

INTERSTATE COMMERCE COMMISSION

THIRTIETH ANNUAL REPORT

OF THE

DIRECTOR

BUREAU OF LOCOMOTIVE INSPECTION

TO THE

INTERSTATE COMMERCE COMMISSION

FISCAL YEAR ENDED

JUNE 30, 1941



UNITED STATES
GOVERNMENT PRINTING OFFICE
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**ANNUAL REPORT OF THE DIRECTOR
BUREAU OF LOCOMOTIVE INSPECTION**

OCTOBER 1, 1941.

To the Interstate Commerce Commission:

In compliance with section 7 of the act of February 17, 1911, as amended, the Thirtieth Annual Report of the Director of the Bureau of Locomotive Inspection, covering the work of the Bureau during the fiscal year ended June 30, 1941, is respectfully submitted.

Summaries are given, by railroads, of all accidents, showing the number of persons killed and injured due to the failure of parts and appurtenances of locomotives, as reported and investigated under section 8 of the Locomotive Inspection Act and those reported to the Bureau of Statistics under the Accident Reports Act of May 1910 and not reported to this Bureau in accordance with requirements.

The tables showing the number of accidents, the number of persons killed, and the number of persons injured have been arranged to permit comparison with previous years as far as consistent. These tables also show the number of locomotives inspected, the number and percentage of those inspected found defective, the number for which written notices for repairs were issued in accordance with section 6 of the law, and the total number of defects found and reported. The data contained therein cover all defects on all parts and appurtenances of locomotives found and reported by our inspectors, arranged by railroads.

Summaries and tables show separately accidents and other data in connection with steam locomotives and tenders and their appurtenances and accidents and other data in connection with locomotives other than steam.

TABLE I.—*Reports and inspections—Steam locomotives*

	Year ended June 30—					
	1941	1940	1939	1938	1937	1936
Number of locomotives for which reports were filed....	43,236	44,274	45,965	47,397	48,025	49,322
Number inspected.....	105,675	102,164	105,606	105,186	100,033	97,329
Number found defective.....	9,570	8,565	9,099	11,050	12,402	11,526
Percentage inspected found defective.....	9	8	9	11	12	12
Number ordered out of service.....	560	487	468	679	934	852
Number of defects found.....	37,691	32,677	33,490	42,214	49,746	47,453

TABLE II.—Accidents and casualties caused by failure of some part of the steam locomotive, including boiler, or tender

	Year ended June 30—					
	1941	1940	1939	1938	1937	1936
Number of accidents.....	153	164	152	208	263	209
Percent increase or decrease from previous year.....	6.7	17.9	26.9	20.9	125.8	14.0
Number of persons killed.....	15	18	15	7	25	16
Percent increase or decrease from previous year.....	16.7	120.0	114.3	72.0	152.2	44.8
Number of persons injured.....	182	225	164	216	283	215
Percent increase or decrease from previous year.....	19.1	137.2	24.1	23.7	131.6	19.5

¹ Increase.TABLE III.—Accidents and casualties caused by failure of some part or appurtenance of the steam locomotive boiler¹

	Year ended June 30—							
	1941	1940	1939	1938	1937	1936	1915	1912
Number of accidents.....	43	67	52	59	63	75	424	856
Number of persons killed.....	12	16	15	5	19	10	13	91
Number of persons injured.....	64	110	55	59	73	80	467	1,005

¹ The original act applied only to the locomotive boiler.

TABLE IV.—Number of casualties classified according to occupation—Steam locomotive accidents

	Year ended June 30—									
	1941		1940		1939		1938		1937	
	Killed	In-jured	Killed	In-jured	Killed	In-jured	Killed	In-jured	Killed	In-jured
Members of train crews:										
Engineers.....	5	41	5	70	4	46	3	70	8	106
Firemen.....	5	68	6	49	6	66	2	80	5	78
Brakemen.....	3	21	4	24	2	18		31	3	30
Conductors.....		8	1	4		5		6	1	18
Switchmen.....		6		4		6		7		10
Roundhouse and shop employees:										
Boilermakers.....			1	3	1	1		2	2	2
Machinists.....	1	3		3		2				2
Foremen.....		2						1		
Inspectors.....								1		
Watchmen.....	1	2		1		1	2		1	1
Boiler washers.....								1		
Hostlers.....		3		2		1		6		9
Other roundhouse and shop employees.....		1		1		2		1		3
Other employees.....		9	1	20		2		3	1	14
Nonemployees.....		18		44	2	14		7	4	10
Total.....	15	182	18	225	15	164	7	216	25	283

TABLE V.—Reports and inspections—Locomotives other than steam

	Year ended June 30—					
	1941	1940	1939	1938	1937	1936
Number of locomotive units for which reports were filed.....	3,389	2,987	2,716	2,555	2,416	2,361
Number inspected.....	5,558	4,974	4,581	4,024	3,615	3,118
Number found defective.....	319	298	260	274	328	252
Percentage inspected found defective.....	6	6	6	7	9	8
Number ordered out of service.....	21	16	14	9	24	11
Total number of defects found.....	905	766	696	769	991	674

TABLE VI.—Accidents and casualties caused by failure of some part or appurtenance of locomotives other than steam

	Year ended June 30—				
	1941	1940	1939	1938	1937
Number of accidents.....	11	7	5	4	12
Number of persons killed.....					
Number of persons injured.....	11	7	5	4	14

TABLE VII.—Number of casualties classified according to occupation—Locomotives other than steam

	Year ended June 30—									
	1941		1940		1939		1938		1937	
	Killed	In-jured	Killed	In-jured	Killed	In-jured	Killed	In-jured	Killed	In-jured
Members of train crews:										
Engineers.....		1		2		3		3		7
Firemen.....		5		2		1				2
Brakemen.....		1				1				2
Conductors.....		1		1						
Switchmen.....				1				1		
Maintenance employees.....		2		1						
Other employees.....										
Nonemployees.....		1								3
Total.....	11		7		5		4			14

TABLE VIII.—Accidents and casualties resulting from failures of steam locomotives and tenders and their appurtenances

Part or appurtenance which caused accident	Year ended June 30—														
	1941			1940			1939			1938			1937		
	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured
Air reservoirs															
Aprons				1		1	1		1	3		3		3	3
Arch tubes															
Ashpan blowers															
Axles	1		4	5		6		13	2	5		6	2	2	1
Blow-off cocks				5		2		5		5		5		2	2
Boiler checks	4	1	5	2		2	3	3	5	5		5	1		1
Boiler explosions:															
A. Shell explosions													1	4	2
B. Crown sheet; low water; no contributory causes found	7	6	27	7	12	13	4	5	7	5	5	3	5	9	2
C. Crown sheet; low water; contributory causes or defects found	4	5	2	1		2	2	7	4				3	4	6
D. Miscellaneous firebox failures															
Brakes and brake rigging	5		6	1		1	5	5	6	6	7	14			17
Couplers	1		1	10		12	1	1	4	1	4	10			11
Crank pins, collars, etc.	2		2	6	2	5	1	1	5	1	4	6			7
Crossheads and guides				2		2		2	2	2	2	3			2
Cylinder cocks and rigging				2		2		2	2	2	2	3			3
Cylinder heads and steam chests				1		1		1	1	2	2	2			2
Dome caps															
Draft appliances	1		1	1		33	2	1	1						1
Draw gear	1		1							1	1	1			1
Fire doors, levers, etc.	7		7	2		2	2	2	4	4	4	4			4
Flues	5		6	9		11	8	9	3	3	4	4			4
Flue pockets															
Footboards	2		2	1		1	3	3	6	7	2	2			2
Gage cocks															
Grease cups	1		1	2		2	1	1		1		1			1
Grate shakers	4		4	1		1	5	5	5	7	6	6			6
Handholds	11		11	8		8	8	8	7	7	10	10			10
Headlights and brackets				3		3	1	1	1	1	5	5			5
Injectors and connections (not including injector steam pipes)	3		3	6		6	2	2	2	2	5	5			5
Injector steam pipes				1		1				3	4	4			5
Lubricators and connections	3		3	2		2	1	1	3	3	4	4			4
Lubricator glasses				1		1		1							1
Patch bolts															
Pistons and piston rods	1		2	1		1	2	2	3	3	3	3			3
Plugs, arch tube and washout	1		2						1	1	1	2			2
Plugs in firebox sheets															
Reversing gear	11		12	12		12	13	13	12	12	34	1			33
Rivets															
Rods, main and side	3	2	2	1		1	4	5	5	5	5	5			5
Safety valves															1
Sanders	2		2	4		4	3	3	9	9	6	6			6
Side bearings															
Springs and spring rigging	6		6	2		4	3	4	4	4	4	4			12
Squirt hose	3		3	3		3	6	6	6	7	5	5			5
Stay bolts	1		1	3		3	3	1	2	2	2	1			1
Steam piping and blowers	2		2	7	2	6	6	6	7	7	6	6			10
Steam valves	4		4	2		2	1	1	4	4	4	4			4
Studs				1		1				1	1	1			2
Superheater tubes	2		2	3		4	1	1	1	1	1	1			1
Throttle glands															1
Throttle leaking															1
Throttle rigging	4		5			1		1	2	2	5	5			5
Trucks, leading, trailing, or tender	3		5	2		16	2	2	5	5	5	5			6
Valve gear, eccentrics and rods	4		4			1	4	4	4	4	4	5			5
Water glasses				6		6	3	3	8	8	5	5			6
Water-glass fittings															2
Wheels	2	1	1	1		1	1	1	1	3	2	2			2
Miscellaneous	42		43	40	1	40	35		35	66		68	65	1	65
Total	153	15	182	164	18	225	152	15	164	208	7	216	263	25	283

