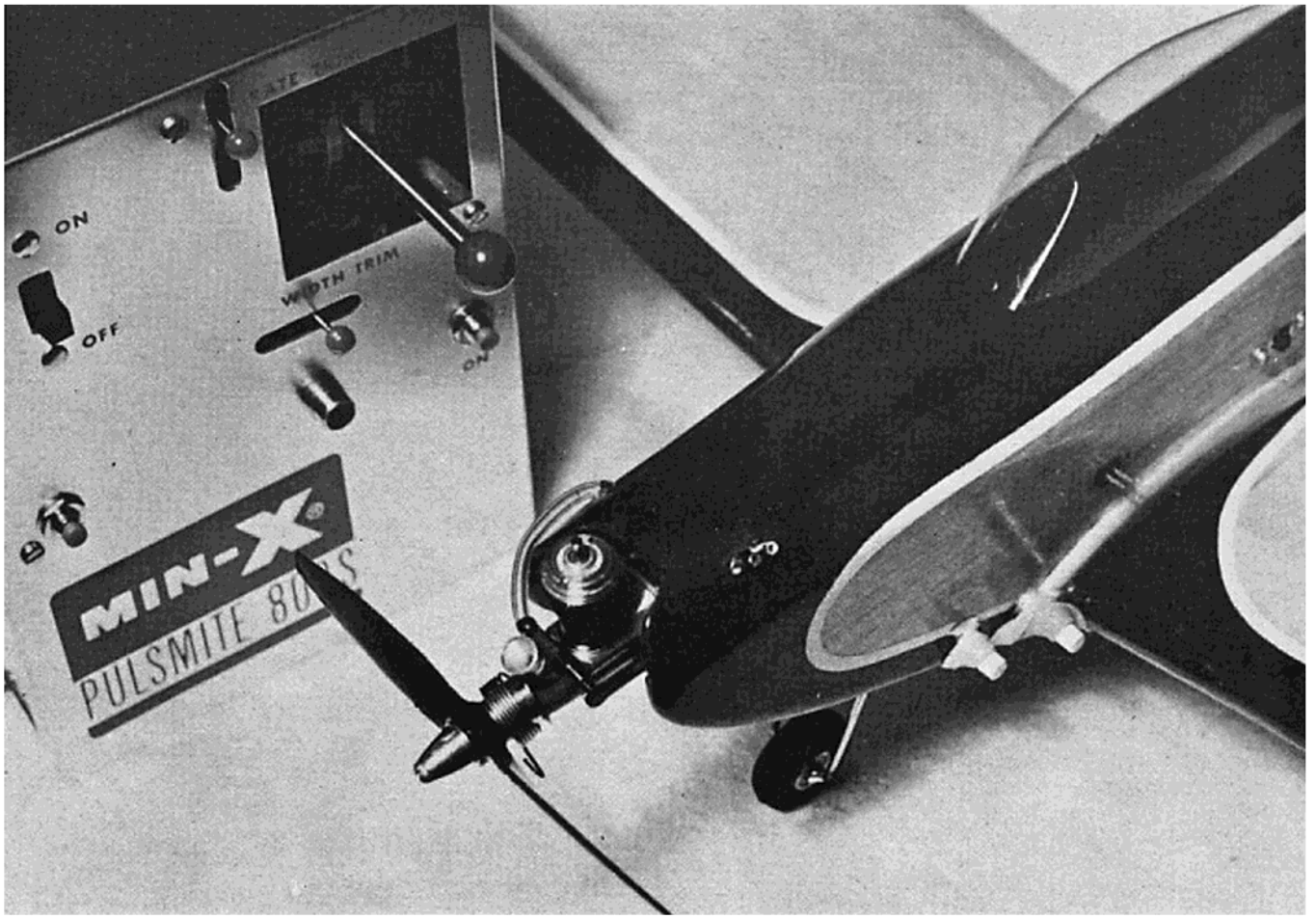
TEE DEE BEE

RCM design contest
RCM
award of merit

by LOREN DIETRICH



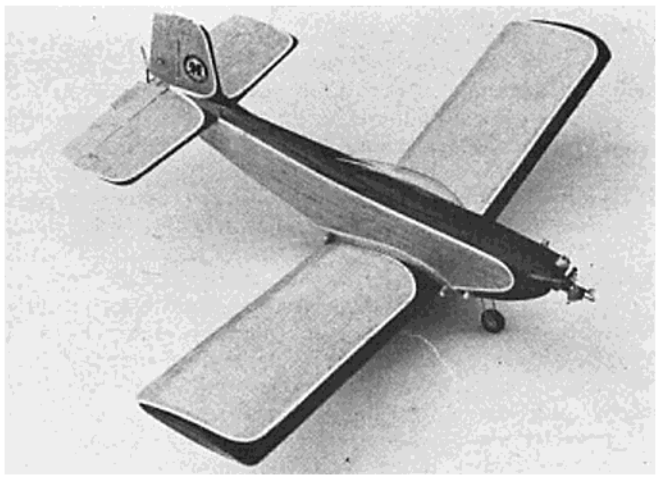
Min-X Pulsemite shows nicad charging jack installed under width trim lever. Full "off" button moved over to new hole drilled at far left of transmitter.

Walt and Wagger go ¼A multi with a 45 m.p.h. fully stuntable, 28" span, trike geared, semi-symmetrical airfoil low-wing design for proportional control—which proves it's a dog's life . . .

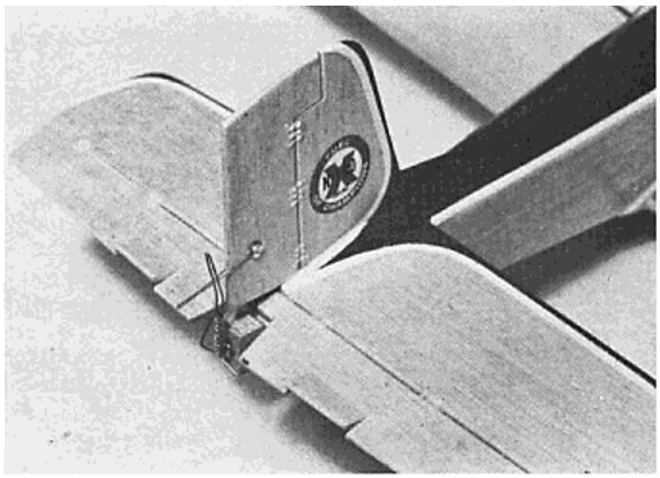
"COME on, Wagger! Move that doggy carcass of yours so I can drag this mess into the shop. Or maybe," added Walt, "I should just stand back and toss it through the keyhole. The largest part left is the fuel and repair bill on this airborne computer."

Perhaps this greeting of a tired businessman for his sad-eyed Bassett left something to be desired, but Walt had just returned from a Sunday at the flying field with his latest propo-multi dream child. Equipment had functioned faultlessly, but the pilot had not! The "Rhumba Child" had **almost** made it out of that maneuver before planting a fleeting kiss upon a protruding bush at 75 mph; the ensuing splintering balsa and ripping of transistors reminded Walt of small children smashing berry baskets! The 27 mile ride back home from the rolling countryside had left Walt with little love left for his particular representative of "man's best friend."

"Look, Walt, why not let that lumberwagon rest for a while and try something smaller?"



