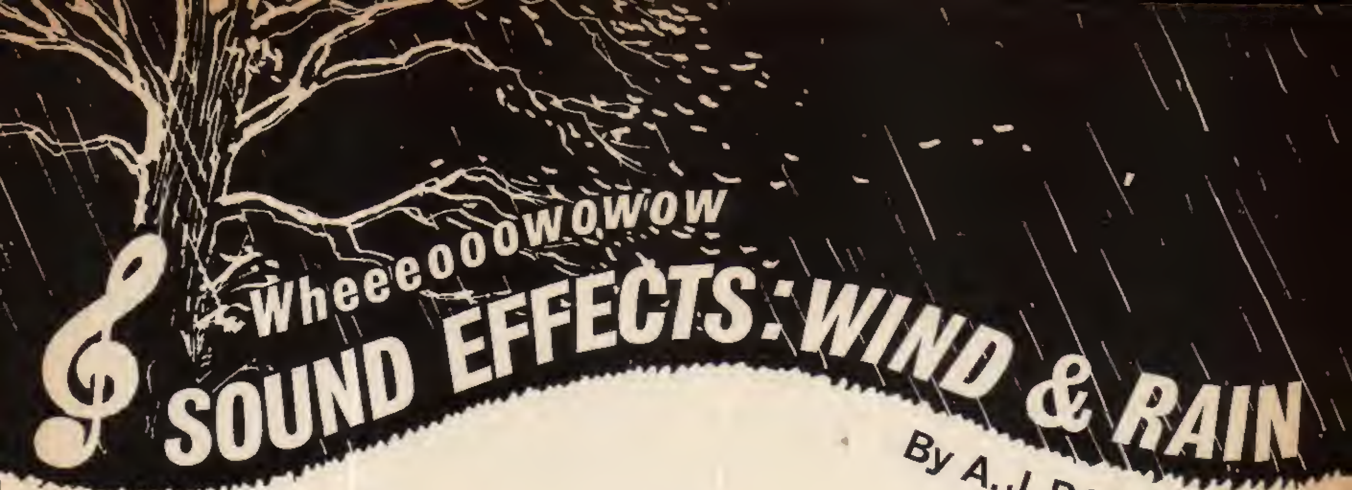

Wheeeooowowow SOUND EFFECTS: WIND & RAIN

By A. J. BASSETT

The output from a white noise generator may be modified greatly by the action of audio filter circuits. The circuit described here gives the effects of howling, moaning wind and driving rain. No doubt, readers will make other effects as suggested by the section on operation.

Figs. 1 and 2 show suitable basic filter circuits using a transformer. An extension of this idea is shown in Fig. 3, where different pitches of sound are selected by operation of the switches to introduce different values of capacitor. This is basically a switched variable tuned circuit to accept or reject a pre-determined range of white noise frequencies.

When the higher values of capacitor are in circuit, the sound takes on a low moaning characteristic, whereas the lower values give higher pitched louder effects. If S4, S5, and S6 are left open and S1, S2, and S3 are used to control the output, more of the higher frequencies are fed to the output, resulting in a sound like that of very heavy rainfall.

ELECTRONICALLY CONTROLLED L/C FILTER

A simple voltage-controlled R–C filter was featured in the *Rhythmic Sound Effects Unit* (last month). A similar technique of electronic control can easily be applied to the circuit of Fig. 3, with the advantages of a more gradual transition from one effect to another. This gives added realism, and the possibilities of automatic and remote control over the filter circuit.

Fig. 4 shows this modified circuit, in which the switches (S1–S6 in Fig. 3) are replaced by transistors.

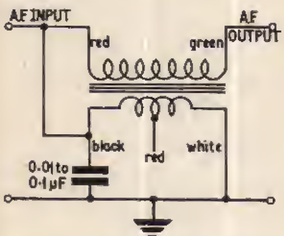

Fig. 1. Simple basic idea of the filter using only the transformer and one capacitor from 0·01µF to 0·1µF

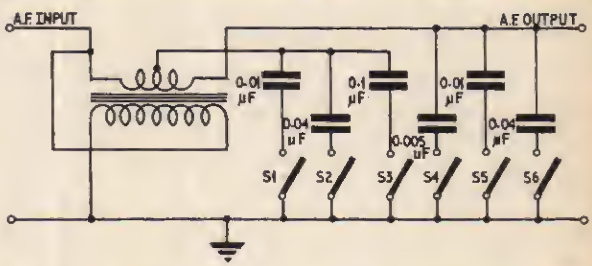

Fig. 3. Extending the two simple versions for giving different pitch sounds

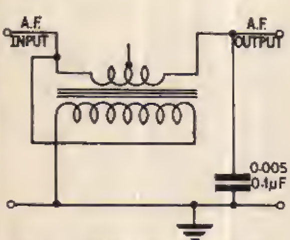

Fig. 2. Alternative circuit to that in Fig. 1. The capacitor value can be between 0·005µF and 0·1µF according to the effect required

