Feb. 28, 1939. R. HOOVER 2,149,219

SIGNALING SYSTEM AND APPARATUS THEREFOR

Filed July 25, 1936 3 Sheets-Sheet 1

FIG. 1

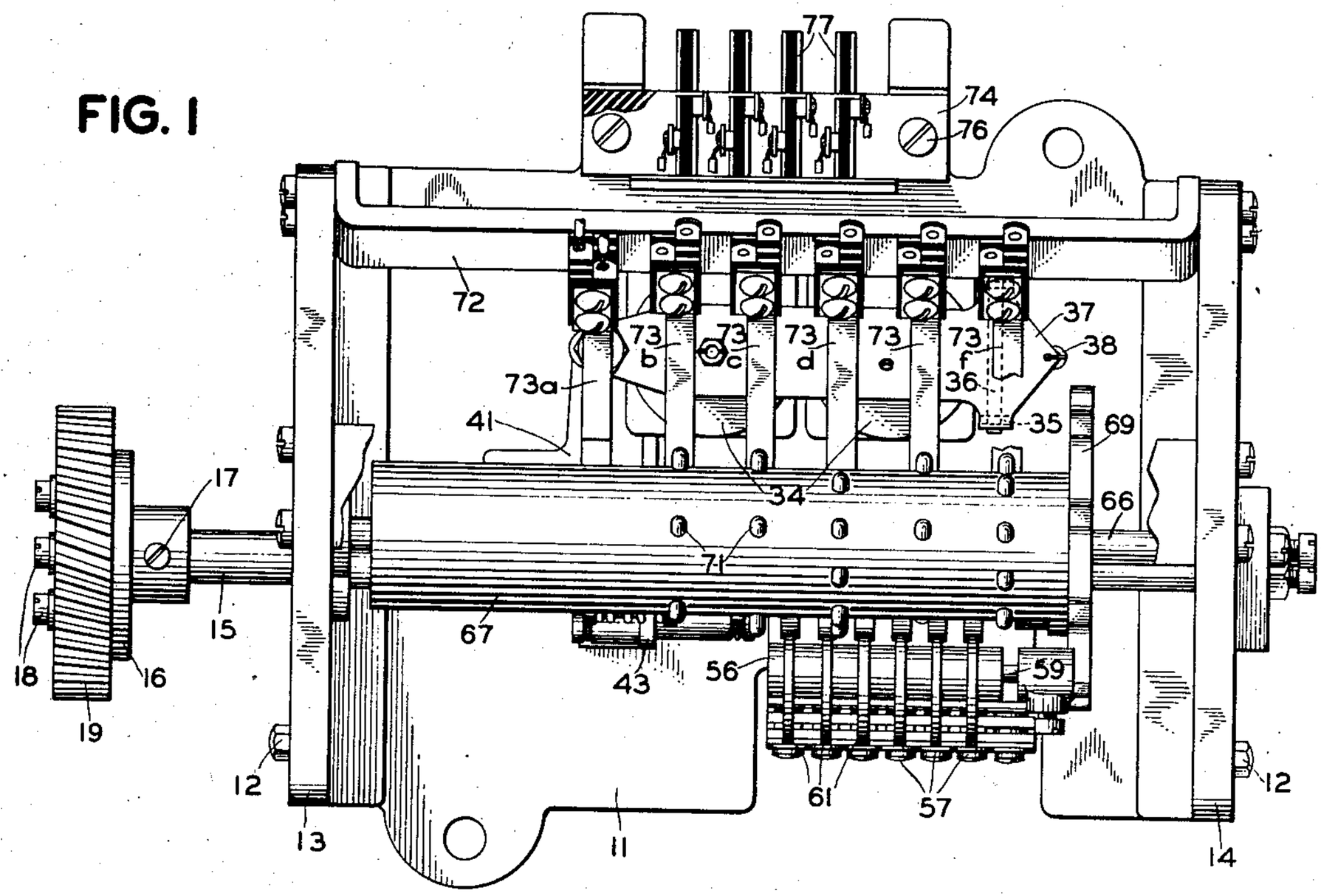

FIG. 2

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FIG. 3

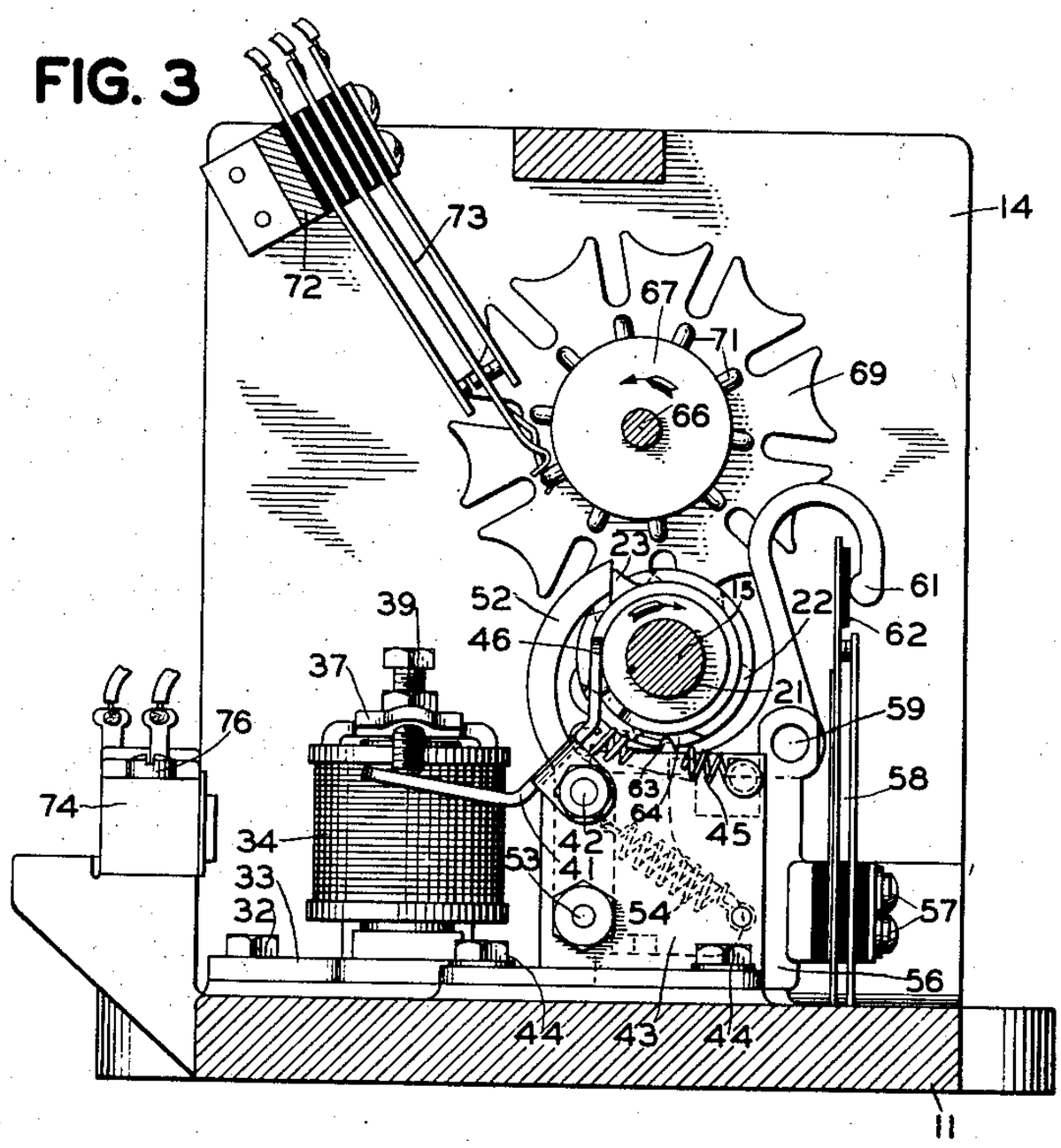

FIG. 4

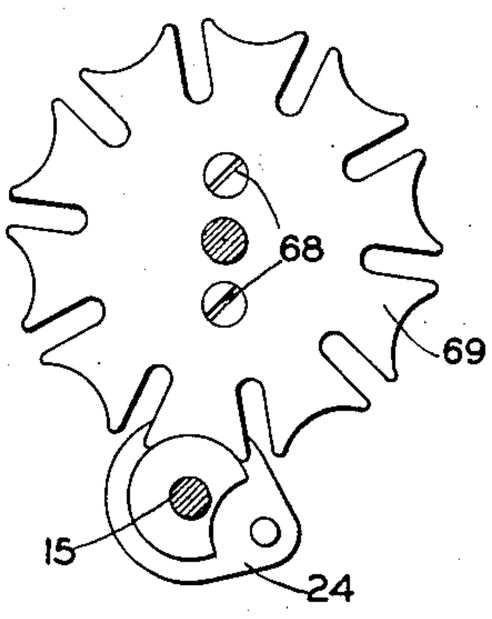

FIG. 5

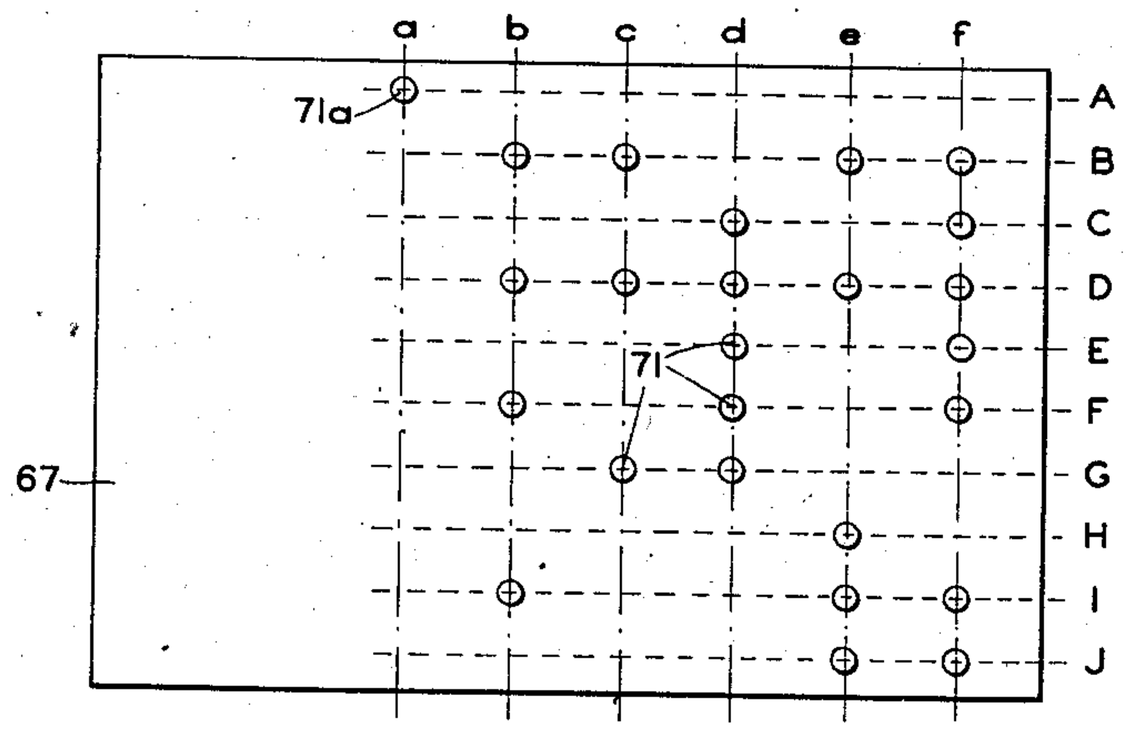

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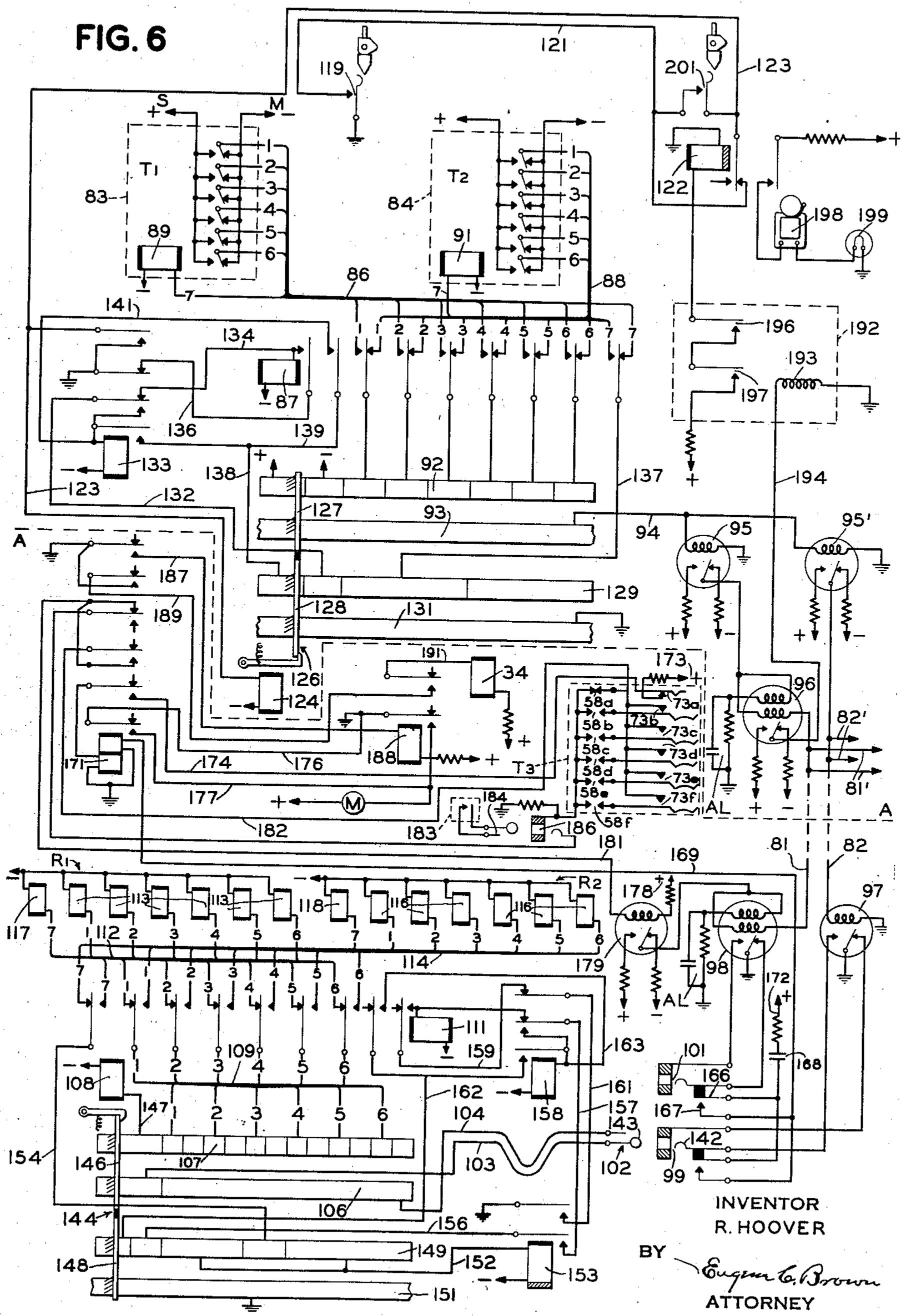
FIG. 6



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UNITED STATES PATENT OFFICE

2,149,219

SIGNALING SYSTEM AND APPARATUS THEREFOR

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Application July 25, 1936, Serial No. 92,629

24 Claims. (Cl. 178—2)

This invention relates to a signaling system and apparatus therefor, and more particularly to an auxiliary system and apparatus which is especially adapted for use in conjunction with a system for selectively controlling remotely disposed stock, commodity and like boards or registering apparatus. A telegraph system with which the hereinafter described embodiment of the invention is particularly adapted for use is one which requires phasing or synchronizing signals or periods and such a system will be described in conjunction with the description of the invention. Reference is made to a pending application of W. F. Quimby, Ser. No. 55,510 for a complete description of such a system. It should be kept in mind, however, that the invention is not limited to such use but may be adapted to be used in conjunction with various other telegraph systems of communication.

