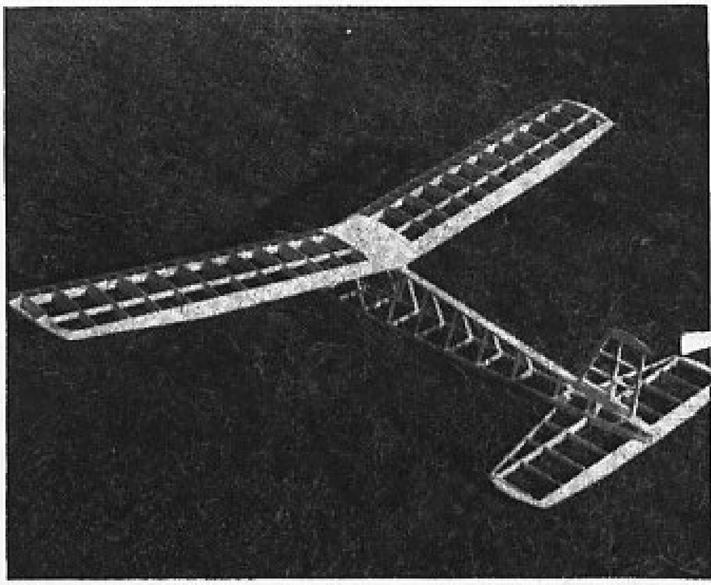
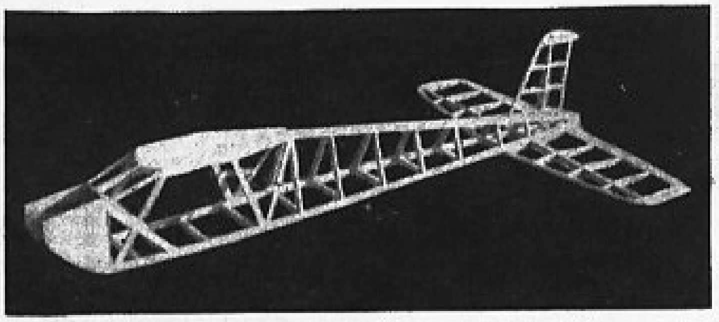
RUDDER BUG

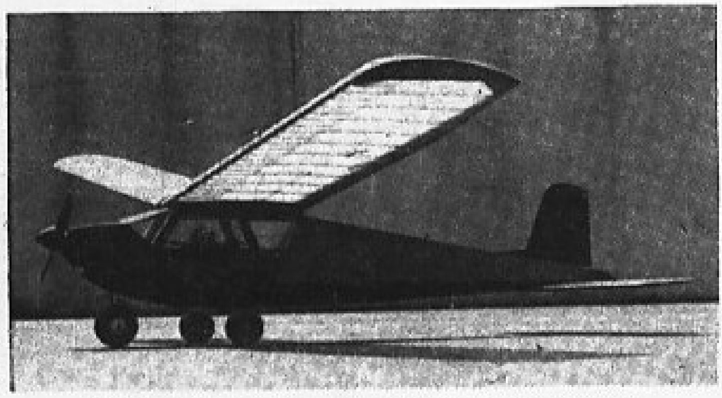
PART ONE



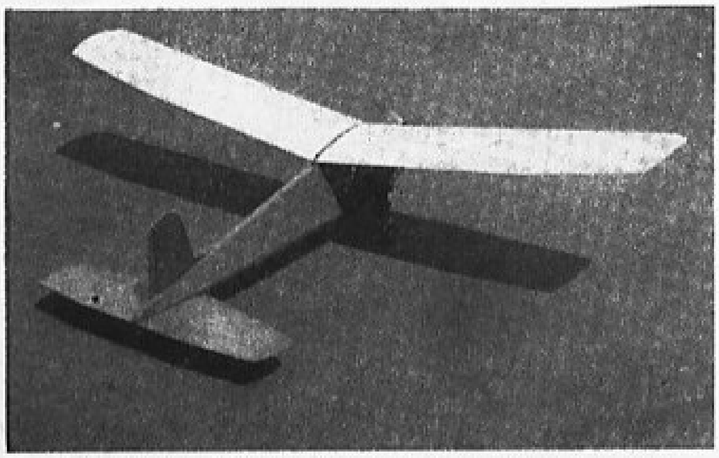
Completed framework ready to cover is simple and rugged



Area under wing is designed to give large unobstructed space



Tricycle gear assures good take-off and taxiing qualities



An attractive model, *Rudder Bug* was designed for a purpose

By Walter A. Good

THE *Rudder Bug* exemplifies the new trend in radio control models—simplicity. It is a far cry from the prewar "giant" R.C. models and a pleasant departure from freeflight gas R.C. conversions. Here's a model designed especially for existing radio equipment; it embodies many design features which are unique for radio control models.

In recent years it has become steadily apparent that the radio control gear is no longer the limiting factor in controlled performance. Strangely enough, the number one problem is the design of the model! The general impression of radio control builders at the 1948 Nationals was that final performance depends about 75% on model design, and 25% on radio gear—of course, with lots of practice added.

Thus, since the model design has assumed such importance, what are the design factors involved? Briefly they are: overall size and payload, stability, number of controls, engine power, accessibility of gear, poweron-poweroff characteristics, landing gear, and ruggedness. These factors are discussed in detail below.

The *Rudder Bug* has almost 6 sq. ft. of wing area, the wing spanning 6′ with a 12″ chord. It weighs in at 74 oz., which includes 16 oz. for the radio gear. The 1 lb. payload is easily carried. The body has a semi-scale appearance with a cabin which sports two king-size access doors. The length is 49″. The tricycle landing gear makes for good take-offs, and landings too. Power is an inverted *DeLong 30*. The radio control gear is a standard Beacon Electronics set, consisting of a transmitter, receiver and rudder escapement. Only rudder control is used which has been found to be very effective, hence the name *Rudder Bug*.

The *Rudder Bug* was in the drawing stage for several years. Almost a year of limited sparetime was consumed in the building—it wasn't quite complete in time for the 1948 Nationals! During six months of flying, the ship has logged 63 flights and verified many of the design ideas involved. Now let's talk about the design.

