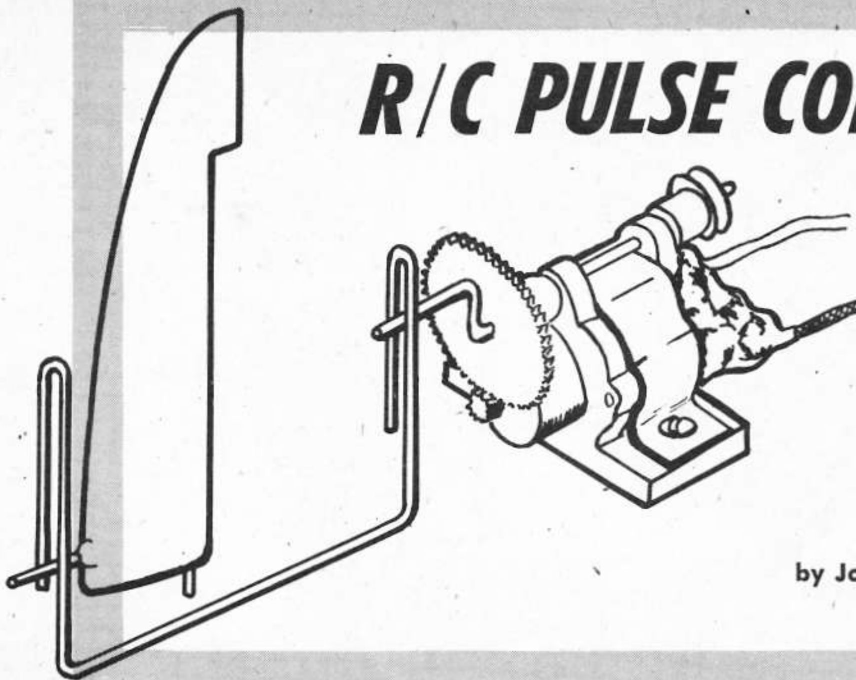
R/C PULSE CONTROL



by John Worth

● Interest in pulse control is increasing. Many of those who are not using it are asking about it. Others have been flying with it for some time. Among these are many who share the plight of most newcomers—they are not sure what it takes to get reliable operation. As with any system, pulse control requires good equipment, properly used, for best results. But, there is not much in the way of good ready-to-use commercial equipment available so that makeshift components and poor practices are prevalent.

With other systems this could be disastrous, but pulse control is tolerant of a great variety of component and installation evils. A description of proved pulse practices follows, to help newcomers get started on the right foot and to indicate where current pulse flyers may improve their operation.

First, one point should be understood. This is, that continuously flapping control surfaces are basic to pulse systems. There should be no concern over this since the model doesn't care about it. It has enough mass to dampen out the flapping so that its flight path responds only to the average position of the control surface.

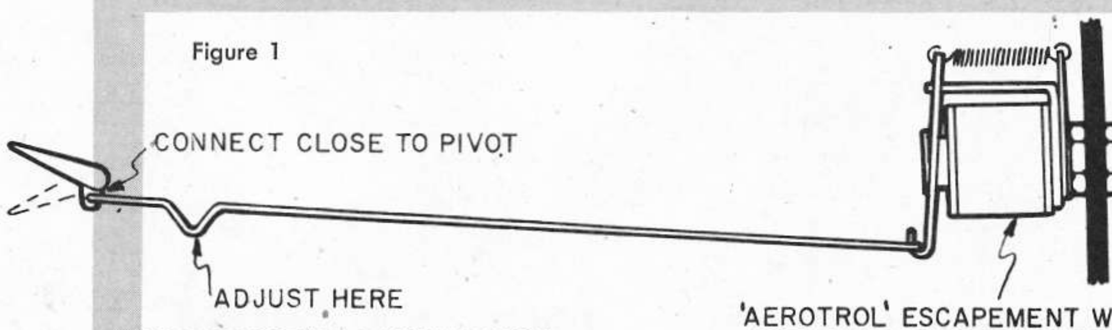
Those models you might see waggling around are operating at too low a pulse rate or are not using properly proportioned control surfaces or linkages. More on this later, but for now it is enough to realize that flapping is normal and that attempts to eliminate the flapping have been unsuccessful or have required substantial compromises in actuator weight and complication of the system.