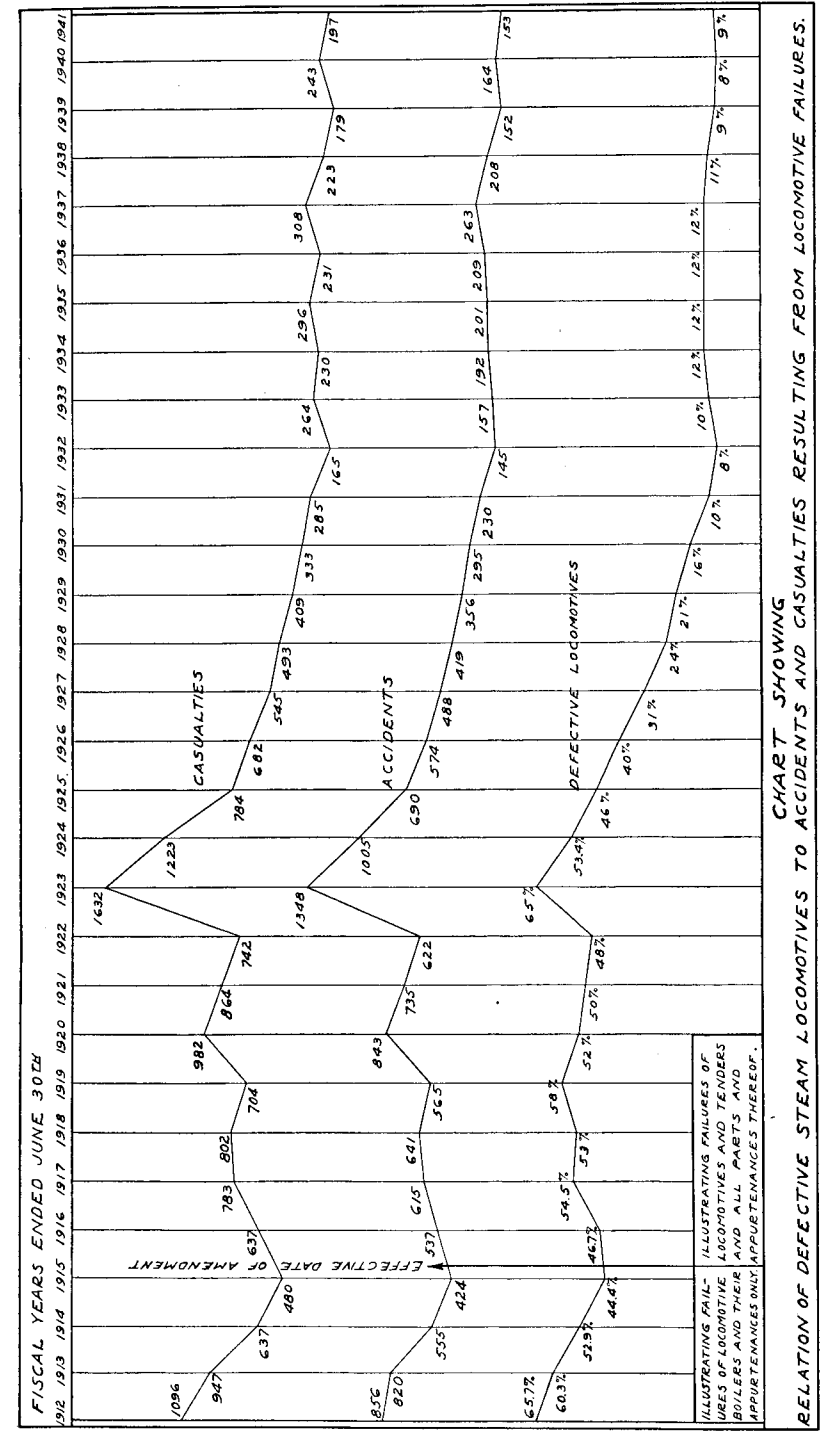


TABLE IX.—Accidents and casualties resulting from failures of locomotives other than steam, and their appurtenances

Part or appurtenance which caused accident	Year ended June 30—														
	1941			1940			1939			1938			1937		
	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured
Brakes and brake rigging	1		1	1		1									
Carburetors													1		1
Couplers													3		3
Crank pins and connecting rods													1		1
Fires: due to overflowing or leakage of fuel, crank case explosions, back firing, etc.	4		4	2		2	1		1	2		2	1		1
Generators and starting devices	1		1						1			1	1		1
Insulation				2		2									
Pantographs and trolleys													2		2
Short circuits				1		1			1			2			2
Miscellaneous	5		5	1		1	3		3	1		1	1		3
Total	11		11	7		7	5		5	4		4	12		14

TABLE X.—Number of steam locomotives reported, inspected, found defective, and ordered from service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30—					
	1941	1940	1939	1938	1937	1936
1. Air compressors	684	567	518	689	766	740
2. Arch tubes	31	20	28	66	105	74
3. Ashpans and mechanism	67	37	67	72	80	79
4. Axles	5	3	2	13	10	13
5. Blow-off cocks	205	191	204	226	199	236
6. Boiler checks	313	288	279	301	352	356
7. Boiler shell	271	266	272	331	347	353
8. Brake equipment	1,945	1,506	1,577	2,044	2,322	2,480
9. Cabs, cab windows, and curtains	1,087	1,078	943	1,226	1,807	1,638
10. Cab aprons and decks	307	277	260	326	466	450
11. Cab cards	97	101	92	109	145	166
12. Coupling and uncoupling devices	74	53	60	73	74	65
13. Crossheads, guides, pistons, and piston rods	858	815	739	905	1,160	1,056
14. Crown bolts	97	54	47	59	76	63
15. Cylinders, saddles, and steam chests	1,332	1,320	1,232	1,645	2,206	1,717
16. Cylinder cocks and rigging	438	447	418	585	729	605
17. Domes and dome caps	94	78	90	109	101	114
18. Draft gear	620	508	450	740	522	513
19. Draw gear	347	306	360	479	560	451
20. Driving boxes, shoes, wedges, pedestals, and braces	1,348	1,243	1,330	1,688	1,637	1,712
21. Firebox sheets	224	191	238	244	371	295
22. Flues	150	147	165	159	225	178
23. Frames, tail pieces, and braces, locomotive	863	665	708	1,001	1,053	997
24. Frames, tender	83	78	71	131	120	113
25. Gages and gage fittings, air	183	132	155	230	261	257
26. Gages and gage fittings, steam	236	211	226	279	324	350
27. Gage cocks	373	400	361	451	538	579
28. Grate shakers and fire doors	430	273	252	403	470	400
29. Handholds	433	333	349	405	510	502
30. Injectors, inoperative	39	30	26	26	38	40
31. Injectors and connections	1,882	1,330	1,457	1,784	2,020	2,085
32. Inspections and tests not made as required	7,215	6,218	6,645	8,204	9,638	9,005
33. Lateral motion	357	313	243	325	446	404
34. Lights, cab and classification	50	49	50	48	90	78
35. Lights, headlight	190	180	177	257	313	251
36. Lubricators and shields	196	185	200	212	254	255
37. Mud rings	187	213	248	203	272	237
38. Packing nuts	508	418	408	448	487	508
39. Packing, piston rod and valve stem	675	660	739	913	1,393	1,133
40. Pilots and pilot beams	142	140	104	154	133	178
41. Plugs and studs	156	156	179	238	238	236
42. Reversing gear	387	320	317	404	492	463
43. Rods, main and side, crank pins, and collars	1,665	1,199	1,293	1,669	2,348	2,093
44. Safety valves	68	61	97	125	132	125

TABLE X.—Number of steam locomotives reported, inspected, found defective, and ordered from service—Continued

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30—					
	1941	1940	1939	1938	1937	1936
45. Sanders	490	415	432	536	655	678
46. Springs and spring rigging	2,597	2,174	2,340	2,901	3,172	3,008
47. Squirt hose	62	50	75	94	133	134
48. Stay bolts	239	227	181	211	276	279
49. Stay bolts, broken	198	271	258	380	542	520
50. Steam pipes	385	255	285	410	446	526
51. Steam valves	110	106	115	141	165	227
52. Steps	555	449	490	631	678	615
53. Tanks and tank valves	952	768	837	955	1,009	877
54. Telltale holes	59	95	58	67	79	127
55. Throttle and throttle rigging	688	647	638	685	909	760
56. Trucks, engine and trailing	636	598	628	762	785	861
57. Trucks, tender	773	705	665	907	1,018	1,108
58. Valve motion	580	506	554	722	798	824
59. Washout plugs	445	478	487	626	598	714
60. Train-control equipment	1	2	5	11	12	6
61. Water glasses, fittings, and shields	788	753	690	915	1,049	1,118
62. Wheels	536	554	466	577	803	790
63. Miscellaneous—Signal appliances, badge plates, brakes (hand)	785	564	610	684	759	608
Total number of defects	37,691	32,677	33,490	42,214	49,746	47,453
Locomotives reported	43,236	44,274	45,965	47,397	48,025	49,322
Locomotives inspected	105,675	102,164	105,606	105,186	100,033	97,329
Locomotives defective	9,570	8,565	9,099	11,050	12,402	11,526
Percentage inspected found defective	9	8	9	11	12	12
Locomotives ordered out of service	560	487	468	679	934	852

TABLE XI.—Number of locomotives other than steam reported, inspected, found defective, and ordered from service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30—					
	1941	1940	1939	1938	1937	1936
Air compressors	22	8	14	6	6	2
Axles, truck and driving	5		1	5	4	6
Batteries	6	1	1	1	4	
Boilers	4	10	6	6	5	5
Brake equipment	69	50	50	74	97	66
Cabs and cab windows	45	22	36	25	51	30
Cab cards	24	13	18	11	25	
Cab floors, aprons, and deck plates	14	17	13	8	17	10
Controllers, relays, circuit breakers, magnet valves, and switch groups	7	16	13	7	8	
Coupling and uncoupling devices	2	6	4	4	3	
Current-collecting apparatus	3	1	5	8	4	16
Draft gear	15	31	17	23	28	24
Draw gear	3	2	4	3	1	1
Driving boxes, shoes, and wedges	36	29	52	16	14	5
Frames or frame braces	1	12	9	37	5	15
Fuel system	62	51	35	47	152	44
Gages or fittings, air	3	1	6	11	1	6
Gages or fittings, steam		2				
Gears and pinions	2	1	2	2	2	
Handholds	12	6	8	13	11	8
Inspections and tests not made as required	243	207	185	204	237	186
Insulation and safety devices	4	2	4	13	13	20
Internal-combustion engine defects, parts and appliances	54	35	32	26	50	23
Jack shafts	3	7	6	1		1
Jumpers and cable connectors			1	1	2	
Lateral motion, wheels	4	-5	1		1	2
Lights, cab and classification	2	1	3	2	5	6
Lights, headlight	1	3	4	4	11	4
Meters, volt and ampere		4	2	2	1	2
Motors and generators	16	12	19	18	10	14
Pilots and pilot beams	12	10	6	1	7	6
Plugs and studs					1	
Quills		4	7	6	3	
Rods, main, side, and drive shafts	4	2	2	2	23	2
Sanders	56	34	28	37	52	25

