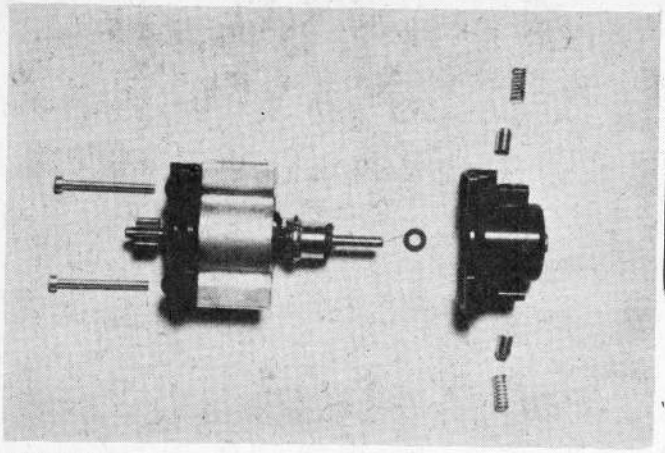
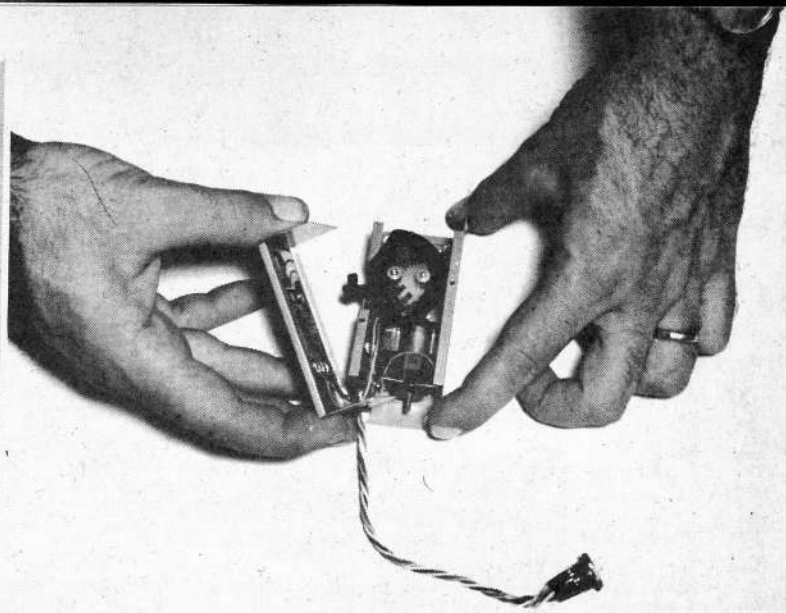
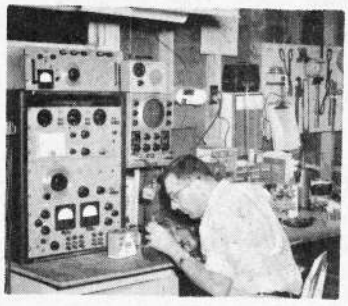


Exploded view of motor. Further disassembly not required.



Proper removal of cover. Note dishpan hands!



Probing The Transmite Servo

BENCH BITS

By Hank Giunta, WA6QE X

EDITOR'S NOTE: *The following maintenance and repair procedures for the Bonner Transmite servo are in answer to numerous requists by RC modelers for such a feature. The methods listed have been designed and thoroughly tested by our Technical Editor for use by those modelers wishing to service their own units, and who have little or no access to test equipment. These are not necessarily the steps used, or recommended, by Bonner Specialties or their service department, and may void the manufacturer's guarantee accompanying the individual servo.*

Probably the most widely used single piece of R/C equipment, and yet the least understood, is the Bonner Transmite servo. How many of us take that little box for granted, seldom, if ever, bothering to inspect and clean it, or to provide the normal maintenance it deserves?

In most cases the Transmite will give excellent performance without such care, but it is certain that it was not intended to be used in this manner. With a little effort on our parts, the life of the servo can be greatly extended, and at $30 each, the savings can be very rewarding.

It might be mentioned here that those of you whose talents **do not** include a gentle approach to electromechanica ldevices should stop reading right now. A servo cannot withstand the "hammer-and-chisel" approach! If you have a reasonable amount of patience, a satisfactory job can be done with no fear of damage.

