MORE FREQUENCIES A MUST! CAN WE GET THEM?

7th YEAR OF SERVICE TO THE R/C MODELER

GRID LEAKS

R/C DATA SERVICE

VOLUME 4 • NUMBER 4

JULY • AUGUST 1963 THIRTY-FIVE CENTS

- Secret of Relayless Operation—Watch that escapement
- How to Build Dick Jansson's Transistor Transmitter
- R/C Small Boats—Don't send a boy on a man's errand!
- New—All Metal Airplanes
- Septallete in Lightning Bug

Ivan Loucks, F.C.C. chief of Amateur and Citizen's Radio, in his Washington office feels out controls of George Wells' multi—see page 5. Not an R/Cer himself, Mr. Loucks is keenly aware of the R/C frequency problem.

HOW TO DO IT: SINGLE-CHANNEL INSTALLATION!

FIRST TIME EVER!
NO ADDITIONAL MONEY CHARGES FOR ORDERS OF ANY SIZE!
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LEES HOBBY SUPPLIES INC.

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GLUE DISPENSER ..... ORDERS OVER $ 3.00
1" SHED RESIST. BRUSH ..... ORDERS OVER 5.00
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Kraft K3VK Relayless Single Receiver ..... .25
Kraft Bonner Amplifier Kit KSAK ..... .25
Kraft 10 Channel Servo Amplifier 1.00
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Shows-Dickerson P O D ..... .25
Ace-Gyro Nicad Charger Kit ..... .25
Marcy Feedback Servo ..... .25
Marcy Motor Control Servo ..... .25
Marcy P R M-1 Transmitter ..... .25
Marcy P R M-1 Super Regen Receiver and Decoder ..... .25
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Kraft 6 Channel Super-Regen Receiver (Relay) 1.00
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Kraft 10 Superhet Receiver (Relayless) 1.00

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48" span, .010-.024 eng., Single Ch., Glider
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NO. 16B5—MAX. III .29 (O.S.) 9.98
NO. 16B6—MAX. III .29 R/C (O.S.) 13.98
NO. 16B7—MAX. III .35 (O.S.) 11.98
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NO. 10A5—MARCYTONE PRM-1 SYSTEM $105.95
First Proportional Rudder only system with positionable engine control. Recommended for .15 engine or larger. Uses no relays. Combo kit includes transmitter, pulser, receiver rudder and motor control servo kits.
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Completely built, all units assembled, ready to install.

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Both kits include ASP 211 telescoping antenna, transistor, tube, crystal, hardware, case, PC board and revised instructions.
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Same as above, but assembled, tuned and certified.

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Single Chan. Tone, matches C. & S. receivers and others.
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Same as above, but in kit form. Easy instructions.
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Transistorized Tone Transmitter, 27.255 mc operation.
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Single Channel Tone Transmitter, Neon-transistor modulation.
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Tone Transmitter designed for MC100T Receiver
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NO. 11A13—KT6K KIT 52 or 52.75 mc 51.95
Kraft 6 Channel kits. Complete with all required parts.
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NO. 11A9—KT10K-M KIT (Specify crystal freq.) 87.50
Kraft Triple Ten Transmitter kits. Complete kit features highest grade components, use of two henry toroids, 10% capacitors, epoxy glass PC boards.

RECEIVERS AND KITS


OTARION 0-21

NO. 12A7—KR1K KIT 26-28 mc 19.95
NO. 12A8—KR1K KIT 50-54 mc 21.95
Most highly recommended single channel super-regen receiver available to kit builders.
NO. 12A9—ECTRONICS KRAFT RECEIVER 29.95
Same as above, only completely assembled, avail. 26-28 mc.
NO. 12A5—COURIER RELAYLESS RECEIVER 21.95
Ectronics relayless single channel, all-transistorized.
NO. 12A10—K3VK KIT 13.95
Kraft 3 volt—all transistor-relayless, 26-28 mc.
NO. 12A6—OTARION 0-21 ..... 24.95
CB relayless tone receiver, weight ½ oz., temperature stabilized.
NO. 12A27—OTARION 0-22 ..... 27.50
Proportional relayless receiver, temperature stabilized 0°-140°F.
NO. 12A26—ECTRONIC RELAYER 24.95
3 V. Relay Tone Receiver! All transistor, 1½ oz.
NO. 12A25—CITIZENSHIP LT-3 COMBO 29.95
Super-regen relayless tone receiver with SE-2 escapement.
NO. 12A28—CITIZENSHIP R/C PAK 32.95
Single channel 27 mc unit with SE-2 escapement, no soldering or wiring.
NO. 12A12Y—MC 100T 20.95
Tube and transistor tone receiver, use with MC250T transmitter.
NO. 12A1—CS-501 HUMMING BIRD 22.50
Weight ⅜ oz. Uses SE-2 or Babcock Mark II escapement, simple wiring.
NO.12A2—CS-503 LARK RECEIVER 29.50
Weight 1⅝ oz. Less than 4 ma idle, 35 ma on signal.
NO. 12A3—CS-505 FINCH RECEIVER 27.50
All transistor dual output relayless receiver. Weight 1 oz.
NO. 12A4—CS-505 FINCH RECEIVER 29.50
Same as above, but with metal case.
NO. 12A15—NIKE SUPERHET CONVERTER 39.95
Convert from broad-tuning super regen receiver to nice sharp superhet.
NO. 12A18—KR6K 27mc KIT 65.95
NO.12A19—KR6K 50-54 mc KIT 67.95
Unique printed circuit two-deck construction. Uses light Deans Reeds for best performance. PC boards are drilled.
NO. 10A3—COMBO 6 CHANNEL RCVR. AND 6 CHANNEL TRANSMITTER $105.95
(Specify freq.—Relay type)
NO. 12A20—KR10K 27 mc relayless 44.95
NO. 12A21—KR10K 50-54 mc relayless 46.95
NO. 12A30—KR6RK 27 mc relayless 40.95
NO. 12A29—KR6RK 50-54 mc relayless 42.95
The kraft multi-fli super regen relayless receiver kits are available with a 6 or 10 channel reed bank. Use with transmite servos.
NO. 10A7—KTR6RK 6 channel relayless 87.95
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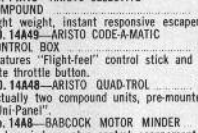

NO. 14A14—ARISTO MOTOR or RUDDER CONTROL 3.95
NO. 14A13—ARISTO SELECTIVE COMPOUND 6.95
Light weight, instant responsive escapement.
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Features "Flight-feel" control stick and separate throttle button.
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Actually two compound units, pre-mounted on "Uni-Panel".
No. 14A8—BABCOCK MOTOR MINDER 4.95
Motor-minder motor control escapement. Perfect in-flight control.
NO. 14A9—BABCOCK MARK II 9.49
Most popular of all model aircraft servos.
NO. 14A10—BABCOCK MARK V 9.49
Easy, reliable stick-box or manual control.

NO. 14A23—BABCOCK DOUBLE DECKER BDC-6 ..... 5.95
Features 3 transistor switching network for positive actuation of Mark II or Mark V escapements.
NO. 14A4—BONNER SN 5.95
NO. 14A5—BONNER VARICOMP 8.95
A versatile and powerful compound escapement.
NO. 14A6—BONNER VARICOMP COMBO 18.95
NO. 14A7—BONNER R. E. VARICOMP 9.75
NO. 14A3—CITIZENSHIP SE2 ..... 7.95
NO. 14A15—ECTRONIC TRANSLATOR 9.95
Super-light weight escapement with built-in memory.
NO. 14A16—ECTRONIC ENGINAC 5.95
Provides high, low and cruising engine speeds when used with translator. Easily adjustable.
NO.14A1—G. & M. MINICOMBO I 6.95
NO. 14A2—G. & M. MINICOMBO II 7.95
Compact, light weight single channel rudder actuators.

KRAFT CUSTOM R/C

NO. 12A22Z—Kraft Superhet 10 channel 89.95
NO. 12A32Z—Kraft Superhet 12 channel 99.95
Smallest, lightest multi-channel superheterodyne receivers available. Weight is 3½ oz.
NO. 12A33Z—Kraft Single Superhet (Convertible) 54.95
NO. 12A23—Kraft Hybrid 10 Channel Receiver 69.95
NO. 12A34—Kraft Single Convertible Hybrid 10 channel kit 47.95
NO. 12A24—Kraft Hybrid Front End kit only 41.95
NO. 11A11Z—KT10 Kraft Transistor Transmitter 119.95
NO. 11A172—KT12 Kraft Transistor Transmitter 129.95
Smallest practical physical size. Light weight.

SERVOS

NO. 14A12—G. & M. BOTOMATIC 12.95
Single channel boat servo. Provides forward, stop, reverse motor and intantaneous rudder action.
NO. 14A11—BABCOCK No. 897 SERVO 9.95
Electric compound servo for even the largest boats.
NO. 14A24—CITIZENSHIP ACTUATOR KIT 11.95
NO. 14A50—TNA SERVO 25.95
Transistorized for direct operation from any standard reed bank.
NO. 14A51—RNA SERVO ASSEMBLED 9.95
NO. 14A52—RNA SERVO KIT 7.95
NO. 14A18—HILCREST MOTOR CONTROL 5.95
Throttle control servo designed for multi channel.
NO. 14A17—BABCOCK No. 887 SERVO 10.95
For battery-powered R/C boats, cars and trucks.
NO. 14A19—BONNER DURAMITE 12.95
NO. 14A20—BONNER TRANSMITE NEUTRALIZING 29.95
NO. 14A21—BONNER TRANSMITE TRIM ONLY 27.95
NO. 14A22—BONNER TRANSMITE AMPLIFIER WIRED 19.95
Relayless transmite servos especially designed for Bramco, Apollo, Kraft relayless 10, orbit and CG.

BONNER COMPONENTS

NO. 14A36—Cam followers ..... .15
No. 14A37—SN Rotor wheel ..... .55
No. 14A38—Varicomp cam wheel 1.35
No. 14A39—R. E. Varicomp cam wheel 1.50
NO. 14A40—Duramite servo sector 1.50
NO. 14A41—Duramite crown gear ..... .50
NO. 14A42—Duramite combination gear ..... .35
NO. 14A43—Duramite pinion gear ..... .20
NO. 14A44—Duramite cans, bottom half 2.00
NO. 14A45—Duramite can, top half less P.C. board 1.00
NO. 14A46—Duramite adjusting screw ..... .15
NO. 23A1—BONNER MOTOR 3.95
NO. 14A34—KRAFT SERVO AMPLIFIER KIT 13.95
NO. 14A54—KRAFT 10 CHANNEL SERVO SWITCHER KIT 49.95
NO. 14A47—CUSTOM BUILT KRAFT 10 SERVO SWITCHER 69.95

ACTUATORS

NO. 14A60—GO-AC KIT (Straeder) 11.95
GO-AC ASSEMBLED (Straeder) 14.95
DU-AC ASSEMBLED (Straeder) 14.95
NO. 14A25—GM PROPOMATIC 15.95
NO. 14A27—SEPTALLETTE MARK III 6.95
NO. 14A28—SEPTALLETTE MARK V 6.95
NO. 14A53—SOUTHWESTERN 5.95
NO. 14A33—POU-VOIR 6.50
Has double coil with only 30 ohms—plenty of power—low drain.
NO. 14A30—MARCY FEED BACK KIT 27.50
NO. 14A31—MARCY FEED BACK CUSTOM BUILT 32.50

PULSERS, P.O.D. KITS

NO. 15A4—CS PULSI-TRAN 504 ASSEMBLED 24.50
NO. 15A5—SHOWS RO PULSER KIT 17.95
NO. 15A3—BAISDEN GG PULSER KIT 17.95
NO. 15A8—WORTH SIMPL SIMUL PULSER KIT 21.95
NO. 15A6—SHOWS POD KIT 12.95
NO. 15A7—BROADHURST POD KIT 7.95

TEST INSTRUMENTS

NO. 22A1—BASIC FSM KIT 1.50
NO. 22A2—BASIC TRANSISTORIZED FSM KIT 2.85
NO. 22A3—SUBMINI 0-1 MA METER 3.45
NO. 22A4—0-500 MA METER 3.95
NO. 22A5—SPACE CONTROL 0-1 MA METER 5.95
NO. 22A6—SPACE CONTROL 0-5 MA METER 5.95
NO. 22A7—SPACE CONTROL 0-50 MA METER 5.95
NO. 22A8—MT 2000 MULTITEST (Imported) 9.95
Low cost pocket multimeter with features found in higher priced units.
NO. 22A9—VOM 102F FUSED KIT 16.95
American made volt ohm milliameter, larager than above unit.
NO. 22A10—METER TEST LEADS ..... .50
40" red and black standard.

BATTERIES

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NO. 38A3—EVEREADY N46 ..... 2.95
NO. 38A4—WILLARD BB 210 LEAD ACID 5.95
NO. 38A34—ARISTO 64 LEAD ACID 4.75
NO. 38A5—MALLORY ALKALINES MN 9100 ..... .35
NO. 38A6—MALLORY ALKALINES MN 1500 ..... .50
NO. 38A36—MALLORY 2400B (AAA pen cell size) ..... .45
NO. 38A37—MALLORY 1400B (Medium cell size) ..... .75
NO. 38A1—MEDCO KM5 POWER PAK AND KIT 4.95
NO. 38A2—MEDCO PM5 (as above but with nicads) 19.95

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NO. 34A8—NICKEL CADMIUM CHARGER KIT 11.95
NO. 34A6—TOWER VARI-VOLT CHARGER 7.95
NO. 34A11—TOWER HYDOMETER TESTER 1.25
NO. 34A7—TOWER BATTERY BOOKLET ..... .25
VINCO CHARGER
KLEINTRONICS CHARGER
NO. 34A9—ARISTO 2-4-6 CHARGER 7.95
NO. 34A1—MEDCO CHARGER 6.95
NO. 34A2Y—MC 2 VOLT CHARGER 6.95
NO. 34A3Y—MC 2-6 CHARGER $11.95
NO. 34A4—MC NICAD No. 1 CHARGER 6.95
NO. 34A10—ACE NICAD CHARGER PARTS PACKAGE 3.75

TRANSMITTER CONVERTERS

NO. 26A5—ACE TC 3, 6 K KIT 10.95
NO. 17A27—WOUND CUP CORE FOR 9.25
NO. 26A1Y—MC 135Y-20 ..... 11.95
NO. 26A2Y—MC 135T-40 ..... 14.95

RECEIVER CONVERTERS

NO. 26A3—KP/CK COMPLETE KIT 10.95
NO. 26A4—KP/C PARTS FOR BUILDING INTO KRAFT RECEIVERS 9.25
NO. 17A26—CUP CORE FOR ABOVE WOUND 3.95
NO. 23A2—MIGHTY MIDGET MOTOR 2.95
NO. 23A4—EXTRA BRUSH SETS ..... .35

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NO. 37A3—DUPLITE FIBERGLASS 1.25
NO. 37A4—SUPERFLITE FIBERGLASS 1.25
NO. 37A1—ACRYJEL REPAIR PLASTIC KIT No. 1 ..... 1.20
NO. 37A2—ACRYJEL MOULDING PLASTIC KIT No. 1 ..... 3.75
NO. 37A16—ACRYJEL PHOTO PC KIT 3.95
NO. 28A30—ACE PRINTED CIRCUIT KIT No. 1 ..... 3.95

PRINTED CIRCUIT SUPPLIES

NO. 28A31—PC STRIPS ⅛"x4"—26 pieces ..... .50
NO. 28A32—PC STRIPS ⅛"x4"—13 pieces ..... .50
NO. 28A33—PC DOTS ¼" dia. 28 pieces ..... .12
NO. 28A34—PC DOTS ⅜" dia. 16 pieces ..... .10
NO. 28A35—FC4—Ferric chloride 4 oz. ..... .50
NO. 28A36—FC8—Ferric chloride 8 oz. ..... .85
NO. 28A37—FC16—Ferric chloride 16 oz. 1.45

ANTENNAS

NO. 37A67—CLA ANTENNA (Center loading Antenna) 5.95
49" long, collapsed 18", increased output.
NO. 37A7—TCU 54 ..... 4.25
Heavy duty, 54", 3 section telescoping antenna. Collapses to 24".
NO. 37A8—ASP 211 ..... 2.45
42" 5 section telescopes to 9¾".
NO. 37AX—TCU 112 ..... 4.95
Deluxe ground based type antenna. Full 112" for effective radiation.

