8th YEAR OF SERVICE TO THE R/C MODELER

Volume 6 Number 1

GRID LEAKS

R/C DATA SERVICE ®

& MODEL AIRCRAFT WORLD

IN THIS ISSUE

- *Toki-Doki Sailplane by Dale Willoughby*
- *Drive an RC Porsche*
- *Stop that "Noise." A cure for interference of internal origin.*
- *For the boat fan—a simple switcher for high-drain motors.*

JANUARY FEBRUARY 1965 35 CENTS

REMARKABLE TRAVELAIR BIPLANE WAS CONSTRUCTED BY BILL NORTHROP, MAN'S RC EDITOR. AUTHENTIC DETAILS INCLUDE ALL LIFT AND DRAG WIRES.

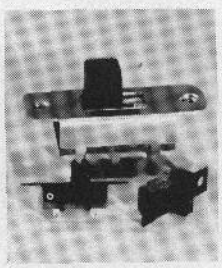
"GALLOPING GHOST" – A NEW APPROACH • SERVOS FOR RUDDER JOBS

A Radio Control Publication for Beginner & Advanced Modeler

ADVERTISEMENT

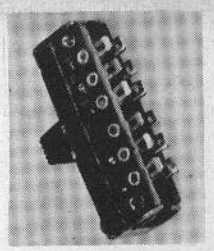
This World Engines advertisement is sort of an experiment to see if something as informal as this is intended to be at the onset, will produce any results. Here at World Engines we recently produced a newspaper called Model Aircraft World. This has recently been merged with Gird Leaks.

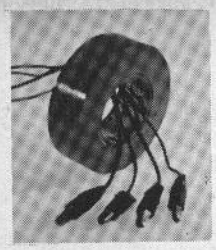
In a way, I miss not having Model Aircraft World as it was a good medium to discuss many of the pros and cons in the competitive side of this model building sport and I hope that I can get a few jabs in now and then in this editorial type advertisement. Actually, I am very happy that Model Aircraft World ended up as a merger with Grid Leaks as Grid Leaks for years has been a pioneering publication for the R/C fan and also Grid Leaks is headed up by the very eminent Mr. Paul Runge. Mr. Runge operates Ace Radio Control — one of World Engines competitors. Frankly, Ace Radio Control is probably the most ethical competitor anyone could have as well as being one of the toughest competitors anyone could have because the service Paul Runge dishes out to his dealers is second to none. In view of these facts it seems a little bit odd that I find myself writing this column in Paul's book but then strange opportunities are always presenting themselves in this hobby business so here goes.



One thing we are working on here at World Engines is a new dealer's newsletter called WENEWS. We try to get this out weekly but generally we only get three issues out a month. Any dealer who is not an active account at World Engines can get this from us simply by writing to us and asking for it. WENEWS is the publication that will be first one out with any new products coming out of World Engines and the reason for this is that the make-up time on this newsletter is only one day. Also, we are using a coded margin to keep dealer's advised as to the status of our Super Tigre, OS and Controlaire items.

TINY SWITCH. World Engines has a new model 1C-T switch for single channel. This retails for 37 cents. This tiny switch will delight the 1/4-A R/C fan. Actually, it is good for any R/C circuit where there is only one line to be opened. Dimensions are 3/16" wide, 3/4" long. Mounting holes will take 2-56 screws. The weight is 12 gr. or .028 oz. It is so light it is almost hard to weigh. The switch has a self-cleaning knife action and a ball detent that assures vibration-free performance.



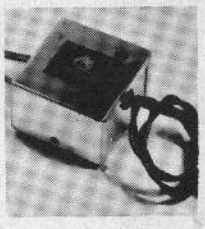


CLEAR TAPE. The average brand electrical tape has just a little bit too much spring or memory to make it a good material to insulate a No. 26 wire connection. Name brand electrical tape will often peel open after the application of the tape. This clear tape has a stretchy consistency which is ideal for insulating a connection using R/C wire. Another thing to recommend this tape is that it is very inexpensive. We sell a 33' roll for only 29 cents. This much electrical tape on a roll would generally run about 69 cents. This catalog number for this tape is CL-33.

MULTI SWITCH. World Engines has a new multi switch — 79 cents. One switch takes care of a complete multi installation. This is our 9F switch. This switch is ideal for multi where it is necessary to open and close three circuits. Generally two DPDT switches are used. This is all done in one switch. The switch features a self-cleaning knife action with ball detent which assures vibration for a performance. You can feel the switch go into position. Dimensions: 1-3/8" x 5/16". Weights: 100 grs. or .232 oz. A hook-up describing the use of this switch with a Controlaire 10 installation is shown in the coming 1965 World Engines Catalog which should be available towards the end of November, 1964. Our new catalog price, incidentally, will remain the same — 70 cents.

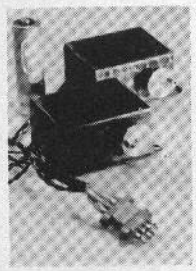
LEAD SETS. Quite often when you are working with servos, escapements, batteries, etc. it is nice to have some handy lead sets to make temporary connections while you are checking out your equipment. We are packaging lead sets two leads per package at 19 cents per package. The leads are shown with the tape.

52 MC EQUIPMENT. Controlaire is now shipping all-transistorized 10 channel transmitters and receivers on 52 mc. These are very similar to the 27¼ mc units with the exception that the transmitter antenna carries no loading coil. These units are available on both 52 and 53 mc. We are also selling single channel Mule transmitters on these frequencies with assembled Controlaire 4 for five matching receivers for single channel work. Our single channel superhet receiver, the SH-100, is available now on 52 or 53 mc.



CHARGERS. There are many chargers available today and there are quite a few variations in their construction. Some of the notable features on the Controlaire charger — assembled $6.98, kit $3.98 — are that the charger comes complete with a isolation transformer which minimizes the chances of getting shocked from the unit. Our circuit includes a bulb which does not light unless the batteries are actually charging which we feel is almost a must for a charger of this type because if your batteries are not charging you stand a chance to lose or crash your airplane. We sell these chargers as receiver chargers — 5 batteries in series — or transmitter chargers — 7 batteries in series. We also give a chart in the instruction manual with this charger showing just what 1/2 watt resistor is to be used in the event you want to charge some other stack of batteries. For instance, the single channel airplane may use three nickel cadmium batteries in series. These other resistors are available from World Engines or, for that matter, almost any electronics shop.

OS R/C EQUIPMENT. We have received our first shipment of 6 Ch./12 Ch. OS receivers and transmitters. These are superhet relayless type. The 12 Ch. OS transmitter is $109.98 and the matching receiver is $89.98. OS manufacturers both dual simul and non-simul single channel equipment. The dual simul transmitter is $89.98 and comes with a leather case as does the 12 channel. The non-simul 6 Ch. less case is $69.98. 6 Ch. receiver $53.98. OS also offers a 1 Ch. superhet receiver $32.50.



World Engines is offering a new cover material called RAYSPAN. This is 23% silk and 77% rayon and will sell for 98 cents per yard. Some people like this kind of material particularly because it fills well when the dope is being applied. This will be available in white, red, orange, blue, yellow and green. We expect to be able to deliver this material around December 15th.

OS has come up with two new single channel servos. We have not priced these yet. We are just testing the prototype models that were sent to us. Also notice the unique OS 7 pin plugs connecting the two servos.

John Maloney

World Engines, Inc.

8206 BLUE ASH ROAD — CINCINNATI, OHIO 45236 — U.S.A.

CONTENTS

PAUL RUNGE, Publisher—WILLIAM WINTER, Editor
WITTICH HOLLOWAY, Art Director—BOBBIE RUNGE, Sec.-Treas.
Contributing Editors: Gordon Flenniken—Phil Kraft
Frank Schwartz—Dale Springsted—John Worth—John Phelps

GRID LEAKS—Model Aircraft World is a bi-monthly publication, and is intended for the modeler who is interested in Radio Control. It is published by Ace R/C, Inc., at 203 W. 19th Street, Higginsville, Mo.

Subscription rate is $2.00 per 6-issue volume. For subscriptions outside the United States, add $1.00 for postage. GRID LEAKS is a registered trademark.

FOREIGN SUBSCRIBERS: GRID LEAKS Subscription Agent for ENGLAND and all CONTINENTAL COUNTRIES is The MODEL AERONAUTICAL PRESS, LTD. 38 Clarerdon Road, Watford, Herts, England.

Second class postage paid at Higginsville, Mo. and at additional mailing offices.

GRID LEAKS AT PLAY

● With this issue of GRID LEAKS, distribution to dealers is going via Kalmbach Publishing Co., Milwaukee, Wisc. This is a notable step upward, we feel, since GRID LEAKS now joins a rather elite company of hobby magazines that are distributed by Kalmbach—*American Modeler, Flying Models, Model Airplane News, Model Railroader,* and other titles. Distribution by Kalmbach is recognition that GRID LEAKS fills a real need in the radio control field.

At the same time, a number of other changes are effective. Distribution to individual subscribers as a rule will come first—barring unforeseen circumstances. Only a small portion of the mailing will be done from the Higginsville office. Most of the mailing will be made by our printer, American Press, from Columbia, Mo.

The date on the cover reads January-February 1965! What happened to your November-December issue? Nothing.

For some time we've been wanting to get our publication date to coincide more correctly with our cover date.

It was necessary to make a reappraisal of the dating of our covers. Rather than skip an issue, we moved up the dating of the cover of this issue.

Every subscriber to GRID LEAKS—MODEL AIRCRAFT WORLD will have his subscription extended for one more issue than currently is read on the stencil. You will not be short a copy.

(Continued on page 24)

THE MONITOR

Regular round-up of new and overlooked aspects of the growing R/C field ● Shop talk and just talk ● A discussion corner.

DURING THE WAR there was a celebrated cartoonist much used by the military to depict assorted foolish flying types who were a menace to themselves and others. Were he available today he could illustrate an RC type we all know too well—the show-off pilot. By show-off is not meant the disciplined precision stunt man who gives demonstrations worth seeing, or skilled and sensible pilots who automatically position their ships for spectator safety—and safety to fellow modelers who almost certainly are not paying attention to crazy antics.

High-speed passes and inverted fly-by's that skim the ground are foolhardy gestures at best, even when done well out from cars and people and parallel to the parked vehicles, but at least the pilot risks nothing but his precious equipment. If interference gets him or a wire let's go, or, or, or, his ship will flip over or roll in, and he is the only loser. Stunting over a crowd, a ready-line, cars, pit areas, etc. is uncalled for. Full-scale aviation has rigid regulations governing such matters. Perhaps it is time we applied ourselves to always being safe pilots.

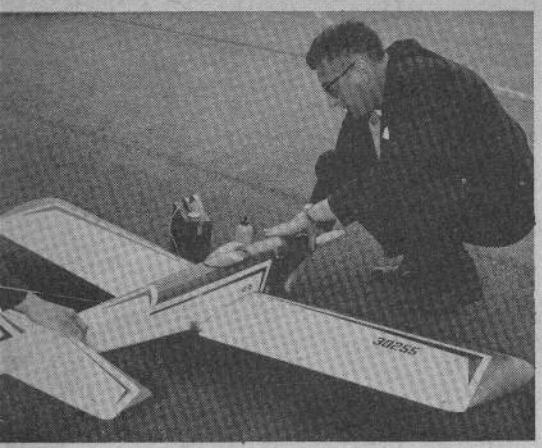
There is an element of the show-off in all of us, for pride or "face" can make a flyer violate his better judgment in seemingly ordinary procedures. Is it safe practice when a long approach doubtfully would clear field-edge obstacles, cars for example, when the pilot could at any time dump the crate undamaged in the weeds—if he were not pig-headed? Test flights can be made from a more removed spot on the takeoff area. Untested multi's in green hands have a habit of swinging into a steep, left turn with torque, especially if horsed off the ground. Many times such a ship will not respond to corrective aileron ("I lost aileron!"), attitude and airspeed and inertia all being against it. Like as not the ship is going to come in—perhaps close to the takeoff spot.

First flights on rudder jobs—especially with escapements and a beginner on the button—can terminate in a high-speed wide spiral. If the takeoff was made at a suitable spot, and distance maintained from obstacles, nothing much is lost except complacency.

Clubs might well give attention to safe flying practices. Those of us who are not associated with a group also should realize that the good pilot is the one who has no accidents, not the exhibitionist, whose close-in airwork gives us fits. You may think yourself a terriffic pilot but, frankly, nobody cares!

We should like to extend a welcome, and good luck wishes, to Lou Andrew's new company, Andrews Aircraft Model Co. Inc., whose line of new RC kits will surely give us all the satisfaction we have come to associate with all

(Continued on next page)



Dennis Allen, maker of Merco and Allen Mercury engines, British Nats. (Aeromodeller)

The Monitor . . . . continued

Andrews designs.

Before going on his own, Lou had been for many years a designer for Guillow, where he built a reputation especially for stunt and RC models. In the late Forties Lou, and his young side-kick Don Ferguson, won both the Open and Senior National Stunt Championships with Lou's Trixter Barnstormer.

His first manufactured radio kit was the cute little Beam, which toted the Citizen-ship 465 receiver and a heavy battery complement on just a Mac .09. Using this low power he demonstrated some truly beautiful touch-and-go's at a long-ago Nats. And, incidentally, if you have a Beam plan in your file, the big modification everyone worked when smaller radios and larger engines became the vogue, was to take one inch off the belly of the fuselage and add one inch to the nose. For *docile* sport flying, you can't beat this modified Beam today.

In many respects, Lou is like that other modeler's modeler, Carl Goldberg, in that he is a meticulous workman and a rounded designer. Patience and perfection are the two words that best describe his preparation for a manufactured kit.

Having been exhorted in print to put multi equipment in a Rudder-Only or Class 1 airplane, we converted two Duramites to Transmites and installed a 10-channel receiver—there being nothing in our stable between one and 10 channels. The Cox .09 in the 4-foot model was swapped for a .15. These days, a .15 in a 48-incher would not make a respectable bean-shooter. High tide at present is a .45 in a little Mombo!

With at least a .35 our ship would be a fairly typical contest job. With the .15 it scoots well enough but lacks "war emergency power" to blast it through out-of-trim loops and all the other jazz. Four-channels, two on rudder and two on motor, obviously is a very nice way to fly such an airplane.

But on the way to the field for the first flight we turned chicken. This so-called rudder-only job now was worth in excess of $200. Unlike many true multi designs it would fly away if anything went wrong. In multi, many ships will not remain long in the air out of control, and besides, an equipment failure usually means a crackup because of the more or less constant stunting. The multi seldom is in the precise flight attitude for a fly-away—it is pointed up or down, or right or left, or is inverted, or a thousand other things. The stable rudder job, on the other hand, can fly out of practically anything to vanish over the horizon. With a big engine it is a homesick angel.

With misgivings the ship was launched and, wouldn't you know it, the reception was in and out, only dumb luck obtaining a low motor and, every time it circled the transmitter, a couple of rudder controls. The inescapable conclusion was that putting high-cost multi with servos in such an airplane is foolhardy—unless you are a dedicated Class 1 contest flyer for then it is your best hope of placing.

Well, what do you do when you want simplicity, reliability, and rudder-motor or rudder-motor-elevator without going into multi? Of course, there are six and four-channel radios. A four does not cost too much more than good single, but then you've got at least $60 of servos—if Transmites, less if Annco's—and you'd be better off with a six if you could swing it. With aileron instead of rudder, there's a number of kits which yield a reasonable facsimile of multi (real multi).

Here again equipment cost freezes out most hobbyists, so you think hard about escapements and pulse proportional. In the long run you cannot obtain good multi reliability from an escapement setup. Yet, uncounted thousands have flown escapements through the years, and the escapement remains very much a part of the future.

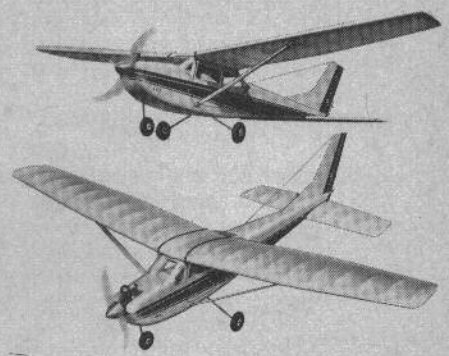
The escapement seemingly never will be replaced until something better is offered at a comparable systems cost. An escapement man himself, the writer would be among the first to concede that proportional is, in theory, a better system. But so far the beginner and most sport flyers hesitate to take the step.

Frankly, pulse scares the beginner. More words have been written about the modifications to, and weaknesses of, Mighty Midgets than any other subject in this field. Articles on "good" pulsers imply that all previous units lack something. So the unit you must buy, is expensive and must be adapted to your transmitter. Magnetic actuators seem to be limited to .049 maximum power.

For the tyro the simple proportional stuff is a confused picture of pulsers, trick actuators, and endless published articles on how to make things work properly. What is particularly unreal is a vast gray area between typical single channel practice today and the remarkable but costly multi-channel deals. If the Mighty Midget, world renowed as the best motor for the purpose, is not truly adequate, why does not the industry solve the problem? It seems impossible that the market does not offer a simple, competitively priced proportional system which the customer *would prefer* to escapements—which suffer from limitations no one can deny.

We do have packaged pulse systems available, so it cannot be claimed that equipment is nonexistent. We do know that, having flown single channel long enough to know his business, the hobbyist realizes that it is not perfect; but, lacking funds, and perhaps interest, for multi he is baffled by the industry's tranquil attitude toward single.

The most reliable single-channel outfit in the writer's experience is his 17-year-old Good Brothers. ■



Cessna Skylane, Carl Goldberg Models Inc., is 42-in. single-channel for .049. Cost $5.95.

Pete Waters, Min-X service agent for G.B. and his Merco-engined multi. (Aeromodeller)

Live Wire Acrobat multi stunt/trainer for 1965 production. Spans 58 in. top wing, 48 in. bottom. Area is 1070 sq. in. Steers with ailerons and handles like low wing; 35 to 50.

LEES HOBBY SUPPLIES INC

WE STOCK COMPLETE R/C AND HOBBY EQUIPMENT

FIRST TIME EVER! No additional money charges for orders of any size! We Welcome Your Patronage.

2094 Fifth Street ■ East Meadow, L.I., N.Y. 11554 ■ 516-489-1123

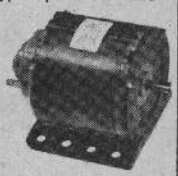
LEE'S SUPER SAVINGS CATALOG

OVER 64 PAGES COMPLETE WITH PHOTOS AND DESCRIPTIVE INFORMATIONS OF THOUSANDS OF RADIO CONTROL ITEMS.

CATALOG IS SO DESIGNED THAT SUPPLEMENTS CAN BE ADDED. SUPPLEMENTS WILL ALSO BE MAILED AS THEY BECOME AVAILABLE, THROUGHOUT THE ENTIRE YEAR.

ONLY 25¢

GM #1 HECTAPERM $9.95
A super powerful drive motor for extra large or extra fast boats or cars. Precision made, sturdy, dependable and highly efficient.



Voltage	3—12V
Idle Current	.8A
Max. Current	6.5A
RPM	1000/volt
Efficiency	62%
Length	2⅜"
Diameter	2⅛"
Shaft	⅛"x⅜2" dia.
Weight	11 oz.

GM #2 DECAPERM $7.95
A powerful, heavy duty, highly-efficient electric motor, ideally suited for large boats and many other hobby uses. Sintered bearings for long, dependable service.

• Voltage 3—12V • Idle Current .6A • Max. Current 5.A • RMP 1000/volt • Efficiency 60% • Length 2⅜" • Diameter 1⅜6" • Shaft ⅛"x⅜2" dia. • Weight 6⅜ oz.

GM #33 SUPER MONOPERM 3V ... $4.95
Max. Current 2.6A°—Efficiency 55%

GM #36 SUPER MONOPERM 6V $4.95
Max. Current 1.5A°—Efficiency 61%

GM #361 SUPER MONOPERM 6V .$5.95
with 1.3 Gear Ratio

	3V	6V
Drain (Amps)	2.2	1.2
Power (Watts)	2.7	4.
RPM	3200	4700
Torque (cm/gms)	80	80
Length	2"	
Diameter	1¼"	
Weight	3½ ounces	

GM #43 MONOPERM 3V $3.95
Max. Current 2A°—Efficiency 50%

GM #431 MONOPERM 3V $5.95
with 3:1 Gear Ratio

GM #46 MONOPERM 6V $3.95
Max. Current 1.1A°—Efficiency 55%

GM #461 MONOPERM 6V $4.95
with 1:3 Gear Ratio

GM #462 MONOPERM 6V $4.95
with 1:27 Gear Ratio

	3V	6V
Drain (Amps)	1.7	.7
Power Watts	1.75	1.9
RPM	3400	4800
Torque (cm/gms)	50	40
Length	1⅛"	1½"
Diameter	1¼"	1¼"
Weight	2¼oz	2¼oz

MICROPERM & MILLIPERM MOTORS $3.95
Highly efficient, rugged dependable, light weight with low battery drain. Make excellent servo motors and drive units for miniature models. Sintered bronze bearings and heavy duty brushes guarantee easy, smooth operation.

	MICROPERM GM #63 3V	MICROPERM GM #64 6V	MILLIPERM GM #53 3V	MILLIPERM GM #56 6V
Diam.	1⅛"	1⅛"	⅞"	⅞"
Lgth.	1"	1"	1⅛"	1⅛"
Wt.	½ oz.	½ oz.	¾ oz.	¾ oz.
Max Cur.	1.3A	.4A	1.58A	.05A
Torque (cm/gm)	6	6	10	15
Drain (Amps)	.8	.25	1	.37
Power Watts	.54	.55	.68	.9
RPM (x100)	8000	88	72	56

GM #73 NANOPERM 3V $3.95

GM #76 NANOPERM 6V $3.95

6 Volt—2500 RPM/per Volt • Min. Drain —160 ma • Max. Drain—480 ma • Diam. ½x⅜" • Length ⅞" • Weight ⅓ oz.

MARINE DRIVE PARTS

Steel shaft, threaded both ends. Oversized brass housing with fitted ends, and brass stop collar with set screw.

	SHAFT DIA.	SHAFT LGTH.	HOUSING DIA.	HOUSING LGTH.	PROPELLER BLDES	PROPELLER DIA.	PRICE
M4	5/32"	13.7"	¼"	11"			$1.95
M4	5/32"	11.8"	¼"	9.5"			1.60
M4	5/32"	9.8"	¼"	8"			1.50
M4	5/32"	7.9"	¼"	6"			1.40
M3	⅛"	12"	13/64"	10"			1.50
M3	⅛"	10"	13/64"	8"			1.45
M3	⅛"	8"	13/64"	6"			1.40

The following shafts and housings come equipped with swedge mounted props and stop collars, and plastic tube couplers.

M2	¾"	10"	5/32"	8.5"	3 L/R	15/16"	1.60
M2	¾"	8"	5/32"	6.5"	3 L/R	15/16"	1.50
M2	¾"	6"	5/32"	4.4"	3 L/R	13/16"	1.25

NICKEL PLATED BRASS PROPELLERS THREADED TO FIT GM SHAFTS

M4	5/32"	2 L/R	2¼"	.95
M4	5/32"	3 L/R	2¼"	1.10
M3	⅛"	2 L/R	1½"	.55
M3	⅛"	3 L/R	1¼"	.65

WHITE METAL PROPS— threaded centers

M4	5/32"	3 L	1¾"	.40
M3	⅛"	3 L	1¾"	.40
M4	5/32"	2 L	1½"	.30
M3	⅛"	2 L	1½"	.30

G.M. MARINE VARI-SPEED EQUIPPED WITH BUILT-IN VARIABLE GEAR REDUCTION!

