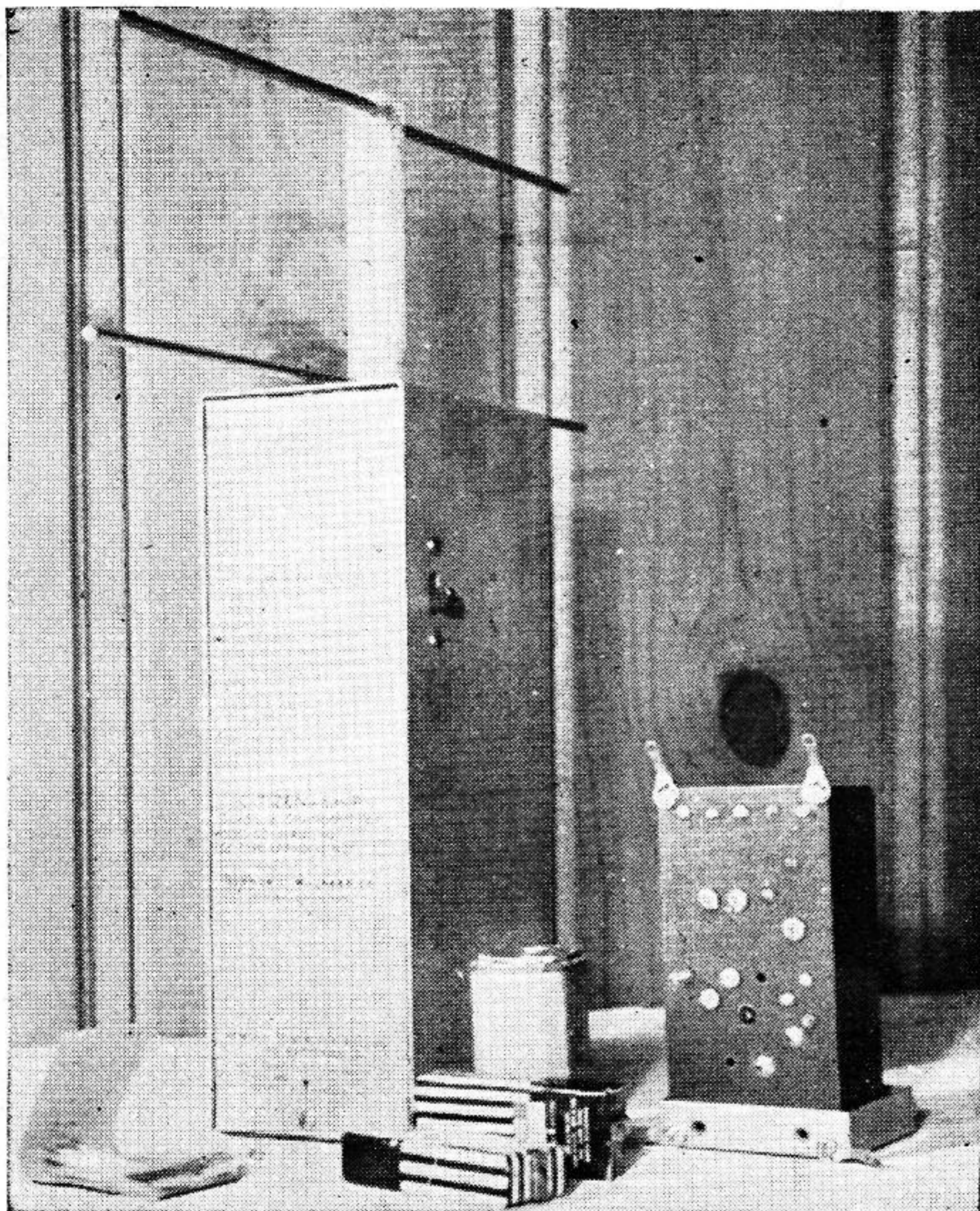


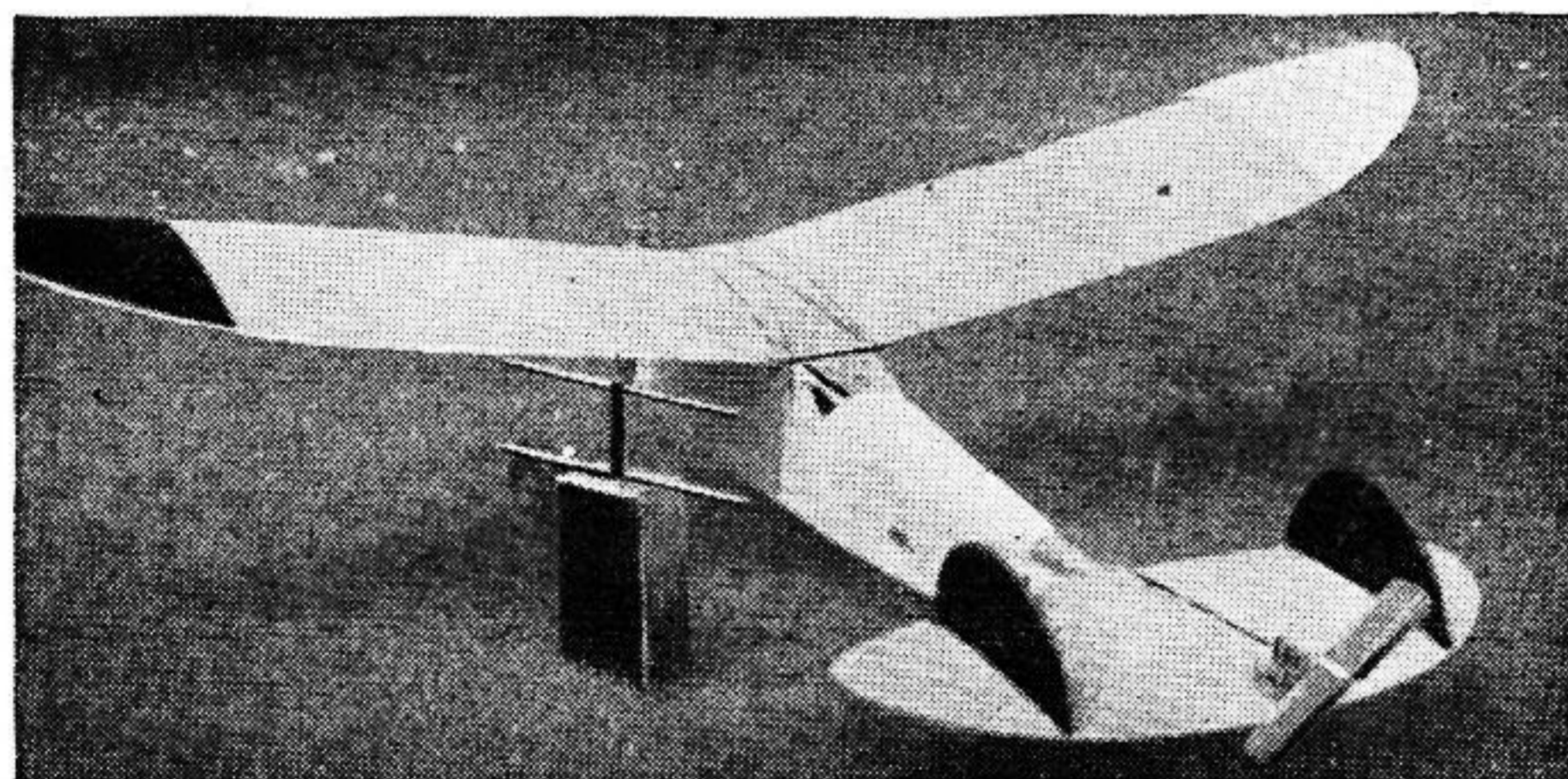
# Radio Control For All

R. C. enthusiasts have long wanted a "License-Free" band; it's now here and so is the equipment!

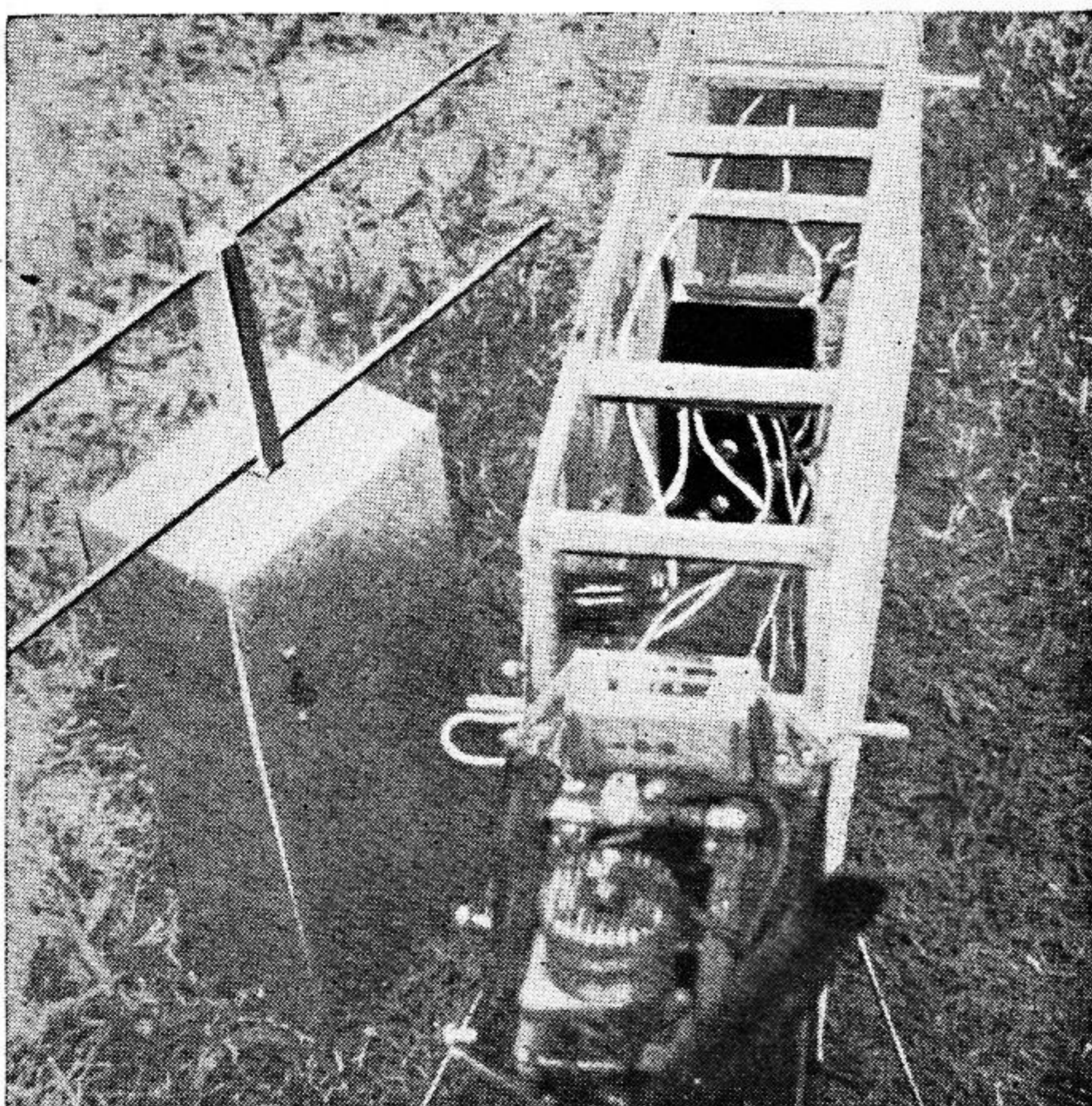
by VERNON C. MACNABB



Transmitter is completely self-contained. Receiver with batteries at right



Test plane was controlled over the 465 mc. channel



Receiver has built-in antenna, will fit in small cabins such as this

FOR well over a quarter of a century, it has been illegal by Federal edict to operate a radio transmitter without a license granted by a Federal Bureau, currently the FCC, or Federal Communications Commission. This law was modified in June, 1949, to allow the layman, Mr. John Q. Public, to obtain a license to operate a radio transmitter without the necessity of being examined to determine his technical knowledge of radio, or even of knowing one character of the International Morse Code. The Citizens Band, for plain citizens and model airplane builders and fliers, was opened June first. There are, of course, certain definite restrictions, because these transmissions must not interfere with already established and licensed services. They are excerpted as follows from FCC Rules and Regulations governing the Citizens Radio Band.

1. Any citizen of the United States eighteen years of age or older is eligible for a station license.
2. No more than one person may be licensed for the same apparatus.
3. Any person may operate a station with permission of the licensee. The licensee must be responsible for the station operation at all times.
4. Application for a station license using FCC approved equipment must be made on FCC Form 505. This is available from any FCC Field Engineering Office or from the Federal Communications Commission, Washington 25, D. C. Approved equipment will carry a name plate showing the FCC type approval number.
5. When using non-approved equipment, a construction permit application must be filed on FCC Form 505. After completion of construction, the station license application is made on FCC Form 403.
6. Licenses are issued for five years and may be renewed at the end of that time.
7. The serial number on the license will constitute the station call signal. Stations licensed for radio control are not required to broadcast their call signals.
8. The address of the licensee will be the official license location of the station, although the station may be operated anywhere within the United States.
9. Stations used for radio control must not radiate energy continuously.
10. 

