INTERSTATE COMMERCE COMMISSION.

REPORT OF THE CHIEF OF THE BUREAU OF SAFETY UPON AN ACCIDENT WHICH OCCURRED ON THE SOUTHERN RAILWAY, NEAR ORANGE, VA., ON OCTOBER 21, 1917.

NOVEMBER 6, 1917.

To the Commission:

On October 21, 1917, at 7 01 a m., there was a side collision between two passenger trains on the Southern Railway, at Larmond, near Orange, Va., resulting in the death of two employees and the injury of six passengers, one employee, and five postal clerks

After an investigation as to the nature and cause of this accident I respectfully submit the following report:

This collision occurred on the Washington division of the Southern Railway. The line in the vicinity of the scene of this accident is double tracked, and trains are operated by time-table, train orders, and an automatic block signal system. The point of accident was at the north end of the north passing siding at Larmond, approximately 2.3 miles north of Orange.

The trains involved in this accident were northbound passenger train No 16, consisting of locomotive 1216, two baggage cars, and three coaches, with Conductor Nolan and Engineman Fairfax in charge, and northbound passenger train No. 38, consisting of locomotive 1339, postal car, club car, and six Pullman sleeping cars, with Conductor Tucker and Engineman Larmond in charge Train No. 16 was a local, originating at Charlottesville and en route to Washington, while No. 38 was a through train, known as the New York and New Orleans Limited, being received on the Washington division at Monroe. All the cars in train No. 16 were of wooden construction, the two rear coaches having steel underframes, and all the cars in train No. 38, except the postal car, were steel cars, the postal car having a steel underframe with wood superstructure.

Beginning at a point about 350 feet north of Orange station and proceeding northward to the point of accident, there is a 3° 10′ curve to the east 1,000 feet long; there is then 1,860 feet of tangent, followed by a 4° curve to the west 905 feet long. Then there is a

tangent 422 feet long; the next curve, 3,016 feet in length, is a compound curve toward the east, varying in curvature from 4° to 57′ and extending to a point 80 feet from the south end of Larmond siding From that point northward the track is tangent for a distance of 4,576 feet to the north end of the siding, where the accident occurred

From Orange station the grade is descending at a rate of 1 per cent for 2,000 feet, and it is then ascending at the same rate for 2,400 feet to a point just beyond signal 842; there is then a descending grade for 2,100 feet, followed by a short piece of level track and an ascending grade of 0.2 per cent, of a total length of 2,000 feet, to a point 500 feet north of the south end of Larmond siding The grade is then descending at a rate varying from 0 45 to 0 9 per cent to the scene of the accident At the point where the accident occurred there is a cut from 30 to 35 feet in depth, which starts a short distance south of the north passing track switch.

On this division of the Southern Railway automatic block signals were installed in June, 1914, with a normal length of block of approximately 2 miles, although the spacing is varied to meet local conditions, the blocks being shorter at terminals and other points where trains close up. The usual practice is to locate a signal not over 500 feet in advance of the entrance switch to the passing siding. Indicators are not used at the switches, nor are the signals overlapped Derails of the lifting type are connected by pipe lines so as to operate with the switch. Line control wires are unnecessary, owing to the use of three position track relays

Alternating-current track circuits are used, extending from signal to signal, regardless of the distance Switch boxes are provided at all switches, with the connection attached to the closed point when the switch is set for the main track At trailing switches the track circuit is shunted through the switch boxes, but at facing points the track circuit is divided by insulated joints and the wires connecting the two sections thus formed are run through contacts in the switch box, so that when the switch is opened this track circuit is not only shunted but also broken

The signal mechanisms are of the top post type operating on 110-volt alternating current and are electrically lighted Signal indications are given in the upper right-hand quadrant, the arm in a horizontal position indicating stop, inclined upwardly 45°, caution, and vertical, clear. By night the corresponding indications are given by red, green, and white lights. Power is transmitted by a 4,400-volt, 3-phase line, supported on poles separate from the telegraph line, and is stepped down by transformers at each location.

The interlocking signals are also block signals, but the "stick" feature is omitted, so that at interlocking plants as long as the lever