TABLE XI.—Number of locomotives other than steam reported, inspected, found defective, and ordered from service—Continued

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30—					
	1941	1940	1939	1938	1937	1936
Springs and spring rigging, driving and truck.....	58	50	16	43	36	29
Steam pipes.....	1	4	-----	5	1	2
Steps, footboards, etc.....	35	22	18	23	13	-----
Switches, hand-operated, and fuses.....	2	3	5	7	2	2
Transformers, resistors, and rheostats.....	3	1	1	3	-----	-----
Trucks.....	30	43	33	40	41	42
Water tanks.....	1	-----	1	-----	1	-----
Water glasses, fittings, and shields.....	1	1	-----	3	-----	4
Warning signal appliances.....	4	-----	1	3	2	1
Wheels.....	28	22	16	11	21	26
Miscellaneous.....	8	15	10	7	20	39
Total number of defects.....	905	766	696	769	991	674
Locomotive units reported.....	3,389	2,987	2,716	2,555	2,416	2,361
Locomotive units inspected.....	5,588	4,974	4,581	4,024	3,615	3,118
Locomotive units defective.....	319	298	260	274	328	252
Percentage inspected found defective.....	6	6	6	7	9	8
Locomotive units ordered out of service.....	21	16	14	9	24	11

INVESTIGATION OF ACCIDENTS AND GENERAL CONDITION OF LOCOMOTIVES

All accidents reported to the Bureau as required by the law and rules were carefully investigated and appropriate action taken to prevent recurrence as far as possible. Copies of reports of accident investigations were furnished to interested parties when requested and otherwise used in our effort to bring about a diminution in the number of such accidents.

STEAM LOCOMOTIVES

One hundred and fifty-three accidents occurred in connection with steam locomotives, resulting in 15 deaths and 182 injuries. This represents a decrease of 11 accidents, a decrease of 3 in the number of persons killed, and a decrease of 43 in the number of persons injured, compared with the preceding year.

The chart on page 5 shows the relation between the percentage of defective steam locomotives and the number of accidents and casualties resulting from failures thereof and illustrates the effect of operating locomotives in defective condition.

Table VIII shows the various parts and appurtenances of steam locomotives and tenders which through failure have caused serious and fatal accidents. If the information contained in this table is taken advantage of and proper inspections and repairs are made in accordance with the requirements of the law and rules, many accidents will be avoided.

During the year 9 percent of the steam locomotives inspected by our inspectors were found with defects or errors in inspection that should have been corrected before the locomotives were put into use;

this represents an increase of 1 percent compared with the results obtained in the preceding year. There was an increase of 15 percent in the number of locomotives ordered withheld from service by our inspectors because of the presence of defects that rendered the locomotives immediately unsafe.

Detailed results of our inspections of steam locomotives of each railroad are shown in table XII, and a comparison of the condition of locomotives of each railroad over a period of years is shown in table XIII.

EXPLOSIONS AND OTHER BOILER ACCIDENTS

All of the 11 explosions that occurred in the fiscal year, in which 11 persons were killed and 29 injured, were caused by overheating of the crown sheets due to low water. There was a reduction of 1 in the number of persons killed and an increase of 14 in the number of persons injured from this cause as compared with the preceding year.

Four of the explosions were particularly violent; 1 of these accidents occurred while the locomotive was hauling a passenger train at an estimated speed of 50 to 55 miles per hour. Two employees were killed and 1 employee and 5 Pullman employees were injured. The force of the explosion tore the boiler from the running gear and hurled it forward 330 feet where it struck the track, rebounded and again struck the track and came to rest on its right side, in reverse position, near the east side of the track. The running gear, tender, and first 4 cars were derailed where the boiler first struck, and the track was torn up from this point for a distance of 350 feet. Parts of the wreckage were scattered in various directions up to 725 feet from the point of explosion. In another accident, in which no fatalities occurred but in which 10 employees and 3 nonemployees were injured, the explosion occurred about 38 minutes after arrival at a station while the locomotive and empty passenger train were being moved, together with another locomotive and its empty passenger train, from the final terminal station for the passenger train to the yard and enginehouse. The force of the explosion tore the boiler from the running gear and hurled it upward and partly over the other locomotive to which it was coupled. In its descent the boiler struck the back edge of the cab of the other locomotive and landed on top of the tender and a baggage car immediately to the rear, then rolled to the ground and came to rest upside down on the adjacent tracks about 154 feet from the point of explosion. Three employees were killed in another explosion while the locomotive was hauling a freight train at an estimated speed of 8 miles per hour. The force of the explosion tore the firebox casing sheets and mud ring, together with stays, braces, and various appurtenances, from the cylindrical part of the boiler. These parts were hurled forward 347 feet and came to rest on the track, where they

were struck by the front or low-pressure engine which had become separated from the rear frame due to breakage of the articulated casting. The cylindrical part of the boiler was torn from the rear engine, the running gear of which stopped 72 feet from the point of explosion. This part of the boiler, with torn firebox sheets attached to the inside throat sheet, was hurled forward 196 feet, where it alighted on the track, then skidded and came to rest on the north side of the track, 235 feet from the point of explosion, with attached parts of the firebox sheets extending across the track. In another explosion, in which 4 employees were killed and 1 nonemployee was injured, the force of the explosion tore the boiler from the running gear and it alighted on the outer rail of an adjacent siding, then rolled to the left and came to rest in an upright position 107 feet ahead and 40 feet to the left of the point of explosion. Parts of the back end or firebox casing sheets were blown off, and the part of the crown sheet to the rear of the combustion chamber, with the entire right firebox side sheet, a major portion of the left side sheet, and 2 small portions of the door sheet were blown out and ahead 491 feet and came to rest on the main track, where these parts were struck by the running gear. Parts of the wreckage were blown for various distances up to 562 feet from the point of the explosion.

Two employees were killed and nine employees were injured in the remaining seven accidents in which the explosions were less violent than those described in the foregoing paragraph.

Boiler and appurtenance accidents other than explosions resulted in the death of 1 person and injuries to 35 persons; this is a reduction of 3 deaths and 60 injuries as compared with the preceding year.

BOILER-FEEDING AND WATER-LEVEL-INDICATING DEVICES

Our investigations of two of the explosions, some results of which are shown in plates 10 and 12, revealed serious neglect in not maintaining the boiler-feeding devices in condition to perform their intended function. Repeated reports of impairment of capacity of these devices had been made over considerable periods of time prior to the explosions. All of these reports were signed for purporting to show that work had been done on the parts reported but later reports showed that the defective conditions continued until the explosions occurred. Repeated reports on the same defective condition should be sufficient warning that proper repairs had not been made and demonstrate the necessity of making such inspections and tests after reports of defective conditions, and after repairs have been attempted, that will definitely show whether or not the purpose of the repairs has been accomplished.

Serious neglect is also evident in some instances in the matter of maintaining water-level-indicating devices in good condition, which

includes thorough cleaning of gage cocks, water glass cocks, and water-column connections each time the boilers are washed, or more frequently if needed to prevent stoppages or partial stoppages of the water and steam passages, inspections and repairs sufficiently often and thorough to insure that these devices operate and indicate as intended, and the condition and proper placement of water glass lamps. Special attention is directed to plates 13, 14, 15, and 16 which show conditions conducive to false water-level indications and overheating of crown sheets found by our inspectors in the past fiscal year.

EXTENSION OF TIME FOR REMOVAL OF FLUES

One thousand one hundred and eighty-two applications were filed for extensions of time for removal of flues, as provided in rule 10. Our investigations disclosed that in 98 of these cases the condition of the locomotives was such that extensions could not properly be granted. Nineteen were in such condition that the full extensions requested could not be authorized, but extensions for shorter periods of time were allowed. Seventy-two extensions were granted after defects disclosed by our investigations were required to be repaired. Twenty-nine applications were canceled for various reasons. Nine hundred and sixty-four applications were granted for the full period requested.

LOCOMOTIVES PROPELLED BY POWER OTHER THAN STEAM

There was an increase of four in the number of accidents occurring in connection with locomotives other than steam and an increase of four in the number of persons injured as compared with the preceding year. No deaths occurred in either year.

During the year 6 percent of the locomotives inspected by our inspectors were found with defects or errors in inspection that should have been corrected before the locomotives were put into use; this percentage is the same as in the preceding year. There was an increase of five in the number of locomotives ordered withheld from service by our inspectors because of the presence of defects that rendered the locomotives immediately unsafe.

SPECIFICATION CARDS AND ALTERATION REPORTS

Under rule 54 of the Rules and Instructions for Inspection and Testing of Steam Locomotives, 225 specification cards and 6,786 alteration reports were filed, checked, and analyzed. These reports are necessary in order to determine whether or not the boilers represented were so constructed or repaired as to render safe and proper service and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found.

Under rules 328 and 329 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, 447 specifications and 39 alteration reports were filed for locomotive units and 100 specifications and 91 alteration reports were filed for boilers mounted on locomotives other than steam. These were checked and analyzed and corrective measures were taken with respect to discrepancies found.

LEGAL

Based upon investigations made by the Bureau, 1 case of violation of the rules and instructions for inspection and testing of steam locomotives and tenders and their appurtenances, comprising 17 counts, was transmitted to a United States attorney for prosecution. This case is now pending in the district court.

APPEALS

No formal appeal by any carrier was taken from the decisions of any inspector during the year.

LOCOMOTIVES AND ACCIDENT PREVENTION

The purpose of the Locomotive Inspection Act is to promote the safety of employees and travelers upon railroads; the act makes it unlawful for any railroad to use or permit use on its line of any locomotive unless said locomotive and all parts and appurtenances thereof are in proper condition and safe to operate without unnecessary peril to life or limb, and provides for a general safety standard through the promulgation of rules and instructions for inspection and testing. It has been found that these rules and instructions reduce the hazards of locomotive operation in practically direct proportion to the degree of compliance.

