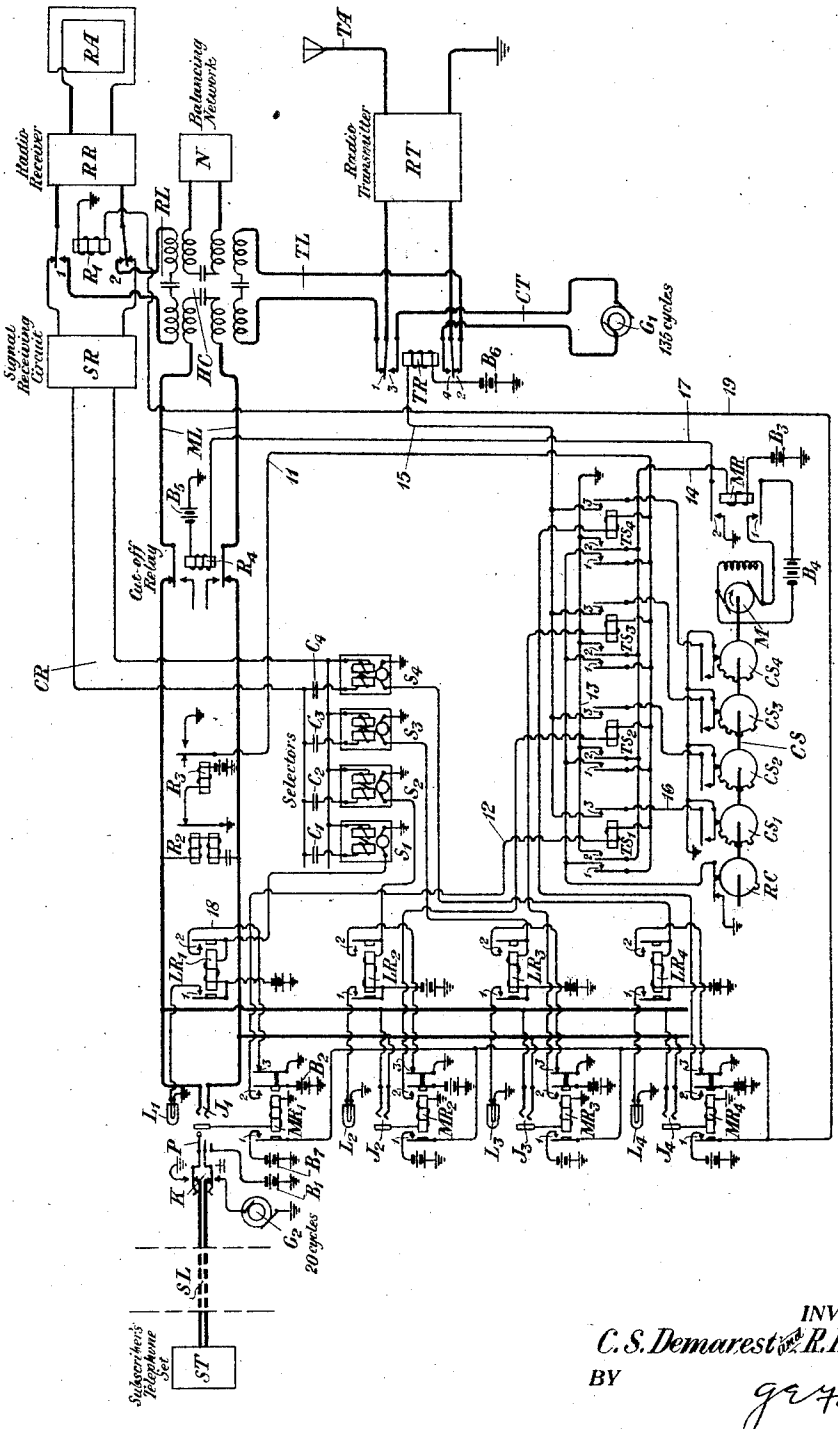
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RADIO SIGNALING SYSTEM

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RADIO SIGNALING SYSTEM.