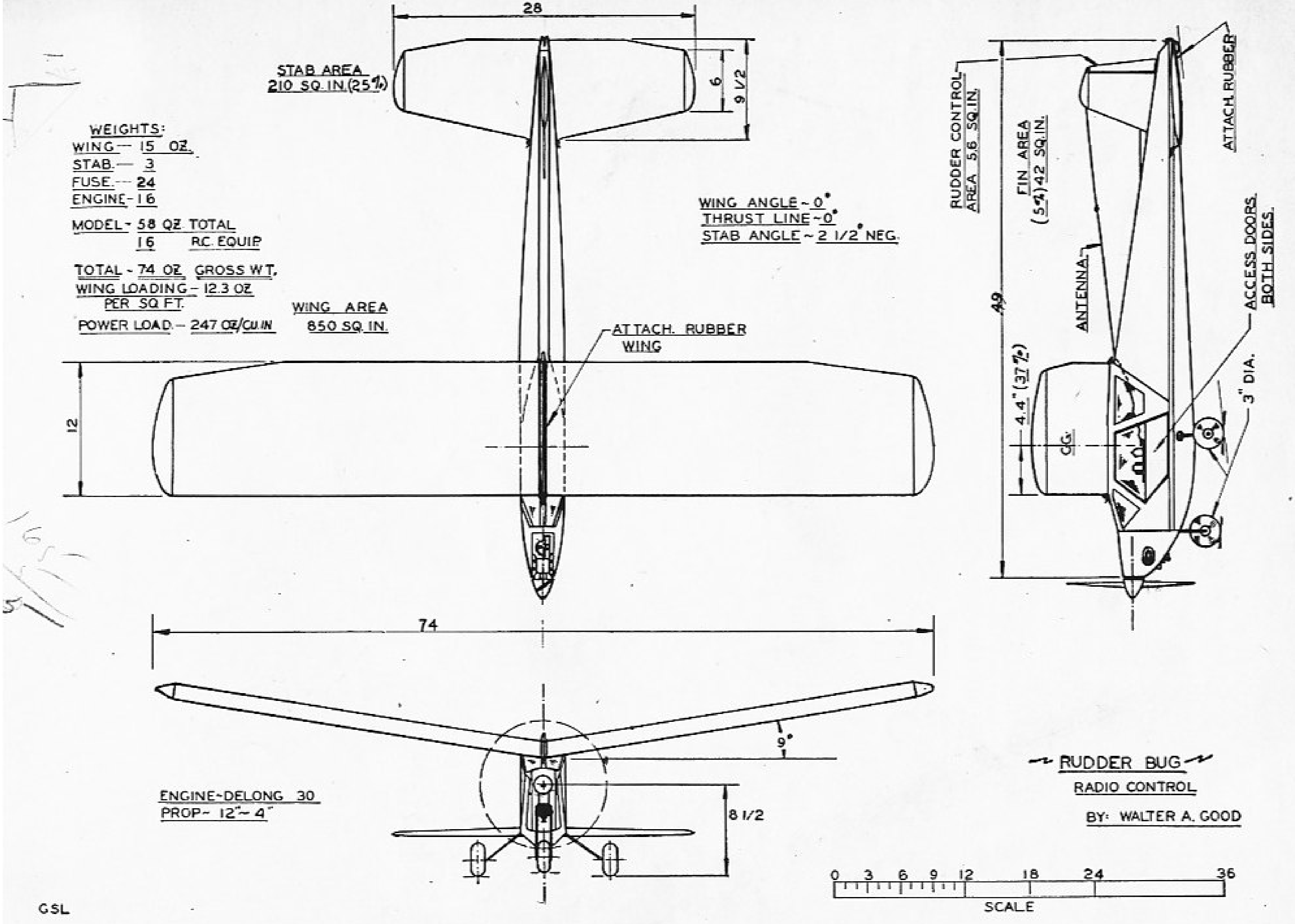
Large R.C. models (above 8′ span) are certainly beautiful flyers, as demonstrated by Charley Siegfried and others. They, unfortunately, do have two distinct disadvantages—they are awkward to transport, and require many long hours of building and repair time. How about small (below 5′ span) models? They are easy to transport and build.

It has been observed, however, that they rapidly shrink from view during flight maneuvers, giving the operator the feeling he's "controlling" a small dark blob rather than an airplane structure. Small models may have difficulty carrying the necessary radio gear with ease. The 6′ size of *Rudder Bug* is felt to be a reasonable compromise. Note how this size lends itself to conventional types of construction.

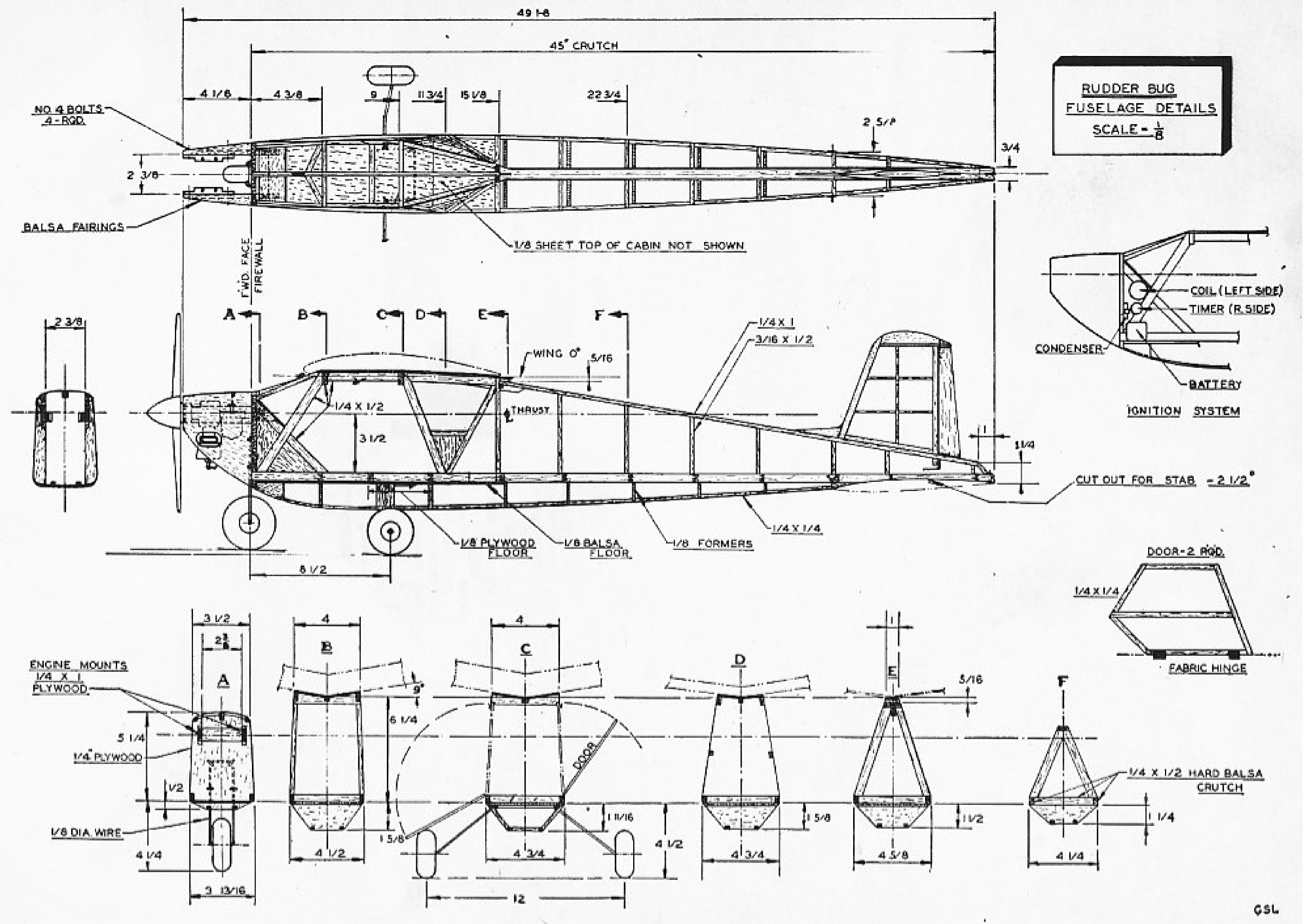
Good longitudinal and spiral stability are prime requisites of the radio control model. For this size model, Frank Zaic suggested that a 25% stab would be about right for a quick

