A. H. Rudd Discusses Train Control at Philadelphia Engineers' Club

I. C. C. Criticised for Not Ordering Other Safety Devices as Well; Costs of Pennsylvania Tests Explained and Cab Signals Advocated

A. H. RUDD, chief signal engineer of the Pennsylvania, speaking before the Engineers' Club of Philadelphia, on November 17, set forth in considerable detail his views on the general question of safety of train operation and, in particular, on the course which a railroad company ought to pursue in the wise expenditure of its money for the most effective protection of the lives of its passengers and its employees (and of travelers on the highway at railroad crossings). Mr. Rudd's views in this field have been published before, especially in the paper that he read before the Signal Section of the American Railway Association, at Swampscott, Mass., in September, 1924; (*Railway Signaling*, October, 1924, pg. 391); but in the present essay he makes a more thorough study, citing the main facts in considerable detail.

In opening his address, Mr. Rudd said that he was speaking for himself only, not as a representative of the railroad company; and that he would not criticise the Interstate Commerce Commission; observing, however, that while, perhaps, the signal engineer is today exaggerating the importance of automatic train control, it is quite probable that the members of the Interstate Commerce Commission do not fully realize it. He went on to discuss the philosophy of safety on railroads in all its phases.

Considered entirely by themselves, automatic devices might be said potentially to be able to save 15 passengers a year (estimated value $1,500,000); but to equip all of the railroads of the country is simply out of the question; the railroads do not control all of the capital in the world. This element cannot be considered by itself. The speaker then went on to recount the results of the enormous expenditures which the railroads have made in recent years to promote safety—better tracks, better locomotives, better cars, increases in block signal mileage, improvements in discipline and great advances in the morale of employees.

The Commission's Part in Train Control

Discussing the relation of the government in the train control situation Mr. Rudd said:

"For years John J. Esch, then Chairman of the Committee on Interstate and Foreign Commerce of the House of Representatives, was an earnest advocate of the block system and tried to have laws passed giving the Interstate Commerce Commission authority to compel their adoption. Finally his opportunity came and, as joint author with Senator Cummins of the so-called Esch-Cummins Bill, now the Interstate Commerce Law, he included Section 26, giving this authority to the Interstate Commerce Commission, of which he is now a member.

"Attention is especially directed to four words in this law: The Commission may order a railroad to install automatic train stop or train control devices *'or other safety devices.'*

"Included in the 'other safety devices' are the various block systems, interlocking, etc., *which Mr. Esch wanted years ago,* but, as far as I have been informed, I do not know of a single case where a block system has been ordered in directly on a foot of territory, though thousands of miles of road have been ordered to put in automatic stops or speed control. The Commission is not a unit on this matter, as is evidenced by a dispatch from Washington:

"'Washington Oct. 22.—The Interstate Commerce Commission today ordered the Great Northern Railway Company to install an automatic train control device on the 106 miles of its line between Williston and Wolf Point, in Montana, in spite of a petition by the railroad asking to be relieved of the expenditure.

"'Commissioners McManamy, Hall and Eastman dissented from the ruling and Commissioner McManamy held that "a clear showing has been made that greater safety will result from an extension of automatic block signal system than from the same amount of money spent in the installation of the more complicated and expensive train control devices required by our order".'

"The Congress in 1906 authorized the Interstate Commerce Commission to investigate train control and the use of automatic block signals. At that time, about 50,000 miles of track in the United States was block signaled, about 7,000 of this being automatic signals. As stated awhile ago, we now have 141,000 miles of track voluntarily protected by block system, an increase of 91,000 miles, and 69,000 miles of automatics, an increase of 62,000 miles—almost 3 times the mileage of block systems and 10 times the mileage of automatics than in 1906. The Pennsylvania alone has an investment of approximately $27,000,000 in automatic and manual signals and interlockings.