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This invention relates to signaling systems, and more particularly to arrangements in such systems for selectively transmitting and receiving signals between a primary or central station and a plurality of secondary stations constituting a high-frequency communication system, which system employs a single signaling frequency or a relatively narrow band of signaling frequencies.

In a high-frequency communication system comprising a primary or central station and a plurality of secondary or distant stations, it is desirable that the primary station should be able to call any one of the secondary stations without at the same time signaling any of the other secondary stations. It is also desirable to have arrangements that will enable any one of the secondary stations to call the primary station without at the same time signaling any of the other secondary stations. It is further desirable to have arrangements at the primary station for indicating which one of the secondary stations is calling the primary station.

It is an object of this invention to provide a selective signaling system whereby any secondary station may be called by the primary station to the exclusion of all other secondary stations.

It is another object of this invention to provide a selective signaling system whereby any one of the secondary stations may call the primary station.

It is a further object of this invention to provide means at the primary station for indicating which one of the secondary stations is calling a primary station.

While the nature of the invention will be pointed out with particularity in the appended claims the invention itself, both as to its objects and features, will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing which represents one form of embodiment of the invention. It will be understood that although the invention will be shown and described in one particular embodiment, it may be shown and described in various other embodiments within the scope of the appended claims.

Referring to the drawing, a primary station is schematically shown which includes wiring and equipment to be used at the primary station for transmitting and receiving calling signals and voice signals between the primary station and a plurality of secondary stations (not shown). These secondary stations and the primary station, when taken together, might represent a ship-to-shore system of wireless telephone communication in which the drawing represents the shore station and the secondary stations (not shown) represent the ship stations.

The rectangle ST represents a subscriber's telephone or telegraph set or the switchboard terminal equipment in a local telephone control office. This subscriber's telephone set is connected through a line SL by means of a plug P to a main line or circuit ML for the transmission of signals. Speech transmitting and receiving circuits TL and RL are associated with the main line ML through a balanced transformer or hybrid coil HC. In order that the circuits TL and RL may be rendered conjugate with respect to the main line ML so that the electrical disturbances in one of these circuits will be without effect upon the other, the main line ML is balanced by a balancing network N.

A radio transmitter RT is connected to the speech transmitting circuit TL through the contacts 1 and 2 of a transmitting relay TR when speech signals are being transmitted. A radio receiver RR is connected to the common receiving circuit RL through the contacts 1 and 2 of a relay R_1 when speech signals are being received. The radio transmitter RT comprises means for modulating a carrier current by speech or voice signals or by low frequency calling signals for transmission by a common transmitting antenna TA to any one of the secondary stations. The radio receiver RR comprises means for demodulating the speech or voice signals or low frequency calling signals from the modulated carrier current received by the common receiving antenna RA as transmitted by any one of the secondary stations.

For the reception of low frequency calling signals the winding of the relay R_1 becomes de-energized, as will be explained hereinafter, to connect the output of the radio receiver RR with a signal receiving circuit SR. For the reception of voice current the relay R_1 becomes energized for con-

necting the output of the radio receiver RR with the speech receiving circuit RL. For the transmission of low frequency calling signals the winding of the transmitting relay TR becomes energized, as will be explained hereinafter, for connecting the low frequency signaling source G_1 of, for example, 135 cycles, with the radio transmitter RT through the calling signal transmitting circuit CT. For the transmission of voice signals the transmitting relay TR becomes de-energized so that the speech transmitting circuit TL is connected with the radio transmitter RT.

There are shown a plurality of jacks, J_1 to J_4, inclusive, each corresponding to one of the secondary stations to which the transmission and reception of signals may be established. Associated with these jacks J_1 to J_4, inclusive, are line lamps, L_1 to L_4, inclusive, each of which lights when incoming calling signals are received, thus indicating which one of the secondary stations is calling the primary station. While only four channels of transmission have been indicated in the drawing, it will be understood that any number of transmission channels may be included without impairing the effectiveness of the invention.