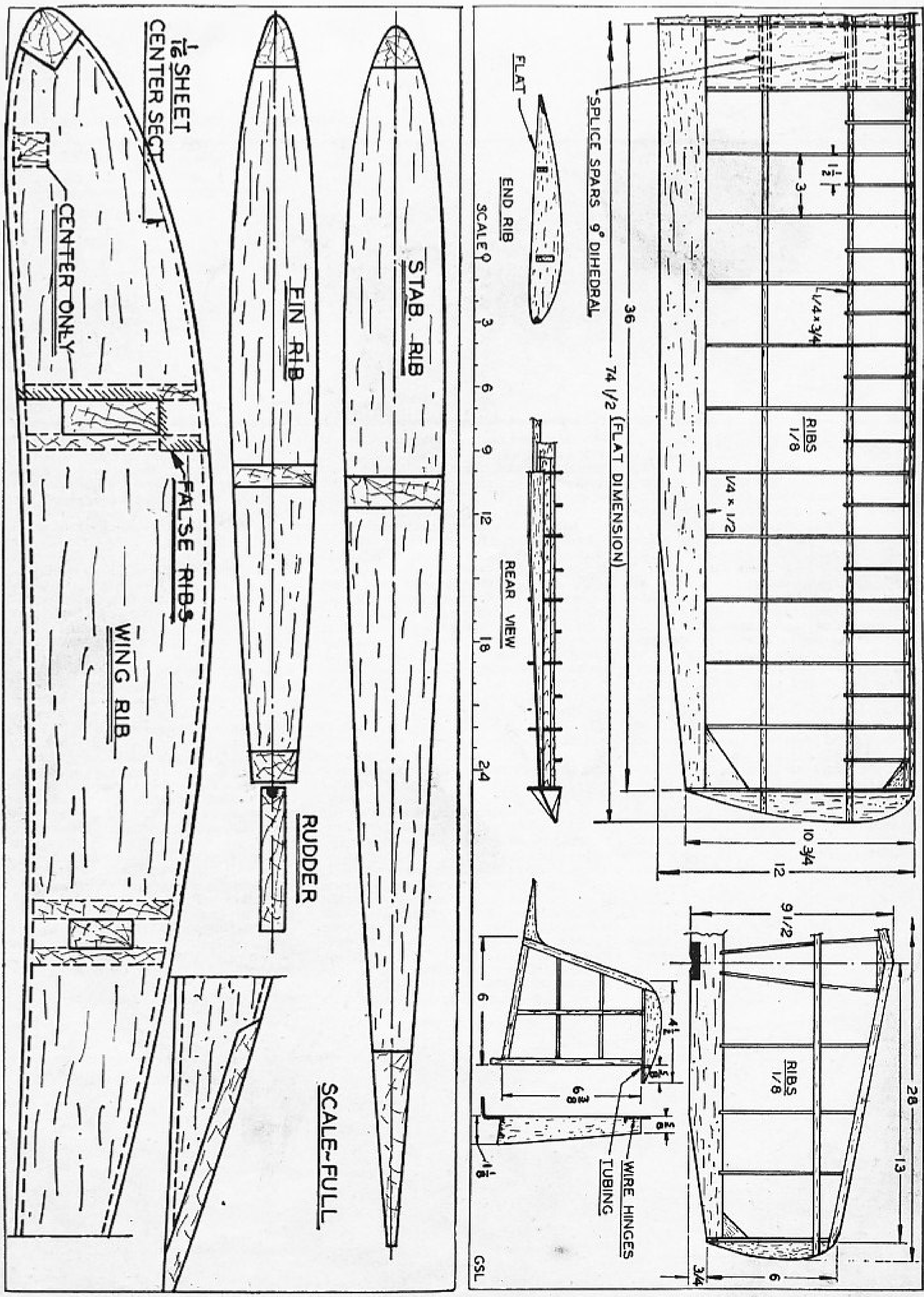
(*Turn to page* 37)

Walt Good has retired faithful old Guff, a real veteran, and has produced this up-to-date design for radio control



28
STAB AREA
210 SQ. IN. (25%)
6
9 1/2
WEIGHTS:
WING — 15 OZ.
STAB. — 3
FUSE. — 24
ENGINE - 16
MODEL - 58 OZ. TOTAL
16 RC. EQUIP.
TOTAL - 74 OZ. GROSS WT.
WING LOADING - 12.3 OZ
PER SQ. FT.
POWER LOAD. - 247 OZ/CU. IN
WING AREA
850 SQ. IN.
WING ANGLE ~ 0°
THRUST LINE ~ 0°
STAB ANGLE ~ 2 1/2° NEG.
ATTACH. RUBBER
WING
12
74
9°
8 1/2
ENGINE - DELONG 30
PROP - 12" ~ 4"
RUDDER CONTROL
AREA 5.6 SQ. IN.
FIN AREA
(5%) 42 SQ. IN.
ATTACH. RUBBER
ANTENNA
ACCESS DOORS
BOTH SIDES.
49
4.4" (37%)
C.G.
3" DIA.
RUDDER BUG
RADIO CONTROL
BY: WALTER A. GOOD
0 3 6 9 12 18 24 36
SCALE
GSL


RUDDER BUG
FUSELAGE DETAILS
SCALE - 1/8
49 1-8
45° CRUTCH
4 1/8
4 3/8
9
11 3/4
15 1/8
22 3/4
2 5/8
3/4
NO 4 BOLTS
4-RQD.
2 3/8
BALSA FAIRINGS
1/8 SHEET TOP OF CABIN NOT SHOWN
FWD. FACE
FIREWALL
A
B
C
D
E
F
WING 0°
5/16
1/4 X 1
3/16 X 1/2
1/4 X 1/2
3 1/2
THRUST
1
1 1/4
CUT OUT FOR STAB - 2 1/2°
1/8 PLYWOOD
FLOOR
1/8 BALSA
FLOOR
1/8 FORMERS
1/4 X 1/4
8 1/2
COIL (LEFT SIDE)
TIMER (R.SIDE)
CONDENSER
BATTERY
IGNITION SYSTEM
DOOR-2 RQD.
1/4 X 1/4
FABRIC HINGE
3 1/2
2 3/8
ENGINE MOUNTS
1/4 X 1
PLYWOOD
5 1/4
1/4" PLYWOOD
1/2
1/8 DIA. WIRE
4 1/4
3 13/16
4
9°
6 1/4
4 1/2
1 5/8
DOOR
1 11/16
4 3/4
4 1/2
12
1 5/8
4 3/4
5/16
1 1/2
4 5/8
1/4 X 1/2 HARD BALSA
CRUTCH
1 1/4
4 1/4
GSL



