Multi-ball play ..
NOW ON HAUNTED HOUSE!

Our first prototype demoed at Sorgues pinball expo (France, February 2012) topped with our giant display (optional add-on)

What a beautiful pinball! But what a pity there's not much to do on the playfield.

The layout is good, but this game sorely lacks a development worthy of passionately enthusiastic players like us.

A sad comment heard a thousand times: "Haunted House is very beautiful, it's a shame it is not multi-ball, it's boring". Because we kept hearing this same comment, and because we remained frustrated by this great-looking but not very exciting game, finally a decision was made: WE'LL DO IT!

Nothing would have been possible without the pinball know-how of Cédric and the development of the new **PI-80** board by Pascal Janin as part of the French "Flippp !" association.

In effect the game had to be reprogrammed from scratch. To use the original Gottlieb CPU board would have required reverse engineering the original code without any documentation and, moreover, illegally since the US copyright holders actively protect their rights. It would then have required extensive modification to

handle multiple balls. Even then it would still not have had the benefits of new hardware and software capabilities a modern replacement board can bring.

The **PI-80** board is 100% compatible with the original game but also allows the user to modify at will the functions and rules. Why not experiment: almost anything goes! Further developments of the board also remain possible to incorporate new ideas.

However, fitting the new board is not sufficient in itself. There are some essential modifications which need to be made to the game mechanics to handle the revised control of the balls and the flippers.

In making this transformation, we made a decision to stick to the spirit of the Gottlieb "era". So no question of adding opto-switches or other modern devices; we chose to fit only parts which were used on Gottlieb pinball machines at the time, the idea being that the game could very well have been released in this format in 1982.

It is unfortunately not possible to implement such a ruleset without making some irreversible changes to the playfield, although these could be avoided to some extent if another method of management of the balls were chosen. However it would still be necessary to introduce a method to store and deliver the additional balls during the course of a game.

Similarly, when devising the additional game rules, we aimed to keep them in line with other Gottlieb games of the period. We wanted to simply improve a game, not to build a UFO!

Here is an overview of the first ruleset as presented at *PlayExpo* show on October 2012 in England:

How to play **HAUNTED HOUSE** 3 BALLS PER GAME

BONUS MULTIPLIER	Ball changing levels advances bonus multiplier except lower level up-kicker and upper level ramp.
DOUBLE SCORING	Completing lower level target bank twice or upper level target bank three times lights double scoring for middle level. Making 11 "hits" on upper level lights double scoring for lower level. Making 11 "hits" on lower level lights double scoring on upper level.
DOUBLE BONUS	Three holes at entrance light double bonus when lit. Left hole lights upper level, center hole lights lower level, right hole lights middle level.
EXTRA BALL	Completing targets 1-5 in order or completing any drop target bank lights EXTRA BALL.
SPECIAL	Completing targets 1-5 in order or completing upper level target bank three times lights lower level hole for SPECIAL. Completing lower level target bank twice lights upper level bank for SPECIAL.
MULTIBALL	Capture 1 ball in the lower level SPECIAL, then a second ball in the middle level EXTRA BALL. Multiball play begins as soon as any points are scored with the third ball. All scores are 3x when 3 balls are in play and 2x when 2 balls are in play
JACKPOT	When all 1-2-3-4-5 targets on main playfield are hit (in any order) during multiball, it scores 50,000 x the number of balls in play

1. List of electronic and mechanical changes required for the upgrade

1. Replace the original CPU, Power and Driver boards with a PI-80 all-in-one board.

This change is unavoidable (see previous explanation) since no development is planned for the original Gottlieb CPU.

When ordering the board, specify the Haunted House multi-ball software which will be supplied at no additional cost.

This may be incorporated in the standard software in future (under study).

2. Modify the main ball trough to act as a multi-ball feeder

It is obviously necessary to store the balls somewhere on the main playfield level when not in play.

When not in multi-ball mode the game behaves in the same way as a standard single ball game (with the exception of the capture areas of course).

3. Modify the lower level playfield to enable ball management at this level and, critically, avoid having multiple balls simultaneously in the Vertical Up-Kicker (VUK)

The VUK is the vertical ejector that allows a ball lost on the lower playfield to be returned to the main level.

It is the main source of problems on this game, and the main reason for arcade operators not wanting to site the game. Because ejection of the ball is vertical (unlike on Black Hole for example) it requires precise and invariable alignment of the vertical plastic tube which overlooks the ejector.

Otherwise the ball drops back, and the (infernal) cycle repeats until eventually it works … or not.

The game also needs to prevent additional balls falling into the ejector, as there is insufficient power in the kicker to eject more than one ball at a time and the game would hence be left in a complete impasse!

It is therefore necessary to install a second special multi-ball through on the lower playfield.

4. Modify the control of the 8 flippers on the game

On the original game, a relay prevents simultaneous operation of the flippers on the upper and lower playfields.

However, simultaneous operation is required in order to be able to play a game when balls may be present on all 3 playfield levels at the same time.

5. Add additional switches for detection of the additional balls

These are required in particular for management of balls in the main and lower playfield ball troughs.

6. Add speech

Thanks to new sound proms for the original Gottlieb sound/speech board, sentences are said throughout the various stages of the game, with the same « voice » as the other Gottlieb games of the same series, the speech processor being exactly the same.

It is important to note that adding speech is not mandatory at all: the game can play very well without it. Moreover, the **PI-80** board has no way to tell whether the sound board has become speech-capable or not (none of the pinball games of that series, equipped with original Gottlieb boards or not, can "know" what sound board is installed in the backbox).

7. Optional animation features

To bring the playfield more to life, animations (blinking existing lamps) are added to indicate which zones the player should be aiming for, for example, a ball capture or a trigger to start multi-ball mode.

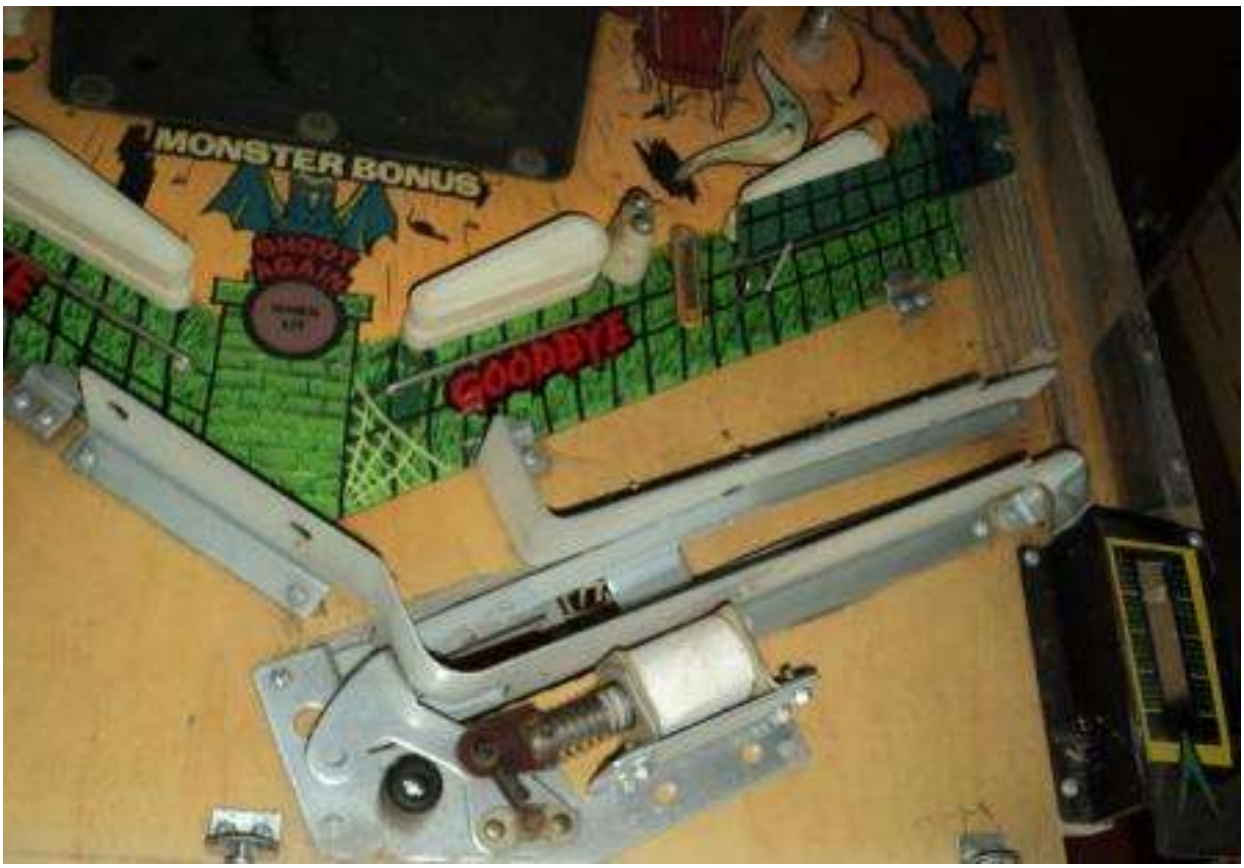
Additional lamps can be added to highlight certain areas of the game, e.g. the lower entry to the VUK tube.

The **PI-80** board allows control of a greater number of lamps than the original Gottlieb CPU.

2. Modification of the main ball trough to act as a multi-ball feeder

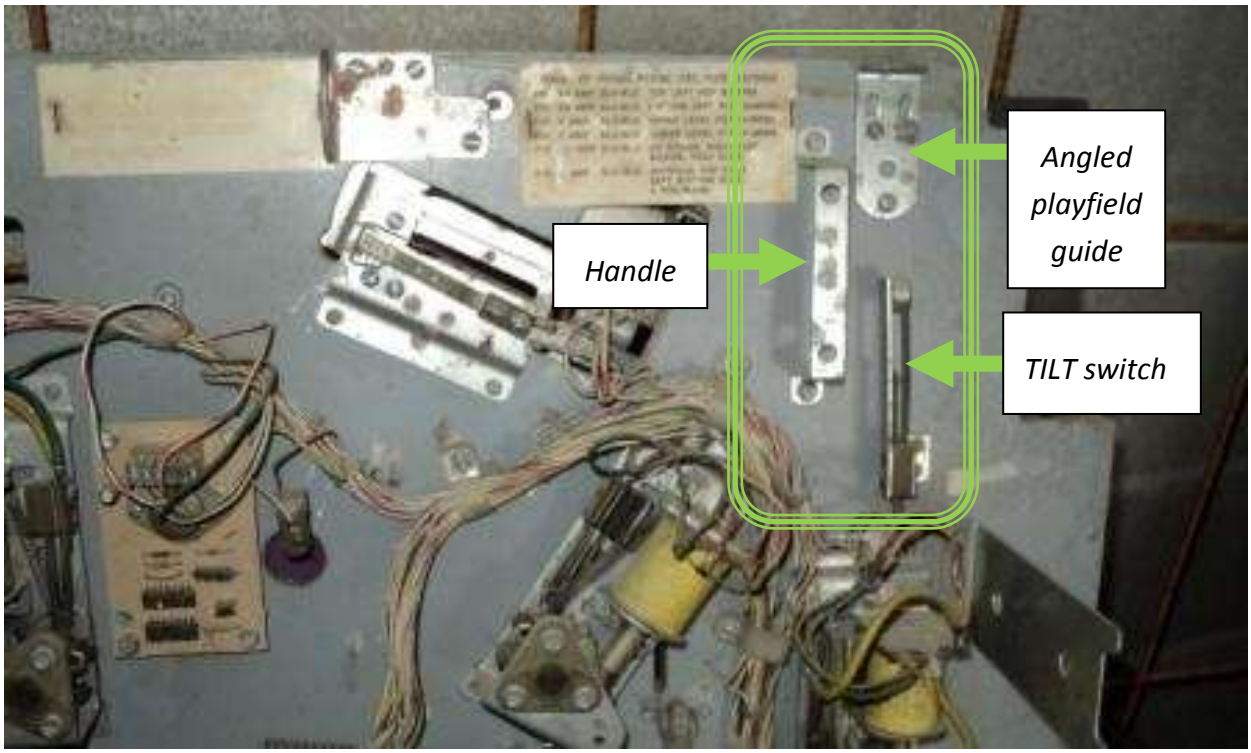
This basically consists of replacing the original ball trough with a multi-ball trough.

To do this, first remove the card holder apron and then the old trough and eject mechanism:



Remove items from under the playfield in the area where you will drill the wood.

Compare the photo below with that on page 10 to see which items to disassemble:



Use a strap to keep the wire loom away from the drilling area and avoid damage to the wiring through contact with the drill:

The multi- ball mechanism will need to be recovered from another wide body Gottlieb playfield such as: Mars, Volcano, Black Hole, Devil's Dare, Spirit, etc...

The mechanism on standard (not wide) body games is not the same and is not suitable for this purpose.

Drilling the holes

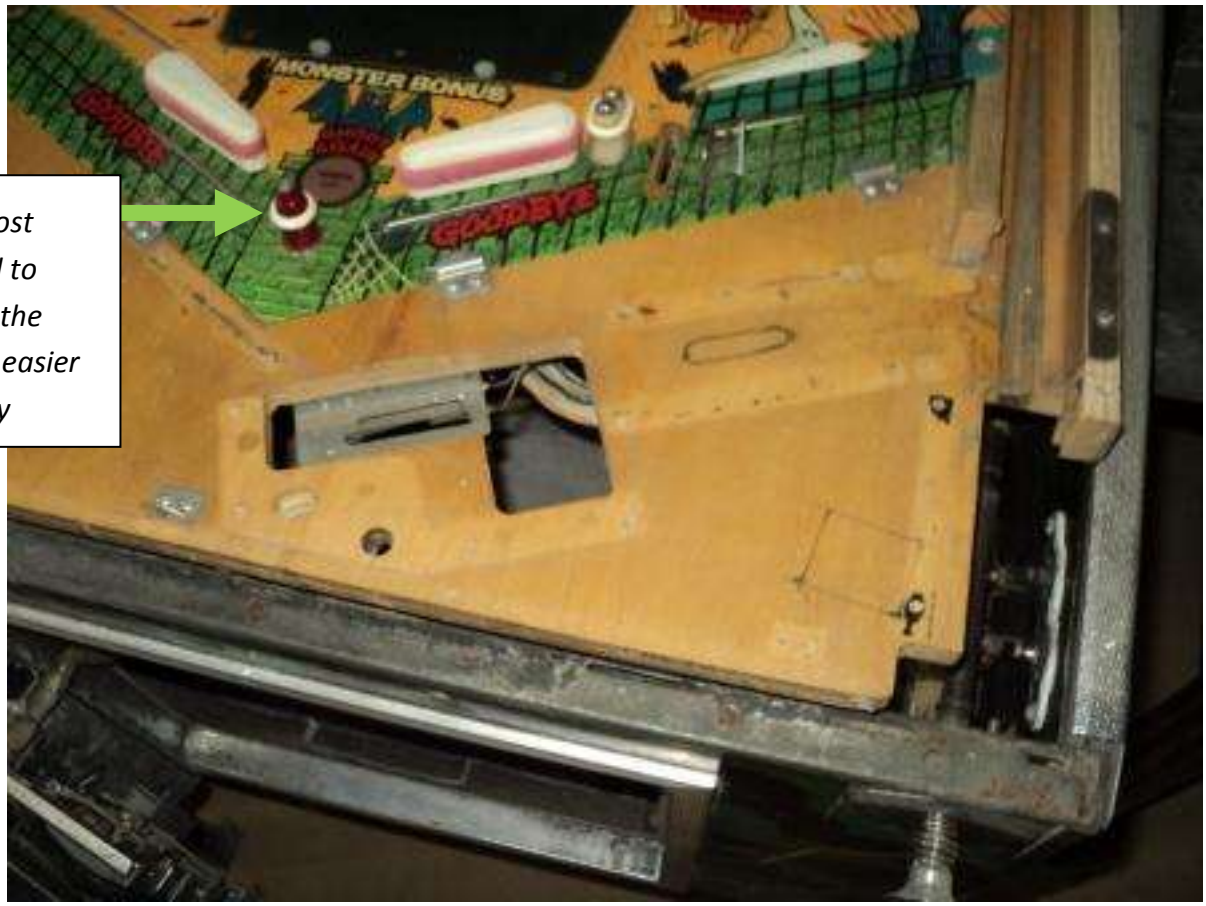
We understand that you may be reluctant to drill your playfield!

We can tell you that these holes are not required. They do greatly simplify installation but it is possible to adopt alternative methods of detecting balls in the trough (e.g. opto switches) and of ejecting the balls which avoid the need to drill.

However, not everyone will have the DIY skills to do this.

What we are doing is what Gottlieb would have done, no more, no less.

Carefully note the measurements of holes to be drilled and mark on the playfield:



Red post added to make the game easier to play

In the photo above we have installed an additional (red) post between the flippers. This is not on the original game, but makes the multi ball version more forgiving.

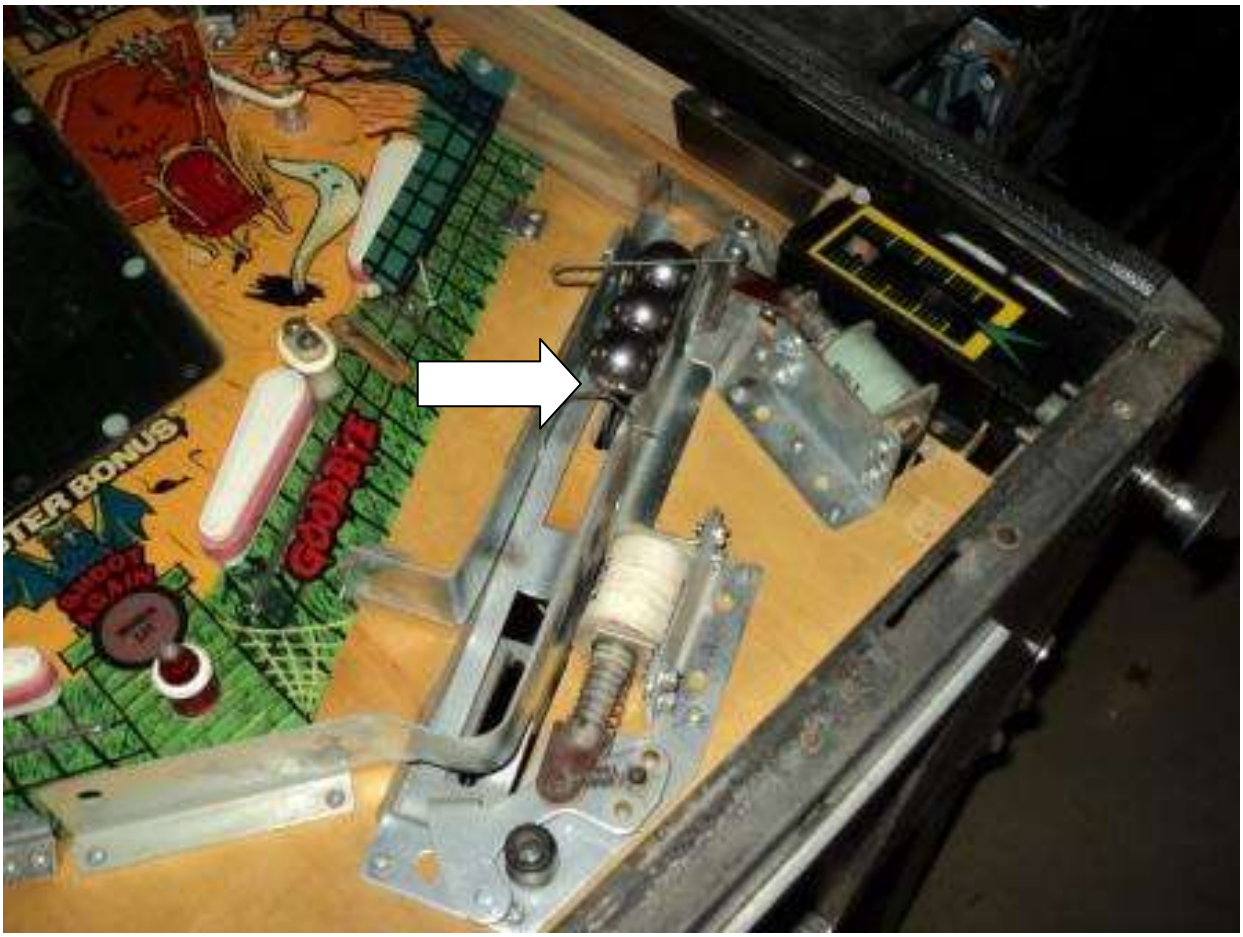
Now, we are drilling the location of the additional switch:

Join the drilled holes with a jigsaw:

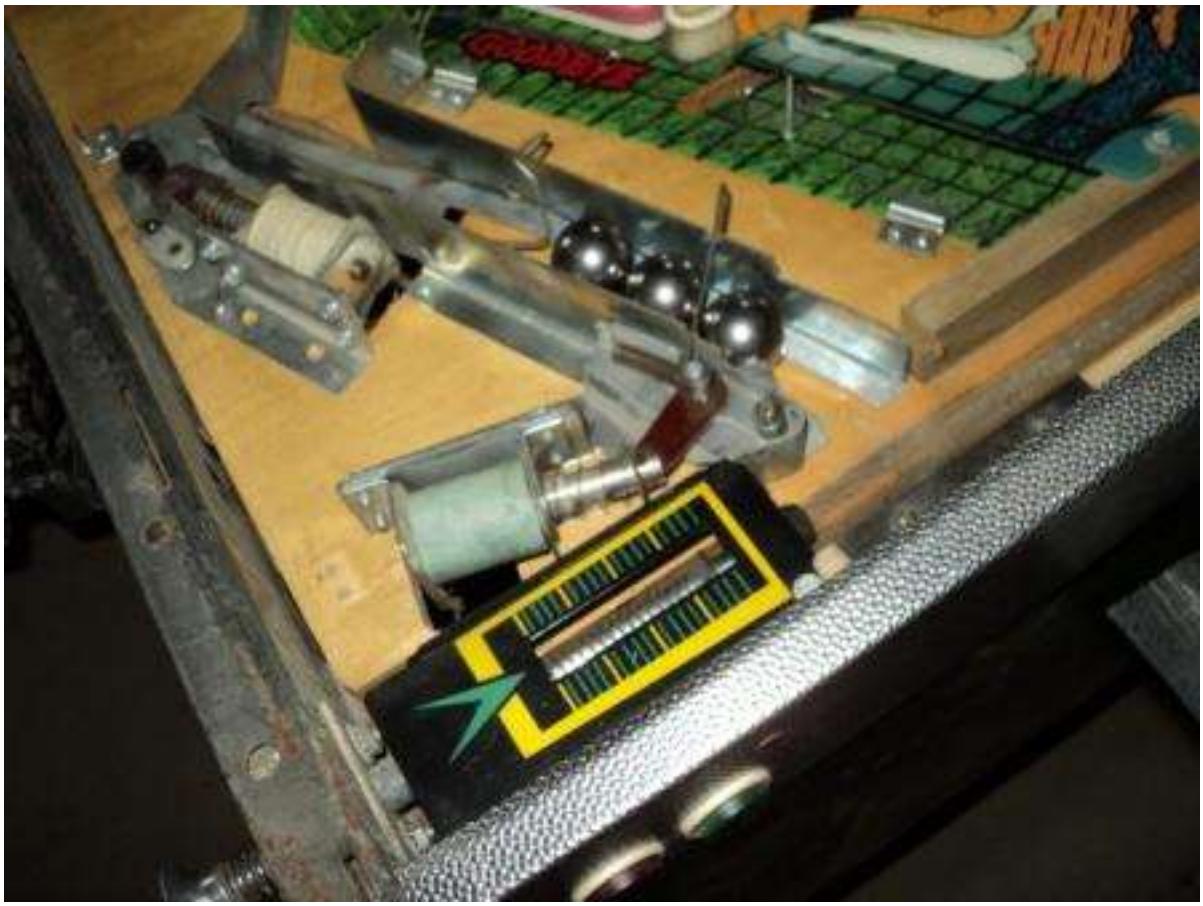
A little sanding and a good vacuuming will be needed.