For the transmission of calling signals, coded impulses characteristic of each of the secondary stations are produced by the opening and closing of contacts brought about by cams CS_1 to CS_4, inclusive, which are all mounted on the same rotatable cam shaft CS, which is driven by the motor M in the direction indicated by the arrow. For the reception of calling signals, coded impulses characteristic of each of the secondary stations are selected by selectors S_1 to S_4, inclusive, into an appropriate channel. The operation of the selectors will be referred to only generally herein since a more detailed description of the selectors may be found in the patent to J. C. Field, No. 1,343,256, dated June 15, 1920. For the sake of simplicity the selectors are shown schematically.

The operation of the system for the transmission of a calling signal from the primary station to one of the secondary stations will now be described. The plug P is inserted in a jack, for example, J_1 which is associated with a channel corresponding to one of the secondary stations. The ringing key K is then operated, thus connecting a ringing generator G_2 with the main line ML. This ringing generator may be, for example, a generator capable of transmitting current of 20 cycles. An alternating current relay R_2 is bridged across the main line ML in series with a condenser and the armature of this relay is attracted when the key K is operated. This then causes the de-energization of the winding of a direct current relay R_3, thus putting ground on a conductor 11 by virtue of the release of the armature of the relay R_3.

Also, when the plug P engages the jack J_1 the winding of the relay MR_1 becomes energized by the flow of current from the battery B_1 through the sleeve of the jack J_1 and the winding of the relay MR_1. Then the armatures of the relay MR_1 are attracted, closing contacts 1 and 2 and opening contact 3 of that relay. By closing contact 2, current from the battery B_2 flows through the winding of a transmitting selecting relay TS_1 in a circuit which includes battery B_2, contact 2 of relay MR_1, conductor 12, the winding of the transmitting selecting relay TS_1, conductor 11 and the armature of the relay R_3. The transmitting selecting relay TS_1 then brings about the operation of a motor relay MR, starts in rotation the motor M and the rotatable cam shaft CS associated with it. This then prepares the circuits for the transmission of a coded impulse characteristic of one of the secondary stations, as will be explained hereinafter.

The transmitting selecting relay TS_1, when energized, closes three contacts, 1, 2 and 3. Contact 1 puts a locking ground on the winding of this relay through the contact established by the armature controlled by the release cam RC. Contact 2, controlled by the transmitting selecting relay TS_1, closes the circuit including the winding of the motor relay MR. This circuit includes battery B_3, the winding of the motor relay MR, conductor 14, contact 2 of the transmitting selecting relay TS_1 and conductor 13. As winding of the relay MR becomes energized its armatures are attracted, closing contacts 1 and 2 associated therewith. Contact 1 of the motor relay MR causes the operation of the motor M by a flow of current through the field and armature of the motor from a battery B_4. Contact 2 of the relay MR closes a circuit which brings about the energization of the winding of a cut-off relay R_4. This circuit includes a battery B_5, winding of the cut-off relay R_4, conductor 17, and contact 2 of the motor relay MR. The operation of the cut-off relay R_4 disconnects the main line ML from the line SL connected to the subscriber's telephone set ST. Contact 3 of the transmitting selecting relay TS_1 closes the circuit including the winding of the transmitting relay TR as the rotatable cam shaft CS revolves. This circuit includes a battery B_6, the winding of the transmitting relay TR, conductor 15, contact 3 of the transmitting selecting relay TS_1 and the armature and contact associated with the cam CS_1. Whenever the winding of the transmitting relay TR becomes energized, low frequency signaling current of, for

example, 135 cycles, from the source G_1 is transmitted to the radio transmitter RT through the calling transmitting circuit CT. The cam CS_1 is mounted on the rotatable cam shaft CS and is so formed as to transmit a signal characteristic of one of the secondary stations from the primary station to that secondary station. The calling signal therefor consists of spurts of low frequency signaling current of 135 cycles, which is superimposed at the radio transmitter RT on a carrier current of suitable high frequency.

After the signal characteristic of the secondary station has been completely transmitted the release cam RC momentarily takes ground off the contact 1 of the transmitting selecting relay TS_1 and brings about a de-energization of this relay. As the transmitting selecting relay TS_1 releases, it opens the circuit to the motor relay MR which includes the conductor 13, contact 2 of the transmitting selecting relay TS_1, conductor 14 and the winding of the motor relay MR. All of the cams CS_1 to CS_4, inclusive, are mounted on the same rotatable cam shaft CS; and each is so formed as to transmit a signal characteristic of one of the secondary stations.

