interest, if we add these, the maintenance and operation will be as follows:

7 per cent. depreciation on $2,014.00 (cost per mile)	$140.98
Interest at 4 per cent. on $2,014.00	80.56
Cost maintenance and operation as given	233.79
Total cost per mile, per annum	455.33

The length of blocks on this territory (found by dividing the number of signals into the distance) is about eight-tenths of a mile. This charge has become a fixed charge per mile irrespective of the volume of traffic.

With few exceptions automatic signals are located from maximum conditions as shown on an existing time table, consequently the blocks are shorter than they need be, if the train schedules were slightly changed length of blocks could be increased, thus reducing considerably the first cost, and at the same time not in any way reducing the capacity of the tracks for trains in the twenty-four hours. For example, the time table of a railway shows a train movement of 30 trains per day in one direction, five of these trains are scheduled to leave 3 minutes apart, the ordinary practice in locating the signals would be to base the length of block on the 3-minute interval. The interval so far as the track and number of trains is concerned is forty-eight minutes, if then these five trains were spaced differently, the length of block would be longer, and the expense of installation would be decreased. Is there any good reason why this should not be done? On lines carrying heavy suburban business, the maximum traffic conditions must be considered as the congested period recurs daily, and forms a very large proportion of the total traffic, but with the ordinary steam railway on the whole, in automatic blocking, the blocks are shorter than need be, and they are made to provide facilities which should come from the motive power department, or to overcome traffic conditions, which are considered unchangeable, to a large extent, because no one has had the courage of his convictions to change them. The result of this is that the charge for maintenance and operation is greater than it should be per unit of traffic.

The second claim that they will detect an open switch is not necessarily peculiar to the automatic; any of the manual systems can be made to do so.

The third claim also is not dependent on the use of automatic signals.

The fourth claim is more theoretic than practical. The only broken rail that is certain of causing interruption to the track circuit, and thereby causing a signal to indicate stop, is one which has a clean break through the rail somewhere away from the joint, and where the two broken ends have actually drawn apart. A break at the joint will not be detected on account of the fact that it is bonded, and the track circuit is not in any way interfered with, piped rail, broken head, broken base, and other breaks which would be dangerous to a train would in no way affect the signal.

The record of rail failures on a certain road for six months gives a summary of breakages as follows:—

Split	95	16%
Piped	197	33%
Crushed	111	19%
Breaks at joints	94	16%
Breaks outside the joints	94	16%

What proportion of these rails which were removed from the track as unsafe would have been detected by automatic signals is impossible of determining; it would only be some unknown percentage of the 16% of the whole shown as breaks outside the joints. I doubt very much that, if this was the only element in favor of the automatic, there would be very many installed.

The chief objection to the automatic, in my estimation, is the fact that in its very nature it must be a permissive signal thereby violating one of the very fundamental principles of safe block operation. From this feature of the automatic, that is, its permissive nature, has arisen the complicated system of indications advocated in the Railway Signal Association. The necessity of distinguishing to the engineer a permissive signal from an absolute stop signal naturally gives rise to inconsistencies, and a multiplication of the number of aspects with which the runner must familiarize himself, this multiplicity of indications is certainly not tending to simplicity. Again, the automatic system is not all sufficient in itself for the operation of trains, but must only be an addition to some other system of moving trains. The question then arises, if the method of controlling train movement has been found unsafe and uneconomical, is the railway bettered by adding automatics to its existing method, or does it not seem more reasonable to expect that if the expense is going to be incurred at all that it would be much better to discard the already discredited method and adopt a consistent method of moving trains based on the principles involved?

It must be borne in mind that the expense for dispatchers and operators is not eliminated by the use of the Automatic system. As above stated, the blocks being as a rule considerably shorter than the total traffic requires, some of the operators may be dispensed with, but as the traffic increases more operators will have to be employed. The trains, under the Automatic system, are still operated by time table and train orders. I do not for a minute mean to convey the idea that Automatics will not increase the capacity of a track, as it can easily be shown by statistics that they do so, but when you have the added expense of Automatics to the cost of operating under train orders, there is still the inherent defect of this system, i.e., their permissive feature to be reckoned with, trains may still get together, and the signals may fail in the clear position, so that the expense due to preventable accidents has not been eliminated.

Another objection to the Automatic, due to the permissive feature, is that when a break-down of a train occurs, the signals do not prevent other trains continuing to move up to the place of the break-down, increasing the difficulty and expense of getting the repair outfit up to the place of the wreck. The point where there should be the least congestion becomes the point where there is the most.

The Manual Control system is divided into two methods the Lock and Block, and the Staff methods. The Standard Code of the American Railway Association divides the Manual system into two classes: The Telegraph Block system—"A block system in which the signals are operated manually, upon information by telegraph, and the Controlled Manual Block system—a block system in which the signals are operated manually, and so constructed as to require the co-operation of the signalmen at both ends of the block to display a clear signal." The first of these is another make-shift, and is used in America, at least, in conjunction with the train order system, we can pass over this without further remark. The Controlled Manual system is based on the principle of preventing more than one train being in the block on the same line at the same time, and the failure of any part of the apparatus, including the human element in this case, will not be able to show a clear signal if the conditions are not right.

The Lock and Block, as this system is called in England, is operated as follows: The line is divided into blocks of a length varying with the volume of traffic, the entrance to, and the departure from, each block being controlled by a