

April 25, 1944.

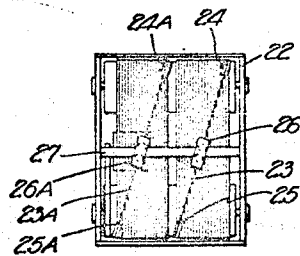
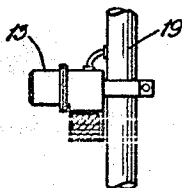
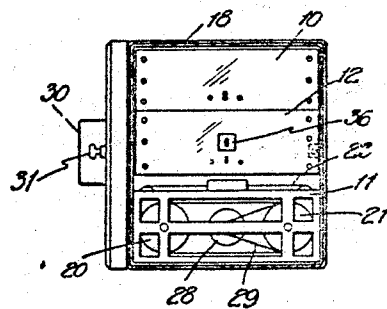
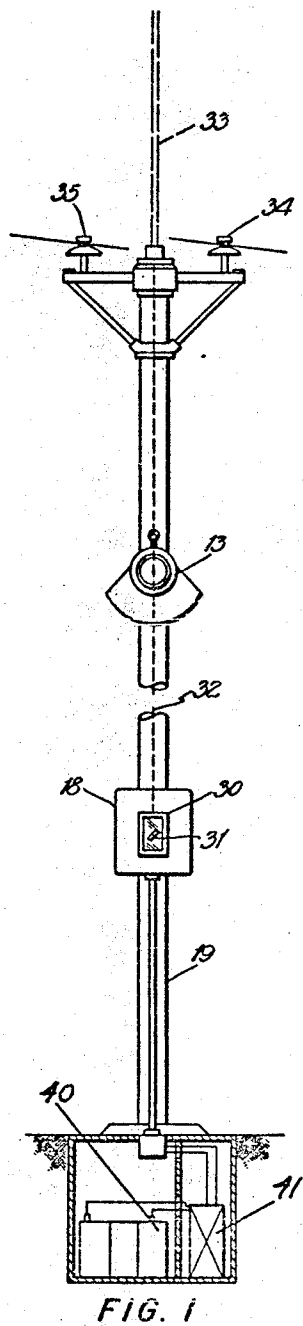
W. S. HALSTEAD

