A GUIDE TO NICKEL CAD BATTERIES

JANUARY
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GRID LEAKS

R/C DATA SERVICE ®

VOLUME 5 • NUMBER 1 • THIRTY-FIVE CENTS

SPECIAL!

• Multi-proportional—the pros and cons of the three basic circuits—systems compared to the theoretical ideal. Penetrating analysis of a complex field, by Vernon C. Macnabb.

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A Radio Control Publication for Beginner & Advanced Modeler

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Transistorized Tone Transmitter, 27.255 mc operation.
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Same as above, only completely assembled, avail. 26-28 mc.
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Ectronics relayless single channel, all-transistorized.
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Kraft 3 volt—all transistor-relayless, 26-28 mc.
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Single channel 27 mc unit with SE-2 escapement, no soldering or wiring.
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Tube and transistor tone receiver, use with MC2SOT transmitter.
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All transistor dual output relayless receiver. Weight 1 oz.
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Same as above, but with metal case.
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Convert from broad-tuning super regen receiver to nice sharp superhet.
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Unique printed circuit two-deck construction. Uses light Deans Reeds for best performance. PC boards are drilled.
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(Specify freq.—Relay type)
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The kraft multi-fli super regen relayless receiver kits are available with a 6 or 10 channel reed bank. Use with transmite servos.
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Light weight, instant responsive escapement.
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Features "Flight-feel" control stick and separate throttle button.
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Motor-minder motor control escapement. Perfect in-flight control.
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Most popular of all model aircraft servos.
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Easy, reliable stick-box or manual control.
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Features 3 transistor switching network for positive actuation of Mark II or Mark V escapements.
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A versatile and powerful compound escapement.
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Super-light weight escapement with built-in memory.
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Provides high, low and cruising engine speeds when used with translator. Easily adjustable.
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NO. 14A2—G. & M. MINICOMBO II 7.95
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Smallest, lightest multi-channel superheterodyne receivers available. Weight is 3½ oz.
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Formed and finished control surface couplings for fast, accurate, easy G-C hook-up. Kit contains: Elev. tie bar, rudder arm, crank "Universal" couplings, torque bearings, spare "Floating" bobbin. Ready to install with complete instructions only $2.00

ALL NEWEST ORBIT EQUIPMENT IN STOCK

SOLDERING GUN

USES CAR BATTERY TO POWER (6-12V)

- CONTROLLED HEAT
- WEIGHS ONLY 8 OUNCES
- ALSO USED ON AC
- HEATS IN 4 SECONDS

ONLY **$6.95**

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The Magnifocuser headpiece has nothing to lift or adjust . . . No wasted hand motions . . . Both hands always free to work without interruption.

10" FOCAL LENGTH POWER: 2.25:1

ONLY **$12.50**

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This fully transistorized monitor can detect any interference on the wave band a modeler is using, and it will indicate whether the operator's transmitter is emitting a carrier wave and will audibly indicate the tone and clarity produced.

Both models are fully tunable.

CUSTOM BUILT—FULLY GUARANTEED
27 MC ____ **19.95**
6 METER ____ **24.95**

CHART CHARGER FOR NICADS

Charging is still very simple with the CHART CHARGER, since you simply select the number of batteries, the rate of the charge and turn the pointer. Unit is housed in a molded bakelite instrument case, with an etched aluminum front panel, measuring 2" x 3¼" x 6¼".

SAVE 2.00 BY ACTING NOW!
REG 9.95 ONLY **7.95**

3 VOLT—TRANSISTOR RELAYLESS RECEIVER KIT

Contains ¼ watt resistors; pre-selected transistors; sharp Printed Circuit Board drilled and ready for soldering; wound coils and step-by-step fully explained instructions. Only tool required is a 30 watt soldering iron—operates from 400 to 700 C.P.S. (any existing 27 mc transmitter). Single ended output operates all escapements on market. (Note: Cannot operate motor driven units.)

KIT ONLY ____ **9.95**
READY BUILT—TESTED ____ **12.95**

LEE'S LIGHTNING TRANSMITTER

- TWO PIECE CENTER LOADED ANTENNA
- THREE TRANSISTORS

Crystal controlled on 27.255 Mc this transmitter uses three VHF transistors in M.O.P.A. circuit with 100% Collector modulation for maximum efficiency. It is temperature stable and will operate satisfactorily from 20° to 120°F. The output tone is 600 to 700 cycles.

Accessory provision in this transmitter has been made for installation of a quick BLIP-TIMER which will permit a signal to be transmitted at 1/100 of a second; eliminating the difficulty of pulsing with the thumb.

TRANSMITTER AS SHOWN **$23.95**
All units thoroughly tested prior to sale.

Accessory provision BLIP-TIMER **$8.00** ADDITIONAL

EXCLUSIVE DEAL — BEGINNER'S BONANZA!

COMPLETE R/C PACKAGE FOR THE BEGINNER

If you're getting started here's the combo for you. Included is the newest and hottest K.B. .049. For a kit we've selected none other than the tried and tested, Fabulous Jr. FALCON. With this you get LEE'S own guaranteed Transmitter and receiver, plus the finest selective citizenship escapement. To make it really complete you also get a pint of LEE'S "Grip of Steel" Cement.

$56.54 VALUE → YOU PAY ONLY **$46.95**

EXCLUSIVE PLANE-ENGINE COMBOS

Bill Winter's sensational "Krackerjac" for single channel fans. Big, roomy and responsive with excellent penetration.

$36.69 VALUE → YOU PAY ONLY **$24.95**

John Roth's U.S.A.F. Championship design winner in 1961 and 1962. Just released by Jetco. Ideal for contest, sport or multi-training. Easiest multi to build and fly. 62" span, 740 sq. in. wing area.

$54.69 VALUE → YOU PAY ONLY **$39.95**

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ECONOMICAL • FUEL PROOF • BRILLIANT

ITEM	4 OZ.	PINT	QUART	GALLON
CLEAR	.45	1.25	2.19	8.50
THINNER	.40	1.00	1.65	5.25
GRAIN FILLER	.40	1.20	2.19	8.50
CUB YELLOW	.45	1.50	2.89	10.95
INSIG. WHITE	.45	1.50	2.89	10.95
INSIG. RED	.45	1.50	2.89	10.95
FOKKER RED	.45	1.50	2.89	10.95
INSIG. BLUE	.45	1.50	2.89	10.95
LIGHT BLUE	.45	1.50	2.89	10.95
GREEN	.45	1.50	2.89	10.95
BLACK	.45	1.50	2.89	10.95
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KWIK KLEEN REMOVES OIL AND GRIT PINT **59c**

BRUSHES SHED-RESISTANT 1" WIDE **$1.45**

BALSA PUTTY COVERS GRAIN FILL CRACKS MAKE FILLETS 4 OZ. **79c**

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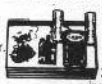
- ACE R/C Inc., 203 W. 19th HIGGINSVILLE, MISSOURI
- G.M. HOBBY SPECIALTIES Inc., 105 CLIFTON BLVD., CLIFTON, N. J.
- C. & S. ELECTRONICS, 7377 BEVERLY BLVD. LOS ANGELES 36, CALIF. (Priced 10% higher due to freight charges.)

ANOTHER LEE'S PRICE BREAKTHROUGH

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

1. The famous **3VK** 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
WEIGHT 3½ oz. total including battery

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

All for only . . . (Fully Guaranteed) **19.95**

NO. 12A34—Kraft Single Convertible Hybrid 10 channel kit 47.95
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Smallest practical physical size. Light weight.

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Single channel boat servo. Provides forward, stop, reverse motor and intantaneous rudder action.
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Electric compound servo for even the largest boats.
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Transistorized for direct operation from any standard reed bank.
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NO. 14A52—RNA SERVO KIT 7.95
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Throttle control servo designed for multi channel.
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For battery-powered R/C boats, cars and trucks.
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NO. 14A21—BONNER TRANSMITE TRIM ONLY 27.95
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Relayless transmite servos especially designed for Bramco, Apollo, Kraft relayless 10, orbit and CG.

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Has double coil with only 30 ohms—plenty of power—low drain.
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NO. 15A6—SHOWS POD KIT 12.95
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NO. 22A3—SUBMINI 0-1 MA METER 3.45
NO. 22A4—0-500 MA METER 3.95
NO. 22A5—SPACE CONTROL 0-1 MA METER 5.95
NO. 22A6—SPACE CONTROL 0-5 MA METER 5.95
NO. 22A7—SPACE CONTROL 0-50 MA METER 5.95
NO. 22A8—MT 2000 MULTITEST (Imported) 9.95
Low cost pocket multimeter with features found in higher priced units.
NO. 22A9—VOM 102F FUSED KIT 16.95
American made volt ohm milliameter, larger than above unit.
NO. 22A10—METER TEST LEADS ..... .50
40" red and black standard

BATTERIES

NO. 38A35—NICKEL CADMIUM 4AH 1.95
NO. 38A3—EVEREADY N46 ..... 2.95
NO. 38A4—WILLARD BB 210 LEAD ACID 5.95
NO. 38A34—ARISTO 64 LEAD ACID 4.75
NO. 38A5—MALLORY ALKALINES MN 910D ..... .35
NO. 38A6—MALLORY ALKALINES MN 1500 ..... .50
NO. 38A36—MALLORY 2400B (AAA pen cell size) ..... .45
NO. 38A37—MALLORY 1400B (Medium cell size) ..... .75
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DEANS REED BANKS
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NO. 27A23—10 channel 3K ohm coil 18.50
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NEW HAVEN REED BANK
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Convert from 3..6V to 135v
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NO. 23A4—EXTRA BRUSH SETS ..... .35

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49" long, collapsed 18", increased output.
NO. 37A7—TCU 54 ..... 4.25
Heavy duty, 54" 3 section telescoping antenna. Collapses to 24".
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42" 5 section telescopes to 9¾".
NO. 37AX—TCU 112 ..... 4.95
Deluxe ground based type antenna. Full 112" for effective radiation.

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NO. 17A23—ST11 ..... 1.25
NO. 17A24—JE102T 2.50
NO. 17A25—Zebra 1.25
NO. 17A26—Receiver cup core tx 3.95
NO. 17A27—Transmitter cup core tx 3.95
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NO. 17A29—455-B2—Interstage 1.60
NO. 17A30—455-B3—Output 1.60
NO. 17A31—Iron core tapped Oscillator coil ..... .65
NO. 17A32—TOROID, 1 henry 6.95
NO. 17A33—TOROID, 2 henry 7.95

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CRU for transmitter, third mode series type, Each $2.95
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NO. 20A11—27.045 **NO. 20A14—27.195**
NO. 20A12—27.095 **NO. 20A15—27.255**
CRU for transmitters of the doubler type. Final frequency is double the xtal frequency, Each $4.25
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GRID LEAKS

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Frank Schwartz—Dale Springsted—John Worth—John Phelps

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GRID LEAKS AT PLAY

● The new year is starting off with a bang in several areas.

In our last issue you undoubtedly noticed the Interference Report Form. We're happy to advise that GRID LEAKS has a quantity of these which are available for use by individuals and clubs. There is no cost on these forms but we do urge judicious and correct use. GRID LEAKS will continue to act as a clearing house for these as a service for the radio control modeler. Request reasonable quantities of these and we will be happy to supply them.

The AMA petition before the Federal Communications Commission filed by Courtney & Associates is under way, and hearings will be begun. We will keep you posted on this and advise just as quickly as something definite is learned. We feel encouraged because concrete action instead of wishful thinking generally brings results.

We are trying to get clearance on publishing the frequencies. If we do so the info will be added at the end of this column.

● For those of you who may have missed it in the January issue of **Model Airplane News** we'd like very much to thank editor Walt Schroder for the splendid coverage he gave this GRID LEAKS' sponsored Heart of America Contest. A little belatedly, but we'd like to give credit to two other photographers who shared in the taking of the pictures. They are, W. A. Butts Jr., of Higginsville, and Lee Gelhaus, Kansas City.

Carl Lindsey and other CD and Leader Members in the area are already beginning to roll on plans for the Second Annual Heart of America Contest, and things are really looking up. It is likely that this year's event will be held at the Richards-Gebaur Air Force Base, and Air Force personnel will be available to assist. With such facilities and this kind of personnel, the 1964 event could easily, and we hope will, top the first, held in 1963. Watch GRID LEAKS for further details and date. The tentative date sets this meet about a month before the Nationals in Dallas.

● We've invited a number of R/C Clubs to participate in a special money making project, selling subscriptions to GRID LEAKS on a limited offer basis.

If your club would like more information, drop a note here to us at Higginsville, Mo., and we will be happy to oblige.

We are delighted at the way the subscription list to GRID LEAKS continues to grow, (*Continued on page* 32)

THE MONITOR

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

VERNON C. MACNABB's article on multi-proportional, page 4, provides a timely and badly needed perspective of the different systems as well as their pros and cons. When GL pressed "Mac" to describe his rumored new proportional equipment, he countered with the suggestion that he might prepare just a resume of basic systems. And, if it were not for good old insomnia—in this case Mac's—we'd never have gotten that either, because he was now pushing his system toward production readiness. So, after all the years we've known Mac and dealt with him as an editor—without ever getting an article—it is nice indeed to have him favor GL with this typically to-the-point report on proportional.

Back in 1948 had written in *Model Airplane News*—Howard McEntee then being editor—that there was no way to fly R/C legally unless you had a ticket. Mac contested that statement and sent us one of the 465 prototypes to inspect. Since our knowledge of radio was zero, we drove him to distraction with what-do-we-do-now questions. He still tells the story about our telegram which read: "What is this in series stuff?" A couple of years after, lo and behold, FCC established Class C in the then new Citizens band for remote control purposes.

GL finally convinced Mac to say something about his own proportional system. We now switch you to Indianapolis. . . .

"It will be a combination system pulse-width, pulse-rate and discriminator." Macnabb states. "The reasons for this selection are as follows:

"It appears to be the most economical system to build, thereby bringing a lower cost system to the modelers. It will use continuous modulation which qualifies as the best defense against interference. Also, the pulse voltages are taken after one of the discriminators which is highly selective against interference. It will have holding circuits where needed for neutralizing all controls plus low-motor as fail-safe.

"The transmitter will use inductors as tone generators to prevent drift from temperature and voltage variation, and temperature stabilized toroids for the receiver discriminator coils.

"Servos have been designed, using rugged, powerful motors at no sacrifice in resolution or tracking," he continues. "Temperature changes in the servo amplifiers will be compensated by thermistors.

"The superhet receiver will have an amplified AGC system to insure more constant output and avoid signal distortion close to the transmitter. Regarding stick arrangement, this is the modeler's choice. I believe if it were not for the habit-conditioned reed fliers, ailerons and elevator should be on one stick, and rudder and motor on another."

Mac thinks tri-proportional with trimmable motor is attractive cost-wise. It saves a costly discriminator and tone generator, and saves money on the motor servo which becomes a simple modification of a reed servo with no feed-back loop.

"Maybe we'll make it," Mac concludes.

● In these days of interference there is a certain wry humor in hearing of new and strange applications of radio control, even when there is no real connection between these uses and our own field. It is fun to pass on informational bits about radio-controlled elephants and tsetse flies. Every once in a while somebody plants a radio in some critter, the latest being General Electric's Space Sciences Lab *Continued on next page*

Recipient of a Citizen-ship award for a win using their equipment is Frank Schwartz, Nashville, Tenn. The ship is his second Taurus. ZR-10 receiver, TMS transmitter.

THE MONITOR . . . continued

installation of a 500-kc transmitter in a rat, using the rat as the sole source of power. GE did this by implanting an electrode under the skin and another in the peritoneal cavity—power pack, would you say? The sophisticated reader will note that maximum power is 155 microwatts with a 500-ohm load at .23 volts. Open circuit voltage, .68. According to the story in *Aviation Week* GE has a $77,328 contract with NASA, part of a two-year study of bio-electro-genesis which grew out of a biological fuel cell development program. If this has meaning to the model field you may find yourself someday using batteries which operate from the interaction of yeast and glucose. Perhaps we can pop into the drug store for another bottle of yeast tablets, instead of charging nicads. Whimsy aside, the pay-off would be in the biological and medical fields, since physiological reaction in a body could be monitored, and body functions regulated, without using externally connected wires.

We might observe that the "GE Rat" probably has more radio range than some of the transmitters we've used in the past. Over a six-month test period the rat displayed no voltage variations. Nor did he seem to mind the experiment.

• Now that the "control-axis rules" which define Classes 1, 2 and 3, are going into a second season, we are reminded that not a single letter on this subject has been received by us, either on GRID LEAKS or *Model Aviation*. Considering the turmoil—particularly in Class 2—that characterized the hammering out of these rules, the apparent silence is deafening. Could it be possible that most people are happy with these rules? This would be an historic first.

While the rules proposals were still in the works, had talked with both John Worth and Walt Schroder about what we considered the unique opportunities that would accrue to reeds and servos in rudder-only. As an old rudder man, it seemed that two servos, one on motor and the other on rudder, might give the proportional boys a bad time. Escapements surely seemed to have about had it for major competitions. Walt was on the same kick and such a set up was flown to a Nats win by his son John. Worth reported that he had checked around and that neither the pulse or escapement people he talked to were concerned.

We haven't seen the end of Class 1 ramifications. Since control is limited to the yaw axis it matters not how many servos you use for that axis. Suppose then that a trim-type deal be applied to rudder using two servos—third for motor. Even better might be two self-neutralizing servos (with trim bar hookup) with the second giving slight rudder, which might even be held on for precision. With a simultaneous transmitter, one servo could operate off the elevator lever switch (turned for left-right), and the other off normal rudder or aileron switch. You would then have precision rudder, mild over-control and, with simul, megaton rudder. This is just idle reflection for it is not the place, we think, for GL to editorialize in such sensitive areas.

After a season of the new Class 1 rules, there is little evidence that anyone thinks the beginner, the sport flier or even the low-budget man has been deprived of anything. He can still win, it is said. So if we refrain from arguments to the contrary on the grounds that there is no incriminating evidence, we can, however, score the obvious shift in thinking behind rules evolution. Recall a chance meeting not too many years ago with Walt Good and Howard McEntee when Walt asked our opinion about the very daring possibility of adding motor control to rudder. The popular opinion was that nothing should complicate an airplane meant for the beginner in R/C. Motor control came in only after much soul-searching on the part of the then rules committee. Dare we ask if the dream is now dead?

Strangely, it seems to us, most of the disappointment is in Class II and there only because the yaw-and-pitch axis category has not been galvanized to new highs by rules which were to be a panacea. While some gains were made, rumors have been heard about the advisability of dropping Class II (Intermediate) at the Nats, which we seriously doubt. Why does Class II, and Class I, lack for entrants? Is it that most of us who can get to contests care only for Class III? Or, in Class II, has something been overlooked?

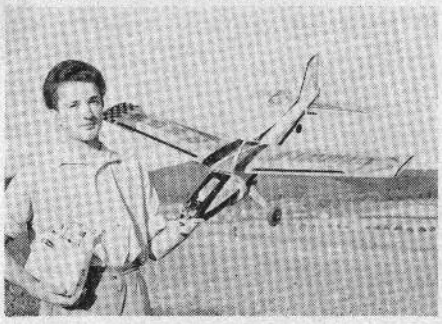
Anyone who has seen, say, a Falcon with strip ailerons rather than rudder (plus elevator and engine), knows how vastly superior and satisfactory such a plane then becomes. Do we offend anyone by inquiring why a builder cannot be given a choice in Class 2 between the yaw and roll axis? (Presumably everyone would want ailerons, but you can never tell about these things.) Such an option does not seem to upset the scheme of things.

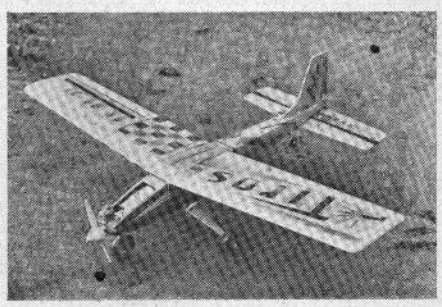
• Radio-controlled free-flight is seriously suggested by Don L. Thompson in a recent issue of the Illinois Model Aero Club newsletter. For duration, not stunt this would permit simultaneous operation by superhet, precise engine-run control, thermal hunting and exploitation. Either by dethermalizing and spiralling under control, a ship could be kept in a small area—and you know what the flying site problem is in free flight.

"It is my opinion," said Don, "that eventually the majority of free-flight contests would be held in this manner . . . meaning 10 or 15 years from now."

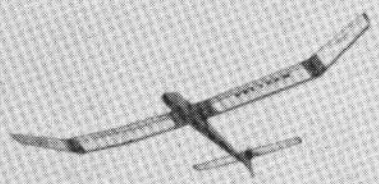
If interference problems are implicit at meets, it cannot be argued easily that rules should prevent potential conflict. Free flighters presumably will term it progress—and it is. The writer lives in a glass house because he has for years been free-flight adjusting things like Rebels with long thermal flights requiring only occasional control applications—one 20-minute soaring expedition using only one blip to straighten out a near-by (*Continued on page* 32)

Frantisek Farnik, Czechoslovakia, and his OS Max 19 rudder job. Radio is Bellaphon.

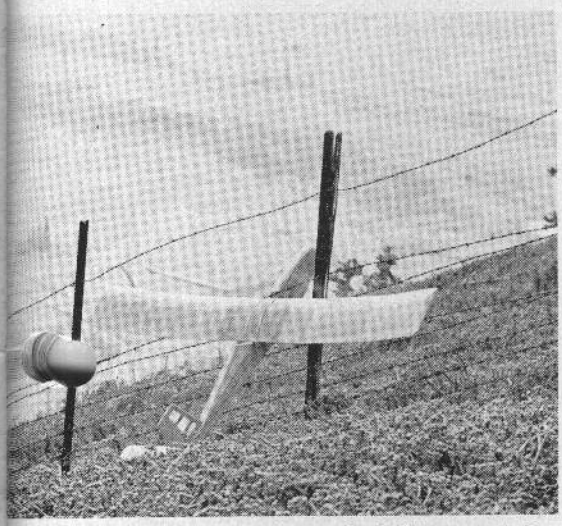




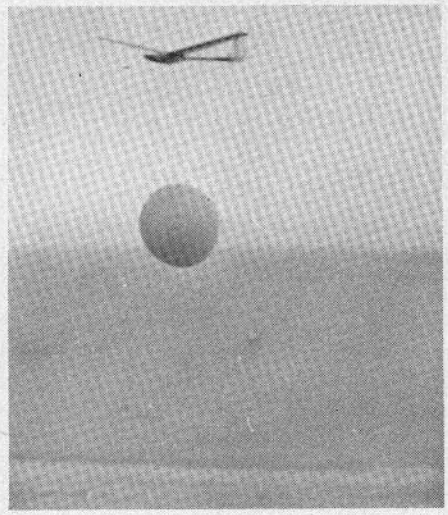
Borivoj Trmac, also a Czech, made this OS Max 19 rudder (MC) job with Grundig gear.



ABOVE—The Harbor Slope Society's flying site, Jay Jones' glider passing over.
RIGHT—Author's Italian Pelican coming in for landing. Excellent craft for beginner.



Low wind and marginal lift caused Dr. McPherson's glider to tangle with fence.



Frank Colver's pass misses as daylight fades but by using elevator made kill.

GLIDER BALLOON BUSTING

A most unusual Californian contest runs into "ideal" power weather and balloons proved terribly hard to hit.

Two at once! Frank Colver waits in background with a checkerboard Nordic 72 ship.

by DALE WILLOUGHBY

■ Balmy Indian summer weather with almost no wind and marginal lift conditions handicapped this novel contest held on Nov. 10, by the Harbor Slope Society at Back Bay, Calif. Only gliders with a 9- to 10-ounce loading could continue flying for more than 20-30 seconds after launch. When wind slacked, the balloon rode high in sky, but with a surge of wind would stream in to hug the face of the cliff, an extremely difficult target for a rudder-only glider with such little lift present. Class III entrants were generally grounded, at most getting in only a couple of passes. Evidence of the tough conditions were the 27 flights which totaled only 2 hrs. and 15 mins. air time. A high overcast which moved in made picture taking dubious, but the author made some 24 shots of which the more exciting are reproduced here. Despite the lack of wind deflected up the slope, the contest was judged fun. ■

Dr. Ralph Brooke with his World Championships winner, 1963. Proportional came into its own in '63, Maynard Hill setting altitude mark. (Aeromodeller)

WHAT LEVEL OF EXCELLENCE?

by VERNON C. MACNABB

The ideal proportional system begins to approach the requirements of guidance systems used in missiles. What do we really want? What is good enough? What is acceptable?