The beauty of pulse control is that the airborne gear is inherently reliable since it can be extremely simple. Simplicity in the model installation is to be encouraged and should not be compromised unless basic reliability can be retained. Simple type actuators have proved to be the most acceptable. Instead of light weight or gadgetry, to reduce the flapping action, look for sufficient power, low current drain for good battery life and mechanical simplicity which avoids the need for constant attention.

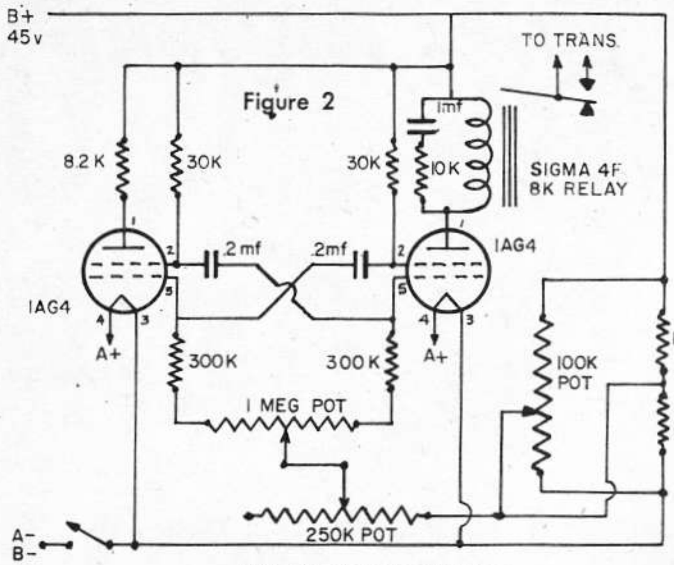
On the ground, where weight and bulk is of little bother, reliability is enhanced by rugged and stable equipment. Be concerned less with compactness, pretty packaging and ingenious design than with unfussiness, resistance to rough handling and, above all, that clean and stable pulsing is provided with practically no need for readjustment.

Now, some specific recommendations: **Pulsers:** A good one is a must. This is the automatic switch which keys the transmitter and a pulse system is only as good as its control signals. Many published pulser designs have not held up in continued use and have been discarded by the successful flyer. For rudder and auxiliary controls, other than proportional elevator, most motor drive mechanical-type pulsers are satisfactory, provided the motor has low drain (not

Figure 1

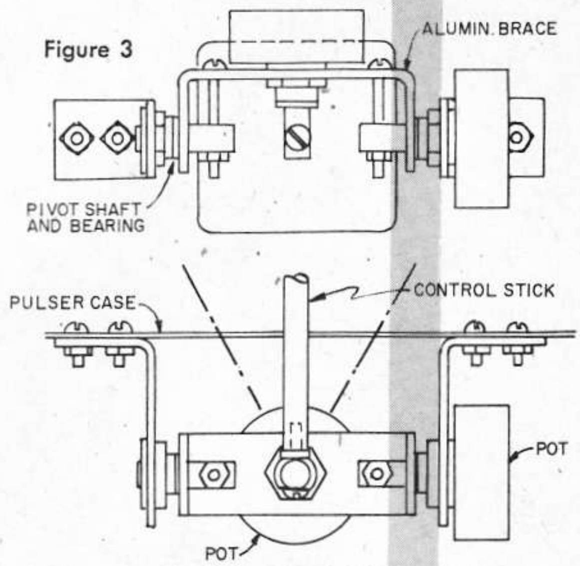


ESCAPEMENT CONVERSION



PULSER SCHEMATIC

Figure 3



CONTROL STICK ARRANGEMENT

more than 300 ma. running under load), uses good quality gears (not the stamped toy type) and has clean contact keying (wiping rather than bounce action).

Mechanical pulsers have **not** been satisfactory for dual-proportional pulse control. The most successful is the multivibrator electronic-type introduced by **Walt Good.** The version shown (Figs. 2, 3) requires no gears for the control stick pots. Also, a separate rate trim pot is provided. This is helpful in dual-control to compensate elevator trim for different wind conditions, and also in rudder control to find the natural rate at which the system seems to work best. This type pulser is recommended as first choice for rudder only, as well as dual-control, since it is flexible and ultra reliable. The importance of the multivibrator type circuit is that it has neglible interaction. This is desired for dual-proportional systems to minimize changes in elevator signals when giving rudder control.