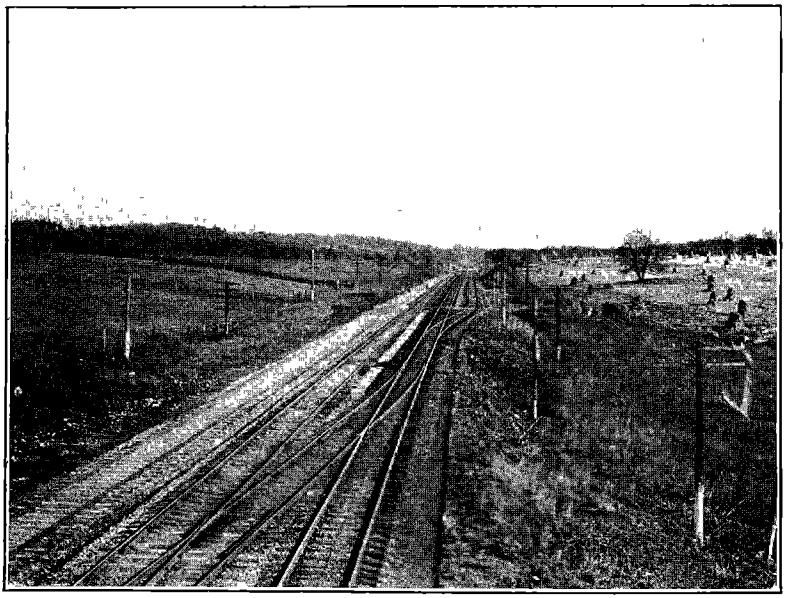

FIG 1—VIEW NORTHWARD FROM SIGNAL NO 834 TOWARD SCENE OF ACCIDENT

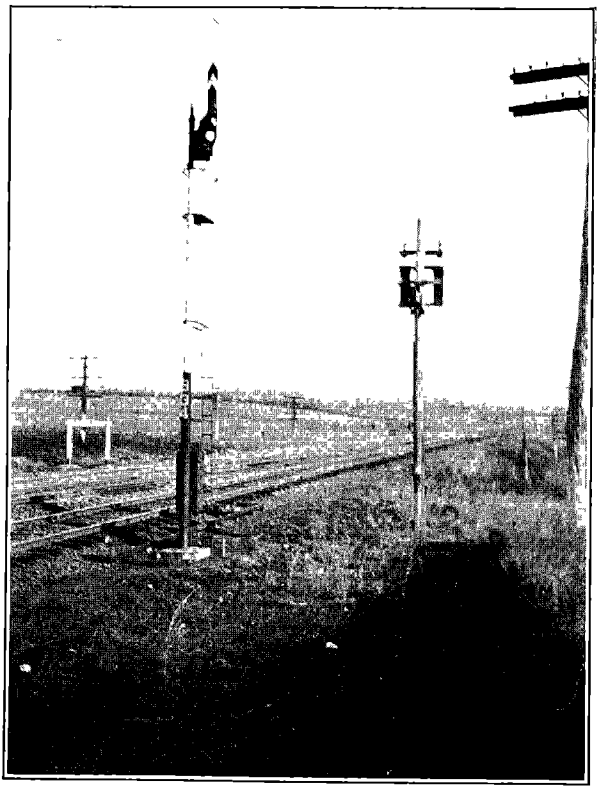

FIG 2—SIGNAL NO 834

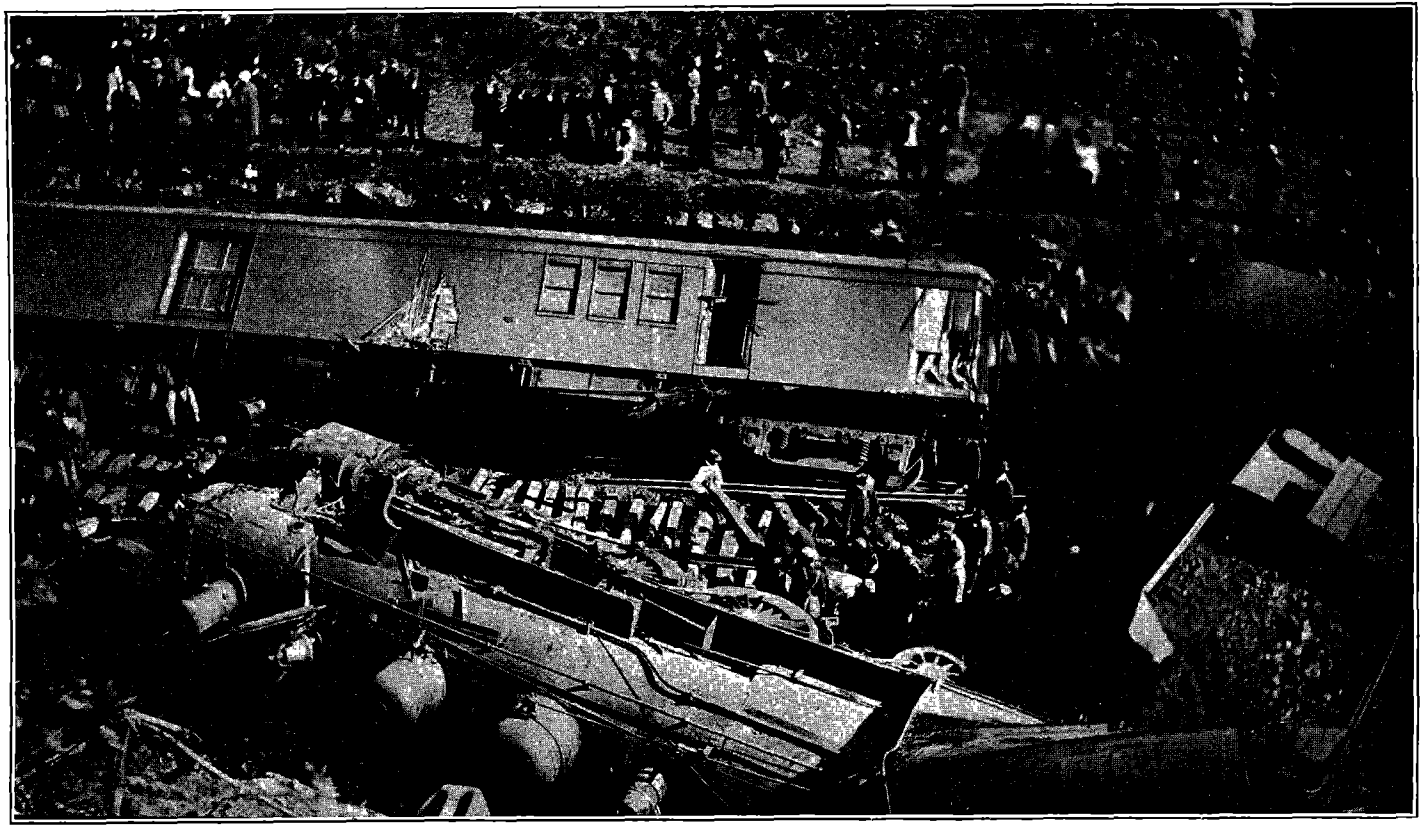

FIG 3—GENERÁL VIEW OF WRECKAGE

controlling a home signal is reversed that signal will act exactly as an automatic signal, going to "stop" behind passing trains and assuming the "caution" position when the train passes from the block The northbound home signal at Orange has two arms, the upper being the one controlling main-line movements, and the lower leading to all diverging routes, as well as acting as a "calling on" arm which can be used to permit a slow-speed movement into an occupied block.