Reassembly of the trough and guides should present no difficulty:

And with 3 balls in the trough, the 3rd ball is closing the newly installed additional switch:



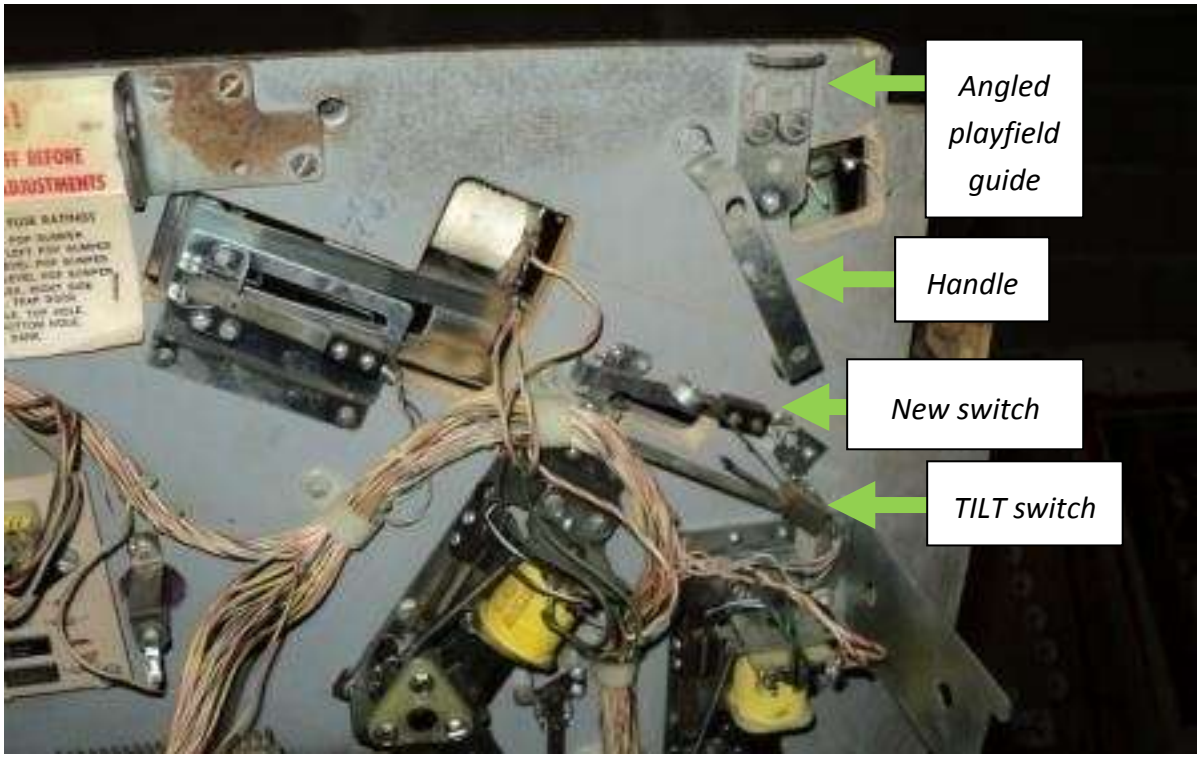
Great care must be taken to correctly position the ball release coil mechanism: a small error here will result in balls not being released to the plunger. To do this, first ensure the playfield is fitted in the game and at its normal operating angle before fitting the ball release mechanism.



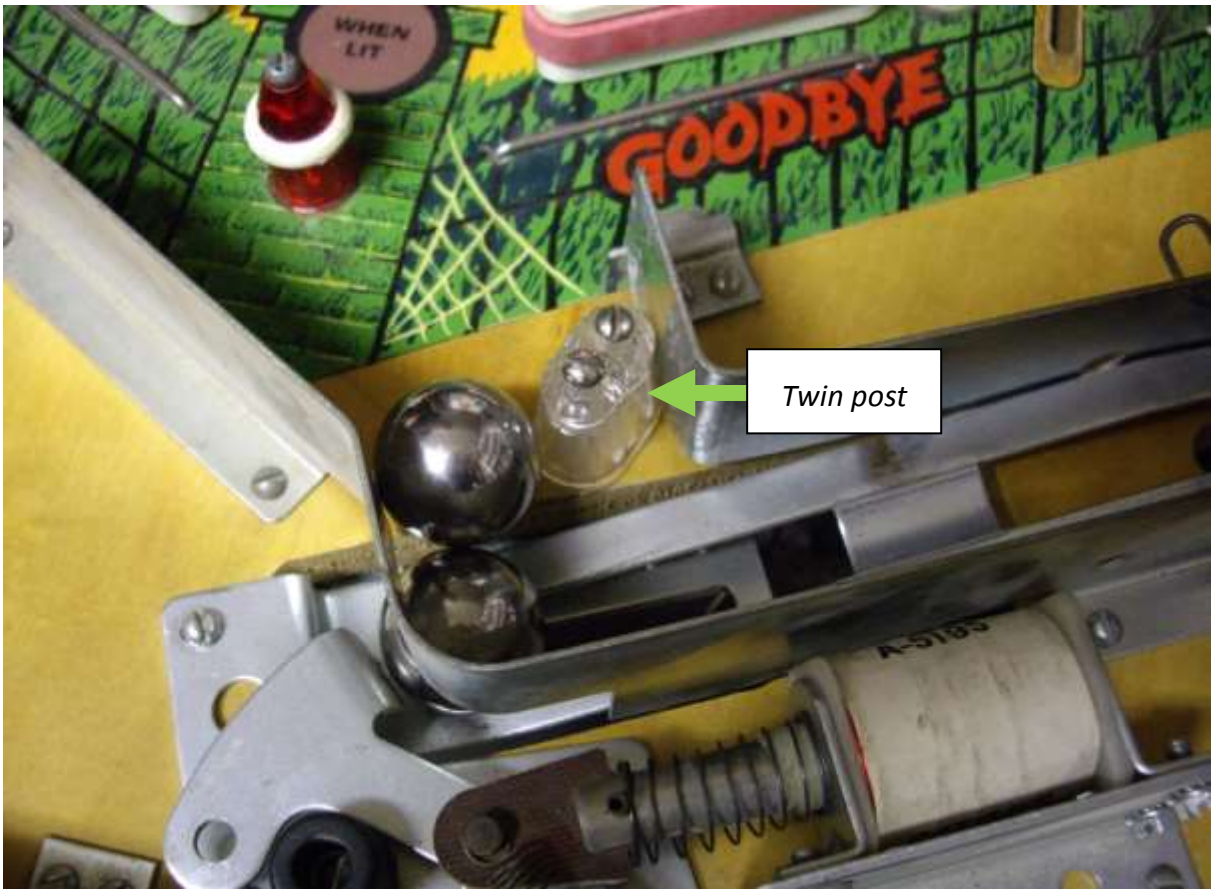
That's it for the top side of the playfield.

Just need to reassemble on the underside.

Everything we took off is refitted but some positions need to be moved:



It only remains to add a twin post to prevent a ball jam in the outhole if two balls arrive at the same time:



3. Electrical connections for the new multi-ball through on the main playfield

We now connect the new switch and the additional coil in the new ball trough so that the PI- 80 can control them:

- The switch closes when all 3 balls are present in the trough
- The coil opens the gate that releases 1 ball at a time to the plunger.

Electrical wires to use

Each usage requires a different type of wire:

- Switches on the switch matrix carry a very low current drain: a flexible wire with small cross section (0.3mm2 for example) will do nicely.
- Coils, on the other hand, are controlled by currents of several amperes: a wire of greater cross section (0.8mm2) will be necessary.
- If in doubt about the size of wire to use, look at the wiring to the existing coils and switches.

Always use flexible stranded wire, which is much easier to handle and to thread through the existing cable clips.

Also prefer using many different colours so as to better identify the use of a particular thread, and preferably use bright colours, which will identify the new wire added in the middle of existing cables.

Personally, we took orange and purple larger section wire for coils, and green, grey and yellow small section for most switches, lamps and relays.

Wire section and « gauge »

The word "**gauge**" expresses the inverse of the section of the wire: the smaller the "gauge", the thicker the wire.

!!! Important – pay attention to the direction of wiring of the coil !!!

All coils on this generation of electronic pinball machine have a correct direction of wiring related to the diode which is fitted to them (called a freewheeling diode).

Each diode has a banded end (with a white ring) side and a non-banded end.

Take great care. Fitting the wiring in reverse will immediately destroy the transistor which controls the coil! This is true regardless of the game and the control electronics!

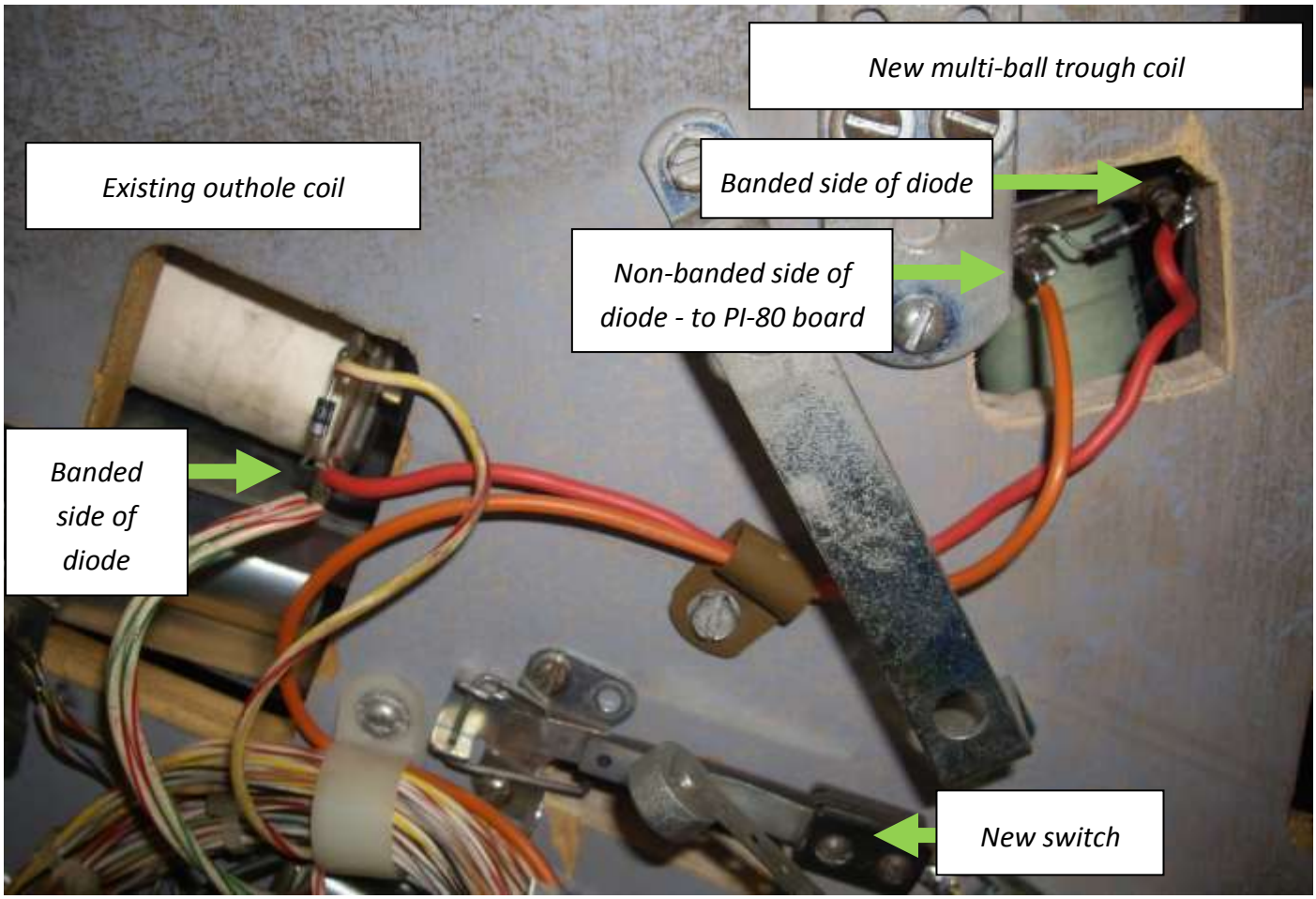
1. Connecting the coil

Solder a short wire between the banded side of its diode and the banded side of the diode on the *outhole* coil to its left: this is where the common +24 VDC arrives at the coils. (see photo : red wire)

Solder a long wire to the non-banded side of its diode: this will go to the existing A12J8/P8 connectors, then to the **PI- 80** board. This wire must pass through the entire playfield, so provide a good length! Feed it through the existing cable clips to prevent it drooping. (see photo : orange wire)

For now, leave the other end of the orange wire free – connection instructions are given later.

A small extra clip (in brown on the photo) will ensure those 2 wires don't hang loose:

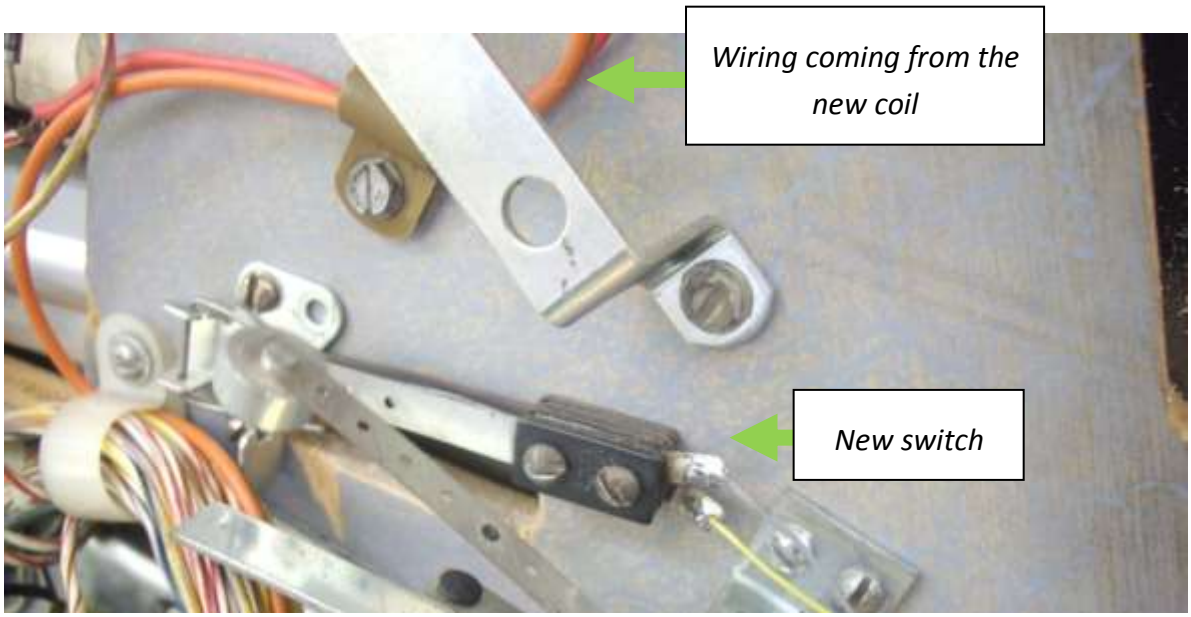


2. Connecting the switch

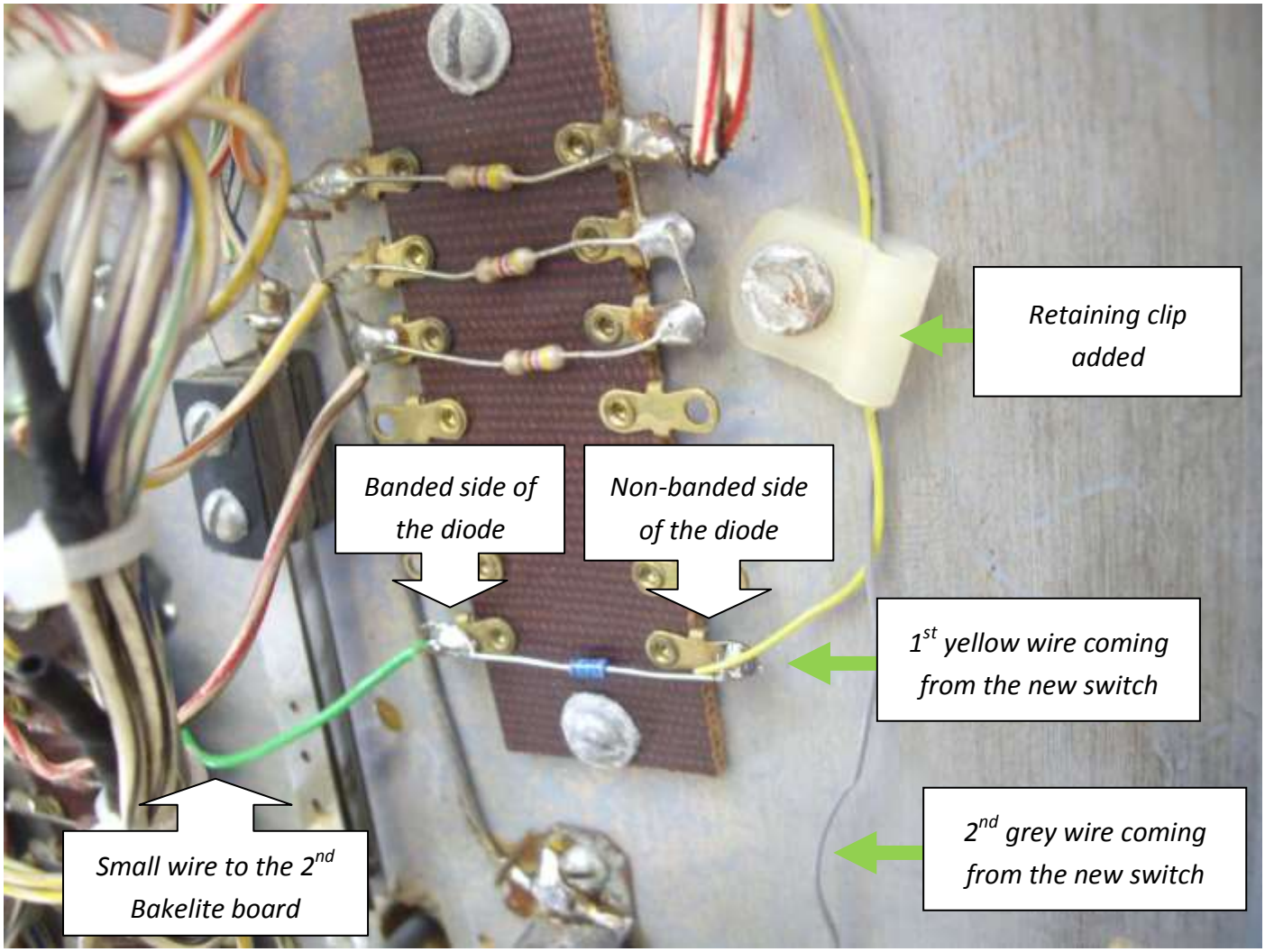
This switch will be numbered 56 in the switch matrix. It will be connected between the existing wires:

- 1st wire: signal STROBE 5, colour code 455 (yellow green green) through a diode
- 2nd wire: signal RETURN 6, colour code 666 (blue blue blue)

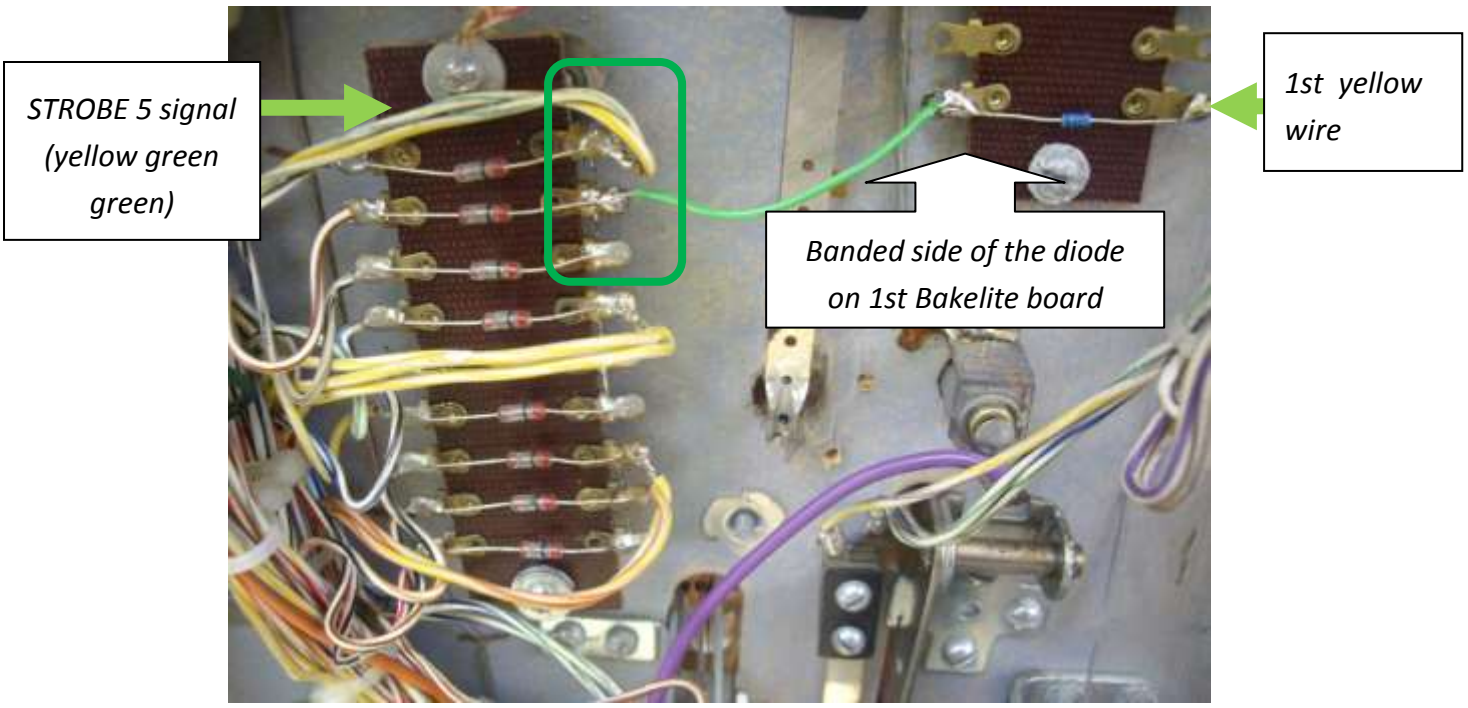
Big advantage: no extra wires to be added to the **PI-80** board!



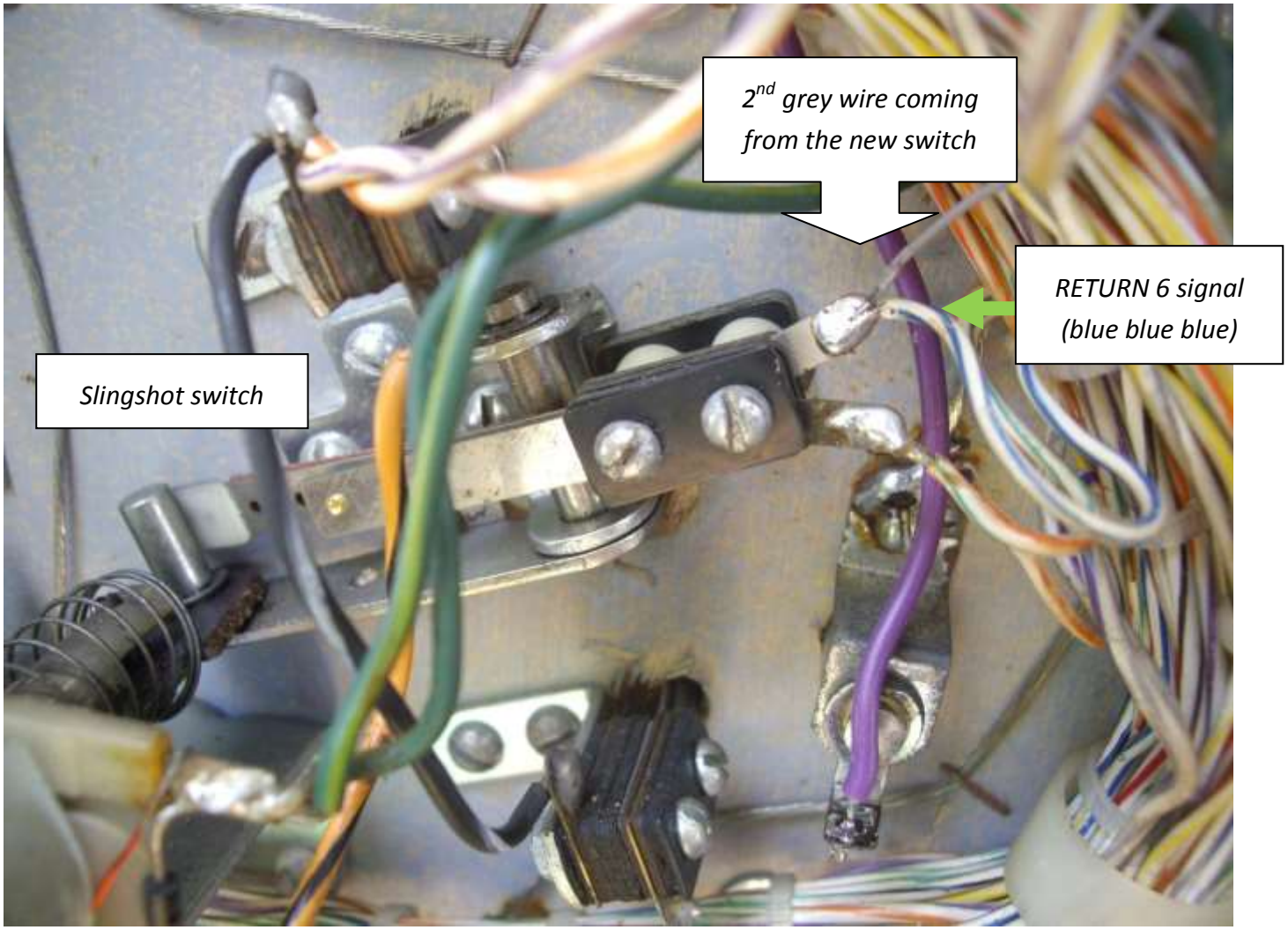
The 1st wire (yellow in the photos) goes to the non-banded side of a Schottky diode (BAT42 BAT43 or BAT85 kind, not 1N4148!) soldered between 2 free terminals on the Bakelite card to the middle right of the playfield:



The other banded side of the diode connects to the STROBE signal 5 on the 2nd Bakelite card to the left of the previous one, using a small insulated wire:



The second wire (grey in the photos) connects to the RETURN 6 signal wiring, which is common to all the 10 points switches and the slingshots on the main playfield. We connected to the slingshot switch to the left of the *extraball* passage:



Wiring Housekeeping

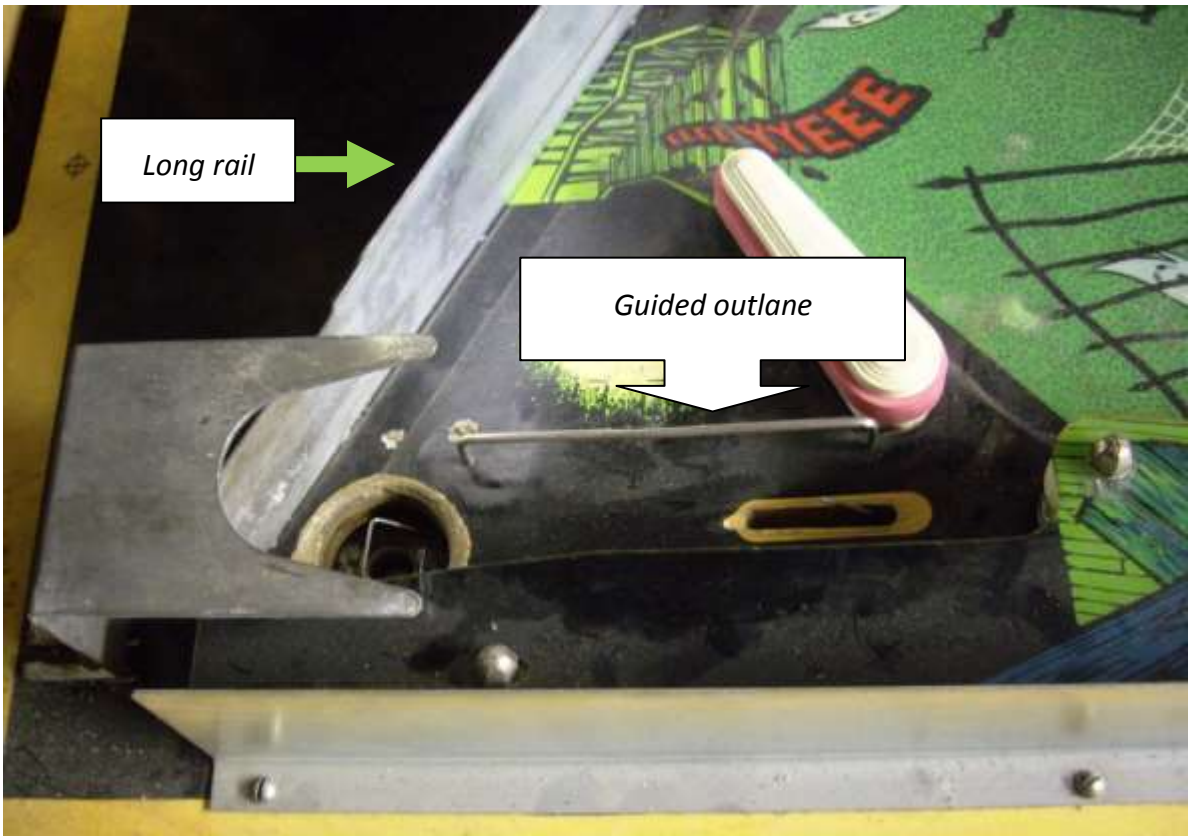
Pass the extra wires through as many of the existing plastic wiring clips as possible, to keep things neat and tidy and prevent the wires getting caught in moving mechanisms or being crushed by the metal rail which supports the playfield.

This will avoid the risk of breakage or short circuit of the wires.

Add additional clips if necessary where the wires are loose.

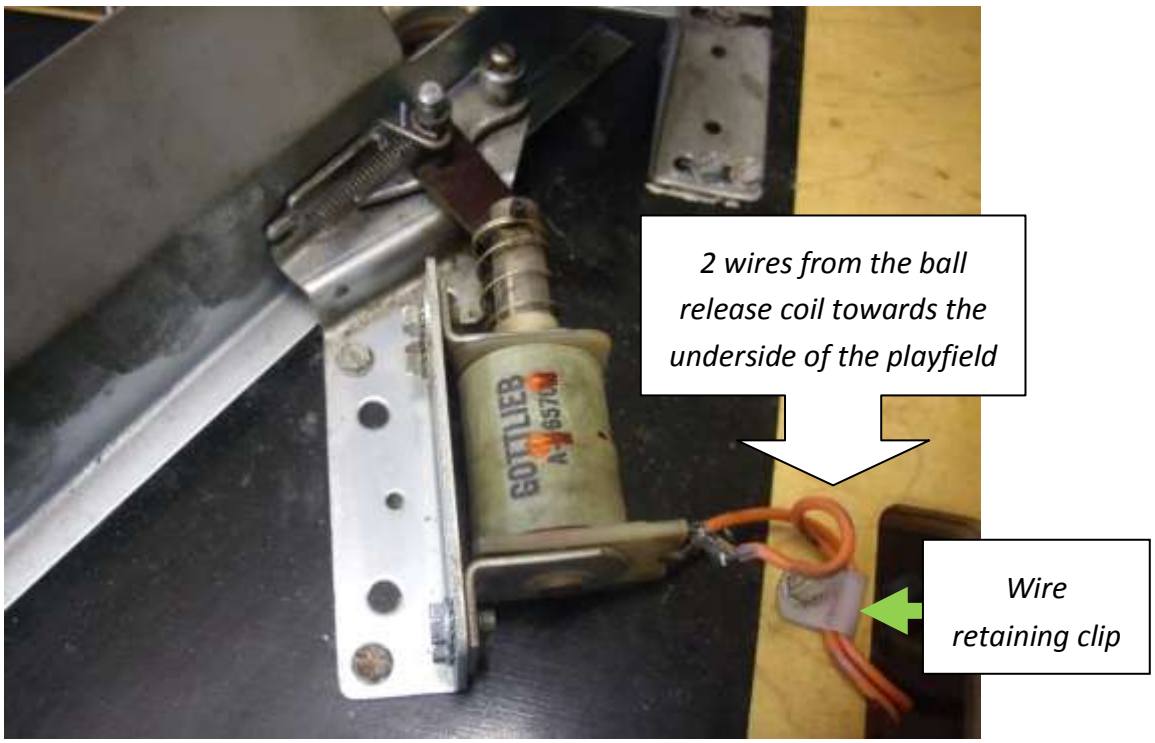
4. Modification of the lower playfield

The existing lower playfield has a long metal rail, which recovers the ball when it is lost between the flippers, and a guided outlane to the left of the flippers:

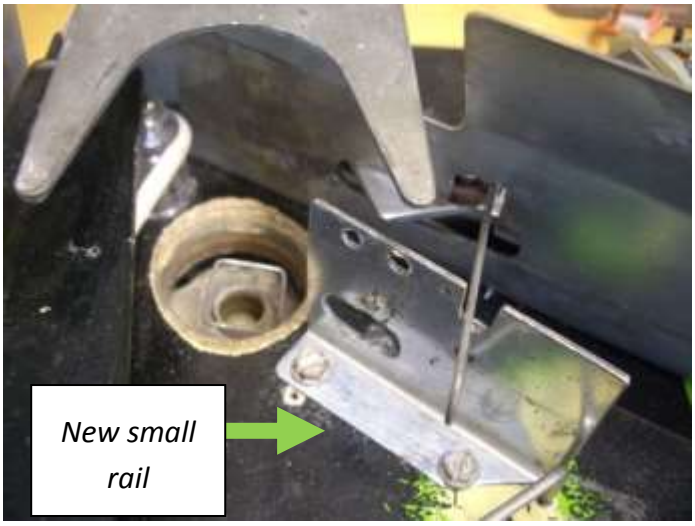


1. Machining of the long rail, and installation of an additional small rail

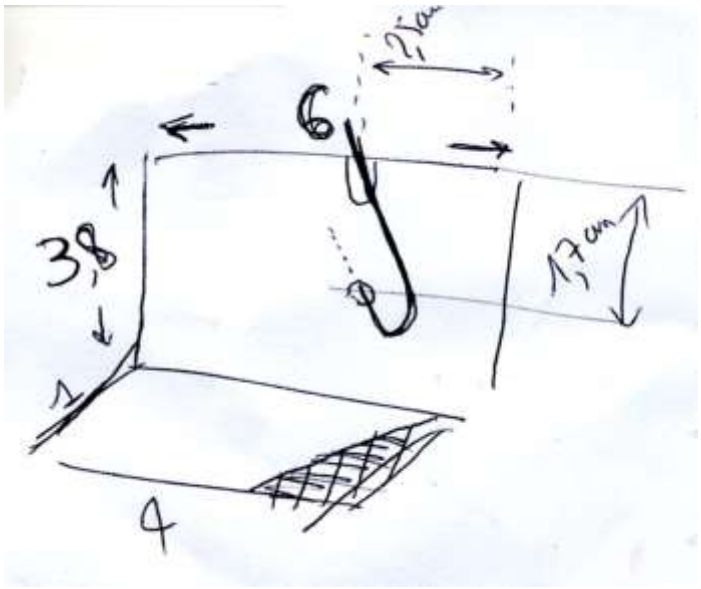
The long metal rail must be machined (drilled and grooved) to be able to install a ball retainer and release mechanism identical to that already installed on the main playfield:

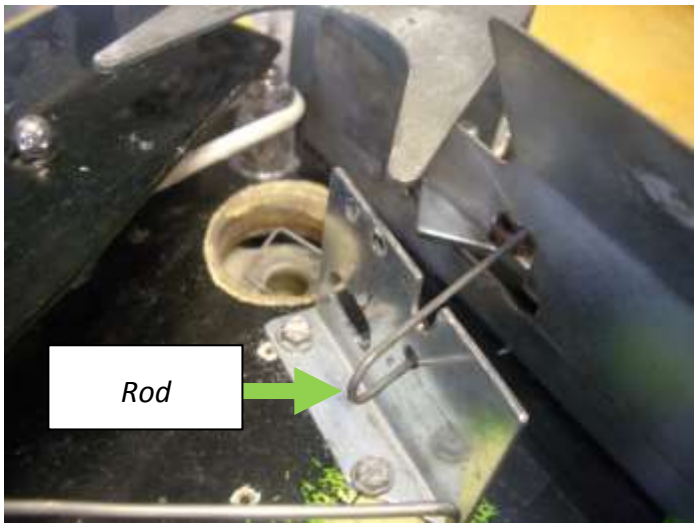


A new small rail, to be recovered from an existing game, should be installed in front (see photo right), and pierced to receive the metal rod that comes from the new ball retainer mechanism.



The dimensions (in cm) of drilling and cutting of the small rail are shown in the drawing below:

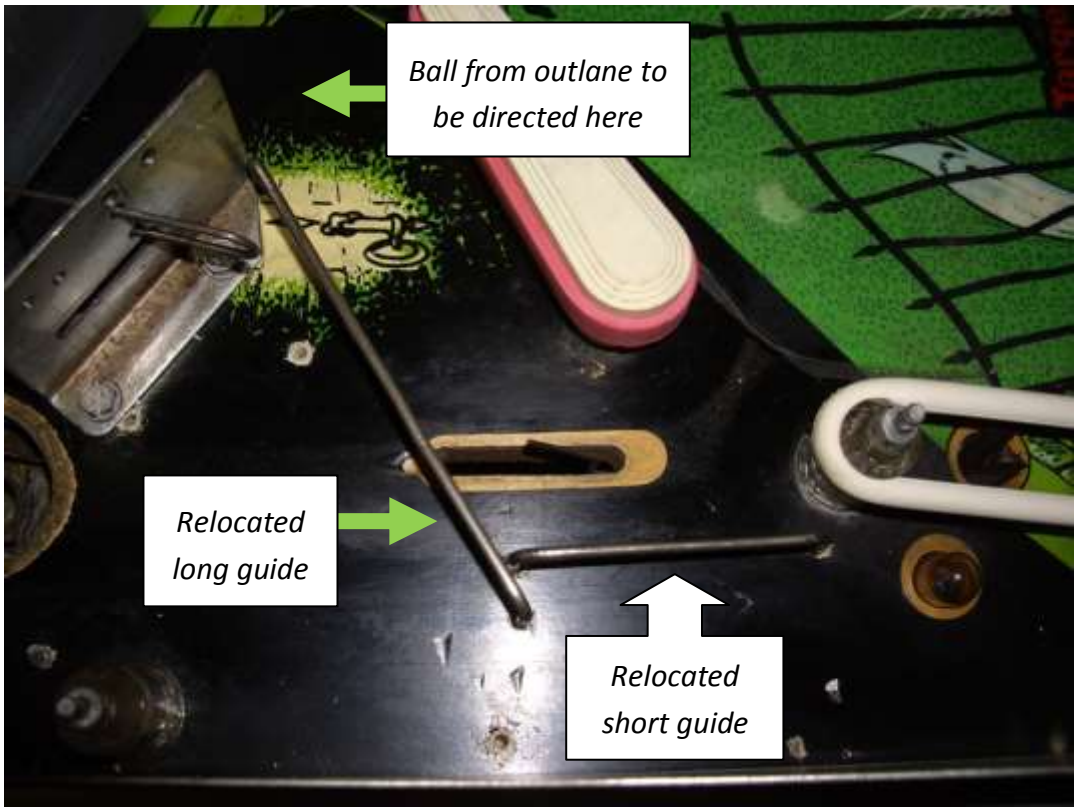




Take care to ensure that the rod will slide smoothly.

