The Lackawanna Tests

WIRELESS telegraphy, bearing a long list of triumphs wrested from the waters, has found new fields to conquer on land in conveying intelligence to speeding railroad trains. It is predicted that the new application of the art will revolutionize railroading, as it relates to the safety and convenience of travelers, for already passengers have experienced the novelty of reading news of the minute while they rode in cars thundering along at the rate of sixty miles an hour.

The value of a wireless installation was strikingly illustrated during a test on the Lackawanna Railroad train which left Hoboken at fifteen minutes after ten o'clock in the morning on November 24. The conductor of the train, known as the Lackawanna Limited, which was bound for Buffalo, became ill when thirty miles east of Scranton, Pa. Ordinarily it would have been necessary to stop the train and send a telegram asking for a relief conductor to be ready to take charge, or else wait for another conductor when the Scranton station was reached. The Lackawanna Limited is scheduled to run from Hoboken to Buffalo in nine hours and forty-three minutes, which means there is a constant fight against the loss of time.

On this occasion David Sarnoff, chief inspector of the Marconi Wireless Telegraph Company of America, was operating the wireless apparatus on the Limited train. The train was running at a speed of fifty miles an hour, but a wireless message telling of the conductor's illness and asking for a relief was dispatched to Scranton. The train arrived in Scranton about half an hour afterward and another conductor was on the station platform ready to step aboard.

When the Limited left Hoboken it was filled with passengers, and as it continued the conductor realized that he would need another coach. It was only

necessary for him to notify the man at the wireless apparatus of what he wanted and a few minutes afterward a message was sent flashing over the mountains to Scranton, asking for another car to be held in readiness and added to the Limited when it arrived. The car was waiting when the train reached Scranton and no time was lost.

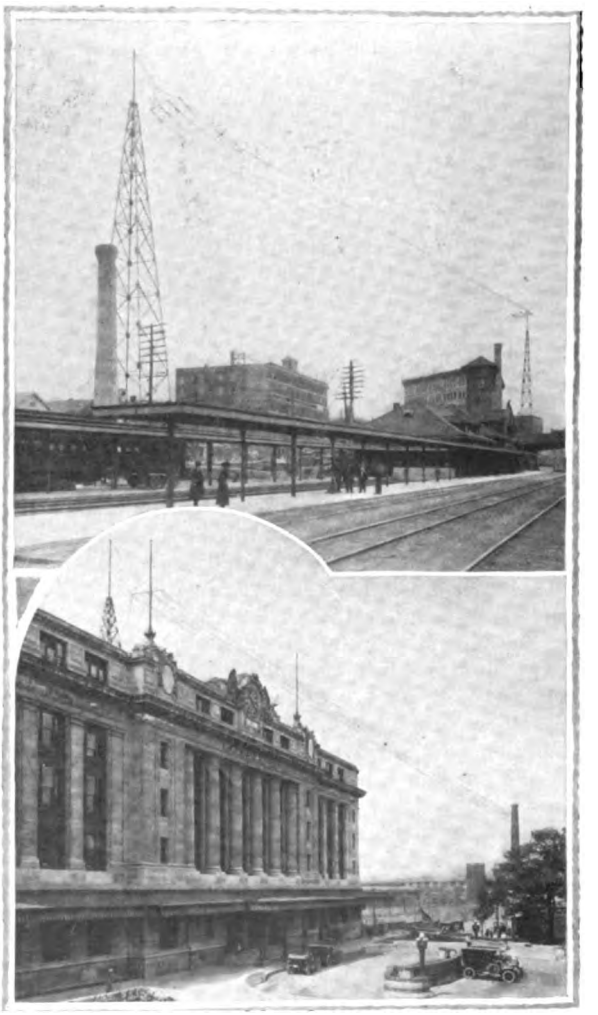
In charge of the wireless test on the train was L. B. Foley, Superintendent of Telegraph for the Lackawanna. He decided to get off at Scranton and return to New York on a train due in the former city two hours after his arrival. Mr. Sarnoff, however, remained on the train to continue the tests, and as the train Mr. Foley had planned to take —the Eastbound Limited—was due in Binghamton an hour before the arrival of the Lackawanna Limited, the Marconi employee decided to leave for New York on an express at midnight.

While in Scranton, however, Mr. Foley was informed that the Eastbound Limited was an hour behind time. A wireless message was therefore sent to Binghamton from Scranton and thence to Mr. Sarnoff on the Lackawanna Limited, informing him that he could make the connection with the Eastbound Limited at Binghamton. In consequence, he and Mr. Foley returned to New York on the same train.

