with an electric bell, but only an indicator signal on the engine, which the driver might or might not see, and which it is proved, by the report of the Inspector travelling with the train, he very frequently did not see, when the electric signal from the rear van in the train was effectively worked throughout. The engines were changed at Leicester.

The following failures are reported :—

3rd January. In consequence of a break-down at Ilkeston, the carriages of the 4h. 55m. p. m. up train from Leeds on the previous evening did not reach London that night, and spare carriages and van were used to form the 9h. 10m. a. m. train. It is not stated whether these carriages were regularly fitted or not, but the electric apparatus would not work in starting from King's Cross, but worked right after leaving Bedford. On the return ourney the apparatus would not work between Trent and Leicester.

6th January. The Inspector tried many experiments in signalling from the rear van and one of the carriages ; some of these signals were acknowledged, others were not, in the 9h. 10m. a. m. down train ; and on the up journey, singals from the rear van could not be given when starting from three stations. Several signals were given from carriages and acknowledged, and the communication is reported perfect after passing Kettering.

7th Jannary. 4h. 55m. p. m. up train. Signal given from front van between Syston and Leicester was not acknowledged by driver or rear guard. 9h. 10m. a.m. down train ; no signal could be given between the train and the driver between London and Leicester. At Leicester the engine was changed, and the communication worked properly afterwards.

8th Jannary. 4h. 55m. p.m. up train. The signal failed when starting from Oakenshaw, and between that station and Masbro', but worked rightly afterwards.

9th January. 9h. 10m. a. m. down train. No signal could be given from the rear van from Trent to Leeds; and there was the same defect from the same van in the 4h. 55m. p. m. up train, Leeds to London, in the evening.

The Inspector, writing on the 18th January, says " there has been no serious defect since the 9th instant. There is no dependence upon the drivers observing the singal ; many of the signals given have been missed by them. The men say that looking out and watching their engines occupies their attention so much that there is no dependence to be placed upon their seeing the signal." The Inspector made a large number of signals from the vans and carriages, and reports that they were acknowledged by the guards, but only occasionally by the drivers.

25th January. 9h. 10m. a.m. down train. Communication defective between London and Bedford, and the guard suspecting the fault was in composite carriage No. 221, carried a wire-rope round it, and after that the communication was good.

27th January. 9h. 10m. a.m. down train. Communication defective at starting, and remained so throughout the journey. Bells rung at intervals in each van. Cause of failure not then ascertained.

29th January. 9h. 10m. a.m. down train. Similar failure to those on the 25th and 27th

30th January. 4h. 55m. p. m. up train. No proper signals could be given between Leeds and Normanton, and a composite carriage showed a defect ; the communication was severed, and a wire-rope was carried round that carriage, and then the electric communication worked properly.

4th February. 9h. 10m. a.m. down drain. Signal to start from King's Cross could not be given ; the signals improved after leaving London, but were feeble to Leicester, and from Leicester to Leeds more feeble still. At Trent they failed as in London. I was at King's Cross when the train left, and at the rear van, but I do not know whether the failure was in the engine or in the train.

6th February. 4h. 55m. p.m. up train. The signals worked correctly up to Leicester, but failed at Market Harborough, Kettering, and Wellingborough, where it was traced to the engine. At Bedford the driver discovered some cotton waste interfering with contact, and after that was removed it worked rightly.

I went down by the Midland train, 9h. 10m. a.m. on the 10th instant, and tried the communication from several carriages, and it worked properly to the two vans.

The working of Mr. Preece's system has been very severely tested on the Midland Railway; two mistakes have, however, I consider, been made respecting these experiments. Mr. Preece should, I think, if he had been requested to do so by the Midland Railway Company, have taken care that it was made as perfect as he could make it, and not have put on the engine an indicator signal which worked without noise, and was certain to fail to be observed. The failure has been very conspicuous.

The explanations which are forthcoming as to the failures are as follows :—It is surmised that the failure on the 6th January was due to the weakness of the battery. On the 9th it was evidently caused by a mechanical defect in the apparatus. The knob which is pressed against by the guard in his van, when he desires to give an electric signal, passes through a collar, *formerly* made in two parts, the outer one of which unscrews; this had become unscrewed, and prevented the knob from being pushed sufficiently far in to make electrical contact.

