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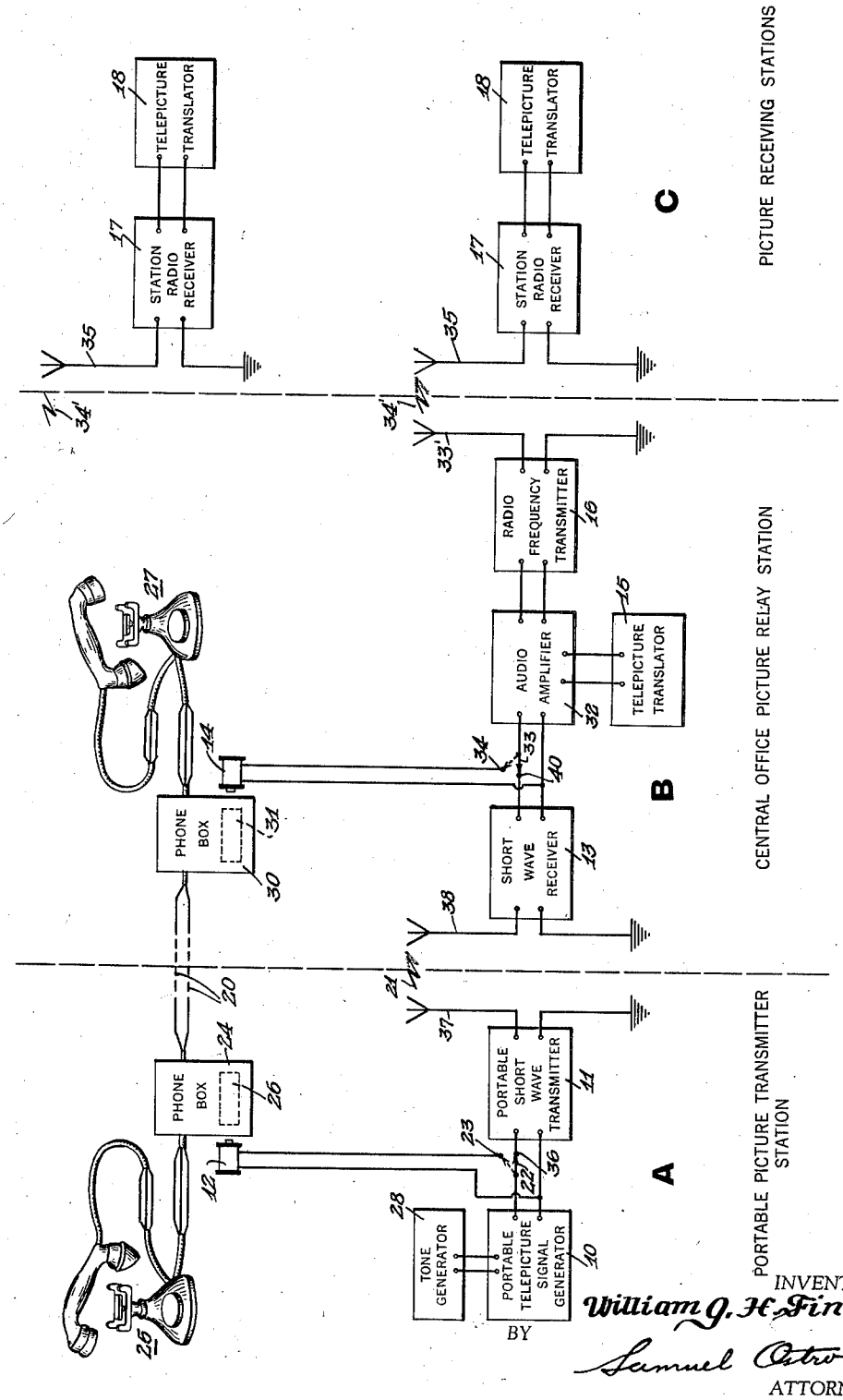
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Feb. 16, 1937. W. G. H. FINCH 2,071,227

PORTABLE TELECOMMUNICATIONS SYSTEM

Original Filed Feb. 26, 1936



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PORTABLE TELECOMMUNICATIONS SYSTEM

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Original application February 26, 1936, Serial No. 65,869. Divided and this application May 18, 1936, Serial No. 80,313

8 Claims. (Cl. 250—8)

My invention relates to telecommunications systems and more particularly relates to novel apparatus for and methods of transmission of pictures to remote points, and is a division of the parent application Serial No. 65,869, filed February 26, 1936, which matured into Patent No. 2,047,863 on July 14, 1936.