1/16 SHEET CENTER SECT.
CENTER ONLY
FALSE RIBS
WING RIB
FIN RIB
RUDDER
STAB. RIB
SCALE-FULL
END RIB
FLAT
SCALE 0 3 6 9 12 18 24
REAR VIEW
SPLICE SPARS 9° DIHEDRAL
36
74 1/2 (FLAT DIMENSION)
1/4 x 3/4
RIBS 1/8
1/4 x 1/2
1 1/2
3
10 3/4
12
9 1/2
RIBS 1/8
28
13
6
3/4
6
4 1/2
6 3/8
1 1/8
WIRE HINGES
TUBING
GSL

Rudder Bug

(*Continued from page 11*)

longitudinal recovery. This has been verified in the air. The high lift NACA 6412 wing section is set with its bottom at 0° incidence. The C.G. is at 37% of the wing chord, and the stab is set at −2.5°. During tests, the C.G. was varied from 25% to 40% accompanied by the corresponding stab setting, with the above figure giving the best recovery.

The good spiral stability of the model is attributed primarily to the proper relationship between dihedral and fin area, plus the "washed-out" wing tips, which reduce wing tip drag. The wing has 9° in each panel, or a total of 18° dihedral. The fin area is 5%. The wing tips have a built-in negative twist of about 2.5° which also helps prevent tip stall and promotes clean recovery.

How many controls should a radio control model have? The author believes that if you want to spend lots of time in the air and very little on the ground, then you should choose the most effective control combined with the greatest simplicity and reliability. Currently, the author prefers rudder control. It must be pointed out that the infancy of the radio control game has not allowed real standardization of "the" final system. Many other systems suggest themselves. Rudder with coupled elevator to give tight nose-high turns looks good. Maybe ailerons alone would do? A butterfly tail with its combined rudder and elevator could be worked out. The *Rudevator* of Owbridge and Schumacher has been perfected and gives coupled turns plus up-and-down. These are but a few of the possibilities. Many flight tests of these and other ideas will be required before standardization occurs.

The fantasy that radio control ships need large engines was finally dispelled at the 1948 Nationals, where several ships appeared with Class B engines! The *Rudder Bug* mounts a *DeLong B* which does very nicely; in fact, on some flights it would have been desirable to throttle it back after reaching maneuvering altitude. The important point is to use a steady, reliable engine—not a host of power. After all this is not a screaming contest ship!

The accessibility is measured by the ease with which you can get at the receiver, the batteries, the escapement, and the wiring. Two large doors, one on each side of the cabin, give entrance to the receiver and battery compartment. Converted free flight designs usually cannot afford such large access openings because their structures would be too greatly weakened. The doors, which hinge along the bottom edges, allow quick checks of battery condition and adjustment of the receiver. The escapement and its linkage are mounted within the fuselage just below the fin and are reached through the bottom of the fuselage when the stab is removed. The escapement rubber band threads forward in the body and is wound through the cabin door. Winding once a week is recommended! Removal of wing and stab does not interfere with any of the radio installation, thus you need only the fuselage for radio testing, a handy consideration in a small workshop. Because the cabin roof is covered, there are no dust catching holes when the model is stored. This also protects the sensitive relay contacts from excessive contamination.

It is desirable that neutral rudder result in straight flight with engine power both on and off. Similarly, fixed left and right rudder deflections must produce equal sized circles. Can you adjust your contest gassie to do this?

Of course, if the normal torque effects could be eliminated, the problem would be solved. A method is used here which does not eliminate the torque effects, but greatly reduces them. This type of model would normally be expected to turn left under power. A large portion of the "left turning" torque is due to the spiralling prop wash acting heavily on the left side of the fin because the fin is usually well above the thrust line. In this model the fin has been lowered drastically such that the thrust line is directed through, or slightly above, the center of the fin area. As a result, this model flies straight with no motor off-set! An earlier model which had the whole fin completely below the thrust line turned violently to the right "against the torque" with all adjustments neutral. So don't ignore the spiralling slip-stream. Gene Foxworthy has another solution by removing the fin from the slip-stream and using double fins on the tips of the stab.

Proneness of the two-wheel gear on the old *Guff* to cause ground loops led us to try something different. Jim Walker's demonstration of his tricycle gear provided the answer. While all three of the wheels are fixed it still is possible to "steer" the model with the rudder during the take-off phase. Long, lazily realistic take-offs are made comparatively easy. Landings, too, benefit from the fact that very little bounce results, even on a hard runway. "Flat" landings have been made which exhibited no perceptable bounce followed by a terrific roll she really needs brakes! Remember the wheels absorb most of the landing shock, so choose good rubber ones, especially for that poor nose wheel.

Real ruggedness is required to withstand violent maneuvers and an occasional rough landing. Experience has shown that the radio equipment is far more shock resistant than the model. So if you have to retire from the field early, it's more likely to be due to an unrugged model. Also, there is a payload aboard which stresses the model structure too. Plywood firewall and plywood landing gear platform aid the strength. The nylon covering has held up well even through two bad landings; one in a tree, the other downwind into a fence. In fact, total damage was a broken prop and a few dents. The nylon is strongly recommended.

Since most of you are familiar with standard building methods, only general construction notes will be given. The materials should be carefully selected. All pieces may be cut from standard sizes except the two crutch longerons, which require splicing. Due to the crutch type construction, most of the body can be built before removing from the board. The 1/8" diameter steel landing gear wire is fastened in position with "J" bolts. The motor cavity is suitable for a variety of engine sizes. Note: motor beans are replaceable. The slab-sided nose is not as pretty as a cowl, but is certainly easier to make and is a practical expedient.

Attention is called to the 1/8" floor in the forward section of the body. Batteries are mounted along this floor. Wing and tail fasten to the body by conventional rubber band methods. Use plenty of glue on all joints; two or three coats will repay the effort in greatly added strength.

The wing spars were first carefully joined at the correct dihedral angle and then the ribs and other parts were assembled. The trailing edge of 1/8" was copied from Effinger's *Buccaneer*. To produce the built-in negative twist in the tips, build the entire wing flat with "square" tips. Then slice off the angled trailing edge and shape the bottom of the ribs to fair smoothly into the trailing edge. The tip rib should have a perfectly flat bottom. The nylon covering worked best for the author by covering "wet" the same as silkspan. This way no stretching is required although repeated wetting may be needed because nylon dries quickly. The model was doped with three coats of clear and two of color which naturally was a deep orange.