2,347,477

SIGNALLING SYSTEM

Filed Sept. 8, 1941

7 Sheets-Sheet 1

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SIGNALING SYSTEM

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7 Sheets-Sheet 2

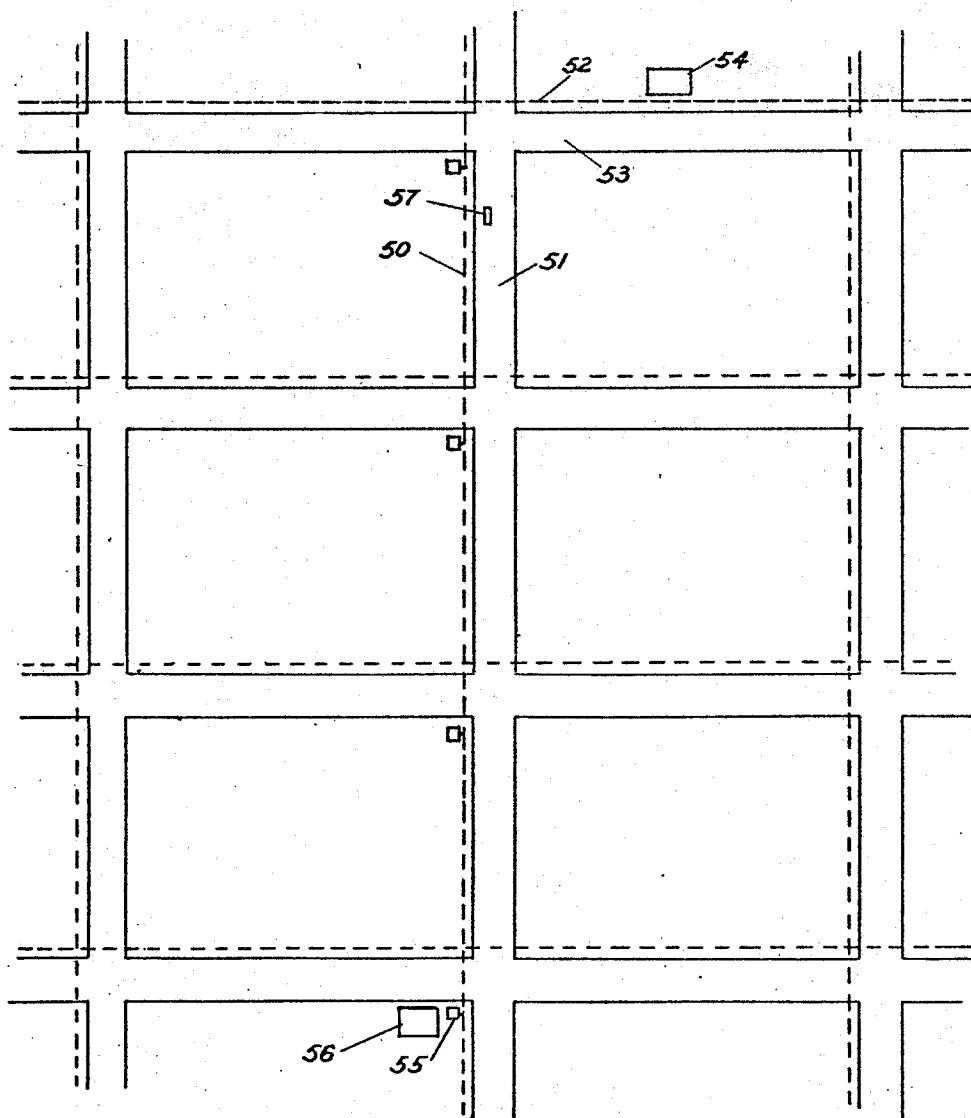


FIG. 5

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SIGNALING SYSTEM

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7 Sheets-Sheet 3

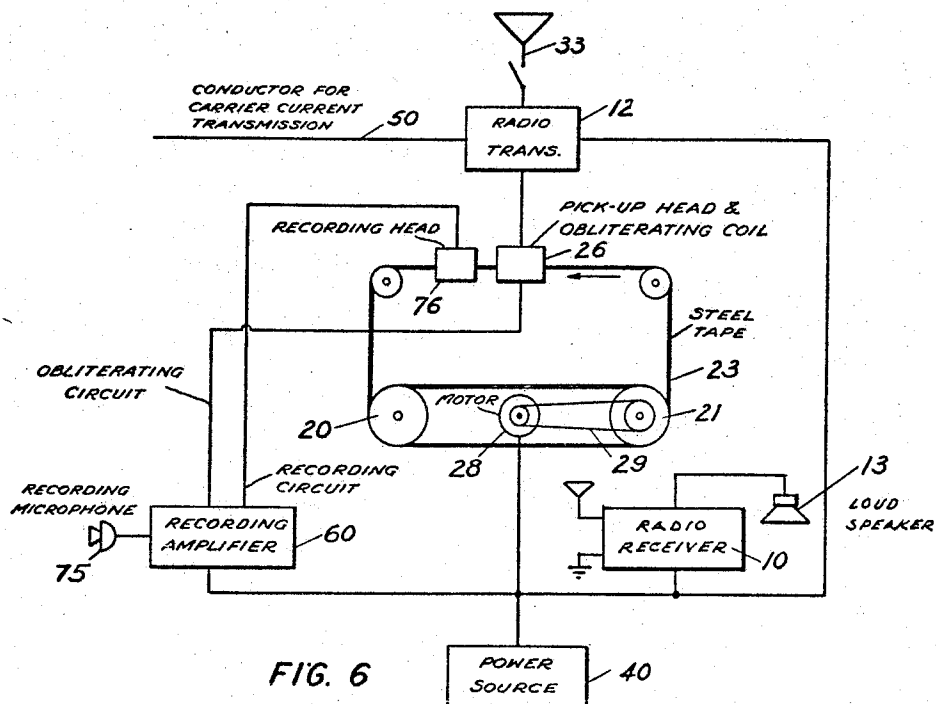


FIG. 6

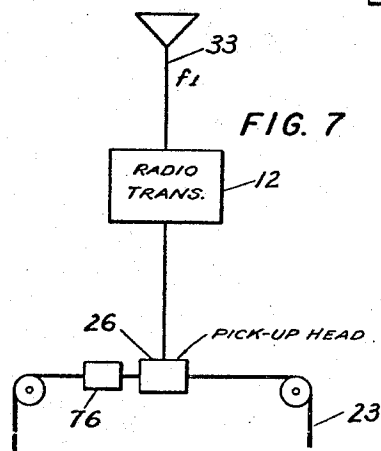


FIG. 7

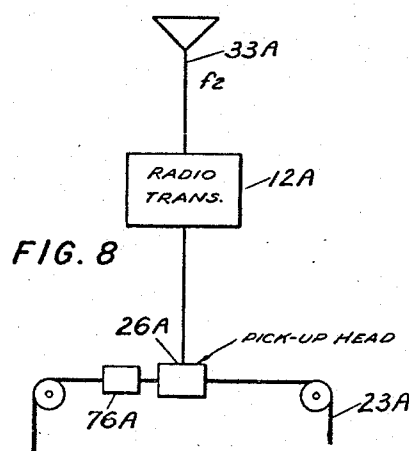


FIG. 8

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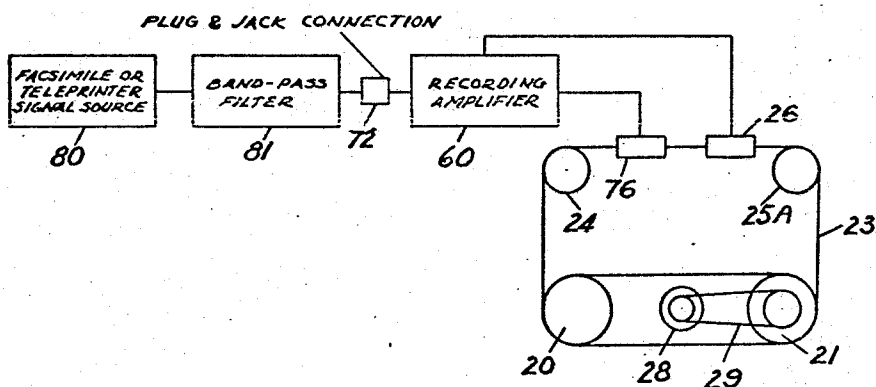
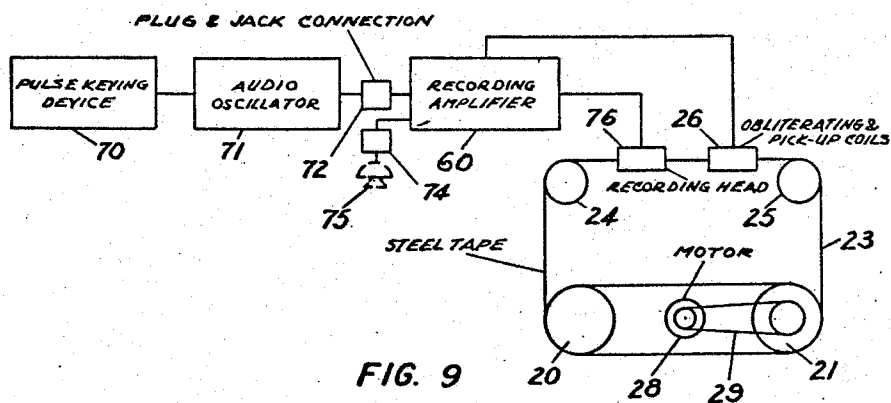
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SIGNALING SYSTEM

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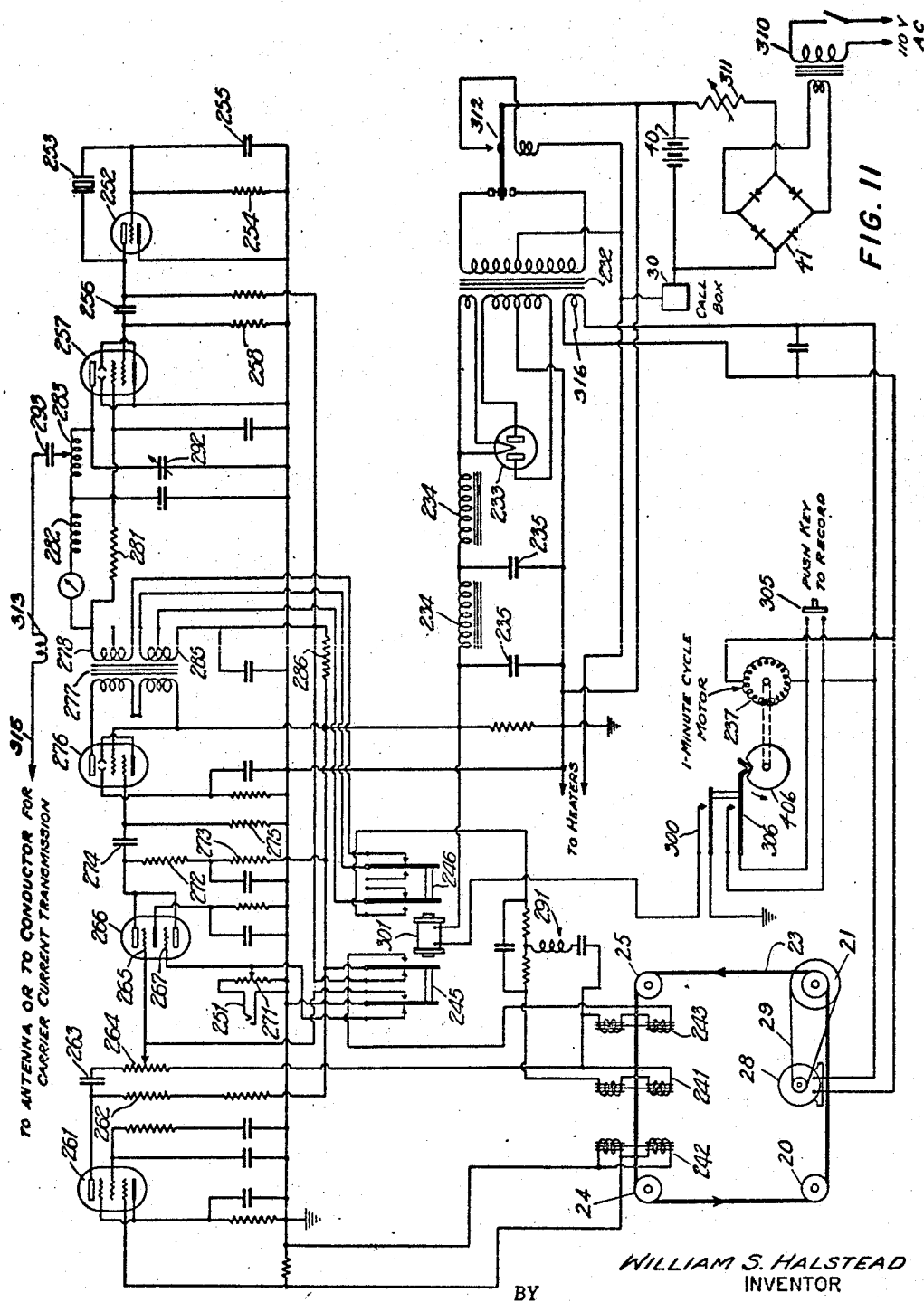
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SIGNALING SYSTEM