All of the secondary stations of the system receive the modulated high frequency current, and each of these secondary stations has selecting means thereat which is responsive to a calling signal characteristic of that secondary station. The selecting means employed at the secondary stations may be selectors of the type disclosed in the patent to J. C. Field, mentioned hereinabove.

The reception of a calling signal characteristic of one of the secondary stations is received at the primary station in a manner which will now be described. At the secondary station there may be a rotatable cam shaft having a cam thereon so formed as to transmit a signal characteristic of that secondary station. That calling signal is transmitted on a carrier current in a manner similar to the transmission of calling signals at the primary stations by means of radio transmitter RT. This calling signal is received by the radio receiver RR through the common receiving antenna RA. When voice signals are not being received the relay R_1 remains de-energized and the calling signal, after being demodulated from the carrier current at the radio receiver RR, is transmitted to the signal receiving circuit SR. The output of the signal receiving circuit SR is connected to the calling signal receiving channel CR in the output of which there are a plurality of selectors, one corresponding to each of the secondary stations, each being responsive to a calling signal characteristic of one of the secondary stations. When a calling signal is received which corresponds to the signal to which the selector S_1 is responsive, the relay LR_1, will be operated by the connection of ground at the selector S_1. As the winding of the relay LR_1 is energized its armatures are attracted, closing contacts 1 and 2 of the relay. The closure of contact 1 lights the lamp L_1, thus indicating at the primary station which one of the secondary stations is transmitting a calling signal. It will be understood that while a lamp has been employed for indicating which secondary station is transmitting a calling signal, that any other indicating means, whether visual, audible, or otherwise, may be employed instead thereof.

Contact 2 of the relay LR_1 locks relay LR_1 through contact 3 of relay MR_1. Thus the lamp L_1 remains lit until the plug P engages the jack J_1. When the plug P engages the jack J_1 the relay MR_1 becomes energized by the flow of current through the winding thereof from battery B_1. This brings about the opening of contact 3 of the relay MR_1 and unlocks the winding of the relay LR_1. As the winding of the relay LR_1 becomes de-energized the light of the lamp L_1 becomes extinguished. As contact 1 of the relay MR_1 becomes closed, current flows from the battery B_7 through contact 1 of the relay MR_1, conductor 19, and the winding of the relay R_1. As the winding of relay R_1 becomes energized its armatures are attracted, closing contacts 1 and 2 thereof and connecting the output of the radio receiver RR with the speech receiving circuit RL. This then puts the main line ML in condition for the reception of voice currents.

Although the transmission and reception of calling signals at the primary station has been described for only one channel corresponding to one secondary station, it will be understood that the transmission and reception of calling signals at the primary station for the other channels corresponding to the other secondary stations takes place in a similar manner, and the description of the one channel will be deemed sufficient to describe the other channels.

While the calling signals have been described herein as produced by apparatus which includes rotatable cam shafts having cams thereon so formed as to set up characteristic signals, it will be understood that other apparatus well known in the art may equally well be employed for producing these calling signals.

While the arrangements of this invention have been disclosed in one embodiment, it is to be understood that the invention may be embodied in other and widely varied or-

ganizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a radio signaling system, a central station, a plurality of secondary stations, a plurality of radio transmission circuits inter-connecting said central station and said secondary stations, one radio transmission circuit for each secondary station, a rotatable cam shaft at each secondary station having a cam thereon so formed as to transmit a signal characteristic of the corresponding radio transmission circuit, a plurality of selectors at said central station, one corresponding to each secondary station, each selector responding to a signal characteristic of the corresponding radio transmission circuit, and means at the central station for indicating which secondary station is signaling the central station.

