AIR HORN

This kit is available from Talking Electronics

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for prices and postage

AIR HORN

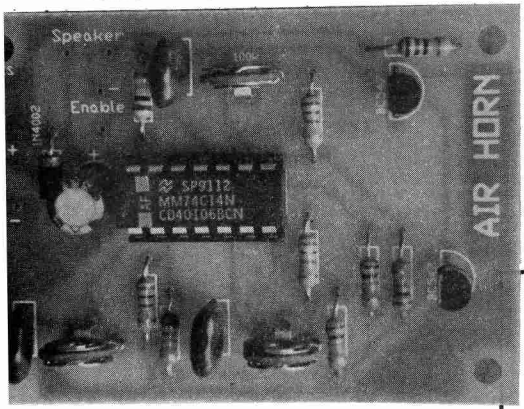
Add a little extra life to the shunting yard with this dual or triple Air Horn.

One effect rarely included in a model railway is SOUND. Many modellers keep electronics to a minimum so, due to the complexity of the circuits needed to produce sound effects, they are quite often out of the question.

Undoubtedly there are many ways of producing sound effects, ranging from playing recordings of real trains, to complicated circuits which are synchronised to the motion of the trains on the layout.

There are some sound effect chips on the market, but they are not readily available and will not be considered in this book.

The circuit presented here simulates a dual or triple AIR-HORN as used on diesel and electric locomotives. It is based on the versatile CMOS Schmitt Inverter, the 74c14 or CD 40106.



HOW IT WORKS

Only 4 of the six Schmitt Inverters are used in this project, three as oscillators, and the fourth in the gating or control circuit.

Each oscillator consists of a Schmitt Inverter, a 47n capacitor, a 1k resistor and a 100k mini trim pot. It functions as described in the article on the WARNING LAMP FLASHING UNIT. The only notable differences are that the oscillators in the AIR-HORN project operate at audio frequency and can be adjusted via the trim pot.

The output of each oscillator is mixed, via a 10k resistor, into the base of a BC 547 transistor which is part of the gating circuit that enables or disables the sound output.

The collector of this transistor is connected to the output of the fourth Schmitt inverter, which is normally LOW, held there by a 100k pull-up resistor on its input.

The emitter of the transistor is held LOW by a 10k pull-down resistor and from the junction of these two components the signal is taken to the output transistor via a 4k7 separating resistor.

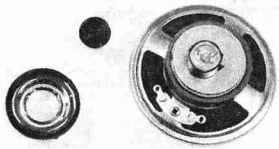
When the push button at the enable input is closed, the output of the Schmitt Inverter will go HIGH, taking the collector of the transistor HIGH. The transistor will now function as an emitter-follower. Any signal at its base will appear at its emitter. The signal will be amplified by the second transistor to produce the sound.

When the switch is released, the output of the inverter falls LOW, taking the collector of the transistor LOW.

With the collector LOW, the emitter follower is disabled and no signal can pass to the amplifying transistor and the horn is silent.
Why such a complex method of switching?

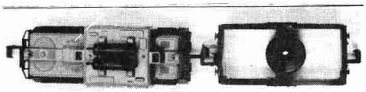
Wouldn't it be easier to have the push switch wired directly between the oscillators and the amplifier? Or wired so that it switches power to the whole unit?

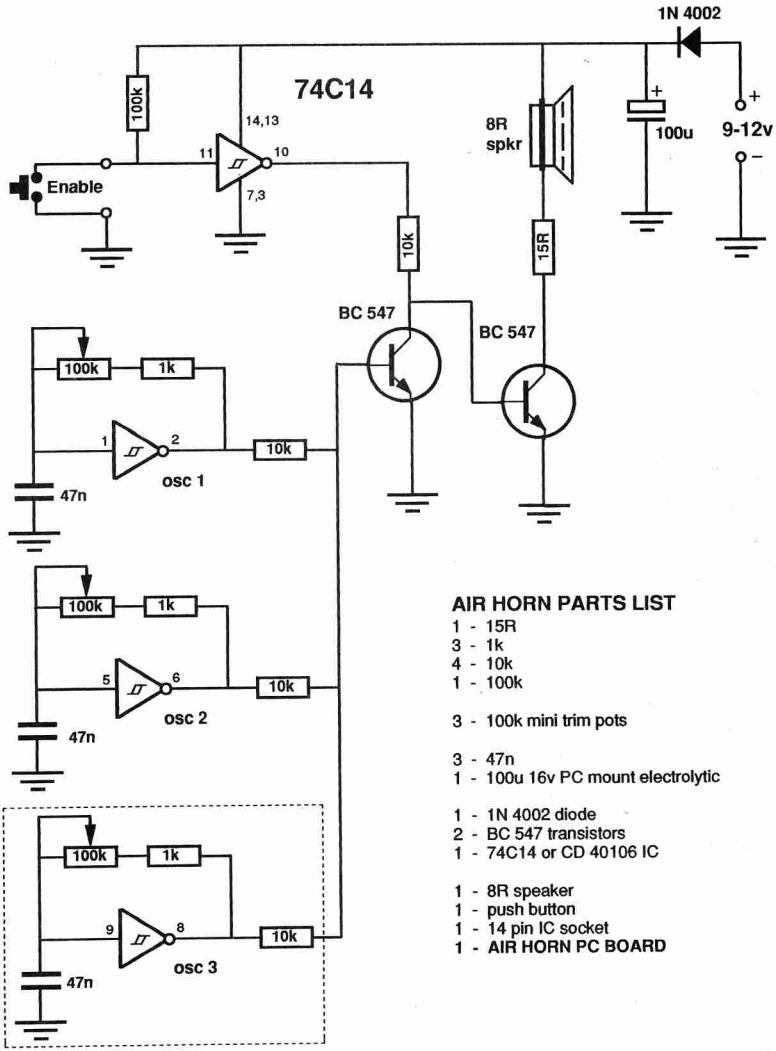
This method of switching was chosen because it can be controlled by a digital circuit. An active LOW signal at the enable will sound the horn, which opens great possibilities for automatic control of the horn.



