INTERSTATE COMMERCE COMMISSION.

REPORT OF THE CHIEF OF THE DIVISION OF SAFETY COVERING THE INVESTIGATION OF AN ACCIDENT ON THE BALTIMORE & OHIO RAILROAD AT FELTON, PA., ON DECEMBER 17, 1915.

JANUARY 28, 1916.

To the Commission:

On December 17, 1915, there was a rear-end collision between a passenger train and an extra train composed of deadhead passenger train equipment, on the Baltimore & Ohio Railroad, at Felton, Pa., resulting in the death of 1 passenger, 1 employee on duty, and 3 employees off duty, and the injury of 8 passengers, 4 employees on duty, and 9 employees off duty. After investigation as to the nature and cause of this accident, I beg to submit the following report:

The trains involved in this accident were No. 124, a daily passenger train running from Baltimore to Philadelphia, and at the time of the accident consisting of engine 858, 2 baggage cars, 2 coaches, and 1 milk-refrigerator car; and extra 5108, consisting of 9 empty baggage and express cars, and 1 coach, which were being taken from Washington to Philadelphia.

Train No. 124 left Camden station, Baltimore, at 2.05 p. m., on time and passed Silverside, Del., a station approximately 6 miles south of the point of the accident, at 5.13 p. m., 14 minutes late. At Felton this train pulled in on a siding for the purpose of allowing a through passenger train, No. 524, to pass. After clearing the main track, this train proceeded along the siding toward the switch opposite Felton station. No. 524 passed this train before it reached the end of the siding. Train 124 stopped on the siding a short distance from the switch at the north end. The baggageman went forward, examined the switch indicator, threw the switch, and gave a signal for the train to proceed. The train then pulled out of the siding onto the main line and stopped to allow the baggageman to close the switch. While standing at this point it was struck by extra 5108.

Extra 5108, in charge of Conductor Taylor and Engineman Spurrier, left Baltimore at 2.58 p. m., and took the siding at Silverside to be passed by train No. 524. Train No. 524 passed Silverside at 5.27 p. m., two minutes late, and as soon as it cleared the block the switch at the north end of the siding at Silverside, controlled by Silverside tower, was unlocked and extra 5108 came out on the main

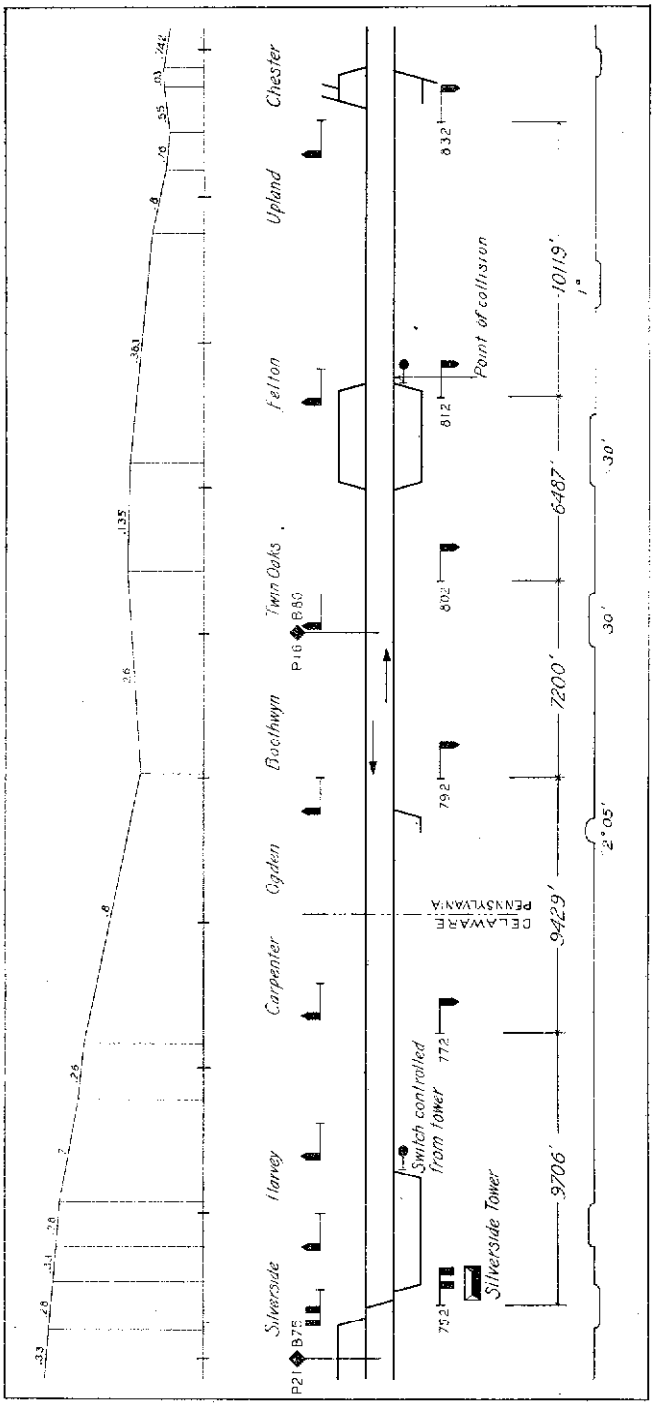
line. It then proceeded toward Philadelphia and collided with the rear end of No. 124 at Felton at about 5.40 p. m. At the time of the accident the weather was foggy and misty. Shortly after the collision between train No. 124 and extra 5108, westbound passenger train No. 117 collided with wreckage on the westbound track, but without causing any material damage.