Available for the first time, the new G.M. Variable Speed Reduction gear, Marine drive, with 6 popular geared ratios, that can be changed instantly.

The G.M. Vari-Speed features:

- Low drain efficient monoperm or super-monoperm electric motors.
- Built in on-off, forward and reverse switches.
- 6 drive ratios: 3:1, 6:1, 12:1, 16:1, 32:1, 60:1 all housed in the quick change gear box.
- Heavy duty 5/32" shaft.
- Low current drain (200 mils to max. 1.5 amp) for longer running time.
- "Tuff" efficient gear train
- 2 models available

GM #836 with Super Monoperm $9.95
6 volt operation, 1.5 maximum amp draw, weight only 5 ounces, size: 4" x 1⅞" x 1⅝".

GM #846 with Monoperm $7.95
6 volt operation, 1.5 maximum amp draw, weight only 4 ounces, size: 4" x 1⅜" x 1⅝".

GM #1046 TRANSA-SPEED .....$5.50 with 6 Volt Monoperm

- 5 Speed Nylon gears shiftable to ratios 1:2, 1:4, 1:8, 1:16 and 1:32
- Graduated Shaft diameters 5/32", ⅛", 3/16"
- Overall size— ¾"x11½"x3"
- Weight 3.5 oz.

7 PRONG PLUGS
Silver plated prongs for positive contact. Wired 7 prong plugs and jack. Top of plug removable for changing wires—95¢.

MT-17 MOTOR TORPEDO BOAT ... $7.95

21" long x 5½" beam Scale model Torpedo Boat. Precut hardwood parts, turned Torpedo tubes. Easy to build—suitable for R/C.

MT 17 FITTINGS KIT $3.25
Contains prop shaft and rudder, cast metal ventilators, cleats, etc.

TRAWLER $12.95

Scale model European Fishing Trawler with precut hardwood parts. Easy to build. Excellent for R/C or shelf model. 26½" long, 6¼" beam.

TRAWLER FITTINGS KIT $5.95
Includes brass portholes, plastic deck fittings, shaft and propeller, brass railings, etc.

DELUXE FITTINGS KIT $9.95
Contains everything in the regular fitting kit plus turned brass stanchions, brass capstans, blocks, ring bolts, chain, spotlight, yard hoops, etc.

VEDETTE $9.95

Cabin Cruiser. All precut hardwood parts, easy to assemble, lots of room for R/C installation. 29" long x 7½" beam.

VEDETTE FITTINGS KIT ...$6.95
All brass fittings — portholes, shaft, prop and rudder, etc.

R/C COMMANDER $12.95

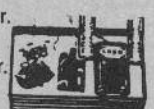
Fittings included

Beautiful luxury yacht. All precut hardwood parts. Designed to be built inverted, just like the real thing. Excellent R/C handling characteristics. R/C installation a snap. Comes with painted plastic deck fittings.

ANOTHER LEE'S PRICE BREAKTHROUGH

FOR LESS THAN THE PRICE OF MOST RECEIVERS LEE'S MAKES THIS FABULOUS OFFER ....

1. The famous **LEE'S** custom assembled receiver.
2. **CITIZENSHIP** selective SE-2 escapement.
3. **DU-BRO'S** new vibration proof 2 pen cell holder.
4. Two factory fresh **"ENERGIZER"** batteries.
5. Secure locked **"ON-OFF"** switch.
6. Foam Rubber for mounting.



EXCLUSIVE All for only . . .

Plus: All units harness wired, factory tested and ready to install without any additional electrical work! **19.95**

WEIGHT 3½ oz. total including battery (Fully Guaranteed)

FABULOUS PHELPS PULSER KIT

For some time the Phelps Pulser has been used in various forms by modelers throughout the country with outstanding success. John Phelps, Applications Engineer for General Electric, has updated the design and we are proud to bring you this first in a series of Phelps kits, which will be added to the LEE's line from Ace R/C during 1964. Using a uniunction transistor, this pulser may be used for rudder only or for Gallooping Ghost. Has both rate control and width control, and rate and width trim. Is temperature stable from 140 down to 10 degrees. Uses new silicon GE devices.

Kit comes with the spring centering Protrol dual stick assembly so that you have a self-centering snappy action on the box.

The deluxe kit contains all components required and is highly prefabbed, and instructions are exceptionally complete.

No. 15A11—Phelps Pulser Kit **28.95**

CONTROLAIRE 5

RX. KIT

The Controlaire 5 is a 3 volt relayless all transistorized receiver. The physical specifications on this receiver are: 9/16 x 1⅛ x 1⅞ inches. Weight, ⅜ oz. The fact that this receiver does not have any noticeable swamping characteristics differenciates it from many 3 volt receivers. This receiver is very reliable and quite sensitive. The receiver design is excellent for rudder only control, particularly of tiny airplanes such as .010 powered Top Flight Models.

TONE: The Controlaire 5 responds to transmitters preferably with modulation above 80% at frequencies of from approximately 500 to 1000 cycles per second.

READY BUILT—TESTED ____ **139.5** RX. KIT IT **$7.95**

EXTRA SPECIAL LIMITED OFFER

LOOKING FOR A FUTURE? Our expanding business requires qualified retail personnel.

Readers Write

INFO—TOO LITTLE, TOO LATE

As a newcomer I have bought just about every model magazine (I subscribe to GRID LEAKS) including a couple from Great Britain. A modeler can put out a reasonable sum or quite a large sum, depending on what kind of outfit he decides to get. You probably know how confusing it can be for a beginner to go over all the ads and claims of the manufacturers, countless articles on planes, servos, actuators, escapements, Galloping Ghosts, etc. The next step is to answer some of the advertisements which seem to offer desirable components for your system (still very hazy).

The advertisers invite you to send for literature, sometimes require a nominal sum for booklet or catalog. The reader sends and waits—and waits—and waits!

In my experience there is no such thing as an answer by return mail—with few exceptions. Answers usually take five to seven weeks, sometimes never come. And many answers are fly-sheets with less description than the advertisement! I wonder how many would-be modelers are lost because of cooling enthusiasm during their long wait and disappointing replies from the manufacturers?

JAMES MORGAN SR., Philadelphia, Penn.

VIEW FROM DOWN-UNDER

How nice it is to see a magazine print really down to earth articles! "Proportional in Perspective" was a really good article, well timed and badly needed. The follow up in the "Monitor" was even more illuminating.

I have been manufacturing RC equipment for about 13 months now, having taken over from John Marquette who started the Silvertone line about four years ago. We have built up the name to the point where almost every competition flown in Australia is dominated by flyers using our gear.

It took all this time to develop a really reliable reed set, and now, just when all problems have been eliminated, the demand has swung to all transistor Tx and Rx! When we develop these, the demand will be for something else. These are normal manufacturer's complaints, but it is this trend which makes our hobby so expensive. The result is the crux of Phil Kraft's article.

In Australia, we are about four years behind the U.S. and at the moment the only proportional flying is done by the home experimenter. I was a keen proportional man myself, prior to taking over the manufacturing. My first thoughts were to develop a proportional set and get it out as soon as possible. Over the years I had tried just about everything, from Galloping Ghost to feedback servo, and found the feedback servo quite good. But my experimenting was done in large, basically single channel, planes which chugged around. The proportional effect was good and if I had a bit of wander or inaccurate centering on the servos, it did not show up much in flight.

I had never flown any reed equipment until I started to manufacture, so like a good manufacturer, I fitted out a Gee-String with one of our reed sets. This thing really moved, and was unlike anything I had ever flown before. During the trimming I noticed that ½ turn on a DuBro Kwik-Link was enough change on elevator trim to cause a gentle climb or dive. My ideas on proportional were completely shaken up. No one could be expected to hold center as accurately as this!

Since then I have come to almost the same conclusions as Phil Kraft. The situation in Australia is even more acute. At the most I could expect to sell only a small number of these sets (20-30). This would not even pay for development. My latest thoughts, run along the lines of an adaptor kit for adding four proportional channels to a 10-channel reed set. This would give quad-simul 14-channel operation.

I hope to put proportional on elevator and ailerons, and use reeds on rudder, motor, and all various controls, such as folding undercarts, flaps, etc. The only problem is servo tracking and centering, which I feel is the biggest problem in all proportional sets. The scheme eliminates a large proportion of the expense, and should give almost comparable results.

We are witnessing an upsurge of beginners due to the recent release of a cheap Japanese RC set. This definitely points the way to all future development. Cost is the only thing keeping people out of the movement. Anything which improves reliability, and reduces cost is for the benefit of the modeling industry at large.

What is badly needed is a cheap two-channel set which will allow the use of a multi servo. This will rid rudder only of the biggest pitfall, the escapement. These things have crashed more kits than all other causes combined. No matter how well made, and well looked after, the end is always the same. Sooner or later the escapement sticks on. When put into the hands of new beginners, the result is usually disaster. It took your Monitor article to wake me up to the fact that manufacturers tend to get carried away, as much as anyone else.

A typical advert, usually starts off "using our gear so-and-so won such-and-such."

This carries little weight to the average modeller contemplating new equipment, if so-and-so paid $1000 for the gear in question or, more to the point, was loaned the set by the manufacturer. Boiled down it is no use selling the Rolls Royce of RC gear, if nobody can afford to buy it.

It is back to the drawing board for me, to design a new range of cheap reliable sets.

BOB YOUNG, Silvertone Electronics, Tempe, N.S.W., Australia

• *Although GL rigidly adheres to a policy of avoiding opinionated comment and prefers its staffers to be anonymous, except for the usual formal credit, and then usually only on the masthead, it is perhaps unique in its willingness to look at itself, the industry, and the hobby with a self-critical viewpoint when called for. The trade evidences appreciation of this realistic approach; the timely articles by Phil Kraft and Vernon Macnabb, for example, have brought letters from all over the world.*

SOUTH AFRICAN OPINION

Although your rules don't concern me, I'd like to add my two cents worth to the rudder-only rules controversy. Our RC classes are: Class I—single channel (any single); Class II—up to 6 channel; Class III—over 6 channel and multi-proportional. So you see, we have a class for the fairly broke types (like myself). I do feel though, that perhaps Class I should be single escapement or compound servo, with the proportional boys pushed up to Class II. It is something which our Club wants to bring up at the next SAMAA Annual General Meeting. Anyhow, that puts you in the picture with our rules. I do feel that the U.S. rules at present do make money too important.

Many thanks for an excellent magazine—in anticipation for many more!

A. S. "SANDY" BENNIE, Cambridge, East London, South Africa

SAYS HE ATE CROW

I must confess to having to eat some crow! A few months ago, I made a few adverse comments about GL contents. No publication can be a winner every issue, and I suppose I must have examined a few of the weaker issues in order to be sufficiently provoked to comment. Recent issues are more than sufficiently interesting and this includes the article on the submarine. Not only is the topic a fascinating one, but the electronics and power equipment and systems makes the run-of-the-mill Class II (old definition) boys, like myself, look like a bunch of pikers.

Your publication stands out as one whose inherent worth extends over many years. It is not like the majority of books, the contents of which are timely only at the moment.

THOMAS J. ESHELMAN, Reading, Penn.

GL DOESN'T KNOW EITHER

I think Monitor exposed very eloquently one of the principal ills of RC modeling. . . that of inadequate instructions, jargon and far-out language. It's a wonder the hobby grows as it does! I found Phil Kraft's article very interesting. I agree with much of its content, but not some of his conclusions. That is, proportional is the ultimate, of course, but it doesn't *have* to be complex, it doesn't *have* to have four channels, it doesn't have to have 23 transistors, and it doesn't have to cost $400. Why didn't we walk before we tried to run? How many single channel and two channel systems are on the market? Why did the industry start with 4 and work down to one? Why was two skipped. . . . the very one required for a basic rudder-elevator-engine (with POD) system?

GORDON MARCH, Cedar Rapids, Iowa

• *The six-channel airplane, with RE&M control if it is a high wing, or with ailerons instead of rudder for low wing and shoulder-wing configurations is rewarding at greatly reduced expense. Similarly, dual proportional fills the niche between single and triple, etc., more cheaply, more reliably. But by a strange quirk of reasoning, the shortcomings of home-designed-and-built dual outfits of a few years back still unnerve the potential producer, whereas the most exotic, go-for-broke projects have a hypnotic attraction. Dual, in fact, comes closer in its possible results to full-house prop, than does six-channel reeds to the 10's and 12's. Gordon March asks an understandable question. Are we, the modelers, to blame for the situation?*

ACCOLADE FOR MACNABB

Permit me to say that Vern Macnabb's article on the "pros" and "cons" of Proportional was the best thing we have read on the subject and you could do no greater thing at this time, than release more articles along these lines. This is the sort of information the boys are starving for, right now!

KELVIN J. KIDD, Onehunga, Auckland, New Zealand

GREAT AWAKENING!

Please enter my subscription as soon as possible. I saw my first issue yeterday and can't imagine how I have managed to overlook such a fine magazine for a year that I have been in radio control. Along with the many fine electronics articles, I was most impressed with the piece by Phil Kraft "Proportional Control in Perspective."

JOHN E. MATTHEWS, Tempe, Ariz.

CANDID COMMENT

I am enclosing $3.50 to extend my present subscription to GRID LEAKS another two years. I would like to congratulate you on the excellent job you do with GRID LEAKS. I look to this by-monthly more than all the other mags put together and sometimes it seems more like six months between issues than two months.

I am a modeler for pleasure and an electronics hobbyist, therefore GL fills in the big space for the electronics end of radio control modeling. About the only things that I did not wish to see space-wasted on were RC Bibliography, Jan.-Feb. '63 issue, Equipment Survey, Sept.-Oct. '63 issue, and a lot of space wasted on nationals and contests, as all the other mags play these up, and claim first coverage on Nationals, exclusive and all that jazz. The number of modelers that attend or follow these events is only a very small part of the whole. Most of us are just out to enjoy ourselves, and our hobby is just a hobby, not a livelihood.

Congratulations on that Sampey article which tells you what the whole system really is, what it looks like, and how it operates.

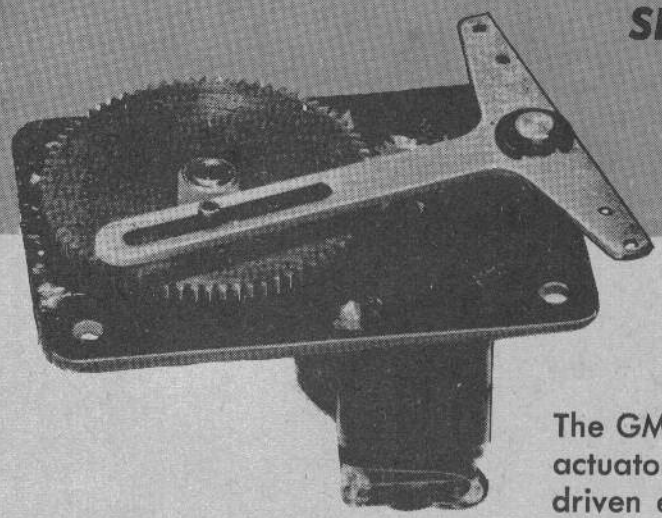
I am for GRID LEAKS a monthly, and would gladly pay 50¢ per copy as is now.

MERWYN ELY, South Bend, Ind.

POWER-A-PLENTY!

GM-MINICOMBO

SINGLE CHANNEL SERVOS



The GM Minicombo and Minicombo II single channel actuators are the perfect replacements for rubber driven escapements.

The Minicombos are light and compact enough for the smallest models.

MINICOMBO II . . . $7.95

Weight: 1.5 oz.
Size: 1⅜" x 1½" x 2"
Batteries: 2 to 4 1.5V pen cells
Action: 2PN (Rt.-Left-Neutral)

MINICOMBO . . . $6.95

Weight: 1.5 oz.
Size: 1⅜" x 1½" x 2"
Batteries: 2 to 4 1.5V pen cells
Action: SN (Rt.-Neutral-Left-Neutral)

- **SELF NEUTRALIZING**
- **LIGHT AND COMPACT**
- **POSITIVELY POSITIONED BY REVERSE CURRENT IMPULSE**
- **NO BATTERY DRAIN WHILE ON POSITION**
- **MAY BE MOUNTED IN ANY POSITION**
- **UNAFFECTED BY VIBRATION**
- **RUGGED—CRASH RESISTANT**

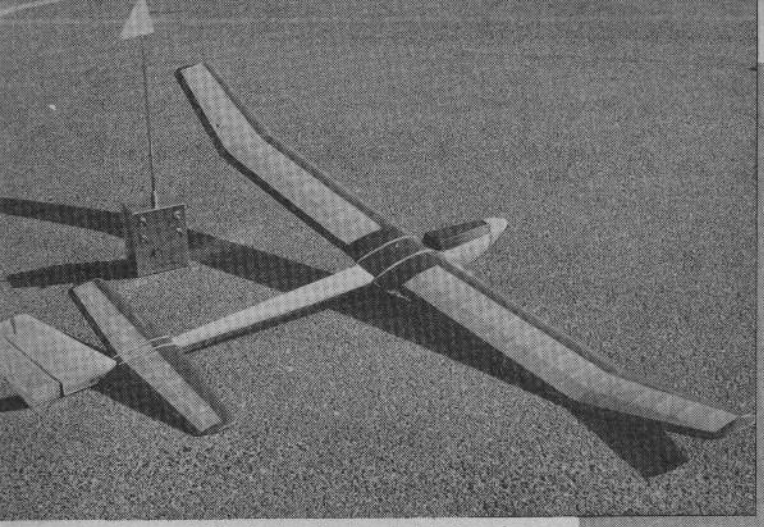
DISTRIBUTORS OF ALL HOBBY SUPPLIES

GM **HOBBY SPECIALTIES** INC.

2094 Fifth Street East Meadow, L.I., N.Y. 11554 516-489-1123

FOR COMPLETE CATALOG AND INSTRUCTION SHEETS ON ALL GM PRODUCTS
SEND ONLY 25c

By DALE WILLOUGHBY



Lowered dihedral and relocated tail surfaces with large, swept fin, are obvious changes.

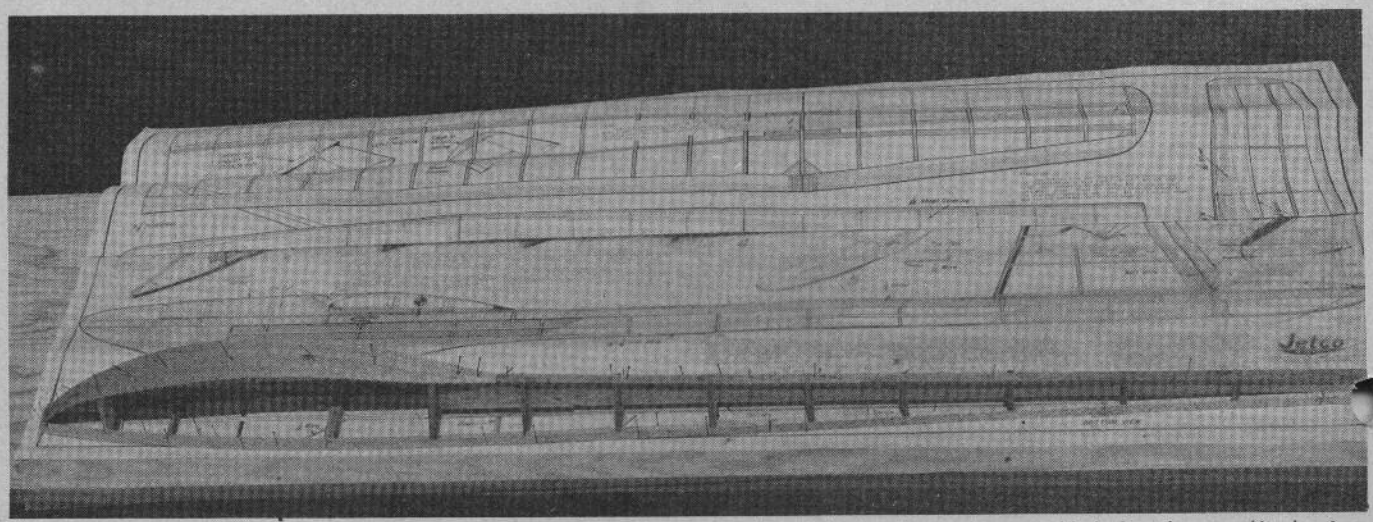
TOKI DOKI 時々

The author launches Toki Doki over the bluffs at Newport Bay, Calif. gliding site.

HOW YOU CAN MODIFY JETCO 72 NORDIC FOR TRULY MAGNIFICENT SOARING

STAND ON THE EDGE of a sandy cliff with a cool breeze blowing in from the ocean; a brand new six-channel transmitter in hand, then launch this reliable, well proven, slope soaring glider for the very best in radio controlled flying! No props, starting batteries and noisy, messy engine to contend with. Just fly and fly!

The designer of this modified version of Frank Ehling's Nordic 72 kit by Jetco may be slightly biased, but he turned to RC slope soaring after 30 years building all kinds of models, even microfilm, carried on as much as service life in the U.S. Marine Corps would permit. I've built and flown models in China, Japan, Okinawa and Korea, as well as on both the East and West coasts of United States, and Hawaii. It was while in Virginia that I began to fly radio control



In this photo the widened fuselage with bottom for radio compartment shows clearly. It can be assembled directly over kit drawing.

power models in 1959, and built my first RC glider in which I flew on the golf course at the Naval Shipyard in Portsmouth.

On hot summer days, thermals were abundant, generated by hot cement areas surrounding the golf course, and flights of five to six minutes were common, using a 200-foot towline. This same glider, a Bill Dean Nordic A/2 configuration, was flown at Hughes Hill near Santa Monica, Calif., while I was on my way to Japan, and was the basis of the article "Slope Soaring is Fun" published in the March 1960 issue of *Flying Models*.

By way of explanation, I use the words "glider" and "slope soarer" interchangeably, whereas in the strictest sense a glider can do little but to descend from the altitude from whence released, whereas a soarer or sailplane is capable of maintaining and gaining altitude after release. Likewise, "slope soaring" and "ridge soaring" are interchangeable. However, when I use "ridge" I picture a razor-back hill in the midst of a mountainous chain, but to me "'slope" indicates a gentle incline, with a nearly level top.

Frank Ehling, who designed this good sturdy glider for FAI Nordic-class flying, must have had RC equipment in mind when he allowed for 5 ounces of weight in the nose. By widening the nose a bit and changing the fuselage shape from a "V" to a rectangular cross section; using the full-sized parts shown on the plan; building a new swept tail with a balanced rudder, and installing your favorite radio equipment, your Nordic glider will give unmatched performance on any slope and will thermal soar.

Weight of the second test model was kept to 25 ounces, even with a fiberglassed nose section, for a wing loading of 8.3 oz./sq. ft. We used the new Kraft Custom Six receiver driving a Kraft Servo. Power pack was a Medco PM 2.5-6V, so the equipment totalled about 10 ounces, the fuselage and stab about 9 ounces, and the wing 6 ounces. Of course, single channel equipment can be used, with an escapement or servo, and a lighter wing loading achieved. But I prefer to fly with reeds, because I am sure of getting the command I want from them.