A LETTER FROM GRID LEAKS asked if Citizen-Ship would like to write an article outlining a projected proportional system which rumor stated we were about to announce. As a result of my reply, in which I outlined and reviewed the general subject of proportional systems as evidenced by the state of the art, I was asked to enlarge upon the subject for the benefit of the modelers contemplating the purchase of such equipment.

The following information is written as a result of nearly five years of studying, experimenting, observing, listening, testing and flying as much information and equipment as could be obtained. No conclusions are drawn as this would be presumptive in my situation, but the opinions expressed are unprejudiced and lean to the positive side wherever some point is questionable. It is, of course, only one man's opinion.

Recently a friend of mine obtained an early proportional system and reported constant trouble, even though serviced and revised, and finally he gave up trying to use it. (I hope he will forgive me for telling this story.) I borrowed this equipment to try it out. Upon installation in a plane, I could get it into the air, but made a mess of flying it. However, another modeler, who had built and flown proportional systems, took over and flew it beautifully. We made six successive flights with complete success. There was no interference in an area where we knew we had interference in the Citizens Band. Maybe the trim changed; maybe there was interaction between controls; maybe (I know there was) temperature drift but, in my opinion, the equipment was acceptable and usable. The question is: what level of excellence are modelers demanding? This was not the only negative report on that equipment. Such reports were somewhat general, yet there were also many enthusiastic reports. Is it the man or the equipment?

The above example is cited as a background for the "meat" of this article. What is good enough? What is acceptable? Let's write the specs for an ideal proportional system:

1. It should be quad-proportional.
2. It should be infinitely variable (no steps).
3. It should have an exact repetitive center return to neutral (like reeds).
4. It should not be subject to interfer- (at least no more than our good reed systems).
5. It should not drift with temperature.
6. It should not drift with voltage changes.
7. Both transmitter and receiver must be transistorized.
8. It should be fail-safe.

Such a system can be made and may still be made within the pocketbook limitations of the average modeler, but a proportional system begins to approach the requirements of guidance systems used in missiles. Need I say what these cost? No R/C manufacturer can afford the selected precise components — particularly transistors — that space agencies can use.

In addition, the total dollar volume of radio control equipment could scarcely justify the cost of research and engineering required to design such an ideal system. The R/C industry is small. Fortunately, we have a benefactor in the persons of dedicated modelers in other industries who are willing to devote their time gratis to design this equipment, often with no thought of financial gain. Nearly all the systems currently available have been evolved in this manner. To name but a few, such men as these come to mind: Good, Toomey, Sampey, Pullin, Mathes, Brown. May we have many more!

At present—at least, to the limit of my knowledge—there are three basic types of circuits used, any of which can be used as a complete system, or in which pieces of one may be combined with others. They are:

1. The pulse-width, pulse-rate method.
2. The discriminator.
3. The appropriately named digital method.

The first: pulse-width-and-rate is well known to any early proportional designer and, of course, was pioneered early by Walt Good. At that time it had the limitation of giving only two controls plus two or three motor positions sequentially. For the benefit of the novice, a pulse can be generated that looks like Fig. 1 on a scope, the width of the pulse may be varied and also independently the repetitive frequency, (each independently of one another), and detectors are easily made to convert these pulses into a plus-or-minus DC Voltage when measured from the center point of, say, 6 volts (four flashlight batteries).

Lately, an ingenious variation of pulse-width has come out which uses two pulse-width voltages and one pulse-rate, giving three channels *plus* trimmable motor as used with reeds. The only possible objection to this system is that whenever motor is trimmed, all other controls neutralize.

The second system, Discriminators, depends on the audio selectivity of a pair of tuned audio inductors tuned in close proximity to each other and, by varying the transmitter tone frequency either side of the center frequency, a plus-and-minus voltage may be detected. See Fig. 2a for a possible arrangement of detectors. In order to get four channels, four such discriminators must be crowded in between 0 and 4000 cycles, the maximum modulation frequency permitted on the Citizens band. Good selective coils must be used and yet they must be small. Also, the lower the frequency the more difficult it is to make small selective coils, so 1000 cycles is about the low limit and, of course, about 3600 the high.

In addition, all four tones cannot be transmitted at once because beats between them produce chaos, and the discriminators do not know which signal to accept. Therefore, it is necessary to send the tones sequ-

entially, one at a time, to avoid the beats and unwanted signals. This could be done by a rotary four-position switch, but normally is done electronically by a ring counter (we are starting to use computer techniques).

The third system, called digital, is probably so named because it borrows many of its circuits and techniques from digital computers. The transmitted signals are pulses which are variable in width (not unlike #1 system) except that the first pulse-width may be different from the second pulse-width, and the spacing between the pulses may be varied, again independently. The receiver is a very sophisticated decoder which receives these variable pulses and channels them to the desired servo without getting mixed up, and each pulse causes its own assigned servo to operate, and the other three ignore it. Its output system also differs from the two preceeding systems in that the detectors of the pulses do not produce a plus-minus DC voltage, but the pulses themselves trigger the correct output transistor in the servo to drive the motor in one direction or another. More will be said about this in servos.

A combination of pulse-width, pulse-rate and two discriminators can be used to obtain four channels. This combination was used in the first system to be put on the market.

Servos for the first two systems (also the combination system) are more or less similar. The plus-or-minus voltage is amplified to turn on an output transistor to drive a motor in one direction or the other, let us say clockwise for plus, and counterclockwise for minus. The motor is linked to a potentiometer which resets the input voltage to zero and the motor stops. Fig. 3 shows the circuit of a possible feedback or closed-loop servo, as they are called.

The disadvantage of this servo is the fact that very small changes in the input voltage (the plus-or-minus from either pulse or discriminator) will not cause enough current to flow to start the motor, so this proportional system actually moves in a series of minute steps, but the steps are so small that the servo seems to follow the stick in the transmitter continuously. It is obvious that the more sensitive the motor, the more steps can be had, and early servos used the German Micro-Mo motor which would start at about 20 milliamps. However, the output transistors are capable of delivering up to 600 milliamps, so any change except the minutest gives full power. To employ sensitive or more rugged motors, there are tricks that can be used, such as a small amount of AC or so-called trigger circuits that make the less sensitive motors satisfactory.

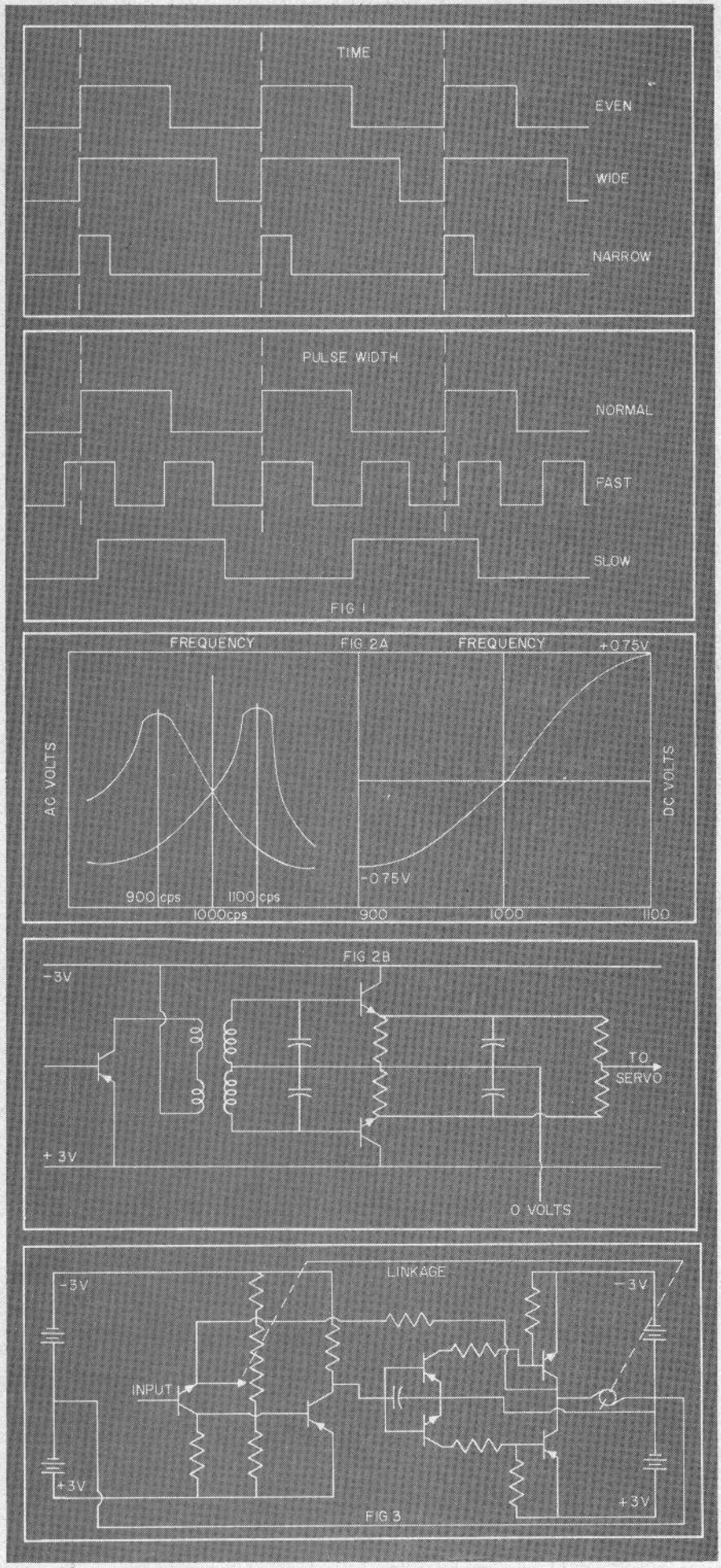
Servos for the digital system respond to a series of rapidly repeated pulses that drives the output transistor to saturation with each pulse, so there is no condition of low current that will not start the motor. This servo also drives a potentiometer, but there is no DC to be balanced out. This potentiometer is in a pulse generating circuit in the servo amplifier that cancels out the pulse coming into the servo from the receiver when it has been rotated to the proper point by the motor and, at that point, since the output transistors are receiving no pulses, the motor stops.

Now that we have outlined the possible systems currently available, or to be available, let us compare them to our early specifications for an ideal system:

1. System one alone, so far as the writer knows, has not yet been made quad-proportional. It can be made tri-proportional with trimmable motor.

System two (discriminators) is quad.

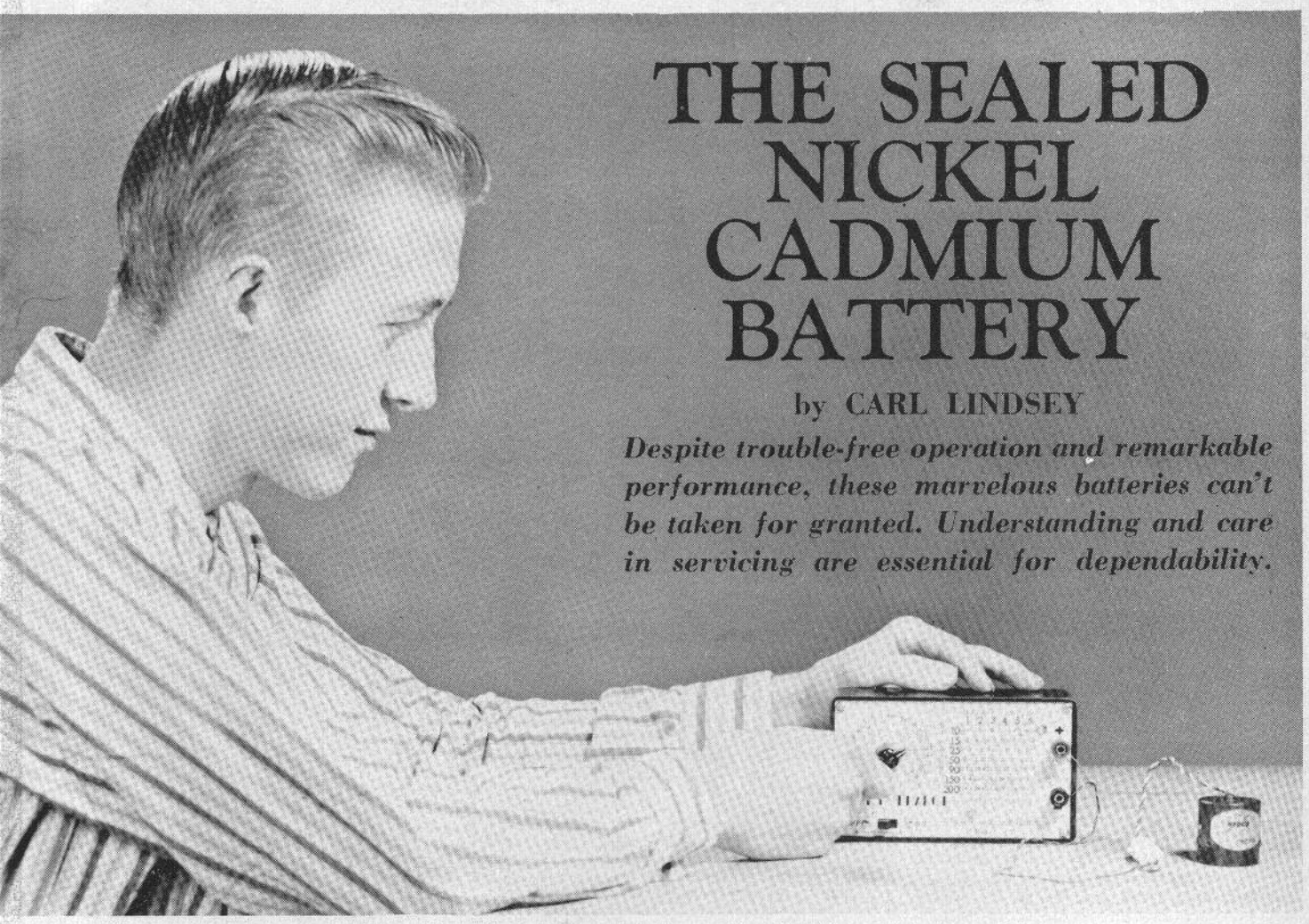
(*Continued on page* 30)



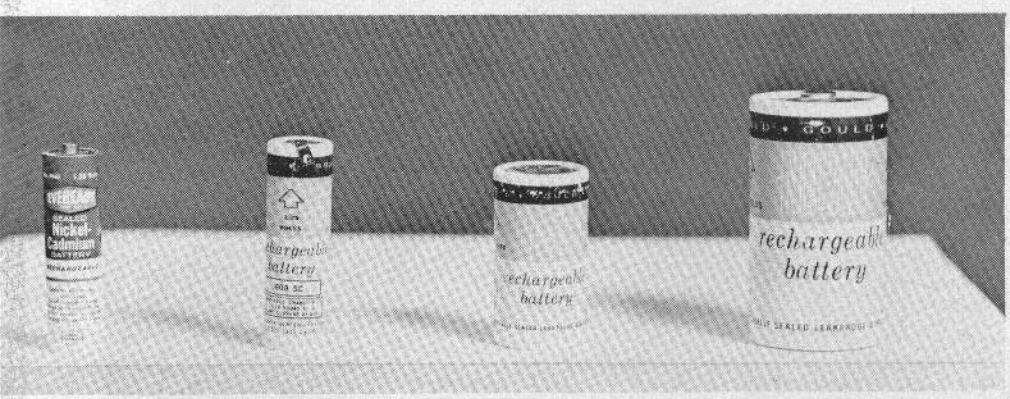
THE SEALED NICKEL CADMIUM BATTERY

by CARL LINDSEY

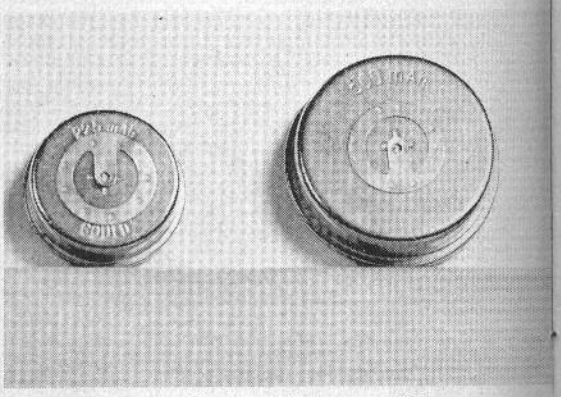
Despite trouble-free operation and remarkable performance, these marvelous batteries can't be taken for granted. Understanding and care in servicing are essential for dependability.



Charger should always be plugged into the battery pack before putting the AC cord into the socket.



Some representative cell types. Recommended charge and discharge rates should never be exceeded because of faster disintegration of the electrodes.



Popular button-cell sizes shown are 225 and 500 mah capacity. Voltage is 1.2.

A TRUE STORAGE BATTERY which uses one of the best electrochemical systems available today, the nickel-cadmium battery has been used in Europe for more than 50 years in its original form (unsealed cells) and was introduced into the United States in 1945. In 1946 the Signal Corps awarded research and development contracts to improve the battery. Technical advances in recent years made possible small, hermetically sealed, maintenance free, rechargeable cells. Two patents have been awarded for such cells—one in France and the other in Germany—which became available for radio-control applications in 1958. These cells are made of expensive, active raw materials and are of complicated construction, but the advantage of a rechargeable cell offsets initial high cost. *Battery Terminology*: The terminology should be understood before proceeding with this article.

- A "battery" consists of two or more electric cells usually connected in series.
- The "capacity" of a battery is the output capability, usually expressed in ampere-hours.
- The electric "cell" is the basic unit for converting stored chemical energy to electric energy.
- The state of "charge" of a cell refers to the capacity remaining in the cell.
- "Charging" is the process of supplying electrical energy for conversion to stored chemical energy.
- "Cut off voltage" is the cell voltage below which operation is not recommended.
- A "cycle" is one discharge and one recharge.
- The withdrawal of electrical energy from a cell is referred to as "discharge."

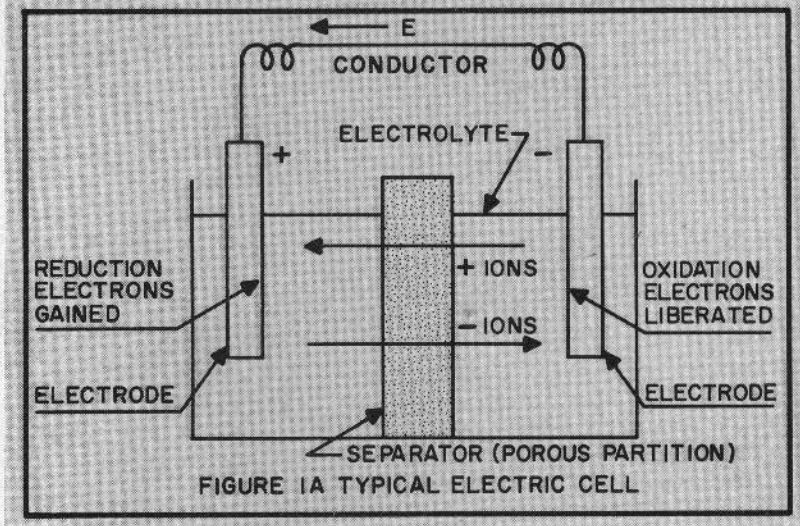
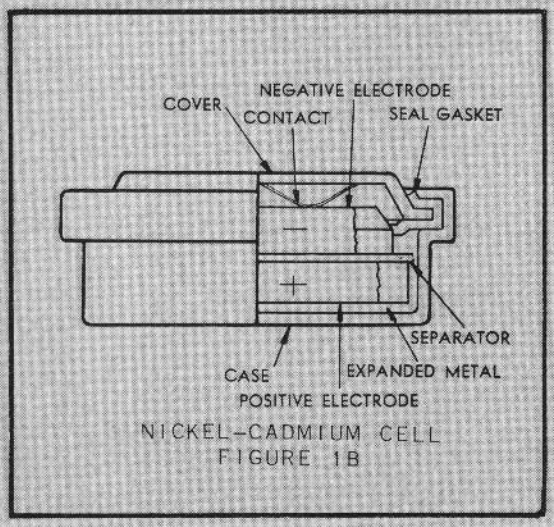


FIGURE 1A TYPICAL ELECTRIC CELL



NICKEL–CADMIUM CELL
FIGURE 1B

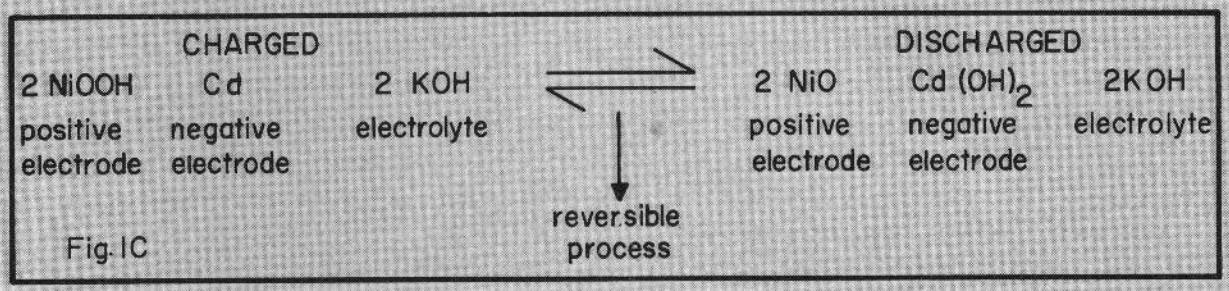
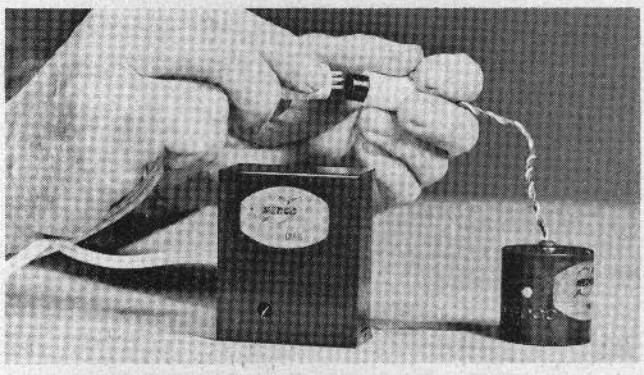


Fig. 1C


Medco charger and pack. Many chargers are meant for particular battery set-ups; not for indiscriminate use—should not be employed indiscriminately.

- The withdrawal of current from a cell is referred to as "drain."
- The "electrolyte" is the solution in the cell that permits electron conduction between the positive and negative electrodes.
- The "end point voltage" is the cell voltage below which operation is not recommended.
- "Float charging" is a method of recharging wherein the cell is continuously connected to a constant voltage supply that maintains the cell in a fully charged condition.
- The "internal resistance" of a cell is the opposition to current flow within the cell expressed in ohms.
- "Nominal voltage" is the voltage of a fully charged cell when it is being discharged at rated capacity.
- A "primary" cell is a cell that cannot be recharged once it has been discharged.
- A "secondary" cell is a cell that can be recharged once it has been discharged.
- "Shelf life" is the period of time, at a storage temperature of 70° F, after which the cell retains a specified percentage of its original energy.
- "Trickle charging" is a method of recharging wherein the cell is continuously or intermittently connected to a constant current supply that maintains the cell in a fully charged condition.

Theory of Operation: The nickel-cadmium cell is a secondary electric cell wherein chemical energy is converted to electrical energy and electrical energy is stored as chemical energy. The active materials of the cell when brought together in a solution react spontaneously with each other to produce an electric current. The negative electrode is oxidized and the positive electrode is reduced. Oxidation-reduction reactions involving active materials are accompanied by a transfer of electrons. Oxidation is due to the loss of electrons and reduction is due to the gain of electrons. The oxidizing materials and the reducing materials are placed in separate compartments in the cell. (A nickel-cadmium cell is shown diagrammatically in Fig. 1A and 1B.) The oxidizing action at the negative electrode results in the liberation of electrons and the reducing action at the positive electrode results in a gain of electrons. A porous partition (separator) permits the migration of electrons from one part of the cell to the other. The solution in the cell (electrolyte) functions only as a conductor for the transfer of electrons. The electrolyte is potassium hydroxide (KOH) and has a constant specific gravity. When a conductor is connected to the electrodes the circuit is complete and current flows in the cell.

In a fully charged cell the negative electrode is metallic cadmium and the positive electrode is nickelic hydroxide. The electrodes in the cell are converted on charging and discharging according to the following chemical reaction.

