INTERSTATE COMMERCE COMMISSION

REPORT OF THE CHIEF OF THE BUREAU OF SAFETY COVERING THE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE MICHIGAN CENTRAL RAILROAD AT IVANHOE, IND., ON JUNE 22, 1918

AUGUST 8, 1918.

To the Commission:

On June 22, 1918, there was a rear-end collision between two extra trains on the Michigan Central Railroad at Ivanhoe, Ind., which resulted in the death of 67 passengers and 1 employee and the injury of 127 passengers. An investigation of this accident was made in conjunction with the Indiana Public Service Commission, a hearing being held at Hammond, Ind., June 27. After investigation as to the nature and cause of this accident, I beg to submit the following report:

The accident occurred on the West Division of the Michigan Central Railroad at Ivanhoe, Ind., about 5½ miles east of Hammond. The line at this point has two main tracks, and the general direction is east and west. The division is completely equipped with automatic block signals, operated on the normal clear system, interlocking plants being provided at railroad crossings and important connections. All signals are of the upper quadrant three-position type, the night indications being given by red, yellow, and green lights. The signal mechanisms are of various types, but of modern design, and those in the vicinity of the scene of accident are top post, Hall Style K, installed about two years ago. They are all operated by primary battery, and direct current track circuits are used. The average length of blocks is a little more than a mile. The control circuits are so arranged that the caution position of the signal is controlled through the track, but the clear position is controlled through line wires. At all hand switches switch boxes are provided, and indicators are used to show the approach of trains.

At interlocking plants the home signals are motor driven, and they also act as block signals, giving the same three indications as automatic signals. These are normal danger signals, and are cleared when the towerman reverses his lever and when the block ahead is

clear the control of these signals being similar so far as the occupancy of the block is concerned to that of automatic signals The signals in the rear of the home signals, although referred to as distant signals are no different in form or functions from the automatic signals but in addition to control by circuit-breakers on the home signals their clear position is controlled by levers in the tower

The interlocking tower at Ivanhoe is located just west of the Elgin Joliet & Eastern Railway which crosses the Michigan Central Railroad at that point, the plant consists of a 33-lever mechanical interlocking machine the high signals being electrically operated and controlled This plant, shown in Fig 1, controls the Elgin, Joliet & Eastern Railway crossing crossovers between the Michigan Central tracks, and a connection from the westbound Michigan Central track to the Gary & Western which parallels the Michigan Central on the north

The westbound home signal located about 950 feet east of the Elgin, Joliet & Eastern crossing, has two arms, the upper arm governing movements on the main track and the lower governing movements to the Gary & Western Automatic signal 2581, shown in Fig 2 which serves as a westbound distant signal for the Ivanhoe interlocking is about 5 360 feet east of the home signal, just east of the beginning of the tangent which extends through the interlocking plant The next westbound automatic signal 2571, is 6,200 feet east of signal 2581 The approach of trains is announced by telephone from Tolleston plant about 3 miles east of Ivanhoe Approach locking is installed to lock up the route when a train passes the distant signal in clear position

Beginning at Tolleston and proceeding west, the direction in which the trains involved were going the track is tangent for about 1¼ miles followed by a 16-minute curve to the right about 3,300 feet long From the west end of this curve the track is tangent for about 3 180 feet to the point of accident 990 feet east of the westbound home signal at Ivanhoe The grades from Tolleston to signal 2581 are very slight varying from 0 105 per cent ascending to 0 19 per cent descending The grade is level for about 600 feet west of signal 2581, when it ascends at the rate of 0 5 per cent for 2,700 feet, followed by a level piece 700 feet long, after which it descends at the rate of 0 11 per cent for 1,600 feet to the point of collision

The trains involved in this accident were westbound extra 7826 with a part of the Hagenbach-Wallace Circus in charge of Conductor R W Johnson and Engineman Gasper en route from Michigan City, Ind , to the Indiana Harbor Belt Railway at Gibson, Ind , and westbound extra 8485 an empty equipment train, in charge of Conductor

