split point switches. Spring rail frogs are being used with practically all new rail laid, resulting in a smoother riding track. The protecting of the men engaged in the train and yard service by fitting the frogs, guard-rails and the heel of switches with foot-guards has been done on many roads. The condition of the fences has been considerably improved, but cattle-guards are being neglected by many of the small roads and some of the large roads are not giving them sufficient attention, claiming them to be unnecessary, as live stock is prohibited by law from being allowed to run at large. Claim is also made that cattle-guards are not effective. If cattle are allowed to graze about crossings they will sometimes find a way to get across the cattle-guards, but if being driven along the highway they nearly always turn aside when they come to a cattle-guard and will not cross it. The block-signal systems on the roads where previously used have been improved and extended and more of the roads are adopting some form of block signal. New interlocking plants have been installed governing the movements of trains in yards, cross-overs on double, or more, tracks, at grade crossings of railroads, etc., also adding to the safety of operating trains. New and greatly improved station and other railroad buildings have been erected at various places and necessary repairs to others given proper attention. The motive power and rolling stock have been increased. Locomotives are being constructed larger and of improved design. Passenger cars are being made stronger and the fittings more elegant. Freight cars are made of increased size and weight to carry greater loads. All cars in regular service are now equipped with automatic couplers, and all passenger cars and nearly all freight cars with air-brakes."

Concerning electric railroads the inspector says:

"The several new electric railroads which have been built and the extensions of existing roads which have been constructed in this State during the past year have been constructed in a first-class manner with proper weight of rails, good ties and broken stone or gravel ballast. Concrete culverts and openings on these lines have been put in. A large portion of the new construction has been on private right-of-way; in these cases the track has been properly ditched and right-of-way fenced in most instances. A large amount of new rail has been added to existing roads, replacing lighter rail. The improvements in the physical conditions of existing roads has been quite general throughout the State during the past year. At present there is very little 6-in. girder or 45-lb. 'T' rails remaining in the different city systems, and most of the companies owning these roads have made arrangements to replace this class of rail with heavier ones in the near future.

"The improvement in cars and equipment has kept pace with those made in track and roadbed construction. These improvements have been on the lines of larger cars, more comfortable inside furnishings; most of the cars which are now being added to the different systems are double truck, which adds greatly to the comfort of passengers, doing away with the end oscillation which is so disagreeable to passengers in the single-truck cars. Nearly all of the new double-truck cars placed in service during the past year have been equipped with power-brakes, and in a large number of cases this class of brakes has been placed on cars which were in service previous to this year. More attention has been given to the matter of cleaning cars; they are at present kept in a better condition on the inside and present a better appearance on the outside than formerly. There has been a marked improvement in the electrical equipment of cars, motors of a greater horse-power capacity have been placed on them, which has resulted in avoiding the numerous delays caused by the breaking down of over-loaded motor equipments.

"Nearly all of the leading railroad systems and a number of the smaller ones have recently reconstructed their power plants; in a number of cases the power has been centralized by combining the equipment of several plants in one. There has been a change in the method of transmission of power; several of the larger systems are at present transmitting power from a central station to transformer stations, located at different points on the systems; this transmission from the power-house to the transformer station is made at voltages varying from 6,000 to 23,000 volts. A number of the suburban lines in the State are supplied with power which is transmitted from water plants located some distance from the lines. This transmission of power is in most cases made over lines which are located on the highways. The transmission of power at the high voltages used over lines on the highways adds an element of danger to the operation of electric railroads. The safety of the public requires that lines carrying currents of this character should be properly constructed and maintained, and, where possible, should be located on private right-of-way.

"The methods of operation on the different electric railroads have been greatly improved during the past year. This is especially true of all of the city systems. There has also been an improvement in the methods of operation on the suburban roads. Cars on five of the larger suburban systems are now operated under the authority of train despatching systems. Train orders on one of these roads are issued by means of a telegraph system, on the other roads by telephone. These improvements in safety appliances and methods of operation should be continued."

The Commission renews recommendations heretofore made concerning the operation of street railroads, and in particular urges upon the companies that oil tail-lights be provided on all cars operating on suburban lines. Many rear collisions would have been avoided were the cars equipped with these lights, and in a great number of instances the Board has recommended directly to a company that the lights be provided, which recommendation has been complied with. Not alone on suburban lines should the lights be provided, but in all cases where the streets are not well lighted.

