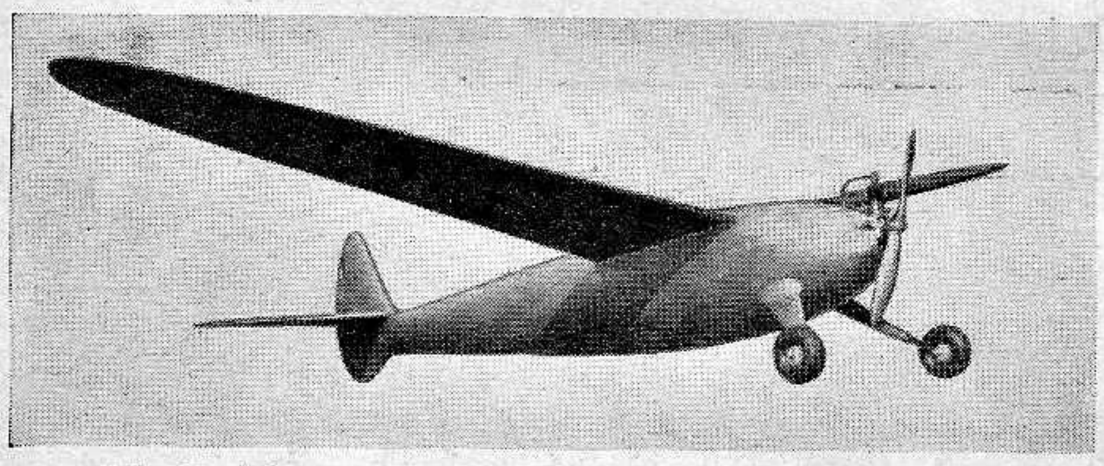
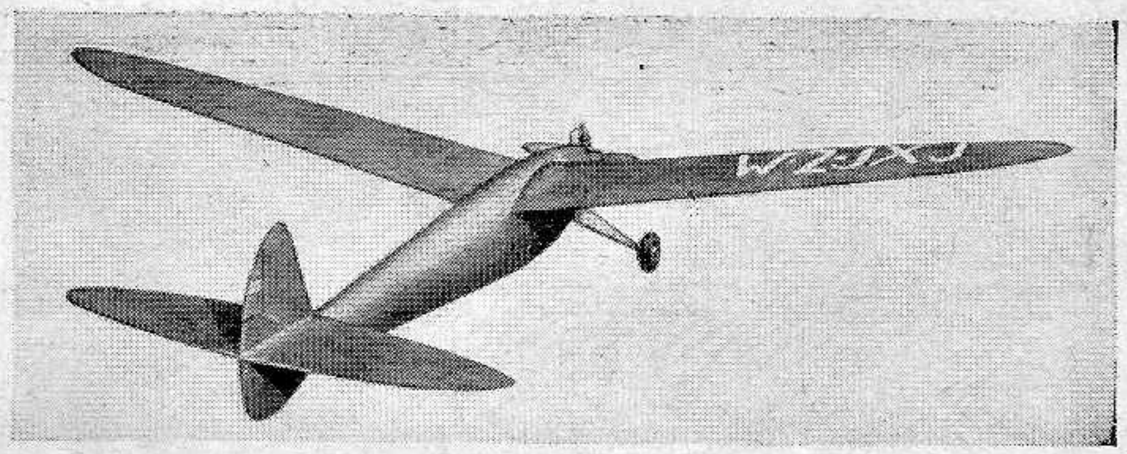