2. Modification of outlane guides

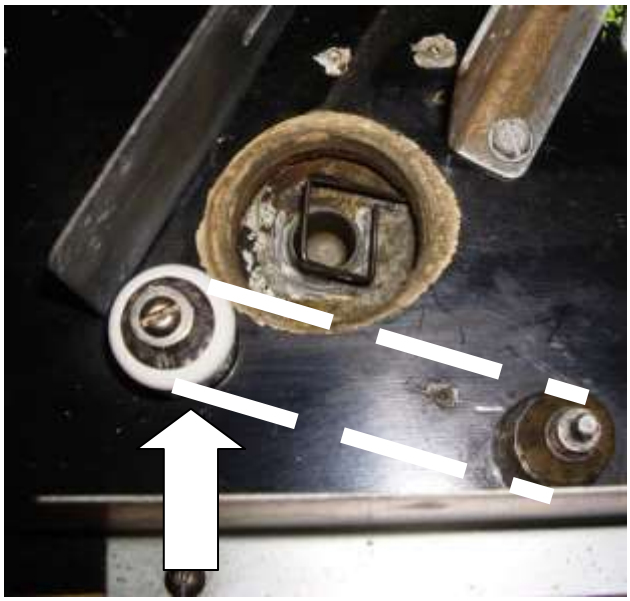
Balls passing through the outlane need to be redirected into the ball retaining mechanism. This will require the existing ball guide, and another larger one recovered from under the plastic adjacent to the outlane, to be bent to the correct length and relocated as shown below:

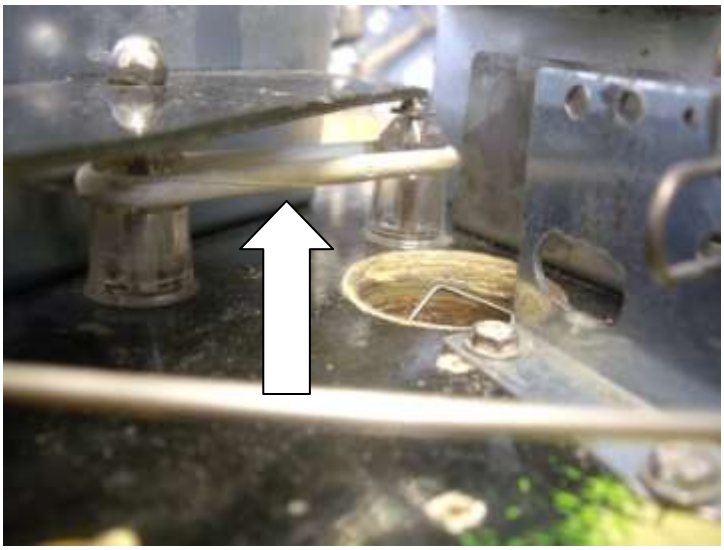


3. Add an additional post

A new post must be added behind the eject hole to ensure a ball does not jump the hole and get caught in that area. This could not happen with the old outlane design.

You can also add a rubber ring to connect this post to the existing one in the bottom right (see picture below) :

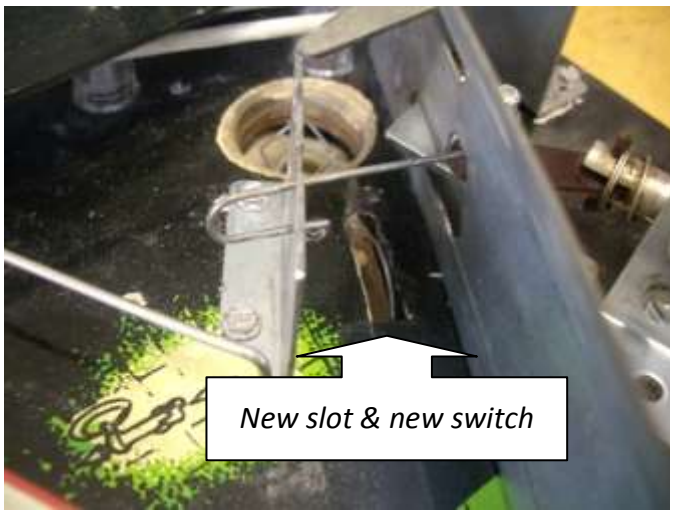


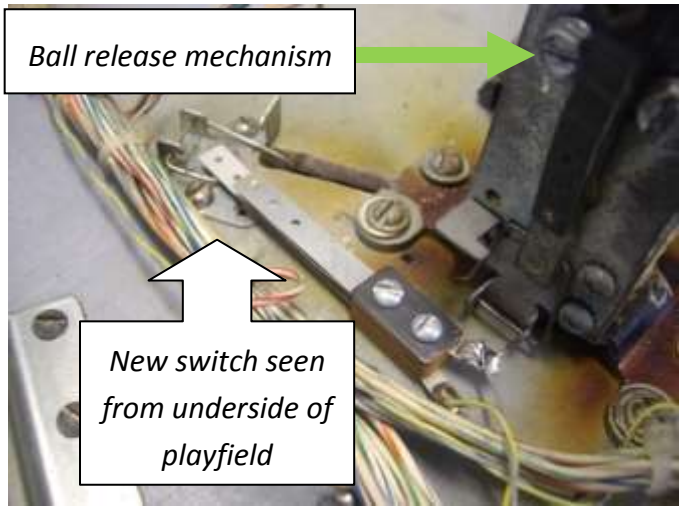


4. Add a new rollover switch to detect the presence of a ball

This switch must be closed when a ball is present in front of the holding rod.

Cut a slot in the playfield and use a standard rollover switch:





Important: the ball may arrive at low speed at the switch (given the shallow slope of the long rail), it is vital that the playfield at this point is perfectly smooth.

If necessary, cover the slot edge with black tape.

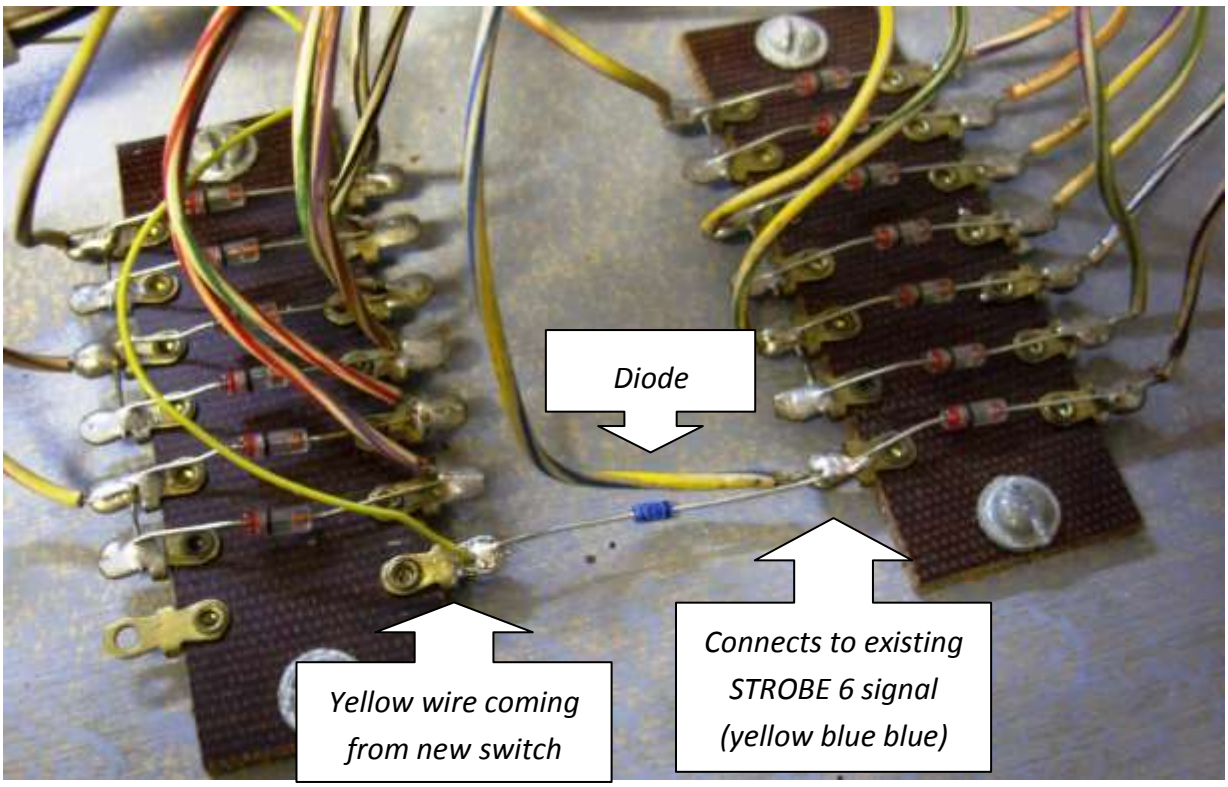
This switch will be numbered 61 in the switch matrix. It will be connected between the existing wires:

- 1st wire: signal STROBE 6, colour code 466 (yellow blue blue), through a diode
- 2nd wire: signal RETURN 1, colour code 611 (blue brown brown)

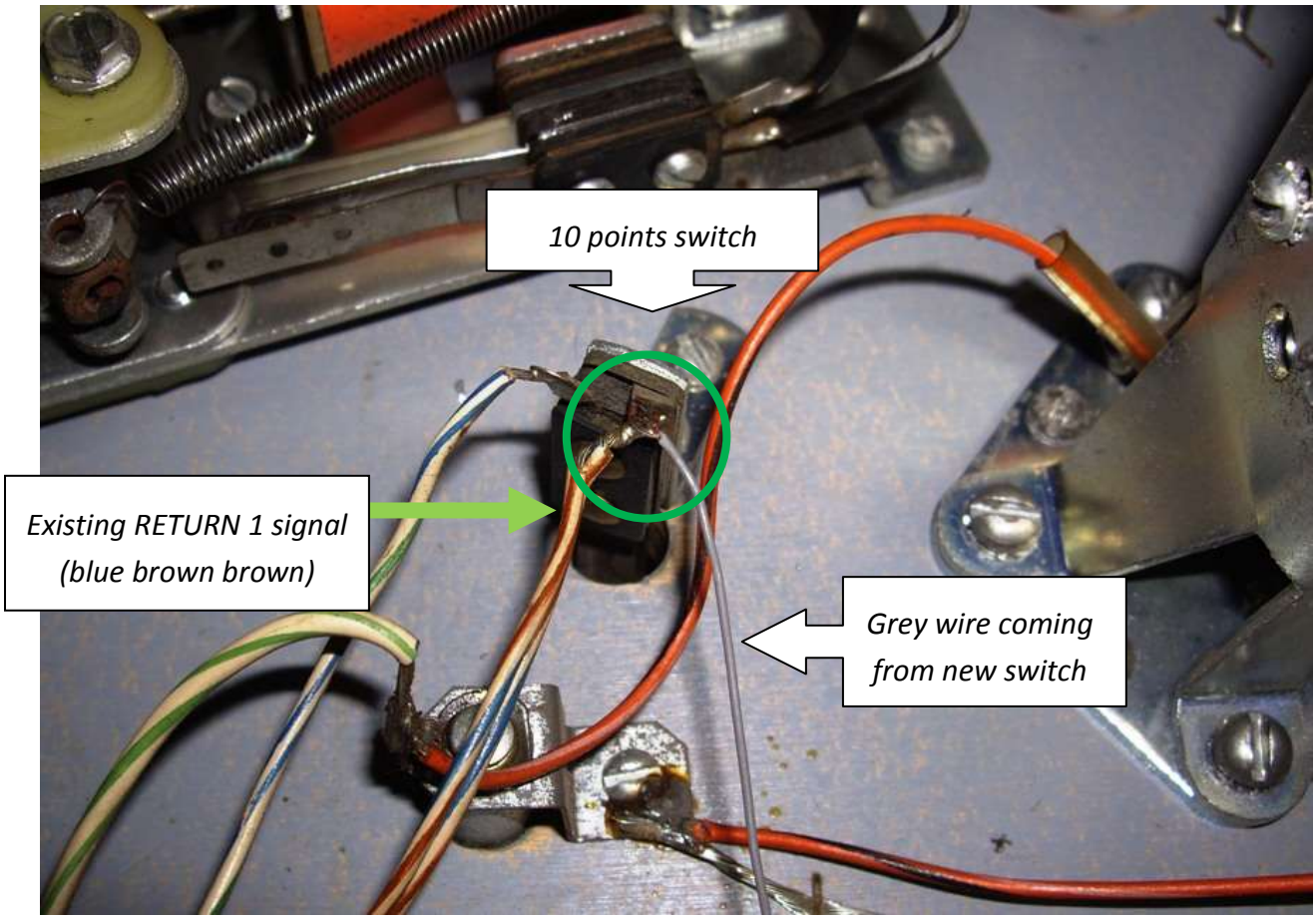
Big advantage as for the new switch on the main playfield: no extra wires to be added to the **PI-80** board!

The 1st wire (yellow in the photos below) goes to the non-banded side of a Schottky diode (BAT42 BAT43 or BAT85 kind, not 1N4148!) on a free terminal of the 1st Bakelite board under the lower playfield.

The other banded side of the diode connects to the STROBE 6 signal on the 2nd Bakelite board to its right:



The 2nd wire (grey on the picture) goes to one of the many 10 points switches already connected to RETURN 1 signal, such as this one between the right flipper and the pop bumper:



An alternative version using opto switches is being tested on our prototypes

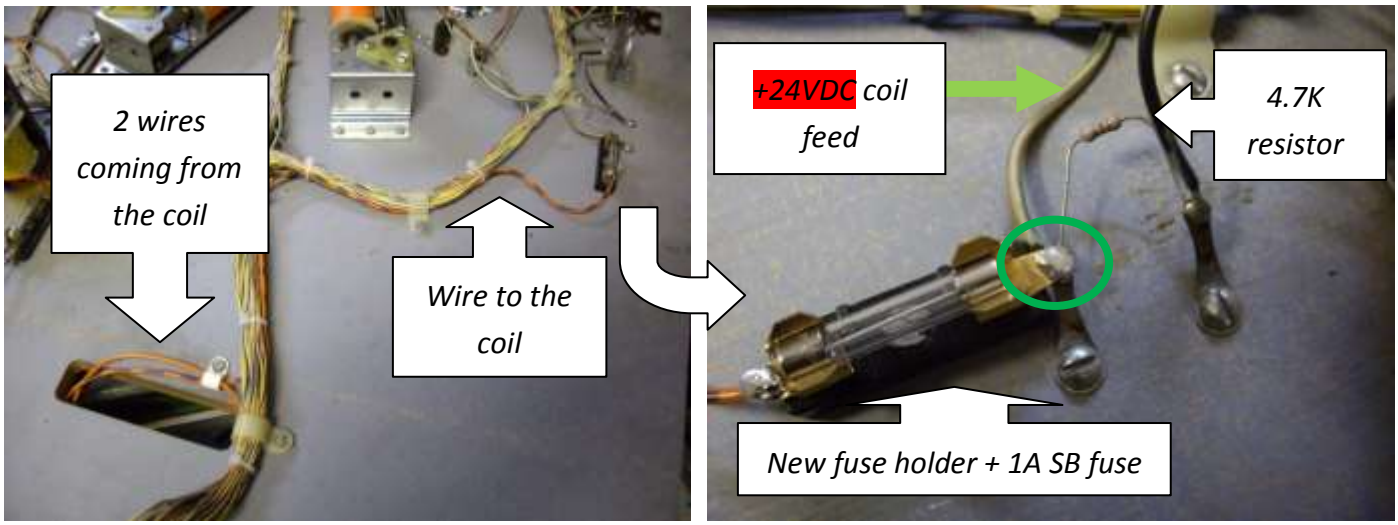
Advantage: No playfield drilling required.

Disadvantage: It would no longer be "Original Gottlieb"!

5. Connecting the additional coil

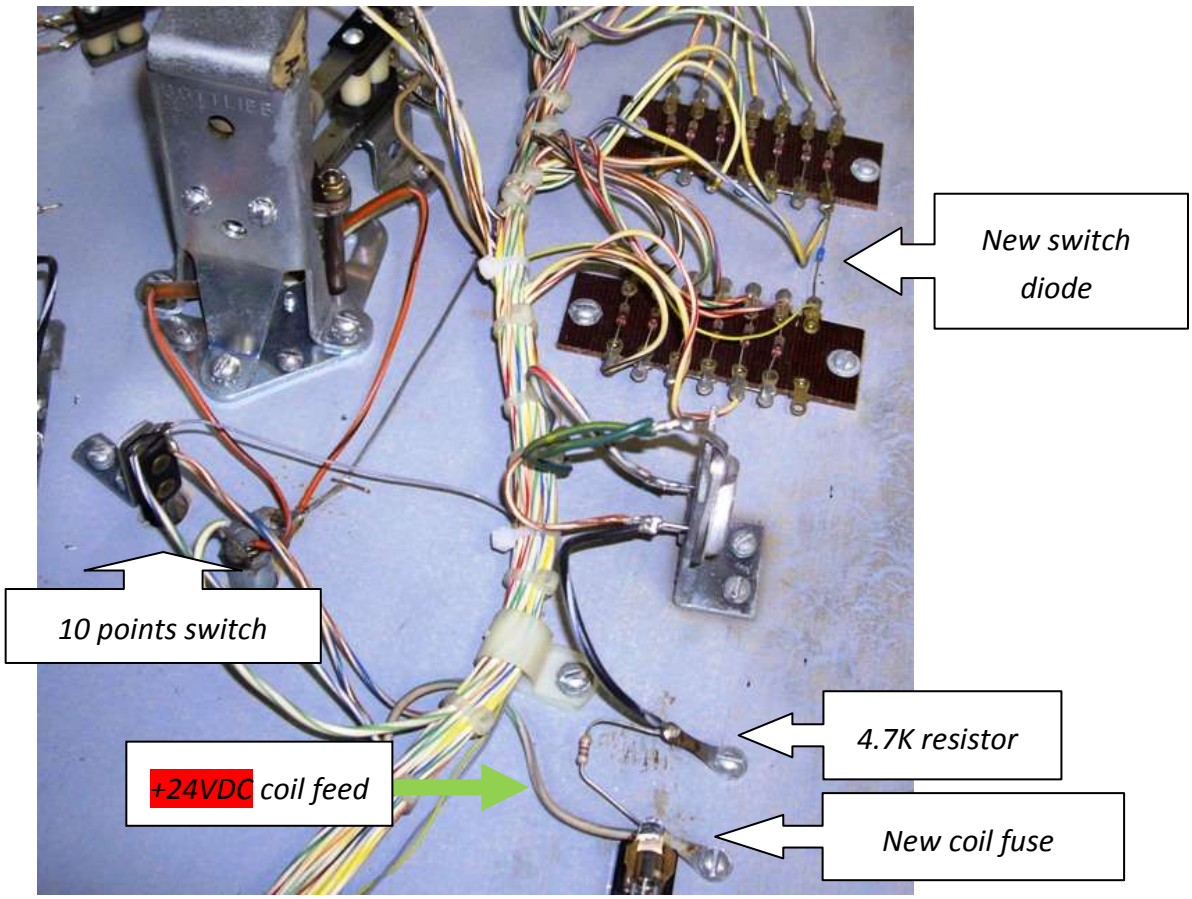
The banded side of the diode of this coil must be connected to the common +24VDC feed to the coils, through a 1A antisurge (*slowblow*) fuse and its fuse holder. Photo below: orange wire with black dots.

The +24VDC coil supply can be accessed (slate green green wire, code 855) from the terminal connected to the 4.7K resistor (yellow-purple-red-gold), by soldering it directly to the terminal of the fuse holder:



The non-banded side of the diode goes to SOL3 output of the **PI-80** board, as explained in the next chapter.

Lastly, an overview picture:



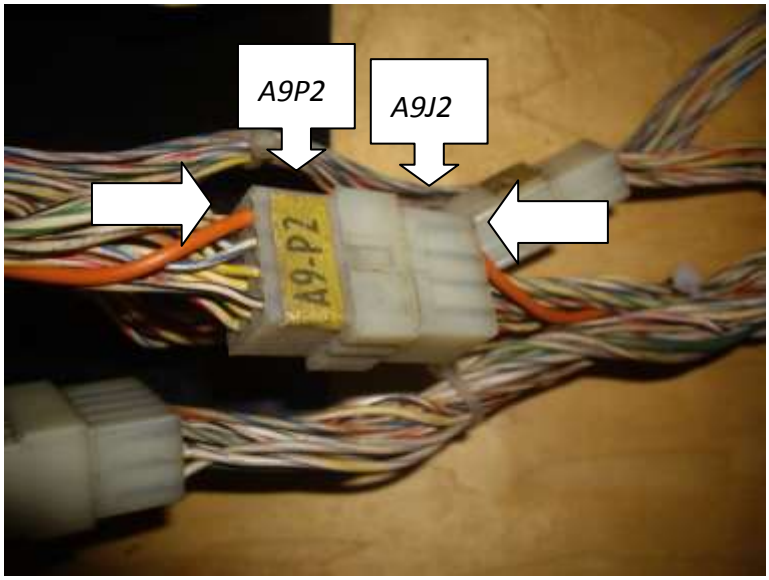
5. Connecting the coils to the PI-80 board

The two coils we have added to manage the multi-balls, i.e. one on the main playfield and one on the lower playfield, must now be connected to the **PI-80** board.

