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TRANSMITTERS FOR ELECTROMAGNETIC COMMUNICATION SYSTEMS

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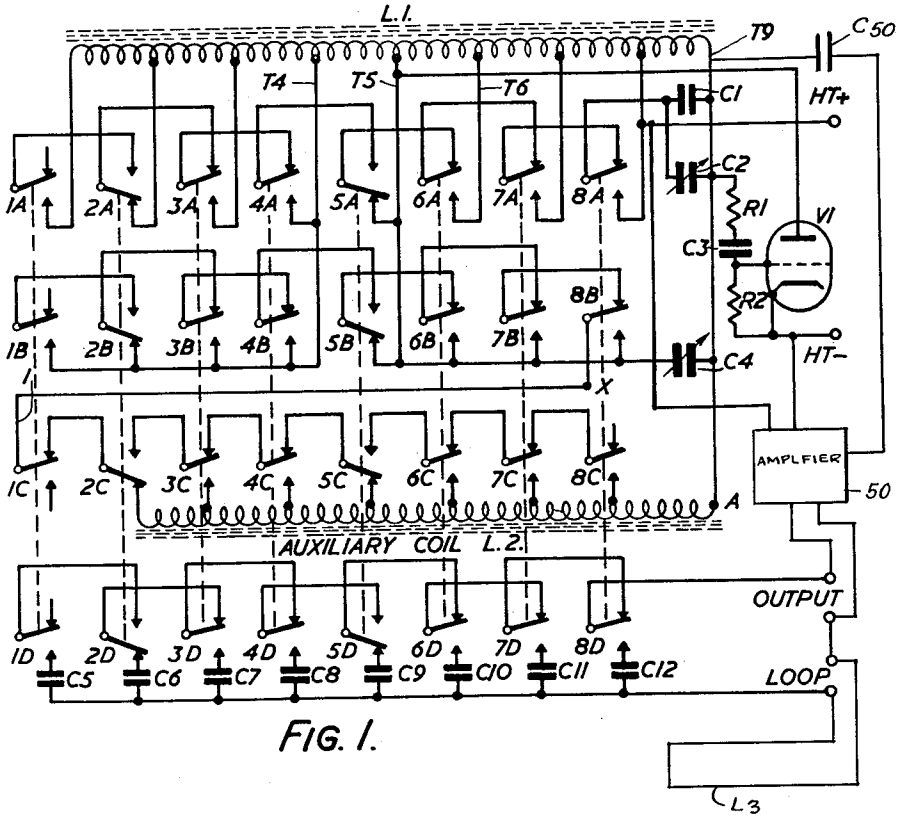


FIG. 1.

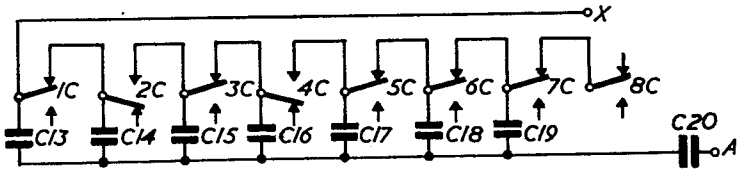


FIG. 2.

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# TRANSMITTERS FOR ELECTROMAGNETIC COMMUNICATION SYSTEMS

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This invention relates to transmitters for electromagnetic communication systems whereby individuals can be selectively called by transmitting signals on a correspondingly selected frequency within the audio and intermediate frequency range.

The invention has for an object to provide simpler apparatus and to simplify the procedure for calling one of a number of persons.

A further object is to provide means whereby a call can be sent out by pressing either one or two keys of a press button or piano key switch of a type commonly used in radio receivers. In this type of switch the pressing of a key causes any key already pressed to be released. The key pressed remains down until further keys are pressed. It is however, possible in such switches to lock down two keys at once by pressing them down simultaneously.

It will be seen that, for example, with eight keys, eight settings are possible with a single key depressed and 28 settings are possible with two keys depressed, making a total of 36 possible call numbers. With ten keys the number of possible call numbers is 55 and with 12 keys the number of possible call numbers is 78.

Considering the 8-key arrangement, the possible combinations are represented by two digit numbers. It will be apparent that under this system the call numbers 84 and 48 would give rise to the depression of the same keys and would therefore be identical. It is preferred, therefore, that only numbers in which the first digit is less than the second be used as call numbers.