The Dolphin in which the control system was installed



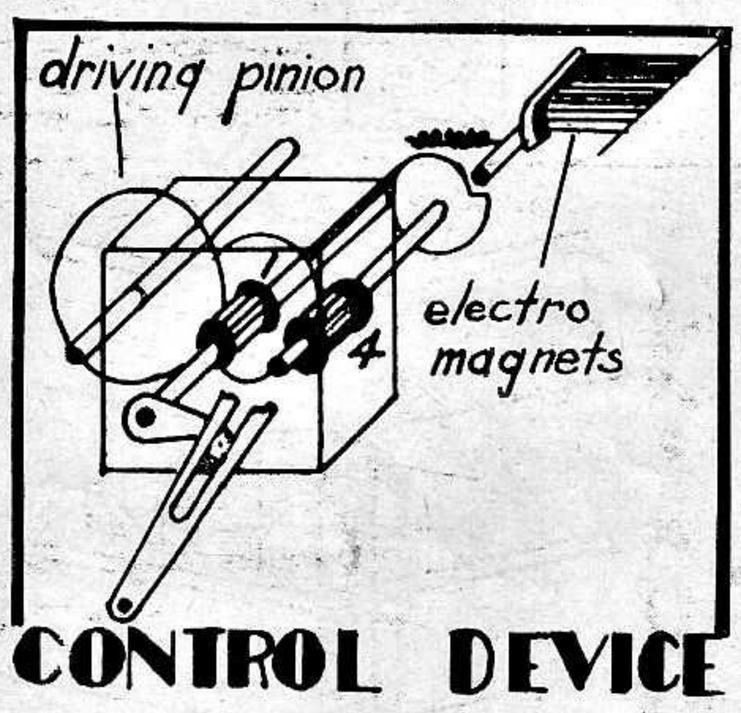
A rear view showing the radio-controlled rudder

A RADIO CONTROL FOR GAS JOBS

A System Providing Individual Control of an Infinite Number of Control Units Through One Receiver and Transmitter

By THRACY PETRIDES and LEON HILLMAN

IT WORKED perfectly on the ground, but would it work in the air? The tank was loaded with gas and the booster batteries plugged in. The prop was turned over once, twice—then she caught. On the control panel a small switch was thrown, the motor which had just been running in medium spark position idled, simultaneously a small colored bulb lit on the panel board indicating to the operator that the condition was such. Then, a shout was given! A flash of lights on the control panel showed a change of controls, the needle of the meter jumped in accordance with the transmitted impulses—action! The Dolfin taxied with neutral rudder to the center of the runway, with its nose pointed in the wind, the engine could be heard releasing its power; with a steady run the plane took off and quickly gained altitude and once sufficiently high responded admirably to every impulse transmitted by its "landlubber" pilots.



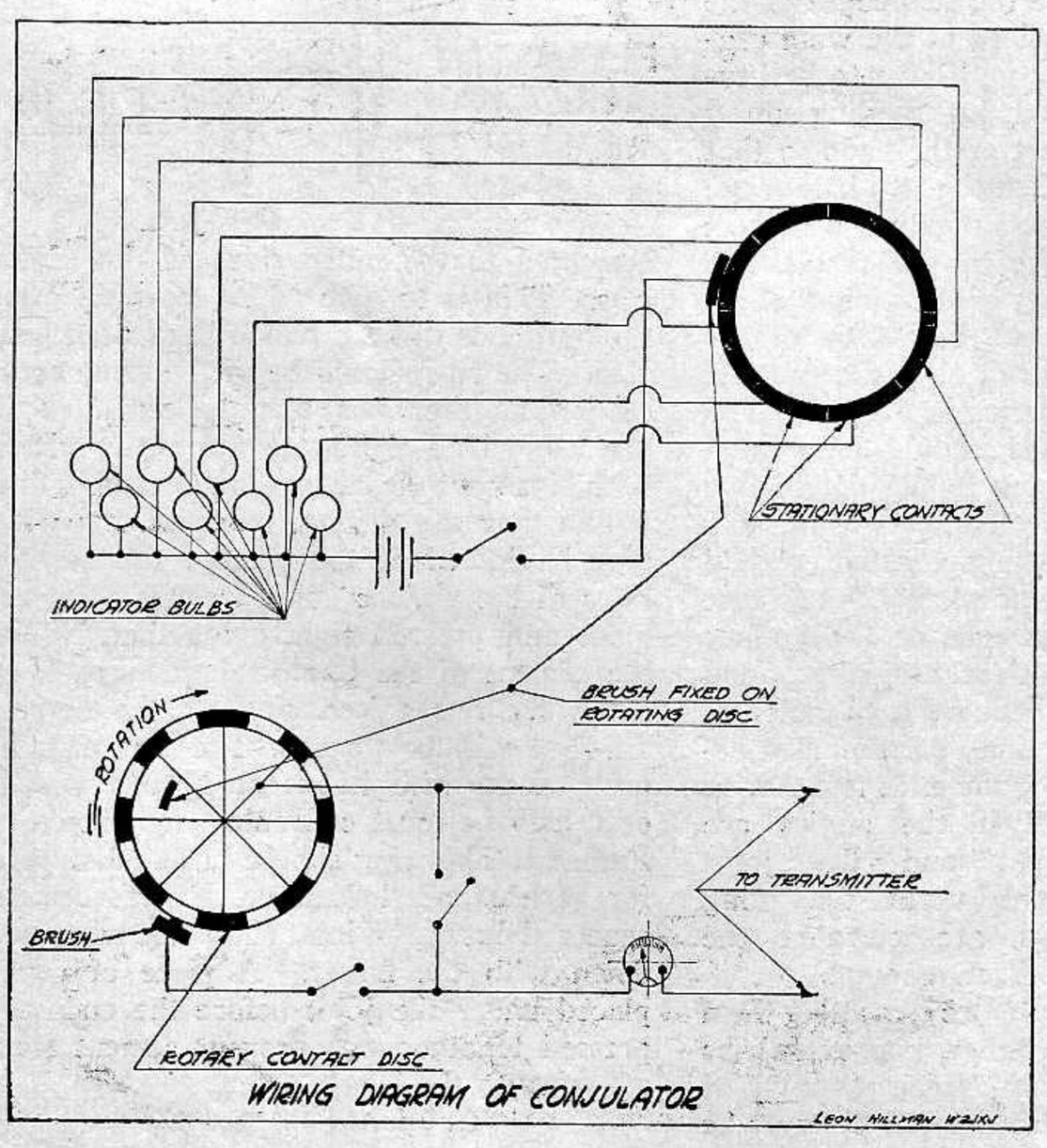
This scientific feat was accomplished through a simple system of control. An attempt will be made to show the reader the basic principles of the control system used in the Dolfin and some of the problems of radio control that were encountered and solved.