For those who wish to experiment with sound through rails systems, there are several small speakers available. The picture above shows two 12mm Mini - speakers and a 27mm speaker with a standard 58mm or 2¼" speaker.

The photograph below shows the 12mm speaker inside an 'N' gauge wagon.





AIR HORN PARTS LIST

1 - 15R
3 - 1k
4 - 10k
1 - 100k

3 - 100k mini trim pots

3 - 47n
1 - 100u 16v PC mount electrolytic

1 - 1N 4002 diode
2 - BC 547 transistors
1 - 74C14 or CD 40106 IC

1 - 8R speaker
1 - push button
1 - 14 pin IC socket
1 - **AIR HORN PC BOARD**

The sections of the Air Horn circuit can be easily seen from this diagram. Oscillator 3, which is drawn inside the dotted box, is omitted for the dual version.

CONSTRUCTION AND SETTING UP

Firstly decide whether you want a dual or triple horn. If you want a dual horn, omit all parts shown in the dotted box on the circuit diagram and solder a link onto the PC board in place of the 47n capacitor.

Before commencing construction, check that the trim pots fit into the holes on the board. If not, open them up with a slightly larger drill.

Install all resistors except the 10K resistor connected to oscillator 3 (pin 9 of the IC). Next fit the IC socket, followed by the trim pots, capacitors and transistors. Finally insert the IC.

Power is connected to the board via the terminals near the edge. Be careful not to swap these wires or the electrolytic will explode! The chip may also be damaged. If you like, a 1N 4002 diode could be placed in line with the positive lead to protect the circuit. Wire an 8 ohm speaker to the circuit and the project is ready for testing.

The push button will be connected between the holes marked 'ENABLE' and '-', but for the moment, connect a length of hook-up flex between these holes.

Switch on the power. You should hear two oscillators 'beating' against each other. Turn the trim pot on oscillator ONE to the lower end of its travel. Turn the trim pot on oscillator TWO so that the two oscillators are running at the same pitch. Slowly advance oscillator TWO until all beating stops again. For those who are musically minded, tune it to a 'fifth'.

Solder the remaining 10k resistor into the circuit.

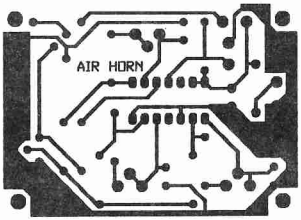
When you power the unit this time, you should be able to hear the third oscillator. Adjust it to the same frequency as oscillator TWO. Then slowly advance it until the beating stops again. In other words, tune it to a 'seventh'. Cut the length of hook-up wire and solder in the push button.

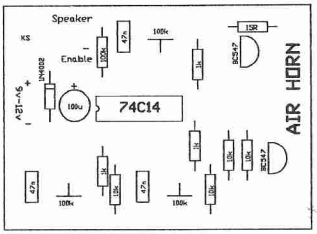
The unit is now complete.

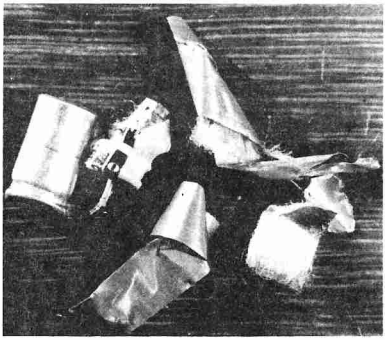
GOING FURTHER

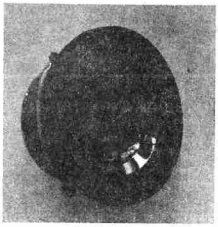
Several speakers could be mounted at locations around the layout. These could be stations, level crossings and tunnels. Each of the speakers could then be selected via a rotary switch or by spare contacts on relays that are being operated by track detection circuits. The AIR-HORN could also be triggered by detectors placed around the layout.

Experiment with it. The possibilities are endless.









ABOVE: This 100 mfd capacitor which was across the power rails of one circuit, exploded when accidently connected in reverse to 12 volts. It covered the desk in electrolyte and the flying cap left a small dint in the ceiling. It exploded within 5 seconds of being connected to the power.

LEFT: Pictured here, larger than life, is the 27mm speaker. It has a clear plastic cone. These speakers are not readily available and are often over priced.