INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT NO. 3480

CHICAGO, ROCK ISLAND & PACIFIC RAILROAD COMPANY

IN RE ACCIDENT

NEAR OKARCHE, OKLA., ON

JULY 18, 1952

SUMMARY

Date:	July 18, 1952
Railroad:	Chicago, Rock Island & Pacific
Location:	Near Okarche, Okla.
Kind of accident:	Boiler explosion
Train involved:	Freight
Train number:	Extra 5026
Locomotive number:	5026
Consist:	Locomotive and 45 cars
Speed:	15 m. p. h.
Operation:	Freight service
Track:	Tangent and ascending
Time:	10:55 p. m.
Casualties:	3 killed
Cause:	Overheated crown sheet resulting from low water

INTERSTATE COMMERCE COMMISSION

REPORT NO. 3480

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION REPORTS UNDER THE LOCOMOTIVE INSPECTION ACT OF FEBRUARY 17, 1911, AS AMENDED

CHICAGO, ROCK ISLAND & PACIFIC RAILROAD COMPANY

October 20, 1952

Accident (boiler explosion) near Okarche, Okla., on July 18, 1952, caused by overheated crown sheet due to low water.

REPORT OF THE COMMISSION[1]

PATTERSON, Commissioner:

On July 18, 1952, about 10:55 p.m., near Okarche, Okla., the boiler of Chicago, Rock Island & Pacific Railroad locomotive 5026 exploded while the locomotive was hauling a freight train at an estimated speed of 15 miles per hour. The engineer, fireman, and brakeman were killed.

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[1]Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Patterson for consideration and disposition.

DESCRIPTION OF ACCIDENT

Chicago, Rock Island & Pacific Railroad locomotive 5026, hauling freight train Extra 5026, departed from Caldwell, Kans., at 7:30 p.m., July 18, 1952, en route to El Reno, Okla., and proceeded without any known unusual incident to a point 1/2 mile north of Okarche, Okla., a distance of 93 miles from Caldwell, where, at about 10:55 p.m., the boiler of the locomotive exploded while the train was moving at an estimated speed of 15 miles per hour.

The train, as originally assembled for departure from Caldwell, consisted of 43 loaded and 6 empty cars and caboose, 3470 tons. Two miles from Caldwell, the locomotive stalled on a hill and train was moved back to Caldwell where 2 loaded cars (120 tons) were dropped. The train then proceeded to Enid, Okla., 47 miles, where cars were set out, the tender water tank filled, and other cars picked up. The train, then consisting of 42 loads, 2 empties, and caboose, 3326 tons, departed from Enid at 9:50 p.m. The tonnage rating for this locomotive from Caldwell to El Reno is 3450 tons. The explosion occurred near mile post 388, a point 1/2 mile north of Okarche and 46 miles south of Enid. The track southbound from mile post 378 to mile post 388 is generally ascending with a maximum grade of 0.7 percent. At the point of the accident the track was tangent and 0.4 percent ascending. So far as is known, the engineer, fireman, and brakeman were in their proper places in the locomotive cab when the explosion occurred.

The force of the explosion tore the boiler from the frame and hurled it upward and forward 215 feet where the smoke box struck the track and gouged a hole 18 inches deep in the road bed. The boiler bounded forward and turned; the back head knuckle struck the track 288 feet ahead of the point of explosion, making a hole 4 feet deep in the right of way, and came to rest in an upright position in center of track headed in the direction of train movement, with rear end of boiler 299 feet ahead of the point of explosion.

The smoke box was crumpled and torn; the mud ring was bulged outward 7 inches at center; the arch brick and various small pieces of the locomotive were found scattered over a radius of 500 feet; the smoke box front was blown off and fell on the track 300 feet south of point of explosion; the firepan was blown down on the trailing truck frame; the superheater units in the bottom three rows of flues were blown about 7 feet into the smoke box; the front and back flanges were broken from the cylinder saddle; the back flange was carried away on the smoke box and the front flange remained attached to the right

and left saddle flanges; the right steam pipe was broken at top and bottom flanges; and the left steam pipe pulled from the cylinder.

The engineer's body was found 69 feet north and 40 feet west, the fireman's body 29 feet north and 37 feet west, and the brakeman's body 74 feet north and 59 feet west of the point of the explosion.

