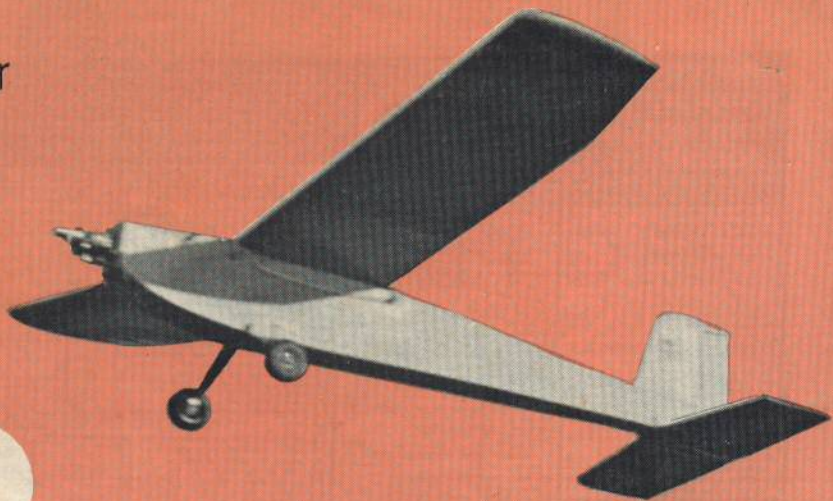


A Radio Control Publication for
Beginner & Advanced Modeler



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R/C
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SERVICE

VOLUME 5 • NUMBER 2 • THIRTY-FIVE CENTS

MARCH-APRIL-1964

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The new, all new, Quadruplex Mark II is still priced way under the other comparable advertised proportional kits. Consists of transmitter with nicad batteries, receiver with nicad batteries, 3 surface servos 1 motor control servo.

Charger for the above extra 1595

All for only 389.95

FABULOUS PHELPS PULSER KIT

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No. 15411—Phelps Pulsor Kit 28.95

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Carrier cannot be confused as can be done with other super-range equipment, so that CB class D signals are rejected almost as if it were a superhet.

For single channel equipment this is one you can't beat because of the economy offered by super-range equipment, as well as the ease with which it goes together.

Silicon transistors mean a temperature stability of from 0 to 120 degrees. Uses red switch instead of a relay, so that pulsing up to 100 pulses per second is possible! Has provisions on the PC case for adding electronic switching when it is to be used with motors for actuators. These components are not furnished with the kit, but are available separately.

Measures 1 1/2 x 2 1/2 inches. Kit complete with diode and transistors, drilled PC base, instructions, 1/4 watt resistors, capacitors, red switch.

only—19.95

CONTROLAIRE 5 RX. KIT

The Controlaire 5 is a 3 volt relayless all transistorized receiver. The physical specifications on this receiver are: 9 1/2 x 1 1/2 x 1 1/2 inches. Weight, 9 oz. The fact that this receiver does not have any noticeable swamping characteristics differentiates it from many 3 volt receivers. This receiver is very reliable and quite sensitive. The receiver design is excellent for rudder only control, particularly of tiny airplanes such as .010 powered Top Flight Models.

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

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GRID LEAKS AT PLAY

● The Heart of America Contest which was held last year, and which was such a success, has led into something which promises to be even finer, as we hinted in the last issue.

Bill Ong, president of the Kansas City Aero Club, the N.A.A., and local representative of the F.A.A., is working along with Carl Lindsey, our Contest Director. The Heart of America promises to grow into the first Mid-America Regional Championships. We're rather proud that industry cooperation which made the Heart of America Contest possible, has grown such fine fruit.

● On all sides we hear laments about where are the Juniors? To this we feel we must add a few words. We have a letter from friend J. B. Young, who has the following comments: "Presently much is being written about 'where are the many Junior novices of yesteryear?' To me the answer is simple. He takes all of his hard earned savings, and without the help and guidance—that you had and he needs—buys, builds, flies, and 'totals' his first kit. There are more demands on his time than there were years ago. He is discouraged, but not stupid. When he can again afford to try a hobby, he returns to the hobby shop, and for less money buys a different kind of kit. Today you will find him having a ball—slot racing."

While we do not agree entirely with friend J. B., there are areas of considerable improvement on the Junior question that can be done by radio control clubs.

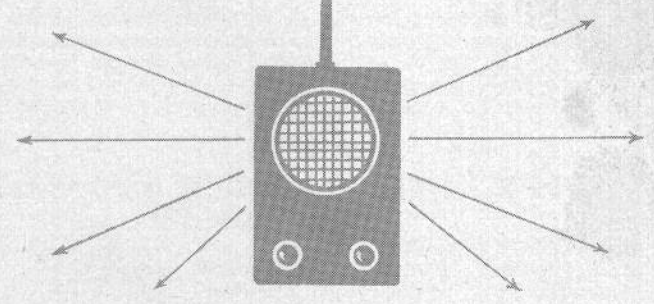
It is very heartwarming, for instance, to pick up the *Beep Sheet*, which is published by the Pittsburgh Arcs, and note that among their accomplishments for 1963 they detail a cooperative venture in which they made an effort to promote model building and flying for boys under 12 years of age. Admittedly some of this was control-line flying, but here is a group that recognizes their future membership will come from some of the modellers that as yet have not spread their wings in any form of modeling. Also, this same club has pictures of their Boy Scout demonstrations. Apparently they are making an effort with their variety club and their various boys' clubs, and are in our opinion, to be highly commended.

The January issue of *Model Aviation* calls attention to the Tri Valley R/C Club of South Bend, Ind. as having the following goals:

(Continued on page 28)

THE MONITOR

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

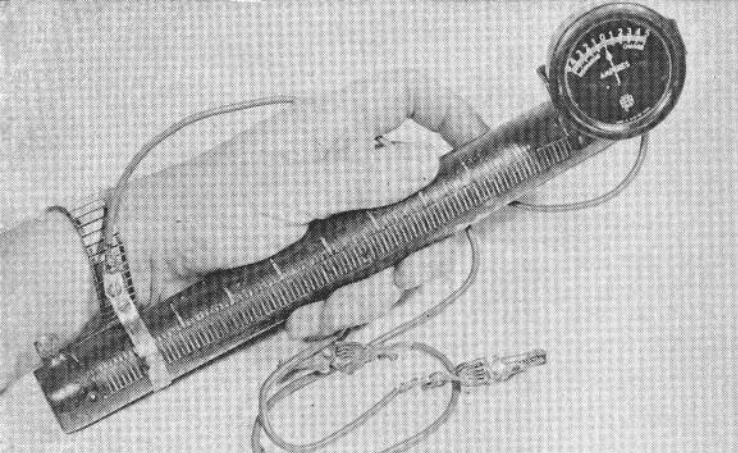


THE BUFFALO BISONS TWO-DAY R/C conference, January 31 and February 1, covered by the editor—Paul hits the Toledo (Weak Signals) and Washington (DC/RC) conferences—was ambitiously planned, and faultlessly executed and well attended. Numerous happy devotees of the black arts, including a couple from California and way stations, and a strong representation from Canada, wandered through the manufacturers' exhibits along the motel ground-floor corridor, a large banquet room where numerous exhibited models vied for prizes, and a smaller room where some highly effective demonstrations always held a ready audience. An afternoon session of the usual talks went by like a high-speed run, thanks to an absorbing informal "panel" on International flying, by our two most experienced crusaders, Bob Dunham and Ed Kazmirski who fielded topics with the naturalness of a couple of TV panel performers. The Bisons were particularly proud that every magazine published in the U.S. had representation—as far as we know a historic first.

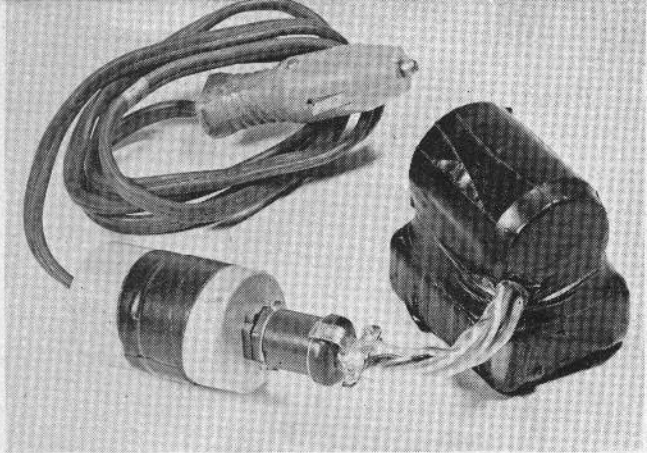
It is to be confessed that one editor viewed the proceedings more as a wide-eyed modeler than as a duty-first rep, leading to such findings that Dunham (Continued on next page)



The Ace- and Grid Leaks-sponsored 1963 Heart of America contest—early morn in this shot—becomes this year the First Annual Mid-American Regional Championships, sponsor Kansas City Aero Club. Aug. 15-16, Richard-Gebaur AFB.



For quick emergency charging of X-mitter batteries at the field, this 200-watt 2-ohm slide resistor with ammeter attached, clips to the car battery. The meter fastens to one lug on resistor. The resistor and meter are in one of the leads between car battery and batteries undergoing charge.



On trips and at contests, the auto cigarette lighter outlet allows charging of sealed cells. The splice box contains a wire resistor whose value is determined by checking with a rheostat. Very important is finding of resistor value with engine at road speeds, since car batteries then have higher voltage.

THE MONITOR...continued

tried and tried to make his celebrated inverted low-level passes with his one-stick proportional rig (he then tried the two stick and was back in business on the first try) because he disturbed the elevators when touching ailerons. (The difference is whether the fin shows grass stains?) With new proportional rigs coming out like apple blossoms in the spring, much talk centered on "prop" with everyone going home more confused than when they arrived as to whether it will be one stick, two sticks or four sticks.

Three rigs were in evidence, the Min-X four-stick (along with the complete line), the Kraft two-stick, and the Orbit two-stick—the latter two informal bureau-top help yourself demonstrations. The one-stick, of course, is most like a real airplane and seems to offer (to hear tell) few problems to the guy getting into multi, but the two-stick is more natural to many people who have rigid think patterns from twiddling four sticks on a reed box. Multiplied to the Nth degree were the arguments over what should be on which stick. GL makes no bets!

Kazmirski held a spell-bound audience with his typical low-key discussion of design, this time his opinions and impressions of international competition jobs. Wind and turbulent air are common in Europe—his Taurus dropped six-feet at a time flying straight out from the transmitter—so that the Europeans build heavy. Fritz Borsch, the German who tied for first with Ralph Brooke, had a 9-pounder on a Super Tigre double BB 56. After the meet Ed got him to fly some demonstration maneuvers, and the ship had the pep to fly effortlessly through vertical eights. Ed's own thinking is that we need a compromise, which would be about 7½ pounds on the .45. (Did he really say .45?)

In the question period, Kazmirski discussed the difference between proportional and reed airplanes with the Taurus, said not to be a good prop ship, as an example. For proportional it would need more dihedral to offer a rock-back tendency against which you could hold stick (which flattered our own secret opinion), and a shorter tail moment, the long-tail Taurus being meant to dampen out the obvious (to judges) elevator corrections. The smoother control of proportional permits a shorter tail. (Locally, our "experts" were saying that proportional should be longer.) On reeds turns necessitate a nearer neutral stability to "stay put." We talked with Ed

about his latest and rather startling developments.

He's a guy who ponders, who does not accept the satisfactory as the ultimate, who visits airports to study real-estate details, or consults with full-scale authorities who have broken ground in fresh areas. Cooking now is a pusher, rather short tailed but quite long nosed, which looks like a jet. This notable experiment is intended to eliminate the varying effects of the slipstream of the nose prop during maneuvers. (This bothers him!) Other R&D work found that a leading-edge sweep makes the best wing, as say 12-inch chord with a six-inch tip chord.

Updating the Orion, pages 4-5, is based on things Ed told us, and on data supplied by Sid Axelrod at Top Flite. While the Orion is too hot for this rusty flier, we do much prefer watching one fly than the Taurus. Since Ed always stresses "penetration" which the Orion had to burn, and at the same time pursued high-drag airfoils in the Taurus and things to come, can't help but wonder whether Ed really has been compromising to make multi easier for the average Joe.

Running proportional a close second at Buffalo were the demonstrations of styrofoam techniques. Ed Izzo and Norm Holland have perfected techniques which made it evident to those who were lucky enough to see the demonstrations that, as Joe Niedermayr stated quite a while ago in the *Montreal Model Bugs* club paper, "Styrofoam, is the Material of the Future." It might be. (Though John Maloney, our good friend from World Engines, wondered—as did some other old stick-and-cement hands—whether it wouldn't be the end of everything.)

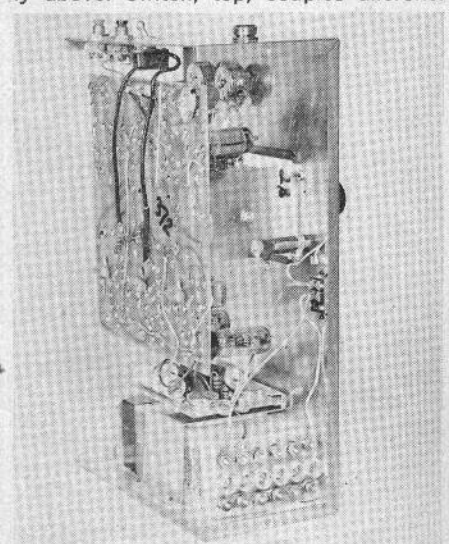
"Foam" has been used many times before but only now promises a breakthrough. GL published (Mar-Apr. '63) two pix of a powered R/C version of those hobby-shop B-70 kites. Hegi's Completa is all foam with wood inserts (July-Aug. '63 GL). Matty Sullivan was talking foam in 1950—in fact, Gordon Light, the two-time Wakefield winner in early thirties, showed us samples during WW-2. During the mid-fifties George Moir, the team race man who went with Duke Fox, had a Carrier job published which used two foam slabs and a full-depth spar for the wing. Aubrey Kochman had a foam fuselage .010 R/C job published. Sterling had a foam ready-to-fly Cox 15 U/C Mustang. If you've taken months to build

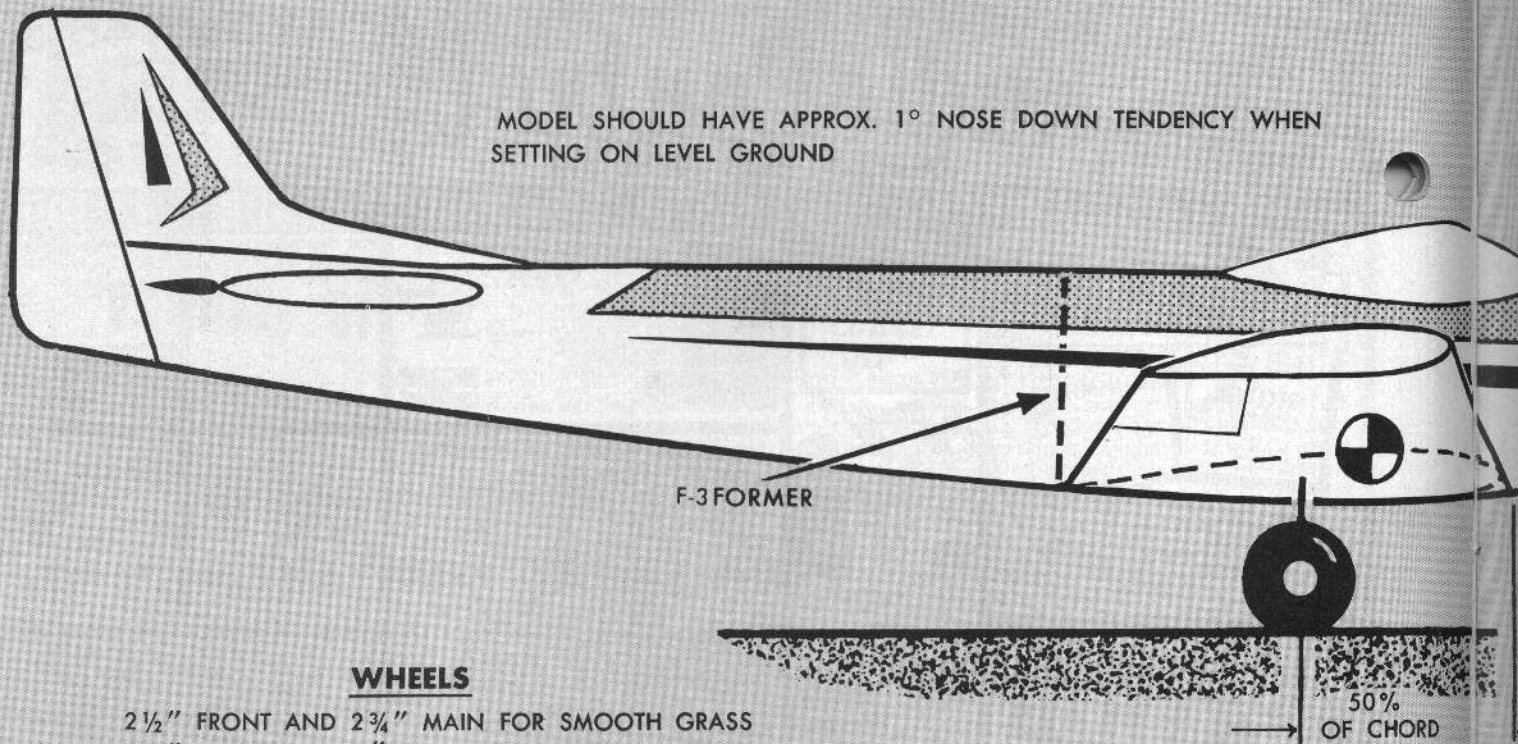
an R/C, you would've been shaken by Isso's demonstration of making a Hustler delta in a matter of minutes.

Ed will be doing a detailed article for MAN. Elsewhere this issue will find a coincidental article from *Montreal Model Bugs* which we've had ready-to-go since mid-1963. Incidentally, Izzo, who builds lovely craft for contest flying, has an 80-inch high-aspect job with a foam wing, root 14 and tip 7. The wing has 860 sq. in. area, weighs 28 ounces (with 1/16th balsa skin, balsa spar inserts and 4-ounce landing gear.)

Another spectacular demonstration (by R. Smith) featured quick vacuum forming of canopies from Tri-Acetate sheet (film base). Several coil (like springs) heating elements in a box, over which a wood frame holding the film was placed until soft (this is easy only if you know the tricks, which we can't give here); then the frame was quickly squeezed down over a male form, in a vacuum box from which air was sucked through small holes by an old vacuum cleaner. Smith also had the styrofoam bit, the principal difference being that he covered it with .0007 film base, first hung up and sprayed with color Krylon, then applied with (we think) Armstrong (Continued on page 31)

Below: Physical arrangement of the Dee-Bee multi-proportional transmitter has PC board mounted on stand-offs. At bottom of case is typical tube-transmitter pack of six nickel cadmiums, converter directly above. Switch, top, couples ailerons.





MODEL SHOULD HAVE APPROX. 1° NOSE DOWN TENDENCY WHEN SETTING ON LEVEL GROUND

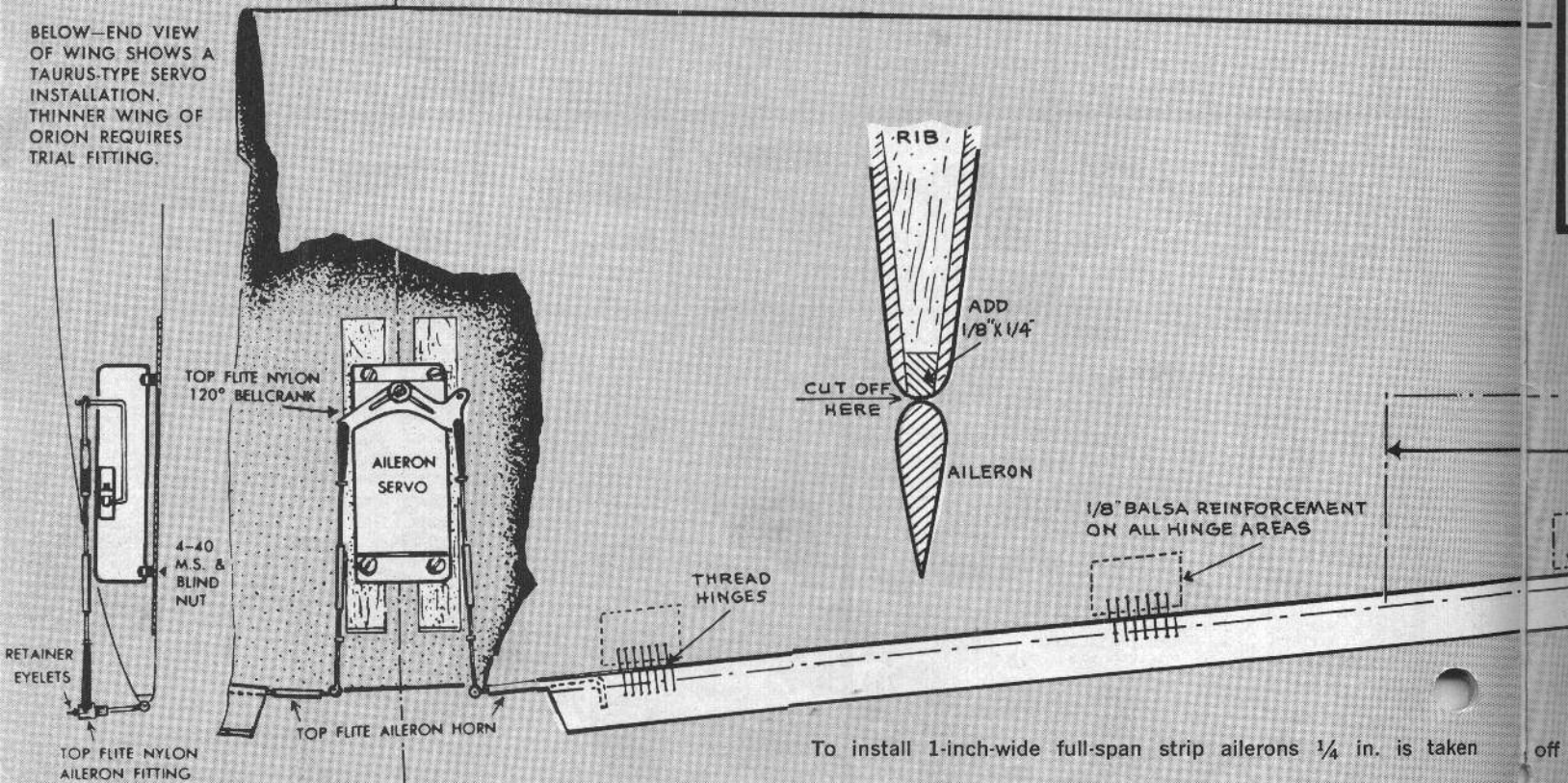
WHEELS

2 1/2" FRONT AND 2 3/4" MAIN FOR SMOOTH GRASS
 2 3/4" FRONT AND 3" MAIN FOR ROUGH GRASS

UPDATING THE ORION

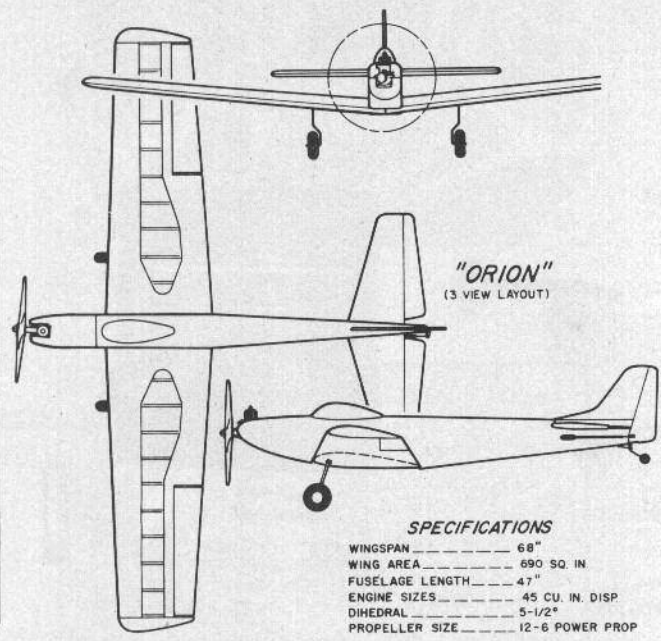
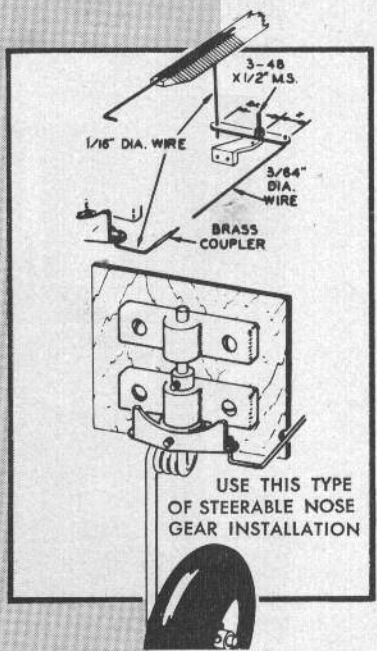
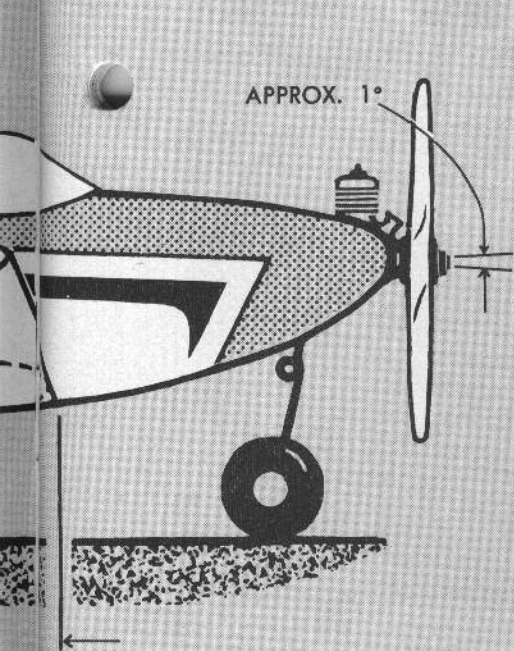
ED KAZMIRSKI, DESIGNER OF THE ORION—WHICH WON THE WORLD'S CHAMPIONSHIP IN 1960—DETAILED FOR GRID LEAKS THESE MODIFICATIONS FOR 1964.

