

Ten games, on screen scoring, sound effects . . .

# New video ball game

Our new Video Ball Game will provide hours of fun for all the family. There are 10 distinct games, digital on-screen scoring, and sound effects provided by the TV sound system. Due to the use of pre-assembled modules, construction is relatively easy, and the cost has been kept to a minimum.

by DAVID EDWARDS

The 10 games provided on this new video game unit are football, hockey, gridball, target tennis, squash, basketball, solo squash, solo basketball and solo target. All of the games are similar in nature, with the players controlling one or two bats, and attempting to make a ball pass through an opening or a goal mouth.

Each player has a joystick pot, and can move his bat over the full screen area. Handicapping is provided by ball speed and bat size options. Each bat can be individually selected to be either large or small. In all games, the ball starts at low speed. In the high

speed mode, it will switch to high speed after nine consecutive hits by the players, if a goal has not been scored.

The direction at which the ball rebounds from the bat is determined by where the ball hits the bat. The bats are divided into five segments, each segment defining a different rebound angle. The zones (listed from the top of the bat) provided rebound angles of 40° up, 20° up, 0° (horizontal), 20° down and 40° down.

Scoring is automatic, and is colour coded to the player's bats. Thus the score for the white bat is shown in white, while that for the black bat is

shown in black. The games terminate when one player reaches a score of 15. Tones of 500Hz, 1kHz and 2kHz are produced for a 32mS period when the ball hits a wall, a bat or a goal respectively.

Further details of the various games are provided in the accompanying diagrams.

Turning now to the circuit diagram, we can discuss the circuit implementation. Clock signals for the LSI game chip are provided by a single transistor oscillator, which is tuned by means of a slug and coil.

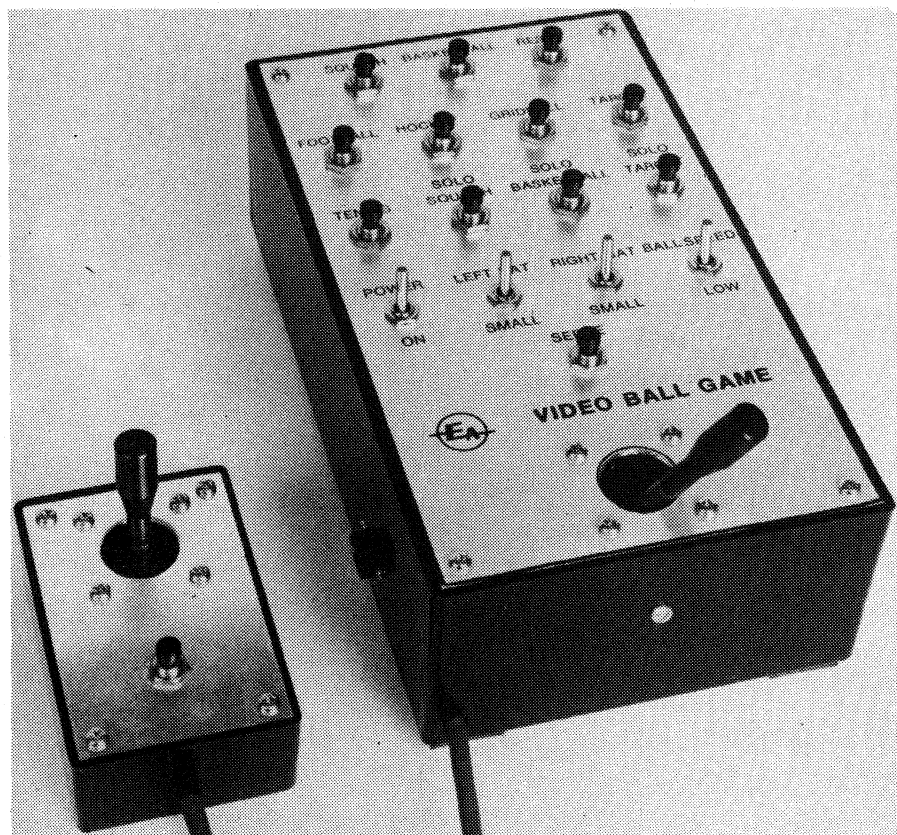
Not much information is available about the AY-3-8600 game chip itself, although it is fairly obviously a digital device. Game selection is by means of a matrix of momentary contact push switches. This means that the front panel is rather forbidding, but is fairly economical, as this type of switch is quite cheap.