Between Silverside, where extra 5108 took the siding for train 524, and the scene of the accident, the grade is generally descending northward, varying from 0.26 per cent to 0.8 per cent, except that for about 1⅜ miles immediately south of Twin Oaks, 2¾ miles from the scene of the accident, there is an ascending grade of 0.26 per cent. At the point of accident the actual grade is 0.383 per cent descending. The alignment consists mostly of tangent, with four slight curves within the limits mentioned above, which amount to about 20 per cent of the total distance. Between Twin Oaks and Felton there is a curve to the right, or east, of 30 minutes about one-half mile long. The accident took place on a tangent about 1,200 feet north of the north end of the curve.

On this part of the Baltimore & Ohio Railroad normal danger automatic block signals were installed about 13 years ago by the Hall Signal Company. The signals are of the three-position, electro-gas type, and give their indications in the lower right-hand quadrant. Red, yellow, and green lights are used for the night indications of stop, caution, and clear, respectively. Indicators are placed at all hand switches, and display a red disk when a train is approaching, or is in the block in which the switch is located. When no train is within these limits the disk is withdrawn. The indicator circuits are so arranged that the disk is not displayed until the head end of the train passes the second signal in the rear of the switch; that is, the one that gives the caution indication. There is, therefore, no overlap or preliminary section for the indicators. The control wires are on the same poles as the telegraph wires, on the east side of the track.

Block signal No. 812 at Felton is 545 feet in the rear of, or south of, the switch at the north end of the passing track, and signal No. 802, which gives the caution indication when the Felton signal is at stop, is at Twin Oaks, 6,487 feet farther south. The first signal north of Felton, No. 832, is located 10,119 feet from the Felton signal. The length of blocks in this vicinity varies considerably, but none is less than a mile long. The Felton signal is about 600 feet north of a curve, and the Twin Oaks signal is located at the north end of the curve; but as the curvature is only 30 minutes, a good view is had of both of these signals in ordinary weather.

The track circuits are rather long for direct current, though the ballast conditions are good. There is one section between signals



Sketch showing profile and alignment of track between Silverside and Chester, with location of sidings, signals, and switch indicators.

802 and 812 and there are two in the 10,119 feet from signal 812 to signal 832. No trouble is experienced from foreign current. The fouling sections on sidings are on a shunt. All siding switches are fitted with switch boxes, and the derails, which are pipe connected to the main line switch, also have switch boxes. The track circuit is shunted through these switch boxes, but the line circuits are not broken through them.

At the outgoing, or north end, of the Silverside siding, there is a special arrangement by which the switch lever is controlled by the tower at Silverside. Trains desiring to go out on main track must first get permission from the operator, who can release the levers only when the block is clear and his eastbound home signal is in the stop position.

While much of the apparatus, especially the relays, is old, it is all well maintained.