BATTERY BOXES

NO. 38A14—#2A, for 2 miniature pencells ..... .40
NO. 38A15—#5, for 1 regular pencell ..... .30
NO. 38A16—#6A, for 2 regular pencells ..... .40
NO. 38A17—#7, for 3 regular pencells ..... .65
NO. 38A18—#10, for 2 medium C cells ..... .50
NO. 38A19—#12, for 2 regular D cells ..... .50
NO. 38A20—#13, for 1 22½ volt ..... .40
NO. 38A21—#14, for 2 22½ volt ..... .50
NO. 38A22—#17, for 1 short 30 volt ..... .40
NO. 38A23—#19, for 1 long 30 volt ..... .40
NO. 38A24—#20 for 2 long 30 volt ..... .60
NO. 38A25—#130 for two E90, Mn9100, half pencells ..... .50

METAL CASES

NO. 21A8—#D1, 1⅝ x 2½ x 4" $1.40
NO. 21A9—#1, 2 x 3 x 4" 1.45
NO. 21A10—#1A, 2 x 3 x 4" 1.85
NO. 21A11—#1B, 2 x 4 x 4" 1.65
NO. 21A12—#2, 3 x 4 x 5" 1.95
NO. 21A13—#3, 3 x 5½ x 8" 3.45
NO. 21A14—#5, 7 x 8 x 10" 4.95
NO. 21A15—#6, 8 x 10 x 10" 5.95
NO. 21A16—#7, 3 x 8 x 9⅝" 5.95
NO. 21A17—#8, NEW! Sloping front design. Used in new Ace Nicard Charger kit. Measures 3 x 4 x 6½". 3.50

PLASTIC CASES

NO. 21A1—PB #1a, 1 x 1 x ⅝ ..... .05
NO. 21A2—PB #1, 1⅝ x 2¼ x 1 ..... .10
NO. 21A3—PB #2, 2 x 2⅝ x 1 ..... .15
NO. 21A4—PB #3, 3½ x 4⅝ x 1¼ ..... .25
NO. 21A5—PB #4, 1¼ x 5½ x 1¼ ..... .15
NO. 21A6—PB #5, 2⅝ x 3⅝ x 2 ..... .25

BASES, PRINTED CIRCUIT

NO. 28A4—AOSK, Add On Switcher ..... $ .50
NO. 28A5—KR1, for Kraft single receiver 1.75
NO. 28A6—K3VK, for 3 volt relayless receiver 1.75
NO. 28A7—KR6 combo, set of two boards for Kraft six channel super-regen receiver 4.25
NO. 28A8—PCB4610, RF bottom deck for 4, 6, 10 channel receiver by Kraft. Super-regen 2.25
NO. 28A9—PCT6, top board for relay deck of Kraft 6 channel receiver 2.25
NO. 28A10—PCT10, top deck for Kraft 10 channel relayless receiver 2.25
NO. 28A11—PCK10SH, for Kraft Superhet, single, 10 or 12 channel 3.25
NO. 28A12—PCKSS10, for Kraft 10 channel servo switcher, a set of two boards 4.25
NO. 28A13—WAG PC, Walt Good's TTPW Receiver with a PC base designed by Jack Campbell. Complete with a reprint of the Grid Leaks article 3.50
NO. 28A14—KT1, Kraft single channel audio trans. 3.25
NO. 28A15—KT6, Kraft 6 channel trans. 3.25
NO. 28A16—PCBX10, Kraft 10 channel triple transmitter with phosphor bronze contacts eyeletted on 11.95
NO. 28A17—PCBX10PI, Plug In pot deck for above 3.95
NO. 28A18—KSAK, Kraft servo amplifier for Duramite 2.50
NO. 28A19—Duramite switch plate for use with KSAK or KSS10, 10 channel servo switcher 1.50
No. 28A20—Annco switch plate for use with KSS10 ..... .75
NO. 28A21—TC3.6 Transmitter Power Converter 1.50
NO. 28A22—KCP, Receiver converter by Kraft ..... .50
NO. 28A23—SROP, Shows' Rudder Only Pulser 2.25
NO. 28A24—SPOD, Shows-Dickerson POD 1.50
NO. 28A25—POD2 low voltage by Broadhurst ..... .75
NO. 28A26—PRM-I Servo, Marcy Feedback Amplifier 1.25
NO. 28A27—PRM-I Receiver, Marcy Proportional Rx 2.95
NO. 28A28—PRM-I Transmitter with pulser and tone generator for Marcy Proportional System 3.95

REED BANKS

DEANS-REED BANKS
NO. 27A20—6 channel (.008 reeds) 17.50
NO. 27A21—10 channel (.008 reeds) 22.50
MEDCO REED BANKS
NO. 27A22—10 channel 75 ohm coil 18.50
NO. 27A23—10 channel 3K ohm coil 18.50
NO. 27A24—12 channel 75 ohm coil 24.95
NEW HAVEN REED BANK
NO. 27A26—10 channel, 20 ohm for 3 volt 19.95
NO. 27A27—10 channel, 50 ohm for 6 volt 19.95
NO. 27A28—10 channel, 3K ohm for 22½ to 45 volt 19.95

WHEELS, BRAKES

DU—BRO DURA - HUB WHEELS
NO. 25A23—NH1 2¼" (1¾ oz.) $2.59
NO. 25A24—NH2 2½" (2 oz.) 2.79
NO. 25A25—NH3 2¾" (2½ oz.) 2.99
NO. 25A26—NH4 3" (3 oz.) 3.19
NO. 25A27—NH5 3¼" (3½ oz.) 3.39
NO. 25A28—NH6 3½" (4 oz.) 3.59
NO. 25A29—WB-M1 DuBro Brakes, pair $7.95
NO. 25A2—RCN-1 Top flite trike gear $9.95
NO. 25A1—Top flite Tauri Nose wheel $5.95
NO. 25A21—de Bolt Retract-Gear R/C8 ..... $24.95
NO. 25A16—RC9 de Bolt Trike Gear $5.95
NO. 25A17—R/C de Bolt Nose wheel $3.95

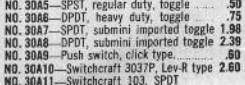
LANDING GEARS

DE BOLT FORMED GEARS
NO. 25A18—RC-4 for ¼ A models ..... .49
NO. 25A19—RC-5 for A-B models $1.00
NO. 25A20—RC-6 for B-C models $1.25
NO. 25A13—Blackwell Coil Gear $2.95
NO. 25A14—Blackwell Nose Gear $3.95
NO. 25A15—Blackwell Brake $2.95
NO. 25A30—Nutter Nose Gear $10.00
NO. 25A22—Air Span Wheel Brakes, pair $1.15

R C TANKS (VISUAL FLOW)

NO. 16A24—VF1-1 ounce $1.20
NO. 16A25—VF2-2 ounce 1.25
NO. 16A26—VF4-4 ounce 1.30
NO. 16A27—VF6-6 ounce 1.35
NO. 16A28—VF8-8 ounce 1.40

SWITCHES



NO. 30A1—SPST, slide type, knife action ..... .20
NO. 30A2—DPST, slide type, knife action ..... .25
NO. 30A3—DPDT, slide type, knife action ..... .35
NO. 30A4—4PST, tandem slide type. ..... .65
NO. 30A5—SPST, regular duty, toggle ..... .50
NO. 30A6—DPDT, heavy duty, toggle ..... .75
NO. 30A7—SPDT, submini imported toggle 1.98
NO. 30A8—DPDT, submini imported toggle 2.39
NO. 30A9—Push switch, click type. ..... .60
NO. 30A10—Switchcraft 3037P, Lev-R type 2.60
NO. 30A11—Switchcraft 103, SPDT push button red ..... .75
NO. 30A12—Switchcraft 203, as above black ..... .75
NO. 30A13—Otarion 2705, Submini US toggle, ⅜ x ¼ x ¼ inch 1.98

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CONTENTS

VOLUME 4 • NUMBER 4

G/L SPECIAL REPORT

● From Washington comes word of an event that will mean much to the radio control fan in several areas.

Beginning January 1, 1964, the application of a Citizens Band station license will require an $8.00 fee to be processed. This will give the applicant a license which will be valid for a five-year period, the same as it is now.

This was announced by the F.C.C., as part of their continuing pattern to broaden their effectiveness and their ability to work with the expanding Citizens Band operation on both radio control, which is Class C, and two-way voice, which is Class D.

Hams will be required to pay a $4.00 application fee.

Personally, we feel that this is a welcome move on the part of the F.C.C., and we think it is a move that has long been over due. Actually, when the cost is considered at $8.00 for a five-year period, it becomes a very small sum to pay for an enjoyable hobby. No one really has a valid complaint that this fee is unreasonable, or certainly that a fee of any kind is not needed.

The users of these services of the Federal Communications Commission, represent only a small segment of the taxpaying public of the United States, and therefore it is not reasonable for them to expect the taxpayers as a whole to pay for the administration of the technical end of the administration of their hobby.

The money will be used to good purpose in providing faster service by the Federal Communications Commission, as well as making sure that the services both Class C and D, and others who will be charged the fee, will be limited to the uses for which they were established.

In the long run we feel that the charging of a fee for the procurement of a station license will have a good effect. First, it has been our experience that people value more that which they pay for than that which is given them! Next, it will mean that the Federal Communications Commission will have the money and the manpower to make sure that these services are being operated fairly for all.

We believe that every reader of GRID LEAKS should welcome this move because in the end it will result in better radio control for him.

It definitely does mean that the move to get registered now gains an added emphasis over what it had previously.

So, if you want not only to be heard and registered in numbers, but want to save $8.00, send in your form 505 now! Sending it in before December 31, 1963, can insure you five years of station operation at no fee involved. If your license expires this year, renew it before the end of 1963 and the same applies.

NOTE: If your license expires in 1964, you may not renew until it is almost due to expire. The application on form 505 now is for all who have not previously had station licenses, and for those whose licenses expire during the calendar year of 1963.

So, get with it now and send in that form 505.

Paul F. Runge, Publisher

EDITORIAL

Can We Get More Frequencies?

by GEORGE WELLS

Even super-hets have proved inadequate protection against the voice transmissions of a growing army of more than 300,000 Class D licensees. Relief is not out of the question, suggests this considered appraisal.

Editor's Note—Because organized planning and action within our industry and press are almost totally lacking, GRID LEAKS enthusiastically presents this thoroughly researched article by a professional writer and public relations man who has invested much time in interviews and discussions with people who count.

MORE PEOPLE ARE GETTING into radio control, but enjoying it less. The problem is the scarcity of usable radio frequencies. The way R/C is growing in this country, we desperately need and deserve more radio space, and need it now.

The addition of five new frequency spots to the Citizens Band in 1958 gave rise to super-het equipment, which allows more experts to get in more flying time, but it has not done much for the beginner. The increasing use of the 50-54 Mc Amateur frequencies also has helped R/C, but this again is for the experts, not the beginners.

Hopefully, more frequencies will be available in the future. The question is when. It is preceded by the question how. This article is an attempt to lay the groundwork for an intelligent appraisal of the situation, and consider some factors which may affect obtaining more frequencies in the future.

There should be no question about the need. The 27 megacycle antennae are growing like weeds. Flight lines are getting too long to manage without a scorecard, and require increased alertness of the Sunday flier. Incidents of being "shot down" are occurring more frequently.

Super-hets are not immune to interference. This can be another flier on "your" frequency, improperly tuned equipment on your part or someone elses, or Citizens Band voice transmissions permissible only 10 kc away. If the super-hets are not too close to each other, certainly they are too close to the voice communicators.

Voice activities on the Citizens Band are increasing alarmingly. Until about a year ago voice interference was seldom heard on monitors checking for interference at Washington, D.C., area flying sites. Now the air is alive with conversation emanating from service trucks, taxi cabs, dad coming home from work, and just plain noise. Some is loud and clear, powerful enough to affect flying.

There are now about 300,000 licenses issued for voice communications in the Class D Citizens Band on frequencies between 26.96—27.255 Mc. This is more than the total Amateur class licenses issued. It compares with about 43,000 Class C licenses issued of the type used for R/C. Applications for voice transmitting stations are coming into the Federal Communications Commission at a rate of about 18 to 1, compared with Class C applications.

In October 1962, 1000 Class C licenses were applied for, compared with about 18,000 Class D. At the current rate, the FCC will grant as many licenses for voice communications in three months as the total licenses granted to R/C users to date. Those

Continued on Next Page

More people are getting into R/C but enjoying it less—due to the scarcity of frequencies. Here, Jim Shows, left, lends helping hand to Howard Henderson at a recent McDonnell R/C club contest at Kratz Airport, St. Louis County, Mo. At press time, we had almost 50,000 Class C's.

CAN WE GET MORE FREQUENCIES . . . continued from preceding page

flying on 50—54 Mc will be comforted to know that only 28,000 Technicians licenses have been issued, and their rate of growth is far below Class C.

The real pity of the frequency squeeze is that the beginner in R/C is the worst victim. The greatest stimulant to R/C in the last two years is the advent of tiny, transistorized, single-channel receivers, and aircraft of less than 30 in. span to go with them. It is not practical to cram one of today's super-hets into one of these little planes. Compared with super-regen, single-channel equipment, super-het equipment costs about one-third more—enough to discourage many from giving the hobby a try. If someone wants to hold down costs by building his equipment from kits, he is really left out when it comes to super-hets.

Comments like this one are coming from areas where super-hets predominate: "I sure feel sorry for the guys flying super-regen equipment. They're getting shot down all the time."

Perhaps it is unfair for modelers who have spent extra money for super-hets to sit on the ground while one operator of super-regen equipment flies. But a lot of super-regen equipment is still being sold, and it looks like it will be around for a long time. The solution will not be found in discriminating against the flier with super-regen, but in working to get more frequencies.

Unmistakably, super-het has been a wonderful development for R/C, and will continue to be vital even if more frequencies are obtained. Suppose, for example, we were able to obtain six more frequencies at least a megacycle away from those we are now using. The AMA sought this several years ago. Super-hets could continue to fly on the present frequencies, as well as the new frequencies. With 12 frequencies to operate on, there should be two or three slots for the super-regen flier at every club flying field.

The super-regen frequencies would have to be determined according to the radio activity in each community. Any new frequencies we might be allocated in the crowded spectrum would be very close to some other user. For example, if we were given permission to operate on 33.10 Mc, some areas might find an industrial user operating as close as 15 kc away, and up to 500 watts. Should this be the case, super-regen equipment would be useless on this frequency in this area, and super-het would be the only answer. The super-regen flier would have to look to another of the new frequencies which had relatively quiet surroundings in his area. Except in the four or five largest population centers in the country, several of the new frequencies should be suitable for super-regen flying.

Now, what are the chances of getting new frequencies? The FCC paints an extremely pessimistic picture. Ivan Loucks, chief of Amateur and Citizens radio, says that applications for new frequencies are coming into the FCC in bushels—and that there just are no new frequencies available. The government has locked up about half of the available frequency space. This is primarily for military uses, and the FCC has very little to say about how it is allocated. Commercial broadcasters have half of what is left, or about one-fourth of the available frequencies. The remaining fourth is divided about equally between common carrier uses such as telegraph and telephone, and what the FCC calls land mobile uses. The last category is where we fit in.

Most of the applications for new land mobile frequencies have strong backing. For example, there are seven frequencies allocated for taxi cab use, and as many as 35 cab companies in some cities. Pandemonium breaks loose when five companies try to operate on one frequency. Even as tight as the frequency situation appears to be, Mr. Loucks admits that if we were willing to make some compromises, and if our case were convincing enough, we might be squeezed in somehow. With the problems we are facing from the growth of R/C—and the growth of CB voice operation—even the slightest chance is worth our best effort.

We have obtained the frequencies we now use strictly as a result of a genuine need, and through perseverance in presenting our case. Before 1945, there was no Citizens Band, and the amount of R/C flying that was done in compliance with the law was on ham frequencies. Although the Citizens Radio Service was chartered in 1945, covering the band 460—470 Mc, not many persons rushed to take advantage of it. Difficulties were encountered in building equipment and developing technical standards, and the first licensing of Citizens Band stations on a regular basis did not take place until June 1, 1949.

Early the same year the Academy of Model Aeronautics, at the urging of Dr. Walter A. Good, pointed out to the Commission the need for frequencies for model control, and the unsuitability of the 460—470 Mc frequencies. The Academy was advised that there did not seem to be any solution other than the Amateur Radio Service. However, the Academy was granted an experi-

mental license to operate a few test transmitters on the Industrial, Scientific and Medical Devices frequency, 27.255 Mc. After about two years of testing by individuals in various sections of the country, the FCC originated Class C of the Citizens Band, and 27.255 Mc was to be used only for the radio control of remote objects or devices.

In addition to remote control of model aircraft, boats, etc., Class C literally opened the door for that greatest of all status symbols—radio controlled garage doors. Also, Class C nurtured paging receivers for hospitals, factories and the like, and that monster of all monsters, radio controlled traffic lights. A maximum of 30 watts is allowed on this frequency.

The pressure of requests from industrial users for new frequencies, and complaints of overloading on established channels forced the FCC in 1958 to set up "narrow-band" standards for land mobile services, and to reallocate some channels. The band 26.96—27.23 was taken away from the Amateurs and given to the Citizens Radio Service. The original Citizens Band, 460—470 Mc used by Class A stations was reduced in width, and tolerances increased. We retain the opportunity of operating on 465 Mc for what it is worth. Class B was modified slightly, but is still designed for users of the higher frequency equipment.

The big development in 1958 was the birth of Class D, and with it came the "Citizens Band Boom." These Class D Citizens Banders were given 22 frequencies around and among five new frequencies allocated for radio control use. As stated before, these voice frequencies are as close as 10 kc to ours. Class D stations are limited to the same power input as Class C, five watts, and while they may use the frequency 27.255 Mc, they are limited to 5 watts on that as well.

Beginning in May 1959 the number of Class D station licenses issued rose from 600 per month to the current level of more than 15,000 per month. The FCC was rightfully proud of itself for it had accomplished what it had been striving for since the Communications Act of 1934 was written, "to encourage the larger and more effective use of radio in the public interest."

But soon a fly dropped into the ointment—perhaps shot down by interference. Citizens Banders began using their frequencies for amateur-type communications and activities, including D.X. contacts whenever the "skip" conditions were right. This type of hamming was in spite of specific prohibitions to the contrary in the Commission's rules. It was encouraged, the FCC says, by misguided magazine (Not in our field—Editor) articles. As the Citizens Band boomed, more and more unnecessary mutual interference was encountered, and the FCC finally had to issue more strict rules prohibiting miscellaneous chatter and non-essential communications. Still, the FCC admits, there is some miscellaneous chatter on the air.

Early in the Citizens Band Boom the AMA could see what was going to happen to its RCers. In 1959 another presentation was drawn up with the aid of Dr. Good, and filed before the Commission. It suggested additional frequencies in the ISM band at 40.68 Mc, in the 72-76 Mc band, and certain frequencies which are used by other services but limited to low power. No additional action has been taken on this presentation, and the Commission's docket has been closed.

The strategy has been to postpone further requests until some development makes it more likely that more frequencies will be available and that favorable action could be taken by the Commission. In the ways of Washington it is better not to act than to act and be denied. Hope rests primarily on the possibility that new frequencies will be made available by shifting the "vast wasteland of television" from the broad VHF spectrum it dominates to UHF. This strategy has been given a fair trial. We have been waiting since 1959, and the shift has not taken place, nor does it seem much closer. Even if it happened next year, we have no assurances that the shift would help us, what with all the frequency applications pending.

We must act now, and the first step is to prepare our case flawlessly. As in the past, we would expect that the AMA would be the prime mover. Communications lawyers cost money, and we need a first class counselor. How AMA will finance this is a good question. At least 5000 members are RCers, and may be willing to provide some extra help. Also, all those who stand to gain from the expanding R/C business that could result may consider it a responsibility to help, too.

We have several things going for us that commercial users seeking frequencies do not. First is the FCC's interest in promoting the use of radio by as many private citizens as possible. It also supports the community service aspect of radio, namely the Amateur Radio Service. Radio control provides both. It should be in the interest of the FCC to promote radio control for its educational contribution to the nation, as well as the worthwhile activity it provides to individual communities. Certainly, industries using radio contribute to the welfare of the nation also. But they should not be given frequencies to our exclusion, nor should we expect to infringe on their requirements. The point is there is room for both. Here is why.

We need comparatively little transmitter power to operate. Our range is short, and the possibilities of our causing interference are much less than in the case of Amateur radio or other high power users. Although we are permitted to use up to five watts input on the five new Citizens Band frequencies, most transmitters on the market use far less than the maximum. Our RF-type transmitters are about 50 per cent efficient, and are putting out a half watt or less.

Several transmitters which operate on an input of 100 milliwatts have proven sufficient for some R/C applications. Because input is less than 100 milliwatts, such is considered a "low power communications device" by the FCC, and no license is required to operate it. Admittedly, a 100-milliwatt input does not supply enough margin to satisfy most fliers of large and expensive aircraft with which more range is required. This equipment does prove, however, that it is possible to fly successfully on 1/50th the power input allowed.

