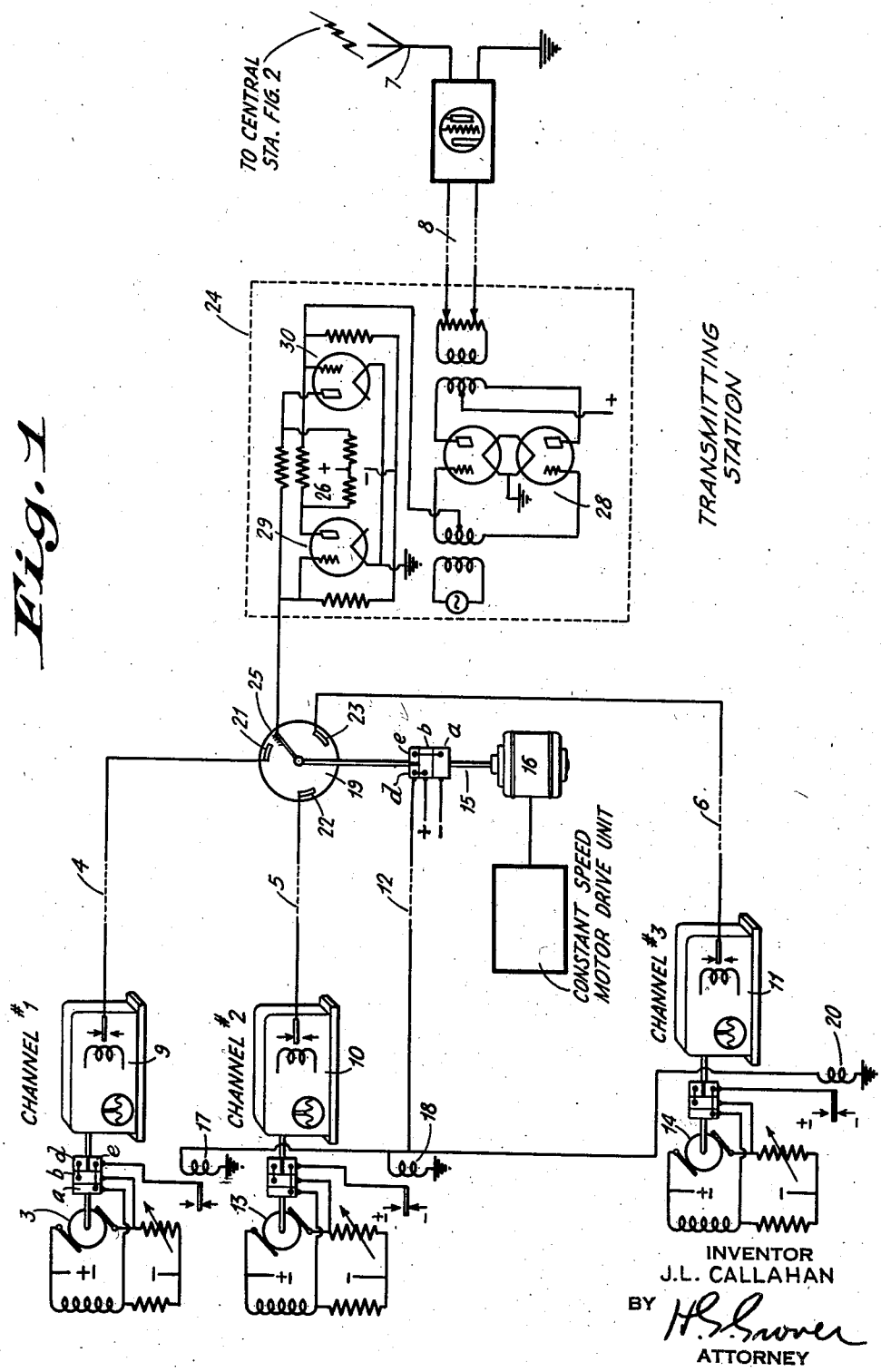
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MULTIPLEX TELEGRAPH SYSTEM

