

INDEX

A

- Ace Hardware, 64
- acrylic sheet, 93–94
- Adafruit_MCP9808* library, 295
- ADC DAC8562 digital-to-analog converter, 234, 239
- ADCs (analog-to-digital converters), 46–47, 73, 238
- alarm trigger, Garage Sentry, 142–143
- Amico H7EC-BCM counter, 95
- ammonium persulfate, 14
- amplitude, 256
- analog meters, 202–203, 208–209
- analog-to-digital converters (ADCs), 46–47, 73, 238
- Arduino boards
 - clones, 2, 5. *See also* Deek-Robot Pro Mini
 - Nano, 2
 - vs. Arduino Pro Mini, 263
 - in Automated Agitator for PCB Etching, 43, 45, 51–52, 57, 58, 60, 64
 - in Chromatic Thermometer, 282, 284–288, 295–298
 - in Chronograph Lite, 232–233, 234–236
 - connecting, 6–8
 - in Custom pH Meter, 192, 195, 197, 198
 - in Full Ballistic Chronograph, 234–236, 238–239, 244
 - in Garage Sentry, 136–138, 143, 147–149, 152–153
 - programming, 6–8
 - in Reaction-Time Machine, 28–31, 36, 38, 39
 - time measurement with, 28–29
 - in Watch Winder, 94, 97–101, 108–109, 123–125
 - preparing, 2–3
 - Pro Mini, 2
 - vs. Arduino Nano, 263
 - in Chronograph Lite, 221, 225, 232
 - connecting, 8–11
 - connecting Uno to, 9–10
 - programming, 8–11
 - in Regulated Power Supply, 70, 74, 76–79, 81–82
 - in Square-Wave Generator, 259, 260, 262–264, 269–271, 273
 - Uno, connecting Pro Mini to, 8–10
 - uploading sketches onto, 5–11
- Arduino IDE
 - compiling routine in, 32
 - installing, 5
 - using, 5–6
- ATmega328 microcontroller, 59, 97, 235, 259
- Automated Agitator for PCB Etching
 - automatic motor reversal in, 44–45
 - breadboard, 50–53
 - construction of
 - crank bushing in, 63–64
 - limit wires in, 62
 - packaging, 64–66
 - downloads, 44
 - etching process, 66–67
 - H-bridge, 48–49
 - parts list, 43
 - required tools, 43
 - reversal threshold, 46–48
 - schematic, 45–46
 - shield
 - design notes, 58–60
 - PCB layout, 57
 - sketch, 53–56
 - automatic watches, 90, 92

B

- ballistic chronographs. *See also*
 - Chronograph Lite; Full
 - Ballistic Chronographmuzzle velocity measurement, 219–220
- purpose of, 217
- Battery Saver
 - battery types, 181
 - breadboard, 164–166
 - construction of
 - assembling all the parts, 178–179
 - contact support, 172–173
 - copper contact assembly, 173–174
 - e-clips, 175–176
 - enclosure preparation, 171–172
 - mounting supplies for the solenoid, 175
 - pylon, 177–178
 - release lever, 176–177
 - release rod, 175–176
 - springs, 175–176
 - downloads, 160
 - high-current switch, 162
 - how it works, 162–163
 - installing into a vehicle, 180
 - notes of caution, 158
 - operation of
 - Cool Amp application, 182–183
 - normal, 180–181
 - protection from environment, 182
 - threshold voltage, setting, 181
 - parts list, 159–160
 - patent, 183
 - required tools, 157–158
 - schematic, 160–164
 - shield, 168–170
 - sketch, 167–168
 - timing sequences, 164
 - trigger point, 163
 - uses of, 156
 - wiring on boat, 158
- bearing box acrylic, Watch Winder, 110–114
- bipolar voltage, 193
- BNC connector, 188, 213, 262
- boats, Battery Saver for, 157

breadboard

- Automated Agitator for PCB Etching, 50–53
 - Battery Saver, 164–166
 - Chromatic Thermometer, 286–288
 - Chronograph Lite, 224–226
 - Custom pH Meter, 197–201
 - Garage Sentry, 136–138
 - inserting pins into, 3
 - Reaction-Time Machine, 30–32
 - Regulated Power Supply, 76–79
 - Square-Wave Generator, 269–271
 - Watch Winder, 98–102
 - wiring up, 99–102
- buffer solution, 190
- Bulova, 92

