## A PENNSYLVANIA SIGNAL DEPARTMENT REPAIR SHOP.

The signal department repair shop for the Western grand division of the Pennsylvania is situated at East Liberty, a suburb of Pittsburgh, Pa. The shops occupy a part of the building shown in Fig. 1, which is 149 ft. by 200 ft. in size; and the general arrangement of the shops, assembling room, and store rooms, to which the building is given over, is shown in Fig. 2.

Fig. 1. Shop Building.

The blacksmith shop at the northeast corner of the building

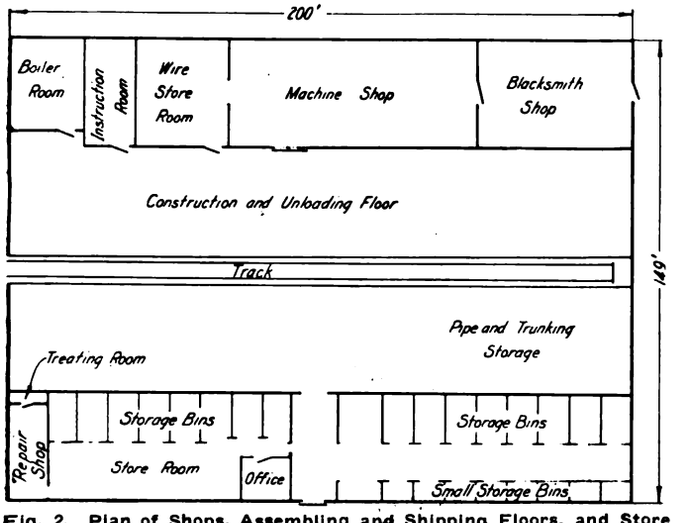


Fig. 2. Plan of Shops, Assembling and Shipping Floors, and Store Rooms.

contains the necessary equipment for heavy blacksmithing, including a number of power hammers. A 5-h. p. motor furnishes the power for this shop. The machine shop equipment includes

Fig. 3. The Blacksmith Shop.

a bolt-threading machine, a 54-in. lathe, a shaper for cutting locking, a power drill-press, and a number of bench lathes and emery wheels, all driven through counter-shafting by a 15-h. p. motor.

In addition to the blacksmith and machine shops there are a wire storeroom, instruction room, and a boiler room on the west side of the building. On the west side are located two storerooms, the offices of the shop foreman and his assistants, and the relay repair department.

Fig. 3 is a view in the blacksmith shop; Fig. 4 shows the machine shop; Figs. 5 and 6 show the assembling and shipping floor, and Fig. 7 shows a corner of the storeroom looking toward the main entrance. The offices may be seen at the right of this picture. Fig. 8 is a view looking toward the entrance from the north end of the main storeroom; and Fig. 9 shows the relay repair department at the extreme south end of the storehouse section of the building.

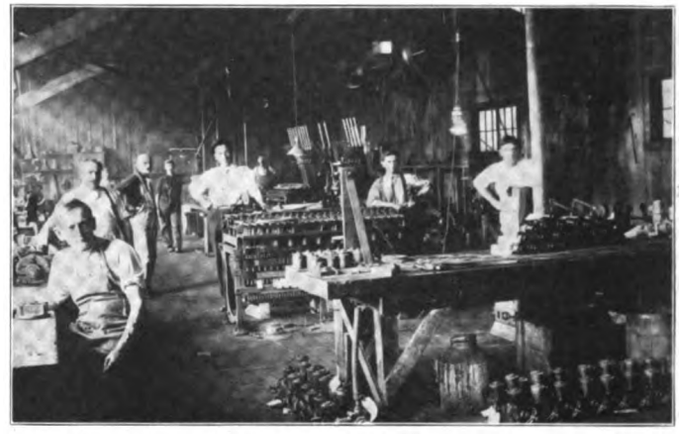

Fig. 4. The Machine Shop.

