

"push-pull" power output stage, using heater-type tubes. The heater and plate power is obtained directly from the 64-volt direct-current train supply circuit. Illustration "B" shows the complete circuit of the amplifier and the loudspeaker. The two voltage amplifier stages both use type 76 tubes. The transmitters of the diner telephone, rear car telephone and rear car extension set are connected to the first stage voltage amplifier by means of an input transformer. The first stage is resistance-coupled to the second stage, and the second stage is transformer-coupled to the push-pull power output stage. A potentiometer connected between the first and second stages, provides means for controlling the output volume of the amplifier assembly.

Type 43 tubes are employed for the third (push-pull power output) stage. The power-output stage feeds the loudspeaker through a transformer attached to the speaker frame. The filaments of all tubes are in service across the 64-volt power supply, with an additional resistor in the circuit to hold the applied tube-heater voltages slightly below their rated potentials. This arrangement insures good tube life under the condition of continuous operation. The plate supply circuits include two noise filters (one for the first stage and the other for the second and third stages together), thus securing adequate suppression of supply circuit noises. Since the plate-supply voltage is only 64 volts, the grid bias for the first and second stages is provided by Mallory Bias cells instead of the more usual method of self-bias. The third stage, however, because of its comparatively large bias voltage requirement, receives its control grid bias in the form of a drop across a resistor placed in the common cathode return circuit.

The correct volume control setting is that for which the loudness of the voice from the loudspeaker is adequate for proper understanding by the engineer when in his normal driving position. To adjust the amplifier volume control, it is so set that satisfactory loudspeaker volume is obtained (with the train running) when a trainman is talking in the ordinary manner from one of the cars to the engine cab.

In view of the difficulty normally experienced in locating an open heater in a series circuit, the amplifier is provided with means for directly indicating which tube has failed in such a manner. A 5-point, 2-pole switch, designated as SW-1 on Diagram B, is so wired in combination with the tube filaments and

the pilot lamp that the pilot lamp may be used to indicate the open heater.

The switch is turned from the normal position (position No. 5) to position No. 1. This connects the pilot lamp in multiple with the filament of the tube in the first stage; and the pilot lamp will glow brilliantly if the filament of tube No. 1 is open. If the filament of tube No. 1 is complete, the pilot lamp will not receive sufficient current to glow. If tube

No. 1 tests O.K., the switch is next turned to position No. 2. If the filament of the tube in the second stage is open, the pilot lamp will glow brilliantly; otherwise the pilot lamp will remain dark. In this manner, the condition of the individual tube heaters may be determined by observing the pilot lamp for the various switch positions.

The telephone equipment on the Rocket trains was supplied by the Automatic Electric Company.

## Illinois Central Petitions to Remove Train Control

THE Illinois Central has applied to the Interstate Commerce Commission for authority to substitute "the protection of modern three-indication color-light automatic block signals of the searchlight type on the wayside" for the automatic train-stop and two-indication cab signal devices now in operation on its 122-mile line between Champaign, Ill., and Branch Junction. The application, which takes the form of a petition for a modification of the commission's order of June 13, 1922, sets forth, among other contentions, that traffic conditions in the territory involved have changed substantially since the present system was installed, and desired maximum train speeds can be achieved only after an expenditure of \$68,411 for rearranging the present roadside apparatus to provide the full braking distances required.

Rather than make this expenditure the road would prefer to spend \$123,045 on the proposed new automatic block system, because the latter would bring only \$18,967 a year in operating costs as compared with the \$44,421 spent annually to operate the present system. Thus, the petition points out, the extra \$54,633 investment will result in an annual saving of \$25,454.

The system which the road desires to discontinue was completed in January, 1926, at a total installation cost of \$394,307. It is the Union Switch & Signal Company continuous induction type automatic train stop with forestalling feature and two indication cab signal without permissive wayside signals; 94 locomotives are at present equipped. Present conditions, and those to be expected in the future, the petition says, are such that they "will not hereafter reasonably require the

continued maintenance and operation of the present expensive system to afford adequate protection and safety." The density of traffic and number of trains moved have both diminished, chiefly because of the "development of improved highways in the territory and the increased use of trucks, buses and private automobiles."

As to train speeds it is pointed out that at the time of the installation in 1926 the maximum operating speed in the territory involved was 60 m.p.h. This has been gradually raised and it is now desired to put in an 85 m.p.h. maximum for passenger trains and a 60 m.p.h. limit for freight trains. These plans, if carried out with the present system in operation, would require the \$68,411 rearrangement expenditure mentioned above.

On the other hand, the petition insists, the proposed signal installation will provide adequate protection, adding that signals of the same type are now in service on the Illinois Central on 1,533.7 miles of road and 2,293 miles of track. Citing statistics of accidents in the automatic train stop territory the petition regards it as "noteworthy" that these have occurred in spite of the system. Also, there are "no known instances" wherein the system has prevented collisions or accidents on this line which would have occurred in its absence. Meanwhile the system "has caused numerous undesired brake applications resulting in stopping and delaying trains and damage to equipment and lading." Elimination of the latter and the discontinuance of the locomotive devices are cited as economies, in addition to the above-mentioned saving in operating costs.