Engineman Webb, of train 124, stated that while at Twin Oaks, the first station south of Felton, the conductor instructed him to take siding at Felton. Train No. 524 passed before train No. 124 reached the north end of the siding, and as soon as this train came to a stop a short distance from the derail the baggageman walked ahead, opened the switch, and gave him a signal to proceed. The train pulled out of the siding and had just gotten out on the main line when the collision occurred. At the time of the collision he had his hand on the throttle, waiting for the passing track switch to be closed and for the whistle signal to proceed, and, as the shock knocked him off of his seat, he pulled the throttle wide open, at the same time kicking the brake valve handle into full release position. The force of the collision drove his engine forward quite a distance, and he stated that he kept it moving as far as the pumps would keep the brakes off. He could not tell exactly what time the collision occurred, but thought it must have been about 5.35 or 5.37 p. m. He stated that he pulled out his watch after his engine came to a stop following the collision, and it was then 5.39 p. m.

After the collision he at once thought of westbound train No. 117, which was about due, and turned to instruct the fireman to go out and flag that train, but he found that the fireman was not in the cab, and just about that time train No. 117 passed and ran into the wreckage. He thought then that his fireman had been struck by train No. 117, but afterwards ascertained that immediately after the collision occurred the fireman had taken the lanterns and attempted to flag No. 117, but did not have time to get out a sufficient distance to give that train proper warning. Engineman Webb stated that the fog was very dense, and at times he was not able to distinguish signals for a distance of more than 50 feet. He stated that under the rules and practices in force on this line the switch at Felton must not be

opened until the indicator is clear, but when the indicator is clear the switch may be opened and a train has the right to come out on the main track. He was satisfied when the brakeman signaled him to proceed that the track was clear and that it was proper for his train to leave the siding.

Conductor Kelly, of train No. 124, was killed in the collision.

Train Baggageman Engle, of No. 124, stated that when his train pulled into the siding at Felton he was at the rear end, and after the brakeman had opened the switch and the train had entered the siding he changed the rear markers. At that time he heard No. 524 coming up behind him, and he thought his train was near the middle of the sidetrack when No. 524 passed. He went forward to the head end of the second baggage car, and when the train stopped about 5 car lengths from the derail he stated that he jumped off, walked up to the switch, held his lantern up to the indicator, and, noting that the indicator showed clear, turned around, unlocked and opened the switch, and signaled the train to come ahead. He stated that the indicator at this point is 7 or 8 feet from the switch stand, and that after examining the indicator he turned his back to it for the purpose of throwing the switch. He thought it was not more than a couple of seconds from the time that he looked at the indicator until he opened the switch. When the train cleared the switch he gave a stop signal and closed the switch. Just as he was about to lock it he saw the headlight of extra 5108. He said the fog was very dense, and thought that a signal could not be seen for a distance of more than 100 to 500 feet. He thought extra 5108 was running in the neighborhood of 50 miles an hour at the time of the collision. He did not think that the engine was working steam; the brakes were applied, as fire was flying from the wheels. He stated positively that the switch indicator was clear when he examined it before throwing the switch. He said that he did not look at the indicator again.

Brakeman Minker, of train No. 124, stated that he opened the switch to permit the train to head into the sidetrack at Felton, the train stopped while the switch was being closed, and the baggageman changed the markers on the rear end. No. 524 passed before No. 124 reached the north end of the siding. The baggageman went forward to open the passing track switch and the brakeman again changed the markers on the rear end. The train pulled out of the siding and stopped; the baggageman closed the switch and had just called that everything was all right when extra 5108 appeared and the collision occurred. He stated that the shock of collision drove No. 124 ahead approximately the full length of extra 5108. When he saw the headlight of extra 5108 he tried to signal the engineman of his train to proceed, but there was not sufficient time for that train to get under way. He ran up an embankment at the side of the

track, and after the trains had come to a stop, following the collision, he ran around the rear of extra 5108, but had to jump out of the way of train No. 117, which just then ran into and through the wreckage. He stated that under the rules a passenger train which has entered the sidetrack can again go out onto the main line as soon as the switch indicator shows clear. The same procedure is followed every day when train No. 124 goes into the siding for No. 524, either at Felton or at some other point. Brakeman Minker was unable to fix the time of collision definitely. He stated that he did not look at his watch, but thought the collision occurred about 5.35 p. m. He said it was 5.27 p. m. when the train entered the siding, and thought No. 524 passed Felton at about 5.33 p. m. He stated that No. 124 was 20 or 30 car lengths from the north end of the siding when No. 524 passed it. The train stopped 3 or 4 car lengths from the derail, stood there a short time while the baggageman went forward to open the switch, and then pulled out onto the main line. He stated that the first intimation he had of extra 5108 approaching was when he saw the headlight. He thought at that time extra 5108 had passed the signal opposite the siding near Felton. He did not hear the train whistle for Felton, or for the crossing at that point.