DESCRIPTION OF LOCOMOTIVE

Locomotive 5026 was of the 4-8-4 type; built by the American Locomotive Company at Schenectady, N. Y., in March 1930; cylinders 26 x 32 inches; driving wheels 74 inches in diameter over new tires; total weight of engine in working order 433,500 pounds; weight on driving wheels 263,400 pounds; tractive effort 62,118 pounds; equipped with Baker valve gear; Alco Type G reverse gear and a front end throttle; the driving wheels were roller bearing; the engine truck and trailing truck wheels were conventional type friction bearings. The locomotive had made 112,244 miles since last classified repairs. The tender was a rectangular cast-steel water-bottom type with a capacity of 20,000 gallons of water and 4100 gallons of oil. The cab was equipped with seats for the engineer, fireman, and head brakeman.

The boiler, builder's No. 68289, was a 3-course straight top type with a wide radial stayed firebox and a sloping back head. The inside diameter of the first course was 84-1/4 inches and the third course was 95-7/8 inches. The thickness of the barrel in the first course was 15/16 inch, the second course 1-1/32 inches, and the third course 1-1/16 inches. The boiler was equipped with 202 3½-inch flues and 77 2¼-inch flues, 21 feet 6 inches in length; a combustion chamber 54 inches in length; a low water alarm; a superheater; two non-lifting injectors; one Signal Foam Meter blow-off cock and two Okadee manually operated blow-off cocks; four 3½-inch safety valves; and a 3-inch oil burner. The working steam pressure was 250 pounds per square inch.

The firebox was original, of four-piece construction, and consisted of flue sheet, throat sheet, door sheet, and one-piece crown and side sheets. All sheets were carbon steel and all seams were butt welded. The flue sheet was 5/8 inch thick, the throat sheet was 1/2 inch thick, and all other sheets were 3/8 inch thick. The firebox was 96-1/4 inches wide and 132-1/8 inches long and had a combustion chamber, 54 inches in length. It was equipped with four Nicholson thermic syphons, three in the firebox and one in the combustion chamber. The back flue sheet, lower three-fourths of door sheet, both lower half side

sheets, a 3-hole diaphragm section of inside throat sheet, and three-fourths of the three firebox syphons were renewed in November 1949. At that time a 12-inch by 50-inch patch was applied in front top center of crown sheet and small patches were applied to front and back ends of the combustion chamber syphon flange and to the front end of the left firebox syphon flange. A patch had been welded in left side sheet.

The crown sheet was supported by 21 longitudinal and 41 transverse rows of stays. The first 3 transverse rows back of the flue sheet extending to and including the 10th longitudinal row on each side of the row located on the longitudinal center line were expansion stays 1-1/8 inches in diameter. The 6 longitudinal rows on each side of center to the rear of the first 3 transverse rows were tapered driven-head stays, 1-1/4 inches in diameter at bottom end and 1-1/8 inches diameter in body section. The 7th longitudinal row on each side of center line from the 4th to 19th transverse rows inclusive and the 8th longitudinal row on each side of center line from the 4th to 41st transverse rows inclusive were driven-head stays, 1-1/4 inches in diameter at bottom with body 1-1/8 inches in diameter. The 9th, 10th, and 11th longitudinal rows from the 4th to 41st transverse rows inclusive were flexible radials 1-1/8 inches in diameter. The remainder of the stays in the firebox sheets were rigid bolts, 1-1/16 inches in diameter, with the exception of the bolts in the breakage zones and two rows around the outer edge of door sheet which were flexible bolts, 1 inch in diameter, and the bolts in the syphon flanges of throat sheet which were 1-1/8 inches in diameter. The stays in firebox sheets were spaced approximately 4 x 4 inches. The carrier's print shows the crown sheet to have been 7-1/4 inches higher at the front end than at the back end.

EXAMINATION OF BOILER AND APPURTENANCES

BOILER

Approximately 25 square feet of the crown sheet at top front end and 2 square feet at top of back flue sheet had been overheated. The front end of the left side of crown sheet, with parts of left side sheet, flue sheet, and combustion chamber syphon attached, was blown down into and against the right side of the combustion chamber and there were numerous other tears and folds in the sheets.