Our chances of obtaining new frequencies would be increased measurably if we lowered our power requirements. By adding a more efficient power amplifier stage to our present type transmitters, efficiency could be increased well above the present 50 per cent. Certainly, equipment could be designed to produce sufficient output on two watts input, and it is possible that one watt would be enough. The current all-transister reed transmitters probably fall within this range. Adding a power amplifier stage to a transmitter would not be as costly as the addition of super-het. This would be particularly true when the amplifier is incorporated into new designs for new frequencies, rather than added on to present equipment.

By reducing our input requirements to say 1.5 watts, we would improve our chances of obtaining frequencies in two major areas. One is in the land mobile category. Special radio services have been set up by the FCC in this category, and hundreds of frequencies allocated. Some are for high power operation, and some for low. Many of the frequencies are shared by several users. The following frequencies are allocated for operating handy talkie type equipment with an input of no more than three watts: Industrial Radio Service, 33.14, 35.02, 42.98, 154.57 and 154.6 Mc; Police Radio Service, 39.06 Mc; and Fire Radio Service, 33.42, 46.30 and 153.83 Mc. How often is handy talkie equipment used by the fire department or police within a couple of miles of your flying field? Do any industries use low power communications devices near your field?

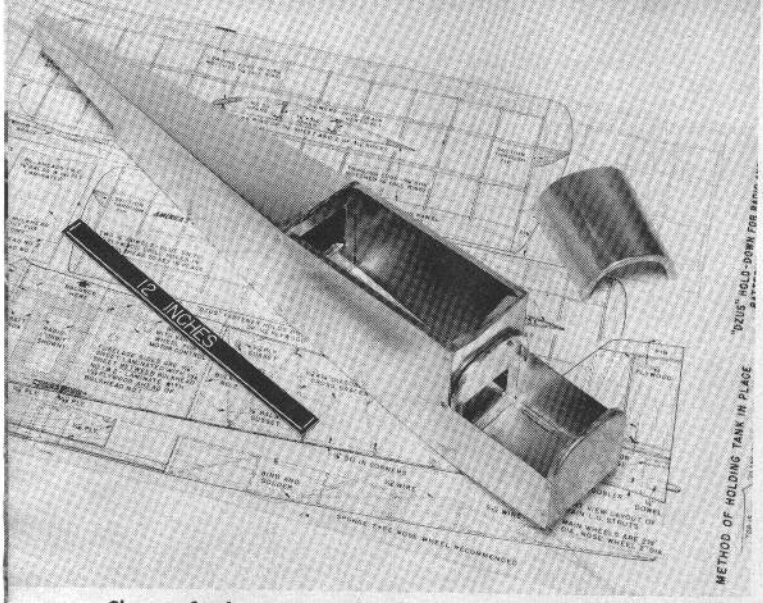
A search of the land mobile spectrum by a qualified communications lawyer should turn up additional frequencies which could be used by RCers without conflict with other users if our input were a mere 1.5 watts. The FCC probably would want us to monitor any such frequencies we might share, and to shut down if any interference occurred. It is doubtful, however, that any more interference would be encountered on most of these frequencies in most parts of the country than is presently encountered on the 50-54 Mc Amateur band. The ideal situation would be for the FCC to set up a special radio service for radio controlled devices operating on 1.5 watts or below, and provide a number of frequencies to be shared.

Another potential hunting grounds for frequencies is in the half of the spectrum controlled by the government. Many of these frequencies are quiet, being held for use in a national emergency. When activated, they will blast in with enough power to override anything we might be operating on 1.5 watts. Should this country be attacked, it probably will be too windy for flying, anyway. So far, no success has been scored in getting the government to release any space for civilian transmissions. The AMA's request in 1959 got into this area, and we should try it again. The government, and particularly its military arm, should appreciate the value of encouraging radio control as a stimulant to careers in electronics and engineering.

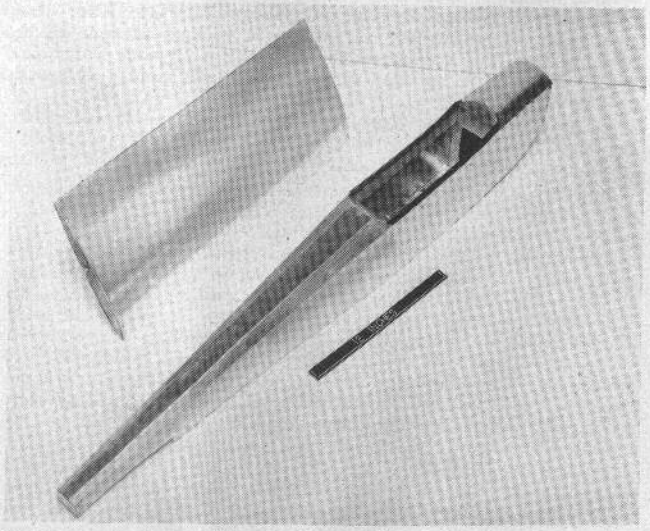
Although the FCC has no control over allocations of these frequencies, it does have representatives on the controlling body, the Inter-Departmental Radio Advisory Committee, Office of the Telecommunications Advisor, Executive Office of the White House. Requests for specific government frequencies can be made to the FCC, which will forward them to the IRAC. The military services also have representatives on this committee, and their support should be sought in accordance with the interest they already have shown in model aviation and R/C. Of course, the government spectrum should be explored for potential frequencies by a communications lawyer before any action could be initiated.

Aside from the land mobile frequencies and the government controlled spectrum, a good lawyer might turn up some other possibilities. We never have approached the FCC on the basis of such low power requirements. In the land mobile area, three watts is considered low power, and no license at all is required to operate on certain frequencies with 100 milliwatts input. Perhaps by being in between these two classifications, we could receive some special consideration.

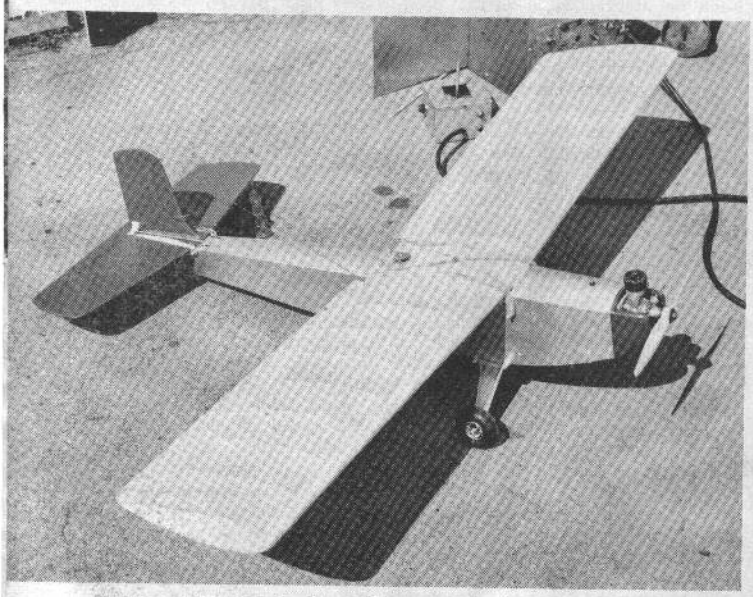
Time is of the essence. Unlike Perry Mason, a good communications lawyer cannot put a case together overnight. We could not expect action on a new petition in less than a year, and more likely two. Meanwhile, our loquacious companions on the Citizens Band continue to multiply at a rate of more than 180,000 per year, and our own breed increases by more than 10,000 per year. We need and deserve more frequencies, and the time to go after them is now. •



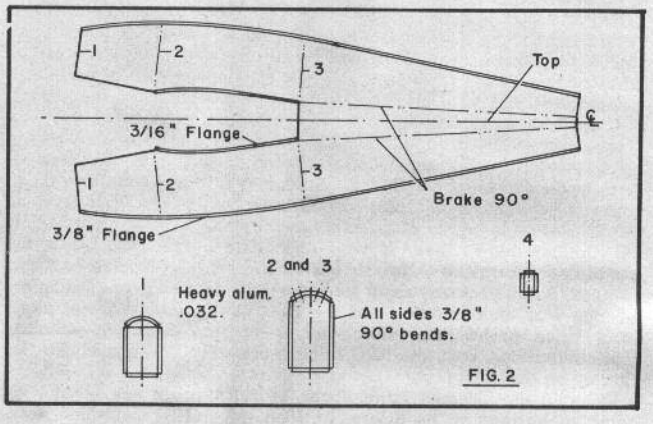
Charger fuselage was made right from magazine plan, as was the DeeBee. Aluminum is .015 thick, is easily repaired and no fuel-proofing.



Fuselage and wing panel for DeeBee multi. Only hard-to-find item is 3- to 4-ft. brake, although a homemade brake can be built from angle iron.



DeeBee with metal fuselage. Almost any fuselage can be built this way, but some will require modifications to eliminate the compound curves.



BY RUSSELL MEHRING

The old "tinsmith" claims only two, three hours for fuselage, and all sorts of other advantages for his novel construction.

All Metal Airplanes

Courtesy of the "BEEP SHEET" Greater Pittsburg Aero Society—

A FUSELAGE FOR a 56- to 60-inch wing span which takes only two-three hours to complete, needs no fuel-proofing, has an excellent appearance and finish, costs only 25 to 60 cents, is light, and is easy to repair, is almost too much to even dream about. But this article describes just such a construction project. The fuselage is made of 0.015-in.-thick aluminum and, in construction and flight, is all that it is claimed to be.

A minimum amount of equipment is needed for construction, the only hard-to-find item being a 3- to 4-foot-long sheet-metal brake. (A homemade brake could be made from angle iron.) Other items needed are metal shears, a scribe, a 3-foot scale and some riveting tools. Your author used a "Pop" rivet gun, although other rivets could be used almost as easily.

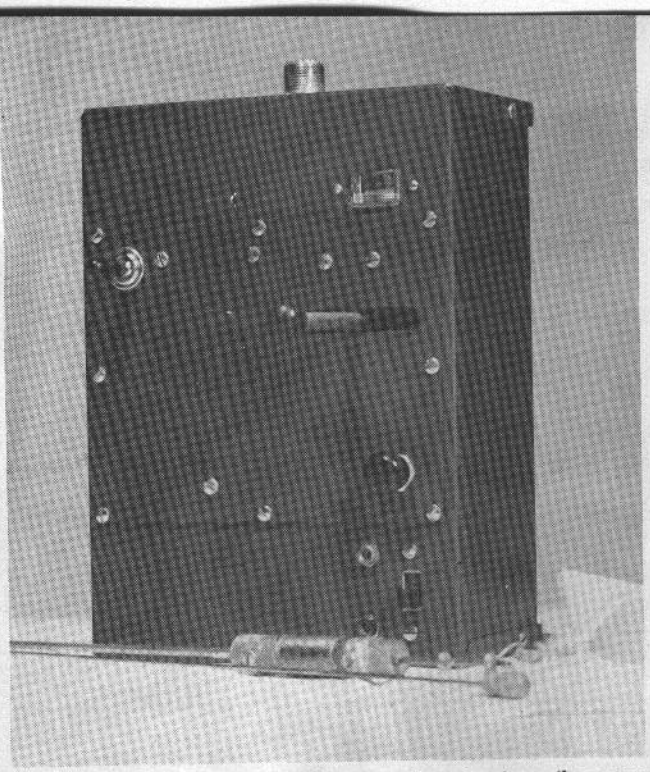
1. Begin construction by drawing a centerline on a sheet of .015 aluminum. Lay out the top back section of the fuselage from the centerline and then lay out both sides as shown in figure 1. Now add ⅜" around the bottom of the fuselage on which the wing will set. This will form a flange for future use.
2. For a round turtle back, bend the top around a curved surface by hand and then use a metal brake to complete the bending until the fuselage sides are parallel. Now bend the ⅜" flanges 90 degrees.
3. The bulkheads should be made of .015 aluminum in the conventional way, except that a ⅜" edge should be added again for a flange. It is suggested that the firewall be made of two layers of .015 or of .030 aluminum for strength. Bend the flanges 90 degrees. Then position in the fuselage.
4. Rivet the bulkheads in place by drilling as many holes as necessary and riveting onto the bulkheads' flanges.
5. Lay out bottom of fuselage off centerline. Rivet bottom into position.
6. Lay out top cowling and bend to desired shape. Cowling is held in position with sheet metal screws so that access will be had to the front compartment.
7. ⅜" balsa should be added underneath the wing flanges for reinforcing. Glue or bolt these into position. Now insert dowels.
8. Make a ⅛" plywood fuselage firewall identical to the aluminum bulkhead #1. Glue balsa nose blocks to plywood and sand to shape. Add motor—nose block assembly to bulkhead #1.

The original plane was flown with Marcy two-channel equipment and no receiver or electrical difficulties were experienced because of the aluminum fuselage.

Your author believes that almost any fuselage can be built with the described technique, although some may require a few modifications to eliminate compound curves. The Dee Bee fuselage pictured was constructed right from the plans as was the Charger. The other fuselage is my own design. •

An Adaptable Transistor Power Transmitter

Concluding a two-part discussion of superhet systems, the author presents a specially designed and proven companion X-mitter.



The assembled transmitter. Complete control section is easily removable for replacement by another, allowing construction of basic RF unit.

by DICK JANSSON

NOW THAT SO MANY MODELERS are using hand-held transmitters we discover one flaw that was not present with many ground-based transmitters, namely, being easily adaptable to a variety of control systems. With a ground-based unit a simple change of control box would suffice for a system change.

The following description will cover a transistor transmitter, Fig. 1, that overcomes many shortcomings of many present hand-held units. It has a complete control section that can be easily removed and replaced with another, allowing the construction of a basic RF unit usable for almost any radio control scheme.

Previous effort by this writer (GRID LEAKS, May-June 1962) was quite successful, but it used a fairly expensive germanium transistor. This transmitter uses a silicon transistor costing only $2.06 in small quantities (price based on early 1963 lists). In addition the silicon transistor is more stable and less sensitive to temperature effects while delivering more power.

Circuit design for this transmitter follows in line with the successful earlier precepts: a grounded emitter overtone oscillator at 27 MC followed by an un-neutralized grounded base power amplifier. Modulation methods have to be employed that will minimize the effect of peak current on the batteries. Consequently, the current drain and RF power is held at low values during tone-off conditions, but allowing the essential peak powers when needed with tone on during modulation. Due to the basic nature of the grounded base final amplifier the RF power used to drive the final also appears at the antenna, a bonus in power output but a hinderance in that 100% modulation is not necessarily achieved with the modulator used. This does not bother a superhet receiver at all, the deviation from 100% modulation being small. Super-regenerative receiver systems, on the other hand, may be affected by the modulation. Data on super-regen receiver performance with this transmitter is not available as it hasn't been tried.

Power output measurements are difficult to make owing to the nature of the antenna system used. Short length whip antennas are efficient if they are center loaded and tuned, forming a ½ wavelength system instead of the conventional ¼ wavelength used on ground based antennas. They are therefore high input impedance and voltage driven rather than low impedance current driven systems. Output stage tuning is appropriately adjusted for this type of antenna, the tuning being completely changed if a low impedance resistive load is used to measure power output. Other less quantitative methods indicate that this transmitter has one whale of an output.

Two arrangements for the power supply have been tried and are shown in Fig. 4a, 4b, and 14. Dry cells have lower initial cost and have good operating life, while the nickle cadmium supply has a high initial cost but can be recharged and used for about as long as I'll be flying models (a good many years), at the cost of a 10 ma. trickle charge when not being used.

In following the article in the May-June 1963 issue, dealing with a Class I superhet control system, the control section shown here is adjustable for a 3600-cps tone pulsed at about 20 cps with a variable pulse width for proportional servo control. There is no reason that this overall system be limited to a single channel; in fact, work is presently underway on multiple control channel systems using the outlined building blocks. Many other control sections can be designed and published in GRID LEAKS, governed by modelers' responses.

The basic tone generator-pulser circuits are well tried transistor multivibrators (MV): a low rate MV with a control stick and trim pot to vary pulse width, coupled with the use of transistor switch to pulse a tone MV whose frequency is stabilized with the same tuned network components as used in the receiving end. A two-transistor switch, AC coupled to the tone generator, is used to modulate the power supplied to the RF final amplifier.

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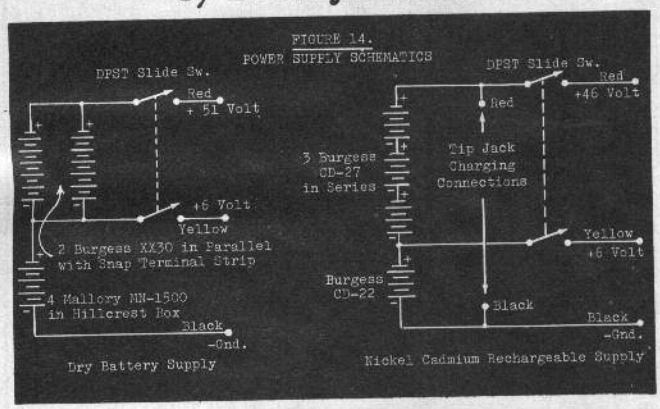
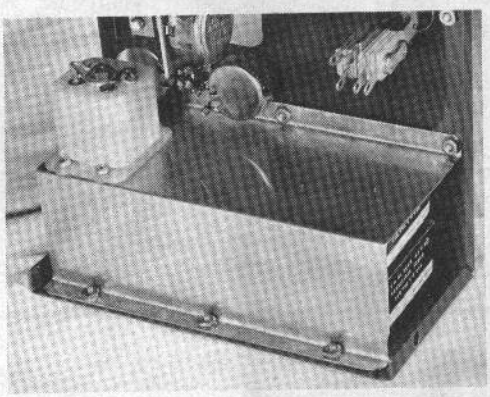
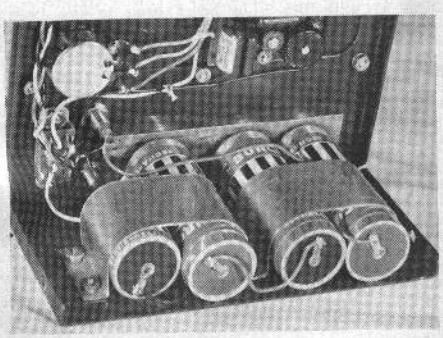


Two Types Of Power Supply

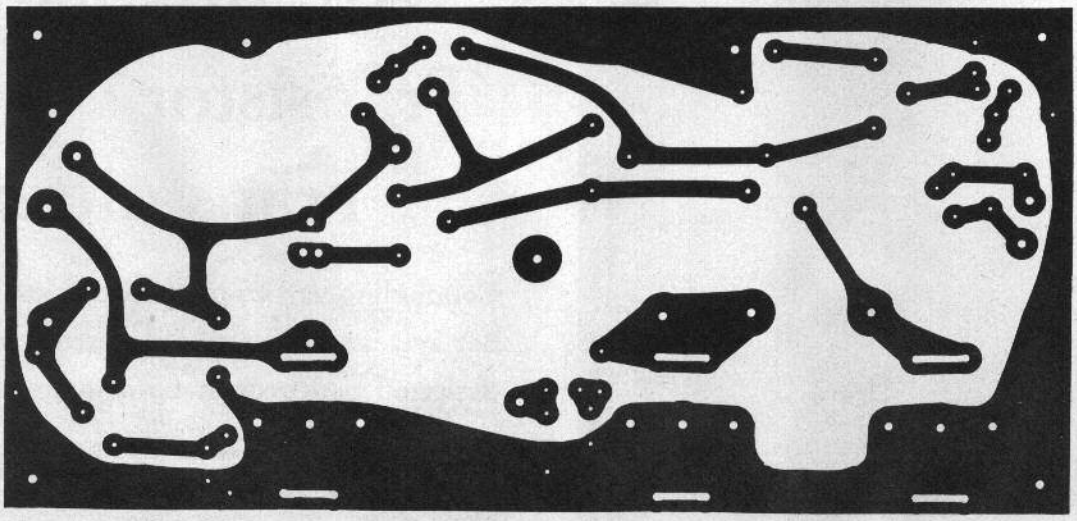




Above—Dry battery assembly, one of 2 arrangements for a power supply.

