THE WRIGHT SYSTEM OF RADIO CONTROL

INSTRUCTIONS AND RECOMMENDATIONS FOR OPERATION, INSTALLATION, AND MAINTENANCE.

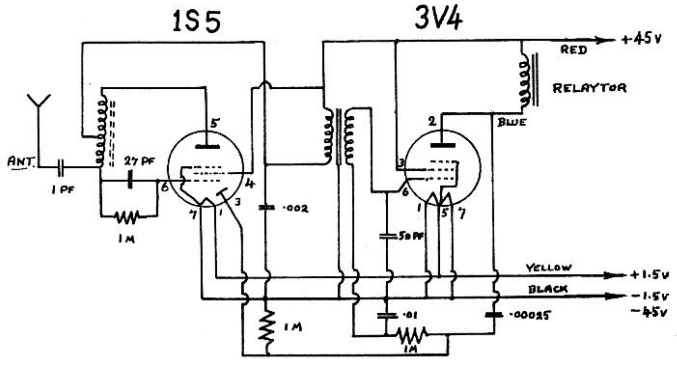
A WORD FROM THE DESIGNER.

I feel that you will be interested to know that throughout the design and development stages of the radio control equipment which is now yours, my sole aim has been to produce a system which would not only give the utmost reliability and simplicity of operation but which would do so without the necessity for any knowledge of electronics on the part of the operator.

These objectives have been achieved. Many hundreds of modellers have used the system in the five years since first it was made available. I have every confidence in placing the equipment in your hands knowing that whether you are expert or beginner, you will gain the fullest satisfaction from its operation.

Technically, all three units are practical in their design which is based on sound electronic and mechanical principles. As a result, you have not only a highly efficient system, but one which at no time will require critical adjustment of any kind. In practise these desirable features will mean for you an entirely new conception of radio controlled operation, allowing you to gain maximum enjoyment and educational value from the design and operation of your model, free from the problems accepted as inevitable with technical equipment in the past.

P. Wright



WRIGHT MODEL II RECEIVER CIRCUIT DIAGRAM

The WRIGHT System has three basic units:-

The Transmitter, which is used by the operator to control

The Receiver)
The Relaytor) which are mounted in the model.

If extra controls are required additional Relaytor(s), one of which must be a multi-Relaytor, may be installed. Either two or three distinct control services will then be available from the one transmitter and receiver.

DESCRIPTION OF UNITS AND BATTERIES REQUIRED.

The WRIGHT Transmitter. This transmitter uses a particularly stable circuit which has been rigorously tested by the New Zealand Radio Licencing authorities. Under no operational conditions will it ever deviate from the allocated frequency bands.

Transmitting Frequencies. Type CTA/1 27.12 megacycles.
Type CTB/1 35.7 megacycles.

External Controls. 1. On-Off battery switch.
2. Socket for remote control switch lead.

Aerial. The 27.12 mcs transmitter uses a 4-section aerial.
The 35.7 mcs transmitter uses a 3-section aerial.

Battery connections. Red: High tension positive + 90 volts.
Yellow: Low tension positive + 1.5 volts.
Black: High and Low tension negative.

Remote Control Switch A hand-held, "key", or press switch is connected to the transmitter by seven feet of flexible lead.

Battery Types Required. 2 Type 482 Eveready or equivalent for 90 v H.T.
1 No. 6 Cell for 1.5 v L.T.

These batteries can be expected to last at least two years with normal use. We recommend that the H.T. be rejected when under sustained load (10-20 secs.) the voltage falls below 75v, and the L.T. when the on load voltage falls below 1.25 v.

Range. The transmitter will operate the WRIGHT receiver at as great a range as the model can be seen. Refer to the section, "Range and Sensitivity", in the Receiver section of these instructions.

The WRIGHT Model 11 Receiver. This receiver employs a stable and sensitive two valve transformer coupled circuit. Its action depends upon the fact that a superregenerative detector produces a characteristic hiss until a transmitted signal at the tuned frequency is received -- then the received signal mutes the hiss. In this circuit the "hiss voltage" originating in the detector is amplified and rectified and then applied to the grid of the output valve so that it restricts the current which the output valve will pass under normal idling "hiss" conditions to approximately ½ milliamp. When a transmitted signal is received, the "hiss "voltage" disappears, and the output valve then conducts without restriction and passes about 6 milliamps.

The operating principle of both Model 1 and Model 11 receivers is identical, but some Model 1 receivers were fractionally slow to respond due to inherent circuitry. With the introduction of the multi-relaytor which demands instantaneous response from the receiver, the delaying components were designed out of the circuit. The result is the Model 11 receiver.