The overheated area of the crown sheet extended from the 10th longitudinal row of stays on the right side of center to the 11th longitudinal row in the left side at flue sheet and

from flue sheet backward to about the 18th transverse row on right side and 19th transverse row on left side and tapered upward and forward from about the 6th longitudinal row on each side to the 4th transverse row at longitudinal center line at front end of combustion chamber syphon. The overheated area was a deep blue in color and was tufted where it had pulled from the stays. The ends of the stays were a distinct blue and some were cupped to a maximum of 3/8 inch. The stay holes were elongated to a maximum of 1/2 inch. The line of demarcation indicated that the water level had been 5-1/2 inches below the highest part of the crown sheet.

The initial tear appeared to have occurred in the flue sheet between the top and 2nd rows of superheater flues to the left of center line and continued diagonally upward on the flue sheet to a point between the 10th and 11th longitudinal rows of crown stays. From this point it continued into the front bolt hole in the 11th longitudinal row and downward to the 2nd bolt in the 18th longitudinal row in the left side sheet which then folded down, the fold extending from the 2nd bolt in the 18th longitudinal row back to the 15th bolt in the 21st longitudinal row. Then a tear extended irregularly upward to the center line of crown sheet at the 21st stay, then irregularly downward to the 18th bolt in the 12th longitudinal row to the right of center line and the sheet folded down, the fold extending forward 6 inches from where the sheet again tore, extending irregularly upward across the top center line into the 16th stay in the 5th longitudinal row; the crown sheet then folded down at the 17th stay in the 6th longitudinal row, the fold extending irregularly forward to the flue sheet. Back of the torn section the crown sheet folded down extending irregularly through the 20th and 21st transverse rows of stays.

The crown sheet pulled from 317 stays; the left side sheet from 138 stays; and 38 stays were pulled in body of combustion chamber syphon. One staybolt in left side sheet was broken prior to the explosion. Four expansion stays located in the first three transverse rows were pulled through the staybolt sleeves. Thirty-nine expansion staybolt sleeves in the first 3 transverse rows had been reamed from 1-5/32 inches to 1-5/16 inches. The heads of the expansion stays were 1-3/8 inches in diameter when new.

The flue sheet pulled from seven 3½-inch flues and four 2¼-inch flues and folded down. The fold extended across the flue sheet through the 2nd row of superheater flues on the left side then diagonally across center line to a point directly above the 6th row of flues to right of center line.

There was an accumulation of 4 inches of mud across the back end of mud ring, and an area 20 inches long and 4 inches high around the left blow-off cock was filled with mud.

APPURTENANCES

Safety valves: The boiler was equipped with three 3½-inch Ashton open-type and one 3½-inch Ashton muffled-type safety valves located on the boiler shell back of the dome. These were tested on a locomotive of the same class and opened at 240, 242, 246, and 250 pounds. Under forced firing three safety valves relieved the boiler and the fourth valve did not open.

Steam gage: One Ashcroft duplex steam gage, with 6¾-inch faces and graduated to 500 pounds, was mounted on the center of the boiler head. It was destroyed and only the steam tube was found. The siphon cock was broken off at the boiler and was not found. The part remaining in the boiler was crushed, completely closing the opening into the boiler. The siphon pipe was broken and crushed, but the parts found were unobstructed.

Water level indicating devices: The boiler was equipped with a Hancock brass water column, 4 inches in outside diameter and 27-1/4 inches in length, located on the boiler head 14-3/4 inches to the right of center. A Sargent water glass, type R 4 SNA, using a tubular glass with 6-1/4 inches clear reading, and three Sargent double-seated gage cocks, spaced 3 inches vertically, were mounted on the column. The top water-column connection was located in the wrapper sheet 7-3/4 inches to the right of center and 10 inches ahead of the back head seam. It was connected to the column by a 2-inch O.D. copper pipe which was not found. The bottom connection nipple extended through the back head 2-1/2 inches. Opening through the bottom connection to the boiler was 3/4 inch and the opening through the top connection was 1-3/4 inches in diameter.

A second water glass, similar to that referred to above, was applied to the boiler head 14-3/4 inches to the left of center. The top valve was located in the wrapper sheet, 8-1/4 inches to the left of center and 10 inches ahead of the back head seam. The glass was connected to the top valve by an 11/16-inch O.D. copper pipe.

The right top water-glass valve, broken off at the column, was found in closed position with stem bent so badly it could not be turned. The pipe connecting this valve to the top of

the water glass was broken off at both ends. The right bottom water-glass valve was broken off and this valve and the water glass were not found. The water column and right water-glass drain valves were found broken off and closed. The water column, right water glass, and gage-cock dripper drain pipes were found clear of obstruction. The dripper cup was not found.