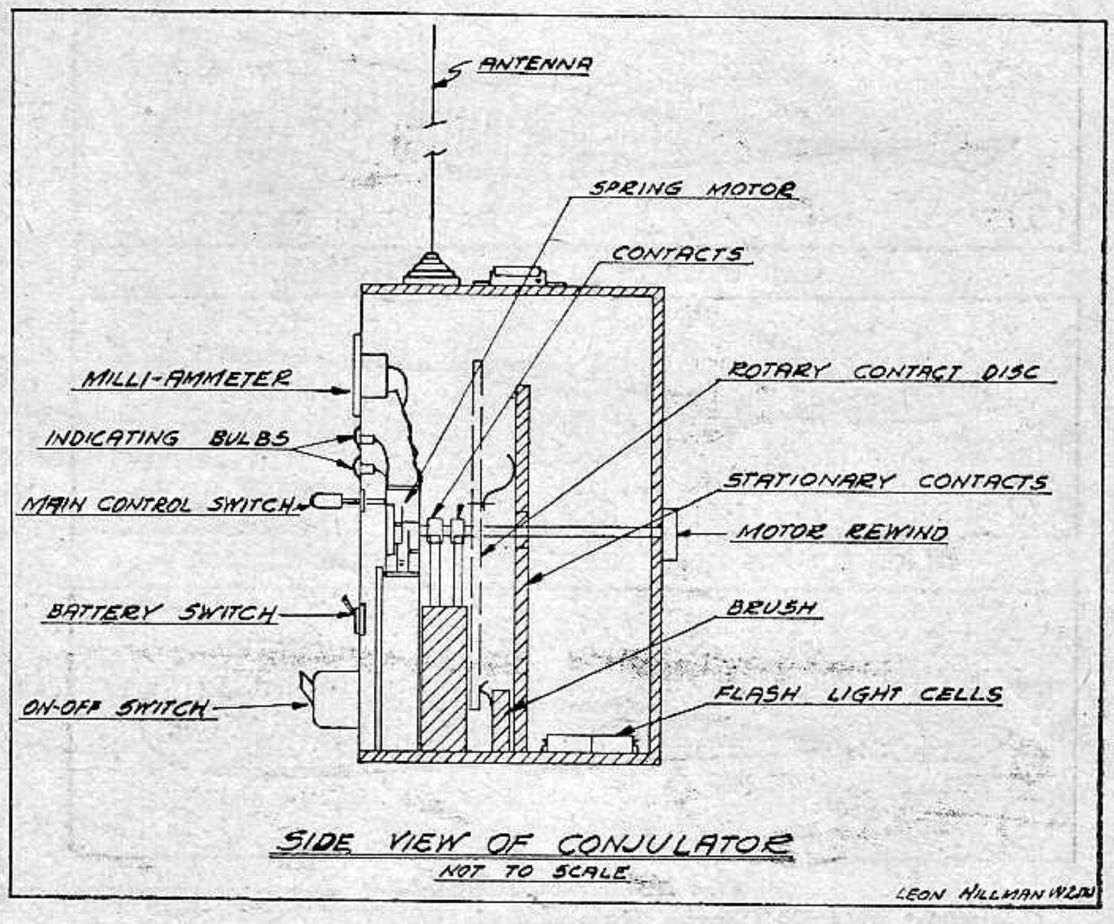
The entire system may be classed into three units.