In Fig. 1C, the reaction proceeds to the right on discharge and, on charge, the reaction is reversed and proceeds to the left. One of the outstanding (*Continued on next page*)

THE SEALED NICKEL CADMIUM BATTERY . . .

properties of the nickel-cadmium electrochemical system is the reversibility of the above reaction under extreme environmental conditions. Since the electrolyte does not enter into the reaction there is practically no change in the specific gravity of the solution.

At the end of the charge cycle and during overcharge, gas is generated in a nickel-cadmium cell. Hydrogen is formed at a fully charged negative (cadmium) electrode and oxygen is generated at a fully charged positive (nickel) electrode. In a sealed cell the generation of gas must be prevented or disposed of within the cell. This is accomplished in the following manner.

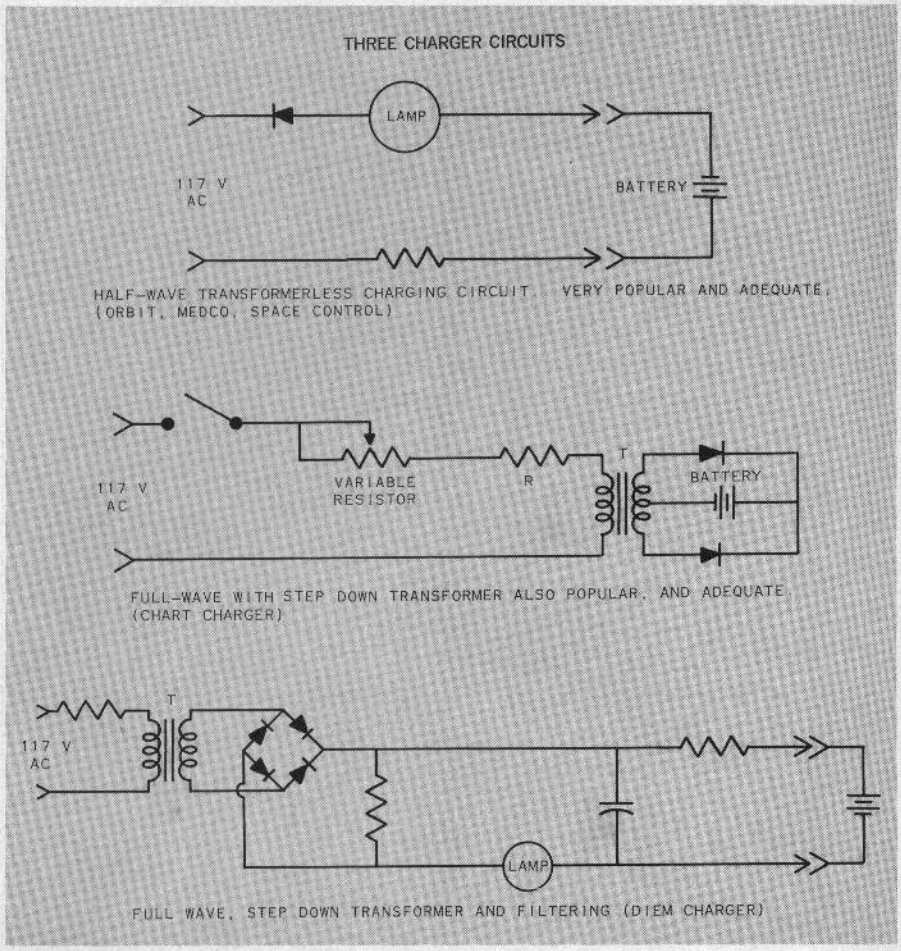
When the cell is being charged and the positive electrode reaches its full capacity, oxygen will be evolved. The negative electrode is constructed so that it never becomes fully charged. Therefore, evolution of hydrogen gas is completely suppressed. The oxygen gas migrates through the porous separator to the negative electrode. The oxygen reacts with the finely divided metallic cadmium to form cadmium hydroxide. The cadmium hydroxide is continuously electro-chemically reduced to metallic cadmium. At the recommended charge rate for the cell the rate of evolution of oxygen gas is equal to the rate of recombination with the metallic cadmium. The oxygen pressure thus established is normally 7-15 psi. The above process can continue for long periods of time without deterioration of the electrodes. Since the level of oxygen pressure established in the cell is determined by the charge rate it is very evident that charging at excessive rates will cause cells to rupture.

When cells are connected in series to form higher voltage batteries the possibility exists that during discharge one or more cells, which may be slightly lower in capacity, may be driven to zero voltage and then into reverse. During reversal hydrogen gas is evolved at the positive electrode and oxygen gas at the negative electrode. Most cells available today have built in reversal protection. The mechanism functions in a manner similar to that stated above for protection during overcharge. Diodes connected in parallel with cells will also provide protection against reversal.

Electrical Characteristics: The sealed nickel-cadmium cell, especially suitable for applications that require a stable voltage supply, has a very low internal impedance and a high effective capacitance. In fact, such cells can be used to replace very large capacitors for filtering the ripple out of d-c power supplies when they are being continuously overcharged. A word of caution, the voltage across the cell must be limited to 1.46 to 1.48.

Small packages of high energy, the cells are maintenance free, requiring no addition of electrolyte or water. Under conditions of light service, such as most RC applications, a life of several years can be expected. It is very difficult to predict life expectancy or cause of failure because sufficient information on the subject is not available. The cells can be used over a wide range of temperatures, (0°F to 110°F) and they are not adversely affected by long periods of storage in either charged or discharged condition.

Disintegration of the electrodes is accelerated by repeated charge and discharge at rates higher than those recommended by the manufacturer. The life of the cell is also shortened considerably by repeated discharge below the recommended cut-off



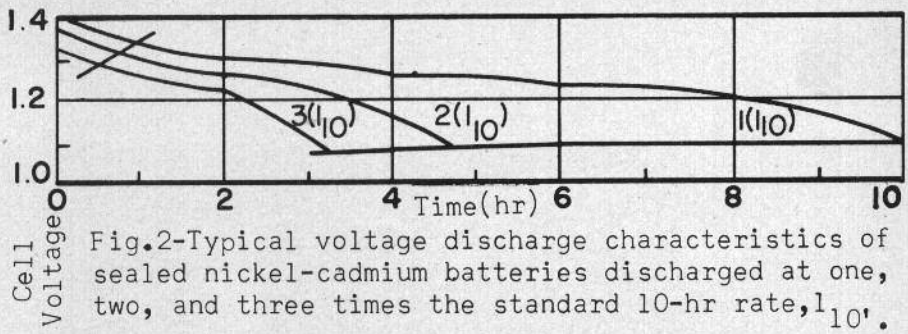


Fig.2-Typical voltage discharge characteristics of sealed nickel-cadmium batteries discharged at one, two, and three times the standard 10-hr rate, I_{10}.

voltage which is usually 1.1 volt.

A sealed cell is considered to be fully charged when the voltage, during charge, reaches 1.46 to 1.48 volts at an ambient temperature of 50°F to 90°F. The open circuit voltage of a fully charged cell is 1.29 to 1.33. The average voltage of a cell during discharge is considered to be 1.2. The voltage curve is nearly flat until the cell approaches complete discharge (See figure 2). Most of the energy of the cell is dissipated above 1.1 volt. The ampere-hour rating of a cell is based upon a discharge period of ten hours and an end point voltage of 1.1 volts. This is referred to as the ten-hour rate. This means that for maximum capacity the recommended discharge for a 500-milliampere-hour cell is 50 mah for 10 hours.

The following example illustrates the decrease in available capacity if the drain is greater than the recommended standard drain for a 500-mah cell.

$$\text{Standard drain} = \frac{\text{milliampere-hour capacity}}{10} = \frac{500}{10} = 50$$

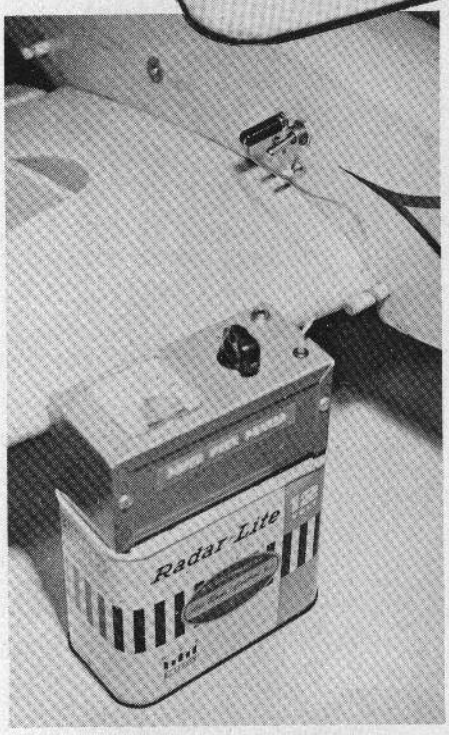
$$\frac{\text{Proposed Drain (ma)}}{\text{Standard drain (ma)}} = \frac{250}{50} = 5$$

Using manufacturers' curves and the factor 5 we find that the available cell capacity is 85% or 425 milliampere-hours. Bear in mind, though, this is for continuous drain and RC use is usually intermittent drain. This points out again the excellent power source that is available in the nickel cadmium cell.

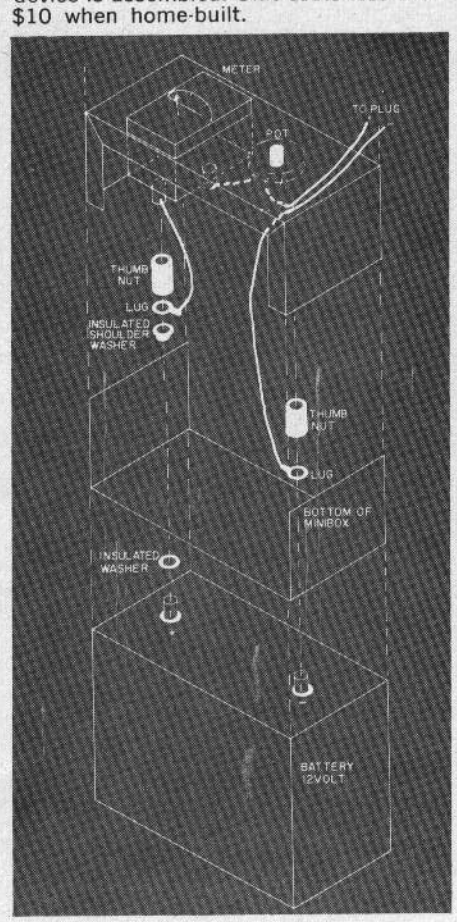
When cells are stored for a period of time they will lose some of their capacity through self-discharge. Approximately 15% of the capacity is lost during the first week, 25% during the first month and 35% during six months of storage. The nickel cadmium cell has lower self-discharge rates than any other secondary cell presently available. Self-discharge rates are increased considerably if the storage temperature is above 100 degrees F and prolonged storage at this temperature cause irreparable damage to the cells. It is best that cells always be stored at temperatures less than 70° F. *Charging*: Cells that have been stored for six months or longer should not be charged immediately but first should be fully discharged. The cells should then be charged with a current not exceeding the 20-hour rate. It is necessary (*Continued on page* 29)

POWER PACK PEAKER

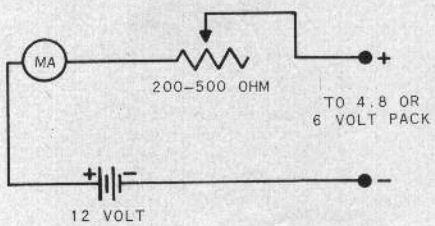
Mighty handy gadget to have around, the "portable charger" will fill a genuine need.



Above—Peaker mounted on 12V Burgess lantern battery (Type TW-2). Lafayette meter 0-50 or 0-100 ma, and Bud Minibox. At left, peaker shown plugged into plane. Drawing, below, shows how the device is assembled. Unit costs less than $10 when home-built.



by FRANK SCHWARTZ



THERE HAS ALWAYS BEEN a need for a truly portable nickel cadmium battery charger. Many "all day" fliers find that a portable charger or "battery peaker" is a handy gadget to have around between flights, just to keep a little extra charge going into the battery pack. There is also the case of the flier who is out of town at a contest and needs an overnight trickle charge or full charge, or needs to keep his battery supply at its peak on the field while waiting his turn to fly. The Power Pack Peaker is the answer.

It is so simple that no inside view of the unit is necessary. Since most receiver power packs (nickel cadmium) are six volts or four-point-eight (4.8) the 12 volt Burgess Lantern Battery type TW-2 is ideal for our needs. It will give long life and still function even when it is down to nine volts or so. It sells for about $1.85 at your local radio supply house. This means that the entire unit can be built from scratch for much less than $10. Replacement batteries are negligible in cost.

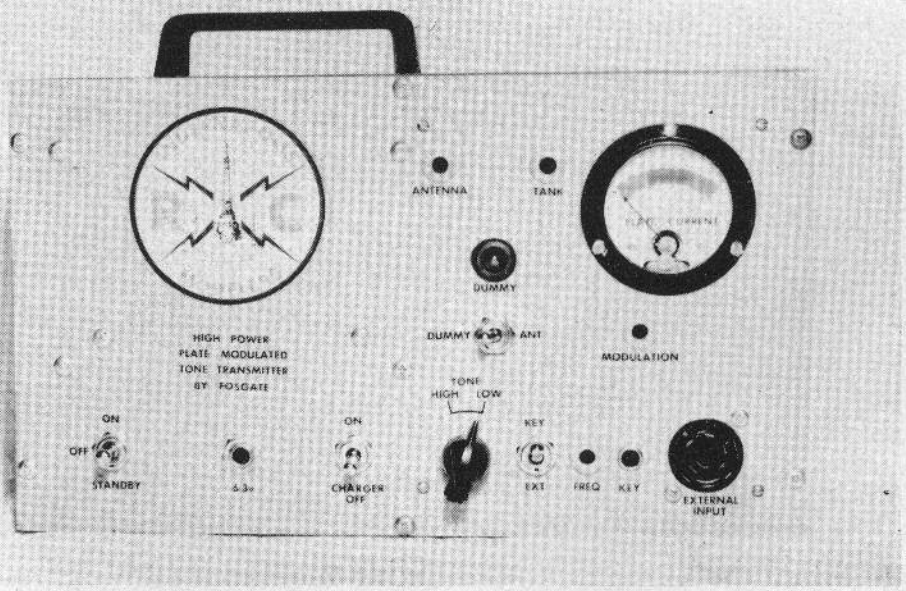
A 50- or 100-milliampere meter, a 250-ohm wire-wound potentiometer and a Bud Minibox are needed—plus a grommet, a few lugs and wire. The suggested meter is the Lafayette TM-402 (0-50ma) or the TM-403 (0-100) which sells for $2.95. This meter is just the right size for the Bud Minibox which (#CU 2104A) is 5 inches long, 2¼ wide and 2¼ high, selling for about $.97. Most any brand of variable pot can be used and the exact value is not critical for most uses—a 200-ohm or a 500-ohm will do nicely.

Note that the battery has large thumb-screw-type terminals and they hold the Minibox to the battery securely. The negative terminal is mounted directly to the case of the Minibox (through a proper size hole) and a solder lug is slipped over the screw and secured with the thumb-nut. The positive terminal also goes through the bottom of the Minibox but (most important) a shoulder washer is used on either side of the Minibox to keep the battery from shorting out. A terminal lug is mounted on top of the shoulder washer and secured with the other thumb-nut. The circuit is completed as per the diagram.

The only other refinement would be to contact your friendly shoemaker and secure a strip of leather for a strap. Some bolts in each end of the box will finish the job and make an excellent carrying handle. Note that there is a jack mounted on the box. This is a a "storage" jack and is merely there to have some place to put the plug, rather than have it flopping around.

A charging jack is provided in the plane (the other switches are servos, receiver) and a pushbutton for high motor, since I use a 'fail-safe' which gives me low motor after a set time of no signal—also goes into low motor as soon as I turn on the servo supply, so the pushbutton is across the low-motor reed (I can run the engine back to high without having to turn on the transmitter). Almost all fliers using re-chargeable packs these days and more fliers have a charging jack in the fuselage of their planes. This is much better than unplugging the servo plug from the wiring harness every time a charge is needed.

Your battery peaker, I believe, will prove a handy accessory. ▪

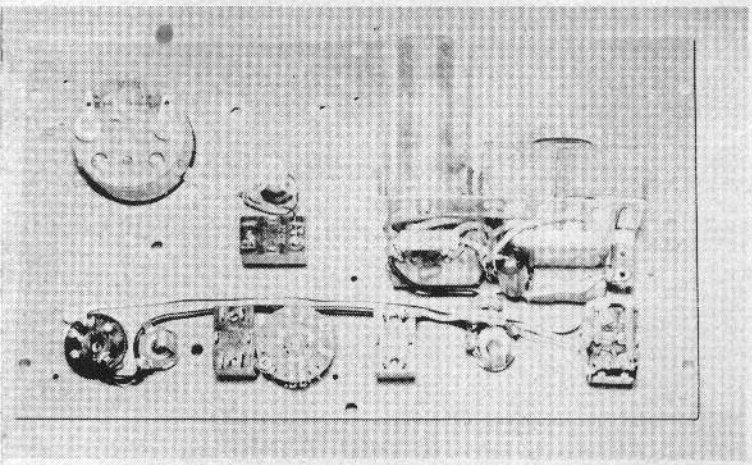


Front of the completed transmitter showing plate current meter at the upper right.

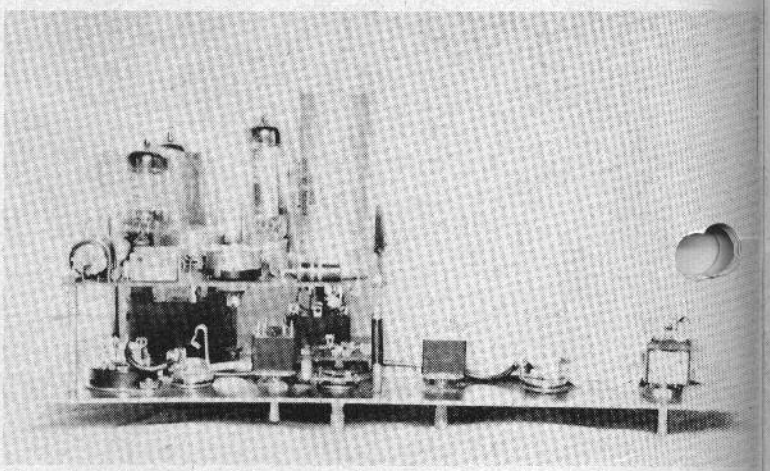
by JAMES FOSGATE

An effective way to reduce interference from C.B. stations is stepped up output. With 1½ watts output at antenna this job outscores many others when compared on a field strength meter.

THE FOSGATE TRANSMITTER



Reverse side of the front panel shown partially wired. Cover which goes over the power supply has not yet been installed.



Side view of completed front panel assembly. Cover has been placed over the power supply, but the wiring is incomplete.

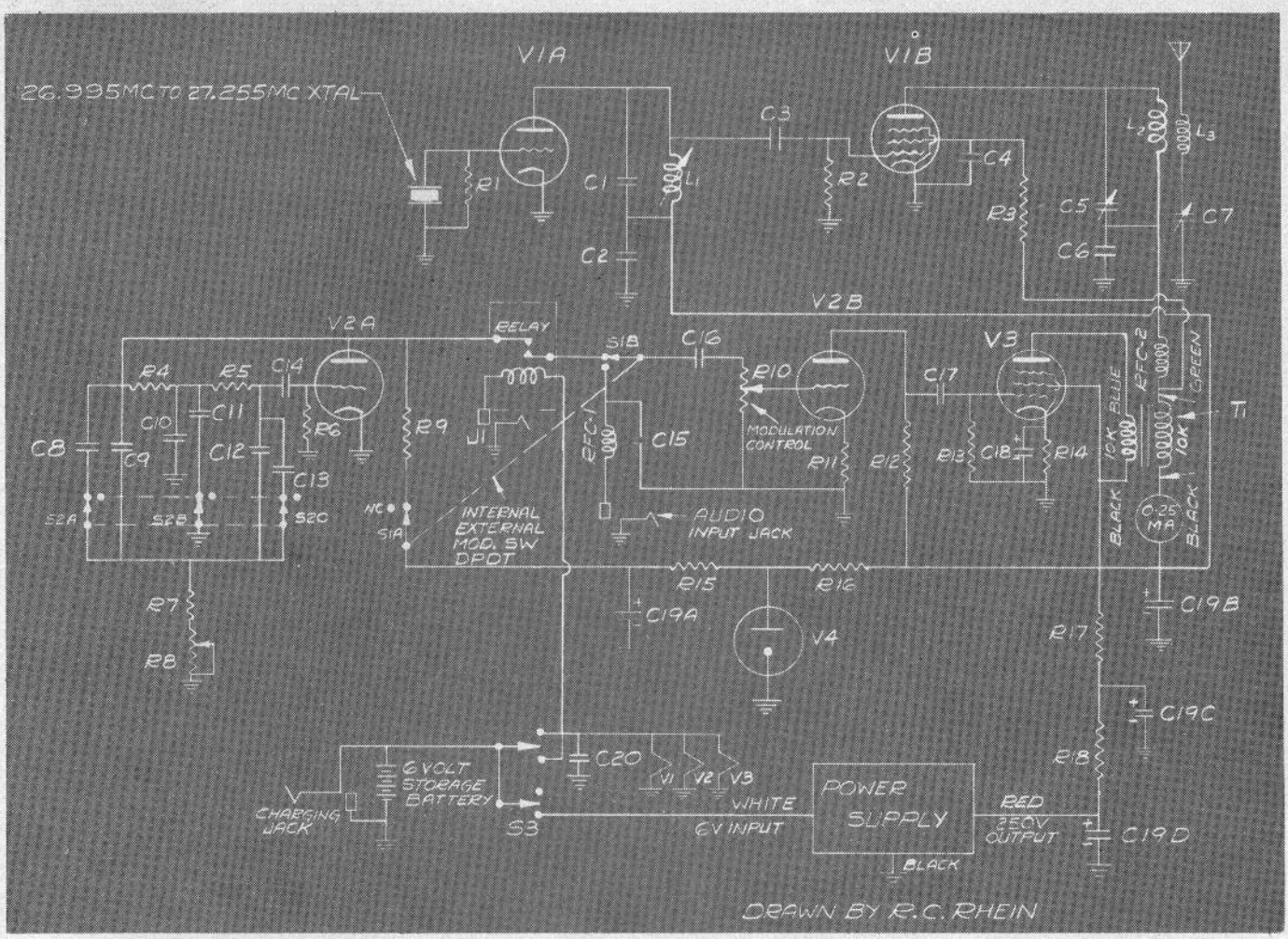
THIS TRANSMITTER WAS DESIGNED for those who want enough power to fly successfully super-regen receivers with our present C.B. interference, or for anyone who likes some extra power to bring back those fly-aways.

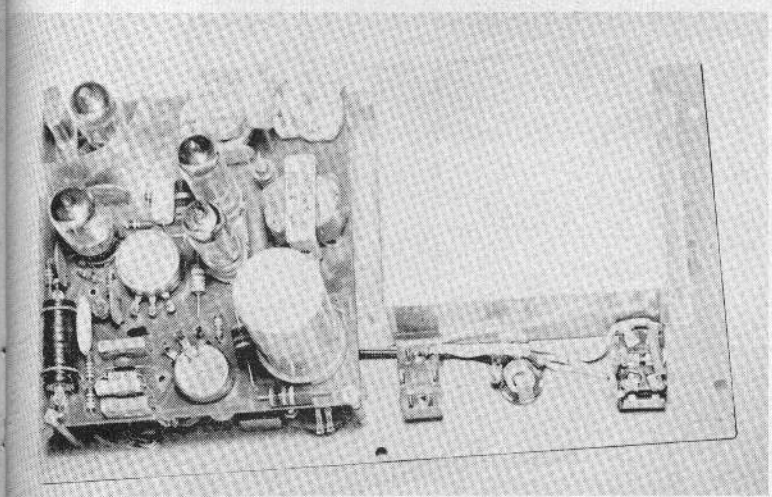
It has 1½ watt output at the antenna (without tone) which increases with tone, a characteristic of plate modulation. Final plate circuit input power is 2.7 watts and efficiency is 55 percent. When comparing this transmitter with other transmitters for power output as indicated on a field-strength meter the results are surprising, usually the same reading at a distance of from five to 20 times farther away from the antenna.

