

Aug. 11, 1931.

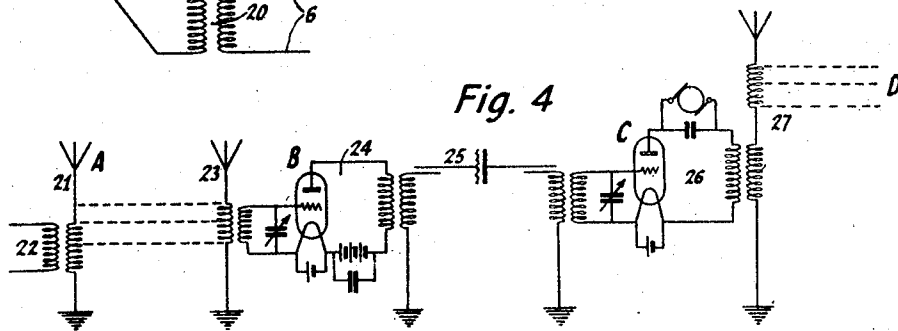
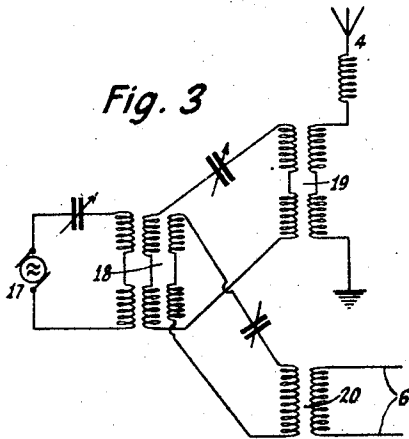
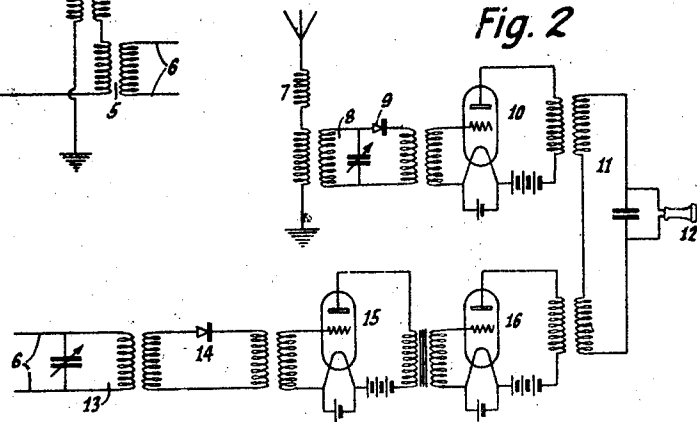
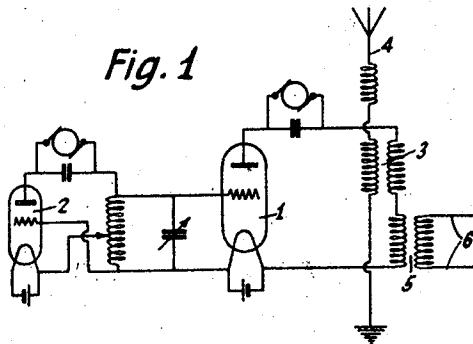
A. BECKMANN