"You can put all of the principles of a multi-monster design to work astride a two foot wing. Just install a Tee Dee .020. . . ."



"Elevator tabs shown in photos and plans are not necessary and were used on test prototypes. They can be eliminated completely."

Wagger emitted a gusty sigh before sauntering to one side to allow the passage of man and machine, both broken in mind and body. To Walt's back he muttered something that sounded like "Rough!"

"Rough indeed, Wagger old buddy. I love controlled flight, but not at the price of one flight a week and a workbench of broken bones. Any suggestions, old horsehide?"

"Woof. Woof, woof," said Wagger. "Or to put it in the slang of your species, why not let that lumberwagon rest for a while and try something smaller? At least it won't take so long to repair if you goof-up while flying something light and small!"

Having given this opinion in his low, growling voice Wagger slumped contemptuously onto his blanket to one side of the bench. Walt, who often imagined that he had long conversations with this particular dog, did not look surprised but merely raised a skeptical eyebrow.

"Thanks, but no thanks, fleabite. I was flying escapements when you were cutting your puppy teeth on paw-launched gliders. The thrill is gone in just guiding a missile. I want to fly my ships, not just aim them. So, my mutt, move that wagging tail of yours so I can get to work. And don't be so happy."

"Dear master," groaned Wagger, "Lassie-like, I am sending you a message. Have the decency to say something like 'What is it, girl?' or 'Look, she's trying to tell us something!' anyway. Observe the wagging tail, please."

