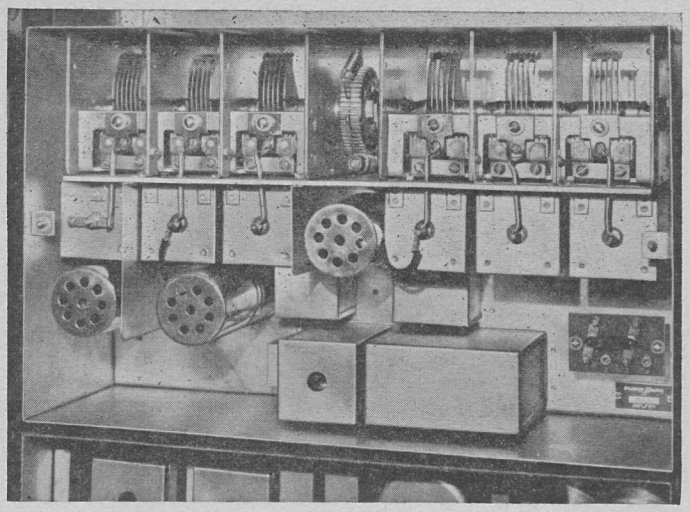

Fig. 2—The radio-frequency amplifiers incorporate accurate gang tuning through a worm drive with a double scale dial

and one to 15, and all three would be connected to the intermediate-frequency amplifier. If the station were on the air it would be immediately heard, and the two unnecessary amplifiers turned off. If it had not yet come on the air the operator would hear it the moment it did and would not lose the station announcement by having to tune successively to several frequencies.

The 13A Receiver is completely a-c. operated: the necessary transformers, rectifiers, and filters being incorporated in the voice-frequency amplifier unit. The signal gathered by the antenna first enters one of the radio-frequency amplifiers where it is amplified, passed through a series of selective circuits, and is then beat down to a frequency of 385 kc.—the frequency of the intermediate amplifier.* Here undesired frequencies are filtered out by sharply tuned circuits, further amplification is obtained, and the signal is detected. The resulting audio-frequency signal, which covers the band from 40 to 5000 cycles, is then further amplified in a suitable audio amplifier before distribution over the Waldorf system.

Outstanding features of this receiver are the high degree of selectivity, an electrical and mechanical design that insures dependable operation as well as high quality reception, and a sensitivity that permits good reception on signals as low as one microvolt. In the radio-frequency amplifiers there are five tuned circuits ahead of the modulator. These, together with the beating oscillator, are tuned by a six-gang condenser operated through a carefully constructed worm drive, shown in Figure 2, which gives very accurate selection. Frequencies separated less than one-tenth of one per cent may be readily tuned in. In the intermediate-frequency amplifier, Figure 5, there are eight additional tuned circuits. In this amplifier there is also a band-changing switch which, in the event of bad noise conditions, can be used to decrease the width of the audible frequency band and thus reduce the interference. Automatic gain control is provided, which is particularly important for short-wave reception, where the variation in signal strength with time may be considerable.

No matter how efficient a radio receiver may be, it must depend on the antenna to extract the maximum amount of energy from the arriving signal with the least amount of noise. Considerable attention was therefore given to the design of an antenna that would best secure these results, and at the same time would not mar the appearance of the building with tall ungainly structures. The multiple-doublet arrangement provided serves admirably to receive signals over a wide range of frequency and direction of arrival with a maximum of noise elimination.

When a horizontal wire is exposed to a high-frequency electro-magnetic field, it acts somewhat as a tuned circuit, and a current-measuring device placed at the mid-point would show maximum current when the length of the wire was approximately half the length of the radio wave. Such a wire differs in action from a tuned circuit, however, in responding not only to the fundamental frequency but to all odd multiples of this frequency. Thus a wire equal in extent to a half wave-length of a 3000 kilocycle signal, or 50 meters, would respond to frequencies of 3,000, 9,000, 15,000, and 21,000 kilocycles, and so on. If such a wire is broken at its mid-point and a tuned circuit or a transmission line leading to a tuned circuit is inserted, the resulting arrangement is known as a doublet. After the introduction of this associated circuit the tuning of the wire is only moderately sharp, and as a result it responds fairly well over a frequency range extending perhaps 20 per cent above and below the various frequencies corresponding to the length of the wire. By using several of these doublets, therefore, it is possible to secure good reception over a wide range of frequencies.

In the Waldorf installation, three such doublets are employed, having ap-

(Continued on Page 19)

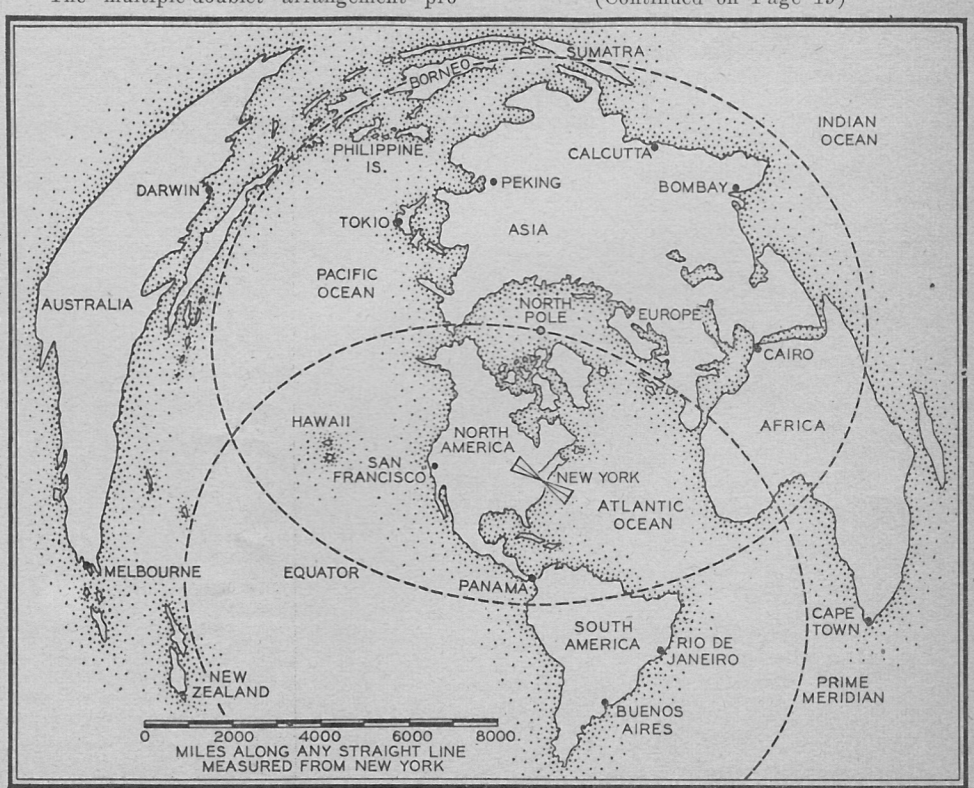

Fig. 4—A great-circle chart of the world centered at New York. The paths of radio waves coming to New York are straight lines on this chart.

*Suppressor grid modulation is employed.