BELOW—END VIEW OF WING SHOWS A TAURUS-TYPE SERVO INSTALLATION. THINNER WING OF ORION REQUIRES TRIAL FITTING.



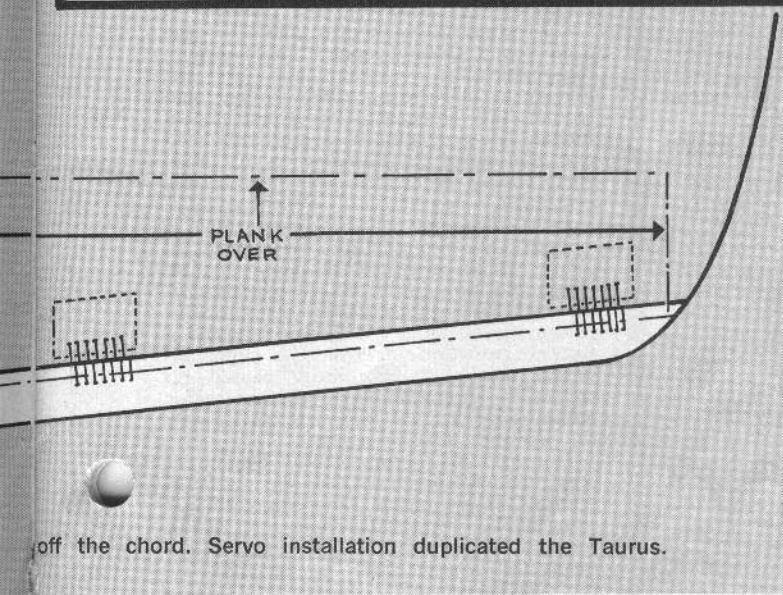
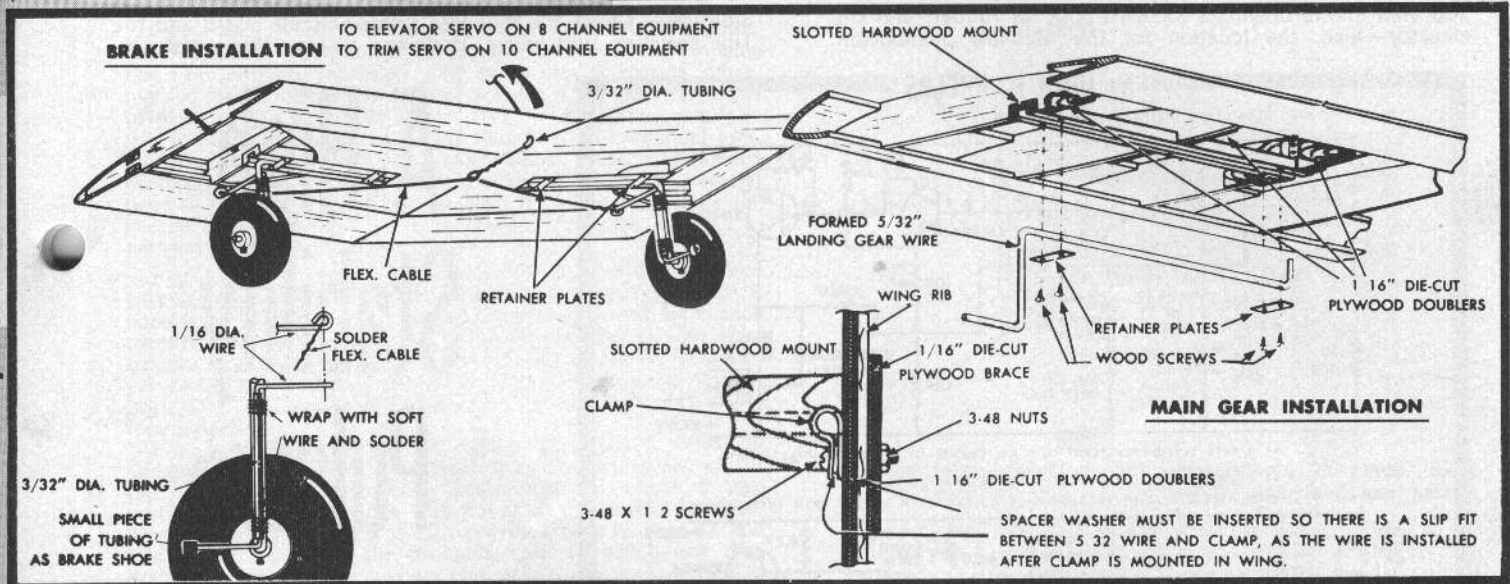
To install 1-inch-wide full-span strip ailerons 1/4 in. is taken off

Below—The standard Orion had wing-mounted two-wheel gear and conventional ailerons. Wing area 690 sq. in., span 68.



SPECIFICATIONS

WINGSPAN	68"
WING AREA	690 SQ. IN.
FUSELAGE LENGTH	47"
ENGINE SIZES	45 CU. IN. DISP.
DIHEDRAL	5-1/2°
PROPELLER SIZE	12-6 POWER PROP.

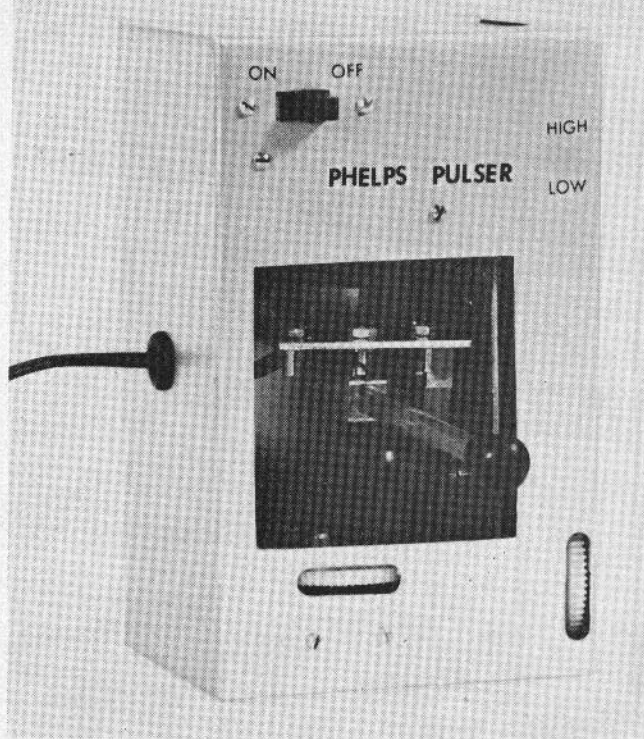


IS THE ORION OBSOLETE? Ever since the less lively Taurus came along, the Orion—the world's best less than four years ago—seems to have fallen into disfavor. The Orion was designed in part to overcome approach accuracy problems with a two-wheel gear and this drag-it-in approach got many into trouble with bungled finals. With trike gear it could be flown on in the now approved manner.

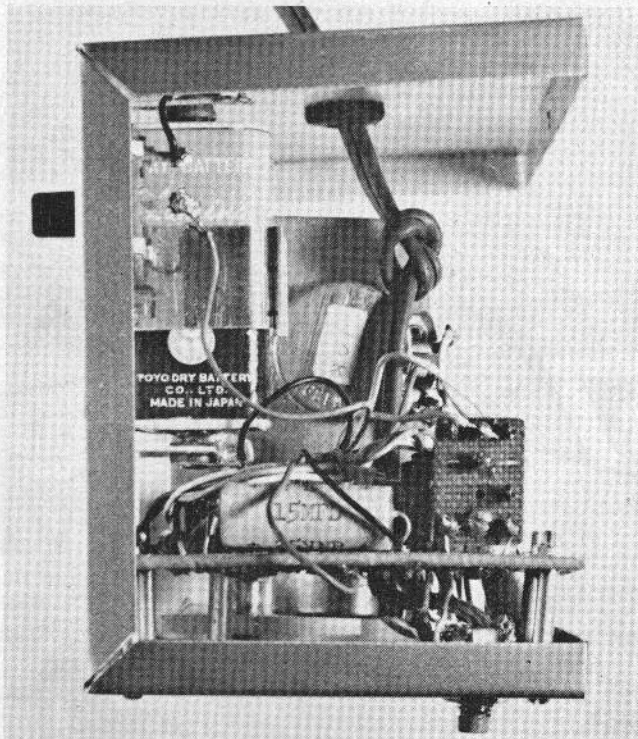
Interviewed by GL, Ed Kazmirski felt that quite an airplane would result if the Orion also was given strip ailerons. With the help of Top Flite's Sid Axelrod who marked up the Orion plans, and by adapting various details from Taurus and Orion kits, GL was able to present this feature.

The Taurus is a reed airplane with long fuselage to dampen out elevator corrections for the judges' eyes, and has dihedral calculated to maintain a smooth turn with reed-type control. The shorter tail moment of the Orion is suited to proportional. Ed thinks it will make a good proportional airplane.

Getting wind of this GL release the trade cleaned out the Orion inventory!



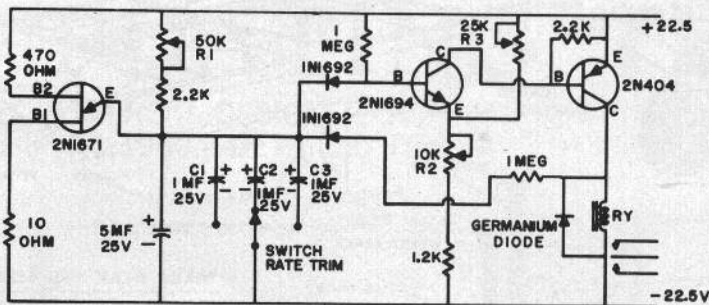
Top view shows openings for trim pots for rudder, and the elevator—also, the location for the high-low pushbutton.



Side view shows the mounted printed-circuit board and the Tini switches protruding. Drawings display the variations.

by JOHN H. PHELPS

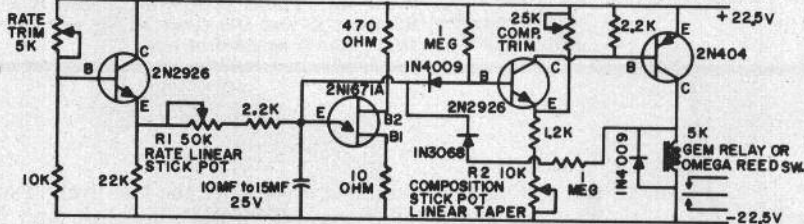
FIGURE 1 HIGH STABILITY, INTERACTION-FREE PULSER



R1 - RATE (FREQUENCY) CONTROL 4:1 CHANGE IN 90° SHAFT ROTATION

R2 - COMPOSITION (DUTY CYCLE) CONTROL 90/10 IN 90°

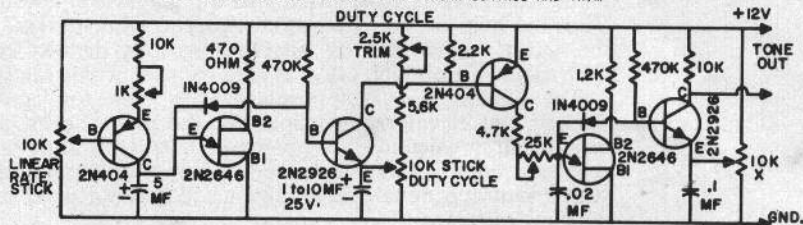
FIGURE 2 HIGH STABILITY, INTERACTION-FREE PULSER WITH SMOOTH TRIM (RATE/COMPOSITION)



BOTH STICK POTS ARE ARRANGED TO TRAVERSE A 90° POT SEGMENT (±45° FROM CENTER). FOR R2, (THIS SEGMENT IS THE LAST 90° OF ITS TRAVEL SO THAT FULL DOWN (STICK FORWARD) REMOVES ALL POT RESISTANCE. RATE TRIM DOES NOT ALTER THE RATIO OF HIGHEST RATE TO LOWEST RATE. IT TRIMS LOW, CENTER AND HIGH RATES EQUALLY. THE TOTAL RATE CHANGE AVAILABLE MAY BE ALTERED BY ROTATION THE STICK POT FROM THE RECOMMENDED POSITION TO DECREASE THE AMOUNT OF RATE CHANGE. THE CHANGE CAN BE INCREASED BY DROPPING THE 2200 OHM SERIES RESISTOR TO 1000 OHM.

THE RATE CAPACITOR C. IN THE RANGE SHOWN, PROVIDES A 4-8 CPS MID RANGE PULSE RATE. AN EXACT VALUE IS NOT GIVEN DUE TO THE WIDE TOLERANCE RANGE ASSOCIATED WITH ELECTROLYTIC CAPACITORS.

FIGURE 3 RELAYLESS KEYED TONE GENERATOR WITH LINEAR CONTROL AND TRIM



X TONE COMPOSITION ADJUST ADJUST FOR 50% DUTY CYCLE TONE. SET AT MID RANGE INITIALLY THE 2N2924 AND THE 2N2926 ARE INTERCHANGEABLE.

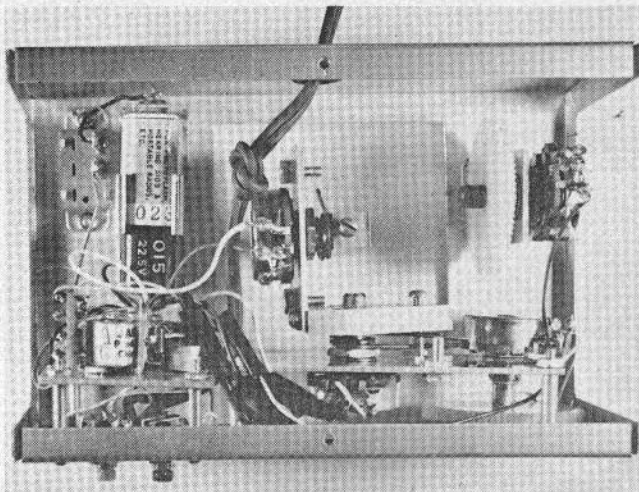
A High Stability Pulsar

SEVERAL YEARS AGO the progress in proportional control indicated the need for a pulser capable of precision, reasonable cost, easy duplication and immunity to drift with battery voltage and temperature changes. The circuit shown in Fig. 1 was developed to meet this need and has, since its introduction in 1959, been widely duplicated with the success hoped for.

In response to requests from users a smooth rate-trim feature was added in 1960, which provided a trim function which did not dilute the effectiveness of the stick function (elevator). This modification proved to be a valuable one and a further reduction in cost. The slight increase in circuit complexity caused no confusion among builders and no major compromise had to be made to achieve the additional feature.

During 1961, 1962 several equipment manufacturers incorporated the essential features of the pulser and both the 1963 Intermediate Nationals champion, Ralph Jackson, and the 1962 winner, Don Dickerson, flew equipment using the pulser as part of the transmitter.

TWO NATIONALS INTERMEDIATE WINNERS USED THIS PULSER, NOTED FOR ITS PRECISION AND IMMUNITY TO DRIFT WITH BATTERY VOLTAGE AND TEMPERATURE CHANGES. HAS AN EXCEPTIONAL TRIM-RATE FEATURE.



Bottom view shows arrangement of protol, mounting of the trim pots. Full-on, full-off switches are under PC board.

Fig. 2 depicts the most generally useful form of the pulser and has added the option of a reed switch for very fast pulsing and near ultimate reliability. One other very important refinement is the use of the new high performance 2N2926 transistors in place of the physically larger 2N1694 units. The pulser in this form is recommended for all so-called single-channel uses, including Kicking Duck, Galloping Ghost, pulse rudder, etc. Since high rate is possible, one may refine existing pulse installations to include feedback servos, with the pulser providing the precise accurate encoding signal needed for such systems to perform at an optimum level.

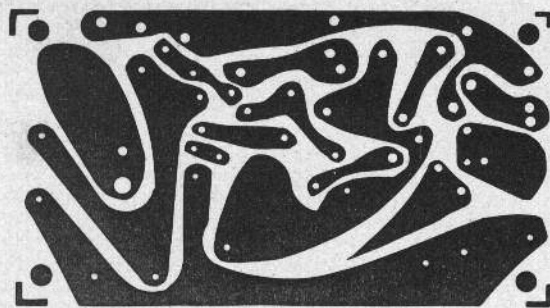
Fig. 3 adds a relayless provision which provides a pulsed tone for application to the modulator of a transmitter. This is considered to be an advanced experimenter's circuit since each transmitter requires judgment for proper installation. The chief benefit of this approach is its suitability to serve advanced relayless feedback servo systems at high pulse rates by providing a very high quality low-interaction encoder with very stable tone frequency.

Fig. 3 also details another option particularly useful in advanced systems. Here a constant current charging source for the timing capacitor forces a linear sawtooth which in turn allows a linear rate change with pot shaft movement. Independent non-interacting trim is also provided as a by-product and this circuit represents the probable limit to which one may desire to carry a simple encoder (pulser).

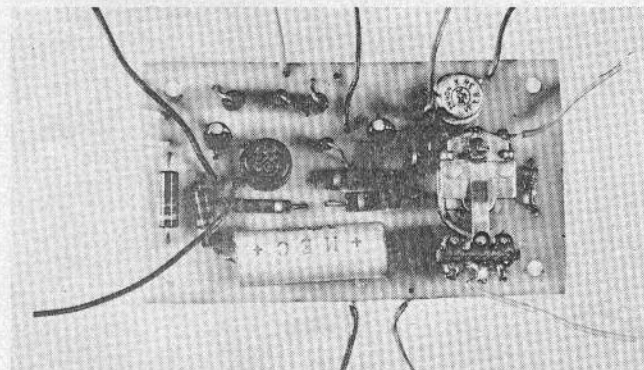
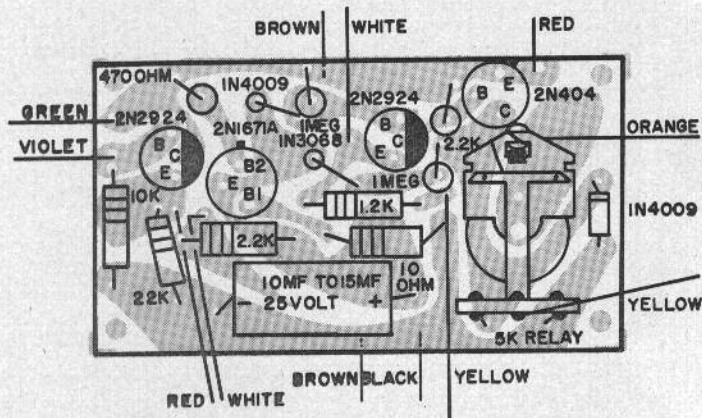
For the advanced experimenter the more sophisticated circuits offer sufficient advantages to make their use desirable. The basic unit in Fig. 2 has been chosen to offer as a kit since it is not only thoroughly proved in field performance but has been built successfully by a large number of individuals without the benefit of kit features.

Common to all versions of the pulser is the section responsible for the generation of the essential waveform, a rectangular wave whose duty-cycle and repetition frequency are variable, independently, as control commands.

The first portion, a unijunction oscillator, furnishes a sawtooth beginning near ground and rising to approximately 12 volts. The frequency or period of the sawtooth is determined by the value of the timing capacitor, C, the intrinsic standoff ratio of the unijunction and the rate (elevator) stick pot setting. Since the period is defined by the relationship among three variables, two of which are predetermined (unijunction transistor characteristics and timing capacitor tolerance) a trim provision of sufficient range is provided to absorb these variables. The elevator stick pot is a standard 270-degree linear taper 25K-ohm pot and should be positioned on the stick assembly so that the moving wiper hits the pot stop with the stick all of the way forward. This position gives the greatest possible frequency change ratio (4:1) for the 80-degree stick travel. Less elevator control can be had (and a lower pulse frequency at center position) by rotating the pot away from this initial adjustment. The two stage high gain squaring amplifier is a NPN PNP direct coupled pair. Both transistors are



ACTUAL SIZE



Printed circuit portion with components in place. Existing installations can be refined to use feedback servos.

turned on and the PNP saturated by the 1-meg resistor to the plus-22 volt rail. The stick pot in the emitter of the 2N2926 (a standard 10K linear taper 270-degree pot) sets a d.c. voltage which determines the voltage level at which the sawtooth turns off the squaring amplifier. The scheme of calling upon the sawtooth only for turn-off duty assures light sawtooth loading (22 micro amperes maximum) and assures low control interaction and exceptional temperature stability. The result of squaring at various voltage levels (determined by the "rudder" stick pot) is a variable duty cycle square wave. Eighty degrees of stick travel changes the duty cycle from 80% on to 20% off, to 20% on to 80% off.

The duty cycle should be set for 50% with the trim pot at center travel and the stick straight up. An ohmmeter connected between the relay armature and either contact (or across the reed relay) will read duty cycle directly as mid-scale deflection (average) for a 50% duty cycle. Shielded cable, with the outer shield connected to both transmitter chassis and the pulser box, is necessary to prevent transmitter RF from creeping into the pulse box and raising hob. Transistor choice and component values team together to guarantee 10-degree F—140-degree F pulser operation. Weak dry batteries are readily exposed by low temperature, so check by cold soaking the battery. Pulsers will stop at a level determined by relay spring tension. Reed relays will stop at a battery voltage of 17 volts so keep a weather-eye on the 22½ volt battery. While an Acme #13 battery box is shown for an O15 battery, one or two paralleled sections of an Eveready No. 455 is recommended for more life.

Transistor substitution should be strictly avoided. The manufacturer's specification for the units chosen form as important a part of pulser designs as the value of passive components.

THE NEW F.C.C. FORM 505

The sample Form 505 reproduced in reduced size on this page has been filled out to guide you when you renew or make application for a Class C station license which permits you to transmit on the approved frequencies for our radio control purposes. Form 505 can be obtained from your District Federal Communications Office (Check phone book under U.S. Government) or Federal Communications Commission, Gettysburg, Pa., 17325, or at Washington 25, D.C.

It is required to have read a current copy of Federal Communications Commission Rules and Regulations—Vol. VI, Part 19, when you send in your filled out form 505. An order blank, with instructions for ordering Vol. VI, Part 19, is part of form 505; fee \$1.25 for "Part 19" if you live in the U.S., or territories, Canada or Mexico; \$1.75 elsewhere. (This fee does not cover your Form 505 application.) "Part 19" includes information as to whether a fee (and amount)

is required with your 505 application. All payments must be made by check or money order to Federal Communications Commission.

The reverse side of Form 505, shown underneath front side, requires of us only that it be signed at bottom where required, and that an appropriate box at bottom be checked to show if individual applicant, etc.

The complete Form 505 then is sent to Federal Communications Commission, Gettysburg, Pa., 17325.

Any U.S. citizen 12 years of age or older may file for a station license for Part C (R/C). When you receive your call sign, it should be posted on your transmitter, and the license should be in your pocket at all times you operate the transmitter.

FCC FORM 505
REVISED MAY 1963

UNITED STATES OF AMERICA
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 2054

FORM APPROVED
BUDGET BUREAU NO. 52-81231-0

**APPLICATION FOR CLASS B, C, OR D STATION LICENSE IN THE
CITIZENS RADIO SERVICE**

DO NOT WRITE IN THIS BLOCK

1. Application for Class A station license must be filed on FCC FORM 400.
2. Complete on typewriter or print clearly.
3. Be sure application is signed and dated. Mail application to Federal Communications Commission, Gettysburg, Pa., 17325.
4. Enclose appropriate fee with application, if required. DO NOT SUBMIT CASH. Make check or money order payable to Federal Communications Commission. (See Part 19, Volume VI of FCC rules to determine whether a fee is required with this application.)

1 NAME OF APPLICANT

BUSINESS NAME (OR LAST NAME, IF AN INDIVIDUAL)
RUNGE

FIRST NAME (IF AN INDIVIDUAL)
PAUL

MIDDLE INITIAL
F.

2 IF AN INDIVIDUAL OPERATING UNDER A TRADE NAME, GIVE INDIVIDUAL NAME, OR IF PARTNERSHIP, LIST NAMES OF PARTNERS (Do not repeat any name used in item 1)

LAST NAMES FIRST NAMES MIDDLE INITIAL

SAMPLE

FOR INFORMATION ONLY

3 MAILING ADDRESS

NUMBER AND STREET
1107 MAIN ST.

CITY
HIGGINSVILLE

STATE
MO.

ZIP CODE COUNTY OR EQUIVALENT SUBDIVISION
64037 LAFAYETTE

4 CLASSIFICATION OF APPLICANT (See instructions)

INDIVIDUAL ASSOCIATION GOVERNMENTAL ENTITY
 PARTNERSHIP CORPORATION OTHER (Specify):

5 CLASS OF STATION (Check only one)

CLASS B CLASS C CLASS D

6 IS THIS APPLICATION TO MODIFY OR RENEW AN EXISTING STATION LICENSE?

YES (Give call sign): NO

7 DO YOU NOW HOLD ANY STATION LICENSE, OTHER THAN THAT COVERED BY ITEM 6, OF THE SAME CLASS AS THAT REQUESTED BY THIS APPLICATION?

YES NO

8 TOTAL NUMBER OF TRANSMITTERS TO BE AUTHORIZED UNDER REQUESTED STATION LICENSE

THREE
(Number)

9 DOES EACH TRANSMITTER TO BE OPERATED APPEAR ON THE COMMISSION'S "RADIO EQUIPMENT LIST, PART C," OR, IF FOR CLASS C OR CLASS D STATIONS, IS IT CRYSTAL-CONTROLLED? (If no, attach detailed description: see subpart C of Part 19)

YES NO

10 A WILL APPLICANT OWN ALL THE RADIO EQUIPMENT? (If no, answer B and C below)

YES NO

B NAME OF OWNER

C IS THE APPLICANT A PARTY TO A WRITTEN LEASE OR OTHER AGREEMENT UNDER WHICH THE OWNERSHIP OR CONTROL WILL BE EXERCISED IN THE SAME MANNER AS IF THE EQUIPMENT WERE OWNED BY THE APPLICANT?