-L Johnson and Engineman Sargent en route from Detroit, Mich to Chicago Ill

The circus train extra 7826 drawn by engine 7826, consisted in the order named of 7 stock cars 14 flat cars 4 sleeping cars and a caboose all except the caboose being the property of the circus company This train left Michigan City at 2 30 a m June 22 with orders to take the Gary & Western at Ivanhoe It proceeded at about 25 miles an hour slowed up on account of the caution signal east of Ivanhoe, due to the diverging route being lined up and was stopped by the engineman upon a signal from the conductor with the train partly over the connection and the engine only a few feet from the Elgin Joliet & Eastern crossing The cause of this stop was a blazing hot box on the south side of the train which was noticed by the flagman from the rear as the train approached Ivanhoe this proved to be on flat car No 72, some 10 or 11 cars from the rear end The train stopped at 3 55 a m and was struck about 3 57 a m by extra 8485

Extra 8485, drawn by engine 8485 and consisting of 21 Pullman sleeping cars, partly standard and partly tourist, left Michigan City at 2 57 a m and proceeded at about 25 to 30 miles an hour, passed the automatic signal two miles east of Ivanhoe at caution, passed the next signal at stop, passed the flagman of the circus train with a fusee, and collided with the rear of the circus train at 3 57 a m At the time of the accident the weather was clear

The wreckage immediately took fire, the four sleeping cars on the rear of extra 7826 being entirely destroyed Views of the wreckage are shown in Figs 3 and 4 A flat car 9 cars from the head of the circus train was broken in two by the impact no other serious damage was done to the circus train equipment Engine 8485 of the equipment train was derailed and after the collision lay across both main tracks with the boiler heading southwest and the tender heading northwest as shown in Fig 5 The car next to engine 8485 was lifted off the rails but dropped back on the track when the train was pulled back The damage to engine 8485 did not exceed $2 000, and the damage to the cars in its train was estimated to be about $450

Engineman Gasper of extra 7826, stated that he left Michigan City at 2 30 a m with instructions not to exceed 25 miles per hour to head in on the Gary & Western at Ivanhoe He proceeded at about this speed or less received a clear indication at the second automatic signal east of Ivanhoe, a caution indication at the next automatic signal west and found the top arm of the Ivanhoe home signal red with the lower showing a yellow light which was the correct indication for him to take the Gary & Western connection He shut off steam at the distant signal, as there was a slow order of 8 miles per hour over that switch, and when about 20 car lengths from

the Ivanhoe home signal, he looked back and saw a stop signal being given by a fusee from the caboose He made a light application of the brakes, on account of having passengers in the rear cars, and stopped with his engine about 70 feet from the Elgin, Joliet & Eastern crossing After stopping he looked back expecting to get a proceed signal, and released his automatic brakes, but set his independent engine brake to hold the train in case anyone should be working under the cars After about two minutes as he was looking back to see what was wrong he saw a headlight coming around the curve, but was not positive whether it was on the Michigan Central or on the Gary & Western About the same time he saw the flagman on the ground with his red and white lanterns and saw him light a fusee, giving a violent stop signal with it He could not state how far the flagman was from his caboose, nor how fast the other train was approaching He then saw the fusee thrown into the air, although he did not hear the signals of the flagman answered, it was his impression that the engineman of the approaching train had seen the fusee and the flagman was throwing it away Shortly afterwards he felt a slight shock and his air pump started to work rapidly, he then assumed that they had been struck and an air pipe broken but did not think from the slight shock that the damage could be great He could not state whether the approaching train had shut off when it reached the distant signal or not, but he did not hear the exhaust or any whistles, nor did he see any evidence of the fireman putting in a fire After the collision he got off his engine with a fusee to flag eastbound trains and met his conductor going to the tower He went back to the rear end, but when the conductor came from the tower, he went back to his engine so as to be ready to move the head end of his train to allow the wrecking train to get as close as possible to the wreckage He did not talk with either the engineer or the fireman of the equipment train concerning the accident either then or later He did not know why he was stopped until the conductor told him he had a hot box His markers were burning brightly at the times he had looked back, and all signal lights were burning brightly

Fireman Phillips of extra 7826 stated that there was nothing unusual in the run from Michigan City until they were stopped at Ivanhoe but as it was his first trip so far west he was not familiar with all the signals and could not state what they indicated He had not looked back during the run as the head brakeman was on the engine and kept a lookout toward the rear end About two minutes after the train stopped he stated that he felt a shock much as though a coupling were being made Then he looked back and saw fire breaking out

