

The Bryn Athyn Collision on the P. & R.

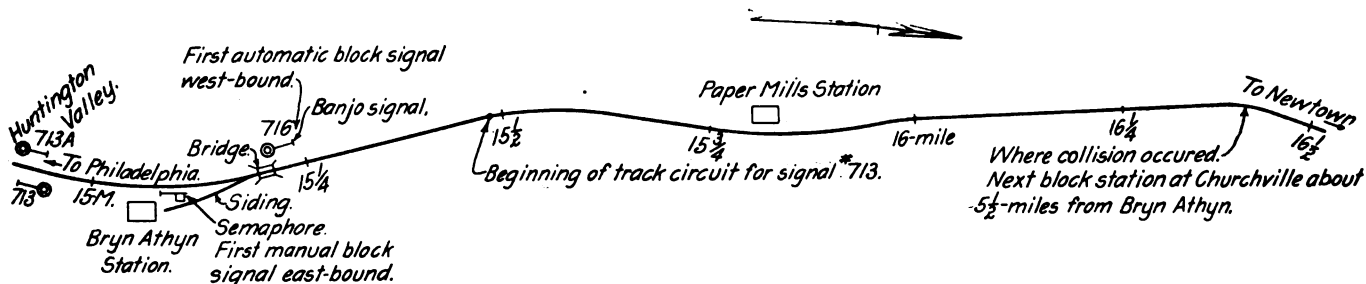
Bureau of Safety, Interstate Commerce Commission, Asks That Railroad Be Required to Install Automatic Train Control and Severely Criticizes Laxity of Supervision

THE butting collision of passenger trains on single track on the Newtown branch of the Philadelphia & Reading, 16 mi. north of Philadelphia, on the morning of December 5, resulted in the death of 27 persons and the injury of 70 more. The accident was investigated by representatives of the Bureau of Safety of the Interstate Commerce Commission jointly in connection with representatives of the Pennsylvania Public Service Commission. Under date of December 23, 1921, W. P. Borland, chief of the Bureau of Safety, submitted a report with recommendations to the Interstate Commerce Commission. The causes leading up to the accident and a summary of the testimony taken is set forth in detail. The report, which appears below, is given practically in full.

Location and Method of Operation

This accident occurred on the Newton Branch of the New York division. This branch leads off from the

one arm; it governs eastbound trains only, a flag being used when there are train orders for westbound trains. About 515 ft. east of this signal is the point of a switch, which leads to a spur track extending westward paralleling the main track on the south and ending near the telegraph block signal; this track was used as a passing siding. One hundred and seventy feet east of the point of the switch is located automatic block signal 716, which is the first of the automatic block signals governing westbound trains. The track circuit controlling signal 713 begins at a point about 1,500 ft. east of signal 716. Between the point of the switch and signal 716, the track passes over a steel bridge about 50 ft. in length, spanning a small stream. Beginning at Bryn Athyn station and proceeding eastward there is a 4-deg. curve to the left which extends to the point of the switch. From the point of the switch eastward the line is tangent for a considerable distance. Trees located on the north side



Section of the Newtown Branch in the Vicinity of the Accident

double track of the New York Short Line branch at Cheltenham, Pa., and is single track from Cheltenham to Newtown, Pa., a distance of 16.6 miles. The movement of trains is governed by time tables and train orders, eastbound trains being superior by direction. In addition there is a block system, part of which is automatic and part manual; from Cheltenham eastward to Bryn Athyn, a distance of 5.4 miles, the automatic block system is used, the signals being of the inclosed-disk type, while from Bryn Athyn to Newtown, the end of the line, a manual telegraph block system is in use. There are two telegraph block sections, one from Bryn Athyn to Churchville, a distance of 5.7 mi., while the other is from Churchville to Newtown, a distance of 5.5 mi. Between Bryn Athyn and Churchville there is an intermediate non-block station, Southampton, where trains frequently meet.