YES NO

11 HAS APPLICANT READ AND UNDERSTOOD THE PROVISIONS OF PART 19, SUBPART D, DEALING WITH PERMISSIBLE COMMUNICATIONS FOR WHICH THIS CLASS OF STATION MAY BE USED?

YES NO

12 WILL THE USE OF THE STATION CONFORM IN ALL RESPECTS WITH THE PERMISSIBLE COMMUNICATIONS AS SET FORTH IN PART 19, SUBPART D?

YES NO

13 WILL THE STATION BE OPERATED BY ANY PERSON OTHER THAN THE APPLICANT, MEMBERS OF HIS IMMEDIATE FAMILY, OR HIS EMPLOYEES? (If yes, attach a separate sheet listing the names and relationship of all such persons and give a detailed reason for their operation of your station)

YES NO

14 IF APPLICANT IS AN INDIVIDUAL OR A PARTNERSHIP, ARE YOU OR ANY OF THE PARTNERS AN ALIEN?

YES NO

15 IS APPLICANT THE REPRESENTATIVE OF ANY ALIEN OR ANY FOREIGN GOVERNMENT? (If yes, explain fully)

YES NO

16 WITHIN 10 YEARS PREVIOUS TO THE DATE OF THIS APPLICATION, HAS THE APPLICANT OR ANY PARTY TO THIS APPLICATION BEEN CONVICTED IN A FEDERAL, STATE, OR LOCAL COURT OF ANY CRIME FOR WHICH THE PENALTY IMPOSED WAS A FINE OF \$500 OR MORE, OR AN IMPRISONMENT OF 6 MONTHS OR MORE? (See instructions. If yes, attach a separate sheet giving details of each such conviction)

YES NO

17 IF APPLICANT IS AN INDIVIDUAL OR A PARTNERSHIP, ARE YOU OR ANY PARTNER LESS THAN 18 YEARS OF AGE (LESS THAN 12 YEARS OF AGE IF FOR CLASS C STATION LICENSE)?

YES NO

18 IF THE PRINCIPAL LOCATION WHERE THE STATION WILL BE USED IS DIFFERENT FROM THE MAILING ADDRESS (ITEM 3), GIVE THAT LOCATION. (DO NOT GIVE POST OFFICE BOX OR RFD NO.)

NUMBER AND STREET
CITY
STATE

IF LOCATION CANNOT BE SPECIFIED BY STREET, CITY, AND STATE, GIVE OTHER DESCRIPTION OF LOCATION

DO NOT WRITE IN THIS BOX
SCREENING Y N
SIGNATURE Y N

SIGN AND DATE THE APPLICATION ON REVERSE SIDE

CANT IS AN UNINCORPORATED ASSOCIATION. ANSWER THE FOLLOWING ITEMS:

	YES	NO
IS THE APPLICANT OR DIRECTOR OF THE ASSOCIATION AN ALIEN?		
DOES ANY ONE-FIFTH OF THE VOTING MEMBERS OF THE ASSOCIATION OR REPRESENTATIVES OF ALIENS, FOREIGN GOVERNMENTS OR CORPORATIONS ORGANIZED UNDER THE LAWS OF A FOREIGN COUNTRY?		
IS THE ASSOCIATION DIRECTLY OR INDIRECTLY CONTROLLED BY ANY ALIEN? (If yes, give detailed explanation)		
ANY ADDITIONAL INFORMATION OR REMARKS		

FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND IMPRISONMENT. U.S. CODE, TITLE 18, SECTION 1001.

ALL INFORMATION FURNISHED HEREON IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE. DATE 10-15-2009 BY 60322 UCBAW

ent copy of Part 19 of the Commission's rules governing the exercise as against the regulatory power of the United States of the Federal Communications Commission. No person shall be authorized to operate any radio station licensed to him pursuant to the present rules of the Federal Communications Commission unless he has in his possession a copy of the present rules of the Federal Communications Commission. The Commission reserves the right to take such measures as it may deem necessary to prevent its use by unauthorized persons.

The statements in this application are true, complete, and correct to the best of my knowledge and belief and are made in good faith.

DO NOT OPERATE UNTIL YOU HAVE YOUR OWN LICENSE. USE OF ANY CALL SIGN NOT YOUR OWN IS PROHIBITED.

SIGNATURE: Paul Runge DATE SIGNED: 10-21-63
(Check appropriate box below):
 INDIVIDUAL APPLICANT MEMBER OF APPLICANT PARTNERSHIP OFFICER OF APPLICANT CORPORATION OR ASSOCIATION OFFICIAL OF GOVERNMENTAL ENTITY



TOLEDO!

Weak Signals Conference

New products abound at Toledo. Top Flite's Six Axelrod is holding podded twin-engine pusher, left, above. The World Wide booth shown is typical of more than 30 exhibitions.



Two twins, a Jenny, a scale Fokker Triplane, Tri-Squire, and a multi-stunter suggest variety of modelers' display.



Trends? Who knows? In this small corner of display note three biplanes, a Mustang. Conference held Feb. 29—Mar. 1.

by PAUL RUNGE

WE WERE IMPRESSED. That's a commonplace word, and possibly trite, but it covers the situation. Other words might not do this impressive event true justice.

We have attended "conferences" over the years, and had tended to feel that the Toledo shindig was just more of the same. Friends McEntee, Schroder, deBolt and many others insisted that this affair was different—and finally succeeded in twisting our arm enough to make us schedule this one instead of the Trade Show of the HIAA in Chicago earlier in the month of March. We're glad they did.

The similarity implied by the word

"conference" to other affairs of this nature we have attended over the past few years, proved purely imaginary. The only similarity is in the name!

When you have realized that this is a "conference" unlike any other, you can sort your thoughts. In reality the Toledo affair is a combination symposium and trade show. It is like a 30-ring circus with all events happening at once.

Anyone attending this conference for the first time will probably be engulfed in the "how come" of this event now in its tenth year. Why should this Mid-Winter Conference have the power to attract increasing crowds year after year? Why should the Weak Signals now be faced with the problem of "where do we go from here?" for 1965?

This year over 1300 R/C fans registered as attendees. This almost doubles the 1963

crowd. This is *excluding* the ladies and children present. More than 30 manufacturers and jobbers had tables in the big Champion Spark Plug Hangar to show off their wares. The conference program included top names like Kazmirski, Sampey, Brett, Kirkland—and so on. While these names might be an adequate attraction in themselves, there was a basic ingredient in the success recipe used by the Weak Signals group that seemed to make this affair so different.

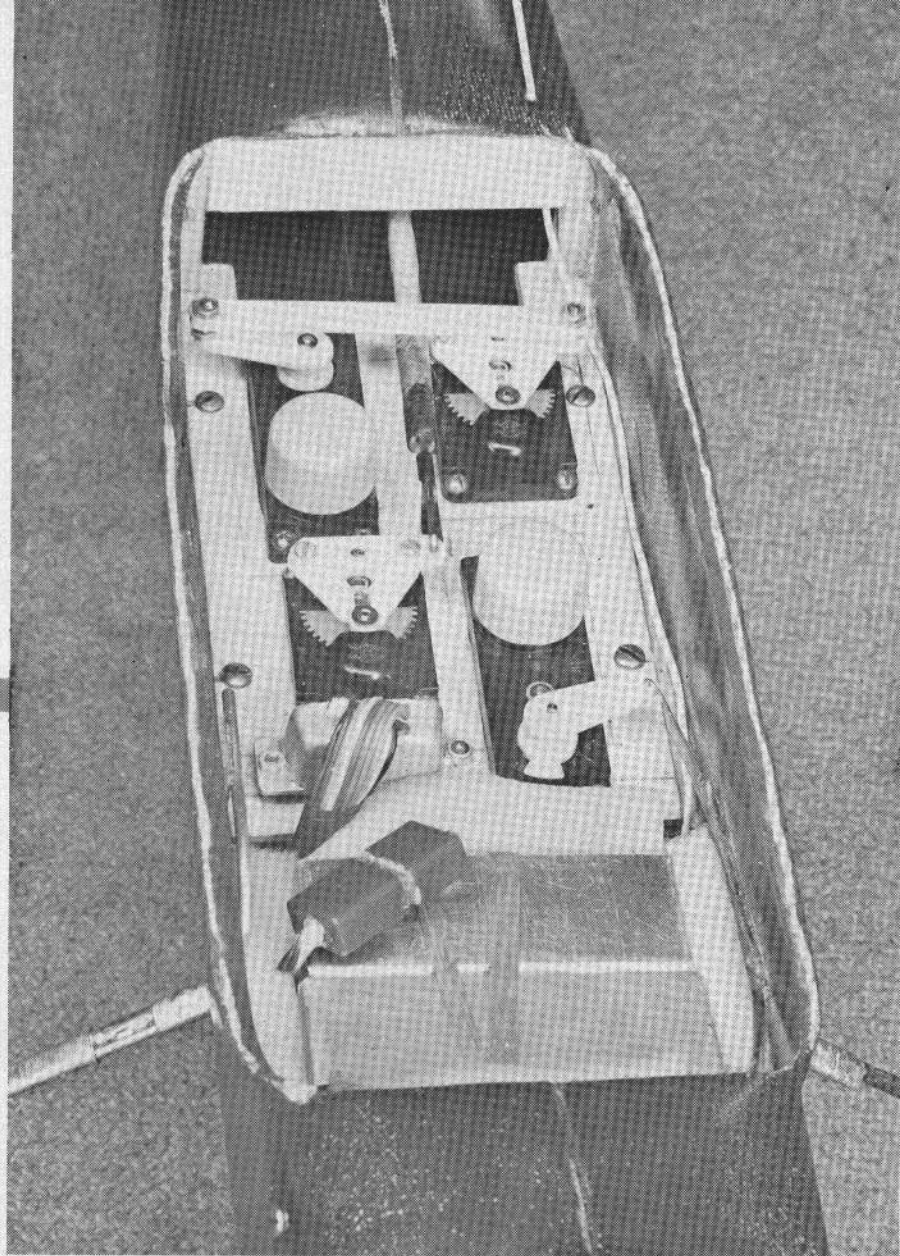
Anyone who deals with satisfying the demands of the public is interested in such reaction—or should be. The Toledo conference provides an excellent opportunity for the manufacturer to meet his ultimate customers face to face. Bobbie and I relished the comments—yes, even the criticisms—because they put us in touch with those we have to satisfy. We believe that

Right: The ultra-compact installation of four Bellamatic servos in a 54-in. Class I or Class II plane of a molded fiberglass construction developed by the author. Elevator pushrod was not in place in this picture. Positionable servo for motor control operates the throttle on the side-mounted Cox .15.

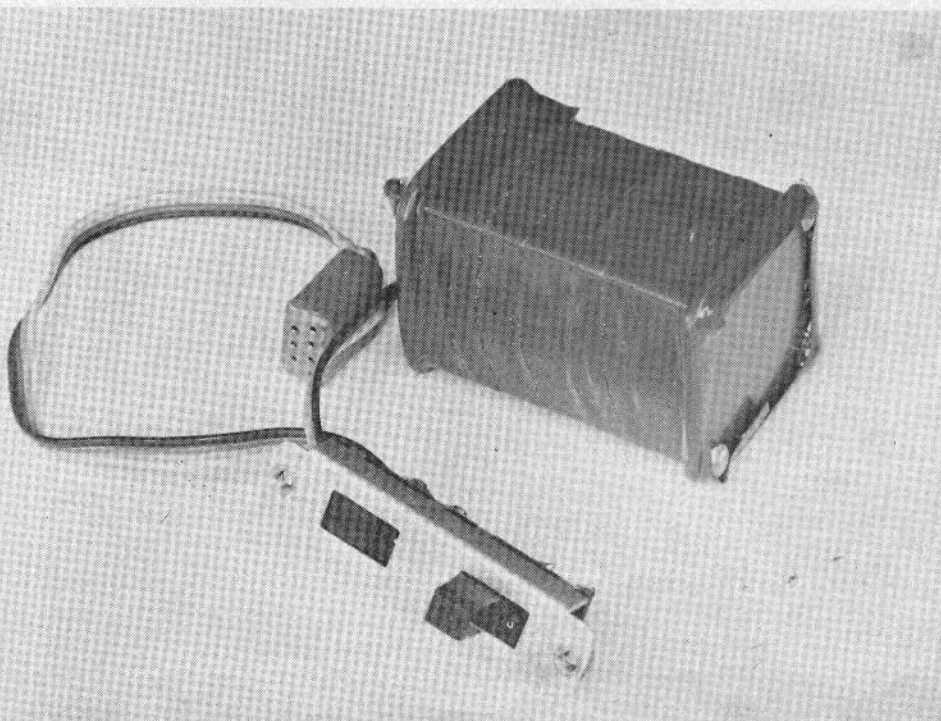
Below: A taped nickel-cadmium battery pack with 4-pole slide switch and the connector. Blind nuts in switch ears allow inside mounting via two screws through fuselage side. Weight of the plane is only $3\frac{1}{4}$ to $3\frac{3}{4}$ pounds, depending on the installed radio gear.

by DICK JANSSON

Thanks to new proportional, four- and six-channel reed rigs, servos have come into their own in Classes I and II. Three installations may inspire your dream project.



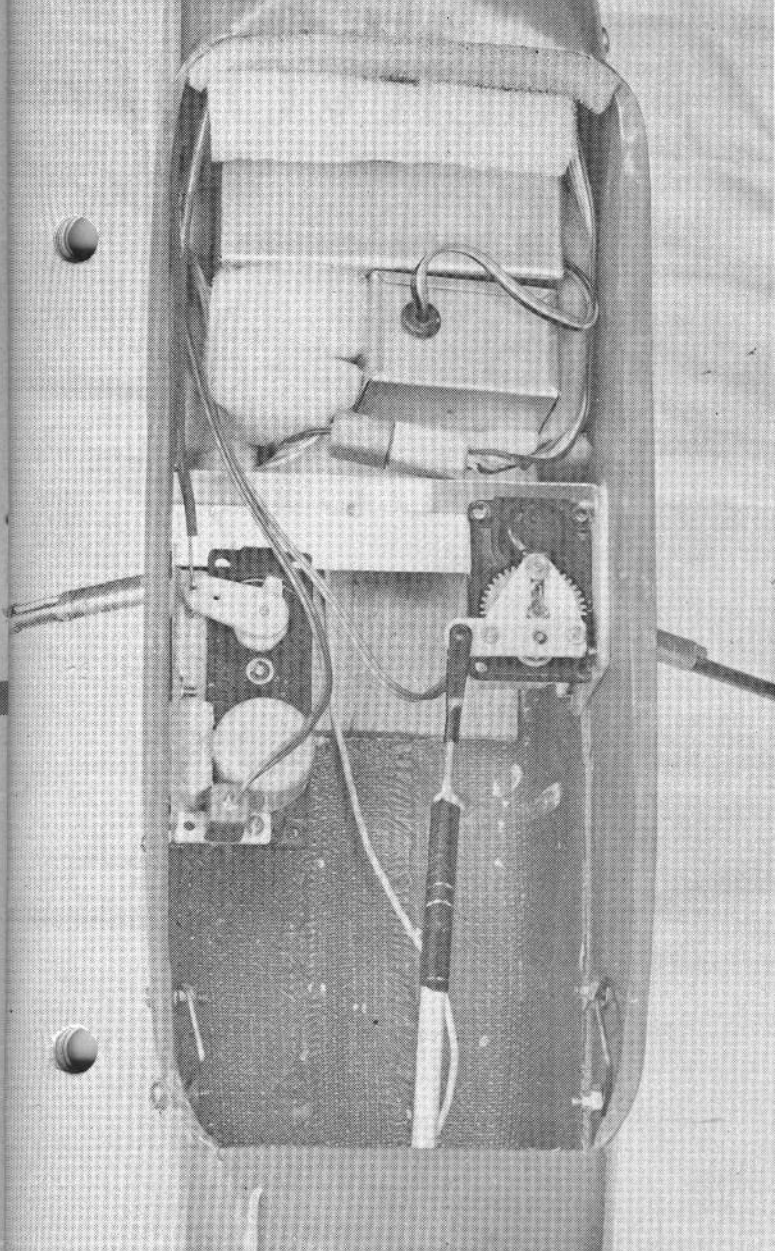
Class II—Four servos on reeds.



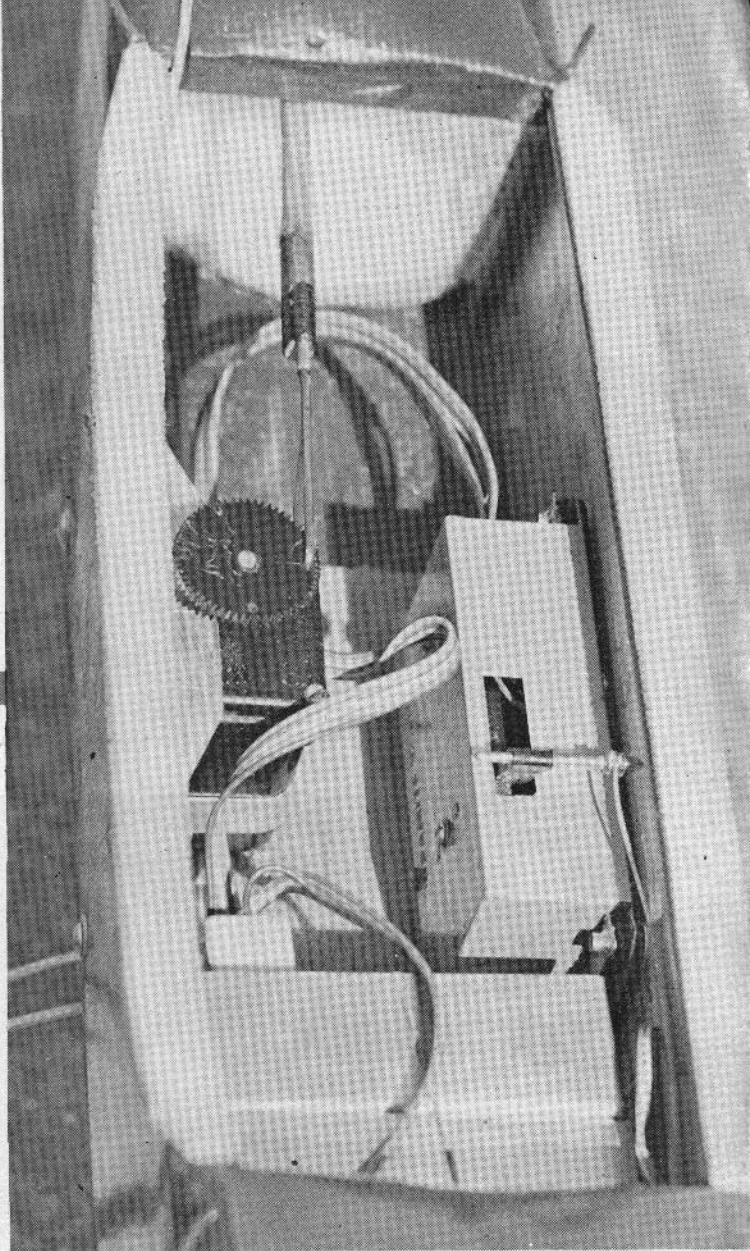
... SERVO M

■ THERE HAVE BEEN SEVERAL very fine articles in the last few years on the subject of equipment installation. GRID LEAKS, Volume 4, No. 3 and 4, May-June and July-August 1963, presented such articles. Installation methods are, however, as numerous as the number of active R/C modelers. Presented here are some installations to be considered as more fuel for the fire. While not new, they may help other modelers generate their own ideas.

Fig. 1 illustrates a method commonly used by Class III modelers, where there are numerous servos to be installed. Hardwood rails are bonded to the fuselage sides and a removable platform mounts the servos, amplifiers (not shown here, they are on the underside), and a connector. Note the engine servo, lower right, connects to a flexible cable passing through a $3/32$ O.D. tube to the throttle (not



Class I—Two servos on reeds.



Class I—Feedback proportional.

MOUNTING SUGGESTIONS...

shown). Flexible cable methods such as this allow considerable freedom and space saving in the area of receiver placement.

Radio equipment used in these installations is simply supported with soft pieces of foam, constrained by the fuselage sides and bulkheads.

Fig. 2 shows a tape wrapped stack of nickel-cadmium cells with an attached cable, switch and connector. The battery is foam-stuffed into the forward section of the fuselage, while the four-pole slide switch has blind nuts attached to the mounting ears. This permits the switch to be installed from the inside of the fuselage shell with just two screws, and the switch handle on the outside.

Finding that the rail-platform servo mounting method was excessively heavy, the servos were modified by epoxy cement-

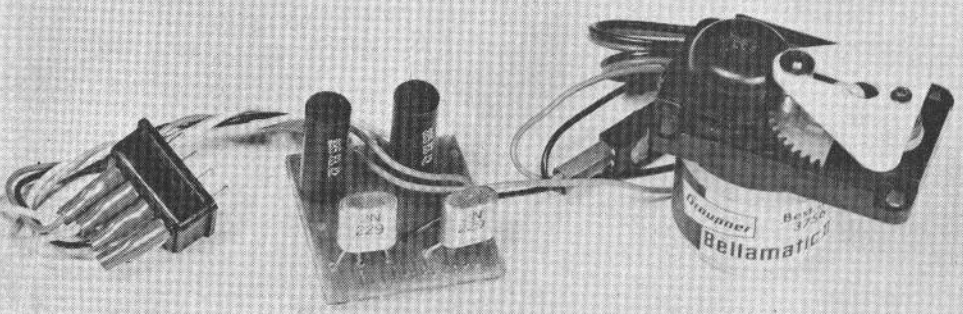
ing a 1/16-inch plastic side plate to each for separate mounting, Fig. 3. Blind nuts are attached to each side plate allowing mounting of the servos directly to the fuselage sides. Attached to each servo is a small connector with the cable running to the equipment case containing the servo amplifiers. Resultant weight savings were quite significant, utilizing the inherent fuselage shell strength without added structure.

Fig. 4 illustrates the above mounting method with the proportional servos mentioned in my article, "Superhet Receivers and Control Systems" in GRID LEAKS, Volume 4, No. 3, May-June 1963. In this case, the servos have their power cables routed to connectors mounted on one of the servo decoder units. Mounting of the feedback rudder servo was accomplished by fabricating a thin gauge aluminum bracket.

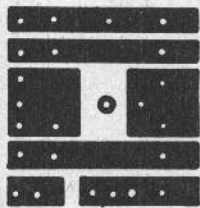
Above: Proportional servos for rudder and engine described in author's May-June 1963 article on Superhet Receivers and Control Systems. Feedback rudder servo mounted on a thin-gauge aluminum bracket. Ship designed to take a two- or three-wheel landing gear.

Top, left: In this four-channel set-up the weight of the rail-platform arrangement was effectively reduced by epoxy cementing 1/16-in. plastic side plate to each servo for an individual mounting. Blind nuts permit fastening each servo direct to a fuselage wall.

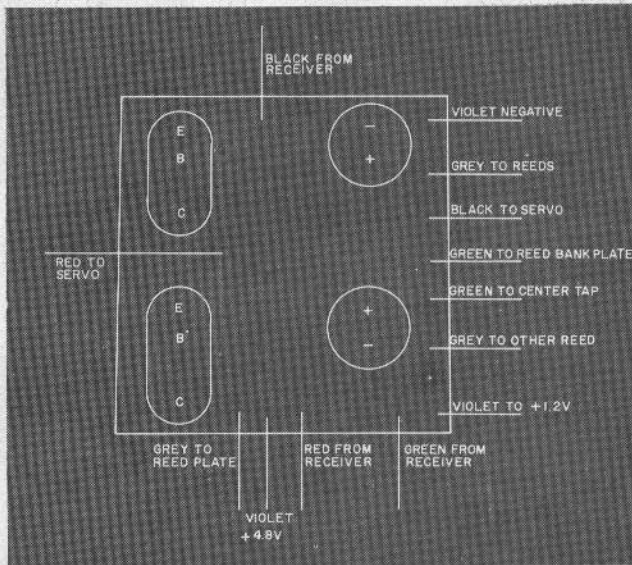
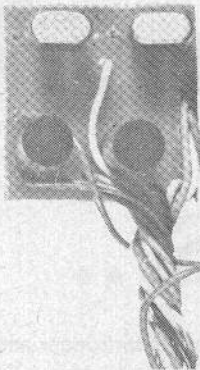
SERVO FOR HALF-A MULTI



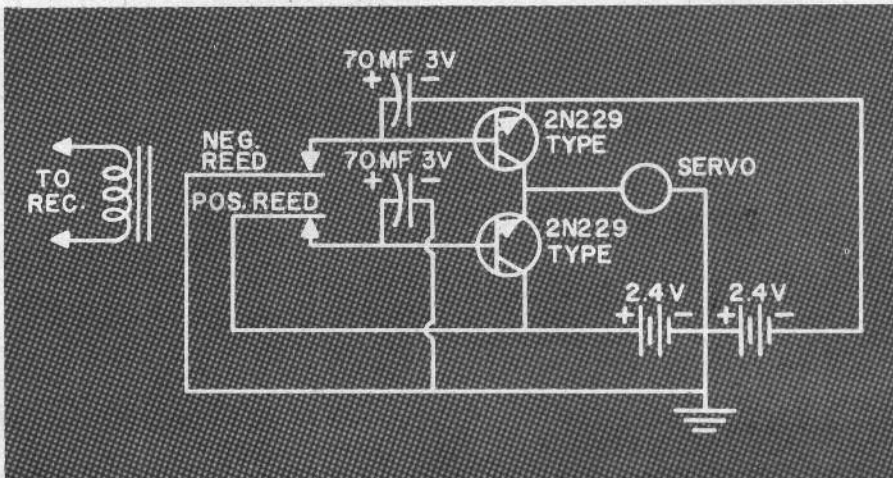
The finished servo amplifier is shown wired to plug and the Bellamatic servo. The small size of the amplifier evident by comparison with connector.



Amplifier PC Board shown full size.



Printed circuit board shows a + 1.2 volt input and a green receiver output. This was used with a tube detector receiver. For all transistor receivers simply ignore these leads.



■ WITH THE ADVENT of the intriguing Schoolmaster Kit by Top Flite, and the announcement by several manufacturers of light, small, six-channel equipment, there is great interest in small, light-weight relayless servos.