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7 Sheets-Sheet 5



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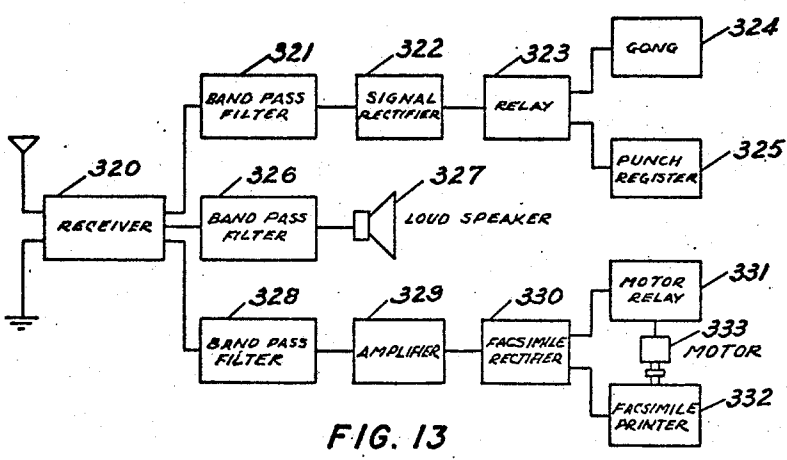
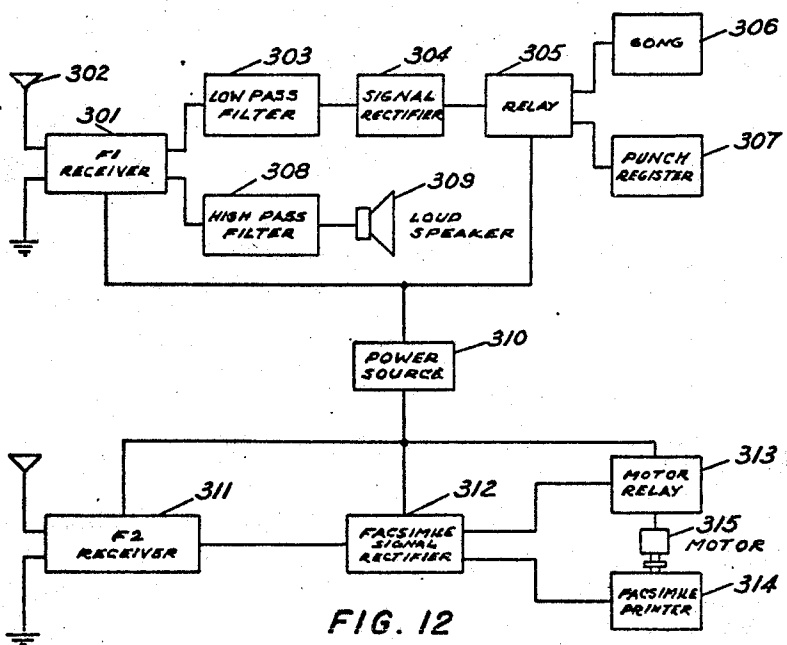
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7 Sheets-Sheet 7