The tone frequency easily can be changed and is frequency stable enough to operate any tone receiver, including Kraft, Marcytone, Mactone, etc., and will follow pulse rates of over 50 pps when the reed relay is driven directly from a transistor pulser. The B & D pulser works fine when connected to the external input jack and, likewise, the audio output from a multi-channel transmitter also can be fed in on the input jack. All that is required is .3 volt R.M.S. for 100 percent modulation. When connecting an audio signal to the input jack be sure to use shielded wire to prevent unwanted RF pick-up.

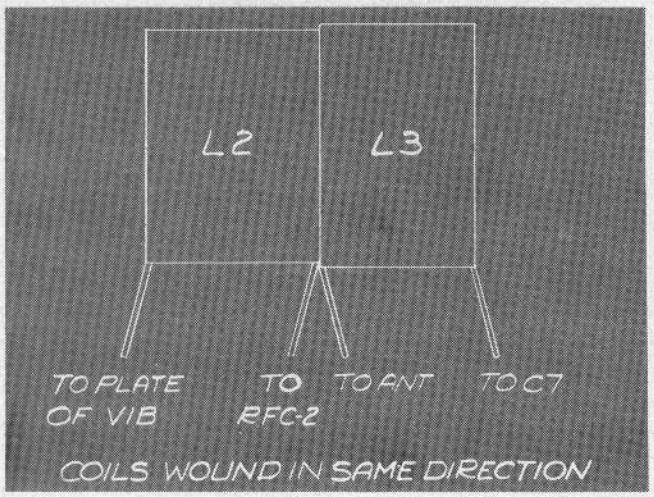
Circuit design is conventional, using a triode RF oscillator V1-A running at the output frequency, which drives a pentode RF power amplifier V1-B that is plate modulated by V-3. V2-A is a phase-shift audio oscillator which can be operated on either of two adjustable tone ranges. V2-B is used as an audio amplifier to drive the modulator V3; tube V4 is a voltage regulator tube which provides regulated B-plus for the audio oscillator for good tone stability. If desired. V4 can be omitted and R15 and R16 replaced by a single 820K ½-watt resistor. Tone stability still will be more than adequate for receivers without tone filters. A search was made for filament-type tubes that could be used in this circuit without exceeding their ratings, or using two in parallel, but none could be found so to insure long trouble-free performance, cathode-type tubes were used. The only disadvantage is the 10- to 15-second warm-up time required. This was partially overcome with an on-off switch which has a stand-by position. The switch is thrown to stand-by before starting your engine; this heats the filaments and, after 10 to 15 seconds, full power is available.

All parts used easily are obtainable at most larger radio stores and, excluding the power supply and battery, are inexpensive; the modulation transformer sells for about $3.00 net. There are three choices available for a power supply. First, is what I used and is the least expensive, but is not recommended for those who are not familiar with vibrator power-supply circuitry. Begin by purchasing an old junk auto radio and tracing the power supply circuit out including input filtering chokes and condensers; output filtering after the rectifier is not needed because this circuitry is included in the transmitter schematic. Silicon diodes should be used in place of the rectifier tube. For safety replace the vibrator, also the buffer condenser or any part that doesn't look good. Next, remove all parts and reassemble inside an aluminum box. I've used this type of power supply in several transmitters with hundreds of hours of use without a failure.





Another view of the transmitter front panel assembly shown in photo, opposite page. Compare with PC board on next page.



The second choice is to purchase a vibrator power supply new, Heath kit #GP-11 or equivalent. The third choice would be to use a transistor power supply. This would cut the current drain from the battery by one-third, but is the most expensive. The supply must deliver 250V at 75 ma.

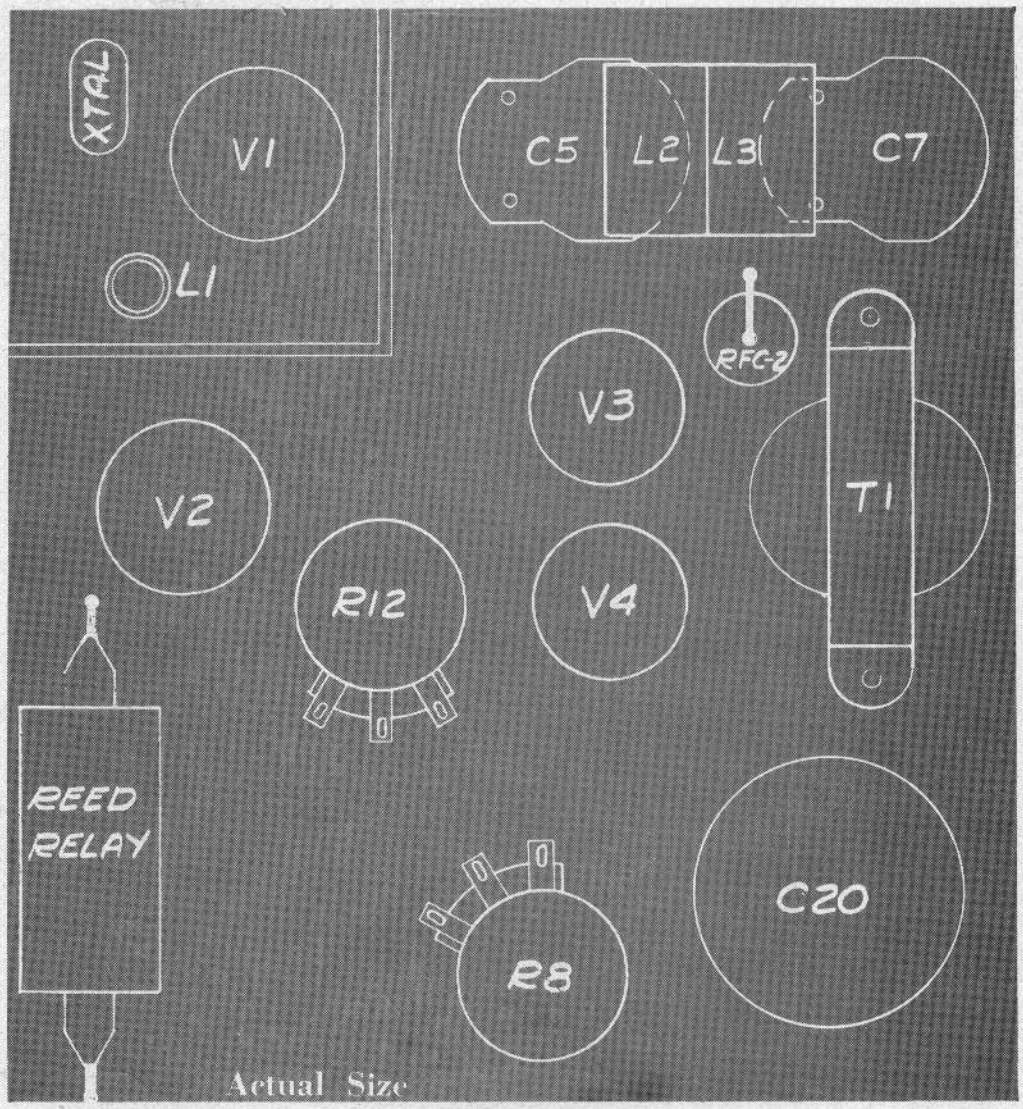
Battery power is a 6V lead-acid storage battery with a rated capacity of 20 ampere-hours, or several Nicad cells series paralleled to obtain six volts at 20 ampere-hours capacity. The transmitter draws about five amps and will run over three hours between recharges with a battery of this capacity.

I built my transmitter complete with battery and power supply in a gray hammertone case 12" by 7" by 6", but the size of the battery used might require a larger case. Drill two or three rows of ¼" holes across the top and bottom of the back of the case so air can circulate and cool the tubes.

Figure 1 shows the general parts placement I used. Although a printed circuit board was used, a metal or aluminum chassis would also work fine. In either case, use good grounding and RF by-passing techniques; also keep all leads carrying RF as short and direct as possible.

In this circuit the audio oscillator runs all the time and the tone is (in effect) turned on or off by opening or closing the input circuit to the audio amplifier. This enables extremely high pulse rates to be used, but to eliminate key clicks, capac-

CONTINUED ON NEXT PAGE



PARTS LIST

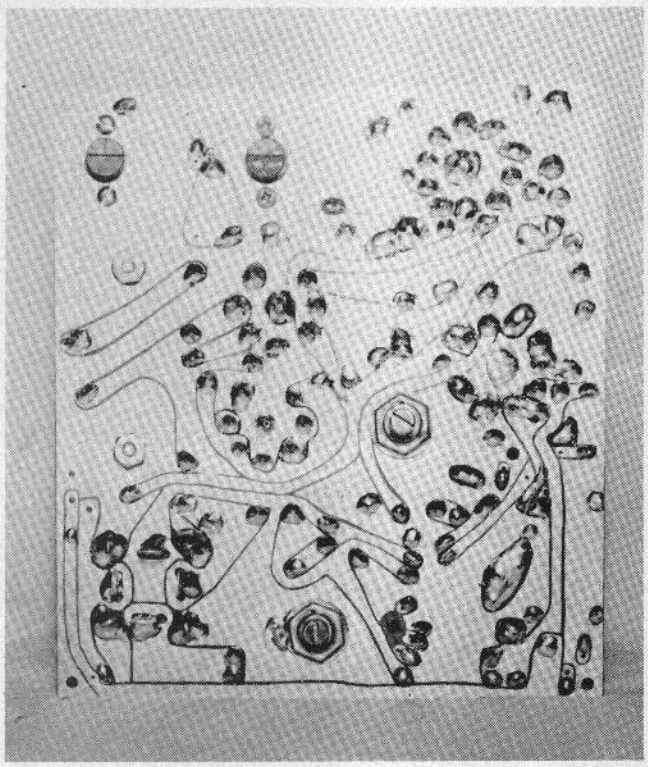
R1, R6—1 meg
R2—8200
R3—1500, 1 Watt
R4, R5—47K
R7—15K
R8—30K pot
R9—120K
R10—1 meg pot
R11—1000
R12—100K
R13—470K
R14—390, 1 Watt
R15—2700
R16—12K
R17, R18—100, 1 Watt
C1—11mmf NPO
C2—.003mfd
C3—50mmf
C4—.0015mfd
C5—3 to 25mmf variable (APC25)
C6—.003, 1000V
C7—3.9 to 50mmf variable (APC 50)
C8, C13—.0015 mylar 10%
C9, C12—470mmf, mica 10%
C10—.005 mylar 10%
C11—.05 mylar 10%
C14, C16, C17—.01mfd
C15—100mmf
C18—20mfd 15V electrolitic
C19 A, B, C, D—20 to 40mfd 350V
C20—.005mfd
RFC1, RFC2—2.5mh, 25ma
T1—Merit #3007 modulation transistor
L1—10½ turns #32 wire, ¼" PC form
L2—9 turns B&W Miniductor # 3011 ¾" ID
L3—9 turns #22 ins. wire, close wound
S2—3 pole rotary switch
Reed relay or Gem wtih 100-ohm coil
9½' antenna
Tubes: V1—6U8
V2—12AX7
V3—6AQ5
V4—0B2
(Note—All resistors ½ Watt 10%, all condensors 400V 20%, unless otherwise noted.)

FOSGATE TRANSMITTER

itor C-16 should be small enough not to pass frequencies as low as the pulse rate. Capacitor C-16 will be about .001 mfd or smaller depending on the tone frequency and pulse rates to be used. Use shielded wiring to prevent tone leak-through. With the values given for C9, C10, C12, in the high position the tone frequency range is approximately from 3,000 cps to 4,000 cps. When in the low tone position capacitors C8, C11, C3, are paralleled across the other condensers and the tone range is from 500 to 700 cps. By adjusting the value of these three capacitors simultaneously the tone can be changed as desired.

Tuning is simple. Connect a No. 47 bulb from the antenna terminal to the case for a dummy load. Then observe the reading on the plate current meter and the brilliance of the bulb, adjust L1 for a peak reading, then adjust L1 about ¼ turn off peak. Next, adjust C5 for a dip as indicated on the plate current meter, then adjust C7 for a peak reading. If everything is OK the No. 47 bulb will be almost too bright to look at. Final tuning of C5 and C7 should be done with the antenna installed and the unit placed on the ground or concrete (where it will be used). These two adjustments will not effect the frequency and should both be adjusted for a peak reading as indicated on a field-strength meter.

Once set, all adjustments will hold for long periods of time. Readjust C7 slightly if ground conditions change very much (like setting the transmitter on concrete instead of grass). The modulation control should be set by checking with a scope. Be careful when setting modulation control R-10 because, if anything is out of tune when the modulation is adjusted, the percentage of modulation will change when the transmitter is tuned properly. The best way to avoid trouble is to put the fully extended antenna on, adjust C5 and C7, then, without disturbing anything else, set the modulation — 100 percent upward and downward modulation is obtained easily and the output is a good sine wave. ■



This is the bottom view of the printed circuit board. Slotted pot shaft ends will help reference it to the other pictures.

R/C INTERFERENCE REPORT

Definition—For the purpose of this report, "Interference" is defined as any source of radio energy which causes the radio controlled model plane to crash, fly away, or behave in a dangerous manner.

PLEASE FILL IN AS MANY OF THE FOLLOWING SPACES AS POSSIBLE:

WHEN 1. The interference was observed on _____ (month day year) at _____ o'clock.

WHERE 2. The location of the incident was _____ miles from _____ (city, state) at _____ field.

WHAT 3. Describe briefly what happened. Give character of interference, such as "occurred only above 50 ft." etc.

_____

_____

_____

_____

_____

_____

PROOF 4. What evidence do you have to show proof of interference?

a. Monitor receiver (what type? Superhet or superregen).

_____

b. Model receiver with earphones.

_____

c. Interference activates model's controls on ground.

_____

IDENTITY 5. Could you identify the type and source of interference such as voice, code, etc.?

a. Class D phone—call letters _____

b. Part 15 phone (100 mw) _____

c. RC transmitter _____

d. Other _____

EQUIPMENT 6. What equipment was used by the model which experienced the interference?

a. Receiver (superregen, superhet, reeds).

_____

(Name of equipment)

b. Transmitter—exact frequency.

_____

(Name of equipment)

OWNER 7. Name _____

Address _____

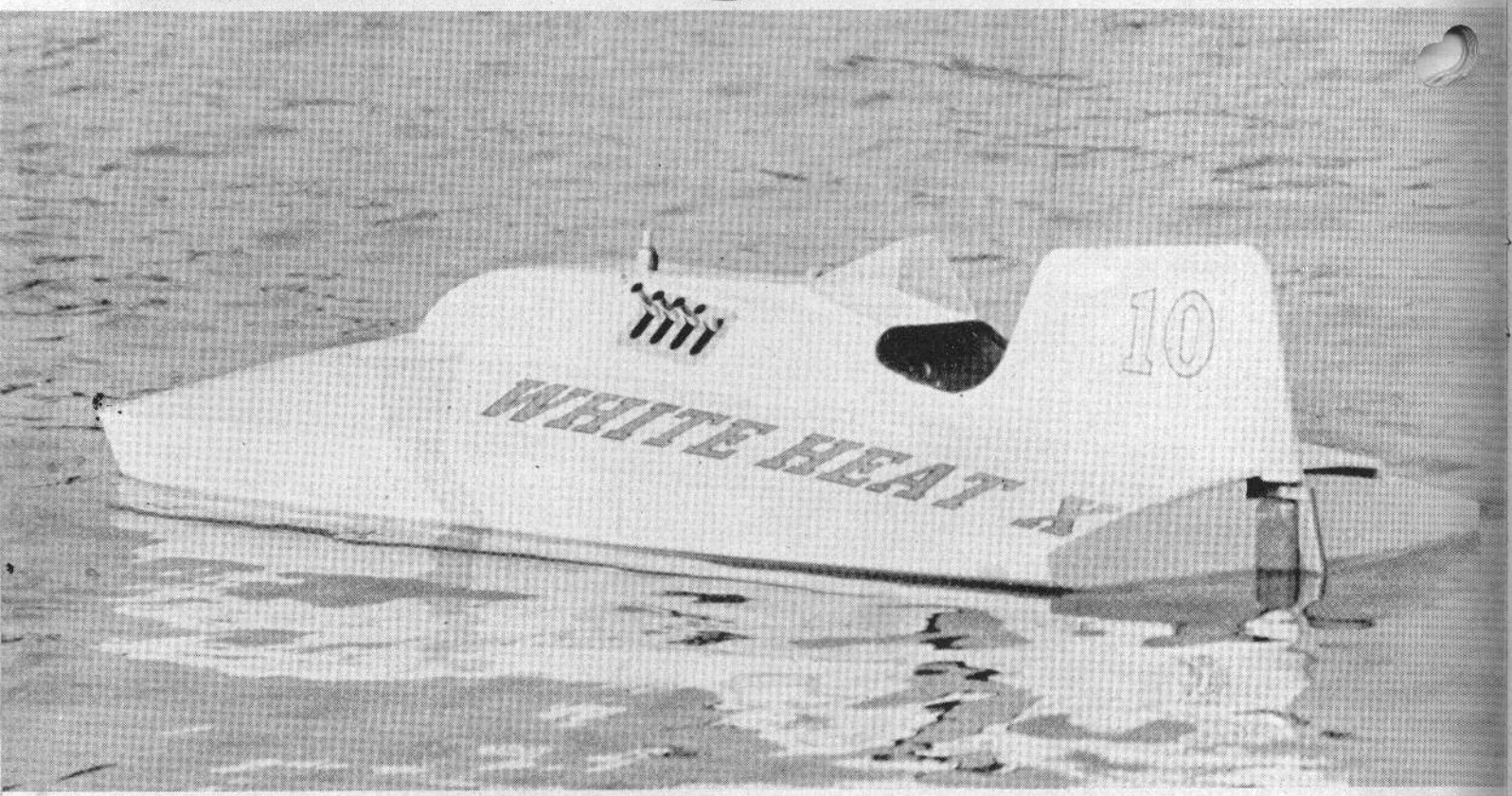
AMA license No. _____ FCC license No. _____

No. of years in R/C. _____

REMARKS

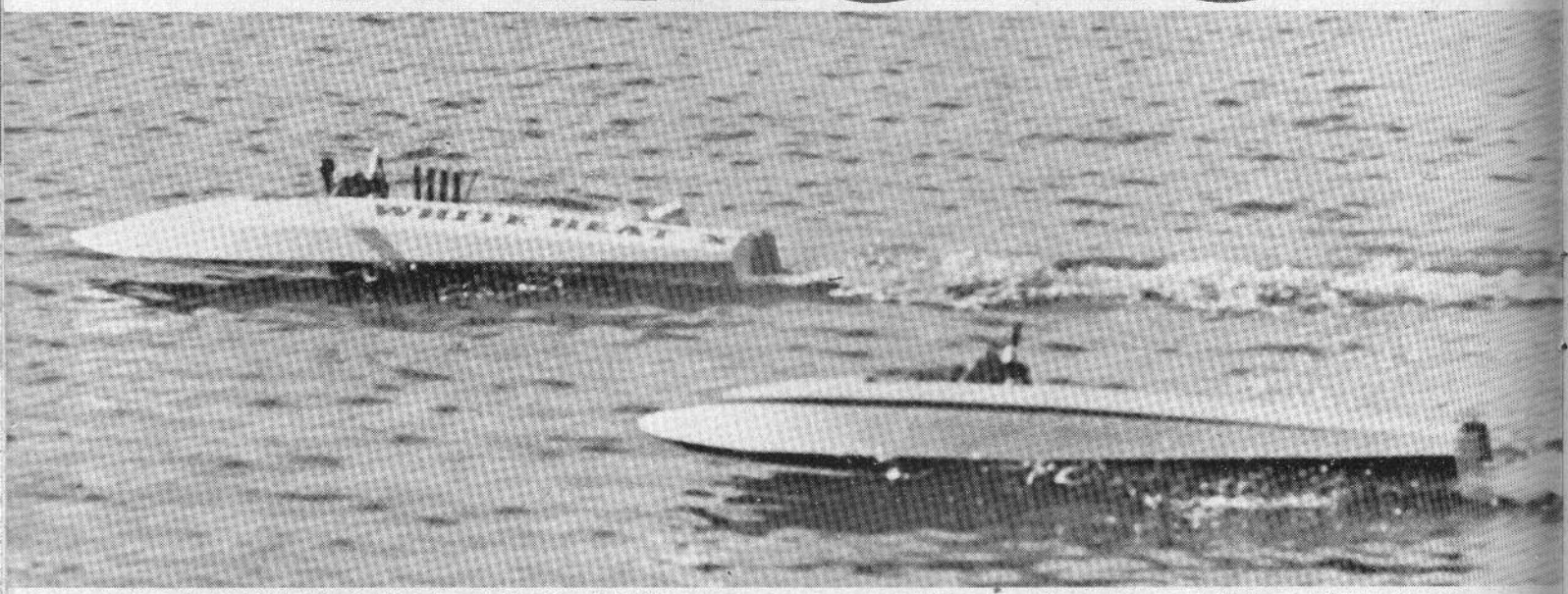
IMPORTANT NOTE—Please send your filled out Interference Report to GRID LEAKS MAGAZINE, Box 301, Higginsville, Missouri. After photo copies are made for future reference, reports will be forwarded to the AMA-FCC Liaison Committee for appropriate action.

ANATOMY OF



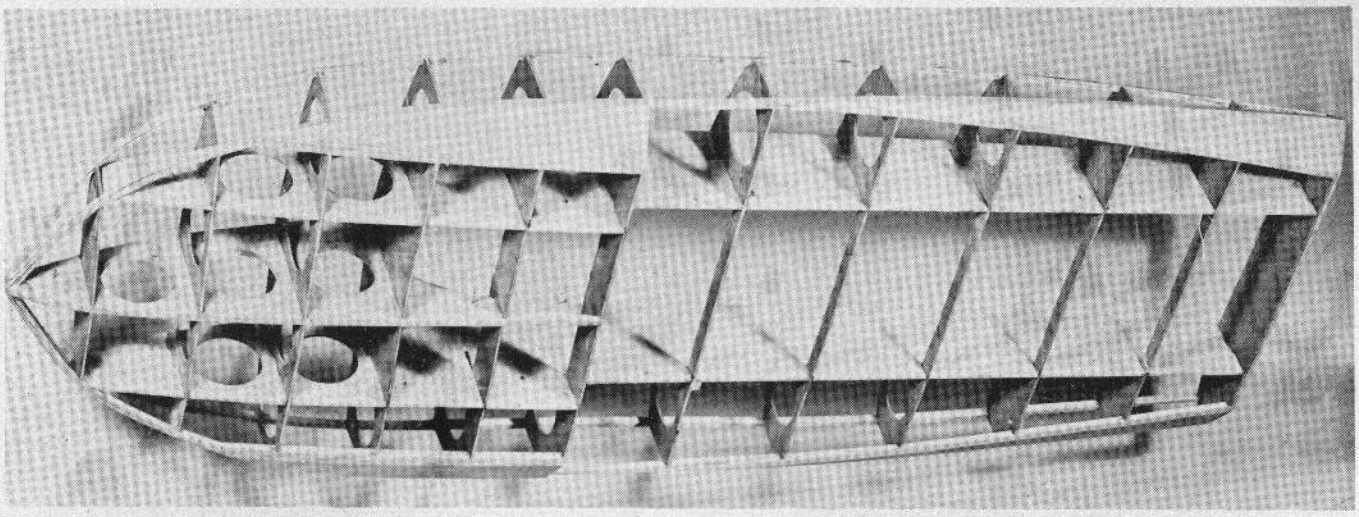
Don Sussland's White Heat X. Fiber-glass cowl, cockpit and fin in kit form fit well-known White Heat V. Stacks are functional and connect to exhaust collector ring. Note spark plug above stacks. Boat rests on water after a racing run.

