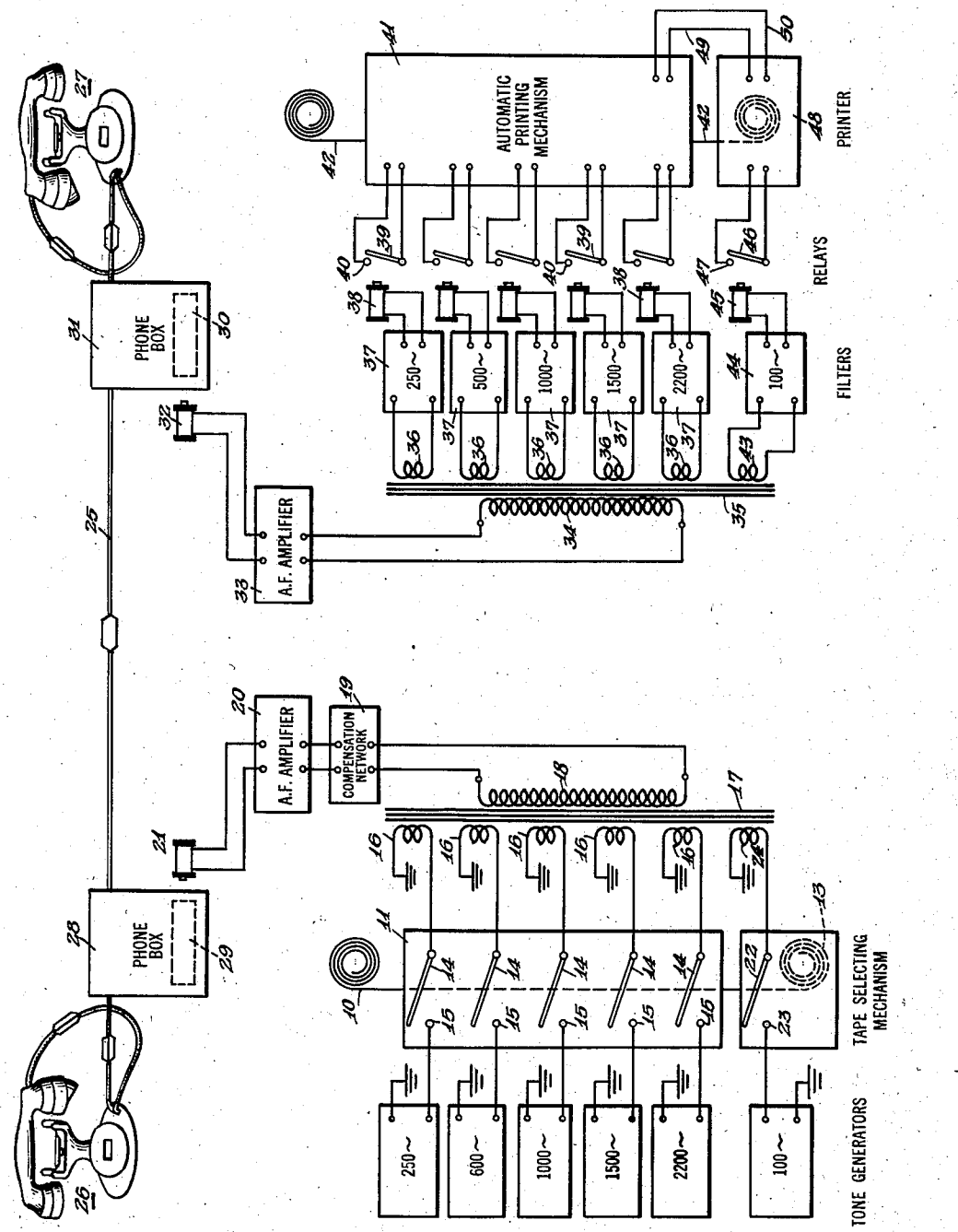
Oct. 18, 1938. W. G. H. FINCH 2,133,811

AUTOMATIC PRINTING TELEGRAPHY SYSTEM

Original Filed June 24, 1936



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Patented Oct. 18, 1938 2,133,811

UNITED STATES PATENT OFFICE

2,133,811

AUTOMATIC PRINTING TELEGRAPHY SYSTEM

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Original application June 24, 1936, Serial No. 86,902. Divided and this application August 1, 1936, Serial No. 93,773

10 Claims. (Cl. 179—4)

My invention relates to telecommunication systems and more particularly relates to novel apparatus for and methods of high speed automatic printing telegraph operation between remote points over telephone lines.