The Signal Department of the Lackawanna.

The Delaware, Lackawanna & Western established its signal department on April 1, 1900, and Mr. A. H. Rudd, the signal engineer, formerly of New York, New Haven & Hartford, was appointed on that date. A brief note of the liberal expenditures which have been made in this department of the Lackawanna, and a few of the statistics showing the energetic work that has been done, were given in the *Railroad Gazette* of November 14 last, page 870, (in which number also will be found Mr. Rudd's statement of signaling principles, which he made for the Railway Signaling Club). Signal engineers and operating officers will, however, be interested in a fuller statement of the details and of the rapidity with which the improvements have been made, and to show these features we give the accompanying table. It will be observed that in the figures showing the final total number of signals in service, each two-arm semaphore is counted as two, though in some of the other items such a signal is counted only once. In the statement of the number of signals worked by wireless circuit, the total, 870, includes, apparently, both the home and the distant arms of the signals in the sections operated by this system.

It will be observed that the interlocking is classified as mechanical, electro-pneumatic and electric. The electro-pneumatic plant includes 46 signals and 82 switches; and there are worked also from this power five block signals, not included in the total number of block signals shown in the table. The all-electric interlocking plant is at a draw bridge.

In 1901 green glasses for the all-clear indication were put into all signals, and the use of white for the all-clear night indication was abandoned; at the same time the distant signals were fitted with yellow glasses for the "caution" indication. Interlocking plants not maintained by the Lackawanna road are not shown in the table.

PROGRESS OF SIGNALING ON THE DELAWARE, LACKAWANNA & WESTERN.