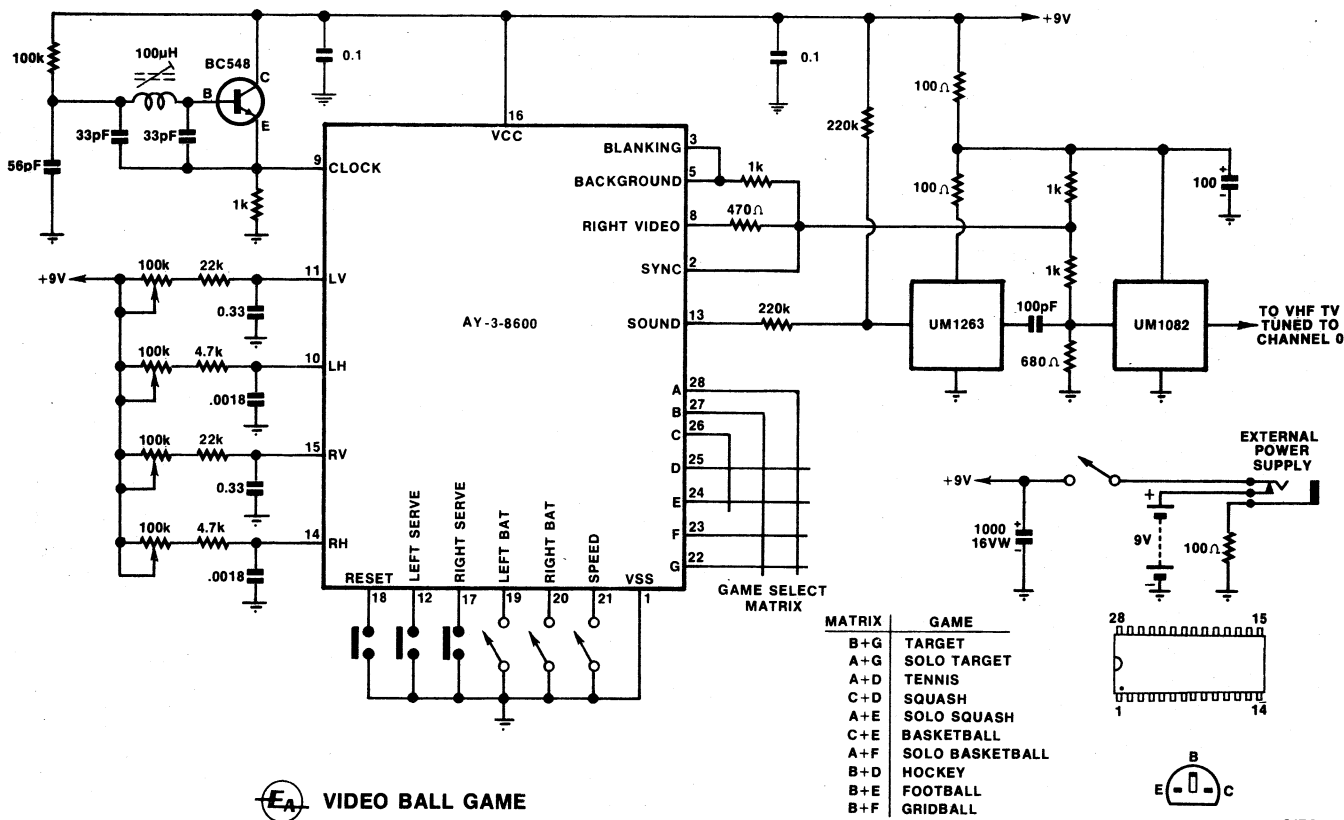
A further three momentary contact switches are used for the master reset and the left and right serve controls, while three miniature toggle switches are used to select bat sizes and the ball speed. Toggle switches rather than slide switches have been used because they are much easier to mount in the front panel.

The video output signals are summed and attenuated in a resistive network, and applied to the input of the UM1082. This is a pre-assembled VHF modulator unit, which produces an output signal on Australian channel 0. A 100 ohm and 100uF RC combination is used to decouple the supply rail, preventing intermodulation between the clock oscillator and the channel 0 oscillator.