On the 25th, 27th, 29th, and 30th January, one of the carriages (a composite, No. 221) had the electric wire broken, and no communication could be made through it. This is said to have been done by the working of the draw-bar against which it rested, the carriage not having been properly fitted in the first instance, or the fitting had subsequently been disturbed

On the 4th February the failure is attributed to a weak battery.

Thus there have been failures reported on 11 days out of 34. Five of these failures are, I think, satisfactorily accounted for; but, on the whole, the working of Mr. Preece's electrical apparatus on the Midland Railway is much less satisfactory than on the London and South-Western Railway.

Mr. Preece has informed me that he had a man to look after the fitting-up of the train, and to look after its working for a portion, not the whole, of this time ; and that he abstained from looking into the matter himself, because it might tell its own tale free from his interference. I think this was a mistake. The results of the working, whatever it might be, would come from the Officers of the Midland Railway, and he should have made the apparatus as effective as possible.

4. The South-Eastern Railway Company have, since July 1866, run the 7h. 25m. a. m. down, and the 3h. 45m. p. m. up mail train between London and Dover (88 miles) ;—and the 8h. 30m. p. m. down mail, the down tidal train, the 4h. 15m. a. m. up mail, and the up tidal train between London and Dover, and London and Folkstone, from February 1867, all fitted up with Walker's electrical system of communication between passengers, guards, and drivers ; and subsequent to the 24th November last, and up to the 20th January inclusive, these trains have been started from the terminal and such other stations as they have stopped at by means of a signal given by an electrical bell on the engines, worked from the vans at the rear of the trains.

The 7h. 25m. a. m. down mail starts form Charing Cross, calls at Cannon Street and attaches other vehicles, and drops some at Ashford without stopping the train, between Cannon Street and Dover. The communication is reported by the guards as having been perfect for 45 days, imperfect on three days, and on one day the train was not fitted with the apparatus, the fitted stock having been taken for extra traffic on Boxing night. On the occasion of the first failure the train was started by the electric bell, but the communication became imperfect between the guards on the journey, supposed to be owing to the weakness of the battery employed. The second is, strictly speaking, not a failure, as an unfitted van was attached without being properly connected up. The third also can scarcely be called a failure, as it was due to one of the vans having had new wheels put on without the knowledge of the Telegraph Department, and the connexion wires for the earth had not been made. The train was started by electric signal, but the testing afterwards was imperfect. The average number of vehicles in each train was 10.

The corresponding 3h. 45 m. p. m. up mail train had only one failure, in which the communication with the engine only was imperfect, but perfect throughout the carriages, whose number averaged nine, during the 49 days. This train started from the Admiralty Pier, Dover, called at the Dover Town Station and Cannon Street, and thence ran on to Charing Cross.

The 8h 30m. p.m. down mail starts from Charing Cross, calls at Cannon Street to attach carriages, and runs to Dover; average number of carriages 8. On two occasions the train was not fitted, and three failures are reported during the 58 days. On one occasion the bell in a van attached at Cannon Street was faulty ; in another the battery in one van had been sub-

jected to rough usage (a collision), previous to being attached to the train, so that a wire broke in the journey; and in the third the train was started all right by electric signal, but the bell in front van began to ring after passing Red Hill; the cause could not be traced when the train was stopped, but it worked rightly for the rest of the jour ney.

The corresponding 4h. 15m. a. m. up train, average number of carriages eight, on one occasion only had one van fitted in the train, but the communication with the other is said to have been good. No other failures reported during 57 days; the train did not run on one day.

The down tidal train starts from Charing Cross, calls at Cannon Street to attach carriages, and also at Red Hill, and thence to Folkstone; average number of carriages 10. On one day the train was not fitted, the proper carriages having been used for the extra Christmas traffic. On another day an unfitted van was attached at Charing Cross without passing a wire round it. This was a case of negligence, and not a failure in the electric communication, which was complete for the 56 days.

The corresponding up tidal train starts from Folkstone, calls at Red Hill and Cannon Street, and runs on to Charing Cross. Two failures are reported during 56 days. In the first, six vehicles were attached to the front part of the train at Folkstone junction, without being connected. This cut off the communication with the engine, but it was in good order for the tidal train proper. In the other case the electric communication is stated to have been complete throughout the carriages, but imperfect to the engine.

