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The Ins and Outs of Aero Radio

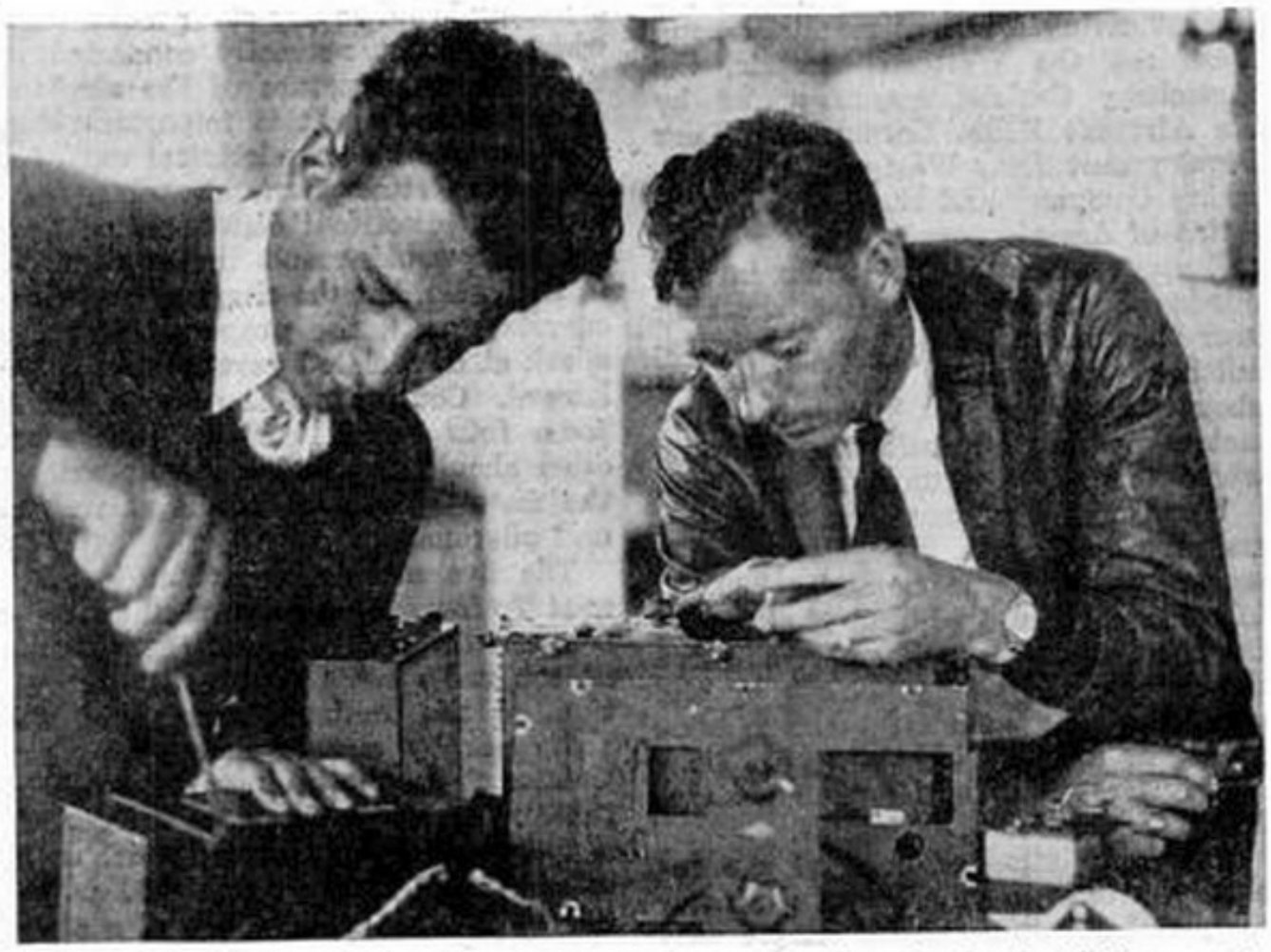
by ALFRED CELLIER

Practical instructions in radio for the private owner who wishes to install a radio receiver upon his plane. This is a straightforward non-technical article on the installation of a receiver and the laws governing its use.

MUCH has been written of radio's part on the airlines and of its use by the army and naval air services. Occasional items have told of its part with planes on antarctic expeditions and trans-ocean flights, but these have all seemed too technical for further consideration by private flyers who could greatly benefit by it.