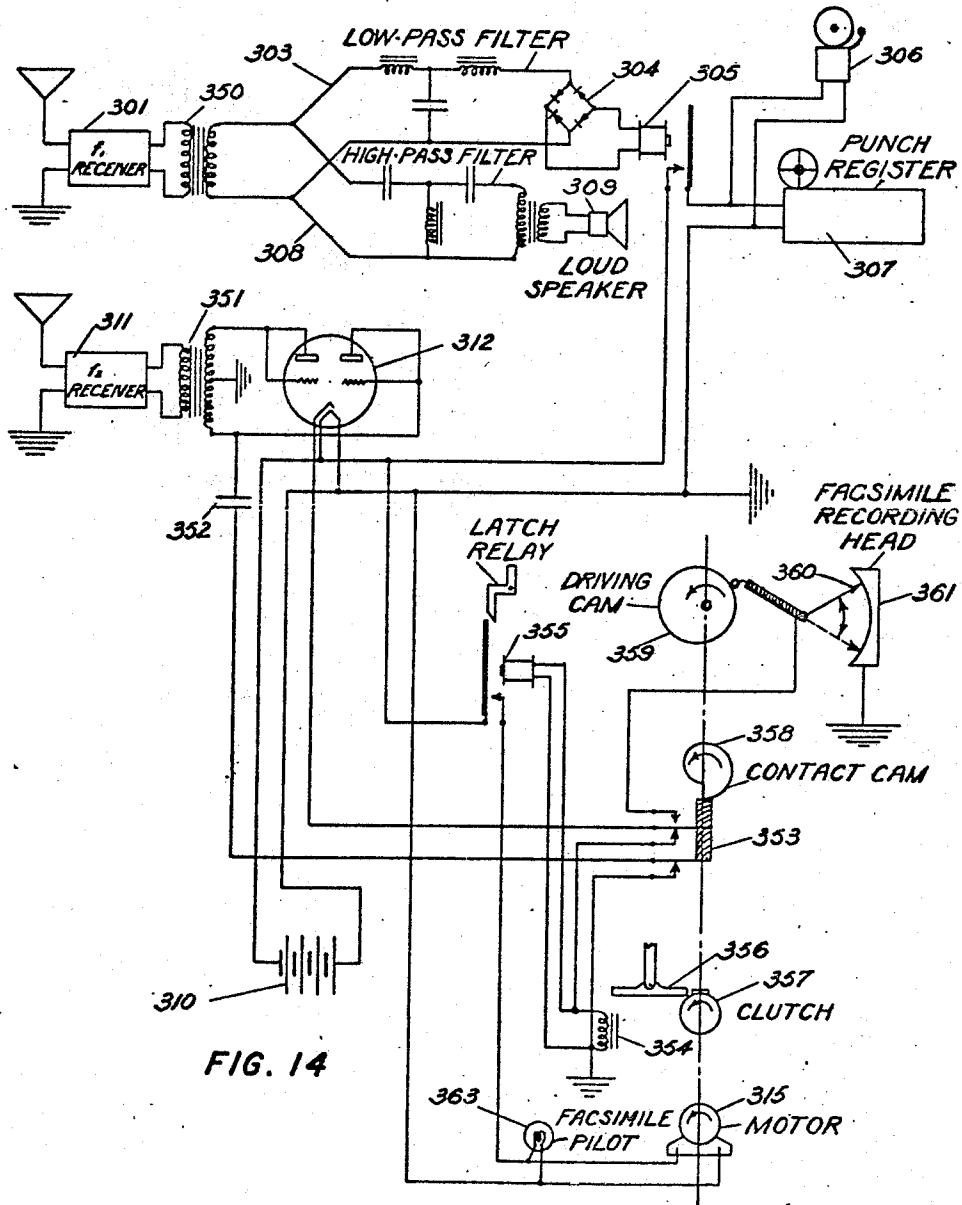


FIG. 14

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UNITED STATES PATENT OFFICE

2,347,477

SIGNALING SYSTEM

William S. Halstead, Huntington, N. Y.

Application September 8, 1941, Serial No. 410,069

9 Claims. (Cl. 178—5.6)

19.9
17-337

This invention relates in general to signaling systems and is more particularly concerned with automatic means for transmission of aural signaling intelligence by carrier wave energy to cooperating receivers located within a predetermined signaling zone.

In my co-pending application, Serial No. 260,644, filed March 8, 1939, now Patent No. 2,255,055, granted Sept. 9, 1941, of which this application is a continuation in part, a signaling system was disclosed in which a repeating signal-record storage device in combination with a carrier wave transmitter having means for establishing electric wave signaling along lanes of traffic was employed in automatically conveying pre-recorded aural intelligence addressed to traffic within the signaling zone. Means were also disclosed in the co-pending application by which the transmission of intelligence was initiated automatically through the operation of an electric switching device associated with a relay control circuit.

The system of this invention is an improvement on that disclosed in the earlier application and likewise employs a repeating signal-record device of magnetic-tape or other suitable type operating in conjunction with a carrier wave transmitter having means for establishing electric wave signaling to traffic within an effective signaling zone associated with the transmitting system, and includes switching means for automatically initiating repetitive transmission of a pre-recorded communication carried by the signal-record medium.

It is an object of the present invention to provide automatic means for the transmission of voice signals, coded impulses, and facsimile or teleprinter signals to vehicles as well as to fixed stations within the signaling zone associated with the carrier wave transmitter after the transmitting system has been placed in operation by the operation of an initiating device such as a call box or electric relay connected with a control circuit, subsequent reproduction of the signals at the receiving points being in aural or visual record form.

It is an additional object of the present invention to provide automatic means whereby pre-recorded voice signals, coded impulses, facsimile or teleprinter signals identifying the location of the point of origin of the signals may be automatically transmitted in repetitive manner without mutual interference to vehicles or fixed stations within a predetermined signaling zone, the signals being reproduced at receiving points in

aural and visual form through selective operation of existing loudspeakers, punch recorders, facsimile printers or teletypewriters.

Another object of the invention is to provide a signaling system having automatic means at a coacting receiving station for receiving voice and teleprinter signals as automatically transmitted from one or more of a plurality of remote signal transmitting stations, each of said transmitting stations having an automatic repeating signal-record device with pre-recorded voice and teleprinter signals impressed thereon, and either manual or automatic means for initiating operation of each of said signal transmitting stations to cause the pre-recorded signals of the signal transmitting station to be automatically transmitted in repetitive manner for reception in repetitive manner at the receiving station, the received signals being automatically reproduced in aural and visual record form.

A further object is to provide a signaling system employing a plurality of signal transmitting stations each including a signal storage means having a record of facsimile or aural intelligence impressed thereon, and a central receiving station for automatically receiving the transmitted facsimile or voice signals from any of the transmitting stations in the system to provide a reproduction of the transmitted facsimile and voice intelligence without employment of a facsimile transmitter at the signal transmitting stations, said signal storage means serving as a source of the transmitted facsimile and aural signals.

Other and further objects reside in the constructional and circuit arrangements for effecting automatic operation of signal record apparatus, transmission equipment, and cooperating receiving and recording apparatus as set forth in the specification herein following and by reference to the accompanying drawings in which:

Figure 1 is a front elevational view of an electric light pole showing attached thereto signal storage apparatus, a carrier wave transmitter, and a signal initiating device employed in placing the apparatus in operative condition for automatic transmission of pre-recorded intelligence to remote receiving points.

Figure 2 is a front elevational view of the interior of a metal case shown on the electric light pole of Figure 1, the case containing repeating signal record and carrier wave apparatus employed in the system of the invention.

Figure 3 is a plan view of a preferred form of signal recording and reproducing machine of

magnetic-tape type which is enclosed in the lower section of the case shown in Figure 2.

Figure 4 is a side elevational view of a downwardly disposed loudspeaker which is employed at the transmitting location for the purpose of receiving an acknowledgment from a central station of the reception of the automatic signal transmission.

Figure 5 is a plan view of a plurality of intersecting streets with an illustrative disposition of automatic transmitting stations of the system of the invention at street corners.

Figure 6 is a schematic block diagram illustrating the combination of carrier wave and repeating signal record apparatus, together with control equipment employed in the system of the invention.

Figure 7 illustrates in block diagram a signal record device having an associated carrier wave transmitter and antenna.

Figure 8 illustrates the same signal record device with independent pick-up head connected to a second carrier wave transmitter and antenna.

Figure 9 is a schematic block diagram illustrating an arrangement of apparatus employed in recording coded control impulses or voice signals on the recording device employed in the system.

Figure 10 illustrates the combination of units employed in recording facsimile or teleprinter signals on the recording device shown in Figure 9.

Figure 11 is a circuit diagram of a present preferred form of recording, reproducing and carrier wave transmitting apparatus employed in the system.

Figure 12 is a schematic block diagram showing the arrangement of reproducing and recording apparatus at a central receiving station cooperatively associated with the signaling system.

Figure 13 is a block diagram showing the arrangement of parts employed in a modification of the receiving system illustrated in Figure 12.

Figure 14 is a schematic diagram illustrating circuit connections employed in receiving aural signals and in recording signaling intelligence in permanent visual form at the central receiving station.

Referring to the drawings in detail wherein like reference characters indicate corresponding parts throughout the several views, a carrier wave transmitter 10, Figure 2, is disposed in a weather-proof case 18, located on an electric power pole 19, Figure 1. A signal record device, such as a magnetic tape machine 11, is also enclosed in the same case as shown.