In the hereinafter described arrangements of transmitting market signals, as for example those used to control a quotation board, from a transmitting or sending station to a receiving station, two separate channels or wires are used, and with an active market, these signals are continuously transmitted simultaneously over each of these wires during the market hours. One wire normally controls the operation of the receiving station while the second wire is provided for use in case of failure of the first wire. In the system to be described, one wire is adapted for differential duplex service and provides a channel of communication during the market hours from the quotation board receiving station to the sending station and this channel is operated by terminal equipment consisting of start-stop type sending and printing units located at the quotation board receiving and sending stations respectively. This channel of communication with its associated terminal equipment will be hereinafter referred to as the auxiliary signaling system.

The market signals are of the type which, as is familiar to those versed in the art, generally operate in conjunction with periodic synchronizing signals or periods. Such signals are provided to bring or keep the receiving units in proper phase relationship with the transmitting units. During an active market in this system these synchronizing or phasing periods are automatically interposed into the quotation board signals after the transmission of every hundred and twenty or some other predetermined number of quotations or at predetermined intervals. By means of the auxiliary signaling apparatus, the receiving station may at any time communicate with the sending station and request extra synchronizing signals, the rewriting of quotations or any other information or signals that may be desired at the receiving station.

When trouble develops on the wire normally controlling the receiving station, a changeover is made at the receiving station from that wire to the other wire. As the sending station has no way of determining when such a changeover is made, no synchronizing signals will ordinarily be transmitted at that time. Therefore, the receiving station either has to request synchronizing signals by means of the auxiliary signaling apparatus at the time of the changeover, or wait for regular synchronizing signals which are automatically transmitted at predetermined intervals as hereinbefore stated. If, during an active market, the changeover occurred shortly after a regular synchronizing period, the receiving station may lose as many as one hundred and twenty quotations unless the receiving station immediately after the changeover requests a synchronizing period. At best, however, and under the most favorable conditions, an appreciable length of time elapses and consequently a considerable number of quotation board signals will be lost by the receiving station before the sending station transmits the required synchronizing signals.

It is, therefore, one of the objects of this invention to provide a mechanism and means for controlling such a mechanism whereby under the above stated conditions the transmission of one or more predetermined signals will be automatically initiated with a changeover at a receiving station from one channel of communication to another in a telegraph system.

Another object is to provide a mechanism which operating in conjunction with the above mentioned type of telegraph systems will automatically cause the sending station to transmit a synchronizing period concomitantly with a change from one channel of communication to another at the receiving station.

Another object is to provide a method and mechanism whereby telegraph service of the hereinbefore described character can be more expeditiously and conveniently handled.

Further objects of the invention will appear as a description thereof proceeds with reference to the accompanying drawings, in which:

Fig. 1 is a plan view of a transmitting mechanism adapted for use in conjunction with this invention;

Fig. 2 is a front elevational view thereof;

Fig. 3 is a detail cross-sectional view thereof taken on line 3—3 of Fig. 2;

Fig. 4 is a fragmentary cross-sectional view thereof taken on line 4—4 of Fig. 2;

Fig. 5 is a developed view of a contact-actuating drum used in the transmitting mechanism of this invention; and

Fig. 6 is a circuit diagram showing the electrical connections of the transmitting mechanism, the electrical connections of the telegraph system associated therewith and the electrical connections therebetween.

The preferred embodiment of this invention contemplates the employment at the receiving station of a so-called auxiliary transmitting mechanism which will transmit to the sending station a group of signals at the time of a changeover from one wire to another. This transmitting mechanism comprises an independently rotatable transmitting cam with transmitting contacts associated therewith and operated thereby and a drum successively positioned by the rotation of the transmitting cam to selectively actuate a group of secondary contacts to set up code combinations in said contacts. The transmitting cam distributes these code combinations to a sending circuit in the proper order sequentially with the positioning of said drum. Two relays are also employed to control the operation of a motor used for driving the transmitting machine and for other purposes which will be fully described in the following detailed description of the invention.

A description of the structure and operation of the auxiliary transmitter and transmitting mechanism will first be given and referring now to Figs. 1 and 2, a base plate 11 has attached at opposite ends thereof by screws 12, two vertical side plates 13 and 14 between which are mounted the elements of the transmitter. A shaft 15 journaled in the plates 13 and 14 has a collar 16 attached adjacent an end thereof by a screw 17. Secured for rotation therewith to the collar 16 by screws 18 is a pinion 19. The pinion 19 is adapted to mesh with and be driven by a pinion (not shown) attached to the shaft of a motor M, Fig. 6. Loosely mounted on the shaft 15, Figs. 1, 2 and 3, and prevented from longitudinal movement thereon, by means not shown, is a cam sleeve 21. The cam sleeve 21 has attached thereto for rotation therewith a series of six notched cam discs 22*a* to 22*f*, indicated at 22, Fig. 3, a cam 23 and a Geneva cam 24 (see Figs. 2 and 4). The cam sleeve 21 is adapted to be rotated by a toothed clutch composed of a driven member 25 and a driving member 26.

The driving member 26 of the clutch is a collar secured to the shaft 15 for rotation therewith by a screw 27. The driven member 25 is a collar loosely mounted on the shaft 15 and operatively engaged at all times with the cam sleeve 21 for rotation therewith by interengaging tooth members 28. The driven member 25 is adapted to slide along the shaft 15 to bring teeth 29 disposed on the left hand face thereof into or out of engagement with similar teeth 31 disposed on the opposed face of the driving member 26. With the teeth 29 and 31 on the two members 25 and 26, respectively, engaged, the driven member 25 and the cam sleeve 21 will rotate with the shaft 15, and with the teeth 29 and 31 disengaged, the cam sleeve 21 will not rotate with the shaft 15. The means for actuating the driven member 25 along the shaft 15 to bring its teeth 29 into or out of engagement with the teeth 31 on the driving member will be hereinafter described.

Attached to the base 11 by screws 32 (Fig. 3) is a horizontal clutch control magnet base 33 upon which are mounted the coils of a clutch control magnet 34. On a vertical extension 35 of the magnet base 33, as shown in Fig. 1, is a rod 36 on which an armature 37 is pivotally supported adjacent one end thereof. The armature 37 extends over the coils of the magnet 34 and is in operative relation with the pole pieces of said magnet. A spring 38 attached to the right hand end of the armature 37, as seen in Fig. 1, biases the armature to its retracted position. An adjusting screw 39, Fig. 3, carried in the left hand end of the armature 37, rests on an arm of a clutch control lever or stop-arm 41. The stop-arm 41 is pivotally supported adjacent the center thereof on a stud 42 extending horizontally from a bracket 43 which is attached to the base 11 by screws 44. A spring 45 attached to the stop-arm 41 normally holds the upper end thereof against the circumference of the driven member 25. On the upper end of the stop-arm 41 is a cam follower 46 shown in dotted lines in Fig. 2 which is adapted to operatively engage with a side cam surface 47 formed on the circumference of the driven member 25. The cam follower 46 of the stop-arm 41 and the cooperating portion of the side cam surface 47 are so shaped that the driven member 25 is normally urged to the right as seen in Fig. 2, and consequently its teeth 29 are out of engagement with the teeth 31 on the driving member 26. When the magnet 34 is energized by means hereinafter described, the actuation of the armature 37 causes the stop-arm 41 to also be actuated which in turn causes the cam follower 46 integral therewith to be disengaged with the side cam surface 47. Thereupon a spring 48 coiled about the cam sleeve 21 and disposed between flanges 49 and 51 on the cam sleeve and driven members 25 respectively, forces the driven member 25 of the clutch into engagement with the driving member 26. The driving member 26 will at this time be rotating by means hereinafter described and consequently the driven member 25, the cam sleeve 21, and the Geneva cam 24, will rotate therewith.