C

- capacitors, 188–189, 198, 200, 234–235, 261
- carbon tetrachloride, 14
- CD4011BC NAND gate, 236, 240
- CD4013 dual D flip-flop, 234
- CD4017 decade counter, 230
- CD4017 B decade counter, 261
- CD4040 12-stage binary counter, 234, 236, 240
- ceramic capacitors, 94, 188, 261
- Chip Quik, xxiv, 22
- Chromatic Thermometer
 - breadboard, 286–288
 - construction of, 298–299
 - downloads, 284
 - how it works, 284
 - LEDs, 279, 285, 298–300
 - parts list, 282
 - required tools, 282
 - schematic, 284–285
 - shield, 296–298
 - sketches
 - for LM35 system, 289–292
 - for MCP9808 system, 292–295
 - temperature readout, 295–296
 - temperature sensor, 280–281, 283
 - using, 301
- Chronograph Lite. *See also* Full Ballistic Chronograph
 - breadboard, 224–226
 - construction of, 230–232
 - sensor channel, 232–233
 - wiring up the Pro Mini, 232

- downloads, 222
- parts list, 221–22
- required tools, 221
- schematic, 222
- sketch, 226–228
- test bed, 222–224
- testing with projectile simulator, 229–230
- using, 253–254
- clock speed, 236–238
- colorimeters, 185
- compiling, 32
- connectors, 18–20
- contact support, Battery Saver, 172–173
- Cool Amp, 182–183
- copper bus bar, Battery Saver, 159
- copper contact assembly, Battery Saver, 173–174
- copper salts, 15
- counter, 236
- crank bushing, Automated Agitator for PCB Etching, 63–64
- crimp connectors, 18–20
- crimping tools, 18–19
- Crossman pellet gun, 250
- Crossman T4, 250
- current drain, 48
- current-limiting resistors, 147
- Custom pH Meter
 - analog, 202–203
 - breadboard, 197–201
 - calibrating, 201–202
 - vs. colorimeters, 185
 - construction of
 - circuit board, mounting, 213
 - enclosure, 212–213
 - installing other hardware, 214–216
 - downloads, 189
 - function of, 186
 - LCD, 188, 196–197
 - vs. litmus paper indicators, 185
 - offset and gain, 194
 - parts list, 187–189
 - precautions, 210–211
 - probe, 189–191
 - required tools, 187
 - schematic
 - design notes, 193–195
 - IC selection, 196

- integration of high-impedance probe, 193
- op-amp circuit, 195
- shield, 210–211
- significant figures, 209
- simulator circuit, wiring up, 200–201
- sketch, 205–209
 - centering analog meter, 208–209
 - smoothing the pH and temperature output, 208
 - temperature effects, 202
 - temperature sensor, 204–205, 215–216

D

- DACs (digital-to-analog converters), 238–239
- DDS (direct digital synthesis), 259, 265
- debounce, 97
- decade counter, 267
- Deek-Robot Pro Mini
 - in Battery Saver, 159, 161–162, 165–166, 169–174, 179
 - in Custom pH Meter, 187, 192, 193, 195, 198, 207, 210–211
 - in Square-Wave Generator, 263–264
- Deluxe Garage Sentry
 - construction of, 152–154
 - LEDs in, 151, 152
 - parts, 132
 - schematic, 148–149
 - shield, 151–152
 - sketch, 149–151
- diagonal cutters, 2
- Digi-Key, xxv, 18
- digital multimeter (DMM), 75
- digital quartz electronic watch, 92
- digital-to-analog converters (DACs), 238–239
- DIP (dual inline package), 49
- direct digital synthesis (DDS), 259, 265
- distance calculation, 133–134
- downloads, xxv
 - Automated Agitator for PCB Etching, 44
 - Battery Saver, 160
 - Chromatic Thermometer, 284
 - Chronograph Lite, 222

- downloads (*continued*)
 - Custom pH Meter, 189
 - Full Ballistic Chronograph, 235
 - Garage Sentry, 132
 - Reaction-Time Machine, 27
 - Regulated Power Supply, 71
 - Square-Wave Generator, 262
 - Watch Winder, 95
- Dremel tool, xxiii, 17, 172–173
- drill, xxiii, 17–18
- driveshaft, Watch Winder, 116–119
- dropping resistor, 55
- dual inline package (DIP), 49

