

May 21, 1940.

E. F. NORRITO

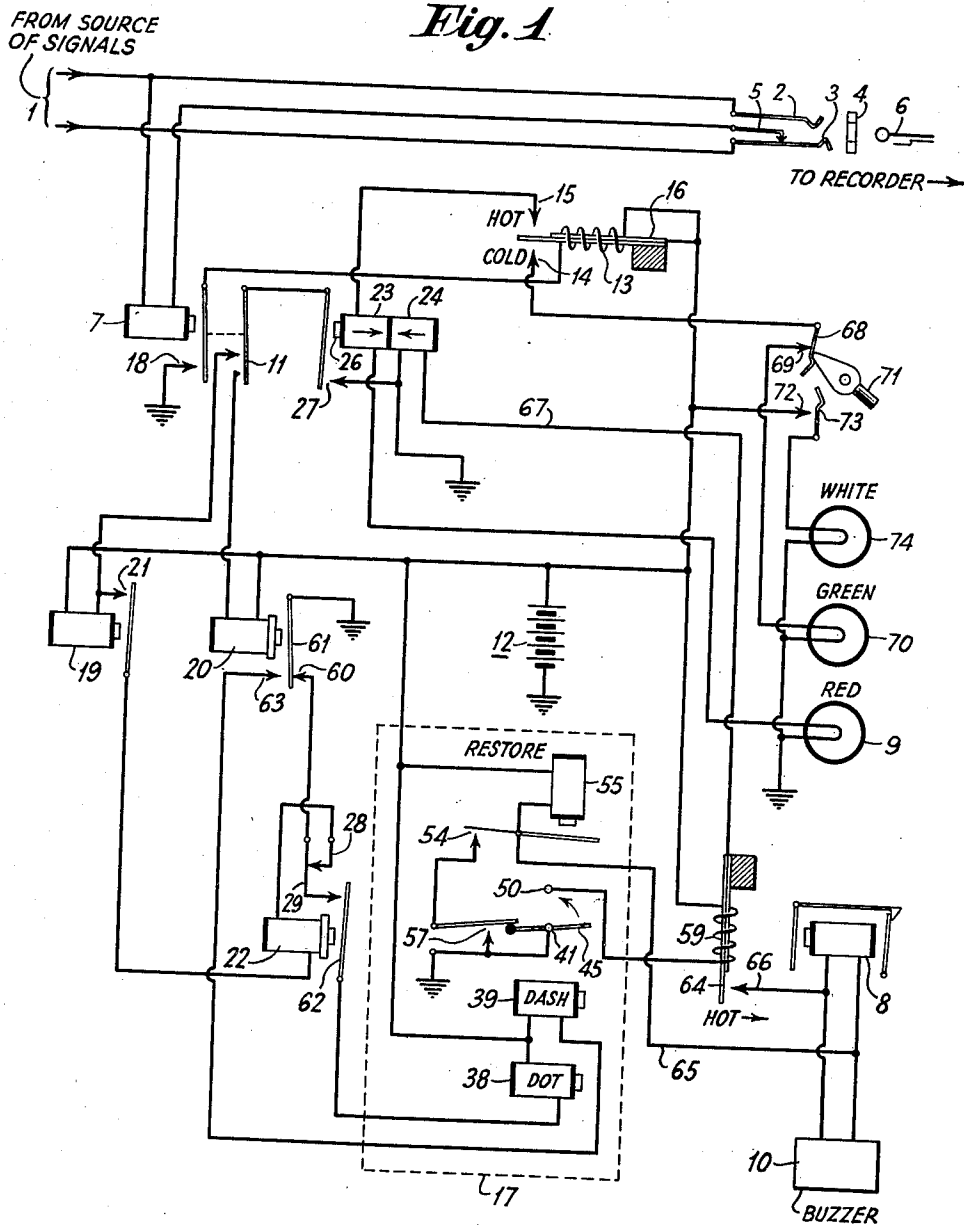
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TELEGRAPH CALL SELECTOR AND MONITORING APPARATUS

