RAILROAD ACCIDENT INVESTIGATION

Report No 3838

MISSOURI PACIFIC RAILROAD

MONROE, LA

JANUARY 22, 1959

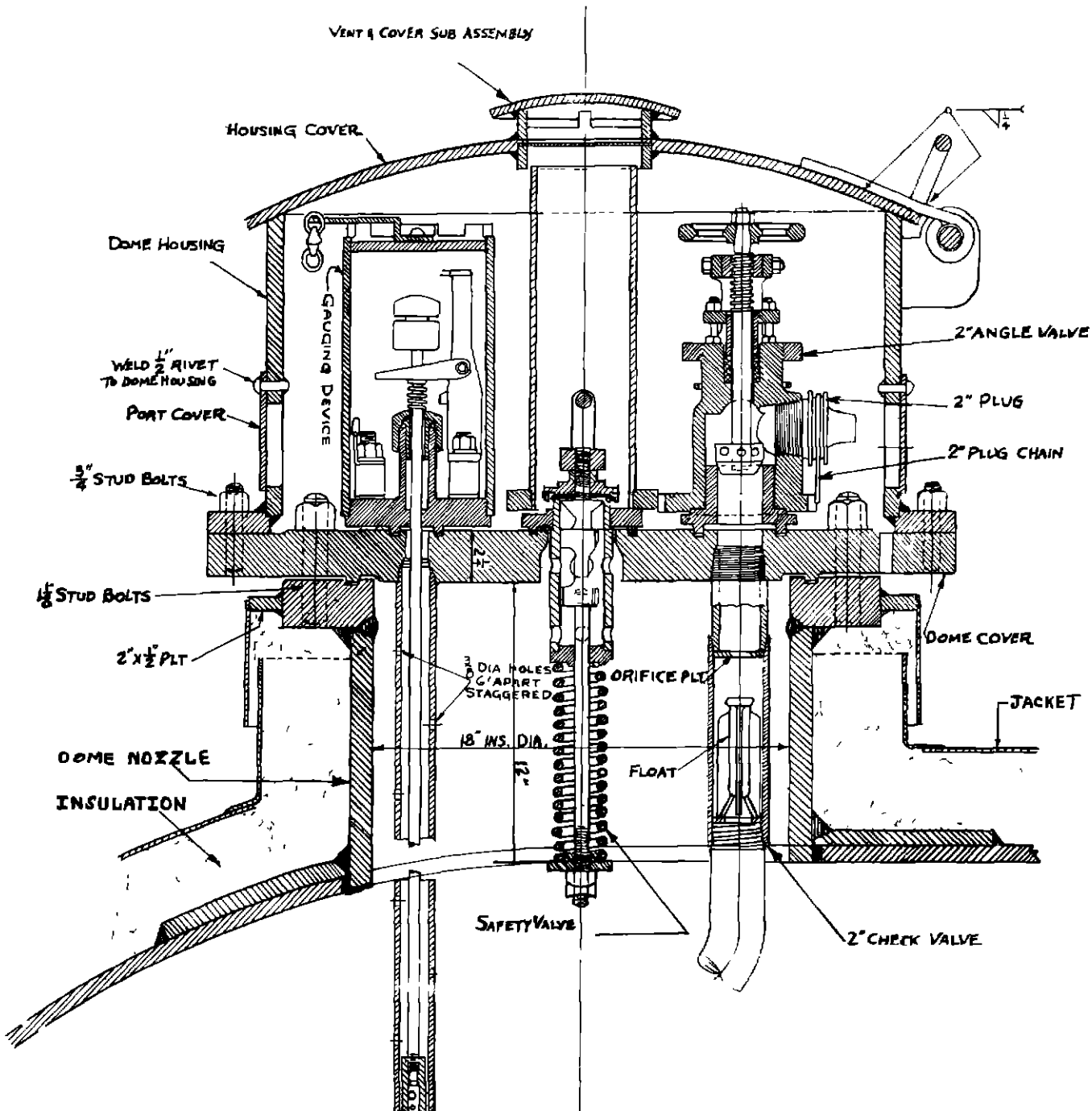
INTERSTATE COMMERCE COMMISSION

Washington

SUMMARY

§§§

DATE	January 22, 1959
RAILROAD	Missouri Pacific
LOCATION	Monroe, La
KIND OF ACCIDENT	Derailment, explosion
TRAIN INVOLVED	Freight
TRAIN NUMBER	360
LOCOMOTIVE NUMBER	Diesel-electric units 315A, 331B, and 325A
CONSIST	143 cars, caboose
SPEED	45 m p h
OPERATION	Timetable, train orders, and automatic block-signal system
TRACK	Single, 1° curve, 0 01 percent ascending grade northward
WEATHER	Clear
TIME	11 15 p m
CASUALTIES	8 killed, 75 injured
CAUSE	Broken journal which resulted in a derailment, and subsequent overheating and rupture of the shell of a tank car containing propylene which resulted in an explosion