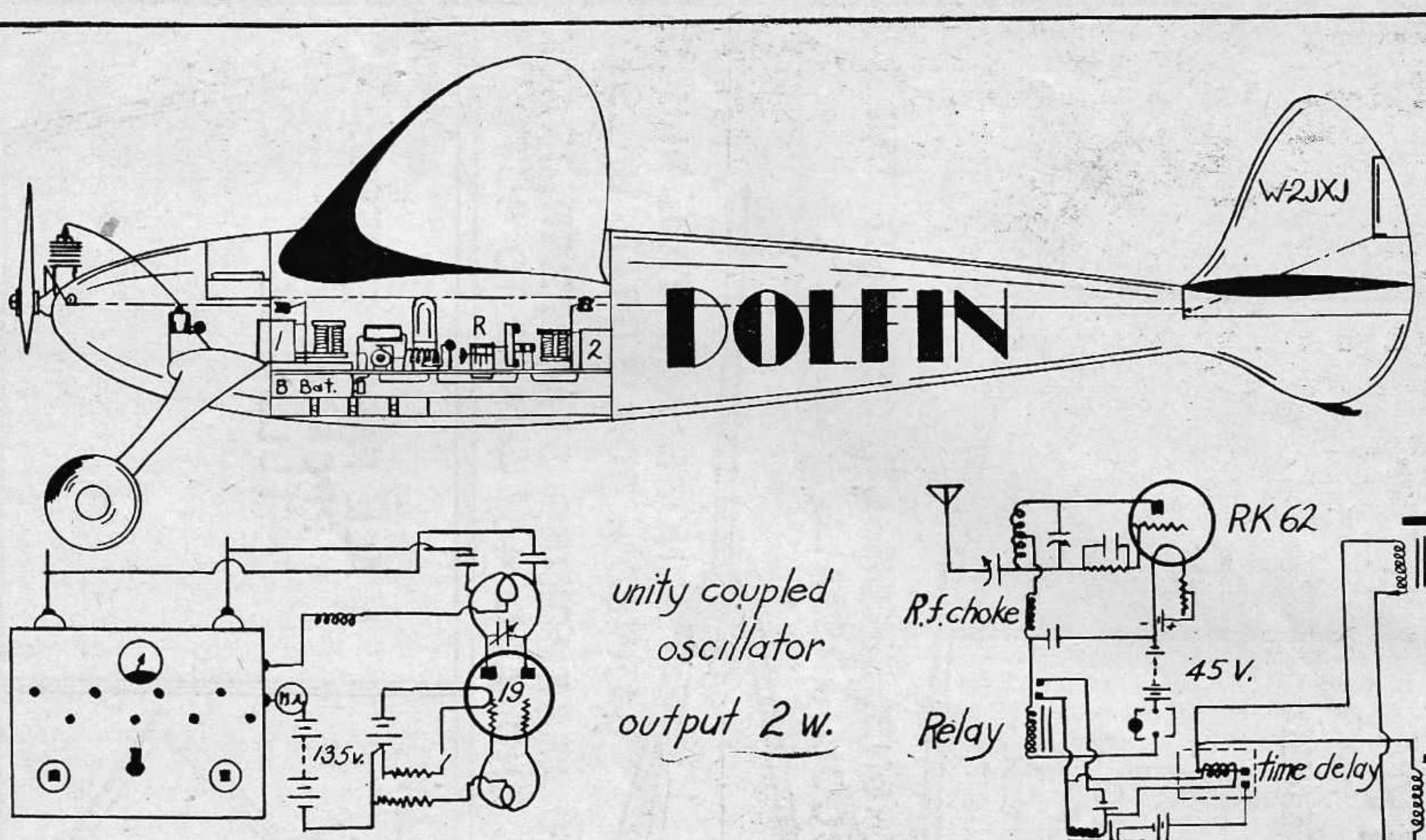
1. The transmitting apparatus on the ground.
2. The receiver in the plane.
3. The mechanisms used in controlling the motor and rudder.