The original act became effective July 1, 1911, and to and including 1915 it applied only to boilers and their appurtenances; during that period there was a steady and substantial improvement in the condition of these parts. An amendment, effective early in the fiscal year ended June 30, 1916, extended the provisions of the act to include the entire locomotive and thereafter the scope of the work of the Bureau was very considerably broadened. About this time the volume of traffic increased with resultant tendency on the part of the railroads to neglect inspections and short-cut repairs, which in turn caused an increase in the number of defective locomotives with corresponding increase in the number of accidents and casualties. The percentage of locomotives inspected by our inspectors which were found defective in the year ended June 30, 1917, was 54.5, and thereafter, until after the fiscal year ended June 30, 1923, in which 65 percent of the locomotives

inspected by our inspectors were found defective, it was not possible to effect improvement due to absence of sufficient appropriations to further the work of the Bureau.

Vast strides have been made in improving the general condition of locomotives since 1924 due to increased funds available to the Bureau and a realization on the part of the railroads that more effective use can be made of locomotives maintained in condition to comply with the established rules and instructions. The percentage of locomotives found defective in the fiscal year ended June 30, 1940, reached a low of 8 percent, and this percentage increased to 9 percent in the fiscal year ended June 30, 1941. This represents 1 percent recession in the condition in the fiscal year ended June 30, 1941, as compared with the preceding year. There was a material increase in the total number of defects found and reported by our inspectors as compared with the preceding year, and there was an increase of 15 percent in the number of steam locomotives ordered withheld from service because of the presence of defects that rendered the locomotives unsafe. Under ordinary conditions these results need not necessarily be particularly alarming since some variations can be expected from year to year; however, under present circumstances special significance is necessarily attached thereto because of the shortage of material and skilled labor. All possible measures should be taken to increase the thoroughness of inspections and to apply timely and substantial repairs to all parts upon which there is any doubt as to safety and dependable performance.

The practice, still too often indulged in, of applying temporary repairs in the hope that the locomotive will make a successful trip and that more adequate repairs may be applied thereafter when the time is most convenient, has been productive of many failures on the line of road; these failures, in addition to increasing the peril to life and limb of employees and others and increasing the ultimate cost of repairs, result in delay to the train involved and frequently affect the orderly movement of other trains. Avoidance of failures of locomotives on the line of road is an essential component of satisfactory railroad performance and it is therefore essential that the practice of applying temporary repairs of the character indicated be reduced to the absolute minimum.

Before a locomotive is started on any trip it should be known that all parts and appurtenances are in safe and suitable condition for service rather than to assume, as is sometimes done, that if the locomotive arrived under its own power it can go out again. All parts to which repairs have been made, the condition or capacity of which may not be determinable by visual inspection, such as air compressors, injectors, and feed water pumps, should be appropriately tested for the output required under service conditions in addition to the usual examinations

made when a locomotive is being prepared for service, since mere observation that these parts "work" when a locomotive is at the terminal is not sufficient to determine whether or not their capacity has been restored. In investigations of accidents we sometimes find reports on the defect that caused the accident repeated many times until failure eventually occurred, together with signatures on the reports indicating that the reported work had been done, or at least that repairs to the reported defects had been attempted each time a report was made. This is proof that the safe repairs required to secure dependable operation of the locomotive had not been made and that labor and time had been wasted.

Complexity of the various appurtenances installed on modern locomotives, coupled with the placing in service of a large number of older locomotives which have been out of service for periods ranging up to 10 years or more, many of which are practically obsolete and therefore not well adapted to the giving of satisfactory performance under present conditions, and the intensive use of all locomotives now in service necessitate increased vigilance on the part of all concerned to effectuate the purpose of the act and to comply with the proclamation of the President, dated August 18, 1941. This proclamation calls upon the National Safety Council to mobilize its nation-wide resources in leading a concerted and intensified campaign against accidents, and also calls upon every citizen, in public or private capacity, to enlist in this campaign and do his part in preventing wastage of human and material resources of the nation through accidents.

Continuous improvements have been made in design and construction of locomotives since the inception of the use of steam power on railroads and improvements will continue, in some measure, in new production during the emergency. All of the outstanding improvements in locomotive design and construction, as with practically all other mechanisms, have been brought about by the process of evolution rather than revolution. All have gone through periods of trial and adjustment, and many have been materially changed from the original conception before satisfactory performance could be obtained.

It therefore cannot be expected that major changes in design, construction methods, or practices will produce any appreciable beneficial effect in time to ease the current and prospective general situation. On the contrary, attempts to produce such changes, due to the accompanying necessary variation in established practices of the builders and the railroads, the necessity for close observation and supervision over the trial periods, and the changes in or the transfer of skill that may be required of the builders' employees and the railroads' maintenance forces, would delay production of locomotives, absorb manpower that could well be used for immediate and more

important purposes, and result in delays to repairs because of interruptions in the established orderly work of the maintenance forces. In the absence of certainty that the merits of any major changes in design and methods of construction that may be proposed would warrant immediate and widespread adoption irrespective of the effects on production and the skilled labor situation, efforts to build and use locomotives involving designs and constructions that have not fully justified themselves through general use should, for the common good, be held in abeyance until the cessation of the emergency.

ACKNOWLEDGMENT

I wish to acknowledge and express my sincere appreciation for the fine spirit of cooperation of the entire personnel of the Bureau and to our inspectors for the energy and good judgment exercised in the performance of their duties.

JOHN M. HALL,
Director.

ACCIDENTS AND CASUALTIES RESULTING FROM THE FAILURE OF STEAM LOCOMOTIVES AND TENDERS AND THEIR APPURTENANCES DURING THE FISCAL YEAR ENDED JUNE 30, 1941, BY ROADS

[A star (*) indicates accidents taken from records of the Bureau of Statistics of the Interstate Commerce Commission. A double star (**) indicates accidents not properly reported, as required by rules 55 and 162. Complete investigations, therefore, could not be made, inasmuch as the Bureau was not apprised of the accidents in sufficient time after they occurred to permit them to be properly investigated.]

ALTON RAILROAD:

*August 4, 1940, locomotive 4399, Mexico, Mo. Employee was cut by a piece of wire which was being used to hold tender-cabin door open; one injured.
One accident; one injured.

ATCHISON, TOPEKA & SANTA FE RAILWAY:

August 10, 1940, locomotive 728, Antioch, Calif. Crown-sheet failure caused by overheating due to low water; one injured.

November 26, 1940, locomotive 3766, Bond, N. Mex. Left main pin and back end of main rod overheated and the brass lost out, causing the eccentric crank arm to work off main pin and resulting in damage to the valve gear; pound on left side of locomotive was reported on November 25; one injured.

December 22, 1940, locomotive 3845, Hinkley, Calif. Employee slipped and fell, caused by having oil on his shoes due to having stepped into waste oil on top of fuel-oil tank; one injured.

January 11, 1941, locomotive 1663, Barstow, Calif. Water-crane hook slipped out of crane handle, causing employee to lose his balance and fall from top of tender; hook was smeared with fuel oil and design of hook permitted it to become disengaged easily; one injured.

May 15, 1941, locomotive 1373, Cadiz, Calif. Top of tender behind fuel space was obstructed by a buffer plate which was stored there, causing employee to lose his footing and fall; one injured.

Five accidents; five injured.

ATLANTA, BIRMINGHAM & COAST RAILROAD:

April 25, 1941, locomotive 120, Birmingham, Ala. Lubricator filler plug broke off while being tightened; one injured.

*May 26, 1941, locomotive 106, Manchester, Ga. Main brake hanger pin broke off inside casting, allowing brake-beam hanger to drop down on rails; one injured.

Two accidents; two injured.

ATLANTIC COAST LINE RAILROAD:

July 10, 1940, locomotive 467, near Barnwell, S. C. Spring rigging became disconnected back of left front driver spring due to spring hanger pin having worked out; head of hanger pin had been worn away by chafing against the front driver tire; spring hanger was reported on June 16, 24 (two times), and 29 and July 7; one injured.

October 10, 1940, locomotive 1669, Hobgood, N. C. Driving-spring hanger broke through old fractures which extended through approximately 50 percent of cross-sectional area; one injured.

Two accidents; two injured.

BALTIMORE & OHIO RAILROAD:

August 17, 1940, locomotive 5141, Washington, D. C. Squirt hose leaking; hose had previously been burned and was defective when applied to this locomotive shortly before the accident; one injured.

November 11, 1940, locomotive 4520, Mount Vernon, Ohio. Tender water-spout hook bent in service; hook was deteriorated; one injured.

November 17, 1940, locomotive 4446, La Paz Junction, Ind. Handrail above Vanderbilt-type tender failed at both ends, causing employee to fall from running board; handrail was badly deteriorated and reduced in thickness at front-end break and break at back end occurred through old fracture; one injured.

November 24, 1940, locomotive 339, Cincinnati, Ohio. Power reversing gear inoperative due to nut stripped and cotter key sheared on end of slide valve stem inside of valve chest; one injured.

February 28, 1941, locomotive 2442, Chicago, Ill. Injector overflow valve stuck in closed position, due to valve, bonnet, and guide being improperly assembled; one injured.

Five accidents; five injured.

BOSTON & MAINE RAILROAD:

**October 11, 1940, locomotive 4022, Mechanicville, N. Y. Boiler check blew off stop valve when attempt was made to tighten the joint while under steam pressure; stop valve was not in proper alignment with check valve and threads on stop valve and in flange on the stop-valve side of the joint were worn and deteriorated; the bore of the flange was enlarged approximately 1/16 inch in diameter due to cracks from the bore; one injured.

November 6, 1940, locomotive 4020, Mechanicville, N. Y. Drain cock to hydrostatic lubricator broke while being tightened with a wrench to stop an oil leak; one injured.

December 23, 1940, locomotive 1008, Beverly, Mass. Coal on top of tank behind fuel space caused employee to slip and sprain his ankle; one injured.

March 17, 1941, locomotive 3630, Potter Place, N. H. Manually operated reverse lever difficult to operate; reversing gear reported on March 5 and 6; one injured.