The distance from the home signal at Orange to the first automatic signal north, No 842, is 4,350 feet; from No 842 to No. 834 is 3,950 feet, and from No 834 to No 816, north of the north end of the Larmond passing siding, is 9,600 feet Signal No. 834 is located 276 feet south of the south switch of the Larmond passing siding.

The investigation disclosed that on the morning of the accident the operator at Orange delivered a message from the dispatcher to the conductor and engineman of train 16, instructing them to take siding at Larmond to permit train No. 42 to pass, train No. 42 being a through pasenger train, and to take siding at Buena, a station approximately 6 miles north of Larmond, to permit train No 38 to pass. Train No 16 left Orange at 6 50, acording to the operator's record, 13 minutes late, proceeded to Larmond, entered the northbound passing track, and was passed by train No 42 before reaching the north end of the passing track. Train No 16 had just started to go out of the north passing track switch onto the main line when it was struck by train No 38. At the time of the accident the weather was clear.

The locomotive of train No. 38 first struck a glancing blow slightly forward of the middle of the fourth car in train No 16, pushing that car off toward the right, and then struck squarely on the corner of the third car in train No. 16, crushing the side of the car for approximately a third of its length and overturning it against the side of the cut, and the fourth car, a day coach was derailed. The side of the rear car, a day coach, was scraped, but that car was not derailed, and the locomotive, tender and first car remained on the rails of the main track ahead of the wreckage. The locomotive and tender of train No. 38 were thrown across both tracks, the locomotive being overturned, coming to rest on its left side, 251 feet from the point of collision, and the tender being thrown off from its trucks. The first three cars were derailed, two of them also fouling the southbound track; the other five Pullman cars of train No. 38 were not derailed or damaged. Approximately 250 feet of the northbound track and 160 feet of the southbound track were torn up.

Operator Johnson, who was on duty at Orange on the morning of the accident, stated that train No. 16 was scheduled to leave Orange at 6 37; on the morning of the accident, however, it arrived at 6 47 and departed at 6 50; train No. 42, which was due at 5.05 a. m.,

passed Orange at 6.54, and train No. 38, due at 5.30, passed at 6.57. He had a message from the dispatcher directing train No. 16 to take siding at Larmond for No. 42 and at Buena for No. 38, and he delivered a copy of the message to both Engineman Fairfax and Conductor Nolan of train No 16. He stated that it was customary for the dispatcher to send a message to the crew in charge of a local train directing them to take siding at specified points to permit through trains to pass, and that there was nothing unusual or out of the ordinary in connection with this proposed movement on the morning of the accident. Both trains 42 and 38 were running at low speed when they passed Orange tower. Operator Johnson stated that he went down and got the engineman's lunch box off from train 38; it was handed off from the engine by the fireman, who asked where they were to pass train 16; the operator told him at Buena, but thought the engine was so far past him that the fireman did not hear or understand his reply.

Engineman Fairfax, of train No. 16, stated that he looked at his watch just before he received the signal to start at Orange, and it was then 6 48; he thought he left the station between 6.48 and 6 49, 11 or 12 minutes late. He received a message from the operator there directing that his train take siding at Larmond for train 42 and at Buena for train 38. His train was not delayed between Orange and Larmond, and he stopped at the south switch at about 6 51; the switch was opened promptly, he pulled into the passing track and stopped beyond the derail, waited until the flagman closed the switch and got on the rear end, and then ran the train down to the north end of the passing track. He said train 42 passed shortly before his train reached the north end of the passing track, and he stopped about a car length from the derail, at about 6.56. The baggage-master had ridden on the locomotive from the south switch, and he dropped off for the purpose of opening the north switch just about the time train 16 stopped at the north end of the siding. Engineman Fairfax stated that his train stood at that point for about four minutes, from 6 56 to 7; in the meantime the baggage-master had gone forward, opened the switch, and returned to the train. He started to pull out on the main line just as the baggage-master was passing the locomotive. On account of escaping steam, he said that he could not see the baggage-master when he threw the switch, but he could see the derail, and he stated positively that the rule requiring a train on siding to wait two minutes after the outlet switch was opened was fully complied with. Just about the time the locomotive had reached the switch the fireman called to him that 38 was coming, and just as he stood up to look back the collision occurred. He opened the throttle and kept the head end of the train moving until