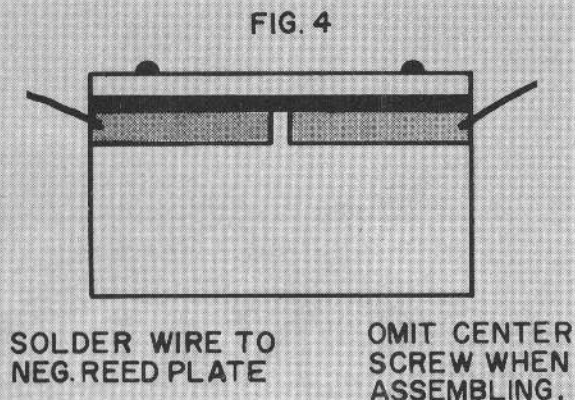
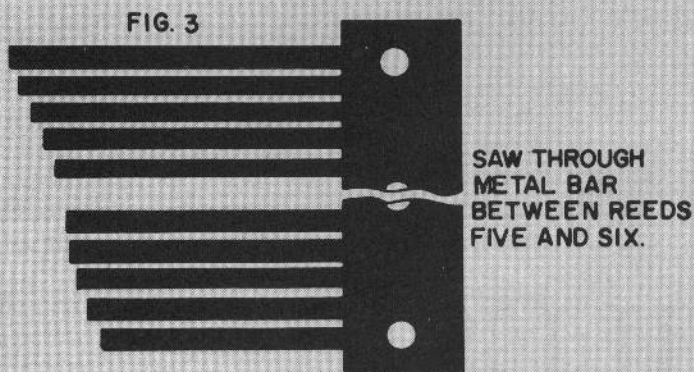
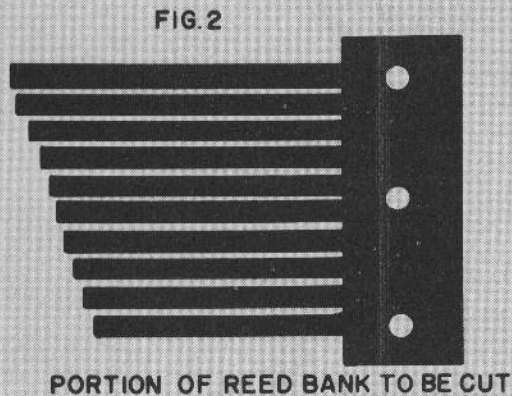
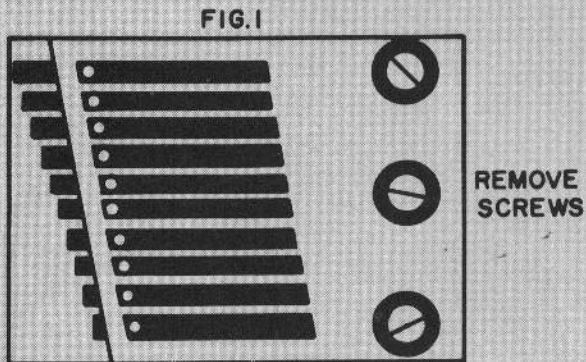
The Bellamatic II by Graupner can easily be converted to relayless type of operation with a very simple servo amplifier. This article will not detail construction, but gives useful hints. This amplifier circuit must be used with a split-type reedbank, since to function effectively each one of the two commanded reeds for each servo must come with different polarities. Reedbanks generally available today lend themselves very well to such splitting.

Fig. 1 through 4 show a Medco 10-channel reedbank and the process required to split it. Use ordinary care in disassembling your reedbank in making the modification, and the same care in reassembly, and you should experience no difficulty.

A full-size printed circuit base is given so that you can make one of these amplifiers for each of the Bellamatics that you propose to use. It is feasible to use one of the reeds to actuate a relay which in turn actuates a three-position motor control escapement. Thus you would only use five of the six reeds.

This type of PC base lends itself to the X-Acto knife method. Place a straight edge on the copper and cut with the knife, bearing down hard and evenly. Move the straight edge over for the correct width and repeat, then strip off the copper in between. The knife point may be used to begin the peel of the copper away at the edge of the board. Pulling it off will be easy if an even easy motion is used.

GRID LEAKS contributor Richard Jansson mentions the fact that a 15-ohm resistor put across the motor of the Bellamatic will nullify the tendency for this particular device to swing past neutral on return from either extreme. A hint from the *Zephyr* has a No. 43 pilot lamp put in series with the Bellamatic. The *Zephyr* states: "Due to variations in the clutch system in the servos, these motors can sometimes be loaded quite a bit at the end of servo travel and draw fairly large amounts of current. With the #43 lamp in series with the motor, the lamp does not light during normal operation of the servo, and the resistance of the bulb remains low. However, if the servo starts to draw more current, the lamp lights, the resistance goes up, and the current will be limited to a maximum of 300 MA. The rated bulb life is 3000 hours, so it could be expected to outlast many airplanes. A PR2 flashlight bulb may also be used; however, its rated life is only 15 hours."



THE KR-31 CHALLENGER

by Jim Dean

As you will note, the wings of my KR-31 are KR-34 wings, that is, the ailerons are on the bottom wing only. The 1931 Challenger had ailerons on both top and bottom wings with a connecting, actuating strut directly to the rear of the main wing strut. The balance of the ship—the OX-5 version—is all KR-31.

The photo with the bare nose is the 1934 version minus the dummy engine, although the cylinder spotting holes may be seen. Here, too, the '31 landing gear is used. I haven't got around to building the '34 radial engine and split-axle landing gear. Since the airplane is made with removable units—wings, tail, landing gear and engine—and is gum-banded together, it is a simple matter to have the '31 and '34 in one model. The ship is built 1" to the 1'. This makes for a 30-in. span.

Length is 21 $\frac{7}{8}$ in. for the KR-31, 21 $\frac{5}{8}$ for the KR-34. Wing area is about 294 sq. in. Weight is 16 $\frac{1}{2}$ oz. for the '31, 16 for the '34. Power, respectively, is a well worn Cub .049 and a Babe Bee .049. Outlines are scale and that includes the tail surfaces and landing gear. Structure is as near scale as practical. Prop would be scale if some manufacturer had a 1"-to-1' OX-5 version of 4-in. pitch. The model has been flown on a Tornado 8 x 4.

The radio gear is the K3VK and three 500-ma nickel cads with a dropping resistor give a peak voltage of 3.5V. The actuator is scratch-built magnetic, wound to 25 ohms on each coil. Ship is Prop RO with switcher unit. Flying speed is about scale, safely turning either direction; can be spiraled down. Covering is dark blue silk on fuselage, yellow wings and stab, clear doped. (Editor's Note: Jim pleads, don't ask for plans!)

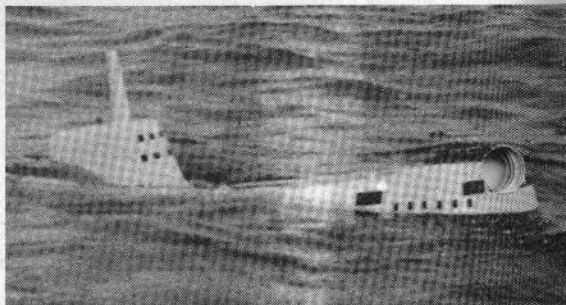




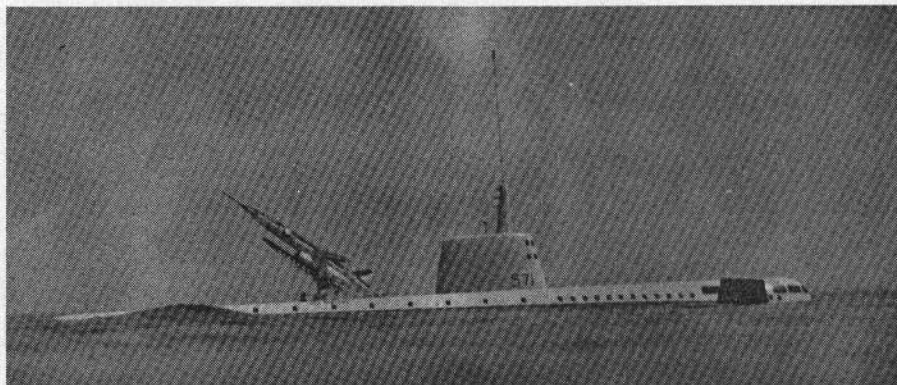
The author and the 56-in. model. It has a beam of 5¼ in., weighs 31 lbs. Hull is constructed from white-pine laminations.

U.S.S. NAUTILUS

By **BROTHER OTTO S.D.S.** . . . Submarine fans will appreciate this study of a successful missile-firing and diving craft. Water ballast can be pumped in or out. And the designer did it all the hard way with single-channel radio, stepping nine channels.

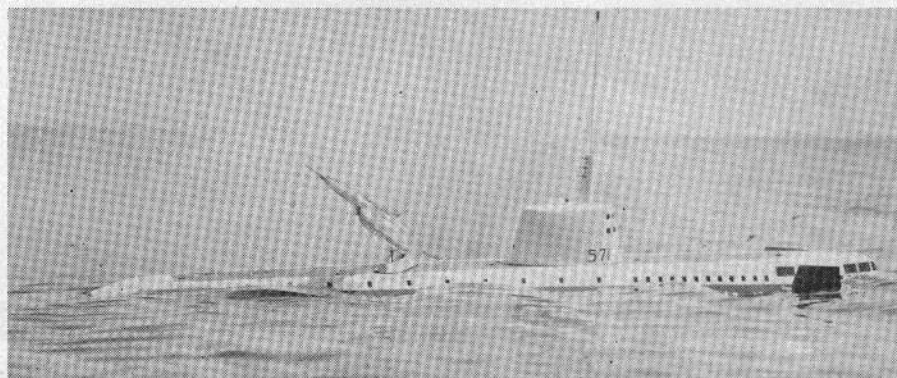


What looks like surfacing operation is case of slight mistrim, says designer.



Missile is plastic Regulus mounted on a rotating ramp. Rocket uses a home-made mixture of potassium nitrate and sugar.

Below: Regulus leaps from launcher in a cloud of spray. A safety cam prevents missile misfiring directly fore or aft.



■ WHEN THE U.S.S. NAUTILUS was launched in January, 1954, a new era began that revolutionized naval warfare. Here was a vessel at home in its true element, probing the three-dimensional depths with almost unlimited range. The performance and reliability of this new sea craft electrified submariners the world over. It has fired new interest into the hobby, model submarine building, and no wonder.

For model submarines have many desirable features. When compared with surface vessels, weight of equipment is no problem. In fact, lead ballast must be added for proper stability. This gives the modeler plenty of room for experimenting with mechanical and electrical devices and, too, since submarines operate in two mediums, the R/C fan has an added realism at the helm of his transmitter. For the avid model builder whose next craft may be a submarine, these pictures, descriptions, and illustrations will be a little help in boosting his project and in seeing it to a successful finish.

The model *Nautilus* is 56" long, has a 5¼" beam and weighs 31 lbs. fully loaded. Its tanks, both fore and aft, take on 2 lbs. and 1½ lbs. of water respectively, and less than a minute is required to pump them dry. A home-made stepper switch provides for nine channels to give these operations: right rudder, left rudder, on,

off, slow, fast, pump, reverse, dive, and missile. The Ace Kraft Audio single-channel transmitter was fitted with a telephone dial for pulsing these circuits.

The plans were enlarged seven times and modified from the original plans in the May, 1954 issue of *Mechanics Illustrated*. Torpedo tubes were drilled for realism and as a means of flooding the tanks. And finally, a live missile was mounted on deck to be swiveled and fired off either side. Before we take you out for a cruise, let's go over construction and controlling.

The hull is constructed of $\frac{3}{4}$ " white pine planks with a $\frac{1}{4}$ " mahogany plywood deck. Its interior was precut with a saber saw, lamination by lamination, then clamped and glued in sections for alignment of walls and corners. This saved a lot of tedious work by having the propeller shafts, planes and rudder axis aligned and drilled before the contour carving of its exterior. The torpedo tubes were also drilled while in the block stage. The $\frac{1}{4}$ -in. Allen cap, tie-down bolts are spaced 9 inches apart and reinforced with oak bulkheads for a secure clamping pressure. There is a lot of pressure applied here, so a brass washer was inserted between the laminations to prevent the bolts from tearing through. This phase of construction should be the point of no return, for if you don't have the strength to make a good seal for the top, you will wind up with a leaky boat.

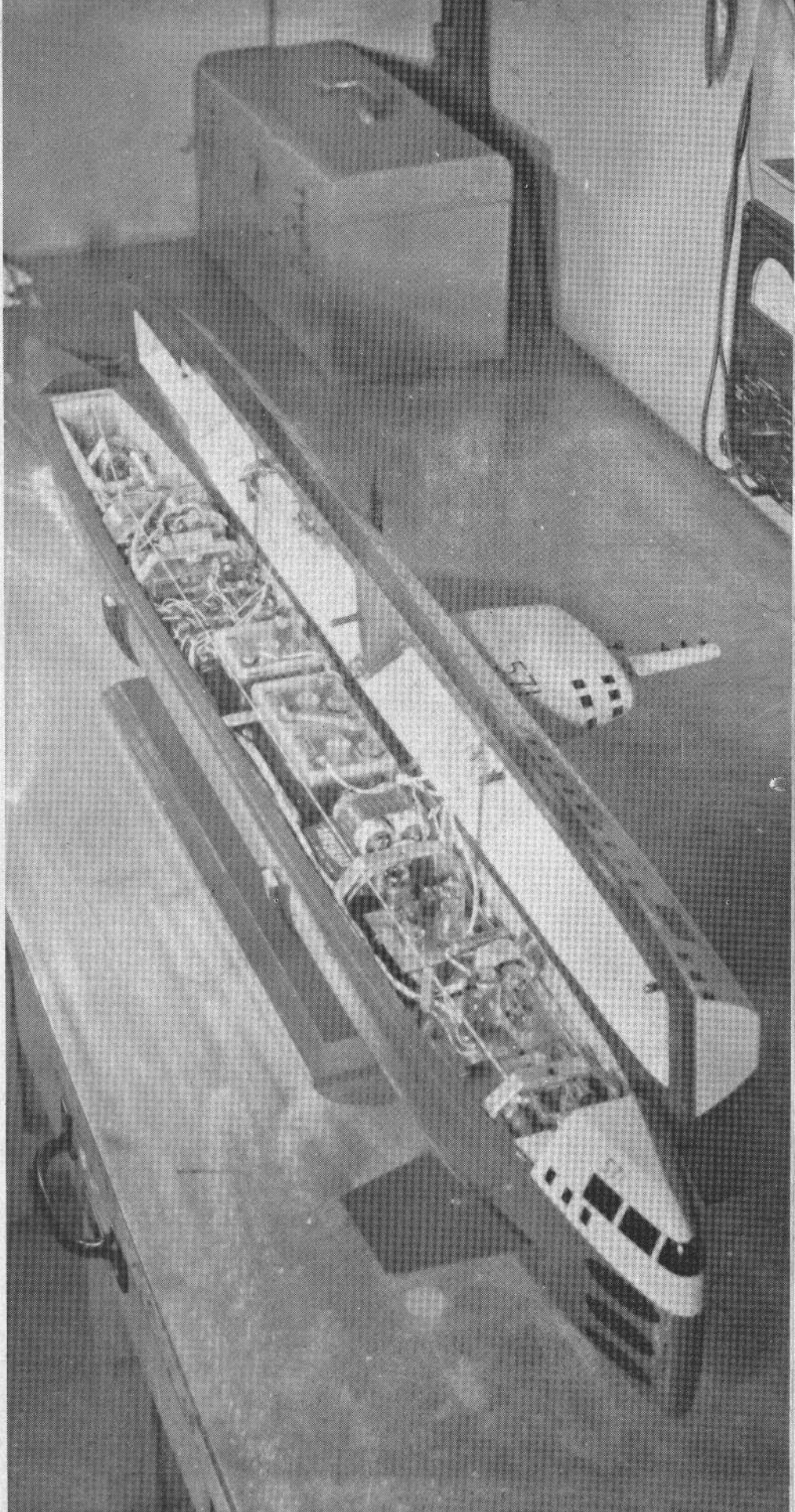
Before carving the exterior the gasket is installed for matching the contour of its sides. The photos show a flat sponge-rubber gasket for the seal, but after several trial runs this proved to be a leaky seal. It wasn't until after several other types were tried that the $\frac{1}{8}$ " round rubber worked the best. It was glued in a $\frac{1}{16}$ -in. groove in the lid, and lubricated with a thin film of vaseline for a good watertight seal. By using $\frac{5}{32}$ " x $\frac{1}{2}$ " U-bar bulkheads as the tie-down nuts, more room is provided for the gear. These are secured to the sides and they provide lateral strength to the hull.

The sail was hollowed out to house a DPST switch for the A battery and power supply. Wax was used for sealing it to the deck since it could be detached. It also housed a $\frac{1}{4}$ -in. tube for venting the tanks.

The tanks are made of #22 gauge galvanized sheet iron and were designed to form to the contour of the interior for maximum volume. A tube under the batteries connects the fore and aft tanks and the equalizing vent tube runs along side of them. Thus, both tanks were vented out through the sail to the mast ports. Since the surface trim of the deck slopes toward the stern a greater volume of water had to be taken in the fore tanks for submerging trim. The calculations for these volumes were on a trial by error basis with sheet lead added or subtracted for compensating the trim.

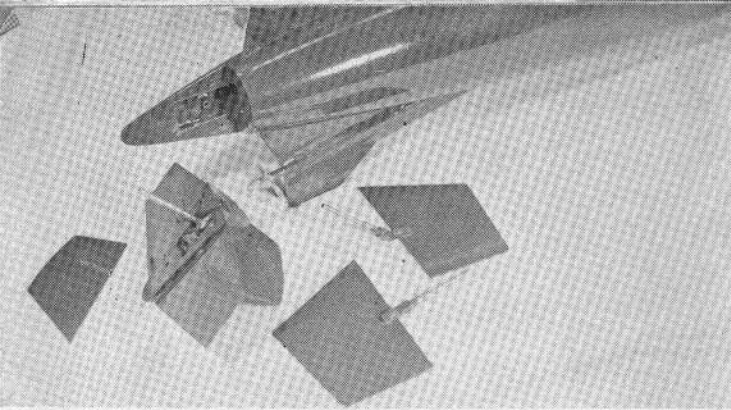
The two #9002B Pittman motors with a 2:1 ratio reduction gear drive counter rotating 2-in. nylon propellers. They draw 4 amperes at full speed and $2\frac{1}{2}$ amperes at slow speed. The power supply is a 6-volt ER-25-6 surplus Signal Corps storage battery. The plates were pulled from the cells, sawed off and refitted in the shortened cell box and then resealed. There's plenty of power in them too. The modified battery has about an 11 amp/hr capacity, and there is a full afternoon of cruising with them on one charge.

The prop shafts are $\frac{1}{8}$ " steel mounted in a $\frac{1}{4}$ " O.D. tube with a brass bearing bushing inserted in both ends. A light jelly-like grease was filled in between the bushings for (Continued on next page)

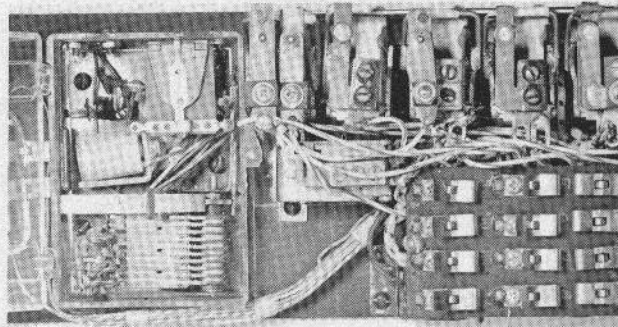


Deck folded back reveals an interior amidships. Seal is $\frac{1}{8}$ -in. round rubber jammed with equipment. Notice wetcells

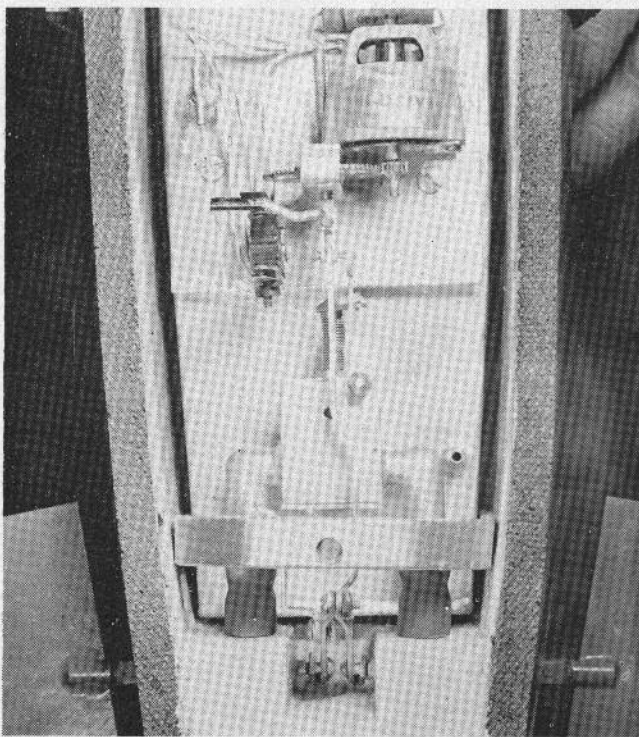
amidships. Seal is $\frac{1}{8}$ -in. round rubber glued in groove, vaseline lubricated.



Stern shot shows rudder unit disassembled on the left. In foreground are the forward driving planes. Props 2 in.



Stepper switch and reedbank show left in pic. At right, top, the relays required to close high-drain circuits.

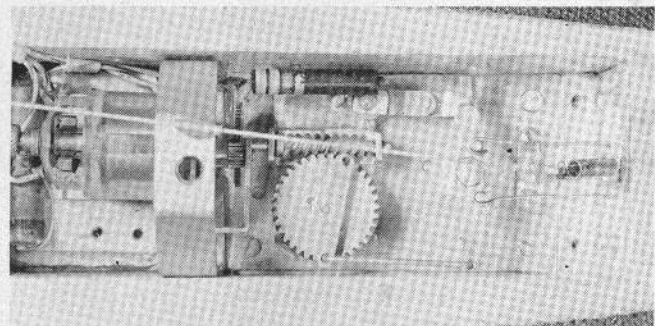
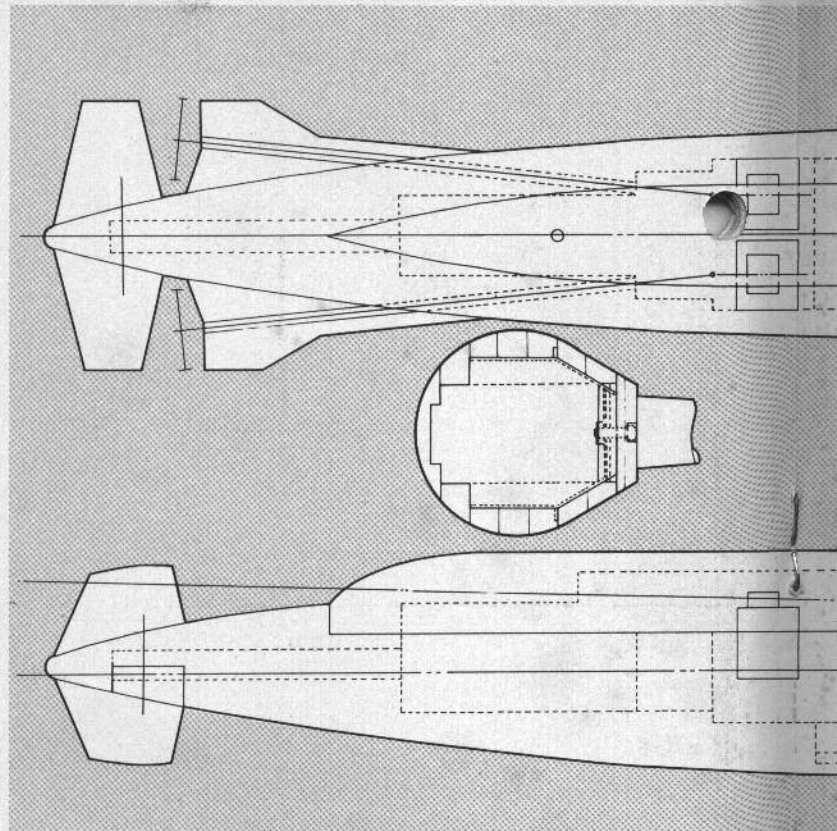


Diving planes—Below in pic—operate from this motor. A linkage connection to water-ballast valving is visible.

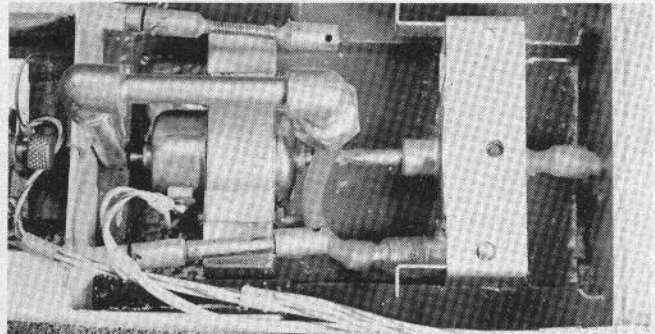
U.S.S. NAUTILUS . . . continued

sealing, which worked very good.

The heart of its guidance system is an Ace Commander Audio receiver and a home-made stepper switch with relay bank. A 250-mfd 6V, capacitor, Fig. 1., affords a delaying action of one second during the selections of circuits. The stepper switch is not self zeroing but is readily made to do so by dialing back to zero after each maneuver. For instance, a right-rudder maneuver would call for dialing 1, and then 9, after its orientation. If you want to turn right and then left,



Steering is accomplished by electric motor near stern. Operation is by two channels, via stepper switch, relay.



Two Pittman motors drive twin screws through gearbox, to right of center in pic. Shafts visible, though uncoupled.

dial 1, and then 1 again, and then 8. The sequencing may become confused if home or zero is not followed through after each selection of channels, but this is the hazard of multiple controlling with a single-channel transmitter. It just takes a little practice.

