a heavy branch line traffic. It was decided here that an automatic interlocking, including the control of the signals but leaving the switches to be thrown by hand, would not only be adequate, but would reduce the cost of operation about $5,000 annually by eliminating the levermen.

This idea of adapting interlocking installations to the requirements of train operation in each individual case opens up a great field for the construction of plants at crossings, where the expense for more extensive plants might not be justified. A new study of the operating conditions at many points might well be made with this idea in mind.

The Purchasing and Stores Departments Can Be an Aid or a Hinderance

DURING an official inspection of a signal installation placed in service recently, the chief engineer of the road stated that "one of the factors that contributed to the completion of the construction program on schedule was the co-operation of the purchasing and stores department." On further questioning, he explained that the engineering department specified what they wanted, the purchasing agent proceeded to secure the materials without delay, and the storekeeper saw to it that the equipment was delivered on time, according to a schedule outlined by the construction forces.

This sounds very simple, but in far too many cases the signal construction forces receive the paint before the concrete materials. Loss of time caused by delayed delivery of materials increases the cost of construction needlessly, but the greatest exasperation is caused by receiving an entirely different class of equipment than was specified on the requisition.

Where such troubles are prevalent, the first move for the signal department is to check up on its own part of the work to see that plans are complete, and requisitions for all materials have been properly made and forwarded to the purchasing department in plenty of time. The second idea, brought out by the chief engineer mentioned previously, can then be given consideration i. e., "the purchasing agent secured it without delay." A signal engineer should be in a position to know what is needed for each job, and on the majority of roads he enjoys the confidence of his superior officers to the end that there will be no haggling or brow-beating on the part of the purchasing department to force him to take any equipment or material other than what he specifies.

On a certain road where a new signal engineer was appointed a few years ago, the purchasing agent and stores officers had long held sway on account of a record which they maintain showing that each year they have purchased certain equipment cheaper, and the total saving is held forth as their personal accomplishment. In the regular procedure, every requisition for materials ordered is eventually, in the course of the argument, signed by the head of the using department. Therefore, in years to come, if any criticism of the material arises, or any accident occurs as a result of using an inferior device, the ranking officer of that department, and not the purchasing officer, will be held responsible.

This is, of course, a classic example of where the purchasing officer is anything but a "great help" to the signal department, and the same condition, to a certain extent, exists on other roads. This attitude may be the result of circumstances that have influenced the purchasing officer in his training, and the situation may in some cases be clarified by the signal engineer explaining his side of the problem. If results are not obtained by co-operation, the signal officer should not calmly sidestep his duty, but should carry his side of the case to the proper executive.

Signal and interlocking apparatus is provided to promote safety and facilitate train movement. Any concession in the way of inferior quality of materials or equipment may result in hazards and an increase in the number of unnecessary train delays as well as an increase in the cost of maintenance and operation. The signal engineer's responsibility, therefore, does not end with specifying what he knows to be best fitted for a certain requirement, but he must also see that his specifications are fulfilled in spite of the desires of over enthusiastic purchasing officers. In the majority of cases, the signal engineer who puts up a stiff fight not only gets the equipment needed, but also gains the respect and confidence of his executives, including the purchasing officer.

Letters to the Editor

Simplification of Apparatus Will Expand Usefulness of Signaling

Cleveland, Ohio.

TO THE EDITOR:

Reference is made in your editorial on page 69 of the February, 1929, issue to the viewpoint of "more conservative men" in connection with new developments. In my opinion this subject is important enough to warrant considerable discussion. As a general proposition, the purpose behind all simplification is progress without sacrificing safety. By progress we mean the widening of the scope and utility of signal apparatus. Under present circumstances, interlocking has grown into such complications that it is limiting its own usefulness, particularly from the standpoint of cost and engineering involved. The matter of safety has probably been overdone. For years we talked about nothing but safety in connection with signals, and made little progress, but we made plenty of progress when we began to talk about the utility of signals. Safety can be taken for granted as a general proposition as it is inherent with signaling systems.

It is the utility and economy, through the saving of train time, and the expedition of train movement which give us the greatest opportunity of selling signals to our railroads. We are only beginning to find it out. One excellent way to widen the application of signaling and signal apparatus is to reduce the cost. This is sure to do it. About the only way to reduce the cost and still have wages go up is to increase production. In order to increase production we must widen the demand for such equipment. When it is considered that the price of one electric switch machine is greater than the price of one Ford automobile an example is presented of what production can do to reduce the cost.

A fair sample of complication to the "nth degree" is the present day modern electric interlocking machine. Of necessity the cost is in proportion to the complication. The manufacturer is confronted with the problem of having scarcely two machines alike. This is everything but a production proposition, and necessarily the cost is in conformity therewith. Is there any real reason

why this should continue any longer than necessary now that we know about it? Interlocking machines can easily be simplified down to a production basis, which will surely reduce the cost and increase the number of applications materially, and bring returns to the railroads in proportion. Considering the possibility of expedition of train movement through the use of signals, interlocking, etc., the field is very large, as only a small proportion of mileage of the roads in the United States has had the benefit of operation by signals; therefore, our market is the remaining portion.

