July 15, 1941. F. H. HANLEY 2,248,923

COMMUNICATION SYSTEM

Filed May 9, 1939 2 Sheets-Sheet 1

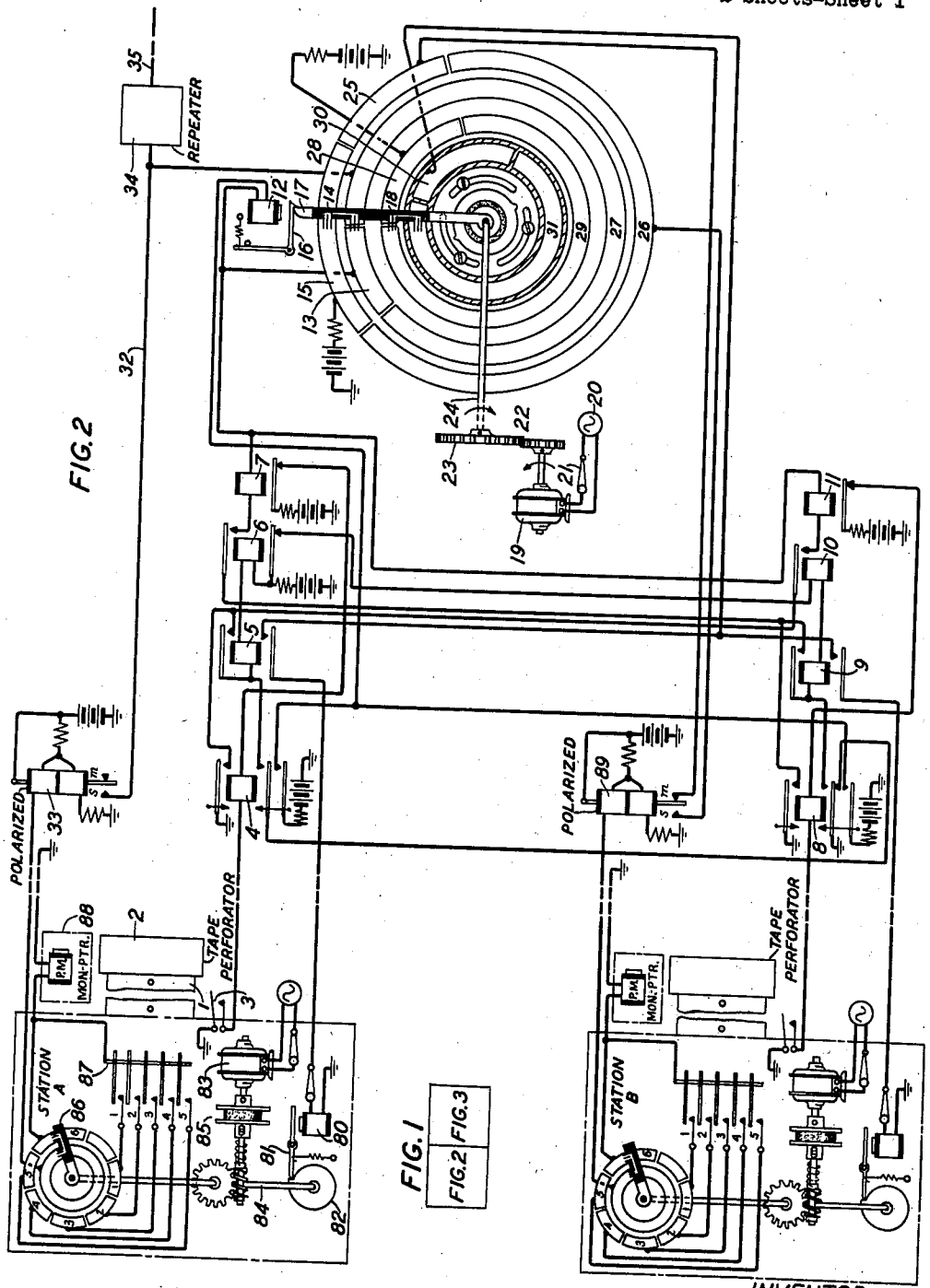


FIG. 2

FIG. 1

FIG. 2	FIG. 3

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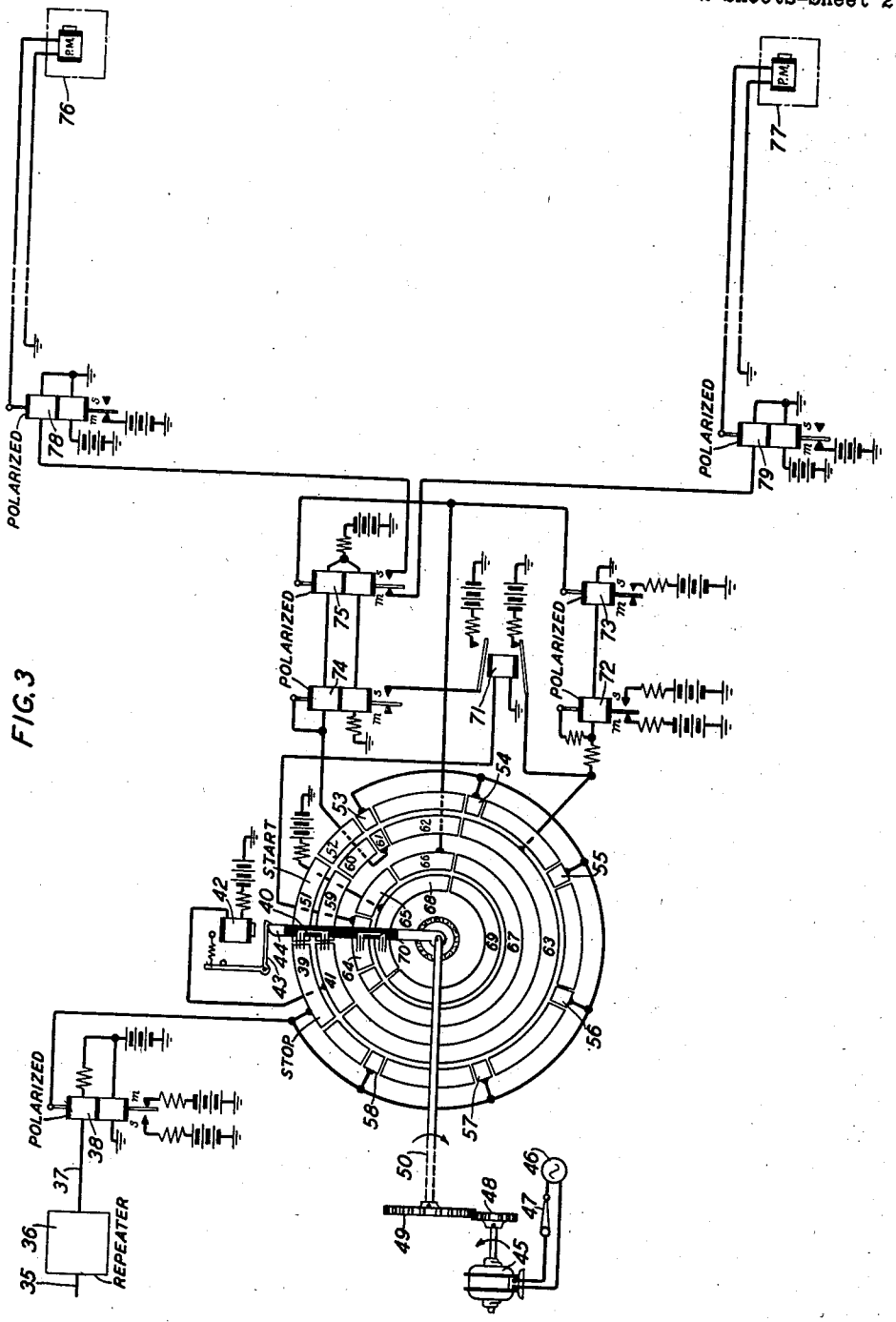


FIG. 3

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COMMUNICATION SYSTEM

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Application May 9, 1939, Serial No. 272,675

7 Claims. (Cl. 178—53.1)

This invention relates to communication systems and particularly to telegraph systems where intelligence is transmitted from point to point by permutation code.

The object of the invention is to provide service for a plurality of subscribers at one point to a corresponding plurality of subscribers at another point over a common channel which appears to each subscriber as a direct individual and permanently established connection to another particular subscriber.