At a predetermined time the magnet 34 will be deenergized and allow the stop-arm 41 to return to its normal or unoperated position. The cam follower 46 will thereupon ride on the circumference of the driven member 25 and in the path of the side cam surface 47. As the driven member 25 continues to rotate, the side cam surface 47 and cam follower 46 will engage and consequently cause the teeth 29 of the driven member 25 to be withdrawn from engagement with the teeth 31 on the driving member 26. A further projection of the side cam surface 47 then engages the cam follower 46 and brings the driven member 25 and attached cam sleeve 21 to a stop in their predetermined stop or rest positions. A lever 52 pivoted on a shoulder screw 53 in the bracket 43 is held in engagement with the cam 23 by a spring 54. The purpose of the lever 52 and cam 23 is to prevent rebound or rotation in a reverse direction of the cam sleeve 21 and its attached parts due to the sudden stop thereof by the stop-arm 41.

A bracket 56 attached to the base 11 has insulatively mounted therein in a vertical position by screws 57 a series of six spring contacts indicated in general at 58, Fig. 3, and individually by ref-

erence numerals 58*a* to 58*f* in Fig. 2. Pivoted on a rod 59 in a bracket 56, Fig. 3, are six hooked bell cranks or contact levers 61*a* to 61*f*. Each contact lever has the hooked upright end thereof in contact with a piece of insulating material 62 secured to the tongue of an associated contact 58*a* to 58*f*. Each contact lever 61 also has a substantially horizontal arm with a vertical projection 63 thereon operatively engaged with one of the cams 22*a* to 22*f* located just above. Thus each of the cams 22*a* to 22*f* is in operative relation with an associated contact lever 61 and each contact lever is operatively engaged with an associated contact 58. The spring tongues of the contacts 58*a* to 58*f* actuate their associated contact levers 61*a* to 61*f* so that the projections 63 thereon are engaged with their respective cams 22*a* to 22*f*. The cams 22*a* to 22*f*, the contact levers 61*a* to 61*f* and the contacts 58*a* to 58*f* are so arranged that when a notch 64 in one of the cams 22 passes over the projection 63 on the contact lever 61, the associated contact 58 is allowed to close by action of the spring tongue.

The cams 22*a* to 22*f* are arranged on the cam sleeve 21 so that in the rest or normal position of the cam sleeve 21, the notch 64 in the cam 22*a* is over the projection 63 on the contact lever 61*a*. Consequently, contact 58*a* is normally closed. The cam sleeve 21 in rotating about one-fourteenth of a revolution from its rest position rotates the notch 64 in the cam 22*a* out of operative relation with the projection 63 on the contact lever 61*a* and thus contact 58*a* is opened. There is then an interval equal to about one-seventh of a revolution of the cam sleeve 21 when none of the projections 63 is in a notch in their associated cams 22*a* to 22*f*. Thus all the contacts 58 are open. After about three-fourteenths of a revolution of the cam sleeve 21, the cams 22*b* to 22*f* allow the projections 63 on their associated contact levers 61*b* to 61*f* to pass in and out of the notches in said cams so that the contacts 58*b* to 58*f* are sequentially closed. Each contact 58*b* to 58*f* is closed for about one-seventh of a revolution of the cam sleeve 21 and as one contact such as 58*b* is opened, contact 58*c* will close, etc. As contact 58*f* opens, contact 58*a* is allowed to close about one-fourteenth of a revolution before the cam sleeve 21 completes a whole revolution in which position it remains until after about one-fourteenth of the following revolution of the cam sleeve 21. Thus it can be seen that as the cam sleeve 21 rotates through a plurality of revolutions, the contacts 58*a* to 58*f* are sequentially closed each for about one-seventh of a revolution of the cam sleeve 21 and that there is an interval between the opening of contact 58*a* and the closing of contact 58*b* equal to about one-seventh of a revolution of the cam sleeve 21 when all the contacts are open.

Referring to Figs. 1 to 3, a shaft 66 is journaled in the plates 13 and 14 parallel to the shaft 15. Secured to the shaft 66 for rotation therewith is a contact-actuating drum or cylinder 67 composed of insulating material. Secured to one end of the drum 67 by screws 68, Fig. 4, is a Geneva wheel 69 which is in operative relation with the Geneva cam 24 on the cam sleeve 21. As shown in Fig. 4, the Geneva wheel 69 has ten slots therein and is therefore adapted to make one revolution for every ten revolutions of the cam sleeve 21. Thus the drum 67 assumes ten different positions during one revolution thereof. Located in a predetermined arrangement in ten axial rows along the length of the drum and in six rows around the circumference thereof are a plurality of pins 71. A developed view of the drum 67 showing the arrangement of the pins 71 in the ten axial rows represented by letters A to J inclusive is shown in Fig. 5.

On a bracket 72 between the two plates 13 and 14, are a series of six contacts 73*a* to 73*f*. These contacts are adapted to be actuated by the pins 71 in the drum 67 as the drum revolves, one circumferential row of pins 71 being associated with each of the contacts 73*a* to 73*f*. The contacts 73*b* to 73*f* are arranged so that when the drum is stopped in one of its ten positions, one or more pins in one of the axial rows will be engaged with one or more of said contacts. Contacts 73*b* to 73*f* are adapted to be closed when their tongues are engaged with the pins 71. The five circumferential rows of pins in the drum 67 adapted to operate the contacts 73*b* to 73*f* are so arranged that they actuate said contacts in combinations which represent, according to a predetermined five-unit signaling code, the following ten signals: (1) figures shift (2) letter S (3) letters shift (4) letter S (5) letter Y (6) letter N (7) equal sign (8) letter B (9) letter O and (10) a blank for the ten operating positions A to J respectively of the drum 67. The contact 73*a* is arranged in conjunction with a pin 71*a* in its associated circumferential row so that the pin will momentarily open contact 73*a* as the drum 67 is being rotated from its J to its A position.

A bakelite block 74 secured to the base 11 by screws 76 has insulatively mounted therein a group of eight terminal clips 77. These clips are adapted to make electrical connection with associated clips, not shown, when the transmitting mechanism is in an operating position.

The telegraph system that the embodiment of the invention shown is particularly adapted to operate in conjunction with will now be described. The system comprises a sending station and one or more receiving stations and in the following description the operation of only one receiving station will be given; any others, if in existence, operate in substantially the same manner as the one to be described and may be connected in parallel therewith.

In general, the sending station comprises two transmitting mechanisms, such as tape transmitters of the general type disclosed in the patent to Benjamin, March 25, 1919, No. 1,298,400, and a distributor mechanism for sequentially and intermittently operating said transmitting mechanisms and distributing the impulses therefrom to the line circuit in the proper sequential order. In general, the receiving station comprises two recording units such as, for example, those used to control a quotation board, and a distributor for distributing the received line impulses to the recording units in the proper sequential order. Each of the recording units is associated with one of the transmitters and they are adapted to record only the signals transmitted by their associated transmitters. As the transmitting distributor alternately sends a code combination from each transmitter, it is necessary that the receiving and sending stations be maintained in the proper phase relationship or substantial synchronism. The manner in which synchronism is maintained will be hereinafter described in detail. The sending and receiving stations will be hereinafter referred to as stations A and B respectively, and the auxiliary transmitting mechanism hereinbefore described in detail is located at station B as will be evident as the description and operation of the system proceeds.

Referring now to Fig. 6, the equipment shown

above the dashed line A—A represents that at station A and that shown below the line A—A represents that at station B. The two stations are shown inter-connected by two line conductors represented at 81 and 82 but it will be apparent that any suitable circuits or channels may be utilized. For the purpose of illustration, line conductor 81 is shown adapted for a differential duplex circuit, and provides a circuit or channel for the hereinbefore mentioned auxiliary signaling system but any suitable circuit may be used for the auxiliary system. Any number of other receiving stations may be connected in parallel with station B to the sending station A by conductors such as 81' and 82'.