Now to consider in detail a few of the points mentioned in the editorial. It is stated that "the conservative men are agreeable to accept modern developments as long as safety is not sacrificed." Let us consider such modern developments as color-light signals without mechanisms, also power-operated switch machines.

(1) The first reference is to the necessity of indication locking, and that it provides additional information and protection at interlockings well worth the increased cost. Let us consider this from the standpoint of signals. We cannot get indication locking on automatic signals, or in automatic interlocking plants, or in signal dispatching without increasing the cost disproportionately, the cost already being so high that it is limiting the applications. On the average signaled railroad, only about 10 per cent, or less, of the signals now have indication locking and these are those at the interlocking plants of "orthodox" design.

The greatest argument in favor of indication locking on color-light interlocking signals is that of protection against "false clears" and this, as statistics will show, is a very remote possibility. If the control of the interlocking signals is simplified to match that of automatic signals, surely they would be no more apt to stick clear than the "automatics" would and as such would need no indication locking. If any indication locking is needed on interlocking signals, it is to insure that a one-light, color-light signal, like a dwarf signal, is showing "red" instead of being "out." When "out," it may be missed by a train which might over-run the signal. Is any road installing such protection?

(2) Indication locking for switches cannot be had except at prohibitive cost on 90 per cent of the switches in signaled territory, but can be provided at high cost on the remaining 10 per cent of the switches in signal territory which are interlocked. Is it not fair to ask ourselves what good purpose indication locking serves on an interlocked switch, except to enforce sequence of lever movement, or tell the leverman, or the maintainer that it did, or did not, indicate? As such, it is an index of when the maintainer should start to hunt trouble. It follows from this that if the indication were eliminated, he would not be obliged to hunt trouble. The power-operated switch either operates or it does not. If it operates correctly, the signal will clear, and if it does not operate correctly, the signal will not clear. If the signal clears, the train will move, and if not, the crew will call up according to rule and receive instructions as to what to do next. Under the indication locking scheme, the same train would stand and be delayed just the same if the signal did not clear on account of the switch not indicating, and, therefore, as far as the purpose of train movement is concerned, indication locking does not help the matter. If an indication on switches or signals at interlockings, or elsewhere, is needed, why not use a lever light, as it is a matter of giving information only, and thereby eliminate the various other kinds of lever locks, indication locks and controlling apparatus and the additional apparatus more recently added to force them down after they pick up in the proper way. This also gets rid of the lever machinery necessary to co-ordinate the action with these various locks.

(3) Elimination of lock rods on power switches must also be considered. Generally it is the practice to cut the notch of a lock rod from 1/16 in. to 1/32 in. larger than the lock plunger, and this is much closer than the variation caused by the running of the rail, or the movement of the switch points can be controlled. The result is that the power switch fails to operate properly, because of the close adjustment of the lock rod and not because there is an unsafe condition. If this secondary protection by a lock rod is desired on the theory of not putting "all the eggs in one basket," why not widen the notch in the lock rod, so that it will be comparable with the variation caused by the normal controllable rail movement. It would then serve well to hold the points from moving under a passing train, should the operating rod become broken or disconnected, and at the same time it would not cause additional failures. The point detector or switch box is the instrument which in automatic signal territory tells whether the switch is safe for a clear signal. Should there be any exception just because the switch is interlocked, and if so, why?

I have in mind a performance record of 20 years to compare the safety of interlocked and hand-operated switches. This record may not be representative of the average condition on all roads, but it is so unique that it should be given thought. The single-track road in question has 1,229 main-track switches and derails, 133 of which, or 10.8 per cent, are interlocked. In 20 years of operation, aggregating 70,000,000 train-miles, there have been two switch failures resulting in the derailment of trains, which the independent lock rod should have prevented; both of these failures were due to broken or disconnected operating rods. One was on an interlocked and one was on a hand-operated switch.

If the train were a freight train and operated about 300 miles per day (the average for 1928 and the high record for all time) it would take this train 65 years to run this distance, before it encountered a defective interlocking switch causing a derailment. This same freight train could run about 600 years before it would encounter a defective hand-operated switch caused by a broken throw rod, resulting in a derailment. With this kind of a record, what argument should be put up to a railroad management in order to secure money for increased safety of its hand-operated switches?

(4) It is stated in the editorial above mentioned that "the conservative men agreed quite readily as to the benefits * * *, but they believed the advantages gained justify the expense for complete circuits * * *." They point out the danger of the common return wire for two or more control circuits causing false-clear signal failures. Apparently there is a misunderstanding as to how signal dispatching operates. Under the system we have installed, the crossing or grounding of control wires between the dispatcher's machine and the unit cannot cause a false-clear signal. False-clears, if any, must originate where they now do in A.P.B. signal systems. The dispatcher's control wires cannot clear a signal falsely any more than it is possible in the "orthodox" practice to clear a semi-automatic signal from a lever, when there is a train standing on the track circuit. Therefore, all told, nothing new is introduced in "signal dispatching," except the elimination of useless apparatus. The protection is actually improved as compared with ordinary A.P.B. systems and the facility of train movement is also improved.