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Fig. 1



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MULTIPLEX TELEGRAPH SYSTEM

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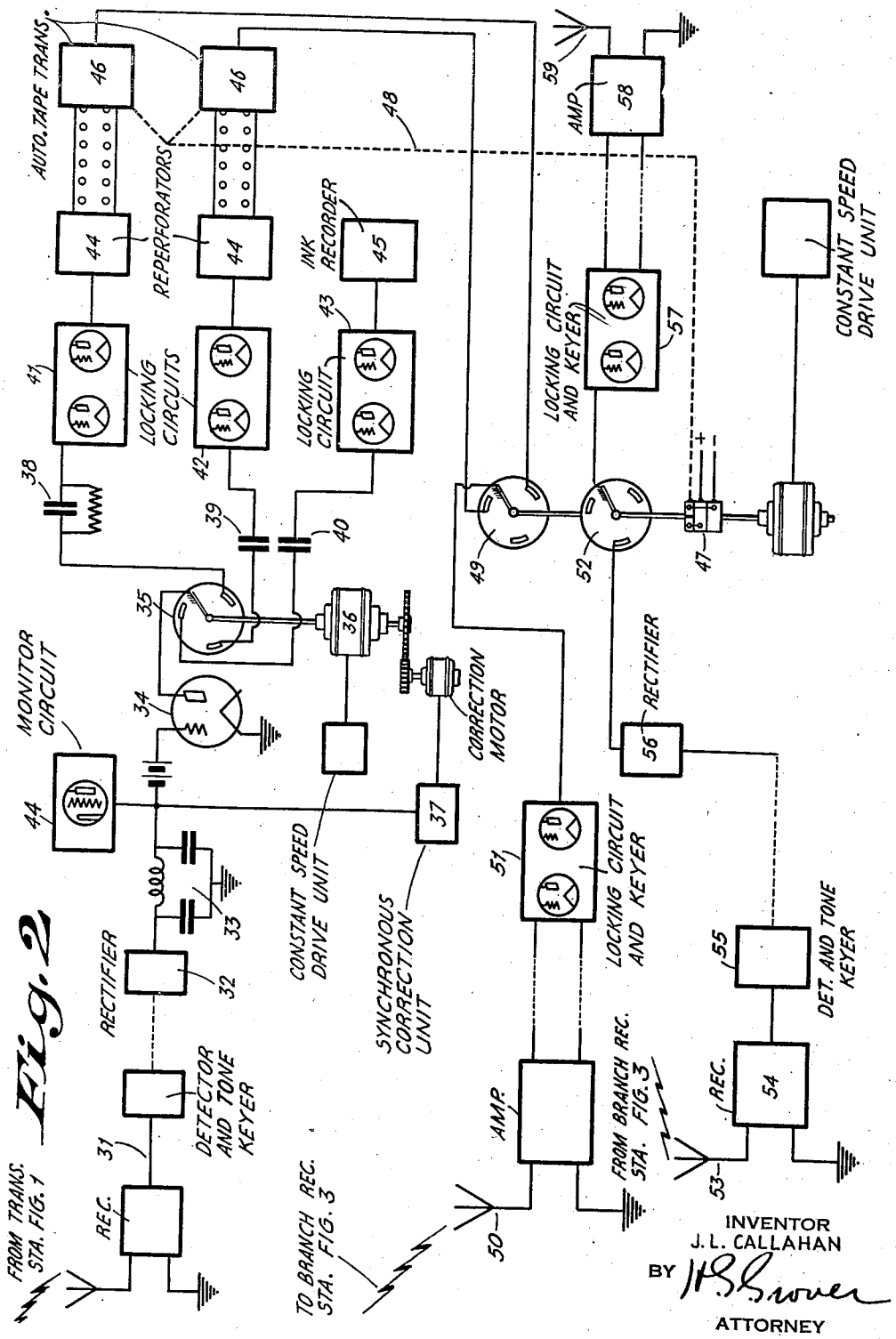


