



Wellington Station Building, New Zealand State Railways.

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Private Automatic Branch Exchange at the new Wellington Station, New Zealand State Railways

ON December 17th, 1934, H.R.H. the Duke of Gloucester laid the foundation stone of Wellington Railway Station building, which had been planned to be one of the most outstanding of its kind in the World. Accommodation for passengers and railway staff at that time fell short of modern requirements and the new building was intended to cater to the full for passengers' needs and to house personnel then scattered over eleven different premises.

The main attribute of the building had to be a size which gave the required platform space, passenger amenities and office accommodation, but it is a matter for congratulation that the size itself was not allowed to remain as the principal feature, the scope offered having been used in the erection of a very worthy contribution to New Zealand architecture.

The opening ceremony, performed by H.E. the Governor-General, Viscount Galway, on the 19th June 1937, placed in public service a gateway to the capital in which New Zealand may well take considerable pride.

The station is situated close to the wharves and the centre of the city, with the

main entrance marked by an impressive colonnade (page 80). On a base of granite, dull-red brick walls rise to five storeys, and are relieved by patterns in purple and green, with white chevrons continuing the lines of the window mullions. Spanish mission tiles on the roof harmonise perfectly. The approach to the station is through lawns and shrubberies, with parquetry of ornamental tiles. During night hours the approach and exterior of the building are floodlighted, enhancing the appeal exerted by the soft colourings on the walls.

Through the colonnade, entry is gained to a lofty booking hall, with marble and buff-cream walls and a brilliantly-lighted ceiling in varied tints. Swing doors lead to the concourse, from which access is obtained to the platforms. Waiting rooms, dining rooms, restroom and bathrooms, hospital, bookstall, shops, posts and telegraph office, telephone bureaux, and a creche and playroom are all well-appointed.

In this largest single business building in New Zealand, devoted to the largest Department of State, it is to be expected that some of the equipment would be notable for its size. For example, the flood-

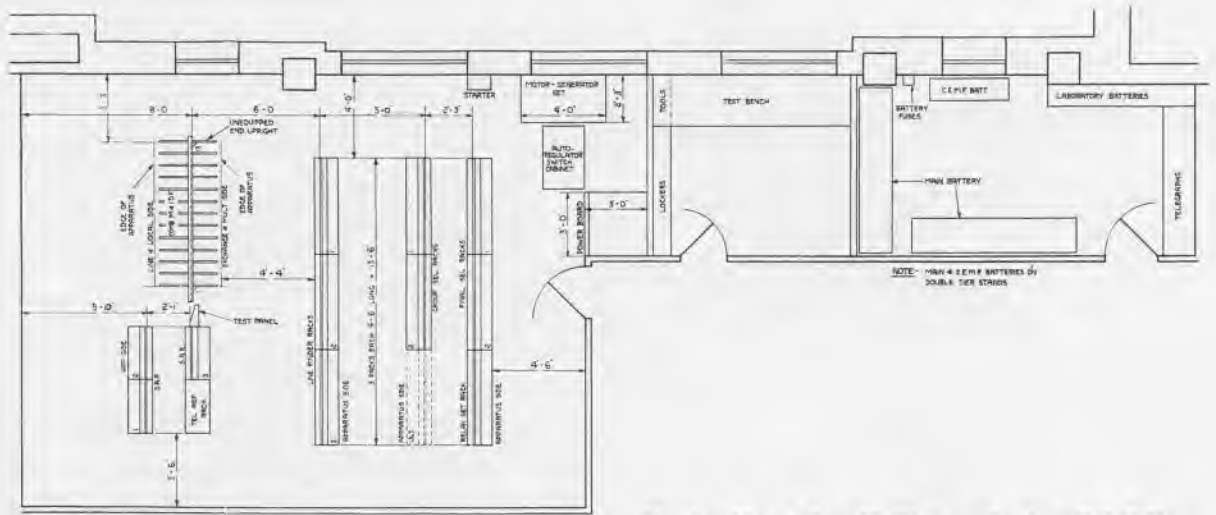


Fig. 1.—Floor Plan, Wellington Station, P.A.B.X.

lighting and interior illumination equipment formed part of the largest single order of its kind which The General Electric Company has received from any part of the world, whilst the British General Electric Company of Wellington, through whom the order was placed, were also able to pass to the Coventry Works the contract for the station telephone exchange—the largest private installation in New Zealand.