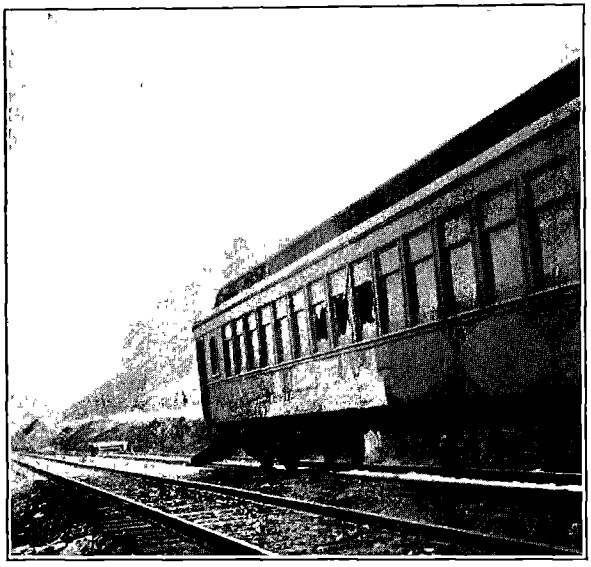

FIG 4 —FOURTH CAR IN TRAIN NO 16

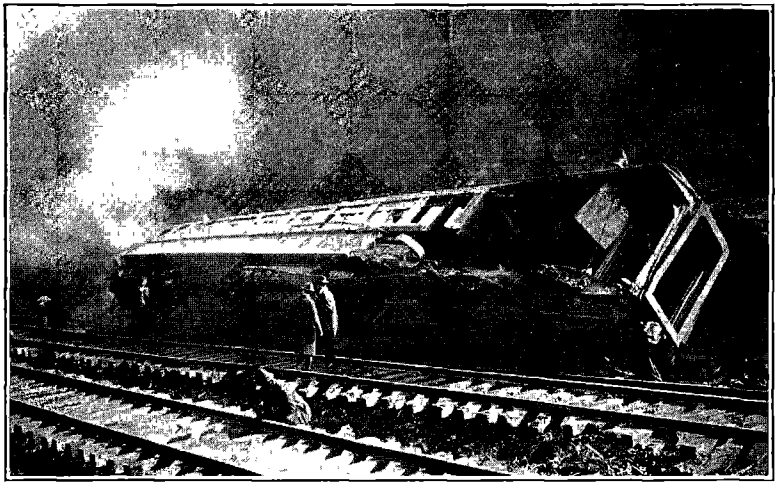

FIG 5 —THIRD CAR IN TRAIN NO 16

train 38 had stopped after the collision. The collision occurred at about 7.01 or 7 02

Fireman Baber of train No 16 stated that his train left Orange at 6 48 or a few seconds after, and it was about 6 51 when the train started into the passing siding at Larmond, the baggage-master opening the switch and the flagman closing it Train 16 was some four or five rail lengths from the north end of the siding when train 42 passed The statements made by Fireman Baber during the investigation relative to the time train No. 16 stood at the north end of the passing side are inconsistent; when first questioned he stated that his train stood at that point only a minute or two, just long enough for the baggage-master to get off from the engine, open the switch and return to the train, while later he stated the train must have been standing there for five or six minutes. He did not look back before the train started to pull out on the main line, but just as the locomotive passed over the switch points he saw train 38, called to Engineman Fairfax, jumped off, and ran up the side of the cut. He was at the top of the bank when the collision occurred; he said that he looked at his watch then and it was seven o'clock or a few seconds after

Conductor Nolan of train No 16 stated that his train was 10 or 11 minutes late at Orange, and they departed from that place at about 6 48 or 6 49, having received the message to let 42 by at Larmond and 38 by at Buena He stated that there was no delay in getting into the siding and the train ran down to the north end at a moderate rate of speed, train 42 passing shortly before his train reached the stopping place at the north end of the passing siding. He stated that there was ample time to comply with the rule requiring a train on the siding to wait two minutes after the switch was opened before pulling out on the main line, and while he was in the train working on his tickets and paid no particular attention to the matter he thought they stood there from three to five minutes, and he assumed that the rule was fully complied with He did not hear train 38 approaching and had no warning of impending danger before the collision occurred

Baggage-master Pollard, of train No 16, stated that Conductor Nolan told him at Orange that they would head in at Larmond for 42 and at Buena for 38 He rode on the baggage car from Orange to Larmond, opened the south switch at Larmond to let the train in on the passing track, rode on the engine to the north switch, train No 42 passing them when they were about half way through the siding; at the north end train 16 stopped with the locomotive about a car length from the derail, and he got off just as it came to a stop He stated that he walked to the switch and opened it and signaled the engineman to come ahead; he then ran back toward

the train and caught the baggage car about opposite the derail, the train having started to move toward the main line before he reached it There was a slight delay in opening the switch, as the ball was frosty and his hand slipped off the first time he attempted to throw it. He stated that train 16 began to move as soon as he gave the signal to come ahead after the switch was thrown After opening the switch and giving the engineman a signal, he ran back toward the train in order to get on before it was running too fast, and he thought it was running 6 or 7 miles an hour when he did get on Before the train started he did not notice any steam escaping from the engine which would obstruct the engineman's view of the switch, and while he did not remember whether or not he saw the engineman when he signaled him to come ahead there was nothing to prevent or to obstruct the view. He did not see train 38 and had no warning of the impending accident.