The fin is symmetrical and is cemented to the body after covering. The movable rudder is made from very light 3/16", which is intentionally left thick to operate effectively. Make sure that the rudder moves easily without stickiness. A 7° angle or about 1/8" deflection of this rudder gives a very tight turn so start your test flights by pinning it in a neutral position.

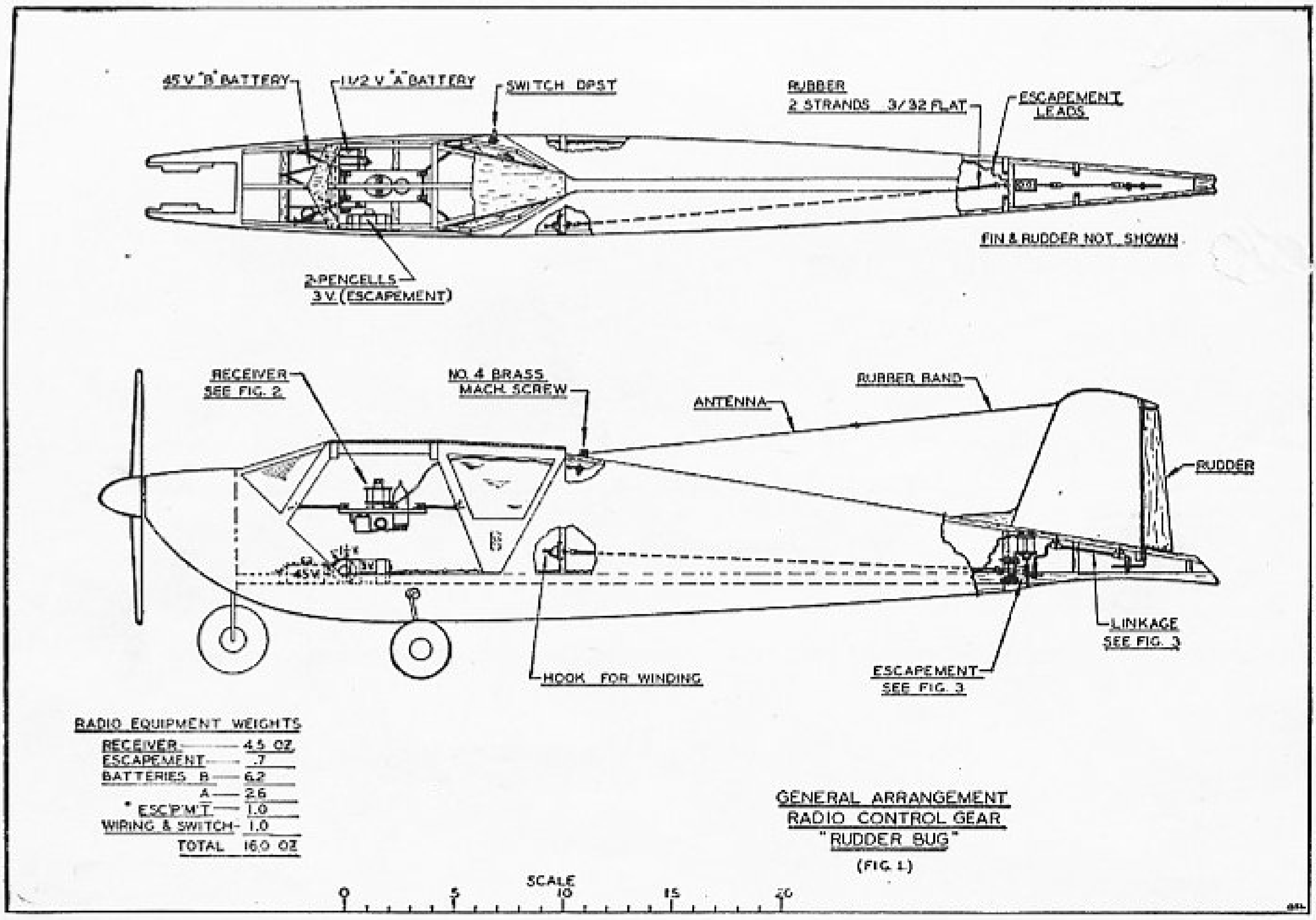
The stab has a symmetrical section and a full depth spar. Keep it light to prevent tail heaviness.

A breakdown of weights is listed on the drawings to be used as a guide.

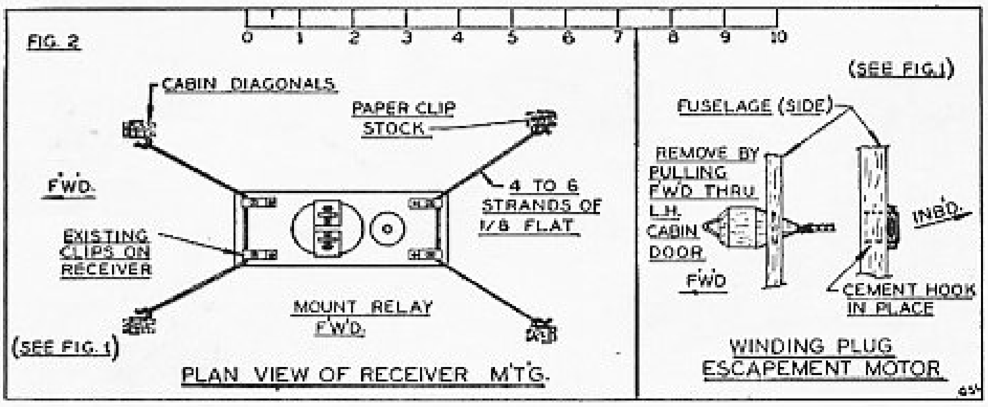
The original model was test flown with no radio gear aboard. The purpose was to obtain approximate trim adjustments, become familiar with the model's characteristics and provide a "shakedown" test. With no payload the wing loading is about 10 oz. per square foot, which makes testing easy. Balance the model at 37% (4-1/2" behind leading edge) by adding weight at the nose or tail. Check the motor for no off-set. It is assumed all warps have been removed. Glide test for a clean fast glide with no sign of a turn. Alter stab and rudder settings to accomplish this. When satisfied, you are ready for power flights.

Using medium power and a 20-30 sec. motor run, try an easy hand launch into the wind. The first job is to adjust for straight glides by changing the rudder angle. Then, if necessary, adjust motor angle for straight power flights. You can stop now, but if you wish, several flights may be made with small amounts of left and right rudder to observe the turning characteristics. However, remember that 1/8" of rudder is a very tight turn, so go easy!

Part 2 will detail the installation of the radio gear, ground check procedures, and radio control flying tips.



GENERAL ARRANGEMENT RADIO CONTROL GEAR "RUDDER BUG" (FIG. 1)



PLAN VIEW OF RECEIVER M'T'G.