"Oh, Piddle!" exclaimed Walt, ignoring the look of pain this brought to his housebroken pet. "I'm not trying any of that wiggle-waggle pulse-proportional tomfoolery! Rudder-only leaves me cold as a well-digger's watchfob, and Galloping Ghost requires just as much airplane and gadgetry as what I have now. Besides, you can't get all that junk into an .049 ship without having a flight pattern like a dropped hatchet, so give up already."

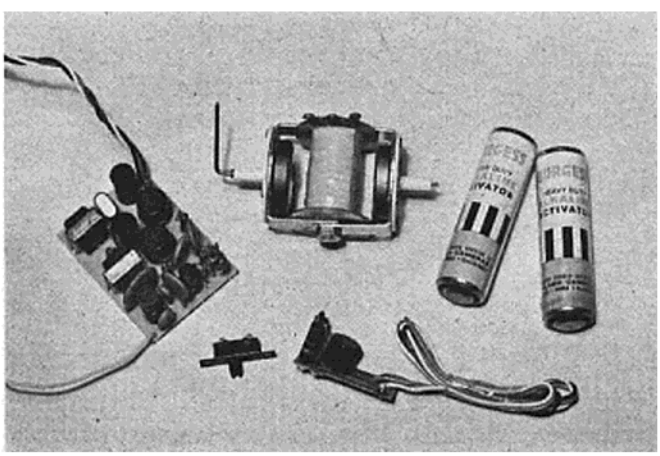
Wagger gave out a low moan and then mumbled patiently:

"Arf, arf. Or more specifically, crawl out of the dark ages, caveman. You can put all the principles of multi-monster design to work astride a two-foot wing. Just install a Tee-Dee .020 on the nose and a magnetic actuator inside, and presto! Multi-simultaneous proportional control of rudder and elevator, and in a cute little ship that flies fast and glides flat, flies a pattern and spins with the best. Woof, woof, and how about that jazz?"

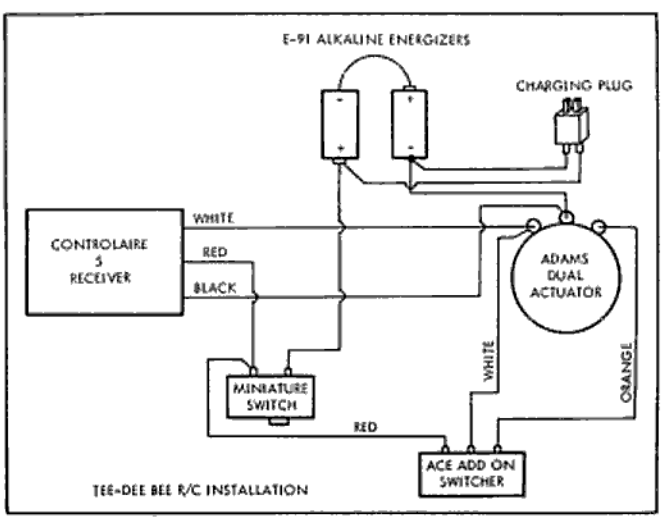
"My lovable laphound," whooped Walt, "you have flipped your dog biscuit. Were there such aircraft, I would have seen or read something about them by now; however, all that has been published has been a rather experimental attempt at driving a rudder which then drives a linkage to drive the elevator. I tried that, but gave up on the adjustment after using up sixteen feet of piano wire. Pray tell, dog, where did you find the solution to this doggy problem?"

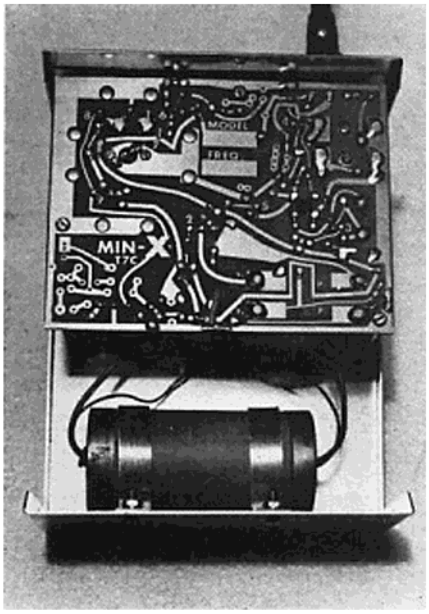
"I soluted it myself, if that's the word," Wagger said smugly. "Look, let's review the problem again with sketches. A magnetic actuator is just like an electric motor that can rotate only 45 degrees on each side of center,

"Here's all you need, O Master. A relayless receiver, Adams Dual actuator, miniature slide switch, Ace Add-On Switcher, and either 2 or 3 pencells."