Engineman Spurrier, of extra 5108, stated that the weather on this trip was foggy all the way from Washington. As night came on the fog increased and it was harder to distinguish signals. When his train approached Silverside he thought he could see the signals about 200 yards. He stated that on this trip he ran under yellow or caution signals between Wilmington and Silverside, but he did not know what train was ahead of him. At Silverside his train received a signal to take the sidetrack. His train came out of the siding several minutes after No. 524 passed; the brakeman and conductor both went forward to the switch, and after the switch was opened the brakeman walked toward the engine to give him a proceed signal, the fog being very dense at that time. His train then pulled out onto the main track and waited for the conductor to close the switch and get on the rear end. He said he did not know what time his train left Silverside nor what time it passed any of the stations between there and Felton, but thought he reached Felton about 5.44 p. m. He said he received a green signal at Twin Oaks, but at Felton the signal was red. He thought at that time his train was running 45 or 50 miles an hour. There was a speed indicator on the engine, but he stated he had not been watching it and did not know the exact rate of speed, although he thought he did not exceed 50 miles an hour at any point between Silverside and Felton. Between Silverside and Felton the first intimation of danger he had was the red signal which he saw when approaching Felton. He stated that smoke and fog together obscured his vision there more than at any other

place, and he was almost opposite the signal when he saw that it was red. He immediately applied the brakes and, looking ahead, saw the rear end of No. 124; the next instant the collision occurred. He stated positively that the signal at Twin Oaks was green; that he called "green" to the fireman and that the fireman answered "green." He stated that after the engine came to a standstill following the collision he looked at his watch and it was then about 5.45 p. m. He thought the collision occurred a minute or two before that. He said train No. 117 ran into the wreckage just about the time his engine came to a stop. Engineman Spurrier stated that he was familiar with the time-table rule requiring special precautions in foggy or stormy weather, but as the signal at Twin Oaks indicated clear he did not expect to get a stop signal at Felton, and stated that so long as he could see the signals for a distance of 200 yards he considered it proper to run at a speed of 50 miles an hour. He stated that approaching Felton the engine was practically shut off. He was working steam enough to keep the cylinders warm.

Fireman Warren, of extra 5108, stated that after leaving Silverside all of the signals between that point and Twin Oaks were green. At Twin Oaks the engineman called the signal green, and the fireman stated that he saw the green signal as the train passed the station. He said he did not see the signal at Felton, and did not see train No. 124 before the collision occurred.

Conductor Taylor, of extra 5108, stated that when his train left the siding at Silverside the switch indicator was clear and the outlet switch had to be unlocked from the tower before it could be opened. He did not see any of the signals between Silverside and Felton and had no warning before the collision occurred. After the accident he got off the rear end of the train and looked at his watch; it was then 5.45 p. m., and in his opinion the accident did not happen earlier than 5.42 p. m. He stated that south of Silverside the train was not running at a very high rate of speed, and apparently slowed down at a number of signals. He saw the engineman at Silverside, but did not consider it necessary to caution him about running at high speed under the foggy conditions prevailing, in view of the comparatively low rate of speed of his train south of Silverside. Between Silverside and Felton he estimated the speed at about 40 or 45 miles an hour. He did not notice that the train slowed down or that the brakes were applied as the train was approaching Felton.

Brakeman Wiles, of extra 5108, stated that the first intimation he had of the accident was when an emergency brake application was made, the shock of which knocked him down. He was unable to fix the time of the accident. He stated that after pulling out of the siding at Silverside he looked at his watch and saw that it was about 5.33 p. m.

Brakeman Foreman, of extra 5108, stated that in his judgment the accident occurred at about 5.40 p. m. He stated that No. 117 ran into the wreckage only a minute or two after the collision occurred. He estimated the speed of his train between Silverside and Felton at about 40 or 45 miles an hour, and did not notice any reduction of speed before the collision occurred.