Fig. 2

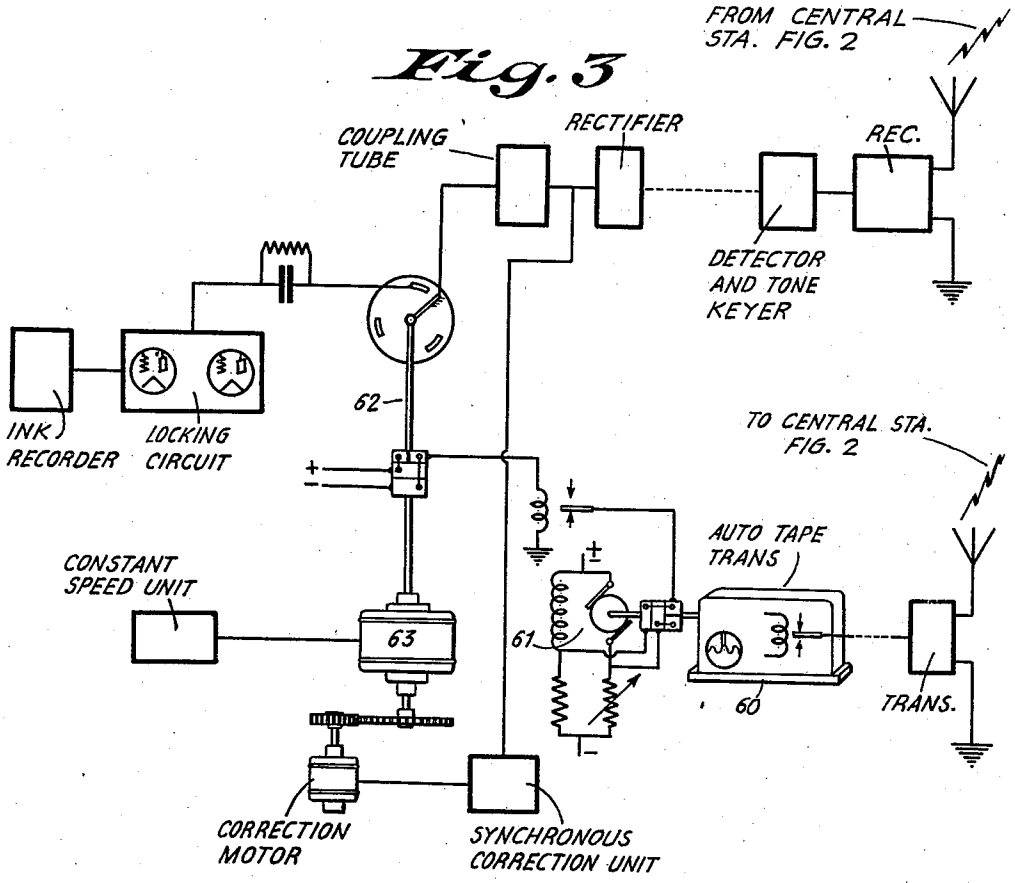
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MULTIPLEX TELEGRAPH SYSTEM

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Fig. 3



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MULTIPLEX TELEGRAPH SYSTEM

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Application June 28, 1934, Serial No. 732,768

8 Claims. (Cl. 178—52)

This invention relates to a multiplex telegraph communication system for relaying radio signals.

The present invention contemplates the use of a multiplex system which operates on the time division principle whereby a predetermined length of code unit, in the present case the dot length, is regarded as the basic unit and the successive basic units of the signal characters of each channel are divided into equal portions of like number as the several channels. In this type of system the transmission circuit is assigned consecutively to successive channels for a time interval equivalent to one of these equal portions, the remaining portion of each basic unit of each channel being discarded and subsequently restored at the receiving unit of the circuit. In other words, the transmission line time is arranged to be divided equally among the different channels so that each channel has a period of transmission time allotted to it which is equal at most to the longest period of which the duration of the individual signal units forming the code are exact multiples, so that each signal unit comprises an equal number of components.

For a more detailed description of the use of the time division principle in multiplex systems, reference is herein made to United States Patent No. 1,979,484, granted November 6, 1934, to R. E. Mathes.

It is an object of the present invention to provide a signal relaying arrangement for a multiplex telegraph system wherein a trunk station may communicate with one or more distant branch receiving stations through a remote, automatically controlled, trunk station. By trunk station is meant an office which is provided with equipment for transmitting and receiving time division multiplex signals of the type hereinabove described, and by branch station is meant an office which is provided with equipment for receiving time division signals and, if desired, apparatus for transmitting only code full length signals.

A further object is to provide means which enables the remote trunk station to synchronize the rotating mechanism at a branch office receiving station with respect to speed and phase.

The advantage of this particular method of communication which discards portions of the signals and combines other portions from a plurality of channels is that it is extremely confusing to unauthorized listeners, thus resulting in a practical commercial secrecy arrangement.

In general, the present invention comprises a time division multiplex radio telegraph system for relaying Morse code signals from a trunk station to one or more distant branch office stations through the intermediary of a central remote trunk station. Assuming, for purposes of illustration, that a local trunk station is located at New York, a branch office station at Los Angeles and the remote trunk station at San Francisco, it is proposed to receive the signals transmitted from New York at the San Francisco trunk station and to store them in any desired manner before retransmitting the signals to the Los Angeles branch office station. Of course, other receiving stations may be located along the coast to receive the same signals relayed by the remote trunk station. At the remote trunk station, the different message signals which are received over the various trunk channels are each made to operate storage equipment in the form of reperforators which, in turn, feed tape into automatic tape transmitters, the latter controlling, through a distributor, a radio transmitter associated with the remote trunk station. The steep wave front of the signal characters is arranged to control the rotating mechanism at the distant branch office stations. Thus, the signals from New York synchronize the equipment at the central station at San Francisco, and the signals retransmitted from San Francisco synchronize the equipment at Los Angeles from a speed and phase standpoint. Any one of several known methods for accomplishing this sort of synchronization may be employed, although it is preferred to use one of the systems described in detail in the copending applications of R. E. Mathes, Serial Nos. 645,171 and 708,378, filed December 1, 1932, and January 26, 1934, respectively, patented April 21, 1936, No. 2,038,375, and Nov. 24, 1936, No. 2,062,009, respectively.