A RACING

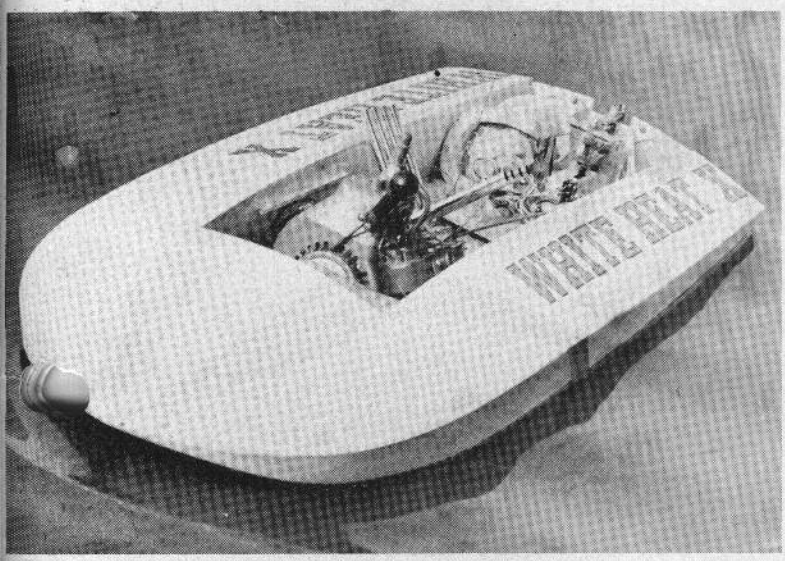


Sussland's White Heat X leading LeRoy Brooks' Miss Laurie down the straightaway, Annual IMPBA Regatta, cowl and fin removed to reduce air resistance. Both boats O&R powered, swinging X70 plastic props. Length of each 42 in., width 16.

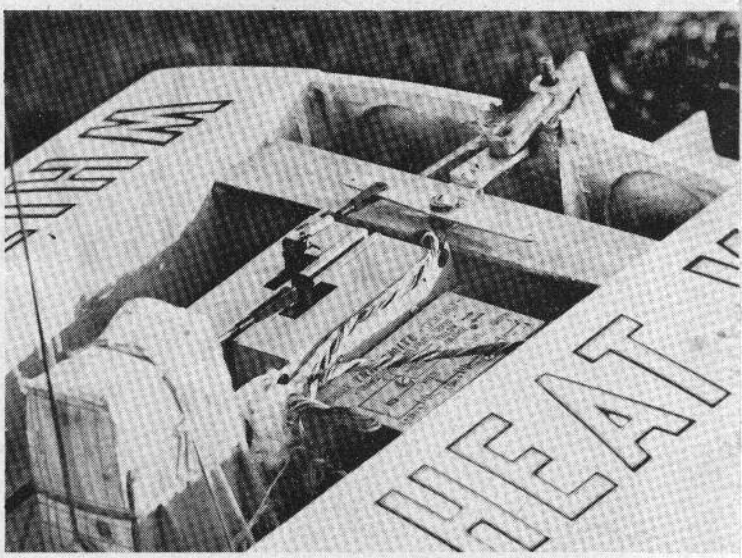
HYDROPLANE



Typical hull construction, bottom view, reveals extensive use of plywood. That weight can be a penalty is indicated by the numerous lightening holes. Bottom of finished racing hull is sanded at step and stern and given at least two coats of wax.

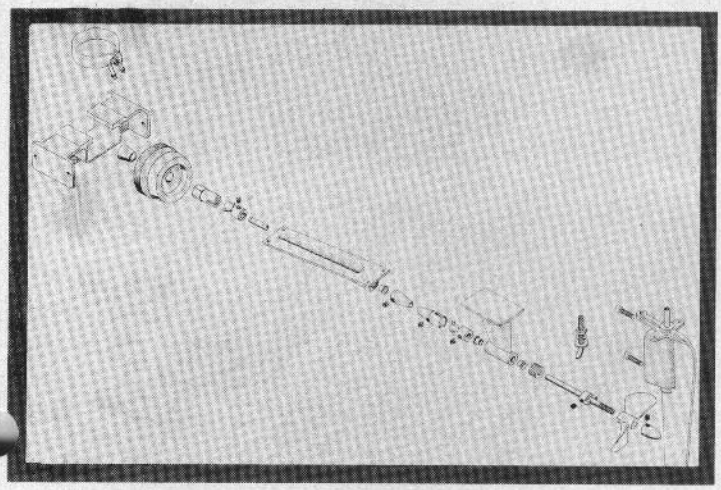


Poly-bagged shock-mounted receiver by Sussland. Steering servo shorts. Servo microswitched, shorts ignition for low.



Modified ukie crank, Zimmerman's V, actuates steering strut. Middle servo shorts ignition. Horizontal servo works throttle.

Simultaneous running of radio-controlled racing boats is a popular competitive event. This article gives the airplane man an insight into hydro techniques.



Hardware for airplane type engine.

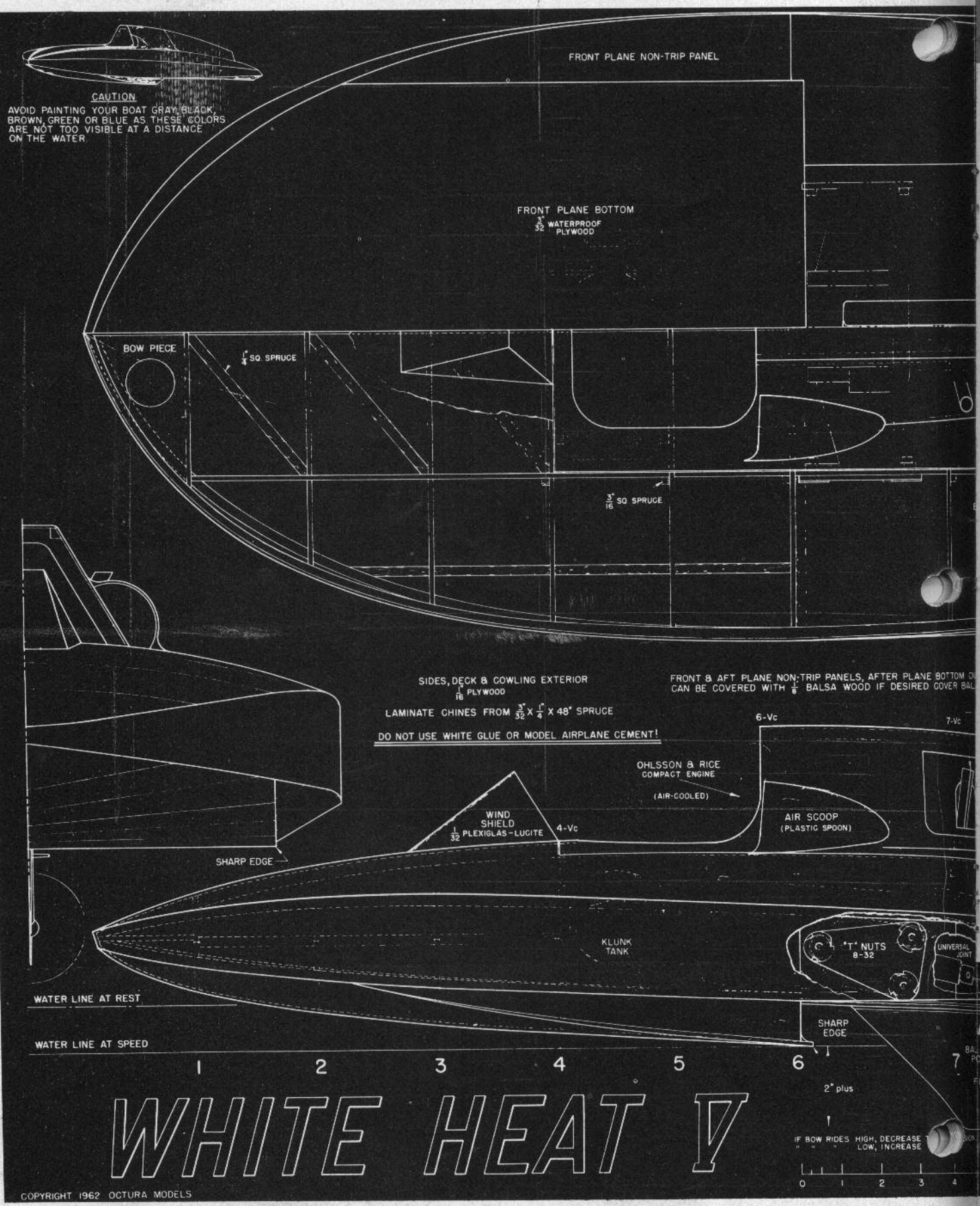
TO THE AIRPLANE-ORIENTED audiences of magazines dealing with radio control, other forms of remotely controlled dynamic models are, with the partial exceptance of electric- and gas-powered boats, for the most part, interesting novelties. GRID LEAKS is indebted to Octura for the pictures and technical information that appears in this feature, to which we have added interesting details culled from releases put out by that firm. Incidentally, we note that a 60-inch Super Tigre 60 White Heat is under development and that the V has done, since the Annual IMPBA Regatta held on Labor Day at Lombard Lagoon, Lombard, Ill., a 1/16-mile straightaway in 8 seconds flat, and an X, the ¼-mile oval in 45 seconds. At Lombard two White Heat V's established world marks of 8.3 for the 1/16 mile, and 49.3 for the two-lap ¼-mile oval, both boats being run by modelers competing for the first time. (The O&R engine is in the F Class.) Following are quotes from releases:

"Fuel consisted of regular gasoline and motor castor-oil in the ratio of 25:1. The ignition point gap was set to .020, the air cleaner and governor vane removed. Both boats made their runs minus the cowling to minimize wind resistance and to give maximum cooling. The boat winning the straight 1/16 record

(*Continued on page* 31)

. . . PLANS ON NEXT TWO PAGES

This general arrangement drawing of the Octura White Heat reveals



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The Superior Model Finish, with These Important PLUS Features:

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Adds structural strength to balsa and silk

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*

Lower finishing cost with less weight

*

10 popular colors and clear, special Filler and thinner.

HOBBYPOXY is a new epoxy polyamide compound especially formulated for model finishing. The chemical combination of polymers cures internally to form a tough, high-gloss film. Pettit's success in marine epoxy finishes, and months of testing on actual models, assures your satisfaction with HOBBYPOXY

HOBBYPOXY COLORS AND PRODUCTS

H-08 Clear	H-56 International Orange
H-10 White	H-81 Black
H-65 Bright Red	H-24 Dark Blue
H-49 Cub Yellow	H-66 Dark Red
H-93 Silver	H-90 Filler
H-33 Stinson Green	H-07 Thinner
H-26 Light Blue	H-50 "Stuff"

H-51 Epoxy Glue

Colors are shown on HOBBYPOXY Color Card. See your hobby shop dealer, or write to our Dept. 9 for more information.

PETTIT

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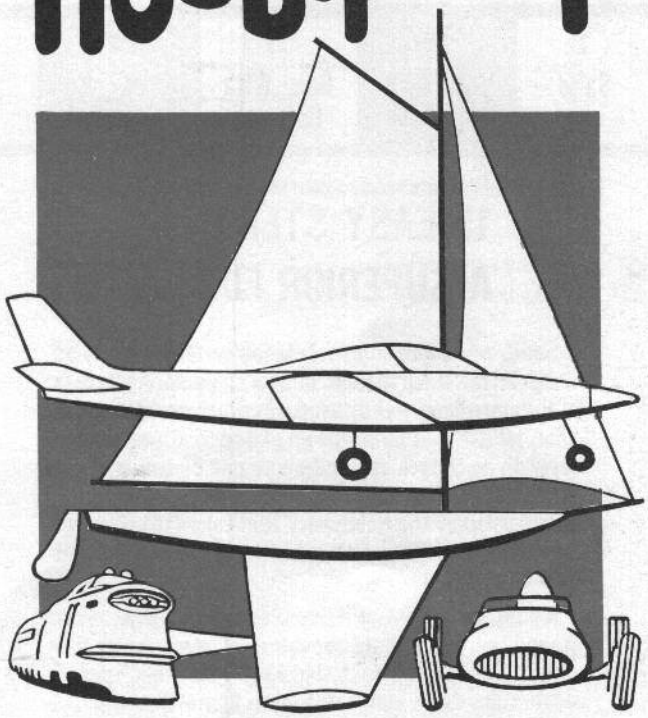
PETTIT

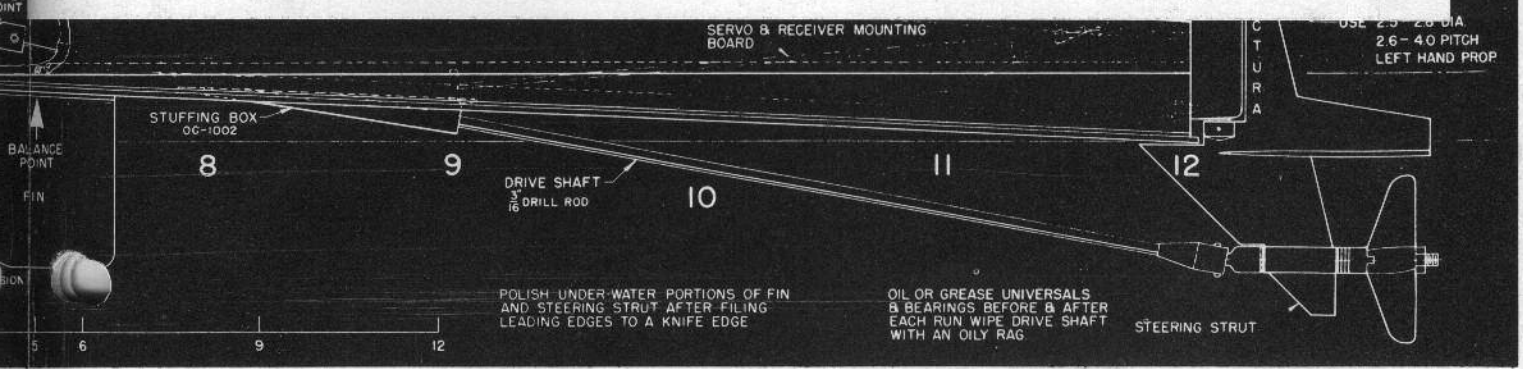
HobbYpoxy



THE MIRACLE EPOXY FINISH FOR MODELS

And how to use it...

READ CAREFULLY . . . THIS IS NOT LIKE ANY OTHER PAINT!



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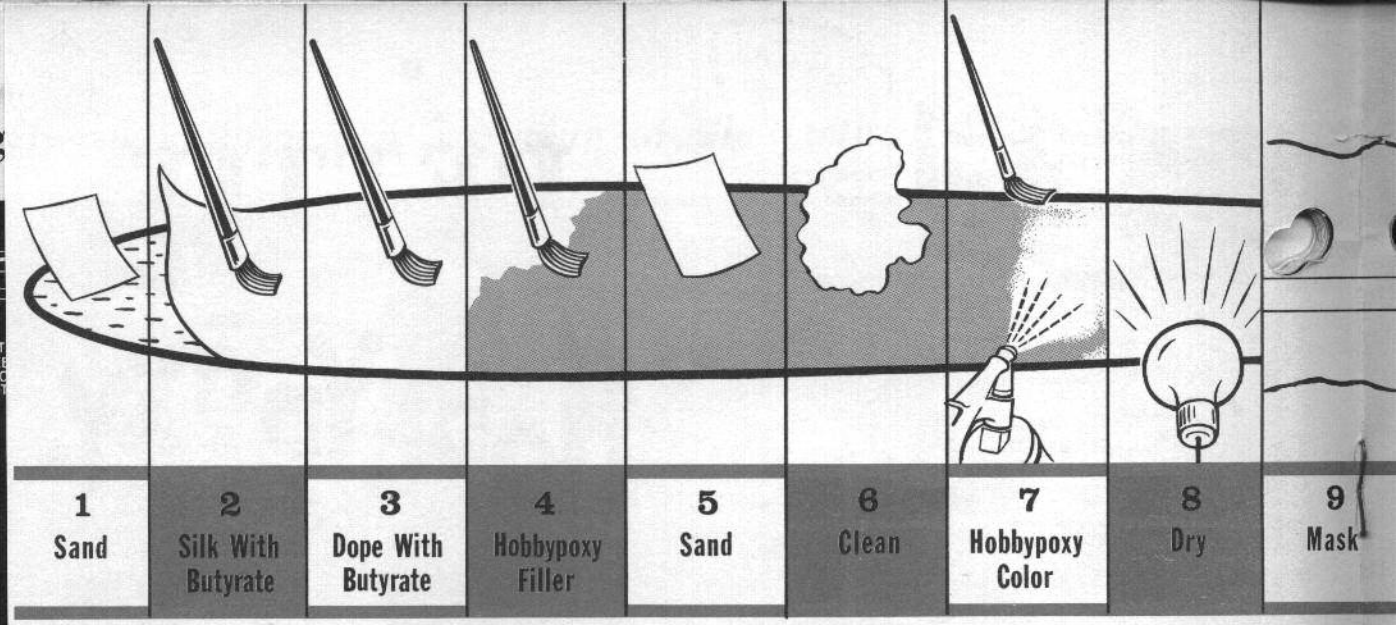
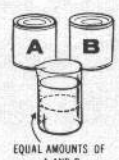


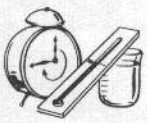
13 EASY STEPS TO A SUPERIOR FINISH

Sand, pre-dope, and cover wood surface with nylon or silk in the usual manner (1 and 2). Following 2 coats of Butyrate dope, lightly sand, (3) brush on Hobbypoxy filler, let dry, and sand smooth (4 and 5). Clean surface carefully with tack rag and apply one or two coats of Hobbypoxy Color (6 and 7). After drying and masking (8 and 9) apply the Hobbypoxy trim color (10). Remove tape (11), dry (12), attach control surfaces and add final details (13).

A third color trim, if it overlaps the two-tone background will necessitate repetition of steps 9, 10, 11, and 12 before going on to step 13. On the other hand, a single color finish eliminates these four steps.

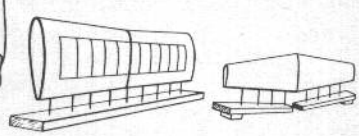


MIXING—Combine equal amounts from can A (clear or color) and can B (hardener). NOTE! Unlike Epoxy glue, increasing the ratio of hardener to part A does not reduce drying time—this will in fact, extend it. A graduated mixing container or a pre-marked bulb type syringe will aid accurate measuring. Unmixed portions may be resealed and kept indefinitely.

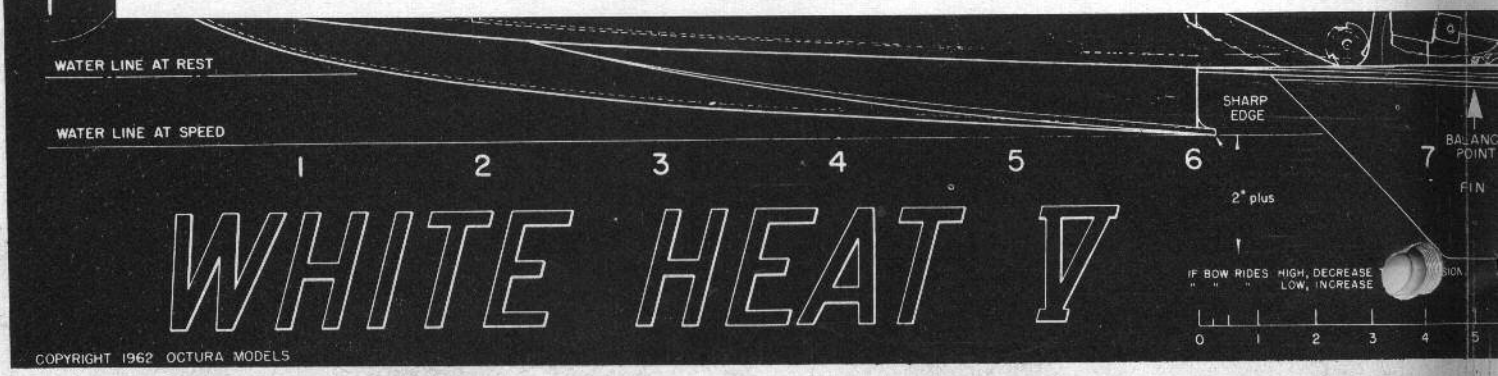


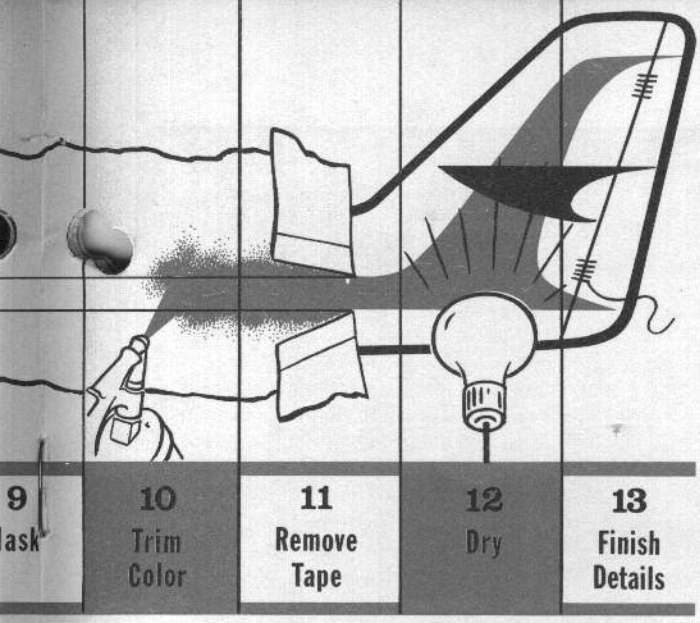
WAIT—After thorough stirring of A and B, let stand 45 minutes before using. Once mixed it may be kept usable for forty-eight hours at room temperature and 3 weeks if refrigerated.

GET READY—To obtain the full benefit of finishing with Hobbypoxy, careful preparation is important. Apply, let dry, and sand Hobbypoxy filler to a consistent tan color. Where Hobbypoxy will be applied over Butyrate or Fiberglas, roughen surface slightly with fine sandpaper for better adhesion. Support model parts by hanging or on pin racks, so entire surface may be covered in one application.



APPLYING—Just before applying Hobbypoxy, clean all surfaces thoroughly with a tack rag (may be obtained from Hobbypoxy dealer or paint store) to remove unseen dust particles. If brushed, Hobbypoxy should be flowed on. Do not brush out excessively. For spraying, Hobbypoxy thinner may be added as needed for the particular spray equipment used. Do not thin by more than 20%. Room temperature, and Hobbypoxy, must be approximately 70°F and humidity not over 90%. Do not apply over Butyrate that has cured less than 72 hours.





ABC's OF USING HOBBYPOXY

	Steps 1	2	3
BALSA—1 Lightweight—without silk	A	B	C
BALSA—2 Medium to heavy—without silk	B	C	
SILK—1 Over balsa including open areas of wing	D	B	C
SILK—2 (Dyed) Where only Hobbypoxy clear is used on open areas	D	A	

A—Hobbypoxy Clear
B—Hobbypoxy Filler
C—Hobbypoxy Color
D—Butyrate Clear

NOTE: On soft balsa (1) Hobbypoxy Clear is used to strengthen the surface of the balsa. This gives the filler better adhesion. Use 2 parts filler to 1 part Hobbypoxy thinner. Mix and apply with brush as smoothly as possible. This will reduce sanding time.

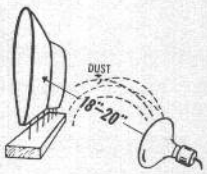
The best weight strength ratio is obtained by using silk (1) fasten silk to balsa with 2 coats of Butyrate Clear.

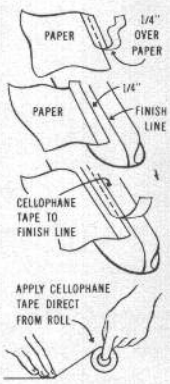
When using only Hobbypoxy Clear over dyed silk, (silk 2) with glue, seal the inside edges of cap strips, leading and trailing edges. Apply silk wet. Pull tight. Use Butyrate Clear to fasten silk to framework. Silk over the open areas must show no signs of Butyrate Clear. (Remove excess with thinner or acetone). First 2 coats of Hobbypoxy Clear are brushed over entire wing. Sand lightly and spray or brush final coat.

SANDING:

1—Always sand bare balsa smooth before step 1.
2—Sand filler after it has hardened. If sand paper loads up, filler is not dry.
3—Always sand Butyrate, wherever it is used, before applying Hobbypoxy.

DRYING — Hobbypoxy becomes dust-free after 15-30 minutes drying time, and with normal air drying 24 hours must be allowed between coats or for masking. Heat lamps, placed so as not to heat surface over 140 °F will dry Hobbypoxy sufficiently for masking or re-coating in 6 hours. Allow 15-20 minutes for Hobbypoxy to level itself before applying heat. Drying with heat lamps actually strengthens the finish. Place lamps as shown to avoid circulating dust onto drying surface.