E

- e-clips, 160, 175–176
- electrolytic capacitor, 261
- Electro-Mechano drill press, 17
- Electronic Goldmine G19852, 159
- enclosure
 - Battery Saver, 171–172
 - Custom pH Meter, 212–213
 - Full Ballistic Chronograph, 245–247
 - Regulated Power Supply, 83–85
 - Square-Wave Generator, 274–276
- etchant, 13, 15
- etching PCBs, 15–17, 66–67
- ExpressPCB software, 11–13, 57

F

- ferric chloride, 14
- flexible voltage regulator circuit, 72–74
- flip-flop, 239
- FreqCount.h* library, 271–272
- frequency, 257
- frequency counter, 258–259
- FTDI-based serial adapters, 263
- Full Ballistic Chronograph. *See also*
 - Chronograph Lite
 - accuracy, 235
 - clock speed
 - adjusting, 238
 - selecting, 236–238
 - construction of, 245–247
 - counter, selecting, 236
 - designing, 238–239
 - downloads, 235
 - high-speed window, 235–236
 - machine code, 235

- parts list, 234–235
- required tools, 234
- schematic, 239–241
- sensor channel
 - building, 247–250
 - cable, 251–252
 - LEDs, 249
 - Optoschmitt photosensors, 235, 241, 248, 250–251
 - PCBs, 248
 - UV LEDs, 250–251
- shield, 242–244
- sketch, 241–242
- soldering, 244–245
- using, 253

- function generators, 255
- Futurlec, 23
- Futurlec TO220SMAL heat sink, 71
- Futurlec TO220ST heat sink, 71

G

- Garage Sentry
 - breadboard, 136–138
 - construction of
 - mounting options, 145–147
 - potentiometer holes,
 - drilling, 145
 - soldering transistors
 - and current-limiting resistors, 147
 - transducer holes, drilling, 144
 - wiring pieces together, 147
- Deluxe
 - construction of, 152–154
 - LEDs in, 151, 152
 - parts, 132
 - schematic, 148–149
 - shield, 151–152
 - sketch, 149–151
- distance calculation, 133–134
- downloads, 132
- how it works, 134–136
- inspiration behind, 130
- LEDs in, 132–133, 143, 145
- parts list, 130–132
- required tools, 130
- schematic, 132–133
- sketch, 138–140
 - alarm trigger, 142–143
 - distance measurement, 141

- loop() function, 140–141
- setup() function, 140
- time-to-distance conversion
 - factors, 142

GBC laminator, 14

grounding, 58

H

Hall effect sensor, 96–97, 100, 108–109, 122–123

Hammond 1591 ATBU, 131

Hammond 1591 BTCL, 152–154, 189, 212–213, 221, 231

Hammond 1591 STCL, 160, 171–172

Hammond 1595C, 261, 274–276

H-bridge, 48–49, 96, 100

HC-SR04 ultrasonic sensor, 130, 134–135, 137–138

HCT 4011 4-input NAND gate, 234

HCT4017 decade counter IC, 261, 270–271, 273

header pins, 3

heat sink, 58

Honeywell Optoschmitt SA5600, 221, 224, 226, 250–251

Honeywell Optoschmitt SD5610, 235, 250–251

hydrogen peroxide, 15

I

I²C (inter-integrated circuit) board

- address, 36
- affixing to LCD, 3–5
- Chromatic Thermometer, 288
- Chronograph Lite, 232
- Full Ballistic Chronograph, 234
- Square-Wave Generator, 261

Igoe, Tom, 208

#include, 35

inline connectors, 160

J

Jameco, xxiv, xxv, 18

jigsaws, xxiii

K

Klean Strip, 115

L

LCD

- affixing I²C board to, 3–5
- Chronograph Lite, 232
- Custom pH Meter, 188, 196–197
- Reaction-Time Machine, 28–29
- Regulated Power Supply, 76–77, 80
- Square-Wave Generator, 276

LEDs

- Automated Agitator for PCB
 - Etching, 52, 64–65
- Chromatic Thermometer, 279, 285, 298–300
- Chronograph Lite, 222–223, 249
- Deluxe Garage Sentry, 151, 152
- Garage Sentry, 132–133, 143, 145
- Watch Winder, 101, 102, 108
 - adding, 122–123
 - number of, 125–126
 - placement of, 125–126

limit wires, 62

LiquidCrystal library, 35, 36

litmus paper, 185

LM317 regulator chip, 70, 72–74, 77, 81–82

LM35 temperature sensor

- Chromatic Thermometer, 281, 282, 283, 284, 285, 287, 289–292
- Custom pH Meter, 187, 215–216