The first consideration is the mechanical condition of the servo. If there is excessive bind, caused by improper gear mesh, bent cases, etc., the amplifier is forced to work much harder than necessary in order to make the servo move. This results in higher battery drain, greater power dissipation in the output transistors, and a general loss of power at the control surface, where it is needed the most.

The maintenance procedure can be broken down into five steps:

1. Disassembly and cleaning.
2. Visual inspection of gears, case, and amplifier.
3. Repair of amplifier, if necessary.
4. Reassembly and mechanical adjustment.
5. Operational checkout.

Disassembly and Cleaning

After removing the servo from your individual installation, remove the grommets from the case. This makes the subsequent removal of the amplifier and case cover much easier. Take out the two sheet-metal screws which hold the cover on the servo, and carefully remove the cover by first sliding in an upward direction, the end opposite the motor. This enables the cover to move enough so that it can be removed from the motor side. Be careful not to exert too much force at this point in order to avoid breaking the wires from the amplifier board which are connected to the switch plate in the cover.

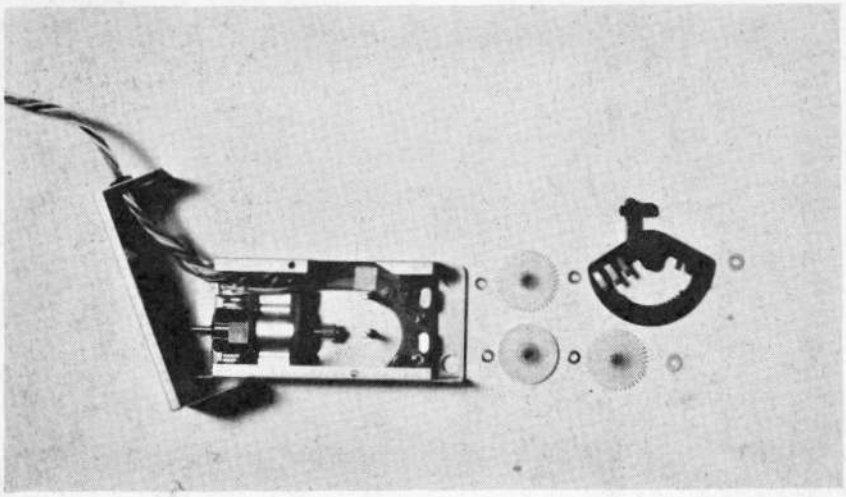
The next step is to remove the sector gear, being sure **not** to lose the two washers which ride against the switcher board in the cover. If you only see one of them, you will find the other stuck to the switcher board. This may be an indication of mechanical bind, so keep this in mind during reassembly. Remove the other two gears and spacer washers. It is a good idea to keep all parts in a suitable container as they are removed. If you wish to risk matirmonial warfare, (single men take note), you may do as I do and steal a shallow dish from the kitchen.

For a quick inspection and cleaning, you need go no further than this in the disassembly. Usually, however, the toughtest part of the job is getting the servo out of the airplane, so you may as well go all the way on the disassembly and maintenance.

Remove the three screws holding the motor and amplifier to the bottom of the case, and carefully slide them out of the case. The motor will have to be lifted slightly upwards, and partially rotated, to clear the two gear posts. Once this operation is carried out, you have completed abotu one-third of the job, and is a good time to take a break.

Disassembly of the motor is the next step, and although it may be omitted if you don't care to tackle it, it is, nevertheless, well worth the time and effort involved.

Remove the two brush retaining clips by **gently** twisting a screwdriver blade between the edge of the clip and the motor body. Make note of the wire color code (green and white). It may be helpful to make an identifying mark on the motor housing to facilitate correct replacement of the brush caps.



Exploded view showing assembly sequence.

You will **not** want to replace the caps more than once, so be sure of the correct orientation the first time.

When the caps are removed, the springs and brushes will likely fall from the motor housing, so exercise due caution to prevent loss of these vital parts. The motor case screws can now be removed and the brush end of the housing pulled away. Now look for the thrust washer. If it is not on the shaft close to the armature, it will be inside the housing which you have just removed. This is a very easy part to lose, so consider yourself forewarned! If the motor has been in service for some time, the inside of the brush end of the motor housing will have quite a bit of finely ground brush material adhering to the nylon housing.

