M. H. PETERSEN.

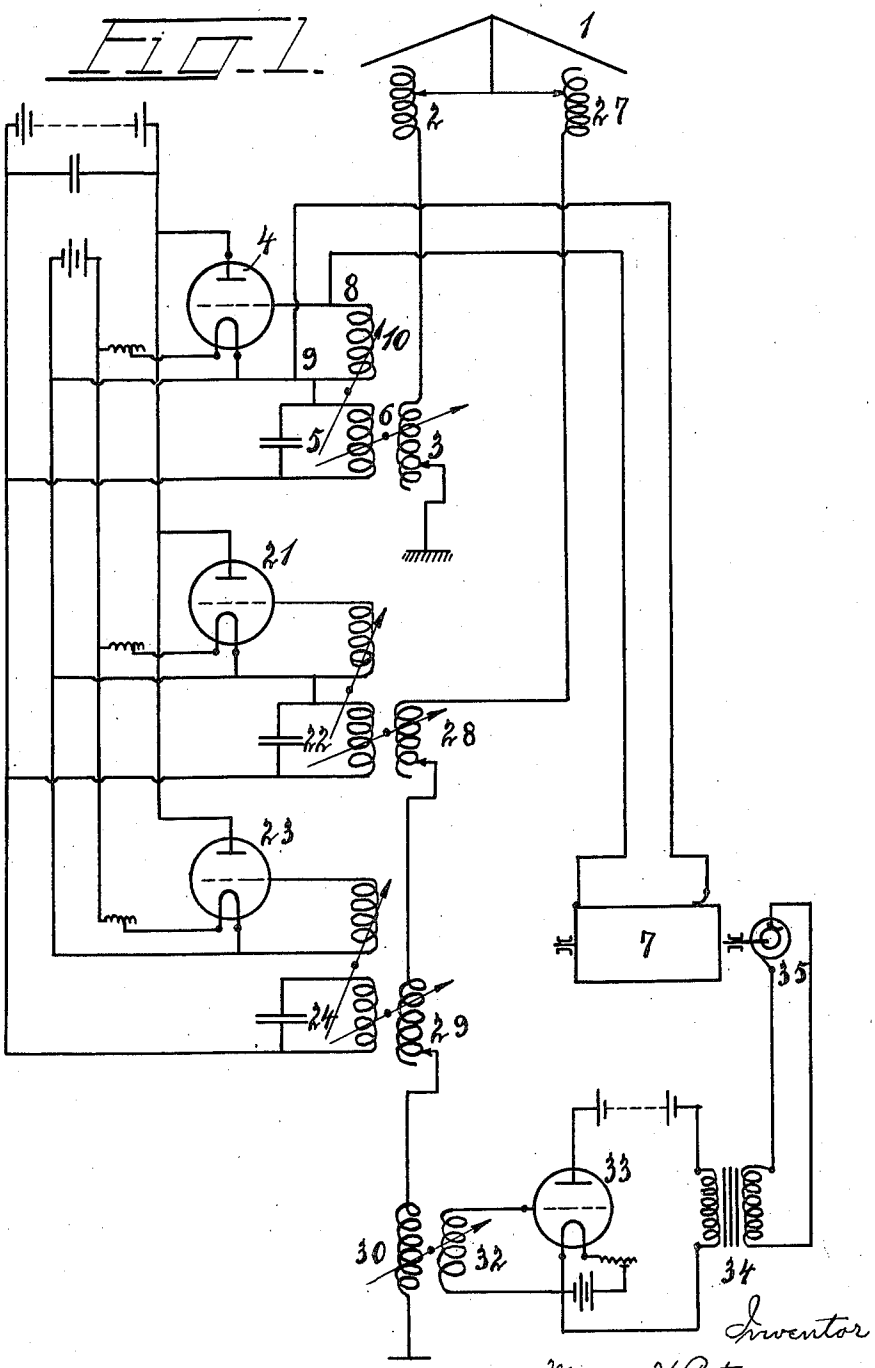
SYSTEM FOR WIRELESS TRANSMISSION OF WRITING, PICTURES, AND THE LIKE.

APPLICATION FILED OCT. 21, 1921.

