hello, all you folks back home!

Modern technology has produced fast transport and centralised industry. A somewhat less desirable side-effect is that close relations have tended to become distant relations. Instead of gathering around the fire as in the 'good old days', we tend to gather around the telephone.
This means of communication suffers, however, from one major flaw: Ma Bell never intended it as a vital link between whole families. The system itself and all the legal restrictions involved with it are geared to private conversations between two individuals. The solution to the problem? A loudspeaking telephone.

1

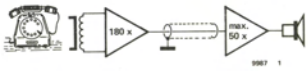


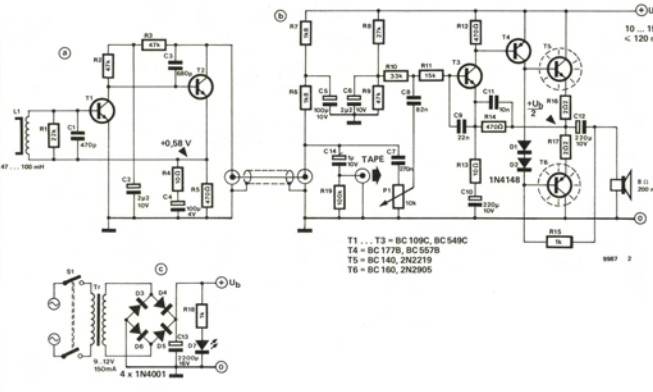
Figure 1. Block diagram of the telephone booster. The signal is picked up by a coil, since a direct connection into the telephone lines is not permitted. The booster itself consists of two sections, one mounted as close as possible to the phone and the other – much larger – section placed in any convenient spot.

The circuit described here will pick up the telephone conversation and reproduce it via a loudspeaker, so that several people can listen in.
This is only possible, of course, if the electrical signals from the telephone are first picked up in some way. Since the Post Office, understandably, does not like people tampering with their wiring, some kind of indirect coupling is required. The most common method is to use a so-called telephone pick-up coil. This operates on a very simple principle: in every telephone there is a transformer which is wound and wired in a cunning way in order to route the incoming signal from the telephone line to the earpiece, and at the same time feed the microphone signal onto the line. In effect, it forms a kind of splitter for audio signals, with good coupling from line to earpiece and from microphone to line, but with poor coupling between the microphone and earpiece to avoid acoustic feedback.
All transformers have a stray field, and this one is no exception. If a suitable coil is placed in this field, it will 'pick up' the audio signals. Logically enough, a device of this kind is called a pick-up coil. The electrical signal delivered by the coil is extremely small, so that a lot of gain is required in the following amplifier stages. As shown in the block diagram (figure 1), the amplifier described here consists of two sections. The first section has a gain of 180 (45 dB). It can be connected via almost any length of single-core screened cable to the second section, which has a gain of up to 50 (34 dB). This second stage drives the loudspeaker.
The advantage of cutting the circuit in two is that the first stage can be mounted quite near to the pick-up coil, minimising the amount of hum and interference picked up by the connecting wires. The bulk of the circuit, including loudspeaker and power supply, can be mounted at any suitable remote position.
Up to 50 m (160 ft) of screened cable can be used between the two stations – more than enough for any practical application we can imagine. The first section has no power supply of its own: it is powered from the main section via the connecting cable.

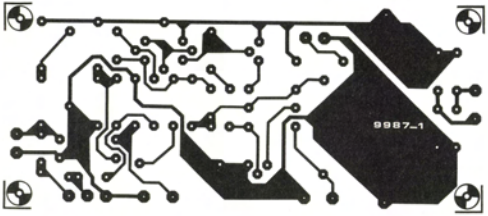
The circuit

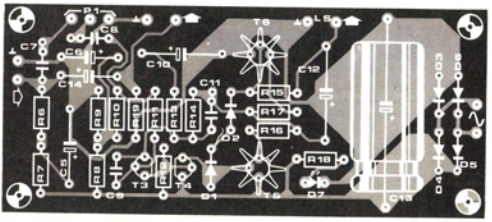
The complete circuit is shown in figure 2: figure 2a is the first stage, which is mounted near the pick-up coil; figures 2b and 2c are the second stage and the power supply, respectively.
The pick-up coil, L1, is a normal miniature choke and the value is not particularly critical. It is sometimes possible to obtain coils designed specifically for this purpose, mounted in a plastic capsule with a suction cup at one end. L1 and C1 together form a resonant circuit, but this is so heavily damped by R1 and the input impedance of T1 that the resonant peak is hardly noticeable – the main effect is to limit the bandwidth to a useful value.
The first stage would be a two-transistor