This present invention is a continuation in part of my parent application Serial No. 65,869, filed February 26, 1936, which matured into Patent No. 2,047,863 and is a division of my co-pending application Serial No. 86,902, filed June 24, 1936.

Modern high speed printing telegraph systems operate with a Baudot or five unit code. A continuous tape is successively punched with a predetermined combination of holes for each character. It is the practice to pass the tape through apparatus having five mechanical feelers which in turn operate contactors connected to contact plates on a mechanical distributor. The mechanical distributor, as is well known in the telegraphy art, comprises a rotating arm for successively contacting the contact plates to transmit coded impulses in succession. The operation of mechanical distributors materially limits the speed of transmission of printing telegraph signals.

The printing telegraph systems employing mechanical distributors either operate over a telegraph wire utilizing direct current energization or modulate a radio frequency carrier for transmitting the successive impulses of the coded combination to remote radio stations. For many commercial services, particularly news services, it is highly desirable to transmit to the main office a message from as near to the scene of action as practicable. Various proposals have been made to utilize the vast telephone system network for rapid and economical and portable operation between the main office and out in the field. None of the proposed systems for portably operating an automatic telegraphy system over telephone lines have, to my knowledge, been successful, particularly since the telephone companies cannot permit any interconnection by a subscriber to its lines unless special precautions and circuit balancing connections are used and a twenty-four hour per day lease is made. The use of telegraph lines or radio systems for automatic telegraphy is not feasible for portable intercommunication with the main office. In accordance with my present invention, I contemplate transmitting the telegraphy signals to the central office from any telephone subscriber station. A telephone call is "put through" to the central office and the telegraph unit is operated on a pay-as-you-use basis. The principle of coupling to the telephone circuit without physical interconnection thereto forms the basis of the parent application hereinabove referred to. The electrical coupling resides in utilizing a solenoid in optimum coupling relationship with the induction coil of the phone box, and a similar coupling arrangement is employed at the receiving station. The companion application Serial No. 86,902 discloses how the telegraphy signals may be used to modulate an audio carrier frequency which is in turn transmitted to the central station individually or with a multiplex carrier communication system wherein telepicture signals are simultaneously transmitted.

The present invention resides in utilizing a plurality of individual tones or audio frequencies sufficiently spaced so that they may be individually transmitted to correspond to the individual coded combinations of the Baudot or other five-unit code, and received and selectively filtered at the receiving station to operate a suitable automatic printing mechanism. The code combinations for each character are transmitted simultaneously so that a relatively high speed of operation of the printing telegraph system is feasible since a mechanical distributor for maintaining the synchronous operation of the transmitter and receiver are eliminated and time for transmission of successive characters is reduced.

It is accordingly an object of my invention to provide a novel high speed printing telegraphy system.

Another object of my invention is to provide novel apparatus for and methods of transmitting automatic telegraphy signals over a telephone system.

A further object of my invention is to provide novel apparatus for and method of portable operation over a printing telegraph system employing telephone lines as the medium of transmission and without physical interconnection thereto.

These and other objects of my invention will become apparent in the following description taken in connection with the drawing which is a schematic electrical diagram of a preferred embodiment of a five-unit printing telegraph system operating over a telephone line.

In carrying out my invention I employ an individual tone or audio frequency corresponding with a predetermined position of each impression of the coded combinations as punched in a paper tape. The well known Baudot code contains five units which are variously combined to form thirty-two characters in a manner well known in the art. A tape is generally punched with holes in five rows corresponding to the particular character to be transmitted. The preparation of the punched tape, the character of the code combination or the number of code units employed form no part of my present invention and may be varied in various ways. For purposes of illustration I use a five-unit code system.