Carrier wave energy from the transmitter 10 may be applied to an antenna 15, or to any conductor, such as the electric power lines or other cables extending throughout the signaling zone with which the carrier wave transmitter is associated. The transmitting equipment is preferably battery operated, as subsequently described, in order that operation of apparatus may be unaffected by failures of commercial power circuits. In the particular arrangement of apparatus shown herewith, the storage battery 16 and associated trickle charger 17 are enclosed in a weatherproof steel case imbedded in the ground at the foot of the pole.

A signal initiating device such as call box 30, of any well-known type, is connected in the storage battery circuit in such a manner that when the contacts of the initiating device are closed, power will be applied to the transmitting equipment, and pre-recorded intelligence, such as words

or coded signals identifying the point of origin of the transmission, will be automatically and continuously transmitted by carrier wave means to fixed stations, such as police or fire stations located within the signaling zone, and simultaneously to all radio-equipped patrol cars within the zone.

Thus, if a short message such as "This is alarm 25, First National Bank, Forty-fifth Street and Madison Avenue," has been pre-recorded in permanent form on the signal record carrier, these words will be repeated continuously at all police stations within the zone and in all patrol cars within the vicinity. Acknowledgement of reception of the signals may be provided by means of receiver 12, which is tuned to a municipal frequency, and loudspeaker 13.

In order to control the operation of existing alarm devices located at police or fire headquarters, coded impulse signals within a predetermined audio-frequency range may be recorded on the same steel tape that is employed to carry the recorded voice signals. Facsimile or teletypewriter signals, with associated control signals may be pre-recorded on the steel tape to effect automatic production of a permanent written record of the transmission at the receiving point.

A present preferred form of construction of the magnetic tape signal record machine is shown in Figures 2 and 3, in which rollers 20 and 21, fabricated of Bakelite or other suitable material are horizontally disposed between bearings in frame 22, Figure 3. In the illustrative arrangement of the recording device, two steel tapes or wires 23 and 23A, which serve as signal record carriers, are helically wound around the two rollers to form separate sections, as shown. The first and last loops of tape 23 are joined together by cross-over rollers 24 and 25 thereby forming an endless loop. The first and last loops of tape 23A are joined in similar manner, by cross-over rollers 24A and 25A. The pick-up heads, 26 and 26A, are disposed midway on the cross-over loop of tapes 23 and 23A, and are supported in position by bracket 27. Electric motor 28, Figure 2, drives roller 21 by means of a belt or chain 29, thereby moving tapes 23 and 23A.

As shown in the block diagram of Figure 6, the pick-up head 26, of the magnetic tape machine is connected to the input circuit of radio transmitter 12. The obliterating coil of the pick-up head is connected to a recording amplifier, 60, of which the circuit details are shown in Figure 11. The recording head, 76, is connected to the output circuit of recording amplifier 60, as also shown in Figure 11, to be described hereinafter in detail. The output circuit of transmitter 12, may be connected to a conductor, 50, extending along a lane of traffic, as shown in the street plan of Figure 5, or to an antenna, 33, Figure 1. The magnetic tape machine, recording amplifier 60, and transmitter 12, are operated by electric power supplied by a source of power 40, such as the storage battery shown in Figure 1. The apparatus is normally maintained in inoperative condition, no power being applied to the apparatus from the power source 40. A call box 30, of any conventional type, or other initiating device may be employed adjacent to the transmitting location in order to apply electric power from power source 40 to the associated equipment. Radio receiver 10, is also connected in parallel with the power circuit of the magnetic tape machine and radio transmitter in such manner that the receiver is

energized by power source 40 when the initiating device 30 is placed in operation. Loud speaker, 13, connected to the output circuit of receiver 10, is employed to reproduce the receiving signaling energy. In normal operation the receiver is tuned to the municipal frequency, differing from that employed by transmitter, 12. It will thus be observed that after the transmitter 12, has been placed in operation through actuation of the control circuit to the call box, or other initiating device, pre-recorded signaling intelligence, such as a police or fire alarm, identifying the location of the point of origin of the signal, may be received at a central station within the signaling zone associated with the transmitter on any police or fire vehicles proceeding within the signaling zone. At the same time, by means of receiver 10, and loudspeaker 13, central authorities may acknowledge the signal and provide advice to the person turning in the alarm.

It is pointed out that in the majority of small municipalities, power lines customarily extend parallel to lanes of traffic, as represented by conductors 50 and 52 of Figure 5. These conductors ordinarily run in proximity to the police or fire stations, such as 54. Application of carrier wave energy to one of the power line conductors, such as 35, Figure 1, or to any other conductor, 50 and 52, Figure 5, will produce an effective electromagnetic field extending longitudinally along the conductor for a distance of several miles, or for the length of a desired signaling zone, and laterally for a short distance. In practice it has been determined that the lateral extent of the electromagnetic field surrounding a power line or other conductor disposed parallel to a traffic lane is sufficient to be effective throughout the width of a highway or city street. If a suitable radio receiver is installed within vehicles, the electromagnetic field may be utilized effectively in conveying signaling intelligence to the occupants of vehicles proceeding along traffic lanes, such as 51 and 55. By the same transmission means, the carrier wave energy may be guided to a central receiving station, 54, where suitable receiving and recording apparatus may be located. In this manner, through utilization of existing roadside conductors, the signaling system of the invention may be employed without the use of antennas or space-radiated wave energy. However, in municipalities to which radio frequencies have been assigned for communications purposes, the space radiation method employing an antenna 33, may be preferable, particularly in extensive metropolitan areas.

In order that a printed record of a received signal may be provided at central station 54, control signals for operation of a punch register, facsimile recorder, or teletypewriter may be recorded on the same tape employed to carry the recorded voice signals. In order to control the operation of a punch register, 307, Figure 14, audio-frequency signals having a frequency below 200 cycles may be employed to provide selective actuation of the visual recording device at the receiving station without interfering with intelligent reception of voice signals transmitted on the same carrier wave frequency.

In the arrangement of apparatus for recording control signals on the steel tape, as illustrated in Figure 9, an audio-oscillator 71, is employed as a source of low frequency (200 cycle) signal energy. Any well-known keying device 70, may be employed to apply the audio-frequency energy to the input circuit of recording amplifier 60 in accord-

ance with a desired keying sequence or coding arrangement. This recording operation may be conducted at the location where the transmitting equipment is installed, or the audio-frequency control signals may be pre-recorded on a phonograph disc or other record-bearing medium at any desired point and subsequently transferred from this record to the steel tape employed in the transmitting equipment. A plug and jack connection 72, is provided in the input circuit of recording amplifier 60, as shown in detail in Figure 11, to facilitate connections at the transmitting point. A microphone 75, may also be connected by means of plug and jack 74, to the input circuit of the recording amplifier.

