Rhodesia has 1215 miles of CTC

By D. H. Constable

Centralized train control has been in operation on the Rhodesia Railways in Central Africa since 1951. April, 1964 saw the completion of the final CTC section in Zambia, and the 1246 mile mainline from Ndola, on the Zambian Copperbelt, to Umtali, at the border between Rhodesia and Portuguese East Africa is now fully signaled. Of the 1246 miles, 1215 are CTC controlled from eight CTC panels and the remainder is composed of double line sections controlled by local signal boxes and automatic color light signals.

The pilot CTC scheme was installed on the Heany Junction—Gwelo section. Originally CTC was to have extended from Bulawayo to Gwelo in the Rhodesian Midlands, but in 1950 it was decided to convert Bulawayo Station from a "through" one to a terminal type and deviate the Salisbury and North main lines around the city. At the same time it was decided to double the track as far as Heany Junction. Incidentally in those days Bulawayo held the proud record of having the second longest platform in the world, 2437 ft. The longest one being at Storvik in Sweden, 2470 ft. The long through platform was fitted with central scissors cross-overs and two full length mail trains could stand at it.

Returning to the original CTC panel, it was delivered wired to control two crossing sidings on the single track between Bulawayo and Heany Junction, so before being brought into use it had to be rewired to take account of the new double track section.

The original installation had hand-operated switches, electrically re-

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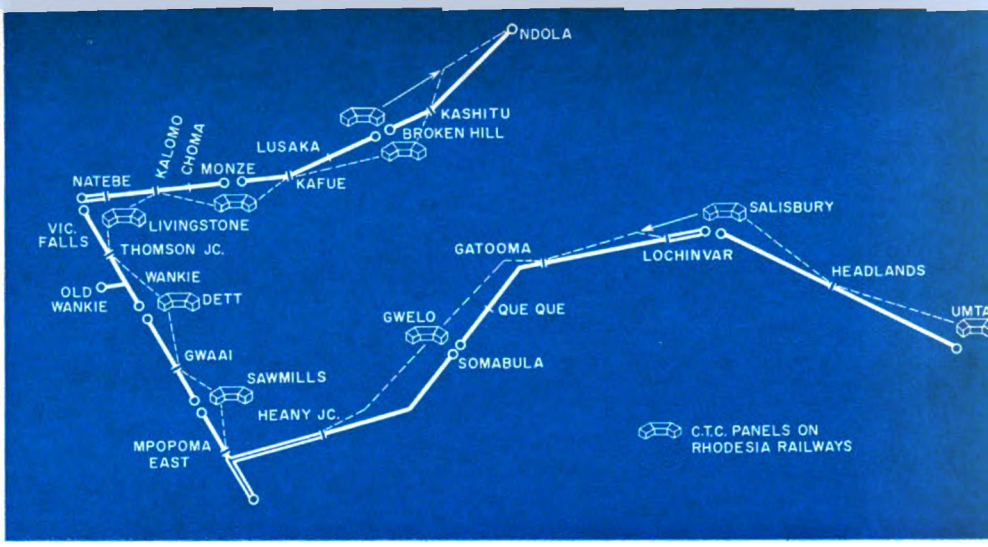
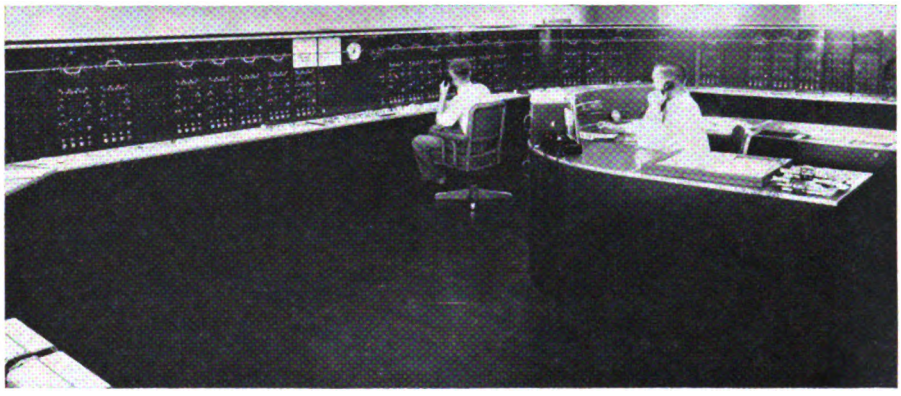
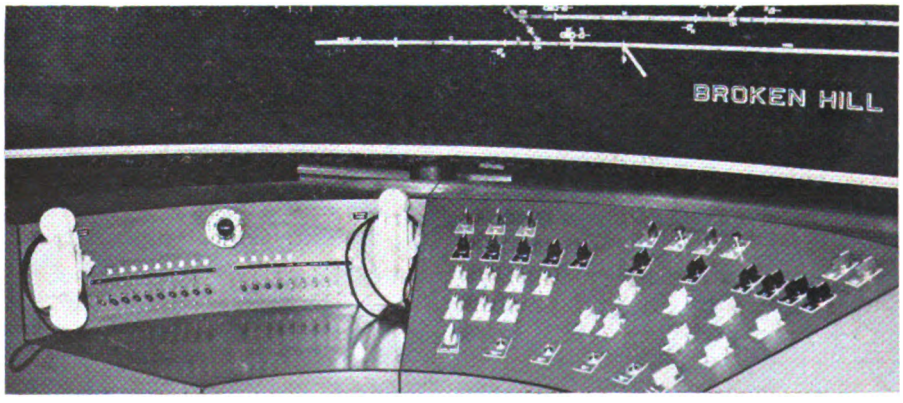