The widest use which telepicture systems today enjoy is in connection with newspaper service where pictures of important news events are transmitted from or near its source to newspaper offices for publication. For such use, it is highly desirable that the picture be transmitted as near to the scene as practicable. Heretofore, it has been proposed to use telephone lines which are usually available at almost any place for the transmission of pictures.

Inasmuch as the telephone company, however, does not permit any interconnection by a subscriber to its lines, it has been necessary to find some other than physical connection means for transmitting picture signals over the telephone lines. It has been proposed that this might be accomplished by acoustic coupling to the telephone line. Such a system comprised a loud speaker unit which transformed picture signals into corresponding sounds which in turn were impinged on the usual telephone microphone.

Although the acoustic method of inducing picture signals into the telephone line has still been proposed as recently as within the past few years, it has many inherent defects which render it impractical. The more serious of the many drawbacks of such an arrangement are the distorted frequency response characteristic of the usual loud speaker, and the even more distorted frequency response characteristic of the carbon microphone ordinarily used in telephone systems. Although for the transmission of speech, poor frequency characteristics are not material, as the ear tends to correct for audible distortions, they are serious in connection with telepicture systems where distortion would be visibly evident on the received picture.

I have discovered a novel electric coupling to the telephone lines which has a linear frequency characteristic with respect to the signals transmitted thereby. Specifically, my system contemplates a novel method of inductively inducing picture signals into the telephone line at the transmitter by a novel portable member which may be applied to any telephone subscriber station box.

The transmission of low frequencies, for example, frequencies below 25 cycles, is greatly attenuated in present telephone systems. Communication requiring signals below 25 cycles may accordingly not be directly transmitted thereby. By modulating an audio frequency carrier wave with such signals, they may then be readily transmitted over the telephone system. The original telecommunications signals are then obtained by demodulation at the receiver. The electrical inducing means of my present invention provides for the linear transmission and reception of such carrier signals. In telegraphy, printing telegraphy and picture transmission systems, such audio frequency carrier operation is preferable.

Among the advantages other than the well known economic advantages, of utilizing a telephone system for telecommunications which my novel coupling means makes available, is the utilization of a portable transmitter. A newspaper reporter, for example, provided with my novel coupling arrangement may be provided with a portable transmitter which he can employ at any telephone station for transmitting to his main office a picture which has immediate news value. In doing so, he will in no way interfere with the normal operations of the telephone line other than to utilize it as any subscriber when he lifts the phone off the hook.

In accordance with one phase of my present invention, I contemplate transmitting the signals induced into the telephone line to the nearest of a number of strategically placed radio transmitting stations for the purpose of either simultaneous or subsequent transmission of the picture signals from such station. This arrangement would not only reduce the telephone costs but would also provide quicker service for national coverage.

In accordance with another phase of my present invention, I contemplate a portable transmitter which radiates a short wave signal modulated in accordance with the picture signals to be received by the nearest of the strategically placed radio stations for re-transmission either simultaneously or subsequently as desired. Inasmuch as these transmitting stations are placed at centralized points of activities of a national newspaper service, the range of the portable radio transmitter need not be very great and accordingly makes possible a relatively light, low-powered unit.

In a preferred modification, I combine these two phases of my invention so that the telepicture transmitter is readily adaptable for transmission

either over a telephone system or over a short wave channel.

Both in the case of the modulated carrier signals over the telephone lines and in the case of the radio carrier transmission, provision is made for automatic signal level control, in a manner well known in the art, to compensate for any variations in the transmission characteristic and insuring a properly shaded received telepicture.

It is accordingly an object of my invention to provide a novel system for the transmission of telepicture signals from a portable transmitter by electrical coupling to a local telephone line to the nearest of a group of radio transmitters for simultaneous or subsequent retransmission thereby to other receiving stations.

Another object of my invention is to provide a novel system of telepicture transmission whereby a portable radio transmitter radiates the telepicture signals to one or a group of radio transmitters for simultaneous or subsequent retransmission.

A further object of my invention is to provide a novel portable telepicture transmission system adaptable for operation by coupling to a telephone system or for radio transmission to a central receiving station.

These and other objects of my invention will become evident in the following description in connection with the drawing which is a schematic electrical diagram of a preferred modification of the telepicture communication system of my novel telecommunication system.

For newspaper work it is very desirable to have a telepicture transmitter which an operator or reporter carries to the scene where pictures are to be taken. The portable picture transmission station A essentially comprises a portable telepicture signal generator **10**, a portable short wave transmitter unit **11** and an electrical induction coil **12**. The picture developed at the scene is inserted into the telepicture generator **10** and the corresponding picture signals are transmitted to the nearest newspaper station in a manner to be described.