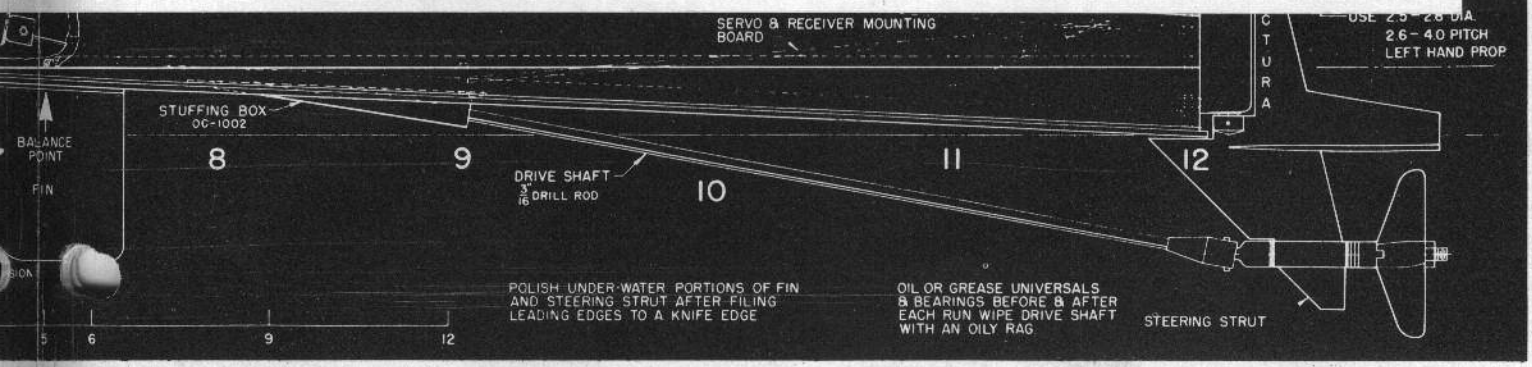




MASKING—Special consideration must be given when masking for Hobbypoxy.

For spraying—Leaving ¼" of tape exposed, place regular masking tape on paper. Apply to model ¼" shy of trim line. Now mask to finish line with clear cellophane tape directly from roll. Carefully press out trim edge of cellophane tape so that trim color will not bleed under tape. After spraying, wait about 15-20 minutes (time for Hobbypoxy to level itself) then remove cellophane tape by pulling back over itself—not straight up. Paper with regular masking tape may then be removed.

For brushing—follow same procedure as above except that preparation which protects model from overspray is not required.



HobbYpoxy

MISCELLANEOUS

REPAIR—When repairing open silk areas where Butyrate dope has been used, sand through the Hobbypoxy finish down to the Butyrate. Patch with predoped covering material, use Butyrate as adhesive. Apply 2-3 coats Butyrate dope, then sand and fill and color as on original finish.

On open silk areas where only Hobbypoxy has been used, sand edges of damaged area and apply silk (which has been stretched and has two coats of dried Hobbypoxy Clear) using Hobbypoxy Glue as adhesive. Sand edges and refinish.

Balsa can be repaired with Hobbypoxy Stuff either brushed or used as a putty to fill the nicks and scratches. Sand and refinish.

Hobbypoxy Glue can be used for construction and all types of repairing. It will set up in 30-45 minutes with complete strength in 60 minutes.

Hobbypoxy Stuff as it comes from the can, can be used like putty for repairing of nicks, scratches, and making fillets. Thinned to a brushing consistency (2 parts Stuff one part Hobbypoxy Thinner) it can be used as a filler. It dries quickly and can be sanded easily.

Hobbypoxy on Fiberglas—roughen surface with fine sand paper for better adhesion and apply 1 or 2 coats of Hobbypoxy color.

HELPFUL HINTS AND REMINDERS

For sanding we recommend NO LOAD SILICON CARBIDE sheets, obtainable through Sears-Roebuck and Co., for lasting longest and giving the best results.

For measuring Hobbypoxy, the BECTON, DICKINSON "ASEPTO SYRINGE" (1½ oz., catheter tip) is available in most drug stores and serves as an accurate method of getting equal parts of A and B.

Allow 72 hours for all Butyrate solvents to evaporate before using Hobbypoxy material.

For masking curved areas, vinyl tape (AT-7610 manufactured by Plymouth Rubber Company, Inc., Canton, Massachusetts) can be used. It is easier to handle than cellophane tape and produces a clean cut edge.

For masking curved areas, PRESTO-SEAL can be cut to any shape. By cutting two sheets at once you can make masks for both wings or both sides of the fuselage. Available in most art supply stores.

Mix Hobbypoxy with extreme accuracy or characteristics of material and drying time will be greatly altered.

When spraying Hobbypoxy, the BINKS "WREN" air brush affords a very good control of the medium, although other small spray units may also be successfully used. (BINKS "WREN" air brush, Model B).

When spraying, better coverage with less coats may be had by using the wet-coat method, i.e., spray vertically first then re-spray horizontally during one application.

For a 2 tone finish, apply lighter color first.

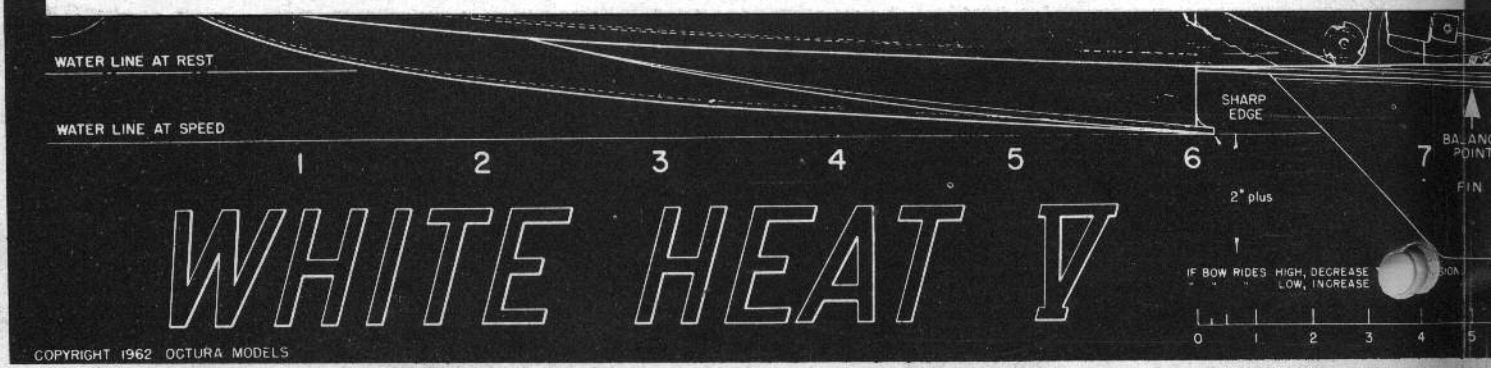
When drying, heating Hobbypoxy over 140°F will cause blistering.

HOBBYPOXY COLORS

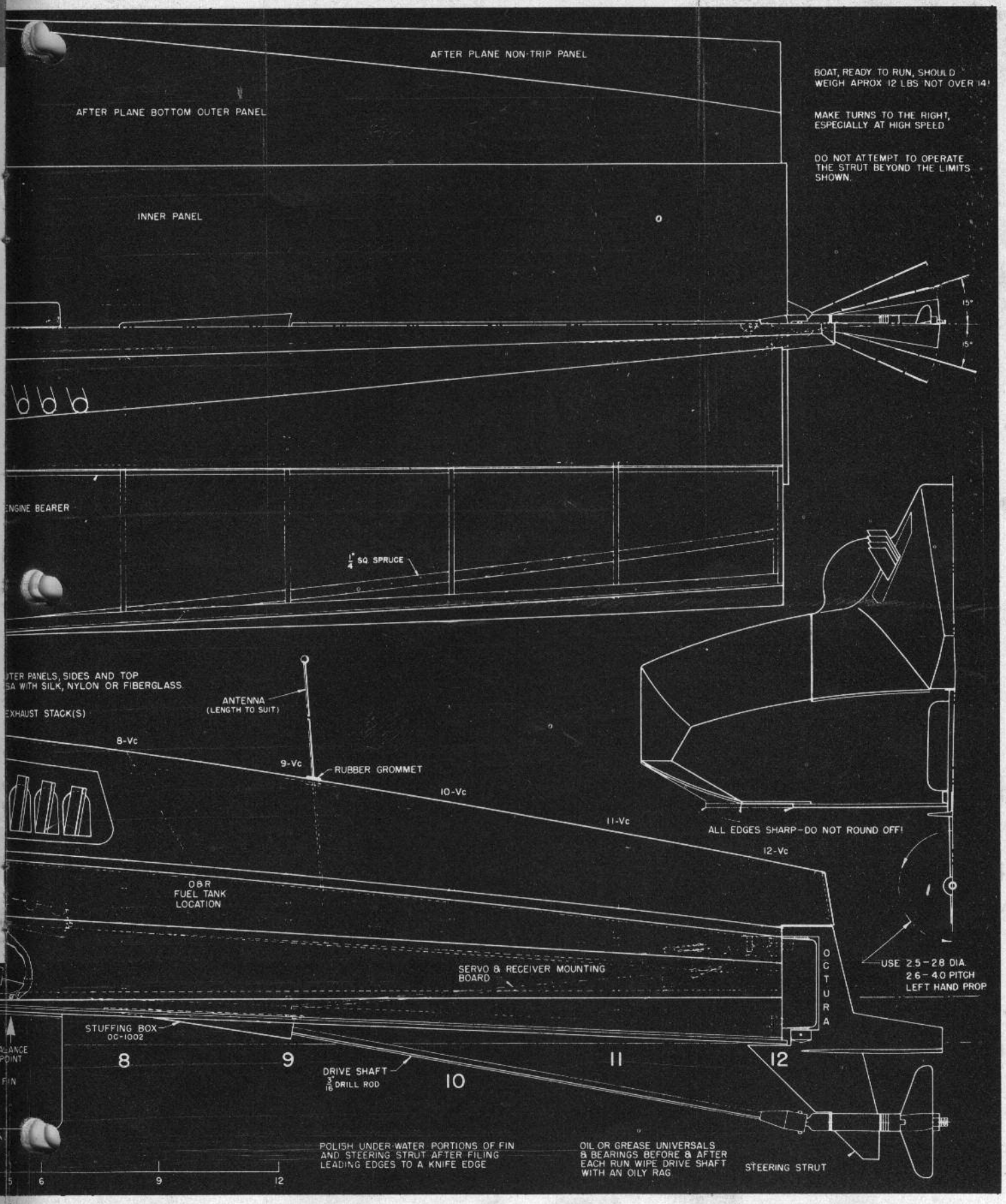
Colors are listed in order of applied weight, starting with the lightest.

1—H-08 Clear	6—H-65 Bright Red
2—H-81 Black	7—H-26 Light Blue
3—H-24 Dark Blue	8—H-33 Stinson Green
4—H-93 Silver	9—H-10 White
5—H-66 Dark Red	10—H-56 International Orange
	11—H-49 Cub Yellow

Note—Black will have an applied weight of .41 ounces for each fluid ounce, while Cub Yellow would be .51 ounces for each fluid ounce.



many technical features — which will interest designed-minded readers.



BITS AND PIECES...

HOBBYPOXY TIPS

■ From Bev Smith comes the following on Hobbypoxy: "An excellent way to apply the clear and colored Hobbypoxy is to heat it to approximately 130 degrees before spraying (with Binks Wren B Air Brush). To do this, place the container of mixed A and B in a pan of hot tap water for about 10 minutes. Hobbypoxy usually requires less thinning (never more than 10%) and sprays very evenly. It dries faster and is dust-free in 10-12 minutes, by using this method. I have been able to mask over and spray another color in 4 hours by applying heat lights 20 minutes after spraying."

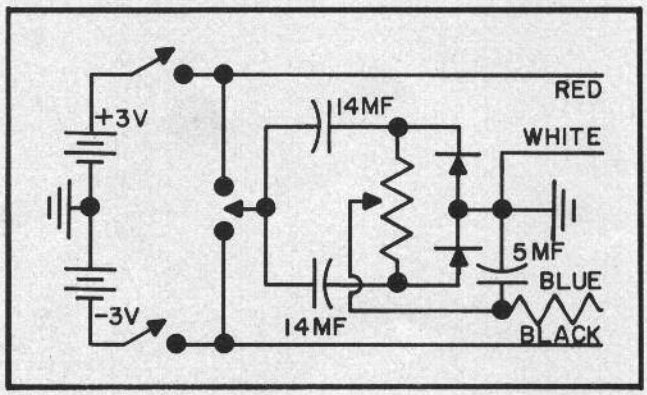
RE KRAFT SERVO AMPLIFIER

by Leland A. Moore, Waco, Tex.

■ I built five Kraft servo amplifiers which work perfectly. I had trouble getting the first one to operate properly and, after changing all the amplifier parts and checking my wiring at least 10 times, I put the amplifier in a different servo and it worked perfectly. My servos are several years old and on several occasions cleaned them. During one of these cleanings I must have got the magnets reversed in the motor which caused the motor to run backwards.

I discovered that for the Kraft amplifier to work properly the polarity of the motor must be as shown in the diagram, that is, when a 3-volt battery is connected with the positive lead going to the motor lug nearest the center of the servo, the crown gear *must* turn counter clockwise. If I had known this it would have saved about four hours of checking. In the future when I take a Bonner motor apart I will mark the magnets to be sure they go back together exactly as they came out. If the servo has never been apart and the green and white wires going to the motor are connected properly, there would be no problem, but I am sure many modelers who are changing over to relayless receivers are using their old servos and, if they have ever taken the servo motor part, they might have this problem.

TIP ON PROPORTIONAL

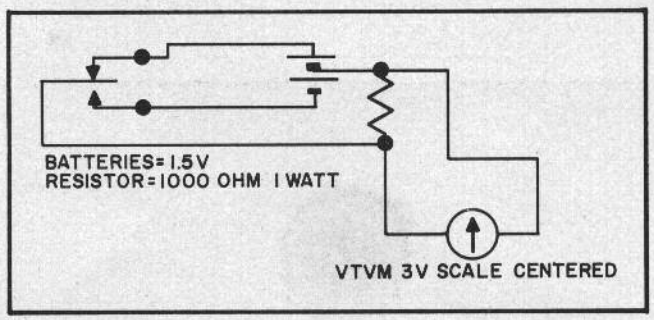


by Lt. James R. Hostetter, U.S.A.F.

■ Have been flying "prop" RO with MC using circuit in July-August GRID LEAKS which allows feedback servo to be used with a relay-type receiver. I use a mechanical pulser and am not able to trim during flight. I found that fail-safe neutral and my pulsing neutral were not the same due to an unbalance in the pulser, slight mismatch in the above circuit, or both.

I made a change in Marcy's circuit which allows the pulsing neutral to be adjusted on the ground before flight. The two 4.7K resistors were removed and replaced by one of your P.C. 10K pots. With the pot set at the mid-point the circuit is balanced at 5K per side. As the pot is moved off center the rudder changes position. This does not change the fail-safe neutral. Fine luck with this circuit, using it with a Broadhurst P.O.D. for motor.

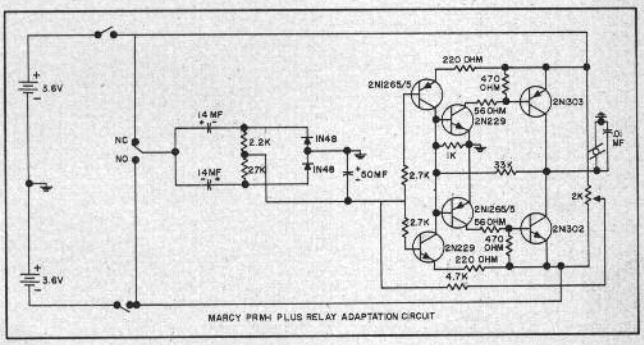
SIMPLE PULSE TEST



by Gordon Lauder, Springfield, Ill.

■ A simple test system for checking pulse systems can be made by using a VTVM which has a variable zero setting (such as the Heath). Simply set the VTVM needle to center scale and read the pulse deviation. The circuit below is the one I use.

FEEDBACK—RELAY RCVR



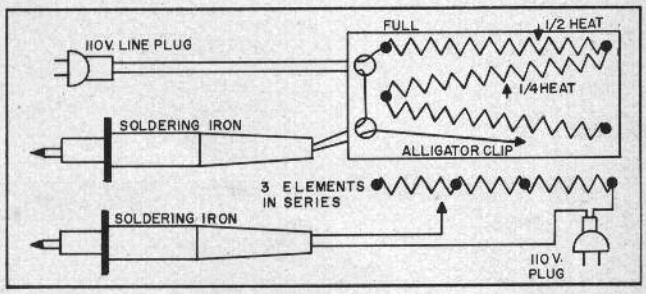
by Capt. Peter E. Rawlings, U.S.A.F.

■ I used a circuit from GRID LEAKS for a feedback servo with a relay receiver, and adapted a Marcy servo circuit.

Incidentally, I tried that circuit with a feedback of John Phelps' in MAN—could never get it to work properly. Marcy PRM-I system servo did work well with it and the whole circuit fits nicely into a Citizen-Ship RNA servo box—with a MM cut down to fit inside with the RNA gear set. I did use a Mallory 2.2K pot, MLC 222L-S, in place of the Marcy pot—it is ½" diameter with a ¼" shaft.

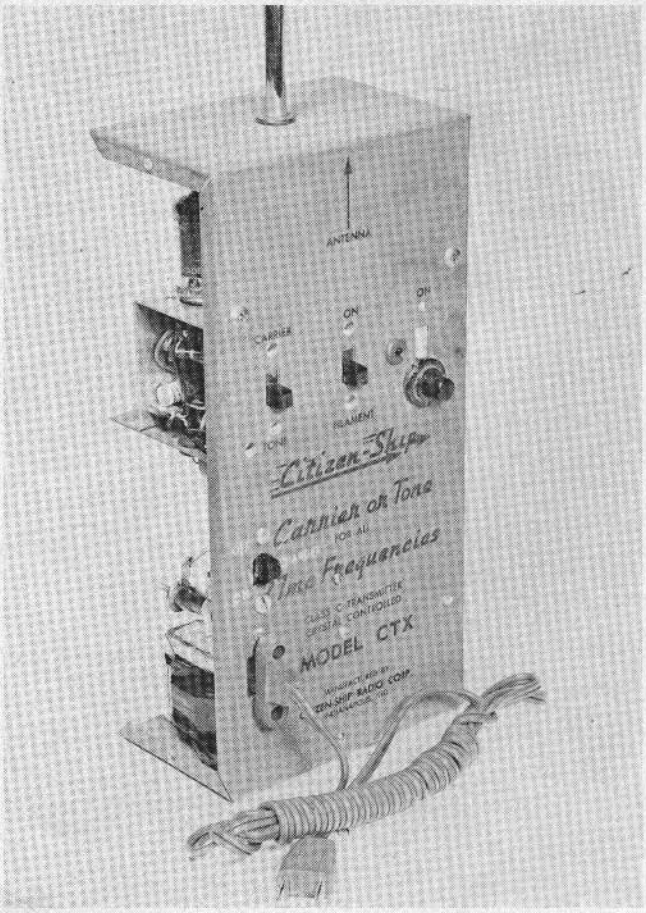
Would also like to know if you know of anyone working on a dual feedback—superhet system that is duplicable and inexpensive—I think there would be a good market for such a system. (Anybody?—Editor)

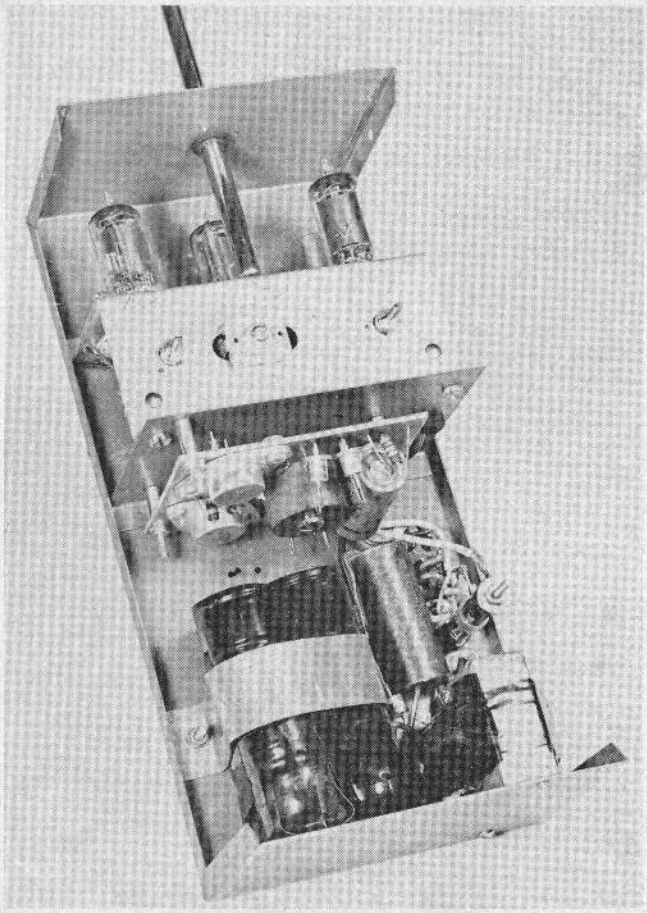
IRON TOO HOT?



by Bob Gaede, Baltimore, Md.

■ Most modelers (on a budget buy one iron—75-100 watts. This is good for piano wire etc. but, when they change tips and attempt to "get by" on printed circuits, etc. the result is cooked components!! By using the rig shown any iron will cut down to 35 or even 25 watts (cost is less than a buck). Mount (3) replacement heating elements on a piece of asbestos shingle as shown (in series). Cover with protector made of aluminum bake pan from dime store. Mark positions of alligator clip on resistance wire to give best heats for PC, etc. CAUTION: *Pull plug before moving clip!*

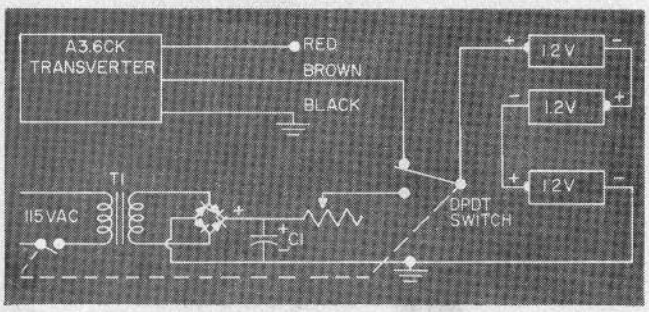




POWER SUPPLY CITIZEN-SHIP CTX X-MITTER

by Norm Rosenstock, N. Wantagh, N.Y.

■ This installation used Ace A3.6CK/transverter kit and nicad charger parts package with three Sonotone 2-amp nickel-cadmium sealed cells. A DPDT switch connects batteries to power supply or to charger. In charge position one pole hooks nicads to output of charger and other pole supplies 115V to charger input. In Off position, nicads switch to converter (115V pole not used in Off). To determine value charge rate resistor, use 0-50 or 0-100 mil meter (depends of charge rate bats used), adjust variable resistor to required current, then replace with proper fixed resistor. TV cheater cord for line voltage.



SOLID STATE BULLETIN

■ Following are changes passed on by Jack Fisher of New Haven Electronics. (The Solid State I.F. Receiver was presented in the July/August issue.)

(1) All receivers should have an 8.2K resistor from the base of the NPN, part number (T5), to its emitter; (2) Some receivers (depending on T3) will require a 15K in place of the 33K (part number 8); (3) For the new 330 to 600 CPS reeds part number 24 should be a 1 Mfd; (4) If only one frequency is used (this will require re-peaking when you change receiver frequency), change part number 37 as follows; Replace wire with size number 24 enamel, replace the 10 mmfd A to C with a 22 mmfd, replace the .001 mfd which is in series with the Ant. with a 10 mmfd.

Note: If only one frequency is used and you do not object to repeaking when changing frequency it is well worth the trouble to make this change.

KILLS MM NOISE

by Herbert R. Foster, Jr., Seattle, Wash.

■ Here's a noise elimination tip for Mighty Midget users. Connect the magnet electrically to one of the brushes. I cut and bent some thin brass so that it presses against the magnet and one of the screws, then connect the screw to the binding post. Another tip is to put a small RF choke in each lead to the receiver. In this case also connect a wire to the receiver ground and place it as far from the antenna as possible. This wire is to complete the antenna dipole system which the battery wiring etc. did before the addition of the chokes.