"And here it is all hooked up and ready to go. Didn't know you could charge alkaline energizers, did you?"





"Converting the Min-X Pulsemite to nicad operation is a snap. Seven or eight button cells and two extra leads to a charging jack in the front panel."

right? Therefore, it can be coupled to a torque rod with plenty of throw to move a rudder from side to side, just like an escapement. The only catch is that full 'off' causes the actuator (and rudder to move to full **left**, and full 'on' moves the rudder to full **right**. Therefore, if we have a transmitter capable of varying its 'on' time to its 'off' time, we can vary the time that the rudder spends on one side of the aircraft and consequently we get the effect of proportional rudder control. Of course, this takes a transmitter such as the Min-X or Controlaire or the addition of a pulser to the normal single-channel transmitter."

"So a GG transmitter on the ground with a receiver, switcher, and magnetic actuator in the ship will give proportional rudder; big deal!" snorted Walt in Wagger's general direction. "With no control over up-and-down, you're in for a life of docile steering or mad zooms. Where will you get that doggoned multi you speak of?"

Wagger settled resignedly deeper into the blanket.

"Toss me another biscuit, and have one yourself while I continue," he grumped. "Remember that we have said we obtained proportional rudder by varying the **width** of the pulses; that is, the amount of 'on' time to the 'off' time. Don't forget that the transmitters we mentioned will also allow us to speed-up or slow down the whole cycle without changing that **width** relationship. In other words, we can change the **rate** we send these pulses; therefore, if we had an elevator sensitive to **rate** change we would be able to have rudder and elevator simultaneously. Right?"

"More electronics, such as decoders and PODs?" said Walt.

"Most emphatically not," replied the canny canine. "Such systems are workable but too heavy and complicated for us. What we are going to do will take place on the rudder torque rod, right back at the rudder itself. Notice that we have attached two arms at right angles to the arm which moves the rudder, thus making a thing like an upside-down tee. Notice also that those arms are directly under the trailing edge of each interconnected elevator, and that the elevator is lightly spring loaded into its 'down' position where it rests on these arms. Therefore, this system will act like the usual conventional Galloping Ghost system in that **even** pulsing will cause both rudder and elevators to spend equal amounts of time at their extreme positions. Varying pulse **width** will still give proportional rudder as before, but with a slight bit of up elevator to help hold the nose up in turns. Are you still with me?"

Walt nodded dubiously, but then pointed out:

"O.K., but there's a hole in your theory, my bone-biting friend. I can see that a slow pulse-**rate** will cause the elevator to spend more time in the **up** position because the rudder will spend more time on each side of the plane. Explain how you get good 'down' and you have a reservation at the head of the table for the next steak dinner!"

At this, Wagger lifted his dewlaps in a good imitation of a maniacal grin.