The general principle of working is such that if more than one number is pressed, the higher number selects a frequency range within which the frequency is to fall, while the lower number selects a frequency within that range, as will appear from the following description: The order of the different frequencies may be the same as or the inverse of the order of the numbers or they may be otherwise related. A single number will be located as if it were a double number of the same digit, i.e. four represents 44 and six represents 66.

In general, it is only required that a call should go out for a short time. Accordingly the pressing of any key or button may be made to operate a timing circuit which starts the call which is then terminated automatically. The key or buttons will remain depressed and will therefore indicate the last call sent until another key or button is pressed for another call. If it is desired to repeat the call for which the keys or buttons are already depressed, this may be done by pressing a repeat key or button or alternatively by pressing momentarily hard down beyond their locking position the keys already depressed.

Such an arrangement has the advantage over a system of independent switches that it is never necessary to return to off position the switches previously operated, before making a new call.

In switches of the type above referred to, a locking or sliding bar is displaced when a key is depressed, and returns whole or part of the way to the original position when the key is locked. The movement of this bar can be utilised to operate micro-switches or normal switches so that circuits are made temporarily to initiate the call. The switches are thus virtually ganged together by this



bar. As an alternative method, each key operated bar can be made to operate a make-before-break contacts. By paralleling the make contacts and the break contacts respectively on all the keys, leaving the change-over contact unconnected, the pressing of any key will cause a momentary making of contacts, which can be used to initiate the call. It is desirable that there should be a delay of something of the order of a quarter of a second between the making of the contacts and the starting of the call to ensure that both the keys pressed are in position and all previous keys have been returned before the call starts.

Embodiments will now be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a circuit diagram of a frequency selecting arrangement according to the invention,

FIG. 2 is a circuit diagram illustrating a modified form of part of the arrangement shown in FIG. 1 from the point X therein.

In the preferred arrangement according to the invention as illustrated in FIG. 1, a main switch 1A and subsidiary switches 1B, 1C, 1D are ganged together for operation by the number 1 key, a main switch 2A and subsidiary switches 2B, 2C, 2D are ganged together for operation by the number 2 key and so on up to key number 8. The keys themselves are not shown in the circuit diagram. The frequency range is selected by the highest number key depressed by virtue of its selecting the tap on an inductor $L_1$ to which tuning condensers $C_1$ and $C_2$ are connected. One lead from the condenser $C_1$ is connected to the end of $L_1$ and the other lead from the condenser is taken to the moving contact of the main switch 8*a* on the highest number key. If the key is pressed the condenser $C_1$ is connected to the first tap on the inductor $L_1$. If the key is not pressed, the condenser is switched through to the moving contact 7*a* of the next key. If this main key is pressed, connection is made to the next tap on the inductor $L_1$. If this key is not pressed, however, contact is made to the number 6 key, and so on. Accordingly, the tap to which the condenser is connected is determined by the highest number key pressed.

The frequency within the range is selected by the lower number key depressed in that it shunts the whole or part of the main inductance $L_1$ with a subsidiary inductance $L_2$ preferably of higher value. For this purpose, a lead 1 from a tap $T_4$ or $T_5$ on the main inductor, which tap is selected by the subsidiary switches 1B to 8B, is taken to a moving contact 1C operated by the number 1 key. If this key is pressed the lead is connected nowhere. If the number 1 key is not pressed, the lead 1 is connected to the moving contact of subsidiary switch 2C operated by the number 2 key, and if this is pressed the lead 1 is connected to the highest impedance tap on the subsidiary inductance $L_2$. If the number 2 key is not pressed, it connects the lead to the moving contact on the number 3 key which, if pressed, connects it to the next tap on the inductance and so on, all as illustrated in FIG. 1.

It is of course possible to have modified arrangements which make all connections to the keys in the reverse or different orders to achieve the same effect.

The frequency selection is illustrated in FIG. 1, where keys 2 and 5 are shown depressed and the coils are shown coupled to a valve V1 to maintain oscillation. It will be seen that the point on the main inductance $L_1$, to which the auxiliary inductance $L_2$ is connected, is varied according to whether the highest number key pressed is greater or not than 4. If the key is greater than 4, the part of the main inductance across which the auxiliary inductance is shunted will be smaller. The result of this is that the percentage gap between adjacent frequencies is less at

higher frequencies. In the case of a 36 frequency transmitter with frequencies between 2,000 and 14,000 cycles per second, the spacing between adjacent channels might be 9 percent at the lower end and 5 percent at the higher end.