Filed June 6, 1936

2 Sheets-Sheet 1

Fig. 1



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TELEGRAPH CALL SELECTOR AND MONITORING APPARATUS

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2 Sheets-Sheet 2

Fig. 2

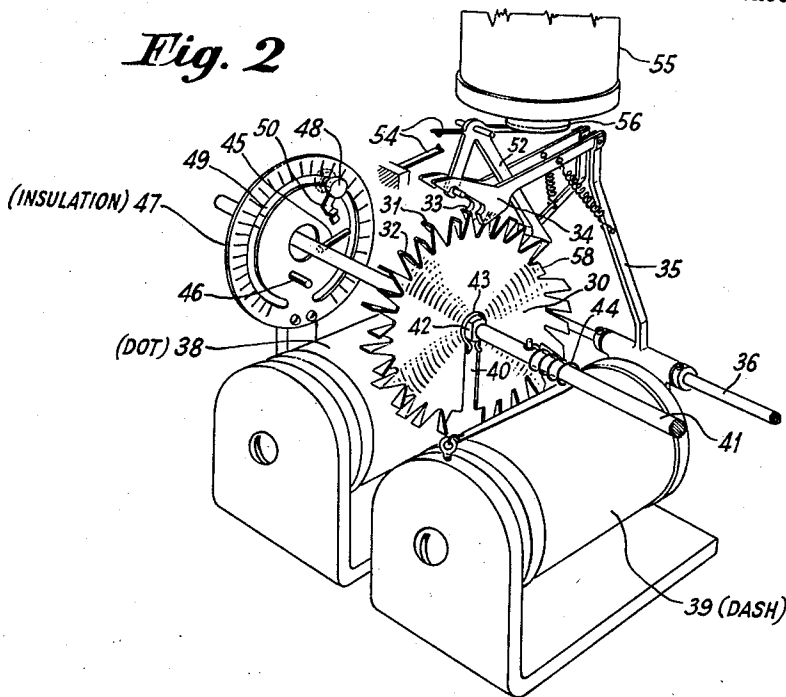


Fig. 3

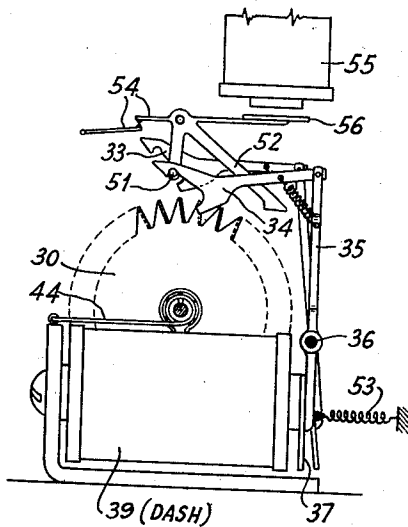
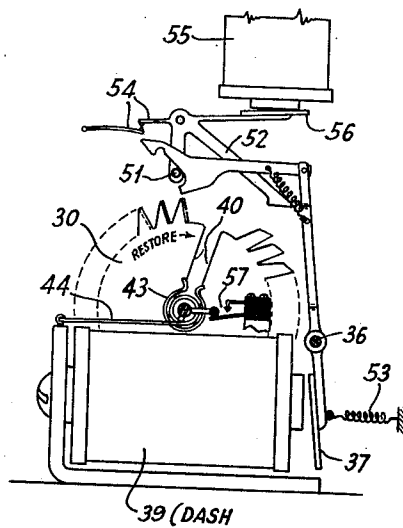


Fig. 4



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TELEGRAPH CALL SELECTOR AND
MONITORING APPARATUSEarl F. Norrito, Brooklyn, N. Y., assignor to Radio
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4 Claims. (Cl. 177—332)

This invention relates to terminal apparatus for communications circuits and has particularly to do with monitoring devices and a call selector which, though useful in ordinary telegraph lines, are found to be particularly applicable to radio receiving circuits.

In a radio communications system involving the use of a considerable number of radio frequency channels, problems are encountered in connection with the monitoring of such channels in order to reduce to a minimum the number of operators at a central station and also in order to detect any abnormalities of operation of the circuits. With the aid of my invention an operator at a concentrator board is enabled to respond promptly to an incoming call on any particular channel without the necessity of listening in at all times to the signals which may be received on each and every channel.