The tape 10 is moved at a predetermined rate through the tape selecting mechanism 11 by the

stepping mechanism 12. The portion of the used tape 13 is shown dotted in rolled form within the stepping mechanism 12. The selector mechanism 11 contains five mechanical feelers which operate contactors to electrically close corresponding circuits in accordance with the punchings of the perforated tape. Since such selecting mechanism is well known in the art, I have merely schematically illustrated the selector 11 by five armatures 14 and corresponding contacts 15. It is to be understood that the electrical circuit between any set of contacts 14—15 is closed in accordance with the actuation of the mechanical feelers in correspondence with the punchings on the perforated tape.

An individual tone generator is associated with each contactor set 14—15 having, in one arrangement, the following spaced frequencies, 250 cycles, 600 cycles, 1000 cycles, 1500 cycles and 2200 cycles. A primary winding 16 on the coupling transformer 17 is used for each set of contactors and the associated tone generator. The tone generator, the contactor 14—15 and the primary winding 16 of each set are respectively connected in series including a ground return connection. The secondary 18 of transformer 17 is connected to a compensation network 19, the output of which connects to the input of audio frequency amplifier 20. The output of amplifier 20 is connected to the coupling solenoid 21 which is used to transmit the signals over the telephone system in a manner described in detail in the parent application and in application Serial No. 86,902.

Sustained current flow of the respective frequencies of the tone generators flowing through the primary windings 16 in accordance with the particular group of actuated contactors 14—15 cause corresponding induced tone signals in the secondary winding 18 which are impressed upon the amplifier 20 through the compensation network 19. The signals flowing across secondary winding 18 represent different combinations of the audio frequency currents in accordance with the combinations on the perforated tape for the character being transmitted. After a predetermined interval corresponding to the period for transmitting each character automatically stepping mechanism 12 will advance the tape one position to present to the selector mechanism the perforations for the next character to be transmitted and a corresponding combination of the plurality of tones will be induced upon secondary winding 18 and be amplified and flow through the coupling solenoid 21.

Contactors 22—23 illustrated in the stepping mechanism 12 are actuated preferably between transmissions of each tape character during the advancement of the tape 10 through the selector mechanism. Contactors 22—23 are accordingly connected once for each character transmitted to connect the 100 cycle tone generator to the primary winding 24 of the coupling transformer 17. A 100 cycle signal of predetermined duration will accordingly be induced across secondary winding 18 and flow through the solenoid 21. The 100 cycle note impulse represents the stepping signal and printing impulse for the receiver station as will be hereinafter described.

The printing telegraphy signals of my present invention are transmitted across the telephone line 25 without physical interconnection thereto by the coupling solenoid 21 at the telephone station 26. The operator telephones from a nearby telephone station 26 and an operative connection is made between his telephone station 26 and the telephone station 27 at the central office which is to receive the telegraphy signals. The solenoid 21 is clamped upon the phone box 28 associated with the telephone station 26 and is adjusted in optimum coupling relation with the induction coil 29 located within the phone box 28 in a manner described in the applications referred to above. The optimum coupling condition of solenoid 21 is a coaxial alignment between solenoid 21 and induction coil 29. The printing telegraphy signals induced across the telephone line 25 flow through the induction coil 30 connected within the phone box 21 associated with the telephone receiving station 27. A solenoid 32 is mounted upon the receiver phone box 31 in optimum coupling relationship with the induction coil 30 therein. The solenoid 32 "picks-up" the electromagnetic signals emanating from induction coil 30 and introduces them to the audio frequency amplifier 33. The output of amplifier 33 is connected to the primary winding 34 of the receiver coupling transformer 35.

The signals at the primary winding 34 correspond to the telegraphy signals at the secondary winding 18 of the transmitter coupling transformer 17. Where it is necessary to correct for a non-linear frequency characteristic of transmission between the transmitter transformer winding 18 and the receiver transformer winding 34 a compensation network 19 is preferably introduced in the transmitter circuit as illustrated. The compensation network 19 is designed in accordance with principles disclosed in the hereinabove referred to applications for smoothing out the frequency characteristic of transmission across the telephone system.