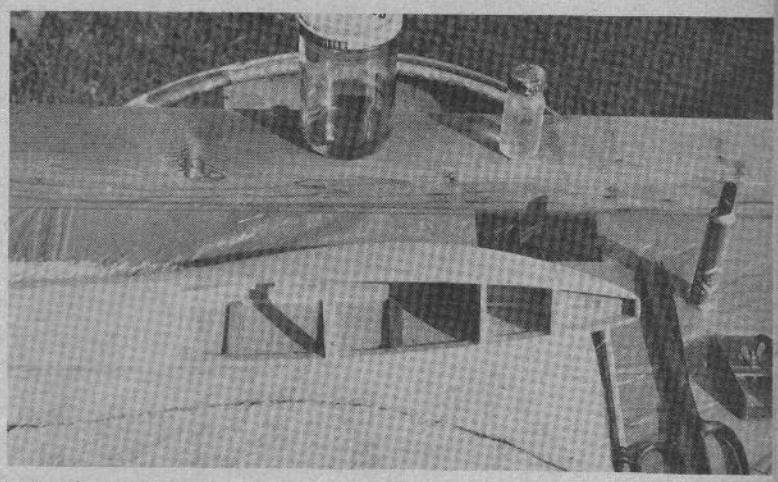
The first model used a Kraft 10 receiver with DEAC 225 mah power pack, and a Transmite servo with equal success. The reason for changing to the Kraft servo was to determine through actual tests, the comparable battery life, this in preparation for an assault on the world's RC Glider duration, distance and altitude records. Phil Kraft says the motor used in the Kraft servo draws only 35-40 mah while running, which is a bench-test figure. This drain rate goes up when there is a bind in the pushrod, or other friction is present.

Most readers interested in building this RC version of the Jetco Nordic 72 can pick up a kit for $4.95. At the same time, buy two sheets of 1/16 × 3 × 36″ hard balsa sheet, and check over your scrap box for the necessary hardware for the RC installation. The first step is to cut out the portion of the keel as shown to allow for space for the receiver, power pack and servo. Next, from the 1/16th hard sheet cut the bottom portion of the fuselage. Referring to the plans, build the crutch right over the plans as modified. This widens the fuselage to 2¾″ at the widest point under the leading edge of the wing. Make sure there is sufficient room for the servo. On number one RC Nordic the Transmitter was mounted on end, and on number two, the Kraft Servo was mounted flat, both in line with the fuselage so that the pushrod wire required no bending.

Install the keel as in Step #2, using a triangle to insure correct alignment. Now install new formers F-1, F-2, F-4 and F-5. Note that F-1, F-2 and F-4 are cut from 3/16″ balsa removed from the keel. Aft of F-5, instead of using the triangular die-cut balsa, use 1/16 × 3/16″ hard balsa, and install after the 3/32 × 3/16″ cap strip has dried for several hours. This feature permits the ⅛″-diameter wooden dowel, used for the rudder pushrod, to pass freely through the fuselage. Three pieces of 3/32 × 3/16″ on each side of the fuselage strengthen the equipment compartment, spaced as shown on the plans.

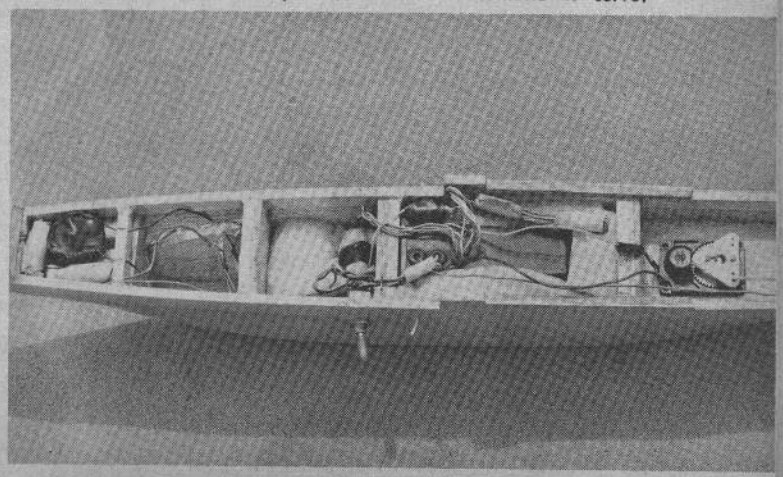
Now remove the crutch from the plans and, using the 1/16 × 3″ hard sheet, plank the top of the crutch from the end of the fuselage to former F-4. The hard balsa block furnished for the nose block is cut equally in half, and both pieces glued in front of former F-1. When dry, shape with a Razor Plane, as it appears on the cover of the box. Among the members of the Harbor Slope Soaring Society, there is a varied opinion as to the merits of a replaceable soft balsa block vs rock hard balsa pine. I chose the hard block in order to provide a substantial base for the fiberglass.

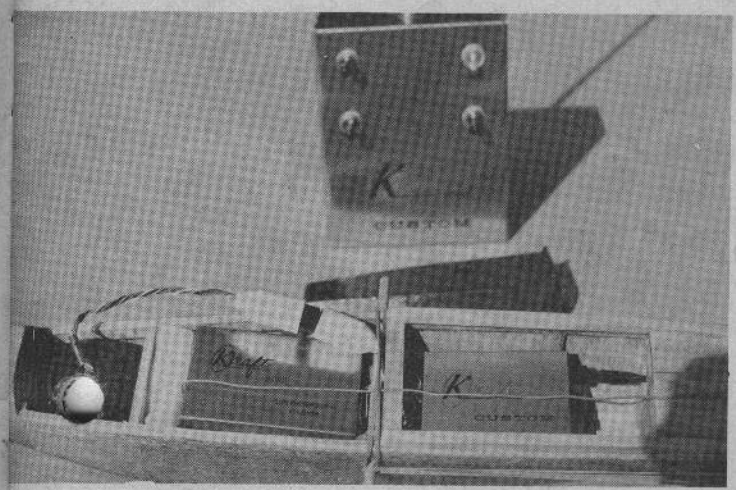
The die-cut sheet fuselage sides provided in the kit are now of no value except for scrap as they no longer fit. New sides are cut roughly to shape and put aside. Prior to cementing them to the fuselage, two ⅛″ square medium balsa pieces are blued to the edges of the bottom sheeting to reinforce the joint where the sides join the bottom. When dry, glue the sides, noting that a slight curve exists in the top edge that butts against the crutch. Trim to shape when dry, again using the Razor Plane to good advantage, rounding the bottom edges slightly. The top hatch is constructed just as shown in Step 4 on the plans, except the formers are cut sufficiently to allow freedom of passage for the wiring from the power



Materials required for fiber-glassing sheet-balsa-covered nose.

Below: John Wathen's conversion works very well with Orbit 10-channel receiver, an amplifier, and the Bellamatic II servo.





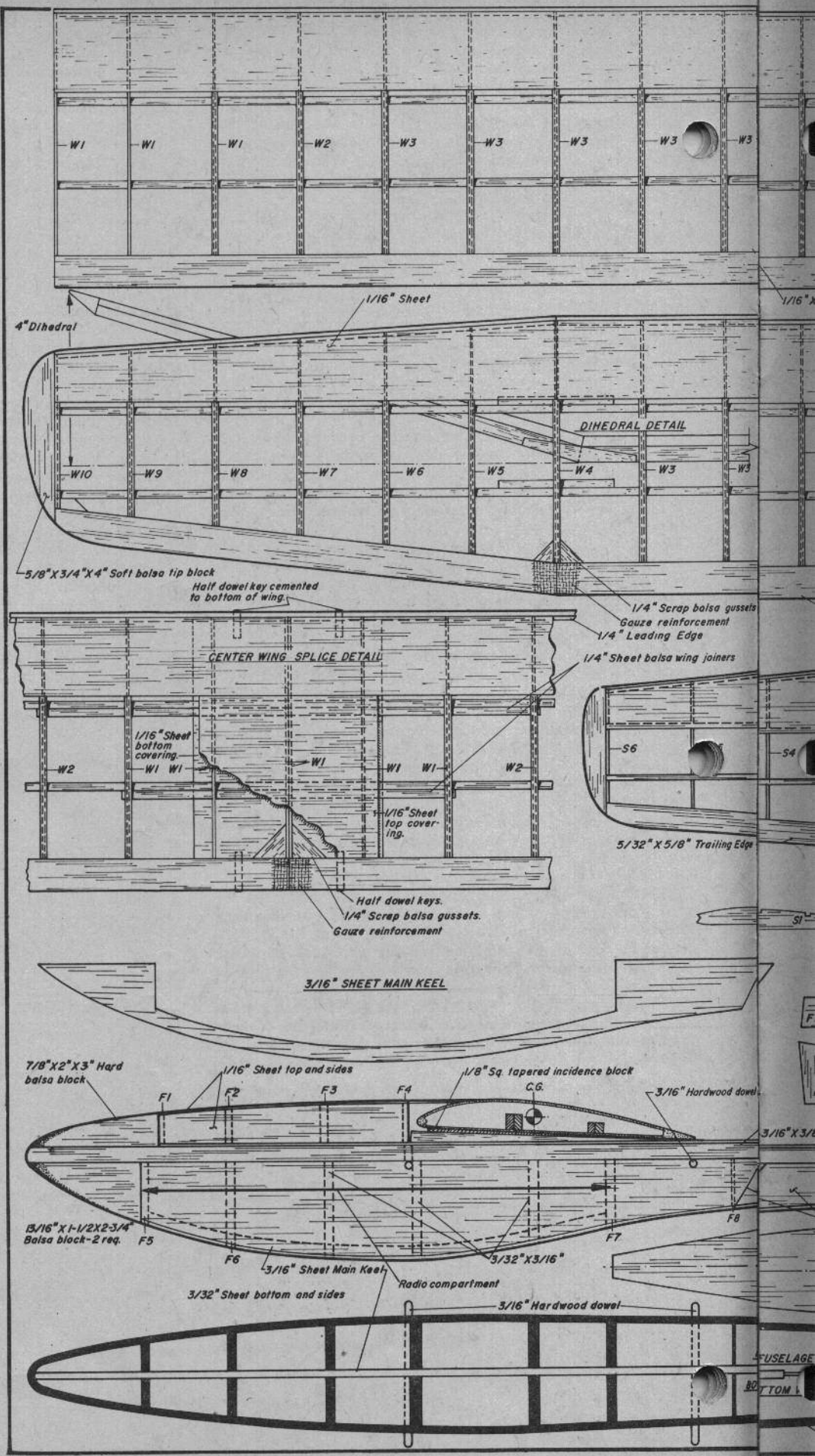
Author's installation of Kraft 6 superhet with Medco powerpack forward and Kraft servo, rear, is neat, efficient arrangement.

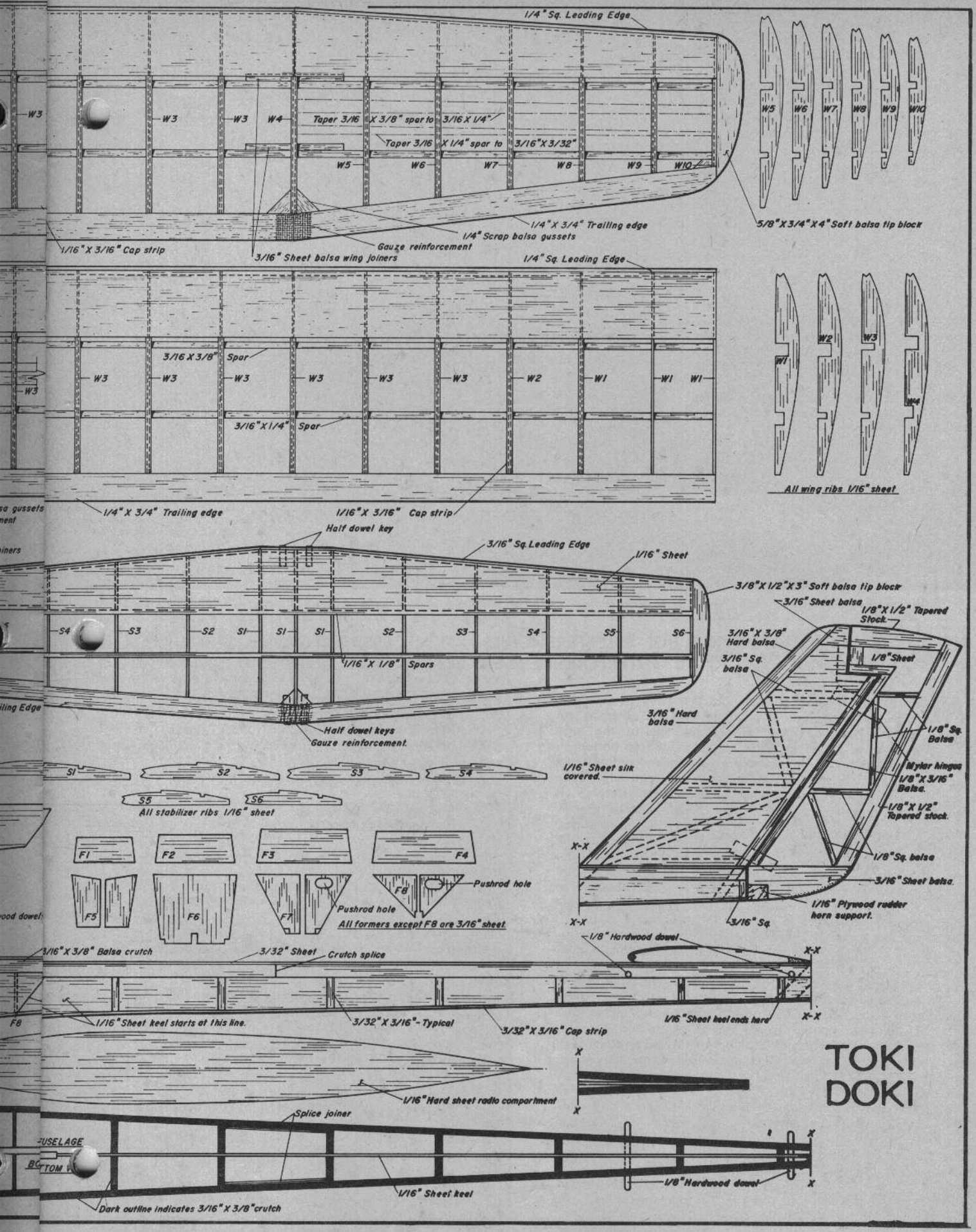
pack to the receiver, and the connecting plug.

In my last three gliders, I have eliminated the switch and, when not flying, keep the plug disconnected. The hatch is held down by a dowel inserted into the nose block and by rubber bands across the opposite end, using the wing dowel, as shown in the photo. Two short 1/16" dowels protrude from the hatch to retain the rubber bands. The next step is to sand the fuselage smooth preparatory to fiberglassing the nose section to former F-5. Dope the fuselage twice, sanding between coats, to remove the grain and all bumps. I used 2-oz. mat (see July-August GRID LEAKS for description of mat) which I split evenly, making approximately 1-oz. weight material, which was cut to size and applied. I like the firm feel that a glassed fuselage gives, plus the crash resistant properties and strength provided. Our slope is undergoing a face lifting (people building homes) and the bulldozers have uncovered some mighty hard clay surfaces, whereas before it was soft sand and weeds. In order to keep weight to a minimum (the strength comes from the fiberglass, not the bonding resin) I squeezed out the extra resin by using a sheet of Saran Wrap, pulling down on the inverted fuselage and tacking it to a short piece of 2 × 4 placed under the fuselage. This produced a smooth keel section and a few wrinkles near the nose, but these were resin-rich areas and so sanding them smooth was no problem. It was finished with 400 wet-and-dry and two coats of clear dope.

The vertical swept tail was designed to provide a good turning radius without the glider going into a spiral dive after a 180-degree turn. My first Nordic, similar to John Wathen's shown in the photos, had a conventionally placed rudder and too much altitude was lost on a steep turn. The new surface allows a turn with the same radius, but with little or no loss of altitude. It will spiral down, however, if held over for 360-degrees, and this makes a safety feature that is necessary. Booming thermals can take a design like this into "the wild blue yonder," if there is no way to spiral down. Even in test flying!

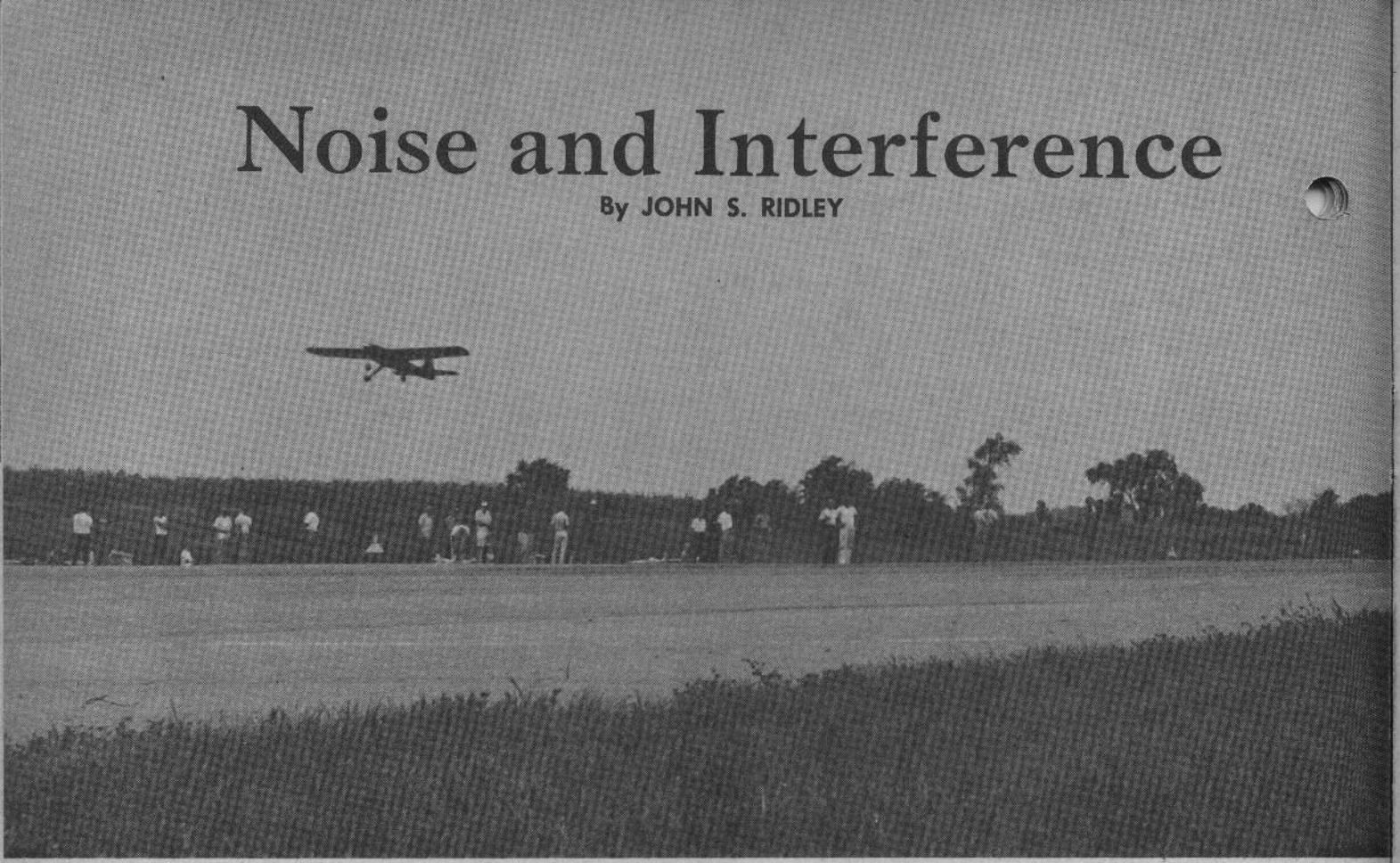
I had about 400 feet altitude, and a thermal took over and carried the glider almost a half-mile down wind, and I guarantee I was spiraling down as safely as I could with a new design, for the houses under construction were looming closer. Another desirable flight characteristic of the *(Continued on page 24)*




1/4" Sq. Leading Edge
W3
W4
Taper 3/16 X 3/8" spar to 3/16 X 1/4"
Taper 3/16 X 1/4" spar to 3/16"X 3/32"
W5
W6
W7
W8
W9
W10
1/4" X 3/4" Trailing edge
1/4" Scrap balsa gussets
Gauze reinforcement
1/16" X 3/16" Cap strip
3/16" Sheet balsa wing joiners
5/8"X 3/4"X 4" Soft balsa tip block
3/16 X 3/8" Spar
3/16"X 1/4" Spar
W1
W2
All wing ribs 1/16" sheet
Half dowel key
3/16" Sq. Leading Edge
1/16" Sheet
3/8"X 1/2"X 3" Soft balsa tip block
S1
S2
S3
S4
S5
S6
1/16" X 1/8" Spars
Half dowel keys
Gauze reinforcement
All stabilizer ribs 1/16" sheet
3/16" Sheet balsa
1/8"X 1/2" Tapered Stock.
3/16"X 3/8" Hard balsa
3/16" Sq. balsa
1/8" Sheet
3/16" Hard balsa
1/8" Sq. Balsa
1/16" Sheet silk covered.
Mylar hinges
1/8"X 3/16" Balsa.
1/8"X 1/2" Tapered stock.
X-X
1/8" Sq. balsa
3/16" Sheet balsa.
1/16" Plywood rudder horn support.
3/16" Sq.
F1
F2
F3
F4
F5
F6
F7
F8
Pushrod hole
Pushrod hole
All formers except F8 are 3/16" sheet
3/16"X 3/8" Balsa crutch
3/32" Sheet
Crutch splice
1/8" Hardwood dowel
1/16" Sheet keel starts at this line.
3/32"X 3/16"- Typical
3/32"X 3/16" Cap strip
1/16" Sheet keel ends here
1/16" Hard sheet radio compartment
Splice joiner
FUSELAGE
BOTTOM
1/16" Sheet keel
1/8" Hardwood dowel
Dark outline indicates 3/16" X 3/8" crutch
TOKI DOKI

Noise and Interference

By JOHN S. RIDLEY



A multi-control shoulder-wing climbs out realistically during the 1964 Maryland State Championships. (Photograph by Bill Coker.)

NOISE CAN BE INTERFERENCE, BUT INTERFERENCE IS NOT NECESSARILY NOISE. IT IS UNFORTUNATELY TRUE THAT "EXTERNAL" INTERFERENCE GETS BLAMED FOR ANYTHING UNEXPLAINED.

MOST OF US HAVE RUN INTO the problems of electrical "noise" and interference at some time or other in our flying. This type of problem is perhaps one of the most difficult to solve; it can be elusive and difficult to correct.

Definition: Noise can be defined as broadband interference or interference which covers wide bands of frequency. Noise can be classified as interference, however, interference is not always noise. Interference may be a relative narrow band signal originating from another CB or RC transmitter.

Symptons: Electrical noise and interference can cause erratic operation, lock in controls and even mask the signal from the transmitter. These same symptoms can be caused by faulty escapements and linkage. Therefore, it is necessary to determine by monitoring with headphones or by the process of elimination that noise is actually the problem.

Source of interference: There are two major categories of interference: A) Externally generated and, B) Internally generated.

Most external interference originates from CB transmitters, traffic signals, diathermy, power leaks from electrical power lines, neon signs, arc welders, unsurpressed spark plugs, etc. Internal noise originates from arcing of motor brushes, switches, relay contacts and moving metal parts contacting one another, such as torque-rod and escapement. This noise may be radiated to the receiver or may be conducted through the wires.