CTC is in service on 1215 miles of mainline; signaled mileage totals 1246.

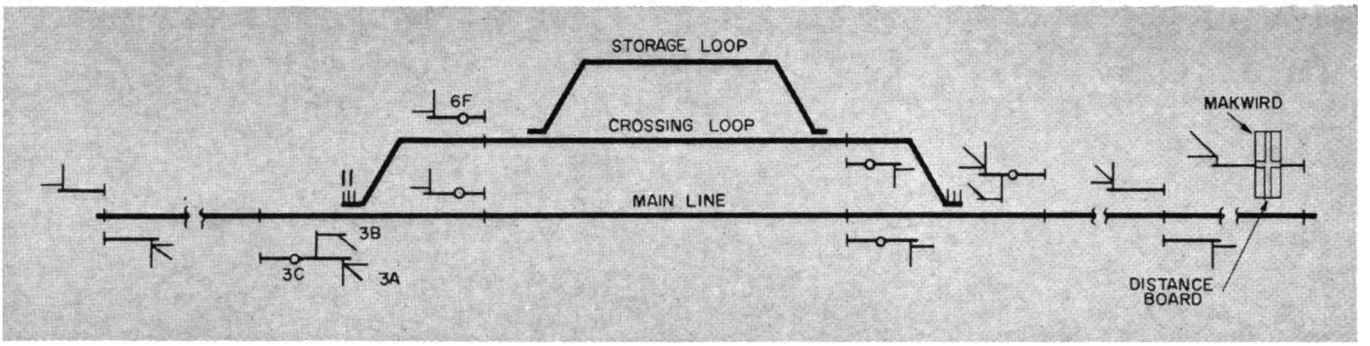


Salisbury machine controls 318 signals, 78 switches on 184 miles of line.

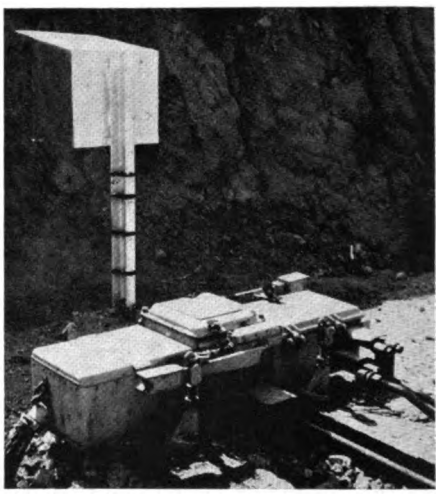
Gwelo CTC machine controls 182 miles of line between Gatooma and Heany Jct.