It is an object of my invention to provide apparatus of a type conveniently built into a concentrator board such that for each radio communications channel there shall be provided a jack for plugging in any desired recording apparatus or printing telegraph instrument, a call selector and an associated annunciator for giving a signal to the attendant of an incoming call, a plurality of pilot lamps for indicating the operating conditions of the circuit, and a switch key for controlling the operation of at least two of the pilot lamps in accordance with operating or shut-down conditions.

It is another object of my invention to provide a novel form of call selector which is adapted to respond to a particular sequence of dots and dashes constituting a code call.

It is another object of my invention to provide means in connection with the terminal equipment whereby abnormalities of a radio receiving circuit or abnormalities of the radio frequency channel may be indicated and promptly corrected.

Other objects and advantages of my invention will become apparent in the specification to follow.

Present day radio communications plants quite frequently include a radio transmitting and receiving station located in the outskirts of a city where large areas are available for the installation of an antenna array and where conditions are best suited to the operation of high power transmitters as well as for reception of radio signals with minimum disturbance. When the radio signals arriving at such a station are amplified and detected in a radio receiver of any

suitable type, the resultant land-line signals may be impressed upon a telegraph line for transmission to a central office located in the heart of a city. Under these conditions the radio station becomes a relay and repeater station for communications from remote points to the central office within the city. The attendants at the radio station are not in a position to know whether communications are being properly received at the central station or whether fading or other difficulties occur. It is, therefore, desirable to have monitoring apparatus installed at the point of reception of the incoming traffic in order that the attendant at the radio station may be promptly notified of any difficulties that may occur.

According to methods of radio communication heretofore in general use for trans-oceanic and trans-continental service it has been necessary for radio operators to keep constant watch by listening in for calls from various outlying stations. The difficulties in a radio communications system are much greater than those prevailing in land line telegraphy because in the latter case one operator can man a switchboard or concentrator system through which he has immediate control over many cities. His attention is called to an incoming call either by a pilot light or by the operation of an annunciator. With radio communications, however, it was necessary for an operator to listen in on each radio frequency channel and to distinguish the call signals destined for his particular station from all other traffic.

It has for some time been the practice of transmitting stations, even when not busy with the transmission of traffic, to maintain a continuous transmission of test signals, at least during certain hours of the day.

With conditions as they are and as described above, it will readily be appreciated that a call selector properly connected to a wire line between a radio station and a central office for the transmission and reception of radiograms has very decided advantages. It is also advantageous to combine with such apparatus a system of pilot lamps such that when the keying of a telegraph circuit becomes faulty either due to what is known as "heavy marking bias" or "light spacing bias", or due to other abnormalities of the operating circuit, the difficulty may promptly be noticed and remedied.

The details of construction of the apparatus which I prefer to employ and the mode of operation thereof will now be explained, reference being made to the accompanying drawings in which

Fig. 1 shows diagrammatically a preferred embodiment of the monitoring apparatus including a call selector and pilot lamps and the necessary circuit and relay arrangements for carrying out the objects of my invention;

Fig. 2 shows in perspective certain of the essential elements of a code call selector according to a preferred embodiment thereof; and

Figs. 3 and 4 show different views of the code wheel of the call selector in elevation and in combination with the actuating means therefor, Fig. 3 showing the actuating mechanism at one stage of its operation preliminary to restoring the rotor to its normal position, and Fig. 4 at a subsequent stage of the same operation.

Referring first to Fig. 1, I show a pair of conductors 1 on which incoming signals may be brought to the concentrator at the central station. These conductors are connected to the contact springs 2 and 3 of an ordinary jack 4. A conventional two-conductor cord and plug 6 may, therefore, be inserted in the jack for connecting up a recorder, a teletype printer, or other receiving and/or transmitting apparatus.

Since my invention is designed to meet those conditions in which the number of incoming circuits is greater than the maximum number of receiving and transmitting instruments required for handling traffic at a given central station, it is preferable to provide a call selector system and an annunciator, so that a considerable number of circuits, such as that shown may be monitored by one operator. When there is no plug in the jack 4, contacts 3 and 5 will engage with one another so as to place the relay 7 in circuit with the incoming conductors 1. This relay 7 will then respond to any and all incoming signals.

Since it is frequently the case that the incoming signals may be intended for reception at some different station, means are provided under control of the relay 7 for actuating a code call selector generally indicated within the broken-line enclosure 17. Thus if a combination of dots and dashes is received to which the selector is set up to respond, then either an annunciator 8 or an audible indicating device 10 or both may be actuated, whereby an indication is given to the operator that a distant transmitting station is calling his particular station.