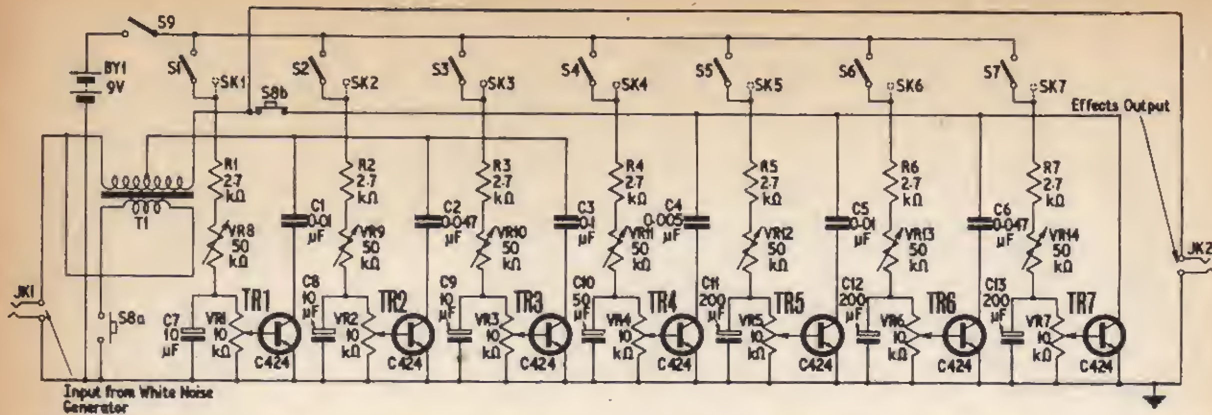

Fig. 4. Final circuit of the electronically controlled filter. The bias points here are terminated in sockets but by the addition of a switch in each bias path the unit can be triggered from a 9V battery. No other battery is necessary

Base bias is supplied to each transistor through its own bias control network; thus electronic control over the filter is achieved by supplying the bias input points from suitable d.c. positive sources. A 9 volt battery may be used, connected by way of switches to each bias input point, although higher and lower voltages, within the limits of the transistor characteristics, can be used quite successfully.

The use of transistors without any obvious source of d.c. collector supply may seem to be a little unusual. With this type of circuit the emitter and the collector are considered as a short circuit to a.c. when the transistor is switched on.

When the trans stor is biased on at its base, it will pass current between the other two electrodes, emitter and collector. It is conventional to use the transistor as a one-way switch passing d.c. current in one direction only between collector and emitter; in this respect the bi-directional capabilities of the device are largely ignored and often forgotten. When a.c. is applied under certain working conditions the current through collector and emitter alternates its direction in sympathy with the positive and negative half-cycles on the a.c. signal.

ONE STAGE

Consider any one of the transistors in Fig. 4; the working collector supply for the transistor is obtained from the audio signal itself on the positive part of the cycle, by way of a capacitor in the collector circuit Due to the low saturation voltage of the transistor used, the transistor will act almost as a short-circuit when biased fully on, as the collector-to-emitter path will be seen by the external circuit as a very low resistance.

During the negative going part of the cycle the collector will receive a negative potential by way of the capacitor. Once again, as the base current supplied is assumed to be sufficient to bias the transistor fully "on", the emitter-to-collector path is seen by the external circuit as a very low value resistance.

During the full cycle one side of the capacitor in the collector is effectively grounded to a.c. via the transistor, as long as the transistor is biased "on". The capacitor will then appear across the output in conjunction with part of T1. However, when the transistor ceases to receive base bias current, it will then no longer conduct, and the capacitor in the collector circuit will no longer be able to pass audio current. Thus when the transistor ceases to conduct it temporarily cuts off the action of the associated capacitor; conversely, when the transistor conducts, it enables the capacitor to work as a reactive component, its reactance varying according to the frequency applied.

CONSTRUCTION NOTES

The circuit of Fig. 4 has six of these stages; the capacitor in each may be switched in or out by the associated transistor, according to the amount of base-bias received. If the transistor is partly conducting the capacitor will be brought into use with an effective series resistance formed by the collector-emitter path of the transistor.

For automatic or semi-automatic operation, the bias supplies may be derived from triggered bistable

COMPONENTS . . .