In accordance with this invention a sequence circuit is provided for alternately giving the various transmitting stations command over the common channel so as to allow the alternate transmission of a character code from each station in a condition to transmit. When only a single station is in such a condition then that station takes the full time of the common channel but when more than one is in a condition to transmit then the time is divided share and share alike.

I am aware of an arrangement disclosed in Patent 2,171,542, granted to Cunningham et al. Sept. 5, 1939, wherein the time of a common channel linking a pair of synchronously operating distributors is divided among connections which appear to the subscribers to be direct individual and permanently established connections between corresponding local stations at opposite ends of such channel. I am aware of the fact that such appearance in this disclosure is maintained by the transmission between each character code over such common channel of signals identifying that apparent connection which is next to have the use of such common channel.

I am further aware of the disclosure in patent granted to Borgeson et al. Ser. No. 174,468, filed Nov. 13, 1937, which issued on Dec. 10, 1940 as Patent No. 2,224,250 wherein start-stop distributors are employed at each end of a common channel and identification signals are transmitted for each operation of such start-stop distributors prior to the transmission of intelligence signals for each apparent connection with the time of inactive connections given over to active connections.

I am further aware of the disclosure in Patent 2,207,314, granted to Cunningham et al. July 9, 1940, wherein a novel start-stop distributor means at each end of the common channel is employed comprising a high speed distributor for transmitting identification signals and a low speed distributor for transmitting intelligence signals together with a circuit arrangement whereby the time of inactive connections is given over to and divided equally and automatically among active connections.

My contribution to this art is an arrangement employing start-stop distributing means at the opposite ends of a common channel wherein the identification of the next in turn active connection to be given command of the common channel is made invariably at the same point in the operation of the said start-stop apparatus. In my system, upon the exclusive appropriation of the common channel to a connection there is first transmitted what may be termed an appropriation signal notifying the start-stop apparatus at the distant end that the common channel has been appropriated and that the apparatus at the near end has started. This acts to start the apparatus at the far end and to immediately prepare selecting apparatus thereat for the reception of the identifying signal. The identification signal then follows. According to my invention, the identification of a connection is made by different character signals rather than differently timed signals. This is of great advantage in the saving of time since the time for the operation does not have to extend over a number of distributor segments equal to the number of connections but is carried out in the space of a single segment.

In the specific embodiment of my invention the identification signal takes the form of either a mark or a space signal but it will be understood that I contemplate other forms of signals, all of which are transmitted at the same instant and over an equal length period.

A feature of the invention is an arrangement whereby the time usually used in start-stop permutation code sending for sending the start signal is used for sending, instead, an identification signal to denote the particular station which is about to transmit a code and to select to receive that code the particular receiving station which forms a seemingly permanently established connected pair with the said particular station about to transmit. The usual start pulse is then generated locally at the receiving end of the common channel and transmitted to the receiving station in time to start the receiving apparatus thereat to properly receive the transmitted permutation code.

The drawings comprise two sheets of drawings which, when placed as indicated in Fig. 1, form a circuit diagram illustrating the invention.

Let us first assume that station A in the upper

left-hand corner of Fig. 2 is in condition to transmit. This means that sufficient tape 1 will have been perforated by the perforator 2 to cause the closure of tape switch 3. Thereupon a circuit is closed from ground through tape switch 3, winding of relay 4, the back contact and armature of relay 7 to positive battery. Relay 4 is energized and closes a circuit from ground, the inner lower armature and back contact of relay 8, the inner lower armature and front contact of relay 4, the winding of relay 5 and the winding of relay 6 to positive battery. Relays 5 and 6 become energized and lock in a circuit including ground, the upper armature and front contact of relay 4 and the front contact and upper armature of relay 5.

Relay 4 also closes a circuit from negative battery through its outer lower armature and front contact, winding of latch magnet 12, segment 13, brush 14 and segment 15 to positive battery, whereupon the latch 16 is withdrawn from engagement with arm 17 and this arm carrying the brushes 14 and 18 begins to revolve.

The device generally at the right of Fig. 2 is a start-stop type distributor. A motor 19 energized by a source of current 20 in a circuit including a switch 21 runs at a constant speed. Through appropriate gears 22 and 23 the motor 19 drives the shaft 24 and this, through any well-known type of slip clutch, drives the arm 17 carrying brushes 14 and 18 when the arm 17 is not held stationary by the latch 16.