The elements shown in combination in Fig. 1 include a system of relays interposed between the relay 7 and the selector 17 for distinguishing between dot and dash signals. The system further includes an annunciator 8 and a buzzer 10 both responsive to the actuation of the selector 17, and a plurality of pilot lights for indicating conditions on the line.

Assuming that a code signal is sent in on the line 1 for actuating the code selector 17, it is important that at the outset a preliminary signal be given such as a long dash for preparing the necessary circuits to be actuated whereby the selector 17 will respond to dots and dashes differentially. It will be assumed, therefore, that the code selecting signal is prefaced by a long dash signal sufficient to hold the armature of the relay 7 against its front contact 18 for a period of say two or three seconds. During this interval current is fed from the battery 12 through a heating coil 13 which is adjacent a thermal relay 16, preferably comprising a bimetallic strip. The circuit for the heating coil 13 is closed through the armature and front contact 18 of the relay 7. After a predetermined time interval, the relay 16 responds by closing a circuit through its hot-

side contact 15 and thence through a winding 23 of a differential relay 26 and thence through the filament of a pilot lamp 9 and to ground. Relay 26 operates to close a circuit through its contacts 27 thereby grounding the armature 11 on the relay 7. The differential relay 26 remains in its actuated position even though current may cease to flow in the winding 23 and until its armature is thrown into the circuit-opening position by the energization of differential winding 24.

The system is now prepared to receive code signals consisting of dots and dashes. The means and the method for differentiating between the dots and dashes are as follows: Assuming that a dot impulse is received, the relay 7 will respond by momentarily closing contacts with the now grounded armature 11. Relays 19 and 20 will be energized because their windings are in circuit between battery 12 and ground. Relay 19 is quick acting, while relay 20 is slow acting. The dot impulse will be of insufficient duration for the armature of relay 20 to pull up. The closing of contacts 21 on relay 19 will complete a locking circuit through which, however, no current will flow until the moment when the relay 7 releases. Since contacts have been made at 21 before they are broken at 11 (at the cessation of the dot signal on relay 7) the locking circuit for relay 19 may be instantaneously established as will be seen by tracing the circuit from battery 12 through the winding of relay 19, contacts 21, the winding of relay 22, contact springs 28 and 29, back contact 60 and armature 61 of relay 20 and thence to ground. Relay 22 is somewhat slow acting but not so slow as relay 20. When relay 22 pulls up its armature 62 it first makes contact with the spring 29 and subsequently breaks the connection between springs 29 and 28. It is, therefore, during the pull-up stroke of the armature 62 that an actuating impulse is sent through the code-wheel-actuating magnet 38 for advancing the rotor or the ratchet code-wheel of the call selector one step.

As will presently be described, the call selector 17 is provided with two stepping magnets 38 and 39 and the mechanism is such that a predetermined one of these magnets must be actuated for making each particular step of advancement of the rotor 30, (Figs. 2, 3 and 4) which is mounted on the shaft 41.

Upon completion of the pull-up stroke on the armature 62 by the relay 22, the locking circuit which includes the windings of both relays 19 and 22 will be broken, thereby de-energizing both of these relays.

It will be noted that the locking circuit for relay 19 can not be established if a dash impulse is received on relay 7 because in that event the relay 20 will pull up its armature 61 before relay 7 opens its grounding connection to relay 19. The relay 19 in this case will be de-energized while its locking circuit is open at contact 59, and no impulse can then be transmitted to the dot-stepping magnet 38.

Relay 20 has a front contact 63 for closing a circuit through the dash-stepping magnet 39, hence the response to a dash signal will be one in which relays 19 and 20 will both be actuated. The stepping magnet 39 will respond because relay 20 is actuated but the stepping magnet 38 will not respond because during the first part of the interval occupied by the dash impulse on relay 7, both sides of the relay 22 are maintained at ground potential and during the last part of

the dash impulse the circuit for relay 22 is open.