LM7805 regulator

- Battery Saver, 159, 161, 165–166
- Custom pH Meter, 188, 193, 199
- Full Ballistic Chronograph, 234
- Garage Sentry, 131
- Regulated Power Supply, 77–78, 81–82
- Square-Wave Generator, 273
- Watch Winder, 97, 99, 108, 109

LMC6001 op-amp, 196

LMC6042 op-amp, 196

LMC7660 power inverter, 188, 193, 198

LMP7702 op-amp, 196

logic gate, 236

loop() function, 108, 140–141

LTC1799 oscillator, 260, 262, 265, 268–270, 273

M

machine code, 235

Magnavox AC adapter, 131

- male crimp connects, 71
- map() function, 209
- MCP9808 sensor, 281, 282, 283, 285, 292–295, 297, 298
- mechatronics, xxii
- Melexis US5881LUA, 94
- Mellis, David, 208
- methyl chloride, 115
- microcontrollers, 185
- MiniBoard service, ExpressPCB, 13
- mini-USB, 6
- motor assembly, Watch Winder, 110, 116–119
- motor bushing, Watch Winder, 117–118
- motor mount, Watch Winder, 110–114
- Mouser, xxv, 18
- multimeters, 47
- muriatic acid, 15
- muzzle velocity, 219–220

N

- NAND logic gate, 234, 236
- negative feedback resistor, 195
- Newark Electronics, xxv, 18
- NIST (National Institute of Standards and Technology), 204, 281
- NPN transistors, 98, 162
 - 2N5172, 234
 - ZTX649, 131

O

- Ohm's law, 46, 74
- OPA129 op-amp, 196
- OPA627/637 op-amp, 196
- op-amp circuit, 195–196
- Optoschmitt photosensors
 - Chronograph Lite, 221, 223, 226
 - Full Ballistic Chronograph, 235, 241, 248, 250–251
- oscillators, 260, 262, 265, 268–270, 273

P

- paint stripper, 115
- parking assistant. *See* Garage Sentry
- PBC Fab-in-a-Box, 14
- PCBs (printed circuit boards), 10
 - drilling, 17–18
 - etching, 15–16
 - layout, 57, 168–169

- making, 13–18
- patterns, applying, 14–15
- period, 257
- Permatex silicon RTV sealant, 182
- pH
 - measurement of, 187
 - temperature effects, 203
- pH probe
 - calibration, 189, 191
 - electrical impedance, 190
 - high-impedance, 193
 - integration of, 193
 - output voltage, 189
 - simplified drawing of, 190
 - taking care of, 190–191
- phototransistors, 221, 222–224
- pliers, xxiii
- Pololu Robotics and Electronics, xxv, 18
- potentiometer, 109, 142, 195, 201, 261
- printed circuit boards (PCBs). *See* PCBs (printed circuit boards)
- printed wiring board, 10
- projectile simulator, ballistic
 - chronographs, 229–230
- projects
 - Automated Agitator for PCB Etching, 41–67
 - Battery Saver, 155–183
 - Chromatic Thermometer, 279–301
 - Chronograph Lite, 221–233
 - Custom pH Meter, 185–216
 - Full Ballistic Chronograph, 233–254
 - Garage Sentry, 129–154
 - Reaction-Time Machine, 25–40
 - Regulated Power Supply, 69–87
 - Square-Wave Generator, 255–278
 - Watch Winder, 89–127
- PulsarProFX, 14
- pulseIn() method, 141
- pylon, 177–178

R

- R1-R9 voltage divider, 73
- R4A-2RS bearing, 110
- reactions, 27–28
- Reaction-Time Machine
 - breadboard, 30–32
 - construction of
 - hardware mounting, 38–39
 - sturdy case for, preparing, 37–38