Brush 14 makes contact between one line of segments 15, 25 and 26 and another line of segments 13 and 27. Likewise, brush 18 makes contact between one line of segments 28 and 29 and another line of segments 30 and 31. The line of segments 30 and 31 is adjustable with respect to the other lines of segments for purposes of orientation, which function is well understood in the art and hence will not be further explained herein.

Immediately after arm 17 has been unlatched it moves under control of shaft 24 in a clockwise direction. Immediately, therefore, the connection between segments 13 and 15 through brush 14 is broken and latch magnet 12 is allowed to release. Immediately thereafter a connection is established between segments 15 and 27 for the purpose of applying positive battery to the line 32, thus putting a spacing condition on this line. The spacing condition is transmitted through the repeater 34 over line 35 through repeater 36, line 37 and receiving relay 38 which is driven to its spacing contact. Relay 38 establishes a connection from its spacing contact over stop segment 39, brush 40, segment 41 to latch magnet 42 and thence to negative battery, resulting in the energization of the latch magnet 42 and the movement of latch 43 to free the arm 44.

The distributor shown in Fig. 3 operates like the distributor in Fig. 2 though its segments are cut in a different manner. Here a motor 45 is run at a constant speed from a source of current 46 through a circuit including switch 47. The motor 45 drives a set of gears 48 and 49 to cause shaft 50 to rotate at a constant speed. The distributor arm 44 is associated with the shaft 50 through a slip clutch and will rotate in a clockwise direction when freed by latch 43. This arm carries two sets of brushes. Brush 40 makes connections between the line of segments 39 and 51 to 58, inclusive, and the line of segments 41 and 59 to 63, inclusive and the brush 70 makes connections between the line of segments 64 to 67, inclusive, and the line of segments 68 and 69. The arm 44 is constructed and arranged to complete one full revolution in slightly less time than the arm 17, so that if arm 17 is caused to rotate continuously without being stopped by the latch 16 then arm 40 will become latched just in time to start a new revolution as arm 17 reaches the point where it will normally be unlatched.

In the latched position of arm 4 and for a short time after this arm is unlatched and starts to travel, brush 70 makes connection between segments 64 and 68 whereby relay 71 is energized. This relay serves in its energized position to lock relays 72 and 73 in their marking positions and to open a locking connection for relays 74 and 75. Shortly thereafter brush 70 leaves segment 64 and relay 71 therefore returns to normal.

As the arm 44 continues to revolve, brush 40 establishes a connection between segments 53 and 61 for the purpose of selecting either station 76 or station 77 to receive the code impulses about to be transmitted. If relay 38 is on its spacing contact at this time, then relays 74 and 75 will move to their spacing contacts and a circuit from the armature of relay 73 will be established to the sending relay 78 and relays 74 and 75 will lock on their spacing contacts through the back contact and upper armature of relay 71. If relay 38 is on its marking contact at this time, then relays 74 and 75 will remain on their marking contacts and a connection will be established from the armature of relay 73 to the sending relay 79.

It should be particularly noted that the identification signal results in the operation or nonoperation of relay 75 and that this is due to the different character of such identification signal. It should be further noted that other means are contemplated within the scope of this invention, such as other relay arrangements responding to other types of different character signals which might include differential arrangements, marginal arrangements or even various alternating current tuned arrangements. While the simplest type of polar arrangement is shown as an example, it is to be understood that the invention is not to be limited thereto.

Returning now to the sending distributor, it will be noted that as the arm 17 is unlatched and begins to move a connection is established between segments 15 and 27 to put a spacing condition on line 32 as before mentioned. As the arm 17 progresses, and in accordance with the setting of the before-described orientation means, a connection will presently be established by brush 18 between segments 28 and 30 whereby battery is connected to the front contacts of the lower armatures of relays 5 and 9. Since it was assumed that station A was in a condition to transmit, this connection will result in the energization of latch magnet 80.