At station A the apparatus shown embraced within the two parallelograms 83 and 84 represents two transmitters T1 and T2, such as tape transmitters. The tongues of the transmitters are movable to make contact with marking and spacing bus bars in combinaions representative of the character signals to be transmitted therefrom. The tongues of transmitters T1 are connected by cable 86 to respective make stops of the third to the eighth contact groups on the right of a relay 87. The tongues of transmitter T2 are connected by a cable 88 to respective break stops of the third to the eighth contact groups of the relay 87. The tongues of relay 87 normally rest on their break stops and are adapted, as is well known in the art, to simultaneously make contact with their make stops when the relay 87 is energized as will be hereinafter described.

The break and make stops of the ninth contact group of relay 87 are connected by means of the seventh conductors of cables 86 and 88 to operating magnets 89 and 91 respectively, of transmitters T1 and T2. The tongues of the third to the eighth contact groups of relay 87 are connected to the third to the eighth segments of a segmented ring 92 of the transmitting distributor. The first and second segments of the ring 92 are connected to spacing and marking battery, respectively. A solid ring 93 associated with the segmented ring 92 is connected by a conductor 94 through the coils of two polar relays 95 and 95', in parallel, to ground. The tongue of relay 95 is connected through the coils of a differential polarized relay 96 to the line 81 and an artificial line AL so that the relay 96 is unresponsive to all signals transmitted from station A, in a manner well known in the art. The tongue of relay 95' is connected to the line 82.

At station B line conductor 82 is connected through a polarized relay 97 to ground and line conductor 81 is connected to a differential polarized relay 98 in such a manner that it is responsive to signals received over line 81 from station A. The tongues of relays 97 and 98 are grounded and the spacing and marking stops are connected to the sleeve and tip of jacks indicated at 99 and 101 respectively. A plug 102 associated with the jacks 99 and 101 has the tip and sleeve connected by conductors 103 and 104 to the first and second segments of a segmented ring 106 of the receiving distributor. Associated with ring 106 is another segmented ring 107, the first segment of which is connected through a receiver start magnet 108 to battery. The second, fourth, sixth, eighth, tenth and twelfth segments of ring 107 are respectively connected by a cable 109 to the tongues of the second to the seventh contact groups inclusive, from the left, of a relay 111. The break stops of the second to the seventh contact groups are respectively connected by a cable 112 through relays 113 to battery. The make stops of the same contact groups are connected by a cable 114 through relays 116 to battery. The relays 113 and 116 represent the groups of selecting relays of the two hereinbefore mentioned recording units of a quotation board at station B and will be indicated and hereinafter referred to as recording units R1 and R2, respectively. For the purpose of illustration two recording units known in the art as Teletype 25-A printers, are employed, which are disclosed in U. S. Patent No. 1,448,750, Relays 117 and 118 represent the operating relays of their associated recording units and are connected by the seventh conductors of cables 112 and 114 to the make and break stops respectively of the first contact group of relay 111. The other sides of the relays 117 and 118 are connected to battery.

At station A the equipment and relays are shown in their normal rest positions and the operation of this station will now be described. Assume that there are signals to be transmitted from the two transmitters T1 and T2 and the operation of station A is initiated by manually closing a key 119. The key 119 is adapted to remain closed and its closure completes a circuit from ground over conductor 121 through the break stop and tongue of the first contact group of a relay 122, over conductor 123 and through the coil of a start magnet 124 of the transmitting distributor to battery. The energization of the start magnet 124 causes the release of a brush arm indicated at 126 which is normally tending to rotate at a predetermined speed. The brush arm 126 is composed of two insulatively separate brushes 127 and 128 which bridge their associated rings 92 and 93, and 129 and 131 respectively. With the brush arm 126 in its rest position, a rest or spacing impulse is transmitted to the line conductors 81 and 82. As the brush arm 126 leaves its rest position, the brush 127 bridges the second segment of ring 92 with the ring 93 and transmits a start or marking impulse. During the transmission of the start impulse the brush 128 bridges the second segment of ring 129 and ring 131. This completes a circuit from the grounded ring 131, through the brush 128, over a conductor 132, through the tongue and break stop of the second contact group from the bottom of a relay 133, over conductor 134 and through the coil of the relay 87 to battery. The energization of relay 87 causes its tongues to make contact with their make stops and a locking circuit is provided therefor through the tongue and make stop of its first contact group, over conductor 136 through the break stop and tongue of the third contact group of relay 133 to ground. As the relay 87 is energized, its tongues connect the respective tongues of the transmitter T1 to the third to the eighth segments of the ring 92 and as the brush 127 subsequently passes over these segments a code combination of impulses representative of the settings of the tongues of transmitter T1 will be sent to the line conductors 81 and 82. As the brush 128 applies ground to the third segment of ring 129 a circuit is completed over conductor 137, through the tongue and make stop of the ninth contact group of relay 87, it being energized at this time as hereinbefore described, to the operating or stepping magnet 91 of transmitter T2, and causes a tape therein to be advanced.

As the brush arm 126 starts over the distributor

rings a second time, the brush 127 causes a rest impulse to be again transmitted to the lines which is followed by a start impulse in the same manner as previously described. As the brush 128 contacts the first segment of ring 129 a second time, it applies ground thereto and over conductors 138 and 139, through the tongue and make stop of the second contact group of relay 87, over conductor 141 and through the coil of relay 133 to battery. This energizes the relay 133 and its tongues make contact with their make stops. The tongue of the third contact group of relay 133 in moving from its break stop opens the locking circuit of relay 87 whereupon relay 87 is deenergized and its tongues fall back to their break stops. The tongue of the first contact group of relay 133 is adapted to contact its make stop with little movement of the tongue and thus insure the continuation of the circuit through relay 133 before relay 87 breaks the same. With the relay 87 deenergized, the tongues of transmitter T2 are connected to respective segments of ring 92 and as the brush 127 subsequently contacts these segments, a code combination of impulses representative of the setting of the transmitter tongues will be sent to the lines. As the brush 128 leaves the first segment of ring 129, it grounds the second segment thereof and continues a circuit therefrom over conductor 132 through the tongue and make stop of the second contact group of relay 133 and through said relay coil to battery and thereby keeping the relay energized. The brush 128 leaving the second segment of ring 129 breaks the circuit to relay 133 and the tongues thereof return to their break stops. As the brush 128 grounds the third segment of ring 129 a circuit is completed over conductor 137 through the tongue and break stop of the ninth contact group of relay 87 and through the coil of the operating or stepping magnet 89 of transmitter T1. This causes the tape to be advanced and set the tongues thereof in a combination representative of the next perforation in the tape.

Thus it is evident that on the completion of the second revolution of the brush arm 126, the relays 87 and 133 will be in their normal position which is as they were when the key 119 was initially closed. Therefore, on the next or third revolution of the brush arm 126, a code combination of impulses will be sent to the lines from the transmitter T1 followed by a combination from the transmitter T2 on the fourth revolution of the brush arm in the same manner as the first two described revolutions of the brush arm.

To stop the operation of the sending station, the key 119 is opened which opens the circuit to the start magnet 124 and allows the latch to stop the brush arm 126 of the distributor in its normal rest position. However, if the key 119 is opened during an odd revolution of the brush arm 126, the arm will not be stopped when it next reaches its rest position. This is because, as hereinbefore described, at the beginning of the second or an even number of revolutions of the brush arm 126, the relay 87 is energized and therefore, as the brush 128 bridges the first segment of ring 129, the relay 133 will be energized and apply ground through the lower stop and tongue of the fourth contact group thereof over conductor 123 to the start magnet 124. The energization of the magnet 124 occurs before the brush arm 126 reaches its rest position, and therefore, it will not be stopped for this revolution. As the brush 128 passes from the second segment of ring 129, the circuit to the relay 133 is opened, which in turn causes the opening of the circuit to the start magnet 124. Thus the brush arm 126 will be stopped when it again reaches its rest position and transmit to the lines a prolonged rest impulse.