To begin with, the private owner may purchase a dependable receiving set for as low as $150. There are many good sets on the market that will give him all the information so essential to cross-country flying. The cost of bonding the airplane will depend on its size. A great many of the more recent airplanes have been bonded at the factory during their construction, and consequently the owners will be saved the cost of this work.

The shielding of the engine does not run into a large amount. Considerable expense may be saved, and a great deal may be learned, by the plane owner undertaking to do either part of this work himself. He will familiarize himself with many things, which will enable him to do his own upkeep and service later on.



And here they are, with the radio on the bench, getting it ready for installation on the plane. Not a big job but one that requires care.

Undoubtedly, the main hold-back in the acquiring of radio sets by this class of pilots, has been the objection to learning code and spending months of preparation to pass an examination in order to secure an operator's license, so no further interest has been displayed to find out what it really is all about. Nothing could be further from the truth; the use of aircraft radio is available to all those possessing a receiving set of the proper frequencies, so that they may tune in on the weather reports, upper air conditions, airport stations and radio beam.

No operator's license is necessary for this. Many of those who use their ships for business purposes could have paid for such a set many times over, by the time lost in laying over on some small airport due to bad weather and the loss of some big business deal by deciding not to abandon the ship. Many such flights have been started without taking the trouble to get weather reports before leaving. The radio has saved many such a situation by enabling the pilot to go around the storm or given him time to make another decision after he was in the air.

Those who have used the receiving set in their ships, will shortly be desirous of two-way equipment and cast longing eyes on the transmitters. For the transmission of messages from aircraft a license is needed, both by the operator and the station (airplane). An operator's license, known as Radio Telephone Operator Third Class License may be acquired by passing a theoretical examination at the government radio supervisor's office.

The requirements for this license are a knowledge of the adjustments and operation of radio telephone apparatus. The ability to transmit and receive clearly conversation by radio telephone apparatus, the knowledge of the regulations applying to the exchange of radio telephone communications, are part of the regulations referring to the safety of life.

After the license has been obtained you are allowed to call ships in flight, airport stations for your weather reports, condition of the field and various other information when making an airport in bad weather. The license for the airplane station is issued after filling out blank forms, giving information as to type and license number of the airplane, make and type of transmitting set, description of the receiving set and the class of service to be rendered.

There are two methods of receiving the radio beam signals, but which will only be mentioned here, due to the numerous articles which have already appeared on this subject. First, the receiving of the signals by the aural or (A) and (N) system through the headphones, and second, by the visual or Reed indicator mounted on the instrument board. This is just one more of the accommodations offered the pilot with a radio equipped plane.

The latest figures of the Radio Division, Department of Commerce, show that there are 121 aeronautical ground stations and 350 aircraft radio stations licensed for operation in the United States, the majority of the airplane stations being ships belonging to the air transport lines. All of these radio aids are on twenty-four hour service and are available gratis to anyone possessing the proper equipment to take advantage of them.

The various frequencies assigned to aviation for distress, calling and navigational work are as follows: 278 kilocycles, calling and working frequency from all ground stations to itinerant airplanes; 333 kilocycles, international air calling frequency; 375 kilocycles, radio compass; 500 kilocycles, international calling and distress frequency for aircraft over the seas; 3,106 kilocycles (97 meters), National calling frequency for all transport and itinerant airplanes; 393, 400, 414, 420, 457 kilocycles, for stations on chains, providing no interference is caused with other services.

For planes on sea flights, desiring immediate frequencies, 333 or 500 kilocycles is used for calling; 414 or 457 kilocycles for working and 375 kilocycles is used for radio compass. However, the private owner about to ac-

quire a receiving set need not worry how he is going to tune these stations as the operation of these sets is no more of a task than the one you use by the fireside to listen to the broadcast programs.

No attempt will be made to describe the various receiving and transmitting sets, but it is recommended that one designed especially for aircraft be used. There are several makes on the market giving excellent results, among these are the Western Electric, the Stromberg Carlson manufactured by the Aircraft Radio Corporation, Lear Development Inc., Westport Manufacturing Company and the Radio Corporation of America.

Some confusion may exist in the minds of those who, after checking over the various receiving and transmitting sets, wonder what it is all about in regard to kilocycles, kilometers and meters, believing that the whole thing is too confusing to them.