1,436,676. Patented Nov. 28, 1922.

2 SHEETS—SHEET 1.

FIG. 1.




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Magne H. Petersen,

By Albert G. Davis Jr. Atty.

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2 SHEETS—SHEET 2.

FIG. 2.

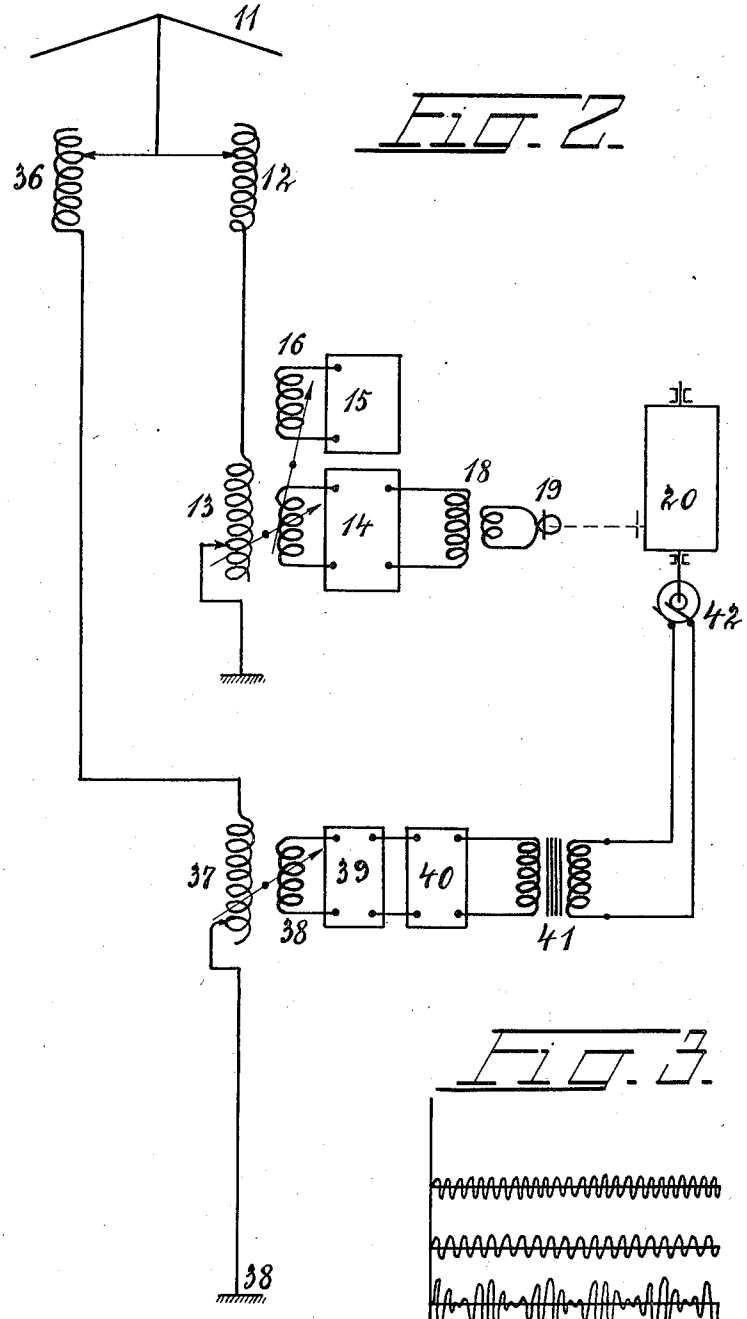



FIG. 3.



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Patented Nov. 28, 1922. 1,436,676

# UNITED STATES PATENT OFFICE.

MAGNE HERMOD PETERSEN, OF CHRISTIANIA, NORWAY.

## SYSTEM FOR WIRELESS TRANSMISSION OF WRITING, PICTURES, AND THE LIKE.

Application filed October 21, 1921. Serial No. 509,416.