Since external noise is largely beyond our control and relatively easily spotted by monitoring and, since it is not the fault of the RC equipment or installation, we will consider only the internal noise problem.

Construction practice: The noise problem should be considered throughout the construction and installation of the equipment. It is good practice to observe the following rules:

A. Isolate all metal parts in linkage system.

B. Never mount relays so that the armature pivot is in the same line as the shaft of the engine. In other words, mount them so that the armature pivot is in any direction but fore and aft in the aircraft.

C. Mount receiver in plastic or rubber sponge.

D. Use separate batteries for receiver and actuators whenever weight is permissible.

E. Do not cable actuator leads with receiver power supply or signal leads.

F. Twist actuator leads.

G. Use noise suppressor circuits across motor armatures and relay contacts.

H. Keep antenna lead as far away as possible from control circuit wiring.

I. Motor actuators should be enclosed in a metal box.

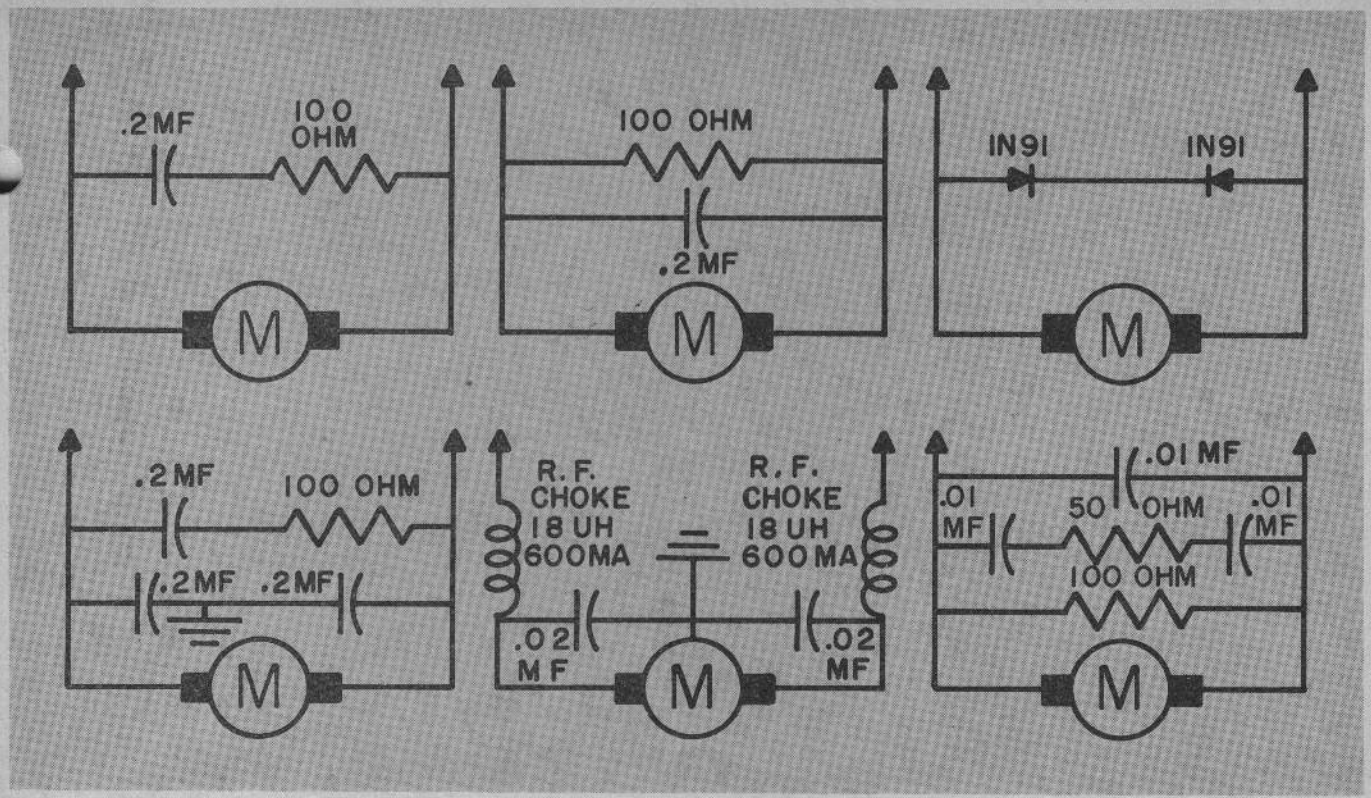
Internal noise generation: The most difficult noise to cure is that caused by motor commutators. It is caused by the brushes bouncing, which causes a discontinuity in the contact, and resulting arcing. Motor noise suppression can be accomplished by the methods shown in sketches. (See drawing, top of page 11.)

Relay contacts carrying current arc when they open because of the inductive kick caused by the escapement coil or motor they are controlling. If they are carrying heavy current the arcing can cause relay failure.

Examples of relay contact arc suppression, are illustrated at bottom, right, page 11—the two items at the left side of the figure.

Moving metal-to-metal contacts cause noise in the following manner:

Lets say an escapement is used to drive a rudder through a metal torque rod. The escapement is connected to the batteries and to the receiver, so it can be considered a part of the ground system. The long torque rod is connected to the escapement and thus acts as a further extension of the ground system. When the installation is new, the points are clean enough to offer little electrical resistance; however, when they get dirty they offer variable resistance as the escape-

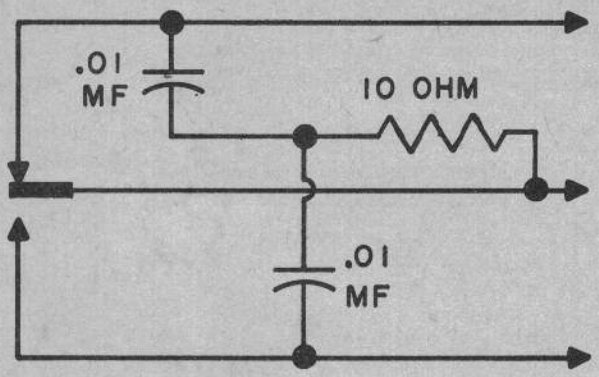


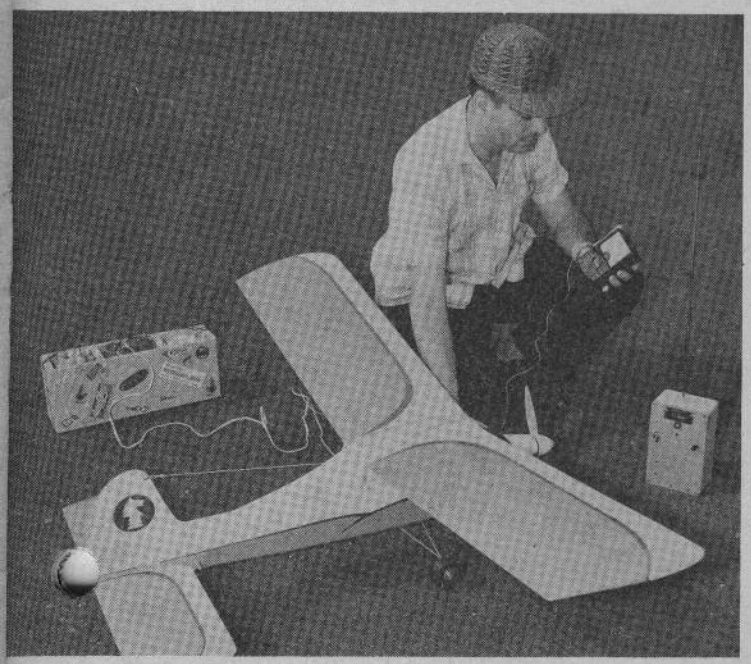
ment moves or as the motor vibrates.

Methods of relieving this problem are: A) Bonding and B) Isolation. These items appear on the right side of the figure, bottom page 11.

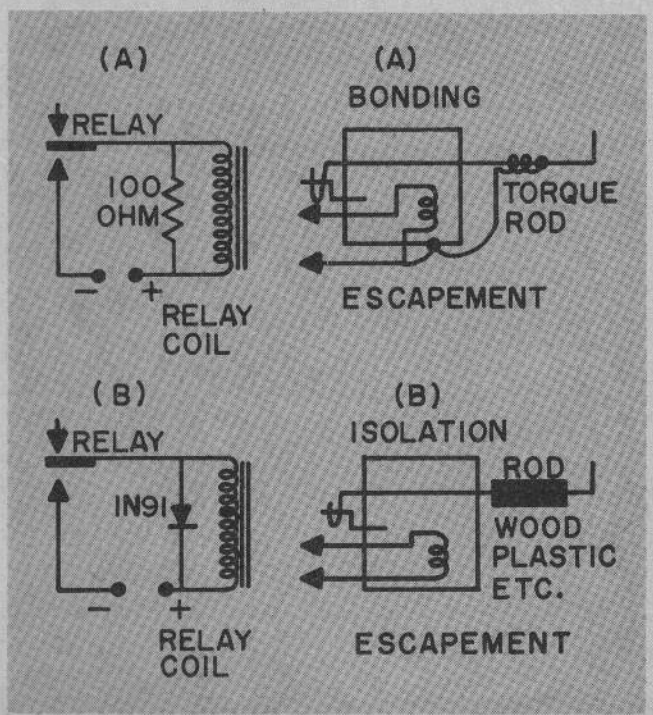
Diagram, center, right, page 11, pertains to Mighty Midget and Bonner servos.

(Editor's Note: This article appeared originally in the R/C Emitter, *published by the Covina Hobby Center (Calif.). Although the interference effects of "noise" have long been recognized few hobbyists take precautions because many people —including some manufacturers—say flatly that we need not be concerned. Most flyers who have used various installations, at one time or another have observed the results of "noise." Precautions cost little.)*



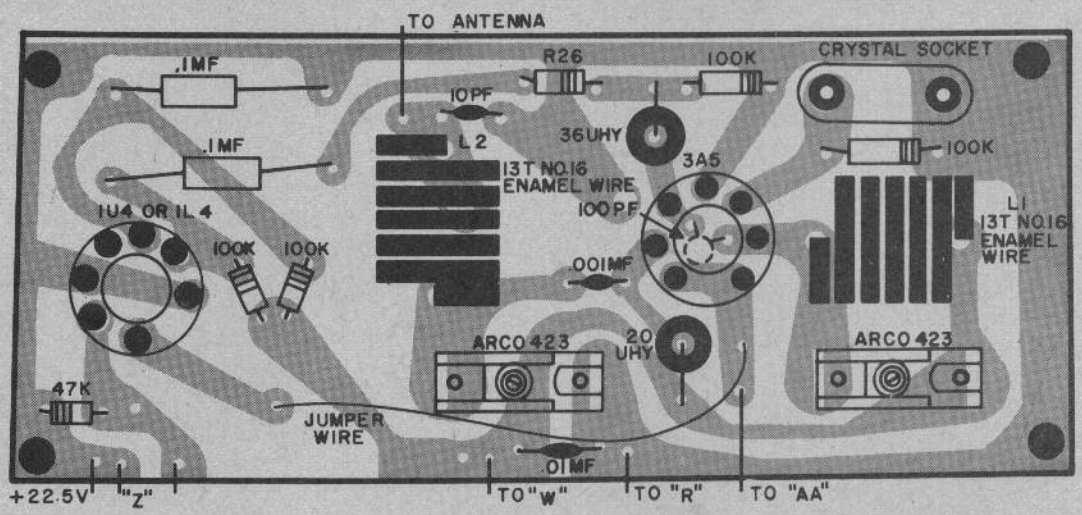


Walt Musciano resorts to meter while hunting some illusive "gremlin" in his neatly finished trike-geared rudder-only craft.

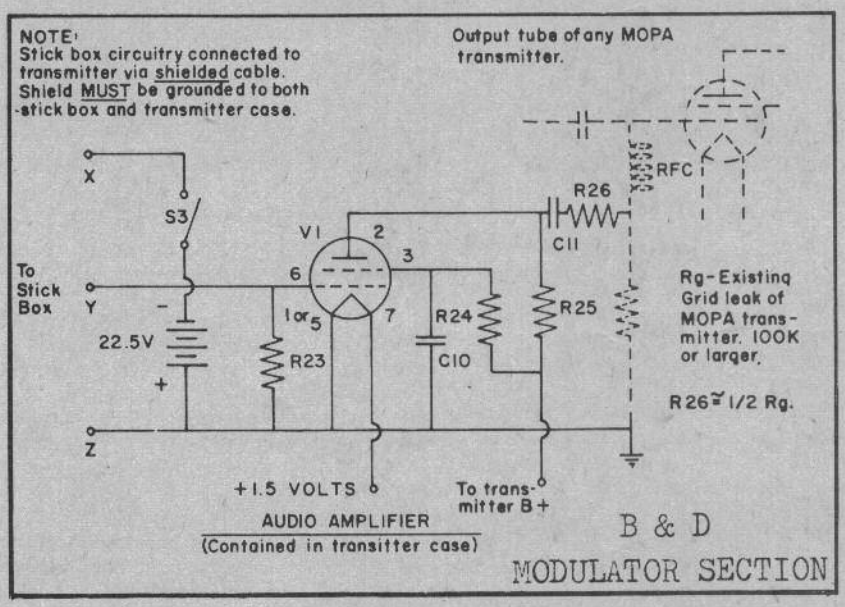


This base utilizes the 3A5 section of the Kraft MOPA and section of the modulator, making it easier to construct this popular system.

NEW P.C. BASE FOR B&D PROPORTIONAL

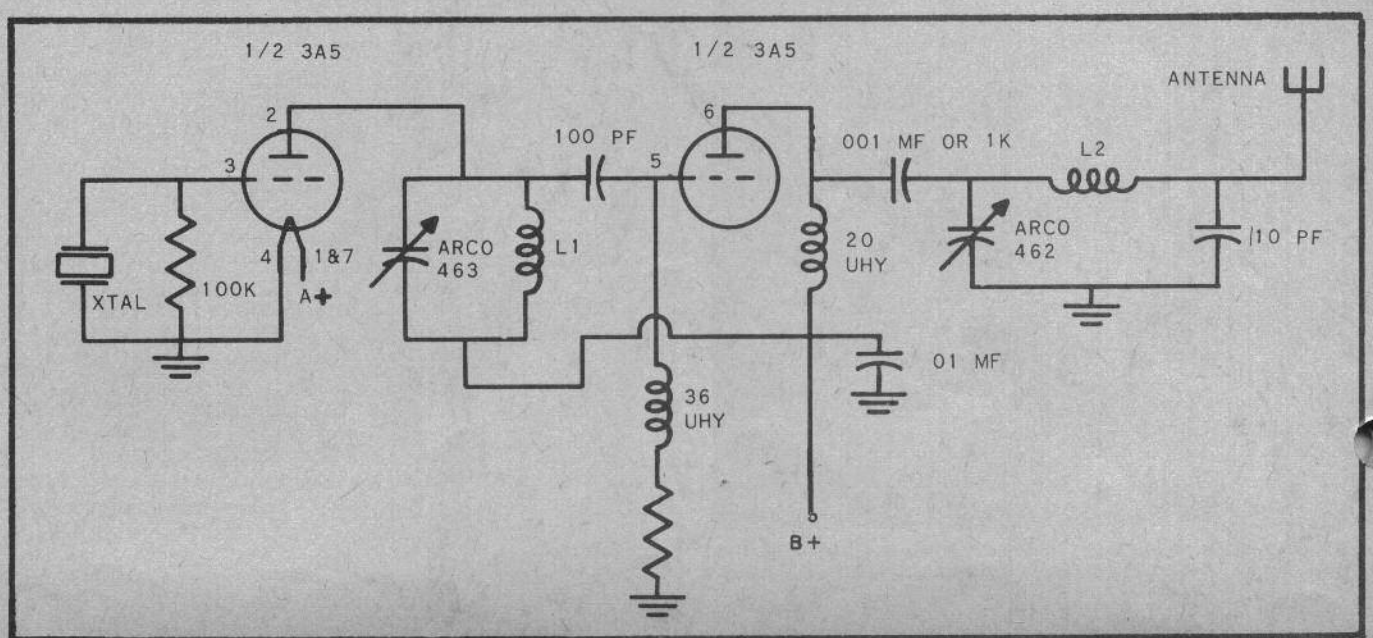


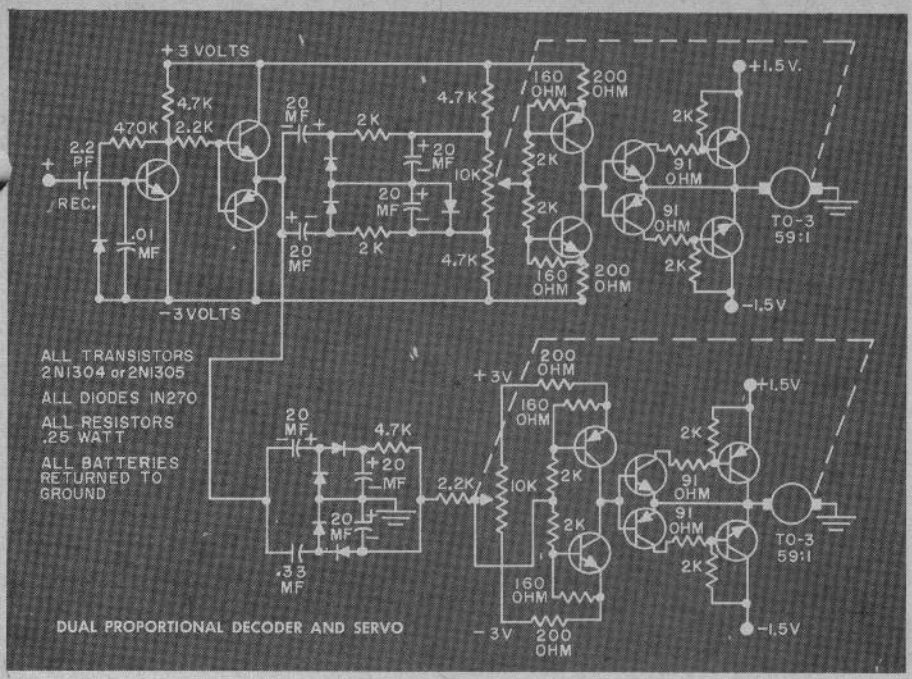
by JOHN RAWLINGS



■ Much interest exists in the B & D Proportional System which appeared in *Model Airplane News* in early 1963. This is the Beeler and Dickerson proportional version for Class II. The original article contained only a modulator section with the suggestion that it could be used with virtually any MOPA-type of transmitter.

John Rawlings of the McDonnell Aircraft Club of St. Louis has developed a PC base which utilizes the 3A5 section of the Kraft MOPA, and the section of the modulator, all on one board. For our B & D fans, we are presenting the board and the layout of the physical components. For a refresher, also presented are the two schematics of the Kraft MOPA section, and of the B & D modulator. This unit may be housed in a hand-held cabinet such as the Ace #7 case. ▪

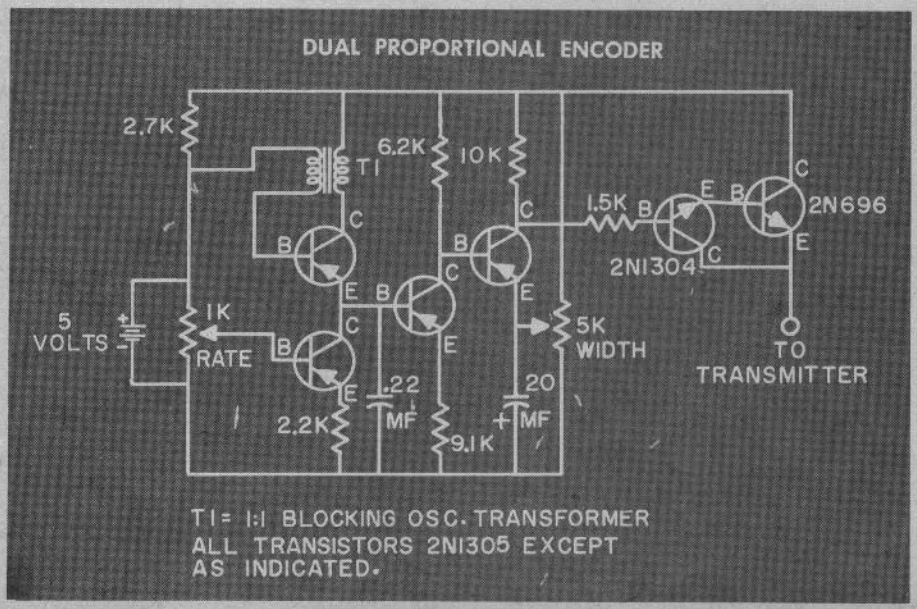




PROPORTIONAL CONTROL IN GLIDERS

By C. J. MUNSEY

Publisher's Note: The statement in July-August Grid Leaks that the Munsey front-end was used in the superhet system described by Frank Colver, lead to many questions. This follow-up presents additional circuitry and description which appeared in the Zephyr. This data supplements the July-August article, and schematics.



THIS IS NOT A construction article. It is my intention to report a variation in detail on an already popular system. It is fitting that this should be published in the *ZEPHYR*, since the innovation is suitable for gliders.

Perhaps the greatest advantage of a modern proportional system is its remarkably small battery drain. The system to be described operates on two pencells for the motors and four Burgess NE cells for the receiver and servo amplifier. Life expectancy in normal flying is practically equal to battery shelf-life. Not to be overlooked is the greater satisfaction of operating the more realistic "joy stick."

Development of the Micro-Mo series of motors is second only to the transistor as a boon to model control systems. In this application a TO-3 motor with a 59:1 gear radio drives the control surface and position potentiometer directly. The motor and pot are mounted with their shafts in-line and coupled with a piece of plastic tubing forced over each shaft. Motion is transmitted to the control surfaces via a pushrod driven by an arm mounted on the potentiometer shaft. This arrangement provides a rigid coupling between the pot arm and control surface to insure control surface alignment. Motor gears are protected from damage by the slip inherent in the plastic sleeve coupling. No mechanical stops are provided, nor are they needed, since the servo amplifier inherently limits pot travel to a suitable maximum. A military surplus potentiometer is used. While there is no question as to the suitability of a reworked commercial pot, no experience can be reported. Needless to say, low torque is a must.

Control system centering is accomplished by rotating the pot body in its mounting. The "servo mounting" feature of the surplus pot (G. M. Giannini & Co., Inc.) (Model 875 T—2 watts per section, 10,000 ohms; ⅞" diameter x ⅞" long x ⅛" diameter shaft) is clearly an advantage over the bushing-mounted commercial pots. An alternative would be to provide fine centering with an adjustable pushrod.

The widely used pulse-width, pulse-rate system is employed in this application. Many excellent references are available which fully detail the operation of this type of system. I was most influenced by Herzog's paper "Transistors Simplify Control of Target Drone," by G. B. Herzog, *ELECTRONICS*, May 1959. Also see "Dual Proportional Boat," by Ralph Mifflin, GRID LEAKS, November-December 1963.

It is important to note that since the signals employed in this system are long pulses, good low frequency response is required. Sub-miniature audio transformers are not satisfactory. Frank Colver's receiver uses capacity coupling in the audio stages to avoid this problem.