In similar manner, facsimile or teleprinter signals may be recorded on the steel tape employed at the transmitting point. One arrangement of apparatus to effect this purpose is illustrated schematically in the block diagram of Figure 10. A source of facsimile carrier signals 80, such as a facsimile scanner, not illustrated, may be connected to the input circuit of the recording amplifier 60, to effect recording of the facsimile signals on the steel tape 23. The audio-frequency facsimile carrier signal may be limited to a predetermined band-width by means of a band pass filter 81, connected between the signal source and the recording amplifier. The frequency of the facsimile carrier signal may, for example, be in the neighborhood of 7,000 cycles, with side-bands extending over a frequency range of 2,000 cycles.

If desired, the facsimile signals may be recorded on the same steel tape employed to carry a magnetic record of voice and coded pulse signals. By virtue of their frequency separation, the three types of signals may be transmitted and received simultaneously, without appreciable mutual interference, provided that suitable audio-frequency filters, such as band pass filters 321, 326 and 328, Figure 13, are employed to separate the various signals at the receiving point. However, it may be desirable to record the facsimile signals on a separate tape, such as 23A, Figures 3 and 8, having individually associated therewith transmitter 12A operating on a frequency different from that employed by transmitter 12. In this case effective separation of the facsimile and voice signals will require the use of separate receivers 301 and 311, Figure 12.

Referring to the circuit diagram of the recording and transmitting system, as shown in Figure 11, in which is shown a present preferred arrangement of parts, battery 40, is employed as a source of power. The battery is kept in a charged condition by means of a rectifier 41, which is connected across the low voltage winding of transformer 310 having a primary circuit connected to a source of commercial power. A voltage reducing resistor 311 is employed in series between the rectifier and storage battery to provide the correct charging voltage. A call box 30, is connected in series between storage battery 40, and the circuits of the transmitting equipment as shown. Vibrator 312 is disposed in the primary circuit of transformer 232, the vibrator being placed in actuation by the operation of call box 30. A secondary winding, 316, on transformer 312, supplies alternating current energy of desired frequency to motor 28 of the magnetic tape machine and recording timer motor 237. Another secondary winding of transformer 232, as shown, provides operating voltage for the heater of the rectifier 233. An additional winding provides high voltage to the anodes of rectifier 333. The

high voltage provided by the rectifier is filtered by means of chokes 234 and condensers 235. The heaters of all amplifying and transmitting tubes are directly energized by the battery, as indicated.

The source of motive power, 28, continuously moves steel tape 23 through the pick-up heads and recording heads, consisting of pick-up coils 242, recording coils 241, and obliterating coils 243. The magnetic variations in the steel tape cause corresponding fluctuations in voltage in pick-up coils 242 when the tape is moving past the pole pieces associated with the coils, and these electrical variations are impressed upon an amplifying and modulating circuit, which will hereinafter be more completely described. By means of recording coils 241, magnetic variations corresponding to speech variations are impressed upon the tape in the recording process. Coil 243 is employed to obliterate any magnetic variations from the tape when it is desired to change a message recorded thereon.

The switch members, 245 and 246, of relay 301, are normally connected to impress the signal voltages generated in pick-up coil 242, upon the modulating circuit. In the recording position, the switch members 245 and 246 disconnect the transmitting circuits and apply signal energy from input jack 251 to the recording coils 241 after having passed through the associated amplifier circuits.

The transmitter employed in the system may preferably be of the crystal control type, as illustrated in Figure 11, and may consist of an oscillator tube 252, the frequency of which is controlled in conventional manner by crystal 253. The required grid-biasing potential is secured by means of resistor 254, and its associated by-pass condensers 255. The output of the oscillator is coupled from the anode thereof, by means of condenser 256, and resistor 258, to the grid of a power amplifier 257, which, as illustrated, is a beam power tube. The power amplifier may be of the well-known class C type, and the modulation of the carrier wave is effected within this amplifier.

During the transmission of a signal pre-recorded upon the steel tape the fluctuating voltage developed within pick-up coil 242 is transferred to the grid of a conventional amplifier 261, which is illustrated herein as a pentode. The anode circuit of this pentode is connected to the source of direct current through the load resistor 262.

The amplified signal is then coupled by means of condenser 263, and volume control 264, to a control grid 265, of another amplifying tube 260, which is illustrated herein as a duplex triode. Another control grid 267, of this tube is joined through volume control 271 to recording jack 251, in which a microphone or other source of signal energy may be connected. As indicated, both anodes of the duplex type are joined together and thus the signal appearing across load resistor 272, will depend upon the signals impressed upon both grids. Switching members 245 and 246 insure that when signals are impressed upon one grid the other is at ground potential or otherwise inoperative.

The anodes of the amplifying tube 265 are joined to the direct current source through load resistor 272, and, as indicated, through a decoupling filter 273. The amplified signal is coupled by means of condenser 274, and resistor 275 to the control grid of an amplifier 276, which pro-

vides in the output thereof a signal of sufficient amplitude to modulate the carrier current originating at the oscillator.

The anode circuit of amplifier 276 is electrically joined to the source of direct current through transformer 277, the secondary coil of which is divided and contains a plurality of taps for reasons which will be more fully described. One end of section 278 of the secondary coil of transformer 277, connects with a grid of the class C power amplifier 257 through resistor 281, and is in addition joined to the anode of tube 257 through a radio-frequency choke coil 282, and through the inductance 283, of the transmitting tank circuit. The other end of this section of the secondary coil is joined to one contact of the switching member 246. The radio-frequency choke 282, serves as filtering means to aid in preventing feed-back of radio-frequency energy in the power and amplifier circuits.

The second section 285, of the secondary coil is joined to one pole of the switching member 245, and in addition to the source of high voltage through resistor 286. The opposite end of section 285 of the secondary and the center tap thereof are in addition joined to poles of switching member 246.

Also joined to contacts of switching member 245, are both grids of amplifier tube 266, and the direct current source. The direct current source is connected to a pole of switch 245 as shown. The recording coils 241, are joined through an equalizing network 291, to a contact of switching member 246.

When switching member 245, is moved to the left, as viewed in Figure 11, and the switching member 246, is moved to the right, the system will be in transmitting position, the voltage generated in the pick-up coil 242, will be amplified by amplifier 261, and impressed upon the grid 265, of amplifier 266, while grid 267 of this tube will be grounded through a contact of switching member 245. Accordingly, the signal recorded upon the tape will be amplified by tube 266, and again by the beam power tube 276, and will be impressed on the secondary of the modulating transformer, 277.

Switching member 246, when in the position mentioned, inter-connects both sections of the secondary coil of modulating transformer 277, and switching member 245, connects one end of the secondary to the source of direct current. The transformer 277, will function when the switching members are thus oriented to modulate the carrier current supply by oscillator 252.

The anode circuit of the class C amplifier 257, contains the tank inductance 283, and variable tuning condenser 292, and through condenser 293 the modulated carrier is coupled to the conductor associated with the antenna 33, Figure 1, or cable 50, Figure 5.