A newspaper service may have a plurality of radio transmitter-receiver stations positioned at strategic locations over the nation. These radio stations are equipped to receive and retransmit telepicture signals. The central office picture relay station B essentially comprises a short wave receiver **13** and electrical pick-up coil **14**, a telepicture translator **15** and a radio frequency transmitter **16** for simultaneous transmission over a standard radio frequency channel. The central office station B records the received picture from station A at the translator **15** and relays or reradiates the telepicture signals to the stations of the newspaper service in a manner to be hereinafter described. The picture receiving stations C are located in other newspaper offices which are to obtain replicas of the picture transmitted at station A and essentially comprise a station radio receiver **17** tuned to the relay station B transmitter **16**.

The portable picture transmitter station A is operable over the telephone lines **20** or over the short wave channel **21** in accordance with the position of the switch **22**. With switch **22** closed on contact **23** the inducing coil **12** is directly connected to the output of the portable telepicture signal generator **10** and the telepicture signal currents flow through the solenoid of the device **12**. The principle of the electrical induction of the telepicture signals across a telephone system without physical interconnection thereto forms the basis of the parent application Serial No. 65,869 hereinabove referred to. The solenoid **12** is clamped onto the local box **24** of the telephone station **25**. The position of solenoid **12** is preferably co-axial with the induction coil **26** within the phone box **24** for optimum signal induction. A preferred physical embodiment for the solenoid **12** and its clamping and adjusting mechanism is disclosed in my co-pending application Serial No. 70,591, filed Mar. 24, 1936, which matured into Patent No. 2,048,604 on July 21, 1936.

The operator of the portable transmitter A office B from any telephone subscriber station diate news value directly to a newspaper central office B' from any telephone subscriber station such as **25**. He phones in a regular manner from his station **25** to establish communication with the telephone station **27** at the central office B. The drawing shows the hand-set off the base of the respective receivers **25** and **27** to indicate the establishment of an interconnection between the stations **25** and **27**. The interconnection between stations **25** and **27** is through the land wires indicated at **20** which include repeater stations, battery ringers and other central telephone office equipment and need not be described herein. The portable telepicture generator **10** contains a scanner mechanism which translates the shading of the picture to be transmitted into corresponding electrical variations. A tone generator **28** is utilized at the signal generator **10** to provide an audio frequency carrier wave for the picture signals in order to suitably transmit the telepicture frequency band over telephone lines **20**. Signal generator **10** contains audio frequency amplification to provide sufficient energization of the solenoid **12** in order to induce signals of sufficient strength across the telephone system **20**.

The phone box **30** of telephone receiving station **27** contains an induction coil **31** through which the induced telepicture signals flow. A pick-up solenoid **14** is placed in operative relation with the induction coil **31** to electromagnetically intercept the telepicture signals and impress them upon the input of audio amplifier **32** when the switch **33** is closed on contact **34**. Audio amplifier **32** amplifies the telepicture signals sufficiently to provide sufficient energy to actuate the telepicture translator **15**. The telepicture translator **15** is controlled by the received telepicture signals to build-up a replica of pictures transmitted from station A. Translator **15** is maintained in proper synchronism with the signal generator **10** of station A in a suitable manner, for example, as described in my application Serial No. 65,869 supra.

If the audio frequency carrier induced to the telepicture signals by the tone generator **28** is to be eliminated from the reproduced picture at translator **15**, the translator **15** is provided with a demodulator to rectify the tone and impress the original picture signal variations upon the scanning mechanism thereat.

It may be desirable to simultaneously re-radiate the picture signals being radiated by the portable transmitter A by a powerful radio station transmitter for reception at distant newspaper receiving stations. The output of the audio amplifier **32** is connected to the relatively powerful radio frequency transmitter **16** which radiates a radio frequency carrier wave modulated in accordance with received picture signals over antenna **33'**.

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The frequency of the radio frequency transmitter 16 may lie in a commercial frequency band and need not at all be of the same frequency as that of the carrier of the short wave transmitter 11 of portable station A. The modulated radio frequency signals are transmitted from antenna 33' across radio channel 34' to corresponding receiving antenna 35. The station radio receivers 17 are located at the plurality of newspaper receiving stations to receive the picture signals from a central office picture relay station B. The station radio receivers 17 detect and amplify the audio frequency telepicture signals of the radio carrier and impress them upon their corresponding telepicture translators 18 which are similar to the telepicture translator 15 of station B.