Frequencies	Class of Station	Maximum Power
460-462 mc.	"A" (at fixed locations only)	50 watts
462-468 mc.	"A" and "B"	10 watts
468-470 mc.	"A"	50 watts
11. Frequency Tolerance:  
 Class "A"  $\pm 0.02\%$  of frequency to which transmitter is adjusted.  
 Class "B" All operation shall be confined to 465 mc.  $\pm 0.4\%$ .

Item 1 above may look at first reading like a definite limitation to our junior model builders, but item three (3) takes junior off the hook. His dad (and whose dad would not) may obtain the license and junior may use it.

Item 4. A list of Field Engineering Offices with their telephone numbers is as follows:

District No. 1—Customhouse, Boston, Mass., Hubbard 2-6200.

District No. 2—Federal Building, New York, N. Y., Watkins 4-1000.

District No. 3—U. S. Customhouse, Philadelphia, Pa., Market 7-6000.

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- District No. 4.—Old Town Bank Building, Baltimore, Md., Plaza 2662.
- District No. 5.—New Post Office Building, Norfolk, Va., Norfolk 24963.
- District No. 6.—Federal Annex, Atlanta, Ga., Walnut 3396.  
Sub-office, Post Office Building, Savannah, Ga., Savannah 7602.
- District No. 7.—Federal Building, Miami, Fla., Miami 9-5431.  
Sub-office, Post Office Building, Tampa, Fla., Tampa M-1773.
- District No. 8.—Audubon Building, New Orleans, La., Canal 1739.  
Sub-office, U.S. Courthouse & Customhouse, Mobile, Ala., Mobile 2-3341.
- District No. 9.—U.S. Appraisers Building, Houston, Texas, Woodcrest 61906.  
Sub-office, Post Office Building, Beaumont, Texas, Beaumont 4010.
- District No. 10.—U.S. Terminal Annex Building, Dallas, Texas, Central 5943.
- District No. 11.—Post Office & Courthouse Building, Los Angeles, Cal., Madison 7411.  
Sub-office, U.S. Customhouse, San Diego, Cal., Franklin 9-4101.
- District No. 12.—Customhouse, San Francisco, Cal., Yukon 6-4141.
- District No. 13.—Central Building, Portland, Oregon, Beacon 0931.
- District No. 14.—Federal Office Building, Seattle, Wash., Seneca 3100.
- District No. 15.—Customhouse, Denver, Colo., Keystone 4151.
- District No. 16.—Uptown Post Office & Federal Courts Building, St. Paul, Minn., Cedar 8033.
- District No. 17.—U.S. Courthouse, Kansas City, Mo., Victor 3755.
- District No. 18.—U.S. Courthouse, Chicago, Ill., Harrison 4700.
- District No. 19.—New Federal Building, Detroit, Mich., Cherry 9330.
- District No. 20.—U.S. Post Office, Buffalo, N.Y., Washington 1744.
- District No. 21.—Stangenwald Building, Honolulu, Hawaii, Honolulu 56879.
- District No. 22.—Federal Building, San Juan, Puerto Rico, San Juan 2-4562.
- District No. 23.—Shattuck Building, Juneau, Alaska, Juneau 721.  
Sub-office, U.S. Post Office & Courthouse, Anchorage, Alaska, Main 535.

Regarding the statement about approved equipment, the law states that the transmitter used on the Citizens Band must be approved by the FCC. If a manufacturer intends to put such a unit on the market, he has to submit a sample to FCC, and this sample must pass the rigid engineering tests needed to conform to specifications outlined in Item 10. The rules also state that FCC will not go to the trouble of approving a transmitter unless at least one hundred (100) are to be built. This rules out homemade equipment. After such approval has been granted and FCC is convinced that this manufacturer can reproduce other units to these exacting requirements, they may then be offered for sale to any citizen of the United States and a license to operate this transmitter may be obtained by simply filling out Form 505 (no examination needed).

Item 5 briefly outlines the steps necessary to build and operate your own equipment. As will be seen later in describing the equipment, illustrated in Fig. 1, the

technical difficulties to be encountered will be outside the abilities of most model builders. Anyone so qualified could probably easily obtain a "Ham" license and operate their control systems on the 6-meter band as has been done for the last decade or more.