SECT "A-A"
AT DOME HOUSING

PLATE 1

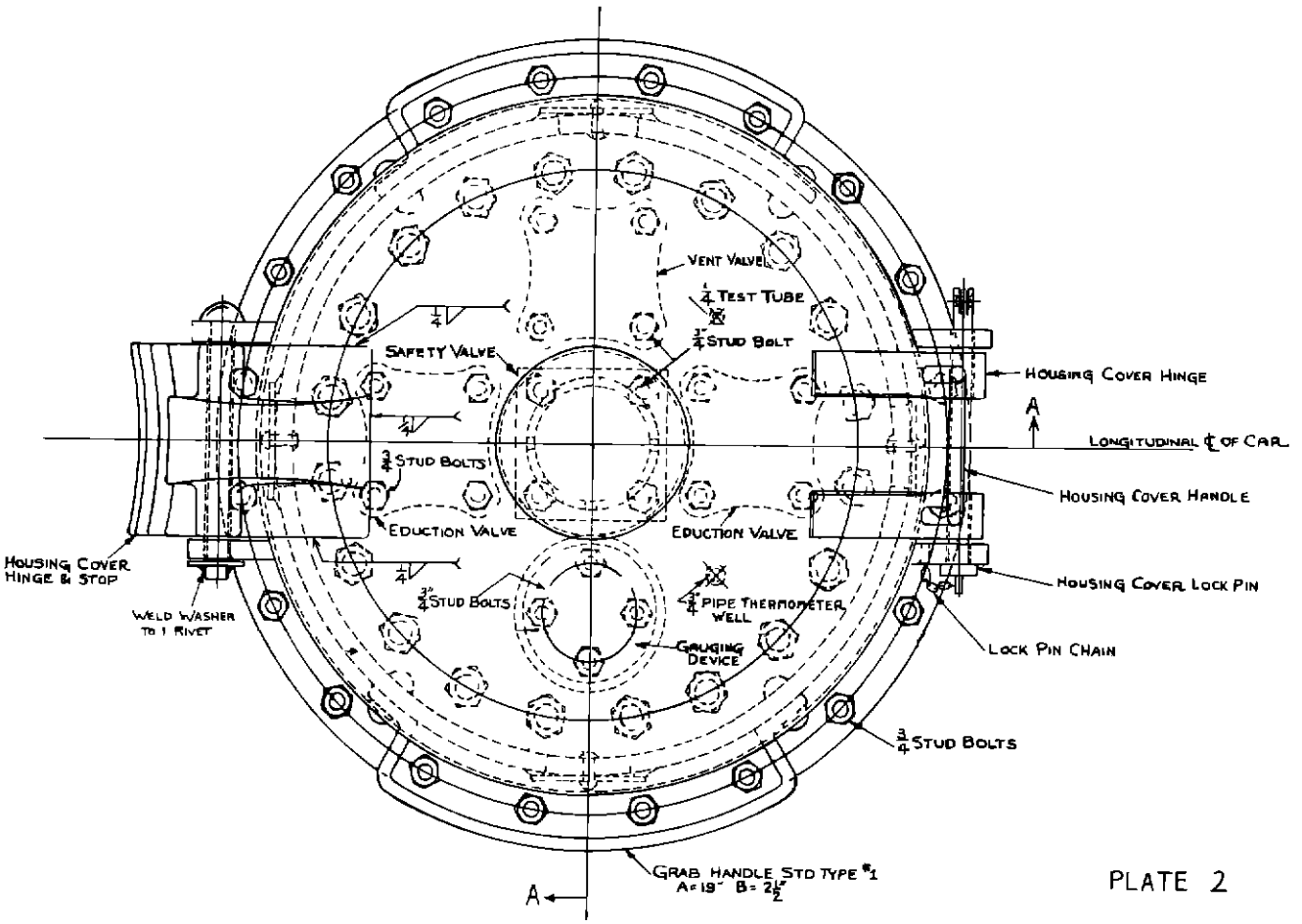