Conductor Lee, of train No. 117, stated that as near as he could tell his train ran into the wreckage at about 5.39 or 5.40 p. m. He said that his train was 3 minutes late and was due to pass Felton at 5.36 p. m.

Engineman Jeffries, of No. 117, stated that approaching the scene of the accident his train was running about 40 or 50 miles an hour. Someone flagged him, and when he saw this signal he shut off and applied the brakes. He stated that his fireman was slightly injured by a timber coming through the cab window.

Dispatcher Williams, who had charge of the line between Baltimore and Philadelphia at the time of this accident, gave the following information regarding the movement of the trains concerned in this accident:

Train No.	Left Baltimore.	Left Silverside.	Left Chester.
124	2.05 p. m.	5.13 p. m.	.....
Ex. 5108	2.58 p. m.	5.29 p. m.	.....
524	3.48 p. m.	5.27 p. m.	5.39 p. m.
(W. b.) 117	.....	.....	5.38 p. m.

Dispatcher Williams stated that it is the practice for train 124 to advance as far as possible ahead of train 524, and then to go into clear for that train at the most convenient point without receiving special orders or instructions from the dispatcher, and that on the date of the accident it went into the siding at Felton for train 524. He gave instructions to the operator at Silverside to have extra 5108 take the siding for No. 524 at that point. He stated that under the rules in force each of the trains on the sidings would have to wait until No. 524 cleared the first block signal beyond the outlet switch before the switch indicator would clear and before the train would be permitted to leave the siding. Extra 5108 was running on passenger-train schedule time and was subject to no special speed restrictions, the maximum speed limit being 60 miles an hour, applicable to all passenger trains. He stated that he had no record of the time train No. 524 passed Felton, as that is a nontelegraph office, but that its schedule time should have brought that train to Felton at 5.35 p. m., and, estimating from approximate running time, extra 5108 should have passed Felton at about 5.38 p. m. Train No. 117 left Chester at 5.38 p. m., 5 minutes late, and its running time between

that point and Felton is 3 minutes; on this basis this train should have reached Felton at about 5.41 p. m. He stated that he knew the weather was foggy and that trains lost some little time on account of the fog. It was his opinion that the accident occurred between 5.38 p. m. and 5.41 p. m. He stated that while extra 5108 would be allowed, under the rules, to run at a maximum rate of 60 miles an hour, this train did not make that time between Baltimore and Silverside, the average speed being not quite 30 miles an hour. Several stops were made and the train was also delayed by freight trains. Dispatcher Williams stated that the records indicated that between Newark and Landenburg Junction, a distance of 8.4 miles, the train was running at approximately 60 miles an hour, consuming 8 minutes between those stations. He stated that frequently No. 124 would go into clear for No. 524 at Chester, and he expected No. 124 to go to Chester ahead of No. 524 when he gave instructions to have extra 5108 sidetracked at Silverside.

Division Engineer Hoskins stated that he arrived at the scene of the accident approximately two hours after it occurred. He thought train No. 124 was standing with its rear end about 10 feet from the switch at the time of the collision, and that the force of the collision drove that train forward a distance of 833 feet. He stated that he examined the passing track switch at Felton and found that it was set for the main line, in the position in which the baggageman stated he left it before the collision occurred. He examined the switch indicator and the block signal at Felton, and both were at that time indicating red; he sent the signal supervisor and maintainer back to the distant signal, and they reported that it was in the caution position. He said that the weather was foggy and misty, but a red signal which he examined was perfectly visible for a distance of 500 feet, and that by looking steadily at it he could distinguish the signal for a distance of about 1,000 feet.

Signal Supervisor Keller and Signal Maintainer Stang both stated that the signals in the vicinity of the scene of this accident had given no trouble prior to the accident, and examination of them shortly after the accident occurred indicated that they were in good condition and working properly. The signal supervisor stated that he left Wilmington about 6.45 p. m., riding on a motor car, and arrived at the scene of the accident at about 8 o'clock. At that time the weather was very foggy and misty, but he could distinguish green and red signals for a distance of 400 or 500 feet. The signal maintainer arrived at the scene of the accident at about 8.10 p. m., and he estimated the distance at which he could see a signal properly at between 300 and 400 feet.

The testimony at the investigation indicated that the time element was an important factor in this accident, and in order to aid in de-

termining the cause certain tests were made on December 19 with a train duplicating as nearly as possible the equipment and arrangement of train 124 on the evening of the 17th.