June 29, 1941, locomotive 3670, Waltham, Mass. Insufficient clearance between reverse lever-latch guide bolt and ell at brake-valve connection; one injured.

Five accidents; five injured.

CENTRAL RAILROAD OF NEW JERSEY:

**March 31, 1941, locomotive 831, Jersey City, N. J. Bottom cap blew out of steam heat pressure regulator valve body, due to fracture at bottom rim of valve body; lower part of fracture was old break; one injured.

One accident; one injured.

CHICAGO & EASTERN ILLINOIS RAILROAD:

**August 30, 1940, locomotive 1012, near Momence, Ill. Glass in cab window shattered; cut by flying glass; one injured.

One accident; one injured.

CHICAGO & NORTH WESTERN RAILWAY:

August 12, 1940, locomotive 2526, near Blodgett, Ill. Trailing truck spring hanger broke through old fracture and a part of the broken hanger struck and cut the brake pipe hose on the first car of the passenger train, resulting in emergency application of the brakes; one injured.

August 29, 1940, locomotive (C. M. St. P. & P.) 912, Iron River, Mich. Insufficient clearance between manually operated reverse lever and back wall of cab; one injured.

October 5, 1940, locomotive 2902, Chicago, Ill. Gas explosion in firebox resulted in the fireman being burned; safety lugs on fire-door frame were worn, allowing excessive opening between fire door and frame; cover plate of inspection hole in fire door was stuck in open position; one injured.

*November 18, 1940, locomotive 2629, Chicago, Ill. Insufficient clearance between locomotive handhold at gangway and tender deck when on a curve; one injured.

December 10, 1940, locomotive 1561, Keesus, Wis. Manually operated reverse lever unexpectedly moved to full forward position, resulting in back draft through the open firebox door; one injured.

December 17, 1940, locomotive 3024, DeKalb, Ill. Employee's clothing caught on handle of tank feed pipe valve, causing him to fall from gangway step; extension stem and handle of tank valve projected too far outside of tender side wall; one injured.

December 28, 1940, locomotive 2169, Milwaukee, Wis. Piece of wire attached to cab-hood curtain caused injury to employee's eye; one injured.

April 7, 1941, locomotive (C. St. P. M. & O.) 366, Tigerton, Wis. Wire protruded from seat-box cushion; one injured.

June 30, 1941, locomotive 1767, near Cavour, S. Dak. Crown-sheet failure caused by overheating due to low water; one injured.

Nine accidents; nine injured.

CHICAGO, BURLINGTON & QUINCY RAILROAD:

*July 4, 1940, locomotive 5622, Savanna, Ill. Insufficient clearance between tender buffer plate and handhold at gangway when on a curve; one injured.
One accident; one injured.

CHICAGO GREAT WESTERN RAILWAY:

**December 1, 1940, locomotive 856, Frederickburg, Iowa. Nos. 1 and 3 grate rocker bars and 26 units of grates were burned out. Engineer fell from gangway while attempting to make emergency repairs; one injured.
One accident; one injured.

CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC RAILROAD:

January 5, 1941, locomotive 387, Freeport, Ill. Mechanically operated fire door closed unexpectedly, catching fireman's hand, due to operating lever slipping off air operating valve piston extension; operating-lever fulcrum pin, pin hole, and stationary fulcrum jaws were badly worn; one injured.

March 4, 1941, locomotive 379, Miles City, Mont. Undesired emergency application of brakes, caused by fractured train line at rear of tender; coupler yoke key was longer than standard and end of key had fouled and bent the train line at point of fracture; opening in bottom of cast-steel end sill was not properly located to permit application of retaining pin to standard-length coupler yoke key; two injured.

April 24, 1941, locomotive 105, Sturtevant, Wis. Flue failed at defective safe end weld; one injured.

Three accidents; four injured.

CHICAGO, ROCK ISLAND & PACIFIC RAILWAY:

**July 31, 1940, locomotive 887, Rome, Ill. Undesired movement of manually operated reverse lever to full forward position, caused by defective valve gear; one injured.

One accident; one injured.

DELAWARE AND HUDSON RAILROAD:

July 16, 1940, locomotive 1116, near Wells Bridge, N. Y. Backfire caused by displacement of extension smokestack in front end, due to three of the six supporting bolts losing out; one injured.

**March 7, 1941, locomotive 1013, Hudson, Pa. Derailment of tender and three cars, caused by front engine-truck frame being in contact with swing bolster which prevented free side swing of the truck and caused truck wheels to derail on a curve; truck swing link pins and bushings were worn, due to lack of lubrication, and long pins through lower ends of swing links and bolster were bent downward which allowed the truck frame to contact swing bolster; work reports indicated that truck frame and bolster had been fouling for some time; one injured.
Two accidents; two injured.

DELAWARE, LACKAWANNA & WESTERN RAILROAD:

December 8, 1940, locomotive 1615, Corning, N. Y. Hexagon nut was thrown against clear-vision window, breaking the glass and injuring the fireman's eye; apparently this nut had worked off bolt in footboard brace; one injured.

*January 8, 1941, locomotive 992, Haynes, N. Y. Tender axle broke; four injured.

January 9, 1941, locomotive 203, Scranton, Pa. Insufficient clearance between locomotive and tender when on a curve; one injured.

**April 24, 1941, locomotive 1402, near Dalton, Pa. Employee's hand was cut on a sharp end of a cotter pin which protruded beyond the side of nut on fire-door hand-lever fulcrum stud; one injured.

Four accidents; seven injured.

DENVER & RIO GRANDE WESTERN RAILROAD:

**October 22, 1940, locomotive 771, Salida, Colo. Coal on tender behind fuel space; one injured.

January 30, 1941, locomotive 1605, Green River, Utah. Power reversing gear was difficult to operate due to insufficient lubrication; reversing gear reported very difficult to operate on January 23 and 26; one injured.

February 4, 1941, locomotive 1804, Denver, Colo. Crown-sheet failure caused by overheating due to low water; 13 injured.

Three accidents; 15 injured.

DETROIT, TOLEDO & IRONTON RAILROAD:

**February 20, 1941, locomotive 703, Rosewood, Ohio. Approximately one-half of the rim of right front engine-truck wheel broke off, causing locomotive to derail and turn over on its side; failure occurred through old crack in the plate near rim fillet which progressed circumferentially and turned into and outwardly through the rim; three injured.

One accident; three injured.

DULUTH, MISSABE & IRON RANGE RAILWAY:

*September 9, 1940, locomotive 1311, Brimson, Minn. Bell cord broke; one injured.

One accident; one injured.

ERIE RAILROAD:

September 13, 1940, locomotive 3308, Pymatuning, Pa. Coal board fell from rack and struck employee's foot; coal boards were below standard length; wing sheets to which rack castings were attached were bent outward at the top and flanges on rack castings were too short; one injured.

December 9, 1940, locomotive 3132, Overbrook, N. J. Oil cup on high-pressure air cylinder of air compressor broke off at threaded portion while attempts were being made to remove the oil-cup cap; corners of the boss on oil-cup cap were so badly worn that cap could not be removed with the usual wrench; one injured.

*December 13, 1940, locomotive 2936, Akron, Ohio. Coal board fell out of bracket; one injured.

*March 21, 1941, locomotive 3095, Pittston, Pa. Wedge from draw gear between locomotive and tender fell out due to the bolt through wedge which fastened the chain being broken off and the bolt through wedge and wedge casting sheared off; one injured.

Four accidents; four injured.

FLORIDA EAST COAST RAILWAY:

October 25, 1940, locomotive 802, near New Smyrna Beach, Fla. Combustion-chamber crown-sheet failure caused by overheating due to low water; two killed, six injured.

One accident; two killed, six injured.

FORT WORTH & DENVER CITY RAILWAY:

October 26, 1940, locomotive 454, Amarillo, Tex. Extension operating rod to air-compressor steam throttle became disconnected due to the cotter key which secured the rod to valve yoke bending and working out; one injured.

One accident; one injured.

GRAND TRUNK WESTERN RAILWAY:

*September 12, 1940, locomotive 7485, Detroit, Mich. Insufficient clearance between gangway handhold on locomotive and tender deck when on a curve; one injured.

One accident; one injured.

GREAT NORTHERN RAILWAY:

July 2, 1940, locomotive 1359, Fergus Falls, Minn. Handhold at locomotive gangway gave way due to nuts coming off bolt which secured top end of handhold; one injured.

July 30, 1940, locomotive 3091, near Herman, Minn. Manually operated reverse lever jerked to front end of quadrant, and while being moved to original position it suddenly jerked to rear of quadrant; reversing gear defective and had been reported on July 2 (two times), July 14 (two times), and July 29; one injured.

**September 18, 1940, locomotive 2033, Ray, N. Dak. Driving box ran hot; driving box had been overheated and blocked previously on this trip, but the blocking had worked out of position; driving-box journal was badly grooved and roughened due to having previously been cut; hot driving boxes and grease cellars had been reported repeatedly; one injured.

Three accidents; three injured.

GULF, MOBILE & OHIO RAILROAD:

April 11, 1941, locomotive 59, Louisville, Miss. Locomotive derailed, caused by right front driving-wheel tire slipping on wheel center; tire loosened and slipped 1 1/8 inches inward on wheel center due to insufficient shrinkage; one killed.

One accident; one killed.

ILLINOIS CENTRAL RAILROAD:

**December 23, 1940, locomotive 1432, Travalac, Ind. Main crank pin broke through old fracture which extended through approximately 60 percent of cross-sectional area; one injured.

**April 10, 1941, locomotive 1630, Whaley, Miss. Bell ringer became inoperative; one injured.

**May 28, 1941, locomotive 738, La Salle, Ill. Air bell ringer inoperative; bell ringer reported on May 21, 22, 24, and 28 (prior to accident); one injured.

**June 9, 1941, locomotive 8000, Futrell, Ky. Branch pipe from main reservoir pipe to air brake control valve chamber broke off at tee in main reservoir pipe, causing undesired application of brakes; one injured.

Four accidents; four injured.

INDIANA HARBOR BELT RAILROAD:

*August 15, 1940, locomotive 400, Riverdale, Ill. Brake adjusting rod broke off brake piston; one injured.

One accident; one injured.