Use a high resistance relaytor with a Model 11 Receiver, (1S5 and (3V4 valves).
Use a low resistance relaytor with a Model 1 Receiver, (1R5 and (3S4 valves).
The high resistance relaytor has a green banded coil. The low resistance relaytor has a yellow coil.

Unmatched receivers and relaytors will sometimes work under ideal conditions, but they are nevertheless unmatched electrically and there is little safety margin in such an arrangement to accept inevitable voltage variations with use and temperature.

Receiver Operating Frequency. The Model 11 receiver will operate satisfactorily from less then 27 mcs to higher than 36 mcs.

Receiver Controls. 1. On-Off Switch.
2. Tuning Control. See, "Tuning".

Aerial. Aerial length is not critical. See, "Range and Sensitivity".

Current Supply Required. L.T. 1.5 volts at 150 ma, (constant)

H.T. 45 volts at 1.0 ma (idling)
45 " " 7.0 ma (on signal).

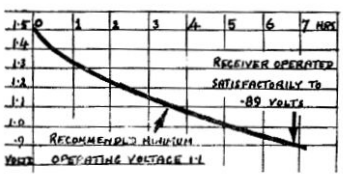
The receiver will cease to operate properly should the L.T. drop below 0.9 volts, or the H.T. drop below 28-30 volts.

Connections to Batteries and Relaytor:

Red	:	High Tension Positive + 45 volts.
Yellow	:	Low Tension Positive + 1.5 volts.
Black	:	High and Low Tension Negative.
Blue	:	Receiver to Relaytor.

Battery Types and Life. Any adequate source of 1.5v and 45v will operate the equipment. Lengthy experience has found satisfactory an ordinary Type 950 torch cell, which weighs 3 ozs, and either a Type 455, or two 22.5v sections of Types 467 or 490P, any of which weigh approx. 7.5 ozs total. A particular point should be noted here. Failures have been experienced due to failure of the factory soldering of the plain wire which joins the two 22.5v sections of these batteries. We recommend that this plain wire be discarded, and the two 22.5v sections be joined with a short length of flexible wire.

The Type 950 will run the receiver for 7 hours, and is safe enough to trust for say 3 hours operation. The graph shows the fall of voltage with continuous operation; intermittent use is easier on the battery. We recommend that the L.T. cell be rejected when the on-load voltage falls below 1.1 volts.



TYPICAL VOLTAGE DECAY WITH TIME

TYPE 950 CELL

MODEL II RECEIVER.

The H.T. Batteries are so little extended that they ultimately become unreliable due to age rather than use. Six months would normally be considered a fair life. We recommend rejection at 6 months, or when the on-load voltage falls below 40 volts. Reject also if a very severe bump has disturbed the stack of cells, because the battery is then unreliable.

For special applications very much longer life batteries are available: for instance 4 Kalium cells, at ¾ oz each, yield approx 35 hours supply. Write to the Technical Adviser if you have any special problem.

The WRIGHT Relaytor. This relaytor is a combined relay and actuator escapement which is operated directly by the receiver from the power of the receiver batteries. No sensitive relay or separate escapement circuit and batteries are used. The current change from the receiver operates a trigger mechanism so that the energy stored in a twisted rubber motor is released one quarter of a turn every time the transmitter key is depressed or released. The control spindle of the relaytor must be connected to the surface to be controlled through a suitable linkage.

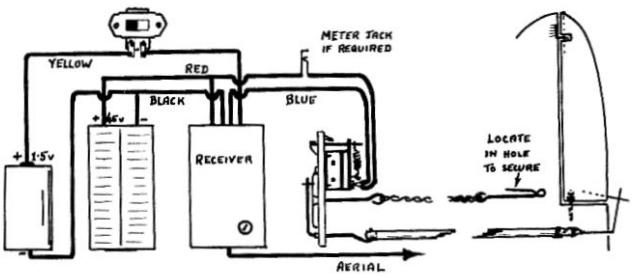
Relaytor Connections. Two terminals are mounted on the terminal strip. Solder the blue wire from the receiver to one of these, and connect the other to the red +45V battery lead.

WIRING AND INSTALLATION.

As the installation of radio control equipment into a model aeroplane generally presents more difficulties than its installation into a model boat or static model, the methods described here will be those suitable for a model 'plane. They may be adapted as necessary for other less exacting conditions.