Station A is equipped with a tape transmitter consisting essentially of a constant speed motor 83 driving a shaft 84 through a slip clutch 85. When the latch magnet 80 becomes energized, the latch 81 is moved out of engagement with the cam 82 and shaft 84 moves the distributor arm 86. The distributor arm 86 is constructed and arranged to make a complete revolution in approximately the same time as arm 17. The orientation device is so set that this tape transmitter is started at such a time that the brush arm 86 is sweeping over the segments connected to the tape contacts generally designated 87 while the brush 18 is making connection between seg-

ments 26 and 27. While the brush arm 86 is stationary and for a short time after it starts, a connection is made from ground through the monitor printer 88 to the relay 33, holding this relay to its marking contact. Shortly thereafter arm 86 passes over its start segment whereupon the connection to relay 33 is opened and relay 33 goes to spacing. It is at this time that brush 14 is making a connection between segments 25 and 27 and it is also at this time that brush 40 is making a connection between segments 53 and 61.

Since station A is sending, a spacing condition is put on line 32 both by the relay 33 and by the relay 89 from its back contact, segment 25, brush 14, segment 27 to line 32. Therefore, relay 38 will be on its spacing contact and station 76 will be selected.

If, on the other hand, station B had been sending, then at this time relay 33 would have been marking and relay 89 would have been spacing, with the result that line 32 would have been marking, relay 38 would have been marking and station 77 would have been selected. Thus, the time of the start pulse of station A or station B is used to transmit over the line 35 a differentiation signal rather than a start-stop signal.

As the arm 44 passes over the point where brush 40 makes connection between segments 53 and 61, the brush 70 makes a connection between segments 68 and 66 whereupon the selected relay 78 or 79 is driven to spacing, thus sending a start signal to the selected station. As arms 17, 44 and 86 advance, arm 17 reaches a point where brush 14 bridges segments 26 and 27. With station A transmitting, this connection is ineffective since sending relay 33 makes direct connection to line 32, but with station B transmitting, this connection is effective as a means to place the marking and spacing signals from relay 89 on line 32. The distributors are so timed that, as the arm 86 at station A or the corresponding arm at station B is passing over the middle part of its code segments, the brush 40 will be passing over segments 54, 55, 56, 57 and 58 and relay 73 responding to the action of relay 33 or relay 89 will transmit corresponding mark or space signals to relay 78 or 79 and thus operate the station receiving apparatus 76 or 77.

During the signaling period, brush 18 passes off segment 30, whereupon magnet 80 is released. At the receiving end the locally generated start pulse is ended by the movement of brush 70 off segment 66 just before the first signaling pulse is received.

After the five signaling pulses have been transmitted, brush 14 bridges segments 13 and 15, whereupon latch magnet again becomes energized to allow arm 17 to continue on for transmitting the next character, providing tape switch 3 is still closed and station B still remains in a non-transmitting condition.

At the receiving end, brush 40 bridges segments 39 and 41 preparing a circuit for latch magnet 42, but, as heretofore pointed out, arm 44 reaches the latching position slightly ahead of arm 17 and hence will latch. Shortly after brush 40 bridges segments 39 and 41, brush 70 makes a connection between segments 64 and 68, with the result that relay 71 is energized. Relays 72 and 73 are thereupon locked in a marking position and relays 74 and 75, if in a spacing position, are released to their marking positions.

Let us now assume that both station A and station B close their tape switches at exactly the same time. Relays 4 and 8 will become energized simultaneously. Relay 8, however, will cause the operation of relays 9 and 10 and these relays will lock to the front contact and upper armature of relay 8. Relay 11 will become energized in a circuit from positive battery, segment 15, brush 14, segment 13, relay 11, front contact and armature of relay 10, front contact and upper armature of relay 4 to ground. Relay 11 releases relay 8 and this relay then closes a circuit for relays 5 and 6, which lock to the upper armature of relay 4. Relays 9, 10 and 11 release, and now the circuit for relay 8 is again closed but this relay is slow to operate. In the meantime, the latch magnet 12 has released arm 17 so that before relay 8 could again operate to close a circuit for relay 7, brush 14 has passed beyond segment 13. Relay 7 will not operate in series with latch magnet 12. Therefore, if both stations A and B start to transmit simultaneously, station A will take command.

After the arm 17 has almost completed a revolution, brush 14 again bridges segments 13 and 15. Now relay 7 operates and causes the release of relays 5, 6 and finally itself. When relay 6 releases, relays 9 and 10 are operated and a circuit is prepared for relay 11. However, relay 4, like relay 8, is slow to operate and will not complete the circuit for relay 11 until brush 14 has passed beyond segment 13. Therefore, station B now has command of the circuit and will transmit a character.