1,818,669

RADIO FREQUENCY TELEGRAPHY AND TELEPHONY SYSTEM

Filed Jan. 9, 1925

2 Sheets-Sheet 1



INVENTOR
AUGUST BECKMANN
BY *Ira J. Adams*
ATTORNEY

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A. BECKMANN

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2 Sheets-Sheet 2

Fig. 5

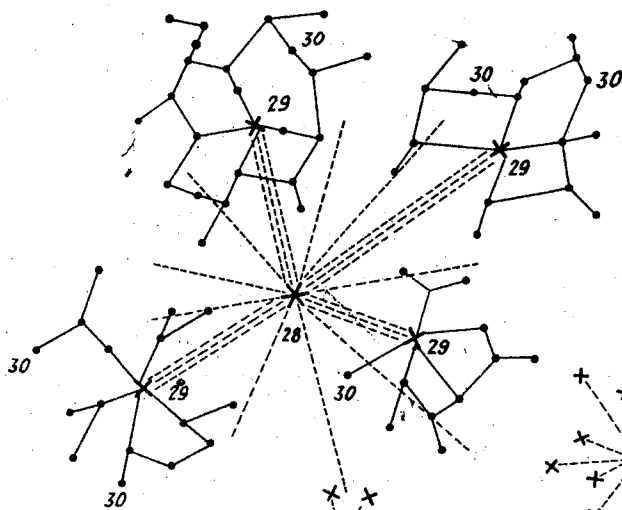


Fig. 6

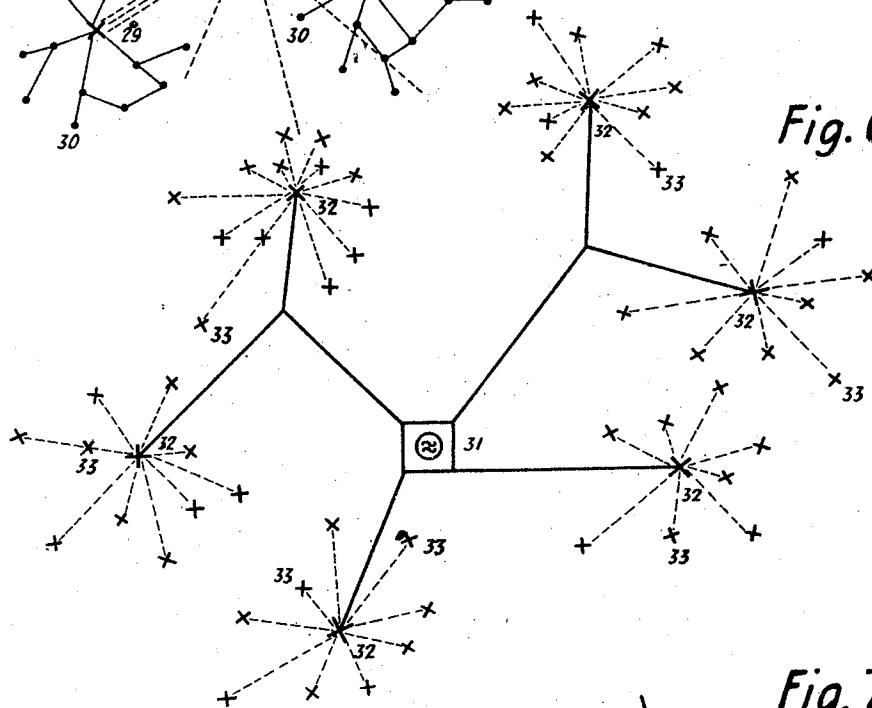
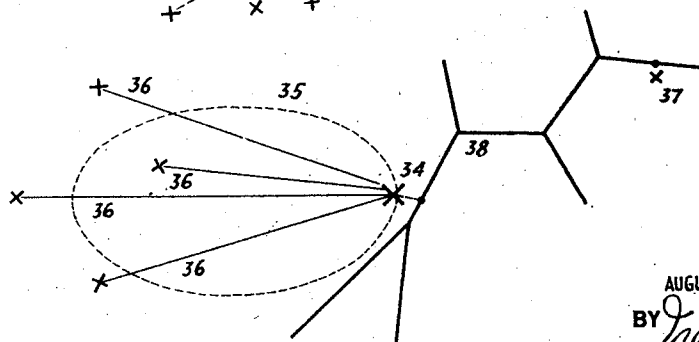


Fig. 7



INVENTOR
AUGUST BECKMANN
BY *Tracy A. Adams*
ATTORNEY

UNITED STATES PATENT OFFICE

AUGUST BECKMANN, OF BERLIN, GERMANY, ASSIGNOR TO GESELLSCHAFT FÜR DRAHT-
LOSE TELEGRAPHIE M. B. H., OF BERLIN, GERMANY, A CORPORATION OF GERMANY

RADIO FREQUENCY TELEGRAPHY AND TELEPHONY SYSTEM

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My invention relates to a novel means and method for disseminating news or intelligence from a central station.

One object of the invention is to provide such a means and method as will give a very large degree of reliability as well as great efficiency from a standpoint of total power consumed.

Another object of the invention is in the novel method and means for receiving and relaying such intelligence.

