EXPERIMENTS WITH SOUND LIGHT & COLOUR

PART 3

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THIS month we complete the description of the conversion of an old TV receiver to provide a colour display.

DEFLECTOR COIL AMPLIFIERS

The four essential circuits required for the c.r.t. display to produce colour patterns similar to those shown on the front cover of the August issue of PRACTICAL ELECTRONICS are two deflector coil amplifiers and two pulse generators. The phase shift network involves only a few components. The two deflector coil amplifiers, one for horizontal and one for vertical deflection, are identical and the circuit for both is given in Fig. 3.1.

The circuit is quite straightforward except for the direct negative feedback between anode and grid to preserve linearity over a wide frequency range. Each amplifier has an ordinary output transformer with a 5 ohm or preferably 15 ohm secondary which will provide a better match with typical television deflector coils. With an average 500mV sine-wave input, full deflection of the c.r. tube beam should be obtainable in either direction over most of the audio frequency range.

Aside from this nothing else is required of the amplifiers or the deflector system of the c.r. tube except that the input of each amplifier could be provided with a gain control for adjustment to the level of the input signals.

MOUNTING ARRANGEMENTS

The deflector amplifiers and the pulse generators were each constructed on a small chassis fixed to the existing TV chassis, but they could, of course, be directly assembled on the TV chassis.

The photographs (Figs. 3.2 and 3.5) suggest a way of mounting the c.r. tube and its chassis in order to

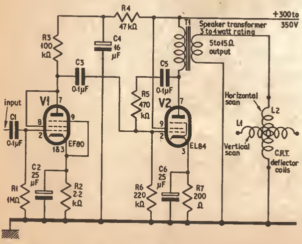
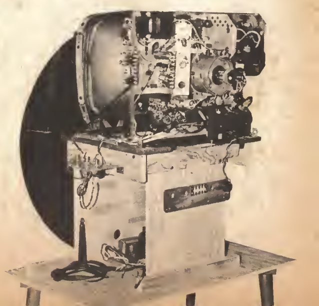


Fig. 3.1. Circuit diagram of the horizontol deflection amplifier. An identical unit is used for vertical scanning

Fig. 3.2. Rear view of the complete c.r.t. display. The separate deflector amplifier and pulse generator chassis are visible beneath the neck of the tube



accommodate the rotating colour scanner. In the original, as can be seen in the photos, a wooden platform was built up upon a baseboard. This baseboard formed the bottom of the outer case (see photo on page 575 in Part 1, August PRACTICAL ELECTRONICS), the case itself being made of hardboard covered with adhesive woodgrain patterned plastics sheet.

GRID PULSE GENERATORS

Next comes the low frequency grid pulse generator shown in Fig. 3.3. This is a conventional multivibrator circuit operating at approximately 10Hz with an over-driven amplifier from which a positive going square wave of approximately 50V amplitude is obtained. This pulse is applied to the c.r.t. grid via a 150 kilohm resistor, which may require adjustment in value one way or the other.

The pulse should bring the c.r.t. to full brilliance from cut-off. Set the brilliance control so that the beam is just cut off. When the pulse is applied it should bring the beam back to normal brilliance but which should automatically be cut on and off at the pulse repetition rate, i.e. around ten times per second. The brilliance control can still otherwise be adjusted in the normal way for viewing.

The second pulse generator is similar but operates in the region of 500Hz to 800Hz. The circuit is given in Fig. 3.4. The output should be approximately 50V in amplitude fed to the c.r.t. grid via a series resistor. The value of 220 kilohms given in Fig. 3.4 may also require changing one way or the other.

CHECKING CORRECT PULSING

In order to check correct pulsing of both generators feed a sine wave signal into one of the deflector amplifiers. This will produce a straight line across the c.r.t. with the brilliance fluctuating at the repetition rate of the low frequency pulse generator. If the scanner is rotating slightly faster or slower than the repetition rate, i.e. at plus or minus 10 revs per second, the "line" on the tube will slowly change colour. If the amplitude of the higher frequency pulse generator is correct the line should be broken into a series of dashes. The

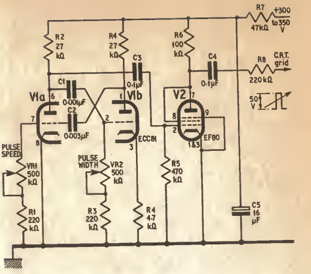


Fig. 3.4. Circuit of the 500Hz to 800Hz grid pulse generator

effect is shown in Fig. 3.6 in which two different waveforms were used, one to each deflection circuit. The higher frequency pulse provides the "dashed" line effect.