Broken Hill panel controls 229 miles of CTC between Ndola and Kafue.



Local control is provided at sidings for switching purposes. The train crew operates the power switch and clears signals from a local control unit at the siding. When on local control the main unit of the signals is out and a purple marker light is illuminated (3C and 6F, for example). With marker 3C lighted, then 3A and 3B heads are dark. Movement over switch 11 is either normal or reverse depending upon its position because it is on local control. When marker 6F is lighted, it indicates that a move is to be made over switch 11 reversed from the crossing loop to the main line. This move is made under local control. On signal 3, under normal CTC control, the lighting of 3B yellow and 3A red indicates a move from the mainline to the loop with switch 11 reversed. Where bad approach distances exist (curvature, bluffs, etc.) that shorten the view of the home or approach signal to a siding, a distance board (signal) is provided. This distance board (see signal at far right of diagram above) can provide either a yellow or green aspect and has a marker board with the name of the station in black letters on a yellow cross. Searchlight signals (below left) are used at the leaving ends of a siding. CTC phone is in a box near M5 switch machine.



leased and locked from the CTC panel. After obtaining a release the train crew reversed the points for the train to enter or leave the loop; resetting after the movement had taken place.

This was of course, a time consuming practice and some years later dual control power operated switch machines were installed. This greatly improved time keeping on the section.

When installed it was necessary to send a control code from the CTC panel to normalize the supervisory circuits in the field after each move. Circuits have since been rewired so that this is done automatically, thus reducing calls on the supervisory equipment and giving increased coding capacity.

One unique feature of this panel was its mobility! In 1955 it was decided to move it out to the new Mpopoma Marshalling Yard on the northern outskirts of Bulawayo, a distance of approximately three miles. There it resided until 1959, when, due to revised operating conditions it was required back in the Bulawayo District Headquarters at the station. So back it came again, being moved and re-connected in the record time of four hours, which called for a high degree of planning between Signals and Operating staff. In 1964 this panel was removed and the control of the Heany-Gwelo section was taken over by the new CTC machine at Gwelo.

The original CTC installation was very much a pilot scheme as the operating and traffic staff were extremely suspicious of its capabilities under African conditions. However, it did not take long for CTC to show its great advantages over the old paper order system. With a booming economy following the Federation of Northern Rhodesia (now Zambia), Southern Rhodesia, and Nyasaland (now Malawi) in 1953, it was decided to install CTC between the great coalfield at Wankie and Bulawayo. This line forms part of the main line to the "Copperbelt" in Zambia.

Panels were installed at Dett and Sawmills, the former being in the center of the Wankie National Game Park. These panels incorporated various refinements over the original one, such as:

(1) Low voltage alarm from sidings when battery voltage dropped below a certain level.

(2) Panel control of diesel generators when no permanent power supply available. Previously the generators had been controlled by time switches and no indication had been given as to whether they were switching on when they should have.

(3) Additional track circuit, and

signal indications.

At this juncture I feel that mention should be made of the steel sleepered sections of the Rhodesia Railways, as they were and still are quite extensive. Between Heany Junction and Gwelo on the original CTC section there were two steel sleepered block sections (wood sleepers have always been provided between home signals and through the loops at sidings). These sections were used for experiments with various pattern axle counters, i.e. mechanical treadle, magnetic, photocell operated; the last being designed to Rhodesia Railway specifications. During the dry season, which normally extends from March to November, the magnetic Siemens-Halske axle counter proved very efficient, but in the wet season November-March, Rhodesia and Zambia are subject to very heavy electrical storms which cause difficulties. In fact parts of Zambia have the second highest isokeraunic level in the world. These electrical storms frequently caused miscounts and although short track circuits were provided over the axle counters so that they would operate only when a train was actually present, delays continued to occur. Also nothing could be done to eliminate lightning flashes causing extra counts through inductive effects when the train had actually proceeded into the block, i.e. the train counted "out" but left additional counts on the motor caused by the lightning flashes. It was therefore decided to relay the steel sleepered sections of the Rhodesia Railways in wood or concrete as the 91 lb rail relaying program was extended. The standard track was 80 lb. RBS up until 1960. Now in 1965 steel sleepers only remain between Kafue and Choma, and Salisbury and Umtali.