Left—Nickel cadmium battery assembly. A 10ma ground-time trickle charge.

ACTUAL SIZE



Assembly–RF Printed Circuit Board

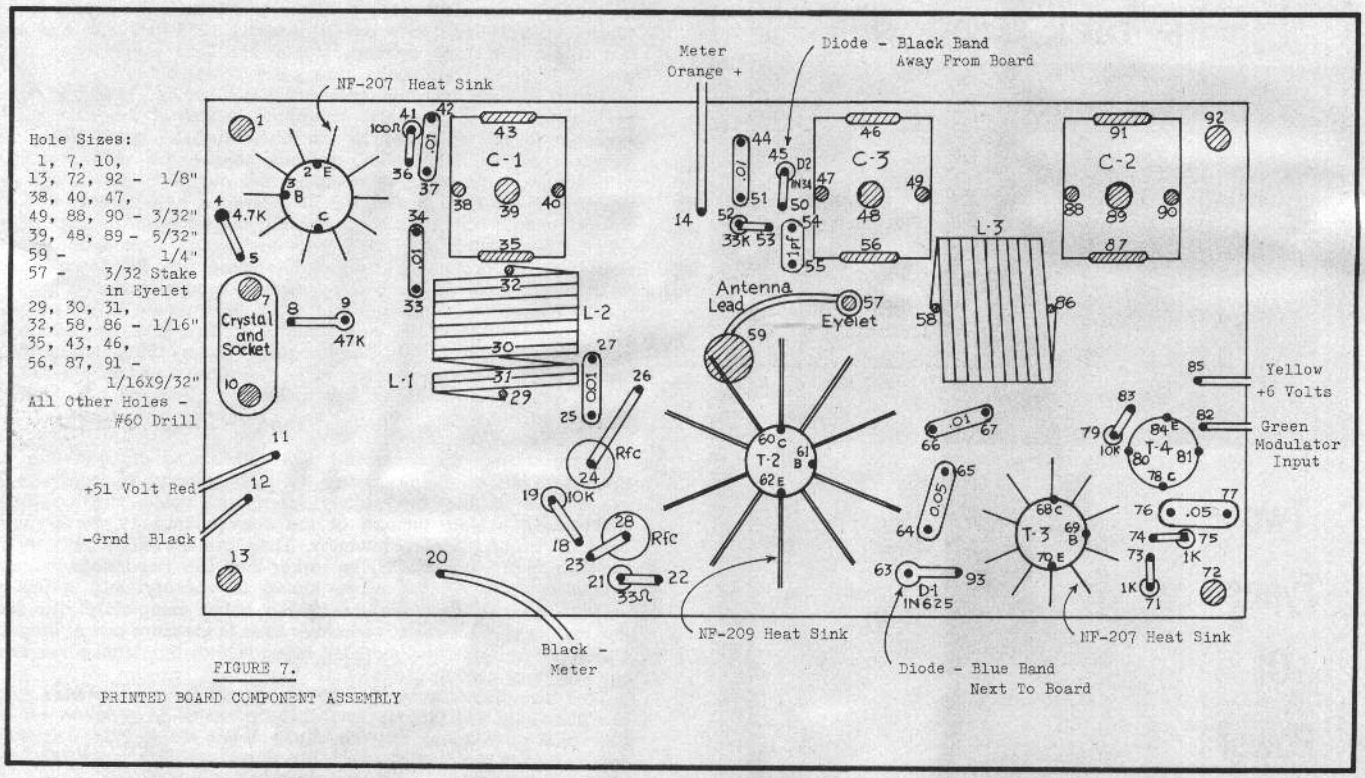


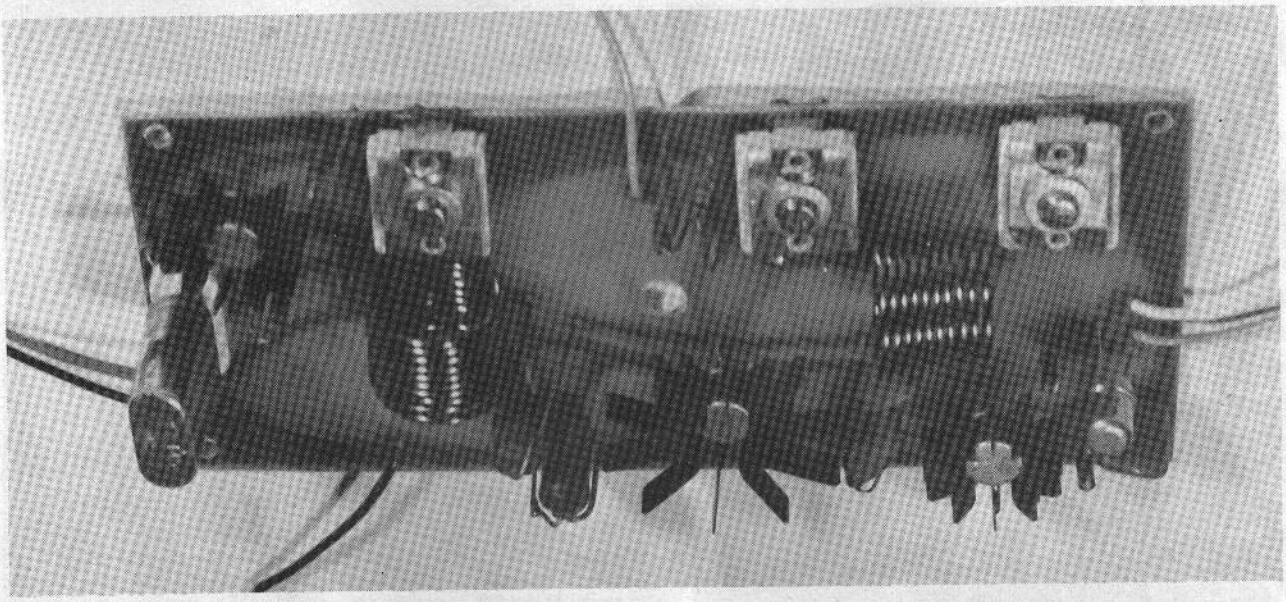
FIGURE 7.
PRINTED BOARD COMPONENT ASSEMBLY

Fig. 2, 5, 6, and 7 describe the assembly of the RF printed-circuit board. The following procedures outline this assembly:

1. Stake eyelet into hole 57 and solder.
2. Place C_1, C_2, and C_3 in their proper holes. Be sure the capacitor plates just under the screw-head are placed next to the edge of the board. Completely solder all tabs and locating pins. Clip off excess tab length.
3. Solder crystal socket tabs in holes 7 and 10 while holding ceramic body close to board.
4. Bend ends of L_1, L_2, and L_3 at right angle to coil cylinder, scrape wire ends bare and solder in holes shown.
5. Solder six 0.01-mfd capacitors, two 0.05-mfd capacitors, and the 1-pfd capacitor.
6. Solder resistors and two chokes.
7. T_4 can be either a 2N224 or a T2516, the differences being outlined in the past article. Solder T_4 with the collector and emitter in holes 78 and 84 respectively, placing the base in either hole 80 or 81 depending on transistor type.
8. Solder D1 over hole 45 with the black band nearest the lead doubled over into hole 50.
9. Solder D2 over hole 63 with the blue band next to the board, the other lead doubled over into hole 93.
10. Snap the heat sinks on the 2N697 transistors for T_1, T_2, and T_3 space transistors ¼ inch from board and solder.
11. Solder the #24 Awg. insulated leads to holes indicated, following the color coding.
12. Solder a 3-inch lead to the SO-239 antenna connector mounted in the case, feed lead through hole 59 and solder to the eyelet at hole 57 after the board is mounted to the case with ⅜-inch-long tubular spacers over 4-40 x ⅝ long screws in holes 1, 13, 72, 92.

Fig. 3, 8, 9, and 10 describe the tone generator-pulser needed to operate the superhet system presented previously. A few assembly steps are outlined below:

1. Insert the miniature Centralab tone adjustment pot into the board, anchor the studs with the nuts supplied and solder the tabs.
2. Unsolder the Rameco SMTF filter leads from their posts, remove filter from its board and remount over hole 80. Solder filter leads in holes 78 and 79.
3. Solder the four blue Ajax capacitors.
4. Solder the two 6-mfd capacitors observing correct polarities.



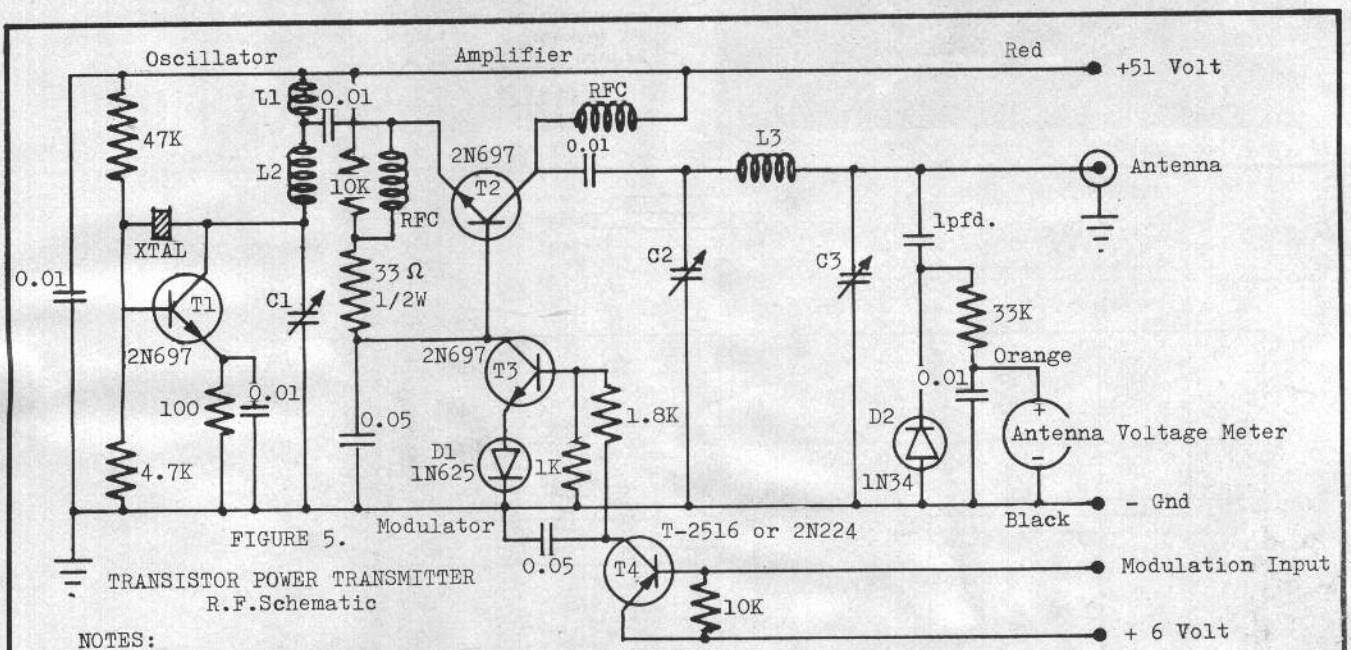


FIGURE 5.
TRANSISTOR POWER TRANSMITTER
R.F.Schematic

NOTES:

1. All resistors 1/4 watt except as noted.
2. All capacitors disc ceramic in mfd except as noted.
3. All coils #16 AWG FormVar 5/8" I.D. close wound; L1 - 2t, L2 - 8t, L3 - 10t.
4. RFC - 70 mhy - Ace.
5. Meter - Lafayette TM-12.
6. Xtal - 27 mc 3rd overtone - Ace.
7. Xtal socket - Miller 33302 or equiv.
8. Transistor heat sinks. Wakefield Engineering, Wakefield, Mass.
   T1 & T3 - type NF-207, T2 - type NF-209.
9. C1 & C2 - Arco 464, C3 - Arco 463.
10. T1, T2, T3 - 2N697 - hfc = 50 min. w/ Ic = 0.05 amp, Vce = 3 volt.

VCE (SAT) = 0.20 volts max. W/Ic-0.005 Amp, Ib = 0.6ma.

5. Solder the remaining capacitor and resistors.
6. Solder the five transistors.
7. Attach the insulated #24 wires as shown.
8. Mount board on ¼-inch-long tubular spacers over 4-40 x ½ long screws to the control panel through holes 1, 81, and 82.

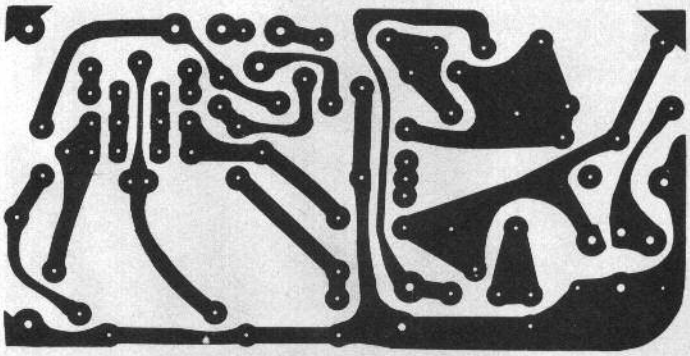
Case assembly, parts shown in Fig. 11, 12 and 13, is conventional, using 4-40 x ¼-long screws and nuts except for the meter and the PC boards previously noted. The meter is held with two 2-56 x ⅜ screws; the nuts should have one side filed flat nearly to the threads. Install the desired power supply and brackets, the DPST power switch, the SO-239 antenna connector, the RF PC board and wiring. Control panel assembly, consisting of a Pro-Trol stick and pot unit, trim pot, lever switch, and tone generator-pulser PC board, is attached to the case and wiring is completed. Mounting the Pro-Trol unit is accomplished by shortening the mounting plate and clamping with the potentiometer nut to the bracket in Figure 12. Take time to do minor adjustments of this assembly to get free operation and no-play stick centering. Pro-Trol limit stops should not be used as the control panel cut-out performs this function.

A slight modification of the lever switch is needed for this circuit. Bend the fixed contact leaf nearest the switch frame in the upper section (operated by lever down or idle engine command) to come in contact with the center moving leaf. This change will give the closed contact needed for pulsing operation and will be opened by lever down motion, but stay closed in center or up positions.

With an ohm meter check the end resistance of the control pot with the stick at its travel limits, adjust the pot shaft until these resistances are equally low in value to insure symmetrical rudder control. When checking the transmitter with the receiving unit, verify the stick (and trim pot) travel directions with the rudder movements; if they are reversed, then a simple swaping of the respective pot end wires will change the operation.

A successful center loaded tuned ½ wavelength whip antenna was detailed in May-June 1962 issue. Since success is not to be knocked, the same antenna is used here and detailed in Fig. 15 and below:

1. Small wooden knob to keep you from lancing your fellow modeler.
2. 1/16 OD music wire.
3. Slight bends in wire to provide a tight slide fit in lower brass tubing.



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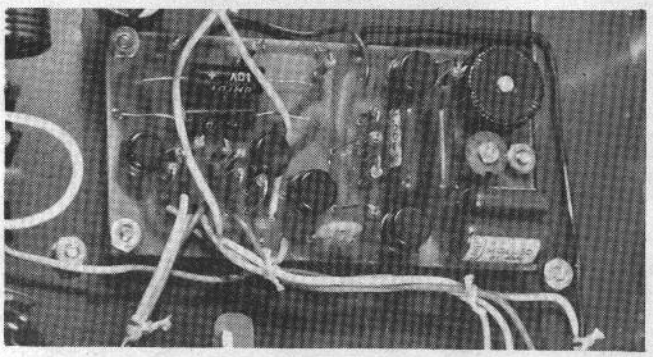
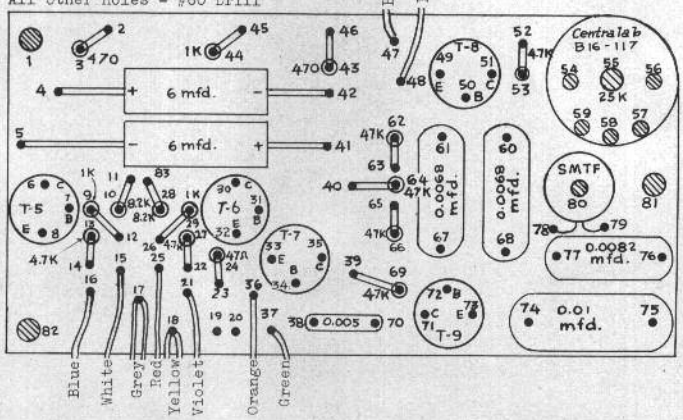


Hole Sizes:
1, 81, 82 - 1/8"
55 - 3/16"
54, 56, 57, 58, 59 - 3/32"
80 - 3/32" C'sink or Copper Side 3/16"
All Other Holes - #60 Drill

FIGURE 10.
TONE GENERATOR-PULSER



The tone generator and pulser assembly is shown in the photo – left. Above is the schematic for this unit and, top left, the actual size PC board. Basic tone generator-pulser circuits are well-tried transistor multivibrators, a low rate MV with control stick and trim pot to vary pulse width, coupled with a transistor switch to pulse a tone whose MV frequency is stabilized with the same tuned network components as used in the receiving end.