All repair operations for the Conemaugh, Monongahela, and Pittsburgh divisions, as well as many other divisions, are conducted at this shop. These include the insulating of switch rods ( a number of these partly completed are shown in Fig. 3), cutting lock rods, and reworking and repairing lugs and other mechanical parts, which are all done in the blacksmith shop; repairing electro-pneumatic valves, many of which are in use on this section of the road; cutting mechanical locking, repairing lanterns; rebuilding and repairing mechanical, electric, and electro-pneumatic interlocking machines, and switch and signal mechanisms; and restoring damaged material to such shape that it can be used again; these operations being conducted in the machine shop.

Fig. 5. One Side of the Shipping Room.

In the electrical repair shop relays, indicators, magnets, and testing instruments are repaired, and coils of various kinds are made or rewound.

The construction floor, shown in Figs. 5 and 6, is used for a number of purposes, such as painting posts, cases, ladders, and signal and interlocking material, and storing interlocking pipe and other mechanical parts, and trunking. The track in the center of the building simplifies shipping and unloading operations.

All of the signal material for three divisions is carried at this point. The shop and storehouses, in the various departments of which 26 men are employed, are in charge of W. H. Stauffer, foreman, who acts as storekeeper.

When material is sent in from the road to be repaired a receipt for it and its identification are entered in the foreman's

accounts, and he then issues a shop order for the proper repairs. The time each man puts on any job is recorded, and an account is kept of the amount of new material that goes into each piece of work so that the foreman knows just how much all repairs cost both in time and material. A comparison of the results obtained from repairs made in this shop with the results formerly secured from operations conducted elsewhere shows not only a big saving in cost, but also, and what is perhaps even more important on some occasions, a very great reduction in the time the material is out of service. An instance of the quick work that can be done in a plant of this kind is shown by the

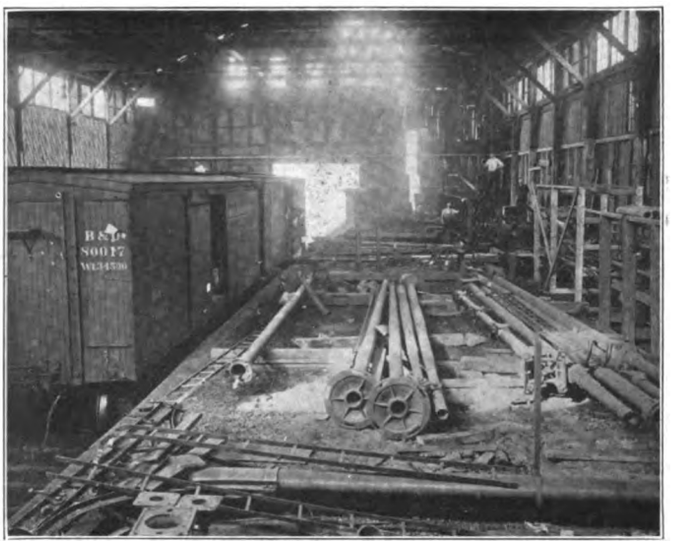

Fig. 6. Assembling Floor.

performance of the machine shop in cutting the entire locking for a 23-lever electro-pneumatic machine in less than 1½ working days, one man only being employed.

The relays used on the district are given serial numbers when they are put in service, and a careful record is kept of the performance of each instrument. When a relay is taken out of service permanently the new one that replaces it bears the same serial number. Every six months the relay inspector makes an inspection of each relay on the district. All of these that do not

Fig. 7. A Corner of the Store Room, Showing Offices at the Right.

test properly are immediately sent to the shop at East Liberty, being temporarily replaced by other instruments. In the electrical repair shop relays are put through a complete rebuilding process. All the metal parts are dipped to clean them, and the binding posts are given special attention in this respect, so that when they are ready to be put back in service they are as clean and bright as when new. In fact these rebuilt relays will last fully as long as new ones before additional repairs become necessary.