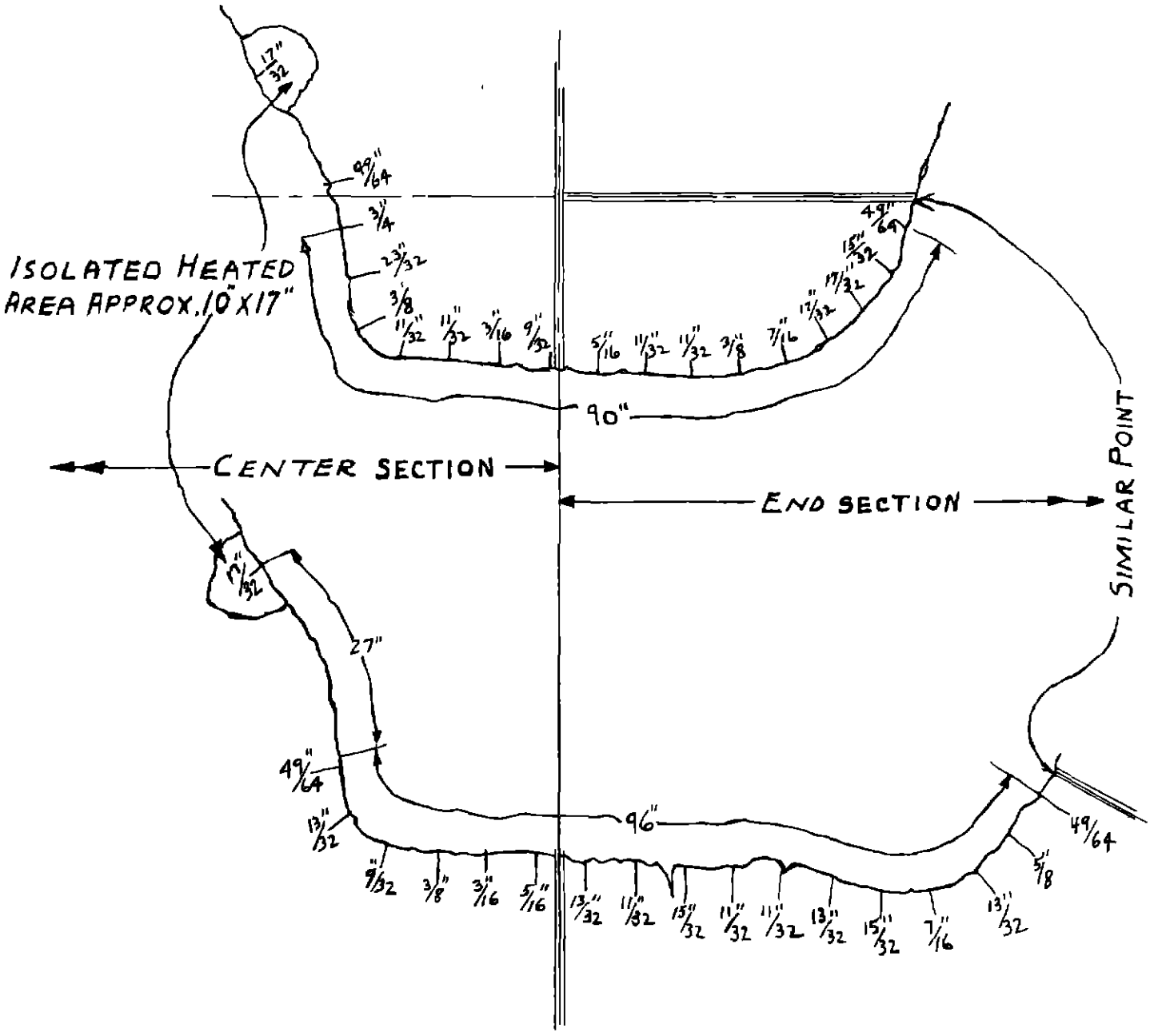