The central office station B serves as a picture relay station so that simultaneous reception at the plurality of the newspaper offices may be effected from a portable short wave transmitter station A having a picture of immediate news value. The central office station B records the transmitted picture by its translator 15. The recorded picture at 15 may then be retransmitted by the transmitter 16 at a subsequent time instead of simultaneous relaying or retransmission thereby.

The portable picture transmitter A may be optionally operated over the portable short wave transmitter 11. The switch 22 is closed on contact 36 to introduce the telepicture signals to the input of the portable short wave transmitter 11. A commercial high frequency channel is preferably employed since a smaller, lighter and more portable equipment may be designed than by using long wave communication.

The useful range of the transmitter 11 may be several hundred miles so that a newspaper office or relay station corresponding to station B may properly receive the picture signals. The switch 22 closed on contact 36 conducts the telepicture signals from the portable signal generator 10 to the input of the portable short wave transmitter 11 for modulation of its carrier wave which is radiated by antenna 37 over channel 21.

The carrier wave of this portable radio transmitter 11 may be in the range of so-called microwaves, for example 60 megacycles, or in the so-called short wave range, for example 150 meters, or any other suitable range.

The corresponding short wave receiver 13 at station B is tuned to the channel 21 and its antenna 38 intercepts the modulated radio waves. The switch 33 is closed on contact 40 for the audio frequency output of the short wave receiver 13 to be impressed upon the input of audio amplifier 32. The signals at the output of the receiver 13 correspond to those picked-up by solenoid 14 from telephone box 30. The utilization of the signal output of receiver 13 is the same as hereinbefore described in connection with those from solenoid 14.

The use of simultaneous re-radiation over a more powerful radio-frequency carrier wave of picture signals having immediate news value as received from a field portable telepicture transmitter makes possible a cheap, efficient and rapid national coverage of the particular picture to all the newspaper receiving offices strategically located over the country.

The portable picture transmitter station A is designed for a minimum bulk and weight. By employing the picture size reduction and subsequent enlargement process disclosed in my copending application Serial No. 67,939, filed March 9, 1936, the telepicture signal generator 10 for scanning the picture to be transmitted may be made small and compact.

The operation of the telepicture transmitter is described in detail in the parent application Serial No. 65,869. A compensation network may be included at the signal generator 10 for changing the frequency characteristic of the transmitting equipment when using the induction solenoid 12 for flattening or making substantially linear the frequency response of transmission over the telephone system 25—27. Such a network is also described in the parent application.

The designs of the radio receivers and trans-

The design of the radio receivers and transsuitable radio equipment may readily be constructed by those skilled in the art. Suitable telepicture transmitter and translator equipment is described in my application Serial No. 65,869, although other designs may be employed in the system of my present invention. The portable picture transmitter station A is preferably designed to be selectively operable from storage batteries and from standard power lighting circuits.

It is to be understood that the portable transmitter station A is designed to be rugged and light in weight so that it is manually transportable and operable from an automobile, airplane, ship or the like. The transmitter may accordingly be readily taken directly to an out-of-the-way news scene. A photograph of the scene is snapped, developed and soon directly transmitted preferably to the nearest central office station B where it is recorded and simultaneously or subsequently re-radiated to the other receiving stations C of the telecommunication system.

Although I have described my present invention in connection with a telepicture communication system, it will be evident to those skilled in the art that other communication signals may equally well be employed using the principles of my invention, for example, telegraph, printing telegraph or the like. Modifications of my preferred embodiment are feasible and accordingly I do not intend to be limited except as set forth in the following claims.

I claim:

1. In a telepicture system, a portable transmitter, comprising means for generating picture signals in accordance with the shading of a picture to be transmitted, means for inducing said signals into one end of a telephone line at a subscriber station, means for generating a radio carrier wave including means for modulating said carrier wave in accordance with picture signals, means for radiating the modulated carrier wave, means for selectively connecting said inducing means and said means for generating the carrier wave to said picture signal generator for correspondingly transmitting said picture signals; a radio station comprising means for receiving said transmitted signals and means for simultaneously re-radiating said picture signals as a modulated second radio frequency carrier wave of greater power.

2. In a telepicture system, a portable transmitter, comprising means for generating picture signals in accordance with the shading of a picture to be transmitted, means for inducing said signals into one end of a telephone line at a subscriber station, means for generating a short-wave radio carrier wave including means for modulating said carrier wave in accordance with picture signals, means for radiating the modu-

lated carrier wave, means for selectively connecting said inducing means and said means for generating the carrier wave to said picture signal generator for correspondingly transmitting said picture signals; a radio station comprising means for receiving said transmitted signals, means for translating the picture signals to form a facsimile of said transmitted picture, means for generating a radio wave, means for modulating said radio wave by said received picture signals and radiating the second modulated radio wave; and a receiving station for translating said re-radiated picture signal waves into facsimile of said transmitted picture.