- customizing, 40
- downloads, 27
- history of reaction-time devices, 28
- how it works
 - speed ranges, expected, 29
 - time measurement, 28–29
- parts list, 26–27
- reaction vs. reflex, 27–28
- required tools, 26
- schematic, 29–30
- sketch, 32–35
 - custom commentary, 35
 - loop, 36–37
- reflexes, 27–28
- Regulated Power Supply
 - breadboard
 - Arduino Pro Mini, preparing, 76
 - building, 77–79
 - LCD, preparing, 76–77
 - construction of, 82
 - circuit board, mounting, 85–87
 - enclosure, 83–85
 - downloads, 71
 - flexible voltage regulator circuit, 72–75
 - parts list, 70–71
 - required tools, 70
 - schematic, 75
 - shield, 80–82
 - sketch, 79–80
 - uses of, 72
- release lever, Battery Saver, 177–178
- release rod, Battery Saver, 175–176
- resistance temperature detectors (RTDs), 280
- resistors
 - Automated Agitator for PCB
 - Etching, 60
 - Battery Saver, 159
 - Chromatic Thermometer, 282
 - Chronograph Lite, 221
 - Custom pH Meter, 199–201
 - current-limiting, 147
 - dropping, 55
 - Full Ballistic Chronograph, 234
 - voltage divider, 74
- retailers, xxv
- reversal threshold, Automated Agitator
 - for PCB Etching, 46–48
- riding mowers, Battery Saver for, 157
- RTDs (resistance temperature detectors), 280

S

- saws, xxiii
- schematics
 - Automated Agitator for PCB
 - Etching, 45–46
 - Battery Saver, 160–164
 - Chromatic Thermometer, 284–285
 - Chronograph Lite, 222
 - Custom pH Meter, 191–196
 - Deluxe Garage Sentry, 148–149
 - Full Ballistic Chronograph, 239–241
 - Garage Sentry, 132–133
 - Reaction-Time Machine, 29–30
 - Regulated Power Supply, 75
 - Square-Wave Generator, 262–263
 - Watch Winder, 97–98
- Schmitt trigger, 97, 250–251
- screwdrivers, xxiii
- semiconductor temperature sensors, 281
- sensor channel, Full Ballistic
 - Chronograph
 - building, 247–250
 - cable, 251–252
 - LEDs, 249
 - Optoschmitt photosensors, 235, 241, 248, 250–251
 - PCBs, 248
 - UV LEDs, 250–251
- serial adapters, 263
- serial COM port, 6
- setting up
 - affixing I²C board to LCD, 3–5
 - Arduino board, preparing, 2–3
 - making own PCBs, 13–18
 - uploading sketches to Arduino, 5–11
 - using PCB software, 11–13
 - using SOICs, 20–24
- setup() function, 108, 140
- Shepherd, Jean, 218
- shield
 - Automated Agitator for PCB
 - Etching, 57–60
 - Battery Saver, 168–170
 - Chromatic Thermometer, 296–298
 - Custom pH Meter, 210–211
 - Deluxe Garage Sentry, 151–152
 - Full Ballistic Chronograph, 242–244
 - Regulated Power Supply, 80–82
 - Square-Wave Generator, 272–273
 - Watch Winder, 108–109