The decoder and servo amplifier circuitry is shown schematically. The functions of each stage have been described in the references above; however, certain points of interest will be pointed out. Both channels employ capacitor coupling followed by diode clamps to ground. This arrangement permits the surfaces to remain in neutral when the transmitter is off. It has been (*Continued on page* 27)

A good finishing job catches the eye. Windows cut out, "glass" on a printed sheet.

DRIVE AN R/C PORSCHE

For off-season or anytime fun, the Plastika automobile kit, with the Boatomatic actuator and GM variable gear-ratio electric drive motor, is an excellent combination.

By BOB FERRIS

THE WINTER is a time for building for much of the country. Many hobbyists take the opportunity to have a fling at novelty projects—especially when left-over radio gear is gathering dust. Actually, RC Jay designer Bob Ferris did not wait for winter to come. A two-season stretch without a major airplane crackup—and he had a spare—left him with nothing to build. This Porsche resulted.

It is a Plastika kit, made in Germany and obtained in this instance through GL advertiser Lee's Hobby Industries. While there are many ways to put RC gear into such a car, including proportional, Bob elected to do it the easy way with a Boatomatic actuator, an old Gyro single-channel receiver—both of which he had on hand—and a new GM 6-volt variable (hand adjusted) gear-ratio motor. In 6 and 12V versions, it has an adjustable feature visible in the pictures, permitting gear ratios to be set at 3, 6, 12, 16, 32 and 60 to 1.

GL's editor had a go at driving the Porsche in a basement approximately 30 feet across. The car is gaited to slow reflexes at 3 to 1, gets lively at 6 to 1, and builds up speed on long straightways at 12 to 1. Higher gear ratios did not apply in this case.

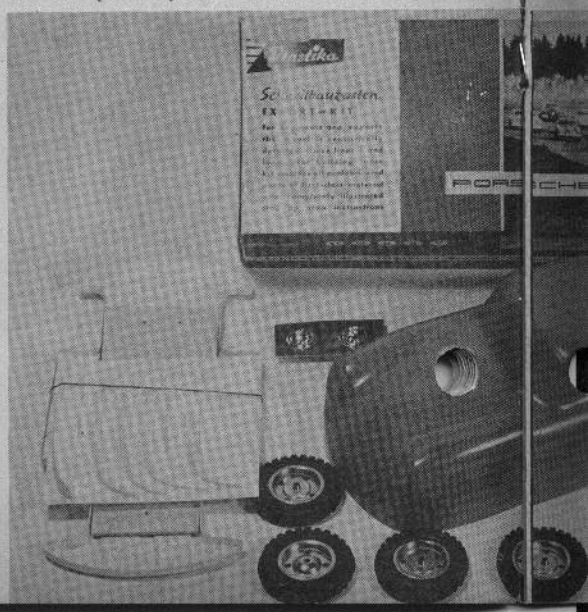
Technique was much like escapement operation, but with a more measured keying, giving forward, stop, reverse, and left-right for steering. There did not appear to be much of an electrical noise problem but Bob used a single 100-ohm resistor across the motor terminals. Incidentally, the car lights are operable.

The Boatomatic provides steering mechanically and motor switching by quick blipping of its electrical contact feature. Steering is not self-neutralizing, despite the SN-like action. (That is, right follows-left-etc. sequence.)

After arranging various obstacles as a steering test, the objects then were arranged as a continuous course, with the result that the course suggested in the drawing, was quickly evolved—good for large basement, parking lot, etc. Turns should be arranged in keeping with the capabilities of the car's speed and control system. *End.*

Ready-to-run model makes a decorative piece. Door lines, etc., might be pointed up.

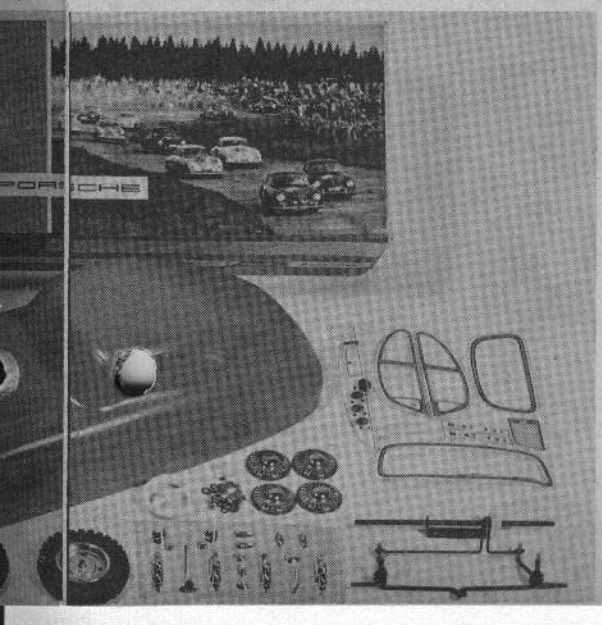
The kit parts speak for themselves. Especially

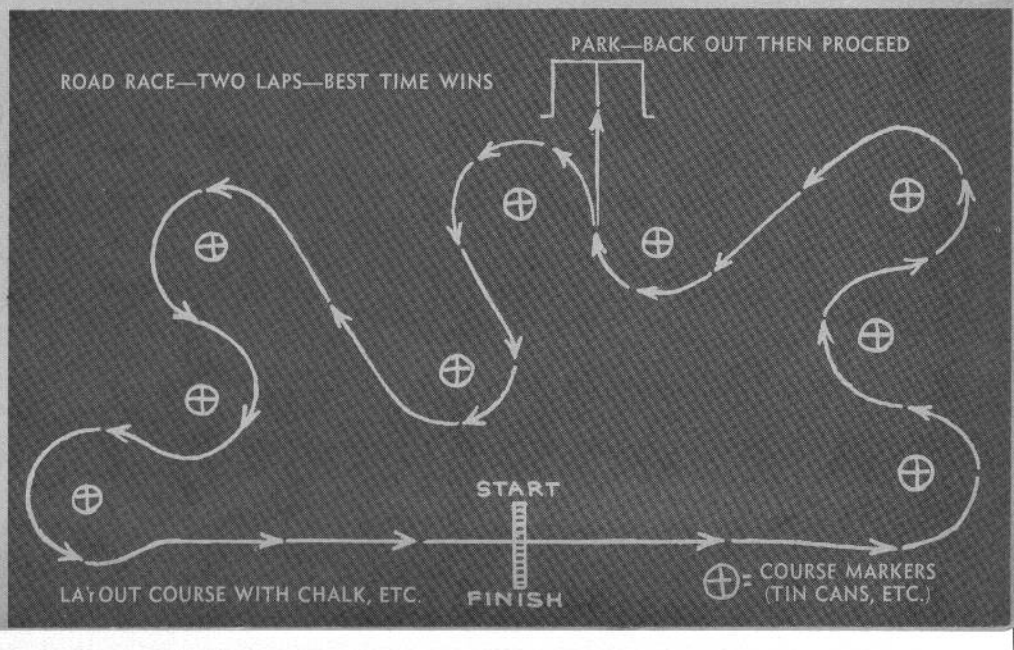


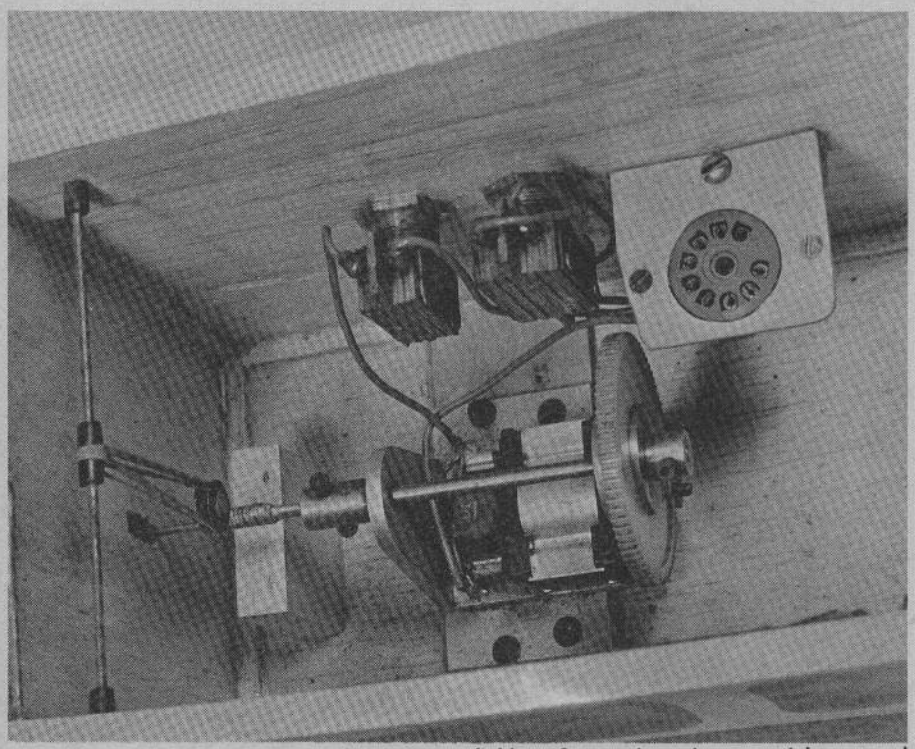
Body removed from chassis to display installation. Actuator and motor fit as neatly as a glove. Servo-pack nicads can be smaller.

ally

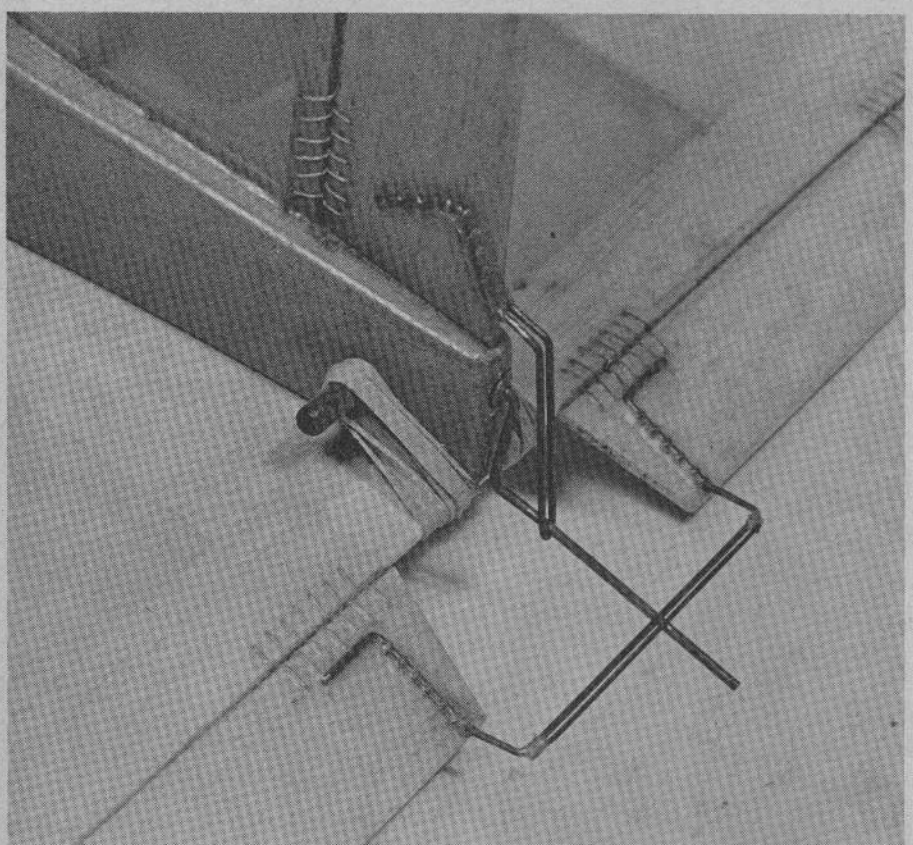
note the rugged assembled steerable front-end.







This home-made servo using rigid frame, Bonner servo motor, proved extremely reliable. Suppression is essential; several methods are shown elsewhere this issue.



Rear-end linkages show clearly here. Note the proportion of elevator area to stabilizer. Nylon thread figure-eight hinging is used and yokes attach with thread, glue.

GALLOPING GHOST SERVO

● The switches and socket in the photo at the left indicate to the practiced eye that the Galloping Ghost installation developed by Danny Maas, of Huntington, N.Y. has been in use for a long time. To GL's certain knowledge his modified Rebel racked up 500-plus trouble-free flights in one year. However, two seasons of trial and error were required to perfect reliability.

It is not our purpose to explain how Galloping Ghost works. The system was presented in *Model Airplane News* eight years ago by John Worth, now AMA's Executive Director, and can be researched in *The RC Digest,* a book advertised by MAN.

Maas found two principal difficulties: receiver and actuator. He tried many of both, and a variety of electric motors for the actuator. Receivers presented two annoying faults. With continued pulsing they broke down, or they were susceptible to noise. It is interesting to note that he obtained best results from an Explorer (tube-type with relay) receiver, now off the market. In his area other flyers had notable success with the Explorer—which was relatively noise free—and the Micro 4 actuator which demands control of noise generation. (See "Interference and Noise", this issue.)

His eventual choice of actuator motor proved the Bonner, which is considered ordinarily not to be ideal for GG. Using six nickel-cadmium pencells (3.6V each side) battery drain was not a problem—ten long flights could be made of an afternoon. A machinist, Danny hogged the actuator frame from a block of aluminum—but a bent-up sheet frame is OK. The important point is that shaft wear in the frame bearings be minimized so that gear meshing remain dependable.

Virtually all combinations of gears failed (teeth too fine generally), and the Ace standard nylon gear with Bonner brass servo gear was above criticism. Danny feels that most GG troubles come from flyers trying to get too much from the system. Adjustments to rudder band tension, down elevator settings, and so on, involve compromises.

The major modification to the Rebel was in the airfoil, which was given a ⅔-⅓ setup—that is, it was near symmetrical, with ⅔ of its depth going into top camber, and ⅓ of the depth into the convex undercamber.

The overall result was a reliable, easily trimmed craft which excelled in a pylon-type of flying. Though the Rebel had a .19 Fox for power, Danny did not use motor control—eloquent proof of perfect and dependable control. ■

ATIONS.....

installations is a challenging area for those who try things.

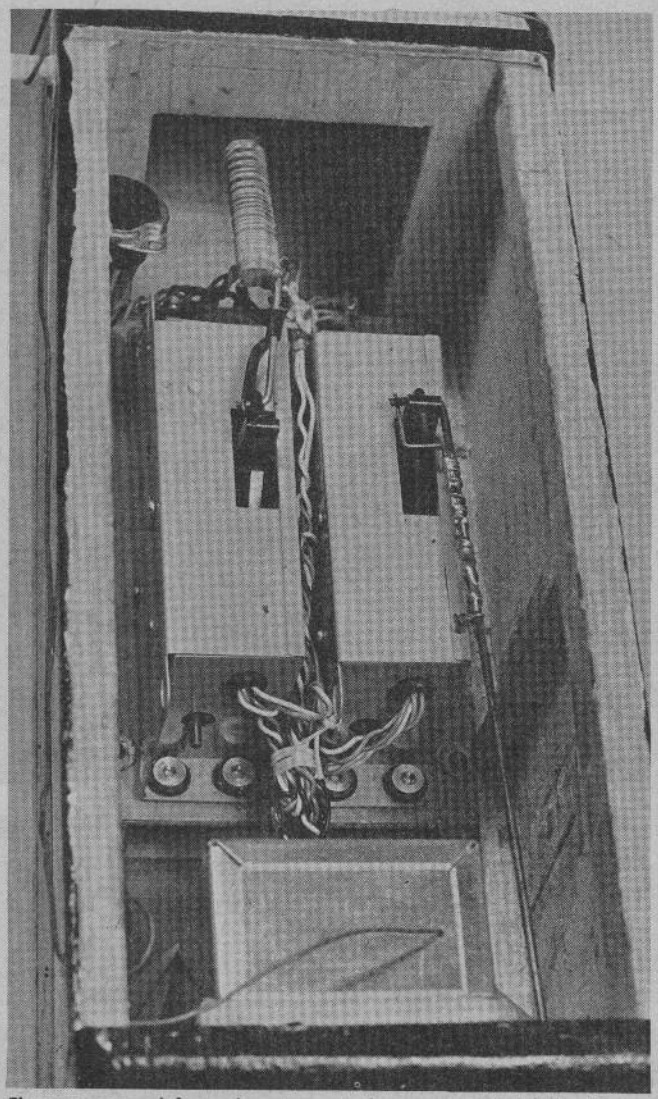
FOUR-CHANNEL "RUDDER-ONLY"

● In the Monitor this month there is a discussion of multi-channel installations in Class 1 or so-called rudder-only aircraft. While there is nothing especially difficult about putting servos into an aircraft, given installations always are of interest for their approach to a problem. And, too, ex-single-channel people with serious plans for Class 1 competition may find such an exposition of value.

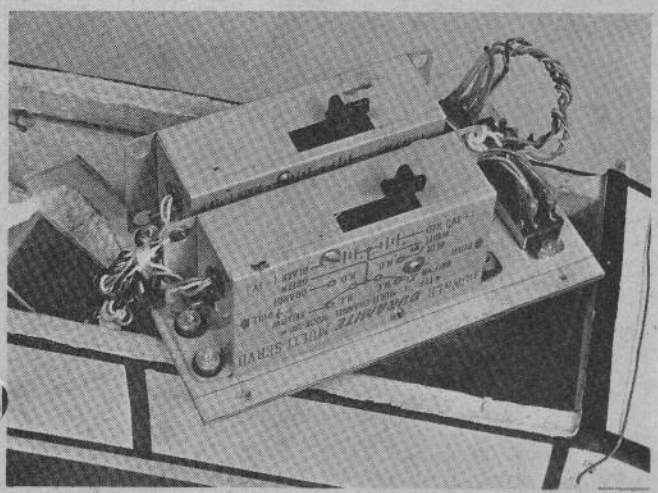
The photographs, right and immediately below, show the interior of a Swamp Box conversion—the original single-channel Kraft-Varicomp-Elmic Corporal, at lower right. The servos are well-used Duramites several seasons old, converted by Ace Kraft amplifier kits to Transmites (transistorized servos for operation with relayless receivers). Adapting full multi practice the two servos were mounted on a removable plywood tray, using DuBro servo hardware kits for the servos, and 2/56 machine screws and blind nuts to attach the tray to hardwood bearers glued in the corners formed by cabin sides and floor.

To make the installation truly removable without wiring or switch being anchored to the structure, a Muter slide switch was mounted on the tray. The switch handle was drilled to take a 1/16 music wire detachable extension arm which extended through the fuselage side. (A bushing in the fuselage side supports the extension.) By bending the inner end of the extension at right angles to point forward through the hole in the switch handle, the servo tray could detach and reengage when put back, by sliding it directly forward before lifting up (the reverse on replacing).

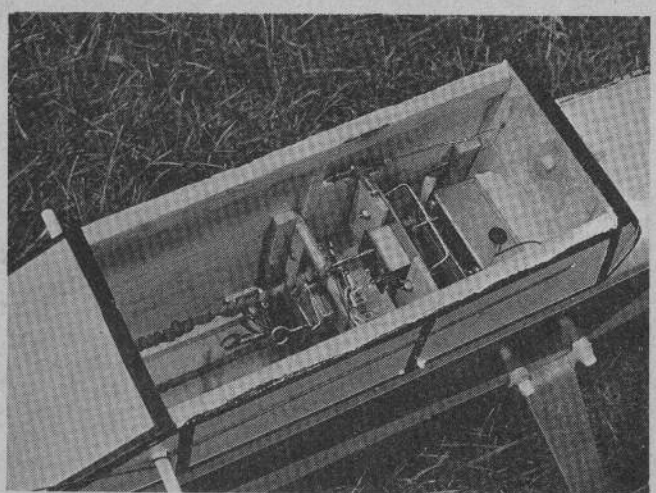
Because the 10-channel receiver could be fully committed to the aircraft, the usual plug and socket, or multi-pin connectors were eliminated—the servos and batteries are wired directly to the receiver. The only remaining requirement is provision for charging of the nickel cadmium servo and receiver battery pack. This was handled by means of a common plug and socket—the latter showing in the upper portion of the picture on the right, and the former being foam rubber wrapped and placed in the nose compartment immediately in front of the main cabin bulkhead. Incidentally, it will be found that a greater gross, as compared with the escapement installation, allows, even requires, a more aft location of the center of gravity. ■



Elevator servo, left, and motor-control servo, nest side-by-side on removable plywood mounting tray. Charging plug at upper left.



Servo unit removed to show switch mounting—operated by an extension arm. Reed-type receiver was mounted on vertical sliding tray.



Swamp Box before modification. Of particular interest is the Elmic MC escapement—a push pull linkage, rubber horizontal, easy to wind.

Arc Suppression for Magnetic-type Relays

By K. G. ROBERTS

•

OMEGA SALES & ENGINEERING

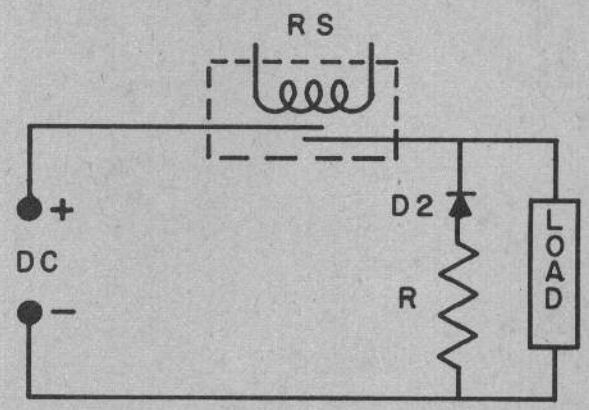


FIG. 1

DIODE AND/OR DIODE RESISTOR

RS MAGNETIC REED RELAY
D2 GENERAL PURPOSE DIODE (REF. 1N456)
R RESISTOR (GENERALLY NOT REQUIRED—USE FOR ADDED PROTECTION: 10 TO 100 OHMS)

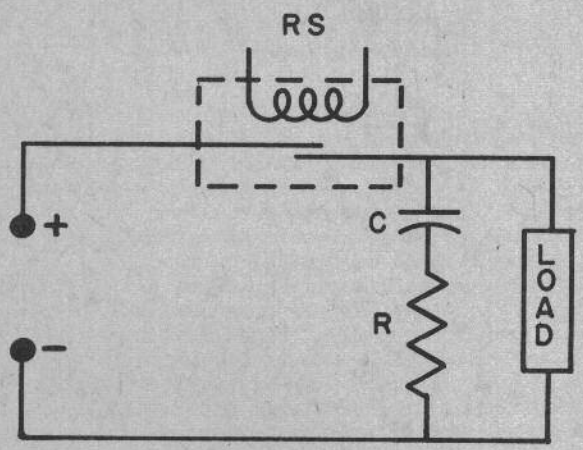


FIG. 2

RESISTOR-CAPACITOR

RS MAGNETIC REED RELAY
C CAPACITOR
R RESISTOR

NOTE: In either case, diode or capacitor method, when a SPDT reed relay is used, *both* sides of these contacts *must* be protected, I.E., the normally closed, and normally open contact.

The two types of loads, commonly used circuits, and easy-to-apply formulae for values.

ARC SUPPRESSION FOR contact protection on any relay device is probably one of the most important applications of modern day circuitry but, needless to say, is one of the most neglected. Although volumes have been written on the subject, the writer will try to present a few basic applications which will normally suffice for magnetic reed-switch applications.

Loads: Contact ratings are given with a particular load factor, either Resistive or Inductive.