Actuators/Batteries: Both must be considered together. For each actuator there is a minimum battery supply for reliable operation. Those listed (Fig. 6) are proved combinations. A good acutator will not drain more than 200 ma. while pulsing under load. For ½A models the converted Aerotrol escapement (Fig. 1) is very satisfactory. All rotating parts are scrapped since only armature movement is needed. Energizing the actuator coil pulls the rudder over to one side and the spring provides opposite rudder. Push-pull rod movement is small so it must be connected closely to the rudder pivot. Power may seem weak, but it takes very little rudder force for a small ship. Adjust spring tension to balance action against slightly used batteries.

A symmetrical type actuator, with electrical power for both directions of rudder movement, is best for ships with .09 power or more. Of the dual-coil single-battery type, the **Southwestern** and the **Mactuator** are successful commercial units while among the dual-battery types the **Mighty Midget** motor is tops.

The dual-battery supply required for the M-M has proved to be very satisfactory, with some precautions. Always pulse the actuator when power is on so that one set of batteries doesn't

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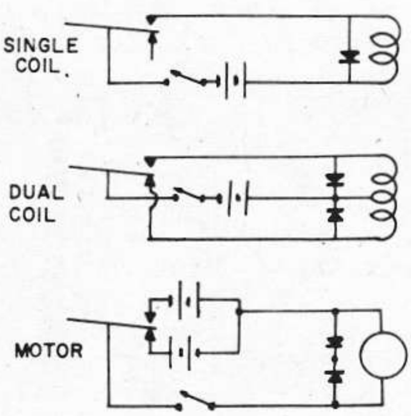
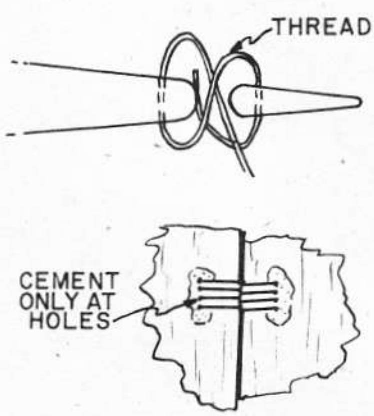
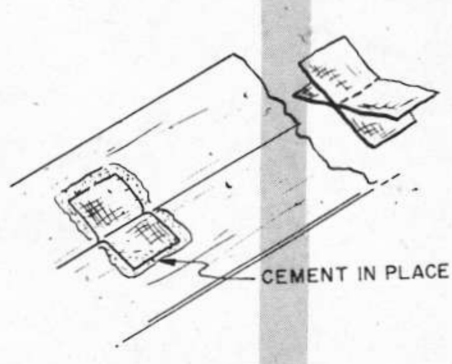


DIODE SPARK SUPPRESSORS
Figure 4



THREAD HINGES
Figure 5



CLOTH HINGE

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(*Continued from Page* 10)

get run down before the other. For instance, don't switch on the actuator circuit until the pulser is operating and, after a landing, keep the pulser going until the actuator is shut off. Successful use of a DPDT relay to eliminate one set of batteries is rare since dual-contact points are difficult to synchronize and are sensitive to uneven dirtying action. Satisfied users of the DPDT relay prefer the **Sigma 22** (surplus) or the **Price** units.

For up to .19 size ships, 3 volts is standard power for the stock M-M. If more power is desired, use extra gearing for higher torque rather than increased voltage which ups the current drain. Gearing may allow operation on only 1½ to 2 volts, reducing the drain without loss of actuator power. The recently marketed **Robot Synchro** actuator, which uses 2 M-M motors, is suitable for largest ships since it has ample power and compensates for its size and weight by requiring only a single battery supply.

The M-M in its "store-bought" form needs some beefing up to withstand the rigors of engine vibration and violent maneuvering. One "must" item is to secure the brush terminals from loosening. Most flyers simply pour Goo or Pliobond cement **liberally** around the terminal blocks and motor housing, including the wires. In addition, it's a good practice to cement balsa blocks between the brushes and fuselage sides.

A .010" or .015" aluminum strap across the top of the motor and to each of the mounting lugs is commonly used to prevent the lugs from snapping off in a crackup. The strap should not rub on the reduction gear shaft. File a flat on the reduction gear shaft to provide a better seat for the large gear set screw. Also, cement the set screw after tightening. Again, use Goo or other soft-setting cement.