Conductor Johnson of extra 7826 stated his train ran at about 25 miles per hour after leaving Michigan City except that they slowed up on East Gary hill to allow the engineman to put a lantern in his head light, which had gone out Approaching Ivanhoe he was riding in the cupola with Trainmaster Whipple and noticed that the signals were all working properly The distant signal for Ivanhoe changed from caution to stop as the engine passed it and was in the stop position when the caboose went under it As they went around the curve east of Ivanhoe, he could see the blaze of a hot box, he lighted a fusee and from the right side of the caboose signaled the engineman to stop As the train stopped he dropped the fusee and it went out As they slowed down, the flagman dropped off taking a fusee lanterns and torpedoes with him He did not caution the flagman as to his duties as he was a competent man, and any instruction or warning were unnecessary Conductor Johnson had been gone from the caboose about half a minute with the necessary equipment for fixing the hot box and had possibly gone 5 or 6 car lengths when he saw the headlight of the following train coming around the curve he heard the engine working, and saw the glare of his flagman's fusee He saw the flagman waving his fusee across the track and he thought the flagman then might have been back 25 car lengths He stated that he heard no torpedoes exploded, nor any whistle from the approaching train, but the engine was working up to the time of the collision he did not think its speed exceeded 30 miles per hour After the collision he went ahead to the tower to call assistance and met his engineman with a fusee flagging an eastbound train which had apparently stopped at the home signal of the E , J & E crossing He did not see the engineman or fireman of extra 8485 but saw the conductor on his return from the tower He did not know how the fire started, although it seemed to break out all at once As the collision occurred before he had reached the hot box, he did not look at it then, but about 5 minutes later when it was examined it was then in a condition too dangerous to run farther he packed it before the head end of the train was moved to Hammond

Brakeman Aust of extra 7826 stated that he rode on the fireman's side of the engine from Michigan City to Ivanhoe, observed all the signals looked back frequently to see if the markers were burning and exchanged signals at each station They received clear signals until approaching the distant signal at Ivanhoe and all lights were burning brightly He estimated their average speed as 15 or 20 miles an hour, with a reduction to 10 or 12 miles through Tolleston and to about 6 miles while pulling in on the G & W On coming around the curve east of Ivanhoe, he crossed to the right side of the engine and looked back but did not look back on the left-hand side after leaving

Tolleston His markers were burning at Gary, he saw the right-hand one at Tolleston and he saw the left-hand one before the collision As he observed the signals, he called them to the engineman As soon as they stopped, he stepped over to the eastbound main track, when he heard an engine coming, and looking back, saw its headlight, but could not tell how far away it was or how fast it was coming At the same time he saw the flagman going back and giving a stop signal with his fusee He also saw the flagman throw the fusee up in the air, but heard no whistle signals from the approaching train which from the exhaust he thought was coming fast and which was working steam when it struck He ran back and met his conductor at the hot box just as the collision occurred Then he flagged a train on the eastbound main track, running back to the tower and after that he uncoupled the first six cars, all that could be moved, on account of the eighth being broken and holding the seventh, to permit them to be moved west of the crossing The train stopped at Ivanhoe at about 3 55 or 3 56 a m , and the collision took place about 2 minutes later

Flagman Timm of extra 7826 stated that he was riding in the caboose by an open window, but went out on the platform at every station He saw no indication of a hot box until they approached Ivanhoe, when they were slowing up to enter the Gary & Western tracks He notified the conductor, who lighted a fusee, he went into the caboose and picked up a fusee himself While in there, Trainmaster Whipple asked him what was the matter and where they were He got off as the train came to a stop and started to walk back with his fusee red and white lanterns and torpedoes He could see the smoke of the approaching train before he could see the headlight, while it was still around the curve When he saw the approaching train which had run by the signal, he started to run lighted the fusee and turned to see if his markers were burning He ran across the track in an attempt to attract the fireman's attention, but returned to the engineman's side, shouted as the engine passed him and threw his fusee which he thinks struck the cab below the window Judging from the exhaust, which he heard just before the train came in sight, he thought the speed must have been about 25 miles per hour He did not hear the usual crossing signal from the equipment train nor were his signals answered, and he could not see the engineer as the engine passed him the cab window being closed The train did not reduce speed as it passed him He had gotten back approximately 700 feet from the rear of his train He had not placed any torpedo as he said his only thought when he saw the train running by the stop signal was to get back as far as possible as he was positive that the engineman must have been asleep He was running back and he thought he would lose time if he stopped to put down a torpedo He saw no one on the equipment train as it

passed, but met the conductor as he ran toward the head end after the collision and after that, when he had crossed to the south side of the train, he met the fireman climbing down from the roof of the third or fourth car He had no conversation with him as he seemed dazed, he did not see the engineman

