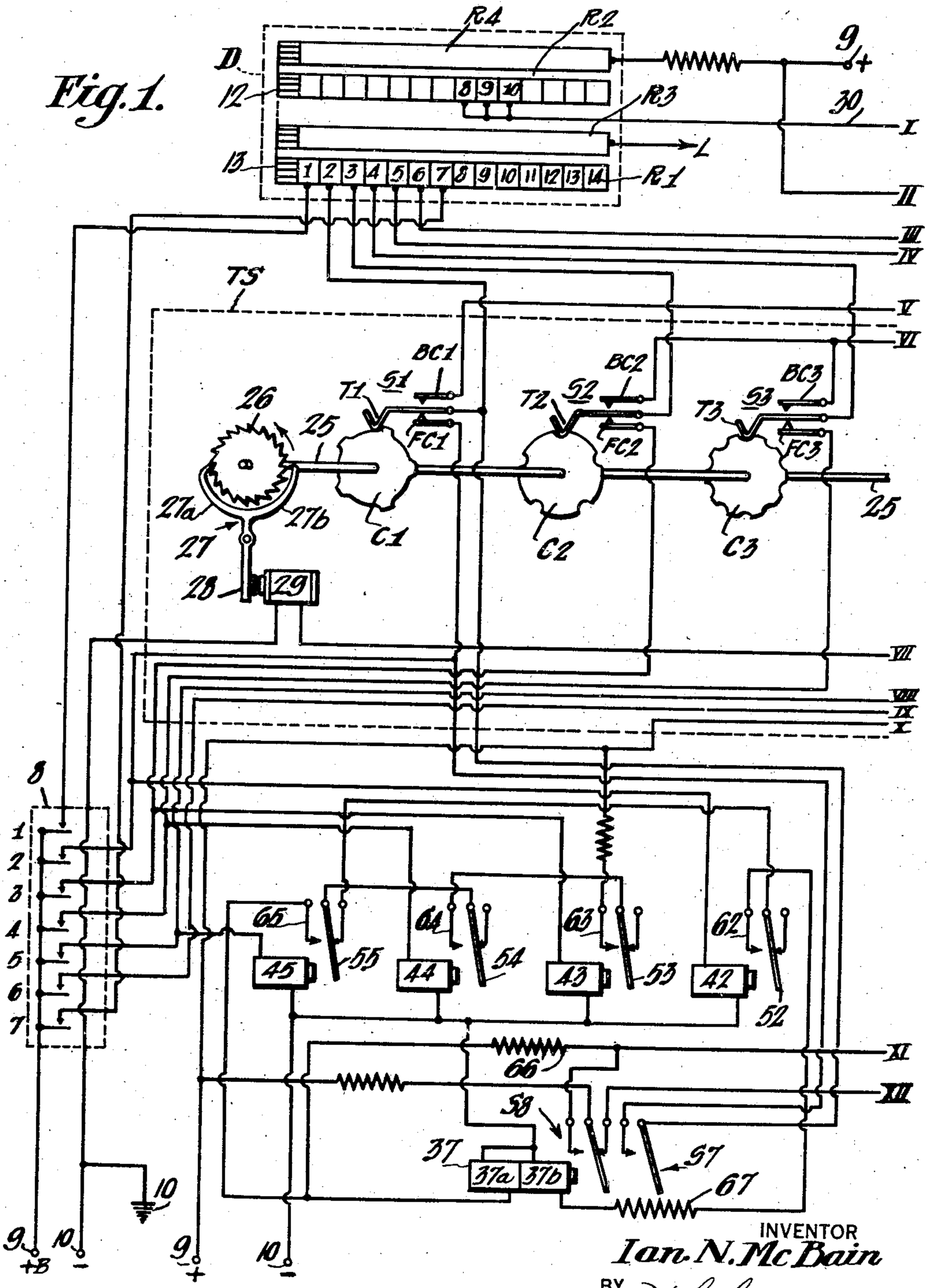
Oct. 25, 1949. I. N. McBAIN 2,486,360

SUPERVISORY SIGNAL SYSTEM

Filed Nov. 8, 1945

2 Sheets-Sheet 1

Fig. 1.