Assuming now that a code signal is transmitted such as to operate the dot and dash stepping magnets 32, 33 in proper sequence for advancing the rotor 30 into a selecting position, a circuit will then be closed between a contact member 50 and ground, since the contacting pin 45 and the shaft 41 are grounded. A circuit is then established from the battery 12 through a heating coil 58 adjacent a thermal relay 64. The contacting pin 45 of the code selector 17 may be held in contact with the brush 50 for sufficient time to actuate the relay 64 through the bimetallic strip of which current may flow in a circuit to be traced as follows:

Starting with the battery 12, current is fed through the winding of a restoring relay 55, through conductor 65 to the parallel disposed windings of relay 8 and of the buzzer 10 respectively and thence to the contact 66, bimetallic strip 64, conductor 67, and the winding 24 on relay 26 and finally to ground. The annunciator 3 will be actuated for giving a signal that a call has been made. The buzzer 10 will be momentarily sounded. The rotor 30 of the call selector will be released by the actuation of the relay 55 as will be hereinafter explained. Finally the relay 26 will be reversibly actuated for opening the grounding circuit on the windings of relays 18 and 20, thereby to disengage these relays from the control of the relay 7.

Thus it will be seen that in response to a given code signal the call selector 17 may be actuated to give both an audible and a visible indication. If, however, a code call signal is sent through the line 1 destined for some different station on this line, the selector 17 will be caused to make a mis-step at some point in the advancement of its rotor and the rotor itself will be restored to normal in a manner hereinafter to be explained.

The system shown in Fig. 1 includes further means for monitoring the conditions on the line 1. The thermal relay 16 is provided not only with a hot-contact 15 but a cold-contact 14. The heating coil 13 of the relay is adjusted for maintaining the bimetallic strip in a neutral position out of contact with the hot and cold contacts during the transmission of normal traffic signals. In other words, under normal conditions of traffic there is a mean ratio between the time intervals occupied by dots and dashes on the one hand and the time intervals occupied by spaces between the dots and dashes. If, however, due to abnormalities of receiving conditions the relay 7 should be locked up in its energized position or even if the condition known as "heavy marking bias" exists, then the relay 16 will make a circuit through the contact 15, through the coil 23, and through the red monitoring lamp 9 for indicating that the condition of "heavy marking bias" exists. If, on the other hand, there is an interruption of the signals or if the signals themselves cease and the line 1 is "opened", then the condition of release of the relay 7 for a given period of say several seconds will result in chilling the bimetallic strip 16 to the point where it will close a circuit through contact 14 and thence to contact springs 68 and 69 to the green pilot lamp 76. In tracing this last mentioned circuit it was assumed that the manual key 71 is to be thrown into its position for closing the contacts 68 and 69 as would be the case under normal traffic conditions and whenever the station from which the signals arise is not shut down. Under shut-down conditions the operator at the concentrator board would be so notified and he would

throw the key 71 into position for closing a circuit from battery 12 through contact springs 72 and 73 to the white lamp 74 which indicates a shut-down condition on the line. The key 71 may be in either of its two positions when a code call signal comes in.

A preferred embodiment of a code call selector per se has been illustrated in Figs. 2, 3 and 4. The structure comprises a rotor 30 in the form of a ratchet wheel having specially shaped teeth 31 and 32. The teeth 31 are formed so as to engage with a pawl member 33, while the teeth 32 are formed so as to engage with another pawl member 34. Each of the pawl members is mounted on the end of a lever arm 35 which in turn is swivelled on the supporting rod 36 and is actuated by virtue of the fact that the lower end of each lever constitutes an armature 37 facing the poles of a magnet 38 or 39.

For convenience of description the magnet 38 will be understood to be one which may be actuated only upon reception of a dot signal, while the magnet 39 is similarly operable only in response to the reception of a dash signal.

The ratchet wheel 30 is preferably designed with a slot 40 having a width such that it may be conveniently removed from the supporting shaft 41 and made interchangeable with other ratchet wheels having, if desired, different arrangements of the teeth 31 and 32, so as to be accommodated to the reception of different code signals. In order to mount the ratchet wheel 30 rigidly on its shaft 41, a hub member 42 may be made fast to the shaft 41. This hub member has flat sides engageable with a correspondingly shaped hole in the center of the ratchet wheel 30 and this hole is larger in diameter than the width of the slot 40 so that when the ratchet wheel 30 is positioned on its hub it may be securely held in place with the aid of a retaining spring 43.