At the local multiplex trunk station (in this case New York) in the relaying system, which for illustration will be called the transmitting trunk station, there are employed a plurality of automatic tape transmitters, one for each channel, which are under the control of a drive motor, the latter in turn being responsive to a constant speed motor control unit. A specially designed brush and commutator device associated with the shaft of the drive motor functions to control the speed of the automatic tape transmitters. A multiplex distributor is used to assign the multiplex equipment and its associated radio channel to the different auto tape transmitters successively, whereby only portions of the code signals of each channel are assigned and transmitted and the remaining portions of the signals discarded.

At the remote trunk station in San Francisco, the received signals are assigned by a distributor, whose rate of speed is synchronized by the incoming signals, to a special arrangement for rebuilding the discarded portions of the basic time units of each channel so that the signals are restored to their original form. The signals are then stored by any suitable storage devices, such as reperforators, which record the signals on tape, the latter then being fed to automatic tape transmitters which send the signals out to the distant branch office stations at Los Angeles and other locations. The signals transmitted from the remote trunk station to the branch office stations are under the control of one section of a multiple unit distributor which is driven by a motor whose shaft is employed to synchronize the speed of the automatic tape transmitters at the remote trunk stations in a manner similar to that employed at the local trunk transmitting station. A section of the multiple unit distributor at the remote trunk station at San Francisco is used to control channels outgoing to the distant (local) trunk station at New York, which channels may contain signals originating at the branch office station at Los Angeles, the remote trunk station at San Francisco, or both.

The branch office station at Los Angeles, in brief, comprises a receiving circuit similar to that employed at the remote trunk station at San Francisco. This station has, in addition, an automatic tape transmitting arrangement for sending signals to the remote trunk station where they may be relayed back to the local trunk transmitting station at New York, if desired.

In the accompanying drawings, Fig. 1 illustrates a local trunk station, herein called the transmitting station, Fig. 2 a remote trunk central station for relaying the signals received from the transmitting station, and Fig. 3 a branch office station, of the multiplex telegraph relaying system of the invention.

Referring to the transmitting station of Fig. 1 in more detail, hereinabove referred to as the New York local trunk station, there are shown three line channels 1, 2 and 3 over which are transmitted regular Morse signal characters to the centrally located transmitting multiplex distributor equipment.

The machines for transmitting the signals are arranged at some distance from the multiplex distributor equipment and are connected thereto by land lines, herein indicated as 4, 5, and 6. The multiplex equipment of the transmitting station and the automatic tape transmitters may, if desired, be located in the same building, the latter in the customary installation being located at some distance from the actual radio antenna equipment, herein designated as 7, and connected thereto by a land line such as 8.

For transmitting the Morse signals over channels 1, 2, and 3, there are shown automatic tape transmitters 9, 10 and 11 which are controlled by perforated tape, by well known means, not shown, the perforations in the tape being made in accordance with the desired signal characters. These automatic transmitters are shown as of the Wheatstone type, although it will be obvious that, if desired, the Creed apparatus may be employed. The rate at which the signals are transmitted from each of the machines 9, 10 and 11 is determined by the respective motors 3, 13, and 14, the latter, in turn, being under control of the multiplex equipment which functions to transmit, alternately, positive and negative pulses to the motor equipment over land line 12. A brush and commutator arrangement on the common distributor drive shaft 15 provides a control frequency for the automatic transmitters 9, 10 and 11 which is held to a high order of accuracy by drive motor 16. Line 12, extending from the brush and commutator arrangement on the distributor shaft is in circuit with polar relays 17, 18 and 20, which are respectively individual to the drive motors 3, 13 and 14 of the automatic tape transmitters 9, 10 and 11. The contacts of these polar relays, in conjunction with commutator and brush combinations on the shafts of the respective motors 3, 13 and 14, which are similar in construction to that on the distributor shaft 15, act to hold the motors 3, 13 and 14 to a constant speed and phase by cutting resistance in and out of the respective fields and armatures of the motors, as shown. At the desired constant speed and phase the automatic transmitters 9, 10 and 11 will transmit the pulses to the multiplex distributor 19 at the proper predetermined intervals.