TONE GENERATOR PULSER

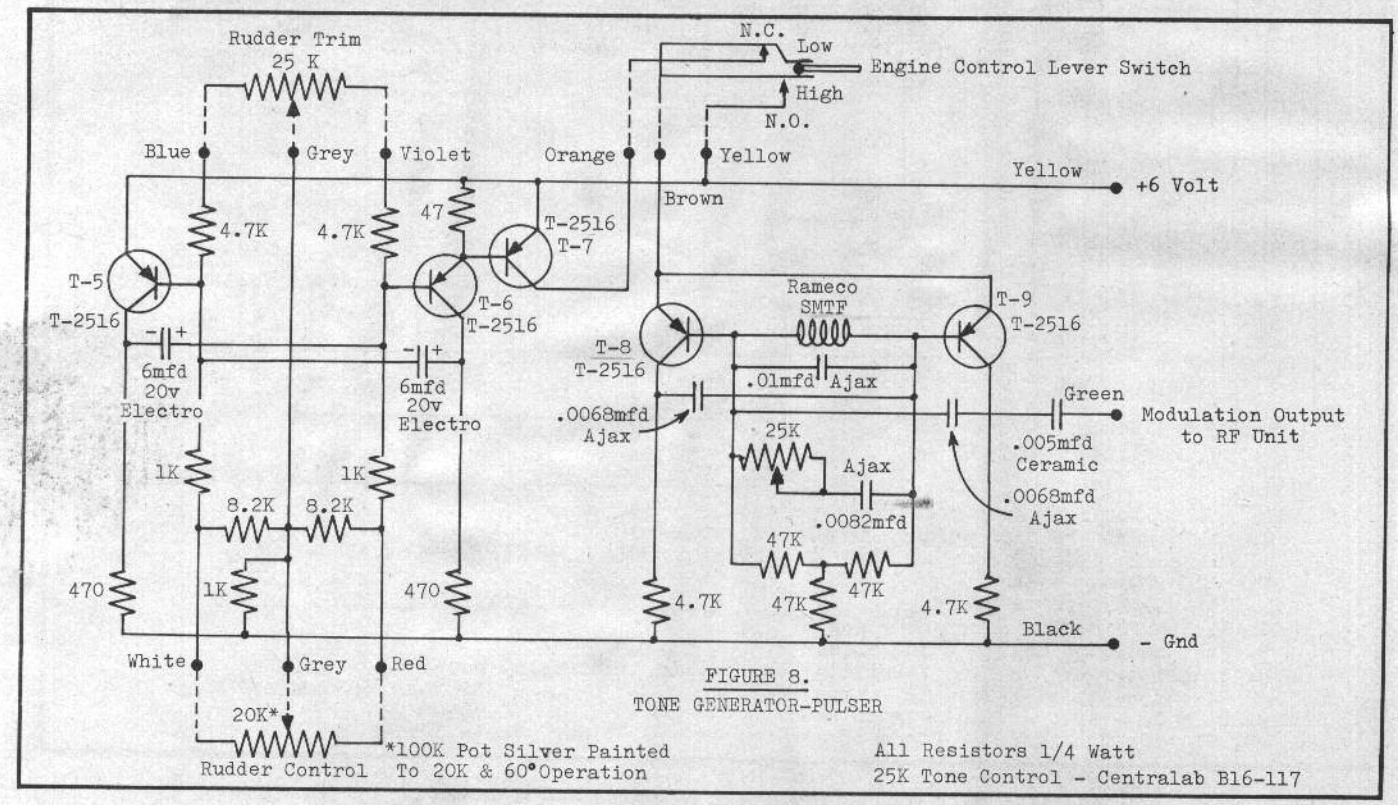


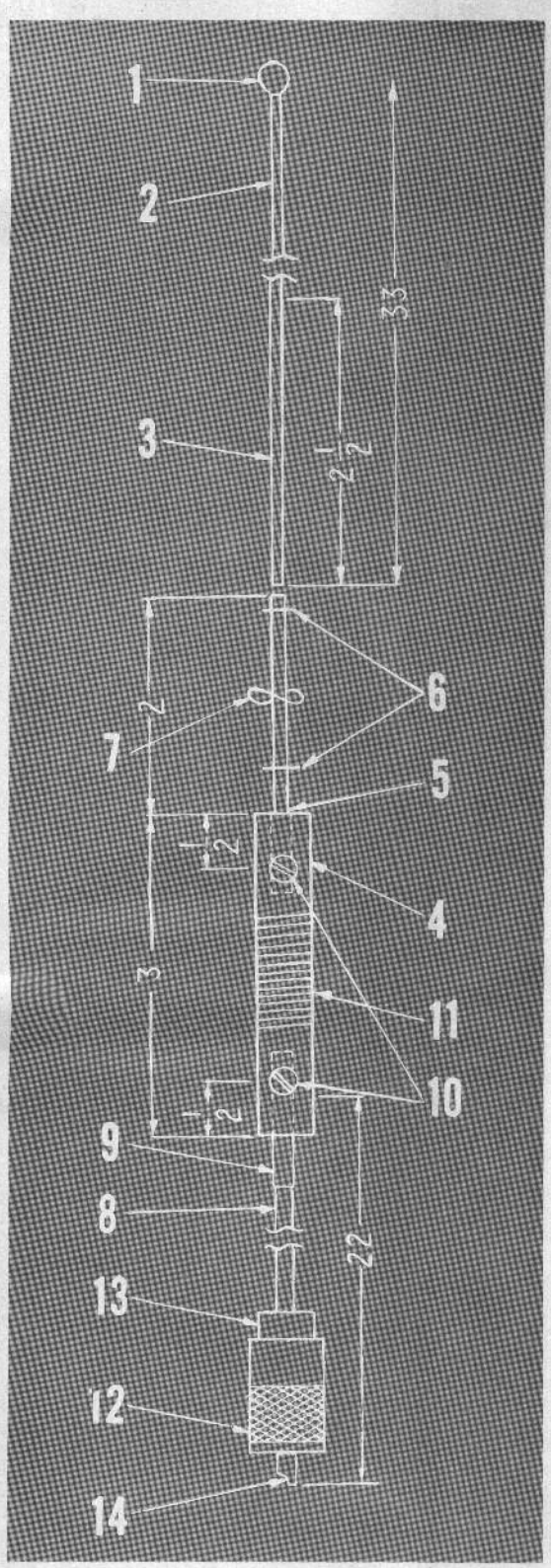
FIGURE 8.
TONE GENERATOR-PULSER

4. ½ inch OD polystyrene rod to support antenna sections and loading coil; bore each end with a 5/32 inch drill, ¾ inch deep.
5. Nest together and solder brass tubing 5/32 OD x ¾ long, ⅛ OD x ¾ long, 3/32 OD x 2¾ long, and insert into (4).
6. Small flat washers soldered to (5) to retain wind flag.
7. Wire loop to hold wind flag.
8. ⅛ OD music wire.
9. 5/32 OD x 1¼-long brass tubing soldered to (8) with ⅜ inch of tubing overhanging wire; insert into (4).
10. Drill and tap for 4-40 screws through both polystyrene rod and brass tubing.
11. 35 turns of #22 magnet wire close wound (allow one turn additional on each end to wind off and meet the 4-40 screws); connect coil ends under screw heads. Cement coil to (4) after winding.
12. PL-259 coax connector.
13. 24/32 OD polystyrene rod ½ inch long bored with ⅛ inch drill; push on to (8) and into top of (12), cement.
14. Ream out contact of (12) with ⅛ inch drill; insert and solder (3).

For the advanced electronics builder who can obtain the use of a grid-dip meter, a check of the antenna free-space (disconnected from the transmitter) resonance at 27 MC can be made, although it is not absolutely necessary.

Tu ning procedures are not complex and require only a plastic screw-driver, but they must be done carefully in order to derive the maximum performance. The procedure outlined below presumes that a careful check of all connections and assemblies has been made. Also plug in a crystal of the proper frequency; it just won't work if you don't.

1. Connect the full antenna and remove the case rear cover.
2. Back off the adjustment screws of C_1 three turns, C_2 one turn, and C_3, ¾ turn.
3. Place a 50-milliampere meter across the +51-volt terminals of the power switch. The reading is oscillator current. Adjust C_1 for minimum reading (about 15 ma to 20 ma) or "dip" indicating oscillator drive; remove meter after adjustment.
4. Operate power switch on.
5. A careful ear turned toward the transmitter should detect a pulsed tone sound.
6. Adjust C_2 for a maximum antenna meter movement.
7. The adjustment of a pie-section tuned network output stage is a process of repeated trial-and-adjustment to obtain the maximum output.
8. Reset C_3 in very small increments. For each small adjustment of



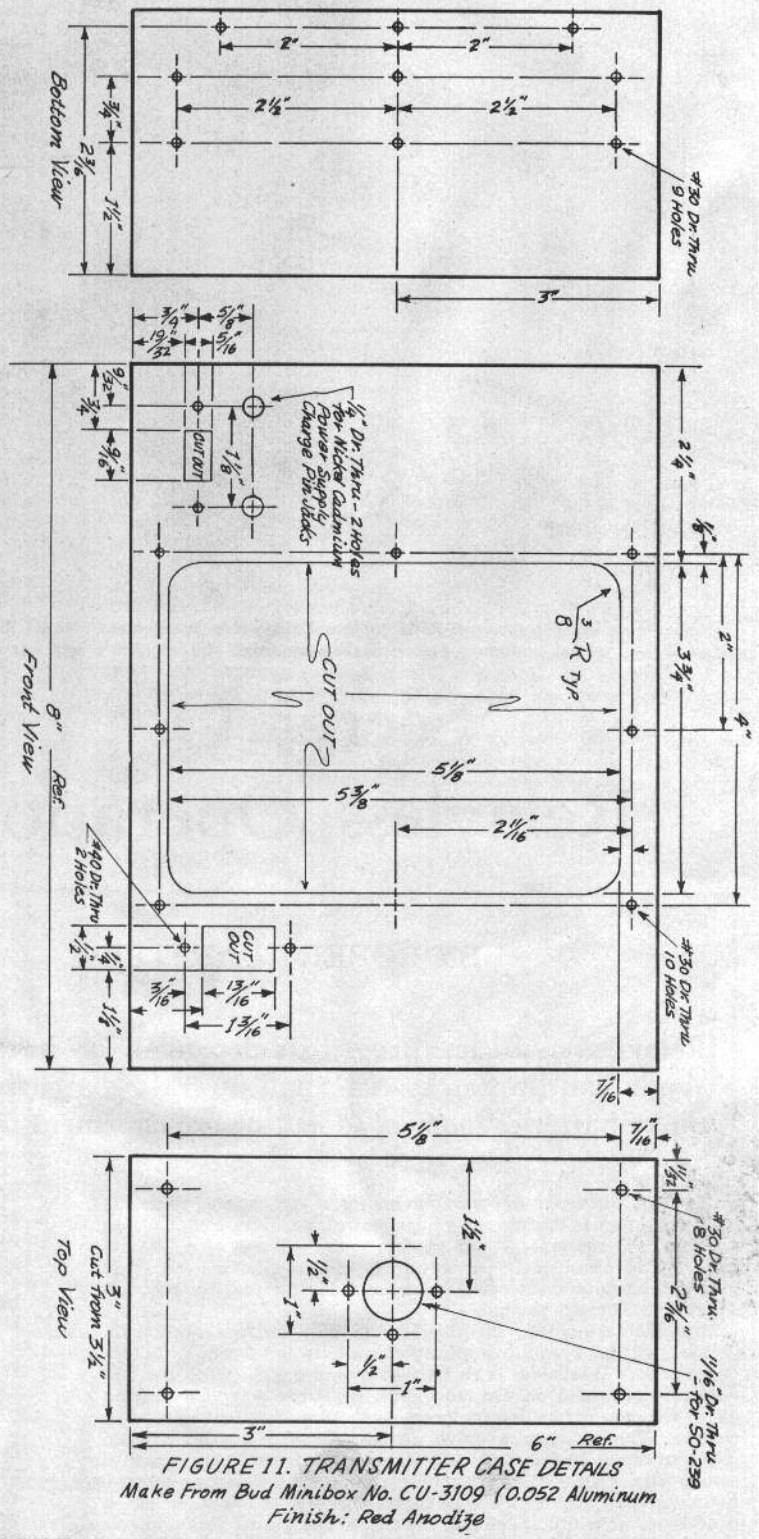


FIGURE 11. TRANSMITTER CASE DETAILS
Make From Bud Minibox No. CU-3109 (0.052 Aluminum
Finish: Red Anodize

MORE DETAILS OF X-MITTER CASE – SEE PAGE 16

C3 the meter should be peaked by tuning C2.

9. With a given setting the meter will reach its highest deflection, somewhere between ½ and full deflection. The meter will also dither slightly due to the pulsed modulation.
10. Recheck oscillator capacitor C1, turning for peak output.
11. Switch power on and off several times to insure proper oscillator starting; readjust C1 slightly off peak to insure instant starting.
12. With the receiver system tuned, and transmitter on, hold control stick to the full rudder direction giving maximum tone-on pulsing. Adjust the miniature tone control pot (mounted on the PC board) until full rudder response is achieved.
13. On either side of this optimum tone adjustment the rudder will have less than full deflection, and will even fail-safe. Insure correct tone adjustment.
14. Bringing the transmitter near an operating broadcast receiver will allow a monitoring of the transmitted tone pulses.
15. Reassemble the case rear cover and thoroughly check the receiver system and transmitter operation.
16. Final tuning and frequency of operation should be checked by a commercial radio operator, equipped with precision frequency measuring instruments, to insure compliance with FCC regulations.

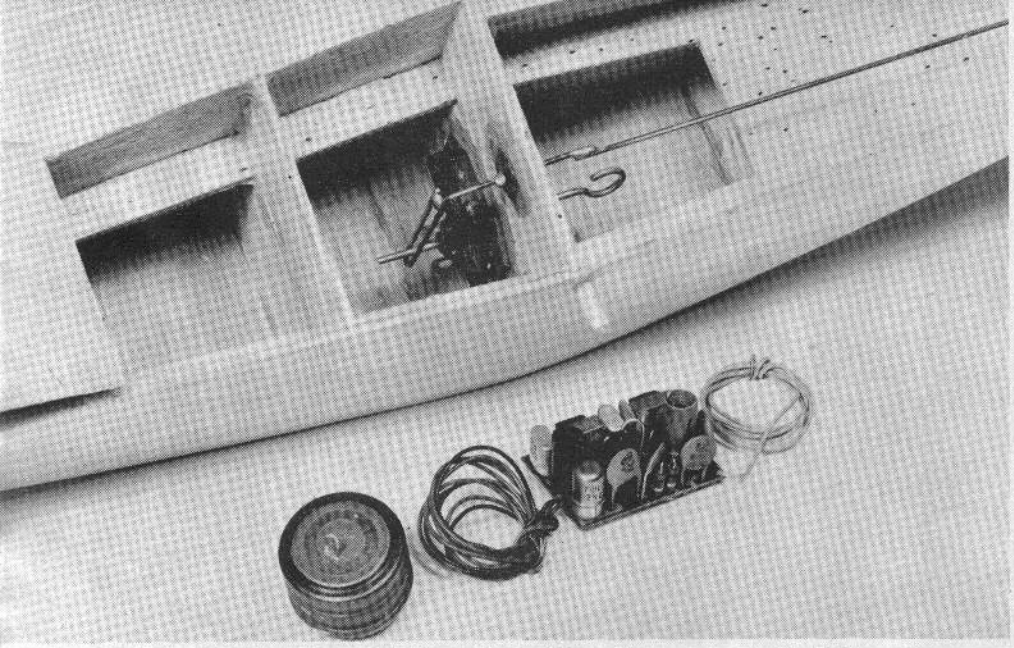
While the instructions given here and in the previous article are not necessarily complete enough to allow a beginner to build this system, it is hoped that they will permit the average modeler an opportunity to fly a highly reliable and sophisticated control that will not be outdated by any rules changes. It will stack-up against any equipment that can be installed in a Class I model.

At the time of writing the Part one article, the only practical feedback servo available was produced by Space Control. Since then several other servos have been shown.

The B & D system shown recently in *Model Airplane News* has a servo much like the Space Control Units. Thus, the B & D servos can be used directly with this system provided the reference potentiometer is connected separately to the receiver battery and not to the servo battery.

Don Steeb of Rochester, N. Y., builds a servo for the Sampey Multiplex system that is potentially applicable. Although compatibility tests are not yet complete, it appears that modification of the servo reference potentiometer and resistors will be needed.

This writer has just begun working on a feedback servo arrangement utilizing a Bonner Duramite. All of the "bugs" here not yet been removed, although results look promising. •

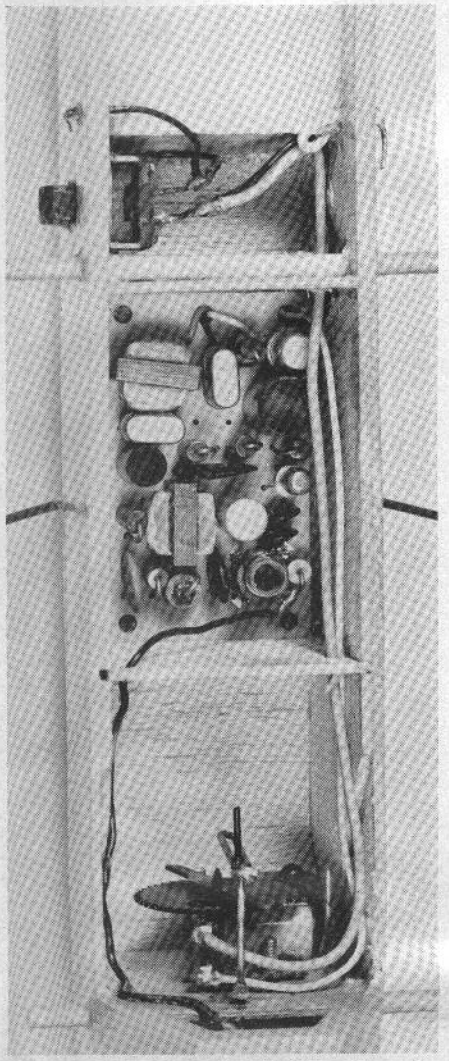


Relayless rcvr in .010-powered Pinto with a Citizen-ship escapement. Model flies well. Alkaline and nickel cadmium batteries recommended, tho all rcvr's will not take latter.

Secret Of Relayless Operation

BY ROBERT PARFITT

Relayless multi has proved its dependability but relayless single can be finicky. In small aircraft the current from dinky batteries requires exceptional escapement technique.



Bonner SN escapement installed in a Nomad. Antenna should be kept away from metal rod.

ONE OF THE MOST important items for single-channel relayless operation is the proper adjustment of the escapement.

Tuning the receiver: I highly recommend the use of a 300-ma. meter in the escapement power supply circuit. I have used a tini jack and tini plug on over 90 flights on a Mambo and Snapdragon 44 with no difficulty to date.

Tune the receiver by inserting meter. Turn on receiver switch. Current will be irregular and anywhere between 5 ma. to 20 ma. going to zero if receiver is on frequency and steady when the CW (carrier) is turned on. On most Kraft receivers with the antenna off a distance of six feet is good. Less than five feet you have trouble. With antenna mounted on the transmitter but collapsed, check at about 50 feet and tune slug for maximum current with a steady signal from the transmitter; about 280-310 ma. is normal. Keep moving further away, checking every 100 feet or so. A good receiver will pull 250 ma. or more at 200 yards. This depends on many things which will be explained.