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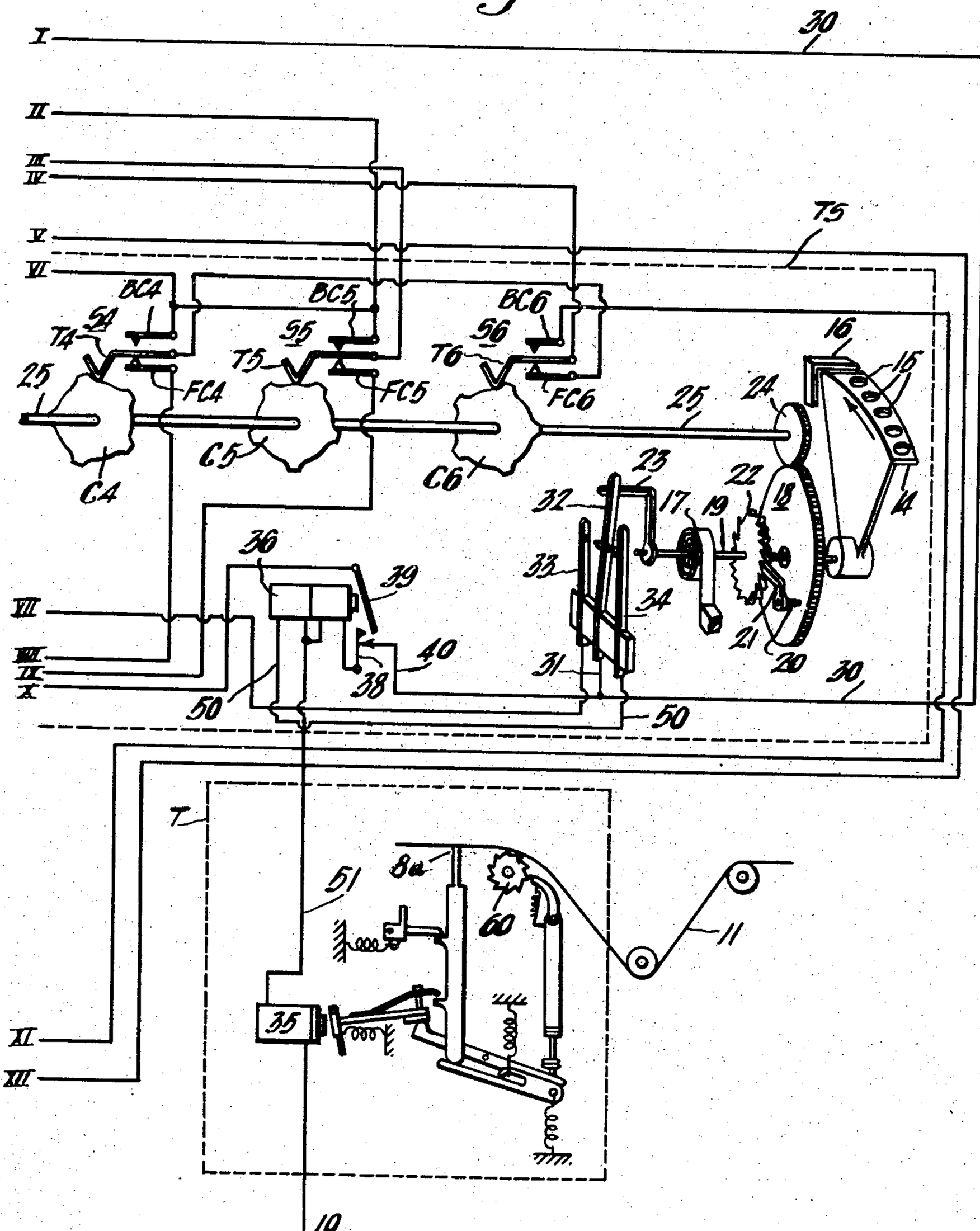
2 Sheets-Sheet 2

Fig. 2.



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UNITED STATES PATENT OFFICE

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SUPERVISORY SIGNAL SYSTEM

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4 Claims. (Cl. 178—4)

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This invention relates to supervisory signal systems and more particularly to a service signalling arrangement for use in connection with commercial telegraph systems.

Devices for transmitting auxiliary signals independently of traffic signals are well known in the art. It is conventional to use a perforated tape transmitter for traffic signals and to use an auxiliary keying device for actuating a bell or other supervisory signal.

In operating a prior art auxiliary keying arrangement, it was possible to transmit automatically a succession of signals which comprised case shift and bell ringing signals for producing any number of bell strokes, say from one to five. In this manner, the different service signals could be transmitted at any time when it was necessary to interrupt the operation of the tape or traffic transmitter.

It has been the usual practice heretofore to transmit the same signals for bell ringing as for the letter "S" or "J." In order to differentiate between the two functions of the same signals, it was necessary, whenever the bell signal was to be transmitted, to precede the same by a "figure shift" signal and to follow the bell signal by a "letter shift" signal.

The transmission of a signal for each bell stroke thus requires the transmission of three code signals which are repeated for each stroke of the bell.

One of the difficulties which have been encountered in the past is that the use of case shift signals in combination with the bell signals occasionally resulted in failure of the receiving printer to properly transcribe code characters following the transmission of the bell signal. This difficulty was encountered because the auxiliary service signalling device might "break-in" on the tape transmitter in the midst of transmission of upper case characters. The restoration of the printer unit to lower case characters was automatically performed as the last function in the automatic bell signal transmitting unit: Consequently when the tape transmitter resumed its transmission the receiving printer would be left in the lower case position and would thereby print, incorrectly, characters which were intended to be in the upper case until the tape transmission called for a "letter shift" signal.