The purpose of all this is to eliminate the noise coming from the motor. The armature acts as an antenna load for the noise, which then goes into the plane's wiring through both of the motor leads.

PULSE NOTES

by Wayne L. Craig, Champaign, Ill.

■ Read the March '63 MAN and the article on the B & D Prop. system. This aroused much interest in our local R/C Club.

I believe this will be the first real chance for the "not so well heeled" R/C builder to get into a good "prop" system at a cost which he can afford. I have flown the "Show's & Dickerson" rudder and motor system all last summer and have been well pleased. If this new system proves to be as reliable as the rudder-only system I'm for it.

A small tip to proportional fans. I have had good luck with a Bellamatic Servo on rudder and another one modified for MC. R/C fliers are passing up a good servo if they overlook the Bellamatic, since it pulses well, has very low current drain and is compact in size.

R/C BIBLIOGRAPHY

Make sure that you haven't missed important material published during the past 12 months, by checking this annual Grid Leaks compilation. ▶ **FOR 1963**

LEGEND

* Indicates drawing or sketch, not a complete do-it-yourself article.

AM, American Modeler
AMA, American Modeler Annual
FM, Flying Models
GL, Grid Leaks
MAN, Model Airplane News
R/CM, Radio Control Modeler
RCM & E, Radio Control Models and Electronics
S & M, Science and Mechanics

R/C COMBOS AND SYSTEMS

B & D PROPORTIONAL SYSTEM, by Norm Beeler and Don Dickerson, Part I.
The system that placed first in Intermediate at the Chicago '62 Nationals, (Receiver).
Man, 3-63, p.18

B & D PROPORTIONAL SYSTEM, by Norm Beeler and Don Dickerson, Part II.
Detailing the pulser modulator section.
MAN, 4-63, p. 20

B & D PROPORTIONAL SYSTEM, by Norm Beeler and Don Dickerson, Part III.
Detailing the construction of the two servos required.
MAN, 5-63, p. 28

DUAL PROPORTIONAL BOAT, by Ralph Mifflin
Complete coverage on transmitter, receiver, coder, and servoes. Also covers suggested installation in boat. GL, V4, #6, p. 14

FALCON 56 R/C MODEL, by William Winter.
Uses the Klinetronics six channel receiver and transmitter.
S & M, 6-63, p. 74

GETTING STARTED IN RADIO CONTROL, by John T. Macken and K. Kenneth Smalley.
Complete details of installing an Otarion Receiver in a Top-Flite Schoolboy Model, complete with instructions as to how to fly your first airplane.
S & M, 4-63, p. 82

MARCY'S PRM-I SYSTEM, by Marcy Inkmann, Part I.
Beginning the two-part series of a construction article for the construction of a proportional rudder and positionable motor control using feed-back servos.
GL, V4 #1, p.6

MARCY'S PRM-I SYSTEM, by Marcy Inkmann, Part II.
This issue features the receiver and transmitter section.
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Here is a jam up artical containing pictures and layouts for three multi type installations and shows hints and kinks which will be very helpful to all multi flyers.
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*BUILD A METER ON YOUR BOOSTER.
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FILLING OUT THE NEW FORM 505.
GL, V4 #2, p. 3

GO FLY A KITE, by Bob Swearinger.
GL, V4 #1, p. 18

HOW TO IMPROVE MULTI MODELS, by Peter Waters.
Some helpful ideas, info about servos, linkages, and other little known kinks.
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*INEXPENSIVE SINGLE PIN CONNECTOR.
GL, V4 #5 p. 20

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GL, V4 #5, p. 4

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A complete run down of the equipment used by all of the contestants at the Chicago Nats in 1962.
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A deluxe show boat installation.
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52'' tip to tip, 45'' overall, takes .10 power and an 8/4 prop. For single channel.
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GL, V4 #5, p. 20

A SIMPLE SERVO SWITCHER, by J. H. Skeet.
RCM & E, 11-63 p. 535

BATTERY ELIMINATOR FOR PULSE SWITCHERS.
GL, V4 #4, p. 18

BI-SIMPL, by Peter Lovegrove, Part I.
An easy dual proportional system.
RCM & E, 8-63, p. 385

BI-SIMPL ENGINE CONTROL, by Peter Lovegrove, Part II.
RCM & E, 9-63, p. 438

BI-SIMPL, by Peter Lovegrove, Part III.
Fail-safe circuits.
RCM & E, 10-63, p. 488

BI-SIMPL SERVOS, by Charles Riall.
Very little effort is needed to convert Mighty Midget Motors.
RCM & E, 9-63, p. 435

BUILD A SERVO, by M. L. Beach.
Shows how to make a simple, powerful relayless single battery servo.
RCM & E, 10-63, p. 485

CONTROL SURFACE FORCES, by R. H. Warring.
Will your servos cope?
RCM & E, 9-63, p. 446

''ELSIE'', by Jim Darke, Part II.
Has two circuits: A self-neutralizing servo amplifier and a fail-safe throttle version.
RCM & E, 10-63, p. 497

FOUR FROM THREE, by G. G. Short.
A tone omission circuit for fail-safe and throttle control.
RCM & E, 2-63, p. 76

GO-AROUND SERVO MODIFICATION, by Bill Steinhauser.
GL, V4 #2, p. 19

''HALF PINT 8'' SERVOS, by Vincenzo Martini.
A simple amplifier.
RCM & E, 7-63, p. 351

MANUAL MOTOR CONTROL CHECK
GL, V4 #5, p. 21

MORE CONTROLS ON PULSE.
GL, V4 #4, p. 18

MULTI SERVO, by J. Marsh, Part I.
Construction details of a multi servo around a Mighty Midget Moter.
RCM & E, 3-63, p. 114

MULTI SERVO, BY J. Marsh, Part II.
RCM & E, 4-63, p. 191

MULTI SERVO, by Dave McQue, Part III.
T.A.S.A., Transistor Amplifiers for Switching Actuators.
RCM & E, 7-63 p. 346

*PHELPS PULSER, by John Phelps.
Reprint of a uni-junction schematic.
MAN, 11-63, p. 33

POOR MAN'S ULTRA MULTI, by Al Thompson
Adding another channel.
R/C M, 11-63, p. 17

PROBING THE TRANSMITE SERVO, by Hank Giunta.
R/C M, 11-63, p. 4 and p. 29

RCM TECH DATA, NO. I.
On escapements, with mounting layout.
R/C M, 10-63, p. 27

REED UNITS, LARGE OR SMALL, by P. T. Bellamy.
Describes home built units.
RCM & E, 2-63, p. 64

RELAYLESS CIRCUITS FOR PROPORTIONAL
Uses Mighty Midget Actuators.
GL, V4 #3, p. 12

RO PULSE PROPORTIONAL.
uses magnetic actuators.
GL, V4 #3, p. 14

RX FOR ESCAPEMENTS, by H. G. Cooper.
R/C M, 10-63, p. 16

SELECTIVE FILTER SWITCHER, by J. H. Brunt.
Eliminates relays, converts single to multi, operates two S/C models from one transmitter.
RCM & E, 2-63, p. 62

SIMPLE SERVOS FOR ''HALF PINT 8'', by G. Tortora.
Uses T05 motors.
RCM & E, 8-63, p. 402

SPACE CONTROL MODIFICATION, by D. D. Foss
How to separate the servos from the receiver for more crash resistance.
R/C M, 12-63, p. 17

SUPER DUAL PROPORTIONAL WITH 2 FEED BACK SERVOS, by I. R. Francis Part I.
A refined home built dual closed loop system.
RCM & E, 11-63, p. 548

SUPER DUAL PROPORTIONAL CONTROL, by I. R. Francis, Part II.
Servos and pulser.
RCM & E, 12-63, p. 606

THE TRIED SQUIRE, by Cde. Dud Billett, Jr. USN. Ret.
A unique approach to a single channel control system.
R/C M, 11-63, p. 13

*THIS CIRCUIT ELIMINATES RUDDER WIGGLE, by Frank Schwartz.
GL, V4 #1, p. 17

*TIP ON PULSE LINKAGE.
GL, V4 #3, p. 14

USING MICRO MO ON RELAYLESS RECEIVERS.
GL, V4 #5, p. 21

COMMERCIAL

ECKTRONICS RADIO CONTROL EQUIPMENT.
AM, 7-63, p. 66

TELECONT ON TEST, by J. H. Brunt.
A review of the 3 channel version of this compact all transistor filter outfit.
RCM & E, 1-63, p. 35

THE FOX .59 ENGINE, by Duke Fox.
GL, V4 #3, p. 18

GENERAL

BLUEPRINT FOR BEGINNERS, by Ken Willard, Part I
R/C M, 12-63, p. 12

INTERNATS DATA SHEET, preface by Harry Brooks
R/C M, 12-63, p. 34

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

GL's coverage of new items, information and trade releases, now includes a coverage of useful products on the market.

Orbit Transmitter T4 and T6: Features are 9-volt operation and high output—One of the most powerful handheld units available. Low current drain. Has characteristic Orbit toroid stabilized one generator. Retains feature of "upward modulation" for real punch when keyed. Size is 6¼ x 6 x 3, weight 3 pounds. Price: T4 (4 channel) $69.00; T6 (6 channel) $79.00.

Orbit Receiver R-4 and R-6: An all-transistor superhetrodyne circuit for 6.25-volt operation. Features extreme sensitivity and very low current drain. Servo power and signal leads prewired from receiver to simplify installations. You just solder connectors for servos to leads. Receiver power plug matches to existing commercially available nicad packs for further simplification. Size: 3 x 1⅞ x 1; weight: 3¾ ounces. Price: R-4 (4 channel superhet) $65.00; R-6 (6 channel superhet) $69.00. Orbit Electronics, 11612 Anabel Ave., Garden Grove, Calif.

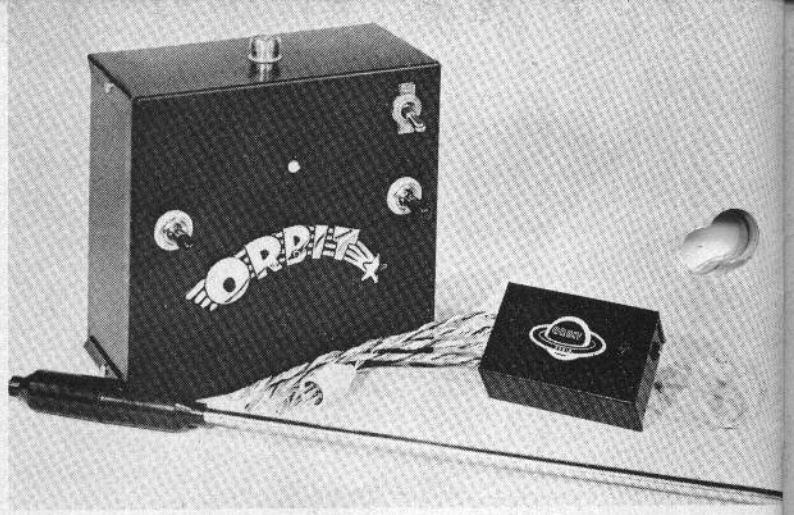
Babock BCR-18 Superhet BCT-18 System: The new BCR-18 receiver must be used with high-resistance escapements (approximately 100 ohms), the reason being that it uses a 9-volt battery (commonly available at almost any drugstore or market). The receiver uses a crystal-controlled converter, and a 37.5 KC I. F. frequency which is tuned by a selective inverse feed-back circuit around a part of the I.F. amplifier, eliminating the need for I. F. transformers or I. F. filters and tuning of the I.F. Converter tuning is non critical.

In the Transmitter, series modulation is used, eliminating the need for a modulation transformer and resulting in a very high percentage of upward amplitude modulation. Input to the RF is less than 100 M.W., making licensing unnecessary. The coder involves a 500 cycle multi-vibrator oscillator keyed by low frequency "lopsided multi-vibrator" resulting in a relative long time-on and short time-off keying to the audio oscillator. This latter multi-vibrator is controlled by a variable time base which permits the pulsing multi-vibrator to send the correct number of commands to the high resistance Mark VI escapement. This type of coding accurately steps the escapement. The "quick-blip" motor control involves a discharge circuit whereby the audio oscillator gives a short command, regardless of whether the button is pushed fast or slow.

MC Charger Price Reduction: Volume purchasing of parts enables MC Manufacturing & Sales, (Kansas City, Mo.) to reduce the $6.95 price of their MC Nicad #1 Charger to $4.95. Charger has a potentiometer with variable charge rate of from 0 to 250 milliamps. Instructions explain adjustment of pointer for any battery up to 2.5 amp jobs. Housed in better, smaller case.

Lee's Receiver System Package: Completely wired and ready-to-install, Lee's Hobby Industries (2094 Fifth St., East Meadow, N.Y.) single-channel system, completely wired and tested, consists of a 3VK receiver, Citizen-ship SE-2 escapement, DuBro pencell battery box, knife-action slide switch, and Burgess alkaline batteries. Dealers can demonstrate at counter with any 27mc transmitter. Fits any single-channel plane from .010 power up. As shown, **$19.95**; receiver only built-up, $12.95.

Raider 10 Multi: Blackwell Models (Canon City, Colo.) now has their new Raider 10 Multi.



Orbit's Four-channel Superhet.

Babcock's Digitran Transmitter.

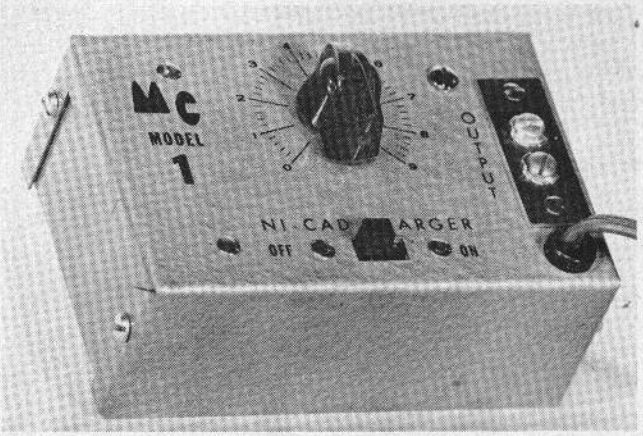
The low wing Raider 10 is a basic airplane, capable of the most advanced maneuvers, yet in the low powered version, is easy to fly by the modeler with limited experience.

Stated construction time for the airframe ready to cover is less than 20 hours. Fuselage features a new flat-deck and top hatch. Radio equipment is easily installed from the top of the fuselage. Two full-scale views show exact installation procedure. Rugged tricycle gear has ample ground clearance; shock coil main gear smooths out landings and take-offs on rough terrain and eliminates spar damage. A simple check-out procedure shows how to quickly and accurately set wing and stabilizer and engine thrust, reducing first flight hazards to the minimum.

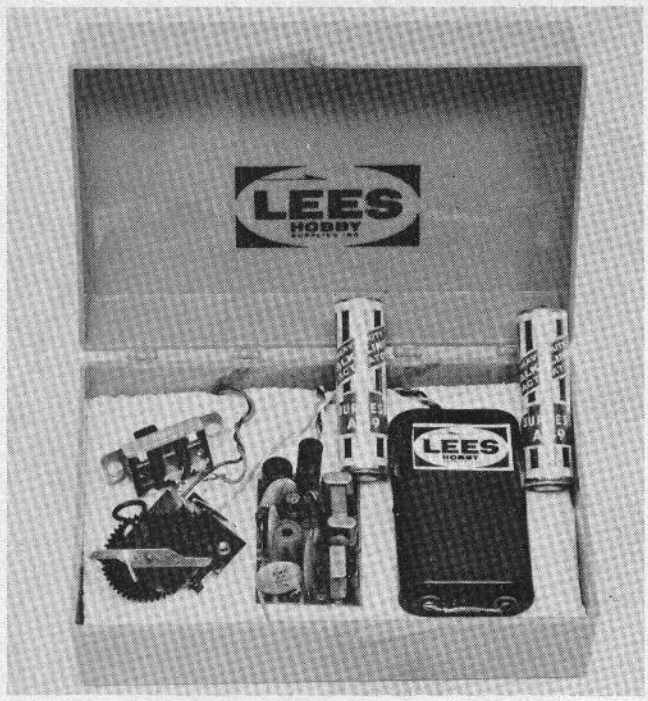
Uses .23 to .29 engines for light-weight installations, up to .59's for heavier full-house. Span is 58", wing area 660 sq. inches, average weight with full equipment, 5½ lbs. Price is $21.95. (Ace R/C.)

New at Sampey: A patent is pending for a "Demodulation Discriminator Module" or DDM-1, designed to operate with all narrow-band "Starlite 200" single-channel proportional receivers, or with other receiver front-ends, presuming the necessary input requirements.

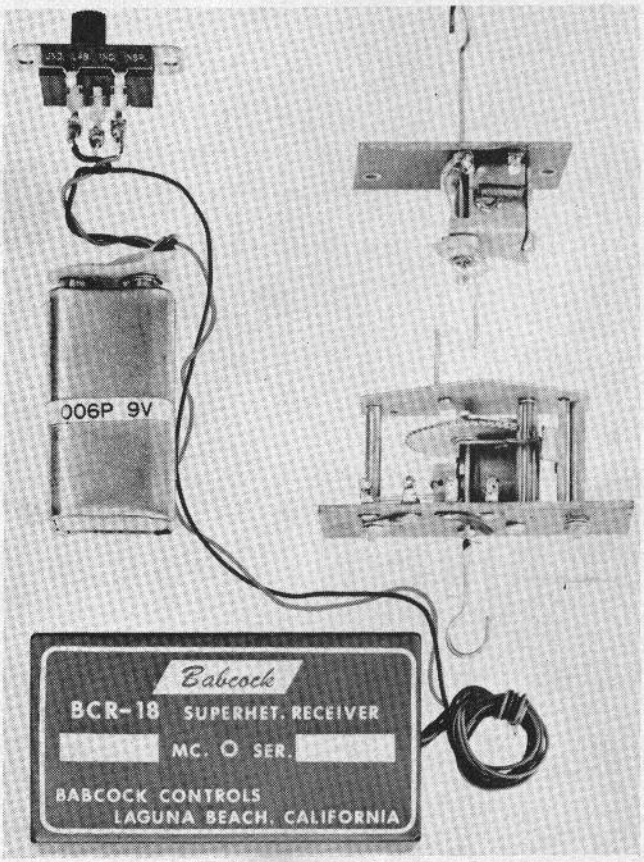
With the proper input frequency applied (1000 to 1500 cps),



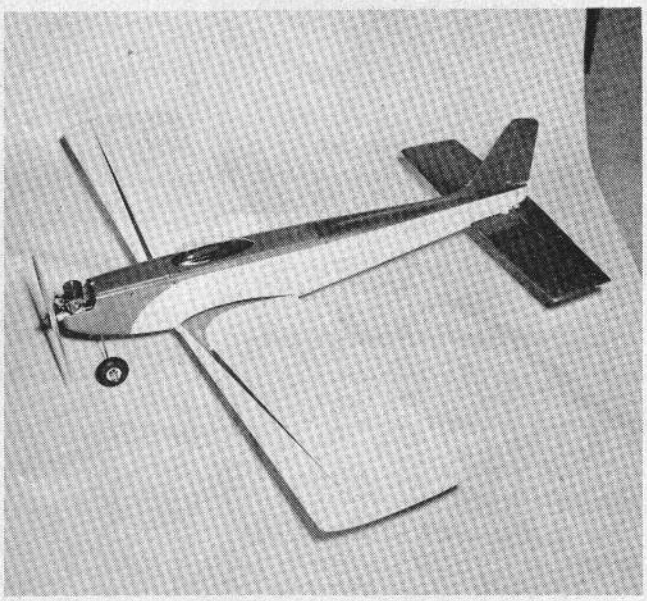
MC's Model 1 Ni-Cad Charger.



Lee's Ready-to-install Package



Babcock's BCR-18—Escapements.



Blackwell Raider 10.

the DDM-1 will supply an output voltage of + or — 0.4 volts DC, which may be used to operate a proportional closed-loop servo. Output voltage is proportional to input frequency applied. Operation temperature stable from 0 to 160 degrees F. Input voltage required is 6 volts DC. Price $12.95.

Starlite 200 series receiver is an all new design concept, single-channel proportional receiver, which employs the above DDM-1 as the proportional discriminator. New epoxy silicon transistors are used for extreme super-regen narrow-band operation and wide operating temperatures from 0 to 160 degrees F. Frequency coverage with this receiver, with the proper RF coil, is between 26 MC to 150 MC. Uses 6 transistors, plus the DDM-1, which provides many features not found in other single channel receivers. Couples directly into Sampey feedback servo.

A modulation omission detector circuit allows motor control escapement to be used when the proportional output is used with a closed-loop servo. Also can be used with a modulation omission detector circuit for compound escapement initially if desired.

Fail-safe operation is provided when the DDM-1 servo signal voltage returns to zero voltage. Input voltage is 6 volts. Size of the receiver is 1¼ x 2⅜ x ⅞.

The Starlite 200 will be available both assembled ($49.95) and in kit form ($39.95). Coming is an all-transistor transmitter (for the Starlite receiver) which, according to Sampey, has a power house signal ouput, range being equal or better than the present tube-type 404 transmitter. Details and price available soon.

With the Starlite 200, matching transmitter and Sampey feedback servo, and a motor control type escapement, the single-channel rudder-only proportional fan has equipment that has long been sought. (Sampey & Co., 1607 Forsythe Rd., Orlando, Fla.)

Epoxy Glue and "Stuff": Pettit Paint (507 Main St., Belleville 9, N.J.) new Epoxy Glue has a pot life of 15 minutes, set s in 30-45 minutes and has complete strength in two hours. By applying heat lights, times can be reduced 50 percent. Said to be an excellent glue for both field repairing and general work. Pettit discovered something in a new material called "Stuff." They made a putty-like material for general repair and filling nicks and scratches. Its stability made it excellent for fillets. Thinning with one part "Stuff" to 2 parts Hobbypoxy Thinner makes an excellent filler. Although (*Continued on page* 26)

Seen These?

(*Continued from page* 25)

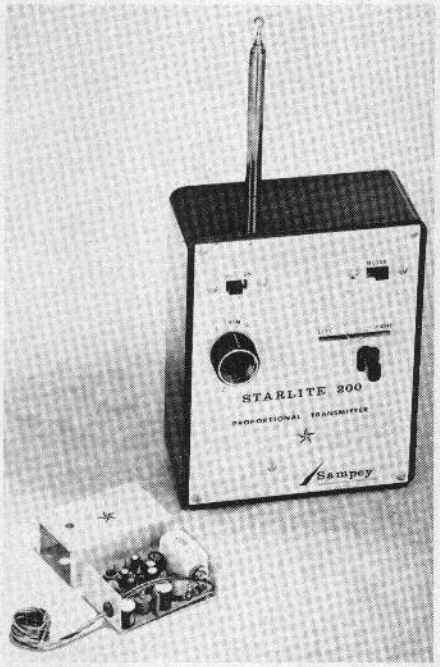
softer than their H90 Filler it works well. In most cases two coats fill completely. Dries quickly, sands as easily as balsa. Sizes and prices to be announced.

Plastic Spaghetti: From C & M Products, Blue Springs, Mo., (available through Ace R/C) Clear Plastic Tubing Spaghetti. Has extreme flexibility. Being transparent, color coding of wires may be used. Will not brittle or harden with age. Fits over No. 24 gage wire. Packaged 3 feet for 25 cents.

New Tanks: Lindwood Accessories (2800 E. Pacific Coast Highway, Long Beach, Calif.) announces the Lindwood Fuel Tanks in 4, 6, and 8 ounces sizes. Tanks are leak-proof, are claimed to weigh less and take less room. The 4-ounce price is $1.55, 6-ounce $1.65, and 8-ounce $1.75.

Liquid Resist: From Tate Products of Indianapolis, comes anouncement of a Liquid Resist, that is thin enough to use in writing and lettering pens, such as Speedball, Ink-o-graph, etc. A pen makes application quick and easy, allows smaller lines, and more detailed patterns. Resist of this type is not suitable for running a large number of printed circuit boards, but lends itself to work generally done by modellers, particularly when only one or two boards of a kind are desired. Our tests indicate it flows easily and smoothly, dries quickly, and etches cleanly. Probably will be offered in both one- and two-ounce bottles, price to be announced (Ace R/C).