The three gage cocks were broken off at the column. They were found closed and in good condition.

The left water-glass shield was badly damaged, but the tubular glass was not broken. This water glass was apparently in good condition before the accident. The top water-glass valve, the steam pipe connecting this glass to the top valve, and the drain valve and pipe were not found. The bottom water-glass valve was broken off at the boiler. It was found wide open and in good condition.

Passages to the boiler through the top and bottom water-column connections, the 3/8-inch opening through the three gage cocks, and the 3/8-inch openings through the right top and left bottom water-glass valves, left water glass, and the broken off ends of the right bottom and left top water-glass valves were found free of obstruction, as was the pipe connecting the right top water glass to the column.

Due to the distorted condition of the boiler the lowest readings of the water glasses and the height of the bottom gage cock above the highest part of the crown sheet could not be determined. According to the carrier's records, lowest readings of 4-3/4 inches above the highest part of the crown sheet for both water glasses and the height of the bottom gage cock were established November 1, 1949, at Silvis, Ill., shops.

Injectors and fittings: The boiler was equipped with two Sellers type "S R" non-lifting injectors, having rated capacity of 6500 gallons per hour, mounted on brackets fastened to the frames on each side under the cab. A single operating lever with a latch and notched quadrant was located by the side of both the engineer's and the fireman's cab seats. Each lever was suitably connected to the injector steam and water valves so its injector could be started with one movement. After an injector was started, the water supply could be regulated by returning the lever slowly toward closed position. The overflow valve closed automatically.

The left injector remained on the bracket but the right one was torn off and the body was bent, throwing the tubes out of line. The operating linkage was torn from both injectors. The

right operating lever was latched 10 notches open on a 15-notch quadrant and the left operating lever was latched in the closed position. Both injectors were disassembled and found to be clean and in good condition, except for the damage to the right one resulting from the explosion. Line checks were built into the injector bodies; the right had 5/8-inch and the left 3/4-inch lift; both were clean and in good condition.

Boiler checks and delivery pipes: The boiler had a 2½-inch Sellers boiler check and separate stop valve on the right side near the front end and a 2½-inch Hancock boiler check and separate stop valve on the left side. The check openings to the boiler were restricted to approximately 2-1/4 inches by hard scale deposits. The right check had 11/16-inch and the left check 5/8-inch lift. Both check valves and stop valves were in good condition. Both stop valves were wide open.

The injector delivery pipes were 2-1/4 inches inside diameter. The right one was restricted by scale deposits to approximately 1-7/16 inches and the left to approximately 1-1/4 inches.

The injector steam pipes were damaged, but were found to be unobstructed.

Steam tests: The injectors from locomotive 5026 were mounted on locomotive 5023, same class as locomotive 5026, and tested under steam. Both injectors operated at 100 pounds steam pressure and raised the water level in the boiler, but the right one, damaged in the accident, would spill some water. At 150 pounds steam pressure the right injector spilled some water, but raised the water level 1 inch in 1 minute 18 seconds. The left injector took all the water and raised the water 1 inch in 1 minute 25 seconds. With 200 pounds steam pressure the right injector spilled some water but raised the water level 1 inch in 1 minute 30 seconds. The left injector took all the water and raised the water level 1 inch in 1 minute. With 235 pounds steam pressure the right injector spilled some water, but raised the water level 3/8 inch in 20 seconds, and broke. It was tried several times but would not work a full minute with this pressure. The left injector took all the water and raised the water level 1 inch in 1 minute 20 seconds. All tests were started with 2 inches of water in the glass. The capacity of both injectors appears to have been materially reduced by restrictions in the delivery pipes caused by excessive scale deposits referred to earlier in this report.

Main steam fountain: The main steam fountain valve and both injector steam valves were found wide open and damaged so badly they could not be closed, but appeared to have been in good condition before the accident.

Blow-off cocks: The two 2-inch Okadee blow-off cocks remained attached to the boiler, one on each side of the firebox 22-1/2 inches from the front end and 2 inches above the mud ring. The right one was found wide open and the left one was about 1/4 open. Both were found to be in good condition.