Conductor Johnson, of extra 8485 stated that they arrived at Michigan City at 2 47 a m and left at 2 57 a m after taking water At Gary the speed was less than 15 miles per hour the train passed Tolleston at about 20 miles per hour, and the speed may have increased to 25 miles per hour after that, this he estimated was the speed at the time of the collision The first indication of the accident was a shock which he attributed to a burst air hose There was but one shock, or a continuous shove, but nothing to indicate that it was not a brake application instead of a collision On going out, he encountered people coming from the circus train Fire broke out at once and burned fiercely He assisted the fireman of the circus train to get down from the car roof, but had no conversation with him, and then he crossed to the north side and assisted people to get out of the wreck Here he met Engineman Sargent, who had removed his overalls, or changed his clothes, and asked him how it happened Sargent replied, 'I was dozing, otherwise asleep' About 35 or 40 minutes later he saw Engineman Sargent on the engine looking at the injectors no one was with him but he saw others on the engine later The brakes had been applied at Gary and at other points and he said he heard Engineman Sargent whistle for Tolleston but not after that He did not notice any of the signals between Michigan City and Ivanhoe, nor did he make any observations of them after the accident He had talked with Engineman Sargent at Bottsford Yard, where he took the train and again at Michigan City, while he was oiling, but noticed nothing unusual When he got on the ground after the accident, it was 3 55 a m, so he thinks the collision must have occurred about 3 53 a m No cars were derailed except the first, which dropped back on the rails when the train was pulled back

Brakeman Jackson of extra 8485 stated that he was riding in the last car He did not see the signals, but noticed the order boards He did not think the speed exceeded 40 miles per hour at any time, the brakes had been applied to reduce speed through Gary, and after that the train picked up a little speed at Tolleston they were not running over 25 miles an hour Just before the shock of the collision he thought the brakes were applied in emergency then immediately there was a second shock, and then a third shock, less severe The shocks were severe enough to throw him over the seats and put out all his lights including the markers He heard no sound of brakes being applied and after getting off the train he did not notice if they

were applied He met the fireman on his way back and he said the engineer had been asleep

Flagman Moyer of the equipment train stated that he estimated their speed at Tolleston to be about 20 miles an hour, and it was increased some after passing that point He did not feel any application of the brakes between East Gary and the point of collision but the air was applied approaching Gary His first indication of an accident was a sudden jar, which caused him to think they had run off the derail He felt two distinct shocks the first of which he thought was an application of the brakes but the second was more severe than the first after which the train seemed to lunge ahead After the shock he lighted his lanterns, which had been extinguished asked Brakeman Jackson to light the markers, and went back to flag the second equipment train, which he knew was following He noticed no burning fusee as he got off, but did see a little blaze, which he thought was the engineman with a torch, and later on looking back he saw the whole sky lighted up When the second equipment train was stopped, he uncoupled the engine in order to pull back his own train, which he thought was on fire and then went to the scene of the collision He saw Engineman Sargent there and later at Gary when he talked with him but he did not at any time discuss the accident As he went toward the head end he saw the fireman who appeared to be in a dazed condition, but beyond inquiring whether he was injured had no conversation with him then or later He noticed the brakes applied several times on the trip and that usually there seemed to be a little trouble in getting them released on the rear cut, but they appeared to hold well at all times He heard the engine whistle at various times but did not remember if he heard it after leaving Gary

Road foreman of engines Doherty stated that he was on the first eastbound train and reached Hammond about 2 30 a m About 3 10 a m he went to the tower and while there was told of the accident He reached Ivanhoe about 4 15 a m and at about 6 a m he was on engine 8485 The throttle was fully closed the brake valve in running position, and the reverse lever a short distance ahead of the center about where it should be with such a train as this engine had However he did not know whether any one else had been on the engine after the collision he said the fire would not have prevented any one from getting into the cab and examining or changing the position of the throttle or brake valve The indications were that the brake had not been applied He did not talk with Engineman Sargent or Fireman Klauss although he saw the former about the wreckage

Engineman Stevenson of the second equipment train following extra 8485 stated that he saw the home signal at Tolleston change from caution to clear as he approached it, the first automatic signal west of there was at caution and the second was at stop He stopped at this signal at 4 10 a m and about at this time he saw the flagman of extra 8485

