

INTERSTATE COMMERCE COMMISSION
WASHINGTON

REPORT NO. 3670

CHICAGO AND NORTH WESTERN RAILWAY COMPANY

FIRE ACCIDENT

AT WEST CHICAGO, ILL., ON

NOVEMBER 10, 1955

SUMMARY

Date: November 18, 1955

Railroad: Chicago and North Western Railway
Company

Location: West Chicago, Ill.

Kind of accident: Boiler explosion

Locomotive number: 507

Consist: Light engine

Speed: Standing

Operation: Called for yard switching service

Time: 6:35 a. m.

Casualties: 1 killed and 1 injured

Cause: Overheated crown sheet resulting
from low water

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

CHICAGO & NORTH WESTERN RAILWAY COMPANY

January 24, 1956

Accident (boiler explosion) at West Chicago, Ill., on November
18, 1955, caused by overheated crown sheet due to low
water.

REPORT OF THE COMMISSION¹

CLARKE, Commissioner:

On November 18, 1955, about 6:35 a.m., at West Chicago,
Ill., the boiler of Chicago & North Western Railway Company
locomotive 587 exploded while the locomotive was being pre-
pared for service. The fireman was killed and the engine
watchman was injured.

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

DESCRIPTION OF ACCIDENT

Chicago and North Western Railway Company's locomotive No. 587 was ordered for yard switching service at West Chicago, Ill. at 5:45 a.m. on November 10, 1955. At 6:35 a.m., the locomotive was standing on the inbound track adjacent to the roundhouse while the engine crew was preparing it for service when the crown sheet failed. The fireman and engine watchman were blown from the deck to the ground. The engineer, who was oiling around and was standing adjacent to the right driving wheels, was thrown to the ground by the force of the explosion.

When failure occurred, the force of the explosion broke the center grate bar, dislodged other grates and broke ash pan clean-out doors and rigging. The track ballast, under the ash pan, was washed away around four ties. A portion of the fire door ring was found approximately 15 feet from the track and pieces of the ash pan and grates were scattered over a radius of 50 feet from the engine. Hot cinders from the locomotive caused fire in an oil accumulation on the ground at storage tanks 200 feet from the point of explosion. The right half of the fire door was broken off and blown into the coal space.

The engineer suffered shock and bruises but was not incapacitated. The injured fireman and watchman were taken to a hospital where the fireman died at 2:30 p.m., approximately 8 hours from time of the accident.

DESCRIPTION OF LOCOMOTIVE

Locomotive 587, type 4-6-2, was built by the American Locomotive Company in March 1914. Cylinders were 25 inches in diameter with 28 inch stroke; driving wheels 75 inches in diameter over new tires; weight on driving wheels in working order was 123,000 pounds and weight of engine 260,000 pounds; total weight of engine and tender 425,700 pounds; tractive effort 36,700 pounds. The locomotive was equipped with an Alco power reverse gear, a carrier's standard balanced throttle, type A superheater and a Franklin No. 9A butterfly type fire door. The tender had a capacity of 8,275 gallons of water, 15 tons of coal and weighed 165,700 pounds when loaded. The locomotive had made 60,000 miles in suburban passenger service since receiving Class #3 repairs.

The boiler was three-course wagon top type, radial stayed, with sloping backhead. Inside diameter of first course 69 inches, and of third course 77- $\frac{1}{2}$ inches. The first course was 21/32 inch thick, the second course was 23/32 inch thick and the third course was 3/4 inch thick. The steam dome and the

inspection manhole were located in the third course. The boiler was equipped with 195 2 inch and 36 5-3/8 inch flues 20 feet in length. The working steam pressure was 105 pounds.

