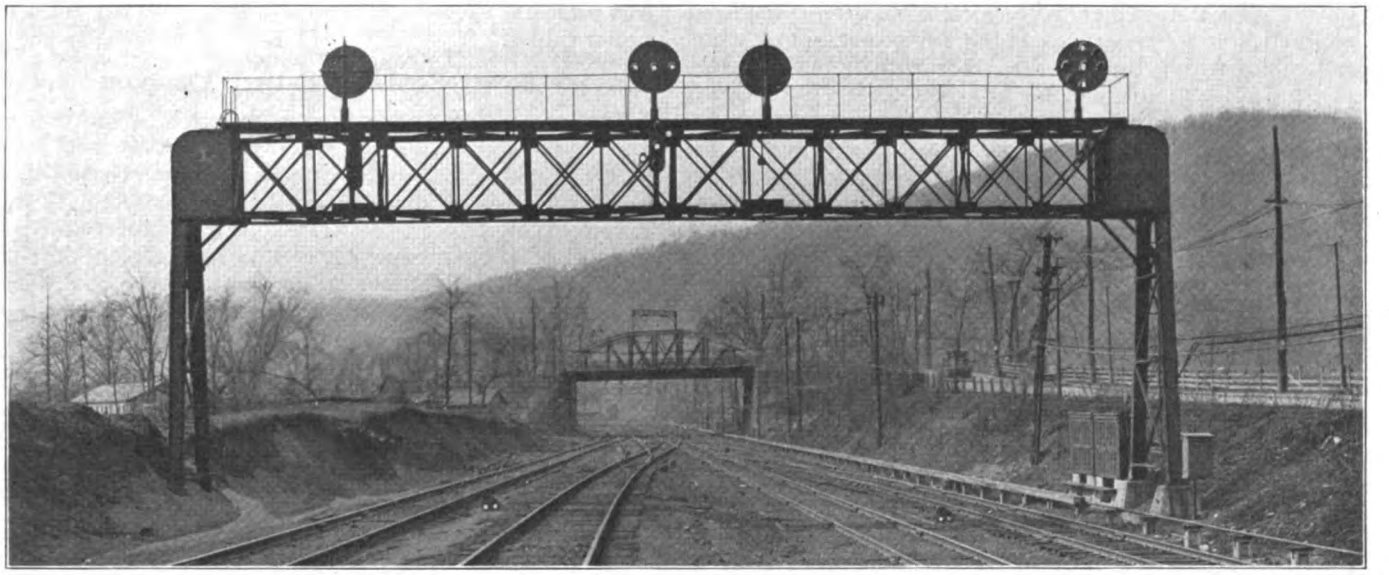

The Home Signal Bridge at North End of Plant, Aspinwall, Pa.

New Plant on the Pennsylvania

Recent Installation of Low Pressure Electro-Pneumatic Interlocking at Aspinwall, Pa., Replaces Three Old Mechanical Plants at Saving of $36,690 per Year

By F. A. Beck

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DURING the summer of 1922, the increasing of track and yard facilities between Fort Wayne Jct., Pittsburgh, Pa., and Aspinwall, on the Conemaugh division of the Pennsylvania Railroad, made necessary the remodeling of three interlocking plants located in vicinity of Sharpsburg, Pa., and Aspinwall. The conditions were such that to remodel meant practically to rebuild throughout, and as the estimated total first cost for the three interlockings was 80 per cent, of that estimated for one large power interlocking, it was decided to construct the latter on account of the advantages to be gained in handling movement of trains and the lower cost of operation.

The arrangement of tracks and signals is shown on the track plan Fig. 1, all functions being controlled from a Union Switch & Signal Company electro-pneumatic interlocking machine of the latest type and consisting of—

18 levers for 53 signals
21 levers for 30 switches and 3 derails
2 levers for 2 m. p. frogs

41 working levers

10 spare spaces

51 lever frame

The tower is located close to the junction of the east and west wye tracks as they enter on the bridge over the Allegheny river. The location combined with the desire to have the operating room in the second floor above track level necessitated the construction of four floors and a basement in which the steam heating plant is placed. The tower is of brick, the outer sides of the fourth floor being copper sheeted. With the compressors and switch board on the first, transformers on the second and relay cabinet with terminal case for cables on third or track level, the fourth floor is left for the operating room.