From the above it is evident that each cycle of operation of the transmitting station comprises two complete revolutions of the brush arm 126 during which a first and second combination of impulses are transmitted from the transmitters T1 and T2 respectively.

The operation of the receiving units at station B will now be described and as shown, the relays and magnets are in their normal positions. Assume that the plug 102 is in the jack 99 and that the first mentioned start impulse is received over the line 82 which throws the tongue of the polarized relay 97 to its marking stop. This applies ground through the tips 142 and 143 of the jack and plug 99 and 102, respectively, and over conductor 103 to the first segment of ring 106. A brush arm indicated at 144 is held in its normal rest position by the armature of the receiver start magnet 108 and has a brush 146 which bridges the rings 106 and 107. Therefore, the above mentioned circuit is continued through the brush 146 over conductor 147 through the coil of magnet 108 to battery. The brush arm 144 is normally tending to rotate and the energization of magnet 108 will release it for rotation. The second segment of the ring 106 is connected by conductor 104 through the sleeves of the plug and jack 102 and 99, respectively, to the spacing stop of relay 97, and as the relay responds to received line impulses, the circuit to the segment is grounded and opened in combinations, representative of combinations of impulses transmitted from the transmitter T1. The brush 146 bridges the segments of the rings 106 and 107 in synchronism with the received line impulses and thus allows the selecting relays 113 of the receiver R1 to be sequentially operated in combinations representative of the received impulses. A brush 148 of the brush arm 144 is adapted to bridge a segmented ring 149 and a grounded ring 151. As the brush 148 bridges the third segment of ring 149, a circuit is completed therethrough over a conductor 152 and through the coil of a slow-to-release relay 153 to battery. With the brush 148 on the fourth segment of ring 149 ground is applied over conductor 154 through the tongue and break stop of the first contact group of relay 111, and through the coil of the operating relay 118 of receiving unit R2 to battery. This causes the recording of a character previously selected by the receiver R2.

The brush arm 144 is adapted to complete a revolution slightly sooner than the transmitting brush arm 126 and while the spacing rest impulse is being transmitted. Therefore the brush arm 144 is brought to rest after each revolution and adapted to be released by the start impulse of the following combination of impulses. As the brush 148 passes over the second segment of ring 149 a second time, ground is applied over conductor 156, through the tongue and make stop of the first contact group of the slow-to-release relay 153, its tongues being in energized positions at this time, over conductor 157, through the tongue and break stop of the second contact group of a relay 158 and through the coil of relay 111 to battery. This circuit energizes the relay 111 and a locking circuit is provided therefor through its first contact group over conductor 159, through

the break stop and tongue of the third contact group of relay 158, over conductor 161 and through the make stop and tongue of the second contact group of the operated relay 153 to ground. The energization of relay 111 also connects the selecting relays 116 to receiver R2 to respective segments of the ring 107. The brush 148 passing over the third and fifth segments of ring 149 a second time maintain the slow-to-release relay 153 energized and as the brush contacts the fourth segment, ground is applied over conductor 154 through the tongue and make stop of the first contact group of relay 111 to the operating relay 117 of receiver R1. This causes the recording of the previously selected character on receiver R1. The second passage of the brush 146 over the ring 107 completes circuits from the selecting magnets 116 of receiver R2 to the spacing stop of relay 97 and causes the relays to be operated in combinations representative of the operation of the relay 97. Thus the first group of impulses is recorded on the receiver R1 and the second group on R2, the recording of the group being performed during the selection of the following group, and two revolutions of the brush arm 144 comprising a complete cycle of the receiving apparatus.

If a third group of impulses follows the second with a prolonged rest impulse therebetween, the receiver operates for the third and fourth groups as previously described, the relay 153 deenergizing during the prolonged rest impulse and breaking the locking circuit to relay 111. When the third or an odd numbered group immediately follows a previous group, the relay 153 is not deenergized, and as the brush 148 contacts the first segment of ring 149, ground is applied over conductor 162 through the tongue and make stop of the eighth contact group of relay 111 over conductor 163 and through the coil of relay 158 to battery. This energizes relay 158 which breaks the locking circuit to relay 111 and allows the tongues thereof to reconnect the selecting relays 113 to the segments of ring 107. As relay 158 breaks the circuit to relay 111, the circuit to relay 158 is continued through the tongue and make stop of the first contact group thereof. Thus the transmitting and receiving stations are kept in synchronism and the signals transmitted from transmitters T1 and T2 are recorded on the receiving units R1 and R2 respectively.

The conjoint operation of the hereinbefore described communication system shown in Fig. 6, and the auxiliary transmitting mechanism hereinbefore described in detail and shown in Figs. 1 to 5 will now be given.

Assume that with the plug 102 in the jack 99, trouble develops on line conductor 82 which throws station B out of synchronism with station A. This condition will be readily discernible to the attendant at station B whereupon he immediately removes the plug 102 from jack 99 and plugs it into jack 101. Station B will thereafter receive the signals over conductor 81 through the differential polarized relay 98 through the tip and sleeve of jack 101. The probability of station B being in synchronism with station A at this time is very remote and therefore, to avoid the loss of signals, the stations should be synchronized as promptly as possible. In the embodiment of the invention shown, means is provided, which will be hereinafter described, whereby the transmission of a synchronizing period from station A is automatically initiated upon the insertion of the plug 102 in either of the jacks 99 and 101. The above mentioned synchronizing period comprises a prolonged rest or spacing impulse.

The electrical connections of the auxiliary transmitting mechanism are shown schematically in Fig. 6 along with those of the receiving units at station B, the transmitting mechanism being indicated at T3.

When the plug 102 is inserted in the jack 101, a tip spring 166 thereof contacts a tip normal 167 and completes a circuit from a charged condenser 168, through the spring 166 and tip 167 over a conductor 169 and through one coil of a doduble coil relay 171 to ground. The condenser 168 is normally charged from battery at 172 and the above circuit allows it to discharge through relay 171 and energize the same. Contact 73a is closed when the drum 67, Figs. 1, 2, and 3, is in its rest position, and therefore a locking circuit is established from battery at 173, Fig. 6, through contact 73a, over conductor 174, through the make stop and tongue of the second contact group of relay 171 and through a second coil thereof to ground. The making of the first contact group of relay 171 completes a circuit over conductors 176 and 177 to a motor M, whereupon the motor starts rotating. The motor M is adapted to rotate the shaft 15, Figs. 1 and 2, through appropriate gears at a predetermined speed.

The making of the third and fourth contact groups of relay 171 completes a circuit from battery at 178 through the operating coil of a relay 179, over conductor 181, through the make stop and tongue of the third contact group of relay 171, over conductor 182 to the tongue of contact 58*a* which is in parallel with the stops of contacts 73*b* to 73*f*. This disconnects a start-stop keyboard represented at 183 from the relay 179 and connects the auxiliary transmitting mechanism T3 thereto which renders said mechanism operable to transmit to the relay 179. The plug 184 of the start-stop keyboard 183 is normally in the associated jack 186. The tongue of relay 179 is connected to the sending side or apex of the differential polarized relay 98. The making of the sixth contact group of relay 171 completes a circuit from ground over conductor 187 to the coil of a relay 188. The relay 188 is slow to make and slow to release and is adapted to operate its associated contact groups an appreciable length of time after the circuit thereto is completed and opened respectively. This time lag is sufficient for the motor M to be up to its regular speed before the relay 188 operates. The making of the fifth contact group of relay 171 completes a circuit from ground over a conductor 189 to the make stop of the second contact group of relay 188. As the relay 188 subsequently operates the above circuit is continued over conductor 191 and through the coil of the hereinbefore mentioned clutch control magnet 34, Figs. 1, 2 and 6, to battery. This energizes the magnet 34 which in turn releases the cam sleeve 21 for rotation with the shaft 15, Figs. 2 and 3, a sufficient length of time after the completion of the circuit to the motor M to insure the shaft 15 is rotating at the desired speed.