Flagman Buckley of train No 16 stated that he did not particularly notice the time of leaving Orange, but knew that his train was 10 minutes or more late He closed the switch at the south end of Larmond passing siding after the train entered, signaled the engineman to proceed, and rode to the north end on the rear platform Train No. 42 passed when train 16 had nearly reached the north end; he thought train 16 ran a train length after 42 passed before stopping for the switch. He thought the train stood there three or four minutes, and just after it started to pull out he saw train 38 on the main line, seven or eight car lengths away. He said the reason he did not see the approaching train earlier was because he was looking ahead along the right-hand side of his train, and he did not hear a whistle or any other sound from train 38. As soon as he saw that train, however, he got his red flag, and standing on the rear steps he waved it on the left-hand side of his train toward train 38; but there was no response to his signal, and he did not see either the engineman or the fireman as the locomotive passed. He thought train 42 was running at the rate of 35 or 40 miles an hour when it passed, and that 38 was running faster, perhaps 40 or 50 miles an hour, as it approached. The engine was working steam and there was no indication that the brakes were applied at that time. Flagman Buckley stated that he did not notice the indication of the signal just south of Larmond passing siding when his train passed or after it had entered the siding

The engineman and fireman of train No. 38 were both fatally injured in the accident Conductor Tucker of train No 38 stated that the first intimation he had of the accident was a jar which he thought was caused by the engineman making an emergency application of the brakes; this was immediately followed by another jar which he believed was due to the engineman reversing his engine; the

next thing was the shock of the collision He said all this occurred within two or three seconds. He looked at his watch immediately after the accident and it was then 7.01. He stated that passing Orange station the train was running at very low speed; he looked at his watch there and it was then 6.56. He said that it took some little time to get up speed again; approaching the signal just south of Larmond he noticed that the train increased speed as though the engineman had received a clear signal, and the train continued to run just about as fast as it could go until just before the collision. Conductor Tucker stated that he was the first one to reach Engineman Larmond after the collision had occurred The engineman was conscious and said that the signal was white; later on he repeated that the signal was white Conductor Tucker thought that the speed of his train had been reduced to about 20 miles per hour when the collision occurred

Baggage-master Kidwell of train No. 38 stated that he was standing in the baggage-car doorway from the time train 38 left Orange until it had nearly reached the first signal north of Orange, and that signal was green, or in the caution position. After that he closed the door, and he did not see the signal at the south end of the passing track at Larmond

Flagman Payne of train No 38 stated that when his train passed the signal at the south end of Larmond passing track before the collision occurred he was riding on the rear end of his train, and he noted that the signal was properly in the stop position, his train having entered the track section controlling that signal He thought the speed of his train before the brakes were applied immediately preceding the collision was about 30 or 35 miles per hour, and at the time of the accident it had been reduced to between 20 and 25 miles per hour. He stated that when he went back to protect his train after the accident occurred the signal at the south end of Larmond passing track was red or at stop, and the next signal south was green or at caution He accompanied Engineman Larmond from Orange to Charlottesville, and Engineman Larmond told him that signal 834 was white when he passed it

Engineman Brum of train No. 42 stated that he passed Orange at about 6 52 or 6.53; he saw the first signal north of Orange when approximately half a mile away from it, and it was then in the stop position, but when he approached with 75 or 100 feet of it and was nearly stopped it changed to green The next signal, at Larmond, was also at stop when he approached it, and he saw train No. 16 going into the siding The switch was closed and the signal cleared just before he reached it and just as he was in the act of stopping He then proceeded and passed train No. 16 when it was from a third to half way down the siding He then ran his train at

schedule speed, the first slow down being when he reduced speed at a curve about 2 miles north of Larmond

Fireman White of train No 42 stated that as his train approached the first signal north of Orange it was in the stop position but changed to the caution position just before they reached it; approaching Larmond the signal was also at stop, and he saw train 16 entering the siding; when the switch was closed the signal cleared; he thought his train was 15 or 20 car lengths from the rear end of train 16 at that time. His train then resumed normal speed, the next signal north of Larmond being in the clear position when his train passed it

Engineman Garr of a southbound freight train stated that he passed train No 16 just as it was heading into the siding at Larmond, and train No 42, running at low speed, was at that time about 20 car lengths south of the signal at Larmond. He met train No 38 a short distance north of Orange; looking back, he saw that the first signal north of Orange was in the stop position but changed to caution just before train 38 reached it, and train 38 did not stop for that signal.

Signal Maintainer Murphy stated that from his home he could see the first signal north of Orange, and on the morning of the accident shortly after 7 o'clock, before he learned of the accident, he noted that signal stood in the caution position When he went up to the scene of the accident that signal was still in the caution position and the signal at Larmond was in the stop position He had had no trouble with either of these signals, and upon inspection after the accident he found that both of them were in proper working condition He said that he made frequent inspection of switch boxes, and he thought he last inspected the switch box at the north end of Larmond passing track on Monday preceding the date of the accident.

Signal and Electrical Engineer Eck stated that the signals in the vicinity of the point of accident had been placed in service in June, 1914, and there was no record of any false clear signal indication since that time between Washington and Orange. Signal 842 had failed in the stop position once and signal 834 had failed in the stop position three times, all of these failures being due to circuit troubles. He considered that the rule requiring a train on a siding to wait two minutes after the switch was opened before going out upon the main line provided ample protection under all operating conditions, as at all facing-point switches signals are located within 500 feet of the point of the switch, and all passing tracks being approximately 5,000 feet long, this results in the exit switch of the passing track being not over 5,500 feet from the signal in any case. He considered such a rule safer than the use of switch indicators, for the reasons that the switch indicator is a small, delicate instrument, liable to get out of order and subject to neglect by the maintainer;

it is installed where only the front brakeman, who is usually the most inexperienced man in the crew, observes it and there is no practical method of checking up his observation of an indicator, whereas everybody on the train can check compliance with the two-minute rule; furthermore, to save expense indicators are ordinarily installed to show red as long as the block is occupied although a train may have passed the switch protected, and that introduces an element of uncertainty in the minds of trainmen as to the meaning of the indicator. Mr. Eck said that there was no rule in effect on the Southern Railway requiring a train after stopping in a block to proceed under control the remainder of the distance through the block, although verbal instructions have been issued to that effect.

