OHMSVILLE

MISSION BOOKLET

The Arcade

A die, a two-player race, and a screen built from a clock that never stops scanning.

Contents

The Arcade

A die, a two-player race, and a screen built from a clock that never stops scanning.

A cabinet is a coin machine, a head-to-head race and a screen that never stops redrawing itself, and none of the three is a chip pretending to be simple. Seven circuits build toward it: a 555 and a counter rolling one random face at a time, two of those counters racing to nine, two rows lit steady on the matrix, one row taken down to a single pin, the whole screen scanned by a clock nobody wired to reset, that same scan slowed until you can see it come apart, and one clock driving two pictures at once because the reset got unhooked on purpose.

The Electric Die

BEFORE

A die needs six faces and no favorite. A switch only ever holds one state or the other — it cannot roll.

AFTER

A 555 races through the display thousands of times a second while the button is held, and a gate resets it to zero the instant it would show six. Let go, and wherever the count lands is the roll — your thumb is the only unpredictable part in the circuit.

HOW PEOPLE GOT THERE

1957 ERNIE, built by Post Office engineers, drew the UK's first Premium Bond winners in June 1957. It used the thermal noise inside a bank of neon tubes as its randomness rather than a clock and a counter — the same problem this build hands to a thumb instead of noise: something outside the circuit has to decide when to stop.

UK Government Actuary's Department and National Savings and Investments records on ERNIE (Electronic Random Number Indicator Equipment), first draw 30 June 1957.

Race to Nine

BEFORE

Two players, two buttons, one board. Whoever's counter reaches nine first should win — but nothing here has ever stopped a counter from just rolling past it.

AFTER

Two counters, each pulled up only by its own player's button, never touch each other. Both can wrap back to zero on an eleventh press, so the circuit never latches a winner — it only ever shows a count. Calling the race is still the players' job, not the board's.

HOW PEOPLE GOT THERE

1966 Texas Instruments' 7490 decade counter — count to nine, one edge at a time, then wrap — became one of the most copied parts in digital logic within a few years of its mid-1960s release, turning up in digital clocks, frequency counters and scoreboards far outside the labs that first specified it. Two of that same counter, one per player, is the whole of a race like this one.

Texas Instruments SN54/74 series data books, 1960s; the 7490 decade counter's wide adoption is documented across period digital-design texts.

Two Bars, Steady

BEFORE

Twelve LEDs, three rows, four columns — and so far every one of them is lit or dark by wiring alone, whole rows at a time.

AFTER

Tie a row to the battery and a column to ground and every LED where they cross lights, the whole row at once. Rows and columns are shared wires, so wiring alone can only draw rectangles — never one dot on its own.

HOW PEOPLE GOT THERE

1969 A pinball backglass lit whole rows of bulbs off a stepper's contacts for decades before anyone put LEDs behind the glass — rows and columns wired the same blunt way this build wires them, current finding whatever junction the wiring lets it reach. Hewlett-Packard's catalogue put the first practical LED numeric display, the 5082-7000, on the market at the end of that decade, and a display finally had a way to run on logic voltages instead of a bank of relay contacts.

HP Journal, February 1969, on the 5082-7000; Smithsonian National Museum of American History on Nixie tubes. The displacement is a span of years, not a date.

One Row, Off One Pin

BEFORE

The two bars came on solid because the battery drove them directly. Now a logic pin has to do the battery's job, and a logic pin is not a battery.

AFTER

A counter's own output bit toggles row 0 on and off with nobody touching the board, but that pin only offers a few hundred ohms to the rail. The row lights, dimmer than before, because a switch that can drive a light is not the same as a switch that can drive it well.

HOW PEOPLE GOT THERE

1964 Texas Instruments' original 7400-series data sheets, in 1964, specified exactly how much current one of these logic outputs could supply before its own voltage sagged — a limit chip designers call fan-out. It is the same limit this build runs into: a counter's output pin can toggle a light, but it was never rated to be the light's power supply.

Texas Instruments SN5400/SN7400 series data sheets, 1964; TTL fan-out specifications as documented in period digital-logic texts.

The Screen Scans Itself

BEFORE

One row lit forever proves the wiring, not a picture. A real display needs all three rows to take a turn, and each one needs to stay bright while it does.

AFTER

Three transistors, each a follower fed off its own row-select gate, hand every row the battery's own current instead of squeezing it through a counter pin. Row 0, then row 1, then row 2, on their own, each one brighter than a row driven straight off logic.

HOW PEOPLE GOT THERE

1824 Peter Mark Roget described the effect this build depends on, in a paper about a spinning wheel's spokes: an eye shown a fast enough series of separate pictures stops seeing separate pictures at all. Scan three rows quickly enough, one at a time, and it reads as one lit sign — ~~the same illusion, wired instead of spun.~~

[8] M. Roget, "Explanation of an Optical Deception in the Appearance of the Spokes of a Wheel Seen through Vertical Apertures," Philosophical Transactions of the Royal Society, 1825 (read 1824).

Slow the Scan Down Until It Comes Apart

BEFORE

The same three rows, scanning at the same rate, look steady. Slow that rate down and at some point the eye should catch it.

AFTER

One capacitor, ten times larger, and nothing else changes: the 555's own clock slows by roughly the same factor, and the row dwell follows it. The scan is still there — slow it down enough and it stops looking like a picture and starts looking like what it actually is.

HOW PEOPLE GOT THERE

1941 When the US set its first television standard in 1941, the field rate — 60 times a second — was chosen in part because a bright, wide picture flickers visibly below roughly 50 to 60 refreshes a second, and a slower rate would have shown on every set in the country. Slow this build's own scan down and it runs into the same floor from below, one ~~capacitor at a time.~~

9 National Television System Committee monochrome standard, adopted by the FCC, 1941; flicker-fusion thresholds for wide bright fields are documented in period television-engineering texts.

Unhook the Reset, and One Clock Draws Two Pictures

BEFORE

Row 0, row 1, row 2, the same three rows, the same clock — one picture, however many times it repeats.

AFTER

Unhook one wire, and the counter's two idle bits start climbing past the count that used to reset it. Route two columns through those bits instead of straight to ground, and the same clock draws three different pictures in turn on a screen that never stored a single one.

HOW PEOPLE GOT THERE

1972 Atari's Pong, built by Allan Alcorn in 1972, drew its whole screen — ball, paddles, score — out of counters and gates alone; there was no memory holding a picture, only different counter states producing different voltages at different moments. This build's three frames come from exactly that trick: two bits with nowhere else to go, put to work deciding what the screen shows next.

Allan Alcorn, Pong, Atari, 1972; design details documented in Steven L. Kent, The Ultimate History of Video Games (2001).

Colophon

Generated from the modules the bench runs on: every circuit in this booklet is the circuit the simulator solves, and every word beside it is the word the manual panel prints.

Built 2026-09-19 from commit 1184ace.