	Apparatus in use on—			
	April 1. 1900.	Jan. 1. 1901.	Jan. 1. 1902.	Jan. 1. 1903.
Banjo, home block signals (stop)	110	104	97	64
Banjo, home block signals (caution, heavy up grades)	10	8	8	4
Banjo, distant block signals (caution)	12	13	19	18
Banjo, home and distant block signals	0	0	2	16
Banjos at trolley crossing	2	2	2	2
Banjos for station signals	0	0	1	2
Total banjos in service	134	127	131	122
Electric semaphores, home block signals	0	60	73	77
Electric semaphores, home and distant block signals (2 arm)	0	1	128	303
Electric semaphores, distant block signals	0	1	4	30
Electric semaphores, distant interlocking signals	0	11	23	51
Total electric semaphores in service	0	74	346	764
Electro gas, home and distant block signals (2 arm)	....	....	....	24
Total electro gas signals in service	....	....	....	48
Total automatic signals in service	134	206	482	939
Automatic signals (normal danger)	132	11*	40*	52*
Automatic signals (normal clear)	2	195	442	887
Slotted home interlocking signals (semi-automatic)	0	24	52	71
Number of signals operated by wire circuit	127	63	19	4
Number of signals operated by wireless circuit	6	136	344	870
Number of signals operated by wire and track circuit combined	0	31	21	65
Banjos removed during the year	0	19	13	50
Banjos re-erected during the year	0	12	15	41
Semaphores removed during the year	....	....	....	42
Semaphores re-erected during the year	....	....	....	43
Main line switches protected by automatic signals	146	243	394	496
Number of Hall switch instruments	130	130	142	79
Number of Union switch instruments	16	113	255	411
Number of Taylor switch instruments	....	....	....	6
Number of miles of single track protected by wire and track circuit combined	1.4	1.7	1.7	4.7
Number of miles of double track protected by wire circuit	29.58	14.47	1.6	0.0
Number of miles of double track protected by wireless circuit	0.82	45.9	95.6	183.9
Number of miles of double track protected by wire and track circuit combined	.0	3.72	11.13	9.2
Total miles (one track) protected by automatic signals	64.2	129.88	218.36	390.9
Number of track circuits for signals and bells together	250	390	585	652
Number of track circuits for bells separate and outlying	4	20	39	30
Number of preliminary track circuits for warning bells, etc	6	8	5	7
Total miles track circuits, all kinds (one track)	67.20	141.18	235.84	403.0
Number of switch indicators	110	11	4	8
Number of annunciators	0	10	10	10
Number of train describer sets	1	4	4	4
Number of cabin warning indicators	38	44	119	156
Number of motor generators	0	1	2	2
Number of electric locks	9	7	30	61
Number of crossing bells operated by track circuits entirely	8	15	25	34
Number of crossing bells operated by track instruments entirely	88	82	72	67
Number of crossing bells operated by part of each	0	3	3	0
Total crossing bells	96	100	100	101
Approximate total of other bells at stations, offices, etc	60	70	75	112
Number of track instruments in use	393	384	305	278
Approximate number of push buttons in use	10	35	40	40
Number of cells of storage battery for signals and switches	0	14	70	70
Number of cells of gravity battery for signals and bells	2,320	3,420	1,636	1,955
Number of cells of Waterbury battery for signals and bells	0	672	664	386
Number of cells of Gordon battery for signals and bells	170	872	492	53
Number of cells of Edison battery for signals and bells, Type "R"	370	1,484	220	71
Number of cells of Edison battery for signals and bells, Type "RR"	0	0	807	1,090
Number of cells of Edison battery for signals and bells, Type "SS"	0	0	3,534	7,086
Number of cells of dry battery	....	....	....	12
Number of cells of gravity battery for track circuits	541	872	1,640	2,198
Number of cells of Waterbury battery for track circuits	....	....	....	8
Number of cells of Gordon battery for track circuits	....	....	....	24
Number of cells of Edison battery for track circuits, Type "R"	....	....	....	0
Number of cells of Edison battery for track circuits, Type "RR"	....	....	....	91
Neutral polar relays	10	117	291	0
Pole changing relays	10	120	96	0
Neutral polar pole changing relays	0	0	108	0
20 ohm relays	....	....	....	47
500 ohm relays	....	....	....	87
600 ohm relays	....	....	....	50
Union universal relays	....	....	....	439
Hall track relays	0	0	167	290
Hall hold clear attachments for banjos	....	....	....	83
Slow acting relays	0	73	199	165
Slow acting slots	....	....	....	222
Signal and overlap relays (old style)	206	149	30	0
Low resistance relays (substitute for compound)	0	0	17	4
Interlocking crossing bell relays	180	170	101	101
Plain crossing bell relays	13	31	64	27
Compound relays	21	6	6	0
Odd relays, 8 and 12 ohm, etc	55	93	50	67
Switches to control distant signals, etc	0	9	38	73
Draw bridge circuit closers	0	2	4	1
Circuit closers on machines	15	20	12	12
Circuit closers on home signals	0	13	48	97
Number of cut sections	0	0	141	35
Number of mechanical interlocking plants maintained by D., L. & W.	17	19	26	30
Number of working levers	222	281	402	527
Number of spare levers and spaces	38	35	45	74
Total	260	316	447	601
Number of interlocking distant signals (11 replaced by electrics)	27	30	19	19
Number of interlocking home signals	75	83	107	125
Number of interlocking dwarf signals	26	72	115	159
Number of interlocking pot signals	10	5	11	4
Number of interlocking derails operated	30	78	90	112
Number of interlocking switches operated	43	51	92	119
Number of movable point frogs operated	0	2	6	6
Number of detector bars operated	71	134	197	256
Number of facing point locks operated	28	52	110	161
Number of switch and lock movements operated	46	68	92	60
Number of draw bridge locks operated	20	20	16	16
Number of draw bridge couplers operated	0	0	8	8
Number of electro pneumatic interlocking plants	0	1	1	1
Number of working levers	0	34	36	36
Number of spare levers	0	13	11	11
Number of electric interlocking plants	....	....	1	1
Number of working levers	....	....	8	8
Number of distant switch signals (took out 2; put in 4)	6	6	9	11
Train order signals (semaphore type, double arm)	1	1	88	158
Train order signals (semaphore type, single arm)	2	2	8	8
Train order signals, Swift's	....	....	....	17
Special signals at grade crossings, etc	6	12	14	13
Number of interlockings extensively repaired during year	....	2	7	2
Number of interlockings rearranged	....	1	3	1
Number of interlockings entirely new	....	1	5	7

*At interlockings.