Let’s Take a Phone to Bits

The Statesman

The Statesman telephone looks like this. The case of this particular telephone is that supplied to the British Railways Board and so is embellished with the BR logo. The other difference on BR models was the fitting of a Bell 84 instead of a tone caller. As we shall see this telephone has been rebuilt to the normal standard with a tone caller.

Case Construction

Opening the Case

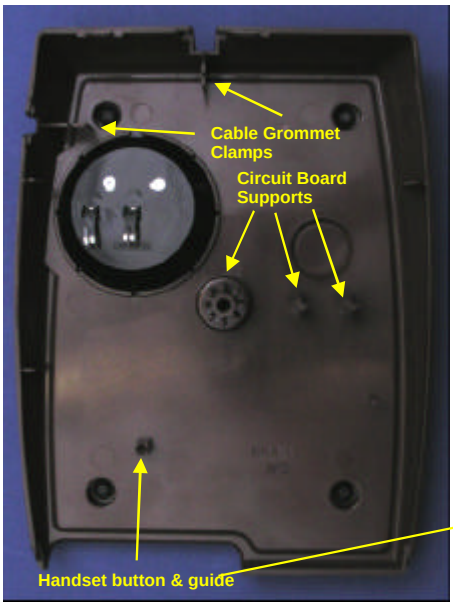
Here’s a view of the underside. The lid is held on by the M4 fixing screw. This is the only screw in the entire case. Models built after about 1985 have the two retaining lugs at the front. The case stays together without the lugs, but someone obviously thought they were needed. The lugs on their own are actually sufficient to hold the case together without the screw.

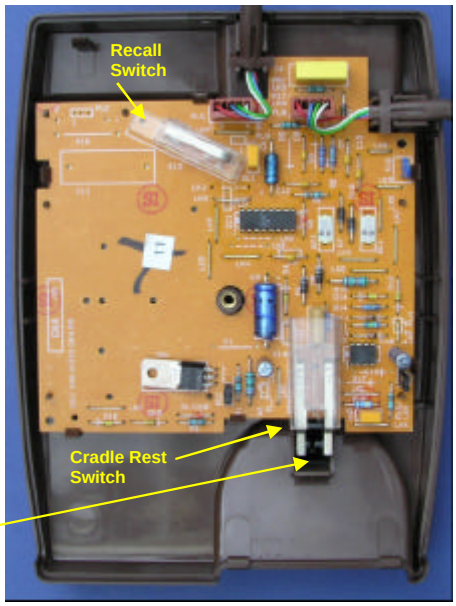
By levering GENTLY with a screwdriver blade the base can be lifted from the cover. The base should lift clear since the tone caller is connected by the spring terminals visible in the picture below. There are no flying leads.

Case Design

Now is a good time to examine how cleverly the case is designed.

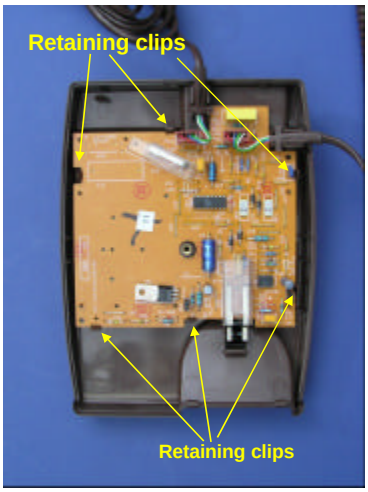
Note the way the line cord and handset cord grommets fit into the case mouldings. When the cover is in place the cords are firmly clamped. There is a guide to keep the handset button straight as it goes up and down. The central pillar where the screw fits is expanded with fingers to hold the circuit board firmly in place. Similarly there are pillars to provide support under the keypad to stop the board flexing when buttons are pressed.

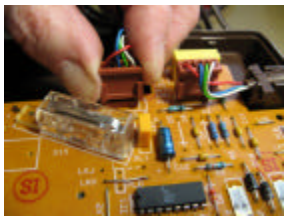




Circuit Board Mounting

There are no permanent connections to the circuit board. The tone caller has spring contacts as shown above. The line cord and handset are on polarised connectors which unplug easily. Wiggling the connectors helps to release them.

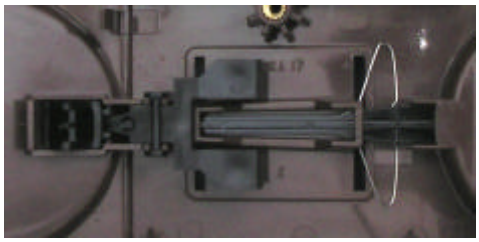




The circuit board is only held in place by retaining clips in the cover moulding, making assembly very quick and easy. The board can be unclipped by pulling the clips away from the board and applying upward pressure to the board. (see picture) I usually start at one end and work towards the other.

The Cover

With the circuit board out of the way the way the cradle rest actuator works is revealed.



The spring fits against a notch in the earpiece lever. The rocking lever in the middle connects to the microphone button and the earpiece lever. A cunning piece of mechanics.