Other objects will be apparent from the following description and claims when considered with the accompanying drawings, in which

Fig. 1 illustrates the invention as applied to sending;

Fig. 2 illustrates the invention as applied to receiving;

Fig. 3 shows another illustration of the invention as applied to sending;

Fig. 4 shows an illustration of the relaying arrangement;

Figs. 5, 6 and 7 are schematic diagrams showing the different ways in which the intelligence can be disseminated from a central sending station to the ultimate receivers.

Lately the system of transmission of news by means of radio frequency over wires has been repeatedly developed besides wireless telegraphy and telephony by using the postal lines which work with low frequency telegraphy and telephony for radio frequency multiple telegraphy and telephony on the one hand, and on the other by using the high tension transmission lines of the central stations for conveying news. It was also proposed to utilize the low tension wire systems which supply light and power for the transmission of news by connecting suitably developed radio frequency receivers to the lines instead of glow lamps or such.

The two methods, namely, the wireless transmission of news and that over wires, are completely different and the only relation between them is that both employ the same apparatus of radio frequency engineering. The invention has the purpose of organically uniting both operating methods and therefore gives new possibilities of utilization for

radio frequency transmission of news and improves the technical usefulness of many a known arrangement.

The base for uniting both operating methods is to employ radio frequency waves which are transferred, partly by wireless and partly over wires, for telegraphic and telephonic purposes. According to whether the radio frequency waves traverse the two ways at the same time or after one another, different embodiments of the invention are required. For short distances the waves may have equal or different frequencies and may also have equal or different functions for attaining certain effects. As far as the waves are transferred by wireless, they may be directive or non-directive; in particular the directive wireless transmission combined with the transmission over wires gives results which can not be attained by the directive wireless transmission alone.

For one group of embodiments of the invention, the arrangement can be such, that the radio frequency waves of the transmitting station are radiated by an aerial as well as transferred to a wire system. For this purpose the transmitting station may employ one or more oscillation generators. If only one generator is used, it can be coupled to the wire system and at the same time to the transmitting aerial.

Fig. 1, for instance, shows this combination for a tube transmitter. A separately excited tube transmitter, the chief tube 1 of which is set into oscillation by a tube generator 2, is, for instance, coupled across transformer 3 to aerial 4 and across another transformer 5 to a wire system 6. If this transmitter is effected by a key (not shown) in any known way or by a microphone (not shown), the news is transferred by electromagnetic wave radiation as well as by transmission over the wire system. Instead of the tube generator any other generator may be used.

Usually more energy is used for supplying the aerial than for the wire system. This fact can easily be taken into consideration in case of the separately excited tube transmitter by coupling the wire system 6 to the tube generator 2 and the aerial only to the chief tube 1.

Another kind of distribution of energy consists in providing two separate generators for the aerial and for the wire system. In this case both transmitters can be affected by a
 5 common keying device (Morse-key or microphone).

Such a transmitter transfers the same news on two ways at the same time. The receivers can also be similarly arranged in such a way
 10 that they simultaneously receive the incoming waves from a receiving aerial and a wire system. A phase regulation which may be necessary in some cases can easily be carried out by known means.

This described two-way radio frequency transference has different technical advantages. In the first place it guarantees an increased surety of transmission of news. If the wire connection is for instance interrupted,
 20 the news is transferred on the wireless way; on the contrary if at times the wireless transmission is disturbed by strong atmospherics, the reception of the signals is maintained, as the wire communication is not influenced by these disturbances. Therefore, it is advisable to arrange the receiver in such a way that it can be disconnected from the one way or the other.

Freedom from atmospherics can also be
 30 attained in such a way that the waves guided by wires are more amplified than the waves transferred without wires before they are led to the indicator of the receiver.

Fig. 2 shows an example of a receiver. The oscillations which are taken up by the receiving aerial 7 are led across a tuned secondary circuit 8, detector 9, audio-frequency amplifier 10 to the indicator circuit 11, including telephone 12; the oscillations which come
 40 from the wire system 6 are led across the tuned circuit 13, detector 14, amplifiers 15 and 16, also to circuit 11. A further advantage of this two way radio frequency system is that the loudness of sound is greater than that of a one way system, and furthermore it is possible to employ a smaller total energy than for wireless transmission alone.