Foam meter: A Signal Foam-Meter, Model GES, blow-off cock with a 1/4-inch opening, was located below the deck on the boiler head, 27 inches to the right of center and 2 inches above the mud ring. It connected to a separator on top of the boiler. The stop valve had an extension handle extending into the cab. The light and instrument box was located on the boiler head in easy reach of the engineer. The electrodes were located on top of the boiler, 40 inches in front of the back flue sheet. The short electrode extended 6 inches inside the boiler. The long electrode extended 8-1/2 inches into the boiler. Both electrodes appeared to be in good condition. The carrier's drawing shows the bottom end of the long electrode to have been 14-1/8 inches and the bottom end of the short electrode to have been 16-5/8 inches above the highest part of the crown sheet. The blow-off valve was disassembled and found to be in good condition. The cut off valve was found wide open. The water end of the blow-off valve and passages to the boiler were full of soft mud. The solenoid valve was badly damaged and the foam meter instrument box was destroyed in the accident.

Low water alarm: The locomotive was equipped with an Ohio low water alarm located in the wrapper sheet, 17-1/4 inches to the right of center and 17 inches behind the back flue sheet. The fusing chamber shell, screwed into the crown sheet from the top, was pulled from the crown sheet. The tube connecting this fitting to the wrapper sheet fitting, with the whistle valve operating rod inside, was bent but remained attached to the top fitting. The whistle-valve rod was down in its tube to its limit and could not be moved, indicating that the water alarm had functioned as intended before the tube and valve rod were bent by the explosion. All fusing metal was missing from the fusing chamber and the fusing chamber, fusing-chamber shell, and protecting cap had been highly overheated. The double steam valve at the top of the assembly which included the test valve, the whistle, and the steam pipe to the whistle valve were found to be in good condition. The test valve was 1-1/2 turns open and the automatic valve was wide open. The double valve with whistle attached was tested on locomotive 5028 and the whistle sounded with test valve closed. The automatic valve was then blocked in closed position and the whistle sounded with the test valve open 1/2 turn and continued to sound in a normal tone while the valve was opened to its limit. Due to the damaged condition of the boiler the height of water on the highest

part of the crown sheet when alarm functioned could not be determined.

Feedwater tank, tank valves, hose, and strainers: The bottom of the feedwater tank was covered with several hundred pounds of scale which had fallen from the splash plates and braces. The tank bracing and splash plates were in place and in good condition. The tank valves were found wide open and in good condition. The tank-well strainers were found in good condition. The left strainer was free of obstruction but the right one was approximately 70 percent obstructed by scale piled up against it. The feed pipes, feed pipe strainers, and tank hose were found to be clean and in good condition, except that the flat perforated strainer on the left side had two holes cut in it. One hole measured 5/8 x 7/8 inches and the other 3/4 x 7/8 inches.

The feedwater tank was equipped with a water level indicator located on the inside of the right water leg. It was tested and found to be in good condition.

Boiler feed water: Water taken at Enid, the last time tender tank was filled, was treated with Zeolite. Dearborn No. 666 powdered anti-foam compound was also placed in the feedwater tank each time water was taken, in the proportion of one pound of compound to 5000 gallons of water. Following is the analysis of a sample of the water taken from the tender of locomotive 5026 at El Reno, July 23:

Total solids	27.1	grains per gallon
Total hardness	6.5	" " "
Alkalinity	14.4	" " "
Caustic hydrate	0	" " "
Chloride	7.1	" " "
Calcium carbonate	6.5	" " "
Alkali carbonate	7.9	" " "
Total chlorides	7.1	" " "
Alkali sulphate, plus iron, aluminum, and silica	6.1	" " "

Fire door: The fire door was the carrier's standard, hinge type and was equipped with an air duct that took air from outside the cab below the deck. The door was blown off and broken. The firedoor ring remained attached to the boiler.

INSPECTION AND REPAIR REPORTS

Locomotive 5026 received class 3 repairs November 1, 1949, at Silvis, Ill., and last annual inspection at El Reno, Okla.,

June 20, 1952, at which time the boiler was last washed.

Daily inspection reports from El Reno and Waurika, Okla., Caldwell, Pratt, Herington, Armourdale, and Liberal, Kans., and Dalhart, Tex., covering the period from June 20, 1952 to the time of accident were examined. The following items which might have had a bearing on this accident were found reported:

June 21, at Herington, Kans., reported by engineer:
"Neither injector will supply boiler." Item noted, "Acid out." Signature of mechanic illegible.
"Right injector will not shut off when running have to pound shut." Signature of mechanic illegible.
Report approved by foreman.