Third trick operator Enfield at Tolleston stated that he announced the circus train to Ivanhoe at 3 44 a m when it passed and the following train passed at 3 52 a m As the circus train passed he was looking out of the window in such a position as to see the south side of the train and is confident that there was no blazing hot box on the train He estimated the speed of the circus train as 18 miles per hour and that of the equipment train as 30 miles He received notice of the accident at 4 06 a m just after the second equipment train had passed From his office the first westbound automatic signal can be seen he did not notice it after the circus and first equipment train had passed but it was at stop after the second equipment train had passed

Car Inspector Voight stationed at Michigan City, stated that he inspected some of the flat cars of the circus train including No 72 on which the hot box developed None of the journals needed packing he put oil in some of them although he did not remember which ones

Division Superintendent Donahue stated that, under the Michigan Central rules when an extra train is made up, it is permitted to occupy the main track and run ahead of superior class trains without orders until instructed by signal or message to take siding On double-track main line, it is not necessary for extra trains to carry classification signals, nor is it necessary for them to clear the time of regular trains as shown in the time-table After being permitted to go out on the main line it is governed by the automatic signals If delayed the rules provide that the conductor shall communicate with the dispatcher in the absence of any instructions, the conductor must protect his train and clear the main track as soon as possible The Gary & Western onto which the circus train was about to go, is controlled by the Indian Harbor Belt but arrangements have been made for its use by the Michigan Central

Engineman Sargent of extra 8485, being under arrest refused to testify at any of the hearings on advice of his counsel In his report of the accident to the officials of the railroad company, he made the following statement

I was called shortly after 8 p m June 21 for deadhead equipment west, engine 8485 for 10 15 p m, and left Kalamazoo at 10 55 p m Had been up since 5 a m June 21 deadheading from my home in Jackson on Train No 41, and

had had little or no sleep during the day Had had a couple of heavy meals before going out realizing that I would not get anything more to eat until some time the next morning Leaving Kalamazoo followed freight train to M C yard and stopped at signal near Center Street Got proceed signal from some one on ground pulled up to Michigan City stopped at standpipe and took water While following this freight train, we stopped first between Dowagiac and Pokagon account signal at danger Stopped again at Pokagon and Niles for some reason this freight train being ahead

Leaving Michigan City, had clear track to East Gary and there caught block of train ahead, reduced speed, but did not have to stop as block cleared before I reached it Reduced speed going through Gary to comply with rules and saw no more signals at caution or danger until approaching curve east of Ivanhoe, where I found second signal east of wreck at caution Was going about 25 miles per hour at this point, but did not reduce speed, as I expected that the next signal would probably clear before I got to it, or that I would see it at danger in time to stop The wind was blowing very hard into cab on my side and I closed the window which made the inside of cab more comfortable Before reaching the next signal I dozed on account of heat in cab and missed it Not realizing what had happened to me until within 75 to 90 feet, I awoke suddenly and saw the tail or marker lights showing red on a train directly ahead of me Not realizing that the rear end of this train was so close I started to make a service application, but before completing it placed brake valve handle into emergency position We struck almost instantly after making the brake application Don't know whether I closed the throttle or not but think I did Looked to see where the fireman was and saw he was running toward the gangway Did not see a fusee burn a torpedo or see any other warning signal up to the time I saw the red tail lights Wreck happened at about 4 05 a m June 22, and I stayed there for an hour or more assisting in getting people out of the wreckage I have been in the service of the Michigan Central Railroad Co for approximately 28 or 29 years the last 16 of which I have been continuously employed as an engineer I am in perfect physical condition as well as mental condition and have had no illness within 25 or 30 years requiring the service of a doctor There was nothing defective about the air brakes or other mechanism of the engine or train that I was operating nor was there any defective condition of any of the signals or track upon which I was operating to the best of my knowledge The accident was due solely to the fact that I accidentally fell asleep and I had no intent to injure any person or was same done with malice but solely through an accident as aforesaid

Fireman Klauss, of extra 8485 also being under arrest, refused to testify and made no statement

This accident was caused by Engineman Sargent being asleep and from this cause failing to observe the stop indication of automatic signal 2581 and the warnings of the flagman of the circus train and to be governed by them

In the absence of any statement from Fireman Klauss, or of any testimony as to his actions immediately preceding the accident it is impossible to form any conclusion as to whether or not he in any way contributed to the cause of the accident