The important aspect wherein a radio-controlled model aeroplane differs from most other model aeroplanes is that it is expected to, and does, fly for many many hours during its life. It follows that the radio gear must not only be put in so that it will work, but also with such care and attention to detail that it will keep on working throughout the flying life of the model, despite hours of severe vibration and a fair measure of rough handling and plain dirt.

Periodic inspection and cleaning take care of the rough handling and dirt. It is suggested that the gear be installed so that the entire installation - LT and HT batteries, switch, Receiver and Relaytor - can be removed from the model without disconnecting any wiring except the aerial. (A banana plug makes an efficient break point for that.) We suggest this because of the convenience and



WIRING DIAGRAM

saving of time which comes from being able to lay out the gear on the bench for cleaning and oiling, yet still connected and working for easy checking.

Any wire which is soldered to a lug and then shaken by vibration will ultimately break off at a point where the solder ends because the sharpest bending occurs there. But if the wire is held for the inch or two nearest the soldered end the sharp bending cannot occur. Note how the wires from the receiver are held by threading them through holes. Do the same thing with the leads to the relaytor, and at the switch. Strap an inch or two of the battery leads to the batteries with rubber bands. If you do these things you will never have any trouble from broken wires.

Make yourself familiar with the wiring diagram, and do not depart from this under any circumstances. Use only flexible, insulated multi-strand hook-up wire for all connections. Under no circumstances use single-strand wire. Treat the +45 volt (Red) wire with respect at all times - it can seriously damage the receiver if it is wrongly connected.

A particularly neat and serviceable installation will be the result if three solder tags are fixed to the insulated base of the switch. (Drill a hole in the paxolin and twist a "tail" of plain tinned wire for each tag.) The wires from every component may then be twisted together and all of them run to or from the switch. There are no loose wires, and no tangle.

A neat and effective method of mounting the switch in the model is to attach it under a ⅛" skin with the slide protruding through a slot. Use either nuts and bolts, or else self-tapping P.K. screws driven through the mounting lugs which have been drilled as necessary.

RANGE AND SENSITIVITY.

The longer the model's aerial, (or the tighter the aerial coupling if this is ever altered,) the more sensitive the receiver will be and the greater the range at which it will respond to the transmitter. There is no point in making it too sensitive because all manner of static and occasional faint signals are being transmitted all the time and the equipment in the model is, of course, also receiving and amplifying these continuous background transmissions. It is thus most important that while the equipment must be sensitive enough always to respond to its own nearby transmitter, it must never be so sensitive that is will respond to any of the fainter background signals. We recommend an effective aerial length - that is, the length which lies clear beyond all other parts and wires of the installation - of not less than 12 inches, and not more than 36 inches. 12 inches may sound short, but on test a standard Model 11 receiver with a 12 inch aerial, controlled satisfactorily at 2.1 miles. Use a longer aerial if you wish, but if you then find that your model sometimes responds to weak signals which are not yours, shorten the aerial to make the installation less sensitive. Never run the aerial parallel to any other wires or to any metal control rod. Experience has shown it desirable to make a few inches at the end of the aerial vertical - this makes the aerial's ability to receive a signal from any angle whatsoever more uniform. Except in the case of metal models, or models painted with conductive paint, (aluminium etc) there is no advantage is running the aerial outside the structure. It will be neater, less trouble, and less prone to damage if it is glued permanently inside. Any copper wire which is thicker than the wire of the aerial coil in the receiver is satisfactory. For the aerial use either stranded insulated hook-up wire; or plain wire glued to the structure and insulated against unexpected electrical contact with several coats of dope and with a flexible wire lead running to the receiver from one end.

The radio waves transmitted from a 27 meg transmitter will not "bend" very much, and those from a 35 meg transmitter will "bend" hardly at all. Ensure that the transmitter aerial and the model can "see" each other at all times. Never let any person or obstruction get between the transmitter aerial and the model, or control may be lost.

Radio waves which pass close over dry, non-conductive ground tend to be absorbed. Those which angle up clear of the ground, or those which pass over water or sodden ground, are absorbed not at all. It follows that maximum control range will always be greater in the air than on the ground, and the drier the ground the truer will this be. The 2.1 miles quoted was measured across the sea.

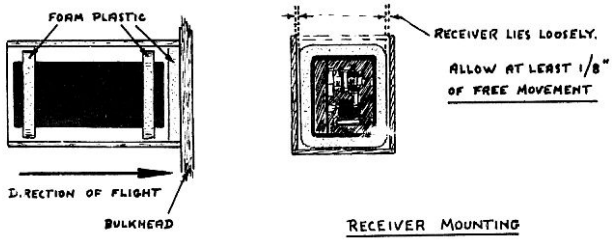
A word about the transmitter. Never let the press switch lie around on the ground to get wet. A short circuit here is disastrous!

