

Iran Rys Have Simplified ATC

Iranian State Railways have installed an approach warning system based upon a simplified form of automatic train control. This system is now in service on about 3,000 track miles and 140 diesel-electric locomotives.

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● Trains are operated from station to station by written train orders on the authority of station agents acting on telephone instructions from the divisional control offices. The block length between attended stations ranges from 6 to 15 miles. Maximum train speed is 50 mph.

Although continuous air brakes are in use, not all vehicles are fully equipped. Those not fitted with brakes have been provided with a through train line connection. Operating rules require at least 25% of the train weight to be braked in the mountain zones (up to 6,000 ft elevation) and 20% in flat territory. In the southern area of the country temperatures are high throughout the year and sand storms are frequent and serious. Other parts of the line are subject to heavy snow with low temperatures during the winter months, so that these factors together with curvature and tunnels make visibility difficult. Also, the long distances and running times between stations raise a problem of keeping enginemen continuously alert at all times.

At present the approaches to sta-

tions and other points requiring speed restrictions are indicated by fixed signs along the right of way. It was felt that a simple and reliable warning system should be installed to make sure that these, and later the colorlight home signals, would be properly observed. Broadly speaking, the intention was to establish a number of check points which must be acknowledged by enginemen, so that should one of these points be passed without acknowledging an automatic brake application would result.

The track equipment of the approach warning system consists of a permanent magnet which is fixed between two cross-ties and located on the approach track to each station, at a point which will allow full braking distance to the position of the future colorlight home signal. In general this corresponds with the position of the present station approach sign, which is placed 3,281 ft (1,000 meters) from the station entry switch. During operational tests it developed that the track magnets would have to be protected from dragging equipment and animals. Hence, track magnets were covered entirely by slotted wood cross-ties placed longitudinally.

On the locomotives a receiver is directly operated by the magnetic field

of the track magnet. The operation of this receiver causes a warning horn to sound in the cab and at the same time extinguishes the blue proving lamp in a small cab signal indicator. The engineman must now operate an acknowledging pushbutton within a preset time interval in order to restore the equipment to normal. If for any reason he should fail to cancel within this 3-second time interval, a service brake application automatically takes place and a red indication appears in the cab signal. This is recorded by a sealed numerical counter.

Once a brake application has been initiated by the train control equipment, it cannot be released until the train has come to a full stop, resetting being done by the main switch which is located outside the cab. The timing is sufficient to enable an alert engineman to cancel even under conditions of poor visibility. The recording of any failure to do so is in itself a factor which increases the alertness of enginemen.

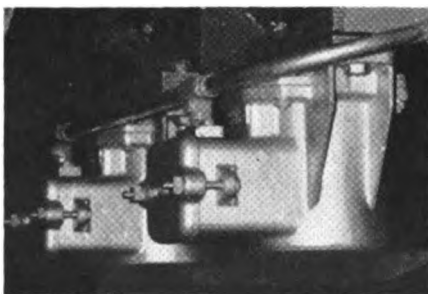
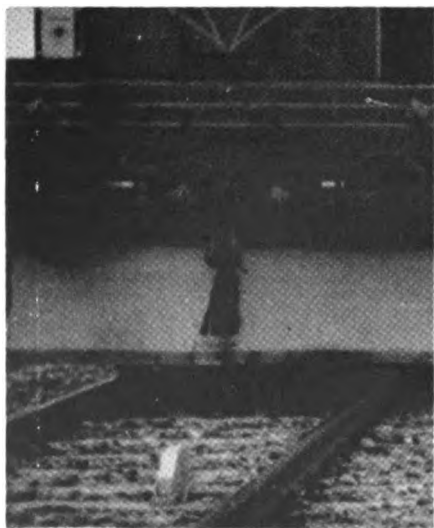
Diesel-electrics are Equipped

The approach warning system has been installed on 140 diesel-electric locomotives. Steam locomotives are not being equipped due to their becoming obsolete in the near future. In most cases the diesel units are used in multiple operation, in which case the train control equipment is operative only on the leading locomotive.

Each locomotive is fitted with two receivers, one or other being switched into the circuit according to the direction of running. This switching is effected automatically by the position of the reversing lever on the engine control panel. The track magnets are also offset from the center line of the track, so that the receiving relay is operated when a locomotive is approaching the station, but remains unaffected on the leaving side.

After the operational tests the ATC receivers, which were originally placed on brackets behind the pilot of the locomotive, were changed to a new mounting between the traction motors on the lead truck. This in turn necessitated the design of special anti-shock mountings for the receiving relays and an increased air gap between the receivers and the track magnets.

As the receiver itself is the main functional element of the system, the special features of the Stin magneto-



▲ Receivers mounted behind locomotive pilot (as shown) have since been mounted between traction motors on lead truck.

◀ Track magnets (since photo was taken) have been covered by slotted wood cross-ties to protect against dragging equipment.