First let us look at a basic relayless circuit such as the K3VK and see what is going on. (See Fig. 1.) Current flows from the negative side of the battery through the escapement winding then through the transistor to the positive side of the battery. Therefore we are dropping voltage at three places:

1. The battery, due to internal resistance. As the battery capacity is reduced the internal resistance goes up.
2. The escapement winding.
3. The transistor.

As a general rule the voltage drop across the transistor is about .8V and the escapement will be about 2.2V with a 3V power supply. Now if we use a voltmeter and measure the escapement drop we can tune the reciever, but how accurately? Well, this is a matter of opinion. I prefer the meter where I can watch the current change as little as 4 or 5 ma. Voltage-wise this change cannot be seen with most voltmeters. When your helper has the transmitter at a sufficient distance, so that the tuning slug can be moved slightly either left or right and the current drops off, you are then approaching maximum ground distance for your receiver. With most Kraft single receivers this is approximately a *minimum* of over 50 yards with antenna in and transmitter on low power; over 300 yards with antenna extended and transmitter on low power.

I have not retuned my Kraft receiver for over eight months; but be sure to distance check it before each flying session. Another hint! Watch the current when the signal is held on for, say, 10 seconds. If the current should start to decrease steadily after two to five seconds look for weak batteries.

We can now approach the *secret to good reliable single channel relayless* flying. The answer is the escapement. The hottest receiver will not pull in the escapement and give us the desired control unless the escapement is properly adjusted. Taking a new escapement out of a factory box will guarantee nothing. The last 10 new escapements I checked pulled in at 275 to over 400 ma. with a 3V supply on ¼ rubber. Most Babcocks escapements will run 6 to 9 ohms internal DC resistance, and with only 2.2V drop at, say 8 ohms, this only gives a maximum of 275 ma.

$$(I = \frac{E}{R} \frac{2.2V}{8 \text{ ohms}} = 276 \text{ ma.})$$

How then can we expect this escapement to operate? It's impossible! Here again I have used both the Bonner and the Babcock in a Mambo and Snapdragon and in over a year neither escapement has been out of the plane. Only new rubber has been installed plus batteries.

Both escapements would not operate with relayless receiver when purchased. With a relay type receiver we have more voltage available at the escapement as no voltage is dropped across the relay contacts, therefore we could theoretically draw $I = \frac{E}{R}$ or $I = \frac{3V}{8} = 375$ ma. If we are lucky and have a 6-ohm escapement we could draw .5 amps. with a 3V battery supply. One or two ohms on an escapement can make a world of difference. I select the one with the lowest DC resistance for relayless work.

To insure proper operation set the Bonner compound to pull in

at approximately 170 ma. with a fully wound ¼ rubber. Set the Babcock to pull in at 180-190 with a fully wound ¼ rubber. The escapement should drop out at a current reading higher than the receiver idle surge current with transmitter off. This obviously is to prevent escapement operation when the receiver is turned on and, more important, if we are flying and give a signal just as the plane flies out of range (or we lose our transmitter signal) the idle current will not prevent the escapement from dropping out. Thus another unexplained spiral dive in the ground. Further, I use a diode across the escapement. (Fig. 2.)

Normal drop-out runs 40 to 60 ma., but with some escapements, 35 ma. is the best I could get. Relay and escapement adjustment has been covered in previous editions of G.L.; however, a few points to remember or to help the beginner: set the escapement up on the bench to check and adjust. (Fig. 3.)

Two things control the pull-in and drop-out current of any relay or escapements:

a. The spring tension.
b. The armature to pole distance.

First let's explain the spacing, as the spring tension should be obvious to everyone. (See Fig. 4.) From this crude drawing it is readily seen that the closer the armature is to the pole piece (where the field is stronger) the less current is required for the escapement to pull in, and less current will hold it in. Also, the more current for a given winding the stronger the field will be.

This is the reason some modelers prefer 4.5V on the Babcock rather than 3V. If proper adjustments are made this is not necessary.

The following should be easily understood:

	MA meter *reading*	MA meter *reading*
Spring tension	pull-in	drop-out
Increased	rises	rises
Decreased	lowers	lowers

	MA meter *reading*	MA meter *reading*
	Amature to Pole Spacing	
Increased	rises	rises
Decreased	lowers	lowers

DO NOT MEMORIZE THIS! Understand it! Now all (the all covers a lot of territory) we have to do is balance the above forces and we are in business.

In conclusion let's adjust a typical escapement just purchased from your dealer.

On our test set up we decrease the pot resistance and check our current until the escapement pulls in. (We will use 250 ma. for discussion.) Now lower the current slowly until drop-out. Let's assume we get 50 ma. drop-out. If we lower spring tension to 180 ma. the drop-out will be about zero, but if we decrease pole to armature spacing, less current will be required due to the stronger electro magnetic field for pull in—yet, at the same time, the field will hold the escapement in with less current. The only answer is to decrease pole-armature spacing (don't let them touch each other) for a low pull-in, then increase spring tension to raise both the pull-in and drop-out. Whenever the armature to pole spacing is changed it will in most cases be necessary to adjust the release arm by bending or filing it. But go easy.

A final word. Don't expect to do this in five minutes. I've spent as much as three hours on one escapement. However, only a properly adjusted escapement is trouble free. Further, use small needle-nose pliers, tweezers, etc. Above all, take your time and analyze the action required, based on your meter reading before you start bending springs, etc. If you mess up an escapement, but learn its operation and adjustment, you have spent $8.00 wisely.

Should the pull-in and drop-out be adjusted properly, but the escapement slips, sticks, or misses, check the release arm contact and cam wheel, as in most cases adjustment or cleaning or alignment is necessary. •

FIG. 1

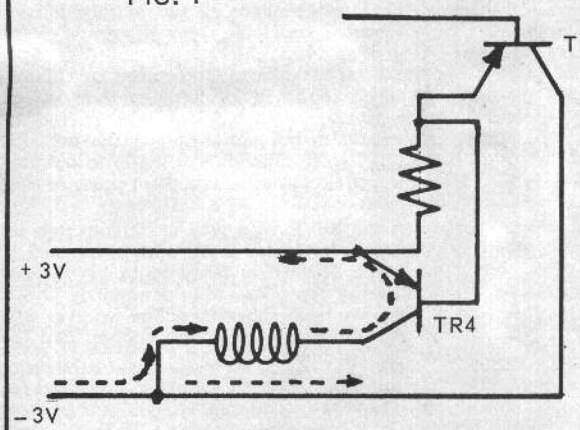
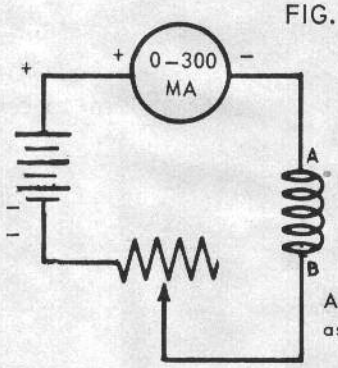
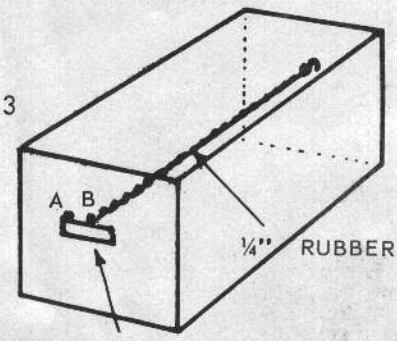


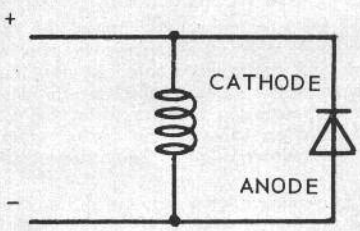
FIG. 3





Any 100 to 1 K ohm pot. 100 preferred as it alows a more accurate adjustment.

FIG. 2



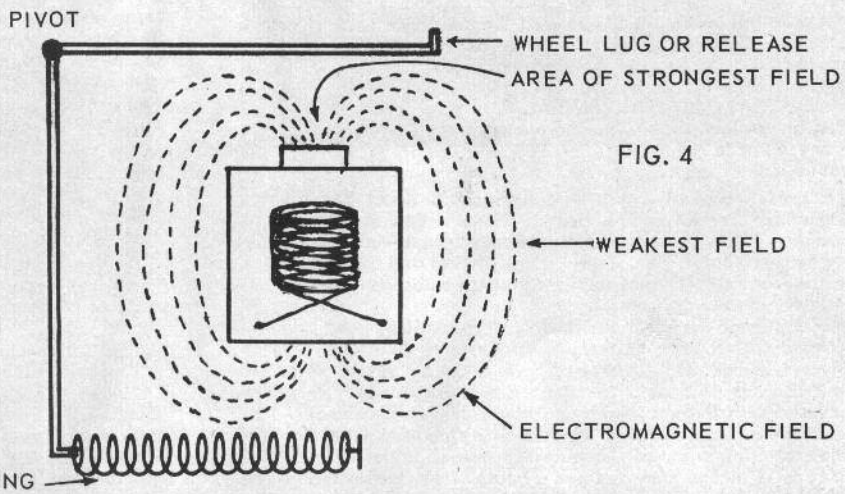
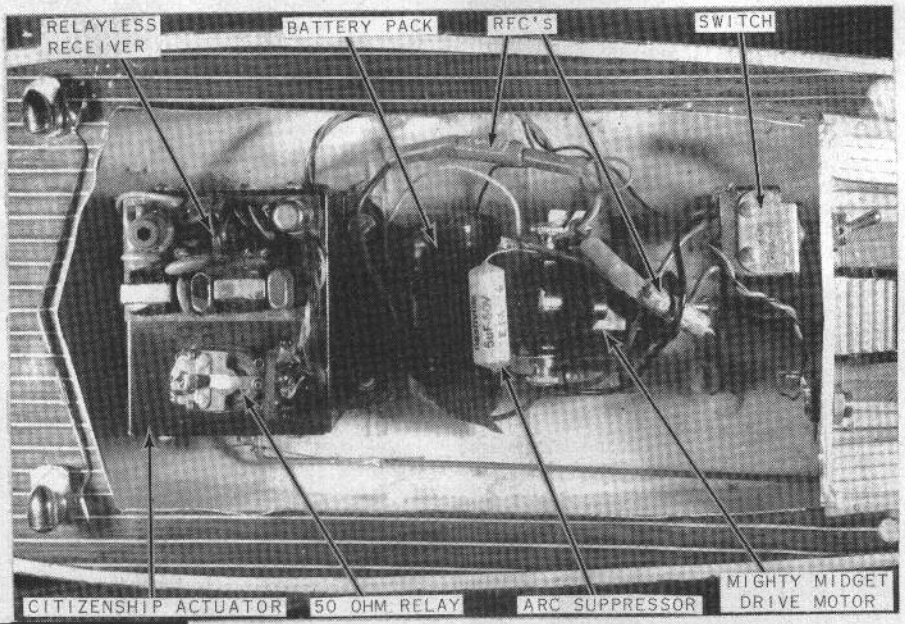


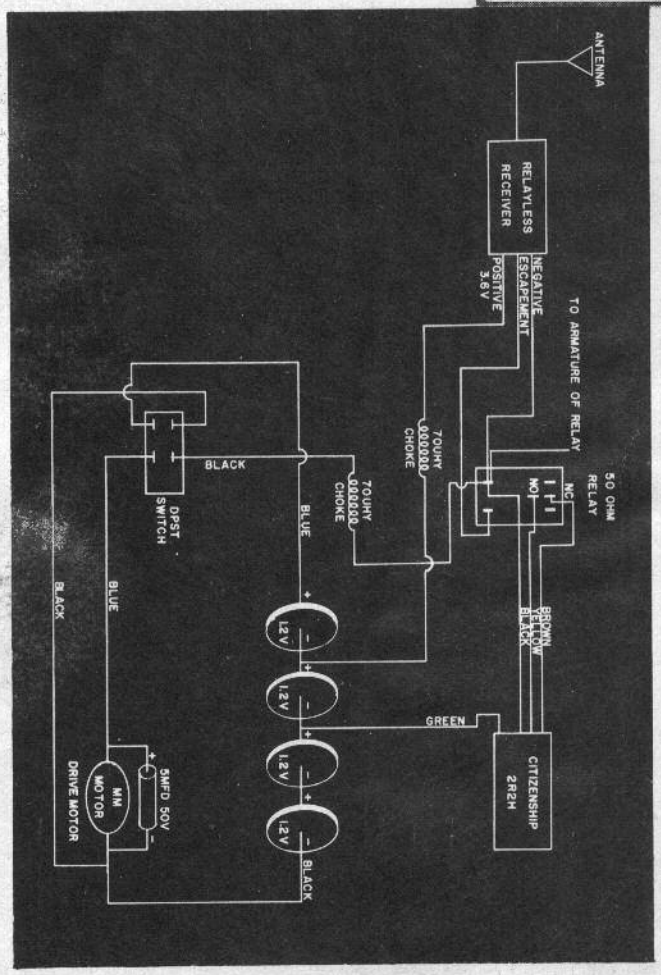
FIG. 4

HOW To R/C A Small Boat

By KENNETH WILSON

This 14-inch Schuco Nautico toy is powered by a Mighty Midget. Citizen-ship actuator, nickel cads, = performance.





THE APPLICATION OF RADIO control to small boats has always been an interesting challenge. Construction articles have appeared—particularly in the British magazines—of boats especially constructed for size, with radio receivers and control devices especially adapted so that extremely small radio controlled boats could be floated under control.

Our challenge was not necessarily the smallest boat that we could find, but a boat that was commercially available, low in price and which could be used with existing radio gear and control devices without a lot of ultra-miniaturization. The photograph and drawing accompanying this article is the result.

A toy boat, manufactured by Schuco and called their Nautico, seemed to offer a lot of the answers in our initial search. The Nautico is 14 inches long and has a beam of 4½ inches. There are many other comparable boats of the toy class which are available, and while this article will concern itself with the presentation of a relayless receiver in the Schuco Nautico, the principles and ideas used can quite easily be adapted to boats of a similar nature.

As will be seen from the photograph, one of the first changes to be made in the Schuco boat was to utilize a Mighty Midget motor for drive. The drain of the Mighty Midget was less than the motor furnished in the boat, and it seemed to furnish a better thrust. The regular mounting of the motor was altered a bit with metal clamps to allow the Mighty Midget to be coupled to the drive shaft with the use of flexible fuel tubing. The reduction gears of the Mighty Midget were removed and the drive shaft was driven directly by the motor output shaft.

Note that a 5-mfd 50-volt axial-lead electrolytic capacitor was placed directly across the brush contacts of the Mighty Midget motor. Solder lugs were mounted under the screw terminals of the motor, for access and ease of soldering the connections.

To provide left and right, an actuator manufactured by Citizenship, and available to the modeler in kit form so that one of several different models could be assembled, was chosen to provide the rudder movement. In our initial set up the actuator was set up as a 2R2H or 2P2N. No attempt was made to put any switching in the motor control circuit, although there is no reason why this could not have been done.

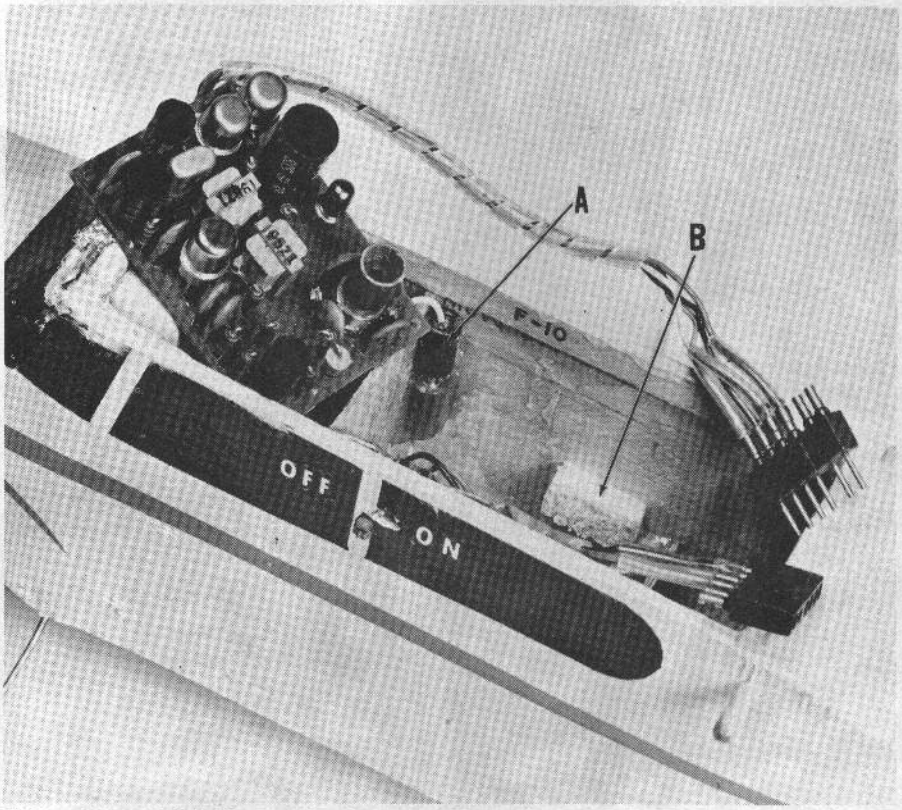
A relayless receiver of the K3VK type was used, although for this application a 50-ohm standard gem SPDT relay was used in place of the escapement coil. A 100-ohm relay could be used as well, or one of the 3-volt relay types as manufactured by C & S or Ecktronics could easily have been substituted. The receiver was shock mounted on the servo case using sponge rubber, and the relay was hard mounted on the same case.

Because the one set of batteries, totaling 4.8 volts, was used for the receiver, the actuator, and the drive supply, this is a pack of nickle cadmium batteries of the rechargeable type. In the original installation VO180 batteries were used. The new Gould-National 225 BH could be used just as well and supply a little longer life, at only a very small increase in weight. The battery pack was taped together with the required tapped outputs coming off of it. The total 4.8 volts is used on the drive motor, 3.6 volts is used on the receiver, and 2.4 volts is used for the actuator.

Because of the tendency for interaction and "noise" the use of 70 UHY/RF chokes as shown on the schematic is absolutely essential. If these are left out, the noise created by the Mighty Midget in the drive system, or the noise created by the Mighty Midget in the actuator, will operate the receiver. It is also necessary in this particular installation to have the carrier from the transmitter on to occupy the receiver and to keep random noise from actuating it.

By leaving the battery pack movable, it may be shifted around to help distribute the weight for an even load so that the boat rides at its best waterline. In this particular installation the actuator is mounted on a plywood base which is contact cemented in the forward section of the boat.