Carefully clean the motor housing inside and out with a small artist's brush and a lintless cloth. Isopropyl alcohol (available at your local drugstore) is a suitable solvent for cleaning the brush end of the housing. (If you use anything else, you are on your own.) Once the housing has been cleaned, inspect the brushes, looking for burrs at the edges. Remove any burrs in evidence with a fine sharpening stone or a very fine file, being certain that they **are** removed, and not just rolled to the inside edge. Place the thrust washer in the armature shaft, then slide the housings together, being sure that the pole pieces fit into the slots in the housing. Now replace the two screws which hold the two halves together. (Yes, it can be done!). Do not tighten these screws excessively, or you will bind up the motor. Wipe off the brushes with a clean, lintless cloth, and drop one of the brushes into its socket, ascertaining that the end mates properly with the armature, and that it is not cocked 90 degrees. Drop the spring into the socket, centering it over the end of the brush. Then slide one end of the retaining clip over the boss on the housing. Slide a needle under the clip and depress the spring, simultaneously pressing the clip downward on the boss. A little practice will enable you to do this rather quickly. I have tried several approaches to this assembly, and this method appears to be the easiest. If you have your own technique, so much the better.

Assemble the other brush components in the same manner.

Although the oilite bearings are permanently lubricated, a very small drop of watch oil or its equivalent will smooth out the motor considerably. **Do not apply more oil than this, or it will seep into the motor and make a mess of the commutator and everything else.**

At this time you should have a very smooth running motor, and a pair of very shaky hands! Take another break.

Assuming that the servo was operating satisfactorily before the cleaning and service, you are now ready for the reassembly of the unit. A small brush and a cloth moistened in alcohol will enable you to thoroughly clean the inside and outside of the servo case. Be exceptionally meticulous about cleaning the gear posts, as grit on these parts will wear down the nylon gears.

Place a **light** film of oil on both gear posts, then place a small washer on the crown gear post, followed by the crown gear itself. Slide the amplifier and motor into the case (don't forget the insulating board under the amplifier), and replace the two screws which hold the motor. Do not tighten these screws yet. Line the motor up so that its shaft is in line with the crown gear post, then tighten the motor screws. Check for smooth mesh between the pinion and crown gear. There must not be so much clearance that the pinion can slip on the crown gear. Differential tightening of the motor hold-down screws will enable you to make slight adjustments in gear mesh. Mount the amplifier securely with the small screws.

Reassemble the spur gears on their respective posts (see photo for exploded view of servo parts), then slide the cover in place. If the method used for disassembly is reversed, the cover will go on with no trouble. Be certain that the two large washers do not get knocked off the gear posts while installing the cover. Gently pull the slack in the wires through the grommet, and secure the cover with the two sheet-metal screws.

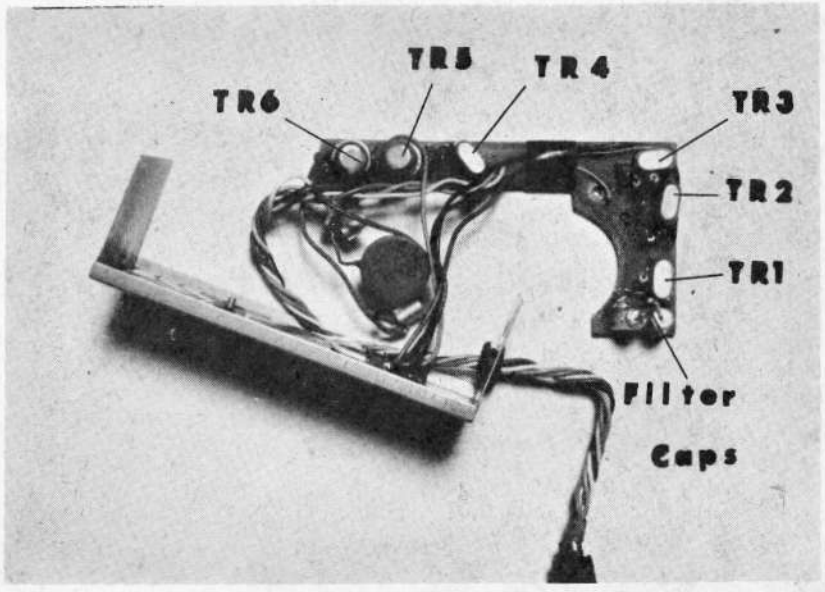
If you have done everything correctly, the servo is ready for service.