This system can, for instance, be employed when a large number of receivers get the news propagated by one wireless transmitter. If these receivers, as is mostly the case, lie within the range of a wire system, for instance, of a central station or of a low tension lighting network, or of a telephone wire system,
 55 the transmitter can easily be connected by wire to a central point of this wire system. If the separate receivers are then also fitted with small additional apparatus for connecting them to the wire system, the general transmission of news can be carried out in the described manner according to the two way radio frequency method.

It is not necessary that every receiver be connected to the wire system and also fitted
 65 with an aerial. If some receivers get only

wireless news and others only news transferred over wires, the number of the subscribers which receive the news from one wireless central station can be greatly increased according to the present invention. If it is necessary to increase the energy of the transmitter for this purpose, this can easily be carried out by an additional apparatus which also may be a separate smaller transmitter for the wire system.

If the news is transferred across the two ways to two different groups of receivers, it is also possible to transfer different news to these two groups. Two signalling apparatus are then necessary and each influences an oscillation generator, if two separate generators are used. If one generator supplies both transmitting ways, these signalling apparatus must be so arranged that the signals are separately led to the two ways. The different news can be simultaneously transmitted with the same radio frequency wave telegraphically as well as telephonically in contrast with straight wireless communication which can employ this method only with different wave lengths.

In the two-way transmission, according to the invention, different wave lengths can of course also be used for the two ways. In many cases it is advisable to supply the wire system with a lower frequency than the aerial. If a regenerative tube transmitter is used, this transmitter may contain two oscillating circuits, one of which is coupled to the aerial and the other to the wire system. If a transmitter provided with means for increasing the frequency is used, the wire system can be connected to one of the lower increase stages, while the aerial is supplied by the highest frequency stage.

Fig. 3 shows an example for this case. The radio frequency generator 17 supplies with energy, on the one hand, aerial 4 across a frequency transformer 18 which is fitted with two secondary windings and also across one or more further frequency transformers 19, and on the other hand, the wire system 6 across an ordinary transformer 20.

A special embodiment of the invention is required in case the two radio frequency waves are traversed by different waves and the same receiver is set up for receiving both waves. A beat or interference reception can be carried out in this case, if the difference of the two wave lengths has a suitable value, without the receiver having a local oscillation generator.

This kind of beat reception also gives the following possibility. Several receivers which are established in the range of a certain wire system and which get telephonic news by means of radio frequency across this central system, are at the same time adapted for receiving telephonic news transmitted by wireless stations which lie far away from

the sphere of the wire system, by using the radio frequency wave of the wire system as a heterodyning wave. A central heterodyne is created in this way. The second wave can also be used for by-purposes of telegraphic communication in general as, for instance, for calling.

In some further embodiments of the invention the radio frequency waves traverse distances by wire system and without wire system alternately. Either the same wave length is used which first traverses a wire system and is then transferred through a range without wire system, or the wave length is altered at the transition spot. Furthermore, the radio frequency can be amplified or another radio frequency generated at the transition spots.

Fig. 4 shows, for instance, the scheme of an arrangement in which a larger transference distance is bridged over by means of intermediate stations. News is to be transmitted from a wireless transmitting station A across the two intermediate stations B and C to a receiving station D which is not drawn in the figure. The station A has a transmitting aerial 21 in which oscillations are set up by any transmitter across the coil 22. The radiated waves are taken up by the receiving aerial 23 of the relay station B and directly transferred to a wire system 25 across a suitable multi-stage radio frequency amplifier, one stage only of which being shown at 24. These oscillations which are guided by the wire system are then taken up by the station C and used for exciting a separately controlled tube transmitter 26. The aerial 27 of this transmitter again radiates these waves which finally get to the receiver D.

In this way a long distance can be bridged over by means of a much lower total energy than if only wireless relay stations are used. Long high tension transmission lines and postal telegraph lines which lie in about that direction which is to be covered, can suitably be utilized for this purpose. In many cases the relay stations in which the wireless transference is altered into a transference over wires require no, or only a small source of radio frequency energy.

Every relay station of this arrangement can be utilized not only for the above described purpose, but also for other purposes, for instance, by transferring news over wire systems which lie within its range or by transferring wireless news in its sphere on other wave lengths than those which are employed for the relay service.