Special Control and Indication Circuits

The operation of all switches and signals is accomplished through circuits in accordance with Pennsylvania System standard practices for SS-control with separate common returns for control of track repeating and signal control relays; polarized switch repeating relays are used in the indication circuits for the electro-pneumatic switches. All track circuits operate on alternating current; with circuits 1000 ft. and less in length, single element vane type relays are used; on the longer circuits the double element vane type are used.

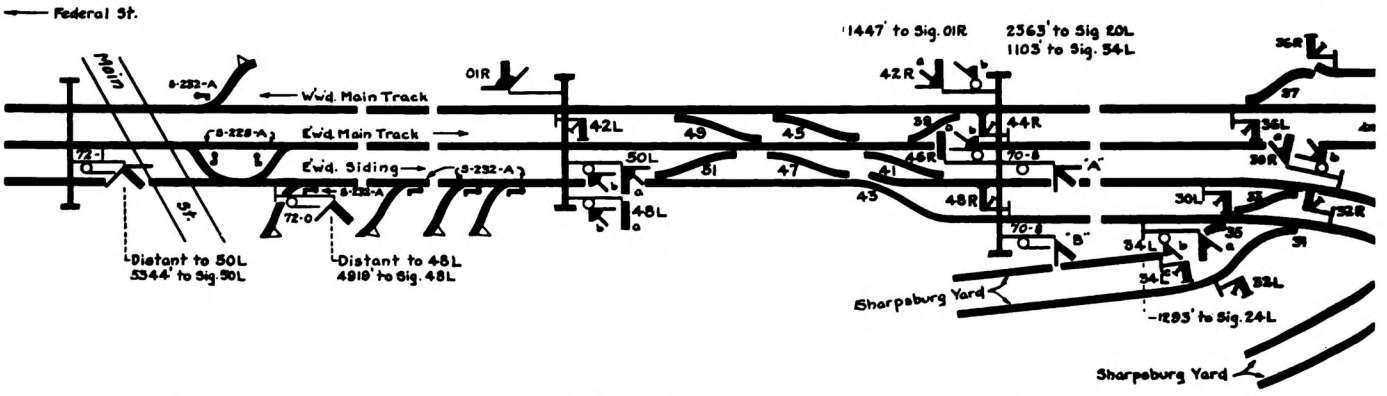
On the front of machine and located under each lever are indication lights which when burning indicate whether track circuits are clear for operation of switches and signals; a small cabinet with lights is located on the operator's table to indicate the presence of trains when the approach track circuits outside of the distant signals are occupied. The information provided by the lights is necessary due to heavy fogs in certain season of the year, and the limits to which the plant extends.

Aerial Cables in Preference to Underground

The home signals at the east and west ends of the plant are 3,740 ft. and 3,700 ft., respectively, from the

tower. This, together with local conditions, made it impracticable to construct conduit for protection of wires and cables within these limits. Accordingly aerial cables suspended from messengers attached to steel crossarms on the existing telegraph poles were used, the cables being opened where necessary at relay and terminal cases. Between these cases and the switches and signals in the near vicinity, wood conduit attached to top of foundations carrying the main air line was used to protect the wires and small switch cables required as controls.