The frequency of any arrangement may, of course, be calculated from the inductance and capacity of the components. The chief uncertainty in the calculation being the stray capacity of the windings and circuit. A method of avoiding this to some extent is to calculate on the basis of a capacity across the main inductance greater than the stray capacity and to insert a trimming condenser $C_4$ permanently across the whole or some part of the main inductance. The trimming condenser can then be adjusted to bring the stray capacity up to the required value.

The oscillator circuit described above may be coupled to an output stage **50** in various manners, for example by condenser **C50**.

The higher number, or single, key pressed may also serve to bring into the circuit one of a plurality of condensers $C_5$ to $C_{12}$ which at the frequency of the signal will constitute a series resonance with the loop $L_3$ or, where a matching transformer is employed, with the reflected impedance of the loop through the transformer.

An alternative arrangement employing a similar switching system is illustrated in FIG. 2. Here the lower number pressed changes a capacity instead of shunting the main inductance with an auxiliary inductance. FIG. 2 shows a modification of the circuit of FIG. 1 consisting of replacing the coil $L_2$ and the section of the switches 1C to 8C in that circuit from the point marked X.

It is, of course, not necessary for all possible combinations of the numbers to be available for use. Thus, only keys 1, 2 and 3 of eight keys could be caused to operate contacts for determining a frequency within a range. All keys higher than 3 could then operate the same contact as 3. This would render the following distinct combinations available:

1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 23, 14, 24, 15, 25, 16, 26, 17, 27, 18, 28.

I claim:

1. In a transmitter for an electromagnetic communication system, means providing for the selection of a desired frequency of transmitted signal from a single oscillator, said means comprising an inductance, a plurality of tappings on said inductance, a main two-way switch for each said tapping, each said main switch except the last having a moving contact normally connected to one pole of the next switch of which the other pole is connected to its corresponding tapping, a tuning capacitor for said inductance connected to the moving contact of said last switch, whereby operation of the switch nearest that end connects said tuning capacitor to the corresponding tapping, whereby to select a frequency range, subsidiary tuning means for said inductance constructed and arranged to change the resonant frequency of the circuit branch comprising said inductance and tuning capacitor when the subsidiary tuning means is connected to said inductance, a plurality of leads connected respectively to tapped portions of said subsidiary tuning means, a subsidiary two-way switch for each said lead, each said subsidiary switch except the first having a moving contact normally connected to one pole of the preceding subsidiary switch of which the other pole is connected to its corresponding lead, the moving contact of said first subsidiary switch being connected to said inductance, whereby operation of the subsidiary switch nearest said first subsidiary switch connects said subsidiary tuning means to said inductance, whereby to select a specific frequency within said range, each said subsidiary switch being ganged with a corresponding main switch for operation therewith.

2. A frequency selector as claimed in claim 1, wherein said subsidiary tuning means comprises a subsidiary inductance and wherein the switches are so arranged that upon operation of two switches, the switch nearer to one side determines the tap on the first-named inductance, and the switch nearer to the other side determines the tap on the subsidiary inductance, the frequency of the signal transmitted being determined by the combination of the two inductances.

3. A frequency selector as claimed in claim 1, wherein said subsidiary tuning means comprises a capacitance, and wherein the switches are so arranged that upon operation of two switches, the switch nearer to one side determines the tap on the inductance and the switch nearer to the other side determines the tap on the capacitance and the combination of the inductance and the capacitance determines the resonant frequency of said circuit branch.

4. A frequency selector as claimed in claim 1, wherein the values of the inductance and of the tuning capacitor and subsidiary tuning means are so arranged that the switch nearer to one side determines which of several ranges of adjacent frequencies is used, and the other switch determines the frequencies within this range.

5. A frequency selector as claimed in claim 4, and means whereby the switch which determines which range of frequencies is selected also changes the tap on the first-named inductance to which the subsidiary tuning means is connected, so as to adjust the spacing of the frequencies within the range to the most suitable values for this range.

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