2

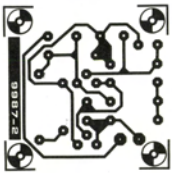

+Ub
10 ... 15 V
< 120 mA
+0,58 V
TAPE
1N4148
T1 . . . T3 = BC 109C, BC 549C
T4 = BC 177B, BC 557B
T5 = BC 140, 2N2219
T6 = BC 160, 2N2905
9987 2
9 ... 12V
150mA
4 x 1N4001

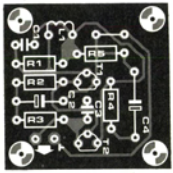
3a


9987–1



3b





Parts list

Resistors:
R1 = 22 k
R2,R3,R9 = 47 k
R4,R13 = 10 Ω
R5,R12,R14 = 470 Ω
R6,R7 = 1k8
R8 = 27 k
R10 = 33 k
R11 = 15 k
R15 = 1 kΩ
R16,R17 = 2Ω2
R18 = 1 k
R19 = 100 k
P1 = 10 k log.

Capacitors:
C1 = 470 p
C2,C6 = 2μ2/10 V
C3 = 680 p
C4 = 100 μ/4 V
C5 = 100 μ/10 V
C7 = 270 n
C8 = 82 n
C9 = 22 n
C10,C12 = 220 μ/10 V
C11 = 10 n
C13 = 2200 μ/16 V
C14 = 1 μ/10 V

Semiconductors:
T1,T2,T3 = BC 109C, BC 549C or equ.
T4 = BC 177B, BC 577B or equ.
T5 = BC 140, 2N2219
T6 = BC 160, 2N2905
D1,D2 = 1N4148
D3 . . . D6 = 1N4001
D7 = LED

Miscellaneous:
L1 = miniature choke, 47 . . . 100 mH, see text
LS = 8 Ω/200 mW loudspeaker
Tr = 9 . . . 12 V/150 mA mains transformer
S1 = DPDT mains switch

amplifier with a gain of 180, if T2 had a 1k8 collector resistor. Following the connecting cable, this resistor can indeed be located: R6 in figure 2b. This little trick, which was also used in the Preco, saves one wire: the same cable is used to feed the audio signal from the first section to the second and to supply power from the second section to the first. The output of the first section is basically a current source and can be loaded by a relatively low impedance, permitting the use of a fairly long cable. The second section is a 'bare-bones' design: only four transistors and a handful of other components are used in this little power amplifier. There is no quiescent current adjustment – that would be an unnecessary luxury for this application. On the other hand, no quiescent current at all would be the other extreme – the maximum gain would be lower. P1 is the volume control. A tape output is also provided, although it should be noted that – strictly speaking – the other party should be notified if the conversation is to be recorded.
The power supply (figure 2c) is straightforward. The only 'luxury' there is the LED, D7.

Construction and use

Printed circuit board designs for the two sections are shown in figure 3. The main (figure 3b) contains both the second section and the power supply. It is perhaps interesting to note that this board can also be used on its own as a low-cost, low-fi 'power' amplifier, provided R6, R7 and C5 are omitted. For that matter, the complete unit can also be used as a 'low-fi' public address installation . . .
Note that T5 and T6 should be provided with cooling fins or clips. There's no harm in them running 'warm', but they're not supposed to get 'hot'.
The two sections can each be mounted in their own case (even a tobacco tin will do for the first stage!) and connected by means of the desired length of cable. The pick-up coil should be connected to the first stage by the shortest possible length of twin-core screened cable: the two ends of the coil are connected to the two cores and the screening is connected to supply common.
The best position for the pick-up coil can be found by trial and error. When the handset is lifted off the hook, a dialling tone is obtained (if no dialling tone is heard, complain to the Post Office, not us) and the pick-up coil can now be moved, twisted and turned all over the telephone (*not* the handset) until this tone is reproduced at maximum strength by the loudspeaker. Note that both the position of the coil and the direction in which it is pointing will influence the 'reception'. Once the best position and location have been found, the coil can be fixed in position.

Figure 2. The complete circuit. Figure 2a is the first section, which is connected by means of single-core screened cable to the second section, shown in figure 2b. The power supply, figure 2c, can also be mounted in the main station.

Figure 3. The two p.c. boards required. The larger of the two (figure 3a), EPS 9987 - 1, is for the main station including power supply; the second is for the first section of the circuit (EPS 9987 - 2).