The exchange was designed to a specification compiled by the Communication Engineer and was installed by his Department. The manual switchboard is accommodated in a room on the first floor, with the automatic equipment and power plant on the floor above. Equipment for 500 extensions is laid out as shown in Fig. 1

Four hundred of these extensions appear on the manual board for incoming calls from the public exchange and connexion to thirty railway district lines. Two hundred of them may obtain direct access to the public exchange by dialling 0.

The trunking diagram is shown in Fig. 2, from which it will be seen that three classes of extensions gain access through line-finders to separate groups of 1st selectors.

The final selectors are of two types—regular and group-hunting. The former complete internal calls in the normal manner but the latter step over groups of two or three lines to find an idle telephone in much the same way as the P.B.X. facility is operated in a public exchange. Selectors serving the group of 100 lines restricted to internal service provide means whereby the busy condition is withheld from a total of twenty lines which are required to be permanently available to any caller.

The association between the 1st selector levels and the final selectors is governed by the characteristics of the dial, as given in Fig. 2, level 6 thus giving outlet to the four-hundreds group when digit 6 is dialled, level 5 to the five-hundreds group, level 4 to the six-hundreds group, etc.

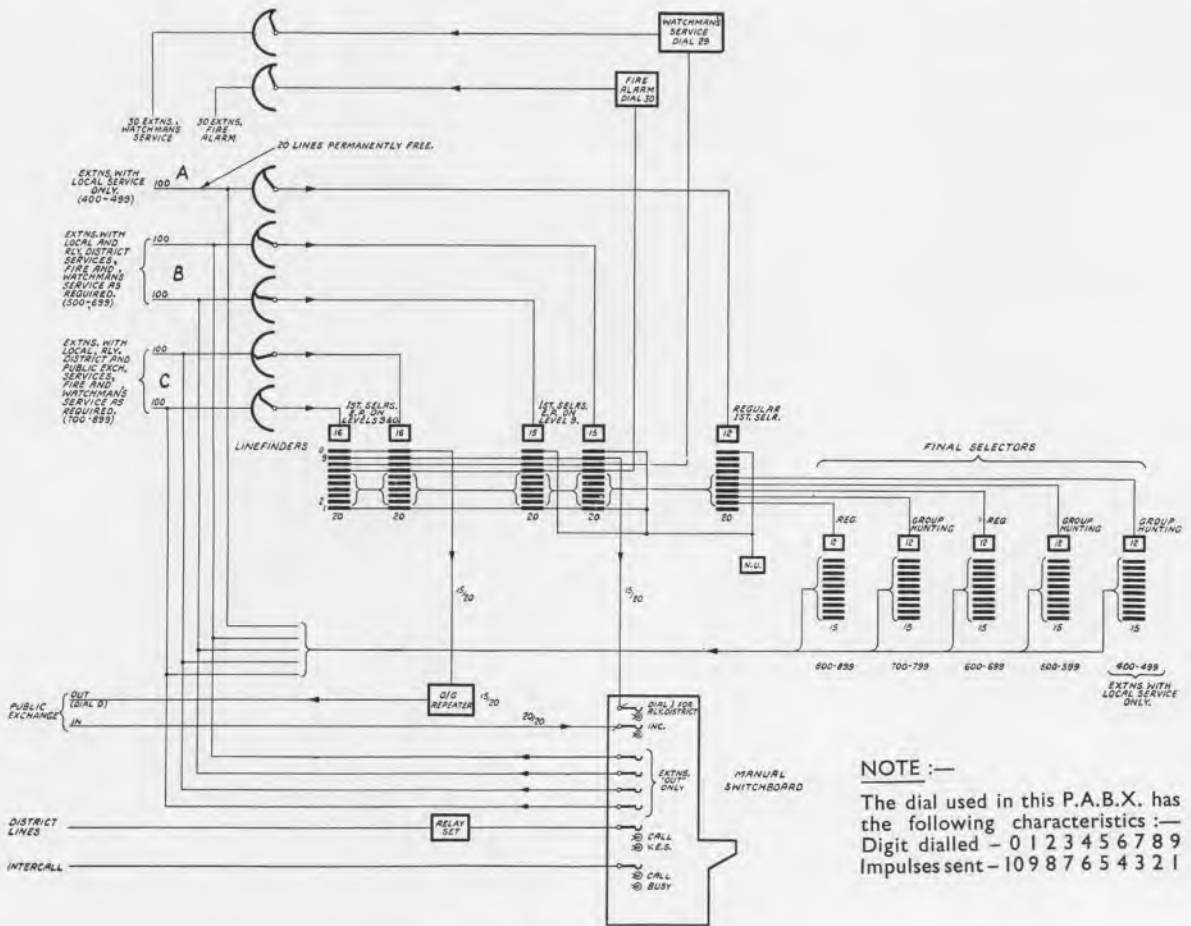


Fig. 2.—Trunking Diagram.

Dials of this pattern are used because the public exchange, into which a large number of extensions may dial, requires the impulses sent to be the difference between 10 and the digit dialled. The dial is of standard B.P.O. No. 10 construction except that the number ring is designated from 0 to 9 in a clockwise direction.

Although lines in groups B and C (Fig. 2) are in general able to obtain connexion to district lines and to the public exchange, the facility may be withheld from selected lines in the groups by means of simple strapping arrangements in the appropriate

line circuits which bring into use the *exchange prohibition* feature in the 1st selectors. This feature is afforded by vertical banks which discriminate between digits and establish circuit conditions such that the dialling of digit 1 for a district-line call or digit 0 for an exchange-line call by an extension barred from the service, results in N U tone being returned.

The district lines are of the magneto-ringing type, ten serving individual stations, whilst twenty serve up to fifteen parties per line, with code ringing from the switchboard. Supervision on these lines is provided by a relay set which converts the

