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HIGH SPEED TELEGRAPH TRANSMITTER

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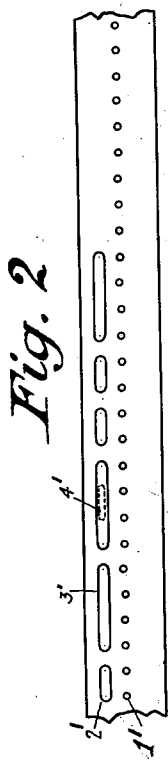


*Fig. 1*

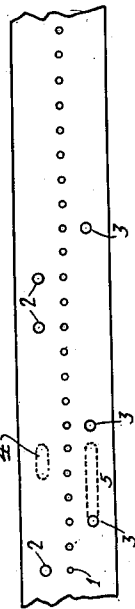


*Fig. 2*

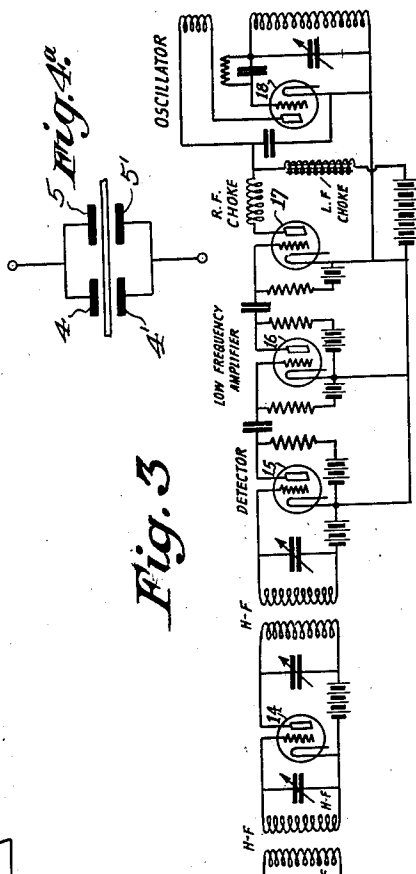


*Fig. 3*

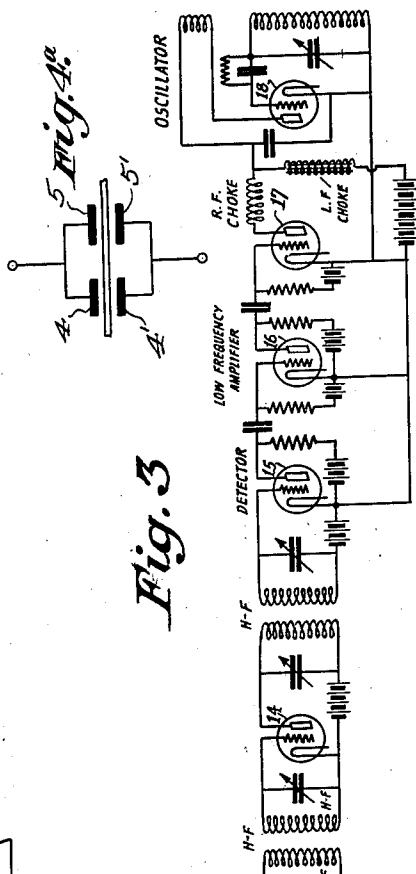


*Fig. 4a*

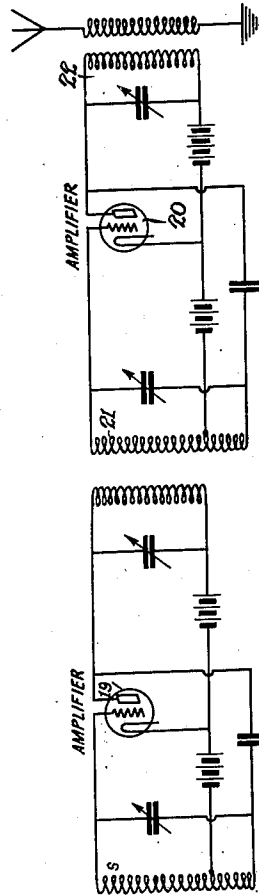
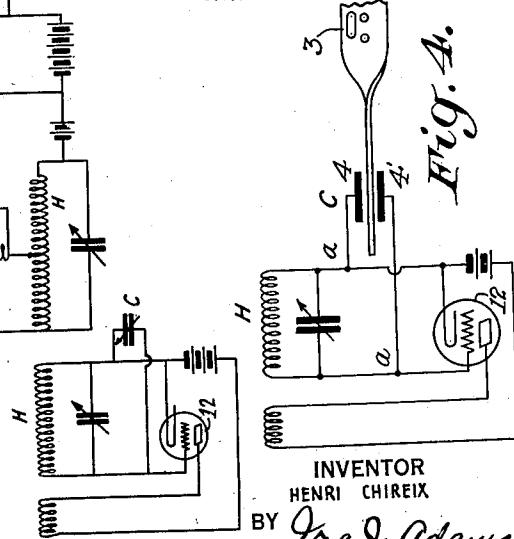


*Fig. 4*



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## UNITED STATES PATENT OFFICE

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HIGH SPEED TELEGRAPH TRANSMITTER

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The object of the present invention is to provide means whereby a line current may be sent according to the rhythm of Morse-code signals, for instance, at an extremely rapid rate, at all events, more rapidly than has been possible by mechanical systems involving inertia in relays, etc.