To obtain more than one control element with one receiver and one transmitter a special system had to be devised as shown in the accompanying diagrams. Its operation is as follows: Transmitting an impulse from the ground closes the sensitive relay in the receiver. This relay is connected to a *selecting receptor* which operates on the ratchet principle. This selector is constructed so that alternately it will complete the motor and tail circuits.

When the desired element to be controlled is in the circuit, a small resistance coil heats up a bi-metal strip which upon expanding completes the circuit of the element to be controlled. This "time delay" is adjusted to make contact in one second, which is ample time to prevent the operation of the undesired control. Alone, this system would not provide for flexible control; for after a few control move-







unity coupled
oscillator
output 2 w.

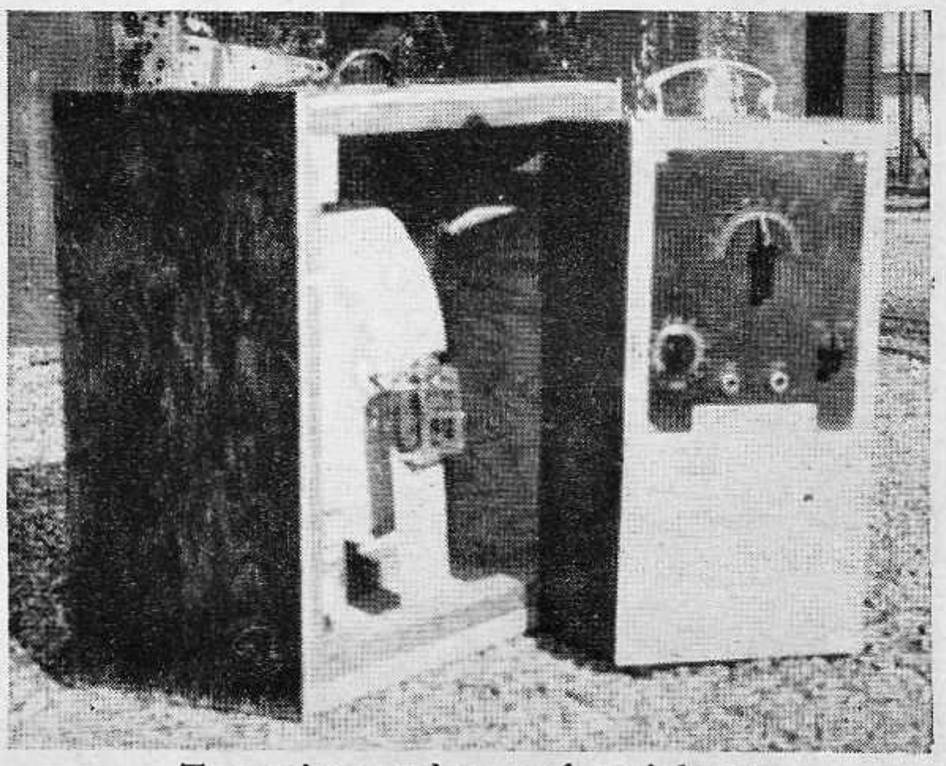
CONJULATOR TRANS.