The first test was made to determine the time required for a train to get out on the main track at the north end of Silverside siding, including the communication with the tower, getting an unlock from the tower, throwing the switch and closing it behind the train. Only one trial was made, and 1 minute and 35 seconds were consumed in this move. This train had only 5 cars, and was lighter than the one hauled by engine 5108, and it therefore probably took less time than would the heavier train.

The other tests were made to determine how long it took this train to leave the siding at Felton and get into the position on the main track occupied by train 124 at the time of the accident. The train consisted of engine 858, which was used on train 124 on the date of the accident, together with the same number and kind of cars, and arranged in the same order as in train 124. The same member of the crew handled the switch in these tests as handled it on the 17th, and he repeated his operations as closely as possible, taking, as well as he could estimate, the same time. Four tests were made and the average time was 1 minute and 17 seconds.

Superintendent Cantrell, of the Philadelphia Division, stated that when a train is to be moved from siding to main line at a point where a tower is located, permission must first be obtained from the operator, who in turn secures authority from the dispatcher, and then when the block is clear the operator unlocks the switch and it is thrown by a member of the crew. He stated that at a switch not controlled from a tower, a passenger train has a right to occupy the main line as soon as the indicator shows clear.

Superintendent Allen, of the Baltimore Division, who was superintendent of the Philadelphia Division prior to August 1, 1915, stated that while he was superintendent of the Philadelphia Division an arrangement was made whereby a local passenger train running ahead of a fast through passenger train was permitted to advance as far as possible and then to take siding at the most convenient point without an order from the dispatcher, to allow the through train to pass for the purpose of avoiding delay to the through train. He stated that he considered such an arrangement good railroading practice and one that decreases the chances for accident.

Time-card rule No. 12 provides that—

At points where telephones have been installed at passing siding outlet switches, trainmen will immediately report to the operator upon arrival at outlet switch and will not pull out of the passing siding until they have received permission from the operator in addition to the clear indicator signal.

While this rule apparently refers to all trains, and Felton is one of the stations listed in the time table at which telephones are located, Superintendent Allen stated that it has not been customary for first-class trains to ask permission to again occupy the main track when they have cleared for another first-class through train. He stated that the practice for passenger trains to go out on to the main line without asking for permission from the operator was in effect when he went on the Philadelphia Division, and that it had not been changed while he was superintendent of that division for the reason that it never came forcibly to his attention that it was not done or that it was necessary that it should be done. He further stated that if some member of the crew of train 124 had gone to the telephone at Felton and had asked permission for that train to leave the siding there was no reason why the operator at Silverside should not have immediately given him permission to occupy the main track, and that, whether or not the provisions of this rule were complied with, the practice prescribed by the rule would have had no particular effect upon this accident.

General Superintendent Blaser stated that he had been unable to find from anyone on the Philadelphia Division that it had ever been necessary, since the provision of time-card rule No. 12, quoted above, was placed in effect, for a first-class train to secure permission from anyone to again occupy the main track after it had taken the siding to allow a through passenger train to pass. He stated further that if the conductor of train No. 124 had that night called the operator at Silverside and requested permission for train No. 124 to pull out of the siding at Felton, the operator would have been surprised and would not have known what the conductor meant, for the reason that train No. 124 had not followed that practice.

Signal Engineer Patenall stated that if the conductor of train 124 had called the operator at Silverside for the purpose of securing permission for his train to again occupy the main line there was no reason, under the circumstances existing at that time, why the operator should not have immediately given the permission requested, but he thought it probable that the operator at the same time would have informed the conductor that extra 5108 had left Silverside. He stated, however, that in his opinion this would not have had any bearing upon the accident.

Signal Engineer Patenall stated that under the method of operating switch indicators on this line there is a brief interval of time during which a man operating a switch first looks at the indicator and a second later opens the switch, and an approaching train may at the same time be passing under the second signal in the rear of the switch, when both the indicator and the signal mentioned would indi-

cate "clear;" but under these circumstances the train would always receive a stop indication at the first signal in the rear of the switch. He stated that all switch indicators on this division are installed and operated in that manner. In a discussion regarding the observance of signal indications under these circumstances, Mr. Patenall called attention to the rule requiring engineman in foggy or stormy weather to approach signals with their trains under control, and said that "under control" means that they should be prepared to stop within the limit of vision. But he stated that under conditions such as existed on the night of the accident, when the enginman of extra 5108, according to his own testimony, was able to see signals only a short distance, he could scarcely be expected to stop before passing the stop signal if he had not first received a caution signal and if he was not running his train in accordance with the rule previously mentioned. Mr. Patenall admitted that if the switch indicator at Felton had been provided with a preliminary setting circuit it would not have been possible for both the switch indicator at Felton and signal 802 at Twin Oaks to indicate clear just before the switch was opened and at the time extra 5108 was closely approaching or passing the signal.