*To all whom it may concern:*

Be it known that I, MAGNE HERMOD PETERSEN, a subject of the King of Norway, residing at Sorgenfrigate 36, Christiana, Norway, have invented certain new and useful Improvements in Systems for Wireless Transmission of Writing, Pictures, and the like (for which I have made application for patents in Norway, September 9, 1920, Ser. No. 21,733; Holland, July 26, 1921, S. No. 19,970; Sweden, September 5, 1921, S. No. 3,158; Denmark, September 3, 1921, S. No. 2,113; France, August 24, 1921, S. No. 148,485; Germany, Nov. 4, 1920, S. No. P. 40,887; England, Aug. 22, 1921, S. No. 22,273; Italy, Sept. 1, 1921, No. 306/3030; Poland, July 26, 1921, S. No. 9,089; and Spain September 1. 1921, S. No. 4420); and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The present invention relates to the systems for transmission of writing, pictures and the like, in which part of the current circuit of an alternating current generator connected to the transmission leads is short-circuited by means of a contact arrangement, which is so actuated by means of the writing at the sending station, that the short circuiting is started or interrupted by means of a contact needle passing over the written lines.

The present invention relates to the adaption of this system to wireless transmission of writing, and has for its object a method by means of which the known systems for transmission of the pictures or the writing can be used practically without modifications for this purpose.

On the drawing is diagrammatically illustrated a form of the invention.

Fig. 1 illustrates a diagram for a sending station and Fig. 2 the diagram for a receiving station.

Fig. 3 shows continuous oscillations.

As in all ordinary radio systems there is used a sender and a receiver. This sender comprises an antenna 1 with an extension coil 2 and the secondary winding 3 of a high frequency transformer. By means of the extension coil 2 the wave length of the antenna oscillations is regulated, and by means of the secondary winding of the high frequency transformer, energy is received from the sending apparatuses.

The sending apparatuses comprise a vacuum tube generator 4 of known construction and effect. This vacuum tube generator generates continuous (undamped) oscillations, the wave length of which is adapted for the purpose, for instance 600 m. The wave length is regulated by means of the oscillating circuit 5—6, and the oscillations are transformed from the primary winding 6 of the high frequency transformer to the secondary winding 3 and emanate from the antenna in the form of electromagnetic waves. 7 is the sending cylinder of the copy telegraph apparatus. The telegram, comprising a picture or writing of any kind is transferred chemigraphically to the cylinder in such a manner, that the lines are electrically insulating. During the rotation of the cylinder a contact needle describes a helical line on the same. When the contact needle touches the metal, a contact is formed, and this contact is broken, when the needle is passing over a line of the writing or picture. From the contact needle and metal of the sending cylinder, two lines lead to the screen circuit of the vacuum tube generator, and are connected at points 8, 9 in parallel to the screen coil 10. It will be understood that when the contact needle on the cylinder is in contact with the same, coil 10 is short circuited, whereby the emanation of waves from the antenna is intercepted, and when the contact needle passes an insulating part of writing, the short circuiting is interrupted, and continuous (undamped) waves emanate from the antenna as in a modern radio station provided with vacuum tube sender. The waves emanated are taken up at the receiving station by the antenna 11 and conducted over the antenna coil 12 to the antenna coil 13 of the receiving transformer, whereupon it is transferred inductively to high frequency intensifying detector and low frequency intensifier of a known type and placed together in apparatus 14. The said high frequency circuits can however not be used directly for driving the receiving apparatuses of the copying telegraph. The receiving apparatuses, which can be used, comprise oscillograph receivers, spark receivers and others. In the present case it is supposed, that an oscillograph receiver is

used, and this apparatus is adapted to work with alternating currents, the frequency of which may vary from a couple of hundred to 12,000 cycles per second. If the incoming waves have a frequency of 500,000 cycles per second, corresponding to 900 m. waves, the frequency must for instance be reduced to 1,000 cycles per second. This is done in a known manner by generating at the receiving station oscillations with a somewhat higher or lower frequency than the incoming waves. The said oscillations are caused to interfere with the incoming, thus producing the well known beat effect, i. e. the resultant oscillation besides their individual high frequency, and this beat frequency is exactly equal to the difference between the frequencies of the interfering oscillations. On the diagram is illustrated beat effect for the frequencies 190,000 and 190,100 cycles per second. The beat frequency in that case will be 100 beats per second. If the incoming oscillations have a frequency of 500,000 cycles per second, and the interfering oscillations have a frequency of 501,000 or 499,000 cycles per second the beat frequency will be 1,000 per second. The interfering oscillations are generated in the vacuum tube generator 15 and are transmitted by means of a coupling coil 16 to coil 17, where they interfere with the incoming oscillations. As the resultant oscillations with beat frequency 1,000 pass the detector, they are rectified in the usual manner, and finally, after sufficient low frequency intensifying reach the low frequency transformer 18, to which the loop 19 of the oscillograph receiver is connected. The said oscillograph serves to register the elementary signs on the rotating cylinder 20 in the same manner as in a copying telegraph for line-telegraphy. In this manner the transmission of signs takes place.