RECEIVING CIRCUIT

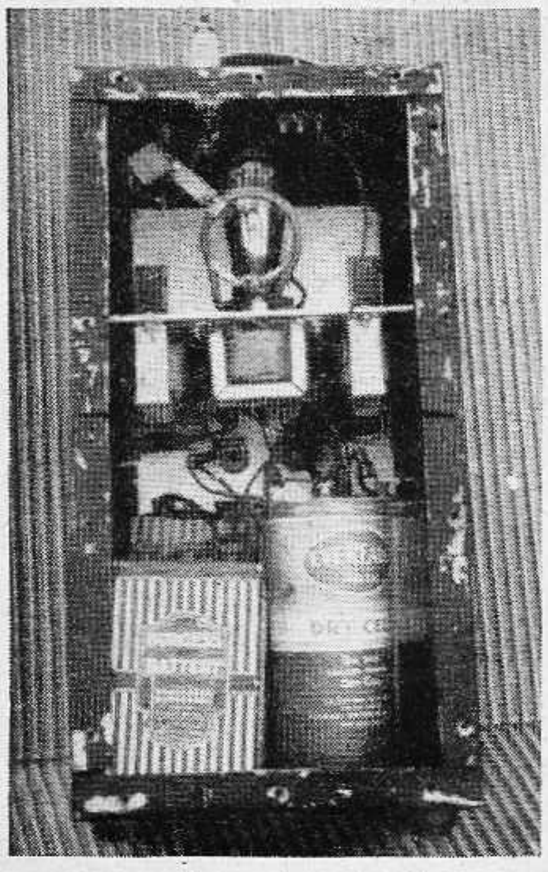
ments the ground pilot would "freeze" at the controls trying to remember which control position he had last and which comes next.

The solution of this problem was the development of an automatic transmitting device which would indicate the position of the controls in the plane by means of colored lights on a panel board and would simultaneously time the transmitted impulses so as to allow the time delay to function. This device was named the *Conjulator*. The Conjulator consists of a revolving disc upon which is mounted a set of contacts energized by means of a click spring and gears. In addition, there is a set of stationary contacts. The diagram clearly shows the arrangement of contacts and brushes. In order to obtain a clear picture of the system, let us go through the complete cycle of radio control. Let us say the rudder is adjusted to a neutral position and motor is in the advanced position. The operator adjusts the Conjulator disc (with all the transmitting switches off) so that the bulb on the panel board indicates that the position of the disc coincides with the neutral rudder and advanced motor setting on the plane. From there on everything is automatic. If we desire right rudder we merely press a button and hold the button down which releases the clockwork in the Conjulator.

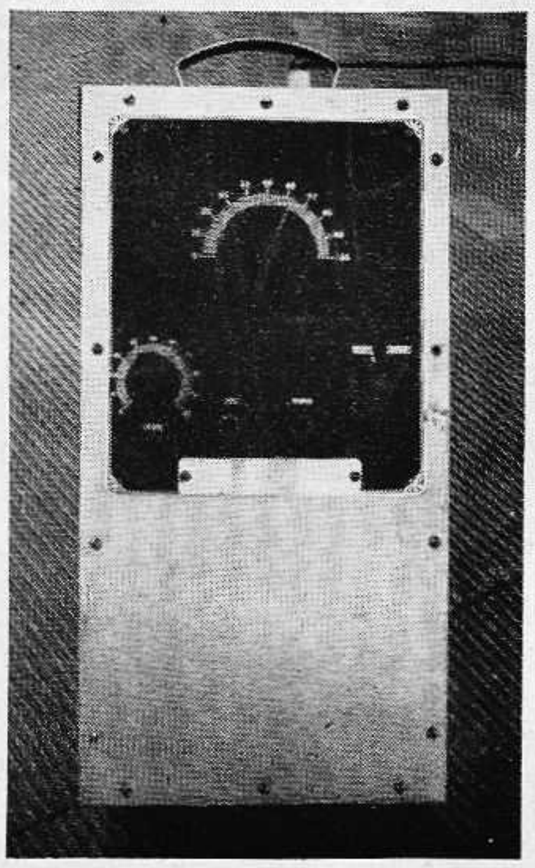
(Continued on page 54)