With signals of "Position Light" type, a. c. track circuits and storage batteries to be charged, a power line of sufficient capacity for present facilities and possible



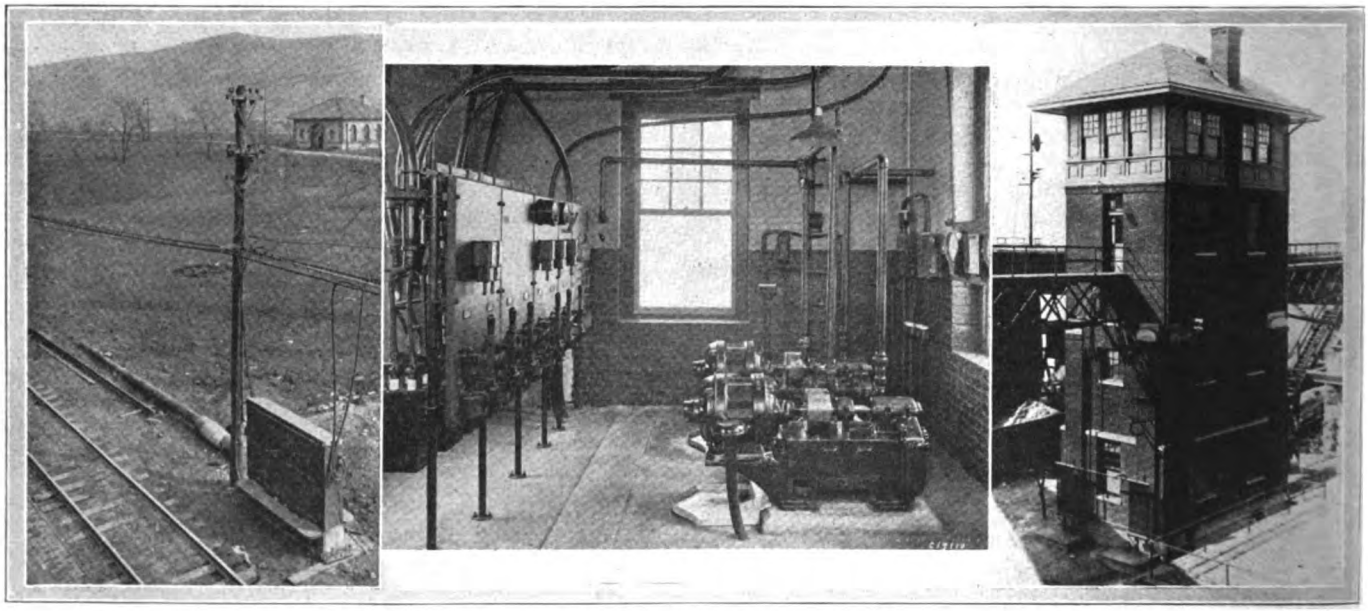
future extensions was necessary. The right of way owned by the railroad was limited and afforded room for but one pole line, consequently the power lines and signal cables had to be attached to the existing line which was already in use for the telegraph and telephone open line circuits.

Safety demanded that the power lines be placed at least four feet above the transformers attached to poles, the transformers to clear the low voltage telegraph, telephone or signal line wires by five feet. The upper crossarms were already at the top of poles. It was not desired to renew the entire line with poles of sufficient height to permit the nine feet separation. Under these conditions it became necessary to clear the poles of open line wires and combine them in a lead covered cable, which was attached to the steel crossarms in company with the signal cables.

Power Feed and Battery Charging

The power lines were then attached to a short crossarm at the top of the poles and consisted of two No. 4 A. W. G. gage h. d. bare copper, over which power at 4,400 volts, single phase, 60 cycles, is carried. At each group of signals a 4,400-110-volt oil immersed transformer of proper capacity is attached across the line. Switches of the outdoor disconnecting type are placed in both sides of power line on the pole next to each transformer location for sectionalizing purposes in case of line trouble. Bus lines from the 110-volt secondaries are carried into the relay cases, where by means of suitable taps, on small air cooled track transformers, the desired voltage for track circuit feeders and signal lighting circuits is secured.