A plurality of secondary windings 36 on transformer 35 correspond to the primary windings 16 of transformer 17 and are respectively connected to band-pass filter networks 37 for selectively passing predetermined frequencies. Each filter is designed to pass only the particular frequency corresponding to one of the tone transmitter generators. Accordingly, the filters 37 are correspondingly designed to transmit 250 cycles, 500 cycles, 1000 cycles, 1500 cycles, and 2200 cycles, corresponding to the predetermined positions of the code combination being transmitted from the perforated tape 10. The output of the filters 37 are connected to relay solenoids 38 which actuate corresponding relay armatures 39 operating upon corresponding contacts 40. The relay contactors 39—40 are connected to an automatic printing mechanism 41 schematically indicated and well known in the telegraphy art. The printing mechanism 41 prints characters upon a tape 42 advanced therethrough in accordance with the combinations of relay contactors 39—40 which are closed before each printing impulse. The particular combination of relay contactors 39—40 closed at any period corresponds exactly to the selector contactors 14—15 closed in accordance with the perforations on the tape 10 operating the mechanical feelers of the selecting mechanism 11. The plurality of audio frequency currents transmitted across the telephone line predetermine the simultaneous closure of the relay contactors 39—40 since the identical audio frequencies are impressed upon each of the secondary windings 36 with sufficient signal strength, due to amplification by amplifier 33, to effect the closure of the relay contactors 39—40 by the relay solenoid 38. The introduction of the selective filters 37 between

the relay solenoids 38 and the secondary windings 36 causes only a predetermined frequency impulse to actuate corresponding solenoids. The solenoids 38 preferably respond directly to the associated audio frequency tone but may well be direct current solenoids if a suitable rectifier is used in conjunction therewith. These rectifiers are preferably of the rugged mineral type such as the copper oxide rectifiers.

A further secondary winding 43 of receiver coupling transformer 35 is connected to a hundred cycle filter 44, the output of which is connected to a relay solenoid 45 operating relay armature 46 and contact 47. The relay solenoid 45 responds to the 100 cycle tone transmitted when the stepping contactors 22—23 are connected between transmissions of the successive characters hereinabove described. When the 100 cycle note is cyclically transmitted, the relay contacts 46—47 are closed to correspondingly actuate the receiver stepping mechanism 48 as well as producing a printing impulse at the printing mechanism 41 to impress the selected character upon the tape 42 and also to reset the printer 41 and associated relay to be responsive to the next succeeding operation.

The receiver stepping mechanism 48 is preferably of the electromagnetic type operated by relay 46—47. The closure of relay 46—47 in response to the stepping impulse from the 100 cycle note is transmitted to the printer mechanism 41 by connection leads 49—50. The impulse across leads 49—50 actuates the printing and resetting mechanism of the printer 41 in a manner well known in the art.

The automatic printing telegraphy system of my present invention functions by the transmission of a plurality of frequency impulses corresponding to characters to be transmitted. The signals are transmitted over a telephone system without physical interconnection thereto permitting portable installation and operation across the telephone system on a pay-as-used basis. A rapid rate of operation is feasible with this system since the characters require a single impulse period for their interpretation at the receiver.

Although in my preferred embodiment I have illustrated a separate frequency impulse and contactors for the stepping and printing impulses, this separate signal may be dispensed with by sacrificing one of the code combinations of the thirty-two and using it as the advance impulse at the end of each operation. Another method is to utilize a relay at the receiving station responsive to all code combinations transmitted, that is, by eliminating the selective filter 44 for the advance relay 45 and employing a time delay mechanism so that the stepping and printing operations at the receiver will occur after a predetermined interval following the reception of each code combination.

My present invention may take other forms without departing from its spirit or scope and accordingly, I do not intend to be limited except as set forth in the following claims.

I claim:

1. In a signalling system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions corresponding to coded impulse combinations of characters to be transmitted; means for stepping said tape through said selecting means at a predetermined rate; and means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils.