Resistive Loads seldom need protection; loads of this nature are of the dry circuit variety, or small heating elements such as small light bulbs. However, when a large peak voltage develops across the load resulting from the "break" action of the relay, protection must be employed also.

Inductive Loads are of primary importance; some examples of common inductive loads are: Motors, electric counters, solenoid and relay coils, wire wound resistors and, in some cases, just the wiring of the circuit itself.

The "break" action of magnetic reed relays is extremely rapid. Whenever an inductive circuit is de-energized, whether AC or DC, high voltage transients are induced. When a magnetic reed relay is used to break this inductive circuit, the switch contacts are subjected to arcing, with the result that the relay device reliability and life is drastically reduced. Particular emphasis should be placed on motors, which the modeler uses extensively. Components of this nature are highly inductive due to natural inherent inefficiencies developing from manufacture.

There are two commonly used circuits of arc suppression which are easily remembered, and will give normal protection for magnetic reed relay applications. These examples are shown as follows:

The Diode Method (Fig. 1) is generally a little more expensive, but is favored because of less feedback, and especially where space is at a premium. As mentioned, a resistor in series as indicated is generally not needed except in extreme cases of heavy peak voltages. Inexpensive diodes are available, such as the General Purpose, 1N456, indicated.

The Capacitor-Resistor Method (Fig. 2) can be used in two ways, either across the load as indicated, or across the relay contacts. This method is usually less expensive, and is adequate for low inductance circuits. The preferred values of "R" and "C" can be evaluated from the following equations:

$$(1)\quad C = \frac{I^2}{10}$$

C = Capacitance in microfarads
I = Current load in amperes of the *closed* circuit.

Example: I = .7 amp, $.7 \times .7 = .49$

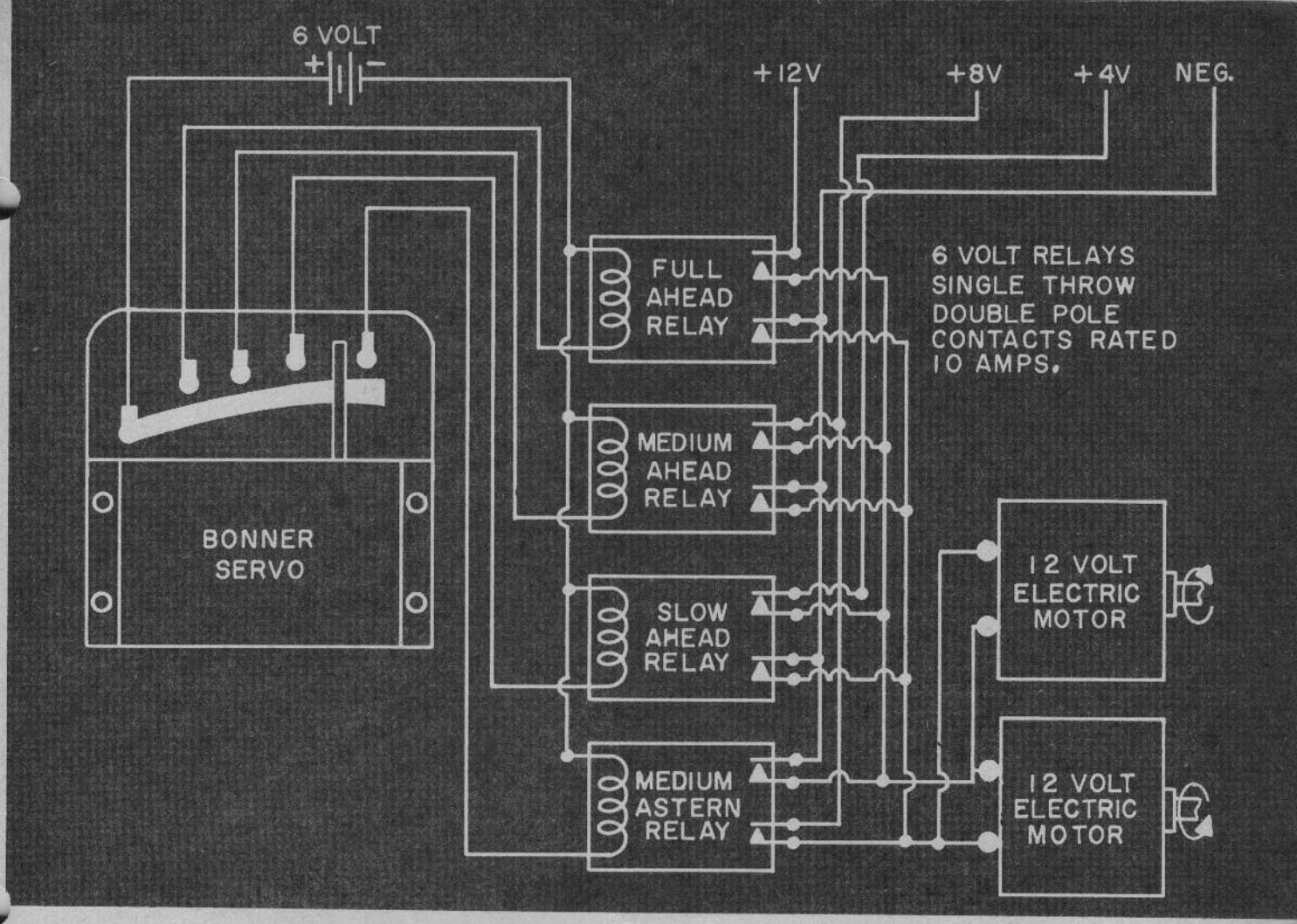
$$\frac{.49}{10} = .049$$

C = .049 Mf. (Select closest value Mf)

$$(2)\quad R = \frac{E}{10\ \left(1 + \frac{50}{E}\right)}$$

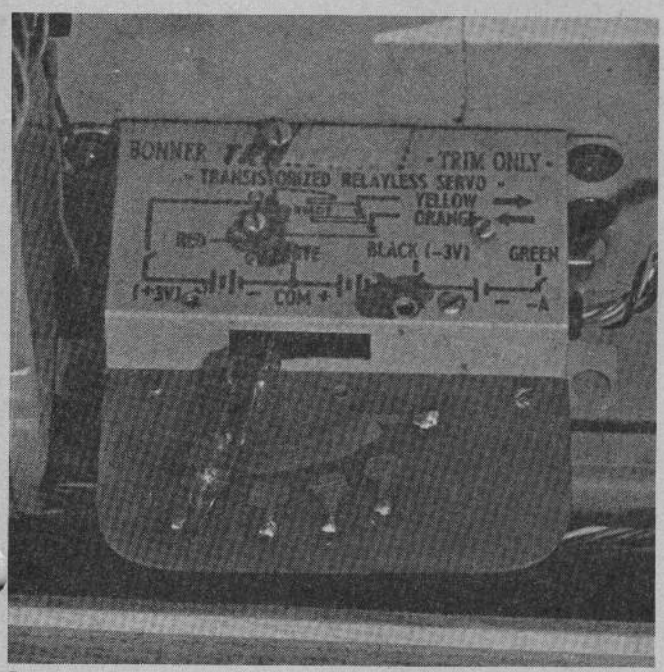
R = Resistance value in ohms.
E = Circuit voltage of the *open* circuit.

To further substantiate the above formulas, and to illustrate with an example of actual radio *(Continued on page 32)*



Simple Switcher for High Drain Boat Motors . . .

Changing motor speeds with electric drive can be real problem in boats. Not now!



Brass contact extension arm selects relay. From right to left: Medium speed astern; slow ahead, medium ahead and full ahead.

By AL SEIDENBERG

●

FOR THE BUDDING BOAT FAN there is no greater problem than controlling high-drain electric drive motors without burning up contacts or equipment. In some installations the current compares with that required by many small appliances. Normal hobby-shop variety switching devices usually lack the necessary capacity to handle such high loads and the gadgetry one sees can be quite complex and costly.

The simple, robust switcher illustrated was used in the Rescue Craft, presented in the September-October issue and the photo, at the left, is a magnified portion of one of the earlier pictures, making clear what the device looks like. Basically, it consists of a Bonner servo on which is mounted a printed circut board with five contacts. Movements of the servo arm, to which is affixed a channel-sectioned brass strip to ride on the contacts, closes a circuit between the contact at the extreme left, and any of the four contacts at the top and right (eliminates moving wires).

The assignment of these contacts is arranged for logical action of the trim-servo. Required for this installation is a minimum of four channels, two for the servo, and two for a second servo giving left-right rudder. The author advises availability of PC boards at $3.50, 6-volt relays at $3 each, four relays mounted and wired, $16.95. Anyone interested may contact Mr. Seidenberg through GRID LEAKS (do *not* send orders or money with inquiry). ■

R/C the REMCO "SHARK"

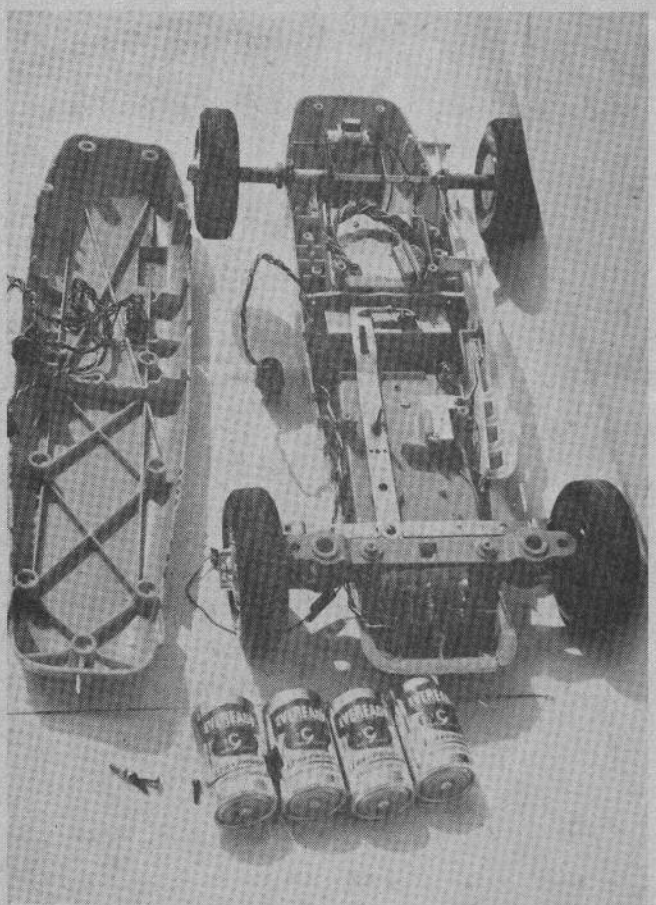
During a Detroit modeling show (Ford Electronic Trimodelers) the author's "mysterious" car made a big hit with young and old.

By LOUIS J. LAMBERT

The toy market abounds with scale vehicles to convert. This car moves at a fast-walk speed. And the modifications are very easy to make.

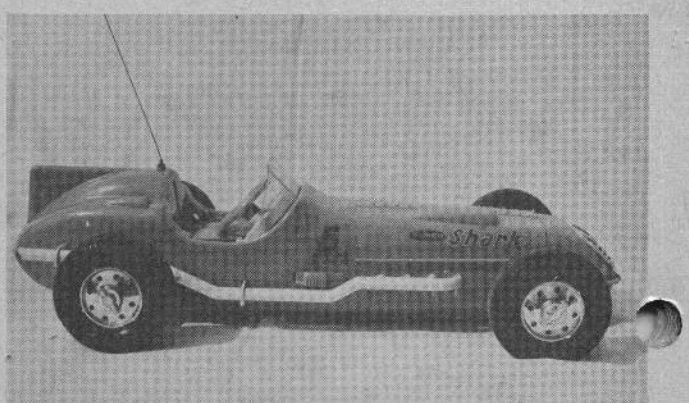
THE CAR USED FOR THIS project is an all-plastic motorized toy marketed by Remco. This car was picked because of the reasonable price and the minimum changes required to install radio-control gear.

As purchased the car has a 6-volt drive motor powered by four D-size cells, plus "U-Control" which provided a steering front axle controlled by a link protruding out the left side. In addition, the car body is moulded from bright orange plastic with vacuum-plated wheels and grill. (*Continued on page* 28)



The four D-sized cells are for the drive motor which comes with the car. Note cross-wise installation Transmite servo.

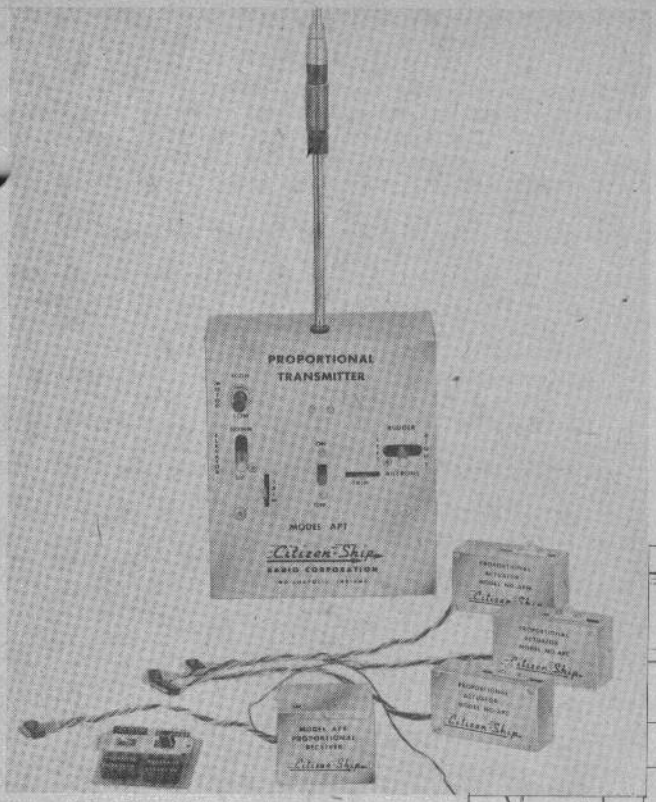
Six-volt nickel cadmium pack (see pic at left) is in after-body, the batteries for drive motor under the hood as seen.



On-off switching of drive motor can be provided by replacing D's with a 6V, 500-ma pack, servo, slide switch/or relays.

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

? SEEN THESE



Citizen-Ship Proportional.

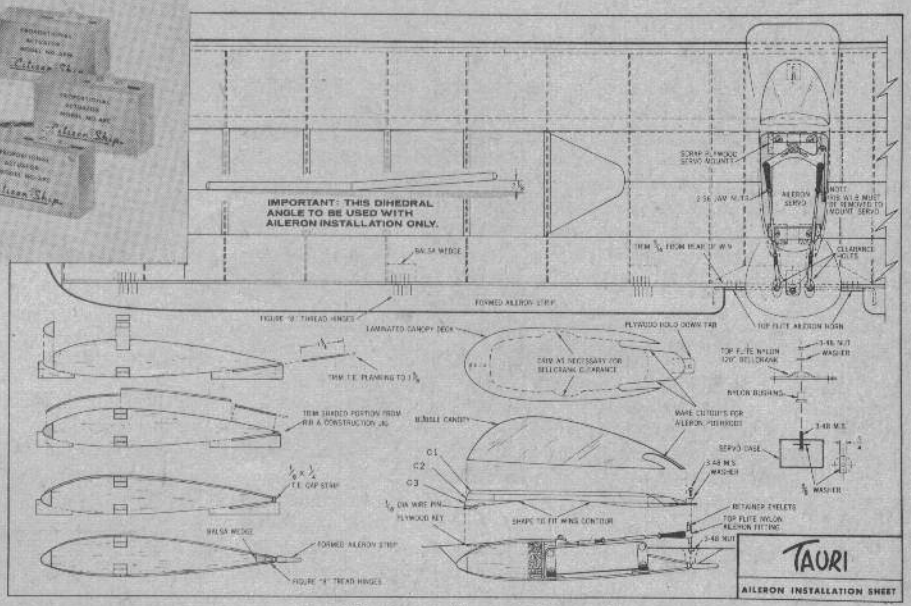
Citizen-Ship Proportional. Firm's recently announced AP (for Analog Proportional) Proportional system offers two functions (rudder or ailerons with elevator) plus a trimmable action for motor control. This third control is the fail-safe—such as turning off the transmitter, which gives zero voltage or neutral on the two primary servos, driving MC to its lowest speed.

System consists of transmitter (APT), receiver (APR) and three servos (two APC and one APM). The APC servos are analog feed-back type for control surfaces, the APM for motor, similar to a transistorized trimmable reed servo. The two APC servos can be run from the same receiver output signal so that a servo can be added to the ailerons for coupled aileron-rudder (called CAR). Provision is made in the printed circuit board for this extra plug and socket (not included).

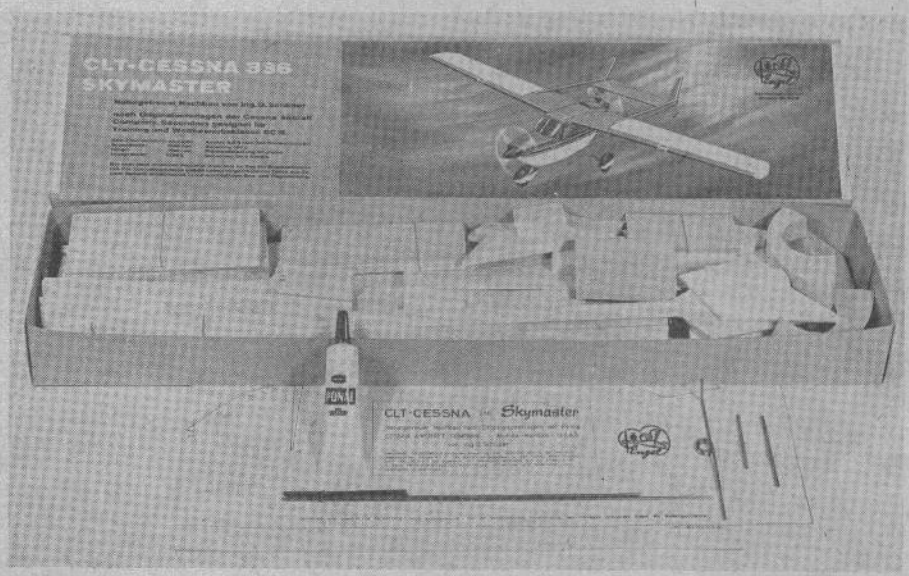
Stabilized from 32 to 140 degree F; trimming permits same neutral within this range, same as at 80F.

PC wiring board includes switch and five plugs; by wiring the servos, receiver, batteries to removable portion of plug, all wiring is complete. Battery requirements are 9V dry cell (transmitter) and eight pencells (2 sets of 4) pencells or eight 450 amp-hr. nickel cads wired for 9.6V in transmitter and, for receiver and servos four 225 to 450 amp-hr., and four 450 amp-hr. respectively.

Receiver measures 2 1/16 in. longest dimension, weights 3¾ oz. Servos measure 2⅝ x 1 9/16 x 1, weigh 2¾ oz. each. Price, complete system, $249.95. Citizen-Ship Radio Corp., 810 E. 64th St., Indianapolis, Ind. 46220. All superhet spots.



Top Flite Tauri aileron addition.



Cessna Skymaster, from GM Hobby Specialties.

Box-Lox construction is what AA (Andrews Aircraft Model Co., Inc., 2A Putnam Court, Danvers, Mass.) calls the method of prefabrication used in their new series of RC kits. The term has real meaning because you can make-believe assemble the fuselage of any—excepting top and bottom skinning—with four rubber bands! As to the kits themselves, two have been announced, and two follow-on designs mentioned.

As shown in the ads, the ready jobs are

(Continued on page 28)

BITS AND PIECES...

LIKES OMEGA SPDT REED SWITCH
by Bob Penko, Willoughby, O.

■ I have begun using an Omega SPDT reed switch in a single-channel Vanguard superhet receiver and have about 40 flights on Galloping Ghost.

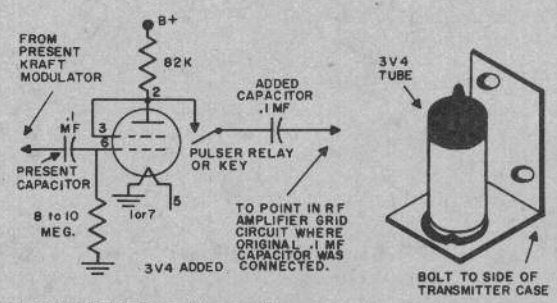
In my opinion it is terrific. No more point adjustment or vibration trouble. I can hold the receiver can right against the fuselage with the engine roaring, and it still pulses away as pretty as you please. No arc suppression either. Using a Micro Mo TO-5/41 ratio, plus or minus 3-volt nickel cadmiums.

INK FOR PC BOARDS
by W. F. Wadsworth, Belmont, Calif.

■ I found an ink which works quite well for hand drawing PC boards. It is "Trojan" Brand, non-phenolic marking ink, made by Superior Marking Equipment Company, Chicago, Ill. I have a 2-oz. bottle of Black Ink which I believe is the smallest size packaged. It may come in other colors; this I have not checked out. It is also packed in 1-gallon cans. It is stocked at most large rubber stamp concerns; cost is about $.80 for 2 oz. retail. The vehicle used in this is "ether." If the PC board is etched within 4-6 hours after applying it works OK. After a while it flakes off.

NO INTERFERENCE ON SUPER-REGEN
by William E. Kenyon Sr., Pompey, N.Y.

■ Still using the basic Marcy receiver, 6-channel super-regen, and have had no interference as yet. It may help, having a K1D 5542 CB number and asking my neighbors to keep off the air when I am going out for an evening of flying. Have found most CBers understanding of our problems and even had a gang of them down to the field to spectate and ask questions. Seems that when they hear the old Marcy tones nearby, they head for the spot and, so far, have turned their transmitters off. Maybe I just live right?



KRAFT SINGLE X-MITTER MOD
by Ben Givens, DCRC Newsletter

■ Some people have found that their Kraft single-channel transmitter does not modulate sufficiently, especially on high power. We have tried this little modification on several DCRC member's transmitters and have found it to solve the problem in all cases tried.

The Kraft modulator should be wired so that it is continually ON or keyed, then the keying button and/or pulser relay should be wired in after the added stage.

There is plenty of room in the transmitter to add this tube. We usually bend a piece of aluminum (shown below) large enough to hold a tube socket and bolt it most any place inside the case as long as it isn't too close to the RF coils. All this stage does is to amplify the signal from the modulator to give enough tone to properly modulate the transmitter.

Note that only one-half of the filament is used, although both halves could be.

TIPS ON B&D PULSATONE
by Roy A. Cartier, Winchester, Va.

■ I have noticed some recent articles in GRID LEAKS on the B & D Pulsatone Receiver and system. I have built two of these systems and after some experience have both working very well. From this experience I would like to give builders a cou of useful tips.