We will use empty slots in the existing playfield connectors: there are no additional connectors to add.

1. Lower playfield coil

There is an empty slot in the pair of connectors A9P2/A9J2 from the lower playfield to the main playfield. Photo: solid orange wire.

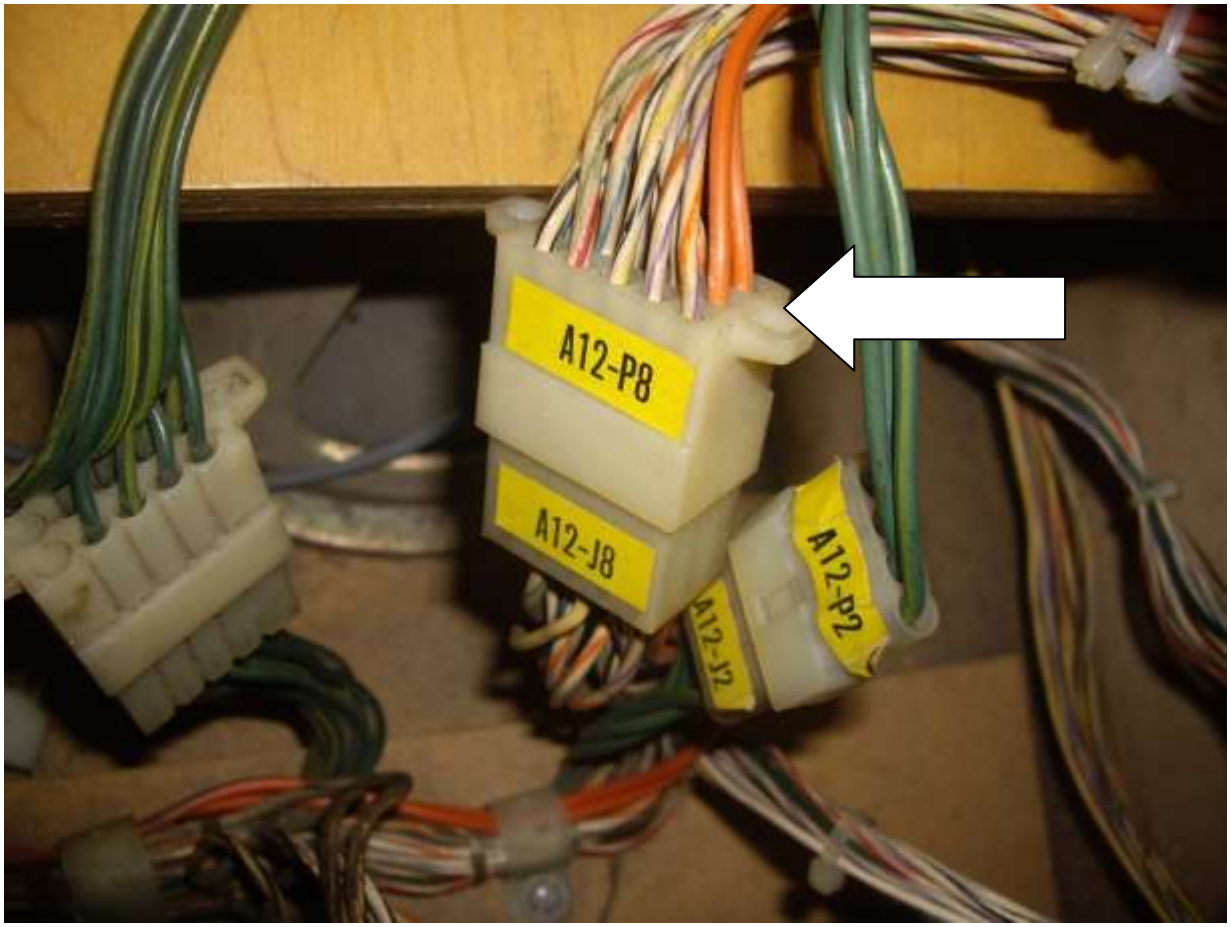


This control wire for the coil then goes to the main playfield. Pass it through all the existing harness retaining collars towards the rear of the playfield.

At this stage, you should have 2 wires arriving at the back of the main playfield:

- 1 wire from the lower playfield coil via connector A9J2
- 1 wire from the main playfield coil, passed through all the retaining clips

These 2 wires are to be connected to 2 empty slots on the pair of connectors A12P8/J8, at the end of the wiring harness of the main playfield:



2. Wiring the coils

To connect the coils to the **PI-80** board, 2 different wiring schemes may be found, since Gottlieb did not use the same assembly procedure between pre-series and full production games.

Most frequent possibility #1 : Your pinball does not have connector A3J6 in the backbox

This is the most frequent case for Haunted House production games.

In this case, you must make your own A3J6 connector, for example with a piece of JAMMA arcade game connector (3.96mm, 0.156" pitch) cut to length (4 pin).

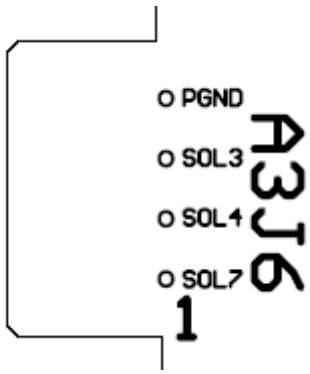
Coming out of A12J8, the 2 wires will therefore "rise" in the backbox and connect to this connector A3J6:

- The lower playfield coil should go to pin 3 corresponding to the output SOL3: coin counter # 3
- The main playfield coil should go to pin 2 corresponding to the output SOL4: coin counter # 4

Pin 1, corresponding to SOL7 output, and pin 4 (power ground) remain unconnected.

Pin on connector A3J6	Function	Connection
4 (top pin)	Power ground	-not used-
3	SOL3 output	To lower playfield coil
2	SOL4 output	To main playfield coil
1 (bottom pin)	SOL7 output	-not used-

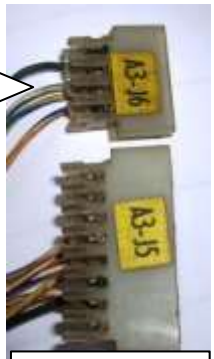
Drawing of connector A3J6 on the **PI-80** board:



Possibility #2: Your pinball is already equipped with connector A3J6

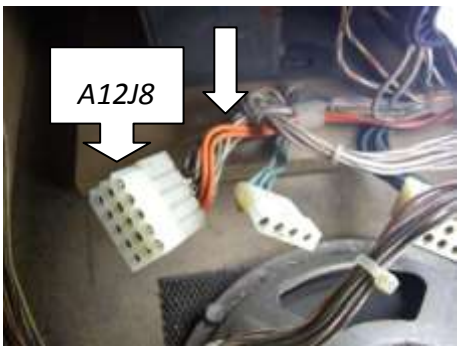
This is particularly the case on early Haunted House games = before mass production.

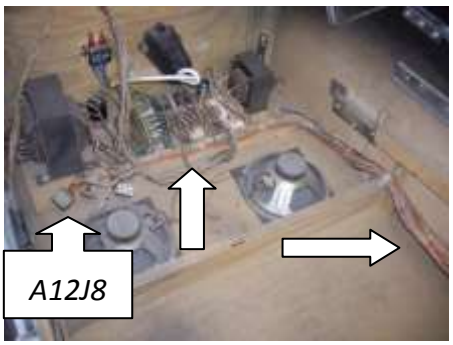
This connector was at the top left of the original Gottlieb driver board.

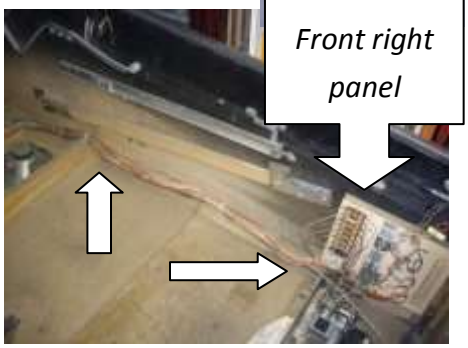


This will simplify the wiring: the existing connector A3J6 already brings the coil control signals SOL3 and SOL4 to the wooden panel that holds the fuses, the volume potentiometer and the coil knocker, located on the front right side of the cabinet.

Coming out of A12J8, the 2 wires will therefore do a full circuit of the cabinet to that panel:

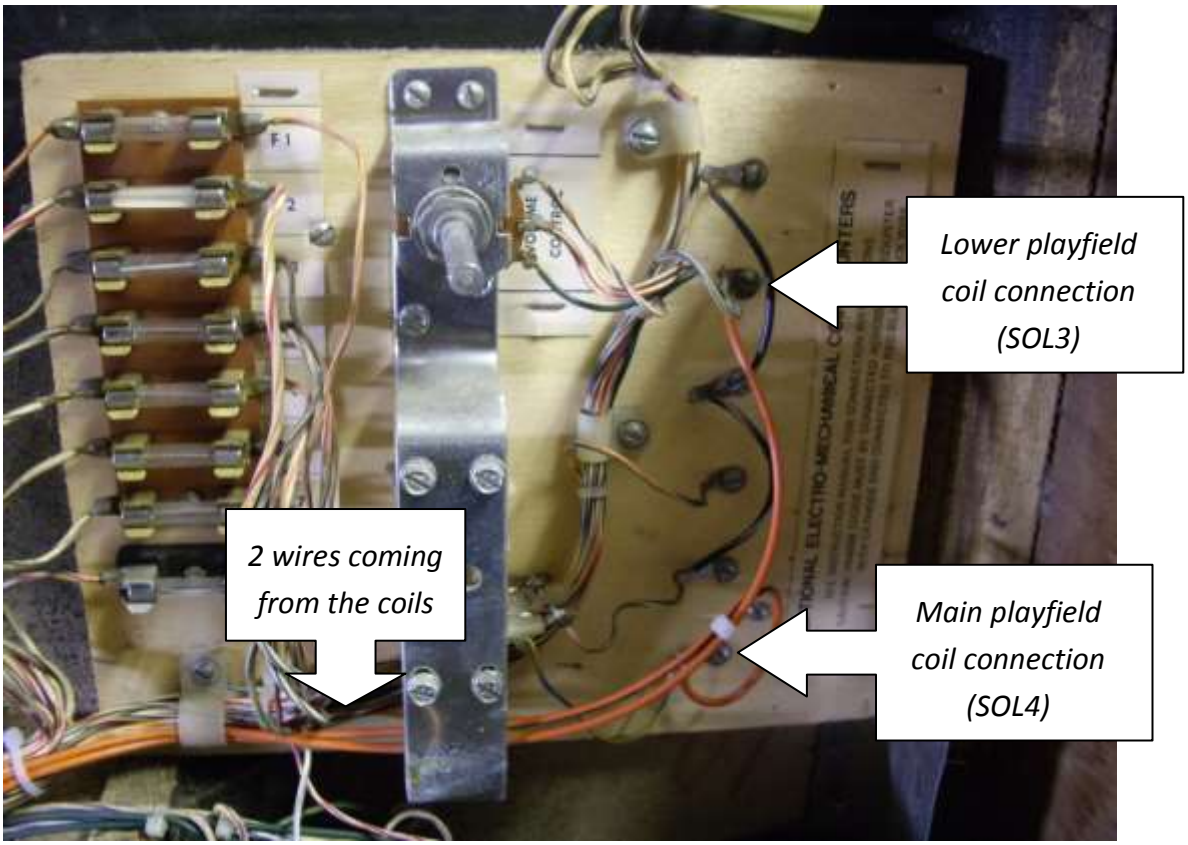






On this panel, 3 pairs of free terminals are available to connect 3 optional mechanical coin counters whose control wires come from connector A3J6:

- The lower playfield coil must be connected to the terminal corresponding to output SOL3: coin counter # 3 , wire code 655 (blue green green)
- The main playfield coil must be connected to the terminal corresponding to SOL4: coin counter # 4, wire code 644 (blue yellow yellow)

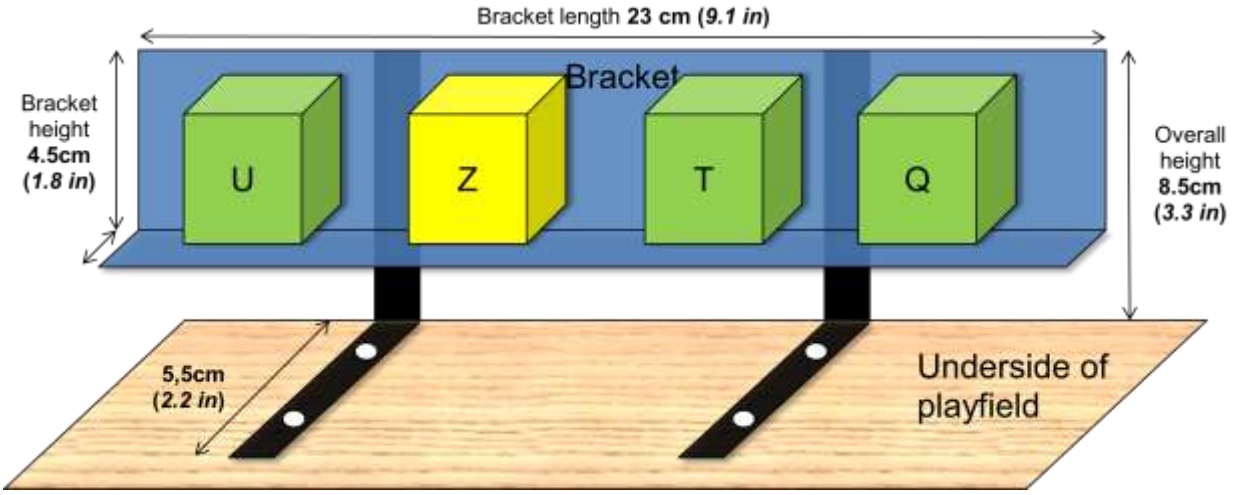


6. Installation of the 4th "Z" relay

A fourth relay is necessary in order to control all 8 flippers at the same time. In the original game the flippers on the top and lower playfields are never active together, whereas the introduction of multi-ball play makes this a requirement. This will require replacing the existing 3-relay bracket with one supporting 4 relays, and an additional relay mechanism.

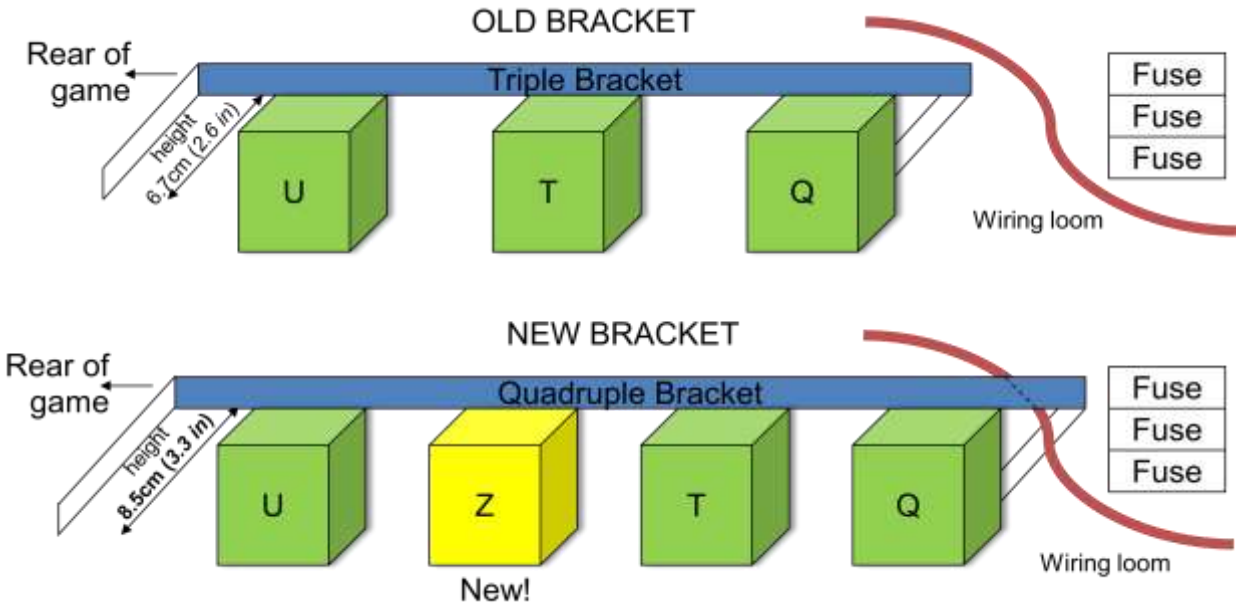
The bracket is a standard Gottlieb part found specifically in electromechanical pinball games, but unfortunately Gottlieb in their wisdom never gave it a part number in their catalogues!

All sizes below are given in both centimeters (cm) and inches (in).



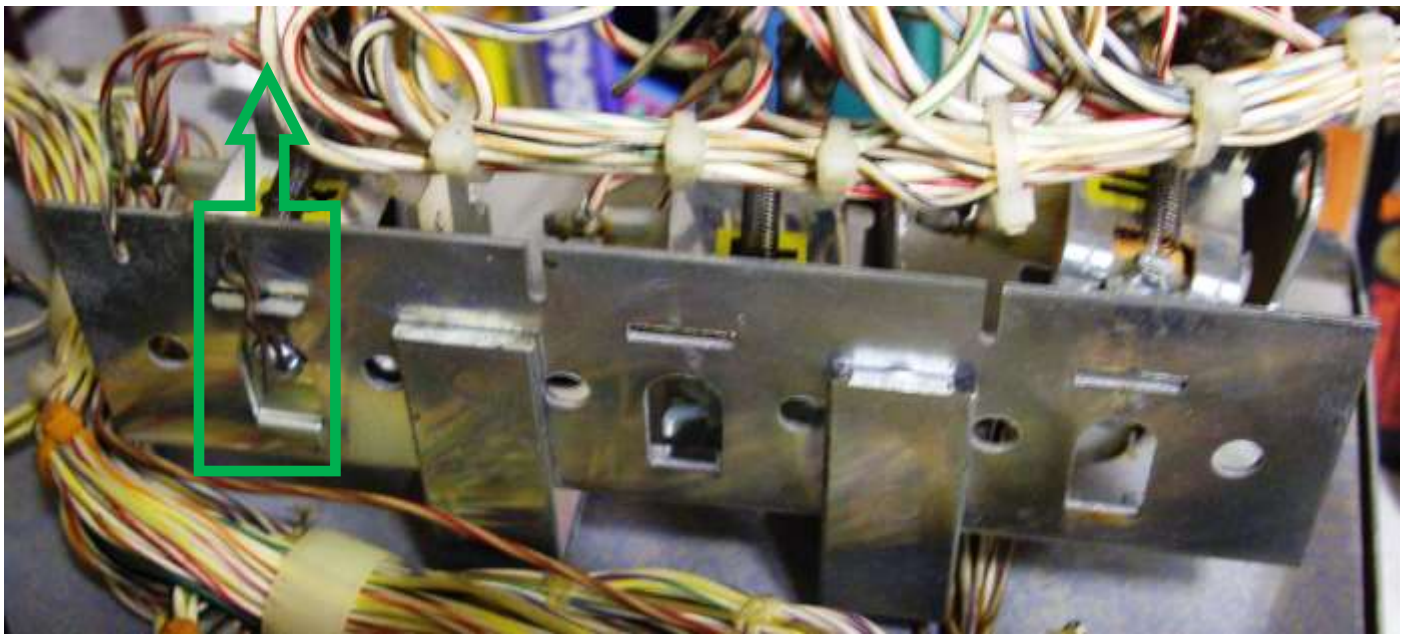
For the 4th relay itself, reuse a standard Gottlieb relay such as a Game Over, Tilt, or other relay.