The first station west of Bryn Athyn is Huntingdon Valley, 0.7 mi. distant. At this station there are two automatic block signals, 713 for eastbound trains and 713A for westbound trains. Bryn Athyn station is located on the south side of the track, the telegraph office being in the station. Seventy-three feet east of the telegraph office, and also located on the south side of the track, is a telegraph block signal. This signal is a 2-position semaphore signal of the upper-quadrant type, having

of the right of way obstruct the view of signal 716 from Bryn Athyn station.

The point of collision was about 1.3 mi. east of Bryn Athyn, and 0.8 mi. west of Woodmont; it occurred in the middle of a rock cut about 200 ft. in length and having a maximum depth of 30 ft. The cut is located on a compound curve to the south about 1,000 ft. in length, having a maximum curvature of 7 deg. On account of this curve and cut the range of vision was much restricted and there was little opportunity for either engineer to see the opposing train. The weather was clear at the time of the accident, which occurred at about 7:55 a. m.

Description

Westbound passenger and milk train No. 154, en route from Newtown to Philadelphia, was in charge of Conductor Stout and Engineman F. Rook, and consisted of engine 265 and 5 cars. It left Newtown at 6:50 a. m., arrived at Churchville at 7:06 a. m., departed at 7:12 a. m., 5 minutes late, and arrived at signal 716 at 7:28 a. m. The train was brought to a stop at signal 716, because it did not have sufficient time to make Huntingdon Valley, its timetable meeting point, for superior train No. 151, also because signal 716 was in the stop position. A flagman was sent ahead and after a few minutes, the train

following him, pulled down to Bryn Athyn station and unloaded passengers. While at the station the crew received form 19, train order No. 9, reading as follows:

"Disregard signal 716 and run carefully. Complete 7.31 a. m."

After discharging passengers and receiving the train order, a flagman was sent back and train No. 154 backed up to a point about 100 ft. east of signal 716 in order that train No. 151, upon arrival, might pull up and back into the spur track to meet train No. 154, the track not being long enough to hold the latter train. After train No. 151 had arrived and backed in on the spur track, train No. 154 proceeded and passed Bryn Athyn station without stopping, according to Operator Clayton's block rec-

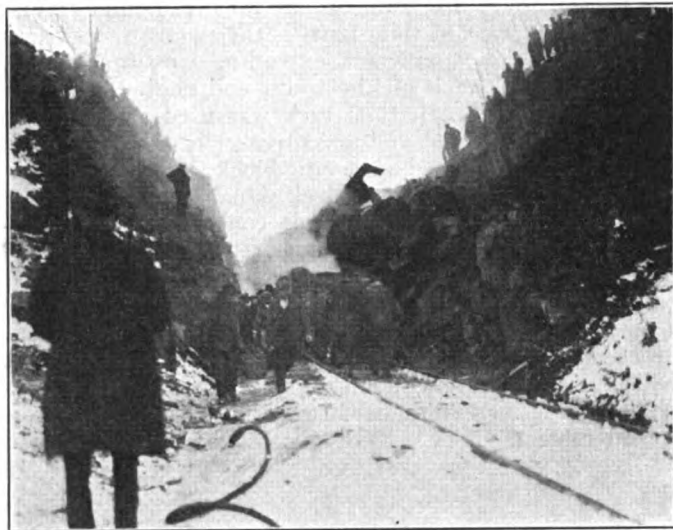


Photo by International

Removing Victims From the Wreckage in the Cut

ord, at 7:46 a. m.; the dispatcher's train sheet, however, showed the train departing at 7:44 a. m., this time having been changed from 7:54 a. m.

Westbound passenger train No. 156, en route from Newtown to Philadelphia, in charge of Conductor Smith and Engineman J. Rook, was made up of engine 278, four coaches and a combination coach and baggage car, all of wooden construction. The train left Newtown at 7:30 a. m. and at 7:41 a. m. arrived at Churchville, where the manual block signal was in the stop position. The conductor went to the telegraph office and received form 31, train order No. 11, reading as follows:

"No. 151 will meet No. 156 at Bryn Athyn. No. 151 take siding. Complete 7.44 a. m."