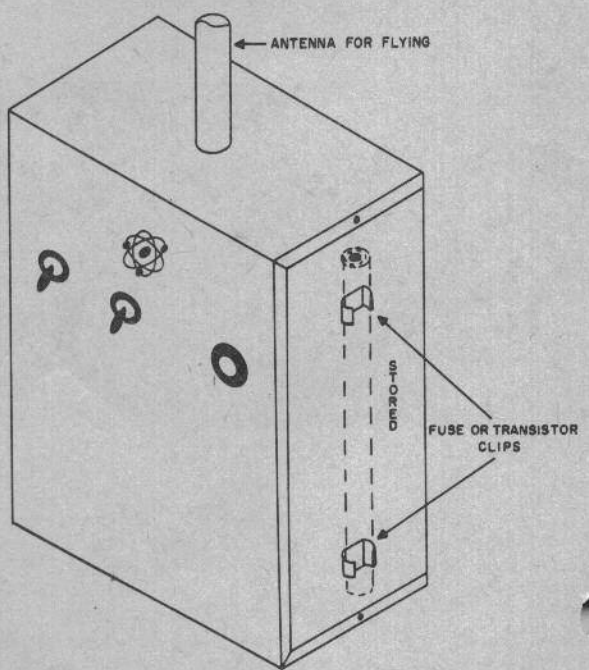
I do not agree with doing without the diode or any of the resistors in the servo amplifiers. If one will check the circuit they will find these are in the circuit for temperature stabilization. The resistor which some people say you can do away with is to give a path for leakage currents of Q1 and Q2. This prevents thermal run-away. The diode maintains uniform gain of the amplifier with temperature changes. I find my units perform always the same under any weather conditions in which I want to fly.

I found my first unit was as erratic as any described in the articles. It was sensitive to anything you changed and you never knew what it would do next. When I was about to give up, I got the right hunch. I substituted a 30-volt B battery for the 22½ and changed the B- connection from where the schematic shows it to ground or the A-minus connection. Since I made these changes it has operated perfectly and the second set is the same. They are the most stable receivers I have ever seen and have excellent range.

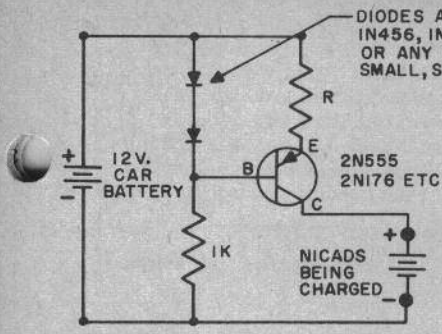
WIRING AID
by Sam Mohr, DCRC Newsletter

■ Have you even tried to thread very fine wire down among closely spaced parts into a small hole? This can be an exasperating task. The next time it happens to you, look in the wife's sewing basket for a needle threader. This is a small oval or disc-shaped piece of aluminum with a loop of fine music wire attached. One is usually packaged with pack of sewing needles. In use, the loop is forced through the small hole in the printed-circuit board. When the loop is completely through the board, the loop springs open and the fine wire is easily threaded through the open loop. Withdrawing the threader then brings the fine wire through the small hole in the PC board. This has been us successfully with wire as small as 44 gauge and through holes made with a #70 drill.

FORGET YOUR ANTENNA?
by Gil Stallings, Joppa Towne, Md.



So you take off the antenna of your transmitter to do a little range checking in your basement. Sunday arrives; you unload your flying gear and where is the antenna? Why not store it in clips on the side of the box?



R	APPROXIMATE CHARGING CURRENT-MA.
47 OHM	30 MA.
33 OHM	41 MA.
22 OHM	65 MA.
15 OHM	84 MA.
10 OHM	120 MA.
5 OHM	230 MA.
2.5 OHM	420 MA.

FIELD BATTERY CHARGER FOR NICKEL CADS

by Allan K. Scidmore, Madison, Wisc.

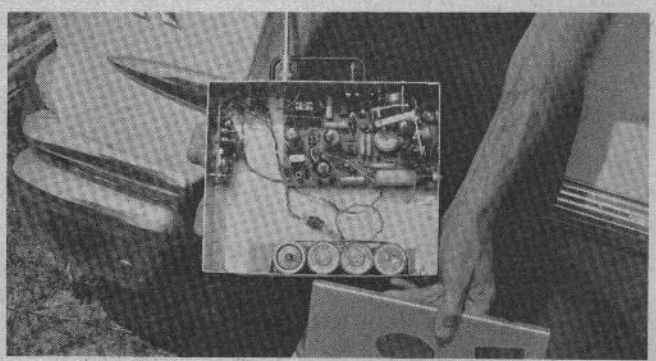
■ The following circuit is for a small portable constant current charger for nickle cads. It is designed to use a 12-volt car battery (I presume your car has one) as a source of charging current although it can be powered by any DC supply of about 10-15 volts or so. The charging current is independent of the number of batteries in series (within limits). With a car battery for power it can charge 6 or 7 nickle cads in series. The transistor is any cheap medium-power PNP transistor (such as 2N176, 2N555, etc.) The 1-watt resistor R adjusts the charging current and its value depends slightly on the diodes and transistors used, but mostly on the charging current desired. The experimental unit constructed gave the currents shown in the table for the listed R's. The R used should be adjusted after construction. For charging currents under 100 ma the transistor should not need a heat-sink, but if the idea is to be extended to higher currents I would recommend heat-sinking the transistor by mounting it on a piece of sheet metal. Remember the transistor collector contact is the case, and that not all cars have the same battery terminal grounded.

ROCK LATH BUILDING BOARD

by Norm Robarr, Lockport, N.Y.

■ For a flat surface to build wings on I have found that a bundle of rock lath is nearly perfect. They come five sheets to a bundle and measure 16 x 48".

I lay the whole bundle on my work bench. The top sheet will be perfectly flat. I draw my wing layout on the lath—they are paper covered—and after using one side of a sheet for a project, turn that sheet over and use the other side. Pins can be pushed into these boards but they must be steel pins.



HIS FOURTH B&D

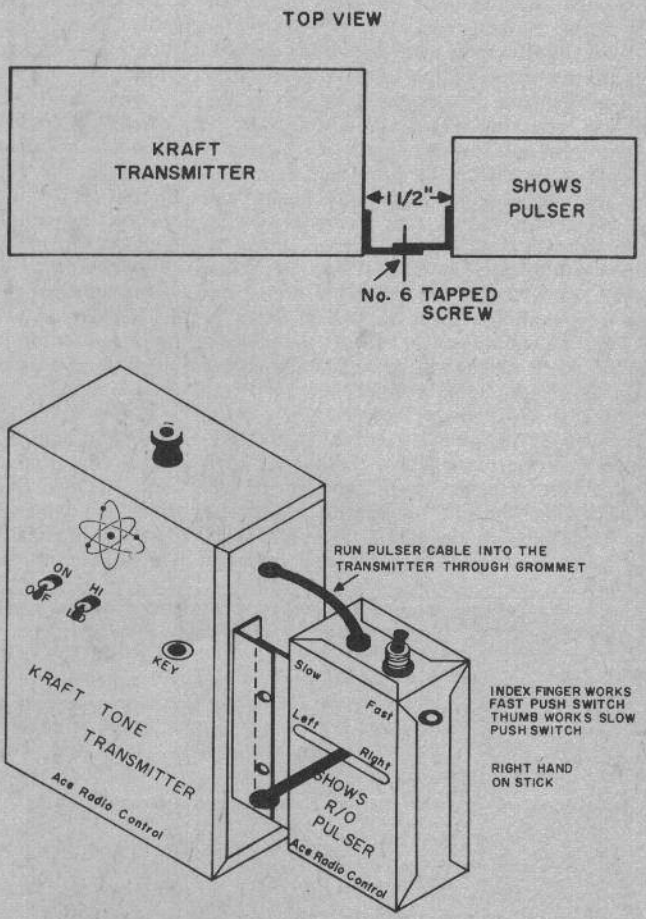
by Ron Little, Vidalia, Ga.

■ Here are some shots of my new B & D transmitter. Use the specified parts right down the line! I can't think of any way for folks to get into trouble building this, just as long as they follow instructions. Don't "little book" in *Model Airplane News* is as clear and precise as any I've seen. I believe there will be a real demand for these rigs as soon as the fellows see them in use, *and* number 2, as soon as some brain comes up with a superhet front-end.

This is the fourth B & D rig I've built, and so far no trouble at all, except for an extremely loose antenna coupling in the second unit, which has since been remedied.

BATTERIES FOR PHELPS RCVR.

■ The Phelps Receiver, May-June 1964, will work satisfactorily generally *only* with a nickle cadmium battery supply. It is *not* happy with dry batteries and, while some reports indicate that magnesiums, *may* perform all right, designer John Phelps states: "The receiver was designed around a 4.8-volt nickle-cadmium battery source." These may be 225 to 500 milliampere-hour size. Since each cell is rated at 1.2 volts, this receiver will require four in series for the 4.8 potential. As with relay receivers, the escapement or actuator battery supply should be separate from the receiver battery pack.



ADDS SHOWS PULSER

by Gil Stallings, Joppa Towne, Md.

■ I find this to be a very comfortable Kraft/Shows combination. In use, the transmitter is cradled in left arm, left thumb and index finger hold pulser and work the solid on-and-off buttons, and right hand the stick on pulser. The mounting bracket is in two pieces, ¾ x 1 x 4 aluminum angle, attached with #6 self-tapping screws to each case—join on centerline with the screws (tapped or with nuts). It is easy to disassemble.

11th ANNUAL TOLEDO CONFERENCE

On February 27-28, this famous conference and exhibition will be held at the New Recreation Hall, Lucas County Fair Grounds, located less than two miles from the Howard Johnson Motor Lodge, at Ohio Turnpike Exit #4. This hall is nearly double the size of last year's quarters, providing ample room for parking and flying demonstrations. Program will be generally similar to last year's. For details write: Conference, Box 2864 Station B, Toledo, Ohio.

Toki – Doki

(Continued from page 7)

combination of the new surfaces and their location is the action in a stall. When buffeted by thermals or gusts, and stalls get progressively larger, a blip of the rudder near the top of the stall will make a slight change in the direction of flight but also level the glider to an amazing degree. When this occurs it appears as though some unseen hand had been placed under the glider and raised vertically, sometimes 10 to 15 feet higher when the wind is steadily blowing. The rudder has enough effective area to steer the glider without banking too steeply and this is a sought-after trait in slope soaring designs.

Construction of the horizontal and vertical surfaces is straight forward as the plans indicate. We made no changes in the horizontal stab, except to move it forward as shown. Be sure you use a hard piece of balsa for the rudder post and also for the leading edge of the fin, which, incidentally, should be shaped prior to cementing the 1/16" sheet to it. When dry, sand the entire assembly well, and try to work the sheet on the fin down to 1/32". This will save ballast in the nose and, when silked, will be sufficiently strong for the task. Some builders may want to use soft 3/32" or ⅛" sheet balsa for the rudder. If so, glue a piece of 1/16" plywood to the place where the rudder horn is to be attached, and sand to a real streamline shape. Forced with a problem of flexibility in the hinge, I chose Mylar. Cut three strips ½ × 1½" and insert in slots cut equidistant in the rudder post and in a similar spot in the rudder. Insert the Mylar hinge, drill a 1/16" hole and then drive a round spruce toothpick into the hole with a small hammer, resting the surface on a flat piece with space for the toothpick to protrude. Cut off on the other side and sand smooth.

Now install the vertical surfaces, cutting a space for both the leading edge and rudder post in the sheet planking on top of the crutch. Cement in place and double cement where the sheet on the fin touches the crutch. As a matter of fact, applications of glue produced a small fillet at the junction, and this made the silk application easier. Apply the silk and keep the hinge line clear of any binding dope accumulations.

Now build the wing as detailed on the plans but reduce the dihedral to four inches. *This is important.* With the excess dihedral, the rudder will give a rocking action to the fuselage at each movement. Finish the wing and stab as you did the rudder. On my next wing for the Nordic, I am going to use ⅛" square spruce for the leading edge and save repairs.

Installation of the radio gear and servo is a matter of individual preference. The photos give two examples of equipment installation.

I was going to call this modification "I-SOAR", but in deference to Frank Ehling's beautifully flying design, will settle for "TOKI DOKI" (pronounced Tokey Doakey), which in Japanese means "Sometimes." Incidently, Toki Doki placed third in a Precision contest the third day after it was completed, and flew for 36 minutes on its third flight, so it has shown possibilities for lots of air time.

We trust you will derive as much pleasure from this design as we have. If there is no slope near you (must be one some place) try some thermal soaring on 300-ft. towlines. It can be done if you keep the wing loading below 9 oz./sq. ft.

Grid Leaks at Play

(Continued from page 1)

There is precedent for this type of dating in the publishing industry. In view of our move to Kalmbach, and other considerations—including letters from new subscribers who did not realize that our dating system did not conform with other magazines—we felt these changes to be in everyone's best interests.

- *Model Aircraft World* readers who also were GRID LEAKS readers, should note a new date on the label of this issue. The date is the combined copies due them from both GRID LEAKS and *Model Aircraft World*. Until now there has not been available a block of time which allowed this consolidation. With the acquisition of *Model Aircraft World*, GRID LEAKS gained a number of individual subscribers. This subscription list of paid individual subscribers now is quite substantial.
- GRID LEAKS will continue to meet your reading requirements. Over the years it has proved a publication responsive to ideas from readers. It will continue to be so.

Our growth will not be spectacular, but a steady continuation of the progress that we have made in the past year.

The combination of GRID LEAKS with *Model Aircraft World*, and now the distribution of the magazine by Kalmbach Publishing Company to dealers, represent substantial milestones in the progress of your publication.

● The AMA Frequency Committee battle goes on.

We know of manufacturers who are applying to the Federal Communications Commission for experimental licenses to begin tests of the 35, 43, and 72-76 megacycle spots. Again, progress is real, and though not spectacular, we feel that our attorney, Jeremiah Courtney & Associates of Washington D.C.—and the AMA—are to be commended.

If you did not read thoroughly the ad in the previous issue of GRID LEAKS giving reasons why you should join AMA, we recommend you read it now. Not only is the petitioning of additional frequencies being developed by the AMA, but there are other worthwhile benefits in an AMA membership. With your membership you receive the publication *Model Aviation*. You are entitled to insurance benefits, you receive a discount on the major model magazines. The solid advances that have been made in radio control equipment are largely due to the contests which are sanctioned by the Academy.

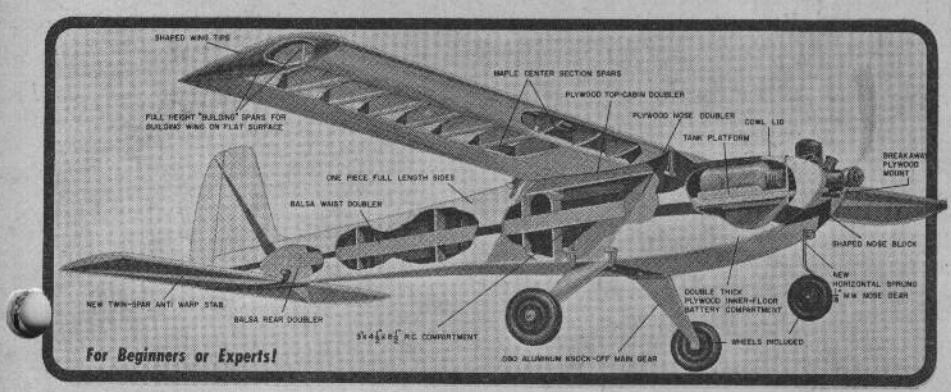
* * *

MORE ON PHELPS' RECEIVER

John Phelps offers an improvement in the Interference Resistant Receiver which was featured in the May-June 1964 issue of GRID LEAKS. As shown in the schematic by heavy lines, he has changed the antenna coupling to the collector of the detector. (It was originally coupled to the emitter.) By changing to the collector, several tens of microvolts of sensitivity are added.

A 25-mf electrolytic is added across the 4.8-volt battery potential. This is to eliminate any tendency for "motor-boating" when batteries decline. The 4.8 must be secured from a nickel-cadmium-type battery, since other batteries have too high an internal resistance for adequate functioning.

(Continued on page 26)

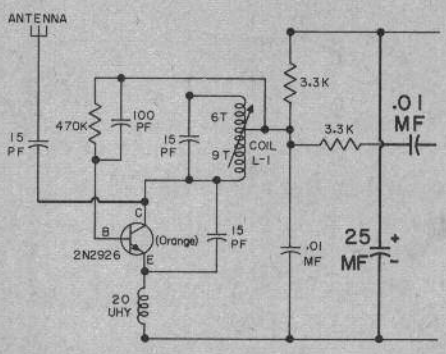


Mambo Special, by Sterling, for one to six channels of control, spans 52 in. Features include full-depth spars for table-top construction, one-piece die-cut sides. Price $11.95.

The first stage coupling capacitor shown in May-June is a .002 capacitor. This should be changed to a .01, since this was an error in the original schematic. The .01 gives the gain required.

Further words from John are as follows: "During the shakedown of the receiver and transmitter for single channel, I found that a diode is *absolutely* necessary across the escapement coil to avoid sticking. Further arc suppression is needed for every pulse proportional actuator tested.

"Further, an extra capacitor is needed to connect escapement wiring to the receiver power supply. A .01 or .02 capacitor from the center reed lead to plus 4.8 volts is the ticket. This eliminates erratic skipping action due to metal-to-metal rubbing, which can occur even on a bonded torque rod."



Heavy lines show Phelps antenna coupling to detector collector, instead of emitter. It adds several microvolts of sensitivity.

COLVER SUPERHET NOTES

● Frank Colver (A versatile Superhet System, July-August issue) writes: Two things I was unaware of, in my GRID LEAKS article: the MS 776, 777, 778 I.F. cans were the wrong size, and no instructions were given describing how they were mounted.

The lugs on the I.F. cans should be bent at right angle to the can, and soldered to the ground plane (top of board). The I.F. transformers used were no longer available at the time I wrote the article, so I searched for a substitute. I obtained some samples from Lafayette that I understand to be the MS 776, MS 777, and MS 778 coils. These coils had the correct specifications, size, and connections. I have checked my latest Lafayette catalog, and have found that apparently the numbers of the coils I had were *MS 780, MS 781, and MS 782.* These coils have the same dimensions and specifications in the catalog as the units I obtained.

I will supply the toroid core for the oscillator for $1.00 with the coil already wound. (Frank Colver, 434 Lenwood Drive, Costa Mesa, Calif.) The core is made by Indiana General Corporation, Magnet Division, Valparaiso, Ind. The core material is Ferramic Q2.

The 31 turns are distributed around the entire core with the last turn ending beside the first turn. The 3-turn coil is then wound in the center of the 31 turn coil as shown. *Each pass through the hold of the core is counted as one turn.*

The dimensions of the core should be corrected to read 15/64" diameter × 1/16" thick. The hole in the center is 1/8" diameter.

The antenna coil is close-wound on the coil form; the tap is 11 turns from the end with the 4.7k and 24k resistors. The coil form and tuning slug are available from Newark Electronics Corporation, 223 W. Madison Street, Chicago, Ill. The coil form and slug are made by Cambion Corporation. The Cambion part numbers have changed from SPC2-D-4L to 2173-3-3 for the form and from X2172-D to 3227-3 for the slug. The Newark part number is 40F3623 for the form (price is $.27 each) and 40F3048 for the slug (price is $.04 each).

The .0012-uf capacitors are Erie style 390 and are available from Newark as part number 19F1737 at $.50 each. These capacitors are very small (.095" diameter × .250" length). Cheaper capacitors with a larger diameter could be used *if a different printed circuit layout is used.*

The printed circuit boards are not being made by anyone at the present time.

The tantalum capacitors shown in the decoder should be changed from 4.7 uf to 6.8 uf. These can be obtained from Newark as part number 17F1010 for $1.32 each. These same 6.8-uf capacitors could be used in the receiver in place of the 5-uf capacitors if so desired. This capacitor measures .125" diameter; unless a cheaper 5-uf capacitor of the same diameter or smaller can be found, I would suggest using the 6.8-uf listed above. The value of this capacitor is critical in the decoder but it is not critical in the receiver.

The 15-uf capacitors shown in the driver and encoder are Newark #17F045 and are $1.52 each.

On the schematic for the receiver, the capacitor in dotted lines across the 10K resistor should be ignored. The emitter resistor in the R.F. amplifier is 2.7K. The capacitors shown across the I.F. coils are included in the cans. The 100-pf (uuf) and 10-pf capacitors are mica or NPO capacitors. I used Arco-Elmenco DM10-100J (Newark #14F1154, $.20 each) for the 10-pf and DM10-101J (Newark #14F1176, $.26 each) for the 100-pf. The ¼ w resistors are Newark #12F205 and list the values. These are $.26 each. The Sprague TG S50 capacitors are Newark #18F937, $.30 each. The TG-S20 is #18F934, $.15 each. The 1N270 diode is Newark #21FX4577, $.32 each. The 1N456A is #22F9634, $.36 each. The 2N711 is Newark #21FX3814, $1.12 each.

On the decoder schematic the terminal marked +6v is the ground or common of the circuit, the other terminal being the −6v supply. Ignore the statement "zero voltage on idle." If the decoder is to be used with the superhet, the transistor driver will have to be used between the receiver and decoder. The collector of the 2N1305 in the driver is connected to the input of the decoder, in which case the 100-ohm resistor in the decoder becomes the load for the driver. The −3v to −6v shown indicates whatever voltage is required for a particular load if the receiver is used with-

out the decoder to drive an escapement, servo, reed bank, etc. To drive a reed bank with the driver, remove the 15-uf capacitor, place the coil of the reed bank where the load is shown and connect a 1-uf capacitor from the collector of the N1305 to ground (+ side of capacitor to ground).

When driving a 200 to 300 ma load with either the driver or decoder, one can obtain a lower drop across the transistor if a 2N1309 is used in place of the 2N1305 in the output (only), and a 2N1308 in place of the 2N1304 in the output (only) of the decoder.

On the decoder schematic the dots at each end of the 680 ohm resistor do *not* indicate connections to the base and emitter of the 2N1304 located directly below the resistor.

The transmitter encoder circuit was included in the article just as food for thought; I later changed to a different circuit after I had trouble with the relay.

If the printed circuit is attempted, be sure the two sides are located in the proper relation to each other by observing the hole pattern. Since this layout does not waste much space one should be careful when substituting parts to make sure that they will fit the board.

Time no longer permits me to supply the completed decoder as stated in the article.

Proportional Control

(Continued from page 13)

our observation that gliders seldom fly completely out of sight, but they are badly damaged by spinning in. For this reason we prefer surfaces to neutralize for out-of-range conditions.

In general, some precautions must be taken to prevent oscillation in feedback systems such as the servo. The Micro-Mo motor is particularly responsive to dynamic braking; advantage is taken of this feature by driving the motor from a low impedance source. Experience indicates that this combination provides an adequate phase margin at useful levels of loop gain; then motor gear train is given additional protection by limiting the current available to the armature. Transistor dissipation is adequate for this purpose if no more than 1.5 volts is used on the output stage. *(Continued on page 28)*

Summarizing, it is clear that the total effect here is to produce a "flea power" servo. Let me hasten to comment that the force available to the control surface is considerably greater than that available from an escapement. The system has been in use in a four pound Bergfalke R/C glider and provided ample torque.

R/C Shark

(Continued from page 20)

A photo shows the drive battery compartment and the 12-channel "Min-X" superhet receiver used. The receiver is installed by removing the instrument panel and steering wheel assembly retained by two screws, and discarding the plastic seat that comes with the car.

Other photos show the "innards." The links for steering are the ones that come with the car, modified only in the location of the pivot points to obtain the desired turning radius with the servo used, in this case a Bonner Transmite. The 6-volt nickel cadmium power pack for the receiver and servo is located in the nose of the car. The switches for the receiver and servo are located in the bottom half of the car and the drive motor switch is the same as used on the toy version. Because the "D" cells were used for drive power there wasn't enough room to install a servo, or relays, to control the on/off switching of the drive motor. Replacing the "D" cells with a 6-volt 500-ma nickel cadmium pack will permit installing a servo to operate a slide switch, or relays, to perform the switching operation.

