planations are given for the transmission of the "31" telephone train order, and these forms must be followed if possible. When a train crew is in doubt as to the correct method of handling an order or wishes to refer to the rules that apply in a particular case, the information is easily found by referring to the forms in the book of rules.

Train dispatching on our lines is a very simple matter when all trains are running on schedule time because our rules prescribe that trains in either direction have no superior rights over trains of the same class in the opposite direction, but that they must meet as per time table unless other orders are issued by the dispatcher.

RECENT IMPROVEMENTS IN SIGNALING*

BY J. S. HOBSON.†

In general, the progress made in this branch of engineering has been more along the lines of developing designs already in general use, than in making radical changes in design or in placing entirely new apparatus on the market. The interlocking and signaling for the new terminal of the Pennsylvania in New York City is a striking example of this, since, while that installation is the very latest development in railway signaling, it differs little in general principles from similar plants installed during the past five years. The most noteworthy features of this installation comprise means for obtaining the positive control of interlocked signals by the actual position of the switches or switch they govern; the automatic control of such signals by track conditions; the automatic locking of all switches in every route by the entrance of trains thereon, and their automatic release immediately the rear end of a train has passed clear of the fouling point of the track including each switch. The special features further comprise means for giving visual indications to the tower operator of every act of a train in actually locking and releasing levers controlling switch and signal operation, and means for permitting the joint use of all tracks for traffic in either direction between adjacent towers, by the co-action of towermen and track conditions.

The foregoing are, however, developments of methods previously in use in other plants, and while, in a sense, improvements, are not radical. There is, however, one somewhat original improvement in the Pennsylvania Terminal installation, used for the first time to any extent; namely, the control of electro-pneumatic valves through magnets actuated by alternating current. The use of alternating current for the operation of signal apparatus has been steadily growing for the past seven years, and the twelve-month just passed represents a more rapid growth of its use than any previous year. Alternating current was first used to any extent in signal apparatus for the operation of track circuits on electric railways, employing either alternating or direct current for propulsion purposes, but now its use has gradually been extended to signals, indicators, locks, etc.

A new field has very lately been opened for signal apparatus on interurban electric railways, the managers of which are taking a very keen interest in this subject, several contracts of this kind having just been closed by this company. Since their conditions differ somewhat from the electrified sections of steam roads, certain modifications have been made in alternating-current signal apparatus, resulting in improvements tending to increase its efficiency. For example, by modifications in the design of alternating-current relays, transformers, etc., the length of track circuits which can be operated without relaying has been materially increased, and the cost of installing alternating-current automatic block systems reduced accordingly.

The only other striking improvement in signal apparatus has been the development of the electro-mechanical interlocking system, in which the switches and their locks are operated manually and controlled electrically, the signals being electrically operated. This system possesses the combined safety features of manual and power operated interlockings at a cost about midway between the two.

Numerous minor developments in products have been made, as, for example, the improving of insulation in electrical material, the standardization of details to fit them for more universal application, and the modification of designs to cheapen the cost of production and expedite delivery of orders, among which may be mentioned the substitution of drop forgings for parts previously made of malleable iron, which from the nature of its manufacture cannot be furnished on short notice.

As an example of the improvement in the design of electrical apparatus, porcelain and insulating moulded material has been substituted, in many instances, for parts previously made of metal and insulated by bushings and washers.

*Abstract of an article in "The Electric Journal" for January, 1911.

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CAUSTIC SODA SIGNAL BATTERIES

BY A. G. SHAVER.*

Less than a year ago railways were buying their caustic soda battery without a very definite specification. The kind used was generally one selected after a series of experiments with the products of several different manufacturers. That concern whose battery appeared to give the best results in service was usually given the order, and if good service from that make of battery continued, then other orders followed to the same concern. Of course the purchasing agent would get prices and these would be a factor in determining whose goods would be purchased; but after a salesman had the first order, he did not much fear losing the business through competition as to prices if his battery only continued to give reasonably good service. In the absence of a specification, no two concerns were bidding for business on the same basis, and it was easy for a manufacturer, once having established a reputation as to the quality of his goods, to shave on the materials as well as the price.

In March, 1910, a Sub-Committee of Committee No. 4 of the Railway Signal Association first took up the question of a specification, and the result of their efforts is the specification presented at the last annual meeting, and now submitted to the members for adoption by letter ballot.

Considering that thousands of dollars worth of this type of battery is now used yearly by a number of the railways, this specification is one of the most important before the Association at this time, and it is hoped that the various signal engineers will appreciate its value and use it, not only to the benefit of their respective roads, but to the benefit of the manufacturers as well. If the manufacturers have only the one standard to follow, they can produce goods of a better quality at less cost, and keep a stock from which to fill orders promptly.

When the Sub-Committee began the preparation of its specification for caustic soda primary battery, it discovered that, although it was common practice to designate the capacity of the battery in ampere hours, no two manufacturers had the same basis for such a rating, nor were they agreed as to the proper basis to use. As the universal practice seemed to be to use 16 cells of caustic soda battery on each low-voltage electric motor semaphore signal, and as such signals would not operate to give the best service on a current source with an E. M. F. of less than eight volts, the sub-committee decided that the proper basis for determining the capacity of a caustic soda cell would be the number of hours it could be discharged at the rate of one ampere before the voltage, measured across the terminals of the cell with the current flowing, would drop below .5. Further, as some of the manufacturers were putting on the market a cell of practicable and convenient size which, when considered on this basis, had a life of 400 hours, and as in actual service on motor signals, considering the usual current discharges, local action, etc., it appeared the cell of such capacity was about the most efficient, the 400 ampere-hour signal cell was decided upon as standard.

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