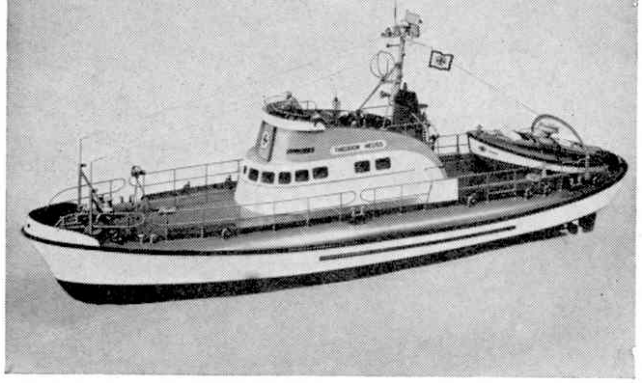
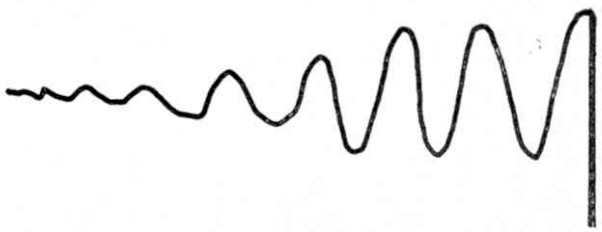




RADIO

by **F. C. Judd A.Inst.E.**

BUILDING models of aircraft, ships and motor cars is in itself a fascinating hobby and a well-made but otherwise stationary model can give much satisfaction to the maker. But how much more satisfying it is to make the model come to life, to almost place yourself behind the wheel of that model launch, to steer it and to control its engine as it glides across the water. You can do this with radio control, which becomes the link between you and the model and the means of conveying your commands.

Radio control can be applied to any working model, be it a boat or an aircraft or a motor car or even a stationary model which has working parts. This introduction deals with the principles of radio control, but later I shall be dealing with the construction of a scale model motor launch and a complete radio control system to steer it and control the engine.

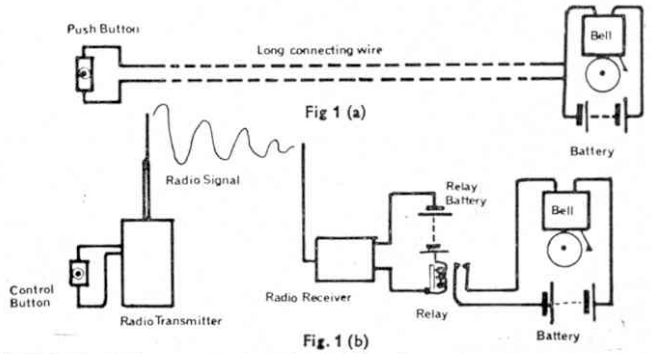
How Radio Control Works

Let's begin with a simple explanation of remote control by means of electric current. The electric door bell is an easy one to understand and when the button is pressed at the front door, the electric current travels down the wire and actuates (remember that word) the electromagnetic mechanism of the bell. This may require long wires between the push button and the bell, but supposing we wanted to actuate the bell at some distance *without* long connecting wires.

Take a look at Fig. 1 which shows in (a) an ordinary bell circuit. In (b) however, the wires have been replaced with a RADIO LINK and the bell, together with its battery, is quite independent. It could, therefore, be placed almost anywhere within radio range.

The electric bell could actually be carried about and be made to ring when required, but how does the RADIO LINK do this? We begin at the 'transmitter' which is normally switched OFF by interrupting the high tension supply. When the switch or control button is pressed the transmitter is ON and radio signals leave the aerial. When the button is released the transmitter is OFF and no signals leave the aerial. Here then is a simple means of conveying COMMAND SIGNALS to the radio receiver.

When a signal is received it must be further changed and amplified so as to finally provide a strong electric current; strong enough to operate a RELAY. A relay is really an electromagnetic switch and is the final link in the chain



A comparison between an ordinary door bell (top diagram) and a radio controlled bell (bottom). Basically, the difference between the two circuits is the radio transmitter and receiver, which replaces the wiring in the ordinary door bell

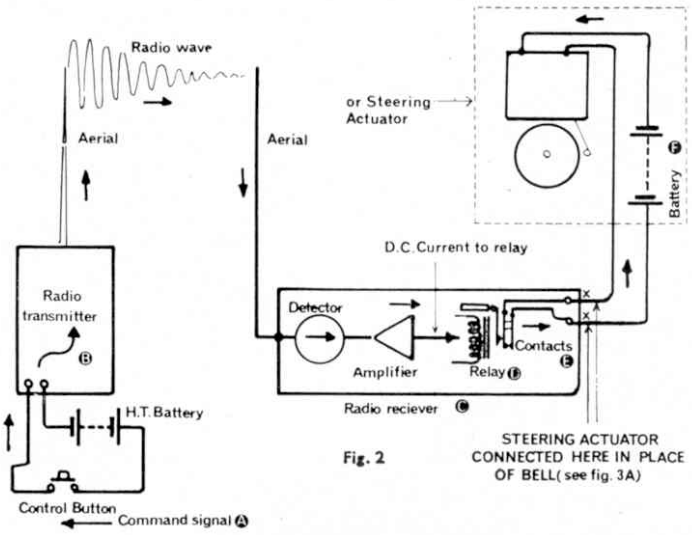
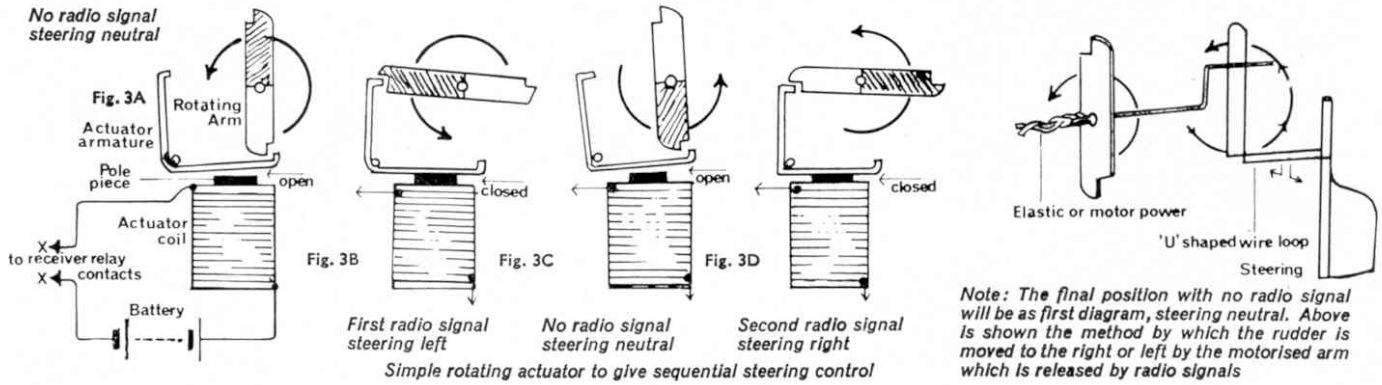


