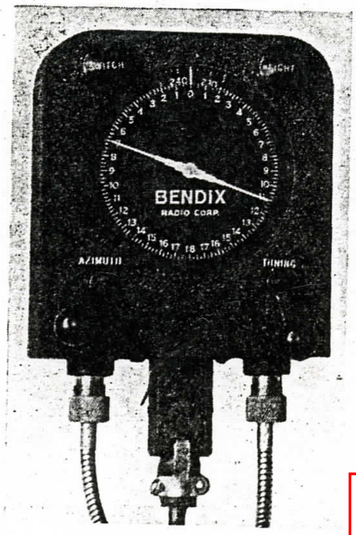
AERO RADIO DIGEST

Newest Developments in the Field of Aircraft Radio

Bendix D-Fs

Proven in several years of service in military aeronautics, Bendix aircraft radio direction finders have recently been made available commercially, in 4 models—MN-1, MN-3, MN-5, and MN-7. These are almost identical except for the method of controlling loop rotation, and permit installation of the loop and its control mechanism in any type of ship in any manner desired.

Bendix D-Fs are designed to operate in conjunction with Bendix Type RA1 receiver, but will also give accurate and dependable bearings when used with any standard radio receiver covering the desired frequency range. They



Remote control head

may be used as fixed-loop homing devices or as navigational direction finding instruments within frequency range of 200-1500 kcs.

Each D-F consists of a loop unit for reception of signals, a coupling unit for comparing characteristics of the signal received by the loop with those received by a fixed antenna, and the necessary cables and connections. The electrical coupling unit automatically resolves the 180° ambiguity of the loop, permitting unilateral bearings.

Principle of operation of the coupling unit is simple. A vertical loop is most responsive to signals originating from points lying within its plane, and least responsive to those at right angles to it. The responsiveness of a vertical loop may be plotted in the form of a "figure 8," showing that zero voltages are produced in the two positions where the plane of the loop is at right angles to the source of signal, and maximum voltages of opposite phase in the two positions where the plane of the loop coincides with the source of the signal. In other words, a vertical loop displays a bilateral directional characteristic, showing two sharply defined minima, essential for radio direction finding; and two relatively broad maxima, suitable for aural reception.

Action of a vertical antenna is non-directional, and its polar diagram would show that the voltage induced by the received signal is of the same amplitude and phase for all bearings throughout the compass. The usual fixed or trailing aircraft antennas, though slightly directional, have an ample vertical component to produce a substantially circular polar diagram.

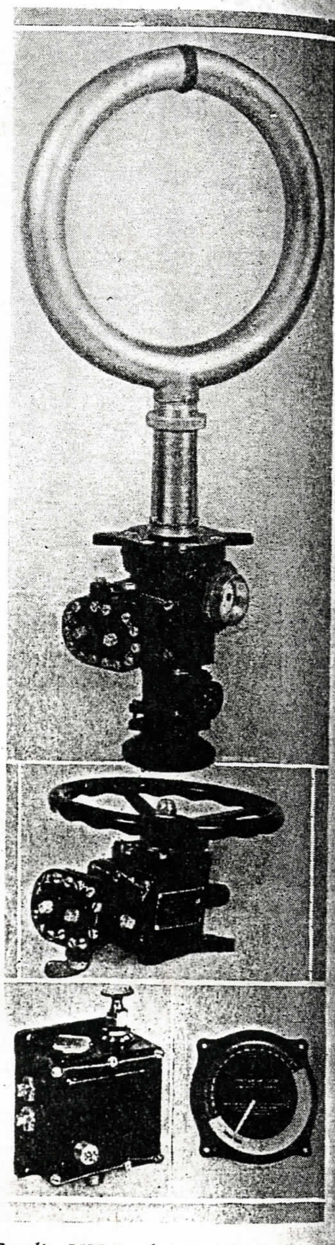
Both the loop and the fixed antenna are connected to the receiver, and the antenna voltage and phase are adjusted to equal the voltage and phase obtaining at one maximum position of the loop. The resultant voltage output for that maximum will be double that for either the loop or the antenna alone. At the other maximum position (loop turned 180°), the resultant output will be zero since the loop voltage is then equal in amplitude but opposite in phase to that of the antenna. At the two loop minima, the resultant output is equal to that of the antenna alone. The combined polar diagram of the loop and the antenna functioning simultaneously is cardioid in shape, exhibiting a definite unilateral responsiveness of the array, permitting unmistakable determination of the direction of the transmitting station. Either bilateral or unilateral reception can be obtained by moving a selector switch on the coupling unit panel.