The firebox was of five-piece construction consisting of crown sheet, tube sheet, door sheet and two side sheets, with the side sheet seams fusion welded to the crown sheet. All other seams in the firebox were riveted. The flue sheet was 1/2 inch thick and all other sheets 3/8 inch thick. The firebox was 169 inches in length and 70-1/4 inches in width at the mudring. It was equipped with four 3-inch arch tubes and a brick arch. The crown sheet was supported by 10 longitudinal and 25 transverse rows of stays. The first four transverse rows of stays at front end, extending to and including the 9th longitudinal row on each side of the center line, were 1-1/8 inch late flexible expansion bolts with 15/16 inch reduced body section. The first six longitudinal rows of stays on each side of the center line back of the first four transverse rows were unthreaded bolts 1-1/8 inch diameter at the bottom and 1-1/2 inch at the top, with body section reduced to 15/16 inch. The stays in 7th, 8th and 9th longitudinal rows of stays on each side of the center line in back of the four late flexible bolts previously mentioned were 1-1/8 inch taper and radial stays with body section reduced to 15/16 inch. All other stays in the firebox were 7/8 inch hollow staybolts with the exception of the 1 inch flexible stays located in the breaking zones. The stays in the firebox were spaced 3-3/4 x 4 inches, the crown stays were spaced 4-1/3 x 4-5/16 inches.

EXAMINATION OF BOILER AND AUXILIARIES AFTER EXPLOSION

BOILER

All of the crown sheet and top portions of the back flue sheet and door sheet had been overheated. The overheated area extended from between the 9th and 10th longitudinal row of staybolts left of the center line of the boiler transversely to between the 10th and 11th row of staybolts right of the center line as shown by the blue color of the sheets, elongated crown stay holes and curved ends of the crown stays. Examination of all visible welds indicated that the water level had been about 16 inches below the highest part of the crown sheet. The crown sheet, which was bogged to a maximum depth of 31 inches, showed no perceptible thinning of the sheet and was pulled from all crown stays with the exception of 7 subsequently listed as broken. The ends of the pulled stays were cupped downward to a maximum depth of 1/2 inch. The stay holes had a maximum elongation of 1/4 inch. The threads in the stay holes and on crown stays appeared to have been in good condition prior to the accident. The top of the flue sheet, with minimal distortion, was loaded downward

approximately 10 inches, had pulled loose from the top row of small flues and partially pulled from the top row of superheater flues. The top of the door sheet with knuckle attached had folded downward approximately 10 inches. The flue sheet and door sheet top knuckle calking edges were sprung. The left side of the door sheet was torn for a distance of 12 inches from the corner of the top knuckle through the top row of staybolt holes to and through the 3th bolt hole to the left of the center line. The right side of the door sheet was torn for a distance of 12 inches from the corner of the top knuckle through the top row of staybolt holes to the 3th bolt hole to right of center line. The crown sheet was torn for a distance of 12 inches on the right side from a door sheet flange rivet to a staybolt in the third row from the rear. The following 7 stays in the crown sheet were broken when the sheet dropped; 3 short radial stays in the 9th row to left of center line; 3 radial stays in the 8th row to right of center line, 2 of which were adjacent, and 1 stay in the 6th row to right of center line. The crown sheet pulled from all other staybolts between and including the 9th longitudinal row on the left side of the center line of the boiler to the 10th longitudinal row of staybolts on the right side of the boiler or a total of 475 bolts. The crown sheet partially pulled from all bolts in the 11th longitudinal row of staybolts to the right of the center line of the boiler and from all staybolts in the 10th longitudinal row of bolts to the left of the center line of the boiler or a total of 50 bolts. Two staybolts, one on each end of the top row at door sheet, were broken. The door sheet pulled from 30 bolts and 10 others were partially pulled from the sheet.

The scale on the boiler shell and flues, was approximately 1/16-inch thick. Scale had accumulated on the wrapper sheet and boiler back head above the water line to a thickness of approximately 3/8 of an inch. A considerable quantity of this scale broke loose at time of failure and fell on the sagged crown sheet. The crown sheet was apparently clean prior to the accident. The crown bolts had an accumulation of scale approximately 3/16-inch in thickness.