The conductor delivered a copy of the order to the engineman, who read it; the block signal was cleared and the train departed, as shown by the records, at 7:45 a. m. It passed Woodmont and while running at a speed estimated to have been between 30 and 35 mi. an hour, it collided with eastbound train No. 151.

Eastbound passenger train No. 151, en route from Philadelphia to Newtown, was in charge of Conductor Evans and Engineman Yeakel. It was hauled by engine 167 and consisted of a combination baggage and passenger car, of wooden construction, and two coaches, of steel underframe construction. It left Philadelphia at 6:48 a. m., and passed Fox Chase, 3.3 mi. west of Huntingdon Valley, at 7:20 a. m., on time. At Huntingdon Valley, a non-telegraph station and its timetable meeting point with train No. 154, it found automatic block signal 713 in the stop position. A flagman was sent ahead and after waiting a few minutes the train followed him to

Bryn Athyn, arriving, the train sheet record shows, at 7:42 a. m. Upon arrival at Bryn Athyn the telegraph block signal was found in stop position, while train No. 154 was standing on the main track east of signal 716. Conductor Evans sent word to his engineman to pull up and back in on the siding, but the engineman insisted that they get an order to do so. Conductor Evans went to the telegraph office and received form 31, train order No. 11, reading as follows:

"No. 151 will meet No. 156 at Bryn Athyn. No. 151 take siding. Complete 7.46 a. m."

After receiving the train order, Conductor Evans returned to his train and delivered a copy of the order to the engineman, while the operator came out on the platform and assisted in handling baggage; the train then pulled ahead under flag protection and backed in on the siding. When the switch was closed train No. 154 departed; then the switch was again opened and train No. 151 pulled out, departing, as shown by the records, at 7:46 a. m. A stop was made at Paper Mills station, 0.7 mi. east of Bryn Athyn, to let off some trackmen, after which the train proceeded and had gone about 0.5 mi., when, while running at a speed estimated to have been 25 or 30 mi. an hour, it collided with train No. 156.

The impact forced both engines upward, engine 167 of train No. 151 coming to rest bottom up, headed west and on top of its own tender, while engine 278 of train No. 156 was on top of engine 167. The combination car of train No. 151 was partially telescoped by the tender of engine 167. The forward end of the second car of train No. 151 was also partially telescoped by the rear of the combination car, while the rear car remained on the rails and was only slightly damaged. The first coach of train No. 156 was completely telescoped by the tender of engine 278. The next car was partially telescoped at its forward end by the wreckage, while the rear truck remained on the rails. The third, fourth and fifth cars of train No. 156 were practically undamaged by the collision. The wreckage took fire immediately, the first car of each train being completely destroyed. The fire spread quickly and destroyed the superstructures of the second and third coaches of train No. 156 and of the second coach of train No. 151. It is probable that many of the deaths were the result of the fire that followed the collision. The employees on duty killed were the fireman of each train.

Summary of Evidence

Conductor Evans of train No. 151 stated that upon arrival at Bryn Athyn he went to the telegraph office and signed and received train order No. 11. He read it in a low tone of voice and was under the impression that it was an order to meet train No. 154 at Bryn Athyn. After receiving the order he walked to the engine and delivered a copy of it to the engineman, neither of them reading it to the other, or making any comment whatever. His train then pulled down and backed in on the siding; after train No. 154 had departed the switch was opened, the train pulled out of the siding and proceeded without a clearance card or other permission from the operator at Bryn Athyn, although the block signal was in the stop position. He stated that it was his understanding that a train order was sufficient authority for a train to pass a block or train-order signal in the stop position without a clearance card. He did not show his copy of the train order to his trainmen, as they were both attending to the switches at the time, but he put it under the baggagemaster's box in the baggage car, as was his custom, so that the baggagemaster might see it.

Engineman Yeakel stated that when Conductor Evans handed him the order he glanced at it and got the im-

pression that it was an order to meet train No. 154 at Bryn Athyn.