The brush and commutator arrangement shown associated with motors 3, 13, 14 and 16 merely comprises two full length insulated segments *a* and *b* and two half length insulated segments *d* and *e*, all of which are insulated from each other, as shown in the drawings. One of the half segments *e* is connected to a full length segment *a* and the other half segment *d* is connected to a full length segment *b* in such manner that individual brushes associated with the full length segmented portions are alternately connected to each of the commutators *d* and *e*, consecutively as the drive shaft revolves. In this manner, positive and negative pulses are transmitted from the multiplex driving unit over line 12 to the polar relays 17, 18 and 20, causing these relays to vibrate and, in turn, to apply positive and negative pulses to their respective commutator and brush assembly units for controlling the speed and phase of the drive motor units 3, 13 and 14. This method of control is well known in the art and functions in a manner which is obvious from a mere inspection of the drawings. A somewhat similar method of motor control is described in United States Patent No. 1,829,420, granted October 27, 1931, to which reference is made for a more detailed explanation of the operation of the motor synchronizing scheme.

Although a single frequency controlling line 12 has been shown for the polar relays 17, 18 and 20, it will be understood that, if desired, individual lines 12 may extend to each of the automatic transmitters, and such would be the case if the transmitters are separated from each other any appreciable distance.

The multiplex distributor 19 consists of any suitable means for assigning the various channels to the multiplex equipment 24. In the arrangement herein shown in the drawings merely for the sake of simplicity, the distributor comprises a plurality of segments 21, 22 and 23, each segment being individual to a channel, and a brush assemblage 25 adapted to sweep over the segments and to obtain therefrom the signal units or pulses transmitted by the land channel equipment. The brush assemblage 25 which is connected to multiplex equipment 24, is arranged to make one revolution for each dot cycle of the automatic transmitter equipment, this dot cycle comprising the basic unit. Actually, the distributor which is used is quite different as

will appear later in the description. In the present instance, since a three channel circuit is shown, the distributor is arranged to supply to the multiplex equipment at most one-third of a dot length of each unit of signal received from the respective channels alternately, thus throwing away the other two-thirds or more of the dot unit which is later restored by a rebuilding circuit in the receiver. The multiplex equipment **24** which, in turn, actuates the radio transmitting equipment **7**, is assigned to the successive channels **1**, **2** and **3** and their respective land lines **4**, **5** and **6** consecutively for a time equal to at most, one of these one-third dot portions.

It will be apparent from Fig. 1 that although three channels are shown, any number of channels may be used. For three channel working, clearly only one third of each signal component is actually operative for each channel, and similarly for larger numbers of channels. This manner of dividing the line time of the multiplex equipment into the various channels is described in great detail in United States Patent No. 1,979,484, supra, to which reference is made.

In actual practice, the distributor **19**, which has been herein shown in its present form for the sake of simplicity, is quite different and consists of stationary brushes with a commutator bar forming a momentary short circuit between pairs of brushes. Such a distributor is fully described in Reissue Patent No. 19,626, granted to R. E. Mathes, June 25, 1935, and functions to select only a small portion of the signal from the middle of the full dot length of each channel and to assign it to the locking circuit **24** described below, the locking circuit, in turn, elongating this small middle portion to one-third of the full dot length (if three channel working is employed). This small middle portion is equal to about one-tenth to one-twentieth of a full dot length.

The multiplex receiving equipment **24** with which the distributing brush assemblage **25** is connected comprises essentially a locking circuit **26** and a tone keyer arrangement **28** for producing tone signals in transmission line **8**, extending to the antenna equipment **7**, which corresponds to the composite signal received from the multiplex distributor **19**. Locking circuit **26** consists, essentially, of two electron discharge devices **29** and **30** which have their anodes and their control electrodes resistively interconnected in a manner such that the apparatus has two degrees of electrical stability. These devices are unstable when both are drawing current, but stable when one tube is passing current and the other tube blocked, or prevented from passing current. The change from one condition of stable equilibrium, such as when device **29** is blocking and device **30** is passing, to the other condition when device **29** is passing and device **30** blocking, or the reverse, is caused by the presence of a suitable predetermined potential on the brush assemblage **25**. That is to say, there exists a predetermined maximum anode current flow in one of the electron discharge devices and a predetermined minimum anode current flow in the other electron discharge device, or the reverse, at the same time. The change is controlled by potential applied to the input terminals of the devices, in this case that obtained through the brush assemblage, and the change is very rapidly accomplished. By utilizing the current flow through one of the devices **29** or **30**, the energization of the antenna **7** through the intermediary of the apparatus **28** may readily be controlled. This particular manner of controlling an antenna system by means of the multiplex equipment shown comprising a locking circuit **26** and a tone keyer **28**, is adequately described in the literature relating to communication systems and, therefore, need not be further described herein. For a more amplified description of such manner of telegraph communication, however, reference is made to United States Patent No. 1,844,950, granted February 16, 1932, to J. L. Finch.