Galloping Ghost Coupler: Special Edition Plans (Box 48, Massena, N.Y.) kit consists of two jig-formed 3/64-in. elevator tie bars, with universal coupling in place. Wire and bolt are joined under more than three tons pressure prior to soldering. Included is the master crank, ready for soldering to torque rod, thrust eyelets, etc. Almost infinite variation for more or less control. Price: $1.00.



Sampey 200—single channel proportional.

Razor Plane: Handy tool available from Willoughby Enterprises (14695 Candeda Pl., Tustin, Calif.) is just the thing for shaping nose blocks, trimming bulkheads and ribs, rounding off fuselage corners.

With care can be used on pine and spruce. Uses standard safety razor blade—even new stainless blades—and is adjustable right down to the very minimum cut.

Royal Products Co.: (2591 S. Bellaire St., Denver 22, Colo.) announces the star (.049 to .07, span 37 in., $5.25 standard, deluxe $5.95), a shoulder wing, trike type; Hunter (29 to 45, span 64, area 624, standard $20.95, deluxe $23.95), a low taper wing, dual gear; Regulus (29 to 49, span 64.5 in., standard $17.95, deluxe $19.95), a cabin, trike type; Skeeter (.07 to .10, span 42 in., standard $6.45, deluxe $7.95), a cabin dual-gear type; and Ranger (15 to 35, span 55 in. standard $11.95, deluxe $14.95), a dual gear cabin type. Deluxe versions include hardware, wheels, horns, where appropriate the tank and canopy. Photos of kit parts indicate thorough die-cutting, including bulkheads.

Wing-A-Jig: This versatile jig can be set up to handle wings of up to 72-in. span with 6- to 12½-in. chords—dihedral included, and stabilizers. Available for either tapered or constant-chord wings. Features pre-cut rib-holder-spars with 3-in. spacing, adjustable supporters for leading and trailing edges or elevator spars. Rigid dihedral support blocks adjust to required angles. Assembles quickly with wood-screws and machine screws. All braces, tips, etc. insert. $15.95, Broadfield Air Models, 56 Cutler Dr., Ashland, Mass.

New at Citizen-Ship: A single-channel system package, a single-channel relayless superhet receiver, and a six-channel transmitter and relayless superhet receiver are four items to be announced at the February trade show.

Packaged System—TTX transmitter is packaged with Citizen-Ship's R/C Pac and either SE-2 or PSN-2 escapement. (Pac completely wired, comprised of LT-3 receiver, escapement, battery holder, switch, pushrod, hook and bearing.) With PSN-2, $59.95 (saves $2.95), with SE-2, $61.95 (saves $2.95).

RSH Receiver—Smallest single, relayless superhet (2 x 1½ x ¾ in.) on market. (Suggested list, $34.95.) Designed especially for SPX transmitter, but also operates with Citizen-Ship's TTX, SL-6 or TMS. Fixed tuning, 7 transistors in this crystal-controlled oscillator set. Idle is 5 MA with 2.8 volts delivered at escapement. Epoxy glass printed circuit board. Does not overload. Weight is 1¼ ozs. Available on all FCC approved frequencies from 26.995 to 27.255 MC. Takes Citizen-ship actuators—SE-2, PSN-2 or SE-2-M. Two pencells.

SL-6 Transmitter — All-transistorized, tone transmitter has same RF output and audio circuitry as 10-channel TMS transmitter. Four transistors, including high-power silicon output transistor. Temperature compensated for absolute organ-tone stability to 140 degrees. Collapsible, externally loaded antenna. Epoxy glass PC board. Six adjustable tone frequencies, from 350 to 650 cycles per second. Weight with 9-volt Burgess D6 or Eveready 276 battery, 3¾ pounds. Measures 6⅞ x 5⅝ x 2¾ in. Available on all FCC approved frequencies 26.995 to 27.255 mc. Suggested list price is $74.95.

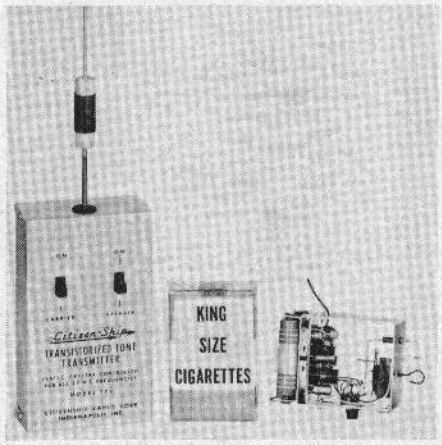
RL-6 Receiver—For use with the SL-6 transmitter, this is a six-channel, all-transistorized, relayless superhet tone receiver with reeds. High reed frequencies of from 400 to 600 cycles per second prevent false commands from vibration, it is stated. Compact PC layout and careful selection of parts makes this superhet smaller than most super-regens and, in fact, it can even be used in Half A installations. Reed bank is built integral with printed circuit epoxy glass board. Has six transistors and is

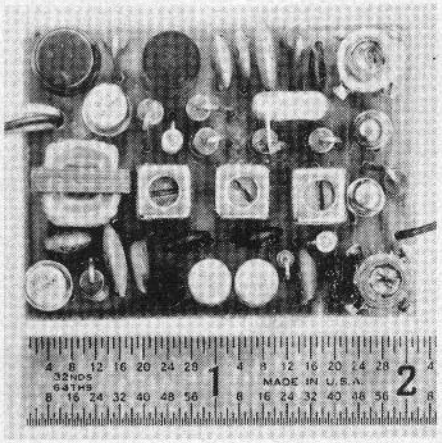
crystal controlled. Idle 5 MA with signa off, current 15 MA with signal on. Though designed for use with SL-6 transmitter, receiver works equally well with TMS transmitter since reeds match perfectly. Weight is 3½ oz. Size 2⅞ x 1-13/16 x 1 in. Uses single hearing aid battery of 9 volts. (Burgess P6, 2U6 or 2N6, or Eveready 226, 216 or 246.) Available on all FCC approved frequencies from 26.995 to 27.255 mc. Suggested list price, receiver alone, $54.95. Combination package of SL-6 transmitter and RL-6 receiver is $119.95 (saves $9.95). Complete system with SL-6 transmitter, RL-6 receiver, and three TNA servos is $189.95 (saves $17.80).

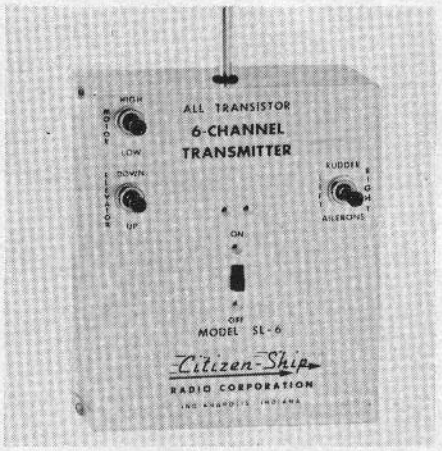
This six-channel equipment will prove especially useful for competition in Class 1 (Rudder), Class 2 (Intermediate) and for Pylon racing—as well as sports flying.

Fibreglass Fuselage: D. R. Hartman, maker of Fibreglass Fuselages, has arranged with deBolt to produce a Fibreglass Fuselage for latter's Interceptor which was published in the January 1964 *Model Airplane News*. Hartman hopes to get into early production with deliveries beginning in late winter. Price is yet to be announced.

Power Converter Transformer: Airborne Control Labs announce that they have a small quantity of an extremely good power converter transformer available. Features 6-volt input with 150 volts at 35 MA out, and another winding which puts out 25 volts. This is a 3-watt unit, a rugged transformer type, and measures 1¼ x 1¼ x 1 inch. Price is a close-out, and at the low figure of $7.95 the item should go fast. Comparable transformers from Triad and so on, run roughly double this price.







1964 Citizen-Ship, L to R: Single-channel package system; RSH single relayless superhet. Bottom, L to R: SL-6 transistor 6-channel X-mitter, RL-6 matching reed superhet.

Nickel Cadmium Batteries

(*Continued from page 8*)

to discharge the cell first to break down the oxide that has formed on the cadmium electrode. Recall that during operation oxygen must react with metallic cadmium.

Sealed nickel-cadmium cells should be charged at a constant current not exceeding the ten-hour rate. A cell charged at this rate to an end voltage of 1.46 to 1.48 volts at room temperature will bring the cell to a fully charged state in a period of 14 to 16 hours. Most manufacturers do not recommend constant voltage charging but it can be used. When cells are charged by constant voltage, a higher initial charging rate results which may be greater than the ten hour rate. The charging circuit must be designed so that the ten-hour rate flows toward the end of the charge. Constant voltage charging has been the cause of rupture of many an RC'ers batteries.

When it is desirable to keep a battery in a fully charged condition it is best to trickle charge or float the battery. The recommended charge rate should not exceed the 100-hour rate. Since the sealed nickel-cadmium cell will stand extended overcharge at the 10-hour rate without damage it is economical and practical for the RC modeler to use a simple charger that delivers current at approximately the 10-hour rate. Charging rates higher than the 10-hour rate accelerates degradation of the cell. Also oxygen may be evolved at the nickel electrode faster than it can be reacted at the cadmium electrode. The pressure may then become sufficient to rupture the cell.

Charging nickel-cadmium cells is simple and can be done with chargers using either half-wave or full-wave rectification. Filtering is not required. Since most batteries associated with RC use require low charge currents, half-wave rectification is satisfactory. Most chargers available for the modeler are based on the diagramed circuits. *Conclusion*: Several practices which should be followed for optimum performance and life.

- First, never solder directly to a cell. This could damage the seals. Use only cells that have solder tabs.
- Never charge at excessive rates, especially at elevated temperatures.
- Never use cells below the recommended cut-off voltage. Usually, this is 1.1 volts.
- Charge battery pack at 10-hour rate for at least eight hours after using and again for 8 to 12 hours before using again.

It should be pointed out that this article covers pertinent facts about sealed nickel-cadmium cells only, and that much more info could be added. As technology improves more facts will become available. Very recently GE perfected a method whereby sealed cells could be very rapidly charged. They have added an auxiliary or "control" electrode.

Oxygen generated during charging is electrochemically recombined with the control electrode material. When the end of charge is reached the control electrode signals such and shuts of the charging. By using the control electrodes a faster recombination of oxygen is possible, thus a faster charge rate, simpler seals and lighter cases are features of this type.

Cells with the control electrode cost 25 to 30 percent more than conventional cells. But increased use because of its rapid charge capability makes possible less expensive, and smaller cells. When the market is developed the price may well drop below comparable batteries because of the increased production volume.

Pocket and Sintered Plate Electrodes: The pressed- or pocket-plate construction was used in the fabrication of nickel-cadmium cells until about 1946 at which time the German battery industry began investigating the sintered-plate type of cell. The early work showed a radical improvement in performance over a wide range of temperature with a decrease in unit weight and volume in terms of energy output. Almost all sealed cells available today are made by the sintered plate process. The sintered cells are capable of high discharge and will withstand continued overcharge with little degradation to the electrodes thus providing a long cycle life.

A comparison of the pocket plate construction and the sintered plate construction will readily show why the sintered plate electrode is more desirable for applications with stringent requirements.

Sintering: By definition sintering is the process by which solid bodies are bonded by atomic force. In the construction of sintered plates for nickel-cadmium cells micro-fine nickel powder is bonded to a fine mesh wire screen using heat and pressure. This forms a plaque which is approximately 80 percent porous, thus having an extremely high surface area. It should be pointed out that this is the feature desired because the capacity of the cell will be directly related to the amount of active material that is exposed to the electrolyte. While the plaque may appear to be relatively smooth it is actually very porous and is a maze of hills and valleys. The active materials are electrochemically deposited in the pores of the plaque. The principal ingredient deposited in the pores of the positive plate is nickelous hydroxide, and in the negative plate it is cadmium hydroxide. An electric current is passed through the plaque, in the presence of an electrolyte, to convert the nickel and cadmium compounds to their final form. Finished plaques are cut to the desired electrode configuration.

The depositing of the active materials in the pores of the plaques is a very important operation because this determines the charging characteristics, the charge retention, and the capacity on discharge.

Pocket Plates: The pocket plate cells are constructed with plates which consist of finely perforated steel pockets locked into a welded steel frame. The active materials are pressed into the plate pockets and permanently held. In this construction the surface area is much less than sintered plates. It must be pointed out, too, that the pocket type batteries have also seen vast improvements in recent years, in many cases high discharge and re-charge rates are also tolerable in many makes. The pocket type also costs less to produce.

The nickel cadmium cell is an economical, constant-voltage, long-life power supply when maintained and used properly. Give it the care it deserves and reap the rewards.

What Level of Excellence?

(*Continued from page* 5)

System three (digital) is quad.
System four (combination) is quad.

2. None of the systems using feed-back servos are theoretically infinitely variable. If one does meet this specification completely it would be the digital.

3. It is doubtful if any system has an exact repetitive center return to neutral. The extreme variation in signal strength from close up to the transmitter to ¼ mile away has some effect on the transmitter information. Receivers are required to handle up to 200,000 microvolts close up to as low as 25 microvolts far out and no AGC (automatic gain control) can handle this signal variation. (Have you ever noticed the distortion and cross modulation in an auto set when driving near a broadcast antenna?) This may be why you hear about "trimming in the air." Also temperature variations, warm-up after turning on, and battery voltage fluctuation will alter this neutral.

4. All proportional systems will be more subject to interference than reeds. It takes an audio tone of an exact frequency to close a reed. If a reed is closed momentarily, it will hardly be noticed. If an interfering signal is added to either pulse or digital, it changes the area of the pulse and can throw a control completely off. Regarding discriminator, if a stray tone is received (particularly a continuous one), it will probably seriously effect the output voltage and cause erroneous commands. Those systems, however, that have continuous modulation to form the desired signals, such as the discriminator and the combination systems, are more likely to reject the interference than simple pulse or digital.

5. All systems probably will drift with temperature. Discriminators are most difficult to stabilize because they depend on tuned circuits which are temperature sensitive. Pulse systems will drift because of transistor changes. The digital system is probably best on drift because it does not depend on DC amplifiers which change their gain with temperature.

6. All systems will drift with voltage, and therefore Nicad packs are indicated.

7. The fact that all modern sets should have both transmitter and receiver transsistorized needs little further comment. However, the problems of transistorizing transmitters for discriminators is greater than for pulse or digital.

8. It should be fail-safe. This means that all controls should go to neutral and the motor to low speed in the event of a lost transmitter signal. This is easy on pulse systems by using the rate for the motor. Use low rate for low motor. Zero rate gives low motor. On tri-proportional pulse systems with trimmable motor it is necessary to add holding circuits to hold the controls in neutral when the engine is trimmed. This automatically gives fail-safe.

Discriminators automatically return to neutral with no signal, so no holding circuit is necessary, except some circuit should be provided to drive the motor to low in case of failure.

In the pulse system and combination system, the width pulse, if lost, will drive the control surface actuated by it to one extreme, so a holding circuit should be added here. This also permits you to turn on the receiver before the transmitter without this servo going wild.

It is not apparent to the writer how holding circuits can be added to a digital system. If signal is lost the servos stay where they are. It is not fail-safe because no DC is available to restore the servos to neutral.

From the foregoing, it is apparent that the three systems described have advantages and disadvantages. As they say, "You pays your money and you takes your pick."

(Editor's Note—A generalized description of the Citizen-Ship multi-proportional system appears in The Monitor, page 1).

Racing Hydroplane

(*Continued from page* 15)

used the new X70 plastic prop while the winner of the ¼-mile oval was swinging a #9 aluminum prop. Boats weighed 11¾ and 12 lbs. ready-to-run with cowling. Cowling weight, as a rule, is about 1 lb.

"A few pointers on getting the best performance out of the White Heat V and O&R Compact engine. First, remove the air filter as it is not needed in a boat installation. Second, adjust the ignition points to .020 and, while you have the blower housing off, remove the governor vane and shaft (voids warranty). Reinstall blower housing. Cut or file a slot in the hex head of the needle valve that will allow a micrometer adjustment with a screw driver. The slot will also give an index point. Take cover off fuel regulator and remove the disk, bent arm, the small roller, the spring and the ball check. Filter screen should be cleaned and left in place. Replace diaphram and cover making sure it seats properly. Install a gas line filter in the line leading from the tank to the fuel regulator housing. Use a klunk tank located so the top of the tank is on or below the level of the carburetor. Be sure boat sets on stand with tank below carburetor otherwise gas will run into carburetor and flood engine. Check spark plug gap for .030-.025 gap. Do not over rev engine when starting or allow it to wind up without a load. For those running multi-channel receivers with relays, a shorting wire from the ignition points to a relay to ground gives a sure shut-off or panic button. Be sure to short out the points, not open the line.

"The fin on the hull should have its trailing edge in line with former #8 to give best turning radius. Strut should not be allowed to swing more than 15 degrees on either side of-center. A slight amount of right rudder will have to be adjusted in, to allow boat to run straight in neutral servo position. Steering servo should be self neutralizing. Due to the propeller rotation and torque the strut has a tendency to swing to the left and at full throttle this force can over-ride weak servo batteries and allow the boat to either veer off to the left or, in some extreme cases, lock into a tight left turn. Be certain servo batteries are up to voltage. Some modelers wire their steering servos to take 4½ volts for right turn, 3 for left. Throttle servo should be wired to be trimmable from low to mid-position, self neutralizing from high to mid-position. This involves disconnecting either the yellow or brown wire on a Duramite servo. With this arrangement the throttle will hold any set position up to mid-point. The mid-point position will usually keep the boat planing, but at a speed able to make tight right-hand turns. The high position is possible only when the high button is held on the transmitter. If you were to lose contact, or have the boat run out of range, it would automatically slow to just planing speed. No need to worry about hitting the proper turning speed, just release the key.

"Lubricate the strut universal and prop shaft before and after each run with particular emphasis on forcing the water out of the strut bearing and ball thrust. Propeller leading edge, whether aluminum, brass or plastic, should have no nicks or burrs as this drastically affects the efficiency of the prop. Leading edge of fin and strut should be filed sharp and polished. Make absolutely certain screws holding mount in hull, motor in mount, fin in hull and strut on hull are tight and that a safety wire is through strut pivot pin. Hull buttom, at step and at stern, should be sanded smooth and waxed with at least two coats.

"Engine cannot be adjusted with the boat being held because this puts too much load on the prop. Adjust carburetor rich and test run boat. If it appears to be running rich bring boat back and, using notch on needle valve for reference, lean out slightly. Release and check again. Engine, when properly adjusted, will not have a sound like a glow engine but will have a deeper sound. Without the ball check in the fuel regulator, the setting will lean out as the fuel level in the tank drops."

The Monitor

(*Continued from page* 2)

landing. There is little difference between such an airplane and any popular free fllight with remote control added. R/C soaring gliders (see page 3) already point in this direction. We leave it all to the pundits—but do suggest they consider how to keep peace in the radio family.

At a Kansas Nationals Chet Lanzo—the same who had the giant prewar RC at a recent Nats, and who controlled an indoor model by a nichrome wire which bent from the radiation of a 100-watt transmitter—put a receiver in his glider. The first two flights provided laughs for everybody but the third produced more protests than had ever been received before in a free flight event. So it has been done. And we have radio in control-line now . . . And walkie-talkies for chasing.

If we obtain more frequencies through the efforts of the FCC-AMA committee, perhaps one or more (including what we have now) might be allotted to miscellaneous model flying at major meets. (We'll take that back if you insist!) for U/C radio hardly seems essential in competition. Does it appear practical for active free-flight events?

• Duties of a new AMA Nationals Advisory Committee, headed up by Walt Schroder, editor of *Model Airplane News,* are to study, analyze, and suggest ways in which the RC event at the big meet can be improved from the contestant's standpoint. Since the Lopshire article "Radio Uncontrolled Nationals" appeared in MAN, it is to be expected that this committee will make effective suggestions. A good sign was the organization of an Advisory Board, to assist in making the final report, of such top competition men as Dale Root, Doc Clark, Ed Kazmirski, Harold deBolt, James Kirkland and Maynard Hill. The wide geographic distribution of the advisory members should insure a representative cross section of findings. Some worthwhile recommendations already have been received by the committee from well known fliers.

The Advisory Committee consists of Howard Bonner, John Maloney, Carl Goldberg, Paul Runge, Ed Manulkin, Al Lewis, Bob Dunhan and your editor.

• The pic of Frank Schwartz, page 2, calls for comment on the Citizen-ship award program, now several years old. If you win—we assume this includes any who receive a place trophy—using Citizen-ship equipment, you simply notify the firm who will give you a merchandise certificate redeemable at your dealer for additional Citizen-ship equipment.

Frank, a GL regular, has been building for nine years. He's in the lady's dress business—one of the most exclusive women's specialty shops in the country, we hear—for 16 years, is 38 years old and has two children. He is an advanced class radio amateur—W4KFK since 1946. Frank helped develop the transistorized circuitry for the Citizen-ship servo. His Taurus is equipped with a ZR-10 receiver, Transmites and Veco 45. Transmitter is a TMS.

• More than 1000 people are expected to attend the 10th Annual Toledo Conference, February 29—March 1, to be held in the Champion Spark Plug Co. hangar at the Toledo airport. Program includes model competition for boats and planes, awards, speeches by experts, a Saturday night auction, door prizes and, possibly, flying demonstrations. For details write Box 2864, Station B, Toledo, Ohio.

• The pictures of the Czech models, sent by Borivoj Trmac, indicate that the aeromodellers club of Tisnov is proficient in single-channel art. Structure is functional, neat. Trmac's job has a unique four-wheel gear, with both nose and tail wheel. If anyone is in a corresponding mood, Borivoj Trmac resides at Tisnov RA 242, Czechoslovakia.

Correspondents also sought by Bjarne Aasbo, Drammensveen 316, Lysaker, Norway. He has been an air traffic controller since 1945, holds a private pilot's license, is 41 and has two boys. In Oslo the 15-man club reads GL with interest. Their Mr. Stephansen placed 12th in the World Championships in 1963. Mr. Aasbo has built a Charger, Tri-Pacer, and has a Bergfalke glider under way.

Grid Leaks at Play

(*Continued from page* 1)

as does the ranks of advertisers. With the November-December issue we saw an increase to 32 pages, and by actual word count we believe we had a greater coverage from an editorial standpoint than any comparable magazine. This tempo we propose to continue during 1964. We're all pledged to bring you the best of the technical aspects.

One little bit, perhaps unimportant, but if you will look at the cover of your current issue you will see in the L, the letter R with a circle. This means that *Grid Leaks —R/C Data Service* now is a registered trademark with the U.S. Patent Office. This does have a deeper and more valid meaning than a copyright, and we are proud of it.

• Corrections!

Try as we might, we seem to have errors still creep in.

The decimal points on the Klebanoff article in the November-December GL were omitted. On the condensers list as 15, 2 and 33 mfd, be sure to put a decimal point in front and you'll be O.K.

On the Form 505, question 13 should be marked NO if this is the case. In most instances it will be. Question 16 should also be NO, not YES. This one could be embarrassing if filled out as shown.

Sorry!

• We've been previewing circuitry for some of the newer devices that will be published in GRID LEAKS during 1964, and we think we can safely guarantee you some of the most exciting radio control electronic reading that you have seen in a long time. There will be what we consider to be some very important break-throughs to be announced on several fronts, and by several designers. Watch for them. As Al Jolson used to say, "You ain't seen nothin' yet!"

Yours sincerely,
Paul F. Runge, Publisher

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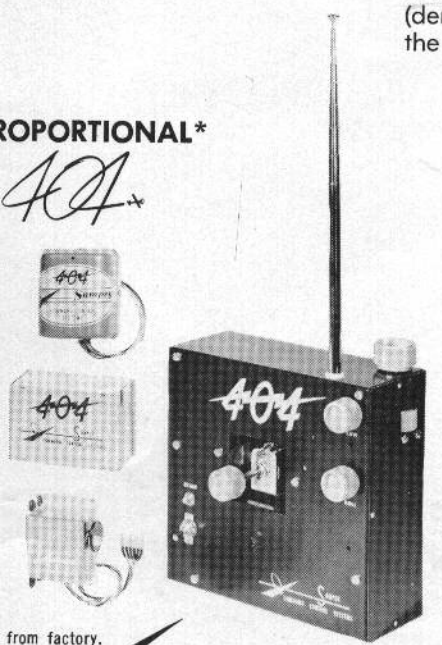

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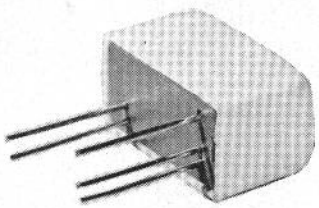

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