"In addition to the block systems, we have better roadbed, improved brakes, steel cars, electric lighting of cars and electric headlights, more reliable signals of greater visibility day and night, and numerous other safety devices, such as approach locking and route locking at interlockings (which prevent signalmen from making mistakes), mechanical and electric checks on the block system, and, as important as any of these and perhaps more so, better discipline due to efficiency tests, better living conditions, so that men may devote their thoughts to their work and keep alert, shorter working hours, rigid physical examinations, checking of the condition of an engineman before he goes on duty, etc., all of which have tended to cut down the accidents due to human inefficiency and inattention, during the past 20 years.

History of Accidents Does Not Justify Such Extensive Installations of Train Control

"Accidents due to railroad operation caused an average number of deaths for the years 1919-1922 inclusive, of 4,157; the average number of deaths due to *all* collisions averaged 201 per annum. In 1923—7,385 people were killed; in 1924—6,922.

ACCIDENTS—I. C. C. REPORT—STEAM RAILROADS—FOR YEAR ENDING DEC. 31, 1924, AS COMPARED WITH 1923

(In collisions of all kinds, including those in yards and on sidings, etc., where there is no signal protection.)

	1923	1924
Number of collisions	7,115	5,166
Number of derailments	16,708	14,259
Number of locomotive accidents	1,038	802
Miscellaneous	2,636	2,141
(*) Grand total	27,497	22,368
(*) Of this grand total, those occurring at highway grade crossings were	66	63
KILLED: (Collisions):		
Passengers	9	11
Employes—all classes	112	85
Other non-trespassers	5	7
Trespassers	8	6
Grand total	134	109
Average number of passengers killed per collision	1 in 790½	1 in 470
Average all classes killed per collision	1 in 53	1 in 47 1/3
KILLED: In Derailments:		
Passengers	32	30
Employes—all classes	115	97
Other non-trespassers	25	23
Trespassers	43	31
Grand total	215	181
KILLED: In *All* Train Accidents:		
Passengers	42	41
Employes—all classes	275	216
Other non-trespassers	43	71
Trespassers	52	39
Grand total	412	367
	1923	1924
KILLED: At Highway Grade Crossings:		
Passengers	1	2
Employes—all classes	33	32
Other non-trespassers	2,101	2,008
Trespassers	133	107
Total	2,268	2,149
Not included in above, various, run over, struck, and killed, not at public crossings	2,618	2,333
TOTAL KILLED:		
Getting on or off cars or locomotives	539	495
Coupling and uncoupling cars or air hose	130	93
Coming in contact with fixed structures	69	63
Miscellaneous	852	719
Total	1,590	1,370
PASSENGERS KILLED:		
In all collisions	9	11
Derailments	32	30
Miscellaneous	1	.....
Total—Train Accidents	42	41
PASSENGERS KILLED:		
Coming in contact with fixed structures	2	.....
Getting on and off trains	41	61
Struck or run over, not at public crossings	34	25
Miscellaneous	19	22
Total	96	108

"Now let us disregard for a few minutes the deaths of employees, non-trespassers and trespassers, and study the causes of the collisions where 9 passengers were killed in 1923 and 11 in 1924.

"In 1923, 8 were killed in rear-end collisions due to disregard of stop signal, and 1 at a railroad crossing. All are charged to negligence of employes. Statistics do not show under what sort of operation these occurred, but they do show that not one was due to faulty equipment, and that 24 passengers were killed by trains running into washouts; one passenger, automobile struck by train. They show that in the eastern district, 3,530 people were killed; of these, 145 perished in *all* train accidents, 3,194 in train service accidents and 179 in non-train (including industrial) accidents. In 1924, 9 passengers were killed in collisions of 2 or more passenger trains and 2 in collisions of freight and passenger—total 11.

"As stated, I cannot find statistics showing the system of protection under which passengers were killed, but the following is illuminating: Under the train order system, of 60 collisions in 1923, due to carelessness of employees, 17 occurred in manual block (12 of which, due to overrun meeting point, *complete manual block would have probably prevented*), none in controlled manual block, 3 in automatic block, and 40 in no block territory; and, in 1924, of 47 such collisions, 16 in manual block (10 overrun meeting point), none in controlled manual, 2 in automatic block and 29 in no block territory.