At the time of the accident the engine crew of train No. 38 had been on duty 3 hours and 46 minutes after a period off duty of 13 hours, and the train crew of train No. 38 had been on duty 9 hours and 51 minutes after a period off duty of 14 hours and 45 minutes; the engine crew of train No. 16 had been on duty 1 hour and 51 minutes after a period off duty of 8 hours and 10 minutes, following a period on duty of 6 hours after a period off duty of 28 hours and 50 minutes, and the train crew of No. 16 had been on duty 1 hour and 51 minutes after a period off duty of 8 hours and 10 minutes, following a period on duty of 5 hours and 25 minutes after a period off duty of 7 hours and 25 minutes.

All the employees involved in this accident were experienced men with good records.

The evidence shows that signals 842 and 834 were working properly within a very few minutes prior to and subsequent to the time of the accident. Examination by the signal maintainer disclosed that the signals were in proper working order and no repairs of any character were made On October 25 an examination of these signals was made by representatives of the Commission, which disclosed that the signals were properly maintained and were in good working order. There is therefore no foundation for any belief that the signals may have failed to operate properly in this instance.

On Wednesday, October 24, tests were made with a train consisting of locomotive 1218, which was of the same class as the locomotive used on train 16 on the day of the accident, and five passenger cars which were approximately equivalent in weight to those used in train 16 on the day of the accident. During the first two tests Engineman Fairfax operated the locomotive, and in the first test Flagman Buckley closed the south switch at Larmond. The first test was intended to duplicate as nearly as possible the run made by train No. 16 on the date of the accident as described by the crew in charge of that train. The second test was made for the purpose of ascertaining the time required after stopping on the siding at the

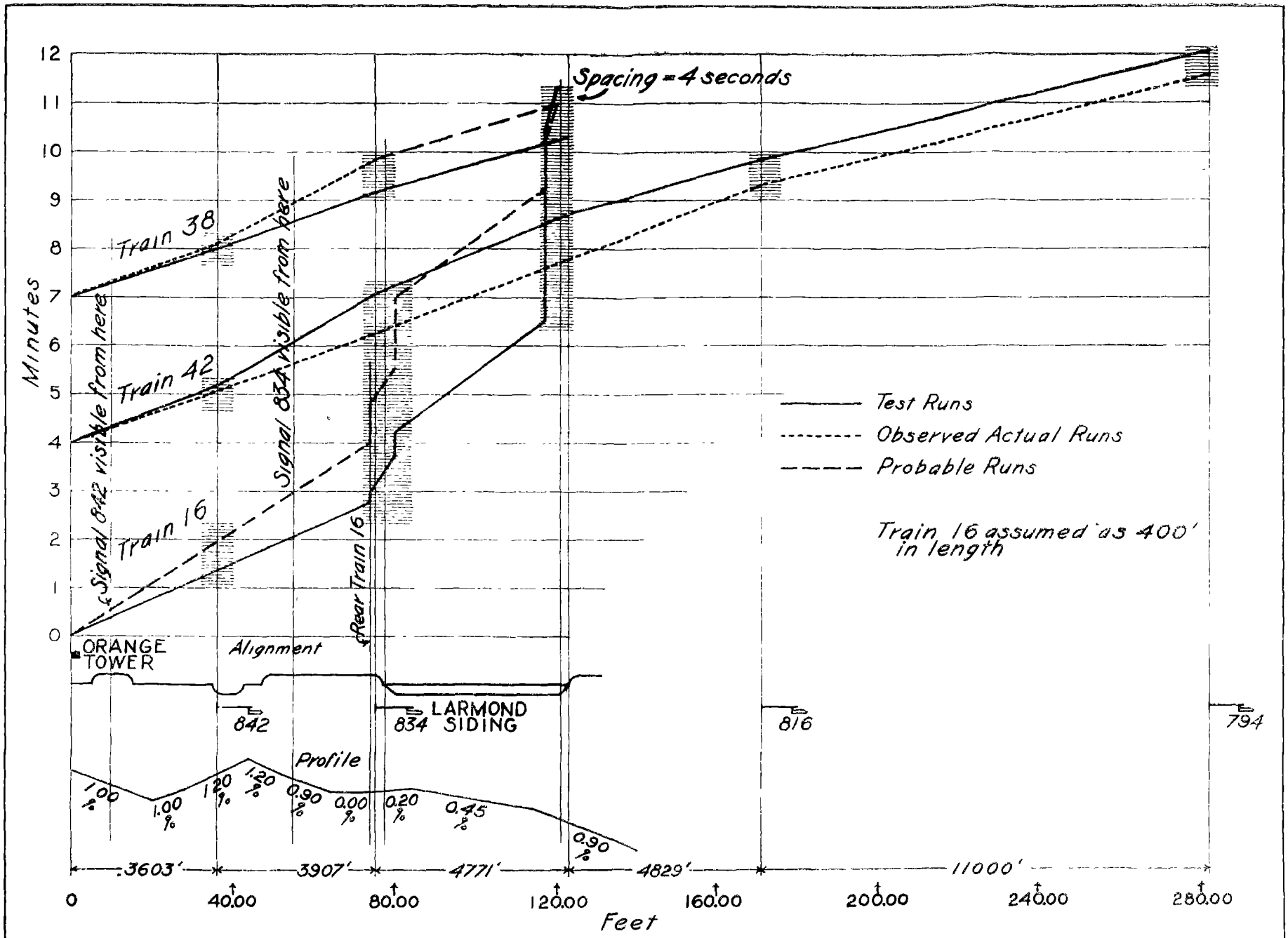
Spacing = 4 seconds
Train 38
Train 42
Train 16
Signal 842 visible from here
Signal 834 visible from here
Rear Train 16
Test Runs
Observed Actual Runs
Probable Runs
Train 16 assumed as 400' in length
Minutes
ORANGE TOWER
Alignment
842
834 LARMOND SIDING
816
794
Profile
1.00 %
1.00 %
1.20 %
1.20 %
0.90 %
0.00 %
0.20 %
0.45 %
0.90 %
3603'
3907'
4771'
4829'
11000'
0
40.00
80.00
120.00
160.00
200.00
240.00
280.00
Feet

