

INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY IN RE
INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE
MOUNT WASHINGTON RAILWAY NEAR THE SUMMIT OF MOUNT
WASHINGTON, N. H., ON JULY 20, 1929.

August 2, 1929.

To the Commission:

On July 20, 1929, there was a derailment of a light engine on the Mount Washington Railway near the summit of Mount Washington, N. H., which resulted in the death of one person, and the injury of two employees and one other person.

Location and method of operation

This railway is a sight-seeing cog railway 3.15 miles in length, extending from Base Station to Summit, N. H., and is owned and operated by the Boston & Maine Railroad. Trains are operated by time-table and run only during the months of July, August and September. A point known as Gulf Tank is located about 3,000 feet from the summit, and the accident occurred at a point approximately 2,100 feet down the incline from this tank. Approaching the point of accident, beginning at Gulf Tank, from which point the engine involved started the descent, the track is tangent for about 1,300 feet, followed by a 10° curve to the left 500 feet in length, and then tangent for a distance of 1,000 feet, the accident occurring on this latter tangent at a point approximately 300 feet from its receiving end. The maximum grade is 36.6 per cent, and at the point of accident it is 25 per cent.

This line is constructed for practically its entire length on trestlework, the supporting bents of which vary in height from 2 feet to 20 feet, according to the contour of the land, and are spaced about 12 feet apart. The track is laid with 32-pound rails, 30 feet in length. In the center of the gauge, which is 4 feet 7½ inches, there is a cog-rail constructed of two angle irons bolted to the track structure, with cross members or teeth to engage the cog wheels on engines. The whole structure appears to be substantially built and well maintained.

The weather was clear at the time of the accident, which occurred at about 5.22 p.m.

Description

Engine No. 1, better known as "Peppersas", was in charge of Engineman Frost and Fireman Newsham, and had proceeded up the incline as far as Gulf Tank. At this point water was taken, after which the engine started the return trip light and running backwards, and shortly afterwards it was derailed while traveling at an estimated speed of 3 miles per hour. The engine then continued down the incline, gaining speed rapidly, and finally left the trestle about 2,050 feet from the initial point of derailment while traveling at a speed of about 35 miles per hour.

The engine fell a distance of about 12 feet and was destroyed, practically the only part intact being the boiler. The person killed was a photographer-writer, who was temporarily employed by the Boston & Maine Railroad, and the persons injured were the engineman, fireman and a photographer, all of whom were riding on the engine.

Summary of evidence

Engine No. 1 made the first ascent of Mount Washington in 1869; it was in regular service until 1878, when it was replaced by the present type of engines in use on this railway. Since that time it made a tour of national expositions as well as being located in museums. On the day of this accident a celebration was in progress on Mount Washington under the auspices of the governor of New Hampshire and the president and directors of the Boston and Maine Railroad. The ceremonies were in connection with the return of "Peppersas" to the mountain where it made its first trip 60 years ago. The plan was to run the engine once to the summit of the mountain and return, after which it was to be placed on permanent exhibition. Six trainloads of guests, each train consisting of an engine pushing one car ahead of it, had preceded engine No. 1 up the mountain to the summit. This engine made one stop while ascending the grade due to low steam pressure and another to lubricate the cylinders. After taking water at Gulf Tank the return trip was started down the grade, and it was on this return trip that the accident occurred.

Engineman Frost, whose regular position with the Boston and Maine Railroad is enginehouse foreman, had worked on the Mount Washington Railway for six consecutive summers as machinist, extra engineman and master mechanic. In preparing engine No. 1 for the exercises on July 20 he examined all parts and found the main parts in very good condition. The main valve was missing, but this was

replaced and other parts were renewed, including the pistons. After the engine was taken to the base of the mountain several trial trips were made by running part way up the mountain and during these tests the engine appeared to function perfectly. On the trip on which the accident occurred he ran the engine up as far as Gulf Tank. At this point he inspected and oiled the engine, after which the return trip to the base was started. Nothing unusual occurred until he reached a point about one-half mile from where the return trip was started when he heard a snap at the front end of the engine, immediately followed by the forward end raising up and when it came down the cog wheel was out of the cog rail. With the assistance of the fireman he attempted to apply the hand brake but without much effect on the speed of the engine, and realizing that the engine was out of control he shouted to the other persons to jump. Engineman Frost could not account for the front end of the engine lifting out of the cog rail unless it was caused by a broken tooth from a cog wheel being stuck in the cog rail. He further stated that he had never known of a cog wheel breaking on any of the engines used on this line; at one time a front pinion gear broke on one of the present type of engines and the train stopped immediately.

The statements of Fireman Newsham substantiated those of Engineman Frost. He estimated the speed of the engine at the time of the accident at 2 miles per hour and at 30 miles per hour at the time he jumped off. He also said that he did practically all of the work in preparing the engine for the trip on which the accident occurred.