ring-off signal into a loop signal to light the supervisory lamp in the cord circuit. There are 10 cords on each of the five positions of the manual board, and all are of the universal type, being suitable for connecting extensions to district lines, interconnexion between district lines, and connexions to intercall lines. The latter are four in number and are special party lines over which operators may call any station by means of dials provided at the switchboard positions.

Provision is made on two positions for two cord-circuit repeaters, which may be connected as required between any two of ten selected district lines or the intercall lines, as well as between any extension and these lines.

In any extension line circuit the jumpering between the multiple and local sides of the I.D.F. may be omitted to give that line one-way service only, *i.e.*, incoming. On the other hand, if the jumpers be wired but a strap between the negative line and the corresponding wire in the final-selector bank multiple be replaced by an N U tone connexion to the multiple, the extension may make calls but cannot receive them. This restriction can very easily be applied to any line serving points at which only one-way service is required.

In a number of instances a telephone is associated with two or three lines, terminating one of them and being switched as required to another. Lever-type keys, fitted in a small box, establish circuit conditions looping the regular line to hold an exchange connexion whilst conversation is held with a second party. With three lines in association, the second party may be held

also whilst the telephone is transferred to the third line. An incoming call over the regular line is signalled at the bell of the telephone instrument, whilst separate bells with distinctive tones terminate the auxiliary lines. Should a hold key not be restored to normal, a buzzer gives a warning signal when the handset is replaced.

Conference Line.

A conference may be held between up to five extensions. Five conference jacks are provided on the manual board, each with a speak and ring key and battery-feed relay. An extension wishing to call a conference specifies to the operator the parties to be included. The operator inserts the plugs of a straight-through cord in a conference jack and the appropriate line jack respectively for each party to the conference and calls each in turn, requesting that the connexion be held. When all have answered, the originating party is recalled and the conference facility is complete.