Testimony of Bryn Athyn and Churchville Operators

The statements made by Operator Clayton, on duty at Bryn Athyn, are conflicting and vacillating. His first statement was to the effect that he did not report train No. 154 clear of the block to Churchville and that the operator at Churchville did not secure his permission to let train No. 156 enter the block. He also stated it was his understanding that the block was between Bryn Athyn and Churchville. Upon subsequent examination, however, Operator Clayton stated that he cleared the block to Churchville as soon as the rear of train No. 154 had crossed the bridge just west of signal 716 and that he gave the operator at Churchville permission to let train No. 156 proceed on a clear block, considering that the block for westbound trains ended at automatic signal 716. After train No. 154 had departed he went out on the station platform to bring in a flag which he had used for a train-order signal, and it was at that time he discovered train No. 151 pulling out of the siding. He made an effort to signal the train to stop, but was unsuccessful.

The block record at Bryn Athyn clearly indi-

Athyn station ready to go. On the second occasion Operator Tomlinson stated that upon the arrival of train No. 156 the conductor came to the office and signed train order No. 11, and that he transmitted the signature to the train dispatcher and received "complete" from him at 7:44 a. m. He immediately communicated with the operator at Bryn Athyn and ascertained that train No. 154 was clear of the block at Bryn Athyn; the conductor of train No. 156 left the telegraph office, went to the engine and delivered a copy of the order to the engineman; while thus engaged Operator Tomlinson cleared the train-order signal and the train departed immediately.

At the investigation Operator Tomlinson produced a record which he identified as the original block record kept at his station. This record showed that train No. 154 cleared the block at Bryn Athyn at 7:45 a. m.; the figure "5," however, bore indications of alteration and upon questioning Operator Tomlinson admitted that he had changed the clearing time from 7:46 a. m. to 7:45 a. m. for the purpose of making the record 7:45 a. m. on the book. The block record produced by Operator Tomlinson was contained in a new record book, the first entry being for December 1. Operator Tomlinson was later required to produce the book containing the record previous to December 1, and upon examination of that record it was apparent that several pages of the book subsequent to November 30 had been removed. In the old record book only three columns were filled in, the train number and the arriving and departing time of trains, while in the new book the columns headed "Train No.," "Signals displayed," "Entered block in rear," "Arrived," "Entered block," "Reported to block station in advance," "Clear block reported to station in rear," and "Advance block reported clear," were all filled in. Upon further examination Operator Tomlinson admitted that the book which he had identified during his previous examination as the original record was not the original record, but a copy which he made for the purpose of this investigation, and that the copy contained additional information not shown by the original record and that the original record had been destroyed by him. He assumed full responsibility for making these changes and for destroying the original record, stating that he acted entirely upon his own initiative, and without suggestion or instruction from any person.

Form 388 Philadelphia & Reading Railway Company

Algeton City Railroad Co. Reading & Columbia Railroad Co.
 Catawissa & Pottsville R. R. Co. The Pottsville & Schuylkill R. R. Co.
 The Chester & Delaware River R. R. Co. The Philadelphia, Newmarket & N. Y. R. R. Co.
 The Harrisburg & Pottsville R. R. Co. Pottsville Valley Railroad Co.
 Middletown & Hummelstown R. R. Co. The Port Reading Railroad Co.
 The Northeast Pennsylvania R. R. Co. The Williams Valley Railroad Co.

Form 31 **Reading** TRAIN ORDER No. 11
 Superintendent's Office Dec 5 1921

To C. E. No 151 At Bryn Athyn
 Operator: M.

No 151 will meet No 156
 At Bryn Athyn No 151
 take siding.

W. J. E

CONDUCTOR AND ENGINEMAN MUST EACH HAVE A COPY OF THIS ORDER.
 Repeated at 7:45 a.m.

CONDUCTOR	TRAIN	MADE	AT	OPERATOR
Eraws	No 151	Complete	7:46	Clayton

The Order. Which Was Disobeyed

cates that the entries relative to trains Nos. 151 and 154 had been altered. Operator Clayton was unable to explain these alterations except on the ground that he was busy selling tickets at the time and that the entries were not made at the time of the occurrence but from memory about an hour afterwards, at which time he was very much excited and disturbed.