In addition to the electric signals given by the guards to start the trains from the several stations, the reports show that, on all these trains, testing signals were frequently passed from one guard to the other whilst running, and to signal the state of the out-of-door signals as they approached some of the stations.

Thus on a total of 327 trains running between the 24th November and the 20th January, the electric apparatus appears not to have acted properly on eight different occasions, besides six others where the train was not fitted, whilst close upon 900 signals appear to have been given on the electric bell during the same period for the starting of the trains, and it is also said that on an average 12 signals were given by the guards upon each journey, making up a total of upwards of 3,750 signals. It is stated that these trains are all broken up and re-marshalled at the end of each journey.

Passengers travelling with these trains have made use of the electric communication, apparently out of curiosity, on five occasions since my last report, and the trains were stopped at the next station under the protection of the fixed signals. The Post Office Clerks made use of it, on another occasion, to stop the train, in order to get a mail bag out of a break-van, in which it had been placed by mistake, and the guard of the train stopped the tidal train on the 10th instant at Tunbridge to attend to a *hot* axle.

I consider the working on the South-Eastern Railway to have been very successful; and that Company, I understand, propose to continue the same mode of working, adopting the electric signal for starting from stations on these particular trains.

An electrical apparatus has also been tried on a few occasions, the invention of Mr. Tatters, between a carriage or van and the engine, on the South Devon Railway. It is on a different principle from any of the preceding, and it could not be worked in connection with them, as two conducting wires are made use of instead of one.

I have also seen a variety of inventions, many of them ingenious, for effecting a communication between the passengers and the servants of Railway Companies in charge of trains; but I hold it to be necessary that any invention must be subjected to actual working on a line for some time before it would be right to express an opinion that it would probably answer.

As regards the possibility of establishing and maintaining electric communication throughout the entire length of a Railway train and from the compartments of the various carriages, I think it is impossible, looking to what has now been going on for a long time on the London and South-Western and South-Eastern Railways, to doubt that it can be done. It is also quite possible that some other mode may be feasible, but I am sure that the electric or any other system which may be adopted must be very carefully looked after, and used at all times for the starting of the trains from the stations, and that it will not do to use it only occasionally, and expect that it will be found efficient when an urgent emergency arises requiring the servants of the Company to be informed that something is wrong in the train.

Referring more particularly to these electrical experiments, I must remark that the more simple the means of communication provided, the better it will be. Visual signals outside each compartment of a carriage, or on the engine, are useless, and only serve to increase the cost of the apparatus. Electric bells to ring in the guards' vans and on the engine are all that can be necessary.

With respect to the question of danger arising to the train, from the signal being made direct to the driver in the first instance, instead of only to a guard, I must observe that the working of traffic on any line of Railway that will not admit of a train being stopped at a

station under the protection of the station signals must be badly conducted if this cannot be done with perfect safety; and the instructions which have been issued by the Railway Companies who have made these experiments direct that it will be proper, when an electric signal is given, to stop the train at the next station, unless the servants of the Company can see that something is wrong that requires the train to be stopped at once.

There are some differences in the several systems which should be got rid of. On the South-Eastern, only a single connecting wire, placed at the centre, is used between the adjacent carriages. On the London and North-Western, London and South-Western, and Midland, two connecting wires are made use of, except between the van and the engine on the Midland, where only one is employed. If the communication can be efficiently maintained by one, as appears probable, it would be very desirable. On the South-Eastern a spiral wire is made use of, which ensures friction against both hooks, and tends, in my opinion, to diminish the chance of failure of electric contact from dust or dirt; but I think it is placed too high, as it would be found inconvenient to couple and uncouple at junctions. It should, moreover, be placed immediately above the screw-couplings between the carriages, and so little above them, that the screw-couplings could not be undone without first undoing the electric coupling.

No mode of communication will, in my opinion, be efficient which does not provide that a signal shall be given to the driver in the event of a train breaking into two or more parts, which frequently happens; and this can be effected with the electric apparatus; and the cord which is now used on some lines of Railway, for some of the trains, does this when that cord is properly secured.