The storage batteries, housed at all home and distant signal locations, are the Exide KXH floating charge type of 125-a.h. capacity and are charged direct off the 110-volt lines through Valley type rectifiers; these are provided with power off relay feature for lighting the position light high signals in case of power failure. The 14-volt and 12-volt batteries for the control of switch valve magnets and signal relays operating from the machine, are provided in duplicate sets of MVS type of 140-a.h. capacity. These are housed in the compressor room,



Cables Carried on Angle Iron Cross-Arms

The Power Switch Board and Compressers

The Tower Is Four Stories High

and are charged from a mercury arc rectifier panel outfit.

All switches, M. P. frogs and derails are operated by the U. S. & S. Company's Type A-1 electro-pneumatic switch movement, the Style-C cut-off valves being mounted on independent concrete foundations. The air supply is carried in a two-inch main air line supported on concrete piers spaced at 10 ft. centers, except at two points where it rests on the bridge structure and the retaining wall.

Pressure is maintained at from 55 lb. to 70 lb. Two motor driven air compressors of the National H-6 type are used, each having a capacity of 52 cu. ft. free air per minute. The motors operating on 220 volts, 3 phase, 60 cycles. Atmospheric after-coolers with radiating surfaces equaling slightly more than one square foot per cubic foot of the compressor capacity are provided for each compressor unit, the coolers being supported on the outer east wall of first floor of tower. Two reservoirs of 10 cu. ft. capacity each are located at the tower, while three others of equal capacity are placed at remote points on the plant as a means of storing reserve pressure.

As a further precaution against air pressure failures, arrangement has been made at clearance points of two spur sidings for placing a locomotive engine and pumping air into reservoirs and from there into the main air line. Brass gate valves are cut into the line at all points where reservoirs are placed or branch lines taken off for purpose of closing line on either side in case of a break or necessity for removing the reservoir.

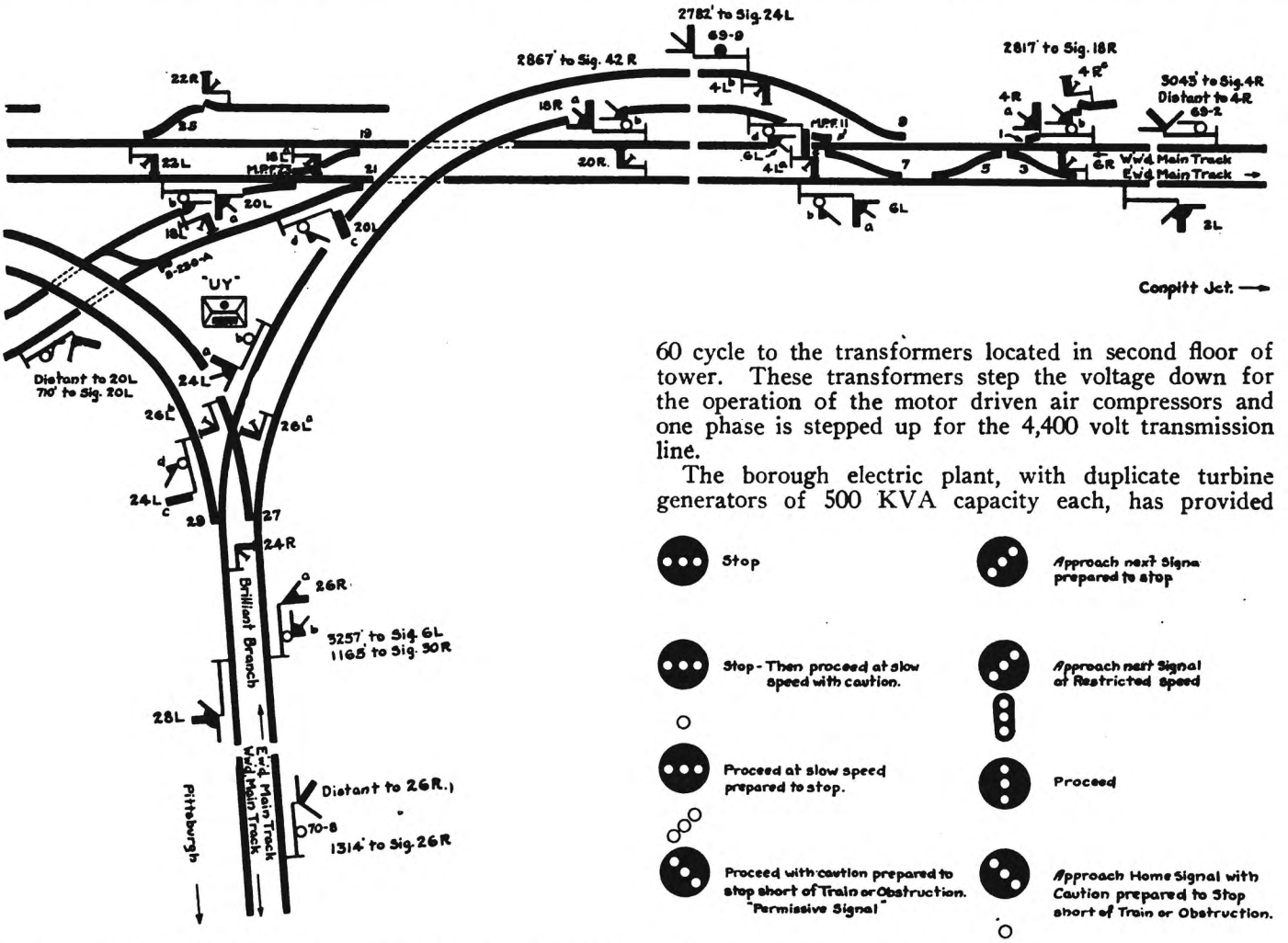
The use of the compressors is alternated every day. Each is controlled through National AR governors set normally to start the compressor when the pressure drops to 55 lb. and to cut out when pressure reaches 65 lb., during the winter months the limits are increased to approximately 58 and 70 lb. On the average a compressor will pump up the pressure from 58 lb. to 70 lb. in about 5 min. and it will drop back to 58 lb. within a 10 min. period.