2. In a radio signaling system, a central station, a plurality of distant stations, a plurality of transmission circuits interconnecting said distant stations and said central station, one transmission circuit associated with each distant station, a rotatable cam shaft at each distant station having a cam thereon so formed as to transmit a signal characteristic of the corresponding transmission circuit, a rotatable cam shaft at the central station having a plurality of cams thereon, each cam at the central station so formed as to transmit a signal characteristic of the corresponding transmission circuit, a plurality of selectors one at each distant station responsive to a signal characteristic of the corresponding transmission circuit, a plurality of selectors at the central station, each responsive to a signal characteristic of a corresponding transmission circuit, and means at the central station for indicating which distant station is transmitting a signal to the central station.

3. In a radio signaling system, a plurality of radio transmission circuits, a rotatable cam shaft having a plurality of cams thereon one corresponding to each radio transmission circuit, each cam being so formed as to transmit a signal characteristic of the corresponding radio transmission circuit, means responsive to an outgoing signal to cause the corresponding cam to transmit the signal characteristic of that radio transmission circuit to a distant station, means at the distant station responsive to the characteristic signal thus transmitted, and means at the distant station for indicating the radio transmission circuit over which a signal is being transmitted.

4. In a radio signaling system, a central station, a plurality of distant stations, a plurality of transmission circuits interconnecting said central station and said distant stations, one transmission circuit corresponding to each distant station, a rotatable cam shaft at the central station having a plurality of cams thereon one associated with each transmission circuit, each cam being so formed as to transmit a signal characteristic of the corresponding transmission circuit, means at the central station responsive to an outgoing signal to cause the corresponding cam to transmit the signal characteristic of that circuit to a distant station, means at the distant station responsive to the characteristic signal thus transmitted, means at each distant station for transmitting the signal characteristic of the corresponding transmission circuit to the central station, and means at the central station for indicating which one of the distant stations is transmitting a signal.

5. In a radio signaling system, a central station, a plurality of distant stations, a plurality of transmission circuits interconnecting said distant stations and said central station, one transmission circuit for each distant station, a rotatable cam shaft at each distant station having a cam thereon so formed as to transmit a signal characteristic of that distant station, a rotatable cam shaft at the central station having a plurality of cams thereon each so formed as to transmit a signal characteristic of a distant station, a plurality of selectors, one at each distant station responsive to a signal characteristic of that distant station, a plurality of selectors at the central station each responsive to a signal characteristic of a distant station, and means at the central station for indicating which distant station is transmitting a signal to the central station.

6. In a radio signaling system, a plurality of secondary stations each having a radio transmitter and a radio receiver, a central station also having a radio transmitter and a radio receiver, means at each secondary station for setting up and transmitting a coded signal characteristic of that secondary station to the central station, means at the central station for setting up and transmitting a plurality of coded signals each characteristic of a secondary station, means at the secondary station for responding to a coded signal characteristic of that secondary station transmitted by the central station, means at the central station for responding to a coded signal characteristic of a secondary station transmitted by the secondary station, and means for indicating which secondary station is transmitting a coded signal to the central station.

7. In a radio signaling system, a primary station, a plurality of secondary stations, circuit arrangements at said stations suitable for the transmission and reception of speech signals by radio, means at each sec-

ondary station for setting up a coded signal characteristic of a secondary station for transmission to the primary station, means at the primary station for setting up a plurality of coded signals each characteristic of a secondary station, for transmission to the secondary stations, means at the primary station for responding to received coded signals characteristic of the secondary stations, and means for indicating which secondary station is transmitting a coded signal to the primary station.

8. In a radio signaling system, a primary station, a plurality of secondary stations, all of the stations being adapted to transmit a carrier current modulated in accordance with calling signals of low frequency current, means at each secondary station for generating a calling signal characteristic of that station, means at the primary station for generating a plurality of calling signals each characteristic of a secondary station, a generator at each station for generating a carrier current upon which the calling signal is modulated, a demodulator at each station for separating the calling signal from the carrier current, a selector at each secondary station selectively operated by the calling signal characteristic of that station to the exclusion of all other signals, a plurality of selectors at the primary station, one corresponding to each secondary station each selectively operated by the calling signal characteristic of a secondary station to the exclusion of all other signals, and means to indicate which secondary station is calling that primary station.

In testimony whereof, we have signed our names to this specification this 28th day of December, 1925.

CHARLES S. DEMAREST.
RALPH K. BONELL.