"In short, there occurred on the 30 per cent of track equipped with manual block, 28 1/3 per cent of the collisions in 1923, and 70 per cent of these are questionable; 34 per cent in 1924, and 63 per cent of these are questionable. Not a single one occurred in controlled manual block territory. On the 30 per cent of automatic block, where the traffic is thickest, 5 per cent of the collisions occurred in 1923, and 4¼ per cent in 1924, and on the 40 per cent non-block territory, usually the lines of least traffic; there occurred 66 2/3 per cent of the collisions in 1923, and 61.7 per cent in 1924. This shows the value of the block system."

Administration of Train Control Order

The course of the Interstate Commerce Commission during the past three years in the administration of its Order No. 13413 was narrated at length, particularly in regard to its dilatory action in connection with the Pennsylvania experiments; and in passing the speaker observed that the recent collision on the New York division of the Pennsylvania, which has called down some criticisms on the heads of the railroad management, occurred on a section of road which was not included in the automatic train control order that was issued by the commission. With these developments in connection with Order No. 13413 the readers of *Railway Signaling* are already familiar.

Following the supplementary order of the commission, which allowed the use of automatic train stops with the forestalling feature, and the decision of the United States Court in the Delaware & Hudson case, extending the time within which the orders of the commission must be complied with, the Pennsylvania (and also a number of other roads) made changes in their plans and decided to use the intermittent stop and forestaller. Outlining his reasons for this course, Mr. Rudd said:

"The intermittent stop and forestaller will, if operative, stop a train whose engineman has missed a signal entirely, or who has misread the signal, unless he operates the forestalling device as a matter of habit. If he has so annulled, he may run at any speed he pleases until he reaches the next signal. With the continuous device, he may do the same thing, but, if conditions become less favorable ahead while he is at any point in the block, he will receive warning and, unless he again forestalls, will be stopped.

"Speed control may be one speed, two speed, or three speed. One-speed requires that ,if the engineman wishes to annul the operation of the device, he must be proceeding at low speed. Two-speed may consist either of a maximum-speed governor working independently of the train-control and the slow speed referred to, or may require reduction of speed at the caution signal and a further reduction at the stop signal, before the stop feature can be annulled. Three-speed consists of the latter device, just described, with a maximum speed governor in addition. With speed control, excessive speed at various places may be guarded against. As these various features are added, the cost and complication of the apparatus increase.

"There is no doubt that a stop and forestaller, properly installed and maintained, will prevent a small number of wrecks, or at least minimize their disastrous effects; and that speed control will perhaps eliminate some others.

"Considered entirely by itself, the control or stop would be justified on parts of many railroads; but it should not

be considered by itself. The Interstate Commerce Commission has authority to order the installation of other safety devices. We have shown the advantages of the (visual wayside block system, especially the automatic. We must admit that under this we have some accidents and an occasional loss of life, which automatic train control would prevent. But the greatest loss of life in railroad operation today is at the highway grade crossing, and the same money spent for the protection of highway crossings would, except in the case of the unfit driver, save more lives than automatic train control.

"There are many other things in other departments which require large sums of money, but, taking my own department alone, if our management were in a position to give me all the money I could spend, I would first install automatic block signals, with alternating current track circuits and light signals (without moving parts) on our double track and four-track lines; controlled manual block on important single track lines, later putting in automatic signals for following movements; adequate warning to the public using the highways, of their approach to a railroad crossing, and at many places automatic signals on the highway indicating the approach of a train; extension of the manual block system to lines where it is not now in use, which, in our case would be lines used exclusively for freight service; unless as a matter of economy, it were better to install automatic signals.

"On the completion of this work and as a final precaution, I would install continuously controlled two-speed cab signals, on the lighter lines and three-speed on the heavy traffic lines, superimposed on the (wayside) signal system, one for the engineman and one for the fireman, which would accomplish all that the train stop does unless the engineman and fireman were both incapacitated at the same time.

"Meanwhile I would develop, on a trial section the full automatic control apparatus, so that, if it were conclusively shown that further safeguards were needed, a simple device could be superimposed as a final precaution."