When it is desired to record on steel tape 23, switching member 245 is displaced to the right and switching member 246 to the left, as viewed in Figure 11. This orientation of the switching members grounds grid 265, of the duplex type 266, and thus voltage fluctuations in pick-up coil 242 are not amplified nor passed on to succeeding amplifying stations. On the other hand, grid 267 is no longer grounded and thus electrical variations entering through jack 251 will be impressed upon grid 267 and amplified by duplex tube 266. In the movement of switching member 245 from the left to the right as described, the

resistor 286, is inserted in series between the anodes of tubes 257 and 252 and the source of direct current. This decreases the anode potential sufficiently to render them temporarily ineffective. Also, obliterating coil 243 is joined to the source of high potential and thus the magnetic fluctuations within the tape are obliterated as the tape passes through its associated pole pieces. Switching member 246 connects section 285 of the secondary of transformer 277, to the recording coils through the equalizing network 291. Thus signals entering the jack connection 251, are amplified by tubes 266 and 276, and are impressed upon the recording coils 241.

It is obvious that the tape 23, must pass through the obliterating coils 243, prior to its passage through the recording coil, in order that the message previously recorded thereon may be obliterated.

The message to be recorded upon the tape 23, must be of a predetermined length to correspond approximately with the time required for the tape to complete one cycle of rotation. A small timing motor, 237, is employed to initiate the recording cycle when desired, and terminate the same automatically at the end of the recording period. As illustrated, the timing motor 237, is started by momentarily depressing push-button 305. This will start the movement of the cam 400, which is fastened to the driftshaft of the timing motor. Movement of the cam will close the circuit of switching member 300, which serves to apply energizing voltage to relay coil 301, placing switching members 245 and 246 in the recording position. The circuit of switching member 306 is also closed by operation of the cam, which shunts push-button switch 305, thereby closing the motor circuit and permitting the operator to release push-button 305. Upon the completion of the pre-determined recording cycle, the motor 237 is automatically halted inasmuch as switch 306 by means of the cam arrangement, is opened at the termination at each revolution of the cam. Likewise, the circuit through electro-magnetic relay 301, is automatically opened by means of switching member 300. The switching members 245 and 246 then assume the normal position required for the transmission of the signals recorded upon the tape.

The output circuit of the transmitter described hereinabove is such that it may be connected to an antenna or to a conductor of any length. A series circuit in which condenser 293, and inductance 313, are employed, provides a coupling means between tank coil 283 and an antenna or other conductor, to which a connection is made at any desired point through single conductor 315. It should now be apparent that the recording of audio-frequency signals on the tape will provide a means by which subsequent transmission of the signals may be effected at any time upon operating call box 30, Figure 11. The transmitting system will remain in operation for a given period, or as long as the power is applied to the transmitting units.

Referring to Figure 12, in which a receiving system for utilizing the signals is described, antenna 302 will provide a means for intercepting the transmitting signals on the frequency to which the receiver, 301, is tuned. Low-pass filter 303, connected to the output circuit of receiver 301, discriminates in favor of that portion of the received audio-frequency signal lying below

200 cycles. Thus low frequency control signals, such as pulses for actuation of punch register 307, or gong 306, pass through filter 303 and signal rectifier 304, with sufficient energy to actuate relay 305, thereupon energizing the aural alarm, such as gong 306, and the visual recording device, such as punch register 307.

Received audio-frequencies above 200 cycles consisting, for example, of voice signals, are accepted by the high-pass filter 308, also connected to the output circuit 301, and energize loud speaker 309. It is pointed out that the voice signals which lie primarily in the audio-frequency range between 300 and 2,000 cycles, are effectively accepted by the high-pass filter, whereas the low frequency control signals, such as those having frequencies less than 200 cycles, are substantially attenuated by the high-pass filter. The resultant voice signals as reproduced by the loud speaker contain little or no aural interference from the coded signals. Likewise, the gong and punch register circuits are free from interference from voice signal energy, which is substantially attenuated by low-pass filter, 303.

In the arrangement of Figure 12, a second receiver, 311, is employed to selectively actuate a facsimile recorder or teletypewriter. The output circuit of receiver 311 is connected to a rectifier, 312, as illustrated in detail in Figure 14. The rectifier applies a rectified motor control voltage to the motor relay 313 when a synchronizing pulse of low frequency is received. Closure of motor relay 319, automatically starts motor 315, which operates the facsimile printer or teletype machine 314. It is pointed out that motor 315 is normally inoperative and the recording mechanism associated with facsimile printer 314 is normally idle. Upon reception of the low frequency synchronizing control signal, which is also recorded upon the steel tape employed in the automatic transmitting device, motor relay 355 applies power to the motor and starts the recording process as will be explained hereinafter. In the arrangement of units shown in Figure 13 the same general function employed in Figure 12 is provided to cause reproduction of voice signals and operation of an aural alarm, punch register, or facsimile printer. In this case, however, a band-pass filter 321, is utilized to select low frequency control signals lying below 200 cycles and pass them on to the signal rectifier through relay 323, which serves to actuate the gong 324, and punch register 325. A second band-pass filter, 326, is also connected to the output circuit of the same receiver 320, the filter serving to pass audio-frequencies lying within the range of 300 to 2,000 cycles, for subsequent reproduction by loud speaker 327. A third band-pass filter, 328, also connected to the output circuit of receiver 320, is employed to pass audio-frequencies lying in the range from 6,000 to 8,000 cycles, which signals are subsequently amplified by signal amplifier 329, and thereupon applied to facsimile signal rectifier 330, which, as described above, serves to control the operation of motor 333 and facsimile printer 332.

In this manner, by use of a plurality of band-pass filters, three separate signals may be electrically separated in such manner that they do not cause mutual interference at the receiving point.

Referring to the circuit details of illustrative receiving equipment as shown in Figure 14, transformer 350 having its primary winding connected to the output circuit receiver 301, is con-

nected in such manner that signal energy in its secondary winding is applied to low-pass filter section 303, and high-pass filter section 308. Low-frequency signals passed by filter 303 are applied to rectifier 304, the direct current output of which is applied to relay 305. Closure of relay 305 serves to operate gong 303 and punch register 307. Signal energy passed by the high-pass filter section 308 is applied to the low filter circuit 309, as indicated.

Transformer 351 connected in the output circuit of receiver 311, is connected in such manner that the signal voltage in the secondary winding is applied to the anodes of a full wave rectifier, 312. The center tap of the transformer secondary is grounded, as shown. Switching member 353, associated with an illustrative facsimile recording machine such as the Finch auto-synchronous type, shown herewith, is normally held in the position shown in the illustration. As will be observed from reference to the diagram, a frequency-discriminating condenser 352, is normally shunted across one half the secondary winding of transformer 351, when the switching member 353 is in the illustrated position. A low-frequency control signal such as a synchronizing pulse will be effectively rectified by rectifier tube 312, and the resultant direct-current voltage will be applied to solenoid 354. Simultaneously, the rectified voltage is applied to the coil of motor relay 355, of latch type, thereupon starting the motor. Clutch arm 356 will be actuated by solenoid 354, allowing cam 357 to turn, thereby causing the contact cam 358, and driving cam 359, to rotate as all cams are on a common drift shaft. Rotation of cam 358 will cause switching member 353 to move, thereby applying rectified facsimile marking signal energy to the recording stylus 360. Subsequent operation of the facsimile recorder follows well-known procedure, the facsimile recording stylus producing a reproduction of printed intelligence originally scanned and translated into electrical equivalents which subsequently were recorded on the steel tape at the transmitting location. In this manner, by entirely automatic means, the facsimile machine may be placed in operation by an incoming signal of predetermined control frequency, and a printed record such as "alarm 25, 1st National Bank, 45th Street and Madison Avenue" will be repeatedly produced in the facsimile machine as long as the remote transmitting unit remains in operation, or until an operator at the receiving station releases the latch relay 355, thus taking the facsimile recording machine out of service.