Wavelengths are measured in meters, and frequencies in kilocycles. Radio waves travel approximately 300,000 kilometers per second, and if either of the other figures are known, you have the answer. Dividing 300,000 by the wavelength gives the frequency in kilocycles, or dividing 300,000 by the frequency gives the wavelength in meters. They are mutually convertible.

The installation of most of the receiving sets is in the rear of the fuselage, and are operated by remote control; the volume control unit being located on the instrument board, while the headset or earphones plug into the volume control unit.

The receiver itself may be secured either to the side or bottom of the inside fuselage, aft of the pilot's seat. The mountings which are constructed of sponge rubber cushion legs, protect the instrument from any vibration or shocks of landing. The best results are obtained by mounting the receiver; and transmitter, if it is desired to install a two-way set, as close to the base of the antenna mast as possible.

A small model short-wave aero radio set made by the Lear Development Corporation.

BONDING AND SHIELDING

The bonding consists of bonding together those metal parts of the airplane, including the instruments and shielding braid or any other metal part, which are not normally connected to the metallic structure of the airplane (the fuselage). It is important that the airplane be one electrical unit, for charges of atmospheric electricity tend to set up electrical disturbances. This not only would result in severe noise in the radio, but the charges might accumulate until the proportions of the spark at an isolated part created a fire hazard. Control and brace wires which come into casual contact with each other should also be bonded, as well as the metal hinges of rudder, elevators and ailerons.

The five main reasons for bonding are: To increase the electrical capacity between the airplane and the antenna of the radio set. To prevent absorption of the radiated energy of the radio set by metal parts which are isolated from the main metal mass of the airplane. To eliminate the danger of sparks occurring between which there exists a difference in electrical potential caused by the collection of a static charge. To eliminate noises produced in the radio receiver, which are caused by the varying resistance between rubbing or vibrating metal parts. To lower the resistance of the metal shielding in order to obtain effective blocking or localizing of an electrical disturbance.

The shielding of the electrical parts of the airplane requires that the entire system of engine ignition be completely encased in a high-conductive metallic shield. High conductivity may be obtained by using materials that are good electrical conductors such as copper and aluminum. The wires of the lighting system should also be completely shielded as these wires may pick up high frequency energy from the ignition or generator causing serious trouble.

One company has on the market a completely shielded magneto designed especially to eliminate any disturbances that might arise inside the housing. Cans to be used with the semi-shielded magnetos are also available doing away with the necessity of having these especially built.

Shielded spark plugs have been designed solely for use on radio equipped airplanes, and there are several styles of shielded covers for spark plugs that will eliminate any interference. However it is important in using the latter, that the shielding does not interfere with the cooling of the plug.

All of the high tension cables may be housed in the ignition harnesses, certain of which by their flexibility

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Flying Without Hands

This stunt doesn't appeal to us!

NO, THIS is not a stick-up. It is just a picture of Johnny Crowell, Charlotte, N. C., flying his ship "hands off."

Crowell, who claims to be the only "hands off" flyer in the world, ties his hands above him, as shown, and then manipulates all of the controls with his legs and feet. He takes off, lands and goes through all sorts of maneuvers.

He is thinking of making a coast-to-coast flight in the near future—hands off. This will be accomplished by the foot controlled throttle and controls he has invented.

Passengers Carry 85 Pounds Excess Weight

ENGINEERS in designing airplane cabins have pointed out the surprising amount of apparatus which the average human being requires to have carried around with him.

A fair estimate of weights for a 170-pound passenger includes 85 pounds incidental weight distributed as follows: Passenger's baggage, 35 pounds; seat and safety belt, 15 pounds; laminated window glass, 10 pounds; upholstery, rugs, soundproofing, 15 pounds; toilet and toilet compartment, 10 pounds.

Aerial Photography Makes Long Shots

AS IMPROVEMENTS are made in airplane and camera design, photographs are possible at greater distances. By means of infra-red filters the summit of Mt. Rainier was recently photographed at a distance of 266 miles.

Many excellent photographs have been taken from points 30,000 to 40,000 feet above the earth. Stable flying qualities and the ability to reach 15,000 feet with the required load are desirable characteristics of photographic planes.

The cabin must be roomy affording space for operation of cameras and developing or printing when desired. Photographs are made obliquely through the door and vertically through the floor.

Vought Corsair

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is 3/32 inch square. The trailing edge is 1/16 x 1/8 inch. The ribs are all cut from thin balsa approximately 1/32 or a trifle less in thickness. The nose ribs are the small sections of a rib placed between each full length rib.