The surplus DPST relays were modified to provide for the latching-circuits as shown in Fig. 2. The fast and on relays open the holding circuits for slow and off. This provides for the possibilities of doubling up on circuits, which I have done recently. For instance, the reverse, on, and fast channels were wired as one channel. At times, when the sub was on a collision course, a fast reverse saved the (Continued on page 26)

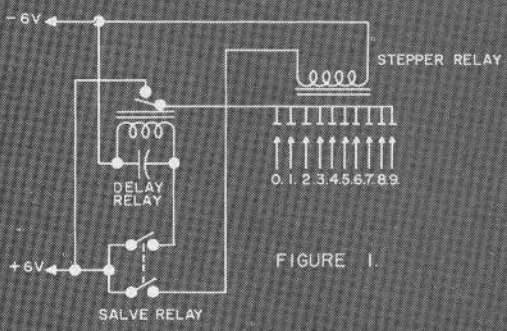
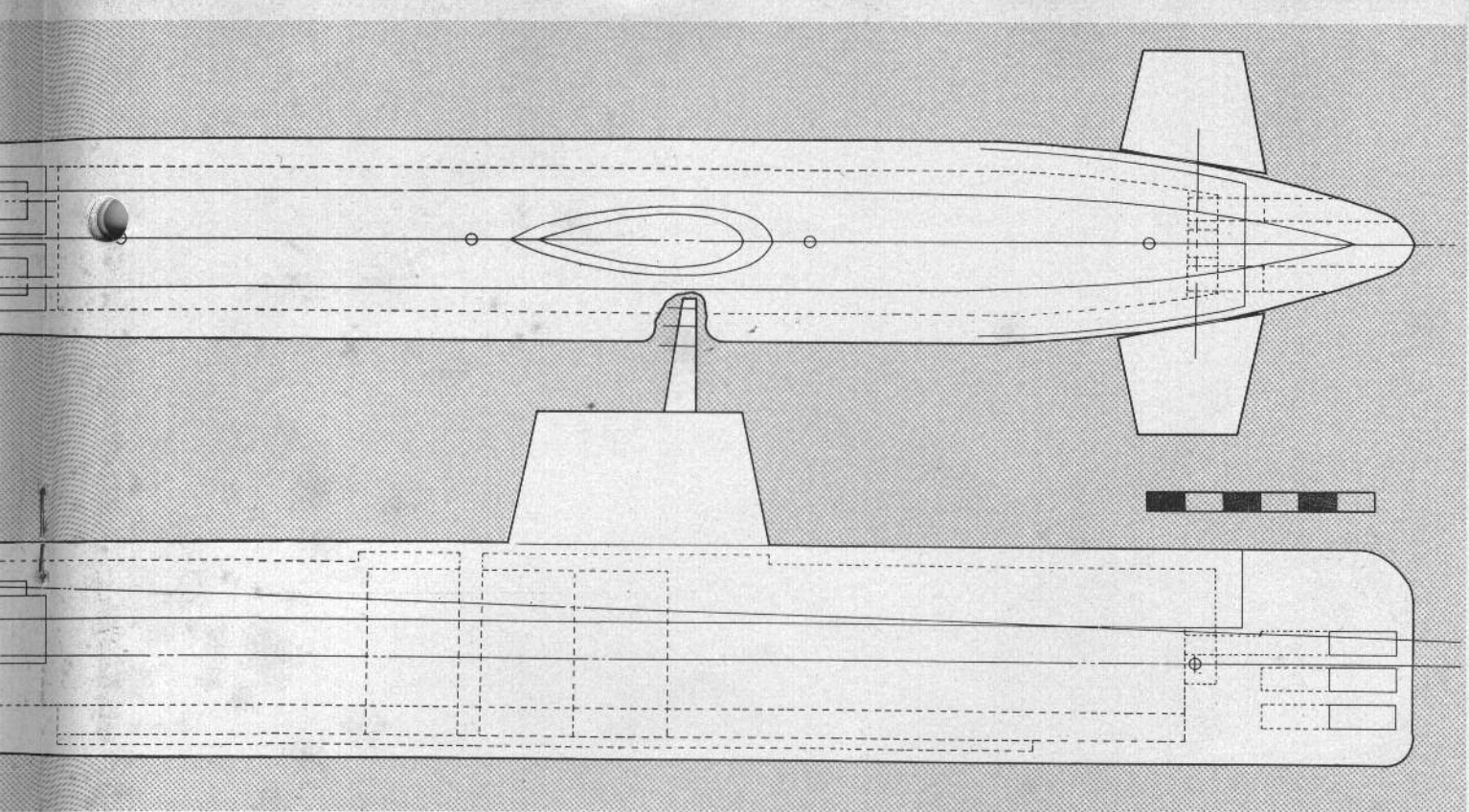


FIGURE 1.

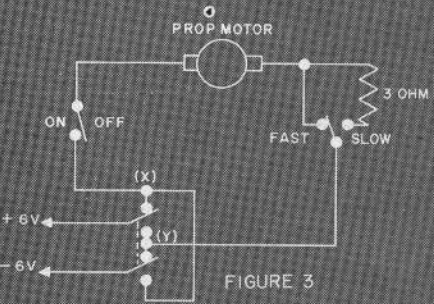


FIGURE 3

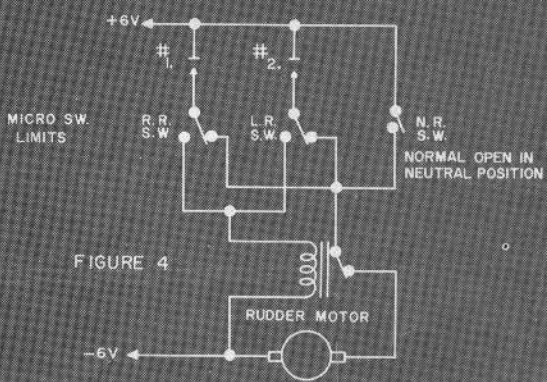


FIGURE 4

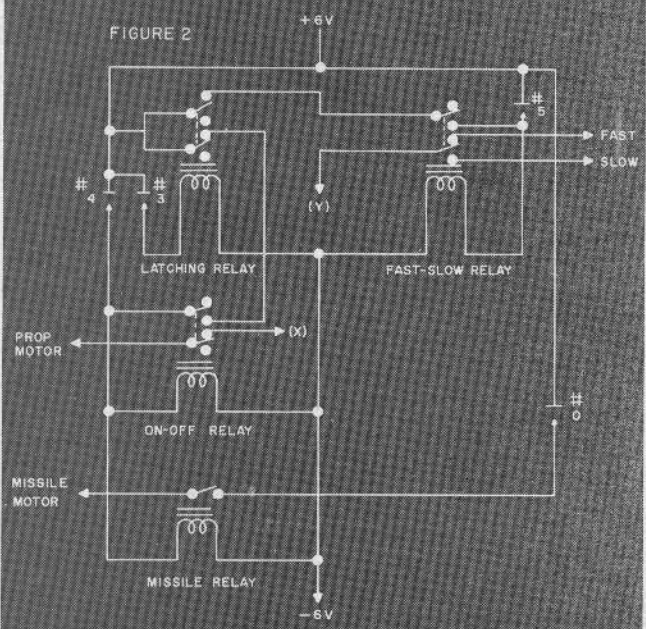


FIGURE 2

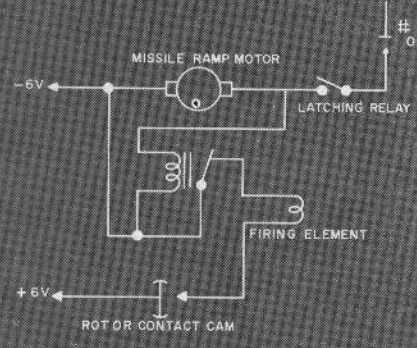


FIGURE 5

by E. M. BLACK, JR. . . . *Non-simultaneous elevator and rudder functions can be selected alternately on any single-channel relay-type receiver for a suitable proportional control.*

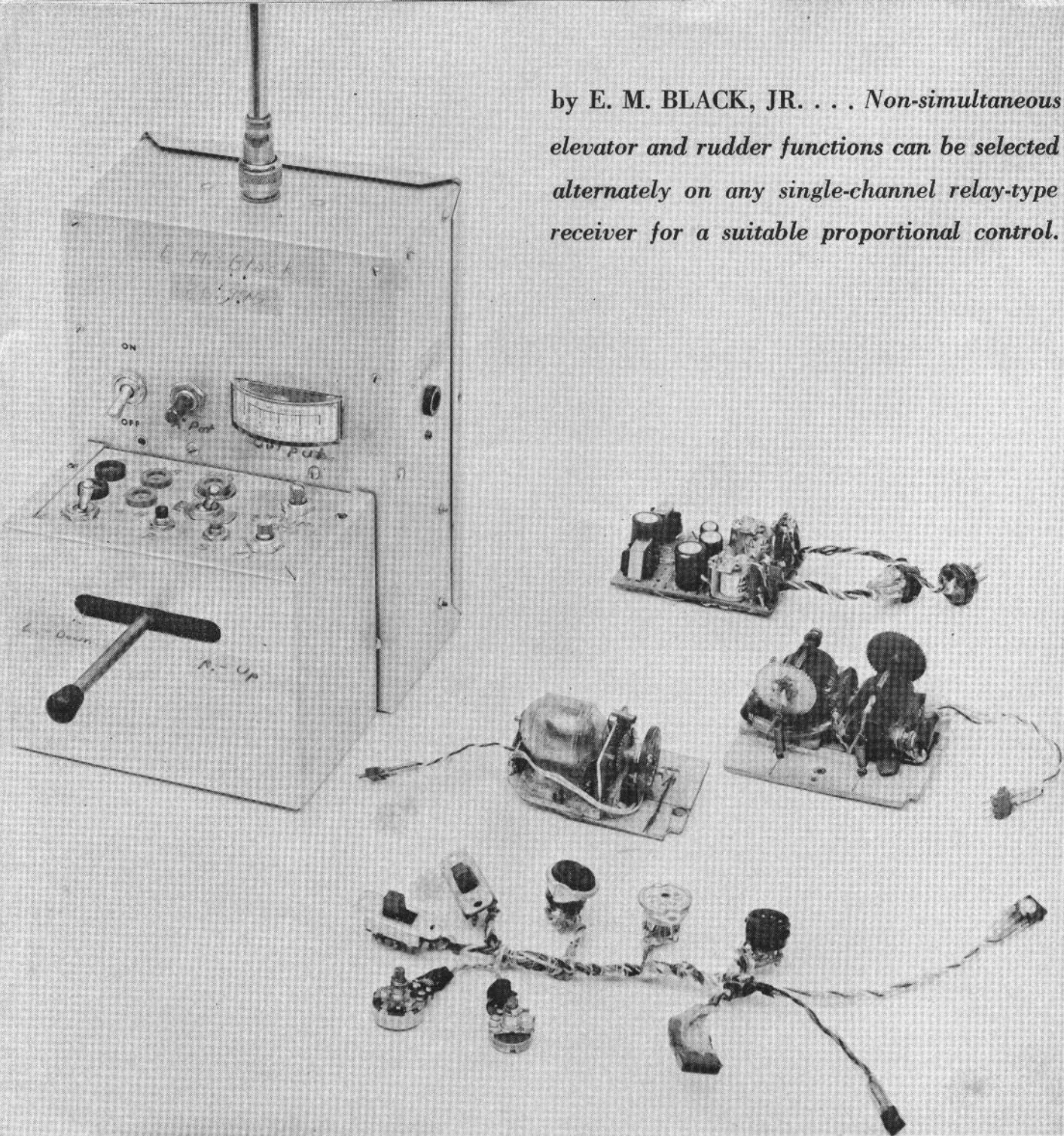
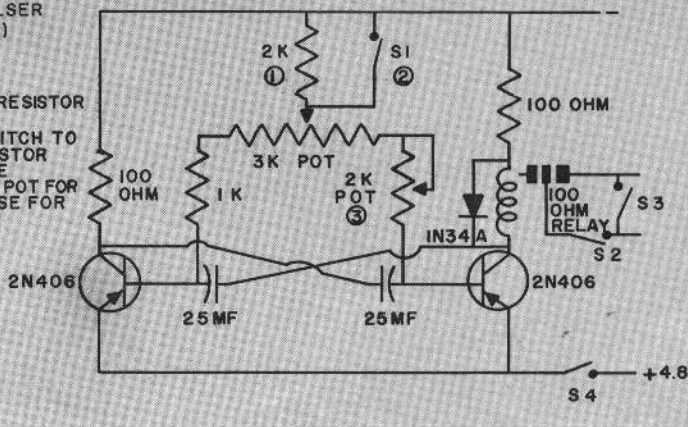


FIG. 1 SHOWS PULSER (REVISED)

REVISIONS

- 1-SUBSTITUTE 2K RESISTOR FOR 510 OHM.
- 2-ADD JUMPER SWITCH TO SHORT OUT RESISTOR FOR FAST PULSE
- 3-SUBSTITUTE 2K POT FOR 1K RESISTOR (USE FOR TRIM)



HA VE YOU BEEN WANTING to get as many proportional controls as possible? Have the high prices of the exotic gear scared you? Do you like to experiment? We believe this system will provide you with the "mostest for the leastest." It can be used with any single-channel relay-type receiver. While it does not provide proportional rudder and proportional elevator simultaneously, you can select these functions alternately through the uses of two well known pulse-type circuits. These are a Pulse-Omission Detector (POD) and a Pulse-Rate Detector (PRD).

With the pulser operating on a slow pulse rate, the stick of the modified Shows' pulser will give proportional rudder control. If this pulse rate is speeded up, the control function is transferred from rudder to elevator. For a motor control, a full on

Simple-Triple Proportional on Single Channel

or off signal will advance or retard the throttle, with the rudder or elevator—depending on which one is in use at the time of command—returning to neutral.

The nice part of this system is the fact that it is usable with existing equipment. In my case, I used a Kraft KR1K kit for the receiver, with a home-brewed tone transmitter, and a modified Shows' pulser. To these were added a Pulse-Rate Detector circuit and a Pulse-Omission Detector circuit on one board, which is illustrated in the photograph, and schematically portrayed in Fig. 3.

In Fig. 1 are given the changes for the modifications to the Shows' pulser. It has been revised to incorporate a pulse-rate change switch and a pulse-width trim pot. There is a slight interaction with the width pot changing the rate slightly while it is centering the control. Including this pot in is not essential to this system, but it is very helpful in trimming the model without having to hold the stick in an off-center position, and you can utilize fully the spring return for neutral on the Shows' pulser.

Fig. 2 shows the relay hook-up between the receiver, the POD and the PRD. This probably is the most important part of the system, and the setting up of these relays must be done carefully and properly, and all three should have full arc suppression at the relay contacts. I had quite a bit of trouble with the POD circuit until I put suppression on the relay.

On the Pulse-Rate Detector, the 50-ohm relay should pull in midway between the slow pulse current and the fast pulse current. Measure this at the relay coil by putting a milliamp meter in the negative lead.

Quite a number of articles concerning the adjustments of POD's, and pulsers, and receiver relays, will be found in back issues of GRID LEAKS. I also found the compilation of previous articles in GRID LEAKS, published under the title "Proportional Control for Rudder Only," to be most helpful in setting up the relays.

Now follow the pulses through the circuit and you will see how the rudder pulses, until the pulse-rate increase pulls in the PRD relay and transfers the pulsing to the elevator. You will also see how full on or off signal pulls the POD relay in and activates the motor servo while returning the rudder or elevator to neutral.

The POD circuit shown in Fig. 3 is the best of three circuits I have tried. Any good reliable POD circuit should do the trick, provided the slow pulse rate does not activate it at extreme stick position. Combined with the POD is the PRD unit. This detector will give reliable operation when the rate is increased from about four pulses per second to around seven pulses per second. Here again any reliable PRD circuit will do, as long as the pulse rate change will activate it. Any proportional actuator should work. Just be sure the rudder and elevator have a positive neutral centering. On my units, I used the reliable double-gearred Mighty Midgets and mounted the rudder and elevator actuators on one board. For motor control I used an old Dmeco 3P with the stops removed. A Hillcrest type of motor control should work well here or one could be made from a Mighty Midget motor.

The wiring harness, shown in Fig. 4, is for those of you who use the Kraft single channel 22½-volt receiver along with the POD and PRD shown in Fig. 3. Mount the two trim pots next to the switches so that minor adjustments can be made from the exterior of the airplane. The POD seldom needs adjusting, but the detector should be checked before every flight. Hook it up so that no signal will give low motor, and your system will be fail safe.

This same type of system could be adapted to any relay type of receiver. It will not function satisfactorily with a relay-less version.

That's it, and I hope this simple bit increases your flying fun.

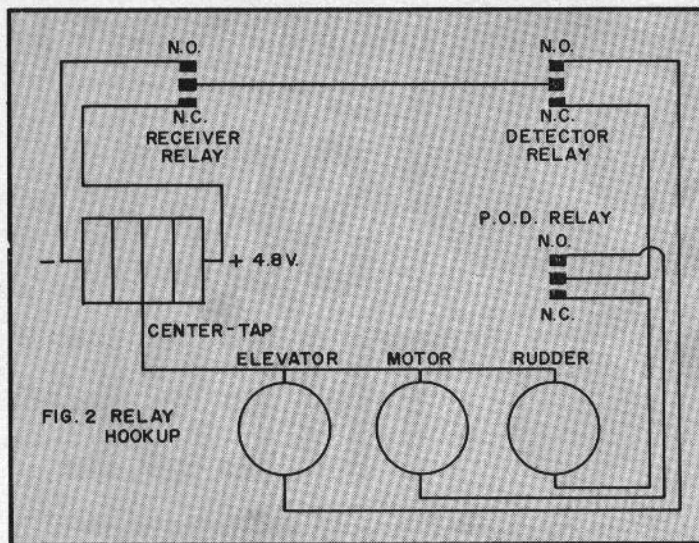


FIG. 2 RELAY HOOKUP

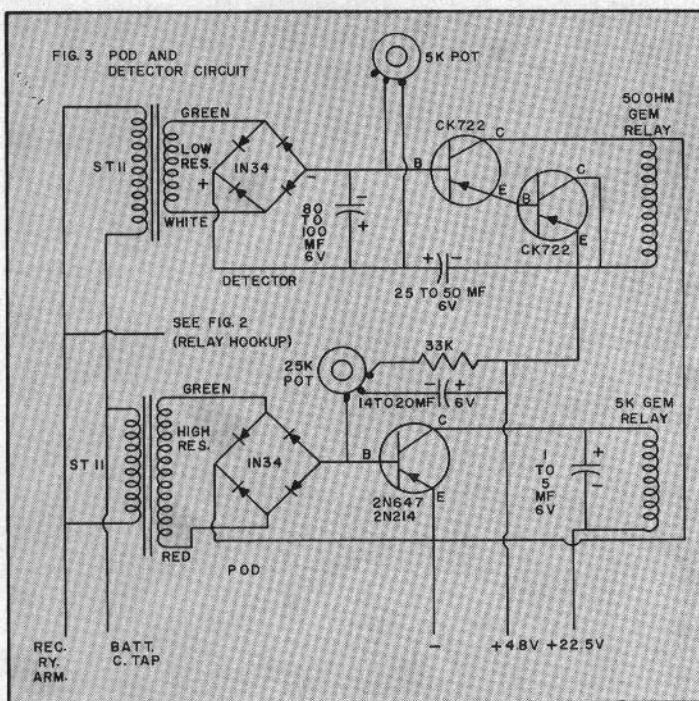


FIG. 3 POD AND DETECTOR CIRCUIT

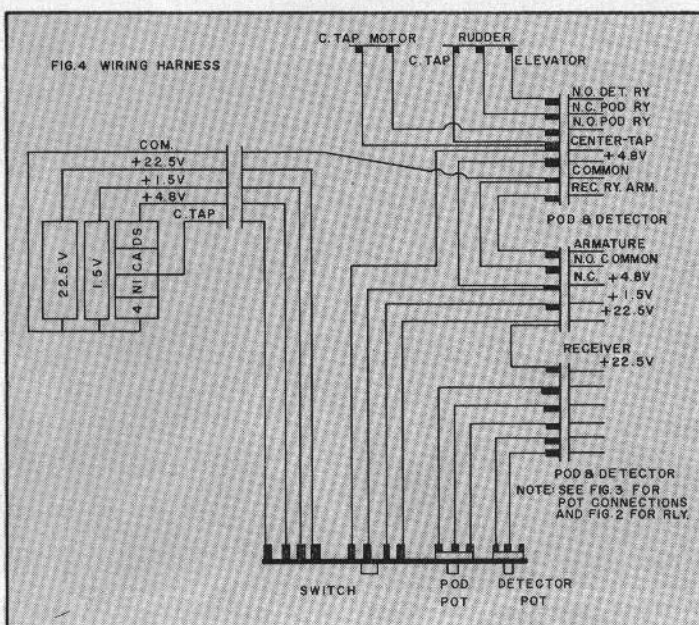


FIG. 4 WIRING HARNESS



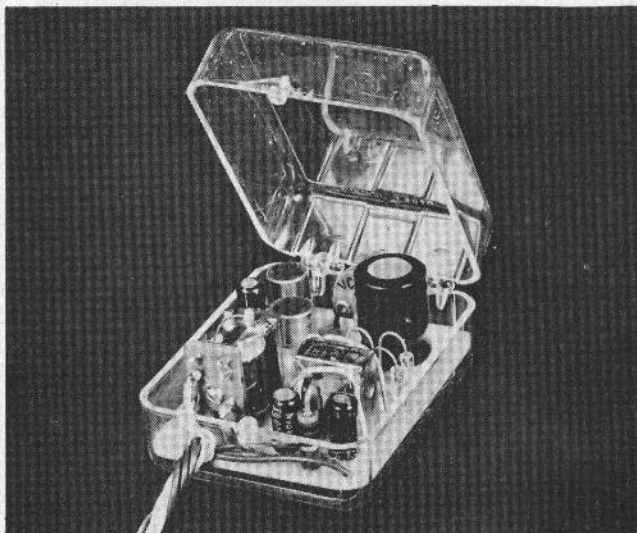
To the trade: This feature is open to all makes of equipment, domestic and foreign. Selection will be edited for reader interest and need.

SEEN THESE

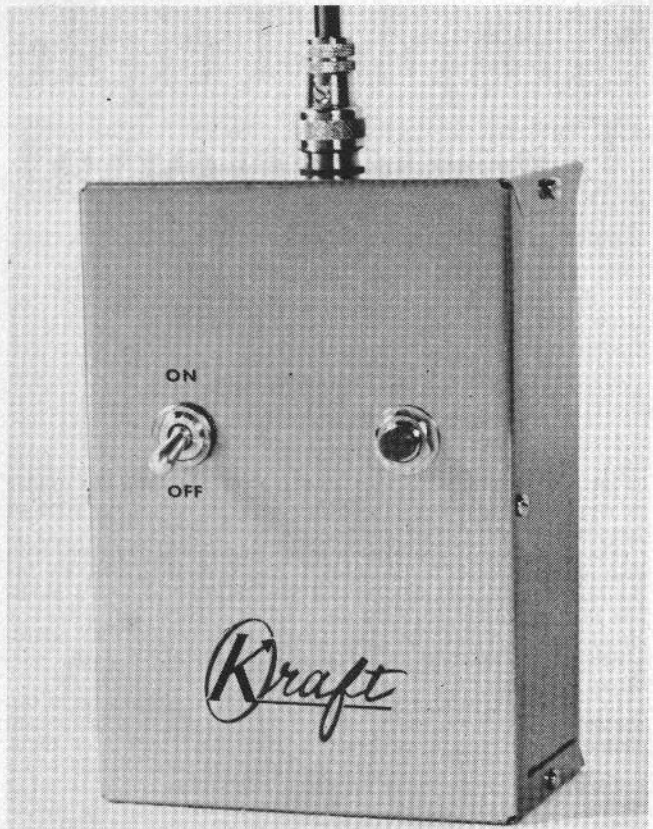
GL's coverage of new items, information and trade releases, now includes a coverage of useful products on the market.



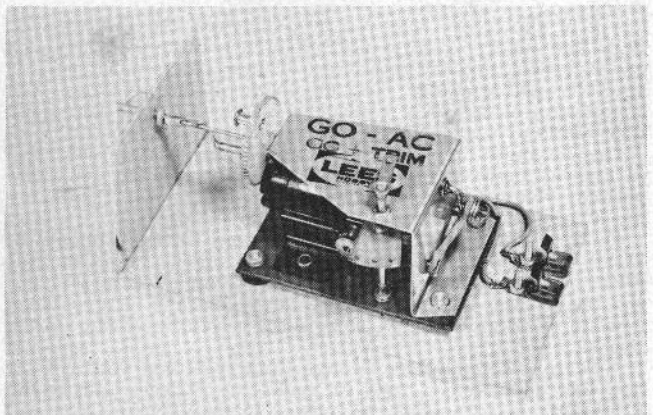
1. Citizen-Ship Proportional Transmitter



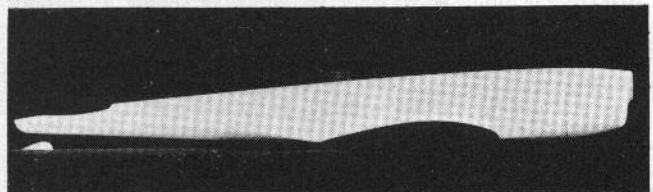
2. Wright Proportional Rate Control



3. Kraft Custom Single Transmitter



4. GO-AC Proportional Actuator



5. Hartman Fiberglass Fuselage Kit

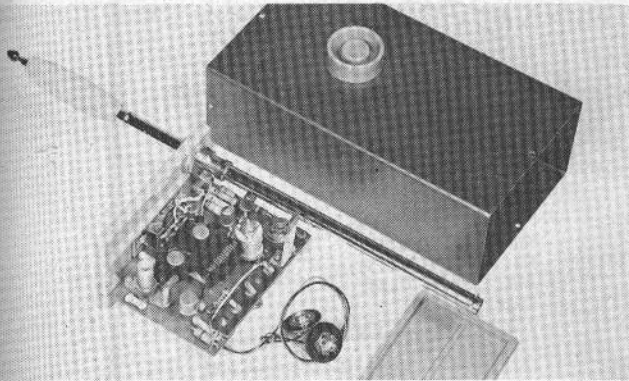
1: Citizen-Ship P-1 transmitter for multi proportional system is quadruple simultaneous, with motor and rudder on left stick, aileron and elevator on right stick—all controls individual trim while airborne. 2: Wright actuator (Andy Wright, 16 Woodfield Ter., Tarrytown, N.Y.) proportional rate control unit actuates any secondary control on rate pulse increase. Price \$14.95. 3: Kraft Channel Tone Transmitter is transistorized, uses sine wave modulation without splatter with 60-in. antenna to eliminate base or center loading. Nine volts, 400 cps. Size 4 $\frac{3}{8}$ x 6 x 2 $\frac{1}{2}$. Price \$29.95. (Ace R/C.) Kraft single-channel superhet relay receiver to be announced at \$39.95. 4: GO-AC (Special Addition Plans, Box 48, Massena, N.Y.) provides proportional rudder with engine control without a second actuator. \$14.95. 5: From D. R. Hartman, Argenta, Ill., a fiberglass fuselage kit for deBolt's Interceptor Zeus, Mk. II. One-piece molded construction, no parts to fit in epoxy. Motor mounts, wing attachment back mounts, servo rails, installed. Zeus was featured in January 1964 MAN who have full-size plans available. Ship has retract gear; for engines .45 to .49.