Another operation that is conducted at this shop is the painting of the signal blades. A duplicate set of blades is kept at East Liberty, and every six months these are distributed over the district by means of a train consisting of a baggage car and engine. When the distribution is completed the signalmen at the various points substitute the new blades for the old ones, and ship the old ones to various central points as designated by the signal foreman, from which they are collected and shipped to the shop. Here they are refinished and put in repair. The old paint is burned off with a gasoline torch, and the blades are then given three coats of the proper colors, over which two coats of varnish are applied. Then the blades are piled one on top of the other in a place provided for that purpose, where they remain

Fig. 8. The Store Room Looking Toward the Main Entrance.

for six months, or until it is time for the next change. The arranging of the blades in piles serves to prevent them from warping or becoming distorted while they remain unused in the store house. It is claimed that with the two sets of blades, each one being used six months, and then kept out of service for six months, the blades can be made to last almost indefinitely, while one set of blades constantly in service will not last much more than two, or at the most, three years.

Still another interesting operation that is performed at the

Fig. 9. The Relay Repair Shop.

East Liberty shop is the restoration of damaged material. For example, in the case of a wreck at an interlocking plant, all the parts that have been damaged are brought to the shop and restored, if possible, to their original shape, and then put away for future use. Front rods, detector bars, tie plates, switch rods, lugs, and other mechanical fittings are made over in the blacksmith shop. The value of this "reclamation" work is shown in the fact that out of a carload of damaged material taken from a plant at which a wreck had occurred, only three or four pieces

were so badly damaged that they could not be made fit for further service.

The eight-lever mechanical interlocking machine shown in Fig. 4 was made up entirely of scrap parts which had accumulated in the machine shop. No two levers came from the same place. This machine, for all practical purposes as good as a new one, was put in service on the district and is still in use. It is the practice to send all scrap parts from the entire district to this shop, and when enough of them that are worth saving have accumulated they are put to use.

A signal bridge may be seen at the right of Fig. 6. This bridge was brought into the shop to be repaired on account of the destruction of some of its members by locomotive gases. The bridge was in service on the eastern slope of the Allegheny mountains about one mile west of the Horseshoe Curve. The grade at that point is 99 ft. to the mile. Freight trains going up this slope generally have three, and sometimes four engines, and the gases and sand-blast effect from the locomotive stacks had eaten the top and bottom chords of the bridge about one-half through and totally severed two of the diagonal members. This bridge was built up of 2½ by 3 in. angle bars.

In addition to the economy resulting from conducting relay repairs in the shop the signal department secures, from the possession of the facilities at East Liberty, an independence not otherwise obtainable. It is almost completely separated from the necessity for outside operations. This, of course, increases the responsibility of the department to a considerable extent, i. e., it obviates the possibility of shifting the responsibility for delays to any other department. But the increased effectiveness of the organization, and the independent spirit which is engendered by the knowledge each man in the department has of what his department can do, more than counterbalances the increased responsibility.

## THE STAFF SYSTEM ON THE SOUTHERN PACIFIC.

BY S. L. BAXTER.

The longest stretch of track operated under the electric train staff system, in this country, covers 94.2 miles of single track on the Southern Pacific, between Loomis and Truckee, Cal. The road between these two points crosses the Sierra Nevada mountains at an elevation of 7,000 ft. and a maximum grade of 2.7 per cent. For 41 miles in the vicinity of the summit, where the snow last winter reached a depth of 27 ft. on the level, the tracks are covered with immense snowsheds, and night signal indications are displayed 24 hours each day.

The summit is 15 miles west of Truckee, which is the eastern staff terminus, and under normal traffic conditions it is necessary to cut out a number of helper engines here each day and return them light to the foot of the grade. These, with the large number of trans-continental trains passing over this road overtaxed the line under the old system of train orders and telephone block to such an extent that traffic was constantly being delayed.

The staff system was furnished by the Union Switch & Signal Co., was installed in 1905 and 1906, and has relieved the congestion by cutting down the delay at meeting points and enabling the dispatcher to keep the trains moving, as he can change a meeting point in about five seconds, whereas with the old system from three to ten minutes would be required; and to change one meeting point would often necessitate changing several others. The 94.2 miles of single track covered by the installation is divided into 35 blocks, averaging 2.7 miles each. Two instruments, one placed at each end, are required for the control of each block, and these are connected by a metallic circuit, a three-conductor cable being used for this purpose through the snowshed district. This is supported by a No. 9 galvanized iron messenger wire tied to oak brackets on the inside wall of the snowsheds. This is dead-ended at each station, and carried to lightning arresters in the pedestal of each instrument by a No. 14 rubber-covered copper wire along with the cable, so that it, as well as the extra strand in the cable, can be used in case of emergency.