When the brush 14 again bridges segments 13 and 15, relay 11 will operate and transfer command of the circuit to station A. In this manner station A and station B alternately have command of the circuit and each in turn sends a character.

It will be understood that if either station has exclusive command of the circuit then that station will continuously transmit, using the full time of the transmission line. If the other station then cuts in, the sequence of alternating transmission will take effect as described, as soon as brush 14 reaches segment 13 and cause a change-over from one transmitting station to the other.

While this description sets forth the circuit arrangement for only two transmitting stations and two receiving stations, it will be understood that the invention is not limited to such a specific arrangement but comprehends alternative arrangements where a sequence circuit is used to alternately put in a transmitting condition those stations which are ready to transmit and which uses the usual time of the start pulse to transmit a station identifying signal.

What is claimed is:

1. A telegraph system comprising a main line, start-stop apparatus connected to each end of said main line, extension lines connected to said start-stop apparatus each having means to transmit stop-start and permutation code impulses and supervisory equipment operatively connected to said start-stop apparatus for substituting a different character signal for identifying the active extension line with each series of impulses received over said extension lines in place of the start and stop impulses from said extension lines.

2. In a communication system, a plurality of subscribers' stations at one locality linked to a like plurality of subscribers' stations at another locality over seemingly direct individual and permanently established connections, a common channel for said connections between said localities, and means to identify each connection ren-

dered effective over said common channel comprising apparatus for controlling the character of a single impulse accompanying each code group of impulses.

3. In a communication system, a plurality of subscribers' stations at one locality linked to a like plurality of subscribers' stations at another locality over seemingly direct individual and permanently established connections, a common channel for said connections between said localities, means for rendering each of said connections effective in turn, and signal transmitting means selectively controlled by said stations for identifying said connections as they are rendered effective comprising an instrumentality for controlling the character of a single impulse accompanying and having a fixed time relationship with the impulses of each code group of impulses.

4. In a communication system, a plurality of subscribers' stations at one locality linked to a like plurality of subscribers' stations at another locality over seemingly direct individual and permanently established connections, a common channel for said connections between said localities, means at each of said stations for transmitting intelligence by start-stop permutation code signals, start-stop means for relaying said signals over said common channel, means for marking each of said connections as in a condition ready to transmit, a sequence circuit for appropriating said common channel exclusively to each of said connections in turn and means for substituting in said common channel a different character connection identification signal for the start signal preceding each permutation signal group upon appropriation of said common channel.

5. In a communication system, a plurality of subscribers' stations at one locality linked to a like plurality of subscribers' stations at another locality over seemingly direct individual and permanently established connections, a common channel for said connections between said localities, a group of relays individual to each said station forming a sequence circuit for successively appropriating said common channel exclusively to said connections, means controlled by said relays for differently identifying each said connection and means responsive thereto for transmitting identification signals over said common channel at the start of each period of appropriation, said identification signals comprising signals of different character invariably occupying the same time period in the total period of appropriation.

6. In a communication system, a plurality of subscribers' stations at one locality linked to a like plurality of subscribers' stations at another locality over seemingly direct individual and permanently established connections, a common channel between said localities, a sequence circuit for successively appropriating said common channel to active ones of said connections, means controlled by said sequence circuit for each said connections, means responsive to the appropriation of said common channel for first sending an appropriation signal, second, sending an identification signal different in character for each said connection and controlled by said first means and, third, sending communication signals, said various signals invariably occupying the same relative time periods in said cycle of signaling operations.

7. In a communication system, a plurality of subscribers' stations at one locality linked to a like plurality of subscribers' stations at another locality over seemingly direct individual and permanently established connections, a common channel for said connections between said localities, start-stop apparatus for communicating over said common channel, a group of relays at the transmitting end individual to each station thereat and forming together a sequence circuit for serially appropriating said common channel exclusively to the active ones of said connections, said sequence circuit functioning further to maintain said common channel constantly in use so long as at least one of said connections is active, means under control of said start-stop apparatus for transmitting an appropriation signal followed by an identification signal before each period of communication, said identification signal being transmitted invariably at the same point in the cycle of operation of said start-stop apparatus.

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