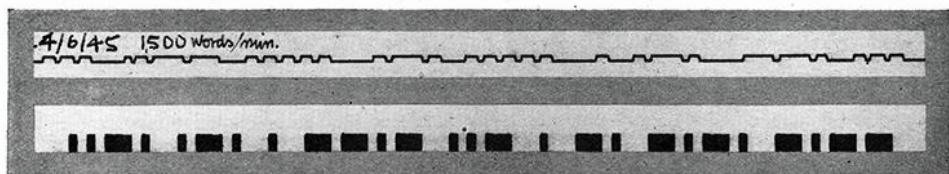


HIGH-SPEED RADIO-TELEGRAPHY



Details of the Romac 3,000 Word-per-Minute System.

MOST of the available channels in those regions of the radio frequency spectrum which are best suited to long-distance propagation have already been allocated and further expansion depends upon better engineering use of existing channels. At the present time, although speeds up to 800 w.p.m. have been achieved with special relays, most traffic is handled at speeds between 100 and 200 w.p.m. so that an increase of operating speed to 3,000 w.p.m., claimed for the system to be described, would be equivalent to the use of an additional 20 channels.

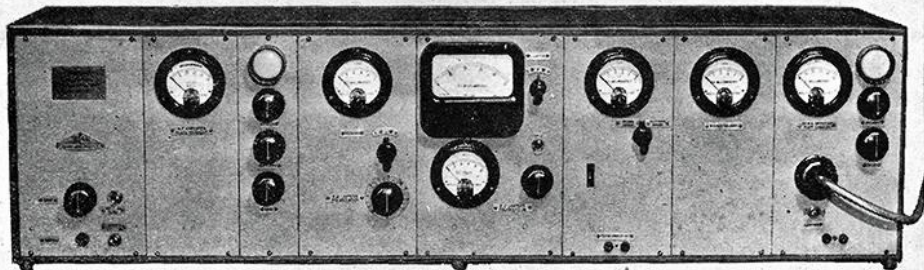
In the Romac system, which was developed some years ago by a group of Polish radio engineers, including S. Lalewicz and Madame M. Konopkova, the limitations of mechanical relays have been avoided by using wax cylinder recorders, and circuits have been developed which give a stable signal of good waveform under

exceptionally severe conditions of interference and noise.

At the transmitter electronic keying is employed. The message is prepared in morse characters on paper tape, particular attention being given to uniformity in the lengths of marking and spacing elements. The tape is then run at high speed past a source of light and the reflected light is picked up by a photocell. The resulting impulses are given a square wave shape by a DC amplifier employing a new gas-discharge relay valve known as the "Teleion," and are then used to modulate the carrier direct, no subsidiary carrier being employed. Sidebands are limited by a double humped filter in the output circuit of the transmitter. The consequent deformation of the square pulses during radio transmission is corrected by a "Teleion" valve at the receiver. It is hoped to give a detailed description of the "Teleion" in a later article; for

the present purpose it is sufficient to state that at one point on its characteristic a very large change of output current is obtained for a comparatively small change of input. The action is reversible and the rate of change from the "active" to the "passive" state has been greatly increased by the use of a "glow up" electrode.

At the receiving end the first unit in the chain is a normal communications type receiver, the output of which is tuned to a beat frequency of 5,000 c/s. This is passed to an instrument described as the "Romac High-speed Telegraphic Unit, Model K 1" which has remarkable powers for extracting recordable signals from an apparently hopeless jumble of interference and background noise. The principle involved is a combination of AF selectivity, AC and DC limiters and automatic gain control. First the signal passes through a bandpass filter with a mean frequency of