Outside of the snowshed district two No. 6 galvanized iron wires are strung on poles set approximately 64 to the mile. This lead also carries telegraph and other wires.

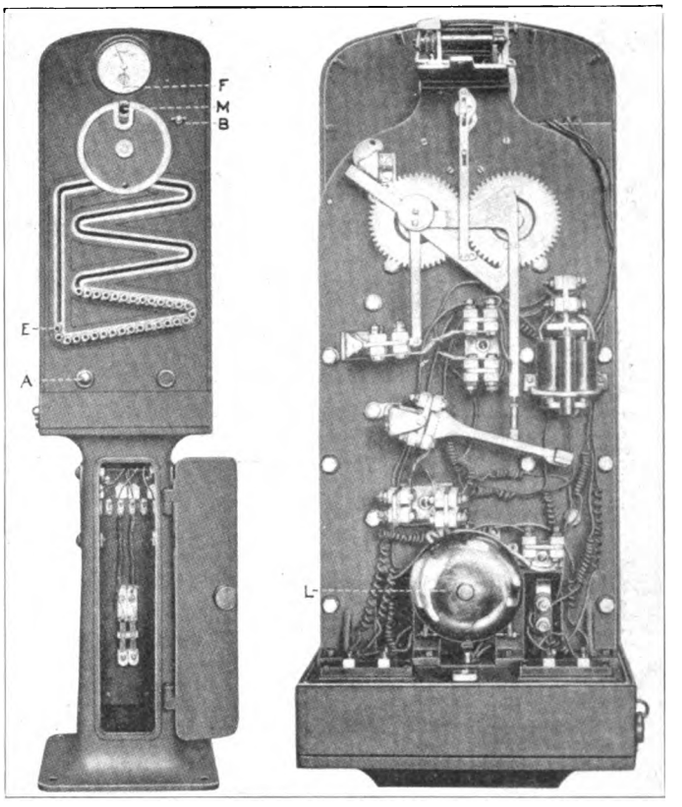


Fig. 1. Fig. 2.

Fig. 1 is a front view of one of the staff machines and Fig. 2 is a rear view of the head with the cover removed showing the mechanism.

To withdraw a staff the operator at "A" presses the button A, Fig. 1, three times, ringing the bell L, Fig. 2, at "B," the

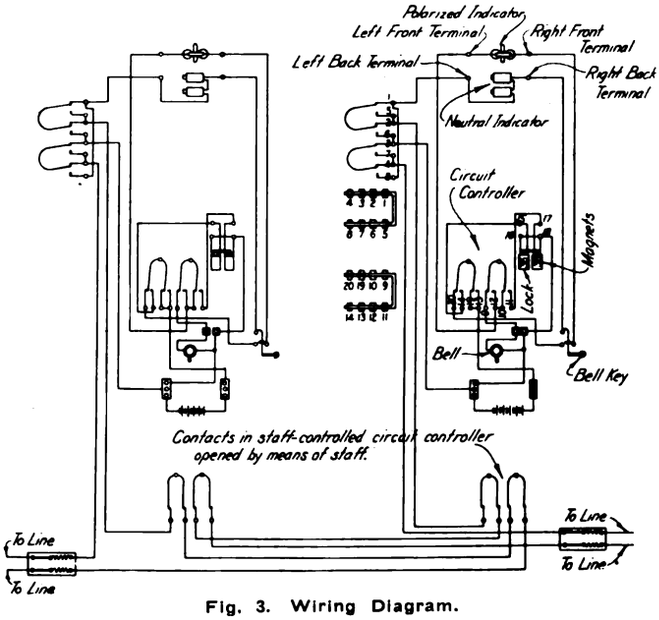


Fig. 3. Wiring Diagram.

opposite end of the block. The operator here, after consulting his block sheet, answers the signal and holds the button in, thus supplying current to the instrument at "A," which is indicated to the operator there by the deflection of pointer F, Fig. 1. "A" now turns the spindle B to the right as far as it will go, and