The rotation of the cam sleeve 21 sequentially actuates the contacts 58*a* to 58*f* as hereinbefore described, to transmit to the relay 179, code combinations of impulses representative of the positions of the contacts 73*b* to 73*f*. These combinations are impulses of current and no-current and are represented by their associated contacts 73*b*

to 73*f*, being closed or open, respectively, at the time their associated transmitting contact is closed.

Assume that the drum 67 is in its rest or normal position which is such that the contacts 73*b* to 73*f* are in operative relation with the pins 71 in axial row represented at A in the developed view thereof, Fig. 5. After the cam sleeve 21 is released and before contacts 58*b* to 58*f* are actuated, the Geneva cam 24 engages the Geneva wheel 69 and rotates the drum 67 to bring the axial row of pins 71 represented at B into operative relation with the contacts 73*a* to 73*f*. Now, as the cam sleeve 21 continues to rotate, it will actuate the contacts 58*b* to 58*f* to transmit to the relay 171 a code combination representative of the pins 71 in row B of the drum 67. Subsequent revolutions of the cam sleeve 21 will successively position the drum 67 from its B to its A positions inclusive, alternately with the transmission of the combinations represented thereby, after which the cam sleeve is brought to rest as will be hereinafter described.

As the drum 67 is being rotated from its J to its A position, a code pin 71*a* momentarily opens the contact 73*a*. This opens the described locking circuit to the relay 171. The tongues of relay 171 will thereupon return to their break stops and complete and break the circuits broken and completed respectively on the energization thereof. Although the relay 171 opens the circuit to relay 188, the motor circuit is not immediately opened because the relay 188 is slow releasing. As the tongue of the fifth contact group of relay 171 returns to its retracted position, the circuit to the clutch control magnet 34 is opened, which will cause the cam sleeve to be stopped when it completes it current revolution. As the cam sleeve 21 is starting its tenth revolution at the time contact 73*a* is opened, the cam sleeve will be stopped at the completion of its tenth revolution. With the cam sleeve 21 in its rest position, the transmitting mechanism is ready for another cycle of operation which is initiated by again energizing relay 171. As described, this was accomplished by the insertion of the plug 102 in the jack 101 but it is evident that the insertion of the plug in jack 99 will also complete the circuit from the condenser 168 to the relay 171 to allow the condenser to discharge through the relay and thereby energize it. Thus the auxiliary transmitting mechanism transmits to relay 179 the ten heretofore mentioned predetermined signals on the insertion of the plug 102 in either of the jacks 99 and 101 when a transfer is made from one of the line circuits to the other.

The relay 179 operates in response to signals from either the auxiliary transmitting mechanism or the start-stop keyboard 183 as determined by the relay 171, and the relay 179 operates into the apex of the differential relay 98 which in turn transmits by means of the duplexed line 81 to station A.

At station A a start-stop printer is represented embraced within the dashed parallelogram 192 and the operating magnet 193 thereof has one side grounded and the other side connected by conductor 194 to the tongue of the differential polarized relay 96. Thus the start-stop printer is responsive to all signals transmitted over line conductor 81 from station B to station A. Two contacts 196 and 197 are mounted on the printer 192 so that they are adapted to be closed by the figures shift and the S bar respectively. These two contacts are in series with battery, the slow-to-release relay 122 and ground. Whenever a figures shift signal is followed by a letter S signal previous to the reception of a letters shift signal, contacts 196 and 197 will be simultaneously closed and consequently complete a circuit to relay 122. This condition is one that will be set up by the transmission of the first two signals of the auxiliary transmitting mechanism T3. The energization of relay 122 completes a circuit through the second contact group thereof from battery to a bell 198 and light 199 to ground. The bell 198 and light 199 will therefore operate and thus establish an audible and visible signal at station A to let the attendant there know that a receiving station is transmitting a message. The fourth, fifth and sixth signals from the auxiliary transmitter at station B are —S, Y and N— which are followed by an equal sign and then two signals representing the station transmitting. The attendant at station A on the receipt of such a message sees that a synchronizing signal is immediately transmitted.

Under normal operation the key 201 is open and therefore as relay 122 is energized, the first contact group thereof opens the circuit from ground through the key 119 over conductors 121 and 123 through the start relay 124. The deenergizing time of relay 122 is somewhat greater than the time required for the brush arm 126 to make two complete revolutions and therefore the brush arm will be stopped on the completion of an even numbered revolution as heretofore described. With the brush arm 126 stopped, a rest impulse is transmitted and a prolonged rest impulse comprises a synchronizing period. Thus on the receipt of figures shift signal followed by a letter S signal, a synchronizing period is automatically interposed into the signals being transmitted from station A. The synchronizing period allows the brush arm 144 at station B to be stopped in its rest position and the relay 153 to deenergize, which are the normal positions for the brush arm and relay.

Synchronizing may be accomplished manually instead of automatically, if desired. With the key 201 closed, the relay 122 in operating will not open the circuit to the relay 124 and the synchronizing period is manually interposed into the signals being transmitted, by the attendant opening the key 119 for a predetermined length of time when the need for such a period is brought to his attention by the operation of the bell 198 and light 199.

It is obvious, of course, that various modifications of the apparatus and circuits shown herein may be made without departing from the spirit or essential attributes of the invention. Thus, while the system described above is directed to the problem of phasing two channels, the invention may be utilized in other synchronizing systems. It is desired, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are specifically set forth in the appended claims.

What is claimed is:

1. In a telegraph communication system, a control station, a remote station, a plurality of channels connecting said stations, means whereby said control station simultaneously transmits signals over a plurality of said channels to said remote station, recording means at said remote station selectively controlled by the signals from one of said channels and means at said remote station for automatically transmitting to said

control station a group of predetermined signals when the control of said recording means is changed from one of said channels to another.

2. In a telegraph system, a control station, a remote station, a plurality of lines connecting said stations, a main transmitting mechanism at said control station normally transmitting to said plurality of lines, a recording mechanism at said remote station normally connected to one of said lines, an auxiliary transmitter at said remote station, means for connecting said recording mechanism to any one of said plurality of lines and means operative on the connection of said recording mechanism to any one of said lines whereby the operation of said auxiliary transmitter is initiated to transmit to said control station a group of predetermined signals.

3. In a transmitter, a motor for driving said transmitter, a source of electrical energy for said motor, means for controlling the application of said source of energy to said motor and means operative a predetermined length of time after the application of said source of energy to said motor to initiate the operation of said transmitter, means to stop the operation of said transmitter and means operative a predetermined length of time after the operation of said last mentioned means for operating said first mentioned means.

4. In a telegraph communication system, a control station, a remote station, a plurality of main channels adapted for communication between said control station and said remote station, a single auxiliary channel adapted for communication between said remote station and said control station, a main transmitting mechanism at said control station adapted to transmit telegraph signals simultaneously over said main channels to said remote station, said signals embodying synchronizing periods interposed therein at predetermined intervals by said main transmitting mechanism, a receiver at said remote station adapted to record said signals normally connected to any one of said main channels and selectively controlled by the signals transmitted over said channel, means for connecting said receiver to each one of said main channels, a main transmitter at said remote station normally connected to said auxiliary channel, a receiver at said control station connected to said auxiliary channel, an auxiliary transmitter at said remote station having a cycle of operation in which a group of predetermined signals are transmitted, means operative whenever said receiver at said remote station is connected to any one of said main channels to disconnect said main transmitter from said auxiliary channel and connect said auxiliary transmitter thereto, means operative subsequently to initiate the operation of said auxiliary transmitter, means controlled by said auxiliary transmitter to stop the operation thereof after one cycle of operation and disconnect the same from said auxiliary channel and reconnect said main transmitter thereto, and means controlled by said receiver at said control station whereby the receipt of predetermined signals automatically interposes a synchronizing period into the signals transmitted from said control station, said predetermined signals comprising a part of the signals transmitted by said auxiliary transmitter in each cycle of operation thereof.