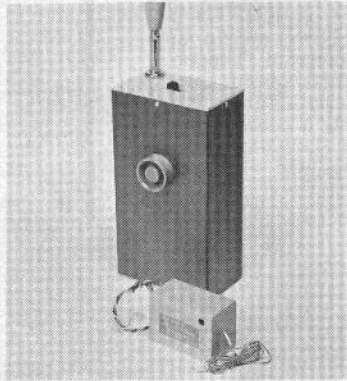
6. Klinetronics Proportional System



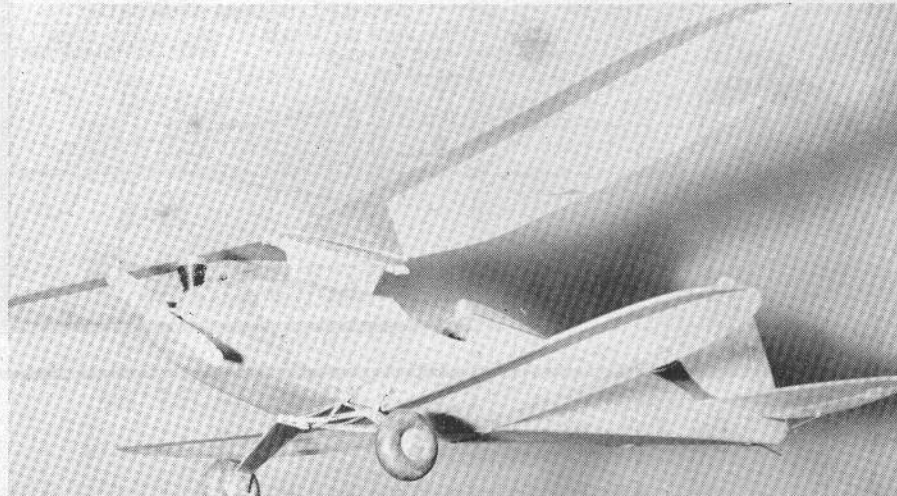
7. Klinetronics Astroguide Transmitter



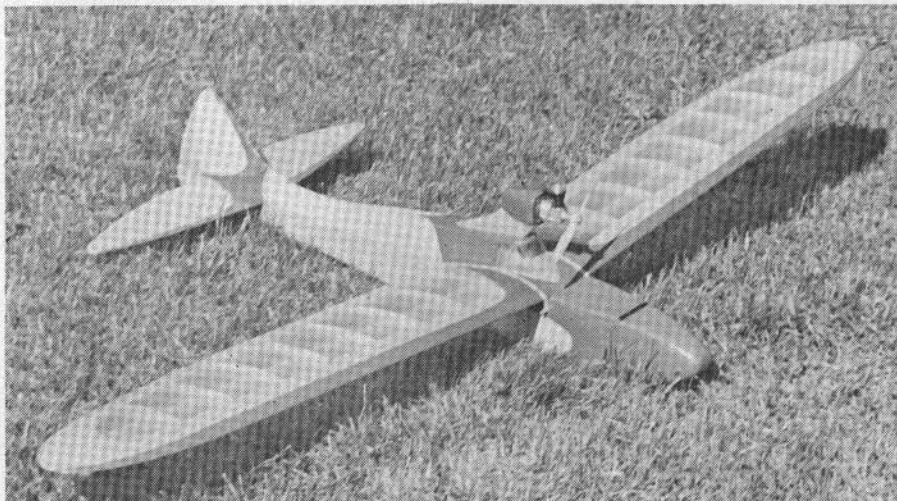
8. Gemini Transmitter



9. Gemini Transmitter and Receiver



10. Strader Chicken Hawk



11. Strader Gypsy

● R.G.A. Specialties, P.O. Box 2241, Kalamazoo, Mich. has several new products. First is the Servo Board called "Servo Xtra Duty," usable in Transmite or Duramite servos, giving added $\frac{1}{8}$ th in. more travel ($\frac{1}{16}$ each direction) as compared to $\frac{5}{16}$ each direction of the original board. Travel is easily reduced to any amount desired, but original travel can be restored by external switching action giving shortened travel and still maintaining maximum travel. The added travel, along with switched-in shortened travel, is ideally suited for multi-channel Rudder-Only Class. Also gives many added possibilities when used with elevators, ailerons, flaps, etc. Tentative price \$2.25.

Second board is a "Servo Solver All-Mite Tray" made to mount three Transmites or Duramites abreast. Size is $3\frac{1}{4}$ by $4\frac{1}{2}$ in. Printed circuitry is clearly identified on board for ease of wiring and so arranged that it may be cut down for mounting two servos. Extra lands are incorporated for connection of receiver, power supply switches, and auxiliary circuits. Installation of servos is simplified, servo plugs are no longer necessary and the entire installation is "cleaned up" to make it more efficient and attractive. Tentative price \$7.95 list.

"Kleen Sheen" is a new formula combination cleaner and wax giving extremely good cleaning action to the common dirt, such as castor oil, grass stains, and simultaneously applying a high-gloss wax. Repeated use of Kleen Sheen gives no undesirable build up of wax. No price or size, trying to keep the price under one dollar. Approximate delivery date April 1.

● From Fly-Tronics, the Mul-T Circuitmaster Printed Circuit Board* for servo mounting. The Mul-T Circuitmaster eliminates plug failures, that rat's nest of wires and plugs, and broken wires through vibration and handling. Claimed by the manufacturer to be the most versatile board. Accepts Bonner and Annco and any other popular servos. Unique method of wiring and tie-down of all wires. Designed for any desired servo layout, but marked for the new slim in-line servo mounting and standard Taurus layout. May be used for 4 channels up to, and including, 12 channels of relayless installations. Board measures $2\frac{3}{4}$ by a big $9\text{-}5/16$ inches long, but may be reduced easily in both length and width if desired. Has provisions to mount switches, receiver plug and power plug on board if desired, although these may be taken off of the board if the board is cut down. (\$7.95.) (Continued on page 27)

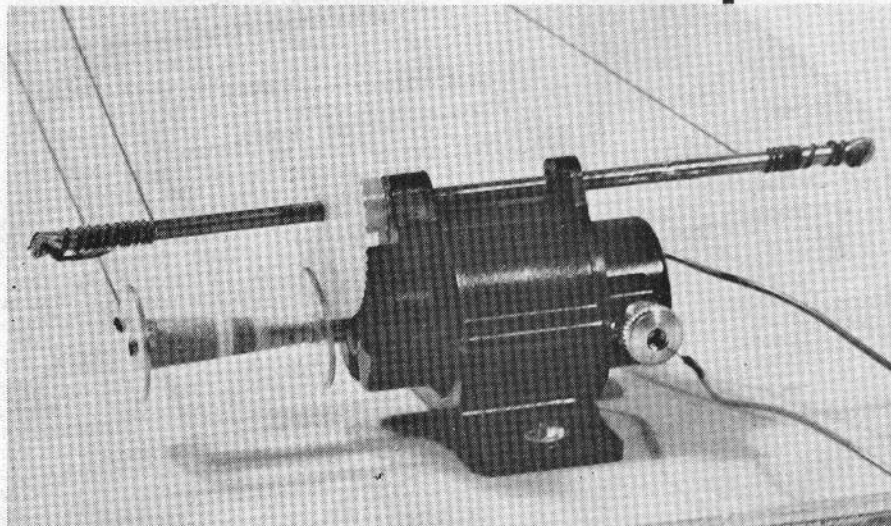
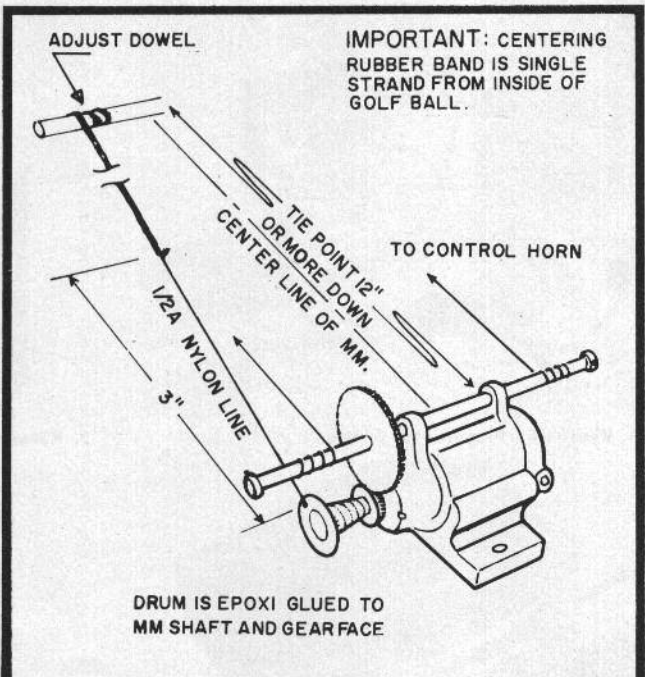
6-7: Klinetronics Astroguide proportional system is 4-stick arrangement aimed at relating reed piloting familiarity to proportional; \$499.95 with Bonner conversion or Klinetronics servos. 8-9: Well-known British Gemini (REP, 24 Upper Brook St., London W.1., Eng.) allows two modelers to fly simultaneously same frequency, via matched-tuned filter transistor receivers. Units available in either high or low tone for dual use. Transistorized transmitter. Receiver, relay or relayless. 10: Ted Strader's Chicken Hawk (Special Edition Plans), \$7.95, kit (by Custom Kits) with formed dural gear, wheels, covering, hardware, die-cut wood. Hot .02-.024 and all .049's; span 34 in. top wing, 25 in. bottom. 11: Strader's 60-in. Gypsy powered glider for .049-.099, big brother of popular Nomad. For relaxed flying, the Gypsy is ideal sport craft. Featured in *Flying Models*. Price is \$11.95. Also a Custom Kit product.

BITS AND PIECES...

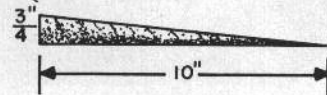
DEAD CENTERING MIGHTY MIDGET

by Dennis M. Jaecks,
Wisconsin Rapids, Wisc.

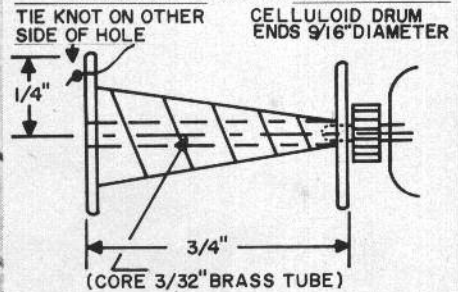
■ This system is not entirely original and is a modification of the Jim Shows' actuator. The main feature is dead centering, and up to $2\frac{1}{2}$ revs on the output shaft of the Mighty Midget. It is important to use a rubber band of low spring constant, such as that of a golf ball band. Adjustment is made by a dowel in the tail of the airplane—as Jim Shows' system in GRID LEAKS article, and as indicated in the diagram. The tapered drum is attached to the spur gear and shaft (motor may need reworking—that is, install a new and longer shaft on the armature). I epoxied the drum on the motor as it comes from the box. It is best to use the longest length of rubber possible, that the plane will allow. This dead-centering MM also cuts down rudder wiggle.



TAPER DRUM MADE FROM NEWS PAPER (FINISH WITH) AND ELMER GLUE. (COAT OF DOPE)



TAPERED CENTERING DRUM DETAIL



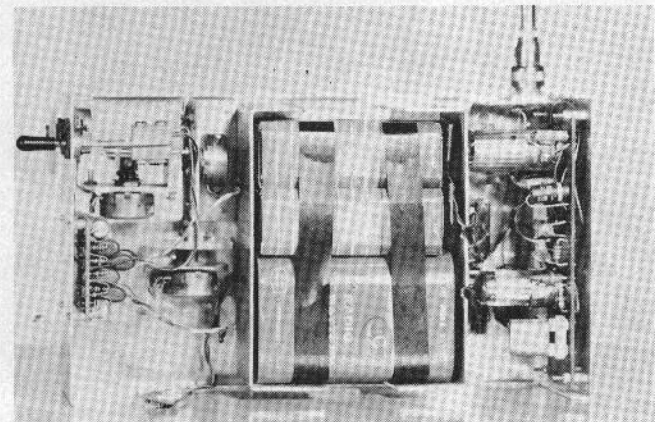
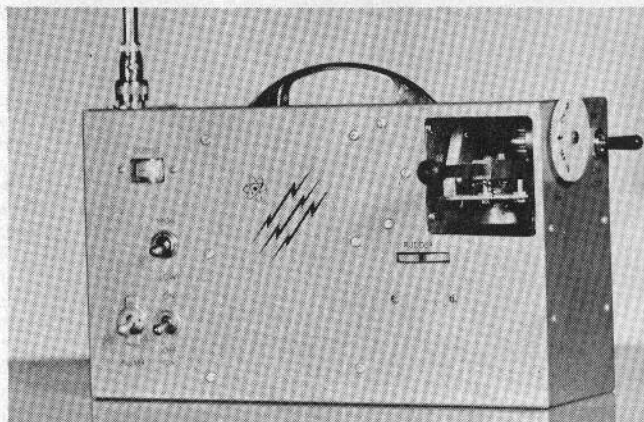
B & D WITH KRAFT RF by J. I. Kinnaman, Baker, Oreg.

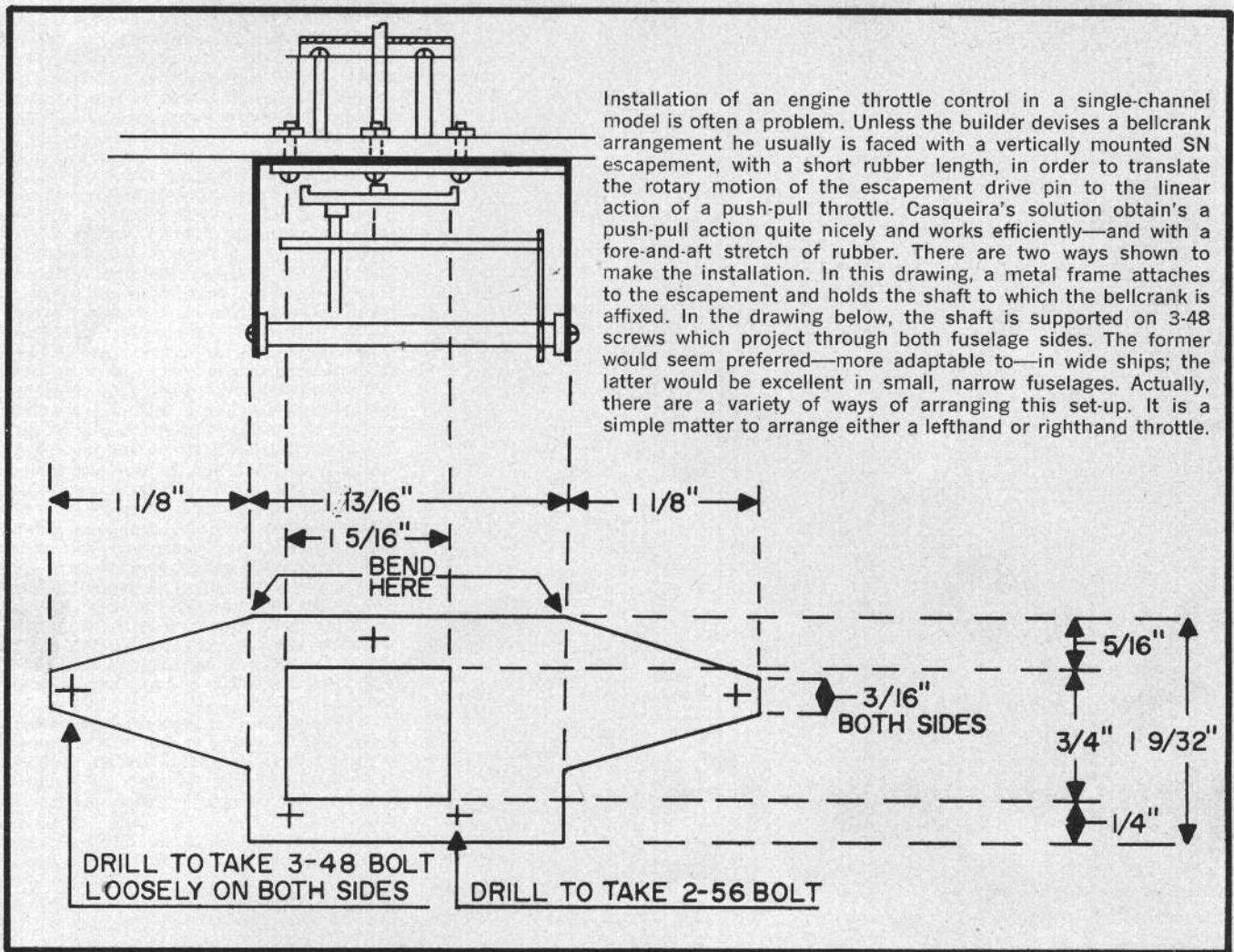
■ I am sending two pictures of the hand-held transmitter I built for the B & D system. It has a very good output and uses Kraft's RF section. The amplifier tube has both heaters going for better amplification and 70-ohm chokes on the output of the P/M. This system works smoothly but the receiver's detector stage had to be changed to get any range. The sensitivity of the receiver can still be improved, but I have been flying the

Falcon with this system and like it very much.

Before I built this transmitter I was using my hand-held home-built with a unijunction pulser (with no modifications except to speed the pulses up to 40 cps.) This also works well and the slight interaction is not noticed in flight.

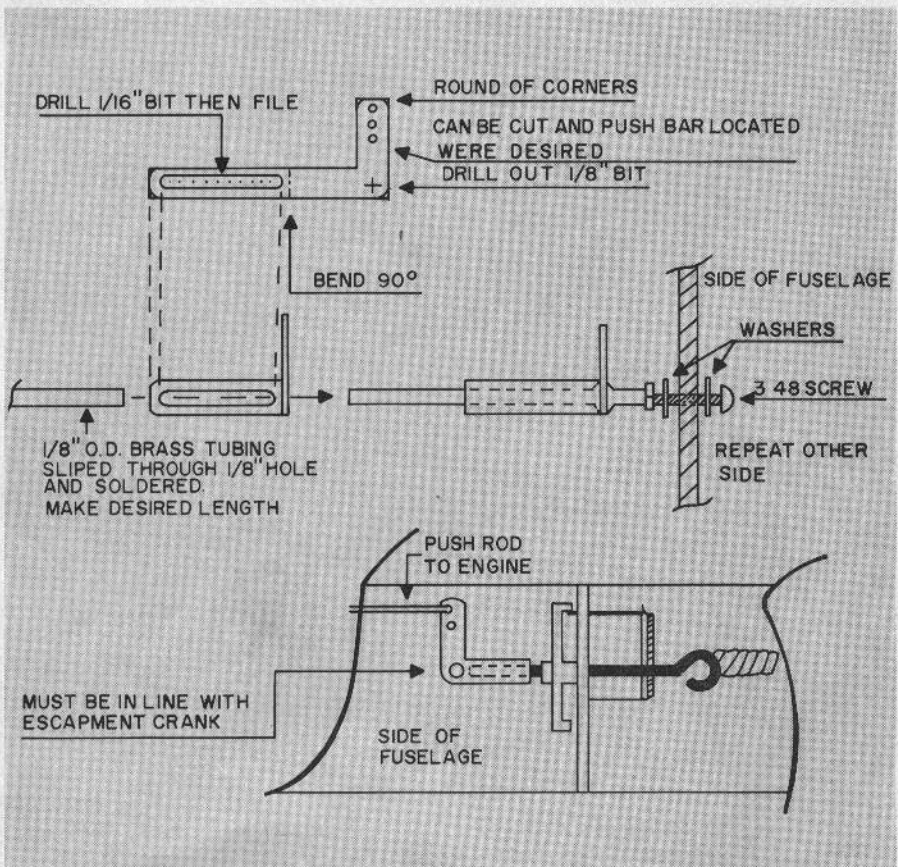
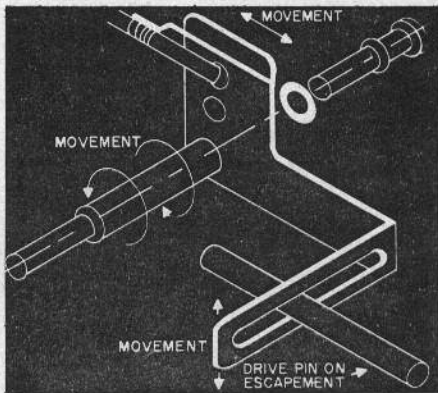
(Editor's Note: The B & D system was detailed in *Model Airplane News*, March, April, and May, 1963 issues.)





ENGINE PUSHROD OFF BONNER SN ESCAPEMENT

by Almond Casqueira,
Antioch, Calif.





GL's editor, left, examines with Ed Lorenz, wings cut by Ed Izzo at Bison conference.

THE IDEA OF USING styrofoam is not new. Various people several times in the last ten years have made attempts to use it which were not always successful because of the manner in which it was handled. I have conducted experiments with this material over a period of time and used it in stressed skin construction in conjunction with balsa wood.

By stressed skin construction I mean that a piece of balsa wood breaks easily but is much stronger if only push and pull forces are applied. Now to keep it straight and be able to apply the push and pull forces on a wing, we need to put the balsa on the skin and have a light core—which is the styrofoam. This acts much like a long continuous rib and keeps the balsa in the desired shape.

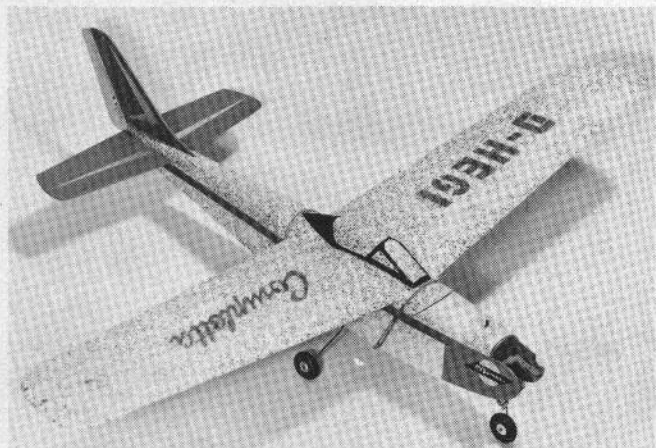
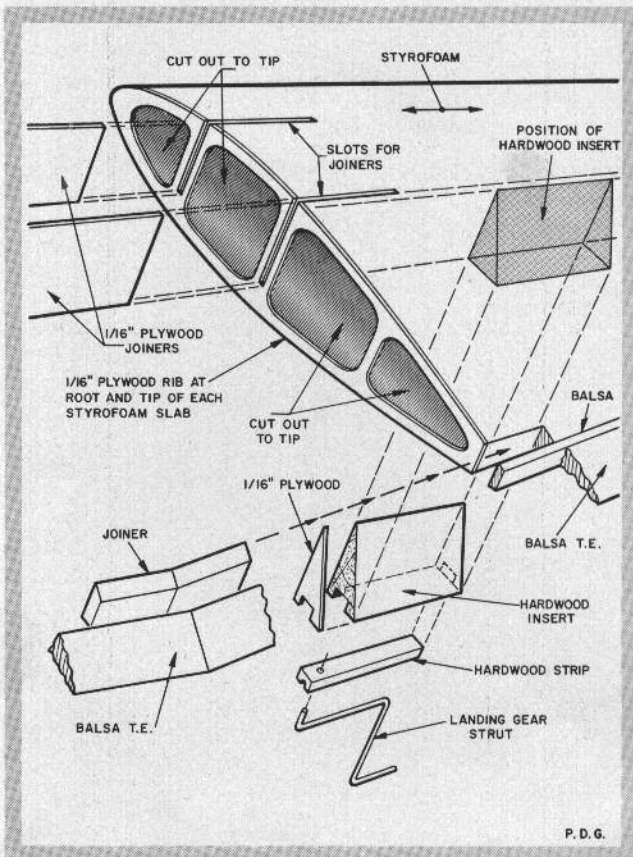
To work with styrofoam, you need one special tool to cut it. I found the best method of cutting it to airfoil shapes, etc., is an electrically heated chromolux wire which is mounted like the string of a bow. To make the bow, buy two approximately 1300-watt replacement elements for hot plates, ranges, etc., and straighten a long enough piece to tie over a bow made from a broom handle, and $\frac{1}{8}$ piano wire as per sketch. Place the rest of the heating coil in an old hot plate and use as resistance for adjusting the cutting bow to the right temperature, which is just hot enough to cut the plastic. If it is too hot, you will get a very wide cut, if too cold you have to press harder.

To explain how to work with styrofoam, I will show you how to build the Sty-o-bat, a combat model similar to the Voodoo but constructed in styrofoam. By the way you can get styrofoam at building suppliers, who use it as insulation material, and florists who use it for floral arrangements. Use only white glue (LePage Bondfast) as other glues will attack styrofoam. (Editor's Note—Further information in the Monitor, pgs. 1 and 2.)

• STYROFOAM • THE MATERIAL OF THE FUTURE

by JOE NIEDERMAYR

"Foil" techniques are now rapidly advancing. This basic article is reprinted from that excellent club paper, the Montreal Model Bugs.