RECEIVER MOUNTING

Model aircraft, even the best of them, sometimes stop very abruptly. All model aircraft with engines, and some marine craft as well, tend to vibrate heavily. The purposes of the receiver mounting are to cradle the receiver but not pass on to it the general vibration, and to protect the receiver from impact damage in the event of a bump. Both purposes will be served if the receiver lies lightly on resilient material in a recess so constructed that the receiver cannot move forward more than say 1/4" before it is resisted by something very strong, such as a bulkhead.

It cannot be stressed too strongly that the receiver must always lie slightly loose and free to move. Even the most resilient material proves useless when it is packed in tight and solid - its strength is too great. If the receiver is held too rigidly in its mounting, the model may occasionally reverse its turn when the engine is running but it will respond perfectly at all other times.

A suitable type of mounting is sketched.



RECEIVER MOUNTING

Cut strips approximately ¼" square from the foam plastic which is supplied with the set, and lightly glue them to the receiver case, or glue them into the recess for the receiver case to lie on. Any contact cement such as Pliobond is a satisfactory adhesive, but never soak the foam plastic with glue or its springiness will be lost. Always allow at least ⅛" of free movement in the recess.

There is no top nor bottom to the receiver. It may be mounted in any position. The essential point is that the model must be able to shake and vibrate without passing the full force of the vibration on to the receiver, and it is only freedom of movement in the mounting which will ensure that this is achieved.

RELAYTOR MOUNTING AND LINKAGE

The relaytor base plate is drilled so that it may be mounted by four bolts in a cut-out in a plywood bulkhead, or similarly in a removable plywood slide. Another method is to drill the flanges of the relaytor base plate with 1/16" holes ⅛" from each of the four corners, and mount the relaytor on two transverse 16 guage wires which run from one side of the model to the other. Slip spacers of fuel tubing over one of the wires to prevent sideways movement.

Always check most carefully, at all stages of installation, first that the relaytor base plate lies at right angles to the actuating rod, of the linkage, and secondly that the whole linkage between the relaytor and the surface to be controlled is free and easy to move. It is usual but not essential to use balsa-wood rods for the linkage. If metal rods are used, insulate them electrically from the relaytor. If this is not done, mechanical rattle in the linkage will be detected as electrical interference by the receiver, and control may be affected.

Useful linkage details are sketched. It is most strongly recommended that the control surfaces of large models be statically balanced. It is probably a fair statement that most control failures are due to imbalance, friction, or binding of the linkage aggravated by acceleration or model flexing under severe flight loads. It is not the purpose of these notes to describe how to build your model, but we emphasise from long experience that the thought and care expended in constructing a sturdy, free-running, and balanced linkage will be amply repaid by trouble-free operation. To check for freedom and balance, operate the control 20 or 30 times in each of the positions right way up upside-down, vertically nose-up, vertically tail-up, vertical bank left, vertical bank right with only a feeble drive from a few turns on the relaytor rubber motor.

Make certain that no loose wires, packing, or other objects can ever foul the trigger mechanism or moving parts. There is no top nor bottom to the relaytor. It may be mounted in any position.

RUBBER MOTOR

Excessive rubber is neither necessary nor desirable, and only sufficient should be used to operate the control as desired. Two strands of ⅛" and 1/24" rubber will generally be found ample for any model aircraft rudder. The relaytor will handle two strands of 1/4" x 1/24", but we recommend that such power not be used unless absolutely necessary. In order to find out whether there is enough power to operate a control , a useful practical test is to blow across the control as the relaytor is moving it toward you. A good puff reaches 60 mph, - 80 mph is possible if you really try, - and the relaytor's ability to move the control directly against such a force is proof that it has many times the power that will ever be required in flight.