Referring now to the remote trunk station of Fig. 2, the composite signals are received over any suitable type of antenna system, amplified, and detected in a well known manner, and then transmitted to the central office. It is preferred, in the present system, to use a diversity receiving antenna arrangement of the type which is described in United States Patent No. 1,874,866, granted August 30, 1932, to H. H. Beverage et al. In this particular arrangement the signals are received over a plurality of geographically separated antennae, amplified, detected and combined in a suitable device for operating a tone keyer which is arranged to transmit audible frequencies which are interrupted in accordance with the received signal. These audible interrupted frequencies are fed from the antenna system into a land line **31** for transmission to the distant central office at which they are detected by apparatus **32**, then passed through a suitable low pass filter **33** herein shown in conventional form as comprising series inductance and shunt capacitance elements, before being applied to coupling tube **34** and the distributor apparatus **35**. Filter **33** serves the purpose of smoothing out whatever tone components remain in the rectified signal in the output of rectifier **32**.

Tube **34** and distributor **35** comprise, essentially, a coupling system for assigning the received incoming signals to their respective channels, and for enabling the received signals to be rebuilt to their original form as at the transmitting station whereby the suppressed portions of the transmitted signals are restored. Distributor arrangement **35** is driven by drive motor **36** which is held in synchronism with the multiplex distributor driving mechanism at the transmitting station, Fig. 1, by means of correction unit **37**, the latter in turn being controlled by the incoming signal. Associated with the individual segments of distributor **35** are condensers **38**, **39** and **40** and locking circuits **41**, **42** and **43** which are individual to the respective channels. These locking circuits which are of the type described in Finch United States Patent No. 1,844,950, supra, function to operate suitable utilization means in the output circuits of the channels and to reproduce the original signal characters transmitted whether they are of the Morse or printer type. The particular manner in which the coupling device **34** and distributor **35** with the associated locking circuits function to reproduce the transmitted signal is described in United States Patent No. 1,995,181, granted to Alfred Kahn, March 19, 1935.

As hereinabove mentioned in connection with the transmitting distributor of Fig. 1, the distributor, in practice, is somewhat different from that illustrated and consists of an arrangement such as is described in Reissue Patent No. 19,626, supra. This distributor at the receiver selects only a small portion of the signal of each channel from the center of the individual one-third dot

length and assigns it to its proper receiving locking circuit which, in turn, elongates the portion to its full dot length.

For maintaining drive motor 36 in synchronism, there is employed any suitable type of synchronous correction circuit which is under control of the received signals. It is preferred to use a synchronous arrangement which is controlled by the steep slope or wave front of the rectified signal for operating a correction motor. A system of this type is described in the said patent to R. E. Mathes, No. 2,038,375.

If desired, a monitoring circuit, such as 44, may be employed for observing the incoming composite signal after rectification, but before application to the coupling tube 34. This monitor circuit may employ a coupling system similar to device 34 shown in the drawings.

For storing the received signals prior to retransmitting them to the remote branch office stations, there are provided reperforators 44 which translate the signal impulses into characters on tape. If it is desired to relay the signals on only two channels, then there may be provided any suitable utilization circuit, such as a printer or ink recorder 45 for terminating one channel either at the remote trunk station as shown, or at a distance removed from the remote trunk station but connected thereto by a wire connection.

The perforated tapes at the remote trunk station are arranged to feed into automatic tape transmitters 46 whose speed of operation is controlled in a manner similar to that hereinbefore described by a brush arrangement 47 located on a multiple unit distributor motor shaft device. This control of the automatic tape transmitters is herein indicated schematically by dotted lines 48.

For transmitting the signals to the branch office station, Fig. 3, the outputs of the automatic tape transmitters 46 are coupled via the segments of one section of the multiple unit distributor device 49—52 to an antenna 50 which is directed upon the branch office station. The wiring arrangement of portion 49 of the multiple unit distributor 49, 52, its associated locking circuit and keyer 51, and antenna 50, is similar to the wiring arrangement of distributor 19, locking circuit 24, keyer 28, and antenna 7 of Fig. 1, previously described.