Hegi's Completa (German) is all styrofoam with wood inserts. It is molded, whereas, so far, modeler's use hot-wire cutting.

1. We cut a block of styrofoam with a fine toothed hack saw blade to size (see sketch).

2. Prepare two template master ribs from 1/16 plywood which have to be sanded very smooth all around the edges so the wire can slip on them.

3. Tack glue these master ribs with white glue (LePage's Bondfast) to face of roughly prepared styrofoam block and let the trailing edge extend 1/8 inch beyond the block so, when starting to cut, you have something to rest on. When doing this, align them carefully so the core will be warp free.

4. We now are ready to cut the core evenly all around with our wire bow. Probably your first core will show marks from uneven feeding or have other little defects so it is a good idea to make the master ribs a little larger so you can sand a bit. To help you to make your first couple of cores as good as possible make colored or numbered reference lines on both sides of the block on the building board, place your left hand in the center of the block, grip the bow in the center, rest the wire on the little tab of trailing edge protruding and start feeding the hot wire as fast as it will cut, always checking with your marks on both sides for squareness.

For cutting it is necessary to hold the core firmly down with your left hand because thin cores will warp up from the heat of the wire and you will end up with a core which is thinner in the center.

5. Now you can remove the ribs and sand the core if necessary. I find medium rough paper is best for sanding styrofoam.

6. Prepare skin from 1/32 balsa wood which should measure 36 x 20. This can easily be done by butt-joining individual sheets together and holding with masking tape until dry. In the meantime, cut a hole in the core with the hack saw blade, as per sketch, to receive the bellcrank.

7. Line hole with 1/16 balsa, use jigs as indicated in sketch for cutting grooves for lead-out wires. Make wing tips and then install bellcrank, pushrod and lead-out wires. Also cover hole above and below bellcrank with 1/16 balsa.

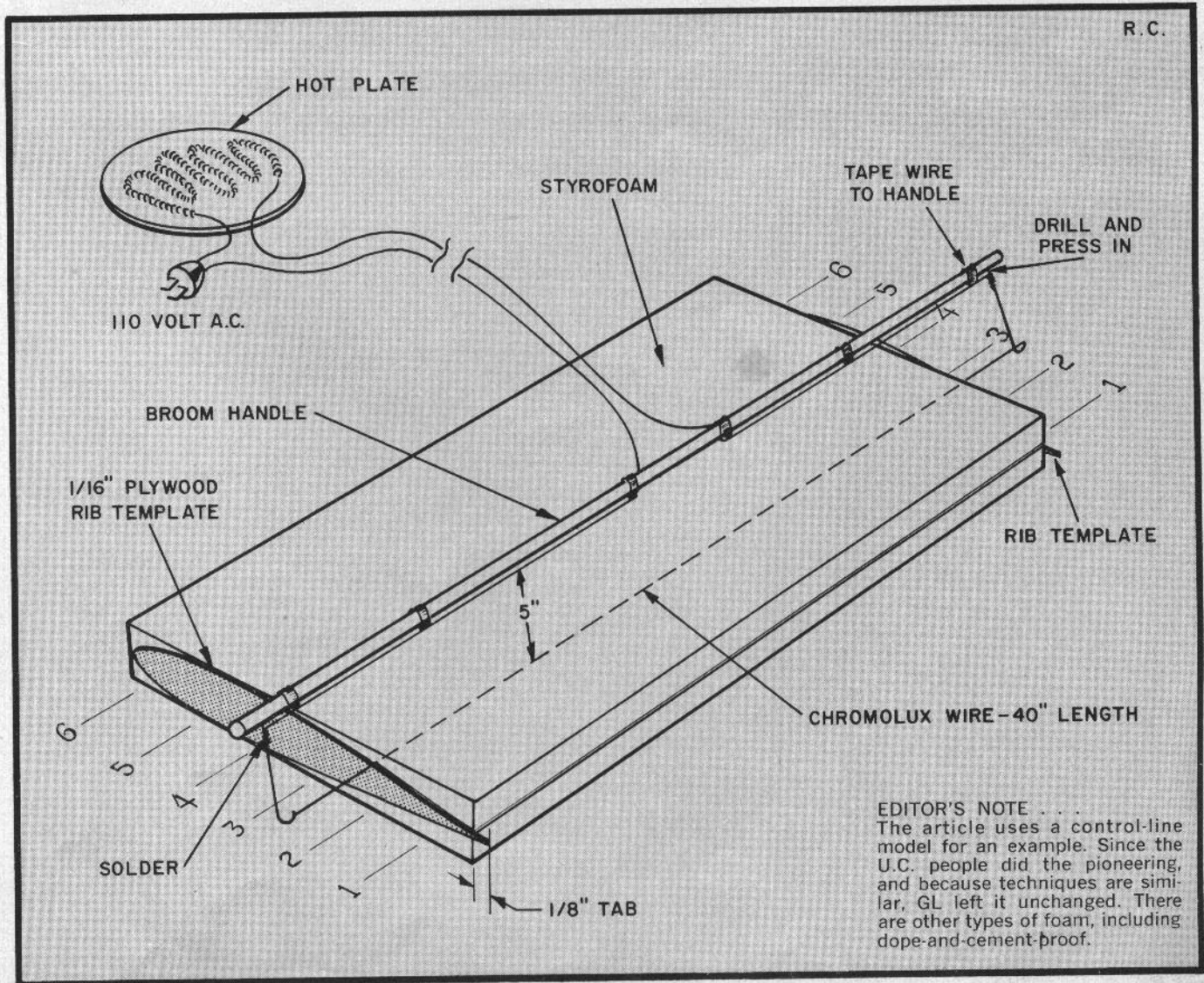
8. You are now ready for applying the skin. Have clothes pins, modeler's pins and rubber bands ready; leave masking tape on the outside of the skin to prevent it from cracking while bending around the leading edge. Cut small hole for pushrod in skin, then soak inside of skin with boiling water to make it bend easier. Apply a thin coat of glue to the inside of the skin and apply to top of core letting the pushrod come through the hole, lining up with the trailing edge first, then slowly working forward and around the leading edge back to the bottom of trailing edge again. Hold skin in place with clothes pins, pins and rubber bands until dry.

9. In the meantime you can prepare your motor mount, tail booms and elevator. When core is dry, cut hole for tank and motor with hack saw blades, sand, and line with 1/16 balsa, install motor mount

with epoxy resin glue and the booms and elevator in conventional manner. Sand entire model and don't be afraid, even 1/64 skin is still strong enough for a man to stand on as I demonstrated to various members of our club. For finishing I suggest covering the model with light Silkspan and dope in conventional manner.

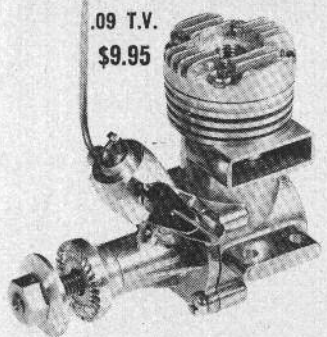
In my experience I have found the white glue very heavy so take it easy on glue when applying the skin. Building combat ships this way is not the only possibility with styrofoam, I have used it for wings on R/C models and turtle-decks and bottom blocks on the fuselage of my new stunt model with 1/32 sheet covering. Also, you can build tapered wings for stunt models and whole fuselages of Comanche type with styrofoam. I found when using it for smaller flying surfaces, such as stabs of 1/8 inch wings, wrapping paper as skin is strong enough. The big advantage when using styrofoam or wings and complicated fuselages is that the construction time is cut in half and the strength is unsurpassed. The weight can be equal to conventional type of construction if care is practiced on selection of wood and economy in glue. The most impressive thing to me on my first styrofoam wing was that it was so strong I could stand on it. I weigh 150 pounds. A one-piece styrofoam wing suspended between two chairs would easily carry the weight of a 30-pound child.

I predict a big future for this material. In fact, European companies are using it frequently in their kits.



EDITOR'S NOTE . . .
The article uses a control-line model for an example. Since the U.C. people did the pioneering, and because techniques are similar, GL left it unchanged. There are other types of foam, including dope-and-cement-proof.

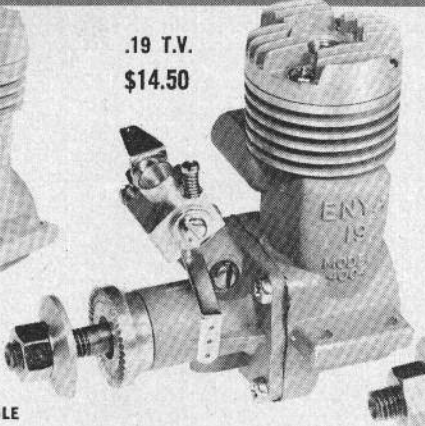
FOR PRECISE ACCURATE CONTROL—ENYA ENGINES WITH ENYA THROTTLE VALVE



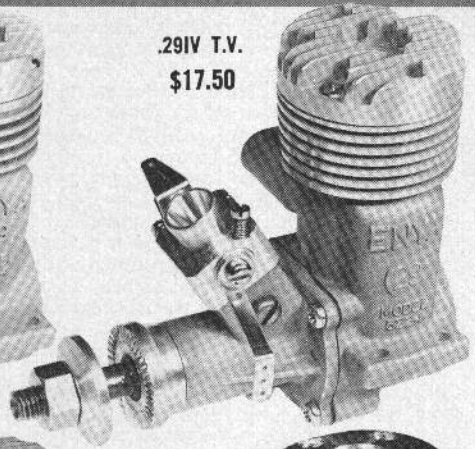
.09 T.V.
\$9.95



.15 T.V.
\$12.50



.19 T.V.
\$14.50



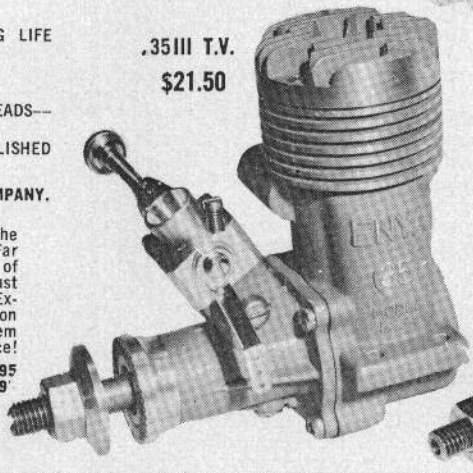
.29IV T.V.
\$17.50

- ALL ENYA ENGINES ARE HAND CRAFTED TO FINE PRECISION NOT POSSIBLE IN USUAL MASS PRODUCTION METHODS
- NEW CONCEPTS OF PERFORMANCE, RELIABILITY, AND LONG, LONG LIFE ARE BUILT INTO EACH ENYA ENGINE.
- EXCEPTIONAL POWER—CONSTANT, EASY STARTING AND STURDY CONSTRUCTION.
- INTERCHANGEABLE VENTURIES—HIGH AND LOW COMPRESSION HEADS—BUILT IN PRESSURE FITTINGS.
- ENYA ENGINES ARE DISTRIBUTED BY MRC-ENYA COMPANY, ESTABLISHED AND RELIABLE HOBBY SPECIALISTS.
- ENYA PARTS & SERVICE READILY AVAILABLE AT MRC ENYA COMPANY.

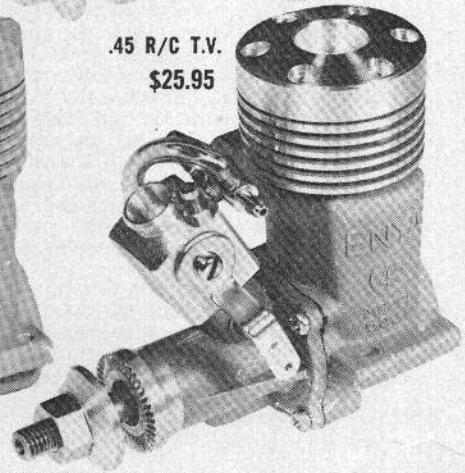
The ENYA THROTTLE VALVE is of the Fuel Intake Restrictor Type. A Far More Precise and Accurate System of regulating speed than the usual Exhaust Muffling Method. It's Much More Expensive to produce but the Precision Control possible with this System makes it more than worth the difference!

Price for the .09 .15 .19 is \$3.95
Price for the .29 .35 .45 is \$5.9

ENYA ENGINE MUFFLER PRICES
For the .15 .19\$2.95
For the .29 .35 .45\$3.50



.35III T.V.
\$21.50

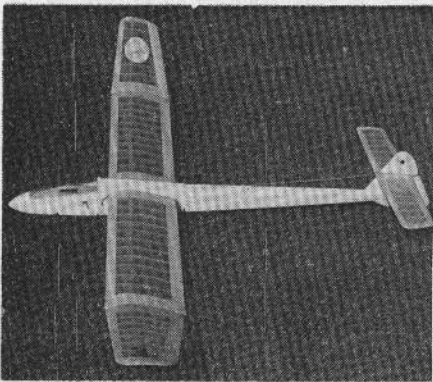


.45 R/C T.V.
\$25.95



MRC-ENYA COMPANY INC. 5300 21st AVE. Brooklyn 4, New York

PELICAN R/C GLIDER



Aviomodelli's popular R/C Glider now available! Designed for single channel receiver with escapement, but easily adapted to multi-channel superhet equipment with servos—See page 3 of Sept/Oct Grid Leaks—Kit includes lots of plywood, clear bubble canopy, cement, all hardware, building and flying instructions in English, French, German and Italian, and plastic Power Pod for .049 engine. An excellent slow flying, very forgiving glider for the beginner in Radio Control\$15.95

D-M WINDER—Nylon and brass, unbreakable, 5 to 1 ratio, with detachable handle\$.95

FREQUENCY FLAGS—Superhet equipment use Brown for 26.995, Red for 27.045, Orange for 27.095, Yellow for 27.145, Green for 27.195, Blue for 27.255 and for all superregen equipment; White for 6 and 10 meter band equipment (Specify color desired)\$.25

RAZOR PLANE—Sturdy all metal plane for shaping balsa, 3 double edge razor blades furnished\$1.75

SUPER SOLDER—Silver alloy bearing solder. Use book match in the field or soldering iron for extremely strong joint. 36 inch length\$.60

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Willoughby Enterprises
14695 Candeda Place
Tustin, California 92680

U.S.S. Nautilus

(Continued from page 16)

day and, when docked, a fast reverse puts you in command in a hurry. In the slow forward motion the fast reverse is hardly noticed since the reverse is not latched and quickly returns to forward when dialed back to zero. (Fig. 3.)

As shown in Fig. 1 a DPST relay is necessary to isolate the delaying relay from the stepper switch. Most receivers use an SPDT relay, so unless a DPST relay is substituted, a slave relay is required. In either case, a .01-mfd capacitor is wired across the points to prevent "motor-boating." Despite all the relays employed, only the motors and this relay required this kind of filtering.

Perhaps the most ideal feature of R/C boating is the selection of right or left rudder and for it to self neutralize. This is done with only two channels. A modification since the photo resulted in the rudder circuitry of Fig. 4. There is one drawback with this system and that is, the rudder motor carries the rudder through a cycle. In other words, by dialing 1, the rudder will turn right. Upon completion of right rudder, it stops and then returns to neutral when you leave this channel. If you want a left turn now, it will promptly do so, but if you wanted a right turn again instead of left, the rudder will carry through left and finally stop on right. For precision fast maneuvers this is a problem, especially in a tight location; Otherwise it isn't so bad and can be tolerated, but I'm not satisfied with it and I'm still working on this problem.

Just for an added touch of realism, a plastic Regulus missile was mounted on a rotating ramp. The prototype sub carries

no missiles but this does not prevent the modeler employing initiative. As it begins its 360 degree arc a lever is tripped and it springs into firing position. It is loaded with a home-made rocket of potassium nitrate and sugar and can be fired off either side of the deck. Fig. 5. illustrates the safety cam to prevent it from misfiring directly fore or aft. This cam gives contact for only firing in a 90 degree arc perpendicular from the deck sides.

Fig. 2 shows how the missile cannot be moved or fired unless the drive motors are latched in off position, a double safety measure for its firing. Upon termination of the missile rotation a relay drops out and the motor is fired by a shorted squid. Twenty-five yards have been scored with some smooth and some erratic flights. This is hard on plastic missiles though. Miniature skyrockets or pop bottle rockets may be used, too, with proper mounting and balancing. The ramp is then returned to its original position for any diving operations.

For diving, the servo drives the fore and aft planes down and opens the double by-pass valve. This floods the tanks and brings the deck to about 1/8 inch from the surface of the water—in other words, a water-logged position. This prevents the sub from reaching the negative buoyancy to sink to the bottom in case of power failure. Control of the submerged ship requires a delicate balance of trim and speed. Slow speed is best, since the fast forward speed tends to force the bow down, which causes the props to thrash about on the surface. It takes some time to trim the nuclear submarines after diving so you can imagine the problems in a model.

The forward diving planes were first made over-size, then they were reduced in size and finally folded up and not used at all. The suction created by the forward

motion was sufficient for diving. In the flooded motionless condition, the trim was so balanced as to have the bow of the ship a little higher than the stern so that the forward diving action leveled off the ship. With a constant speed, the depth of diving depends upon the flooded motionless trim.

A centrifugal type of pump was used for pumping the tanks, with a flat rubber check valve slipped over the end of the discharge line. This check valve was placed in a niche on the bottom of the sub. This type of check is used for inserting chlorine in the suction side of circulating pumps for swimming pools. It is a very efficient valve to prevent reverse flooding.

In conclusion, I think you will find considerable improvements can be made both in the construction and operational devices, especially in the pumping and diving phase. But I feel that this sub is one of few in the pioneering stage and, as a product of this stage, a new field of hobby crafting is wide open. And as we stated in the beginning of this article, there is plenty of room for experimenting, so if you are looking for a challenge that will put your talents to a test, here is the project.

? Seen These

(Continued from page 21)

● From Ted Strader, a Galloping Ghost Control Coupler. Has formed and finished control surface couplings for fast, accurate, easy G-G hookup. Ready to install. Kit contains an elevator tie-bar, rudder-on crank, universal couplings, torque bearings, spare floating bobbin and complete instructions. (\$1.00)

● For some time the Phelps Pulser has been used in various forms throughout the country with outstanding success. John Phelps, Applications Engineer for General Electric, has updated the design. Using a unijunction transistor, this pulser may be used for Rudder-Only or for Galloping Ghost. Has both rate control and width control, and rate and width trim. Its temperature stable from 140 down to 10 degrees. Uses new silicon GE devices. Kit comes with the spring-centering protol dual stick assembly, contains all components required and is highly prefabricated, and instructions are exceptionally complete and profuse. (Ace R/C, \$28.95.)

● In working with designers Phil Kraft and John Phelps, we instigated a search for a 60-in. antenna. It was felt that this length antenna would more effectively radiate the signal than the 42-in. ASP 211. It is five-section collapsible to 13 inches, American-made ASP 346 antenna, featur-

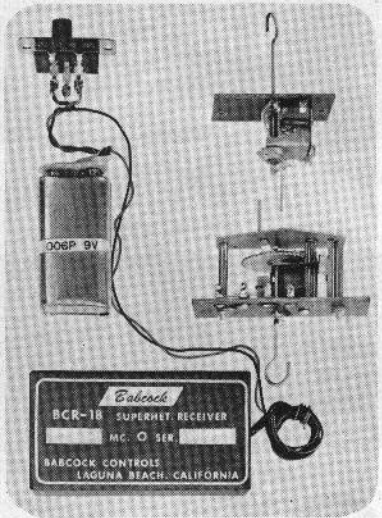
SENSIBLE R/C!

EVERY NEEDED FEATURE FOR TODAY'S FLYING CONDITIONS



The "Digitran" Transmitter
(8 Transistors)

FOOLPROOF
FLYING
FUN
FOR THE
R/C
SPORT
FLIER



Super-Heterodyne Receiver and Escapements
(9 Transistors)

TRANSMITTER 39.95 MARK VI ESCAPEMENT 11.95 MOTOR MINDER 5.95 RECEIVER 39.95

The BCT-18 "Digitran" is a true digital transmitter that forms the pulses, rapidly and accurately stepping the improved high resistance Mark VI Hyper Compound escapement. The BCR-18 is a crystal controlled super-heterodyne (weight 2 1/4 oz.) designed exclusively for model aircraft. These two units with escapements shown for a complete R/C system for right and left rudder, up

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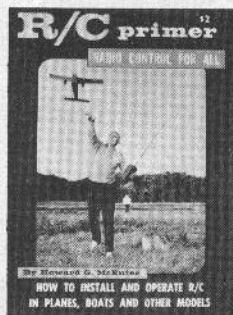
Lightweight with adjustable high-low throttle stops. No escapement binding here! Easy to install.

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This new book on the fundamentals of radio control tells how R/C functions, how to mount them, how to service and maintain them. Many diagrams and sketches on the USE of R/C, NOT on building 'em!

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ing a mic connector type of arrangement, as in the ASP 211. (Ace R/C, \$2.95.)

● A good motor as an integral part of the Phelps feedback servo kit is Japanese in origin. Has excellent drain characteristics, high torque, and may be easily adapted for proportional control actuators of either the rudder or Galloping Ghost type. Motor housing, exclusive of shaft, 1 in. long, 7/8 in. tall, 1 1/8 in. wide. (Ace R/C, \$2.95.)

● Miniature magnetic reed relays from Omega Sales & Eng. (Box 321, Racine, Wisc.), models AR-300, AR-500, HR-1. AR-300 is carried by Ace R/C, AR-500 being added, possibly the HR-1. All are hermetically sealed, have life expectancy of 100,000,000 operations, max voltage 250, max current .5 amps (steady state), max AC power 12 V/A, max DC power 10 watts. Rating at 12 operations per second.

AR-300: 300 ohms, 4000 turns of #40, weight 4.5 grams, pull-in current 8 to 15 ma at 2.5 to 4.5 volts. AR-500: 500 ohms, 5,500 turns #41, weight 4.5 grams, pull-in current 4.5 to 10 ma at 2.3 to 5.0 volts; HR-1: 3600 to 3800 ohms, 15,000 turns #44, weight 5.0 grams, pull-in current 1.5 to 2.7 ma at 5.5 to 9.5 volts.

All are SPST Form "A," with #24 ga. .020 dia. leads to coil and switch. Shock: to 50 G's with pulse duration to 10 milliseconds, either closed or open contacts. Price: AR-300, \$3.50; AR-500, \$3.75; HR-1, \$4.00—these within the above spec pull-ins. Add 25 cents for specific pull-in.

● From Acryjel (Box 306, Oklahoma City, Okla.) announcement that the Acrylic Plastic Powder and Liquid formerly contained only in their #1 and #4 combination kits are going to be available separately. Acrylic Plastic Powder (120 cc) will sell for \$2.00, with the liquid, sufficient for the quantity of powder supplied, 75 cents.

Grid Leaks at Play

(Continued from page 1)

"Next year the club has two goals in addition to improving the field and having more fun: 1) To sponsor two contests, 2) to encourage younger modelers to get into R/C.

"The first step toward the area's youth has been taken in establishing a one-half-normal dues rate for members 18 years and under. We will have an escapement-only competition class at our next year's Rudder-Only contest."

Also to be congratulated is the RC/NC of Winston-Salem, N.C. Their Junior participation program has been excellent for years.

We are sure that there are other clubs that are doing things of this nature, but we would urge that all clubs take this as one of their prime musts for '64.

One of these days GRID LEAKS may sprout a questionnaire. Exactly from where do come the present 50,000 or so R/C'ers. How many of them built models as youngsters, and how many of them had not heard of balsa wood until they entered radio control? We believe such a questionnaire would have interesting answers.

We invite your comments to GRID LEAKS with reference to the problem of how to attract more youngsters into radio control.

● On the AMA front, we were delighted to learn that John Worth has instigated a look at the need for an R/C organization within the AMA.

A proposal by Director John has been

12 CHANNEL SUPER-HET

Flight Proven Reliability

Receiver operates on 6 volts. Temperature compensated zero—140° F. New design high frequency reeds. High impact plastic case 1" x 2" x 3". Wt. 4 1/2 oz.

Ten Channel Super-het _____ \$89.50
Twelve Channel Super-het _____ 99.50

ALL TRANSISTOR TRANSMITTER

Operates on one nine volt battery. Features a meter for accurate tuning and battery checking. High quality components assure RF and tone stability. Size, 3" x 5 7/8" x 8 3/4". Wt. 3 1/2 lbs. with battery.

10 Channel Transmitter _____ \$118.50
12 Channel Transmitter _____ 129.50
(less battery)

DM 60 Six Channel

6 Channel Super-regen. (relay) receiver ... \$57.50
6 Channel non-simul. transmitter _____ 61.50

CONNECTORS

8 pin-polarized _____ \$1.30 pair

SPDT RELAYS

50 ohm _____ \$3.85 500 ohm _____ \$4.00
100 ohm _____ 3.95 1250 ohm _____ 4.10
5000 ohm _____ 4.25

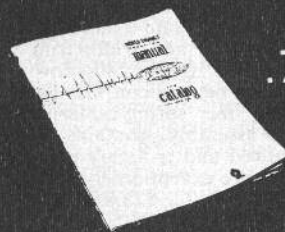
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.70

New Catalog

The new World Engines catalog and technical manual now runs one hundred thirty some pages. We think this to be the most complete catalog in model aviation. To justify the title "Technical Manual" the book includes. . . .

- ▶ Three view scale engine drawings.
- ▶ Circuit diagrams for Control-air transmitter, amplifiers & receivers.
- ▶ Information on the new Orbit proportional equipment.
- ▶ Displacement, bore, stroke information of most of the World's model aircraft engines.



WORLD ENGINES INC.

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made, and it is definitely for an organization to be established within the AMA framework. It will be evaluated by Ernie Kratzet's committee, which will look into the need of such an organization, and investigate how the AMA can more efficiently meet R/C demands.

This is positive forward-looking leadership, and we believe that all parties are to be congratulated for taking this forward step, regardless of whether this organization comes into being or the result is just better AMA operation.

We take this opportunity to thank all who have written us about the improved appearance of GRID LEAKS. It is heartwarming to all of us who work on it so hard, to know that our efforts are being rewarded.

We also welcome the many new subscribers that will be getting this issue for the first time. Welcome aboard.