ALTERNATIVES

Safety valves: The boiler was equipped with two 3-inch Consolidated safety valves, open type, which were mounted on a roof-sheet turret. The valves were removed and tested on locomotive 585 of the same class as locomotive 507. The first valve lifted at 180 pounds and seated at 175 pounds; the second valve lifted at 135 pounds and seated at 130 pounds. The pressure could not be raised above 185 pounds when the fire was forced.

Steam gage The boiler was equipped with a 400 pound Ashcroft steam gage which was mounted on the back head. The gage registered correctly throughout its entire range when tested upon a dead weight tester. The syphon cock was found fully open and its passage clean. The syphon pipe and its connection to the boiler were clean and unobstructed.

Water level indicating devices: The boiler was equipped with a Sargent two-panel water gage which had a clear reading of 6 inches. The lower water glass valve was located on the boiler backhead 10-1/4 inches left of the center line of the boiler. The spud extended into the water space 1-1/2 inches. The valve and spud passages were found clean and unobstructed. The reading faces of the water glass were so located that the engineers would have an unobstructed view of the water level in the glass from their usual positions in the cab. The top and bottom water glass cocks were found in full open position and the drain cock was closed. All valve handles in the cab with the exception of the bottom water glass and drain valves were found coated with fly ash and soot. The condition of the handles indicated these valves may have been operated after the accident and prior to the time of this investigation. The three Sargent double-seated gage cocks spaced vertically on 3 inch centers were mounted diagonally on the boiler back head and were found in closed position. The gage cocks were found to operate easily and passages to the boiler were clean. The gage cock dripper and drain pipe were found open and practically unobstructed. The lowest reading of the water glass was 5-3/4 inches above the highest part of the crown sheet. The lowest gage cock was 5-1/2 inches above the highest part of the crown sheet.

Injectors: The boiler was equipped with two Nathan Manufacturing Company's Monitor No. 11, type XX lifting injectors, each having rated capacity of 4150 gallons per hour, which were located on either side of the boiler inside front wall of cab. The steam valve of the left injector was found in closed position and the water valve, priming cock and overflow valve were open. Right injector steam valve, water valve, and priming cock were found closed and the overflow valve open.

When left injector was tested at 125 pounds pressure, it raised the water in the glass 1 inch in one minute; in a test of two minutes it raised the water in the glass 2 inches and at 115 pounds pressure it raised the water in the glass 3 inches in four minutes.

The right injector was tested at 80 pounds steam pressure but would not operate. After priming which required 50 seconds, the water valve was slowly closed as far as it would turn normally by hand but the injector still did not operate. The injector did not operate when tested at 125 pounds pressure

--with the water valve closed as far as it would turn normally by hand. When the water valve was forced closed, approximately two additional turns, the injector started and in one minute raised the water level in the glass 1 inch. When tested at 100 pounds pressure with the water valve fully open, the injector did not operate but when the water valve was closed with considerable force the injector started and in one minute and thirty-five seconds raised the water level in the glass 1 inch. When the injector was tested a second time at 80 pounds pressure, with the water valve forcibly moved towards its seat as far as possible the injector would not operate. Water continued through the overflow to the ground while the sound of the injector seemed to indicate that the injector was working.

Removal of the water valve bonnet disclosed that hard scale, on the inside wall of the injector water space held the water valve from its seat and prevented proper valve adjustment. Inability to regulate the flow of water in proportion to steam flow appeared to have rendered the injector inoperative at boiler pressure existing prior to the accident.

Steam turret valves: Two steam turrets were located on top of the wrapper sheet inside the cab; both turret valves and valves in injector steam lines were found in fully open position with the valves securely attached to the valve spindles. Valve openings were clean.

Boiler checks: The boiler was equipped with a 2 inch Nathan check valve and a Nathan stop valve, located on each side of the boiler near front of first boiler course. The valves and seats of both boiler checks were found in good condition. The right boiler check had 5/8-inch lift, the left boiler check had 9/16-inch lift. Both check valves were clean; the right boiler check entrance was unobstructed; the left boiler check entrance was about 30 percent obstructed by scale and mud. Both boiler check stop valves were in good condition with the valves fully open and securely attached to the valve spindles. Both boiler check drain valves were found in good condition and closed.