Resistors
R1–7 1kΩ 10%, ¼W carbon (7 off)

Potentiometers
VR1–7 10kΩ linear carbon (7 off)
VR8–14 50kΩ log carbon (7 off)

Capacitors

C1 0·01μF	C4 0·005μF
C2 0·047μF	C5 0·01μF
C3 0·1μF	C6 0·047μF

C7–13 10μF upwards depending on attack and decay required (see text). All electrolytic (7 off)

Transistors
TR1–7 C424 (S.G.S. Fairchild) or ME4103 (7 off)

Transformer
T1 Standard 3:1 intervalve transformer (Radiospares)

Switches
S1–7 Single pole, on-off, toggle (7 off). Can be replaced by wander plug sockets (see text)
S8 Single-pole changeover, push for changeover (Bulgin type SM357) or double-pole changeover (Bulgin type SRM270)
S9 Single pole, on-off, toggle

Miscellaneous
White noise generator (as in January issue)
Aluminium chassis 12in × 5in × 2½in
Bias supply—9V battery
Audio jack sockets (2 off)

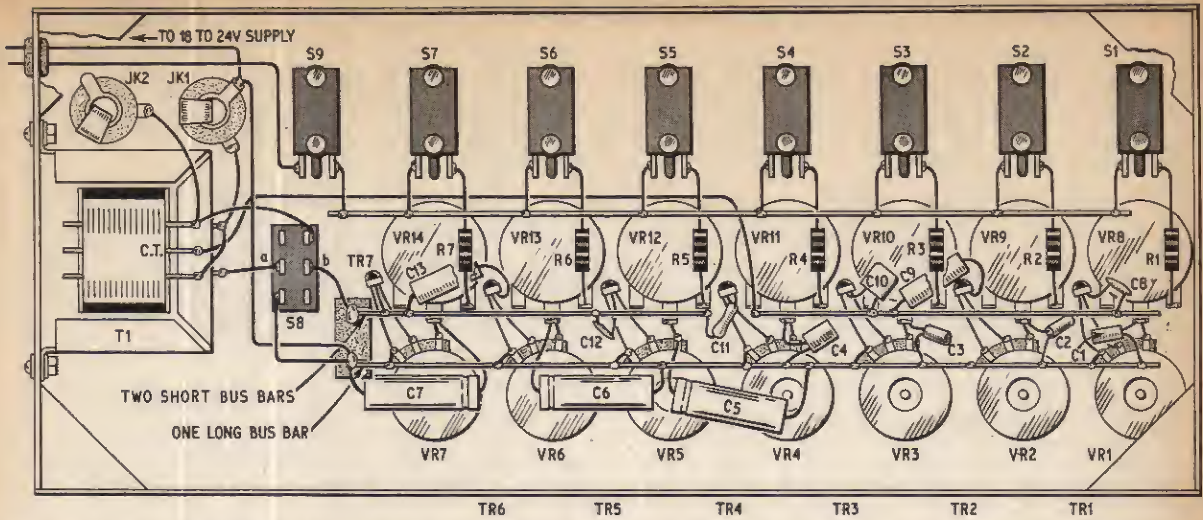

Fig. 5. Layout and wiring of the complete unit. The switches S1–7 can be replaced by sockets for external switching. Transistor TR7 is labelled by the component; other transistors are labelled immediately below the drawing for clarity. The chassis size is 12in × 5in × 2½in and drilled according to the schedule below. Switch S8 shown here is type SRM270. Alternatively, type SM357 with four tags can be used

circuits, ring-counters, or a number of multivibrators similar to that described in the *Rhythmic Sound Effects Unit*.

CONSTRUCTION NOTES

The circuit of Fig. 4 may be built in an 18 s.w.g. aluminium chassis 12in × 5in × 2½in (Fig. 5). The bias points may be connected to a suitable bias source (which may be an internally mounted 9V battery) by way of the switches S1–S7 mounted on the chassis. Alternatively, standard sockets may be used for connection of the bias points to an external switching circuit, and may be mounted at the points otherwise occupied by the switches.

Component positions are not critical but it is obviously easier to minimise wiring as much as possible. Additional stages can be added if required using identical configurations to those shown but with different values of capacitor in the collector leads.

Fig. 5 is reproduced here half scale.

Holes for switches S1–S8—7/16in dia.

Holes for potentiometer VR1–VR14—3/8in dia.

Holes for jacks JK1 and JK2—3/8in dia.

Fixings for transformer—nuts and bolts to suit the component used.

The grommet is mounted in a ¼in hole.

The photograph below shows the tag strips used to suspend the bus bars.