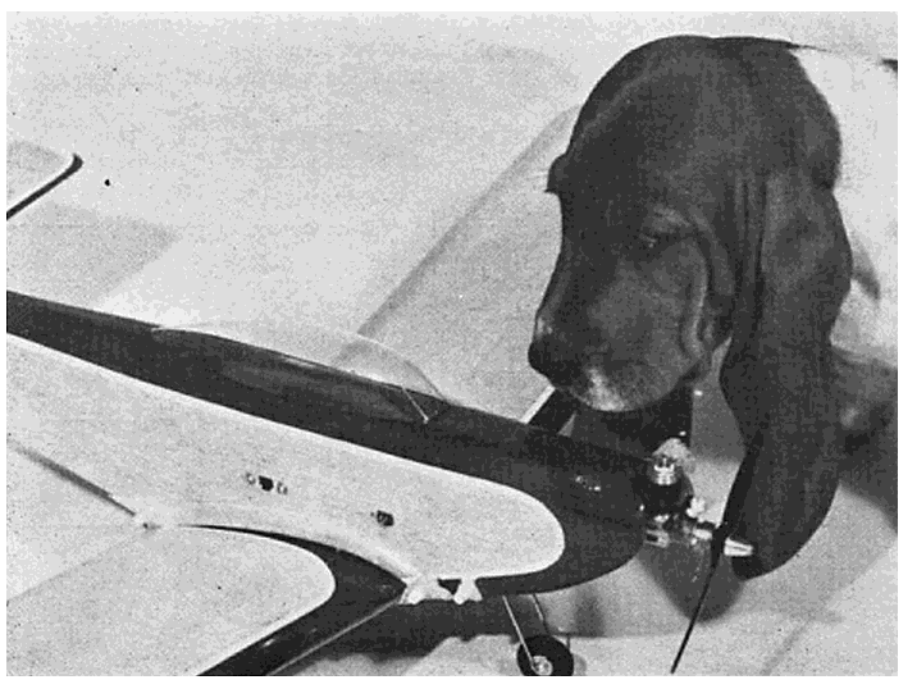
"That's just a short putt from here, mighty balsa-buster," he said. "What happens when you feed very high pulse rates to a magnetic actuator? It sits and 'dithers,' or takes up some position and just shudders slightly. In our case, the rubber band is pulling the elevator down against those two arms so **that** is the position in which it sits and shudders slightly: rudder neutral and elevator down! As a matter of fact, you can move this shudder slightly to one side or the other, thereby giving a small amount of rudder control even with full 'down' elevator. With something less than highest pulse rate, you have some amount of up or down elevator combined with your proportional rudder. Ergo! Propo rudder and elevator! Extra complication? Only 2 inches of piano wire and a rubber band. Get the picture?"

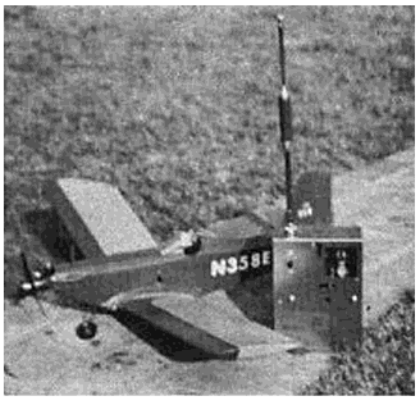
Walt eyed the jubilant Bassett Hound with grudging admiration. Suddenly his eyes narrowed, then he shouted:

"Hold it, you Gaines gobbler! This high airspeed of a propo ship will straighten that elevator out flat unless you make that rubber band as tight as a rat-racer's lead-ins! Magnetic actuators just won't have the power to operate against that much load; those things are notorius for their flea-power, you know."

"Let's not get personal," said Wagger scratching gently. "But I'm not talking about just **any** actuator. The only actuator that I've found for the job is the **Dual**-Adams; a little heavy, but two 1½ volt alkaline pencells will power that receiver and actuator through a good number of 5 minute flights before re-

"You don't have to put a dog yummy by the motor, Walt old boy, to get me to pose with my own plane. Besides, I prefer steak! Ah, well, it's a dog's life!"





TEE DEE BEE

charging. You did know that those alkaline cells rejuvenate nicely, didn't you?"

"News to me," said Walt. "How do you rejuvenate a battery?"

"Just use your nic-cad charger, and give them a charge of about 80 milliamps for several hours at the end of the day's flying," replied Wagger. "As a matter of fact, you can put a small charging jack right into the side of the aircraft and fly for weeks without even removing the wing. For $1.00 investment in batteries, that's cheaper than dog-biscuits. Have another and pass them on, by the way."

Walt passed the box of biscuits over absent-mindly, then said:

"I must admit it sounds good, practical and cheap. I assume that the equipment in the ship would consist of a dual-output super-regen receiver, or an 'Add-on switcher' such as Ace makes to drive the actuator, the Dual-Adams actuator, and two alkaline pencells, plus the torque rod and that little bit of linkage. It does sound like this could be installed in a ship weighing about 7 or 8 ounces. Is there a good, reliable engine to pull that little bucket?"

"Yay, verily, and woof arf," assented Wagger. "The Tee-Dee .020 is ideal; steady running with power to spare for all the maneuvers our ship can perform. Notice I **didn't** say Pee-Wee or .010. We will need the .020 Tee-Dee for this work. You might also give some thought to the fact that this ship will need a low-wing for controlling that power and speed, and while you're at it you might consider a semi-symmetrical airfoil too. Let's aim for real multi performance."

Walt bounded off the stool and barely missed stepping on Wagger's nose.