VENT VALVE
¼ TEST TUBE
¼ STUD BOLT
SAFETY VALVE
HOUSING COVER HINGE
A
LONGITUDINAL ℄ OF CAR
¾ STUD BOLTS
HOUSING COVER HANDLE
EDUCTION VALVE
EDUCTION VALVE
HOUSING COVER HINGE & STOP
HOUSING COVER LOCK PIN
¾ STUD BOLTS
¼ PIPE THERMOMETER WELL
WELD WASHER TO 1 RIVET
GAUGING DEVICE
LOCK PIN CHAIN
¾ STUD BOLTS
GRAB HANDLE STD TYPE #1
A=19" B=2½"
A

PLATE 2

PLATE 3



THINNING OF SHEETS IN HEATED AREA
TANK CAR # SHPX 1828

PLATE 4

INTERSTATE COMMERCE COMMISSION

REPORT NO 3838

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION REPORTS UNDER THE ACCIDENT REPORTS ACT OF MAY 6, 1910

MISSOURI PACIFIC RAILROAD

June 16, 1959

Accident near Monroe, La , on January 22, 1959, caused by a broken journal which resulted in a derailment, and by the subsequent overheating and rupture of the shell of a tank car containing propylene which resulted in an explosion

REPORT OF THE COMMISSION[1]

FREAS, Commissioner

On January 22, 1959, there was a derailment of a freight train, and a subsequent explosion of a tank car containing propylene, on the Missouri Pacific Railroad near Monroe, La , which resulted in the death of 5 maintenance-of-way employees, 1 trainmaster, 1 mechanical department employee, and 1 other employee, and the injury of 3 spectators, 3 employees of the city fire department, 3 bulldozer operators, 4 officials of the carrier, 51 maintenance-of-way employees, 5 mechanical department employees, 5 train-service employees, and 1 train-service employee not on duty

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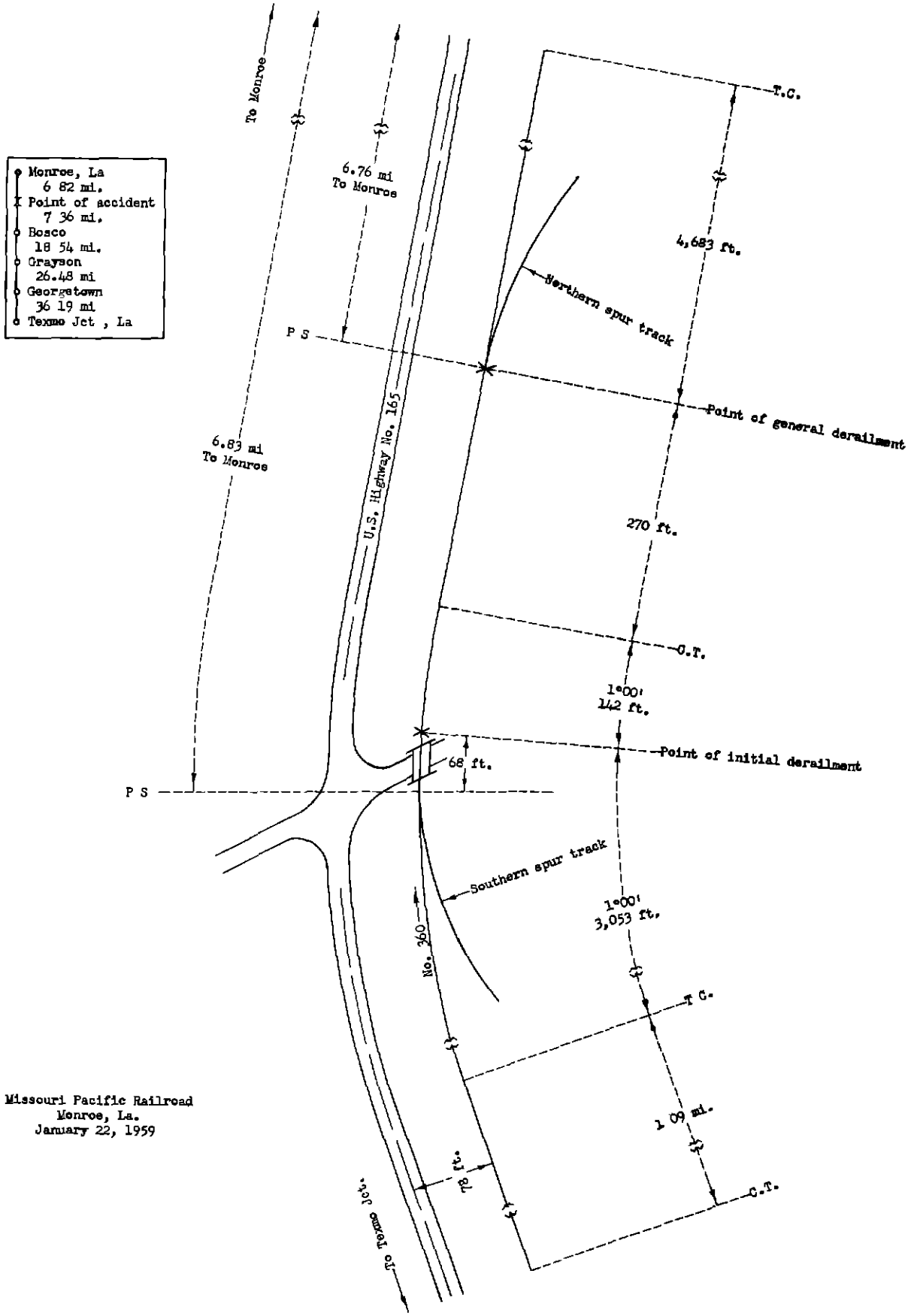
[1]Under authority of section 17 (2) of the *Interstate Commerce Act* the above-entitled proceeding was referred by the Commission to Commissioner Freas for consideration and disposition