5. In a telegraph system, a main station, an auxiliary station, a plurality of channels of communication between said stations, one of said channels being adapted for communication from said auxiliary station to said main station, the rest of said channels being adapted for communication from said main station to said auxiliary station, a receiver at said auxiliary station, means for connecting said receiver to each of said channels one at a time at said auxiliary station, a transmitter at said auxiliary station having a definite operating cycle, control means for said transmitter, means to render said control means operative on the connection of said receiver to one of said channels, means controlled by said control means to initiate the operation of said transmitter whereby said transmitter transmits to said main station and means controlled by said transmitter to stop the same after each cycle of operation.

6. In a transmitter, a motor for driving said transmitter, a source of electrical energy for said motor, means for controlling the application of said source of energy to said motor and means operative a predetermined length of time after the application of said source of energy to said motor and independent of the amount of rotation thereof to automatically initiate the operation of said transmitter.

7. In combination, a telegraph transmitter having a definite cycle of operation in which a plurality of predetermined code combinations of impulses are transmitted, a source of power for driving said transmitter, means for controlling said source of power, means for controlling the application of said power to said transmitter and means for controlling the operation of said first and second mentioned means in a definite timed relation, and means for rendering said first and second mentioned means inoperative in a definite timed relation.

8. In combination, a telegraph transmitter having a predetermined cycle of operation, a motor for driving said transmitter, a clutch interposed between said motor and said transmitter, a source of energy for said motor, an electro-magnet for controlling the application of said source of energy to said motor, a second electro-magnet controlled by said first electro-magnet adapted to operate with a definite time lag after the operation of said first electro-magnet, a third electro-magnet under the joint control of said first and second electro-magnets and adapted to control the operation of said clutch, means to render said first electro-magnet operative, means to render said first and third electro-magnets inoperative during the operating cycle of said transmitter, and means comprising said second electromagnet whereby said source of energy is removed from said motor after the completion of a cycle of operation of said transmitter.

9. In combination, a telegraph transmitter having a definite cycle of operation, a motor for driving said transmitter, a start-stop clutch interposed between said transmitter and motor, means to render said motor and clutch operative in the order named in definite timed relationship, and means to render said clutch and motor inoperative in the order named in definite timed relationship.

10. In a telegraph disseminating system, a central station, a transmitter at said central station, a plurality of remote stations, a recorder at each of said remote stations, a plurality of party lines interconnecting said remote stations with said central station, means to connect a recorder at a remote station to predetermined of said party lines, means whereby such operations are registered at said central station and means auto-

matically operative thereafter whereby said transmitter at said central station automatically transmits signals of a predetermined character to said predetermined party lines.

11. In a telegraph system, a plurality of remote stations, a central station for disseminating groups of signals to said remote stations, means for separating said signals by synchronizing periods normally automatically inserted therebetween at predetermined intervals, a first channel for transmitting signals from said central station to said remote stations, a second channel adapted for communication between said remote stations and said central station, means for connecting each of said remote stations to said first channel, means embodying said second channel whereby said connecting operation is registered at said central station and means whereby said central station thereupon automatically disseminates a synchronizing period.

12. In combination, a sending line, a telegraph transmitter having a definite cycle of operation, a motor for driving said transmitter, a clutch interposed between said transmitter and motor, means to connect said transmitter to said line and concomitantly render said motor operative, means operative a predetermined length of time thereafter to operate said clutch whereby said transmitter is operative, means controlled by said transmitter during the operation thereof for rendering said clutch inoperative to stop said transmitter at the completion of each cycle of operation and concomitantly disconnect said transmitter from said line and means to render said motor inoperative after the completion of each cycle of operation of said transmitter.

13. In a telegraph system of the type requiring phasing, a central station, a plurality of remote stations, means interconnecting said stations, means at said central station for phasing said central station with said receiving stations and independent means at each of said remote stations and said central station for operating said phasing means.

14. In a telegraph system, a central station, a remote receiving station, a plurality of receiving and sending line circuits in parallel between said stations, a telegraph receiver at said receiving station, means for operatively associating said receiver with any one of said receiving line circuits at a time and means responsive to the transfer of the receiver from one of said receiving circuits to another for automatically signaling the central station.

15. In a telegraph system, a central station, a plurality of remote receiving stations, a plurality of parallel line circuits extending between said stations, some of said circuits being adapted for signaling from said central station to said remote station and the others of said circuits adapted for signaling from said remote stations to said central station, a telegraph receiving unit at each of said remote stations, means for operatively associating said receiving units with any one of said first mentioned line circuits at a time and means for automatically signaling said central station over one of said second mentioned line circuits whenever the control of a receiving unit is changed from one of said first mentioned line circuits to another.

16. In a telegraph system, a central station, a remote station, a plurality of parallel line circuits between said stations, a transmitter at said central station adapted to transmit over predetermined of said line circuits, a telegraph receiver at said receiving station, means for operatively associating said receiver with any one of said predetermined line circuits at a time and means for automatically controlling said transmitter at said central station to automatically transmit a predetermined signal to said remote station whenever the control of said receiving unit is transferred from one of said predetermined circuits to another.

17. In a telegraph system, a central station, a plurality of remote stations, a plurality of parallel line circuits extending between said central station and said remote stations, a transmitting mechanism at said central station adapted to transmit simultaneously over predetermined of said line circuits, a telegraph receiver at each of said remote stations, means at each of said remote stations for operatively associating the receiver thereat with any one of said predetermined line circuits at a time and means for automatically controlling said transmitting mechanism to transmit a predetermined signal to all of said remote stations whenever the control of a receiver at any of said remote stations is changed from one of said predetermined line circuits to another.

18. In a telegraph system of the type operating in conjunction with synchronizing signals, a central station, a receiving station, a single synchronizing means for synchronizing said stations one with the other and means for controlling said synchronizing means from either of said stations.

19. In a telegraph system of the type operating in conjunction with and requiring phasing, a central station, a remote station, a plurality of channels between said stations, means at said central station for phasing said station with said receiving station and means for rendering said phasing means operable, said last mentioned means being manually operable at said central station and automatically operable from said remote station when the control thereof is changed from one of said channels to another.

20. In a telegraph system, a central station, a plurality of remote stations, a plurality of parallel line circuits from said central station to said remote stations, a receiving unit at each of said remote stations, means for operatively associating each of said receiving units with any one of predetermined line circuits at a time, and automatic means for transmitting over other of said line circuits to said central station a permutation code signal when the control of any one of said receiving units is changed from one of said predetermined line circuits to another, said permutation code signal being indicative of the station at which the change is made.

21. In combination, a telegraph transmitter having a definite cycle of operation in which a plurality of predetermined code combinations of impulses are transmitted, a source of power for driving said transmitter, means for controlling said source of power, means for controlling the application of said power to said transmitter and means for controlling the operation of said first and second mentioned means in a definite timed relation.

22. In combination, a telegraph transmitter having a definite cycle of operation in which a plurality of predetermined code combinations of impulses are transmitted, a source of power for driving said transmitter, means for controlling said source of power, means for controlling the application of said power to said transmitter and

means for controlling the operation of said first and second mentioned means in a definite timed relation, said last mentioned means comprising electro-magnetic operated means.

23. In a telegraph broadcasting system, a central station, a transmitter at said central station, a plurality of remote stations, a plurality of channels of communication between each of said remote stations and said central station, a receiving apparatus at each remote station, means to connect the receiving apparatus at a receiving station to any of the channels terminating thereat and means operative thereupon whereby transmission from said central station is automatically halted for at least a predetermined length of time.

24. In a telegraph system, a central station, a plurality of remote stations, a plurality of parallel line circuits from said central station to said remote stations, a receiving unit at each of said remote stations, means for operatively associating each of said receiving units with any one of predetermined line circuits at a time, and means for automatically transmitting over other of said line circuits to said central station a group of predetermined signals when the association of any one of said receiving units is changed from one of said predetermined line circuits to another.

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