In 1957 it was decided to review the whole operating procedure at sidings in the light of experience, and subsequently a new basic layout was involved. It was also decided that in due course the existing CTC installations from Gwelo to Thomson Junction would be altered to conform with the new standards. The new standards ensure that when shunting [switching] is in operation, the train shunts towards a red light, the advanced starter, and not a "Limit of Shunt" board.

When shunting is being carried out at an intermediate siding, the mainline switches are put on local control and the train crew operate them as required from a local control unit. At the same time, the applicable starter signal is extinguished, and a purple light switch indicator is illuminated below the starter to advise that the siding is on local control. After shunting has been performed the control is handed back to CTC. This greatly reduces the number of control operations to be made from the panel.

While on local control the position of the mainline switches is not continuously transmitted back to the panel for each and every move, and this reduces congestion of the CTC control lines.

Due to the extent of the proposed installations it was decided to ask certain major signaling contractors; Westinghouse Brake & Signal Co., Siemens General Electric (Signals) Ltd. and AEI-GRS to tender for the supply and installation of CTC from Umtali to Gwelo and Zimba (40 miles north of Livingstone and the Victoria Falls) to Ndola. Eventually contracts were entered into for CTC sections as follows:—

- Umtali-Gatooma: Westinghouse Brake & Signal Co. Ltd.
- Gatooma-Gwelo: Siemens & General Electric (Signals) Ltd.
- Zimba-Ndola: AEI-GRS Limited.

The section Thomson Junction to Zimba had been let to AEI-GRS in 1956, but work was held up pending introduction of the new standards.

The power switches are normally controlled from the panel; when shunting is to take place the operator switches to local control, and the train crews operate the switches from a local switch stand. In the event of failure the power switches are placed on hand control and operated by the Guard.

All the main running signals are of the 2 and 3—aspect searchlight type. This type of signal has been found to be the most suitable for the conditions of bright sunlight found in Rhodesia and Zambia, and they are less likely to produce the elusive "phantom" aspect.

The design of signaling relays has changed considerably since the Heany-Gwelo section was installed, where ordinary shelf type were employed. The plug-in type was introduced on the Wankie-Gwaai section and has now become standard throughout, with the miniature pattern predominating in Zambia.

Brass taped PVC cables buried in the ground are used for all local distribution, with a multicore suspended cable between the main location huts at each end of the siding.

The brass tapes proved very necessary as Rhodesian termites appear to thrive on signaling cables, perhaps it supplements a vitamin deficiency in their diet. While dealing with animal attacks, we have also found the inside of a searchlight signal full of white ants that had forced entry. The maintenance staff also have to contend with elephants scratching their backs on telegraph poles, and bringing the route down, and giraffes running through the overhead routes and becoming entangled. Not to mention a hunter shooting baboons and bringing down a suspended cable!

The telecommunication route which is railway maintained follows the line of rail throughout the countries served by Rhodesia Railways. It normally consists of CTC control wires, CTC spare pair, CTC telephone circuit, carrier and trunk channel pair and selector phone for commercial and operating work. Also a direct panel-to-panel line is provided joining adjacent CTC control

(*Please turn to page 82*)

Eight CTC machines control 125 miles of line

Section	Make	Panel Situated at	Length controlled
NDR-KF	AEI-GRS	Broken Hill	229 miles
KF-KAL	AEI-GRS	Monze	174 miles
KAY-TJ	AEI-GRS	Livingstone	151 miles
TJ-GWI	SGE	Dett	124 miles
GWI-MPO (E)	WBS	Sawmills	88 miles
HYA(Jct)-Gatooma)	SGE	Gwelo	182 miles
Gat-Headlands	WBS	Salisbury	184 miles
Hds-US	WBS	Umtali	83 miles