"You've convinced me! Football field multi-propo is for me! Let me at that drawing board," he said, heading for the closet.

Wagger settled down a little deeper into the blanket, and growled one last

TEE DEE BEE

rejoinder:

"Just don't step on my latest model in there. It's a multi-propo, ¼A, magnetic actuator, dual-simul, low-wing, semi-symmetrical airfoil, realistic, trike-geared, 5-minute duration, fully stuntable and spinnable little football-fielder called the 'Tee-Dee Bee'!"

Construction

Walt glanced up from his workbench and noticed that Wagger was sound asleep on his favorite basket. "Hey, Bonedoggler, front and center!"

"Grumpff," snorted the Bassett. "Does the Paul Bunyan of the balsa rack have problems?"

"Certainly not," rejoined Walt. "Though I am perfectly capable of duplicating this masterpiece of yours, I would like to pick up a few construction hints right from the dog's mouth. How about a short dissertation?"

"A reasonable request," agreed Wagger. "Although I don't say that the Bee is the last bark in airplanes, it **is** rather unconventional and success will depend upon following the original design rather closely. After you know her better, you can make changes and have a bell doing it."

Walt glanced up. "Have a BELL?" he questioned.

Wagger nodded. "Thanks. Don't mind if I do. Would you fetch it, please?"

As Walt sighed and crawled under the bench in search of Wagger's favorite toy, the Bassett described the construction of the Tee-Dee Bee as follows:

"The best dog-gone way I know of to build the wing is to make a simple wing jig out of ⅜" or ½" sheet. Take two pieces slightly longer than each wing panel and sand a dihedral bevel in the center. Make two legs of the appropriate length for the dihedral and glue to each end of the jig panel. Glue the two jig panels together at the center. When dry, add ⅛" square strips, parallel and 4" apart. This provides a jig for the wing, and makes it easy to duplicate your manly efforts.

"When the jig is ready for use, lay your 1/16" bottom sheet down. Glue the ribs in place by pressing down on the bottom sheeting—the sheeting will form the exact contour of the airfoil by being depressed between the ⅛" strips. When dry, glue on the top sheeting. After this is completed, remove from the jig, and add the leading and trailing edges. Next, add the angled 1/16" sheet tips. Sand completely, then reinforce the two center section dihedral breaks with gauze or fibreglass. Apply a couple of coats of (ugh!) dope, sand lightly and cover the entire wing with lightweight silkspan."

Wagger paused for a moment to scratch his left ear with his right hindpaw. (No small feat, mind you.) "You might even add your antenna inside the wing, gluing it behind the leading edge stock and bringing it out through the center section of the wing. This would give you use of the full antenna without it trailing out behind the rudder.

"The fuselage and tail surfaces are easy. Cut out the sides, add the doublers with contact cement, and add the formers. The tank is a modified ¾ ounce control-line tank that completely fills the area behind the firewall – gives you five minute flights, too! Be sure to epoxy the tank in place, allowing room for the blind mounting nuts for the TD .020 and the bolts that will protrude through the back of the firewall. While you've got the epoxy mixed, cement the receiver and actuator slide rails in place."

Wagger picked up the Tee-Dee Bee and looked it over from stem to stern. Walt was busily engaged (in the closet) cutting up sheets of balsa in defiance of the plans for the Tee-Dee Bee.

Wagger shook his head sadly. "The rest of the plane is self-explanatory. Just follow the plans to the letter, keep the weight to a minimum, and cover the entire plane with lightweight silkspan. Color dope should be limited to trim only."

Walt applied the last brush stroke to his newly-finished duplicate of Wagger's ¼A creation, then picked it up and headed for the door. "Cummon, watchdog – quit watching and spring into action! Let's go fly this little wonder!"

Wagger stirred not a muscle except to growl. "Steady, caveman. Much as it pains me to admit it, the Tee-Dee Bee is a single channel system and has limitations. Set it up well and it will give you performance you have never had in a ¼A airplane. Rush into it and you'll add another pile of sticks to that impressive collection of multi-tinder on the bench. Let me list some check-points for you:

1. Make sure the actuator 'kicks' vigorously, with no binding.
2. Set the elevator kickers to give more 'up' travel than 'down' when viewed from the side.
3. Hook up the elastic. Stretch to give slight tension when the elevator is resting firmly on both elevator kickers. Insert the straight pin through the elastic and into the fuselage side, maintaining this tension.
4. Sight that the rudder is neutral. If not, bend one elevator kicker up and one down until rudder **is** neutral.
5. Turn on both receiver and transmitters, with transmitter trim knobs in neutral. Move stick in all

directions, noting that surfaces spend the most time in the appropriate positions. That is, right stick should give right rudder, and so on.