The interval between the time when the circus train stopped and the time of the collision was very short it appears from the investigation

that the flagman started back immediately and made a diligent effort to get back far enough properly to protect his train Had he been able to get back a sufficient distance and place a torpedo on the rail before the equipment train passed him, the engineman might have been aroused and warned in time to avert the accident, or at least to mitigate its severity

The testimony of Conductor Johnson of the circus train that he saw the distant signal No 2581 go to the stop position as the engine of his train went under it together with the fact that the signals worked properly without any repairs as soon as the track was connected up after the wreckage was cleared up, seems to be conclusive evidence that the signals did not fail to give the proper indications In fact, in view of Engineman Sargent's statement there is no reason to suspect that there was a failure Both signals 2581 and 2571 were examined and found to be in good working order after the accident

This collision is another example of that class of accidents which a modern system of signaling is powerless to prevent It has been repeatedly pointed out in reports of other accidents investigated by this bureau that the only known way to guard against such accidents is the use of some form of automatic device which will assume control of the train whenever the engineman fails to obey the stop indication of a signal Frequently is an accompaniment of such accidents there are unfavorable weather conditions such as fog, an obstructed view of signals insufficient braking distance between signals, or excessive speed, but at Ivanhoe none of these conditions existed, on the contrary, everything was favorable for the second train to stop except the one failure that no signal system can guard against, namely, the failure of the man

Since July, 1911 when this bureau began the investigation of accidents it has reported on 50 accidents, or approximately 10 per cent of the total number of accidents investigated, resulting in the deaths of 270 persons and injuries to 1 405 others in which the primary cause was the disregard of signal indications In a number of these investigations it has been shown that the best signal systems, installed according to the latest engineering knowledge on the subject and maintained to a very high standard, will not prevent accidents Employees of the highest class with long records for faithful performance of their every duty have failed at the critical time It must be apparent therefore, that there is some weakness in our system of railroad operation that has not been overcome by the best engineering talent of to-day or by careful selection and training of employees With such a list of accidents, to refer only to the more recent ones, as Tyrone, Milford, Amherst Bradford, Mount Union and North Vernon all occurring on roads where modern signaling is in use the lesson of the urgent need of some further safeguard can not be overlooked

It is for this purpose that the automatic stop has been devised, and devices of this kind have now been sufficiently developed to warrant service trials on an extensive scale

In this connection it is noted that ordinary locations of automatic signals will permit a much closer spacing of trains than will give a flagman time to get back a sufficient distance to protect his train, and under such conditions, protection by flag can not be relied upon if for any reason an engineman disregards a stop signal indication While the two trains involved in this accident were shown on the dispatcher's sheet as leaving Michigan City nearly two hours apart, the circus train had to be collected in the yard and it was only 14 minutes ahead of extra 8485 at Porter 12 miles west of Michigan City This interval decreased and at Tolleston the two trains were only 8 minutes apart with the gap rapidly decreasing on account of extra 7826 slowing up to take the connection to the Gr & W and when extra 7826 was stopped at Ivanhoe extra 8485 not having decreased speed there was not sufficient time for the flagman to get back far enough properly to protect his train Such conditions must frequently exist and without minimizing in any way the advantages of this method of operation, they demonstrate that under such circumstances the flagging rule can be relied upon to furnish but little if any additional protection While it is true that automatic train control devices can not be expected to perform all their functions with 100% efficiency in the early stages of their development they can not be perfected unless put into use on more than an experimental scale and the weak points worked out through actual operation as has been the case with other signal devices It is the duty of railroads to surround their passengers with every known safeguard even though some of the devices may be called upon to act very infrequently

The circus train, all the cars of which except the caboose were the property of the Hagenbeck-Wallace circus was of wooden equipment throughout the sleeping cars being rebuilt Pullmans, with steel platforms and with berths two, and in some cases three high This type of construction is wholly inadequate to withstand the shock of a collision of even less force than that which occurred at Ivanhoe The cars were lighted by oil lanterns hung in the center, and no other lights were permitted Had these cars been of steel construction they would not have burned and while it is possible they might have been crushed by the heavy train striking them, the number of lives lost would have been far less Even reinforced sills would have resisted to a considerable extent the crushing force of the collision, and would have enabled many of the injured to have been removed after the fire started Considering the large number of berths provided for each car, the number of persons exposed to danger is much greater than the sleeping cars in ordinary use There would seem to be therefore

all the more reason for the use of cars for such trains that will compare in strength with those used in passenger service on the lines over which these trains are handled