Check the operation on the bench thoroughly before re-installing the servo in the airplane.

The remainder of Bench Bits will be helpful to those who have servos with inoperative amplifiers. If the servo was inoperative at the onset of the general maintenance and cleaning, and the trouble did not reveal itslef during the preceding service (broken wire, etc.), the amplifier will have to be checked. Many R/C'ers wisely stop at this point and send the servo to a reputable service center; however, if time is important, or no service center is locally available, many troubles can be spotted and cured if a systematic approach is made.

(Continued on page 28)

Transmite component identification



Candy

(Continued from page 8)

install wing dowels. Apply approximately 5 coats of clear dope over the entire plane. Fuelproof the inside of the nose compartment with clear epoxy. Finish to suit yourself, but it is suggested that you use spray cans larger than three ounces!

Radio Equipment

As mentioned, this ship was designed around the Kraft-Pullen proportional system; however, any radio equipment should work equally as well. It has never been flown on reeds, but I believe it would be just as suitable although not as smooth in the maneuvers. The reed installation is shown on the plans, along with the proportional data. There are so many different systems available, the final details will be left to the discretion of the builder. One of the prototypes of Candy has had over 600 successful flights using the first production model of the Kraft-Pullen system. All of these flights have been made without any failure of the system itself. I have suffered minor mechanical difficulties with a couple of the components, plus battery failure during one flight, however this in no way throws a bad reflection on the system itself. The Kraft system as used in the Candy is a triple proportional unit with trimmable throttle. For those of you intending to order this system, a quadruple proportional unit is almost ready for the market. I have flown this unit and it works as well if not better than the triple proportional system, and should prove to be an excellent system for use in the Candy.

The all-up weight of the finished model should not exceed 7 pounds. The prototype weights 6½ pounds. Make sure all control surfaces are neutral and that there are no warps, and Candy should fly right off the board. It does not have any particular quirks except that it does demand plenty of speed for the rolling maneuvers, and does land fairly fast. It should track perfectly on the inside and outside loops. One note about the attitude of the plane while sitting on the ground: It should have a negative angle of attack of about 1 degree, or as it is called, a "rake." The idea here is to dump all left as soon as the nose wheel touches down. If this is done properly, Candy will glue herself to the ground on landing.

I hope you will enjoy building and flying Candy. If anyone has any questions or suggestions on the plane, drop me a line in care of R/C Modeler Magazine. Good luck with your new ship—she's a winner!

Bench Bits

(Continued from page 5)

No claims will be made here that the following procedure is the standard approach, or that normally accepted techniques are used. In fact, those are familiar with electronics may find this approach rather crude. This method was devised in order to alow those who do not possless test equipment to check the amplifier satisfactorily. If you do not know the difference between a transistor and a capacitor, either find someone who does, or **don't** attempt the amplifier repair. There will undoubtedly be cases where this procedure is not sufficient to locate the malfunction, and further trouble shooting with suitable test equipment will be necessary.

Test procedures are listed A, B, C, D, etc. A chart listing the failure symptoms and the probable causes is furnished for your convenience. The chart should be used as follows:

1. Locate the trouble you are experiencing in the "Symptom" column.
2. Under the column, "Probable Causes," read the information given, and make whatever visual checks you can.
3. Under the "Vertification" column, you will see groups of letters — these letters designate the procedure to be used, and in what order to use them. Be sure to follow the order given.

In order to complete the circuits for these tests, the sector gear switch fingers must be making contact with the switcher board in the cover. A simple way to accomplish this is to place the shank of a #42 drill through the hole in the sector gear and the servo cover, using a clothespin to hold the gear against the switcher board. It is recommended that a separate sector gear be purchased for use in this manner, in order that the original sector gear switch fingers will retain the proper factory tension adjustment. Neutral positioning of the sector gear may be ascertainde by visually locating the sector gear at center, and checking the position of the switch fingers on the switcher board.

This about covers the amplifier service. It was felt that going much further with the service information would only confuse those who art not familiar with circuitry of this type .As it stands now, the information given is adequate for a very high percentage of servo amplifier malfunctions.