KANSAS CITY SOUTHERN RAILWAY:

August 11, 1940, locomotive 480, Anacoco, La. Eccentric crank failed through old fracture which extended through approximately 75 percent of cross-sectional area; one injured.

*February 15, 1941, locomotive 902, Lanagan, Mo. Driving box saddle broke; two injured.

April 5, 1941, locomotive 903, Sallisaw, Okla. Two small flues broke off at safe end welds; overheated in welding; fire door was warped, permitting steam and hot water to enter the cab freely; one injured.

Three accidents; four injured.

LEHIGH VALLEY RAILROAD:

July 13, 1940, locomotive 3172, Luzerne, Pa. Blower valve stem threads stripped; threads badly worn; one injured.

August 24, 1940, locomotive 3205, Jersey City, N. J. Fire hose burst; hose weakened by chafing; one injured.

Two accidents; two injured.

LONG ISLAND RAILROAD:

*May 26, 1941, locomotive 37, Holbrook, N. Y. Whistle chain was caught on boiler; one injured.

One accident; one injured.

LOUISIANA & NORTH WEST RAILROAD:

February 21, 1941, locomotive 23, Homer, La. Crown-sheet failure caused by overheating due to low water; bottom water-glass cock was found in closed position; one killed.

One accident; one killed.

LOUISVILLE & NASHVILLE RAILROAD:

August 2, 1940, locomotive 1912, near Butler, Ky. Crown-sheet failure caused by overheating due to low water; two injured.

August 22, 1940, locomotive 46, Paris, Ky. Collision, caused by inability to close throttle; throttle lever was not connected to the proper fulcrum pinhole, resulting in binding on quadrant; teeth at front end of quadrant were worn; one injured.

August 30, 1940, locomotive 1881, Crestwood, Ky. Driving-spring hanger broke through old fracture on each side near bottom of gib seat, permitting the front end of locomotive to drop and cause derailment of the locomotive and 14 cars; one injured.

October 8, 1940, locomotive 2055, North Birmingham, Ala. Handle of air-compressor throttle came off valve stem while being used, causing employee to fall from running board; handle retaining nut was missing; one injured.

**November 16, 1940, locomotive 1368, Stewart, Tenn. Eccentric rod broke; one injured.

December 9, 1940, locomotive 2212, Berry, Ky. Globe valve in steam line to cab radiator leaking; one injured.

*January 18, 1941, locomotive 1266, Mount Pleasant, Tenn. Clamps on smoke-box door were loose; one injured.

January 23, 1941, locomotive 2060, Boyles, Ala. Locomotive moved out of control when throttle became latched open and could not be closed by hand; throttle lever latch lifter had excessive lost motion and throttle quadrant was out of alignment; two injured.

**May 1, 1941, locomotive 168, Flomaton, Ala. Manually operated reversing gear difficult to operate; oil pipe to left valve was cracked through collar at connection to lubricator, allowing oil to leak out; one injured.

May 11, 1941, locomotive 2079, East St. Louis, Ill. Key at back end of left main-rod brass was missing; two setscrews for holding the key in place were loose; "Lined brass back end of L. M. rod" was reported on May 8; one injured.

Ten accidents; 12 injured.

MACON, DUBLIN & SAVANNAH RAILROAD:

June 17, 1941, locomotive 46, Franklinton, Ga. Whistle cord broke; one injured.

One accident; one injured.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE RAILWAY:

**October 21, 1940, locomotive 341, Superior, Wis. Valve-stem packing failed; one injured.

February 8, 1941, locomotive 4020, Medina Junction, Wis. Insufficient clearance between ashpan operating lever and ashpan; one injured.

June 29, 1941, locomotive 4001, Minneapolis, Minn. Cab handhold at gangway fouled corner of tender deck when locomotive was backed on a sharp curve; one injured.

Three accidents; three injured.

MISSOURI PACIFIC RAILROAD:

*September 17, 1940, locomotive 1494, Witherspoon, Ark. Window pane fell from cab window; one injured.

*December 21, 1940, locomotive 1516, Osawatomie, Kans. Fell from running board while making adjustment of check valve; one injured.

Two accidents; two injured.

NEW YORK CENTRAL RAILROAD:

October 19, 1940, locomotive 6701, Weehawken, N. J. Sliding sash of cab window fell out of frame due to improper fit; top and bottom of window frame were loose, permitting excessive vertical play between sash and frame grooves, and metal strip forming inner side of frame bottom groove was too low; one injured.

October 20, 1940, locomotive 5258, North Frankfort, N. Y. Pilot-beam bolt broke and threaded portion with nuts attached was thrown through front cab window of the fast-moving locomotive; bolt had been loose and turning in bolt hole; pilot bolts were reported loose on September 20, 24, October 2, 4, 5, 14, 16, and 17; one injured.

November 28, 1940, locomotive 2794, Mina, Ohio. Grate rod failed at weld; one injured.

December 13, 1940, locomotive 5370, Herkimer, N. Y. Cab and water-scoop heater valve broke off at turret end of adapter due to old fracture which extended approximately 75 percent of cross-sectional area of adapter; attempted to tighten valve while under steam pressure; one injured.

March 31, 1941, locomotive 4535, Chicago, Ill. Boiler check stuck open due to accumulations of scale; "Left boiler check leaking" was reported on March 14 and 22; three injured.

April 9, 1941, locomotive 5401, Pendleton, Ind. Part of a broken tender truck spring leaf on leading locomotive was thrown through cab window of the second locomotive; spring leaf apparently had been broken for some time; one injured.

Six accidents; eight injured.

NEW YORK, NEW HAVEN & HARTFORD RAILROAD:

July 17, 1940, locomotive 3231, Cedar Hill, Conn. Firebox door closed unexpectedly, catching employee's hand; right section of butterfly-type fire door was stuck on bottom of stoker distributor elbow, preventing the door from being latched properly; "Right firebox door striking elevator and sticks" was reported on June 7, and the fire door was rubbing on the elbow when the locomotive was inspected on July 31; one injured.

**September 17, 1940, locomotive 3560, Cedar Hill, Conn. Boiler-check flange joint failed while being tightened under pressure; steel flange was distorted and threads on brass boiler-check casting that engaged the threads on flange were worn and stripped; the construction and assembly of the joint were such as to permit undue stress on the threads on check casting when flange bolts were tightened; one killed.

*November 22, 1940, locomotive 3333, Meriden, Conn. Eccentric blade broke; one injured.

*November 30, 1940, locomotive 3605, New Haven, Conn. Insufficient clearance between cab handhold at gangway and tender deck when on a curve; one injured.

March 11, 1941, locomotive 3507, Reads, Conn. Right sander was stopped up; employee fell from running board while attempting to remove sander clean-out plug; square on end of clean-out plug was not high enough to hold wrench properly; one injured.

Five accidents; one killed, four injured.

NORFOLK & WESTERN RAILWAY:

December 16, 1940, locomotive 410, Pulaski, Va. Throttle lever latch moved to wide-open position when unlatched; one injured.

One accident; one injured.

NORTHERN PACIFIC RAILWAY:

December 18, 1940, locomotive 2238, Three Forks, Mont. Side rod broke and section of the broken rod swung around and punched holes in outside and inside throat sheets; the break occurred at a dressed-out indentation in the top flange which had been previously cut by a tire that came off the wheel center; sander nozzles were stopped up; sanders had been reported repeatedly; two killed.

One accident; two killed.

PENNSYLVANIA RAILROAD:

July 4, 1940, locomotive 4697, Mingo Junction, Ohio. Crown-sheet failure caused by overheating due to low water; feed water heater and pump was erratic in operation and at times did not supply rated capacity to the boiler; feed water heater and pump was reported 13 times in the 30 days preceding the accident; one killed, one injured.

*July 21, 1940, locomotive 6828, Creighton, Pa. Steam-heat connector on tender became disconnected at elbow, fell to the track and lodged in heel of switch, causing derailment of car; one injured.

September 5, 1940, locomotive 3868, Emsworth, Pa. Collar broke off brake-pipe union under tender; ends of brake pipe not properly lined up, placing undue strain on the union; brake-pipe union was reported leaking on August 20 and 28 and September 1, 2, and 5; one injured.

*October 8, 1940, locomotive 8912, Logansport, Ind. Insufficient clearance between gangway step and cab handhold when on a sharp curve; one injured.

October 25, 1940, locomotive 4043, Fort Wayne, Ind. Air compressor stopped; compressor governor did not function properly due to a leaky pin valve; pin valve and seat were cut and there was an accumulation of foreign matter in the diaphragm chamber, particles of which were large enough to lodge under the valve and hold it open; one injured.

January 1, 1941, locomotive 3729, Bodine, Pa. Flue failed at defective safe end weld; mechanically operated fire door did not close fully when released; one injured.

March 10, 1941, locomotive 6793, Altamont, Ill. While employee was attempting to move stoker conveyor trough slide plate his foot slipped into an 18-inch opening at the front end of the trough and was caught by the conveyor screw and crusher; front slide plate was stuck fast under shovel sheet, ahead of the opening in the trough which it was designed to close, by solidified coal dust and foreign matter; one injured.

May 3, 1941, locomotive 3517, Altoona, Pa. Slide at bottom of coal gate dropped down and struck employee's foot; pin for holding coal-gate slide up and chain to which pin was attached were missing; chain not properly secured to coal gate; one injured.

*May 2, 1941, locomotive 6854, East Altoona, Pa. Bonnet of lubricator shut-off valve came off; one injured.

May 9, 1941, locomotive 4512, Mount Vernon, Ohio. Sanders inoperative; foreign matter in the sand; one injured.

Ten accidents; 1 killed, 10 injured.

PITTSBURGH & LAKE ERIE RAILROAD:

**March 27, 1941, locomotive 9011, Youngstown, Ohio. Insufficient clearance between cab handhold at gangway and tender deck when on a curve; one injured.

One accident; one injured.

READING COMPANY:

May 17, 1941, locomotive 1094, Allentown, Pa. Tender cistern anchor bolt at water leg broke during impact; cross-section of the broken bolt showed 80 percent old fracture; one injured.

One accident; one injured.

ST. LOUIS SOUTHWESTERN RAILWAY:

*July 18, 1940, locomotive 567, Dawson, Tex. Bell cord became tangled; one injured.