SOLID LINE PATTERNS

In order to produce solid line patterns it is only necessary to switch off the higher frequency generator. A switch could be connected so as to short circuit the grid of one of the multivibrator valves or to switch off the h.t. supply. This generator is, however, essential for the production of circular patterns made up of colour segments, as will be dealt with later in methods of "programming" the display. (Circular patterns

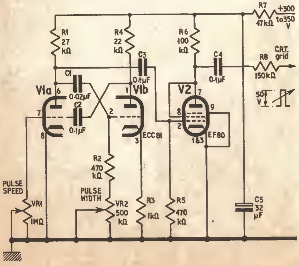


Fig. 3.3. Circuit of the low frequency (approx. 10Hz) grid pulse generator

Fig. 3.5. The c.r.t. display with colour scanner in position

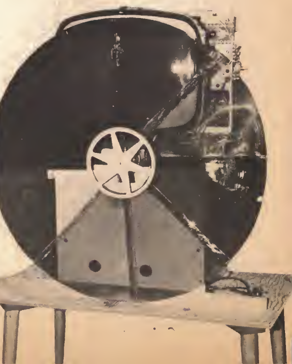


Fig. 3.6. The display produced by feeding different waveforms to the two deflection circuits. The higher frequency grid pulse produces the broken line effect

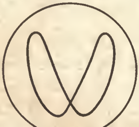


Fig. 3.7. Lissajous pattern created by feeding the scanning amplifiers with frequencies in the ratio 2 to 1

of this nature were shown on the front cover of the August issue of PRACTICAL ELECTRONICS.)

PRODUCING PATTERNS

Probably the best way of checking out the display as a whole is to feed a sine-wave of around 100Hz into one amplifier and another, at say 50Hz, into the other amplifier. Adjust the amplitude of each until full or nearly full deflection is obtained from each. Adjustment to the frequency of one should now produce a typical 2 to 1 Lissajous pattern as in Fig. 3.7. If the two sine-waves are now set to identical frequencies a circle will be produced and its size controllable by adjusting the amplitude of both signals.

By feeding in sine or square wave signals of different frequencies and amplitudes, all kinds of patterns can be produced with or without the dotted line effect and by using frequencies around that of the low frequency grid pulse generator, i.e. around 10Hz to 20Hz, patterns will appear to be made up of different colours.

Now continue the experiments by feeding music signals into one deflector amplifier and sine or square waves into the other, or music signals into both amplifiers. It will soon become apparent that complex patterns can be produced which fluctuate and change colour in time with the music.

PHASE SHIFT NETWORK

We can now take the production of patterns a step further by introducing a simple phase shift network into the input of one amplifier as shown in Fig. 3.8.

When a sine-wave of the right frequency is fed into the two amplifiers simultaneously stationary circular patterns will be produced or square if a square wave is used. The frequency of the input signal must correspond to that at which the phase shift network will produce the necessary 180 degree phase shift. If, however, the frequency is changed one way or the other, oval shaped patterns will be produced.

MULTIPLE INPUT SIGNALS

One can now go on *ad infinitum* and feed in two, three, or even four signals of different frequencies and produce something like that shown in Fig. 3.9, which, due to the colour scanner was displaved in multi-colour. This applies also to Fig. 3.6, in which the separate "dashes" appeared in different colours.

The effects that are possible are almost without limit, but a large variety of these and the methods of producing them will be dealt with next month. Details concerning programming with a tape recorder will also be included.

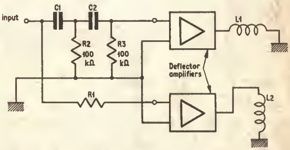


Fig. 3.8. Block diagram illustrates use of phase shift to produce more complex patterns. C1 and C2 are chosen according to frequency: a value of 0·01µF each will produce approximately 180 deg. phase shift at 100Hz. R1 should be up to 100 kilohms to equal the attenuation of the phase shift network

Fig. 3.9. Abstract pattern generated by several input signals. The original was in brilliant colour