If lower frequencies are to be employed for those distances which contain wire systems than for the distances without wire lines, the radio frequency can be increased at the transition spot at which new radio frequency energy is generated for wireless radiation, and, on the contrary, the frequency can be de-

creased at the transition spot from wireless transference to that over wires.

This embodiment of the invention described for the use of a relay line gives new possibilities for a general transmission of news. If, for instance, as shown by Fig. 5, a central wireless transmitter 28 provides a series of wireless receiving stations 29 with news, these receivers can transfer this news to further receivers 30 which lie in their spheres by means of local wire systems, for instance, low tension lighting networks. For this purpose it is only necessary to amplify the received radio frequency waves and to transfer them to the wire system. Of course, the stations 29 can also be fitted with transmitting aeri- als in order to be able to transfer the news to those further receivers which have receiving aeri- als.

Fig. 6 shows the converse of Fig. 5. A wire system, for instance, a high tension long distance wire system, is supplied with energy by a central station 31. This station has a radio frequency generator which supplies the wire system with radio frequency. The radio frequency receiving stations 32, which, for instance, are arranged in the sub-stations of the wire system, get the news and propagate it in their districts by means of aeri- als which, for instance, are effected by separately excited tube transmitters, so that the news can be received by the receivers 33.

It is obvious that in accordance with what has been said hereinbefore, the sub-stations 32 may be fitted with apparatus such as described in connection with Fig. 1 whereby the sub-stations may further propagate the signals to receivers or further sub-stations by wireless and by wire simultaneously.

Further advantages can be attained in some of the described embodiments of the invention by the use of directive wireless transmitters. If, for instance, a directive transmitter is employed in those cases in which the radio frequency waves are transferred at the same time on both ways from the transmitter to a receiver, further energy can be saved, still more than before mentioned. If radio frequency waves are used for the transmission of news in a wire system in which lines of a certain direction are missing, it is appropriate to connect the radio frequency generator to an aerial particularly radiating to that direction in order also to be able to transmit news to that direction.

Another important embodiment of the invention is schematically drawn in Fig. 7. A directive wireless transmitter 34 has a characteristic curve of the sphere of action similar to the shape of curve 35. All the receiving stations which lie in about the direction of the lines 36 then receive the news of this transmitter, but not the station 37. If this latter, however, lies within the sphere of a wire system 38 which also passes near the trans-

mitting station 34, it can also be supplied with news by this transmitter by suitably coupling transmitter and receiver to the wire system 38. In this way such receiving stations which
5 lie within the dead angles or dead spaces of directional transmitters can also be connected to these transmitters.

Having described several embodiments of my invention, I am entitled to all modifica-
10 tions thereof as fall fairly within the spirit and scope of the following claims:

1. In a communication system the combination of means for transmitting radio frequency oscillations by wireless in a direc-
15 tional manner to one group of stations and means for simultaneously transmitting at the same radio frequency by wire to another group of stations without the range of said directive transmission

20 2. In a communication system, means for generating signal modulated electrical energy, means for electro-magnetically radiating a portion of the energy so generated, and means for simultaneously transmitting
25 over wire another portion of the signal modulated energy, the amount of energy radiated electromagnetically being greater than that transmitted over wire and the energy sent by wire being transmitted to a locality poorly
30 reached by the energy electromagnetically radiated.

3. In a communication system, the combination of means for generating signal modulated electrical energy, means for elec-
35 tromagnetically radiating a portion of the energy so generated to a plurality of radio receiving stations, and means for transmitting by wire another portion of the energy so generated to another plurality of stations
40 substantially unaffected by the electromagnetic propagation, the amount of energy transmitted by wire to the last mentioned group of stations being considerably less than the amount of energy electromagnetically ra-
45 diated.

4. In a communication system, means for generating signal modulated undulating electrical energy, means for transmitting by
50 wire the energy so generated to a plurality of sub-stations and means at each sub-station for simultaneously transmitting by wire and by electromagnetic wave radiation the energy received to a plurality of independent re-
55 ceivers, the amount of energy radiated at each sub-station being greater than the amount of energy transmitted over wire.

AUGUST BECKMANN.