Systems known in the prior art consist in the use of a perforated strip or band allowing of the passage at intervals of a beam of light caused to impinge upon a photo-electric cell. Systems of this kind involve the drawback that they require a whole set of optical devices, a photo-electric cell and an amplifier for amplifying the currents produced by the cell.

Now, the system forming the subject-matter of the present invention consists basically in causing interference between two small oscillator tubes of the three-electrode type more generally known as heterodynes, and in detecting the beat currents. The passage of the perforated band, on the other hand, modifies the frequency of one of these oscillators or wave-generators, and thereby the resultant beat frequency. For this purpose, the tape or band acts as a dielectric of a small auxiliary condenser, according to whether a perforation or a solid portion of the strip is active. The dielectric may consist of air or of a material possessing a dielectric constant higher than air. The result is a variation in capacity and consequently a variation in the ensuing frequency. To carry this method into effect, as will be understood, it is necessary that the frequencies of the said small oscillators should be very high in such a way that the action under consideration may result in a variation in beat frequency of several hundred periods. According to a preferable plan, arrangements may then be chosen in the following way: When a solid portion of the band (solid dielectric) is placed opposite the electrodes of the small auxiliary condenser, the beat frequency is made very low, while when the perforated band presents a hole opposite the electrodes of the small auxiliary condenser, then the beat frequency is shifted into the range of musical notes. This frequency is then mod-

erately amplified by the aid of transformers, provided with a limited number of turns so that the grave-note periods may not be transmitted, and then, if desired, the current is detected. Hence, it will be seen that current is available at the output end of the amplifier only in the presence of one or two possible positions of the band (holes or solid portions). By paying out the perforated strip or band at a high rate of speed, radiations of signal current at a high rate of speed are obtained.

A better understanding of the invention will be had from the following detailed description and therefrom when read in connection with the drawings in which,

Figure 1 shows a perforated tape to be used to vary the capacity of the condenser in one of the oscillation generators,

Figure 2 shows a modification of the perforated tape shown in Figure 1,

Figure 3 shows a circuit arrangement including the oscillation generators and the amplifiers,

Figure 4 shows the relation between the variable frequency oscillation generator and the frequency controlling perforated tape, while,

Figure 4a shows a modification of the condenser arrangement of Figure 4.

The plates of the condenser and the perforations of the band may be arranged and chosen in different ways. For instance, it is practically recommendable to use for the Morse code, and in combination with existent perforators, a band of the kind shown in Figure 1.

Referring to Figure 1, 1 stands for the forward-feed holes of the tape; 2, the perforations indicating dots; and 3, the perforations indicating dashes. 4 and 5 finally indicate the projections of one of the electrodes of two small auxiliary condensers connected in shunt relation to the main condensers of one of the two oscillators. If the length of electrode 5 is three times larger than that of electrode 4, it will be seen that during the passage of a dash 3 the capacity will be varied for a period three times longer than during the passage of a dot such as 2, though the varia-

tion in capacity remains the same regardless of whether dashes or dots are dealt with.

As shown in Figure 2, it is also possible to use a special tape directly perforated in Morse signals, the dashes 3' corresponding to a longer perforation than the dots 2'. 1 indicates again the tape feed holes, while 4' shows a projection of an armature of an auxiliary condenser.