The second UM1263 module is a 5.5MHz frequency modulated os-

*Do not be confused by the array of switches shown in this picture, operation of the game is quite simple.*





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illator, and is used to generate the sound signals. The attenuated sound signal from the chip is applied to the input, and the FM signal from the output is mixed directly with the vision signals, and applied to the UM1082.

The bat control signals are developed from the joystick controls using RC circuits. The capacitors are periodically discharged, and the time taken for them to reach a reference charge determines the bat positions. This time depends on the setting of the relevant joystick pot.

The complete circuit requires a 9V supply, and this can be provided either by an internal battery or an external mains power supply. A 1000µF electrolytic capacitor is used to ensure a low supply impedance, while a 100 ohm resistor in the negative supply line of the external power pack minimises any mains ripple.

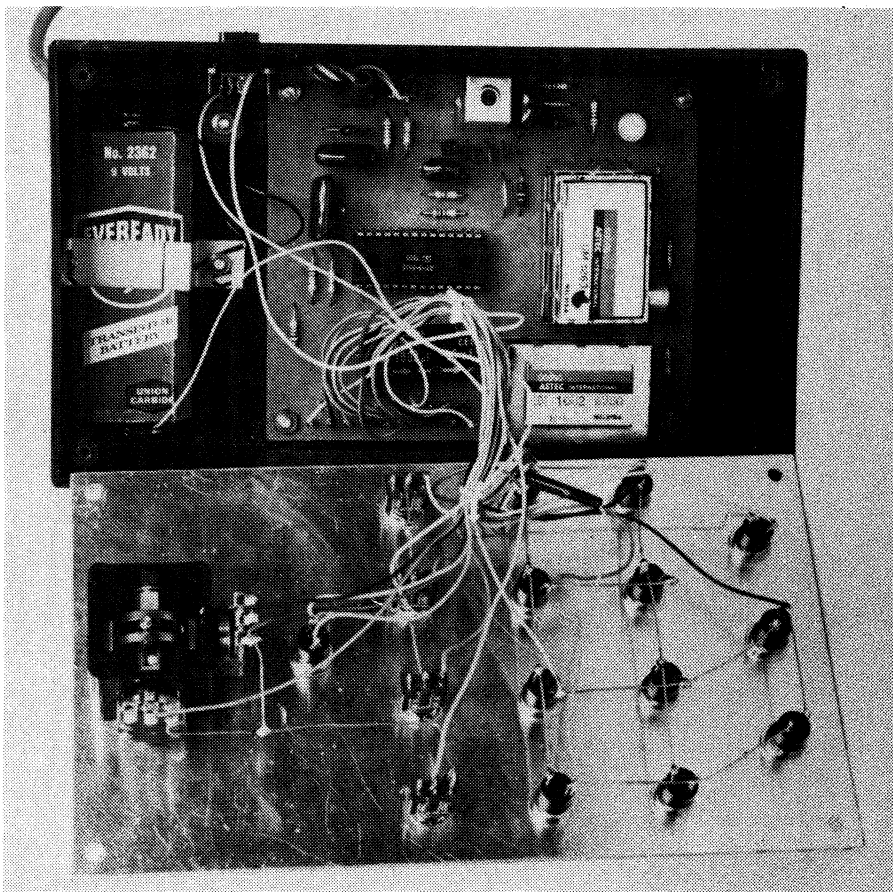
The unit is constructed in two plastic boxes, one large and one small. The large box, which measures 196 x 113 x 60 mm contains the main circuit board and control switches, as well as one set of player controls. The second box, measuring 83 x 54 x 28mm, contains the second set of player controls, and is attached to the first box by a length of four-way shielded cable.

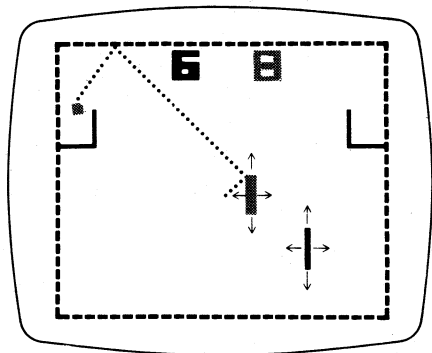
Connection to the TV set is made by a length of 75 ohm coaxial cable, which plugs into an RCA socket on the side of the main box. A socket is also provided for the external power supply.