Caleb Frost, 16 years of age, son of the engineman, stated that on the day of the accident he walked up the mountain behind the engine. When the engine started the return trip he, together with two other persons, got on. The engine was proceeding normally and without indication of trouble until he heard a snapping sound near the front part of the engine and it appeared to be derailed and bumping on the ties. He jumped just as the engine started down the long trestle and the last he saw of the engine was when it disappeared around a curve running at high speed and tearing up the ties.

Assistant to Engineer of Maintenance of Way Watson stated that he arrived at the scene of accident on the morning of July 22 and made an inspection of the track in the vicinity of the point of accident. He found marks on the side of the cog rail between bents 768 and 734 which appeared to have been made by something sliding on the angle iron which forms the side of the cog rail. There were also marks on the ties in the same vicinity which appeared to have been made by a gear sliding on them, and about 50 ties were broken between these points.

Later he found several teeth from a broken cog wheel and parts of the broken main driving gears, approximately 1,100 feet from the first mark of derailment.

Chief Mechanical Officer Richardson stated that he made an inspection of engine No. 1 upon its arrival at Concord shops for the necessary work and repairs in preparation for the ascent of Mount Washington. The main concern was with the strength of the boiler, which was 63 years old; a hydrostatic test with a pressure of 150 pounds was made, which pressure remained applied over night. The boiler was also tested by representatives of the mechanical engineer's office and after the results of these tests had been assembled it was considered perfectly safe to run this engine under a steam pressure of 50 pounds. An inspection of the boiler after the accident showed the flues intact, top of boiler and all seams except the mud ring were tight, the dent on the mud ring being inward. This inspection convinced him that the boiler was not involved in the accident. Mr. Richardson was fully satisfied that the engine was capable of making the ascent safely but had some doubt whether it would descend freely, and during the trial trips it had so much internal friction that it was necessary to push it down by using ^{an} other engine. He rode the engine while it made the ascent on the day of the accident and it functioned as intended. He further stated that in descending the mountain the speed of the engine was regulated by compression in the cylinders, and in addition there was a hand brake connected to the rear axle on which there was a cog wheel in mesh with the cog rail. After the accident the front axle assembly was located and the main shaft and main cog were found in good condition. The two large driving gears mounted on the axle were completely broken, only the hubs remaining. The two pinions were still on the drive shaft, one of them intact and the other forced outward about one-half its width and one tooth broken, but it was still keyed solidly to the shaft. In his opinion the accident was caused by the broken tooth in the pinion gear on the drive shaft, which meshed with a large driving gear on the front axle, jamming the gears and locking the entire front axle assembly. This condition, with the engine backing down the heavy grade, according to the usual practice, caused the front end of the engine to raise a sufficient distance to lift the cog wheel out of the cog rail, and when the engine dropped back the cog wheel did not mesh, permitting the engine to get out of control.

The engine involved in this accident was designed to run forward up the mountain and backward while descending. The frame was of wood construction, reinforced with metal, engine and tender being one unit. The boiler was of the vertical or upright type, hung in trunnions

to permit it to assume the vertical position regardless of the angle of the ascent while climbing the mountain. There was one cylinder on each side of the frame which delivered power through crank shafts to a drive shaft on the front end of the engine, on which were mounted two pinion gears. The front axle was in front of this drive shaft and two large gears were keyed to it which meshed with the pinion gears. In the center of the front axle there was a large cog wheel which engaged with the cog rail and which furnished the tractive power and also acted as a retarding feature in descending the grade. In addition to the driving cog wheel, there were two other wheels with ratchet attachments which served to hold the engine when it became necessary to stop while ascending the grade. In the center of the rear axle there was a cog wheel similar to the one on the front axle and which meshed with the cog rail and was used in connection with the hand brake, although the principal braking power was by compression in the cylinders.

Conclusions

This accident is believed to have been caused by the locking of the driving mechanism on the forward part of the engine.

According to the evidence, the first intimation of anything wrong had by the persons riding on the engine was when they heard a click or snap at the front end of the engine, which then seemed to raise upward and then to drop down, apparently with the driving cog wheel out of mesh with the cog rail. An attempt to control the speed with the hand brake was without avail. Examination of the front axle after the accident showed that the cog or driving wheel was still intact and secured to the axle, although both large driving gears were completely broken. The drive shaft was also found and both pinion gears were attached to it. One of the gears, however, had a tooth broken off and this gear had been forced out of position on the shaft for a distance of about one-half its width; the other gear was in good condition. The damaged condition of this driving assembly indicates that the gears probably were jammed by the broken tooth of the pinion gear becoming lodged between this gear and the large driving gear with which it was supposed to mesh, resulting in the locking of the mechanism. This condition apparently accounted for the raising of the front of the engine sufficiently to disengage the forward cog from the rail, and when this end of the engine came down the cog wheel failed to mesh with the cog rail.

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Engineman Frost and Fireman Newsham had been on duty 12 hours and 22 minutes at the time of the accident, after having been off duty for more than eight hours; both had good records.

Respectfully submitted,

W. P. BORLAND,

Director.