In operation, the radio compass band switch is set to the position corresponding to the frequency band within which the frequency of the received signal lies, and with the selector switch set for bilateral reception, the loop is tuned to resonance to match the output of the fixed antenna. The selector switch is set for unilateral position, and the loop rotated for maximum signal output. The pointer on the Autosyn indicator scale will then point toward the transmitting station. The indicator mask is rotated until its zero-mark coincides with the pointer. Without moving the mask from this position, the loop is rotated until the minimum is found at which the Autosyn pointer lies along the exposed sector of the scale. The observed reading in the minimum position is the true bearing of the transmitting station relative to the heading of the aircraft.

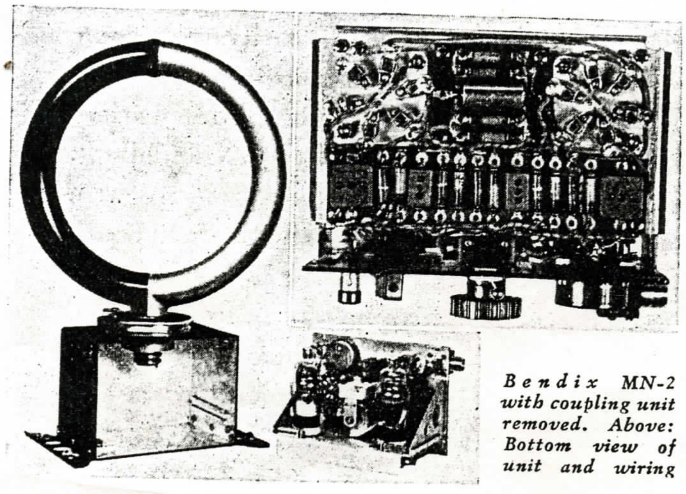
In Type MN-1, the loop is mounted directly on the coupling unit, with manual rotation control and lock at its base. Type MN-3 provides for external mounting of the loop directly above the coupling unit on an extension shaft. Also manually controlled, the loop of Type MN-5 can be mounted at a point not immediately above the coupling unit, with the rotation controls on the loop shaft at the cabin roof. In Type MN-7, the loop is remotely controlled by a handwheel operating a hydraulic pressure system which provides a smooth and positive means of rotation and control over distances up to 25 ft.

The antenna is 12″ in diameter, 1.75″ wide, and weighs 2.3 lbs. The coupling unit, 9″ × 5.25″ × 5.5″, weighs 7.3 lbs., and employs 2 Type 77 tubes operating from the receiver power supply. Total weight of the installation, including cables, varies from about 12 lbs. for the manual models to about 17 lbs. for the remotely controlled hydraulic model.

A feature of all Bendix D-Fs is that, should any component fail, the apparatus becomes inoperative, precluding the possibility of incorrect bearings. Aural reception is simultaneous with directional indication, allowing the pilot to listen to his station while navigating.



Bendix MN-7, showing hydraulically controlled loop, remote loop rotator with Autosyn transmitter, pump, and Autosyn indicator



Bendix MN-2 with coupling unit removed. Above: Bottom view of unit and wiring

Bombing by Radio

Considerable saving in the cost of aerial bombardment training and practice has been effected at March Field, Calif., through the use of an ingenious device developed by the U. S. Army Air Corps.

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Aug. '37