The schematic and photograph should give you some ideas as to how to proceed with your boat, whether it is one manufactured by Schuco or any other small one that you can find in your area. Tune for maximum range, with the boat resting in the water, since the loading effect of water may have an effect upon the receiver. The antenna used in this installation is a 12-inch section of music wire which is simply plugged into an ordinary phone jack. •

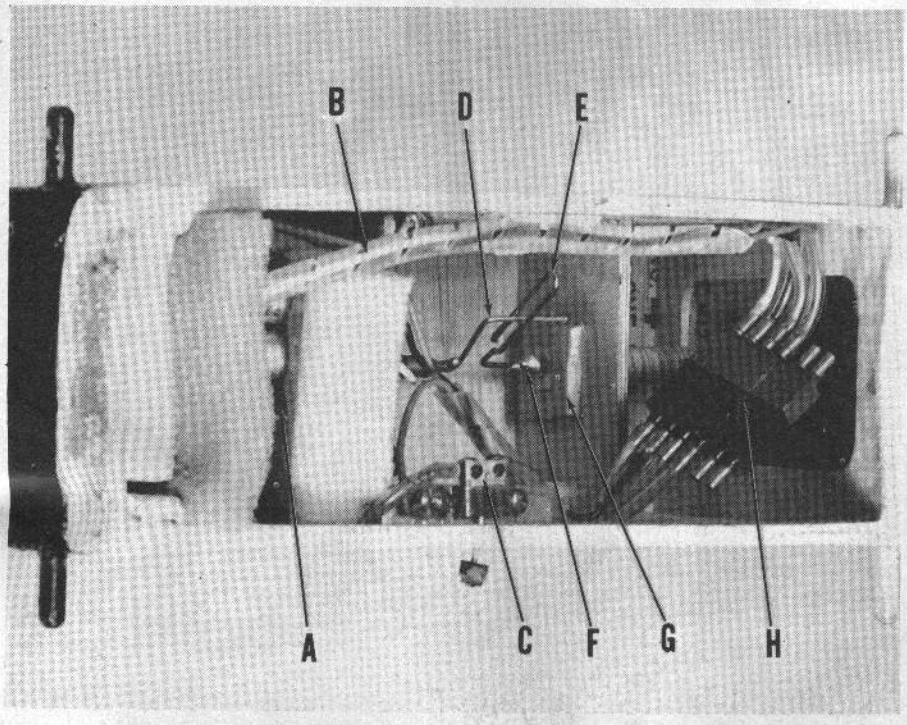


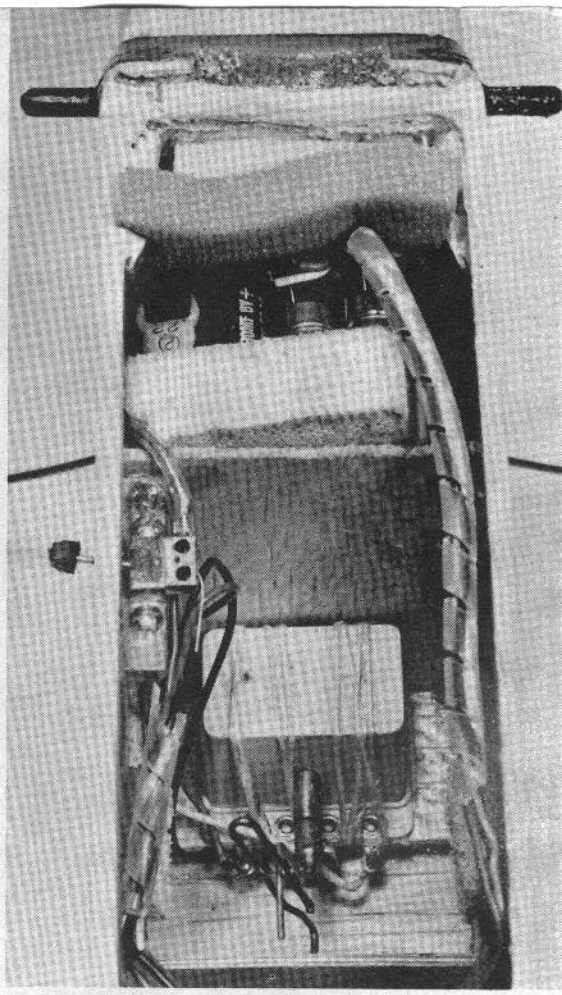
Eliminated is typical rigid-mounted socket—avoids loose plug. Antenna lead from 505 receiver uses single-pin GM plug and socket (A). Foam rubber stops for torque-rod yoke cement to fuselage sides (B).

SINGLE CHANNEL INSTALLATION

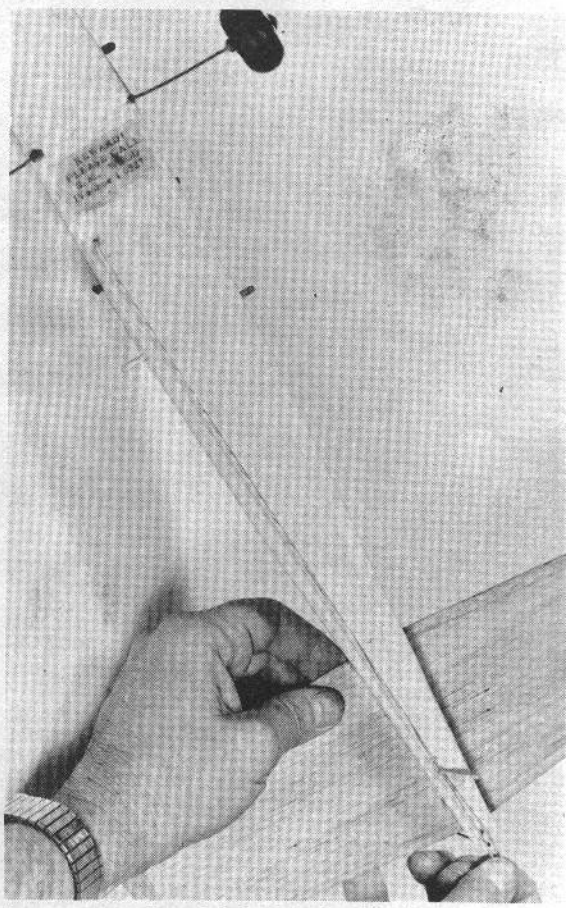
"Stew" Wood's compact arrangement of C&S relayless receiver, Septalette actuator, in Lightning Bug extracts the full aerobatic capabilities of a typical .010-powered aircraft.

Below—Rcvr (A) inserted between foam pads; B—Easy Wrap cables leads; C—Otarion switch; D—Actuator's crank arm; E—Torque rod yoke; F—Soldered washer establishes fore-and-aft play of torque rod; G—Plywood helps support brass-tube bearing; H—Orbit multi-pin connector.





Above—Although smaller Septalette Mark III is recommended for .010's, ship uses bigger Mark V.



Antenna comes through hole in fuselage bottom, is held taut by rubber band looped over the tail skid. A 225-mah DEAC nickel cadmium battery pack supplies both receiver and actuator voltage, is adequate for 6-flight minimum. Set-up is easy to fly proportionately—"bang-bang" stunting.

Drawings Continued from Page 11
(FOR TRANSISTOR POWER TRANSMITTER)

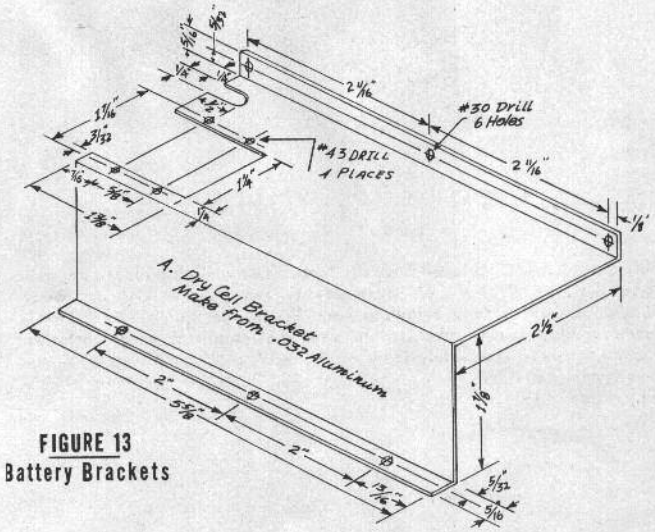
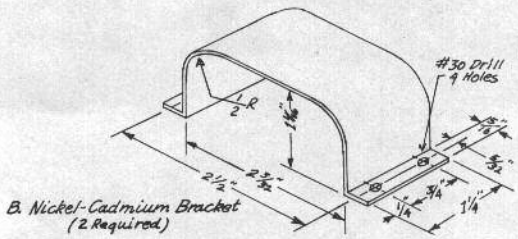


FIGURE 13
Battery Brackets



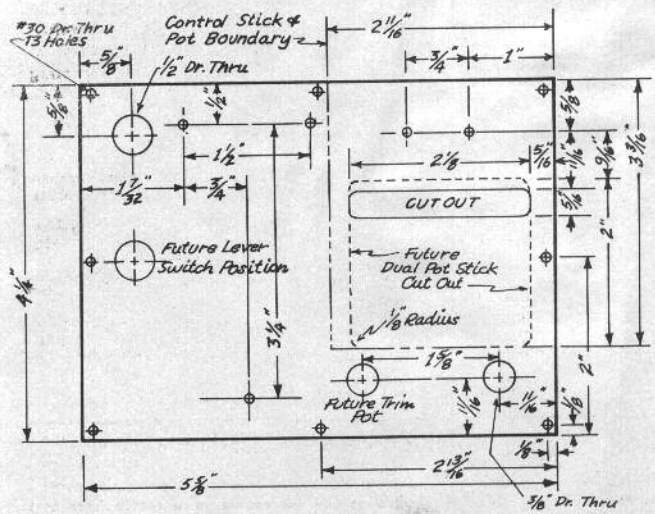
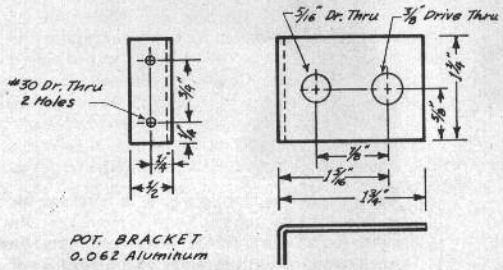


FIGURE 12.
TRANSMITTER COVER PLATE
0.050 Aluminum



POT. BRACKET
0.062 Aluminum

To the trade: This feature is open to all makes of equipment, domestic and foreign. Selection will be edited for reader interest and need.

BUTTERFLY PLANE KIT

Ecktronics announces the "Butterfly," a racing type shoulder-wing beauty with a V-tail for snappy maneuverability as the latest addition to their expanding airplane line. Designed for the .049 to .07 engines, the wing and top of fuselage are built in one piece for easy accessibility to radio gear. Has a 36" span, 260 sq. in. wing area. $7.95.

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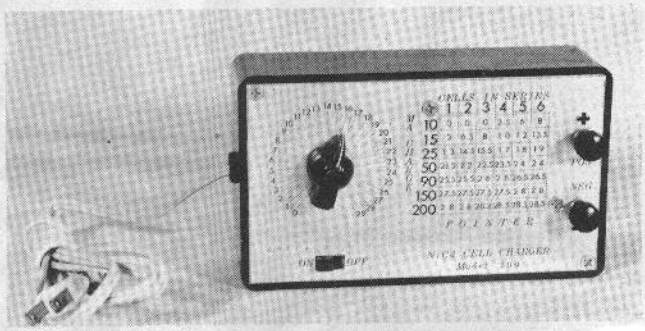


NiCd CELL CHARGER

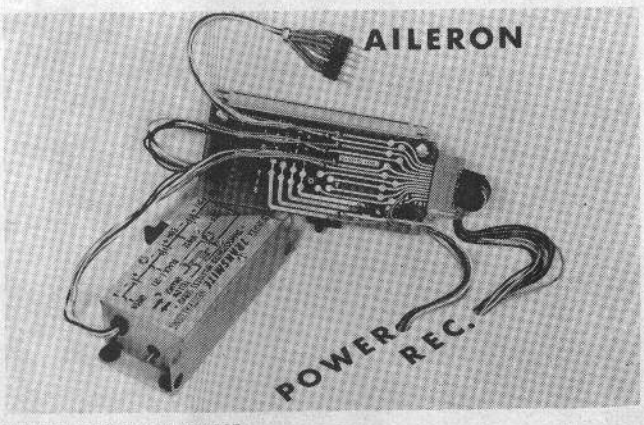
A new charger designed specifically for R/C receiver batteries will appear soon. Manufactured in Chicago, this unit features a heavy duty step-down transformer, to completely isolate the 110-volt AC supply from the batteries being charged.

The NiCd Charger is unique in that the charging rate is set by a pointer knob. A complete charging rate has been developed for use with from one to 6 cells in series. If you want to charge 5 cells in series at a rate of 50 milliamps, simply set the pointer knob at 24 as listed on the chart.

No meter is used or required. This chart rate feature will allow this charger to be used from charge rates of 10 ma to 200 ma for one to six nickel cadmium cells in series.

Unit is housed in moulded bakelite instrument case, with aluminum front panel. Measures 3¾ x 6¼ x 2". Completely assembled, $7.95.

•



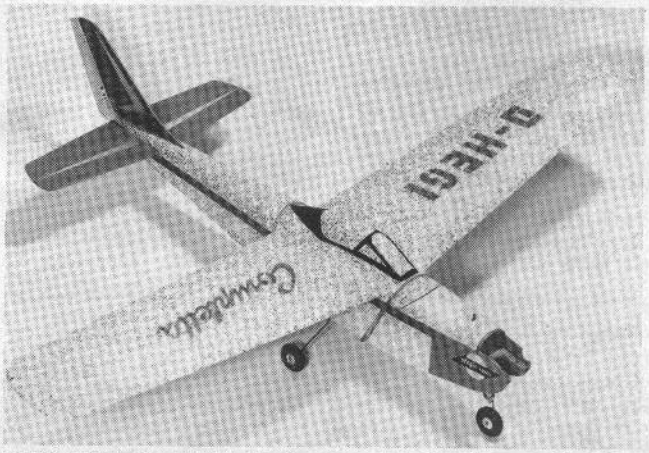
MICRO-TIE SERVO CONNECTOR

Justin, Inc., has announced their Micro-Tie Servo Connector, a high quality PC board which simplifies installation of multi-channel equipment. It eliminates up to 6 connectors and 44 solder joints in the average 10-channel installation, providing hook-up for 5 Bonner servos, power to the receiver and servos, and hook up for the reeds. The Micro-Tie uses a mil-spec edge connector to supply the receiver with all requirements except the antenna lead. The connector has gold contacts and supplies a maximum wipe area to the circuit board and is able to withstand extreme shock and vibration.

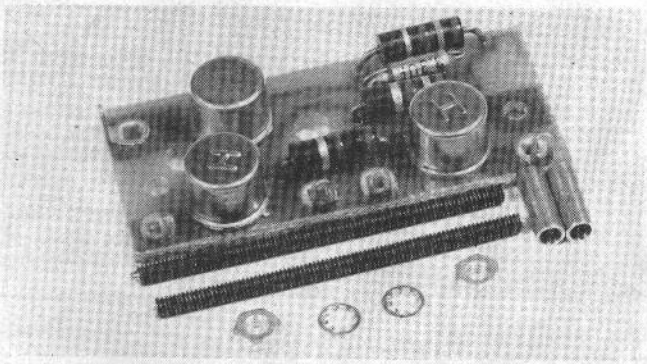
Micro-Tie comes complete with all necessary hardware for mounting to the back of a Bonner servo, although it can be mounted in any convenient spot that allows servo leads to reach the unit. Lacing cord and insulation tubing is supplied.

The Micro-Tie is light and quite small, measuring 4 x 1½ inches. Mounted on the back of a servo it makes a convenient multi installation, especially where space is at a premium.

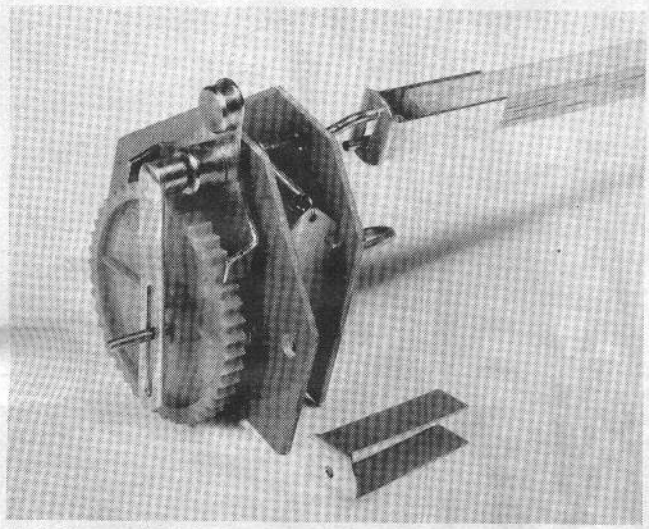
If not available at your hobby shop, Grid Leaks suggests that it be ordered directly from the manufacturer: Justin, Inc., Box 135, San Gabriel, California.



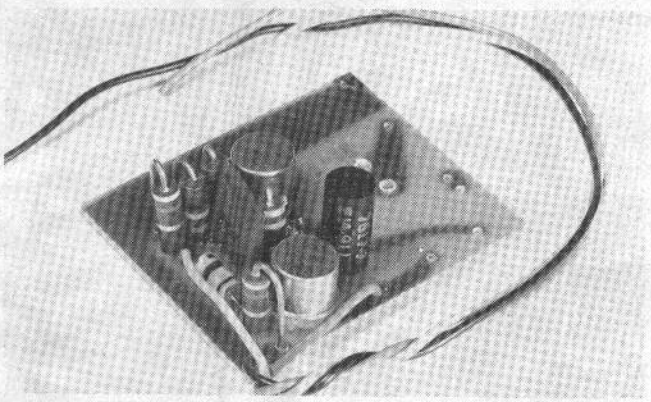
Hegi (imported by Polk's) styrofoam ready-to-fly trike-gear *Completta* for .049's is impervious to glow and diesel fuels. Inset hardwood crutch members, wing spar, firewall, etc. strengthen high-stress areas. Cabin molded to take nicad pack, Graupner rcvr, rudder servo, but others can be fitted. Thrust offsets incorporated. $27.95



Babcock BDC-6 Double Decker kit 3-transistor switching network decoder for Mark 2 or Mark 5 escapements, can be used with any 8- or 10-ohm escp. and any relayless rcvr. Electronic "quick blip." Circuit action similar to mechanical relay, uses 4½V separate escp. batteries, can be mounted separately from escp. Real "sock" for marginal relayless types. For "hybrid" operates on 200 to 4000 cps tone of ½V magnitude. $5.98.