Operation of Air Compressors Is Economical

Power for operating the compressors and all other signal requirements on the plant is delivered by the Aspinwall borough electric light plant at 2,300 volts, 3 phase, 60 cycle to the transformers located in second floor of tower. These transformers step the voltage down for the operation of the motor driven air compressors and one phase is stepped up for the 4,400 volt transmission line.

The borough electric plant, with duplicate turbine generators of 500 KVA capacity each, has provided reliable service, there having been only one interruption of a few seconds since the plant went in service on September 17, 1923. The balancing of the load is also well compensated as the volt meter chart shows but slight variation even with the starting load of the compressors.

The average consumption of current per month has been 5,600 KW at a cost of $175. This power was

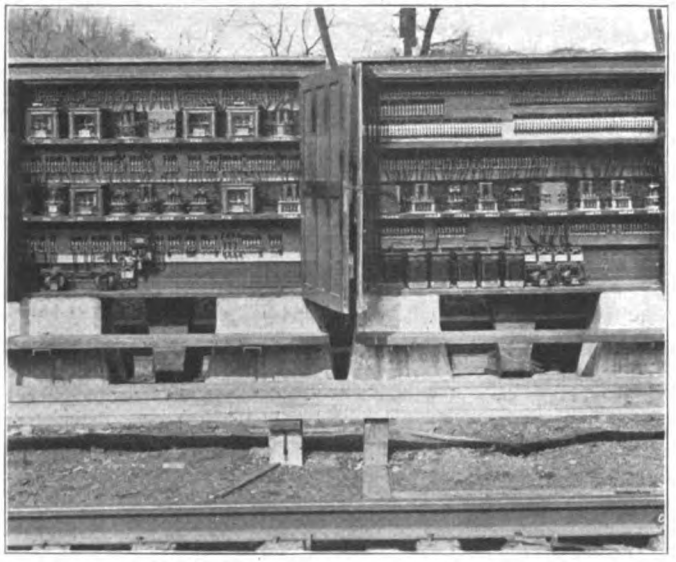


Aspects of the Light Signals

supplied to 42 track circuits and 48 position light signals in addition to charging 14 sets of storage batteries and power for two 9.6 h.p. motor driven compressors. This monthly cost for power is but a small percentage of what would be entailed had it been necessary for the railroad company to construct, maintain and operate a power station of its own.