It will be fitted between relays U and T:



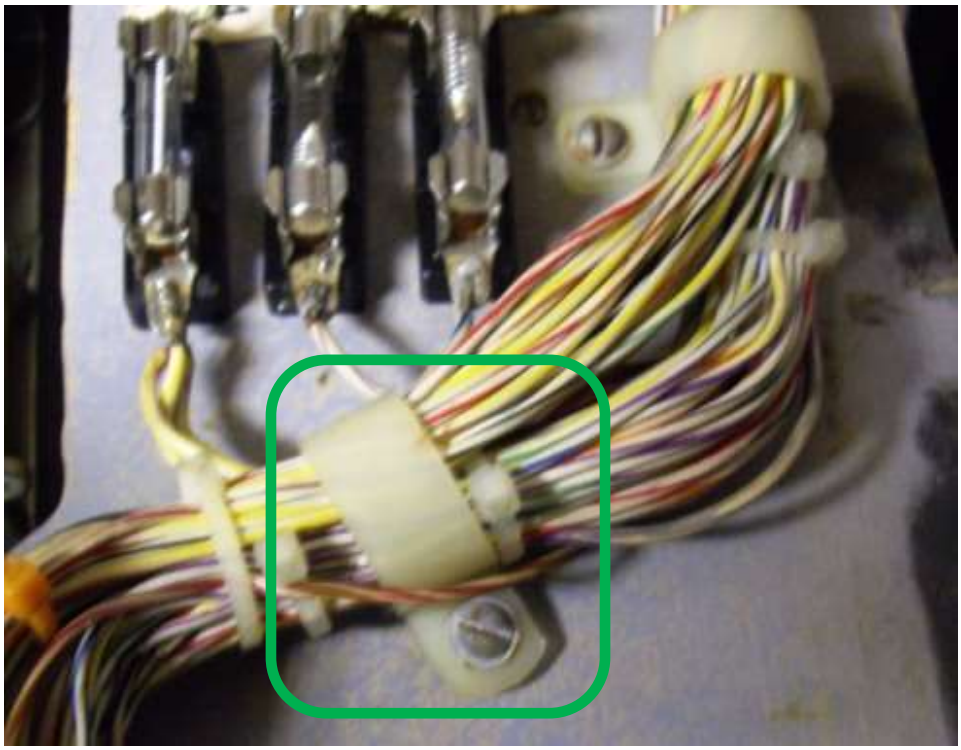
1. Fitting the new relay support bracket

Remove the 3 relays U, T and Q from the original 3-relay bracket by removing the retaining hairpin clips and then tilting the relays forward.



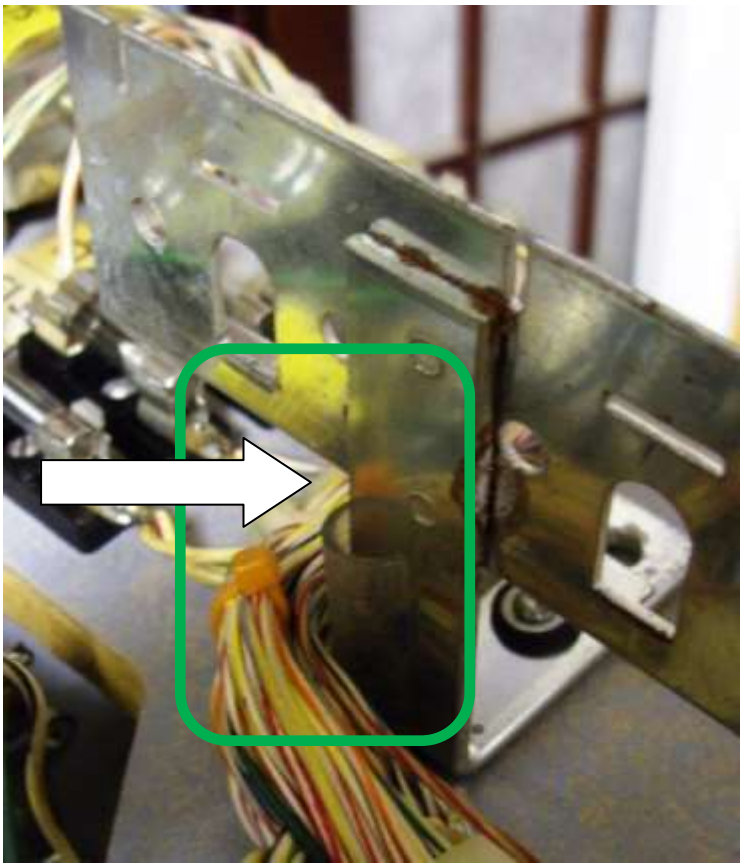
Unscrew the original 3-relay bracket from the underside of the playfield.

Move the plastic clamp holding the wiring loom coming from the top right, which may hinder the installation of the new bracket:



Fit the new 4-relay bracket, without forgetting the plastic shock absorber (black) around each screw:

On the upper leg of the relay bracket, clip a piece of plastic tube slotted along its length, to prevent the wires of the loom being cut by rubbing against metal.



Lastly, re-fit the 4 relays:

- Q (*top*)
- T
- Z (new relay)
- And finally U (*bottom*)

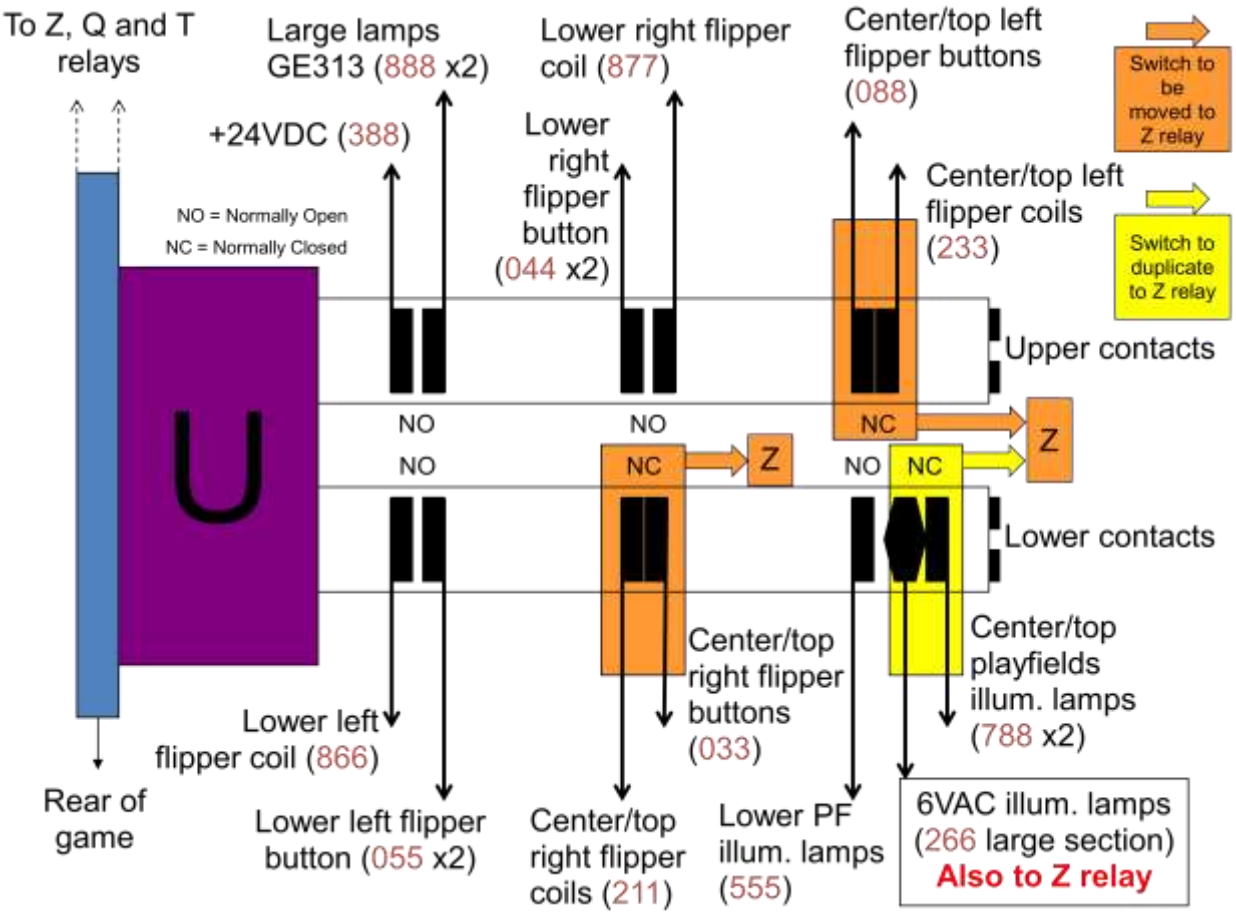
2. De-wiring the existing U relay

Remove all existing U relay switches (7 in all). The switches are held in place by two long thin screws. Use the diagram below to properly identify them.

The wires' colour codes and sections are shown.

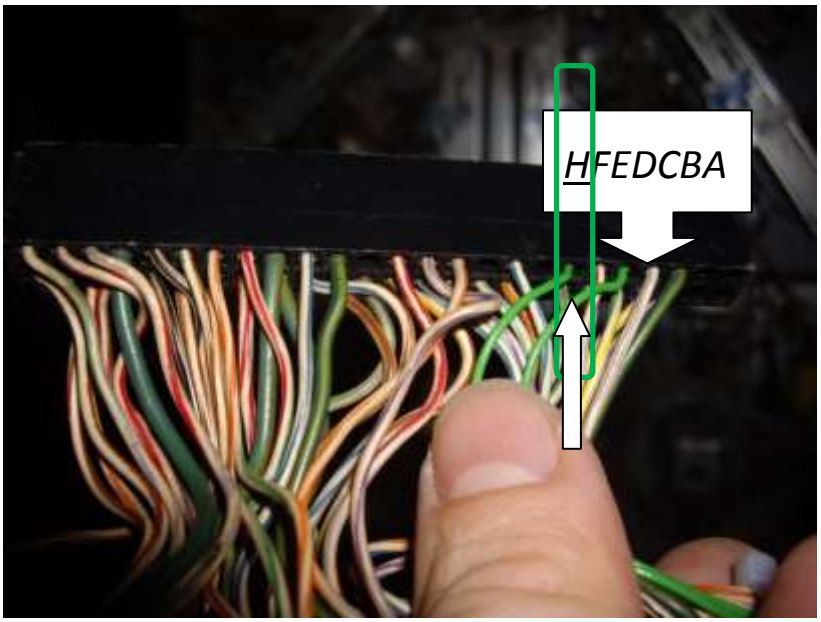
Thick means large cross section (small gauge).

When the relay is at rest, an "NO" contact is Normally Open, and "NC" Normally Closed.



There will be 5 switches to remain on the U relay, 2 switches (highlighted in orange) to move to the new Z relay, and 1 new switch (highlighted in yellow) to be bridged between relays U and Z.

3. Connecting the control circuitry for the new Z relay



The Z relay is activated by a relay coil, it also has a diode with a banded end and a non-banded end.

The relay coil only requires a low current, so the same small diameter flexible wire as used for the switch matrix can be used (green wire in the photo).

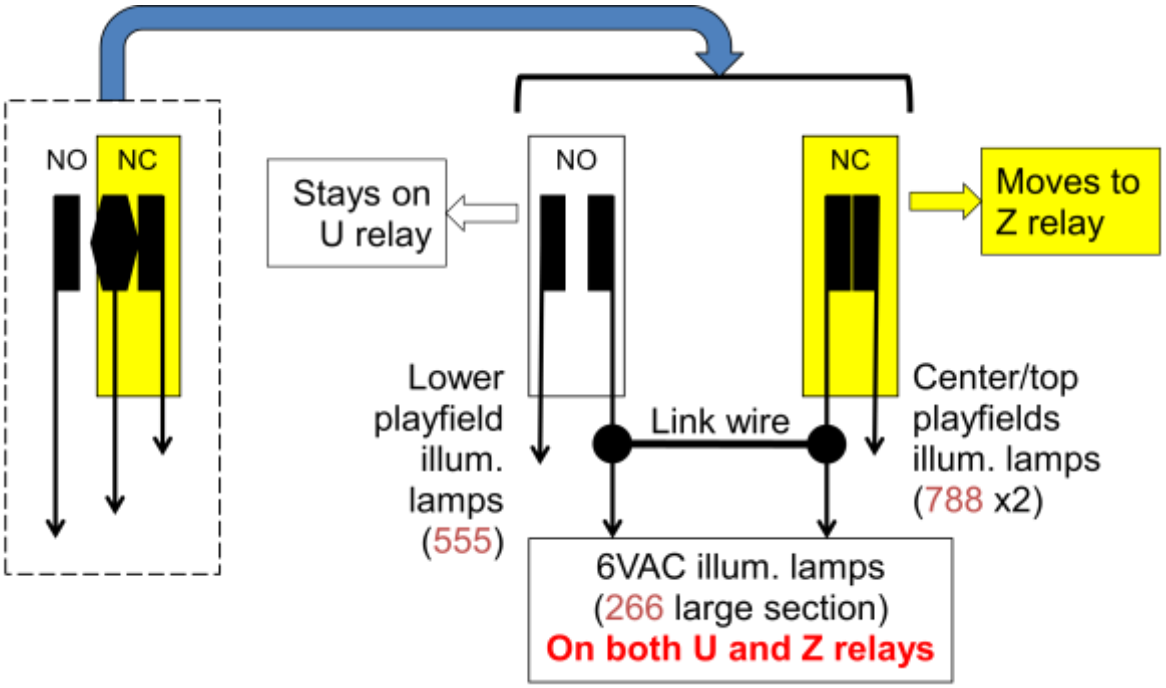
The banded side of the diode should be connected to the banded side of the diode on an adjacent relay coil (U, T or Q).

The non-banded side of the diode goes to the backbox and connects to the lamp output L49: pin "H" connector A3J3. This is the seventh pin from the left on its lower edge. (Note: the photo shows the connector inverted).

4. Wiring the switches on the new Z relay

The bottom right contact on relay U must be duplicated, since the illumination lamps must be driven by both relays U and Z at the same time.

The left « NO » part of the contact stays on relay U, the right « NC » part is moved to relay Z:



The moving center blade of the former dual-purposed « NO/NC » switch of U relay, which is used by both « NO » and « NC » contacts, must then be duplicated:

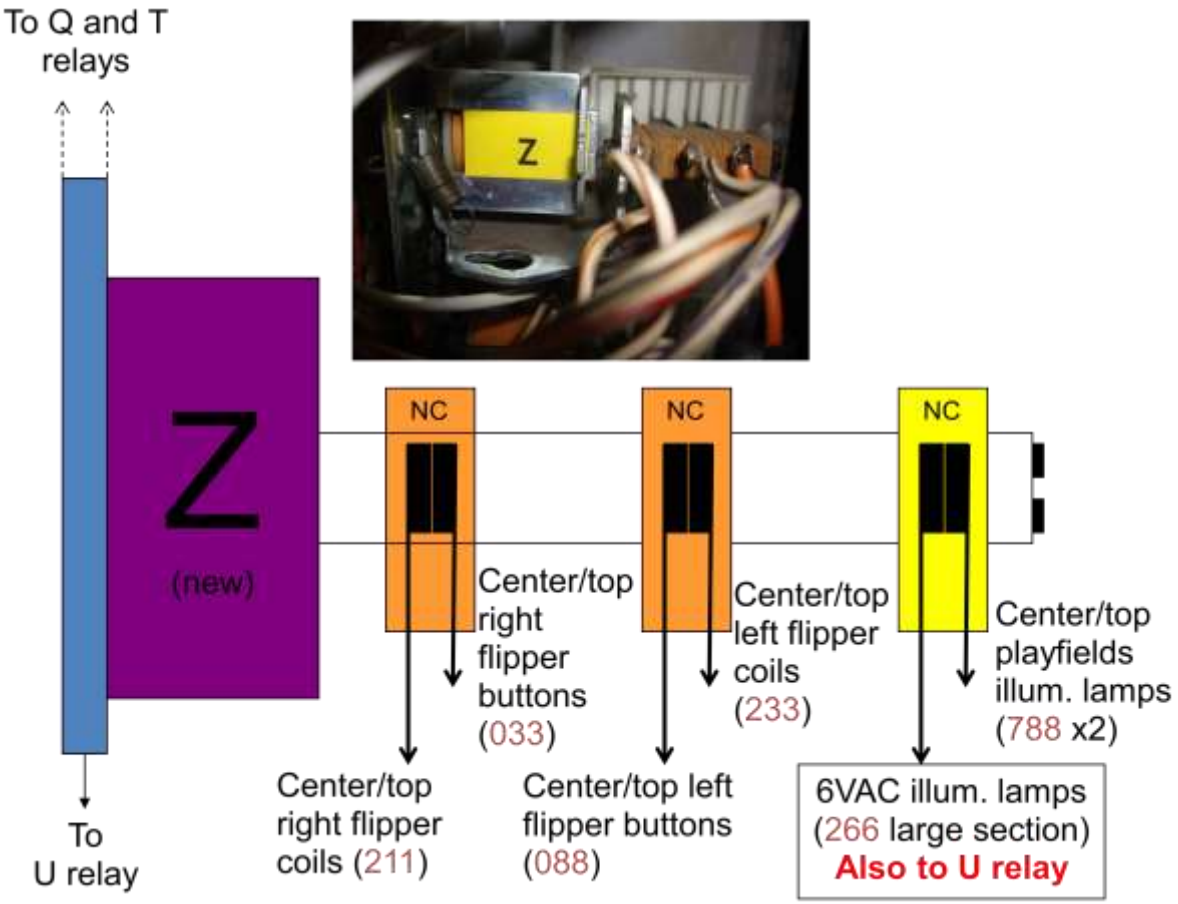
- One blade for U relay + the original « NO » blade, to rebuild the « NO » switch alone
- One blade for Z relay + the original « NC » blade, to rebuild the « NC » switch alone

The 6.3VAC general illumination wire (large section, code 266 red blue blue) then goes to both U relay and Z relay.

Use a large section wire, similar to those used for the coils.

Carefully isolate the soldered joint of the large wire (orange in the photos) with heat-shrink tubing or electrical tape.

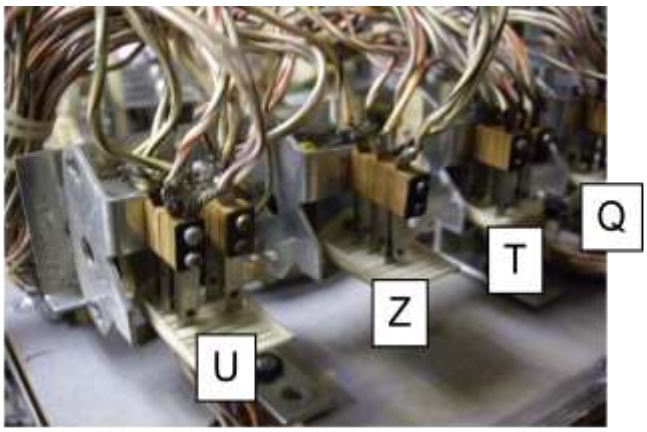
Here is an overview of the 3 switches of the new Z relay:



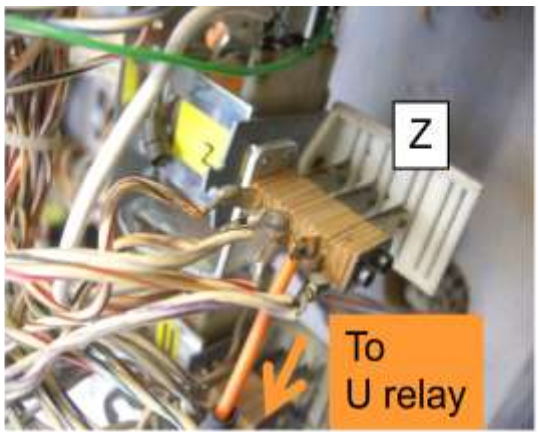
The following pictures show the U, Z, T and Q relays mounted on their new bracket.

The Z relay is mounted between U and T relays.

The last picture shows the large wire (code 266) of 6.3VAC general illumination lamps that goes to both U relay and Z relay at the same time, through a large orange junction wire.



The 4 relays on their new bracket

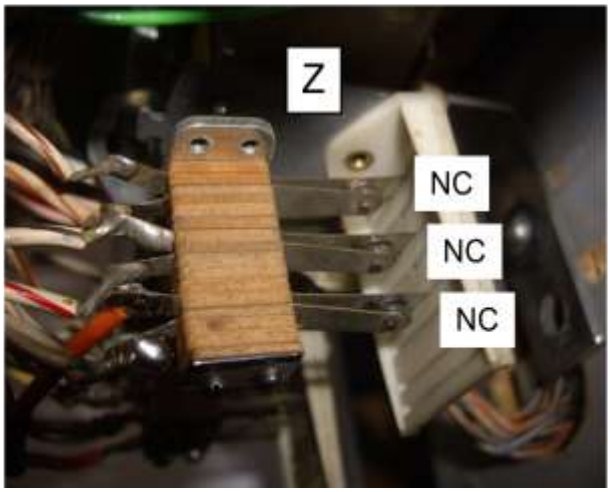


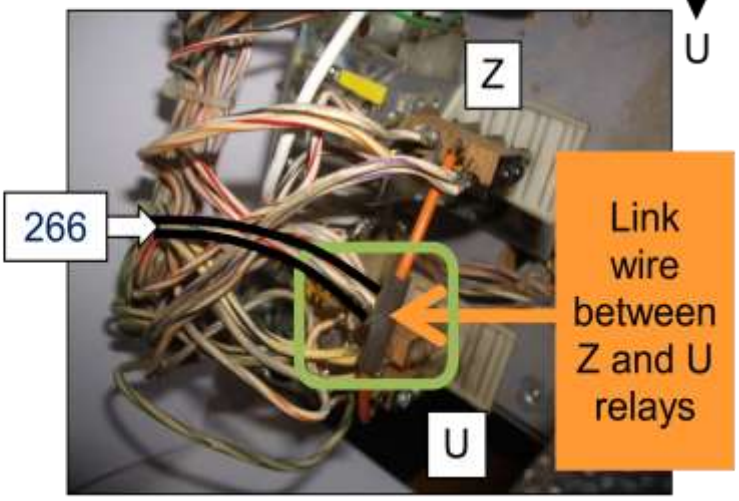
6VAC illumination lamps link wire 266 large section common to Z and U relays

Z

U

3 normally closed (NC) switches





A bit of theory: what does each relay do?