The ratchet wheel 30 and its rotatable shaft 41 are normally held in an initial position by means of a coiled spring 44 with a pin 45 resting against a stop 46. The stop 46 may be fixedly mounted in any suitable manner but has here been shown as mounted on a fixed insulating member 47. This insulating member 47 serves also to support a movable stud 48 within a slot 49. The stud 48 carries a contact spring 50 with which the pin 45 makes contact after the rotor 30 has made a definite number of steps. If the rotor fails to reach the selecting position or is advanced beyond that position without pause, it is because the received dots and dashes constitute a selecting code signal for some other station on the line.

In a call selector of the type herein shown, it is desirable that in the event of the reception of a code signal other than the one by which the selector is intended to be operated, then the selector-rotor will immediately be restored to its initial position. This is accomplished as follows:

Each of the pawl members 33 and 34 has a profile somewhat suggestive of the shape of a lady's high-heeled shoe. Between the toe and the heel, in the instep, provision is made for engagement with a pin 51 mounted on one arm of a retaining pawl member 52. The heel of the shoe acts as the portion of the pawl member which rides over the ratchet teeth. If, therefore, the operating magnet pulls up its armature 37 at a time when there is an engageable tooth for the heel of the shoe to ride over, then

the ratchet tooth will in so doing lift the pawl member so that it is disengaged from the pin 51. In this event the retaining pawl 52 is not moved by the retraction of the pawl member that is actuated.

Upon release of the magnet 38 or 39 the pawl member will be driven in the opposite direction by the spring 53 and will carry with it the rotor 30, causing it to advance one step. The advancement of the rotor through successive steps will, therefore, depend upon the sequence of operation of the magnets 38 and 39 in correspondence with the arrangement of successive teeth 31 and 32. When either of the magnets 38 or 39 is about to make a false step, the corresponding pawl member which it actuates will not rise up to clear the pin 51 because there will be no ratchet tooth behind the heel of the shoe to lift it up. In this event the pin 51 will be caught in the instep of the pawl member and will be carried along with it, thereby raising the retaining pawl 52 clear of all of the ratchet wheel teeth. The final part of the movement of the retaining pawl member 52 is not, however, caused by the retraction of either of the pawl members 33 or 34. The initial portion of its movement is sufficient, however, to close contacts 54 for actuating a magnet 55 having an armature 56 supported by another arm on the retaining pawl member 52. The stroke of the retaining pawl member is, therefore, completed under electro-magnetic action, as shown in Fig. 4. In this position the pin 51 has been slid along the instep of the shoe from toe to heel thereby lifting both of the actuating pawl members 33 and 34 out of engagement with the teeth of the ratchet wheel 30. In this position it will be noted further that either one or the other or both of the contact springs 54 may be flexed. The locking magnet 55 remains energized until the rotor is fully restored to its normal position at which time an off normal switch comprising contact springs 57 will be opened so as to permit the restoring magnet 55 to be de-energized and to release its armature 56, hence to restore the retaining pawl 52 also the pawl members 33 and 34 into engagement with the ratchet wheel 30.

The ratchet wheel member 30 is shown with one of its teeth cut off at the position 58. This arrangement is such that after a selection has been made by advancing the pin 45 to a position of engagement with a hump on the contact spring 50, that is, after closing a circuit to any suitable annunciator 8 or other indicating device 10, that one additional pulse, say a dash pulse on the magnet 39 will advance its pawl member 34 in the same manner that it would be advanced for making a false step. Thus the rotor will be restored to normal upon the completion of any selecting operation. The making of this supplementary step is not in all cases necessary, however, since an auxiliary circuit may be provided for actuating the release magnet 55 automatically.

The particular design of call selector, as shown, lends itself readily to the use of code signals of different length. It is found to be convenient at times to employ different code signals having, for instance, the same dots and dashes for the initial part of the signal. Thus, in order to make different selections within a given zone, supplementary dots and dashes representing differently suffixed code letters may be employed following the portion of the signal which is common to a number of stations within that zone.

Thus it may be the case that several call selectors on a single telegraph circuit may start out in response to a given call signal, but those selectors which are intended for response to a two-letter code will reach the point where they will be restored by the cut-away tooth portion 58, whereas others intended for a three-letter code will be advanced to the selecting position.