Mr. Foley believes that when all trains have been equipped with wireless the absolute severing of all communication between trains and stations will be done away with. This will mean that disasters like the Dayton flood and the San Francisco earthquake will not cut off communication between the storm-devastated sections and the outside world. Wrecked or derailed trains will be able to notify stations about accidents as soon as they occur and word can be flashed to the nearest point outside the storm centers.

"Communication by wireless telegraph to and from fixed stations with moving trains is no longer an uncertainty," he said. "Railroads can now go ahead and install the service without any fear of failure. There are many fields for the wireless telegraph in railroad operation, in routine business, and emergencies when lives and property can be saved by its use.

"And the service can be put into operation without increasing the train crews. Regular trainmen can easily learn the telegraph alphabet or telegraph operators



The towers at Binghamton, showing the antennae suspended beside the railroad tracks.

The Scranton passenger station, with the aerial stretching to a nearby chimney.

on trains can perform the duties of trainmen. Later, it may be found necessary and profitable to place a telegraph operator on limited trains running long distances without stopping to handle commercial telegrams for the public. Telegraph offices on trains in the future may be of as much value to the public as branch offices in hotels and other places where people congregate in large numbers.

"In my opinion the wireless will revolutionize railroading. The time is coming, and it is not far distant, when the wireless telegraph on trains will make the safety and convenience of railroad traveling 100 per cent greater than they are to-day. And as a preventive of accidents I think the wireless will prove of the greatest value.

"In the Hudson tubes and subway, for example, the train dispatcher sits in his room, and by the flashing of lights knows where every train is. If two trains get dangerously close together he can send a signal that will almost instantly stop one or both of them. I believe that the same thing can be done on railroads with the wireless. The dispatcher can sit in front of a board on which the location of each train will be shown by wireless telegraph. If he sees trains getting too close together for safety, he can send a wireless message that will stop one of them any where—out in the country miles from a telegraph station.

"But of course all this is in the future. At present we are only experimenting. As far as they have gone, however, the experiments justify the predictions.

"Our doubt when we contemplated installing the wireless was about using the rails for grounding the electric current. There is a ground wire at every wireless station, but you can't have one from a moving train. So we tried sending our ground current to the rails. The scheme worked well and the first difficulty was overcome.

"And another problem was settled at the same time, that of supplying the electric current for the messages. We simply used the dynamos already in the train for lighting purposes. We had feared that they would not furnish sufficient current for the wireless, or if they did, that using it would weaken the lights. But we used all the electricity we needed and the lights were not perceptibly dimmed. I think it is certain that we can use the rails for ground wires and the ordinary lighting dynamos for our current. This was demonstrated.

"Our next problem is to get our instruments on the train absolutely in tune with those at Scranton and Binghamton. You see, on account of the tunnels and low bridges over the tracks we cannot have a high aerial on the train, but high aerials are necessary if messages are to be sent any great distance, so we built them high at the stations and work them with a low aerial on the train. This makes the transmitting of messages between the train and the stations more difficult, but I believe this difficulty can be overcome.

"We have sent and received messages so easily that we are convinced that the only thing required to perfect the service is a perfect adjustment of the instruments. We shall make an experimental trip every other day until this adjustment is satisfactory. Then the wireless service on the Lackawanna Limited will become a regular thing."

Setting signals by wireless is the next step, according to Mr. Foley. He said that if an operator wishes to set a signal for a moving train not in communication with him he can cause the semaphore blade of the signal post to rise or fall at his will by sounding the correct dots and dashes on his key.

"Signals can be set by wireless," he said, "as easily and as surely as they are now set by electricity conducted in wires.

"This means that if any mistakes are made in the orders issued to engineers and conductors at stations or in the case of any emergency in which a train must be stopped to avert an accident the station operator can signal the train as certainly as if he had direct wire communication with some one on board.

"Another valuable use to which the wireless-controlled signals can be put is the handling of freight trains on long runs. At present a through freight must make many stops between its starting point and destination, so that orders and instructions concerning right of way can be delivered to

the conductors, but these frequent stops are a source of expense and delay which will be abolished by the wireless telegraph.

"Keeping freight trains in motion for long distances without stops will result in great economy of operation. Railroad operating officials know how expensive it is to start and stop heavy freight trains, the additional cost of fuel with the attendant pulling out of drawheads and the wear and tear of equipment being no inconsiderable items in themselves. With direct communication with a train and the ability to set and release signals by wireless, dispatchers can keep in touch with conductors and make the stops needless. The wireless permits the dispatcher to board every train and deliver his instructions as surely as if he handed them to the conductor in a sealed envelope.