Mid-America Regional Championships

The first Heart of America Contest held near Kansas City, Mo., last year, will be superseded by an event of outstanding size, and should attract R/C fans from even a greater area than the successful event of 1963.

Carl Lindsey, Contest Director for the Heart of America, announced that, with the cooperation of the former sponsor, Ace R.C./GRID LEAKS, the first annual Mid-America Regional Championships, under the sponsorship of the Kansas City Aero Club of Kansas City, would be held on August 15 and 16, 1964, at the Richard-Gebaur Air Force Base.

President Bill Ong of the K.C. Aero Club, and of the N.A.A., is closely affiliated with the F.A.A., and the group has gone all out to assure an outstanding event that is sure to attract the top R/C fliers, not only from the Middlewest, but all over the nation. A total of six events are planned. These include Class I, II, III, Open Pylon Racing, Scale, and Combat. (The ground rules for the latter event are still to be determined.)

Judges will be selected from among members of the Kansas City Aero Club, who are all civilian pilots, and from accomplished R/C fliers in the area. There will be six flight lines! Sufficient personnel will be on hand so that judges will be in sufficient quantity to hold continuous flying from six different flying sites. The flying sites will be assigned by frequencies. One will be for the 50-54 slot, and the other will be on the five superhet frequencies. This will allow simultaneous flying on all six flying circles. There is sufficient space to allow this without any hazard.

In addition to five trophies for the first five places in each of the six events, there will be merchandise prizes which will be furnished by the industry. At present the plans also call for the top prize in each of the six categories to be offered some choice radio-control gear, including the possibility of some of the best proportional rigs available. This is still in the nebulous stage, and will be tied down shortly.

In view of the fact that there will be six flying circles, and that these will be by frequencies, advance registration is a must.

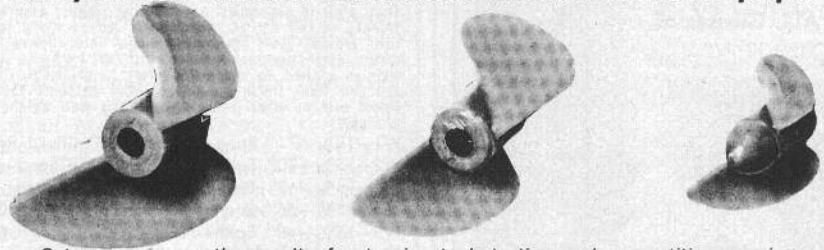
The Air Force Thunderbirds will be a prime attraction, but they will not interfere with R/C flying, since their portion of the program will be conducted on the field away from the six R/C sites. *The R/C event will not be shut down during the Thunderbird demonstrations.*

The Air Force is going all out to help the Kansas City Aero Club, along with GRID LEAKS, to make this the outstanding R/C event in the Middlewest for 1964.

(Continued on page 31)

Prize Winning OCTURA Hi-Impact Plastic R/C PROPS!

Designed specifically for R/C model boats . . . get best performance from your motor and hull combination! Not modified tether props!



Octura props are the result of extensive tank testing and competition running. Are molded of high luster, high impact plastic. Range of diameters and pitches suitable for engines from .15 to 1.50 c.i. displacement. Completely finished and balanced—ready to install and run. Holder of more R/C model boat records, both here and abroad, than any other propeller. Look for the distinctive red color and shape. Propellers X35 thru X70 and 40P thru 62P are supplied with 3/16" bore and slotted to fit drive dog OC-6D.

The X30, 30P and 35P are tapped 8-32 and equipped with a molded tail nut. Available in two patterns, the power thrust designs for displacement and heavier type model boats plus speed thrust design, for hydro and light displacement hulls.

SPEED THRUST	X30—1 1/16" D x 1 1/32" Pitch—15 Eng.—55¢
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	X40—1 9/16" D x 2 1/32" Pitch—29 Eng.—75¢
	X45—1 4/8" D x 2 1/2" Pitch—35-45 Eng.—85¢
	X50—1 3/32" D x 2 29/32" Pitch—56-60 Eng.—95¢
	X70—2 3/4" D x 3 7/8" Pitch—O & R, Twin 60 Eng.—\$1.75
POWER THRUST	30P—1 1/16" D x 1 1/16" Pitch—15 Eng.—45¢
	35P—1 7/16" D x 1 7/16" Pitch—15-19 Eng.—55¢
	40P—1 9/16" D x 1 3/8" Pitch—15-29 Eng.—65¢
	45P—1 4/8" D x 1 13/32" Pitch—29-35 Eng.—75¢
	50P—1 3/32" D x 1 17/32" Pitch—35-45 Eng.—85¢
	55P—2 1/32" D x 2 3/4" Pitch—45-60 Eng.—90¢
	62P—2 1/2" D x 1 23/32" Pitch—60 Eng.—95¢

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Available NOW DIRECT FROM FACTORY ONLY AT WHOLESALE PRICES!

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WEIGHT—2R—1.3 oz. 2RL—1.7 oz.
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 THRUST—Over 3 pounds.
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 MOTOR—5 OHM—180 ma. no load—stalls at 600 ma. @ 2.4V.
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 AMPLIFIER—All model 2RL Servos are equipped our 7 transistor amplifier (DK-7) that features complete burn out proof operation while adjusting centering, or if adjacent reeds are driven at the same time.

No. 2R (RELAY) . . . Only \$ 7.95 Postpaid
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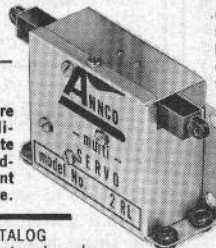
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• **SELECTIVE SUPERHET** Flying for ALL Classes of R/C

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IN
'64

RSH SINGLE CHANNEL RELAYLESS SELECTIVE SUPERHET RECEIVER

The SMALLEST Superheterodyne Receiver on the market. 1/4 or 1/2 A plane accommodates complete installation. Battery requirement 2 pencils. Selectivity permits flying 6 planes at same time. Especially designed for use with CITIZEN-SHIP SPX or TTX Transmitter.



\$34.95

Available in all 6 legal FCC Frequencies. Suggested list price

6 CHANNEL ALL TRANSISTORIZED SELECTIVE SUPERHET SYSTEM:

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Suggested List Price

The all purpose system—multi for the beginner OR the contest flyer. (For rudder, intermediate or pylon racing.)

Complete System—SAVE \$17.80

over items purchased separately
SL-6 ALL TRANSISTORIZED High Power Transmitter. If purchased separately, suggested list price**\$74.95**
RL-6 ALL TRANSISTORIZED SUPERHET Relayless Receiver. If purchased separately, suggested list price.....**\$54.95**
3 TNA SERVOS purchased separately — Suggested list priceea. **\$25.95**



SL-6



RL-6

COMBINATION PACKAGE

SL-6 Transmitter and RL-6 Receiver

\$119.95

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SAVE \$9.95

over items purchased separately Available in all legal FCC Frequencies

NEW BARGAIN PACKAGE Complete Single Channel System. SAVE \$2.95

OVER ITEMS PURCHASED SEPARATELY
 TTX Transmitter (no license required) packaged with completely wired R/C Pak w/SE-2 Escapement—Suggested List Price.....**\$61.95**
 w/PSN-2 Escapement—

Suggested List Price.....**\$59.95**

CITIZEN-SHIP "Awards" Program continued in '64

Send for Catalog for complete description of all Citizen-Ship equipment and details of "Awards" Program.

Citizen-Ship

RADIO CORPORATION

810 E. 64th St. Indianapolis, Indiana

Something New in R-C

Pre Assembled Wings

- ALL UNITS ARE JIG BUILT TO INSURE ACCURACY
- Balsa construction to insure lightness
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Wheel Brakes

Simple—Light—Durable

Easy to install on either 1/8 or 5/32 wire L.G. Gives smooth positive action without binding. A simple idea put to a practical use. Can be used on either the main landing gear or nose wheel.

Main Gear\$1.49

Nose Gear89

At your dealer or direct.

Other popular wing sections will be available soon.

2 new items on the way

Send stamped self-addressed envelope for complete information.

- W1—18%—71" Span Tapered—12" Chord Root Semi-Sym.\$32.95
- W2—15%—70" Span—12" Constant Chord—Full. Sym. 32.95
- W3—15%—62" Span—12" Constant Chord—Full Sym. 29.95
- W4—15%—55" Span—12" Constant Chord Clark-Y 19.95
- W5—15%—48" Span— 8" Constant Chord Clark-Y 14.95

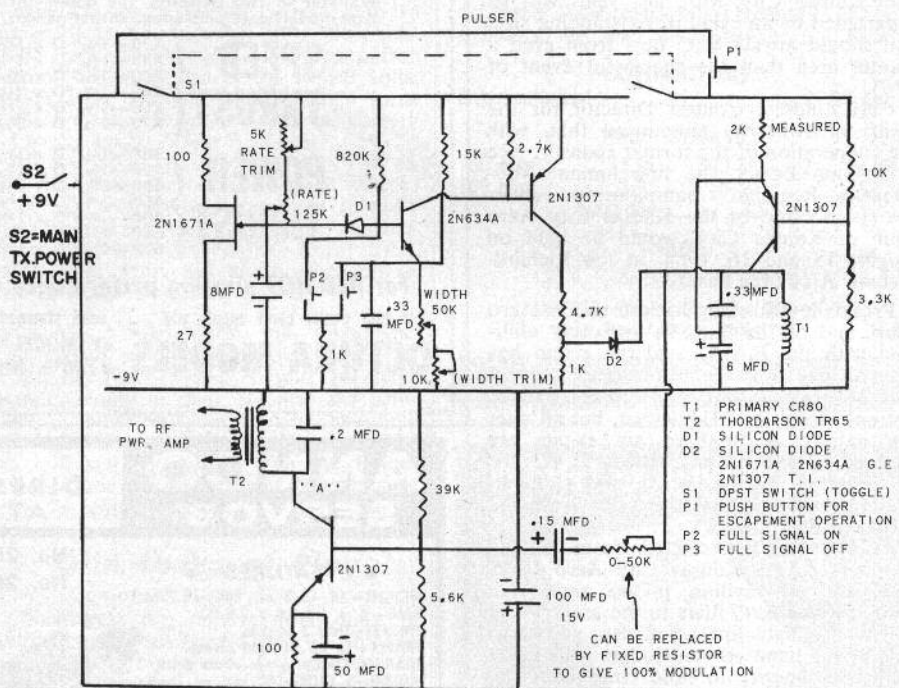
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CORRECTIONS KLEBANOFF TRANSMITTER NOV.-DEC. ISSUE

How to avoid mistakes in schematics is a real problem with all magazines. It is as if these inanimate "squiggles" had a con-

trary intelligence of their own, bent on booby-trapping all who deal with them. In Len's schematic, for instance, many of the decimals faded out in printing, so here it is again with beefed up "dots" and with the 9V main TX power switch added.

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AIRBORNE CONTROL LABORATORIES

FROM THE LAB

Vibration, next to operator error, is probably the major cause of R/C equipment failure. Electronic components are generally quite rugged, but continual stresses due to vibration can cause fatigue and eventual failure. With the popular "gold brick" design used by ACL and others it is somewhat more difficult to isolate the engine vibrations from the control equipment. However, we feel that we have devised an extremely simple yet highly effective mounting scheme that eliminates vibration without loss of rigidity along with servo thrust line. For details send a stamped self-addressed envelope and we'll gladly provide a sketch of the method.

In the '64 American Modeler Annual there is a fine article on CAR (Coupled Aileron & Rudder) that is well worth reading. The point; and it's worth emphasis here, is the ease with which CAR can be accomplished and the fine flying which results. This is important to the sports flier with an eye on equipment cost and performance. The article shows several methods to achieve CAR. Again, if you're interested in the method we use, drop us a note and we'll gladly send you the details.

The **ACL MARK II** is undergoing some revisions for '64. Complete details can be had on request, but here are the essentials. First, servo speed has been increased (without decreasing torque) to the point where we feel we have both adequate torque and speed. Servo speed will certainly be a topic of much discussion among proportional fliers in the future and we feel that the **ACL** servo will be one of the standards.

We're of the "high power school" for transmitters and have been working on a transistorized transmitter with real success. The engineering model is radiating within 10% of the power of our present tube type which has 2.5 watts into the final. We don't plan to use a special antenna; radiated power will come from input power. This avoids the problems of handling and tuning that goes with some of the special antennas.

Another item worth note is the **Mark II B**. This optional version of the **Mark II** allows separate mounting of the receiver and provides greater mounting ease and flexibility. One of the things we hope to do with this development is market a single channel receiver and transmitter to drive an escapement or pulse servo, that can later be converted to the **Mark II B**. This approach should allow a reasonable investment for the beginner without the expense of equipment obsolescence when expansion is desired. If this sounds like something you have been looking for, drop us a note. If there is enough early interest, we'll speed up the development.

One last item, We're moving. Our manufacturing and service facilities will be located in Endicott, N. Y. and our business office in Poughkeepsie, N. Y. This expansion will allow improved delivery and service and at the same time allow more attention to future development.

For our 11 page brochure on the **ACL Mark II** please enclose \$.25 to cover handling and mailing costs.

Airborne Control Laboratories
Box 1493, Poughkeepsie, New York

Grid Leaks at Play

(Continued from page 29)

For further details contact Carl Lindsey, 1505 B Street, Blue Springs, Mo. (Contest Director.) PAUL F. RUNGE, *Publisher*
Grid Leaks Agent for R.C.M. & E.

You may have noticed on the masthead that the British publication, *Radio Control Models & Electronics*, is subscription agent for **GRID LEAKS** for all European countries.

We are happy to advise that **GRID LEAKS** is the U.S. subscription agent for *Radio Control Models & Electronics*. This 12-times-a-year publication has recently increased its format and continues to present some excellent ideas of interest to the R/C modeler. Subscription price is \$5.00 for one year.

We will be happy to serve you for R.C.M. & E., as well as her sister publications, *Model Maker*, *Aeromodeller* and the new *Model Cars*. Write to **GRID LEAKS**, Box 301, Higginville, Mo., for details or sample copies of R.C.M. & E.

The Monitor

(Continued from page 2)

L9 780 contact cement applied with a paint roller—color down. The film (Eastman) was 50 cents per yard. (Note says "like Lucite.") Adhesives should be water soluble (like white glue), but never contain volatile solvents.

A wonderful feature of the Bison Conference is the model exhibit, from which the 600 people who attended chose by ballot, their favorites for the most-attractive and original design and scale categories. Ken Person, who took first in the good-looks category had a Perigee finished in apple green and gold (he told GL it was finished with clear Hobby Poxy—a really fine model in any league). Dick Spidel, Canada, knocked off scale with a huge D-5A Albatross in authentic Loeser black and white (dull as it should be, and judges go hang). Canadian scale jobs were a pre-conference publicity gimmick and the north-of-the-border lads did not disappoint. Bob Dunham received the "VIP" award, the most quiet and unassuming VIP in memory! (On the way home, Bob also received a similar award from the HIAA at their Chicago convention.)

Since the Bisons urge everyone to bring their wives (many kids about but, praise be, not underfoot!), there was a four-piece combo after the banquet, led by the talented Tom Brett who plays a fully proportional piano. For solo visitors movies and slides of R/C doings were simultaneously shown in another room.

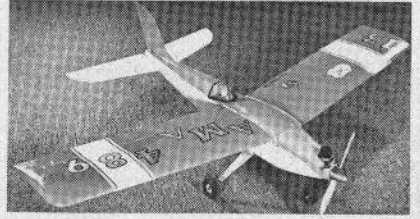
● We did not plan it this way but it does seem that this is a "Bellamatic issue," what with Dick Jansson's fine display of servo installations and the 1/2A multi servo article. The latter is the result of some experimentation by the staff, augmented with info from Howard McEntee's excellent column in the *American Modeler*, and from *Radio Control Models and Electronics*. Material presented by those sources has been updated here for today's transistors, and with printed circuit techniques. So what we've done is to merely round up and update such info as an advancement of the art for today's user.

● Complementing our styrofoam feature are these notes made with Ed Izzo's co-operation: the heated wire is 15 mil chromelox, 17 volts, 3 amps (3 ohms per foot.) Material is Dow polystyrofoam, weighing 1 1/2 lbs. per cu. ft. They work 40 inch panels, two men guiding the wire. Adhesive sources: Hobby Poxy, white

DIFFERENT !!

—or at least we try to be! It's easy to set up our ads showing the standard product available. Naturally, **WORLD WIDE** carries all of these in stock for immediate shipment to you—but since we are R/C specialists, we like to feature the products that are a bit different—as well as those of the more prominent manufacturers!

For example, here's a quality West Coast kit—**Bill Williams "Dominator"**



This is a superior multi channel contest model with over three years competitive flying incorporated in its development. It has won numerous West Coast contests and has placed among the top winners in the 1961 & 1962 Nats. Span: 62" Length: 44" Weight 5 3/4 lbs.

Postpaid \$34.95

In our previous ads, we featured Dwight Hartman's Zeus (Taurus) fiberglass fuselage. It was well accepted and now Dwight has come up with a deluxe fiberglass fuselage for Pappy deBolt's "Interceptor". He calls it the Zeus Interceptor Mk II. It features one-piece molded construction—all bulkheads, motor mounts, wing attach bracket mounts, and servo rails are installed.



The Interceptor is a high speed multi stunter featured in the Jan. 1964 issue of M.A.N. As an extra, we include a full size set of plans with each fuselage! only \$26.95

Spring Special

 TopFlite Schoomaster \$5.95	 Fox 07 R/C \$10.95
both for \$12.95	

Here's just a few of the latest items—

- Miss Behaving kit, multi, 74" span \$29.95
- Strader's Chicken Hawk biplane, .049 7.95
- Sampey Single Channel Proportional "Starlite 200" units

Transmitter	Receiver
Assembled \$59.95	Assembled \$49.95
Kit 49.95	Kit 39.95
• Tone-E Field or Bench Monitor	\$16.95
• Royal Products 3PN Servo, 1 ch.	12.95
• Citizen-Ship RHS Single Superhet	34.95
• Dzus Fasteners, wing hold-down, pr.	.65
• Goldberg Jr. Skylark, .049 twin	4.95
• Fox 59 R/C, new improved throttle	39.95
• Ace Phelps Pulser kit	28.95
• Du-Bro Compac Charger	6.95

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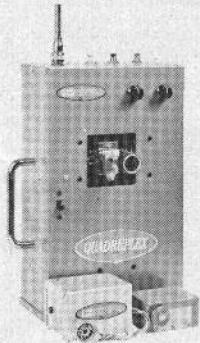
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FOR THE FIRST TIME YOU CAN OWN AND FLY THE AMAZING QUADRUPLEX CONTROL SYSTEM WITH WHICH DON BROWN HAS AMAZED THOUSANDS.

Triple simultaneous, fully proportional QUADRUPLEX, the most complete and most fairly priced unit ever offered to the R/C enthusiast. Completely wired and ready to install. Transmitter complete with charged nicads. Receiver includes power converter, elevator and ailerons.

QUADRUPLEX never needs to be tuned under normal operating conditions and the range is as far as the human eye can see. Totally unaffected by temperature. Left hand models made on special request at no increase in price.



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glue, Adhesive Products Co., NYC. Sheet covering, 1/16 balsa, sanded almost to 1/32 inch. A blank is 16 x 3 x 109, costs \$4.22. Sheet covering is wrapped around leading edge, moistened, masking tape used for positioning.

The plus feature is the lightening of the wing blanks by removing cores tip to tip. Plywood rib templates positioned at center and tip, with lightening holes. A 3/32 in. I.D. brass tube, with small looped wire heating element, fed by wires through tube, inserts through these holes and cuts passageway to tip. Small block guides on table top line it up. Cutting wire now inserted and run around perimeter of lightening holes. The two men talk progress to each other to keep in step. Deep spar notch cut same way, then panel stood on end, white glue poured down slot, and spar slid into place. Hardwood inserts for gear, etc., should have wide stress area. Spar is 3/32, 2 inches deep at rib, 1/2 at tip. Aileron spar (on wing) is 3/16. Hinges are nylon, tooth-picked in place and cemented with white glue.

Toledo

(Continued from page 9)

all of the manufacturers appreciated this opportunity as much as we did.

While many dealers were present, the primary contact was between the manufacturer and the ultimate user—unique as "trade shows" go in this industry. Many dealers seemed to feel that this was a good place to get consumer reaction and therefore receive guidance as to what they should stock. As a matter of fact, one customer led his dealer to one booth and said, "Now, order this stuff so you can get it for me." Many customers do seem to be more aware of the rapidly changing R/C picture than some of their dealers!

Papers presented were excellent and provided a major portion of the program, but attendance was optional. Everything was going on at once. You paid your money and took your choice!

As always with affairs of this kind, contacts between modelers themselves and the exchanging of views are important. These things make this hobby great, whether you are attending a conference or a contest.

It is easily recognized that, when an event of this kind operates as smoothly as this one did, that there has to be a lot of behind-the-scenes work by many persons. You just do not mesh events as smoothly as this without a vast amount of work and preplanning. Many people in the Weak Signals group put in countless man hours to make this a "go" affair. If we knew who they were we would single them out here for recognition.

This factor, I feel, speaks well for the teamwork that must be present to make possible an affair of this caliber. It goes without saying that the members of the Weak Signals have learned many lessons in the 10 years of holding this conference. Our big hope is that they will continue to learn and profit and make their Mid-Winter Conference an ever-growing success. Another hope is that other groups will investigate and learn from the examples of the Weak Signals Club.

To all those who insisted to us that our attendance was a "must" we're grateful for that insistence. Now we're on the bandwagon, and we're insisting that the 1965 Weak Signals Conference is a must for you, too—modeler, manufacturer, jobber, or dealer.

This was our first trip to the Toledo Weak Signals Conference. It definitely will not be the last.

FOR YOU:

Each month the staff of R/C Modeler wraps up another issue designed to bring you the finest material and latest information in the radio control field.

Successful designers and flyers explain the latest trends in RC, providing YOU, The 'RC'er, with up-to-the-minute data on every phase of our sport.

Whether at home or abroad, your RCM editors are constantly searching for new and better material. Foreign news, compiled by Cliff Rausin, is brought to you while it's still news; W. R. Weaver discusses RC techniques in the Far East; Bill Murray scans the Canadian scene; and whether in Germany or Belgium, South Africa or New Zealand, RC activities from every far-off point of the globe are as near as your mailbox.

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FRANCHISE DISTRIBUTION PLAN!

In order to pass on to the consumer the lowest possible user cost for quality R/C, Kraft Custom Radio Control announces that effective March, 1964, all Kraft Custom equipment will be distributed exclusively by through Franchised Dealers. New prices also will go into effect.

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

KRAFT CUSTOM PRICE LIST 3-64

Model No.	Item	User net
KTx1 and KR-1	Matched Single Channel Transistorized Transmitter and Single SH Receiver (NOTE: Both are new items)	\$ 64.95
KT10 - KR10	Matched 10 channel Receiver and Transmitter	\$189.90
KT12 - KR12	Matched 12 channel Receiver and Transmitter	\$209.90
KT-10	10 channel Transmitter	\$119.95
KT-12	12 channel Transmitter	\$129.95
KR-10	10 channel Receiver	\$ 79.95
KR-12	12 channel Receiver	\$ 89.95
KRSC-1	Single channel Convertible Receiver	\$ 49.95

Available in the following frequencies at the same prices:

CB: 26.995, 27.045, 27.095, 27.145, 27.195 mc.

Hams: 52.950, 53.025, 53.100, 53.175, 53.250 mc.

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SERVOautoMATIC



Dimensions: $2\frac{3}{16} \times \frac{3}{16} \times 1\frac{15}{32}$ "
Weight: $1\frac{1}{8}$ ozs.
Operating volt 2.4 volts
Control force 27.75 oz. in.

This is a non-neutralizing multi-purpose 2 channel actuator. For the operation of engine speed control, flaps, spoilers, trim, wheel brakes, marine rudders, etc. Built in Slip Clutch. Contact-Less.

ONLY \$11.95

Here are just a few of the many other quality items stocked by International.

- GRAUPNER-GRUNDIG R/C
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BELLAMATIC II



Dimensions $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{19}{64}$ "
Weight $1\frac{7}{16}$ oz.
Operating volt 2-2.4 volts
Rudder force 5.5-6.9 oz. in.

ONLY \$17.95

This is one of the finest multi-channel servos, available to the Model Field. It was primarily meant for the operation of rudder, elevator and channel operation. However, it is as equally dependable on single channel proportional. Built in Slip Clutch. Spring Center

1 3/4" WIDE

I.M.P. ELMIC COMMANDER



LT. WEIGHT—27 GR.
At last here is a compound escapement, light enough and small enough to install in 1/4A and 1/2A models — yet powerful enough to power larger models. Has quick Blip Motor Control Contacts, Counter Balanced Governor and Nylon Pawls. Will operate on 1/8", 3/16" or 1/4" rubber. No linkage to solder.

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UNIMATIC

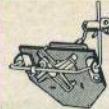


Dimensions: $2\text{-}59/64 \times 1\text{-}25/32 \times 1\text{-}17/64$ "
Weight: 1-15/64 ozs.
Stroke: 2 x 15/64
Voltage: 2.4V.

The Unimatic is a single channel motor driven servo. It comes with 3 P.C. Discs, #1—Rudder and Quick Blip Motor, #2—Sequence Action or Motor Control, #3—Cascaded for Engine and Rudder. Rugged Construction. Instant Action. Low Drain.

ONLY \$9.95

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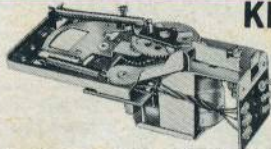


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This is an item that has been in great demand by the R/C model airplane builder, a dependable motor control escapement. Here is a push pull unit only 1 3/4" wide, weighs only 19 grs., has nylon pawls, adj. linkage, will operate on 1/8" rubber and from 1 1/2V. to 6V.

ONLY \$8.95

KINEMATIC



Here is a unit that is like putting multi-channel in your boat or car. It gives you right and left rudder, motor control forward, stop, and reverse and additional contacts. Rugged construction.

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Now You Can Have Your Winder Right in The Model!



- NYLON BODY
- EASY MOUNTING
- FITS ANY MODEL
- 2 WAY RATCHET
- WEIGHT 1/6 OZ.
- SIZE 1 1/4" x 1" x 3/8"

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