Operator Tomlinson, on duty at Churchville, also made statements on two occasions which are conflicting. In his first statement Operator Tomlinson said he permitted train No. 156 to proceed from his station, giving them a clear block signal, and at that time train No. 154 had not been actually cleared of the block by the operator at Bryn Athyn, but that he had an understanding with the operator at Bryn Athyn that train No. 154 stood at Bryn

Examination of Crews on No. 154 and No. 156

Conductor Stout of train No. 154 stated that his train passed Bryn Athyn station at about 7:48 a. m. He also stated it was his understanding that the block for westbound trains ended at Bryn Athyn station. However, upon cross-examination by General Superintendent Fisher he retracted this statement and said the block ended at signal 716. Engineman F. Rook of train No. 154 stated it was his understanding that the rear of a westbound train would have to pass Bryn Athyn station before the block could properly be cleared to Churchville.

Engineman J. Rook of train No. 156 stated that the block signal at Churchville was cleared as the conductor was walking down the platform with the train order. He did not recall the time his train left Churchville, but said it passed Southampton 3 min. late. This would make train No. 156 passing Southampton at 7:49 a. m.; the schedule time from Churchville to Southampton is 5 min., which would make train No. 156 departing from Churchville at 7:44 a. m. Engineman Rook also stated that when he receives a clear block signal at Churchville he understands that the block is clear to Bryn Athyn station and not to signal 716 only. He stated that he saw the engine of train No. 151 when it was about 40 ft.

distant and that he made an application of the brakes just before the collision occurred.

Brakeman Fulmore of train No. 156 stated that when his train was leaving Churchville he looked at his watch and it was then between 7:45 and 7:46 a. m.

Statement of Train Dispatcher and Signal Supervisor

Train Dispatcher Rich stated that when train No. 154 arrived at Bryn Athyn the conductor reported signal 716 in the stop position. At that time one of his telegraph wires was in trouble east of New York Branch crossing, and from this he concluded that the entire signal circuit from signal 716 to Huntingdon Valley was out of order, and to avoid delay to train No. 156 which would result from train No. 154 being required to flag to Huntingdon Valley, he issued train order No. 9 for train No. 154 to disregard signal 716. He admitted, however, that this signal condition might arise with train 151 occupying



Photo by International

Wreckage Piled in Narrow Cut, Which Made Rescuers' Work Difficult

the track circuit between signals 713 and 716; also if train No. 154 entered the track circuit east of signal 716 and was unable to proceed further than Bryn Athyn on account of timetable inferiority, it would be necessary for train No. 151 to flag from Huntingdon Valley to Bryn Athyn.

Signal Supervisor Steele stated that on the morning of December 5, signal 716 was reported as being out of order, but inspection by the signal maintainer disclosed no trouble and that the signal was working properly.

Conclusions of the I. C. C.

This accident was caused by the failure of Conductor Evans and Engineman Yeakel of train No. 151 to obey train order No. 11, directing them to meet train No. 156 at Bryn Athyn; also by their failure to observe manual block signal rules in leaving Bryn Athyn with the block signal in the stop position without securing a clearance card. Contributing to this was the failure of the operator at either Bryn Athyn or Churchville, or both, properly to operate the manual block system.

It is probable that this failure on the part of Conductor Evans and Engineman Yeakel to obey the instructions contained in train order No. 11 was caused by their anticipating the contents of the order and acting upon that impression rather than upon the instructions contained in the order. The evidence indicates that when Engineman Yeakel was requested to pull up and back in

on the siding he would not do so until he received an order directing him to make the movement, and when he did receive the train order he assumed that the order was the one which he had requested.

General operating rule 210, with reference to train orders, reads in part:

"The copy for each engineman must be delivered to him personally by the conductor or pilot, and the engineman must read it aloud to the person delivering it."

General Instructions, Rules for Conductors, rule 1003 reads in part:

"On passenger trains they will show all orders to trainmen."