I have further to report that I have seen Mr. Harrison on the subject of the communication being established between passengers and the drivers by means of a cord, and some carriages are, I understand, now being fitted on the North-Eastern Railway in the manner in which he thinks it likely to answer, even on long trains.

I do not think the system of the cord, as now fitted, is likely to succeed. It is only used to satisfy public opinion, and it is far too roughly fitted up, and comes in contact with too many obstacles, all creating more or less friction, to have any chance of working properly on long trains.

The prominent question for decision at the present time appears to be, shall Railway Companies be compelled, by legislative enactment, to provide the means of communication between passengers and the servants of the Companies in charge of trains, on certain of those trains; and this decision should properly depend on the answers to the two following questions:—1. Is such communication necessary in order to provide for the public safety? 2. Is it practicable?

As regards the necessity for such means of communication, I believe there are few who will now contend that it is not necessary for the very long journeys which are taken by express trains without stopping; and I have already expressed my opinion, founded on actual experience of what has been accomplished, that it is quite practicable. It should be first established for the trains running long distances without stopping, and a discretionary power be given to the Board of Trade to order its extension, from time to time, or gradually, to trains running upwards of 10 miles without stopping.

The mode of communication to be adopted would probably be left to the Railway Companies to settle; but it should be uniform in certain particulars, where carriages may possibly be interchanged, and have to pass from one Company's line to another. There would, however, be no objection, if it were deemed desirable, that a different system should be used in Ireland from that adopted in Great Britain; and a different system might be used on the broad from that followed on narrow gauge lines.

In the event of the Railway Companies being unable to agree as to what system should be adopted, the Board of Trade might be called upon to decide; and I am unable to see that such decision would in any way free Railway Companies from the consequences of any negligence on their part in properly maintaining it, or destroy any portion of their responsibility. Nothing of the kind occurs with reference to the approval given by the Board of Trade, through their Inspecting Officers, as to the nature of the permanent-way laid down, or as to the signals erected for protecting trains at stations or junctions.

Railway Companies should be protected from the improper or unnecessary use of such means of communication, by a penalty being imposed, either by a clause in the Act, or by a bye-law sanctioned by the Board of Trade, for such an offence.

I enclose the whole of the reports which I have received from the different Companies, with the exception of the guards' reports, which, in accordance with my arrangements with the Officers of those Companies, I have to return to them.

D/5243/70

All communications should be addressed to the Secretary.

CIRCULAR No. 21 RAILWAY.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

RAILWAY.

To

THE GOVERNMENTS OF MADRAS, BOMBAY, BENGAL, THE NORTH WESTERN PROVINCES AND THE PUNJAB; THE CHIEF COMMISSIONER OF OUDH; THE RESIDENT AT HYDERABAD; AND THE AGENT TO THE GOVERNOR GENERAL IN CENTRAL INDIA, IN THE PUBLIC WORKS DEPARTMENT, RAILWAY BRANCH.

FORT WILLIAM, DECEMBER 10, 1870.

In continuation of Circular No. 24 Railway of 1869, the undersigned is directed to forward for information, copies of the further papers enumerated in the margin,* on the subject of communication between the passengers, guards and drivers of trains in motion, and to refer to the publications, also noted in the margin,† for further information on the subject.

* Letter from the Board of Trade, to the Under Secretary of State for India, dated 2nd September 1869.
Rules of the London and South-Eastern Railway.
An illustrative drawing.
Report by Colonel W. Yolland, dated 21st February 1868.

† Papers read before the Institution of Civil Engineers on 11th December 1866.
"Preece on communication in trains."
Pamphlet by Latimer Clarke, M. I. C. E. on pneumatic communication, &c., London, E. and F. N. Spon, 1868.

Major, R. E.,
Deputy Secretary.

To The Secy. to the Govt. of Madras
Public Works Department (Railway)

105 Copies

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CIRCULAR No. 21 RAILWAY.

Dated December 10, 1870.

Received 24. -..

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The Acting Consulting Engineer for Railways

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1

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Communication between Passengers, Guards & Drivers of trains in motion. Circular from the Govt of India forwarding papers on the subject of Communication between Passengers & Railway Officials of trains in motion, circ. to the Consulting Engr for Railways.