If a handset should be replaced, the corresponding battery-feed relay will release to give a supervisory signal to the operator, who then withdraws the plugs to free the extension, leaving the conference to continue with the reduced number. At the termination of the proceedings, when all handsets are replaced, the operator acts upon receipt of the supervisory signals to release all connexions. At any time a party to the conference may flash the operator, who may speak to the caller but is not included in the conference circuit.

Signal Cabin Equipment.

Of five lines to signal cabins situated close to the station, three serve one cabin and the

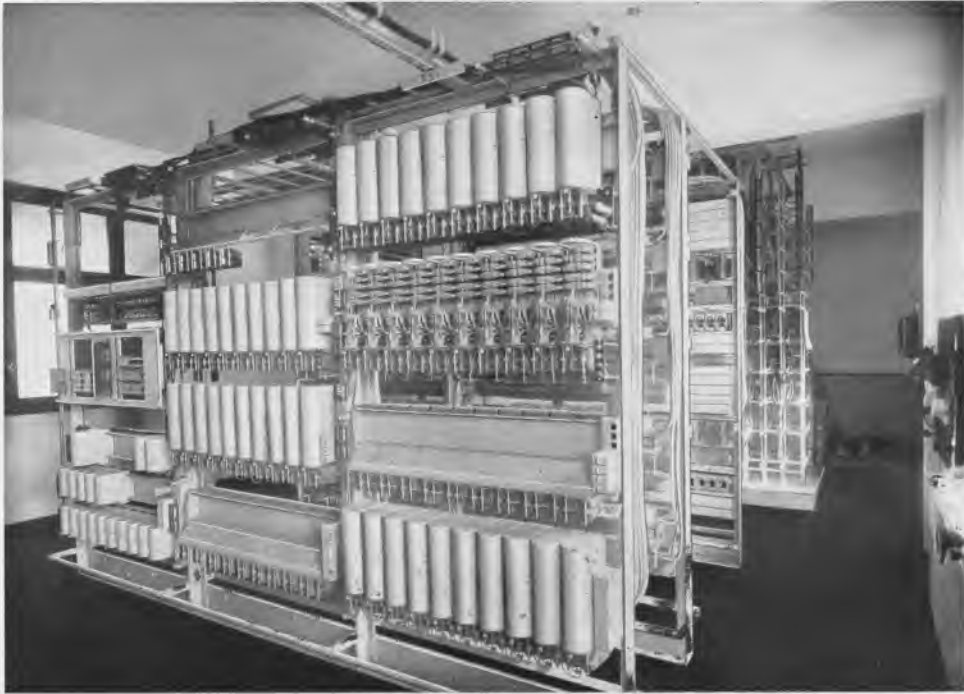


Fig. 3.—Automatic Equipment.

balance a second. Each terminates at an ordinary telephone but may be switched to a common loudspeaking equipment which provides reproduction of incoming speech at high volume level. The signalmen reply by means of special pedestal transmitters, which are fitted with controls for regulating the volume of received speech.

An incoming call is signalled by the bell of the telephone to which the line is connected, and may be answered at the handset or transferred to the amplifier. Should a second call be made—over an alternative extension line—whilst the first is in progress, it is signalled by the bell of the corresponding telephone. It may be held for transfer to the amplifier, a lamp then signalling that the call is waiting and a buzzer providing an engaged signal to the

calling party, or it may at once be switched to the loudspeaker—the signalman then proceeding with whichever is the more important.

The two cabins thus equipped are linked by a tie line over which either may call the other and be instantly connected to the loudspeaker irrespective of whether or not a call is already in progress.

In each cabin, the amplifier, which is operated from the mains, provides two stages of amplification from the line to the loudspeaker, viz., a single-valve input stage and an output stage using two valves in push-pull. One stage of amplification is also provided between the transmitter and the line but is only sufficient to compensate for various circuit losses.

A portion of this amplified output from the transmitter is rectified by a valve con-

nected as a diode and used to bias back the input valve beyond the cut-off point in order to suppress the local loudspeaker and prevent acoustic feed-back.