WINDING PLUG ESCAPEMENT MOTOR

Rudder Bug

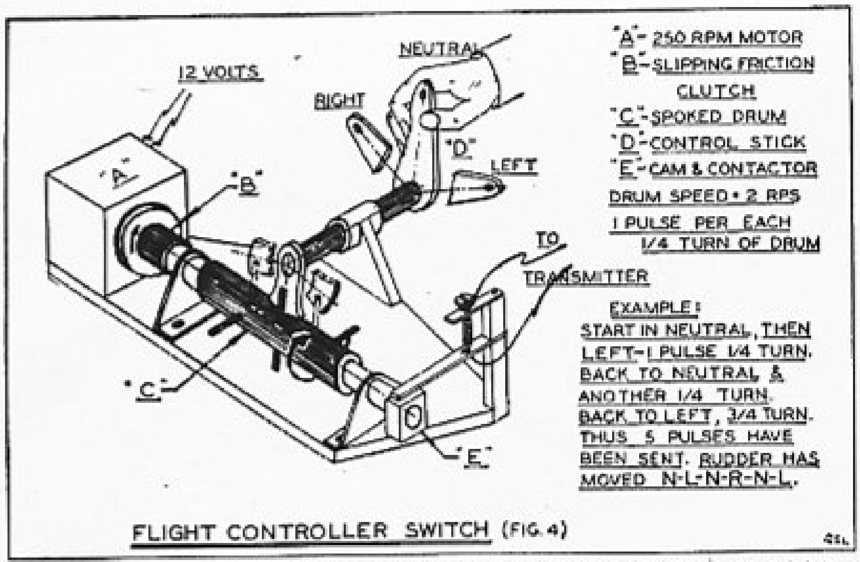
PART TWO

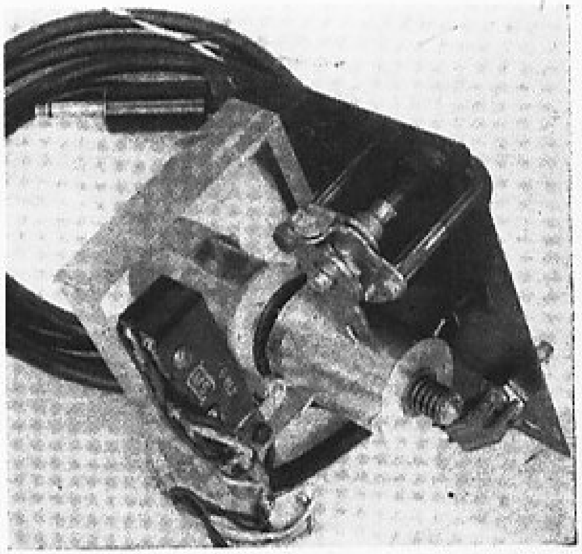
The secret of successful radio control flying is really no secret at all but close adherence to two maxima. One is a thoroughly tested radio control installation; the other is the rigid following of a systematic check-out procedure. It sounds simple but good habits come hard. One reason we feel qualified to give this "advice" is because we have committed most of the radio control mistakes possible and a few horrible ones we dare not admit. (Who was it who launched his radio model after turning the receiver "off" instead of "on"? No answer!!)

The importance of careful installation and check-out cannot be overemphasized. The consequences are too great—unless you enjoy rebuilding more than you do flying. In a free flight gas job, a loose wire may mean a sputtering motor and a not-so-long flight. In an RC model, a loose radio wire may mean hard-over rudder under full engine power. The result may be a juicy spiral dive followed by thirty days "solitary" in the workshop. With such good reasons, let's be careful.

The installation pointers given here apply to the Good Brothers' Beacon radio gear and also to other similarly sized sets. The following covers the installation of the receiver, the escapement for rudder control, and the batteries. It is also well to read and follow carefully the instruction book which accompanies the radio equipment. In particular, before you start installing in your plane, set up your radio components on a wooden bench and become very familiar with their operation.

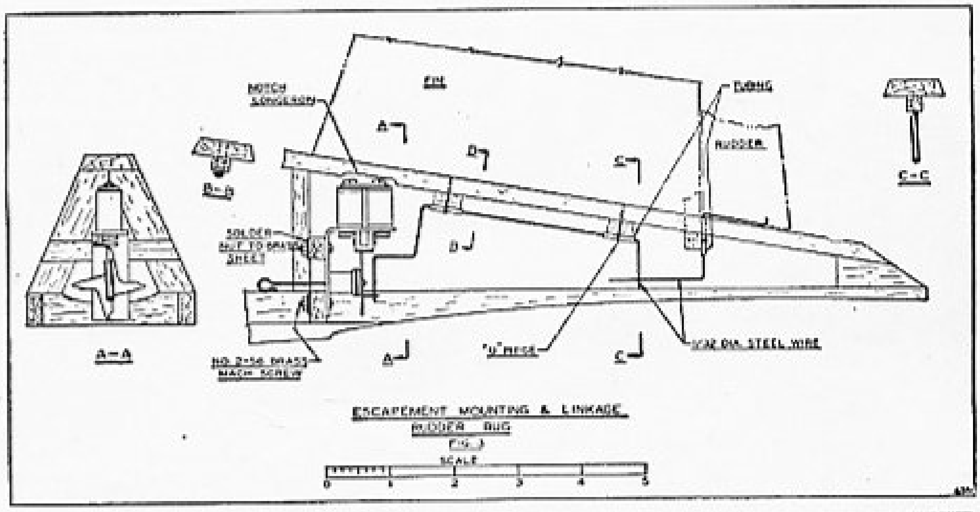
Fig. 1 sketches the general arrangement of the radio department in the *Rudder Bug*. The receiver is shock mounted on rubber bands near the C.G. The batteries are securely fastened to the floor of the cabin. The escapement is mounted in the rear with its rubber band coming forward into the cabin. Total radio weight is 1 lb. Although this is not the lightest installation that can





Control box, developed for greater ease in escapement flying, should prove of interest to every R. C. flier who can't remember where neutral is

by Walter A. Good



be made with the Beacon radio unit, it represents a choice of reliable sized batteries. Smaller batteries result in shorter life and also higher operating cost.