Missouri Pacific Railroad
Monroe, La.
January 22, 1959

Location of Accident and Method of Operation

This accident occurred on that part of the Louisiana Division extending between Texmo Jct , and Monroe, La , 95 39 miles, a single-track line over which trains are operated by timetable, train orders, and an automatic block-signal system In the vicinity of the point of accident two spur tracks diverge to the east from the main track The switch of one of these spur tracks is trailing-point for northbound movements and is located 6 83 miles south of the station at Monroe The switch of the other spur track is facing-point for northbound movements and is located 6 76 miles south of the station at Monroe The initial derailment occurred 68 feet north of the switch of the southern spur track, and the general derailment occurred at the turnout of the northern spur track U S Highway No 165 parallels the main track on the west between Bosco, 14 18 miles south of Monroe, and Monroe In the vicinity of the point of accident the centerline of the highway is 78 feet west of the centerline of the main track, and the highway is laid on a fill approximately 2 feet in height From the south on the main track there are, in succession, a tangent 1 09 miles in length, a 1°00′ curve to the right 3,053 feet to the point of initial derailment and 142 feet northward, and a tangent 270 feet to the point of general derailment and 4,683 feet northward In the vicinity of the point of accident the grade is 0 01 percent ascending northward

In the vicinity of the point of accident the main track is laid on a fill approximately 4 feet in height The track structure consists of 112-pound rail, 39 feet in length, laid new in 1945 on an average of 24 treated ties to the rail length It is fully tieplated with double-shoulder tie plates, single-spiked, and is provided with 4-hole, 24-inch joint bars It is ballasted with crushed rock to a depth of 18 inches below the bottoms of the ties

This carrier's operating rules read in part as follows

110 Running Inspection of Trains on Road —* * *

* * * operators must observe passing trains for defects

Operators at intermediate stations * * * will stand on station platform when trains are passing

Defects to be looked for include * * * hot journals * * *

Employees noting such defects will give stop signals, * * *

If nothing irregular is noted, employes observing trains for defects will give proceed signals to the rear of the passing train

* * *

111 Road Inspection for Defects —When leaving stations, and at every opportunity on the road, conductors must carefully inspect and require their trainmen to carefully inspect the train for defects

* * *

Engineers, firemen and forward trainmen must frequently look back and rear trainmen must frequently look ahead, especially when moving around curves, and approaching and passing stations, to observe signals and to note condition of train

* * *

In the vicinity of the point of accident the maximum authorized speed for freight trains is 50 miles per hour

Description of Accident

No 360, a northbound second-class freight train, consisted of diesel-electric units 315A, 331B, and 325A, coupled in multiple-unit control, 143 cars, and a caboose This train departed from Alexandria Yard, 3 71 miles south of Texmo Jct , at 7 55 p m , 2 hours 55 minutes late, passed Grayson, the last open office, 62 67 miles north of Texmo Jct , at 10 37 p m , 2 hours 22 minutes late, and while moving at an estimated speed of 45 miles per hour, the rear wheels of the rear truck of the 17th car were derailed at a point 68 feet north of the switch of the southern spur track near Monroe The 18th to the 49th cars, inclusive, were derailed at the turnout of the northern spur track

The locomotive stopped with the front end approximately 2,050 feet north of the point of general derailment Separations occurred at each end of the derailed cars The 17th to the 19th cars, inclusive, stopped on or near the track structure with the front ends 1,140 feet, 625 feet, and 540 feet, respectively, north of the point of general derailment The other derailed cars stopped grouped together on or near the track structure within an area beginning at the point of general derailment and extending northward throughout a distance of about 300 feet Most of these cars were approximately at right angles to the main track A fire started immediately after the derailment occurred and spread rapidly throughout the group of derailed cars During wrecking operations the 28th car was moved on two occasions About 19 hours 45 minutes after the derailment, and while wrecking operations were being performed, the explosion occurred The explosion tore the tank from the underframe and insulation jacket of the 28th car, and hurled the tank approximately 200 feet west of the main track Fragments of the jacket and insulation were scattered over a wide area Twenty-one of the derailed cars were destroyed, 6 were heavily damaged, and 6 were considerably damaged

Eight persons were killed and 75 were injured as a result of the explosion

The weather was clear at the time of the derailment, which occurred about 11 15 p m , and at the time of the explosion, which occurred about 7 00 p m , January 23