Blow-off cocks The boiler was equipped with two manually operated Wilson two-piece 1-1/2 inch blow-off cocks having atmospheric discharge which were located on opposite sides of the boiler, one-third of the distance to rear of the front corners of the mudring. The cocks were found closed, free from leakage and in good operating condition.

Feedwater tank, tank valves and nose: The feedwater tank was found full after the accident. The interior of the tank and both tank wells and strainers were clean, splash plates

were in good condition and secured in position. The right tank valve was found open; its operating rod was loose at valve connection and the handle could be moved about 40 percent of its travel between stop lugs on top of the water leg before movement of the valve started. When the valve rod handle was moved slowly against the shut-off stop lug the valve remained open enough to pass a large quantity of water, however, if the valve rod handle was moved quickly against the stop lug, the valve would close. The left tank valve was found closed; its operating rod was somewhat loose at valve connection, but would not materially affect the operation of the valve. A small amount of scale was found in the bottom of the tank but not enough to affect the free flow of water through the tank wall strainers. Both injector water supply pipes were in good condition. Both tank hose were found in good condition, clean and unobstructed.

Firedoor: The right side door of butterfly type fire door was blown off and buried under coal in the coal space of the tender. A 19-1/2-inch segment was broken from the fire door frame. A piece 13-1/2 inches long, containing the door stop and guide, was recovered which showed evidence of an old break at the lower end. The remaining 6 inch segment was not recovered.

INSPECTION AND REPAIR REPORTS

Locomotive 587 received Class 3 repairs at Chicago Shops on April 24, 1952, at which time, jacket and lagging were removed. Caps were removed from all flexible staysbolts on April 20, 1954.

The last annual inspection was made June 10, 1955, at Chicago, Ill., and the last monthly inspection was made at Chicago, Ill., on November 4, 1955, at which time, the boiler was washed.

Daily inspection and repair reports from 40th Street enginehouse, Chicago, Ill., and West Chicago enginehouse, covering the period from September 1, 1955, to date of accident, were examined and nothing found reported which may have a bearing on this accident.

SUMMARY OF EVIDENCE

The engineer and fireman, in charge of the locomotive on its last trip on train No. 75, stated the locomotive performed satisfactorily and no trouble was experienced with either injector. They stated the engine steamed freely, the water was

active in the glass and that the glass was well illuminated. On arrival at West Chicago enginehouse at 11:15 p.m., November 17, 1955, the locomotive was left with a good fire, full head of steam and water glass one-half to two-thirds full.

The middle shift hostler took charge of the locomotive immediately and found the condition substantially as stated above. The locomotive was then serviced with water, sand and coal and, after the fire was cleaned, placed on the parking circle at about 11:45 p.m. with approximately 150 pounds of steam and half a glass of water.

During the night the fire burned down and the steam pressure decreased. When the hostler boarded the locomotive at 6:05 a.m. to move it to the ready track he found no water visible in the gage glass but claimed he observed indications of water discharged from the bottom gage cock. The night injector was used in attempt to supply water to the boiler out, in view of low steam pressure, its sealed condition and results obtained in tests of the injector made subsequent to the explosion, it is doubtful if the injector functioned to introduce water into the boiler. Examination of overheated firebox sheets during investigation of the accident showed the water to have been 16 inches below the highest part of the crown sheet at time of the explosion. Circumstances attendant to movement of the locomotive to the ready track lead to the conclusion that the water level in the locomotive had fallen during the night and that it was offered for service without sufficient water in the boiler to properly protect the crown sheet from overheating.

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 24th day
of January, 1956.

By the Commission, Commissioner Clarke.

(SEAL)

HAROLD D. McCOY,
Secretary.