"That the wireless service for ordinary operating purposes is no longer an experiment is proved by the fact that the Lackawanna has already depended upon it when wire communication was cut off. The railroad has used the wireless for handling train orders, and find it as accurate and reliable as the telegraph or telephone. Recently, when a severe sleet storm put all telephone and telegraph lines out of commission in the Mountain Division of the Lackawanna Railroad, all train orders were handled by wireless between Scranton and Binghamton, where the railroad's two fixed stations are. The signals were strong and distinct, and the messages were received and sent by the operators without difficulty. The wireless was the only means of communication between Scranton and Binghamton for two hours during which fifty-four orders were transmitted."

Commercial telegrams have already been sent from the Lackawanna Limited and a set of regular toll rates is now being prepared.

The wireless apparatus on the Limited has been installed in the forward part of the train. The aerial consists of a quadrangular closed loop on each car, supported at each corner by insulators on iron pipe attached to the corners of the car. They are raised eighteen inches above the roof of the car, this being the maximum space allowable on account of bridges and tunnels. Four cars are thus equipped, the connection between cars being by means of a plug and socket. The aerial on each car is sixty-five feet long and is composed of a twisted cable of seven No. 18 silicon bronze wires. The car aerials are brought together at a point about the center of the train and lead into the station, which is located in a small box-like compartment at one corner of the passenger cars.

The power for operating the train equipment is obtained from the generator storage battery and lighting outfit, and about 2 KW of energy is used for the wireless service. There is no appreciable effect upon the electric lights when the wireless is in operation.

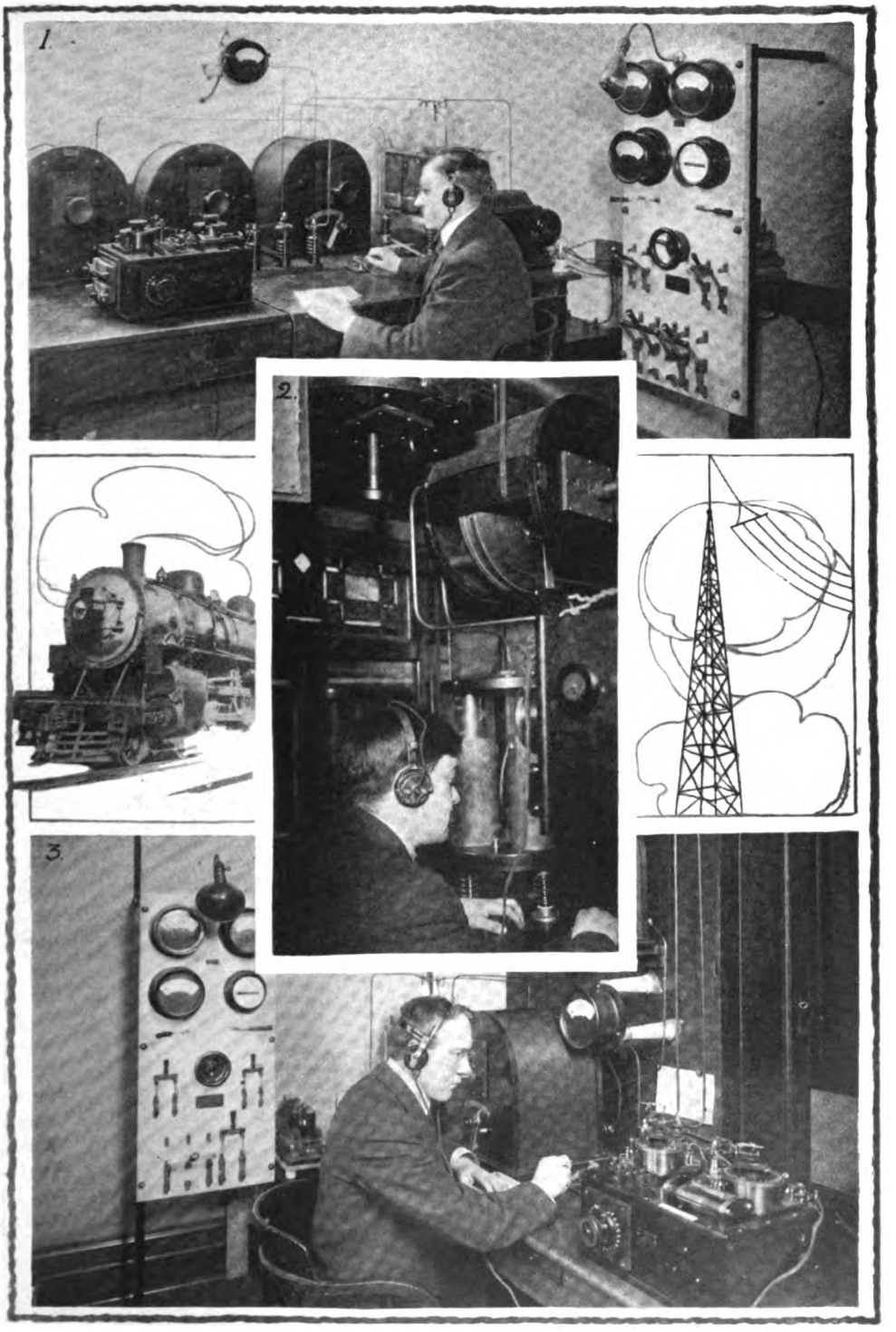
The radius of train operation at the present time is approximately fifty miles, but this range will be extended after the equipment has been tuned up.