The 17th car of No 360 was MP 1523, a pulp wood car, built in October 1941 It is 41 feet 3 inches long over end sills The trucks are spaced 31 feet between centers, and the wheelbase of each truck is 5 feet 6 inches The lightweight, nominal capacity, and load limit are, respectively, 44,000 pounds, 100,000 pounds, and 125,000 pounds When the accident occurred the car was loaded with pulpwood weighing approximately 100,000 pounds The trucks are of the 4-wheel type with 5½ -by 10-inch journals, cast steel side frames, and cast steel journal boxes with waste packing

The 28th car of No 360 was SHPX 1828, a tank car, classification ICC-105A400W, built in August 1948 The inside diameter of the shell was 7 feet 5 1/4 inches, and the length measured inside the heads was 35 feet 2 7/8 inches The shell consisted of three cylindrical steel sections, each 10 feet 4 3/4 inches in length, formed from a single plate 25/32-inch thick with the seam butt-welded The end sections were butt-welded to the middle section with the longitudinal seams of these sections located at the intersections of the shell with a horizontal plane passing through the longitudinal centerline of the shell, and with the seam of the middle section on the opposite side from the seams of the end sections Ellipsoidal dished heads were provided and were secured to the shell by butt welds The dome nozzle (PLATE NO 1), formed of 1-inch steel plate, had an inside diameter of 1 foot 6 inches It was welded to the shell A reinforcing steel ring 25/32-inch thick

and 7 7/8 inches wide was provided at the base of the nozzle and was welded to the nozzle and shell A steel ring was provided at the top of the nozzle for securing the dome cover This ring had an inside and outside diameter of 1 foot 6 inches and 2 feet 2 inches, respectively, was 2 inches thick, and was secured to the nozzle by welds The dome cover was a circular steel plate 2 1/4 inches thick and had a diameter of 2 feet 8 3/4 inches It was secured to the nozzle ring by twenty 1 1/8-inch stud bolts A safety valve was located at the center of the dome cover An eduction valve (PLATE NO 2) was located on the longitudinal centerline on each side of the safety valve Each eduction valve consisted of a 2-inch angle valve with a plug at the outlet The top of the dome cover was also provided with a gauging device, a vent valve which consisted of a 2-inch angle valve with a plug at the outlet, a test tube which consisted of a 1/4-inch pipe screwed into the dome cover with a 1/4-inch angle valve on the top end, and a thermometer well which consisted of a 3/4-inch pipe screwed into the dome cover with a coupling and plug at the top end The safety valve, the eduction valves, the vent valve, and the gauging device were secured to the dome cover by 3/4-inch stud bolts Lead gaskets were provided between these fixtures and the dome cover, and between the dome cover and the nozzle ring The fixtures were encased in a dome housing and cover A port 3 3/4 inches in diarreter was provided on the vertical portion of the housing at the outlet of of each 2-inch angle valve Each port was covered by a port cover 5 1/2 inches in diameter loosely hinged by a rivet at the top and on the outside of the housing Each eduction valve was so installed that when the port cover was open, the outlet plug removed, and the valve opened while the tank contained compressed gas, a stream of gas would flow longitudinally along the tank The outside surface of the shell was provided with insulation 4 inches thick The insulation was encased in a 1/8-inch steel jacket The capacity of the tank was 11,000 gallons

The tank of SHPX 1828 was tested at 400 psi and at North Kansas City, Mo , on June 18, 1957, the safety valve was adjusted to open at 300 psi

The first and third diesel-electric units, and the caboose of No 360 were provided with radio-telephone equipment

Discussion

As No 360 was approaching the point where the accident occurred the engineman were in the control compartment at the front of the locomotive, the front brakeman was in the control compartment of the third diesel-electric unit, and the conductor and the flagman were in the caboose The brakes of this train had been tested and had functioned properly when used en route The members of the crew said that they made observations of the train at every opportunity en route from Alexandria Yard to the point of accident, and that they did not observe anything to indicate defective equipment When the train passed Georgetown, 52 38 miles south of the point of accident, and Grayson, the operator at each of these stations was standing on the station platform The stations at Georgetown and Grayson are located on the east side and west side of the main track, respectively Both operators said that they did not observe any defective equipment in the train The conductor said that each operator gave a proceed signal when the caboose passed their respective stations When the train was in the vicinity of Bosco, 7 42 miles south of the point of the general derailment, two deputy sheriffs of the Ouachita Parish Sheriff's Department, who were on duty and in a patrol car, observed sparks and fire being emitted from the east side of the rear truck of a car in the train They immediately proceeded northward on U S Highway No 165 and a deputy sheriff gave a signal with his flashlight to the members of the crew in the caboose The conductor said that he observed the signal However, he said that he was not concerned because it was not unusual for a motorist to direct the beam of a flashlight on the caboose The patrol car then overtook the loco-