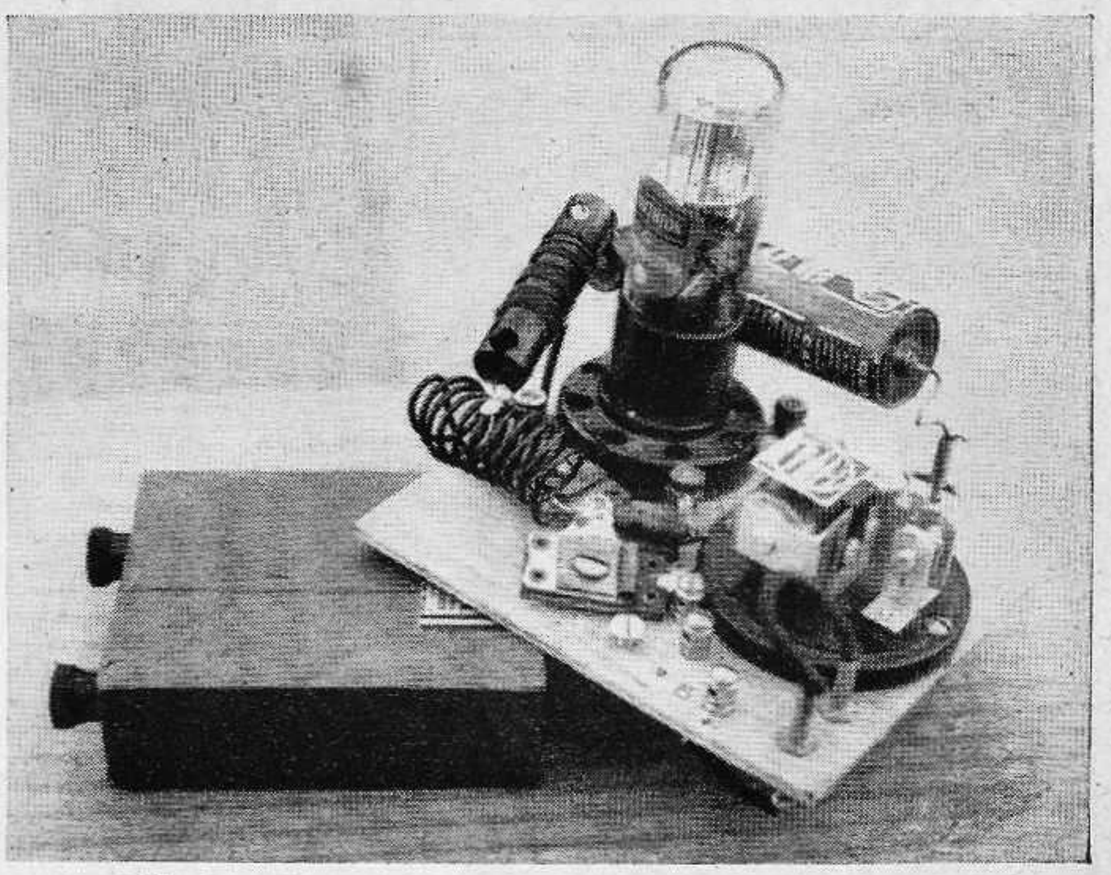
Transmitter and rear of conjulator



Rear view of transmitter



High frequency transmitter



Choke coil on receiver tuning coil and the B battery

the public be permitted to vote for these "beauty" models, and the sponsors feel that is an excellent suggestion.

An auxiliary processing station will be set up at the Sherman so wing areas and fuselage cross-sections can be checked in the cool of the evening rather than the heat of the day. By having this measuring done during the first evening he arrives, a contestant will be spared the laborious task of waiting for the cross-sections and wing areas of his various craft to be determined on the field. The S.P.S. (Sherman Processing Station) will use non-removable decals to indicate "O. K.'ed" areas of cross-sections and wings.

Once again the Fred W. Megow Best Club Award will be eagerly contested for by various Academy Chapters, and further details concerning this event will be available soon. For application blanks and complete data concerning the Chicago Championships, contestants should write to S. J. Meuris, Meet Manager, 1941 Model Airplane Championships, c/o Hotel Sherman, Chicago, Illinois. Requests for a single set of entry blanks should contain five cents in stamps, and those desiring a supply for club use should enclose twenty-five cents in stamps. Application blanks will also be available from the Academy of Model Aeronautics, Willard Hotel, Washington, D.C., as well as from the newspapers sponsoring Air Cadets of America units, but regardless of where you write, be sure to include the necessary stamps.