This line of procedure, when taken in connection with records of serious collisions may seem heartless and unreasonable; but, said the speaker, we have still to consider the large proportion of fatalities from other causes. On the Pennsylvania Railroad in the first nine months of this year, 191 persons were killed in automobiles struck by trains, and 760 injured. Every ten days, seven persons are killed in automobile grade crossing accidents on the Pennsylvania lines.

"Observers and critics everywhere give special prominence to the idea that the use of train control eliminates the human equation. It does not. It may guard against a mistake of the engineman, whatever its cause, but it will not afford this protection if the man who installs it or maintains it makes a mistake; and these mistakes have been made and are made by men in every walk of life, and the railroad man is no exception. If such mistakes are made, if the signals indicate 'proceed' when they should indicate 'stop,' if the automatic stop device fails to operate at the critical time, when perhaps the engineman is depending upon it more or less, the situation is, under such conditions, worse than if such device did not exist.

"If the installation of these devices is forced to such an extent that they become general, the results, as between the man who runs the engine and the man who maintains the apparatus may be such as to require a reranking of various classes of railroad labor. The maintainer's position may be the more important of the two.

"It is claimed, and apparently properly so, that, in view of the varying weights, speeds, and makeup of trains, varying efficiency of the air brakes, varying atmospheric conditions, etc., no two trains are braked alike—those who ride our trains realize this, and the important part that the human equation plays. With the apparatus always applying the brakes in one particular way on all these various classes of trains, will the results be better than at present? Or, will they be worse?"

Costly Experiments

Mr. Rudd then presented some memoranda showing the cost of the experimental installation of the three-speed continuous automatic train control on the Lewistown (Pa.) branch of the Pennsylvania Railroad:

First Cost (to July 11, 1925)	$285,000
Cost of Development Work (to November, 1925)	45,000
Total, Installation and Development	$330,000
Maintenance (to November, 1925)	89,000
Total	$419,000

Of the maintenance charges, $43,500 is assigned to the roadside apparatus; $38,000 to locomotives and to electric current $7,500.

Having decided to make no further installations of this system, the company is installing the stop and forestaller on its line from Harrisburg, Pa., southward to Baltimore, Md., 84 miles. The appropriation for this, including automatic visual signals and one interlocking is $1,582,883. The train stop, including 187 locomotives, takes something less than one-third of this total. The average cost per mile, double track, this will be, for wayside signals $11,553 and for automatic stop, $1,622; locomotive equipment per locomotive $2,600. From Harrisburg to York 27 miles, construction will probably be finished by February. Estimating on the same basis for other sections of the Pennsylvania system on which the government calls for automatic train control, the costs would be as follows:

Camden, N. J., to Atlantic City, 58 miles, including some changes in wayside signals, $955,322. West of Pittsburgh (P. C. C. & St. L. where will be included large numbers of new signals), 340 miles of road, $5,704,100. Middle division, 130 miles, mostly four track, already equipped with automatic signals, $1,023,400. Grand total $7,682,822. Of this total, automatic train control would be chargeable, roughly, with about four millions.

If speed control is provided, the cost will be approximately $1,150,000 additional, based on the cost of speed control as installed on the Lewistown Branch. It is believed, however, that the new and simplified development can be provided for at least 40 per cent less, or at an additional cost of $700,000.

Joseph Beaumont, vice-president of the Regan Safety Devices Company, speaking on automatic train control before the Engineers' Club of Philadelphia, on November 17, reported results of using automatic train control on the Rock Island as being highly profitable in doing away with the need of stopping trains at "stop-and-proceed" signals. He said, in part:

"A systematic analysis was made during September last to determine the exact number of stops actually eliminated by operation under this automatic train control system. Enginemen were instructed that when a train was compelled to stop because of a train in the block, even after passing a signal, under enforced low speed without stopping, that this should not be considered as a stop eliminated by automatic train control. The results of this check showed that an average of 132.1 freight train stops and 12.8 passenger train stops were eliminated per day—an average of 48,216 freight and 4,672 passenger train stops eliminated per annum. This is equivalent to 7,045 freight train hours per annum and a substantial figure for passenger trains which has not been computed. This analysis covered a 30 day period—September 15, 1925, to October 14, 1925, inclusive."