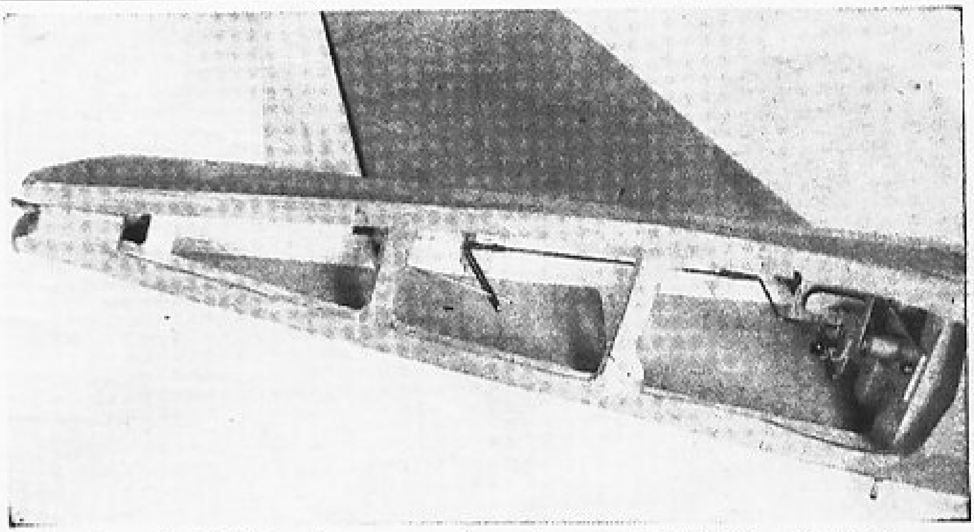
The receiver mounting is shown in Fig. 2 and in the photograph. Anchor the hooks well and cover with fabric for extra strength. Several rubber bands should be used at each end of the receiver; four to six strands of 1/8" flat serve well. If the mounting is too stiff, the motor vibration may bother the relay; if too soft, a hard landing will bounce the receiver from the floor to the ceiling.

All wiring should be neatly done with insulated flexible wire of about No. 22 gauge. Remember that persistent vibration easily fatigues poorly secured wires. Our log book has a note under the date of October 26, 1947, "Never, never use solid wire again." This followed a flying session in which a broken battery wire made intermittent contact during flight. First, the radio would work, then it wouldn't, then it would work again, and so on during a ten-minute flight. It finally quit altogether in the glide about 100' up, but the ship managed to land safely in a tight right circle—it could have been worse.

Follow the wiring diagram in the instruction book and use a good double pole switch. It is wise to check the switch resistance before mounting. If the resistance measures more than 1/10 ohm, don't use it. One side of the switch opens the filament circuit, while the other side opens the escapement circuit.

The antenna in Fig. 1 was copied from Owbridge and Schumacher. It consists of a slack wire from the receiver terminal to a No. 4 brass machine screw aft of the cabin. Outside the body a very flexible bare antenna wire is fastened and then wrapped a number of times around the extended screw. The end of the antenna wire is attached to a short length of rubber band which is secured to the tip of the fin. This allows easy alteration of the length of the antenna merely by wrapping or unwrapping it around the screw.

Test the escapement operation with a wound rubber band on the bench, before installing. It should work on less than 2 volts with a fully wound band. Thus, 3 volts gives considerable safety factor. Mount on the two firm cross members as shown in Fig. 3 and the photograph. The linkage idea was borrowed from Ed Lorenz and has worked quite well. Note

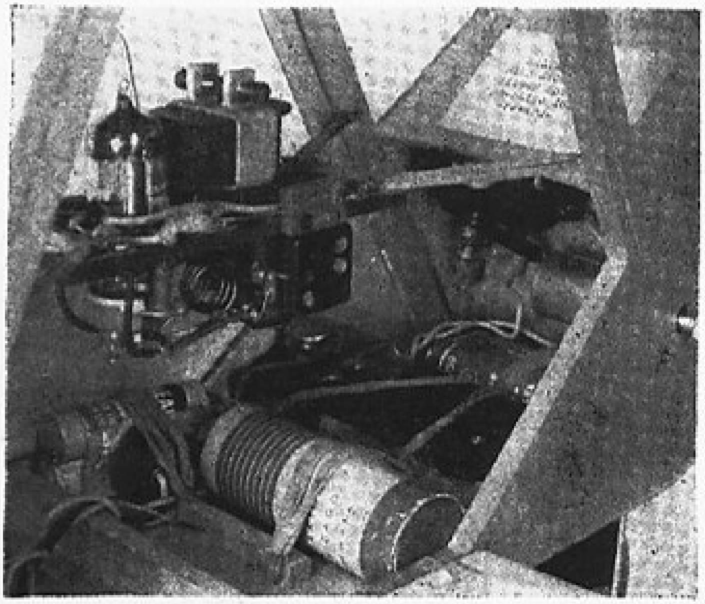


Removal of stabilizer shows escapement mounting and adjustable linkage to rudder

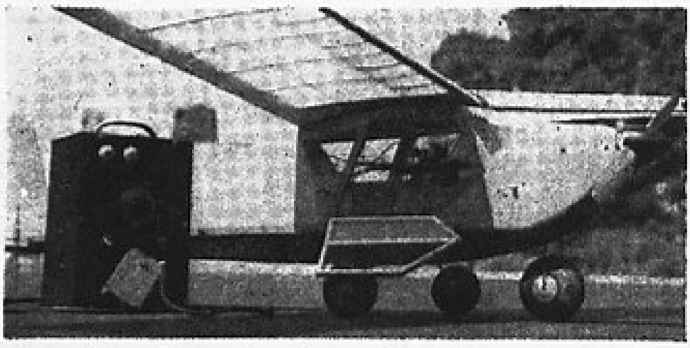
how arm A from the rudder may be bent up or down to quickly change the amount of rudder motion. Bending toward the ground increases the motion. It is best to start with less than 1/8" rudder motion each way, measured at the trailing edge of the flap. Left or right bending of the same arm allows trimming of the "neutral" rudder position to give a straight glide path. Since the linkage is made from 1/32" piano wire, the rudder merely springs over and back if accidentally bumped. The linkage and rudder must not bind in their travel but should be very free with just a "hair" of play in the "U-shaped" wires. Only a few winds in the rubber should cause the system to work.

Two strands (one loop) of 3/32" flat rubber is recommended for this model. It has been flown with two strands of 1/16" flat which had adequate torque. The escapement can handle two strands of 1/8" flat when needed, so the 3/32" represents a very safe compromise. The forward end of the rubber is reached through the cabin door and is wound with a hand drill to show a double row of knots, or about 400 turns. This is adequate for several days of flying.

The two escapement wires are twisted together and tacked to the inside of the body along one of the crutch sides. They are not run near the top of the body because this would place them too close



Large door allows access to receiver, ignition equipment, and batteries



Transmitter with nonautomatic control switch, alongside the plane

to the antenna with possibility of undesirable interaction.

The batteries needed are the 45 volt B, the 1.5 volt A, and the 3 volt escapement battery. Below are listed typical sizes which may be used:—

B—45 volts—Zenith No. Z-30R Plug-In Hearing Aid..6 oz.
A—1.5 volts—Otarion No. GP-2 Plug-In Hearing Aid..3 oz.
Escapement—3 volts—2 pen cells....................1 oz.

We prefer the plug-in type because they are rugged and reliable and eliminate the battery box problem. If you can carry heavier batteries than those listed, it will be found more economical. Soldering up your own batteries can be done but usually leads to more trouble than the plug-in type. After selecting your batteries, distribute them along the floor of the model until the C.G. matches the position (about 36 per cent) found correct in the free flight tests. Make sure a bulkhead is in front of each battery by adding extra cross pieces if necessary. Then cement heavy wire hooks to the crosspieces and fasten the batteries in place with several rubber bands across each battery. "Flying" batteries on hard landings can cause real damage, so strap them down securely.