Construction should be within the

ABOVE: All of the components shown in the circuit diagram are accommodated on single PCB assembly.

BELOW: The vision and sound modulator assemblies are soldered directly to the PCB, as can be seen in this photograph.



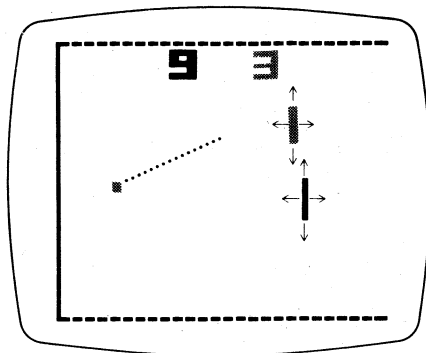


### Basketball

The basketball games use the closed playing area as shown above. The players must deflect the ball and cause it to enter the top of the goal to score. The game starts when both players depress the service buttons. The ball moves from the serve point with a random angle in either direction.

### Solo Basketball

Solo basketball is a one player game which utilizes only the left basket. The right counter displays the number of hits the player makes without scoring while the left counter shows the number of baskets made. Play starts when the right serve button is depressed.

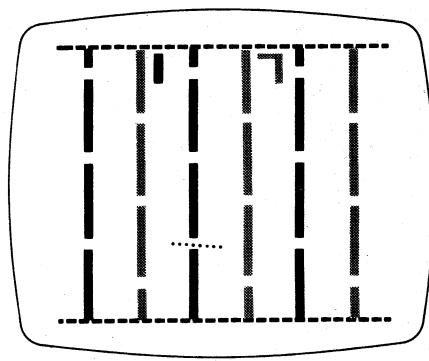


### Squash

This game uses a playing area as shown above. Each player can move over the whole court. The game will start when the player whose service it is, depresses his service button. The ball moves off with a random angle toward the front wall. The colour of the ball will change to the colour code of the next player to hit the ball. Should the wrong player intercept or be hit by the ball it will be considered a fault. Points will only be given if won on player's own service. Points won on opponents serve will only cause a service change.

### Solo Squash

This game is a single player squash. The right score counts the number of successive hits in the current game (to a maximum of 15), the left score the number of volleys played.

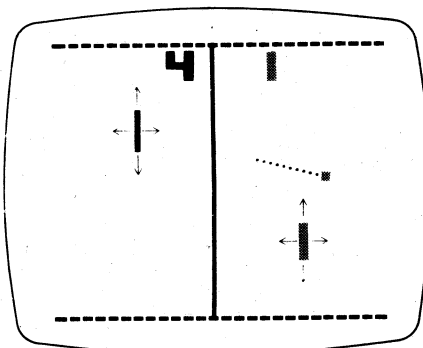


### Gridball

This game uses a playing area as shown above. Each player has three sets of vertically moving barriers to block the ball from approaching his end and opening in the barriers to permit the ball to advance toward the opponent's end. The game starts when both players have depressed their service buttons. The ball moves away from the face off point with a random angle in either direction.

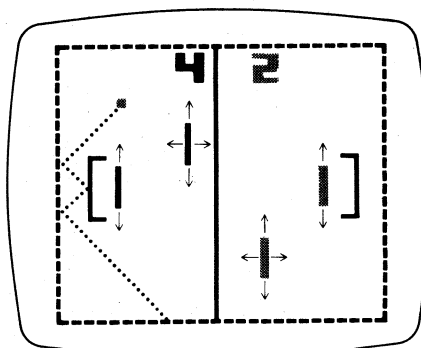
### Target

Both target games have a black target square which moves across the screen at random. The players have individually controllable crosshairs. The object of the game is to align the crosshairs on the target, and then to press the trigger (serve) button. The score shows each player's tally of hits.



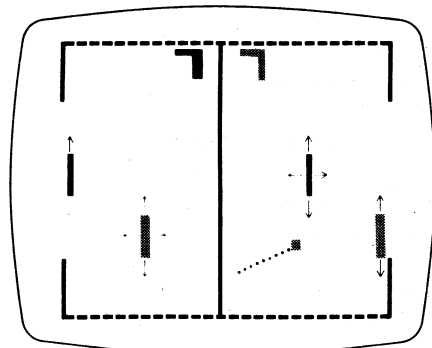
### Tennis

This game uses a playing area as shown above. Each player can only move around his side of the court. The game will start when the player whose turn it is to serve, depresses his service button. The service will automatically change every five points scored. At service the ball will move away from the service point with a random angle but always toward the net.