motive and a deputy sheriff directed the beam of his flashlight on the control compartment of the first diesel-electric unit The fireman observed the signal and that it was being given from a patrol car He acknowledged the signal with his flashlight and warned the engineer who also acknowledged the signal by sounding the locomotive horn The engineer said that he immediately used the radio-telephone to inform the members of the train crew that he was stopping the train for inspection, and that moments after he initiated the call, the brakes of the train became applied in emergency as a result of the derailment The members of the train crew were not aware of anything being wrong until the brakes of the train became applied in emergency The conductor estimated that the speed of the train was between 45 and 48 miles per hour when the derailment occurred, and the engineer and the fireman estimated that the speed was between 40 and 45 miles per hour at that time

Examination of the track structure after the accident occurred disclosed that beginning at a point 4,583 feet south of the point of initial derailment and throughout the distance to the turnout of the southern spur track, the ties, joint bars, and joint-bar bolts and nuts on the outside of the east rail bore scrape marks These marks apparently resulted from contact with the bottom of a truck side frame The east point rail of the frog of the southern spur track was broken and displaced A crossing plank east of the east rail of the main track, located approximately 25 feet north of the switch of the southern spur track, bore a heavy mark at the south end Beginning at a point 68 feet north of the switch of the southern spur track and throughout the distance to the turnout of the northern spur track, the ties bore a flange mark on the gage side of the west rail indicating that a wheel had derailed to the east The general derailment occurred at the turnout of the northern spur track In the vicinity of the point of general derailment the main track was destroyed throughout a distance of approximately 320 feet

Examination of the equipment after the accident occurred disclosed that the right rear journal of the rear truck at location L-4 of MP 1523, the 17th car, had broken and the truck side had dropped sufficiently to be in contact with the track structure The stub of the journal had been in contact with the journal box and had worn through its top The tie strap at position L-4 was heavily abraded on the bottom One journal box bolt was broken and both journal box bolts were bent The journal box was torn from the side frame, the No 4 wheels were torn from the truck, and the truck was torn from the car The journal box showed indications of excessive heating The detached portion of the journal, the journal-box bearing and wedge, and the packing were not found The surface of the break on the stub end of the journal was damaged to the extent that the cause of the fracture could not be determined

MP 1523 was last inspected on January 22, 1959, at Alexandria Yard, and no exceptions were taken According to the stenciling, the journal boxes of this car were last repacked on November 5, 1956, approximately 26½ months prior to the date of the derailment The A A R Code of Rules for Cars in Interchange requires all waste packed journal boxes to be repacked at intervals not exceeding 18 months

Car SHPX 1828 was loaded with 10,250 gallons of propylene at a temperature of 59 degrees Fahrenheit on January 20, 1959, at the Union Carbide Olefins Company plant at North Seadrift, Tex , on the Missouri Pacific Railroad This car was destined to South Charleston, W Va , via the Illinois Central Railroad and the Chesapeake and Ohio Railway Records indicated that it was provided with "Dangerous" placards

Propylene is a colorless flammable gas which becomes liquefied under pressure It is classed as a liquefied petroleum gas under Interstate Commerce Commission regulations and is permitted to be transported in various types of tank cars including those classified as ICC-105A400W Cars containing this material are required to be provided with "Dangerous" placards

After the derailment occurred, SHPX 1828 stopped adjacent to three tank cars containing diacetone alcohol, vinyl acetate, and glycol, all of which were burning The flames of the burning glycol were directed against a side of the tank of SHPX 1828 between the dome and one end At the same time, flames were being emitted from the dome of SHPX 1828 which was in a position slightly off the vertical and inclined toward the burning glycol About 19 hours after the derailment occurred, SHPX 1828 was moved approximately 60 feet northward and stopped upright on the west side of the track structure with the north end fouling the main track Officials and employees of the carrier said that about 30 minutes later, while flames were still being emitted from the dome, the north end of this car was moved westward by means of a cable attached to a bulldozer The car rolled onto its side and stopped at an angle of about 30 degrees from the main track with the dome to the southwest and in an approximately horizontal position After the car stopped in this position, the intensity of the flames being emitted from the dome greatly increased The explosion occurred about 30 minutes after the car was placed with the dome in the horizontal position