FIG. 6.

north end for a man to get off from the locomotive, walk up to the switch and open it, return to the locomotive, and for the train then to start out of the siding and reach the position in which train No. 16 was struck While the make-up of the train in the third and fourth tests was not changed, these tests were intended to duplicate as nearly as possible the runs made by trains 42 and 38 on the date of the accident. On the next day observations were also made of the time consumed between signals by trains 42 and 38.

In test No 2 it was 50 seconds from the time the train stopped near the derail until the switch was opened; it then required 45 seconds for the man to return to the train and 44 seconds longer for the train to start out of the siding and reach the position where train No 16 was struck

On the accompanying diagram the results of the three test runs made on October 24 are shown in full lines. The dotted lines represent the actual runs of trains 42 and 38 as observed on the day following that on which the test runs were made In order to show the conditions leading up to the accident certain assumptions deduced from the tests and from the evidence have been made as to the movements of trains 16 and 38 on the day of the accident, which are shown on the diagram by dashed lines

In each case the origin of the speed lines is the time the rear of the train passed Orange tower, and allowance is made where necessary for the length of the train, but no allowance is made for time consumed by the signals in clearing, which was found to be 10 seconds for a full operation from stop to clear The time shown by the diagram between these trains is taken from the operator's record at Orange tower

The test run duplicating train 16, as plotted on the diagram, shows that if train 16, on the date of the accident, traveled between the points shown in the time stated by the crew, it would have been into clear at Larmond siding before train 42 left Orange and it would have been standing at the north end about two minutes when passed by that train This was not in accordance with the statement of Engineman Fairfax at the investigation, when he said train 42 passed him while he was still moving, nor is it in accord with the statements of the crew of train No 42. It is also shown that if train 16 stood at the north end of the siding four minutes, train 38, under the conditions assumed in the test, would have passed the point where the accident occurred before train 16 started out of the siding Furthermore, under these circumstances had the switch been opened promptly after arrival of train 16 at the north end signal 834 would have been set at stop shortly after train 38 had left Orange and in time to have given it a caution indication at signal 842.

It is believed that the test intended to duplicate the runs of trains 42 and 38 very fairly represent the actual runs ordinarily made by these trains, and a comparison of the actual runs made by these trains on the following day, when train 42 had clear signals and train 38 received a caution indication at signal 842, justifies the conclusion that the test runs substantially duplicated the runs of trains 42 and 38 on the date of the accident The diagram shows that train 38 on the date of the accident should have received a caution indication at signal 842, and the testimony shows this to have been a fact. As shown by the lines representing the tests, train 38 should have received a stop indication at signal 834, as train 42 lacked about 38 seconds, or half a mile in distance, of clearing signal 816 when train 38 reached signal 834 But it is entirely possible that train 42 on the date of the accident ran a little faster than the test train, or that train 38 ran a little slower, in which case signal 834 might have gone to the caution position before train 38 reached it. It would only have meant an increase in average speed from 40 to 56 miles per hour between signals 834 and 816 in the first case, or a decrease from 37 to 25 miles per hour between signals 842 and 834 in the second. In fact, had train 38 actually run on the day of the accident as it did on the day following the tests, when conditions as to signal 842 were the same, it would have reached signal 834 about as train 42 passed under signal 816, and would have received a caution indication

The results of tests made with the special train and the observations made relative to the regular trains on October 25, as well as the statements of other employees involved, are all at variance with the statements of engineman and conductor of train No 16 in respect to the time which elapsed while train 16 was at the north end of Larmond passing siding In fact the investigation developed nothing which would support these statements of the engineman and conductor of train 16, but on the other hand established that the time interval from the stopping of the train at the derail at the north end of the siding until it started out of the siding must have been very short, much less than the four minutes claimed by the engineman or the three to five minutes estimated by the conductor The statement of the baggage-master of train 16 indicated that his train stopped at the north end of the siding only long enough to enable him to throw the switch and start back toward the train, and the fireman when first questioned confirmed this, stating that the train stood at that point only a minute or two, just long enough for the operation of the switch The tests disclosed that it required less than a minute for a man to walk from the point where train 16 stopped to the switch and open it, and only 45 seconds for him to return to his train