This is to better understand the function of each relay, and how to troubleshoot them, in case of need.

- **Q.** Called "game over" relay: when the game in play ends, it turns off the +24VDC feed to flippers, slingshots and pop bumpers coils. It is ON during a game in play.
- **T.** Called "tilt" relay: when the ball in play is tilted by the player, it turns off the +24VDC feed to flippers, slingshots and pop bumpers and turns off all illumination lamps on all playfields. It is ON after a tilt.
- **U.** Powers the lower playfield: it feeds both 6.3VAC to illumination lamps and +24VDC to flippers, slingshots, pop bumpers and to the 8 illumination lamps around the « empty space » of the main playfield. It is ON when at least 1 ball is on the lower playfield.
- **Z.** Powers the center and upper playfields: it feeds both 6.3VAC to illumination lamps and +24VDC to flippers, slingshots, pop bumpers. It is OFF when at least 1 ball is on the center or upper playfields.

During the multi-ball sequence, U relay is ON and Z relay is OFF, so that all 3 playfields are powered at the same time. The lower playfield remains powered throughout the multi-ball sequence, as on Black Hole game.

This leads to the following combinations:

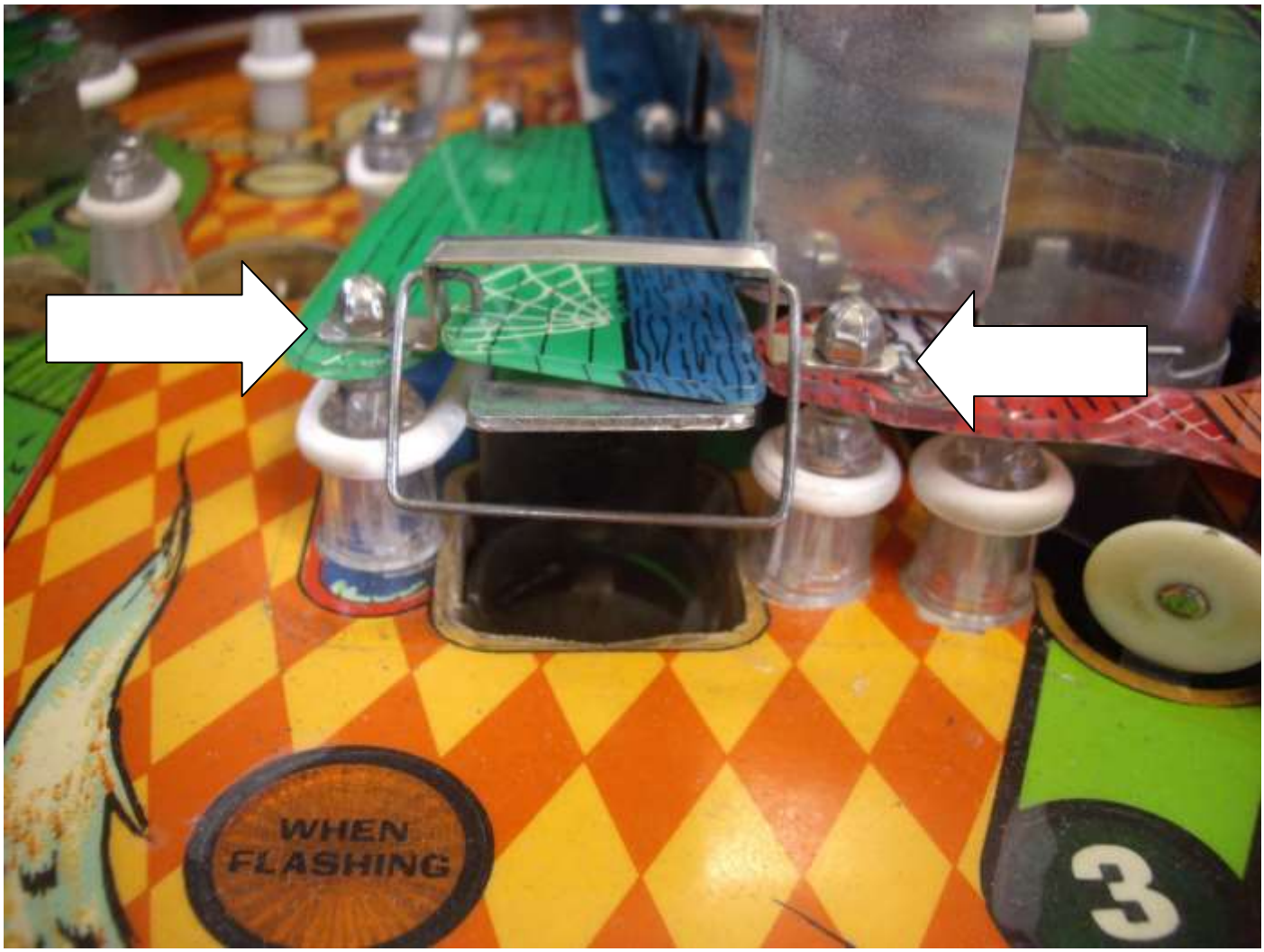
Relay	*Single ball on LOWER playfield*	*Single ball on CENTER or UPPER playfields*	*Multi-ball*
U	*ON*	*OFF*	*ON*
Z	*ON*	*OFF*	*OFF*

7. Non-Return Gate

A non-return gate should be added on the main playfield at the exit of the VUK tube to prevent multiple balls entering from the main playfield and becoming blocked.

The eject coil from the lower playfield only has sufficient power to eject one ball at a time, and hence multiple balls falling into the tube will completely paralyse the game.

Fitting is very simple and requires no drilling of the playfield. The gate is fitted onto the existing posts:



8. Widen the extraball kicker entrance

Locking the 2nd ball into the right side *extraball* kicker is not that easy, the empty space to aim at with the flippers being not so wide.

It is possible to make this capture (a bit) easier by replacing the existing plastic post, located to the top of the kicker entrance, by a narrower metal post:

Note the original location of the post on the playfield, the paint colours at that spot being a bit more vivid (the original post having protected the paint from light, wear and dust).

Optionally the plastic post located on the bottom of the upkicker entrance can also be replaced.

9. About playfield lamps

The following chapters will describe the optional animation lamps.

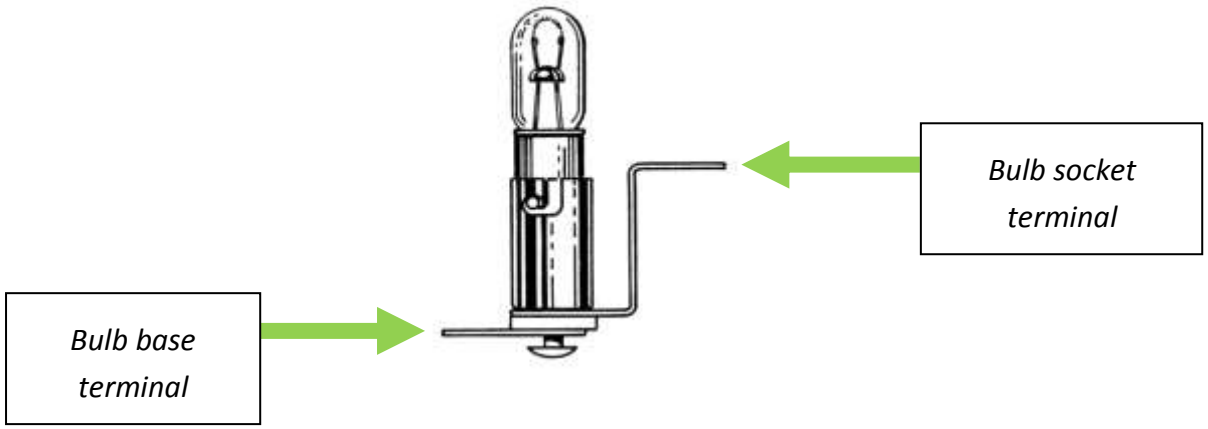
We will first remind the connections and the voltages of the lamps, to make sure that we all use the same terms and to avoid connection mistakes.

Connecting the lamps

A lamp bulb socket (of type GE44 or GE47 widely used by Gottlieb back then) has two electrical terminals:

- One terminal on the lamp socket = the metal part of the « body » of the lamp
- One terminal on the lamp base = the solder bump on the base of the lamp

The lamps sockets vary in shape and length, depending on their use and location, but those 2 connections remain easily identifiable, as on the drawing below coming from a Gottlieb/Premier pinball parts catalog:



Important: illumination lamps and controlled lamps power supplies

There are 3 different power sources for the lamps:

1. 6.3VAC (alternating) : the illumination lamps that light up the playfield plastics.
2. ⚠ +24VDC (direct) : the 8 lamps around the « empty space » of the main playfield, that light up the lower playfield.
3. +6VDC (direct) : the CPU board-controlled lamps (bonus, multipliers, *special*, *extraball*, etc..).

Those 3 voltages come from distinct power sections of the transformers assy.
These must be kept separate and never connected to each other!

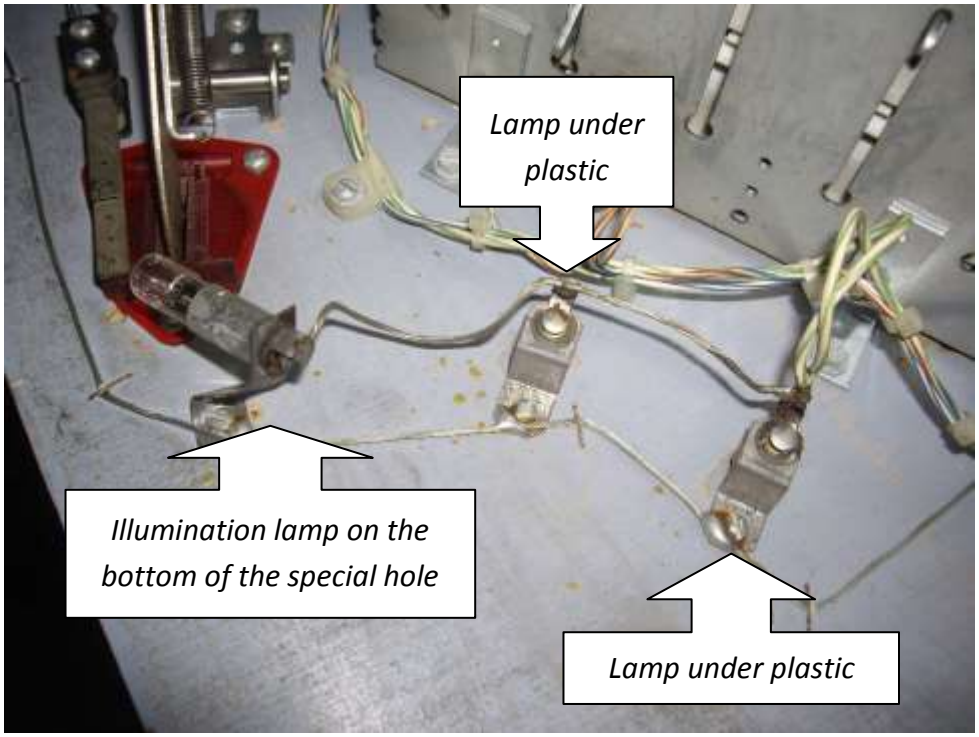
When connecting the optional animation lamps driven by the CPU board, great care must be taken to connect those controlled lamps to the wiring of the other controlled lamps (+6VDC) and not to the illumination lamps by mistake.

Note: the colour codes above (yellow, red or green) are reused throughout all chapters.

10. Optional animation: special capture hole

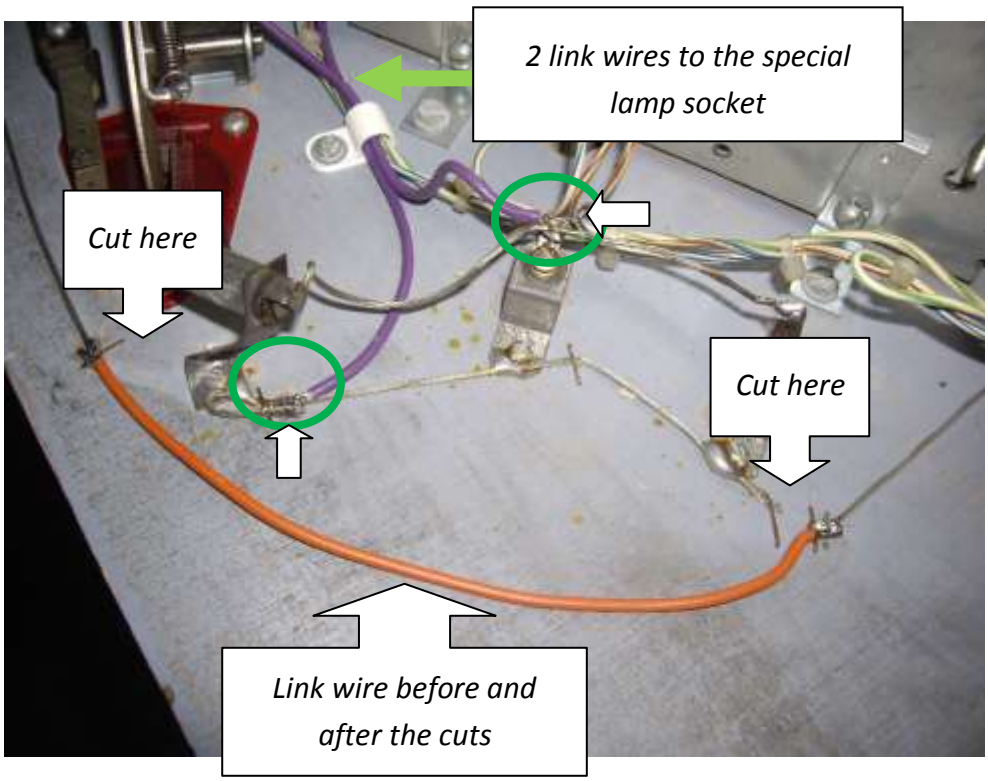
To indicate to the player which hole is first qualified for ball capture, the *special* lamp in front of the capture hole flashes. However, this is not very obvious from the player's point of view. It is possible to flash the lamps illuminating the capture hole itself and around the hole to create a much stronger lighting effect.

Identify the 3 illumination lamps on the lower playfield, behind the drop target bank:



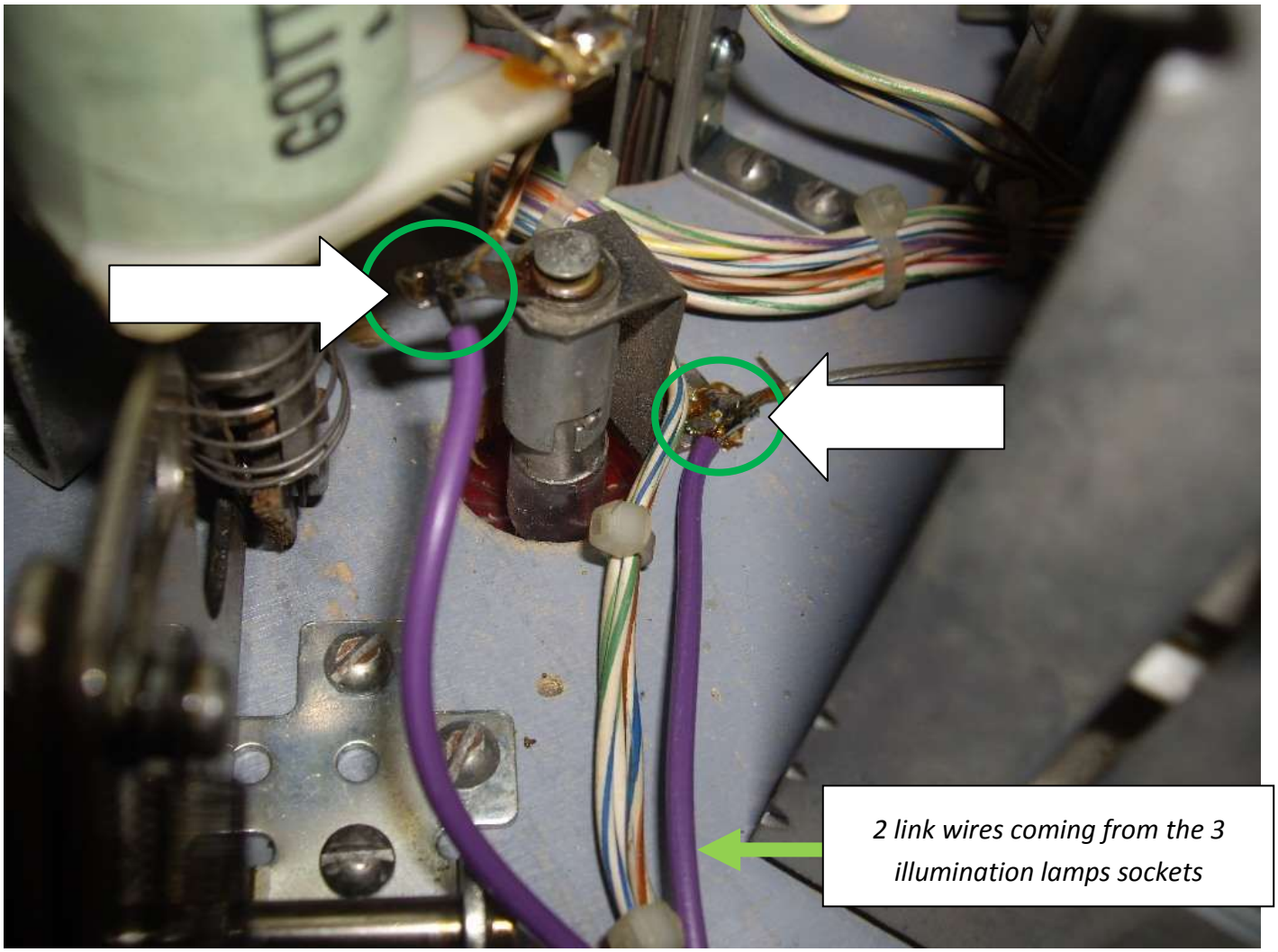
Cut the common wire that connects them to the remainder of the GI lamps 6.3VAC.

Restore the common wire link left and right for the rest of the lamps (orange wire on the photo) :



Lastly, wire the 3 lamps section to the existing special lamp circuit through 2 wires (purple on the pictures) :

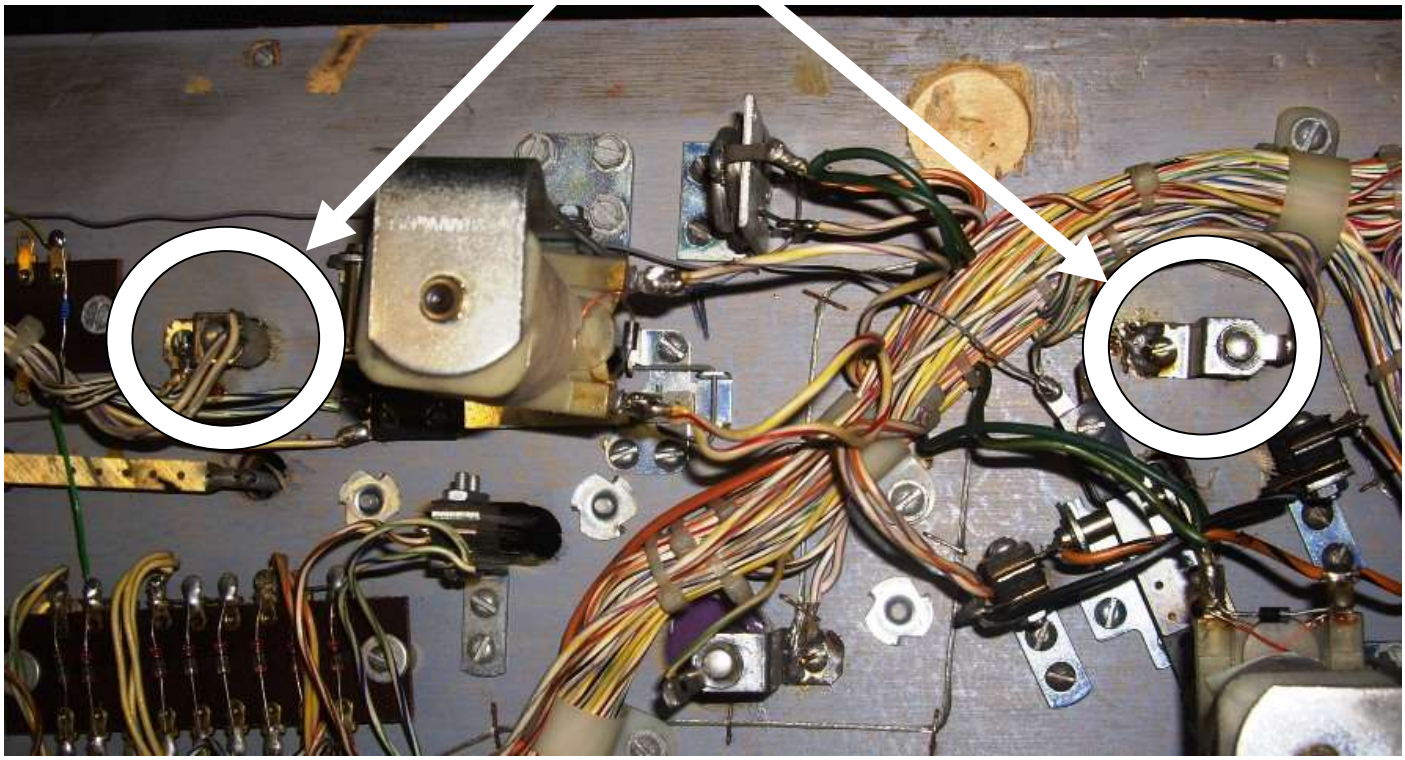
1. One wire on *special* lamp base connection
2. One wire to the bare wire form shared by the other controlled lamps.