So much for the intimate details. It's now up to you to get out pencil and paper and figure how you are going to get to Chicago and how you are going to get back with all of those trophies you'll win.

A Radio Control for Gas Jobs

(Continued from page 11)

Our pilot bulbs will light one after the other across the board until it reaches the right rudder bulb. Keeping in mind that we have neutral rudder and that we want right rudder, it is obvious that two impulses from the transmitter are required; due to the fact that the selector alternately selects the motor and the tail circuits. Now, releasing the button at right rudder bulb position will stop the Conjulator mechanism and allow the time delay in the plane to function. Approximately one second later the tail mechanism will operate. It can be seen that if we still desire further tail control, say neutral rudder, it will be necessary to transmit two more impulses and then allow time for the time delay again to function. In the same manner control of the motor may be obtained. The maximum time between any two controls is approximately two seconds. It is clear that the number of controls that can be operated depends upon the number of contacts the selector has; three contacts on the selector will permit the operation of three different controls. This may seem a complicated and drawn out process, but in reality it is not. It is all taken care of automatically by the Conjulator.

Of course, the above is but one of many systems possible, but to our knowledge, to date, it is the best suited for the average size gas model possessing both control of motor and tail. Considering that the Dolphin complete with radio equipment weighs just seven pounds proves the point. It is without doubt that there are many factors which one must take into account in choosing a radio control system for a gas model. It would be hardly possible for the prospective builder, be he radio amateur or model engineer, to consider his thoughts primarily to one end and expect the other to just fill in. It is a requisite that the best of both radio and airplane be obtained. To have an "old crate" with a good radio or a good ship with a "bum" receiving system will not result in success. In other words "two heads are better than one." So, if you are a model builder interested in building a radio controlled plane, look around for a radio amateur and vice versa. The authors chose the Dolphin for radio control because of the following reasons:

1. It is obvious that the ideal model to be controlled by radio would be one capable of lifting at least forty percent of its weight in payload. The Dolphin not only qualifies in this respect but also possesses streamlined proportions that any ultra modern modeler would wish. In addition, quite contrary to its appearance it has a tremendously low flying speed, a desirable feature since it reduces the sensitivity of control surfaces (rudder flap) enabling the plane to make smooth, stable maneuvers.

2. Because of its low flying speed, to obtain the maximum power from the petite Brown, a propeller of low pitch, large diameter, and considerable area would be required. All but the diameter qualified for our use since a large diameter produced a large torque. An undesirable force because it made turning to the left a dangerous maneuver. To cut down the diameter would result in a decrease in thrust. The solution was a four bladed propeller of medium diameter. It proved extremely satisfactory as it not only did the "job" but decreased the vibration of the motor to a large extent.

3. The mounting of the radio equipment in the model is another problem which is above triviality. It would be wise before inserting the radio to mount dummy weights at their respective positions and test fly the model, tabulating the position and weight of each item so that when the real thing is mounted no surprise would result. Probably by now little need be

said about the placement of weight about the C.G. Inserting weight in a model will either help or "break it." The Dolphin in this respect came through like a soldier. The monocoupe fuselage provided ample room plus the assurance that the equipment could be mounted. Of course the fuselage had to be completely hollowed out, which did not impair the strength of it.

To those who are interested in designing a radio model, the following is an outline of the features that a successful radio model must incorporate:

1. Degree of stability. . . . By this is meant how stable the model is designed. A too stable model will be difficult to control.

2. Controllability. . . . This is concerned with the proper proportioning of the control surfaces.

3. Proper placement of C.L.A. . . . The placement of this center is an important consideration if the model is to be capable of turning under the actuation of the rudder.

4. Action of propeller. . . . To produce torque and gyroscopic torque. Proper counter balancing to minimize effect of these when model is turning.

5. Ballasting effect of radio equipment. . . . Placing of batteries, receiver, control mechanisms, so desired position of C.C. is maintained.

It is hoped that this article will be of some help to those interested in radio control. It should be realized that radio control is by no means an easy task, yet by no means an impossible one. It is within the scope of each and every one of us, if we but meet the problem properly prepared. "Time and work shall merit its reward!"—For more information address: Editor, MODEL AIRPLANE NEWS, 551-5th Ave., New York, N.Y.