Elmic (imported) 8-ohm escp. operates on 3, 4½ or 6V with ⅛, 3/16 or ¼ rubber. Compound action (one for right, etc.) for engine control. Picture shows coupling fittings (included), which simplify torque-rod construction. Fittings thread-wrapped, cemented, as usual. Weight ⅞ oz., price $11.95.



Relay Blip-Timer, Irving Electronics (P.O. Box 9222, San Antonio, Tex.) operates MC with ANY type escp. and relay, or double-ended, relayless rcvr. Two-transistor circuit, turns on engine control for predetermined time which never changes. Size, 1 x 1 x ½; for 100-ohm relay, or with transistor switcher built on. Relay version can be installed on X-mitter. Current 6ma, 2 to 4.5V. Less relay, $4.95; with switching transistor, $5.95.

MEDCO PACK AND CHARGER

Medco, manufacturers of reed banks and of battery packs, have announced a 2.5-6 Medco Pack and Charger. The pack consists of five VO250 MAH cells, and is therefore smaller and lighter than the 500 MAH unit. The charger is designed to give the charging rate required by these batteries. Construction is very similar to the PM5 and CM5, previously offered by Medco.

KRAFT-PULLEN PROPORTONAL

Great interest has been shown in the Kraft-Pullen Proportional system extensively test flown by West Coast fliers for some time. Their contest records indicate the proficiency of the system.

Using Phil Kraft's superhet front-end, the Jerry Pullen proportional system has been refined and repackaged. The receiver uses specially designed Bonner servos in conventional Bonner Duramite cases. The transistor transmitter is hand-held, features two sticks. The stick on the right is for proportional control of aileron and elevator, the left stick for proportional control of rudder and motor.

The units will come complete with nickle cadmium batteries, chargers and wiring harness. This is a combination system and includes all items required.

Limited production is being begun. Orders will be taken for in-turn processing.

Lee Audio Monitor fits shirt or jacket pocket. Contains sensitive rcvr, making it effective interference detector. Ready to use, $19.95.

UNITED STATES SETS NEW F.A.I. R/C RECORDS FOR ALTITUDE AND SPEED

New world altitude and speed records for radio-controlled models were established at the DCRC-sponsored record trials, held at the Dahlgren Naval Weapons Laboratory, Dahlgren, Va. during the July 4 and 5 "Record Smashing Derby."

The new altitude mark of 13,320 feet was set by Maynard Hill who flew an original of 7½-foot span. The old record, held by Russia, was 7,380 feet. Hill's first and second flights respectively went to 11,940 and 12,960 feet. He used Sampey radio equipment and a Fox 59 engine. The plane carried tin-foil reflectors for tracking purposes, done by Naval radar. Special high-powered binoculars enabled the pilot to see the aircraft at the enormous altitudes.

Three other contenders smashed the old record, Walt Good attaining 10,080 feet, Howard McEntee 9,210 feet, and Bill Northrop 7,470 feet.

Charles R. Scott flew a small Huster delta powered by a McCoy 60 engine to a record time of 126.9 mph, his best two-way time over the 200-meter course being 3½ seconds. Bob Dunham and Jack Bentley held the previous record of 116 mph set several years ago. Electronic timing devices at both ends of the speed course clocked Scott's flight which remained within the altitude limits—between 16 and 32 feet. Scott used a home-built reed receiver.

Both records are subject to confirmation by the Federation Aeronautique Internationale. Russia holds the remaining R/C category records: Duration, 6 hours, 13 minutes, 52 seconds; Distance, 182,123 kilometers; Distance (closed circuit), 100 kilometers. For information pertaining to the organization of such record trials write: Frank Ehling, Technical Director, Academy of Model Aeronautics, 1025 Connecticut Ave., Washington 6, D.C.

BITS AND ..PIECES..

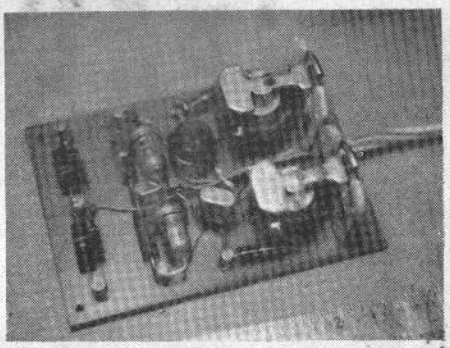
LAST MINUTE NOTES

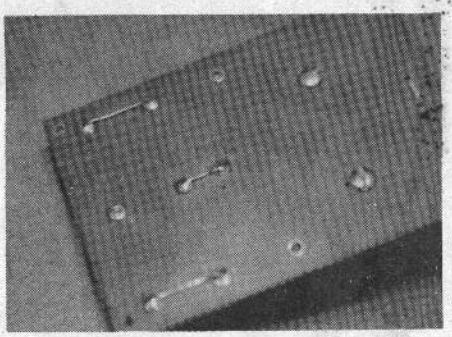
■ Correction: Notes on 3V Kraft Receiver, May-June issue, Fig. 2, reads 2V not ½V. Designations in Fig. 3 and Fig. 4 should have read respectively: TP-2 and TP-3.

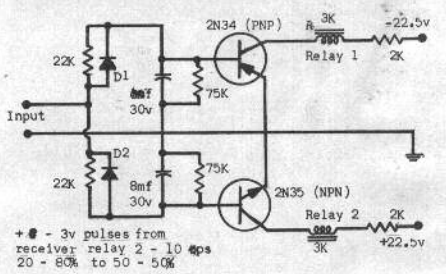
■ FCC advises 1963 revised Form 505 available October 1, not July 1 as announced. Under new time table, applications submitted on 1962 versions of Form 505 will not be accepted after November 30, 1963. FCC now accepts only 1962 versions, returns earlier, obsolete forms without action. Applications on the 1963 Form 505 will be accepted as soon as it is available.

■ What's New—given a more pictorial treatment this month—will continue to feature the most significant, useful items in the future. Appreciation is due Lee's for making available to our photographer several items released by the trade as we went to press.

MORE CONTROLS ON PULSE
by William W. Rohling







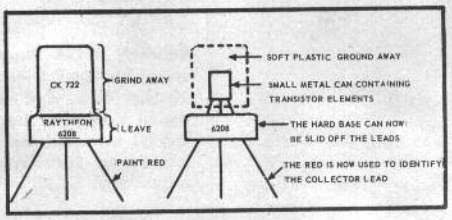
■ In combination of an old circuit with a new twist, it is possible to add two additional functions to most proportional controls, such as the Simpl-Simul and to the Wag Dual 4.

The circuit is based on the principle that as long as pulses (+ and —) are received at the rate of at least 2 CPS, neither relay will pull in; however, if pulsations stop for more than ½ sec. depending on whether the signal is + or — either relay 1 or 2 will pull in. With the resumption of pulsing the circuit will again return to its original condition.

In more detail the circuit operates as follows, taking the upper half first. As positive pulses are received, they are conducted through D1 and stored by the capacitor which is slowly being discharged through the 75-K resistor. This stored voltage is enough to completely cut off the transistor and no current flows to pull in relay 1. When negative pulses are received it goes through the high impedance path of the 22-K resistor, neutralizes the positive charge on the capacitor, develops a negative charge on the capacitor and switches the transistor on, pulling in relay 1. After the desired function has been completed, pulsing is resumed and the circuit returns to the original condition. The bottom section of the circuit operates exactly the same but with opposite voltage polarities.

Modifications may be made in capacitor size and bleeder resistor to change pick up at higher pulse rates. Diodes are not critical but should have good back resistance (at least one order of magnitude higher than the parallel resistor). Those used in original circuit were Transistron IN482.

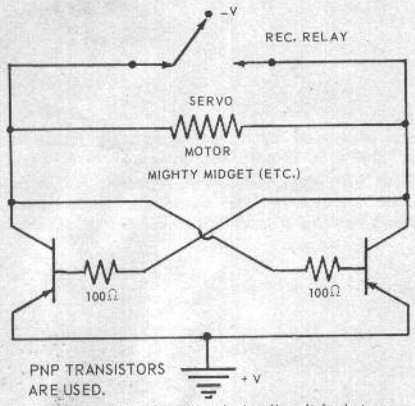
Relays in circuit are 3-K Neomatic with 2-K in series to limit current to 5 ma. These can be replaced with any relay 3-10 K with a suitable limiting resistor in series if necessary. Transistors shown can easily be used because when used as a switch, little power is dissipated in the transistor and those of 50 mw dissipation are sufficient. Current drain for triggering circuits is in the magnitude of micro amps and will never be missed if proportional motor draws 250 ma. Drain of "B" batteries is 5 ma. for short durations of time depending on use of auxillary functions in the overall system. Size of unit was 1⅞ x 2¾ x ¾"



SMALLER CASE ON CK-722?
by Larry Cohen, Pittsburgh, Pa.

■ The CK-722 transistor has a much larger case than is necessary. When using this type in place of the T0037, which is sometimes necessary for better temperature stability, or when using it in a subminiature receiver, the case is sometimes too large. There is a very simple remedy which will reduce the case size to about that of the T0037.

1. Locate the collector lead and identify in some way. I use a small spot of red dope.
2. Gripping the transistor by the wide base, grind or file the case off. The case is just thin aluminum and once a portion of it has been removed the rest may be peeled off by hand.
3. Grind or file away as much of the white plastic that fills the case as is possible. Through this step and step two, take it slow and do not overheat the transistor.
4. When the plastic has been removed you will find a small metal cylinder with about the same dimensions as the T0037.
5. The hard base can now be gently slid off the leads and the red spot on the wire used to identify the collector.
6. A small dab of glue placed where the wires emerge from the case will prevent the wires from breaking off at this point.



GE –2N –107 (55¢) have worked well on light drain actuators. Where high drain actuators are used (200 MA+), transistors with a higher MA rating are needed.

BATTERY ELIMINATOR FOR PULSE SWITCHER
by Forest Norman, Alvin, Texas

■ This switcher is simple and costs about $1.25. I have successfully used this switcher with a Mighty Midget on 3.6 volt for rudder only. Since all the battery drain will have to come from one source, I would suggest nickel cadmiums of about 400-500 ma rating be used.

POLKS...
MONEY $AVING R/C PRICE RIOT!
...OUT OF THIS WORLD EQUIPMENT·LOW PRICES·SELECTION

TRR TONE RECEIVER ~~27.50~~ NOW $19.95

This is a transistorized, single channel tone receiver that has proven itself to be one of the most reliable electronic control devices available to the Radio Control enthusiast.

SPECIFICATIONS — Size: 1¼" x 1⅝" x 2¾" • Weight: 2 ozs. Over 5 MA Current Change • Completely Encased • For use on Newest F.C.C. Frequencies (26.995 thru 27.255) • Deep Etched Printed Circuit • Battery Requirements: 1-22½ VB, 1-1½ VA • One Hard Tube, 3 Transistors, 2 Transformers. Complete with instruction.

RANGEMASTER 2AP TONE TRANSMITTER—~~$29.95~~ NOW $19.95

Undoubtedly one of the finest, most advanced Radio Control Transmitters available today. It employs the super-efficient Aristol-MOPA 3A5 circuit for extreme stability and power output . . . plus a 3S4 tube in a highly efficient modulator circuit for 100% modulation. The expertly "Aristo-Crafted" circuit is housed in a durable, portable enclosure, complete with a chrome telescopic antenna. Complete instructions are included.

SPECIFICATIONS — Size: 3" x 5" x 8" • Ready for use on Latest F.C.C. Frequencies • Special "Buddy Switch" (No assistance is necessary when model is being range-checked) • 100% Modulation • Factory tested and Fully Guaranteed.

ARISTO RANGEMASTER MULTI-CEIVER R8-D—~~$99.50~~ NOW $49.50

This 8-channel SIMULTANEOUS unit is transistorized. Employs the new subminiature relays, in conjunction with the "Tone-Master reed bank and the "Aristo-Crafted" circuit for guaranteed positive control selection without interaction.

SPECIFICATIONS — Size: 2" x 2" x 3½" • Weight: 8 ozs. • Transistorized: uses one pen-cell and one 45V hearing aid battery • Simultaneous operation: uses two controls at the same time on demand • Uses subminiature relays and "Tone-Master" reed bank • Simple-Touch Tuning • "Aristo-Crafted" circuit for stable operation over wide temperature and battery voltage ranges • Tunable over all new F.C.C. allotted frequencies.

TRANSMITTER—~~$99.50~~ NOW $49.50

This 8-channel simultaneous transmitter is the companion unit to the Multi-Ceiver R8-D, 8 channel receiver. Super stable "Aristo-Crafted" circuitry, incorporates close tolerance toroids and component parts. This transmitter has single switches for all directional and aileron movements, and special key-switch for motor control. An indicator light gives visual output check; a permanently attached antenna telescopes into a lacquered aluminum transmitter case for protection and portability.

SPECIFICATIONS — Sizes: 6¾" x 3½" x 9½" • Simultaneous operation of controls • For use on all new allotted F.C.C. frequencies • Low battery Drain

10 CHANNEL MULTI-CEIVER ~~129.50~~ NOW $74.95 **10 CHANNEL TRANSMITTER ~~119.50~~ NOW $74.95**

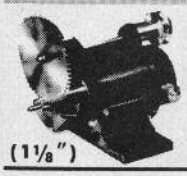
Mult-channel equipment comes with complete "poop" if you wish to convert to "relayless".

AERONCA CHAMPION R/C KIT $24.50

All wood parts of this ... prefabbed kit are carefully cut to shape; the landing gear is complete...she... Fun to build, the step-by-step plans are complete in every detail and ful... Designed by Cal Smith, the excellent characteristics of the Aeronca w... thrill both novice and expert. Designed for single channel or multi-ra... ntrol. (Covering material & wheels not included). Wingspan: 60", Le... Engines: .15 to .35

ROYAL GRACE R/C KIT $27.50

This low wing model has all parts of balsa and hardwoods, cut & shaped. Landing gear formed of piano wire for high egress "spot landing" maneuvers. For multi-radio control. Wingspan: 57½", Lgt. 46½". Engines: .35 to .60



(1⅛")

"MIGHTY-MIDGET" MOTOR $2.95

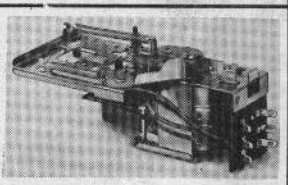
POWERFUL! SELF-STARTING! REVERSIBLE! Current consumption less than flash-lite bulb. Supplied with 7 to 1 reduction gears, pulley, etc. Standard for use on 3 to 6 V. DC. Replaceable brushes fitted with terminals. Armature speed: 4000-6000 rpm. Countershaft speed: 650-6000 rpm. BRASS GEARS 50c per set.

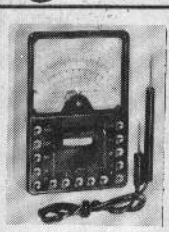
NOSE GEAR $7.95

Heavy-duty, fully sprung; suitable for any tri-cycle gear type plane from 60" wingspan & up. Axle assembly made of 5/32" tempered steel to absorb touch & go on spot landings. Fully steerable, comp. with servo bell-crank attachment. Wheel not included.

ARISTOMATIC COMPOUND ACTUATOR ~~12.95~~ NOW-$9.95

Self-contained electric motor (low drain) plus special integral switching give TWO channel operation from low-cost single channel receivers. FEATURES: Electrical Switching Action — forward / stop / reverse / stop. Mechanical Directional Control — left / neutral / right / neutral. Operates on 3-6 volts. Comp. with instructions.





ARISTO MULTI-TESTER

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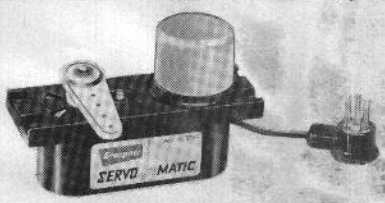
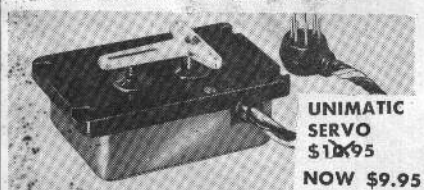


SERVOautomatic $11.95

This 2-channel actuator was designed for model planes and boats — for engine speed control, flaps, trim, wheel brakes, rudders, etc. Non-neutralizing type: control lever can be brought into any desired position by short pulses and held there. This makes it possible to take off and climb with motor running flat out and the throttle back — and fly stunt maneuvers on reduced revs.



UNIMATIC SERVO ~~$10.95~~ NOW $9.95

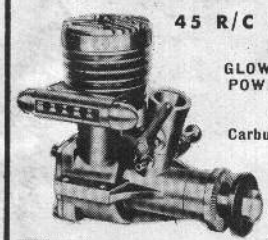
This is an electric motor powered, self-neutralizing single channel servo. Can be used to operate control surfaces or engine throttle. Two extra printed circuit discs supplied so that the Unimatic can be cascaded for additional functions. Wgt.: 2 oz.

BELLAMATIC MKII MULTI-CHANNEL RUDDER SERVO

$15.95

The rudder servo is self-neutralizing. Requires 2 channels for operation. May also be used as a proportional actuator.

SPECS. Motive power: Precision Micro T 03/60 Motor / Dimensions: 1½ x 1-1/32 x 19/64 inches / Wgt: 1-7/16 ozs. / Operating voltage: 2-2.4 / Rudder force: 5.5-6.9 ozs. / Reaction force: 5¼ ozs. / Time per rudder throw: .45 secs.



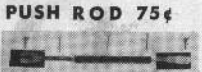
45 R/C ENGINE ~~19.95~~ NOW $9.95

GLOW PLUG • SMOOTH • POWERFUL • RUGGED • Only 9 ozs. / 2 Speed Carburetor / Throttle Carburetor / Displacement: .4531 / Bore: 0.8629 / Stroke: 0.7755 / Flies planes up to 10 lbs. Long life cylinder & piston.

CONTROL HORN 40¢

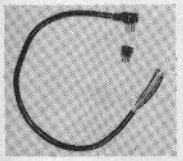
Ingenious plane accessories. Horn is nylon molded. Push-rod may be adjusted to any desired length. Made of nylon molding & brass.

PUSH ROD 75¢



POWER-MITE BATTERIES

Non-spillable, these batteries are made in U.S.A. from high quality materials, and guaranteed against defects in materials and workmanship. Lightweight. 2 MODELS—P65 with amp. hr. life, $6.95 / P69 with 6 amp. hr. life, $8.95



CODED CABLE $1.95

Special 8-stranded connection cable with 8-pin mini-plug and matching socket, color-coded wires. Features short circuit-proof construction, long silver plated contact pins. A stepped keying pin, fits into corresponding groove of socket, prevents any errors in polarity.

ADJUSTABLE MOUNT .....50¢

Lets you mount round motors in almost any position in a model plane. Mount opens by removing screw, insert motor or servo — replace screw and tighten.

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