3. In a telepicture system, a portable transmitter comprising means for generating picture signals in accordance with the shading of a picture to be transmitted, means for inducing said signals into one end of a telephone line at a subscriber station including a portable solenoid attachable to the call-box of the subscriber station in cooperative relation with the induction coil therein, means for generating a short-wave radio carrier wave including means for modulating said carrier wave in accordance with picture signals, means for radiating the modulated carrier wave, means for selectively connecting said solenoid and said means for generating the carrier wave to said picture signal generator for correspondingly transmitting said picture signals; a radio station associated with a second telephone subscriber station connectible to said first mentioned station, and comprising means for selectively receiving said signals from said associated subscriber station or said transmitted radio wave, means for translating the picture signals to form a facsimile of said transmitted picture, means for generating a second radio wave, means for modulating said second radio wave by said received picture signals and radiating the second modulated radio wave substantially simultaneously with the original reception; and a receiving station for translating said re-radiated picture signal waves into facsimile of said transmitted picture.

4. In a telepicture system, a telephone line having a subscriber station at each end thereof; a portable transmitter comprising means for generating picture signals in accordance with the shading of a picture to be transmitted, solenoid means for inducing said signals into one end of said telephone line, means for generating a short-wave radio carrier wave including means for modulating said carrier wave in accordance with picture signals, means for radiating the modulated carrier wave, means for selectively connecting said inducing means and said means for generating the carrier wave to said picture signal generator for correspondingly transmitting said picture signals; a radio station associated with the other end of said telephone line comprising means for receiving said picture signals, a second source of radio frequency carrier current and means for modulating said radio wave by said received picture signals and radiating the second modulated radio wave.

5. In a telepicture system, a telephone line having a subscriber station at each end thereof; a portable transmitter comprising means for generating picture signals in accordance with the shading of a picture to be transmitted, solenoid means for inducing said signals into one end of said telephone line, means for generating a short-wave radio carrier wave including means for modulating said carrier wave in accordance with picture signals, means for radiating the modulated carrier wave, means for selectively connecting said inducing means and said means for generating the carrier wave to said picture signal generator for correspondingly transmitting said picture signals; a radio station associated with the second end of said telephone line comprising means for selectively receiving said picture signals from said telephone line and said radio wave, including electromagnetic means for cooperation with the telephone station at said second end, and a short wave radio receiver for said modulated carrier wave, means for translating the received picture signals to form a facsimile of said transmitted picture, means for simultaneously re-radiating said picture signals as a modulated second radio frequency carrier wave of greater power; and a receiving station for translating said re-radiated picture signal waves into a facsimile of said transmitted picture.

6. In a signalling system, a portable transmitter comprising means for generating electrical signals to be transmitted, means for inducing said signals into one end of a telephone line at a subscriber station, means for generating a radio carrier wave including means for modulating said carrier wave in accordance with the signals, means for radiating the modulated carrier wave and means for selectively connecting said inducing means and said means for generating the carrier wave to said signal generator for correspondingly transmitting said signals; a radio station comprising means for receiving said transmitted signals and means for simultaneously re-radiating said signals as a modulated second radio frequency carrier wave of greater power.

7. A portable signal transmitter for a signalling system having a central translating station including a telephone subscriber station and radio receiving apparatus comprising: means for generating electrical signal to be transmitted; means for inducing said signals into the telephone line at a second subscriber station, said inducing means being physically attachable and detachable to said second subscriber station; a radio frequency carrier wave generator including means for modulating said carrier wave in accordance with electrical signals; means for radiating the modulated carrier wave; and means for selectively connecting said inducing means and said carrier wave generator to said signal generating means for correspondingly transmitting said signals to said central translating station.

8. A portable picture signal transmitter for a telepicture system having a central translating station including a telephone subscriber station and radio receiving apparatus comprising: means for generating picture signals in accordance with the shading of a picture to be transmitted; a solenoid for inducing said signals into the telephone line at a second subscriber station, said solenoid being physically attachable and detachable to said second subscriber station; a radio frequency carrier wave generator including means for modulating said carrier wave in accordance with picture signals; means for radiating the modulated carrier wave; and means for selectively connecting said solenoid and said carrier wave generator to said signal generating means for correspondingly transmitting said signals to said central translating station.

WILLIAM G. H. FINCH.