June 22, at Herington, Kans., reported by engineer:
"Injectors are in very bad shape. It takes them both to supply boiler."
"Steam valve to right injector keeps sticking open."
Both items signed for by machinist.
Report approved by foreman.

June 22, at Herington, Kans., reported by inspector:
"Put acid in both inj." Item signed for by machinist.
Report approved by foreman.

June 22, at Pratt, Kans., reported by engineer:
"Both injectors will not supply boiler." Item noted, "Tested." Item not signed for.
Report approved by foreman.

June 22, at Pratt, Kans., reported by inspector:
"Lime out L. injector." Item signed for by mechanic.
Report approved by foreman.

June 23, at Liberal, Kans., reported by engineer:
"Left injector will not pick up the water." Item signed for by machinist.
"Right injector weak." Item noted, "Tested "OK."
"Bad order foam meter." Item noted, "No repairs."
Items not signed for.
Report approved by foreman.

June 25, at Liberal, Kans., reported by engineer:
"Foam meter not working." Item not signed for.
Report approved by foreman.

June 27, at Pratt, Kans., reported by engineer:
"Left injector will not supply boiler." Item signed for by machinist.
Report approved by foreman.

June 27, at Herington, Kans., reported by engineer:
"Grind in L. boiler check." Item noted, "Serv." Item not signed for.
Report approved by foreman.

June 27, at Armourdale, Kans., reported by inspector:
"L. injector does not handle all the water." Item signed for by machinist.
"Foam meter not operative." Item signed for by machinist.
Report approved by foreman.

June 27, at Armourdale, Kans., reported by inspector:
"Clevis loose on R. injector steam ram." Item signed for by mechanic.
Report approved by foreman.

June 28, at Herington, Kans., reported by engineer:
"Left injector will not pick up water." Item noted, "Lyed out." Item signed for by mechanic.
"Right injector the steam ram will not shut off." Item signed for by mechanic.
Report approved by foreman.

June 29, at Pratt, Kans., reported by engineer:
"Steam valve to right injector is shut off."
"Steam valve to right injector will not seat."
"Left blow-off cock does not seat."
Items noted, "Serviceable" and signed for by mechanic.
"Left injector will not supply boiler." Item noted, "Tested." Not signed for.
Report approved by foreman.

June 30, at Kansas City, Kans., reported by engineer:
"Both blow-off cocks will not shut off."
"Right injector will not pick up water." Item noted, "Renewed tube."
"Left injector will not shut off boiler steam when shutting off injector, necessary to stop train and hammer on injector to shut off steam."
Items signed for by machinist.
Report approved by foreman.

July 1, at Herington, Kans., reported by engineer:
"Right injector will not shut off steam when shutting off injector, necessary to stop and hammer injector to shut it off." Item signed for by machinist.
"Left injector will not take up water or supply boiler." Item noted, "Acid out." Item signed for by machinist.
Report approved by foreman.

July 2, at Pratt, Kans., reported by engineer:
"L. injector wont supply boiler." Item noted, "Tested."
"R. injector disconnected and wont shut off." Item noted, "Repaired."
Items not signed for by mechanic.
Report approved by foreman.

July 4, at Caldwell, Kans., reported by inspector:
"Packing nut loose leaking right injector."
"Tightened steam ram stem to right injector."
Items signed for by mechanic.
Report approved by foreman.

July 5, at El Reno, Okla., reported by engineer:
"Right injector sticks open after shutting off when it has been working." Item signed for by machinist.
Report approved by foreman.

July 7, at Herington, Kans., reported by engineer:
"Right boiler check leaking very bad." Item signed for by machinist.
"It takes both injectors to supply the boiler." Item noted, "Acid out" and signed for by mechanic.
Report approved by foreman.

July 8, at El Reno, Okla., reported by engineer:
"Pack priming valve to right injector."
"Right injector keeps priming have to shut off steam at fountain."
Items signed for by machinist.
Report approved by foreman.

July 9, at Waurika, Okla., reported by engineer:
"Rod to R. injector too short will not shut off steam valve." Item signed for by mechanic.
Report approved by foreman.