Linkage: Torque rods are preferred, but a properly made push-pull rod is satisfactory. With either, bearings and yokes are better sloppy than tight. For ½A models a straight length of .050" music wire is okay, but for larger models hard ¼" square balsa or 3/16" dowel is better. Use only one bearing at each end of the rod, to avoid binding problems.

Wire fittings on the rod ends should be bound with thread and liberally cemented. Check pushrod systems by pulsing with weak batteries while the fuselage is held vertical. If action is not snappy it is not acceptable. Linkages should work well with minimum lubrication.

Control Surfaces: Rudders are good if at least 3 times higher than wide; 6 times greater in span than width for elevators. Average chord width greater than 1½" seems to increase model waggling without increasing control effect. Deflection should be 30°—45° each side of neutral. Friction free pivoting is essential. Controline type fabric hinges are good, as is the simpler cross-thread type (Fig. 5).

Dual Proportional System: Only the so-called "Galloping Ghost" (Feb. '57

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Figure 6
SUCCESSFUL RUDDER-ONLY PULSE AIRPLANES

Model	Engine	Weight	Act.	Act. Power**
Kitten	.049-.065	20-30 oz.	CBE SW	2 Penc. 3 v. 2 Penc. 3 v.
Breezy Jr.	.065-.09	24-36 oz.	CBE SW	3 Penc. 4.5 v. 3 Penc. 4.5 v.
Mambo	.09-.15	36-54 oz.	SW MAC M-M	3 Penc. 4.5 v. 3 Med. 4.5 v. 4 Penc. 3 v.*
Champion	.15-.19	54-72 oz.	SW MAC M-M	3 Med. 4.5 v. 3 Med. 4.5 v. 4 Med. 3 v.*
Cruiser	.19-.25	96-120 oz.	M-M MMg SYN	4 Med. 3 v.* 4 Penc. 3 v.* 3 Med. 4.5 v.

CBE—Converted Berkeley Escapement; SW—Southwestern; MAC—Mactuator; M-M—Mighty Midget; MMg—M-M w/gears.
* Dual Battery Supply SYN—Robot Synchro
** For at least a day's flying; Six 5 minute flights, av.
Note: for extreme cold weather flying, use same number of next largest size battery or use twice the number of same size batteries; connect second set parallel with 1st.

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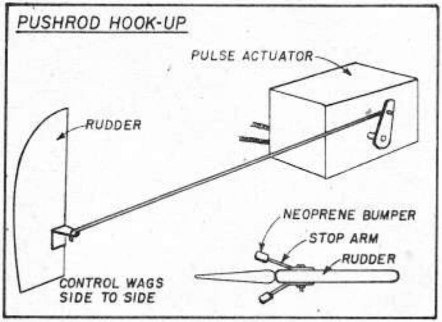
FM) can be recommended to anyone without reservations. It is well proved by over a thousand flights in the hands of several dozen flyers. Just one actuator provides simultaneous proportional rudder and elevator control through mechanical linkage rather than electrical circuitry. The basic idea is that pulse rate determines how much the actuator oscillates while the pulse length variations determine about what rudder angle the oscillation is centered. The actuator oscillation is transferred, through a torque rod, to a crank at the tail of the model which drives both rudder and elevator yokes.



Despite the name tag, galloping need not be typical of model flight with the system if it is properly tailored to the model. This is mainly a trimming proposition which provides a minimum pulse rate for the maximum up elevator position which is not so low as to cause model gallop. A pulse rate range of about 4 to 8 cycles is about right. Though ultra simple the system has no equal for sport or single-channel competition flying and it serves as an excellent sampler or trainer for those who might eventually use Walt Good's dual system.

Receivers Relays: Good pulse receivers will follow at least 10 cps without skip or flutter. Among the most successful are the original Lorenz 2-tuber, Gazistor variations of the same, Controlaire, Citizenship 27 and the Australian 2-tuber. If current change is less than 2 ma, stick with the old reliable Sigma 4F relay. With at least 3 ma change available, subminiature relays such as the Gem will perform satisfactorily. For spark suppression, diodes (Fig. 4) are simple and effective.

Pulse systems are very tolerant of malfunctioning components, such as chattering relays, sticky actuators, sloppy pulsers, etc. Control may be erratic but is seldom lost completely so there is a tendency to fly anyway. But inherent system reliability should not be burdened with marginal components. A smooth functioning pulse system offers piloting satisfaction unmatched by other type control. It is worth working for.