While in the foregoing description a specific application of the system has been outlined, it is understood that the same automatic signaling system may be employed in a number of fields, particularly in connection with communications services in which it is required that intelligence be transmitted to moving vehicles proceeding through established signaling zones.

It will be recognized that the illustrated systems described herein are capable of considerable modification and rearrangement without departing from the spirit and scope of the invention, and it is therefore to be understood that the following claims embrace all such modifications and equivalent arrangements as may fairly be construed to fall within the scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a signaling system of the class described, 75

a signal transmitter, a signal storage means having a magnetic record-bearing medium, a plurality of signals pre-recorded on said magnetic record-bearing medium, one of said signals magnetically simulating voice intelligence, another of said signals simulating graphic intelligence and adapted for recording at the receiver end and having frequencies within a predetermined audio frequency range, pick-up means for converting one of said recorded signals into electrical signals, pick-up means for converting said other of said recorded signals into electrical signals, conductor means connecting both of said pick-up means with a signal input circuit of said signal transmitter, manually-operable initiating means for causing actuation of the carrier wave transmitter and said signal storage means, and a remote receiving station for filtering and translating the first mentioned signals into aural form and for filtering and translating the other of said signals into visual form for providing a graphic record of said received aural signals.

2. In an automatic signaling system, a carrier wave transmitter operable on a pre-determined carrier frequency associated with a given signaling zone, a signal-record storage device electrically connected to the input circuit of said transmitter, said signal-record storage device comprising a signal record carrier having thereon recorded voice signals within a pre-determined range of audio frequency, said signal record carrier also having thereon a record of audio frequency signals lying within a second predetermined range of audio frequencies corresponding to graphic equivalents of said voice signals, said signals also serving to identify the location of said transmitter, said transmitter and said signal-record storage device being normally inoperative, a source of electric power, and a signal initiating device whose operation applies power to said transmitter and said signal storage device for transmitting said voice and the graphic equivalent signals at the same time.

3. In a signaling system, a transmitting station, said station including a signal storage device having a signal-record carrier bearing pre-recorded intelligence, a carrier wave transmitter electrically connected to said signal storage device, said signal storage device and carrier wave transmitter being normally inoperative, initiating means for placing said signal storage device and carrier wave transmitter in operative condition at approximately the same time, said signal storage device thereafter being effective in causing repetitive transmission of intelligence pre-recorded on said signal-record carrier for station identification of the transmitting station, and a receiving station in continuous operation to receive the intelligence transmitted from the transmitting station.

4. In a signal transmitting system, a plurality of normally off transmitting stations disposed adjacent a lane of traffic, each of said transmitting stations including in combination a signal source and a carrier wave transmitter operating on an individual frequency range, initiating means individual to each of said stations for individually placing each of said stations in operative condition, and signal conducting means common to all of said stations for effecting distribution of carrier wave energy to receiving points within a predetermined signaling zone.

5. In an alarm signaling system of the class

described, a signal storage means including a magnetic record of pre-recorded facsimile signals corresponding to a graphic record of signaling intelligence pertaining to the location of the transmitter, a carrier wave transmitter, means for modulating said transmitter by said magnetically pre-recorded facsimile signals, signal emitting means connected to said transmitter for effecting distribution of carrier wave energy within a given signaling zone, and receiving means within said zone for translating said carrier wave energy into a graphic record of said signaling intelligence, including a facsimile recording device for effecting automatic repetitive reproduction of said received intelligence in permanent record form.

6. In an alarm signaling system, a signal storage device having a magnetic record-bearing medium, said record-bearing medium having magnetically impressed thereon a record of facsimile signals corresponding to a master record of intelligence in visual form, said facsimile signals having an audio frequency range extending within pre-determined limits, said record-bearing medium also having impressed thereon a record of synchronizing control signals having audio frequencies extending within a second predetermined range, a carrier wave transmitter, means for repeatedly modulating said transmitter by said facsimile and synchronizing control signals, and automatic receiving means for repeatedly translating said facsimile signals into replicas of said master record, including a facsimile recording device having a marking circuit responsive to said facsimile signals of first audio frequency range, and a driving motor having a control circuit means responsive to said control signals of said second audio frequency range, said control means being effective to initiate operation of the motor upon reception of said control signals.

7. In an automatic signaling system, a carrier wave transmitter operable on a pre-determined carrier frequency, a signal-record storage device electrically connected to the input circuit of said transmitter, said signal-record storage device comprising a signal record carrier having thereon recorded voice signals within a pre-determined range of audio frequency, said signal record carrier medium also having thereon a record of audio frequency signals lying within a second pre-determined range of audio frequencies corresponding to graphic equivalents of said voice signals, said signals also serving to identify the location of said transmitter, said transmitter and

said signal-record storage device being normally inoperative, a source of electric power, a signal initiating device whose operation applies power to said transmitter and said signal storage device for transmitting said voice and the graphic equivalent signals at the same time, a receiving station tuned to the frequency of the carrier wave transmitter, and translating means in the receiving station to provide aural and recorded intelligence of the transmitter signal.

8. In an automatic signaling system of the class described, a normally off signal transmitter utilizing a signal reproducing device of continuously repetitive type having signals impressed thereon corresponding to voice intelligence identifying the transmitter, a motor for driving said signal reproducing device, other signals impressed upon said recording device corresponding to graphic intelligence identifying the transmitter, pick-up means for converting said recorded signals into electrical energy, conductor means connecting said pick-up means with the signal transmitter, means connected to the signal transmitter for initiating operation of said transmitter and said motor of the automatic signaling system, a remote receiving station for receiving the signals transmitted from the signal transmitter, a filter and a signal translating device in said receiver adapted to convert one of said recorded signals into aural intelligence, and a filter and a translating device for converting the other of said recorded signals into recorded graphic intelligence.

9. In an automatic signaling system of the class described, a signal transmitter utilizing a signal reproducing device of continuously repetitive type having signals impressed thereon corresponding to voice intelligence identifying the transmitter, other signals impressed upon said recording device corresponding to graphic intelligence identifying the transmitter, pick-up means for converting said recorded signals into electrical energy, conductor means connecting said pick-up means with the signal transmitter, means connected to the signal transmitter for initiating operation of said transmitter, a remote receiving station for receiving the signals transmitted from the signal transmitter, a filter and a signal translating device in said receiver adapted to convert one of said signals into aural intelligence, and a filter and a translating device for converting the other of said signals into recorded intelligence.

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