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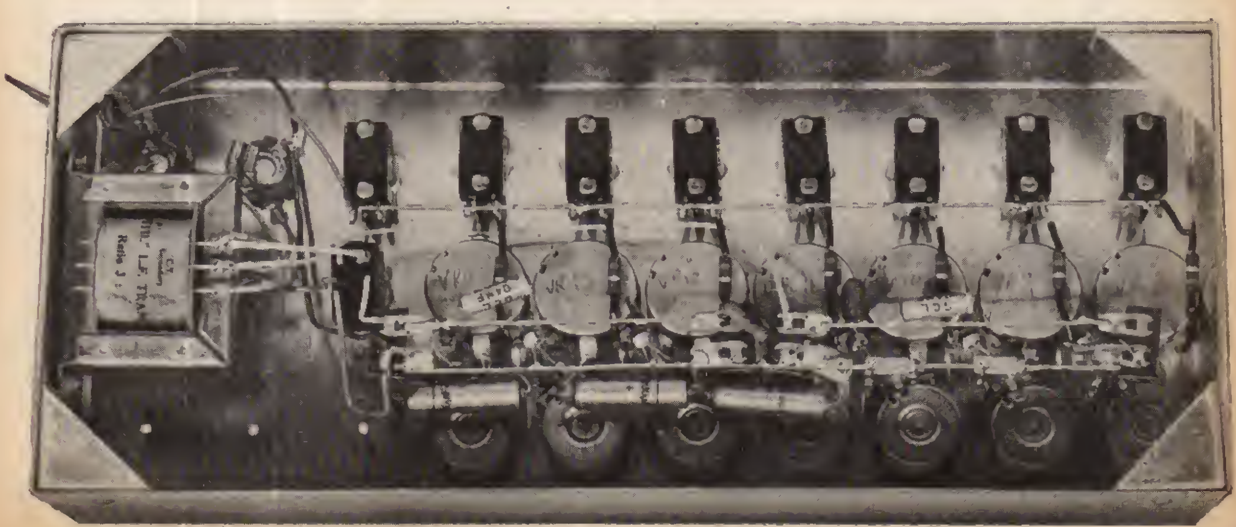

SOUND EFFECTS: WIND AND RAIN

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The transformer used here is not critical and can be a 3 : 1 intervalve type with a centre-tapped secondary winding. Due to the connections of the transformer there may be some loss of bass frequencies, but this can be minimised by using one of high primary inductance.

The transistors can be types C424 or ME4103 or any similar *npn* types.

SETTING UP AND OPERATION

To achieve the effects intended it is necessary to have a white noise generator; the simple unit described in the January issue was designed specifically for this purpose. The output signal from the white noise generator is connected to the input of the electronically controlled "wind and rain" filter. The filter output is connected to an audio amplifier.

Switch on the amplifier and generator; a loud hiss should be heard at this stage. Now turn the bias controls VR1 to VR7 to minimum (wiper nearest chassis tag) and VR8 to VR14 to maximum resistance. No bias is connected to the switches (or sockets) as yet.

Set up each stage one by one, first connecting a bias voltage source (for example, 9V) to stage 7. Adjust VR7 so that, as the voltage on TR7 base approaches 0·5V, the transistor will begin to conduct and the output volume will drop to a low level. Disconnect the bias (or switch off S7), and the output will rise to its previous level at a rate determined by the discharge of C13 through VR7. VR14 is described later.

Connect the bias supply to stage 6 and adjust VR6. As the voltage on TR6 base approaches 0·5V the transistor will begin to conduct, bringing in the 0·047μF capacitor (C6) to function as part of the filter. When this occurs, the output will change in character to a low pitched "moaning" sound, due to the attenuation of high frequencies. If the bias is disconnected or switched off by S6 the audio output will revert to normal.

The other five stages are set up exactly as for stage 6 above, but remember that the pitch of the output will be different for each one. Having set up each stage as described, the scope of tonal effects can be realised. The bias switches can be operated individually or in any combination to provide a wide range of effects likened to various weather conditions.

So far no mention has been made of the other seven controls VR8 to VR14. These can be replaced by fixed resistors of like values, but it will be to great advantage to use these controls to alter the "attack" when each switch is closed. "Attack" is the term used to describe the speed at which the sound is initially affected by applying the bias.

To achieve controlled "decay" (the reverse action of attack) a large value capacitor can be connected across the bias control, the higher capacitance will give longer decay. Some experiment may be necessary here to get the effects required. Examples given in the circuit (C7–C13).

The "attack" and "decay" controls are only effectively achieved by using the electronic circuit.

The electronically controlled filter can be used for a variety of applications including stage sound, music background, and even psychedelics, where the sound can be associated with a system of lighting effects.

Next month: Percussion Effects