According to the evidence, the engineman of train 42 nearly came to a stop at signals 842 and 834 on account of train 16 being ahead

and was close enough to that train to see its rear end as it pulled into the siding. Train 42 also passed train 16 while it was from one-third to one-half the distance between the ends of the siding And since train 42 received a caution indication at signal 842, the rear of train 16 must have passed signal 834 at least 5 seconds, which was the time required for the signal to move from stop to caution, before the engineman of train 42 saw signal 842 change to caution In order for him to have seen the rear of train 16 at a distance of 600 feet, that train in getting into clear must have consumed about 2 minutes or as much time as it required for train 42 to run approximately the distance between signals 842 and 834, or about 3,900 feet Then if it made the same speed through the siding as in the test run, it would have been passed by train 42 about midway between the two ends Allowing about a minute and a quarter for stopping and getting the switch open, and the same time to get out as in the test run, it would have been in the position at 7 01 that it was in when struck by train 38. Consideration of the position of the train in regard to train 42, and assuming no greater speed was made through the siding than in the test, or 25 miles per hour, shows that train 16 could not have stopped at the north end of Larmond passing siding more than 1½ minutes previous to the accident

As it is therefore clearly established that the full line representing the test made in accordance with the statements of the crew of train No 16 does not correctly represent the run actually made by train No. 16 on the date of the accident, another curve, shown as a dashed line on the diagram, has been constructed, based upon the deductions and conclusions arrived at as a result of the investigation of the accident, representing the run of train No 16 as it is believed it was actually made. As the accident occurred at 7.01, train 38 must have been a little slower between signal 834 and the point of accident than the test showed, so a dashed line, representing the probable run of train 38 between those points, has been added

It is clearly established, therefore, and clearly shown by the diagram, that, first, train 16 consumed more time in running from Orange to the point of accident than the test run indicated; second, its crew could not have waited two minutes after throwing the switch before starting out on the main line; third, at the time the switch was thrown, train 38 must have been past signal 834; fourth, on account of the position of train 42, train 38 could not have received a more favorable indication than caution at signal 834, and fifth, train 38 was so close that had any member of the crew looked back immediately before train 16 started out of the siding the accident might easily have been averted.

Rule No 510 in time-table No. 6, effective 12 01 a m September 23, 1917, reads as follows.

A train desiring to come out on a main track through any switch or crossover in the territory controlled by these (automatic) signals shall—

First Open all switches to be used, which will place the signals protecting the switches in stop position

Second Wait two minutes before proceeding

Third Be prepared to close the switches to protect a train which may have passed the signal before the switches were opened

These instructions do not relieve trainmen from strict compliance with rule No 99

Under the method of operation employed on the Washington division of the Southern Railway, it is the practice for local or other slow trains to take siding under instructions of the dispatcher to permit through trains to pass, the through trains not being notified of such movements, but being governed entirely by signal indications. The rule referred to is designed to safeguard movements from siding to main line by providing an interval to permit a following train which may have passed the first signal in rear of the switch to pass the switch or at least arrive in view of the switch before the train on the siding starts

Under the requirements of this rule, train No 16 should have waited two minutes after the switch at the north end of Larmond siding was opened before it started to move out upon the main track, and the crew should also have been prepared to close the switch for an approaching train that had passed the signal before the switch was thrown

This accident was caused by the failure of the crew of train No 16 to observe the requirements of time-table rule No 510, first, by not waiting two minutes on the siding after the switch was opened before coming out upon the main line, and, second, by not being prepared to close the switch promptly for an approaching train

It could not be positively determined whether train No. 38 received a caution or a stop indication at signal No 834 It is noted that Engineman Larmond stated that he received a white indication at this signal. The investigation and tests clearly established that this can not be true, for the reason that the preceding train, No 42, passed Orange only three minutes before train 38, and on account of train 42 being delayed at both signals 842 and 834, train 38 undoubtedly closed up considerably on train 42 shortly after leaving Orange This is borne out by the fact that signal 842 changed from stop to caution only a short distance ahead of train 38, at which time train 42 must have just cleared signal 834; train 42 then had approximately 4 miles to run before signal 834 would go to the clear position, while train 38 had only about 4,000 feet to run before passing that

signal. The tests made indicated that it was quite possible Engineman Larmond should have received either a stop or a caution indication at signal 834, on account of the position of train 42 ahead.

If that signal indicated stop, the engineman should have brought his train to a stop and then have proceeded under control to the next signal, north of the point of accident; but if that signal indicated caution, under the rules of the Southern Railway no blame attaches to him. Engineman Larmond was a man of long experience, having been promoted to the position of engineman in 1880. His record was not only entirely clear, but on two occasions he had received credits. Any failure on his part properly to observe and obey a signal indication under the conditions which existed on the morning of the accident would be beyond explanation.

Under the automatic block-signal rules of the Southern Railway, the caution indication of an automatic block signal is interpreted to mean "Block is clear, second block in advance is not clear," and an engineman receiving a caution indication is required to "Approach next signal prepared to stop." As has been stated in previous reports, it is believed safer operating practice would be afforded if an engineman receiving a caution block-signal indication was required to "Proceed under control, approaching next signal prepared to stop."

In the case of this accident, both trains involved being passenger trains, if rule 510 had been obeyed the accident would undoubtedly have been averted, but under many operating conditions the two-minute period prescribed by that rule is entirely inadequate to provide necessary protection for a movement from siding to main line, particularly in the absence of a rule requiring a train after stopping or slowing down to proceed under control through the remainder of the block. In order to provide a proper margin of safety in making such movements, the waiting period prescribed should be lengthened, and the rule should be rigidly enforced.

Respectfully submitted.

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