These small nose ribs help to maintain the full camber of the wing preventing the tissue from sagging. Each side of the wing has a dihedral of ½ inch beginning at the second rib from the center to each side of the wing. The tips are made of bamboo and when trimmed to the proper size are approximately 1/32 x 1/16 of an inch in cross-section.

WING—LOWER

The lower wing is built in two pieces having spars which are placed on the top side of the rib so that they meet and connect directly with the wing struts. This makes a solid connection when cemented in place. The spars for the top wing are on the underside to give added strength to the strut joint.

Before fitting the struts, the wings must be covered and the struts should be a trifle longer than necessary so that the correct fit can be made at the final assembly. The spars and the leading and trailing edges of the lower wing halves extend beyond the first rib approximately ½ inch. This small extension rests on the lower longeron and securely holds the wing panels in place. The leading edge should be inclined approximately 3/32 inch, which will give the correct angle of incidence.

COVERING

The wing and tail surfaces are covered with yellow tissue. As a silver paper isn't available, the body is covered with red tissue. No tail stripes are used on Navy planes at present, and the only identification are the stars on the upper and lower wings. After all the wings, the stabilizer and the rudder have been covered, they should be pinned to a flat surface and lightly sprayed with water so that the tissue will shrink snugly over the framework.

The body is covered with numerous strips running fore and aft. After the body has been completely covered the stabilizer and rudder are attached and the windshield put in place. The top wing is first cemented to the fuselage by the small inverted center section "V" struts.

The rear center section struts are then added so that the top wing has an angle of incidence approximately 3/32 inch. The lower wing is fitted in position so that the leading edge is one inch farther back in a perpendicular line with the top wing leading edge. As the dihedral has been built into the top wing, the struts should be fitted so that an equal amount of dihedral will also be in the lower wings.

PROPELLER AND TOWNEND RING

The propeller for the flying model should be approximately 7½ inch in diameter. The pitch should be medium. Four strands of 1/32 x 1/8 inch flat rubber are required for the flying model. Five strands may be employed if the model is a trifle heavy. To help streamline the motor, a Townend ring is built from two layers of 1/16 inch balsa with the grain running crosswise, or in direction of the fuselage length. One layer of typewriting paper should be cemented between the layers of balsa.

The ring should be left resting around the form upon which it was built until thoroughly dry.

END.

Radio

(Continued from page 286)

may be used on various makes of aircraft engines, thereby allowing the plane owner to use this same material on another type ship. This is a convenience, in that most of the private owners keep graduating to larger equipment as their flying progresses.

On the instrument board, a metallized strip should connect all the instruments, tubes and wire shielding, and be grounded at both ends to the metal longeren on each side of the fuselage. This of course should be located unseen in the rear of the board.

In checking over the efficiency of the shielding, the radio is adjusted to maximum sensitivity. If the shielding is correct no noise should be heard in the headphones. The best results will be obtained by checking this with the airplane in actual flight, at cruising speed. Frequent inspection of the shielding should be made to ensure vibration or other causes do not make broken ground connections. A certain amount of noise in the receiving set may originate from commutator ripples in the generator, electric tachometers or other electrical instruments, but this may be so slight as to be unnoticeable, and should not interfere with the reception.

In the power plant of the airplane radio, the wind driven generator, for one reason, due to its interference with maneuverability, has given way to the more modern dynamotor units operated off the plane's 12-volt battery supplying the plate potential for the radio receiver. The filament supply is obtained from the same 12-volt battery. It is current practice to use the same battery for the plane's lighting system.

There are three types of antennas in general use today. These are the mast type of antenna which is a short rod or pole about six feet long and mounted in the rear part of the fuselage. The mast may be either of wood or metal tubing, if the latter is used it will be necessary to insulate it. The trailing wire type, which consists of a wire with a lead fish on the end of it, which is run out through the bottom and trails behind and below the ship; and the fixed wire type, which runs from wing tip to wing tip, or from wing tips to the tail.

Not satisfied with the many uses offered to aviation by radio today, engineers have gone a step further and experiments have begun on a system of warning pilots of an impending collision in the fog. Utilizing a frequency of 100,000 kilocycles, signals would be communicated when another ship was within a certain radius. Experiments have also been conducted with radio-echo altimeter that measures distance directly from the ground rather than at sea level. The future will not see the airplane without its hearing and voice.

END.