The present method, however, is also adapted for solving the wireless synchronizing problem, which is also indicated on the drawing.

It is well known that it is absolutely necessary to have an ideal synchronism, when the copy telegraph is to be used for continuous operation. According to the present system for wireless transmission, the sending and receiving apparatus are driven by means of single phase synchronous motors. If these motors shall operate in synchronism, they must be driven from the same source of power, so that all variations in the current take place simultaneously and in the same manner in both motors. Synchronous motors operate with comparatively low frequency for instance 50 to 100 periods per second. The power for driving these synchronous motors must therefore in the first instance be transferred as electromagnetic waves, and secondly must be given a frequency suitable for driving synchronous motors. This, according to the present invention is obtained in the following manner:

At the sending station there is used two vacuum tube generators. These work with a frequency adapted for the radio devices customarily used. If the signs are to be sent for instance with a wave length of 600m., a wave length of for inst. 1600m. will be suitable for driving the synchronous motors. If the said motors are to work with a frequency of 100 cycles per second, this may be effected by making one vacuum tube generator 21 produce in the circuit 22 oscillations of frequency 190,000 cycles per second, while the second vacuum tube generator 23 produces in circuit 24 oscillations with frequency 190,000 or 189,000 cycles per second. Both kinds of oscillations are transmitted to the antenna through the respective high frequency transformers 28—29, and in the antenna the oscillations interfere and produce an oscillating energy of sufficient strength to reach the receiving station and with a beat frequency of 100. The antenna circuits 1, 27, 28, 29, 30 and 31 are tuned for a medium frequency, in the present case either 190,050 or 189,950 cycles per second. This energy is adapted for long distance transmission and at the same time can be utilized for driving synchronous motors. At the sending station part of the energy is transferred through coil 32 to the vacuum tube rectifier 33, and the beat frequency is transferred through the low frequency transformer 34 to the secondary of the transformer, to which the synchronous motor 35 is connected. The synchronous motor accordingly receives alternating currents of 100 periods, and by means of the connecting between coils 30 and 32, the strength of the energy is so regulated, that it is suitable for the synchronous motor. The antenna continuously emanates the interfering oscillations from vacuum tube generators 21 and 23. At the receiving station the interfering waves are received in the antenna circuits 11, 36, 37 and 38, which is tuned to a medium value as above specified. As the branches 2, 3 at the sending station and 12, 13 at the receiving station is tuned to a shorter wave length, 600m., the long waves can not pass this way, but are forced to pass the antenna circuit tuned to the long waves. When the interfering oscillations pass 37 on the receiving station, they are transferred through the high frequency transformer 37, 38 to the high frequency intensifier and detector 39 and the low frequency intensifier 40, whereupon the beat frequency passes the low frequency transformer 41 and supplies alternating current of frequency 100 to the synchronous motor 42. It should be noted that at the receiving station it is necessary to intensify the incoming energy sufficiently

for driving the synchronous motor. It is therefore necessary to use high frequency as well as low frequency intensifying, which is known from radio telegraphy.

It will be understood from the above, that the synchronous motors at the sending and receiving stations are driven from the same source of power, so that the synchronism between the said motors will be accurate.

On the drawing there is illustrated a number of different vacuum tube generators. This, however, it done only for the sake of clearness, as there is nothing to prevent the combination of said vacuum tubes in one vacuum tube of suitable energy for the distance between sender and receiver.