The ground connection on the train is obtained through the steel trucks and wheels of the cars and rails.

The equipment on the train consists of a standard 1-KW Marconi set of modern design, especially adapted to this service. The motor-generator is automatically controlled, the operator simply throwing on and off a switch, as necessary. A special feature of the installation is the limited amount of space required for it. A photograph of the station accompanies this article.

The distance between Scranton and Binghamton is about sixty-five miles, and in the experiments it was found possible to maintain communication from the train running at fifty-five miles an hour, part of the time direct from the train to the fixed station away from which the train was speeding, and when the train had proceeded to a point too far away for its short aerial to force signals through to this first station direct, the signals were delivered to the station by being picked up at the second station and relayed back. At no time during the tests was the train out of communication with both stations.

One of the most striking features in connection with train wireless was illustrated during one of the test trips, when news of the day was received while the train was demolishing distance between

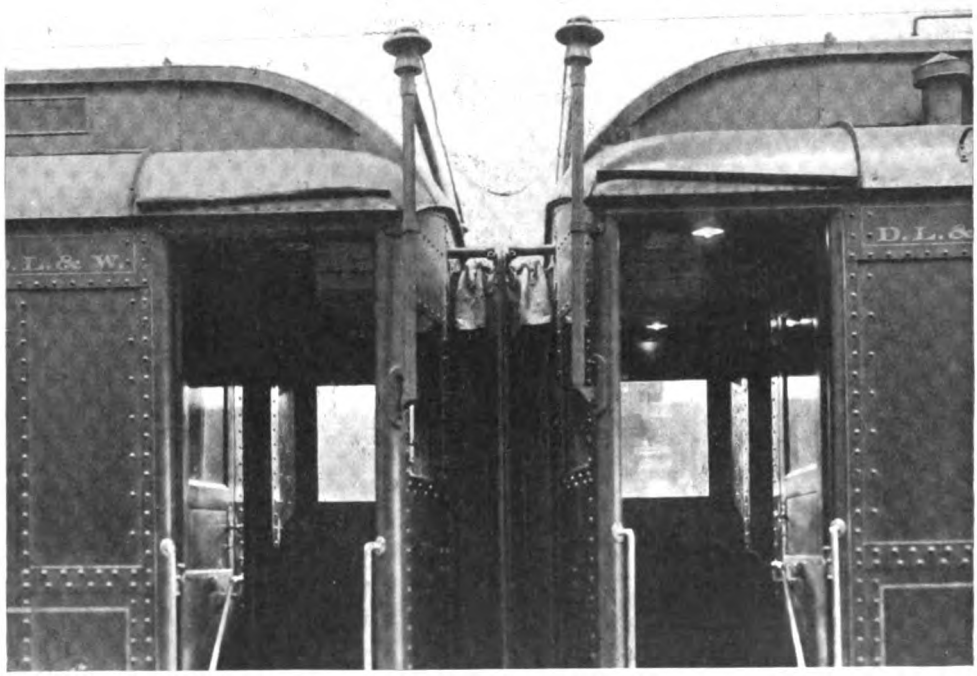


(1) *The wireless room at the Binghamton railroad station.* (2) *Operator at the key of the train station.* (3) *J. J. Graf, Lackawanna electrical engineer in the Scranton station.*

Scranton and Binghamton at a mile-a-minute speed. Passengers were shown the latest dispatches from the United States and abroad, 250 words having been sent to the train by the Scranton Times. The sending of the dispatch recalled the fact that the daily news contained in the Ocean Wireless News, published on ocean steamships, was obtained by wireless and suggested the possibilities of a train wireless newspaper.