A portion of distributor 52 which is a part of multiple unit distributor 49—52, is in circuit with a receiving arrangement comprising antenna 53, receiver 54, detector and tone keyer 55 and rectifier unit 56. These elements are connected together in the same manner as similar parts of the receiving elements associated with distributor 35. Antenna 53 is directed to receive signals sent out by a branch office station as shown by Fig. 3. A transmitting arrangement comprising a locking circuit 57, an amplifier 58, and an antenna 59 obtain the signals collected by antenna 53 as the brush of distributor 52 sweeps over the segments and transmits back to the local trunk station Fig. 1. It should be understood the local trunk station is equipped with a receiving arrangement as shown on Fig. 2, except that the reperforators or suitable storage apparatus are replaced by recording equipment. From the foregoing it will be understood, of course, that other receiving circuits similar to 53, 54 and 55 may be associated with the other segments of distributor 52 for receiving signals from other branch office stations like that of Fig. 3. It will also be understood that a signal originating in the remote trunk office or connected by wire line to it can be combined with the branch office signals in distributor 52.

The operation of the system of Fig. 3 will be obvious from what has been said before. The signals transmitted from the remote trunk station of Fig. 2 are received on a circuit identical with those described hereinabove to receive signals at the remote trunk station. For transmitting signals from the branch office station to the remote trunk station, however, there is provided an automatic tape transmitter 60 whose motor 61 is controlled from the shaft 62 of the motor 63. Since the speed of the distributor motor 63 is controlled by the steep wave front of the signals incoming from the remote trunk station, it will be seen that the signals outgoing from the branch office station are also synchronized.

In the operation of the system as a whole, Morse code signal characters are transmitted from automatic tape transmitters 9, 10, and 11 (Fig. 1) and are delivered to the multiplex transmitting system as brush assemblage 25 sweeps over the segments. Only a portion of the basic unit comprising the dot length is obtained from each channel while the remaining portions of the dot length unit are discarded. Multiplex distributor 19 is driven at constant speed under control of motor drive unit 16, the latter in turn functioning to control the rotating mechanism at the distant automatic Morse code transmitting stations. In this manner all signals in the various channels remain under control of the multiplex distributor which assigns the multiplex equipment at predetermined intervals to each of the channels successively for an interval equal to a predetermined portion of the basic dot length unit. The composite signal composed of positive and negative pulses, received by the multiplex equipment 24, is utilized to energize the radiating antenna equipment 7. At the remote trunk station the signals are picked up by a suitable energy collector, rectified, and the rectified portions of the composite signal applied to a coupling system which, in combination with a distributor 35, synchronously controlled by the incoming signals to rotate at a rate of speed the same as the distributor of the transmitting station, assigns portions of the received signal, which correspond with the portions obtained from the transmitting channel at the transmitting station, to the respective receiving channels where, through a suitable condenser and locking circuit arrangement, as shown, spacing and marking pulses are generated similar to those originally transmitted to affect the respective reperforators which store the signals on tape.

A slight interval of time later the stored signals are retransmitted by automatic tape transmitters 46 under control of section 49 of multiple unit distributor 49—52, to the branch office station, Fig. 3, where they are not only recorded but also utilized to synchronize the receiving and transmitting equipment thereat.

It will be understood that any number of branch stations, and various combinations of automatic tape transmitters may be employed, as is desired. These transmitters may be located as near or as far removed from each other and from their associated stations as convenience and necessity dictate.

What is claimed is:

1. In a multiplex telegraph relaying system comprising a local trunk station, a remote trunk station, and a branch office station, the method of

communication which includes producing at said local station a plurality of message signals corresponding to the number of channels in the system, dividing the successive basic time units of the message characters of each channel into equal portions of like number as the total number of channels used and transmitting a composite signal formed by combining equal portions from the successive channels consecutively and discarding the remaining portions of the basic time units, receiving said composite signals at said remote trunk station, breaking down the composite signal into the different selected message portions, restoring the latter to have periods of time corresponding with those of the original message characters prior to division and selection at the transmitter, storing the different message signals, transmitting from said remote trunk station to said branch office station a composite signal similar to that received by said remote trunk station, said composite signal being formed of selected portions of the stored signals, and receiving said composite signal at said branch office station.

2. A multiplex telegraph system having, in combination, a local trunk station and a remote trunk station, means in circuit with said local trunk station for producing a plurality of message signals and separate means for dividing the successive basic units of the characters of each message signal into equal portions of like number as the total number of channels used, and for combining equal portions from the successive channels consecutively into a composite signal, and additional means in circuit with said local station for transmitting said composite signal to said remote trunk station, means at said remote trunk station for receiving said composite signal and breaking same down into the different message portions and for restoring the latter to have periods of time corresponding with those of the original message characters prior to division, a reperforator at said remote trunk station individual to each channel for recording the message signals of each channel on tape, and an automatic tape transmitter for each reperforator arranged to receive the tape from its associated reperforator for producing signal pulses corresponding to the characters on said tape.