July 10, at El Reno, Okla., reported by engineer:
"L. injector will not supply boiler." Item noted,
"Cleaned out" and signed for by mechanic.
Report approved by foreman.

July 12, at Herington, Kans., reported by engineer:
"Left injector will not supply boiler." Item noted,
"Acid out" and signed for by mechanic.
Report approved by foreman.

July 13, at Liberal, Kans., reported by engineer:
"Neither injector will supply boiler." Item noted,
"Fixed injectors" and signed for by mechanic.
Report approved by foreman.

July 13, at Liberal, Kans., reported by inspector:
"Tighten steam ram on both injectors." Item signed
for by mechanic.
Report approved by foreman.

July 13, at Dalhart, Tex., reported by engineer:
"Steam ram to left injector disconnected and also
loses water when working."
"Right injector don't throw but little water."
Items signed for by mechanic.
"Auto foam meter burns all the time." Item noted,
"Panel shorted, none in stock." Item signed for
by mechanic.
Report approved by foreman.

July 14, at Liberal, Kans., reported by engineer:
"Foam meter burns all time." Item not signed for.
Report approved by foreman.

July 15, at Caldwell, Kans., reported by engineer:
"Neither injector will supply boiler."
"Left water glass light has short in it."
Items not signed for.
Report noted, "No machinist on duty."
Report not approved.

July 15, at El Reno, Okla., reported by engineer:
"Steam leak at low water alarm."
"Clean hose strainer both sides."
"Clean both water glasses."
"Neither injector will supply boiler." Item noted,
"Lyed out."
Items signed for by mechanics.
Report approved by foreman.

July 16, at Herington, Kans., reported by engineer:
"Left injector will not supply boiler." Item noted,
"Put in disk acid out." Item signed for by
mechanic.
Report approved by foreman.

July 16, at Herington, Kans., reported by inspector:
"Lye out injector." Item signed for by mechanic.
Report approved by foreman.

July 17, at Herington, Kans., reported by engineer:
"L. injector will not supply the boiler."
"R. injector will not supply the boiler."
Items noted, "Tested OK" and not signed for.
Report approved by foreman.

SUMMARY OF EVIDENCE

The engineer and fireman who operated locomotive 5026 from Herington to Caldwell, Kans., arriving Caldwell at 5:30 p.m. on the day of the accident, stated that both injectors worked well and that either would supply the boiler except on some hills; that they blew out and tested the water glasses, water-glass valves, gage cocks and water column before departing from Herington; that they experienced no trouble with the locomotive and thought it performed quite well, except that the Signal Foam Meter was inoperative. They further stated that all water-glass valves were open and the water glasses were functioning properly when they were relieved at Caldwell. The engineer made no written report on the locomotive at Caldwell, but the fireman made one and signed the engineer's name. No items were reported bearing on the accident and the Foam Meter blow-off was not repaired.

The locomotive was serviced and supplies at Caldwell by a machinist and one laborer. The machinist stated that he looked around the locomotive, filled the rod cups, filled the tender water tank, tested the water glass and gage cocks, and left all water valves open. Later he saw the outbound engineer test the right water glass and the fireman test the left water glass. The low water alarm was not tested at Caldwell. The machinist did not notice anything unusual in the appearance or actions of the engineer or fireman and thought they appeared to be normal in every respect.

The conductor stated that he talked with the engineer, fireman, and head brakeman before leaving Caldwell, that he talked with the engineer and head brakeman again at Enid, and that they appeared to be normal in every respect. The run from Enid to the point of explosion was made at an average

speed of more than 42 miles per hour. The conductor and rear brakeman noticed nothing unusual about the way the train was handled. They stated that they did not hear the low water alarm whistle on the locomotive at any time.

Various members of several families living near the track and for a distance of two miles prior to the point of accident were awakened by the explosion but did not hear the low water alarm whistle.

The master mechanic stated that he arrived at the scene of the accident about 1 hour 25 minutes after it occurred. He found the water still running out of the tender and about 12 inches of water remaining in the tank. He also found the low water alarm test valve approximately two turns open, the right injector operating lever approximately half open and the left one in closed position.

CAUSE OF ACCIDENT

It is found that this accident was caused by an overheated crown sheet due to low water.

Dated at Washington, D. C., this 20th day of October, 1952.

By the Commission, Commissioner Patterson.

SEAL

GEORGE W. LAIRD,

Acting Secretary.