Had Conductor Evans and Engineman Yeakel complied with these rules, their mistake would undoubtedly have been discovered. This accident again calls attention to the fallibility of the human element and emphasizes the inherent danger in the operation of trains by the train-order system.

It was no oversight on the part of Conductor Evans that train No. 151 left Bryn Athyn without a clearance card on the block signal. According to his understanding of the rules, the train order he had received gave his train the right to proceed without a clearance card with the block signal in the stop position. If he had had a proper understanding of the rules, immediately after the passage of train No. 154 he would have ascertained the condition of the block and thus would have been checked on the misreading of the train order.

The evidence is conclusive that train No. 156 left Churchville on a clear block signal when train No. 154 still stood on the main track at signal 716 with the rear of its train east of the signal. Train No. 151 received "complete" to train order No. 11 at 7:46 a. m., after which they handled baggage, pulled up and backed in on the siding before train No. 154 could even pass signal 716; the order to train No. 156 was completed at 7:44 a. m. and the train departed from Churchville shortly thereafter. There can be no dispute as to the time the orders were completed by the train dispatcher, as both times were taken from the same clock.

The statements of Operators Clayton and Tomlinson are so conflicting and the condition of their block records such that statements made by them are of little if any value. In view of these conflicting statements it is impossible to determine whether the operator at Bryn Athyn cleared the block to Churchville before the operator at Churchville permitted train No. 156 to proceed on a clear block, or whether the operator at Bryn Athyn did not clear the block and the operator at Churchville let train No. 156 go on a clear block signal knowing that the block was still occupied by train No. 154.

Safeguards Provided for Train Operation Ineffective

The investigation of this accident disclosed that in this instance all of the safeguards provided for the operation of trains were rendered ineffective by errors on the part of employees involved, misunderstanding of operating rules, and improper practices which had grown up.

The train-order system failed due to the members of the train crew of train No. 151 misreading or neglecting to read the train order establishing the meeting point.

The manual block signal system failed, due to the crew of train No. 151 departing from Bryn Athyn without authority when the signal was at stop, and due to train No. 156 being admitted to the block under a clear signal when the block was occupied.

In addition to the specific failures of the block system which led directly to this accident, investigation disclosed a general laxity in the observation of block signal rules.

General rule 317-B, which prescribes the method of blocking trains, is followed by this note:

"Note: 317-B is for absolute block for opposing movements and permissive block for following movements on the same track."

Notwithstanding the requirement that a positive block must be maintained for opposing trains, the timetable provides for regular meeting points between schedule trains at Southampton, an intermediate non-block station located in the block section between Bryn Athyn and Churchville, and opposing trains are permitted to enter the block on a clearance or a caution card.

Rule 317B also reads in part:

"A train must not be admitted to a block which is occupied by a passenger train, except as provided in Rule 331, or by special order."

(Rule 331 provides for movement in case of failure of telegraph line.)

Train Dispatcher Rich stated it was his understanding that train No. 156 might enter the block at Churchville with train No. 154 still within the block, provided train No. 156 received a caution card.

The incomplete condition of the block records at both Churchville and Bryn Athyn, together with the fact that the time was not entered on the record at Bryn Athyn until an hour after, are further evidence of the loose method of operating the manual block signal system.

Misunderstanding as to Block Limits

Circular No. 403, dated May 21, 1914, putting the block system into effect in this territory, provides that "Manual telegraph block system will be in operation between Bryn Athyn and Newtown." It also provides that this telegraph block system is in effect at

Bryn Athyn—6.30 a. m. to 7.20 p. m.
Churchville—6.15 a. m. to 2.35 p. m.; 3.35 p. m. to 7.35 p. m.
Newton—6.00 a. m. to 2.35 p. m.; 3.35 p. m. to 7.35 p. m.