6. Move 'rate' trim to full down, and stick to full down. Check to see that elevator 'dithers' in down position.
7. Now start the engine, and operate all controls while viewing from the side. Their movement will be reduced due to the terrific slipstream from the Tee-Dee .020, but should still be moving vigorously. (This accounts for the fact that the 'Bee' is **more** responsive to control during the glide than during powered flight.)"

Wagger rose from his favorite flannel blanket with more enthusiasm than usual as he finished this checklist. Suddenly his eyes opened wide for the first time in months as he barked: "Walt! I could have bet a box of doggy biscuits that you were starting to test glide your Bee! Unless you've practiced throwing spears at sabre-tooth tigers lately, forget it! This little missile has a nice glide with proper elevator control, but has been estimated at 45 miles per hour in level flight!"

Wagger let his eyelids droop to their normal level and motioned Walt to the car. "Cummon," he said. "Let's go out in the country for test flights, so you can win your wings." Whereupon, and without further ado, Wagger got behind the wheel while Walt curled up on the seat beside him. In a few seconds, they were on their way down the street.

Mrs. Glitch looked out the window at the passing auto and exclaimed: "George! Did you see that dog driving that car?"

"Yeah," grunted her husband. "Lousy paw-signals, just like most dogs!"

Final Notes on the Bee

by me

"Kick-up galloping ghost" (or "Kick-in' Ghost") is not really new. Most everything in single channel "gimmick" systems has been around for ten years, needing only someone new to tighten his stomach muscles and launch into another application which will be the "perfect" control. The system in the Bee was developed as a result of two things:

a. flying pulse rudder in a Top Flite "Roaring 20"
b. reading a description of Woody Blanchard's "U-All-2" in Model Airplane News. Woody's system was tried in the '20,' but control was too limited. A new method of obtaining this same result was tried with the present kicker system and flown in the '20' with reasonable success. The "Roaring 20" was flown to a total of 146 flights in the local football field **before** installation of a Tee-Dee .020 in place of the original Cox Pee Wee. The new engine proved much too powerful for the flat bottom airfoil and shoulder-wing, whereupon it was retired and plans subsequently laid for the "Bee."

The "Bee" was designed to control the power of the Tee-Dee with a minimum of downthrust. Also incorporated was a multi-type airfoil which would, hopefully, allow the lift to be turned on and off by means of the limited elevator control this system provides. The large tail surfaces and short moment arms were intended to provide a means of obtaining "snap" maneuvers such as rolls and spins. To a great extent, the Bee has justified these efforts.

I would like to stress some notes of caution:

a. "Bee's" control system is not really new, but the "Bee" is. She has a total of thirty flights on this prototype – for a good ¼A airplane, this is infancy. The **revolution** of this airplane and system has been accomplished, but the **evolution** is just starting. You can make changes after you know the limitations of the present set-up, but until then, be cautious!

b. A loose elastic will give very little down, but a tight elastic will probably limit control throw severely. Elevator trim-tabs also give down load, so don't tighten that elastic much! Better to have more "up" than you need than to have more "down" than you can handle.

c. Adding a third battery, according to the Adams diagram should give increased control throw and make more violent maneuvers possible. However, I am now trying this for the first time and will not know the results for some time.

d. I have found that the pilot **must** learn to fly the "Bee." A ship capable of 45 miles per hour stalls, spins, and snap rolls must be controlled by a knowing hand. "Bee" is rugged, and will tolerate you while you learn – just give her a reasonable chance and soft dirt.

e. Caution!! You can use the full "on" and full "off" buttons in flight, but NEVER in the glide. She'll snap roll every time!

f. The "Bee" will consistently do the following maneuvers: Climbing turns from ROG; Procedure turns without appreciable zooming upon recovery; straight flight; mild dives; power dives after a one turn spiral; consecutive loops; vertical reverses; stalls; three-turn spins; snap rolls; passable Immelmanns; glide to landing, slow; flare for landing; land in short grass without appreciable tripping.

Well, that's all for the "Bee." She's young – I hope she finds some good homes.

From RCModeler Mar. 1966