Examination of the shell of SHPX 1828 after the explosion occurred disclosed that it had ruptured and unwrapped throughout a longitudinal distance of approximately 20 feet (PLATE NO 3) An overheated area approximately 7 feet 6 inches in length and of varying width was found in the unwrapped portion of the shell (PLATE NO 4) This area, beginning at a point about 2 feet from the dome, extended toward the damaged end of the shell The center of this area was at an angle of about 90 degrees to the left of the vertical centerline of the shell when facing the damaged tank head The thickness of the steel plate at the ends and center of the rupture extending through this area varied from 49/64 inch to 3/16 inch, respectively The thickness of plate at all points of rupture other than in the overheated area was 25/32 inch The entire dome was discolored and slightly scaled as a result of overheating

Examination of the dome disclosed that the test tube was broken off flush with the dome cover, that the plug at the top of the thermometer well was loose, and that the vent valve, one eduction valve, and the gauging device were loose on the dome cover It was found that one eduction valve was open slightly and that the plug was out The port cover of the dome housing for this valve was missing The dome cover was loose and a piece of the gasket approximately 6 inches in length was missing The safety valve was tested after the accident occurred and was found to open at 300 psi It could not be determined whether the numerous leaks at the dome resulted from the derailment or from the effects of the heat to which that portion of the tank subsequently was subjected

Approximately 82 percent of the insulation jacket was found None of the recovered portions showed indications of having been subjected to intense heat One portion showed indications of having been crushed longitudinally over an area of about 40 square feet It could not be determined whether the insulation protecting the area where the overheating occurred was damaged or destroyed as a result of the derailment or in the two subsequent movements incidental to wrecking operations

Laboratory analysis of plate sections removed from the shell disclosed that the metal in the overheated area had been subjected to temperatures in excess of 1500° F and was characterized by discoloration and slight scaling Analysis of the metal of the portion of the shell which was not subjected to overheating disclosed no evidence of laminations, seams or other defects The welds were found to be clean and sound

Pamphlet No 22, revised January 1957, and published by the Bureau of Explosives of the Association of American Railroads, contains recommendations for handling collisions and derailments involving explosives, gasoline, and other dangerous articles As stated in this pamphlet, the vapor of liquefied petroleum gas is easily ignited, burns rapidly, and will explode if mixed with the right amount of air It recommends that all tanks in a fire be watched for the appearance of red-hot spots in the metal, which are an indication that the tensile strength of the steel at such spots is being reduced In addition, it recommends that guards be posted to keep all spectators away, and that no effort or expense to accomplish this should be spared The carrier issued copies of this A A R pamphlet to its employees with instructions for the review and discussion of the contents of the pamphlet at safety meetings and rule classes In addition, the carrier issued special instructions directing division personnel to communicate quickly with the shipper, the consignee, or the A A R Bureau of Explosives when in doubt about the safe course to be taken in handling explosive materials and other dangerous articles Immediately after the accident occurred officials of the carrier communicated by telephone with a representative of the A A R Bureau of Explosives and the shippers of the various commodities involved in the accident They were advised by the A A R representative that the burning lading of the tank cars should be permitted to burn out In addition, they were advised by the shipper that the lading of SHPX 1828 was extremely dangerous

The tank of SHPX 1828 was exposed to the intense heat of the burning wreckage for a considerable period of time Escaping gas from the car became ignited and burned at the dome throughout the time the car was standing in the wreckage at the point of the general derailment and continued burning until the time of the explosion, about 19 hours 45 minutes after the derailment occurred When this car was last moved and stopped with the dome in a horizontal position, the intensity of the flames at the dome greatly increased and the heat was directed against the tank The thickness of the shell plate was greatly reduced in the overheated area, and it is apparent that the pressure within the tank was sufficient to rupture the shell plate in the overheated area, resulting in the explosion

In the instant case, the carrier followed the recommended good practice for the handling of dangerous articles with the apparent exceptions that adequate measures were not taken to detect the red-hot spot in the shell of the tank of SHPX 1828, and that sufficient effort was not exerted to keep all persons at a safe distance It is evident that had the overheated area of this tank been observed and adequate measures taken to keep all persons at a safe distance, the heavy casualties would not have resulted from the explosion If the dome of SHPX 1828 had been maintained in a vertical position after the car was removed from the wreckage, the heating of the shell would have been minimized and it is probable that the explosion would not have occurred

Cause

This accident was caused by a broken journal which resulted in a derailment, and by the subsequent overheating and rupture of the shell of a tank car containing propylene which resulted in an explosion

Dated at Washington, D C , this sixteenth day of June, 1959

By the Commission Commissioner Freas

HAROLD D McCOY,

(SEAL)

Secretary

Interstate Commerce Commission
Washington 25, D. C

OFFICIAL BUSINESS

RETURN AFTER FIVE DAYS

POSTAGE AND FEES PAID
INTERSTATE COMMERCE COMMISSION