It further provides that "In forwarding trains signalmen will be governed by rule 317-B." Under this circular it appears that the manual block section for eastbound trains begins, and for westbound trains ends, at Bryn Athyn station, and so far as can be ascertained in that respect has not been subsequently modified, and was so understood by the employees generally at the time of the accident. Notwithstanding this, it is claimed by officers of the Philadelphia & Reading that while the manual block section for eastbound trains begins at Bryn Athyn station, the manual block section for westbound trains ends at signal 716, some 750 ft. east of the station, and that it is proper for the operator at Bryn Athyn to clear the block to Churchville as soon as the rear of a westbound train has passed signal 716.

There was no uniform or clear understanding as to whether the siding at Bryn Athyn was within the limits of Bryn Athyn station or whether it was within the block section between Bryn Athyn and Churchville, and whether or not it was necessary for train No. 151 to have a clearance or a caution card before passing the block signal to back into the siding.

The train-order signal at Bryn Athyn is not clearly defined and the evidence is conflicting as to whether a flag should be used for eastbound trains or whether the block signal should be used.

Laxity in Supervision

Train No. 154 was given a train order to disregard signal 716 upon the assumption of the train dispatcher that the signal was out of order, when, as a matter of fact, it properly indicated there was a train in the block. This

order created a dangerous situation, and was given apparently for no other purpose than to avoid delaying train movements. A similar order was also issued to train No. 156, but was not delivered.

There does not appear to have been any system that required employees to be re-examined on the rules at regular intervals; some of them had not been examined since 1914, and the train dispatcher involved had never been examined.

The investigation disclosed extremely lax supervision by responsible officers over the conduct of employees in the observance of ordinary safeguards to train movement. There was no system of instruction of employees to provide a correct and uniform understanding of the rules, nor any effort on the part of responsible officers to correct existing operating practices which were contrary to rules and a constant menace to the traveling public. The laxity with which the manual block system was operated on this line is a condition which could have been easily discovered had any attempt been made by officers to check it up.

The practice of authorizing trains to disregard automatic signal indications frequently upon trivial occasions merely to prevent delay, is dangerous, tends to lead to a disrespect of all automatic block signals, and cannot be too strongly condemned.

Automatic Train Control One Requirement

To prevent the recurrence of accidents of this character, it is recommended that measures be taken promptly by the carrier to insure that employees properly understand and obey operating rules which are provided to safeguard train operation, and that the carrier be required to install on this line a complete automatic train control system.

All of the cars involved in the accident except the two last cars of train No. 151 were of wooden construction. It is probable that many of the lives lost in this accident were the result of the fire which followed the collision.

Data on Various Train Controls

From time to time descriptions of various train control tests and installation have been published in the *Railway Signal Engineer*, therefore, as a convenience, the following references are listed:

- Miller Train Control on C. & E. I., page 329, November, 1914.
- American (Jones) Train Control Company, on Maryland & Pennsylvania, page 175, June, 1915.
- Julian Automatic Train Control, page 200, July, 1915.
- Miller Train Control, Developments, page 61, February, 1916.
- Bulla Automatic Stop, page 349, November, 1916.
- Webb Automatic Train Stop on the New Haven, page 151, May, 1917.
- Wooding Automatic Train Stop, I. C. C. Tests, page 311, October, 1917.
- Scheweyer's Automatic Train Stop, page 224, July, 1918; page 353, November, 1918.
- Shadle Automatic Train Signal and Stop, page 373, December, 1918.
- American Train Control on C. & O., page 131, April, 1919.
- National Safety Appliance Train Control on Western Pacific, page 312, September, 1919; page 267, August, 1919.
- Shadle Automatic Train Control Test on C. I. & W., page 405, October, 1920.
- Bourdette-Brookins Train Control System, page 411, October, 1920.
- Casale Train Control, Inspection on Rock Island, page 175, April, 1920.
- Regan Safety Devices Company, Inc., Installation on Rock Island, page 204, May, 1920.
- Regan Train Control in England, page 463, November, 1920.
- Regan Train Control in France, page 115, March, 1921.
- General Railway Signal Company, Automatic Train Control Test, page 431, November, 1921.
- Simplex Train Control, page 497, December, 1921.