2. In a signalling system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions corresponding to coded impulse combinations of characters to be transmitted; means for stepping said tape through said selecting means at a predetermined rate; and means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils.

3. In a printing telegraphy system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions corresponding to coded impulse combinations of characters to be transmitted; means for stepping said tape through said selecting means at a predetermined rate, a stepping audio frequency current source cyclically transmittable during each stepping operation; and means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils.

4. In a signalling system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions; means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils; means for receiving said induced currents comprising a second solenoid for coacting with the receiving station induction coil; and printing means comprising local circuits individual to each of said frequency currents, means for electrically separating said received currents, individual to each of said local circuits for conducting predetermined frequency current impulses to said printing means.

5. In a signalling system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions corresponding to coded impulse combinations of characters to be transmitted; means for stepping said tape through said selecting means at a predetermined rate; means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils; means for receiving said induced currents comprising a sec-

ond solenoid for coacting with the receiving station induction coil; and printing means comprising local circuits individual to each of said frequency currents, means for electrically separating said received currents, individual to each of said local circuits for conducting predetermined frequency current impulses to said printing means.

6. In a printing telegraphy system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions corresponding to coded impulse combinations of characters to be transmitted; means for stepping said tape through said selecting means at a predetermined rate, a stepping audio frequency current source cyclically transmittable during each stepping operation; means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils; means for receiving said induced currents comprising a second solenoid for coacting with the receiving station induction coil; and printing means comprising local circuits individual to each of said frequency currents, filter means for electrically separating said received currents, individual to each of said local circuits for conducting predetermined frequency current impulses to said printing means.

7. In a signalling system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions; means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils and arrangeable coaxially with said one induction coil; means for receiving said induced currents comprising a second solenoid for coacting with the receiving station induction coil; printing means comprising local circuits individual to each of said frequency currents, means for electrically separating said received currents, individual to each of said local circuits for conducting predetermined frequency current impulses to said printing means; and means responsive to said stepping frequency current for impressing a selected character and resetting said printing means.

8. In a printing telegraphy system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions corresponding to coded impulse combinations of characters to be transmitted; means for stepping said tape through said selecting means at a predetermined rate, a stepping audio frequency current source cyclically transmittable during each stepping operation; means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils and arrangeable coaxially with said one induction coil; means for receiving said induced currents comprising a second solenoid for coacting with the receiving station induction coil; printing means comprising local circuits individual to each of said frequency currents, filter means for electrically separating said received currents, individual to each of said local circuits for conducting predetermined frequency current impulses to said printing means; and means responsive to said stepping frequency current for impressing a selected character and resetting said printing means.

9. In a printing telegraphy system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions corresponding to coded impulse combinations of characters to be transmitted; means for stepping said tape througn said selecting means at a predetermined rate, a stepping audio frequency current source cyclically transmittable during each stepping operation; means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils; and a compensation network connected in said system for smoothing the transmission frequency characteristic across said solenoids and said telephone lines.

10. In a printing telegraphy system operable by a signal tape and extending over a telephone line having a telephone box including an induction coil at each end: means for generating an audio frequency current individual to each of the predetermined impulse positions of the signal tape, means for selecting combinations of said currents controllable by said impulse positions corresponding to coded impulse combinations of characters to be transmitted; means for stepping said tape through said selecting means at a predetermined rate, a stepping audio frequency current source cyclically transmittable during each stepping operation; means for transmitting said currents across said telephone line comprising a solenoid connected to said currents for electromagnetically inducing corresponding currents into one of said induction coils and arrangeable coaxially with said one induction coil; means for receiving said induced currents comprising a second solenoid for coacting with the receiving station induction coil; printing means comprising local circuits individual to each of said frequency currents, filter means for electrically separating said received currents, individual to each of said local circuits for conducting predetermined frequency current impulses to said printing means; means responsive to said stepping frequency current for impressing a selected character and resetting said printing means; and a compensation network connected in said system for smoothing the transmission frequency characteristic across said solenoids and said telephone lines.

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