During this investigation a report upon this accident, made by C. Selden, superintendent of telegraph and general inspector of transportation, and F. P. Patenall, signal engineer, was submitted, in which the signal situation is discussed and a record showing very good performance of signals in the vicinity of this accident is presented. Accompanying that report is a chart attempting to show graphically the movement of trains 524 and extra 5108 from the statements of time given in the testimony at the investigation. Three lines are shown. One represents train 524 which, according to the block record, passed Silverside at 5.27 and passed Chester at 5.39. Another represents extra 5108 which, according to the block record, left Silverside at 5.29. Allowing 2 minutes 14 seconds for pulling out of the siding onto the main line, it is assumed that this train left that point at 5.31.14, and this line represents its movement according to the time of the accident given by the engineman of train 124, or 5.38 p. m. The third line represents extra 5108 as leaving the siding at 5.33 and reaching the point of collision at 5.44, as given by members of the crew of extra 5108. Upon the basis of this chart, it is contended that if the representations of the first two lines described above are correct, the switch indicator at Felton was red when the switch was thrown, because extra 5108 must have passed signal No. 802 before that time; and that if the representations of the first and third lines described are correct, owing to the position of train 524, extra 5108 received caution indications at signals 772, 792, and 802, and a stop indication at signal 812, and the switch indicator at Felton displayed "red" continuously from the time when

train 524 passed signal 802—5.33.39, as shown by the chart—until the time of the collision.

While this report and the chart accompanying it have been given due consideration in connection with the investigation of this accident, it is believed that the contentions based upon this chart are not well founded. In the first place, no positive evidence is furnished by either crew definitely fixing the time at which the accident occurred. In addition, the time shown for train 524 is taken from the block records at two points, Silverside and Chester, and this train is shown as maintaining a uniform rate of speed of 42.6 miles per hour between those two points, no allowance being made for any variation of speed nor for increased time required due to retardation when the train approached Chester; and furthermore the time of leaving, as shown on the block record, instead of the time of arrival of train 524 at Chester, is used in this diagram. It is therefore believed that this chart does not correctly portray the time of the movement of the trains involved, and that the known facts in the case do not support either of the contentions advanced.

In this connection, the following is a statement made by Gen. Supt. Blaser in regard to the time of the accident:

> Our train master, Mr. Hoddinott, was on train 524 the night of the accident, and he looked at his watch when they passed train 124 on the side track at Felton. He also looked at his watch when train 524 stopped at Chester and noted that train 117 was just pulling out of Chester as train 524 was in the act of stopping at that point. This latter time was 5.37 and 20 seconds, so this rather definitely fixes the time train 117 left Chester as being 5.37 or 5.37 and 10 seconds, and giving them their full schedule time to run to Felton, would put them at Felton between 5.40 and 5.40 and 20 seconds. As the accident occurred not over 45 seconds prior to 117's arrival at Chester (Felton), it would place the time of this accident 5.39 and perhaps 40 seconds. I believe this is as definite as we will ever be able to develop the exact time the accident occurred.
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> The time on the train sheet, for train 117 leaving Chester, is shown as 5.38. In explanation of this, I might add that the operator was across the track delivering a message to train 524 and he did not register train 117 as leaving until he got back in his office, which is on the opposite side of the track.

The locomotives of trains 524 and extra 5108 were both equipped with speed recorders. Speed-recorder Inspector Stoddard, of the Washington Terminal Company, stated that he changed the recorder tape on engine 5108 before it left Washington. When the engine arrived, the recorder tape was wet and so badly torn that he could not make out anything on it. He said he cleaned the machine, filled it with oil, tore off the damaged tape, and put back the remainder of the roll. He said this recorder was not sealed up when the engine arrived and he did not seal it before the engine went out for the reason that he had never been instructed to do so and had never been furnished with any seals.