3. A multiplex telegraph system having, in combination, a local trunk station and a remote trunk station, means in circuit with said local trunk station for producing a plurality of message signals and for dividing the successive basic units of the characters of each message signal into equal portions of like number as the total number of channels used, and for transmitting to said remote trunk station a composite signal formed by combining equal portions from the successive channels consecutively, means at said remote trunk station for receiving said composite signal and breaking same down into the different message portions and for restoring the latter to have periods of time corresponding with those of the original message characters prior to division, a reperforator at said remote trunk station individual to each channel for recording the message signals of each channel on tape, an automatic tape transmitter for each reperforator arranged to receive the tape from its associated reperforator for producing signal pulses corresponding to the characters on said tape, and means at said remote trunk station similar to that at said local trunk station for combining the signal pulses from said tape transmitters to produce a composite signal formed of equal portions selected from the tape transmitters, means for transmitting said last composite signal, and a distant branch office station for receiving said composite signal from said remote trunk station.

4. A multiplex telegraph system having, in combination, a local trunk station and a remote trunk station, means in circuit with said local trunk station for producing a plurality of message signals and for dividing the successive basic units of the characters of each message signal into equal portions of like number as the total number of channels used, and for transmitting to said remote trunk station a composite signal formed by combining equal portions from the successive channels consecutively, means at said remote trunk station for receiving said composite signal and breaking same down into the different message portions and for restoring the latter to have periods of time corresponding with those of the original message characters prior to division, a reperforator at said remote trunk station individual to each channel for recording the message signals of each channel on tape, an automatic tape transmitter for each reperforator arranged to receive the tape from its associated reperforator for producing signal pulses corresponding to the characters on said tape, and means at said remote trunk station similar to that at said local trunk station for combining the signal pulses from said tape transmitters to produce a composite signal formed of equal portions selected from the tape transmitters, means for transmitting said last composite signal, and a distant branch office station for receiving said composite signal from said remote trunk station, rotating mechanism and an automatic transmitter at said distant branch office station, the speed of said transmitter being under control of said rotating mechanism, the phase and speed of said rotating mechanism being under control of the composite signal received from said remote trunk station.

5. In a telegraph relaying system, the method of maintaining synchronism among a group of stations, each of which has rotating mechanism thereat which comprises transmitting message signals from one station to another, utilizing said message signals to control the speed and phase of the mechanism at said last station, storing said signals, relaying said signals to still another station, and utilizing said relayed signals to control the speed and phase of said last station whereby the rotating machinery at all of said stations are controlled in a predetermined manner.

6. In a radio telegraph relay system, a remote trunk station having a single unit distributor and a motor therefor, and a multiple unit distributor and a motor therefor, signal receiving apparatus associated with the said single unit distributor for receiving signals from a distant trunk station, signal transmitting apparatus and additional receiving apparatus in circuit with said multiple unit distributor, means in circuit with said single unit distributor for storing signals received over said first receiving apparatus and for subsequently sending out corresponding signals over said transmitting apparatus through one unit of said multiple unit distributor to a branch station or stations, said branch station or stations having means thereat for receiving the signals transmitted out from said remote trunk station and for transmitting back to the

additional receiving apparatus located at the remote trunk station signals which are controlled as to speed.

7. In a telegraph relaying system, the method of maintaining synchronism among a group of stations, each of which has rotating mechanism thereat which comprises transmitting message signals from one station to another, utilizing said message signals to control the speed and phase of the mechanism at said last station, storing said signals and subsequently relaying said stored signals to still another station, and utilizing said relayed signals to control the speed and phase of said last station whereby the rotating machinery at all of said stations are controlled in a predetermined manner.

8. In a telegraph relay system, a relay station having a single unit distributor and a multiple unit distributor, separate motors for driving each of said distributors, signal receiving apparatus associated with said single unit distributor for receiving signals from a distant transmitting station, means at said relay station controlled by the received signals from said distant transmitting station for controlling the speed and phase of the motor driving said single unit distributor, additional apparatus comprising first and second signal transmitting equipment and additional receiving equipment in circuit with said multiple unit distributor, said second signal transmitting equipment and said additional receiving equipment being connected to one unit and said first transmitting equipment to another unit of said multiple unit distributor, means including signal storage apparatus in circuit with said single unit distributor for storing signals received over its associated receiving apparatus and subsequently sending out corresponding signals over said first transmitting apparatus through said multiple unit distributor to a distant terminal station, said additional receiving equipment being adapted to receive signals from said distant terminal station for transmission over said second transmitting equipment through said multiple unit distributor to said distant transmitting station.

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