Little has been said about preparing the transmitter for the field. Construction of a simple antenna support for the transmitter is well repaid by the saving in set-up time at the field. The addition of a flight controller switch at the end of a 7′ cable eases flight operation. The switch may be a simple push button type or an automatic one, as shown in the photograph and Fig. 4. This motor-driven switch automatically sends the right number of pulses and will always maintain synchronization between the rudder and the control stick.

The heaviest criticism of the escapement-type control has always been leveled at the possibility of forgetting which rudder position comes next after resting awhile in Neutral. Experience has shown that practice soon "conditions" the operator so he knows what comes next, except when he becomes flustered or confused, and this does happen occasionally! Thus, it was decided to build a laboratory model of an idea which would make the switch automatic, thereby "remembering" for the operator. A surplus 250 rpm motor (A) operated on 12 volts, instead of its rated 27 volts, is the driving power. Running continually, it applies torque through a slipping friction clutch (B) to a spoked drum (C). Drum rotation is prevented when the control stick (D) blocks passage of one of the spokes. Motion of the control stick from Right to Neutral allows the drum to rotate one-quarter turn, very similar to the escapement. Note how the cam and contactor (E) at the end of the drum sends one pulse for each quarter turn. Returning the stick to the Right allows drum motion of three-quarters of a turn and sends out three pulses, just the right number to step the escapement to Left, to Neutral, and to Right. This all happens in the short time interval of less than one-half second as the drum speed is set for about 2 rps. In use, the control stick may be wiggled crazily through any series of motions and the escapement always ends in the same position as the control. The original switch was constructed by Loran Wenrich, at the Johns Hopkins Applied Physics Laboratory, after considerable hours of labor. It worked so nicely in the workshop that we quickly clapped it in a box and took it to the field. Many flights, including radio control take-offs, have been executed by this switch, with the effect of allowing more freedom on the part of the operator. Even a rectangular landing approach pattern consisting of four consecutive right turns offers no mental hazards. A secondary advantage appears in that loss of synchronization between the control and rudder immediately indicates trouble and not a poor memory.

The automatic switch as here presented is not intended as a constructional feature but to show the embodiment of an idea which most probably can be duplicated by a variety of methods.

Now for those all important check-out procedures to be made on the completed installation. The philosophy is to adjust the system so completely at home that it could be flown out of your back yard with no further checks. Thus, the field checks are only to see if it has remained in adjustment. For preliminary tests in the workshop, set the fuselage away from any large metal objects. With the Beacon Receiver, the plate current meter should have very short leads (less than 1 in.) for best results. Long meter leads act like antennas and may alter the settings when the meter is removed from the circuit. Adjust the antenna length according to the instructions to obtain optimum sensitivity. Keying the antennaless transmitter should cause the receiver's 6 ma. idling current to drop to about 3.5 ma. Be sure to use fresh batteries and check them under load with a voltmeter. The B battery should measure between 45 and 36 volts and the A between 1.5 and 1.1 volts. The escapement battery under load should read between 3.0 and 2.4 volts. After recording the two plate current values noted above, it is easiest to set the relay contacts by Gene Foxworthy's method. Insert a 10,000 ohm variable resistor in series with the meter and adjust it to obtain the plate current values desired for the relay setting. Setting "in" 1 ma. from each edge is a convenient rule. Thus, for the above currents, the relay should close at 4.5 ma. and open at 5 ma. Now remove the meter and resistor and observe the over-all operation while keying the transmitter. This completes the indoor tests and we adjourn to the backyard.

Sometimes with too long a receiver antenna the set "loads" when the model is placed on the ground. The result is poor sensitivity or no operation. Try this with the antennaless transmitter. With a helper on each wing tip, lift the model up to 5′ above the ground, all the time keying the transmitter. This may "unload" the set if the receiver antenna is too short and cause the relay not to restore from the contact position. Thus, we have two quick checks on the antenna length.

Next, with the model again on the ground, run the engine at different speeds and while keying observe for proper rudder operation. Look for skipping rudder positions when not keying. Although not common, if skipping should occur, it is easy to localize the trouble—turn off the receiver switch and see if the escapement continues to skip. If it does, chances are propeller unbalance may be responsible because of excessive vibration. If skipping does not continue, then the trouble is probably at the contacts of the sensitive relay, indicating that the receiver mounting rubbers are too stiff, or that the relay contact is set too close to the idling current. In any event, don't take a step toward the field until the skip is completely eliminated; a steadily skipping rudder can give a long straight flight.

If space is available, also make the distance check at home. With the help of a "ham", set up your transmitter with its antenna in a clear area. Have a helper wheel the model away and while keying the transmitter determine the operational limits of the frequency setting knob on the transmitter up to a distance of 500′. Set the knob half-way between your limit marks. Now pack the car, you're ready for the field!

At the field set up the transmitter near the up-wind end of the field. Too much wind is not desirable, but a light breeze will not be harmful. Check the motor for proper operation. Repeat the "unload" test and also the distance check. Now you are ready to fly. Set flight timer for 30 to 60 sec. Turn on the radio gear, run through several positions, and leave in Right rudder. Start the motor and adjust (*Turn to page 59*)

Rudder Bug

(*Continued from page 16*)

for 3/4 speed. While the launcher holds the model ready for hand launching, the operator runs the rudder to Neutral to Left to Neutral. This leaves the rudder in Neutral going Right. O.K., let 'er go! Restrain that temptation and get altitude, at least 50′. Give short Right followed by Neutral. Then short Left and again Neutral. The purpose is to "feel out" the control sensitivity. Be cautious! Use the early flights to trim the rudder for straight flight in the glide, then trim for straight flight under power and finally for equal sized circles. Don't adjust the rudder for tight circles until you have a little practice under your belt. At first you may find it difficult to land into the wind and at a designated spot simultaneously, so concentrate on keeping it into the wind and someplace on the field, it's safer. Spot landings come with practice; a square approach pattern may help. ROG flights can be made when you have a good "feel" of the controls. Use full engine power and be ready to quickly correct any deviation. True running wheels are a necessity. The rudder becomes effective about 20′ from release and 50′ to 100′ are required for take-off. Maneuvering near the ground is risky but fun—get plenty of practice before you try it.

When using tighter circles, the model will spiral down quite rapidly so go easy at first. To get a 360° turn requires rudder for about 270°, then neutralize—the model will coast the other 90°. This action is symmetrical either to the left or right. The glide circles will be larger than the power ones and the ship will enter the turn rather slowly, so allow for this when flying.

So happy spot landings and remember there is no substitute for plenty of flying practice!

(Note: Readers interested in RC should study the article by Walter and Bill Good in the March '48 issue of MAN for further information on flying and stunting a model with only rudder control.—Editor)