### Hockey

This game uses a playing area as shown above. The forwards on both sides have freedom to move over the entire playing area. The goal keepers will be locked in the horizontal axis in front of their respective goals but will move in the vertical axis in the same manner as the forwards. The game starts when both players have depressed their service buttons. The ball will move away from the face off point with a randomly selected angle in either direction.



### Football

This game uses a playing area as shown above. The motion of the players is as in the hockey game. The game will start when the loser of the previous goal depresses his service button. The ball will move away from the kickoff point with a randomly selected angle but always towards the goal of the winner of the previous goal.

### Solo Target

This is a one player game. The left counter shows the number of misses, while the right counter shows the number of hits.

capabilities of most enthusiasts, as all components apart from the controls mount on a single printed circuit board. This is coded 77vbg7, and measures 122 x 101mm. It is mounted using machine screws and nuts on the bottom of the main case.

The UM1082 modulator unit is fitted with an RCA socket as the output con-

ductor, and the board has been laid out so that this can be accessed through a clearance hole in the side of the case. The first step in construction should be to determine the position of this hole, and also the board mounting holes.

Next mount the battery and the external power supply socket, using the photographs as a guide for positioning.

The battery must be mounted on its largest side, to allow for the joystick control.

We made the front panel of the prototype from "Scotchcal" photosensitive aluminium, and have provided a full sized reproduction of the artwork used elsewhere in this article. By the time you read this article we hope that

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suitable commercial panels will be available.

Use the front panel as a template to drill the required holes in the front panel. When mounting the joystick, remember to allow clearance for the edge of the box.

After mounting the switches on the front panel, use the wiring diagram as a guide, and wire all the switches together. If you orientate the switches as shown in the diagram, you will minimise the number of crossovers.

The oscillator coil can now be assembled. Wind 100 turns of 30 B&S gauge enamelled copper wire onto the former, anchoring the start and finish with small pieces of plastic tape. The coil can be jumble wound without affecting performance. If you are not using heat strippable wire, use a small piece of emery paper to remove the insulation from the wire ends, being careful not to break it.

After inserting the completed coil into the base, pass the stripped wire ends into the appropriate pins. Then insert the base into the board, and solder it and the stripped wires to the board. Insert the slug into the coil former, using a piece of elastic to ensure the slug remains fixed in position. Complete the assembly by fitting the metal shield can.

Now fit all the remaining components to the board, taking care to insert polarity-conscious devices correct-

ly. We recommend PCB pins for all the external connections, so these can be inserted at this point.

Do not fit the AY-8600 at this stage, and do not remove it from its protective wrapping or conductive foam. Use either a 28 pin IC socket or Molex connectors so that it can be fitted to the board only after all other wiring has

- been completed.
- Use rainbow cable to make the connections between the front panel and the PCB, allowing sufficient length so that there is access to the board when it is fitted to the case. Then fit the battery, and complete the remaining wiring.
- After ensuring that the power is switched off, insert the AY-3-8600. Then

## List of component parts

### SEMICONDUCTORS

- 1 AY-3-8600 TV game IC
- 1 BC548 NPN transistor
- 1 UM1263 sound modulator module
- 1 UM1082 vision modulator (channel 0) module

### RESISTORS (all 1/4W)

- 3 100 ohm, 1 470 ohm, 4 1k, 2 4.7k, 2 22k, 1 100k, 1 680 ohm, 2 220k
- 2 100k joystick potentiometers