The exact cause of the fire could not be ascertained, but probably originated from the lanterns in the cars and the oil headlight, as the evidence indicates it broke out in all parts of the wreckage simultaneously The head end of the engine was not broken open, nor was the ash pan or fire box damaged in such a way as to spill live coals

Engineman Sargent was first employed as switch fireman in 1890 and had a good record up to January 1910 when he was discharged for running past a block signal in the stop position and colliding with the rear of the preceding train After about 2 years he was reinstated on December 30 1911 and has had a clear record since that time

All the other employees involved were experienced men, except Fireman Klauss of the equipment train who was employed in October, 1917, and was making his tenth trip on the main line, and Fireman Phillips of the circus train, who was employed in January 1918, and was making his first trip over this part of the main line None of the employees had been on duty for excessive periods On June 20 Engineman Sargent was on duty from 1 30 a m to 7 20 a m and from 9 10 a m to 1 30 p m or 9 hours and 40 minutes in the aggregate He was then off duty from 1 30 p m June 20, till 9 30 p m June 21 and at the time of the accident he had been on duty about 6 hours and 35 minutes

Respectfully submitted

W P Borland
Chief, Bureau of Safety

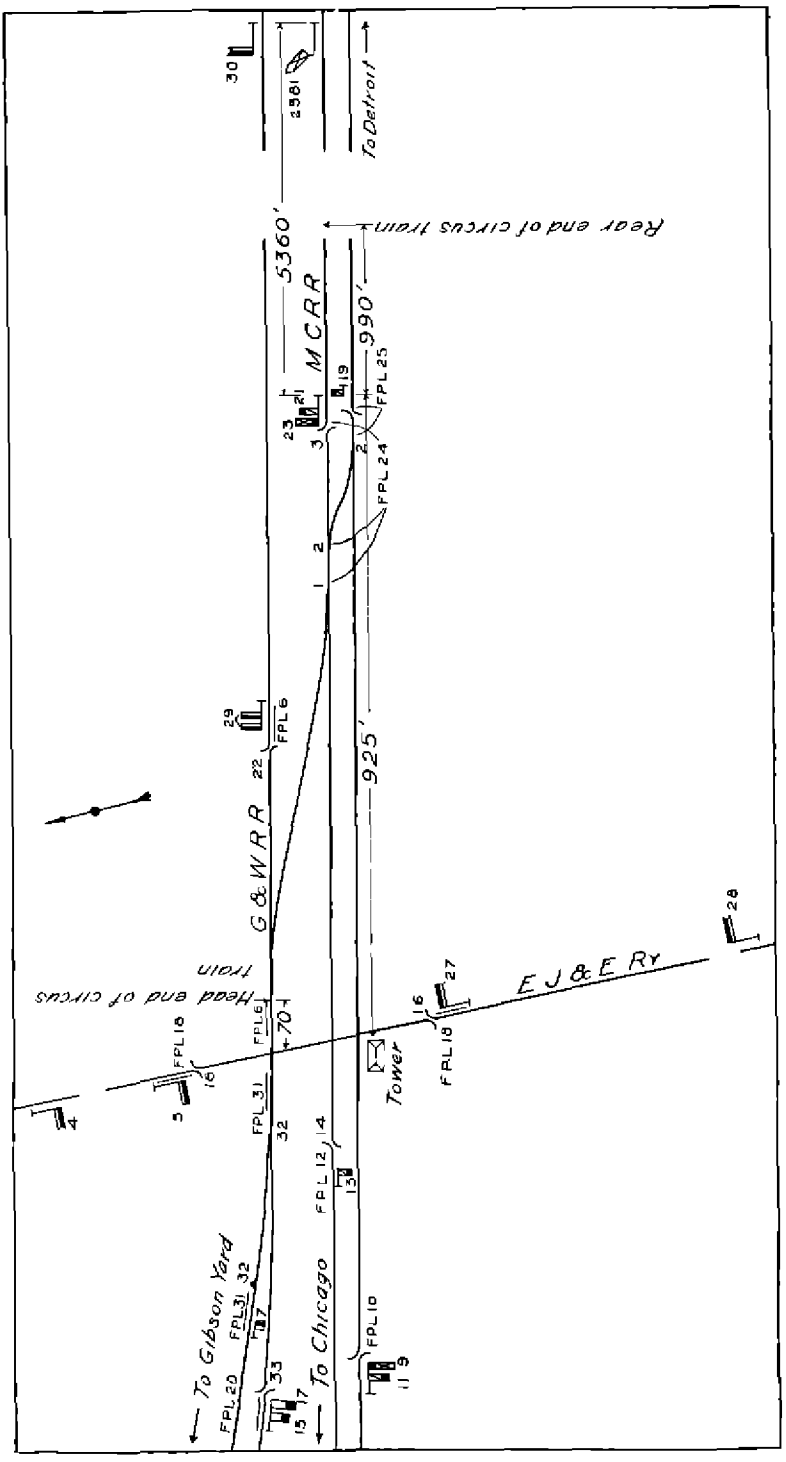

FIG 1.—DIAGRAM OF TRACKS AND SIGNALS

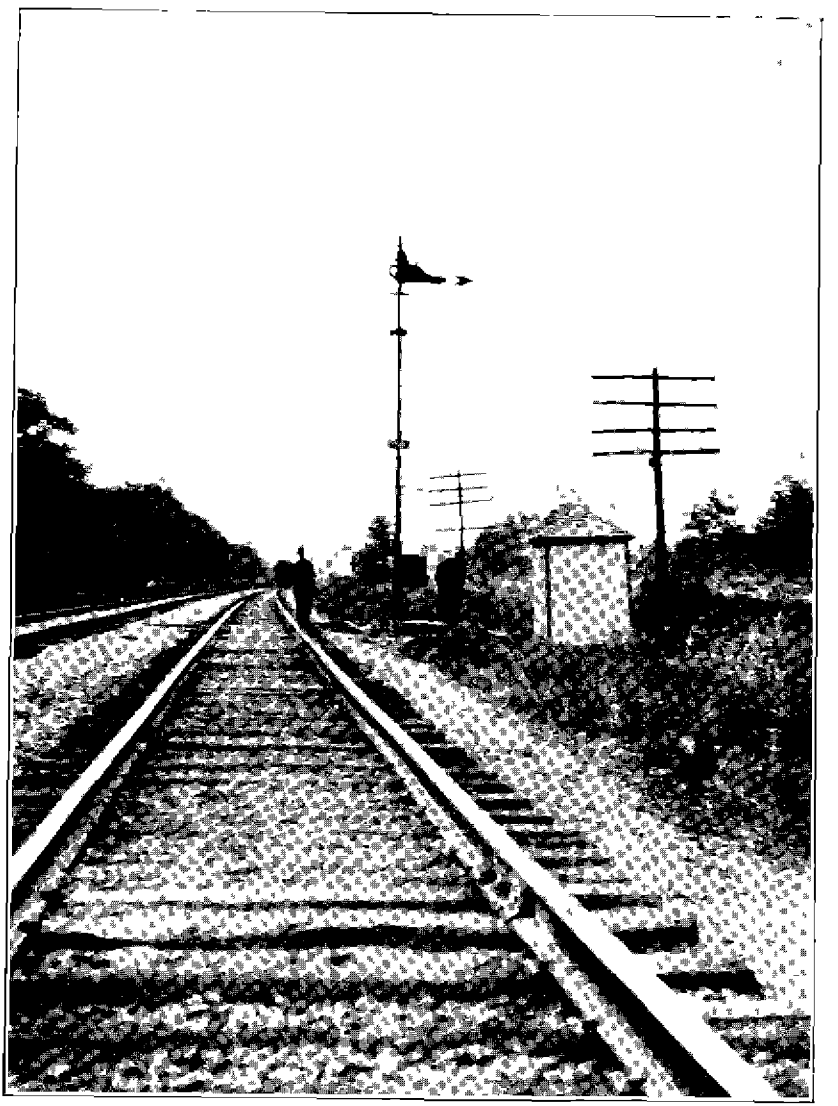

FIG 2—AUTOMATIC SIGNAL 2581 VIEW TOWARD SCENE OF ACCIDENT

FIG. 3.—GENERAL VIEW OF ARTCRAFT FROM THE WEST, SHOWING FIRE

FIG. 4.—VIEW OF LOCOMOTIVE 8485 AND WRECKAGE

FIG. 5.—VIEW OF LOCOMOTIVE 8455. TWENTY BODIES WERE TAKEN FROM UNDER THIS ENGINE