I claim:

1. The method of wireless telegraphy between stations, which comprises receiving signaling oscillating current energy and combining it with the energy of a separately produced auxiliary current whose frequency is slightly different from the frequency of the received current, and translating the combined energy for telegraphic signals and simultaneously producing at one station oscillating current energies of different frequencies differing from the frequency of the aforesaid received oscillations and combining, and translating the latter combined energies at both stations.

2. The method of wireless telegraphy between stations, which comprises receiving oscillating current wave energy and combining therewith at the receiving station auxiliary alternating current to produce beats therewith, and producing at one of the stations correlated current energies differing in frequency materially from the received oscillations, and combining said latter energies at both stations, and translating the combined energies at both stations into synchronized mechanical movement.

3. The method of wireless telegraphy between stations, which comprises receiving oscillating current wave energy and producing a beat frequency of one value by which intelligence is received and simultaneously producing at one of the stations combinable oscillations differing materially in frequency from the aforesaid received oscillations to produce a beat frequency at both stations of a different value from the beat frequency for intelligence, and translating the latter combined energies into mechanical energy at both stations.

4. The method of wireless telegraphy between stations, which comprises sending oscillating current wave energy from one station to another, combining with said energy at the receiving station alternating current energy to produce beats, translating the combined energies into mechanical movement in accordance with variations in the oscillating current wave energy corresponding to signals transmitted, and simultaneously producing at one of the stations two oscillating currents of different frequency and differing in frequency from the signaling current to produce a beat frequency at both stations different from the aforesaid beat frequency, and simultaneously translating the latter energy at both stations into synchronized mechanical movement.

5. The method of wireless telegraphy between stations, which comprises receiving signaling oscillating current energy and combining with it at the receiving station energy of a separately produced auxiliary current whose frequency differs but slightly from the received energy to produce beat effect, and translating the combined energies for telegraphic signals; simultaneously translating at both stations combined oscillating energies having a beat effect differing materially in frequency from the aforesaid beat effect, and translating the combined energies into synchronous mechanical movement at the stations.

6. The method of wireless telegraphy between stations, which comprises receiving signaling oscillating current energy, combining therewith an auxiliary current to produce a beat effect, and translating the combined current for telegraphic signals, simultaneously generating at a station oscillating current energy materially differing in frequency from the aforesaid energy and combining with the latter energy a second oscillating current differing in frequency from the frequency of the latter energy and translating the combined energies at both stations into synchronized mechanical movement.

7. The method of wireless telegraphy between stations which comprises transmitting signaling oscillating current energy from one station to another, combining therewith at the receiving station a current to produce a beat effect and translating the combined energies for telegraphic signals; simultaneously maintaining between the stations combined oscillating currents whose beat frequency materially differs from the frequency of the signaling current, and translating the latter combined current into synchronized mechanical movement at the stations.

8. In wireless telegraph apparatus, means for receiving undamped oscillatory current of one frequency, means to produce alternating current of a frequency differing but slightly from the aforesaid frequency to produce a beat frequency, means to reduce the beat frequency, an oscillograph operated by the energy thus transformed, means to receive high frequency oscillations differing from the said oscillatory current the combined energy of which produces a beat effect differing from the aforesaid beat fre-

quency, and means to translate said energy into useful current, a synchronous motor operated by such energy, and means operated by said motor to receive actinic reflections from said oscillograph.

9. In wireless telegraph apparatus, means at one station for sending a wireless signaling current, means at a receiving station for combining with said current an alternating current of different frequency and means at said receiving station for translating said current for signals; in combination with means at one station to simultaneously produce a heterodyne power current at both stations differenig materially in frequency from the heterodyne signal current, and means for translating the heterodyne power current into synchronized mechanical movement.

10. In wireless telegraph apparatus, means at one station for sending a wireless signaling current, means at a receiving station to combine with the received current a second current to produce a heterodyne current, and means to translate the latter current for signals; in combination with means at the sending station to produce at both stations heterodyne power current materially differing in frequency from the signal current, and means at both stations to translate said power current into synchronized mechanical movement.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

MAGNE HERMOD PETERSEN.

Witnesses:
MORGAN BUGGE,
MARGIL A. AANEESSEN.