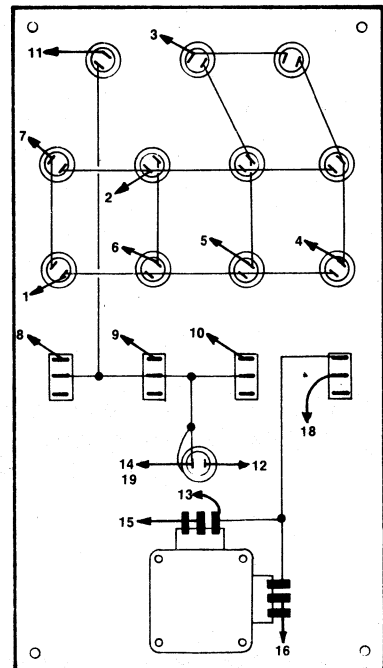
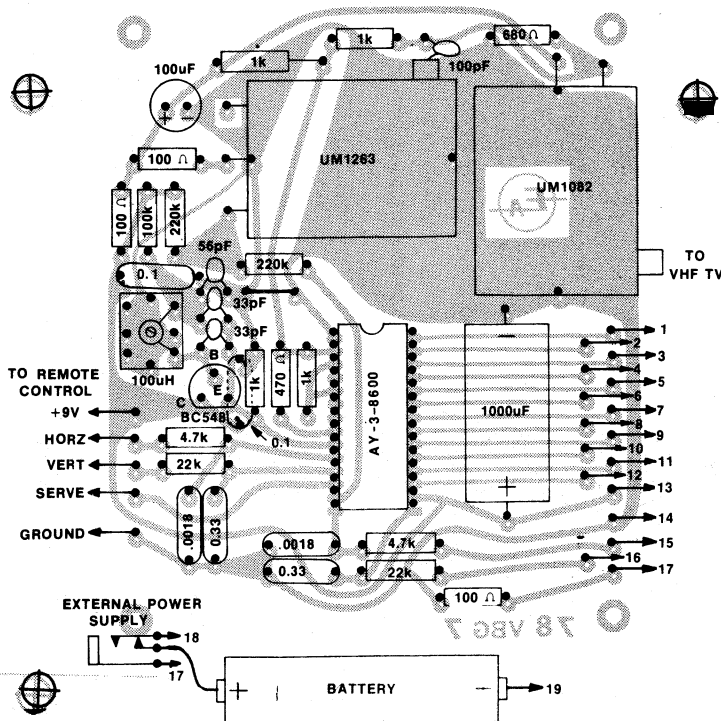
### CAPACITORS

- 1 1000uF 16VW axial lead electrolytic
- 1 100uF 16VW PCB mounting electrolytic
- 2 0.33uF polyester
- 2 0.1uF polyester
- 2 0.0018uF polyester
- 1 100pF ceramic or polystyrene
- 1 56pF ceramic or polystyrene
- 2 33pF ceramic or polystyrene

### MISCELLANEOUS

- 1 printed circuit board, coded 78vbg7, 122 x 101mm
- 1 9V battery, Eveready 2362 or similar, with connecting clips
- 1 2.1mm DC input jack socket with suitable metric screws

- 13 miniature momentary contact push switches
  - 4 SPDT miniature toggle switches
  - 1 plastic "zippy" box, 196 x 113 x 60mm
  - 1 plastic "zippy" box, 83 x 54 x 28mm
  - 2 meters four way shielded cable
  - 1 front panel (see text)
  - 1 5mm subminiature coil former (722/1)
  - 1 6 pin base to suit (5027/6PBL)
  - 1 shield can to suit, 13 x 13 x 20mm (7100)
  - 1 type F16 4mm ferrite core to suit
  - 2 cable clamps
  - 1 aluminium bracket
  - Solder, tinned copper wire, rainbow cable, 30 gauge B&S enamelled copper wire, machine screws and nuts, self tapping screws to suit joystick pots, PCB pins, 2 14-way strips molex IC connector pins.
- NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.



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connect a TV set tuned to channel 0 by a suitable cable, and switch on. You will probably be greeted by some sort of picture. If not, adjust the fine tuning of the TV set. Then adjust the oscillator slug till you obtain a stable picture. Start with the slug well into the coil, and slowly screw it out.

Now readjust the fine tuning to obtain the best definition of the picture elements. Check the operation of all the controls, including the game selection switches. Selection of the two target games may require several pushes of the appropriate switches; this is normal.

If the sound is distorted, you may need to adjust the frequency of the sound oscillator. To do this, remove the clip-on cover from the UM1263, and carefully adjust the slug of the tuning coil. Use a non-metallic tool for this.

After you have checked out the operation of the game, fit the front panel to the box, and commence to enjoy yourself. If you are unable to achieve satisfactory operation, check for wiring faults (dry joints, solder bridges or misplaced components), and for incorrect tuning of the master oscillator or TV set.

The two diagrams on this page are reproduced actual size, and can be copied or traced as desired. Commercial boards and front panels should be available in due course.