Railroad men, both in this country and abroad, have shown great interest in the tests. On December 17 Messrs. Logan and McDonald, of the telegraph department of the Pennsylvania Railroad, made a two days' inspection of the Lackawanna wireless system. They spent the first day watching the wireless work between Scranton and Binghamton. On the second day they were at Scranton when Mr. Sarnoff, of the Marconi Company, on the Limited, fifty miles east of Scranton, sent a wireless message to Mr. Logan, introducing himself. From that time until the train, which was westbound, arrived in Scranton, communication between the Limited and the Pennsylvania men at Scranton was kept up. Then Logan and McDonald boarded the train at Scranton, the former taking the key in the wireless room. He sent messages to both Scranton and Binghamton.

Sarnoff, Logan and McDonald left the train at Binghamton and J. J. Graf, the Lackawanna's electrical engineer and operator on the Limited, sent a wireless from a point twenty-two miles west of Owego to the effect that the train was stalled because of trouble with the locomotive. The message was relayed to the chief train dispatcher at Scranton, and from that time until the locomotive had been temporarily repaired more than a



The aerial consists of a quadrangular closed loop on each car, supported at each corner by insulators on iron pipe attached to the corners of the car. They are raised eighteen inches above the roof of the car.

dozen messages passed between the train and Binghamton. A new locomotive was ordered from Owego by the train dispatcher, and in twelve minutes it had been coupled onto the train.

Attention was called to the fact that if the accident had occurred in a storm that paralyzed the telephone and telegraph lines it would have been impossible to obtain another locomotive until the train reached Owego, and a considerable delay would have been experienced.

Mr. Graf sent out the following call recently while the Lackawanna Limited was forty miles from Buffalo and speeding toward that city: "Any radio station in Buffalo, adjust me." He repeated the call for twenty minutes and finally received a response: "Who are you?" This was followed by "What position are you in?" Graf replied, "Operator on board No. 3 Lackawanna Limited speeding toward your city."

The Buffalo operator, evidently believing that he was communicating with a wireless man on the Great Lakes, asked, "What longitude and latitude are you in?" Once more Graf flashed back an answer, and this time it was understood. The Buffalo operator, Jackson, of the Marconi Wireless Telegraph Company of America, sent his congratulations on the success of the train wireless and met the Limited when it arrived in Buffalo.

The possibilities of wireless applied to railroads multiply almost constantly. Soon after the installation had been made on the Lackawanna Limited, three tramps were discovered by Conductor Simrell riding on the tank of the locomotive, unobserved by the engine driver and the fireman. The Limited was between Scranton and Binghamton at the time and the conductor did not want to stop the train to put the men off. Therefore he reported his discovery to Mr. Foley and Operator Graf, who were in the wireless room.

The wireless apparatus was put in operation and a message sent to Binghamton informed M. F. Collins, a special division agent of the railroad in that city, of the fact that the Limited was carrying three men who were without tickets. When the train pulled into the outskirts of Binghamton and slowed up, Collins and his assistants took the three into custody. The tramps were greatly surprised when they were told of the means employed to capture them, and apparently took pride in the fact that they were among the first of their class to take a place in the history of train wireless.

The first Lackawanna train order was sent on October 23, from Scranton to Binghamton. It marked the first time in the history of the world that a train order was sent by wireless. But already wireless dispatching has become a daily occurrence, and as Mr. Foley says: "The total loss of communication between stations, caused by the prostration of poles and wires is a thing of the past."

THE SHARE MARKET

NEW YORK, December 22.

While Marconis hold at about the same level as last month, a good deal of stock market pessimism has been put to rout, and the scattered but heavy liquidation in leading, or what are termed standard stocks, came practically to an end with the close of the week. A sharp upward turn is now looked for in the general market, and Marconi issues will no doubt reflect the change in sentiment.

The sturdy resistance which Marconi shares showed to the adverse influences growing out of the anti-trust action against the American Telegraph & Telephone Company and the proposal for government ownership of telegraph and telephone lines indicated very definitely that the professional trader has ceased his depredations.

This opinion was confirmed this morning by a leading broker, who stated that the light trading was confined to purchasers of small allotments of Marconi stocks for investors. It was further added that Marconis were every day receiving wider recognition from the conservative investors and with currency matters adjusted in Washington and the new high-power stations opened, a gradual rise could be anticipated beginning with the first of the new year.

Bid and asked prices to-day: American, 3⅞—4⅛; Canadian, 2¼—2½; English common, 16—17; English preferred, 13½—15.