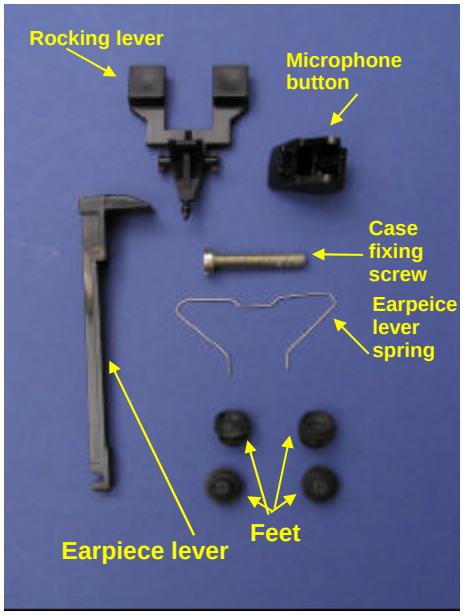
The ends of the spring unclip from the case moulding allowing the spring to drop flat against the cover. The rocking lever in the centre can be pulled from its clips. The microphone button is then free to be removed. The earpiece lever slides out through the earpiece moulding.

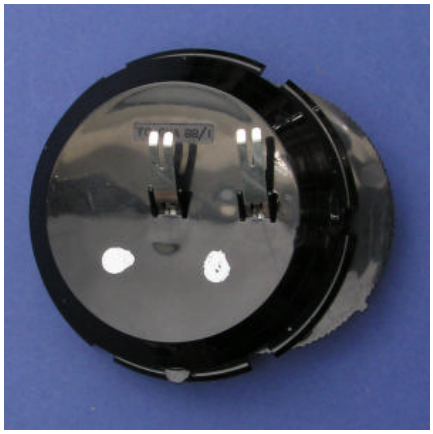
Keypad Assembly & Mat

The key tops have a locating groove at the top of each key top so they will only fit the right way up. Notice the difference in the contact side of the recall button (at the top) on the keypad mat. The other buttons have carbon pads to connect with the printed circuit tracks. The recall button operates a small plastic insert attached to the recall switch and has no carbon pad.

Piece Parts

There are very few piece parts in the entire case assembly which is a tribute to the economy of the design.





The Tone Caller

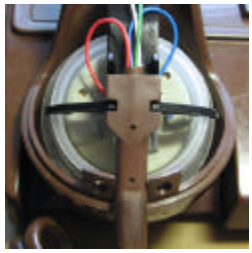
The circuitry for the tone caller is entirely on the circuit board. The visible part (left) is simply a transducer. It snaps into the base moulding, but is quite difficult to remove. A semicircular bump ensures it fits in the correct orientation.

Handset No 16

The handset is held together by the single screw at the earpiece end - the only other screw in the entire telephone - and two pegs at the cord end.

The mouldings snap together along all edges. By applying a little leverage at the cord end the two sections can be pulled apart.

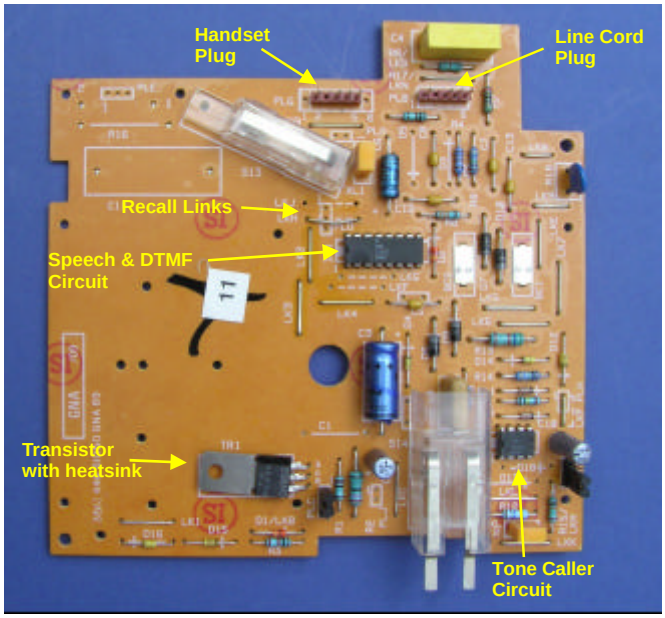
The transmitter and receiver inserts are held in by plastic clips which lock into ridges in the handset moulding. They can be removed by levering the clip upwards at the end nearest the centre and pushing towards the centre (see picture below). The picture can only show the levering part, as I only have two hands and one was holding the camera.



Another cunning bit of design is t he way the cord grommet is held in place by the transmitter insert clip (right).

Here's what the handset looks like with the inserts removed (left). The transmitter is a dynamic capsule, rather than a carbon microphone, made possible by the use of semiconductor transmission circuitry.

Circuit Board



The circuit board is a single-sided board, as evidenced by the number of bridging links. Multi-layer boards are essential for high-speed digital boards, but in this application a single-sided board is the most economical choice. The regular North-South and East-West alignment of components indicates that the board is designed for automatic component placing.

The integrated circuits require a minimum of support keeping the overall component count low. The upper IC provides speech circuits and DTMF signalling. The smaller IC is the tone caller circuit. The only other semiconductors are the power transistor, to control line current, and a number of diodes.

The board as fitted contains a number of unused features of which I am not aware. There are two link selectable options. Marked towards the top are the links LKH and LKJ which select timed-break or earth recall. Beneath the integrated circuit IC1 are LKF and LKG, of unknown function.

Design Conclusions

The Statesman probably represents the pinnacle of British telephone production design for economical manufacture. It combines clever mechanical design with a minimum number of individual parts with, for the time, state of the art electrical design. Low component count and automated assembly made it worthy of its title as the IneXpensive Telephone, IXT.

Although this was nearly the era of the throw-away telephone, a large number of telephones were still rented from the network provider. For this reason the Statesman was also designed to have the most common faults repaired. The case fixing screw mates with a metal threaded insert meaning the case can be opened many times without damage - unlike cases held with self-threading screws which wear out very quickly. The handset and line cord, being the most prone to faults are plug-replaceable.

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