Items 6, 7, and 8 are entirely self-explanatory and need no further comment.

Item 9 states one of the definite limitations on the use of the Citizens Band transmitter that had to be taken into consideration in the design of the equipment, which will again be discussed later in the description of the transmitter and receiver. It is interesting to note, however, that the FCC in writing the law concerning equipment for the Citizens Band, had the interest of the Radio Control of Model Aircraft very much in mind, as it is mentioned several times in the rules and regulations, and is therefore one of the uses for which the Citizens Band is intended.

Item 10 lists the strict requirements of frequency stabilities and limitations of power to be used which may be passed over by the model builder who is not technically informed in the radio art. To those who are, it is evident that they are very rigid and explains the reason why FCC approval must be obtained on all equipment used, so that it does not get off frequency and cause interference with other existing services.

Added to the above, the frequency of 465 mc. is above the frequency at which conventional tubes will operate. It was necessary to go to a subminiature tube (6K4) without a base and the single tube is soldered in place. The necessity of soldering the tube in place solved one problem of conforming to FCC regulation—changing a tube would throw the unit off frequency.

Fig. 1 shows a representative transmitter completely assembled. The batteries are self contained and the complete unit weighs four (4) pounds. When controlling a plane in flight, it is held in the hands and the antenna, shown on top of the transmitter box, is pointed in the general direction

of the plane. The top rod is the antenna and the one near the box, the reflector (A system widely used in television antennas). These rods are half wave antennae for 465 mc., approximately a foot long. Compare this with the eight (8) foot dipole that has to be erected on the 6-meter band.

The receiver shown on the right is also a single tube job and between it and the transmitter in Fig. 2 are the batteries needed to operate it in the plane; one A-battery equivalent to four pen cells which will last better than an hour, and two 30-volt hearing aid B-batteries which will give over five hundred (500) hours of useful life.

The receiver weighs five (5) ounces and the batteries together another five (5) ounces, giving a total weight of ten (10) ounces. Even small ships with .099 engines will lift this.

The transmitter sends out a single frequency, unmodulated signal when the operating button is depressed. The receiver converts this high frequency radio signal into a change of plate current sufficient to operate a sensitive relay. The no signal receiver plate current is approximately 0.2 ma., and this rises to between 1.0 and 1.2 ma. when signal is sent to it from the transmitter.

The system using an unmodulated carrier was selected for several reasons, (1) because it has been used for ten or fifteen years and has been well proven as to reliability, (2) it is the simplest system using only one tube, (3) because Item 9 in the Rules and Regulations states "stations used for radio control must not radiate energy continuously." If a modulation system were used, it would be desirable to leave the carrier on all the time, but this is prohibited by law.

The antenna is built into the receiver. It is a square aluminum band shown in Fig. 1 at the bottom of the receiver. Since it is tuned at the time the receiver is adjusted for frequency it eliminates the necessity of supplying an antenna in the model and

in turn avoids the need for any critical antenna adjustment.

The purpose of this article is to inform those model builders who would like to fly R.C. models, but who have been deterred by law by the necessity of obtaining an amateur license, what sort of equipment will be made available to them for legal operation on the Citizens Band. The brief description given above of progress to date on this equipment proves that it can be done with no sacrifice of weight or distance of control and it seems that it will be simpler to use and operate than present 6-meter equipment. The only limitation is that the average man cannot legally build it himself.

For those model builders who have never considered R.C. due to the license requirement, but might be interested as a result of this article, it is suggested that they look back through their back issues of MODEL AIRPLANE NEWS and read some of the excellent articles that have been written on control systems. It will be found that all radio control starts with a transmitter, and a receiver which is capable of closing a pair of contacts on a relay contained in the airplane. The closing of these contacts are then made to operate auxiliary apparatus in conjunction with an additional source of power, such as a small battery. The best known is a simple escapment that controls the rudder.

In Fig. 2 we see the assembled plane with the transmitter beside it. The plane has a six-foot wing spread and the control system is a *Rudevator* mounted on the stabilizer.

Fig. 3 shows the receiver and its associated wiring mounted in the fuselage of a plane, with the transmitter standing beside it.

(Editor's Note—The Citizens Band equipment illustrated and described in this article has already been checked by the FCC and slight changes suggested by the Commission are now underway. Watch the columns of this magazine for notice of final FCC approval on all equipment suitable for radio control operation on the Citizens Band.)

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