After the accident the recorder tape for engine 5108 was missing and it has not since come to light; nor has the recorder tape for train 524 been produced. The record of the actual speed of these trains therefore is not available. There is no evidence of any character that either the signals at Twin Oaks and Felton or the switch indicator at Felton failed to operate as designed and intended.

There are three possible causes of this accident, as follows:

(1) Extra 5108 may have run by the signal at Twin Oaks in caution position, the switch at Felton having been opened before that train passed that signal.

(2) The baggageman may have opened the switch to let train 124 out on the main track when the indicator was red, extra 5108 having passed the signal at Twin Oaks before the switch was opened.

(3) Extra 5108 may have been very close to or actually passing under the signal at the time the switch was opened, extra 5108 passing the signal at Twin Oaks and the outlet switch at Felton being opened simultaneously, the signal and switch indicator both being in clear position when seen by engineman and baggageman.

The statements were positive that signal 802, when extra 5108 passed it, indicated clear, and that the switch indicator was observed and was clear just before the switch was opened. It is admitted that the arrangement of the signaling is such that it would be possible to observe the indicator which would show clear just the instant the train was about to pass under the signal in clear position. The switch could then be opened and the signal assume caution position too late for the engineman of extra 5108 to observe it. The tests made at Felton on the 19th of December indicate that the time it took train 124 to pull out on the main track was just about the same as it would have taken extra 5108 to reach the point of collision from signal 802. The best obtainable estimate of the time of the accident indicates that the preceding train—No. 524—passed signal 832, nearly 2 miles north of Felton, a sufficient interval before the accident occurred so that this train cleared the circuits controlling this indicator, and therefore so far as train No. 524 is concerned the indicator should have been clear. The indicator at Felton is located 7 or 8 feet from the switch stand, in such position that the baggageman turned his back to it while opening the switch, and it is quite possible that the position of the indicator may have been changed in the second or two that must have elapsed between the time the baggageman examined the indicator and the time he unlocked and opened the switch.

As a result of this investigation it is believed that this accident was caused by extra 5108 passing signal 802 at Twin Oaks practically simultaneously with the opening of the switch at Felton,

both the signal and the switch indicator being in the clear position when observed by engineman and train baggageman; and an additional cause was the failure of the engineman of extra 5108 to obey the stop indication of signal 812, due to the dense fog and the high rate of speed at which he was running his train.

This investigation disclosed that the switch indicators as installed and operated on this line do not provide complete or adequate protection for a train movement from siding to main line. In the early days of automatic signaling, when this installation was made, the need of preliminary circuits for controlling indicators was not as well recognized as at present. Even now there is difference of opinion as to how indicators should be installed, what information they should give, or whether they should be used at all. Standardization of indicator installation requirements has been undertaken only during the past year or two, and there has not yet been opportunity to bring all the older installations up to present-day practice. Nevertheless, the desirability of preliminary setting circuits in signal practice has been understood for several years, and there appears to be no valid reason why any installation of automatic signals, where indicators are used, should not be provided with these preliminary circuits. The older installations should be revised, if necessary, to meet this condition.

Time-card rule No. 5 provides that:

> In weather so foggy or stormy as to obscure in any degree the clear view of signals, engineers will cause their trains to approach them under control.

It is apparent that the provisions of this rule were not observed by the enginemen of either of the through trains concerned in this accident, and the high rate of speed at which extra 5108 was running, in view of the fog and the short distance at which signal indications could be distinguished, was one of the primary causes of this accident. If extra 5108 had been running at the reduced rate of speed required by this rule, the engineman undoubtedly would have been able to bring his train to a stop before running more than 500 feet beyond the stop signal at Felton, and the collision would then have been averted. It is obvious that this rule was not being lived up to and the operating officers were perfectly familiar with the fact that trains were being run at practically normal speed even in dense fogs. The requirements of safety are not properly met unless rules of this character are strictly observed by railroad employees and rigidly enforced by the railroad company.

While the practice prescribed by time-card rule No. 12 probably had no direct bearing upon this accident, there is no question but that having a rule of that character in the time table, so worded

as to apply to all trains, but in practice not being applied to one certain class of trains, tends to a lack of proper respect for all rules and a condition of general laxity in their observance and enforcement.

Respectfully submitted.

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