Figure 3 shows a circuit arrangement which may be used to carry out my invention. Tube 10 produces oscillations of a fixed frequency F. Tube 12 produces oscillations of a frequency H which depends upon the capacity amount of C. The capacity of C in turn depends upon the perforations of the tape. Both F and H are very high frequency so that the slight variation in C will produce a considerable percentage variation in the difference between H and F. This difference H—F need not necessarily be audible. The only requirement is that when an unperforated part of the tape is passing, the difference H—F should be sufficiently out of tune with the amplifier so that nothing happens, but when a perforation passes, the difference H—F should be that to which the amplifier is tuned. Tube 13 is the tube which produces the difference frequency and I have shown a bridge circuit input which would be advantageous in practice as it prevents the oscillators 10 and 12 from influencing each other's frequency. The resistance capacity combination Z is the element required to balance the bridge and its value is determined by the grid filament impedance of the tube. Oscillator 10 is coupled to circuit F of tube 13 while oscillator 12 is coupled to circuit H. The beat frequency H—F is selected by the tuned circuit in the plate of tube 13 and amplified by tube 14 and detected by tube 15. As each dot in the tape passes the condenser there will be an increase of current through the resistance in the plate circuit of detector 15. The pulses of voltage are amplified by tube 16 and applied to the grid of tube 17 which acts as the modulator tube of a Heising system of modulation of which tube 18 is the oscillator which is adjusted to a frequency S which is the frequency at which the radio transmission is to be effected. The oscillator 18 is then coupled to the input of a two stage amplifier which feeds the antenna. This amplifier shown for convenience at the bottom of Figure 3 includes an inductance S coupled to the oscillator 18 and included in the input circuit of an amplifier 19 the output circuit of which is in turn coupled to an inductance 21 in the input circuit of a second amplifier 20. The second amplifier 20 is coupled by means of an inductance 22 in its output circuit to the load circuit which for purposes of illustration has been shown to be a radiating circuit.

Figure 4 shows in detail a variable fre-

quency oscillation generator including a thermionic tube 12, an output inductance H tuned by a main capacity and a capacity C which is variable in accordance with the present invention by changing the dielectric between the plates 4, 4' thereof. As pointed out above, the capacity of the condenser C is altered in the invention by altering the dielectric between the plates 4, 4'. This is accomplished by passing the perforated tape between the condenser plates. Since the dielectric constant of air is different than the dielectric constant of the material of which the tape is composed, the capacity of the condenser C will be varied as the dielectric thereof is composed alternately of air and of the material between the perforations in the tape. In Figure 4, the tape has been shown to be similar to the tape illustrated in Figure 2.

In case the tape shown in Figure 1 is used to control the frequency of the variable frequency generator 12, a condenser arrangement as illustrated in Figure 4a is used. As will be seen in Figure 4a, the condenser C comprises plates 4, 5 cooperating with plates 4', 5' and with the tape shown in Figure 1 to control the frequency of the oscillation generator 12.

It will be understood that the invention is capable of a great number of modifications and embodiments, and that it is, indeed, not confined to the embodiments here shown and described by way of example.

Having thus described my invention, I claim:

1. A high speed telegraph transmitter including a thermionic oscillation generator having coupled input and output circuits, a second thermionic oscillation generator having coupled input and output circuits, means in the input circuit of said last named oscillation generator to tune said last named oscillation generator to a frequency differing from the frequency of the oscillations generated by said first named oscillation generator, an auxiliary capacity connected in parallel with said tuning means, means for varying the dielectric between the electrodes of said auxiliary capacity in accordance with the signal to be transmitted, and a utilizing circuit connected to both of said oscillation generators.

2. In radio communication apparatus, a source of oscillations of constant frequency, means for producing oscillations at a frequency differing from the frequency of said first named source comprising, a thermionic tube having coupled input and output circuits, capacity means for tuning said input circuit, a combining circuit connected with both of said oscillation generators, a beat frequency amplifier connected with said combining circuit, signal translating means connected with said beat frequency amplifier, means for modulating the oscillations produced by said thermionic oscillation gener-

ator comprising an auxiliary capacity connected in parallel with said tuning capacity, and means for varying the dielectric of said auxiliary capacity at signal frequency.

5 3. A telegraph transmitter including a thermionic oscillation generator having coupled input and output circuits, a second thermionic oscillation generator having coupled input and output circuits, capacity means in  
10 the input circuit of said last named oscillation generator to tune said last named oscillation generator to a frequency differing from the frequency of the oscillations generated by said first named oscillation generator, an  
15 auxiliary capacity connected in parallel with said first named capacity, means for varying the dielectric between the electrodes of said auxiliary capacity in accordance with the signal to be transmitted, a thermionic relay  
20 having its input circuit coupled to both of said generators and its output circuit coupled to a selective amplifier tuned to the beat frequency, and a transmitter connected with said amplifier.

25 4. In radio communication apparatus, a source of oscillations of constant frequency, thermionic means for producing oscillations at a frequency differing from the frequency of said first named source comprising, a thermionic tube having coupled input and output  
30 circuits, capacity means for tuning said input circuit, a combining circuit connected with both of said oscillation generators, a beat frequency amplifier connected with said combining circuit, signal translating means connected  
35 with said beat frequency amplifier, an oscillator connected with said signal translating means, a work circuit connected with said oscillator, means for modulating the oscillations produced by said thermionic oscillation  
40 generator comprising an auxiliary capacity connected in parallel with said tuning capacity, and means for varying the dielectric of said auxiliary capacity at signal frequency.

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