Fig. 2

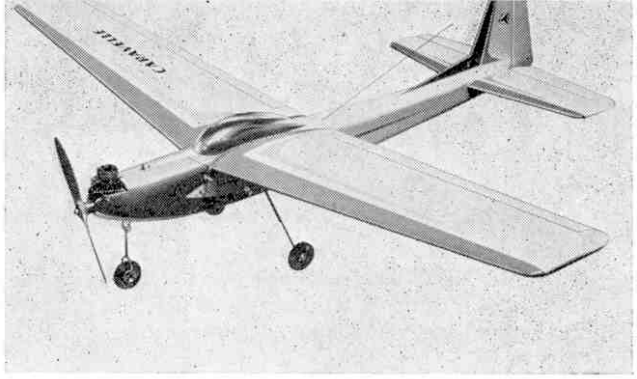
The control signal path in a radio control system



Simple rotating actuator to give sequential steering control

Note: The final position with no radio signal will be as first diagram, steering neutral. Above is shown the method by which the rudder is moved to the right or left by the motorised arm which is released by radio signals

CONTROL



of radio control. The contacts on the relay are used to switch the necessary current, to the electric bell in this case, which is obtained from a separate battery.

Let's go through the chain of operation again with the aid of Fig. 2. Starting at the control button (A) a command (bell on) is sent by pressing the button and holding. The transmitter (B) is, therefore, switched on and sends out a radio signal (called a carrier wave) for as long as the control button is held on. The radio receiver (C) now picks up the signal which is detected. This means that the signal is converted into D.C. (direct current) either by the receiving valve or transistor itself, or by a separate detector valve or transistor. The D.C. signal is, however, very small and may have to be amplified by further valve or transistor stages until it is strong enough to operate the relay (D). The contacts (E) on the relay then close and pass current from the battery (F) to the electric bell. The circuit is completed in just the same way as it would have been using long wires.

When the CONTROL BUTTON at the transmitter is released, the radio signal is stopped. Since there is no signal at the receiver to be detected and amplified there is no current passing through the relay coil. The relay will, therefore, open and cut off the electric current supply to the bell. Thus, by a radio control link, an electric bell can be set ringing anywhere within radio range. A model boat or aircraft can be controlled in exactly the same way without wires between the model and yourself.

Steering Control

The first and most important function is steering and for this we use a STEERING ACTUATOR (sometimes called a servo-mechanism). The most simple steering actuator has a moving claw that engages with a rotating arm which can be powered by twisted elastic (similar to the method used for powering model aircraft propellers) or by means of a small electric motor.

As in Fig. 3A the rotating arm is normally held stationary and in this position the steering is neutral (straight course).

When a radio signal is sent, current is applied via the relay contacts to the actuator whereupon the armature closes inward thus releasing the rotating arm which moves round a quarter turn as in Fig. 3B. It stops here because it is caught by the claw at the other end of the armature. By means of the mechanical linkage the steering has now been moved to provide a LEFT TURN and so long as the radio signal is 'held on' will remain in this condition.

When the radio signal is turned off, the armature will open again and release the rotating arm. This will now take another quarter turn and restore the steering to NEUTRAL as in Fig. 3C. Another radio signal will again operate the actuator and the process will be repeated, but this time, due to the mechanical linkage, the steering will be set for a RIGHT TURN as in Fig. 3D and remain so whilst the radio signal is held on. When the signal is turned off again, the steering will once more return to NEUTRAL.

So here we have a 'sequence' which means that one particular operation or command must follow another. In this case it is: radio off—steering neutral; radio on—steering left; radio off—steering neutral; radio on—steering right; and, finally, radio off—steering once more neutral. The sequence then repeats.

This very simple form of steering control is adequate for small model aircraft and boats but in recent years has been much improved upon by clockwork and electrically driven actuators. These have the same sequential steering control but in addition, allow control over an electric driving motor. One of these, the Kinimatic actuator shown in Fig. 4, will be featured in a radio-controlled model of a Chris-Craft Constellation motor launch I shall be dealing with next month.

Meantime if you would like advance details about this beautiful model and its radio control equipment call at your local model shop or write to: *Ripmax Limited,* 80 *Highgate Road, Kentish Town, London, N.W.5.* Ask for the Graupner catalogue plus the leaflets on Macgregor Radio Control equipment mentioning the article in M.M.