One accident; one injured.

SEABOARD AIR LINE RAILWAY:

January 5, 1941, locomotive 855, Houston, Fla. Manually operated reverse lever jerked to full forward position, catching employee's foot between lever and boiler head; one injured.

February 18, 1941, locomotive 515, Henderson, N. C. Fire-door hand lever broke through fracture at the point of a previous break which had been repaired by fusion welding; one injured.

March 26, 1941, locomotive 448, Raleigh, N. C. Coupler knuckle pin broke; one injured.

March 30, 1941, locomotive 855, Olustee, Fla. Reverse lever jerked to full forward position when unlatched, catching employee's foot between lever and foot rest; "Can't hook this engine up where she should be worked account of kicking back" was reported on March 23; two injured.

June 8, 1941, locomotive 417, Winter Haven, Fla. Squirt-hose valve worked open or was accidentally opened; valve opened easily and operating handle was elliptical in shape and was located in an exposed position where it was subject to liability of opening if contacted by a person using the gangway; one injured.

Five accidents; six injured.

SOUTHERN RAILWAY:

**August 16, 1940, locomotive 1219, Haylow, Ga. Section of tender coal board broke off, causing employee to fall; coal board was too wide for its supporting pocket; one injured.

August 18, 1940, locomotive 6615, Meridian, Miss. Uneven surface of walkway on top of feed water tank caused employee to sprain his ankle; one of the two boards in walkway was sagged downward $1\frac{1}{2}$ inches below the other board, due to insufficient support; one injured.

**September 2, 1940, locomotive 5011, Asheville, N. C. Grate shaker bar slipped off shaker post; excessive lost motion in grate shaker rigging; one injured.

January 5, 1941, locomotive 6355, Stearns, Ky. Grate shaker bar slipped off shaker post; top of the shaker post was too close to opening in the deck to permit shaker bar to slip onto post properly; one injured.

Four accidents; four injured.

SOUTHERN PACIFIC—LINES EAST:

**June 2, 1941, locomotive (T. & N. O.) 919, El Paso, Tex. Broken radial crown stay blew out of wrapper sheet while being calked with an air hammer while the boiler was under pressure; stay broke through a 50 percent old fracture near firebox sheet; outer end of stay had a tapered head, $1\frac{1}{4}$ inches at the small diameter, while the stay hole in wrapper sheet was tapped for a straight-end stay, $1\frac{1}{16}$ inches in diameter, the stay entered wrapper sheet at an acute angle and there was no thread engagement between the stay and wrapper sheet when the stay was applied; one injured.

One accident; one injured.

SOUTHERN PACIFIC—LINES WEST:

July 27, 1940, locomotive 3753, Battle Mountain, Nev. Main pin broke through old fracture which extended through approximately 75 percent of cross-sectional area; one injured.

**August 5, 1940, locomotive 3806, Gallinas, N. Mex. Gangway handhold broke in the bend near top fastening to cab; one injured.

**August 23, 1940, locomotive 2950, Wendling, Oreg. Manually operated reverse lever slipped out of quadrant and struck employee; lever was reported loose in quadrant on August 22 and 25; one injured.

September 6, 1940, locomotive 3275, near Lomo, Calif. Piston rod broke through old fracture at front end of key way, inside crosshead fit, knocking out front cylinder head; piston rod was a poor fit in crosshead; rod had not been ground in as required by the carrier's standard practice; two injured.

October 26, 1940, locomotive 3669, Valery, Nev. Packing gland of power-reversing cylinder worked out, causing the locomotive to reverse itself; the threaded gland was loose in cylinder; one injured.

January 20, 1941, locomotive 5012, San Gabriel, Calif. Superheater unit broke off at ball joint where attached to superheater header; unit had been overheated at the time ball joint was applied; one injured.

**February 6, 1941, locomotive 5011, Willcox, Ariz. Throttle rod was fouling in opening in sand dome which made it difficult to operate throttle properly and control the slack, resulting in rough starting of the train; throttle reported on February 2, 5, 6, 14, March 2, 14, and 16; one injured.

*February 6, 1941, locomotive 4029, Cruzatte, Oreg. Fire went out and train stalled in a tunnel; cut-out valve for oil-supply pipe closed and shut off fuel-oil supply to the firebox; pipe through which the operating cable passed from cab roof down through the floor had rusted in two and pipe shifted and shortened the cable; one injured.

May 3, 1941, locomotive 4199, Cooper, Calif. Crown-sheet failure caused by overheating due to low water; four killed, one injured.

June 26, 1941, locomotive 3411, Douglas, Ariz. Bonnet blew out of injector operating valve; threads on bonnet were worn, bonnet fit in valve was oversize, and blown-out bonnet could be inserted to bonnet joint without thread engagement. A new bonnet inserted to bonnet joint was $\frac{1}{2}$ inch loose; one injured.

Ten accidents; 4 killed, 11 injured.

SPokane, PORTLAND & SEATTLE RAILWAY:

*July 5, 1940, locomotive 3120, Metolius, Oreg. Driving-spring hanger broke; one injured.

One accident; one injured.

STEELTON & HIGHSPIRE RAILROAD:

November 9, 1940, locomotive 28, Steelton, Pa. Crown-sheet failure caused by overheating due to low water; right boiler check shut-off valve opening and right check body opening into the boiler were greatly restricted by mud and scale; right tank valve was out of the well and inoperative due to a large rag being wound around valve stem which obstructed the opening; one injured.

One accident; one injured.

TEXAS & PACIFIC RAILWAY:

May 15, 1941, locomotive 471, Fort Worth, Tex. Steam-heat connection on front of locomotive dropped down and caught in switch frog, bending footboard down and throwing employee, who was riding footboard, to the ground; loop in bottom of supporting coil spring on the flexible metallic conduit connection was worn through and evidently the additional safety hanger provided for this conduit was not in use at time of the accident; one injured.

May 29, 1941, locomotive 300, near Iatan, Tex. Crown-sheet failure caused by overheating due to low water; three injured.

Two accidents; four injured.

UNION PACIFIC RAILROAD:

July 22, 1940, locomotive (O. S. L.) 2562, Minidoka, Idaho. Arch tube plug blew out of throat sheet, due to not having been properly tightened; attempted to tighten while under steam pressure; two injured.

July 23, 1940, locomotive (O. S. L.) 2003, Alexander, Idaho. Superheater flue broke off near back flue sheet, due to excessive grooving on the water side; flues reported leaking on June 12, 26, and 27 and July 3, and on July 6 the boiler foreman reported "I recommend engine be removed from service account bad flues"; one injured.

**November 21, 1940, locomotive 9036, Lawrence, Kans. Stoker failed due to a piece of wire being wedged between screw and housing of elevator; one injured.

March 1, 1941, locomotive 9027, Big Springs, Nebr. Steam pipe to hydrostatic lubricator pulled out of collar at valve connection on cab turret; failure occurred in the brazing around edge of collar; brazing did not extend into the collar; collar had not been belled at bottom or tapered at top for receiving spelter metal during the brazing operation in accordance with standard practice; one injured.

April 26, 1941, locomotive (O. S. L.) 598, Budge, Idaho. Locomotive derailed and turned over, caused by driving wheel tires heating from brake-shoe friction and slipping on wheel centers which kinked and broke track rail under the locomotive; one injured.

May 14, 1941, locomotive (L. A. & S. L.) 6012, Milford, Utah. Combination pilot dropped and fouled pavement of highway crossing, bending footboard under; inside hanger of No. 1 driver spring was broken and equalizer pin had pulled out of the outside hanger; head of the equalizer pin was broken off; inside hanger failed through about two-thirds old fracture and one-third badly crystallized metal; one injured.

*May 18, 1941, locomotive 4470, Ogden, Utah. Edge of footboard was warped, causing employee's foot to slip when he attempted to board engine; one injured.

June 14, 1941, locomotive (O. S. L.) 602, Ontario, Oreg. Employee fell from running board while attempting to adjust injector which was not supplying a normal quantity of water; one injured.

Eight accidents; nine injured.

VIRGINIAN RAILWAY:

August 8, 1940, locomotive 706, Besoco, W. Va. Marker bracket became disconnected from pilot beam, due to nut on supporting bolt working off; one injured.

April 1, 1941, locomotive 800, near Stewartville, Va. Crown-sheet failure caused by overheating due to low water; capacity of left injector was reduced due to a worn and pitted steam nozzle; injectors reported 22 times during the 60 days preceding the accident, 10 of these reports stating that the left injector would not pick up all the water or similar defects; three killed.

Two accidents; three killed, one injured.

WABASH RAILWAY:

February 12, 1941, locomotive 517, Adrian, Mich. Fireman's shovel struck on partly opened mechanically operated fire door; cap screw pin had worked out of left lower guide roller of horizontal fire door and caught on operating lever, preventing the left segment of fire door from opening properly; roller cap screw pin was loose in threads due to having been improperly applied; one injured.

**March 22, 1941, locomotive 665, Decatur, Ill. Mechanically operated fire door was inoperative; connection pin between the operating cylinder piston rod and union link had been removed to facilitate operation of fire door when the locomotive was without air pressure and the pin had not been replaced before the locomotive was set out for service; one injured.

Two accidents; two injured.

WASHINGTON TERMINAL COMPANY:

March 12, 1941, locomotive 26, Washington, D. C. Flue broke off at back flue sheet due to being reduced in thickness; outside of flue was deteriorated and interior of flue was badly cinder-cut; one injured.

April 4, 1941, locomotive 33, Washington, D. C. Flue failed near back flue sheet due to being reduced in thickness; flue had been heavily prossered and was badly cinder-cut internally and wasted away externally at the point of failure; two injured.

Two accidents; three injured.

WESTERN PACIFIC RAILROAD:

*June 3, 1941, locomotive 174, between Timpie and Ellerbeck, Utah. Brick from front arch brick wall fell into firebox; pool of oil which formed between fallen arch brick and burner exploded when brick was being removed; one injured.

One accident; one injured.

WHEELING & LAKE ERIE RAILWAY:

**August 9, 1940, locomotive 4311, Mingo Junction, Ohio. Insufficient clearance between vertical handhold at gangway and tender deck when on curve; one injured.