I hope that the information will be of value to you, even if you don't think you can handle the repair at the present time. As for me, I'm so tired of writing and looking at Transmites that I am going to take a couple of hours off and do some flying! See you next month.

RCM TECH DATA No. 2

TRANSMITE SERVICE CHART

SYMPTOM	PROBABLE CAUSES	VERTIFICATION
Servo drives in one direction only. Does not neutralize.	(1) Broken orange or yellow wire. (2) Defective TR1 or TR2. (3) Broken orange or blue wire from TR5 or TR6 to switcher board.	A, B, C, E, F
Servo drives in one direction only and neutralizes.	(1) Broken orange or yellow wire. (2) Filter capacitor open or broken loose from board. (3) TR1 or TR2 defective.	A, B, E, G
Servo drives in both directions, but will not neutralize.	(1) You may be attempting to obtain neutralizing action from a trim servo. (2) Outermost contact fingers on sector gear not making contact with switcher board. (3) Brown wire to board broken. (4) Defective Flip-Flop.	
Servo drives in both directions, but is much faster in one direction.	(1) Batteries not charged, or one cell weak. (2) Low gain in driver or output transistors. (3) Leaky output transistor (opposite side).	A, B, D
Servo does not drive ,and heavy load is placed on batteries.	(1) Orange and yellow wires shorted together. (2) Two reeds driving at once, attempting to drive servo both ways at once. (3) Shorted output transistors. (4) Shorted driver transistors.	A, B, D, E
Servo drives when orange or yellow wire is touched directly to +6V supply (red wire) but will not drive from vibrating reed.	(1) Filter capacitor open. (2) Reed contacts dirty.	Clean reed contacts A, B, G
Servo drives in one direction without a command, and stays at full throw.	(1) Shorted filter capacitor. (2) Shorted driver transistor.	A, D, E, H
Servo drives hard in one direction and does not stop at full throw. (Usually results in a bent case).	(1) Shorted output transistor.	D

TRANSMITE SERVICE CHART	VERIFICATION PROCEDURES (FOLLOW CHART ORDER)
A.	Set sector gear to neutral (no rotation of motor).
B.	Apply power.
C.	Temporarily connect a 47 ohm resistor from the base of TR5 to the —6V supply (green wire). If the transistor is okay, the motor will run as long as the resistor is connected. If the motor does not run, replace TR5. Repeat this test on TR6. The motor should run in the opposite direction as long as the resistor is connected. If the motor does not run, replace TR6. After replacement, verify proper operation by making the test once more.
D.	Short the base of the conducting output transistor (TR5 or TR6) to its emitter. If the trouble is in a *previous* stage, the motor will stop. If the motor does not stop, replace the output transistor.
E.	Connect the base of TR1 to its collector with a temporary jumper. The motor should run. If it does not, replace TR1. Repeat the test on TR2. After replacement, if any, repeat the test. The motor should *stop* when the jumper is removed. If not, replace TR1 or TR2.
F.	Check Flip-Flop circuit by manually rotating the sector gear slightly off neutral. If the flip-flop circuitry is okay, the motor will run. Check both sides of neutral, ascertaining that the motor changes its direction of rotation when the sector gear is moved from one side of neutral to the other. If the motor does *not* run when the above test is done, proceed with the following tests: (1) Disconnect batteries. (2) Rotate the sector gear to either side of neutral. (3) Unsolder TR3 (see photo) and remove from board. (4) Reconnect power: The motor should run. If it does, replace TR3. If it does not, replace TR4. If the motor still doesn't run when TR4 is replaced, the 1.5K resistor which connects the base of TR4 to the —4.8V supply (long black wire) is probably open. (5) As a final check, temporarily connect a 4.7K resistor from the base of TR3 to the +6V supply (red wire). The motor should stop. If it does, the flip-flop is okay.
G.	If the filter capacitor is open, the servo will operate for all these tests, but will *not* operate when it is driven from a vibrating reed. Temporarily connect another capacitor (15 uf) across the unit on the board and check for proper operation. Observe polarity.
H.	Disconnect power and remove one filter capacitor. Reconnect power. If the motor does not run, the capacitor you have just removed is shorted and should be replaced. If the motor still runs, repeat the test with the other capacitor. If the motor still runs, the trouble is most likely a defective driver transistor.