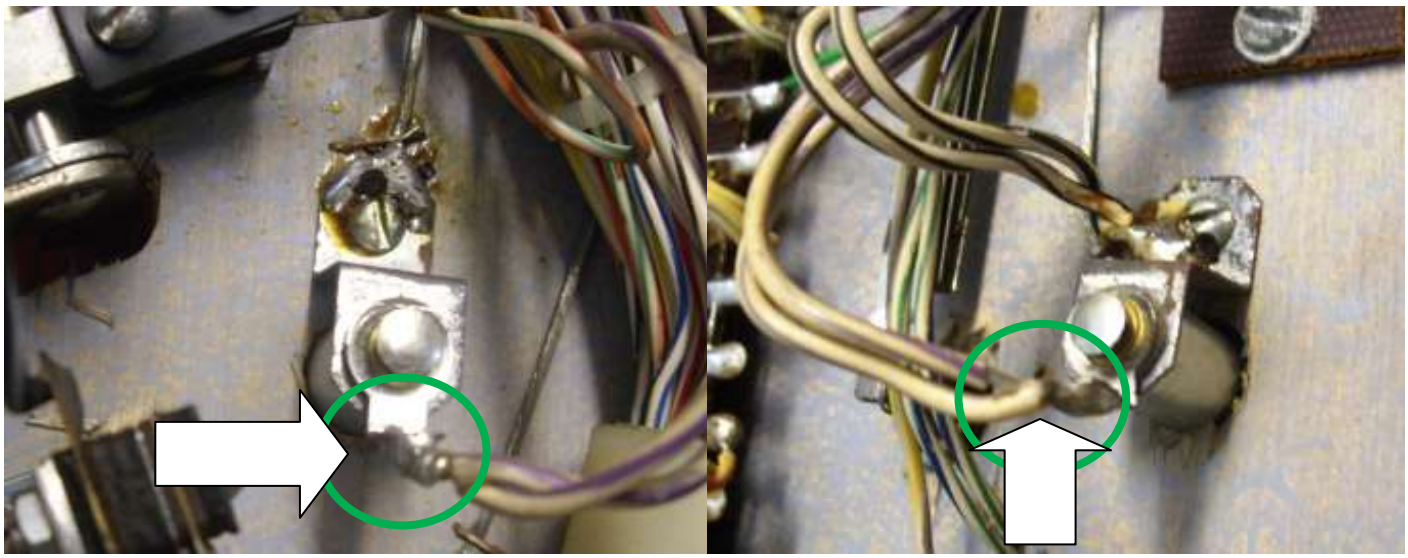
Note: the *special* lamp is already connected to the +6VDC of the other CPU-controlled lamps.

11. Optional animation: extraball kicker

To indicate to the player that the 2nd ball should be captured in the *extraball* kicker, it is possible (as for the *special* capture hole) to flash the 2 illumination lamps of the area around that kicker and create a much stronger lighting effect:



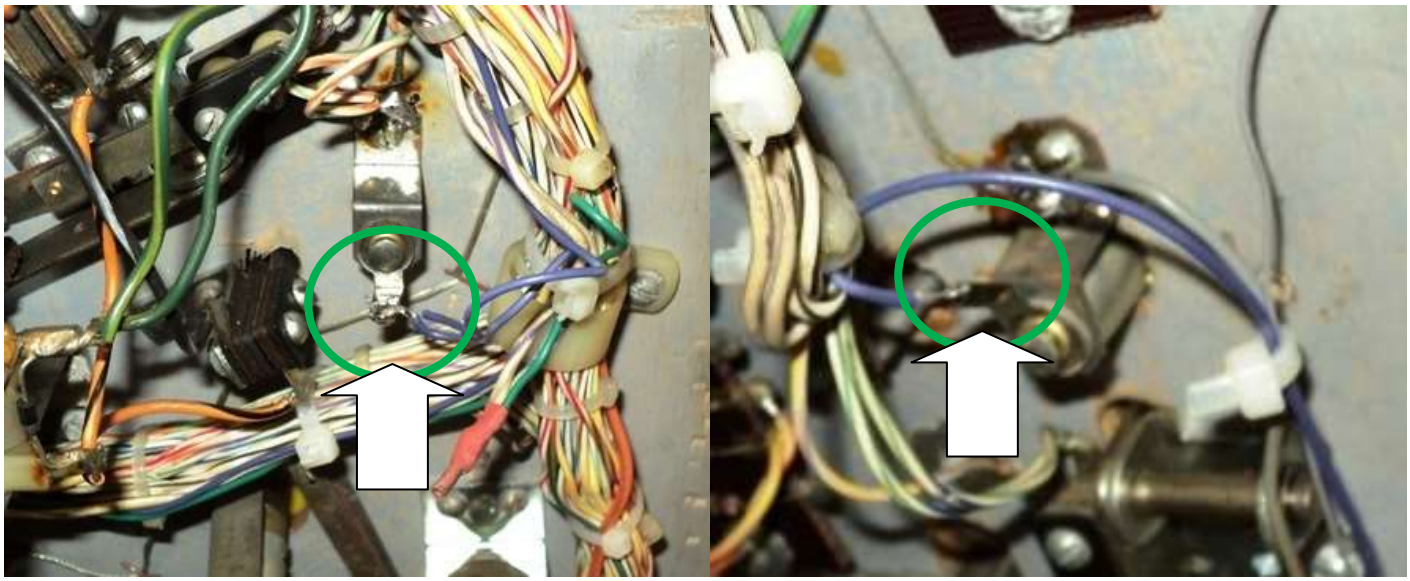
Originally, the sockets of those 2 lamps are wired together through a twin large wire (code 788, purple slate slate) :



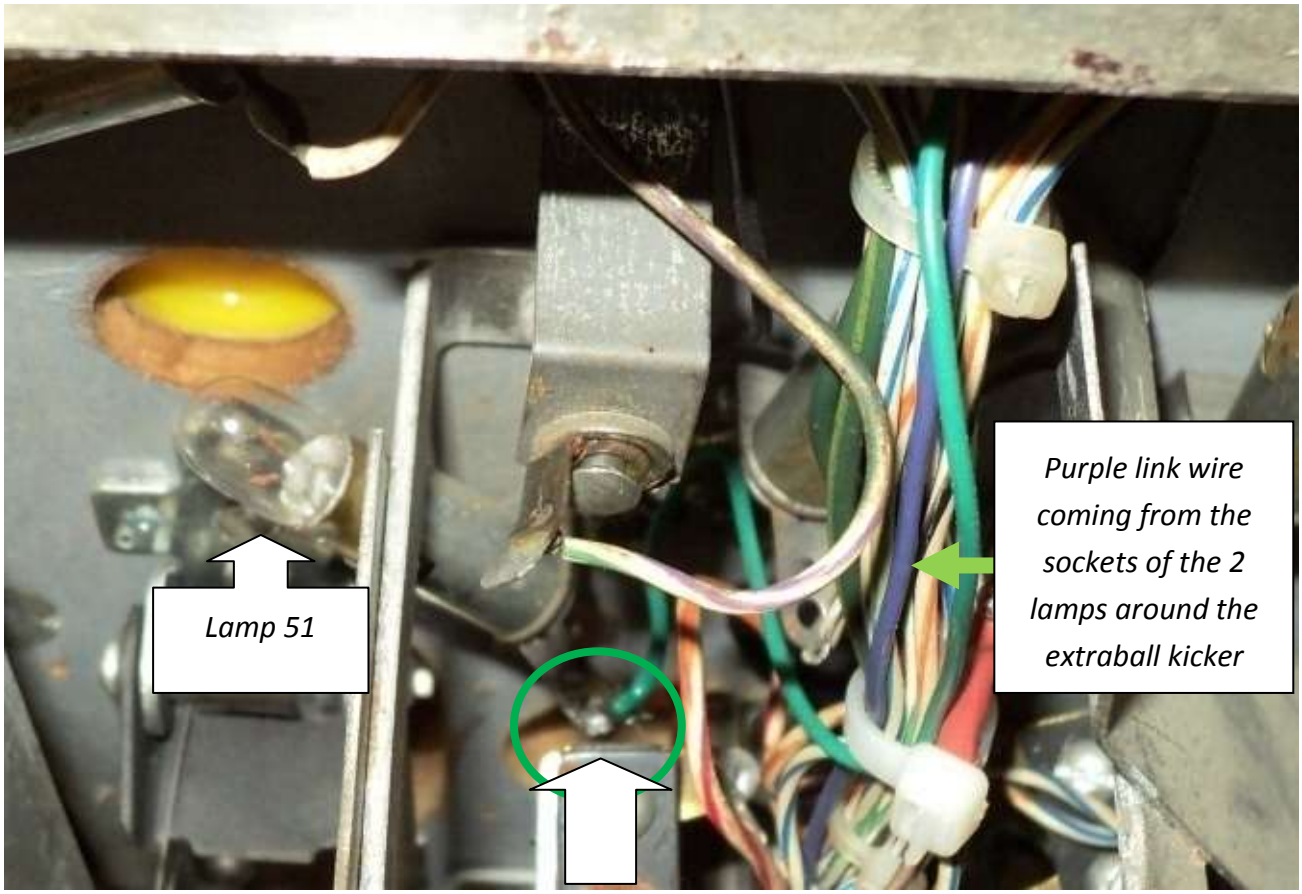
This twin large wire must be disconnected from the 2 lamp sockets (while keeping those 2 wires together) and isolated with heat-shrink tubing or electrical tape, so that they don't make contact with another metal part or another wire.

The 2 lamp sockets must be connected together with a small wire (purple on the pictures) then to the purple slate slate wire (code 877) connected to the base of lamp 51 = the lighted arrow in front of the rolldown pivot target that leads to the lower playfield, which must be first disconnected from the base of the lamp 51.

This allows the 2 lamps around the *extraball* kicker to be driven directly by the lamp 51 output, without running an extra wire to the backbox.



In order to keep that lamp 51 still lit, its socket terminals will be connected to another illumination lamp nearby (powered by 6.3VAC), as on the following picture with a green wire coming from lamp 51:



The purple wire, coming from the 2 lamps around the *extraball* kicker, is connected to the wire formerly connected to the socket base terminal of that lamp 51, the soldering joint being isolated with heat-shrink tubing or electrical tape.

⚠ **REMINDER !!!** The 8 illumination lamps around the « empty space » of the main playfield are powered by +24VDC. Be sure to distinguish them from other lamps, and do not connect anything to them!!

12. Optional animation: VUK tube

The *VUK* tube, which brings the ball from the lower playfield to the main playfield, can be lit by adding a lamp driven by lamp output 48.

This lamp lights the tube and starts flashing when the ball is about to be kicked upwards from the lower playfield, to warn the player to get ready!

We used a green GE44 lamp (which is the game's prevailing colour) whose socket is held against the tube with a simple playfield rubber ring. There is no risk for the tube, as the lamp heats up very little.

The lamp is turned towards the bottom of the tube to light its entrance on the lower playfield:

The lamp 48 output is pin E of connector A3J3. This is the 5th pin on its bottom side, counted from the bottom left corner; refer to the picture in the chapter that describes the wiring of the new Z relay. This wire (green in the picture) is connected to the bulb base terminal of that new lamp socket.

The lamp socket terminal is wired to the common +6VDC rail from another controlled lamp nearby, such as the socket of lamp 32 (target # 3) in the vicinity.

Note: for an even greater light effect, up to 2 additional lamps can be wired in parallel to this green lamp.

13. Summary of all electrical modifications on the playfields

We have wired:

- A coil + a switch on the center playfield for the multi-ball trough mechanism
- A coil + a switch on the lower playfield for the multi-ball trough mechanism
- A relay to drive the flippers on both upper and lower playfields at the same time
- An optional animation of the 3 illumination lamps around the *special* hole on the lower playfield
- An optional animation of the 2 illumination lamps around the *extraball* kicker on the center playfield
- An optional animation of the *VUK* tube

The following chart sums up everything:

CPU Output	Function	Playfield	Mandatory?
Coil 3	*Multi-ball trough mechanism*	*Lower*	**YES**
Coil 4	*Multi-ball trough mechanism*	*Center*	**YES**
Lamp 45	*Animation of the 3 illumination lamps around the special hole*	*Lower*	*No*
Lamp 48	*Animation of the VUK tube*	*Center*	*No*
Lamp 49	*Z relay*	*Center*	**YES**
Lamp 51	*Animation of the 2 illumination lamps around the extraball kicker*	*Center*	*No*
Switch 56	*Multi-ball trough mechanism*	*Center*	**YES**
Switch 61	*Multi-ball trough mechanism*	*Lower*	**YES**

14. Adding speech

Originally, the Haunted House pinball comes with a sound/speech board but without the speech processor.

During the multi-ball development, we considered adding speech to explain the various game sequences, as on the other pinball games of the same series (Mars, Devil's Dare..).

The problem is huge because adding speech does not depend on the CPU software alone: the original *sound proms* of the Gottlieb sound board must be customized to add the additional software needed to say the sentences, split in words then further in phonemes.

This called for a big software development work, entirely taken care of by **François & Thierry Davroux** (*http://www.flipprojets.fr/HHparlant_EN.php* in english language). Our great thanks and congratulations!

1. How to get the new sound proms

Simply ask them by email and they will send you directly the binary contents of the new sound prom.
Free of charge!

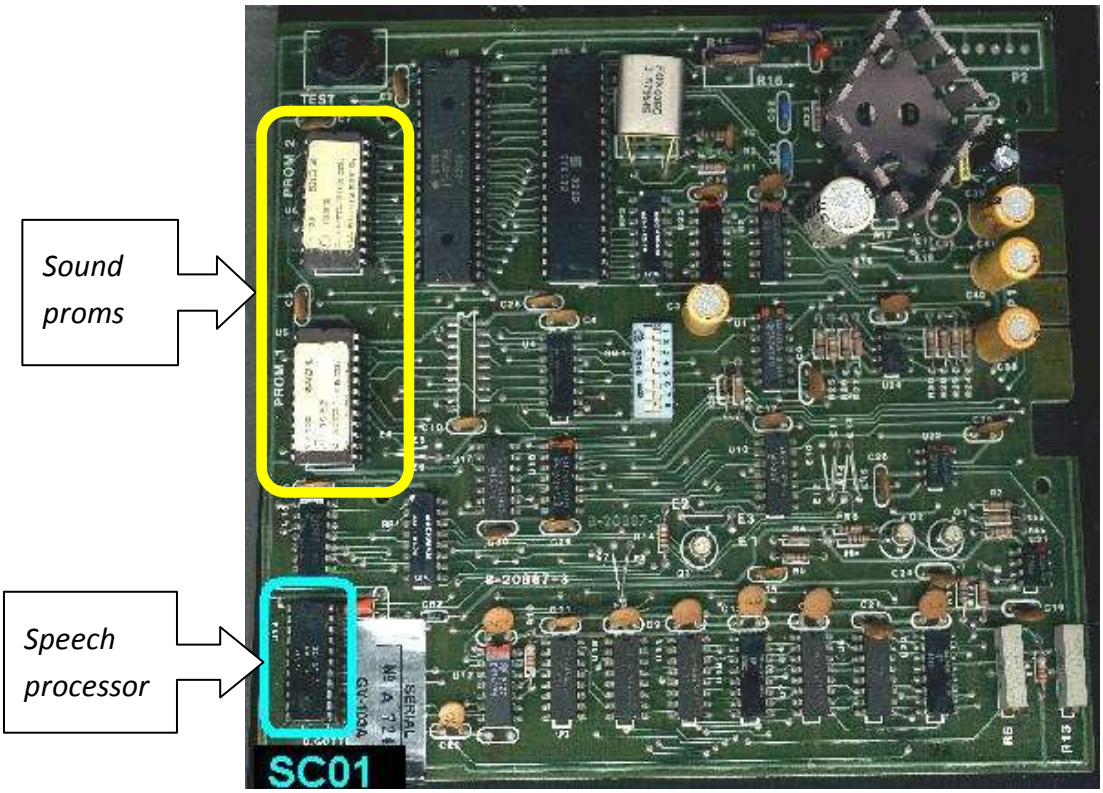
Up to you then to program your own sound memory to install on the original sound board.

⚠ Warning: for software size reasons, the provided binary file may fit a 2764 or two 2732 EPROM chips instead of the original 2716 type. An adaptor may be needed depending on type.

All the detailed information is available on the Davroux brothers' web site above.

2. Installing the speech processor

The speech processor chip, Votrax brand, model **SC-01** or **SC-01-A**, identical to the one found on the other speech-capable games, must be inserted in the empty socket on the bottom left corner of the sound board:



⚠ Warning : this component has become very scarce and is (very) hard to find.

15. Multi-ball game rules

1. Ball capture and multi-ball sequence

The multi-ball sequence start-up is made simple on purpose, so that the player can quickly and easily play in multi-ball mode.

The capture areas are directly lit without the need to achieve a given sequence first. This may, obviously, be modified and improved in the future to increase the difficulty level.

The full sequence is as follows:

1. Lock the 1st ball in the *special* capture hole on the lower playfield
2. Lock the 2nd ball in the *extraball* kicker on the center playfield
3. What to do next depends on the game mode NORMAL or SELECT set in the **GAME SETTINGS** menu:

NORMAL mode

As soon as the 3rd ball scores its first points, the 1st and 2nd balls are released into play one after the other:

1. If the 3rd ball scores its first points on the lower playfield, the multi-ball sequence starts with 2 balls on the lower playfield + the 3rd ball on the center playfield.
2. If the 3rd ball scores its first points on the center or upper playfields, nothing occurs until that ball is sent to the lower playfield.

SELECT mode

The released ball depends on the playfield where the 3rd ball scores its first points:

1. If the 3rd ball scores its first points on the lower playfield, the 1st ball captured in the *special* hole on the lower playfield is released into play: the multi-ball sequence starts with 2 balls on the lower playfield.
   The ball still locked (on the center playfield) is released into play as soon as one of the 2 balls in play is lost on the lower playfield and kicked towards the center playfield by the *VUK* tube.

2. If the 3rd ball scores its first points on the center playfield, the 2nd ball captured in the *extraball* kicker on the center playfield is released into play: the multi-ball sequence starts with 2 balls on the center playfield.
   The ball still locked (on the lower playfield) is released into play as soon as one of the 2 balls in play is sent to the lower playfield.
   Furthermore, if one of the first 2 balls is lost while the last ball is still locked on the lower playfield, it is possible to re-lock the 3rd ball in the *extraball* kicker to restart the multi-ball sequence immediately.

3. If the 3rd ball scores its first points on the upper playfield, or if it falls into the top right hole (located where the ball arrives from the plunger on the center playfield) and is thus kicked upwards onto the upper playfield, nothing occurs: the multi-ball sequence will not start until the first points are scored on the center or the lower playfield with 2 balls as described in 1 and 2 above.

2. Scores

During the multi-ball sequence in either mode, all scores are **3X** when 3 balls are in play and **2X** when 2 balls are in play.

3. Jackpot

During the multi-ball sequence, the *jackpot* is earned by scoring all green targets "1" thru "5" on the center playfield, which are re-lit and flash all together when the multi-ball sequence starts.

The score awarded is 100,000 points with 2 balls in play, or 150,000 points with 3 balls.

Once the *jackpot* has been earned, or when the multi-ball sequence ends (only 1 ball remains in play), the lamps of green targets "1" thru "5" return to their previous state.

It is not possible to score the *jackpot* several times during the same multi-ball sequence.

4. Upon ball end

If the 1st ball remains locked in the *special* hole on the lower playfield without starting the multi-ball sequence, this locked ball is released upon ball end.

This leads to some unavoidable delay between 2 consecutive balls or 2 players, as it takes some time for the CPU board to collect that ball and store it back into the multi-ball mechanism on the center playfield.

16. Summary and postscript

Most of the project's cost lies in the purchase of the **PI-80** board and the speech processor SC-01 or SC-01-A.

The rest of the parts can be recovered from second-hand playfields.

The whole modifications as described above take some 20 hours to complete.

There is nothing insurmountable, and should questions arise, we are here to answer them!

As of january 2014, 3 prototypes had been built and presented at various pinball expos around France, and also at *PlayExpo* (Manchester, England), in 2012 and 2013.

Since then, we regularly receive demands for information, and **the specific software is now embedded in every PI-80 board**: no need to ask for it separately!

What else to say except that the project will live and "bonify" thanks to you.

The multi-ball sequence, and the game rules in general, can always be modified, improved, enhanced.. from your feedback.

Do not hesitate to write us (english OK) through:

- the "contact" page of the FLIPPP web site: https://www.flippp.com/contact.php
- the "contact" page of THE PINBALL WORKSHOP web site: https://www.atelierduflip.com/contact

...and happy *FLIPPP*!

Pascal & Cédric

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