One accident; one injured.

**ACCIDENTS AND CASUALTIES RESULTING FROM THE FAILURE OF
LOCOMOTIVES OTHER THAN STEAM AND THEIR APPURTENANCES
DURING THE FISCAL YEAR ENDED JUNE 30, 1941, BY ROADS**

[A star (*) indicates accidents taken from records of the Bureau of Statistics of the Interstate Commerce Commission. A double star (**) indicates accidents not properly reported, as required by rule 335. Complete investigations, therefore, could not be made, inasmuch as the Bureau was not apprised of the accidents in sufficient time after they occurred to permit them to be properly investigated.]

ATCHISON, TOPEKA & SANTA FE RAILWAY:

*April 25, 1941, unit M-110, St. Joseph, Mo. Employee's shoe caught under loose edge of linoleum cab-floor covering, causing him to fall; one injured.

One accident; one injured.

BALTIMORE & OHIO RAILROAD:

May 20, 1941, unit 59-A, near Wellsboro, Ind. Explosion and fire occurred in crank case of Diesel-electric unit caused by an overheated piston; misalignment of the piston-cooling oil tube and the funnel on the piston resulted in interference which broke the oil tube and prevented the cooling oil from being discharged on the piston; one injured.

One accident; one injured.

CHICAGO & NORTH WESTERN RAILWAY:

*November 19, 1940, unit 901, Chicago, Ill. Injured while replacing ventilator fan belt on pulley in engine compartment; one injured.

One accident; one injured.

CHICAGO, BURLINGTON & QUINCY RAILROAD:

July 31, 1940, unit 9909, near Ethlyn, Mo. Crank-case explosion occurred in No. 1 engine, caused by overheated bearing; lubricating oil lines stopped up with bits of rags; one injured.

April 9, 1941, unit 9911-B, Neponset, Ill. Engine-room ceiling plate fell from its position, striking employee; one injured.

Two accidents; two injured.

CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC RAILROAD:

January 3, 1941, unit E-1, Rockdale, Wash. Explosion occurred in firebox of heater boiler; pressure in oil standpipe dropped to zero, apparently allowing the fire to go out and oil to drip into firebox. When pressure in standpipe was suddenly increased the oil struck the hot side brick and ignited the oil and gas in the firebox; slight leak in heater pipe inside oil-pressure standpipe; excessive openings in cover plate for oil-burner pipe permitted the fire to come out of firebox freely; one injured.

One accident; one injured.

CLEVELAND UNION TERMINAL COMPANY:

**February 16, 1941, unit 209, Cleveland, Ohio. Train-line air hose at rear of locomotive broke, causing emergency application of the brakes; one injured.

One accident; one injured.

GREAT NORTHERN RAILWAY:

July 24, 1940, unit 2303, near Kalispell, Mont. Derailment of gas-electric motor car, caused by failure of rivets of motor nose-support bracket and failure of auxiliary hanger; one injured.

One accident; one injured.

INTERNATIONAL-GREAT NORTHERN RAILROAD:

**December 20, 1940, unit (N. O. T. & M.) 502, near Kirk, Tex. Main gaso-line engine backfired into carburetor, caused by intake valve in left back cylinder not seating. Failure of intake valve was caused by bearing metal having melted out of left back connecting-rod bearing on crank shaft, allowing piston to strike the intake valve and bend the valve rocker arm; one injured.

One accident; one injured.

MISSOURI PACIFIC RAILROAD:

**May 12, 1941, unit 802, Sedalia, Mo. Injured while attempting to crank Diesel-electric locomotive by hand; electric starting device inoperative due to weak batteries; one injured.

One accident; one injured.

SEABOARD AIR LINE RAILWAY:

March 25, 1941, units 3008 and 3014, Wolfolk, Fla. Burned by hot water which escaped from steam-heat hose between the two units when attempt was made to disconnect the hose; one injured.

One accident; one injured.

TABLE XII.—Number of steam locomotives inspected,

Table with columns for locomotive parts (e.g., Air compressors, Arch tubes, Ashpans and mechanism) and regions (e.g., New York, Chicago & St. Louis, Pennsylvania, etc.). Rows are numbered 1 to 63, with a summary section at the bottom.

found defective, and ordered from service, etc.—Continued

Table with columns for locomotive parts and regions (e.g., Pere Marquette, Philadelphia, Bethlehem & New England, etc.). Rows are numbered 2 to 63, with a summary section at the bottom.

TABLE XIII.—Summary of comparison of the percentage of steam locomotives inspected and found defective, with the number ordered out of service for the years ended June 30, on roads reporting on 10 or more locomotives

Table with columns: Road, Percentage inspected defective (1941-1923), Ordered out of service (1941-1923). Rows include various railroad lines like Akron, Canton & Youngstown, Alabama, Tennessee & Northern, etc.

See footnotes at end of table.

TABLE XIII.—Summary of comparison of the percentage of steam locomotives inspected and found defective, with the number ordered out of service for the years ended June 30, on roads reporting on 10 or more locomotives—Continued

Table with columns: Road, Percentage inspected defective (1941-1923), Ordered out of service (1941-1923). Rows include various railroad lines like High Point, Thomasville & Denton, Houston Belt & Terminal, etc.

See footnotes at end of table.

TABLE XIII.—Summary of comparison of the percentage of steam locomotives inspected and found defective, with the number ordered out of service for the years ended June 30, on roads reporting on 10 or more locomotives—Continued

Road	Percentage inspected defective							Ordered out of service						
	1941	1940	1931	1929	1927	1925	1923	1941	1940	1931	1929	1927	1925	1923
Savannah & Atlanta	6	25	19	80	67	73	68	1	4	0	0	0	2	3
Seaboard Air Line	7	3.5	9	37	56	51	55	9	2	2	24	43	33	23
South Buffalo	16	9	39	23	29	75	0	0	0	8	0	1	0	0
Southern Pacific, lines east	1.5	1.1	3.3	5	13	30	47	0	0	1	3	10	37	28
Southern Pacific, lines west	10	7	11	24	27	33	38	12	4	13	47	50	51	24
Southern Pacific of Mexico	79	54	0	30	100	100		7	5	0	2	3	1	
Southern	7	6	9	12	24	36	59	12	15	15	13	38	56	177
Spokane International	0	12	9	13	28	0	37	0	0	0	0	0	0	2
Spokane, Portland & Seattle	5	6	22	22	33	32	60	1	0	1	1	2	4	13
Steelton & Highspire	19	14	19	24	48			0	0	1	0	2		
Tennessee, Alabama & Georgia	25	7						0	1					
Tennessee Central	23	23	14	47	65	74	89	4	3	0	14	40	23	63
Tennessee Coal, Iron & Railroad	23	50	7	38	67	40	50	0	1	0	0	0	0	0
Terminal R. R. Assn. of St. Louis	22	15	32	41	44	62	76	4	6	4	0	3	1	6
Texas & Pacific	9	2	0	1	12	16	62	0	1	0	1	3	1	91
Texas-Mexican	0	29	27	43	50	33	50	0	0	0	0	1	0	1
Texas Pacific-Missouri Pacific of New Orleans	17	23	0	4	10	57	83	0	0	0	0	0	2	0
Toledo, Peoria & Western	0	0	25	65	88	87	93	0	0	2	4	7	2	4
Toledo Terminal	11	4.6	5	45	35	3	41	0	0	0	0	0	0	3
Toronto, Hamilton & Buffalo	0	0	0	0	0			0	0	0	0	0	0	0
Union Pacific ¹²	13	9	9	17	20	30	41	17	16	2	8	17	19	26
Union	23	16	11	9	29	80	10	4	1	1	2	0	0	2
Upper Merion & Plymouth	36	33	28	60	62			11	4	0	7	8		
Utah	0	0	0	11	4	26	19	0	0	0	0	0	0	0
Virginian	43	38	17	22	50	58	75	13	8	1	0	2	5	45
Wabash	2.3	2.2	0	1.5	6	47	82	2	2	0	1	2	21	89
Washington Terminal	33	12	0	10	43	40	89	0	1	0	0	1	1	2
Western Maryland	1.9	2.3	13	26	42	54	76	0	1	1	3	13	22	90
Western Pacific	10	3.6	16	25	19	36	37	0	2	5	9	1	13	9
Wheeling & Lake Erie	7	12	8	42	55	67	74	3	1	1	7	10	20	31
Less than 10, discontinued roads, and industrial locomotives	21	22	32	40	51	56	56	105	94	279	415	758	826	638
All roads	9	8	10	21	31	46	65	560	487	688	1,490	2,539	3,637	7,075

¹ Atlanta, Birmingham & Atlantic prior to 1927.

² Includes Buffalo & Susquehanna and Buffalo, Rochester & Pittsburgh, 1933-41.

³ Statistics prior to 1927 included in Baltimore & Ohio, lines east.

⁴ Includes Grand Trunk Western, 1925-27.

⁵ Includes former Hocking Valley, 1931-41.

⁶ Included in Canadian National, 1925-27.

⁷ Included in Atchison, Topeka & Santa Fe, 1923.

⁸ Includes New Orleans Great Northern, 1935-41. Includes Mobile & Ohio and Gulf, Mobile & Northern, 1941.

⁹ Includes Alabama & Vicksburg, Gulf & Ship Island, Vicksburg, Shreveport & Pacific, and Yazoo & Mississippi Valley, 1927-41.

¹⁰ Includes Portland Terminal, 1932-41.

¹¹ Includes Boston & Albany, Cleveland, Cincinnati, Chicago & St. Louis, Michigan Central, New York Central, lines west, and Peoria & Eastern, 1937-41.

¹² Includes Los Angeles & Salt Lake, Oregon Short Line, Oregon-Washington R. R. & Navigation, and St. Joseph & Grand Island, last 6 months 1936-41.

NOTE.—Omitted statistics not comparable, due to consolidations, separations, changes in corporate identity, carrier not in existence in year shown, less than 10 locomotives, etc.

Fractional percentages not shown unless percent defective is less than 5, otherwise nearest whole number is given.

ILLUSTRATIONS OF LOCOMOTIVE BOILER EXPLOSIONS
OR CROWN SHEET FAILURES AND
LOCOMOTIVE DEFECTS