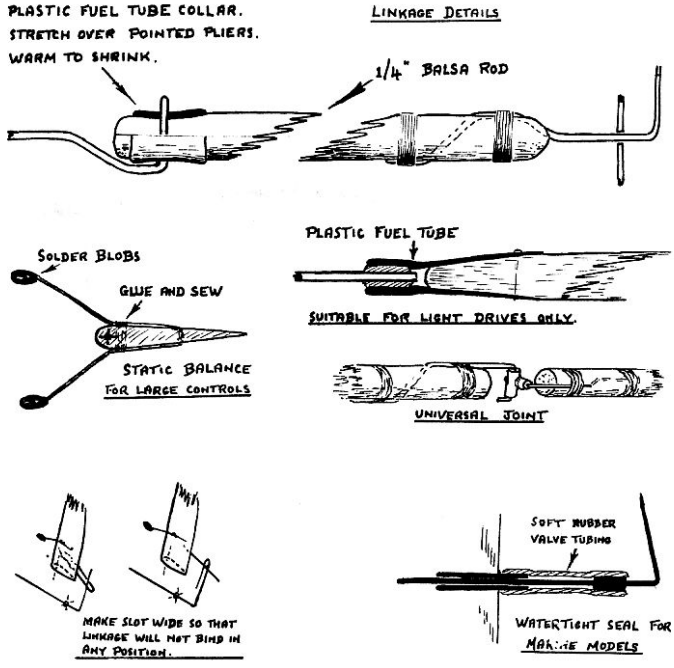
Use as long a motor as you wish, let the length between the hooks be about 70% of the unstretched length of the motor, and lubricate the rubber with rubber lubricant or castor oil, (never mineral oil.) Do not wind the rubber tightly at first, and never wind it to more than half the maximum number of turns per inch that it will stand.

Use up to	35	turns	per	inch	with	1	strand	of	3/16	x	1/24.	It breaks at	70
" " "	30	"	"	"	"	2	"	"	1/8	x	1/24.	" " "	65
" " "	30	"	"	"	"	1	"	"	1/4	x	1/24.	" " "	65
" " "	25	"	"	"	"	2	"	"	3/16	x	1/24.	" " "	55
" " "	20	"	"	"	"	2	"	"	1/4	x	1/24.	" " "	45

RELAYTOR RE-ADJUSTMENT

If minor damage should upset the adjustment of the relaytor, it is important that the following sequence be observed when re-adjusting:

1. Adjust the movement of the trigger armature by bending the armature back stop to give a clearance of .010"to .012" between the armature and the back stop when the armature is fully depressed.
2. Vary the spring tension by bending the spring adjustment lug so that the trigger armature pulls down at 3.0 to 3.5 ma, and returns to up at 2.5 to 2.0 ma. (Model 11 Receiver.) Alternatively, adjust the armature return spring so that a weight of .18 oz, applied at the tip of the trigger armature will just depress it. A piece of 16g steel wire, 14½" long, weighs .18 oz. For this method the .011" gap must be correct.
3. Final slight adjustment to the pallet piece stops may then be made if necessary. With the armature up, the lower stop should clear the lower face of the armature by .003" approx With the armature down, the upper stop should clear the upper face of the armature by .003"approx. It is essential that the working faces and edges of the armature and the upper and lower stops should be clean, sharp, free from blemish, and that all edges should be parallel to the pallet piece spindle and to each other.



TUNING

No control from a distance should be attempted without first tuning the receiver. This is the only adjustment you will have to make to your equipment, and it can only be done when the receiver and aerial are installed in the model ready for operation.

Tuning Procedure. A tuning screwdriver, which will fit into the slot in the end of the tuning slug of the receiver, is supplied. (Should it be lost, an excellent substitute can be made from the shaft of an old knitting needle). Arrange visual signals so that an assistant will key the transmitter on and off as required, then take the model at least 200 yards from the transmitter.

From this point either of two methods is satisfactory.

Electrical Method. Use a meter to measure the current in the red relaytor-to-battery lead, then;-

1. With the transmitter switched on, tune for maximum current The meter should show 5½ to 6 ma at maximum. (Model 11 Receiver.)
2. Key the transmitter on and off to check current swing and response. The meter should show approx ½ ma, slightly unsteady, with the transmitter off; and 5½ to 6 ma with the transmitter on. The relaytor will work, and the rudder assume a turn position, every time the current rises.

Mechanical Method. Proceed as follows:-

1. Switch the transmitter on. Screw the tuning slug in or out until the tuning range of about 3/4 turn is found within which the relaytor will work and the rudder will assume a turn position. The slug will be well in for 27 mcs, and well out for 35 mcs.
2. Key the transmitter on and off to prove transmitter control and hence rough tuning.
3. With the transmitter on, establish carefully and mark on the receiver case the angle of the slot in the tuning slug at each extreme of the tuning range. These are the two points at which the relaytor will return to neutral. The correct tune position will be exactly halfway between these two marked extremes.
4. Key the transmitter on and off to prove control and fine tuning.