It will be noted that the releasing magnet 55 can be operated either by the mechanical lifting of its armature 56 part way so as to close its locking circuit through the contacts 54 as when a false step is made by one of the stepping pawls, or if the rotor is advanced to a selecting position and a call signal is thereby completed then the magnet 55 may be directly actuated in response to the closing of the annunciator circuit at contacts 64-66. During the normal operation of the stepping pawls for advancing the rotor, the retaining pawl 52 is not moved sufficiently to establish contact at the springs 54, but that motion is only sufficient to enable the retaining pawl to ride over successive teeth of the ratchet wheel and to prevent restoration of the ratchet wheel to its initial position before a selection has been made.

By those skilled in the art it will be appreciated that various modifications of my invention may be made without departing from the spirit and scope thereof. The invention, therefore, is to be considered as having all the breadth that is permitted by the claims themselves.

I claim:

1. In a call selector, a ratchet wheel having peripheral teeth, each of said teeth having a lateral extension disposed in one or the other of two pawl-engaging planes, said extensions being sequentially arranged in correspondence with the dots and dashes of a predetermined calling code, electro-mechanical driving means for said ratchet wheel including two pawls each separately operable pawls in its appropriate one of said planes, selective means connected with said electro-mechanical driving means whereby one of said pawls is caused to respond only to a dot signal and the other of said pawls is caused to respond only to a dash signal of said predetermined calling code, a retaining pawl having one portion of its structure in engagement with said ratchet wheel and a second portion engageable with and controllable by the two pawls first mentioned, and a restoring spring under tension of which said ratchet wheel is advanced step-by-step by the pawls of the driving mechanism to a given position for making an indication of the receipt of said predetermined calling code, the three said pawls and said lateral extensions constituting means operable in response to the receipt of a dot or dash signal failing to correspond with any one of the dots and dashes of said predetermined calling code whereby all three pawls are disengaged from said ratchet wheel simultaneously and whereby the spring is enabled to restore said ratchet wheel to its normal position.

2. A call selector having a step-by-step rotor comprising a ratchet toothed code-wheel, a pair of ratchet pawls each individually magnetically retractable at times into a tooth-engaging position for thereafter advancing said rotor, and at other times retractable into a rotor releasing position, certain of the teeth of said code-wheel being engageable with one of said pawls and others of the teeth being engageable with the other pawl, means permitting said pawls to be retracted in a pre-arranged permutational sequence for ad-

vancing said rotor to an ultimate position, and means opposed to the aforesaid means and operable upon retraction of a pawl into a rotor releasing position for restoring said rotor to its initial position.

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3. In a signalling system, a source of dot and dash signals, a switch having a rotor and two stepping pawls actuatable singly and selectively in response to said signals for advancing said rotor from an initial position step-by-step to a circuit selecting position, and by a further step to a limiting position, a ratchet wheel mounted on said rotor and having differently aligned teeth, said teeth being cooperative with said pawls and having a permutational arrangement which matches a predetermined sequence of operation of said pawls necessary to advance the rotor from said initial position to said limiting position, a spring for retrogressive movement of said rotor, and means including a third pawl engageable with each of said teeth successively for avoiding unwanted retrogression of said rotor, said means being also operable by either of said stepping pawls upon departure of its operation from said predetermined sequence, also upon advancement of said rotor to its limiting position, for permitting said retrogressive movement of said rotor.

4. In a call selector, an indicating device, step-by-step mechanism including a ratchet wheel having differently aligned teeth adapted to be advanced from an initial position to a position of control over said indicating device, means including a pair of electro-magnetically driven pawls for advancing said step-by-step mechanism, one of said pawls being engageable only with certain of the ratchet wheel teeth which have an appropriate alignment and being operable only in response to the reception of a dot signal, and the other of said pawls being engageable only with certain of the ratchet wheel teeth which have another appropriate alignment, and being operable only in response to the reception of a dash signal, a restoring device for said step-by-step mechanism, and means including said pawls for controlling said restoring device, and so characterized that it enables said pawls when operated in a predetermined sequence to move said mechanism into position for actuating said indicating device, and is itself enabled to restore said mechanism to its initial position whenever one of said pawls is actuated in other than said predetermined sequence.

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