Loudspeaking Extensions.

In order that the users shall have the convenience and freedom of movement which loudspeaking telephones give, two lines are equipped with amplifiers, microphones and loudspeaker in addition to the normal handset instrument. The arrangement is similar to that described in a previous issue of this Journal, the microphone being fitted neatly and unobtrusively behind the dial, the loudspeaker accommodated in a separate small cabinet, and the amplifier in a wood box. Conversation may be by handset or, after the throwing of a key, by loudspeaker and microphone. In the latter case, removal of the handset cuts off the amplifier and conversation then continues on the former. One valve is used in each direction and filament, anode and biasing voltages are obtained from the mains through rectifier apparatus.

Watchman's Service.

With the premises patrolled at night, means are required of recording times at which a watchman reaches certain points. The telephone equipment is used for this purpose and thus removes the need for a separate recording system. Thirty telephones, at different situations in the building, are selected as the points from which recordings are to be made, and at each in turn the watchman dials 29—allotted as the watchman's service number. On receipt



Fig. 4.—Manual Switchboard.

of the first digit a group selector steps to level 8 and cuts in to extend the calling line to the watchman's service set, which consists of relays and a uniselector. Wires from the selected line circuits terminate on the bank of this uniselector, which, upon receipt of the impulse resulting from the dialling of the second digit, steps to find the contact connected to the calling line. Through a second bank and wiper, operating circuits are established for the pen magnets of a central recording clock.

The telephones themselves are in every way normal instruments and may be used for regular service whenever necessary.

Fire Alarm Service.

In a somewhat similar manner a fire alarm service is provided by the telephone equipment. Telephones at thirty strategic points, not necessarily specially placed there, are selected for use in the event of an alarm becoming necessary. The fire alarm

number to be dialled is 30 and upon receipt of the first digit a group selector steps to level 7 and cuts in to establish connexion with the fire alarm set. This responds to the second digit, rings the bell of a special fire-alarm telephone and gives a general alarm by means of hooters and lamps throughout the building.

The calling line is found by a uniselector which hunts for a marked wire from the line circuit. With the line found, one of a strip of thirty lamps on an indicator situated in a permanently-attended office is illuminated to indicate the extension telephone at which the call originated.

A speaking circuit included in the fire-alarm set enables an attendant at the special alarm telephone to obtain information from the caller. Should the latter replace the handset after giving the alarm, the attendant may recall the extension telephone by depressing a ringing key associated with his instrument.

The general alarm continues until a release key, fitted near the fire-alarm telephone, is depressed.

Conclusion.

Indebtedness is expressed to Mr E. J. Marklew, Communication Engineer of the New Zealand Railways, for permission to publish his comments on the telephone system :—

“There are conditions peculiar to railway working which make statistics of busy hour calls of doubtful value. Many factors upset calculations and one change in railway operation may cause considerable changes

in telephone traffic. The late running of one train may result in two hundred calls from an enquiring public. The work is spread fairly evenly over the day from 6 a.m. to 6 p.m. but on special occasions has risen to 800 inward public calls per hour, mainly, of course, enquiries regarding the departure and arrival of excursion trains.

Probably seventy per cent. of inward calls are enquiries which are answered at once and do not hold the lines. On the other hand, outward calls are of longer duration, since the calls concern railway business with the public.

It is, however, on the railway district lines that the holding times reach their maximum, and conferences between officers of the Department up to four hundred miles apart, may hold the line over half an hour.

Statistics of the calls through the automatic exchange are incomplete since the changeover is still in progress, but the efficiency and importance of the equipment have already been amply demonstrated in co-ordinating the many sections of work throughout the new railway yards.

At the main signal cabin, over three lines in one group, 200 calls per hour are handled during the peak suburban traffic period.

During holiday seasons, when excursion trains are running, the telephone traffic materially increases, but when this coincides with the busy export season of meat, wool, butter, fruit, etc., then every trunk is used to its full capacity and the total calls reach remarkable numbers.”