The mounting of the servo in a cavity behind the battery compartment is a simple matter of cementing a servo board to the cockpit wall. This car originally had single-channel equipment which consisted of a CG superhet and a Cobb boat/car servo. The servo was located in the same area as the present servo. Single-channel operation of the car was fair with only a slight right turn occurring when keying for left.

This project was originally undertaken to provide an extra attraction for my club's (Ford Electronic Trimodelers) annual winter open house. In previous years we had static displays of R/C boats and planes plus movies of our club activities. With the R/C car a dynamic display of R/C in action was possible and proved to be a great crowd pleaser. Car speed is a good walking pace—fast enough for indoor demonstrations!

Seen These?

(Continued from page 21)

the H-Ray for .09 to .15 engines using single-channel equipment with escapements, or four to six-channel with servos; and the S-Ray shoulder wing for .07 to .10 engines, rudder only.

The H-Ray has a span of 50 in., wing area of 425 sq. in., and gross of 2¼ to 2¾ lbs.; Price $12.95. The S-RAY has similar specs, sells for $11.50.

Acryjel colored self-curing acrylic plastic: Available in 120-cc jars of opaque colored or clear transparent powder having same quality as that in No. 4 kit of Acrylic Plastic. In red, yellow, white, blue; and clear. Self-curing Acrylic liquid is available in 2 oz. bottles—sufficient to activate 120 cc's of powder. Jelling in two minutes, it solidifies in 20 minutes into hard, tough Acrylic plastic. It can be cast or shaped with tools. Prices: $2.00 for 120-cc jar of powder; $.75 for 2-oz. bottle of liquid. (Ace R/C, Higginsville, Mo.)

Tauri with ailerons: Announced by Top Flite Models, Inc. (2635-45 So. Wabash Ave., Chicago 16, Ill.) is the "up-grading" of their TAURI kits by adding strip ailer-

(Continued on page 32)

THE YEAR THAT WAS
An AMA Viewpoint

● HERE WE ARE STARTING a new year in R/C, and only the most reckless prognosticators will venture what it will bring. In the past year, we have seen the sport and hobby continue its booming pace toward a yet undetermined goal. On the sport scene (contests), the trend appears to be toward more scale-like appearance of models, more prefabrication, more reliability in equipment—from rudder only to six-function proportional—and, of course, a more expensive enterprise. In fly-for-fun, we see an opposite trend in many respects.

How do you categorize this progress? The year of the transistor. The year of printed circuits. The year of .020 miniaturization. The year of the low wing. The year of trike gear (that rhymes). The year of ailerons. The year of proportional.

This past contest year might be called the year of prefabrication. The Cliff Weirick ship which took the Nats sported a fiberglass fuselage. Foam wings, planked with balsa, rose to prominence in 1964. Even radio equipment seemed to be designed to be more readily plopped into the plane. More companies are selling ready-built aircraft than ever before. And, for the first time, a major finance company entered the radio control equipment sales picture.

At the Nats, a number of the aircraft in the Class III pattern event were semi-scale, military or light aircraft types. Because fiberglass cottons more to a rounded configuration, boxiness in fuselages seems

(Continued on page 30)

(Continued from page 26)

to be disappearing. We have come a long way from the Multibug, Smog Hog, and even the Stormer. Adding to the semi-scale effect is the increasing popularity of foam-core wings. Balsa planking over foam, or even over conventional rib structure, eliminates the evidence of the ribs, which, of course do not show in modern aircraft. The trend toward more scale is a continuing one, not a new one, but new building techniques accentuate it.

Meanwhile, in the other spectrum, fly-for-fun, which is by far the largest, the opposite trend prevails. The emphasis seems to be on simplicity and speed in building. The contest within the non-contest group seems to be whose Esquire or Jenny can fly the most on a Sunday afternoon, and whether or not it will do outside loops seems secondary. The most interesting trend in this area in 1964 seems to be the renewed interest in gadgeteering. In the face of six-function proportional systems popular in contest flying, magazine articles indicate a spectacular rekindling of interest among fly-for-funners in Galloping Ghost. While Class I contest flyers are flying with multi-channel reed and proportional equipment, the Sunday flyers are getting increasing enjoyment out of seeing how many different things they can make a single channel do.

An outstanding example of fun in gadgeteering was Maynard Hill's world record setting endurance ship. While its appearance was as ungainly as a Pelican flying inverted with a beak full of fish, mechanically it is a Rube Goldberg delight. Some of the interesting techniques employed in making the eight-hour-plus flight gave Maynard more satisfaction than a lot of contest flying.

First of all, it was quite a challenge to figure out how to make an engine run continuously for more than eight hours, and still provide enough power to lift the initial fuel load. After testing an ignition engine on gasoline, he ended up with a superior method of gloplug running on a part gasoline mixture. Other pleasing to develop innovations included a float valve for the pressure fuel system, a "wet" wing with fuel being carried between the ribs, and a system to measure fuel consumption. So, on the fly-for-fun side, 1964 might be termed the year of the rebirth of the gadgeteer.

Also on the fun front, 1964 showed a spectacular increase in R/C soaring gliders. While California seems to be leading the popular movement in this area, a number of sailplanes are reported showing up at flying sites around the country. Interestingly enough, the sailplane fans now are clamoring for contest-like activity and FAI world record attempts.

In consensus, it seems there is progress in R/C in a number of divergent directions, and it is only possible to identify trends within specific interest areas. While it would be convenient to point back at 1964 and say that this was the year of something or another, it would be inaccurate.

Similarly, the Academy of Model Aeronautics has made progress in a number of different directions during 1964.

RC is becoming more organized, with the contest side, it conducted the most thoroughly planned, and thoroughly executed RC Nationals event ever witnessed. It is working hard to preserve RC flying at airports and near commercial air lanes, by adopting adequate safety regulations. These are the areas where most contests are held. Through improved administrative methods, contest sanctions are being handled much more efficiently. Although RC contest rules have not been changed significantly in two years, the entire rules-making procedure has been modified for greater modeler representation and more meaningful changes. The entire area of FAI contest participation, including transportation of contestants has been reviewed and improved.

Much of the Academy progress benefits non-contest flyers as much or more than the contest enthusiasts. Club insurance is a good example of a new service offered by AMA which benefits both. The effort to obtain new frequencies for RC gained tremendously in 1964. The 1964 Nationals, as well as many regional RC meets around the country, proved that a number of aircraft for the time being can be flown at the same time successfully on the Citizens band, using carefully checked superhet equipment. The real threat from interference is the voice communicators on the Citizens band. Their number increases at almost ten times our rate. Who is getting shot down the most? The poor amongst us who are operating single channel, super-regen equipment. The sooner we get frequencies off the Citizens band, the better the Academy's encouragement. While not

Neglecting the contest picture, much emphasis will also be given to improving organized fly-for-fun events, and the RC situation in general. Mufflers. The Academy has assumed a leading role in coordinating industry efforts for more quiet flying. By removing noise objections, it is hoped that flying sites will be easier to find, and easier to keep.

Model Aviation, the Academy's news publication, has been upgraded 100 percent during 1964. Its purpose is to be informative of model aircraft progress, provide interesting and useful information on modeling as an organized activity.

AMA has achieved other advancements in 1964 under its new leadership, many affecting areas other than RC, but which will affect RC in one way or another. Coordination with model rocketry fans has interesting implications for RC. The new family membership plan with reduced rates for Juniors should encourage a longer lasting, more substantial interest in modeling, consequently more likelihood of progression from control line and free flight to RC. A closer working relationship with the National Aeronautic Association benefits RC. Model demonstrations AMA has been requested to put on for full scale aeronautics enthusiasts, shows the interest has been in RC, and there has been quite an interest. Modeling is being rekindled as an important and significant project worthy of support in the eyes of some aviation industry people.

Here's to 1965, and another year of progress on all fronts.

Seen These?

(Continued from page 28)

ons together with all of the necessary hardware and fittings. Complete aileron kit only is available direct from the factory for $2.00.

Cessna Skymaster, imported German kit, by GB Hobby Specialties, 2094 Fifth St., East Meadow, N.Y. can be flown by any installation from single through multi. Span is 60 inches, length 43. Normal power is one pusher .19 for rudder-only or up to a .45 for multi. However a nose engine can be installed for true-scale tandem power using two .15's for single channel, or two .19's for multi. Price is $19.95.

TAS P-7 marine engine: For speed or sport (G.E.M. Models, 48 West Le Moyne, Lombard, Ill.), features a recoil starter, 18,000-volt ignition system and ball bearings. This engine has a displacement of 1.31 cu. in. and, according to the manufacturer, has the highest torque of any engine of its size. The diaphragm type carburetor provides positive fuel flow in any position. Built-in forced air cooling or a water-cooled head available at extra cost. The P-7 engine costs $41.00.

Also available from G.E.M. is a limited number of 24-volt, 2/5 hp electric motors for starters, boats drive, etc. (work well on 12-volt car battery). According to the manufacturer, these motors perform well in boats on 6, 12 or 24 volts. Made to military specifications, these motors are 2¼ in. diameter, 4½ in. long, and weigh 2¼ lbs. Price: $6.00. Universals, $2.95.

Arc Suppression

(Continued from page 18)

control devices, and actual battery voltage, let us assume that we will use a Bonner Vari-Comp and a Bonner SN escapements on a 2.4 volt nickel-cadmium battery supply. This, then, will read as follows for formula 1: The total drain of the two devices as used equals .5 amperes. Therefore

$$C = \frac{.5^2}{10} \text{ or } \frac{.25}{10},$$

which means that C = .025 mfd capacitor. Any capacitor in the range of .025, .03, should work satisfactorily here.

For the second formula: $R = \dfrac{2.4}{10 \quad (1 + \frac{50}{2.4})}$

or $\dfrac{2.4}{10 \quad (1 + 21)}$ or $\dfrac{2.4}{220}$

Thus it will be seen that R = .01 ohms. As is noted from the foregoing example, in most low voltage/current applications, the resistor can be omitted, since for general purposes it can be measured within the formula.

While neither of these methods is a cure-all for every application, they should serve to greatly improve the arc suppression problem of inductive circuits, and help the modeler start on the right track.

Kraft Custom Radio Control

FRANCHISE DISTRIBUTION PLAN!

This is a first in the R/C industry. It will provide the finest in distribution for the consumer through his Franchised Dealer. Further details on the Franchise plan may be had by writing Ace R/C, Inc., Box 301, Higginsville, Missouri 64037.

★ HERE ARE YOUR ACE R/C- KRAFT- FRANCHISED DEALERS!

ALABAMA, Birmingham
BILLS HOBBY HAVEN
2102 Warrior Rd.

ALABAMA, Fairhope
FAIRHOPE HOBBY CENTER
Route 1, Box 181

ALASKA, Spenard
RADIO CONTROL SPECIALISTS
P.O. BOX 4-1374

ARIZONA, Phoenix 85012
WEBSTERS HOBBY HOUSE
521 Camelback Rd.

ARIZONA, Scottsdale
HOPKINS R/C HOBBY SHOP
4906 No. 85th Street

ARIZONA, Tucson
DONS HOBBY SHOP
5329 So. 12th Ave.
Box 11187

ARKANSAS, Fayetteville
ROY'S HOBBY SHOP
7 N. Block, 1st Fed. Bldg.

CALIFORNIA, Bakersfield 93301
STEWARTS HOBBY SHOP
900 21st Street

CALIFORNIA, Burbank
T & A HOBBY LOBBY
3518 W. Victory

CALIFORNIA, Covina
COVINA HOBBY CENTER
167 E. College Street

CALIFORNIA, El Monte
North El Monte Hobby
4720-22 Peck Rd.

CALIFORNIA, Eureka
FOSTERS TOYS & HOBBIES
309 F. Street

CALIFORNIA, Fresno 21
EASTMAN HOBBY SHOP
1449 Fulton Street

CALIFORNIA No. Hollywood
VALLEY PLAZA HOBBY SHOP
12160 Hamlin Street

CALIFORNIA, Long Beach 90808
CRAFT SERVICE HOBBY SHOP
3966½ Studebaker Rd.

CALIFORNIA, Los Angeles
COLONEL BOBS
3707-09 W. Pico Blvd.

CALIFORNIA, Northridge
LARRY'S HOBBY CENTER
8960 Reseda Blvd.

CALIFORNIA, Oakland
ROOTS HOBBY HUT
6036 Telegraph Ave.

CALIFORNIA, Pasadena
ACE MODEL SHOP
1655 E. Colorado Blvd.

CALIFORNIA, Redding 96001
SHASTA MARINE SALES
1635 Garden Avenue

CALIFORNIA, San Francisco
FRANCISCAN HOBBIES
1935 Ocean Avenue

CALIFORNIA, Sacramento
C & M HOBBY SHOP
1613 Del Paso Blvd.

CALIFORNIA, San Jose
ED'S HOBBY SHOP
1362 Lincoln Avenue

CALIFORNIA, Santa Monica
EVETTS MODEL SHOP
1636 Ocean Park Blvd.

CALIFORNIA, Ukiah
UKIAH WAREHOUSE SALES
976 No. State Street

CONNECTICUT, Hartford 06103
HOBBY CENTER
222 Pearl Street

CONNECTICUT, Waterford
SHORELINE MACHINE CO.
97 Post Road, Box 222

DELAWARE, Newark 19711
NORTHROP RADIO CONTROL
56 Holly Lane

DELAWARE, Wilmington 3
SIMPSONS HOBBY SHOP
5107 Concord Pike

FLORIDA, Jacksonville 32211
ART'S HOBBY SHOP
10234 Atlantic Blvd.

FLORIDA, Miami 33142
ORANGE BLOSSOM HOBBY
1896 NW 36 Street

FLORIDA, Orlando
COLONIAL PHOTO & HOBBY
636-38 N. Mills

FLORIDA, Pensacola 32505
BOBES HOBBY HOUSE
3319 Mobile Highway

HAWAII, Honolulu
TED'S HOBBY SHOP
1079 So. Benetonia Street

ILLINOIS, Barrington
LANGES BIKE SHOP
120 W. Main Street

ILLINOIS, Belleville
HAROLDS RADIO CONTROL CENTER
200 Optimist Drive

ILLINOIS, Chicago
WEST TOWN HOBBY SHOP
5808 W. Chicago Avenue

ILLINOIS, Hamilton
THE POT SHOP
940 Broadway

ILLINOIS, Harrisburg 62946
THE HOBBY HOUSE
512 So. Granger

ILLINOIS, Quincy
ED'S HOBBY SHOP
18th Koch Lane

IOWA, Des Moines 50309
IOWA SERVICE COMPANY
12th & Mulberry

IOWA, Hampton
REMINDER PRINTING CO.

IOWA, Webster City
HOBBY HOUSE KNIGHT RADIO & TV
Box 312

KANSAS, Lawrence
GEORGE'S HOBBY SHOP
1105 Massachusetts

KANSAS, Shawnee Mission
KENS MODEL AIRPLANE SHOP
5022 Rosewood Drive

KANSAS, Wichita
HOBBY HUT
2309 South Seneca

LOUISIANA, Alexandria 71303
SMITHS HOBBY LOBBY
2123 Linda Road

LOUISIANA, New Orleans
HUB HOBBY SHOP
2618 So. Broad Avenue

LOUISIANA, Shreveport 71105
BOSKOS HOBBY HOUSE
1253 D. Shreve City

MAINE, York 03909
DOWN EAST MODEL SUPPLY
Scotland Bridge Road, RFD #1

MASSACHUSETTS, Cambridge 02138
CROSBY HOBBY CENTER
1704 A Massachusetts Ave.

MICHIGAN, Detroit
JOE'S HOBBY CENTER
9810 Wyoming Street

MICHIGAN, Flint
HOBBIES, INC.
3302 Corunna Rd.

MICHIGAN, Kinross
LOPP'S HOBBY & MODEL SUPPLIES
Box 145

MINNESOTA, Minneapolis
WOODCRAFT HOBBY & ARCHERY STORE
903 West Lake Street

MISSISSIPPI, Gulfport
THE HOBBY SHOP
2500 16th Avenue

MISSOURI, Blue Springs
C & M PRODUCTS COMPANY
1505 B Street

MISSOURI, Florissant
BOBS HOBBY CRAFT SHOP
426 St. Francis St.

MISSOURI, Rolla
ROLLA PET & HOBBY SHOP
605 Pine Street

MISSOURI, Springfield 65804
JIM'S R/C SHOP
2117 So. Luster

MISSOURI, Warrensburg 64093
WARRENSBURG HOBBY SUPPLY
206 W. Coulton

MONTANA, Bozeman 59715
BOZEMAN HOBBY CENTER
13 So. Willson

NEBRASKA, Hastings
DICK'S HOBBIES & CRAFTS
218 North Denver

NEBRASKA, Lincoln 68501
FLITE LINE INDUSTRIES
Box 853

NEVADA, Sparks
SIERRA DISTRIBUTORS
1939 Prater Way

NEW JERSEY, Red Bank
HOBBY HEADQUARTERS
62 White Street

NEW YORK, New York 10011
AMERICA'S HOBBY CENTER, INC.
DIV. OF MOD. AD AGENCY
146-148 W. 22nd St.

NEW YORK, New York
MODEL CRAFT HOBBIES RETAIL INC.
314 Fifth Avenue

NEW YORK, Bronx 71
BROWNS HOBBY CENTER
6031 Broadway

NEW YORK, Buffalo 21
GRELLS TOY & HOBBY
5225 Main Street

NEW YORK, East Meadow L.I.
LEES HOBBY SUPPLIES, INC.
2072 Front Street

NEW YORK, East Northport
LEES HOBBIES SUPPLIES, INC.
3018 Jericho Turnpike

NEW YORK, Tarrytown 10591
ANDY WRIGHTS PRODUCTS
16 Woodfield Terrace

NEW YORK, Vestal
CUSTOM MODEL SHOP
729 Delano Avenue

NORTH CAROLINA, Burlington
RONNIES HOBBY SHOP
111 So. Main

NORTH CAROLINA, Greensboro
COBLE SPORTING GOODS CO.
119 No. Green Street

NORTH CAROLINA, Winston Salem
PAUL'S HOBBY & BIKE CENTER
714 Waughtown Street

NORTH DAKOTA, Minot
MERYL'S HOBBY SHOP
24 B North Main Street

OHIO, Cincinnati 45224
THE HOBBY SHOP
5754 Hamilton Avenue

OHIO, Cleveland
GENES MODEL SHOP
14506 St. Clair

OHIO, Columbus 43211
LINDEN HOBBY & BIKE SHOP
2458 Cleveland Avenue

OKLAHOMA, Tulsa
HOUSE OF HOBBIES
6118 East Admiral Pl

OREGON, Portland 97217
HOBBYLAND
4503 No. Interstate

PENNSYLVANIA, Feasterville 19048
FEASTERVILLE HOBBY SHOP
244 Bustleton Pike

PENNSYLVANIA, Fogelsville
DON MOHR'S HOBBYLAND
BOX 211

PENNSYLVANIA, Philadelphia 19111
ALLIED HOBBIES
6607 Rising Sun Avenue

PENNSYLVANIA, Pittsburgh
A. B. CHARLES & SON
3213 W. Liberty Avenue

PENNSYLVANIA, Norristown
BABY TOWN HOBBY SUPERMARKET
33 Germantown Pike

PENNSYLVANIA, Reading
HAINES HOBBY HOUSE, INC.
60 So. Sixth Street

SOUTH DAKOTA, Sioux Falls
DONOVAN'S HOBBY CENTER
1409 Thompson Dr.

TENNESSEE, Tullahoma
THE HOBBY CRAFT SHOP
317 So. Anderson

TEXAS, Amarillo
AMARILLO HOBBY HOUSE
4400 So. Washington

TEXAS, Dallas 8
BERNIE'S HOBBY HOUSE
209 A. West Jefferson

TEXAS, Houston 5
G & G MODEL SHOP
2522 Times Blvd.

TEXAS, Texarkana 75501
MODELTRONICS
2705 Milam Street

TEXAS, Waco
THE HOBBY SHOP
521 No. 18th

VERMONT, Burlington
CASSLER'S INC.
333 N. Winooski Avenue

VIRGINIA, Elkton 22827
EASTSIDE HOBBIES
Route #2, Box 292

VIRGINIA, Norfolk 5
ZEPHYR MINIATURES
123 W. Little Creek Rd.

WASHINGTON 1, D.C.
CORRS, INC.
813 9th St. N.W.

WEST VIRGINIA, Kenova
BLEVINS MODEL SHOP
1829 Maple Street Rear

WISCONSIN, Milwaukee
HOBBY HORSE
5500 Capital Court

WYOMING, Cheyenne 82001
RADIO CONTROL CENTER
2516 Snyder Avenue

WYOMING, Sheridan
THE MODEL SHOP
659 Marion Street

Kraft Systems, Incorporated

SOUTH EL MONTE, CALIFORNIA

SINGLE CHANNEL PROPORTIONAL...

The BABCOCK BC-22 Proportional System

✔ CHECK THESE FEATURES!

The Babcock BC-22 Proportional System has been designed to give the single channel flier maximum performance and consistent reliability at a minimum cost. Designed and engineered with the sport flier in mind, the BC-22 is ideal for the small-field airplane in the .010 to 049 size range.

- ✔ Pre-wired installation— Only three wires to connect!
- ✔ Interference free!
- ✔ 5 ounce airborne weight!
- ✔ Guaranteed ground range 1500 feet — consistently tested in excess of 7/8th mile!
- ✔ Full Right and full Left controls for stunting!
- ✔ Two standard 9 volt transistor batteries power entire airborne system!

$59.95

FREE! with every BC-22 or BC-21!
FULL SIZE PLAN FOR THE
D.Q.A. 704
featured in the December issue of R/C Modeler

The BABCOCK BC-21
SINGLE CHANNEL SYSTEM

- **Interference free!**
- **4 ounce airborne weight!**
- **Completely trouble-free system recommended for .020 through .15 size planes Selective rudder plus optional kick-up elevator!**
- **A single 9V transistor battery supplies entire airborne system — two economical transistor batteries power the transmitter!**
- **1500 feet guaranteed ground range — tested consistently to 3300 ft.!**

$49.95

Send your order today—Fly tomorrow with the WORLDS FINEST RADIO CONTROL EQUIPMENT!

DIGITRAN $69.95

All Digitran single channel systems will include the improved BCR-18A transmitter and all-new BCR-19 receiver. Provides right, left, up, and down from a single control stick, plus quick blip motor control function.

MAIL NOW

BABCOCK CONTROLS INC.
20762 Laguna Canyon Rd.
P.O. Box 666
Laguna Beach, Calif. 92652

☐ PRE-PAID CASH ORDER
☐ C.O.D. ORDER

NAME _____ ☐ BC-21 SYSTEM
ADDRESS _____ ☐ BC-22 SYSTEM
CITY _____ ZONE ____ STATE _____ ☐ DIGITRAN
AMOUNT ENCLOSED WITH ORDER $_____ BALANCE $_____

PLEASE MAKE PAYMENT BY CHECK OR MONEY ORDER. 20% DEPOSIT REQUIRED ON C.O.D. ORDERS CALIF. RESIDENTS ADD 4% SALES TAX. POSTAGE PAID ON ORDERS OVER $25 UNLESS C.O.D.