Important Notes.

It is obvious that the further away from the transmitter that tuning is carried out, the more accurate it will be.

Check always that the friction rubber remains squeezed in the thread between the tuning slug and the aerial coil former so that the tuning slug will never move under the influence of vibration.

No further tuning will be necessary provided the installation and aerial length remains unchanged.

If the aerial length is ever changed, retune.

Tune a model aeroplane at at least shoulder height, not on the ground.

Tune a model boat in the water.

Never tune any model near an earthed metal object, such as an iron fence or tin shed.

If the receiver is to be used on 35 mcs, there is no reason why the tuning slug should not be removed, cut in half, and one half together with the friction rubber screwed well in to the aerial coil former to tune the set to 35 mcs. This method has the advantages that a smaller slug lies more symmetrically within the coil, and as there is none of the slug projecting outside the coil former, the chance of the slug ever being moved accidentally is eliminated. The receiver will not tune to 27 mcs again on a half slug.

OPERATING NOTES.

The transmitter, used without its aerial, will transmit, feebly, enough power to control a model at a range of a few yards. This can be useful for workshop checking and also as a field check, for if the transmitter, without its aerial, will control the model at about 12 yards over dry ground, or 25 yards over moist ground, then it is certain that it will control it at 1 to 1½ miles when the transmitter aerial is up. Whether or not the transmitter will oscillate without its aerial at the same frequency as with it will depend upon the exact length of the aerial itself, but any variation will be so small that it can be neglected for ground checks.

An unscreened receiver in a boat may change its frequency slightly when it is put in the water if it has been tuned out of the water. For this reason a model flying boat presents a particular problem, which is completely overcome by screening, or enclosing the receiver in a metal case (one end of which may be left open.) One effective method is to cover the receiver case with aluminium cooking foil, glued on with contact cement, and fit an aluminium cover over the tuning coil end.

If you use a spark ignition engine, keep the aerial well away from any part of the ignition circuit. To avoid electrical interference mount a ½ watt 10,000 ohm resistor in the high tension lead as close to the spark plug as possible.

The switch which is supplied with the receiver is of a type which has proven trouble-free, and we recommend it for use in most applications. Many types of switch have been found unreliable when affected by vibration.

Marine models and flying boats present a special switch problem The most practical solution we have found to be a sturdy rotary switch, with a screwdriver-slot cut across its spindle. Mount this on a removable slide inside the model in a position such that a driver (which can be operated from outside the model) mounted in a hatch mates in the slot when the hatch is fitted into position.

PERIODIC MAINTENANCE

It is advisable after every ten hours of flight, and more frequently with models which vibrate severely, to check the following points. Should the model not have been used extensively, check it at least every two months.

1. Clean dust and fluff from the trigger mechanism of the relaytor.
2. Check the working parts of the relaytor for any trace of corrosion or stiffness.
3. Check the working edges and faces of the trigger mechanism for deformation from hammering. Only relaytors which are driven by very powerful rubber motors will show traces of this: but it can lead to "skipping" unless the faces are dressed periodically.
4. Lubricate the relaytor sparingly with light machine oil.
5. Check all wiring and solder joints for broken and frayed strands, and general condition.
6. Check the High Tension voltage.
7. Inspect the rubber motor for condition and lubricate it with castor oil or rubber lubricant.
8. Check the entire linkage for security, condition, balance, and freedom of operation.
9. Check control surface hinges for freedom and condition. (Warning - fabric hinges which have seen long service, tend to fail without warning.)

COMMON SENSE AND FIRST FLIGHTS

Check: That the receiver has been tuned.
That the batteries are fresh.
That the relaytor motor has been wound.
That the radio control equipment is working perfectly, both with engine running and engine off.

Early mornings and evenings are usually calmer than late mornings and afternoons. That art of flying has to be learned, and proficiency comes only with experience. Until you know your own capability and that of your model, do not fly if there is much wind. Keep your motor runs reasonably short - say two minutes at first. Let the model gain plenty of height before trying any steep turns, and always keep the model upwind of you until you are certain that there is not much wind aloft.

Don't forget to wind the relaytor motor every hour or two.

Always check control immediately before you launch. This proves that both Transmitter and Receiver are switched on.

Should you find that you need any further advice or assistance in the use of your Wright equipment, please do not hesitate to write to:

The Technical Adviser,
WRIGHT Radio Control Ltd.,
4 Sharon Road, Torbay,
AUCKLAND, NEW ZEALAND.