- signal generators, 255
 - significant figures, 209
 - silicon band-gap temperature sensor, 281
 - Simpson analog meter, 202
 - sine wave, 258
 - sketches, xix
 - Automated Agitator for PCB Etching, 53–56
 - Battery Saver, 167–168
 - Chromatic Thermometer
 - LM35 system, 289–292
 - MCP9808 system, 292–295
 - temperature readout, 295–296
 - Chronograph Lite, 226–228
 - creating, 5
 - Custom pH Meter, 205–209
 - Deluxe Garage Sentry, 149–151
 - Full Ballistic Chronograph, 241–242
 - Garage Sentry, 138–140
 - alarm trigger, 142–143
 - distance measurement, 141
 - loop() function, 140–141
 - setup() function, 140
 - Reaction-Time Machine, 32–35
 - custom commentary, 35
 - loop, 36–37
 - Regulated Power Supply, 79–80
 - saving, 5
 - Square-Wave Generator, 271–272
 - uploading to Arduino, 5–11
 - verifying, 5–6
 - Watch Winder, 102–108
 - SMT (surface-mount technology) devices, 21
 - SN754410 H-bridge, 94, 99
 - solder lug, 64
 - SOICs (small-outline integrated circuits), 20
 - solder paste method, 21–23
 - soldering directly, 23–24
 - solenoid, 159, 164, 175
 - SOT23 adapter board, 234
 - SPDT toggle switches, 261
 - SPST switch, 64, 71, 232
 - square wave, 256–257
 - listening to, 268
 - uses of, 257
 - Square-Wave Generator
 - breadboard, 269–271
 - construction of, 273
 - enclosure preparation, 274–276
 - wiring the electronics, 276–277
 - definition of, 255
 - design notes and mods
 - battery power, 278
 - displaying frequency in other units, 277
 - reading external input frequencies, 277–278
 - development, 264
 - frequency display, 265–266
 - signal generation, 265
 - downloads, 262
 - oscillator, 268–269
 - parts list, 260–262
 - Pro Mini boards, 263–264
 - projectile simulator and, 229
 - reasons for building, 256–257
 - required tools, 260
 - schematic, 262–263
 - shield, 272–273
 - shortcomings of, 259
 - signal integrity, 266–267
 - sketch, 271–272
- stamp, 186
- Stoffregen, Paul, 265
- surface-mount technology (SMT) devices, 21
- switches, 262
- ## T
- tantalum capacitors, 94, 188–189, 234
 - tap and die sets, xxiv
 - tapered reamer, xxiv
 - temperature sensor
 - accuracy of, 204–205
 - adding, 204
 - Chromatic Thermometer, choosing, 280–281
 - connecting, 215–216
 - remote, 283
 - semiconductor, 281
 - silicon band-gap, 281
 - thermal ink, 15
 - thermistors, 280
 - thermocouples, 280
 - threaded shaft, Watch Winder, 116–117
 - 3PDT toggle switch, 234
 - threshold voltage, Battery Saver, 181
 - TI SN 74LVC1GX04 crystal-oscillator driver, 234, 238

- time base, 259
- time measurement, with Nano, 28–29
- time of flight, 237
- time per cycle, 237
- time pulse, 259
- TL072 dual op-amp, 187, 196, 199
- TLC2262 op-amp, 196
- TO-220 heat sink, 71
- TO220SMAL heat sink, 71
- TO220ST heat sink, 71
- tools, xxiii–xxiv
- tractors, Battery Saver for, 157
- transistors
 - NPN, 98, 162
 - soldering, 147
 - ZTX649. *See* ZTX649 transistors
- transistor-transistor logic (TTL), 8
- trichloroethylene, 14
- trimmer, 188, 201

U

- U bracket, 146–147
- ultrasonic sound, 134
- ultrasonic transceiver module, 130, 134
- USB adapter, 11
- USB cable, 6, 8
- USB-to-TTL devices, 10
- UV LEDs, 250–251

V

- variable frequency oscillator (VFO), 265
- Velcro, 145
- velocity, 237
- VIN port, 228
- voltage, 47
- voltage divider, 73, 74–75
- voltage regulator, 58, 261

W

- Watch Winder
 - breadboard, 98–102
 - construction of
 - bearing box acrylic, preparing, 110–114
 - bonding the acrylic for the bearing box, 114–115
 - driveshaft, 116–119
 - keeping the watches in basket, 124

- leaving the components on display, 123–124
- motor assembly, 110, 118–119
- motor bushing, 117–118
- motor mount, preparing, 110–114
- piano wire pins, cutting, 118–119
- stand, building, 115–116
- threaded shaft, trimming, 116–117
- watch basket, 120–122
- controlling revolutions with Arduino, 96
- design notes, 124
- motor voltage, 126
- rotation counter, 126–127
- total rotation adjustment, 124–125
- downloads, 95
- LEDs, 101, 102, 108
 - adding, 122–123
 - number of, 125–126
 - placement of, 125–126
- monitoring rotations with Hall effect, 96–97
- parts list
 - acrylic parts, 93–94
 - hardware and circuit components, 94–95
- reasons for building, 90
- required tools, 93
- requirements, 95–96
- schematic, 97–98
- shield, 108–109
- sketch, 102–108
- waveform generators, 255
- Weld-On, 115
- while loop, 56, 227
- Wire.h* library, 35

Z

- Zener diode, 159, 161, 188, 195, 200
- ZLazr, 93
- ZTX649 transistors
 - Battery Saver, 159, 162, 166
 - Chromatic Thermometer, 282
 - Garage Sentry, 131, 138
 - Watch Winder, 94, 101, 109