If he finds it so, he responds to the operator at B, 'IB for 1376 to C.' The operator at B then places two of the cards in two hoops, placing them in the station crane, one above the other, for the engineer and conductor of the approaching train to pick up as they pass his station, and then clears his signal governing their movement. Immediately upon the train passing B he reports the fact, giving the time to the dispatcher on the train wire and to the operator at C on the block wire.

"Assuming that engine 1376 is to meet engine 1377 at D. As soon as the operator at B reports engine 1376 passing there the operator at C asks the dispatcher for the block C to D. The dispatcher responds, 'BC No. — to 1376 to D, except hold main line and meet engine 1377 at D.' This the operator at C repeats to the dispatcher, who at the time records it on the train slip that bears the record of the movement of engine 1376, following which he gives the operator at C the O.K. The operator at C then calls the operator at D and says to him, 'B 1376 to D, except hold main line meet engine 1377 at D.' The operator at D records this on his block sheet, and if his record shows that the block between D and C is clear, he then repeats the exception back to the operator at C, who at that time records the exception on his block sheet, following which he arranges to deliver the cards to the approaching train as above described.

"In the foregoing case engine 1377, picking up the block card at E, will find that the card secured at that point gives it authority to run from E to D except take siding and meet engine 1376 at D."

I have described this method of operation at some length, because although it is not perfect by any means, it is based on the correct principles, and even in this incomplete form shows the results that can be attained if the basic principles of train operation are followed. By installing staff instruments, and using staffs instead of the block cards, and with a proper arrangement of signals at each block station, and the application of locks to the main line switches which can only be unlocked by the staffs belonging to the block in which the switch is located, this method would conform to the most perfect method of operating trains so far developed, the staff system.

One of the chief arguments brought forward for the use of automatic signals is that by their use the human element is eliminated, that for this reason the human propensity to err is not reflected in the operation of the trains. This is, however, not found in actual practice, for no matter what means are used the human element inevitably comes in in regard to train operation. In operating a complicated machine like a railway, automatic apparatus is not capable of taking care of the changing conditions, intelligence is an essential part of any system. If the human element can be hedged about in such a way that any mistake which he might make, would simply prevent all movement, then we apply the same principle to the man that we have used in the construction of signal apparatus, i.e., "a failure in any part of the apparatus will produce a stop signal." By this means you still have the protection of the mechanical, with the power to meet new conditions, as they arrive of the human, and a check is established between the man operating the train and the means used to convey the necessary instructions to him.

My object in this paper is not to produce actual figures showing the relative cost of the different systems, but in Canada we have done practically nothing in the way of signalling up to the present. The time has about arrived when something has to be done. The method of operating under train orders has been found wanting. The question now arises, what are we going to substitute for it. Safety and an increased efficiency leads to the adoption of absolute block signalling, with the elimination of the old method of the standard code. Should we therefore get to the use of the automatic which is not all sufficient in itself, but is simply an addition, and possibly a doubtful one at best, to the discredited method now employed. Shall we take our model from the American roads with their collisions, occurring, be it noted, even under the protection of automatics, or are we to adopt the European method, with its practical freedom from such accidents. Evidently one of the elements which will determine which method we will adopt will be the cost. I believe that if all the items of cost, including the effect of increased capacity, are taken into account, that the absolute block method can be shown to be the most economical in practice. If I have succeeded in instilling some wholesome doubt as to the advisability of adopting the automatic system, simply because the American roads have done so. I am quite sure that when the necessity comes for doing something in this line, that we will not go to the wholesale adoption of automatics. I am quite aware that any advice which is asked for from American Signal Engineers, as a rule will probably be in favor of the automatics, but we all know the old fable of Aesop with regard to the fox who lost his tail.

RECORDS OF MAXIMUM RATE OF DISCHARGE STREAM.

H. P. Eddy, consulting engineer for the Commissioners of Sewerage of Louisville, Ky., in his report of the Commissioners, referring to the run-off in certain sections of the city, inserted a table compiled from various sources which gives the maximum run-off in drainage areas of less than one hundred square miles.

Records of maximum rate of discharge of streams have been compiled in the report on the Barge Canal from the Hudson River to the Great Lakes, 1901, State of New York, by Emil Kuichling, M. Am. S. C.E., and in Water Supply and Irrigation Paper, No. 147, United States Geological Survey, by Edward Charles Murphy, M. Am. Soc. C.E. The table given here has been prepared largely from data in these reports, giving the maximum rate of discharge for a few streams having watersheds of one hundred square miles or less in North-eastern United States:—

Maximum Rate of Discharge of Streams in North-eastern United States.

(Drainage Areas less than 100 Square Miles.)

Budlong Creek, Utica, N.Y.—Sq. miles, 1.13; March 25, 1904; Sec. ft. per sq. mile, 120.40; U.S. Geol. Sur. W.S.P. No. 147.

Sylvan Glen Creek, New Hartford, N.Y.—Sq. miles, 1.18; March 25, 1904; Sec. ft. per sq. mile, 56.58; U.S. Geol. Sur. W.S.P. No. 147.

Starch Factory Creek, New Hartford, N.Y.—Sq. miles, 3.40; March 25, 1904; Sec. ft. per sq. mile, 109.62; U.S. Geol. Sur. W.S.P. No. 147.

Starch Factory Creek, New Hartford, N.Y.—Sq. miles, 3.40; Sept. 3-4, 1905; Sec. ft. per sq. mile, 209.; U.S. Geol. Sur. W.S.P. No. 162.

Reels Creek, Deerfield, N.Y.—Sq. miles, 4.40; March 26, 1904; Sec. ft. per sq. mile, 48.36; U.S. Geol. Sur. W.S.P. No. 162.