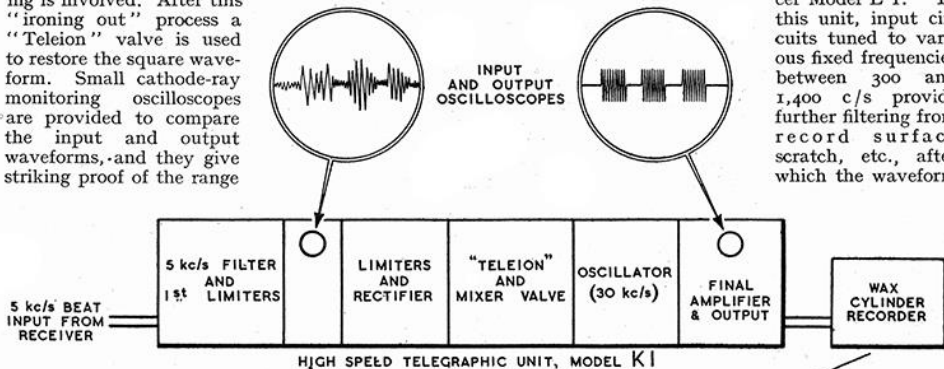


Romac Radio Corporation's Model K 1 High-speed Telegraphic Unit. At the head of the page is shown a specimen of receiver tape, and, below it, a section of the transmitter tape which actuates the electronic keying apparatus.

High-speed Radio-telegraphy— 5,000 c/s and a width of 1,600 c/s, then through a combination of no fewer than eight limiters in which both top and bottom limiting is involved. After this "ironing out" process a "Teleion" valve is used to restore the square waveform. Small cathode-ray monitoring oscilloscopes are provided to compare the input and output waveforms, and they give striking proof of the range

ferred to another machine running at a speed 20 and 60 times slower than the high-speed recorder. The carrier is now between 500 and 1,500 c/s and the morse speed is

sound box fitted with a microphone forms a convenient method of extracting the signal, which is now passed through the "Romac Rectilinear Telegraphic Reproducer Model L 1." In this unit, input circuits tuned to various fixed frequencies between 300 and 1,400 c/s provide further filtering from record surface scratch, etc., after which the waveform

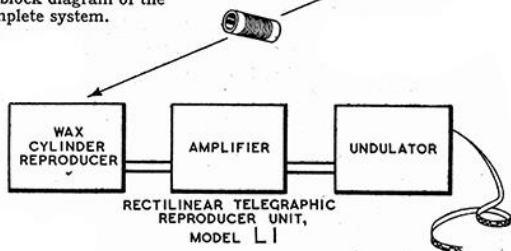


of control. Weak signals hardly distinguishable by ear from the random noise level, and high-powered stations which send the input trace, right off the scale produce the same perfectly regular square-wave signal of constant amplitude on the output CR tube.

The high-speed recorder is a modified wax cylinder machine as used in offices for dictating correspondence. It is provided with a piezo crystal cutter and runs at 700 r.p.m. Signals are recorded at a fixed "carrier" frequency of 30,000 c/s which is modulated by the output from the "Teleion."

The wax record is next trans-

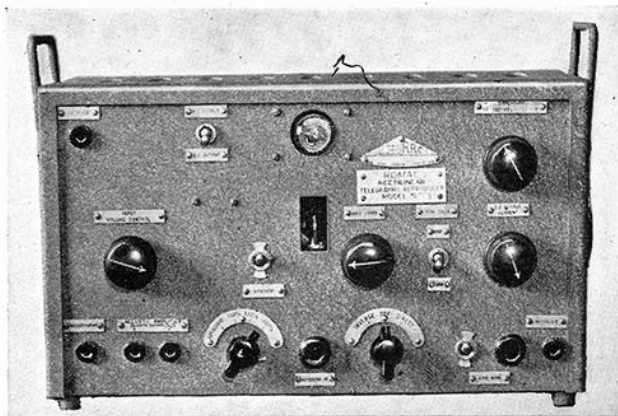
Simplified block diagram of the complete system.



well within the capacity of ordinary telegraphic undulating tape recorders. At the reduced audio frequencies a standard acoustic

of the morse impulses are again reformed by a "Teleion" relay. In this case, however, the wave is not necessarily limited to a square form, but can be given a variety of shapes to suit the mechanical characteristics of the undulator. For instance, an initial peak of current can be provided to accelerate the movement, and an inverse peak to return it to zero after a dot or dash. By "tailoring" the waveform to suit the instrument, the maximum speed of an indifferent recorder can be greatly increased.

A special feature of the Romac system is its facility for recording reliably under conditions of poor signal-to-noise ratio, and the methods used are such that although they were produced in the first instance for the recording of very high telegraphic speeds, they can be usefully employed for the recording of very weak signals of slow or commercial speeds.



Romac Rectilinear Telegraphic Reproducer, Model L 1.