Large Quantity of Materials Used

Some idea of the quantity of material entering into the construction of an interlocking of this size and the extended limits, may be had from the statement that 280 relays, 245 insulated rail joints, 12,000 ft. 2-in. extra heavy galvanized iron pipe for main air line, approximately 1,110,000 conductor feet No. 14 AWG wire in braided and lead cables, 80,000 ft. No. 9 AWG, 70,000 ft. No. 14 AWG, and 25,000 ft. No. 16 AWG insulated wire, 6,600 porcelain wire terminals, and 7,500 ft. trunking conduit of various sizes, were required in addition to 3,000 ft. 3 in. fibre duct line laid in concrete, this type



Relays, Rectifiers and Battery in Outdoor Case

of construction being used at points where it was necessary to carry signal and power cables underground.

New Plant Saves $36,900 a Year

The operating results obtained since installation of the plant have proved that the decision to control all switches and signals of the three former locations from one central station was wisely taken. With the former three interlockings, the towerman at one location could only advance a train to the home signal of the interlocking beyond. With the present layout, through movements can be made without delay and as the levermen and operators became familiar with the flexibility with which train movements could be made within interlocking limits, single line movements against normal direction of traffic, the passing of preferred freight around slower moving trains and the use of portions of the main tracks for quick switching or crossover movements, all without necessity of issuing train orders, have combined to cut down train stops and delays until a conservative estimate of five train hours delay each day is made as one item of saving.

Under the old arrangement nine operators and five signal maintainers were employed at an annual wage of approximately $26,925. With the new interlocking three operators, three levermen and three signal maintainers receive wages approximating $19,250, leaving a saving of $7,675 annually in wages alone. To this there may be added the conservative estimate of a minimum saving of five train hours' delay daily at a cost of $16.12 per hour, or $80.60 a day which is equal to $2,418 monthly, or $29,015 for the year. This sum in addition to the saving in wages amounts to $36,690 as an annual saving, or about 18 per cent return on the total investment. The above figures are given as an example of the savings which can sometimes be had if careful investigation of the signaling re-

An Assembly of Electro-Pneumatic Switch Movements and Valves

quirements of a situation is made, and while the first cost may appear to be such as to prohibit the project the ultimate advantages show the justification for the expenditure.

Number and Wages of Signal Employees for 1923

THE Bureau of Statistics of the Interstate Commerce Commission has issued a report for the 12 months ending December 31, 1923, showing the number of employees and the amounts of their compensation, grouped by departments and duties, for Class I roads of the United States. The report shows that up to and including the rank of general foreman and supervising inspector, that there were 18,503 signal men employed as an average on the Class I roads in 1923. The average monthly wages for each class is given opposite the number employed as shown in the accompanying table.

	Employees	Wage
General foremen and supervising inspectors (signal, telegraph and electrical transmission)	545	$242
Assistant general foremen (signal, telegraph and electrical transmission) and signal and telegraph inspectors	588	215
Gang foremen (signal and telegraph skilled-trades labor)	1,180	191
Signalmen and signal maintainers	8,057	157
Linemen and groundmen	2,535	145
Signalmen and signal maintainer helpers	3,232	97
Assistant signalmen and assistant signal maintainers	2.386	119
	18,503	...

As a means of preventing waste in the use of equipment and supplies and of promoting greater economy in all lines of work, the Chicago, Burlington & Quincy has inaugurated an economy program, a feature of which is the co-ordination of all forces on each division by means of division committees, each consisting of the division superintendent as chairman and the division officers of the engineering, mechanical and stores department as members.