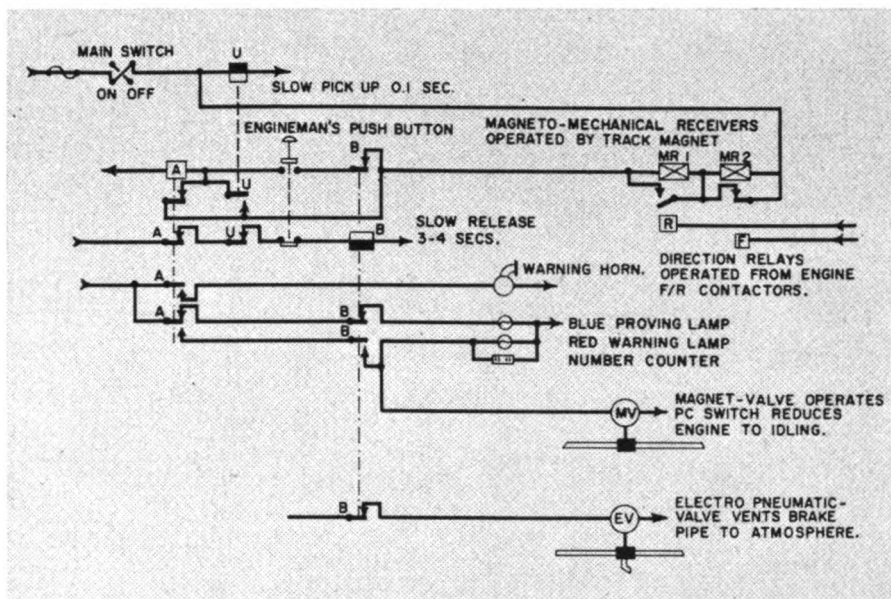
mechanical receiving relay greatly influenced the decision of the ISR in favor of the equipment. The Stin receiver is a non-polarized system, hermetically sealed, and employs a permanent magnetic holding feature for the armature without any moving parts subject to friction. It is not affected by stray currents and is operated from zero speed upwards to limits well above those utilized in train operation.

In accordance with modern ATC practice all functional circuits are checked so that any malfunction will result in a safe side failure. The Stin receiving relay operates directly from the magnetic flux of the track magnet, so that no amplifiers or high frequency circuits are necessary. The relays, fuses, etc., together with the main switch, are mounted in a cast iron case mounted on the catwalk outside the locomotive cab, the relay unit being of the plug-in type with anti-vibration mounting. The cab signal, horn and canceling pushbutton are separate units so that each can be mounted in the most convenient place inside the cab.

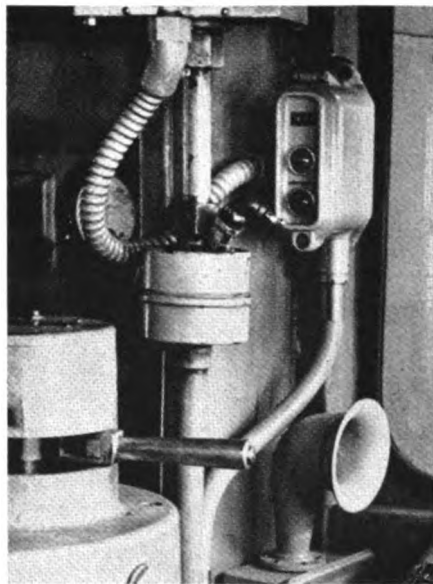
Special arrangements had to be made to adapt the ATC equipment to the electrical control circuits of the locomotives and also to the 6SL braking system. The locomotives have dynamic braking, but do not have any "deadman" control. In the case of an ATC application, a normally energized electro-pneumatic valve operates the pneumatic ATC valve, thus venting the train line to atmosphere. At the same time a second electro-pneumatic valve operates to knock down the PC (power cut-off) switch. This action has the effect of reducing the power motors to idling speed, and at the same time cuts out the action of the dynamic brake. This is necessary to avoid possible slipping of the wheels which would occur if the engine man attempted to superimpose dynamic braking on an ATC brake application.

In addition to the fixed track magnets, a number of portable magnets have been provided. These can be easily carried by track workers and clamped to the rail to ensure observance of any temporary speed restrictions. While the primary purpose of these is to provide protection for gangs working on the line, use of them is also contemplated in conjunction with suitable warning signs at other danger spots such as curves, bridges or tunnels under repair.

It is interesting to note that the adoption of the approach warning system has permitted some economy in the design of the signal system on the line from Tehran to the Persian Gulf port of Khorramshahr, as the warning



Circuit diagram of locomotive equipment of the approach warning system used on the Iranian State Railways. In case of an ATC application, the train line is vented to atmosphere. At the same time the PC (power cut-off) switch is knocked down. This has the effect of reducing the power motors to idling speed and cuts out dynamic braking.



Blue proving lamp and red warning lamp are mounted in engine man's cab over the warning horn, and easily visible.



Acknowledging pushbutton is just ahead of engine man's seat. Pushbutton must be pressed within 3 sec. after horn sounds.

signal given in the cab of the locomotive on the approach to a station renders the use of wayside distant signals unnecessary in most cases. This is possible as train speeds do not exceed 50 mph and the engine man will always be checked at full braking distance from home signal. Distant signals are therefore being installed only at those places where curvature or tunnels reduce the sighting distance of the home signal below normal braking distance.

While at present the approach warning system operates independently of the signal system, the equipment is such that if desired in the

future, the two systems can be interconnected so as to provide two-aspect ATC. Thus, by a slight addition to the existing apparatus, the engine man can be given an indication of the condition of the home signal at the same time as he receives the approach warning.

The approach warning system is a design of Integra Ltd. (Zurich) of Wallisellen, Switzerland, who supplied the equipment and supervised the installation. The work of installation on the locomotives was carried out in the workshops of the Iranian State Railways.