It has also been suggested that the existing methods of transmission and reception be modified in a manner that would enable the bell signal to be transmitted and received without resorting to the use of case shift signals.

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Such an arrangement would no doubt be quite satisfactory in the case of new services but, involving as it does modification of both the transmitting and receiving equipment, its adoption in the case of existing services is both inconvenient and expensive.

The object of the present invention is to provide, by simple modification of existing transmitting apparatus, an arrangement for overcoming the above mentioned difficulties, and which does not affect the conventional requirement of transmitting case shift signals in association with auxiliary or service signals, or necessitate any alteration to existing receiving equipment.

The above mentioned object is achieved, in accordance with this invention, by providing means, responsive to the transmission of case shift characters from the tape transmitter, for automatically ensuring that the transmission of signal characters will continue in the same case if interrupted by the transmission of "Bell" signals until said means is de-energized by opposite case shift characters from said tape transmitter.

The invention will now be described in more detail, reference being made to the accompanying drawing which shows principally in a single circuit diagram and by way of example one practical method of modifying known apparatus in order to carry out the invention. Figs. 1 and 2 should be placed side by side for ease in tracing the circuits.

Referring to the drawing, therein is shown an arrangement of signalling elements 1 to 7 inclusive of a code element keyer, which are included within the broken line rectangle 8 representing the keyer, these elements being arranged as contact tongues which are positionable in contact either with positively or with negatively polarized feeder contacts 9, 10 respectively. The tongues 1 to 7 are arranged to be set in their alternative contacting positions in response to the operation of a set of seeker pins 8a which are controlled in known manner by perforations in the transmitting tape 11. The message to be transmitted is first perforated in 7-unit code signals on a paper tape 11 which is fed at a cyclic rate through the transmitter T. Different code combinations are thus set up on the tape controlled tongues 1—7 for the transmission of marking or spacing signalling elements in each of the seven positions of a uniform code signal. The code signals thus formed are normally applied to individual correspondingly designated segments on a multiplex distributor D.

Such a distributor is indicated as having a

code element ring R1 and a collector ring R3 the latter being connected to the outgoing line L. Merely by way of illustration, the transmitting distributor D, having rings R1 and R3, is shown in the drawing as arranged for a two channel multiplex system. If the system were intended for three or more channels, then the number of segments in the distributor ring R1 would be proportionately increased, and would be preferably a multiple of seven segments.

In addition to the signal transmitting rings of the distributor D, it is conventional to provide segmented local ring R2 and an energy feeder ring R4 associated therewith whereby the cyclic operation of various mechanisms at the transmitting station may be properly timed.

The brush 13 successively bridges the segments of ring R1 across to ring R3 and brush 12 functions in a similar manner to bridge rings R2 and R4. The brushes 12 and 13 are insulated from one another but are mounted for synchronous rotation, being preferably driven by a synchronous motor (not shown) which is held in step with other elements of the multiplex telegraph system in accordance with any of the usual methods of synchronization.

Where it is not desired to provide for the transmission of auxiliary signals other than those originating from the transmitting tape 11 the code signalling tongues 1—7 of the keyer 8, are connected to the correspondingly designated segments of the signal distributor ring R1 without passing through the auxiliary signalling device TS which is commonly known as a tape stop unit.

The need for transmitting auxiliary signals independently of any signals which have been perforated in the tape 11 will be apparent to those skilled in the art.

The special service signals to be transmitted by means of a supplemental signalling device TS are those for instance whereby one or more taps of a bell may be produced at the receiving end.

In consideration of this requirement it is customary to connect a tape stop auxiliary unit TS between certain of the code signalling tongues 1—7 of the keyer 8 and the signal distributor ring R1.

The automatic signalling device, enclosed within the dotted rectangle TS, normally comprises cam operated switches S1 to S5 interposed in the leads connecting the code controlled tongues 2 to 6 of the unit 8 to the correspondingly designated segments of the ring R1 of distributor D.

The spring controlled switch tongues T1 to T5 of switches S1 to S5 are adapted to ride over the peripheral surfaces of cams C1 to C5 respectively and have front and back contacts associated therewith. The tongues T1 to T5 of switches S1 to S5 are connected respectively to the segments 2 to 6 of ring R1 on distributor D. The individual front contacts FC1 to FC5 of switches S1 to S5 are connected respectively to the code controlled tongues 2 to 6 of the unit 8 whilst the back contacts BC1 to BC5 respectively of switches S1 to S5 are connected to positive B supply source 9.

The peripheral surface of each cam C1 to C5 is provided with one or more humps or the like which function to operate the associated spring controlled tongues T1 to T5 from the front contacts of switches S1 to S5 to the back contacts thereof, in different positions, of the cams. The shape and disposition of said humps differ for each cam and said humps are so disposed that simultaneous movement of the cams through a predetermined angle causes different positive potentials and consequently different code characters to be set up on the segments of distributor D.

The cams C1 to C5 are fixedly mounted on a cam shaft 25 in such a manner that the physical relationship between the peripheral humps in the individual cams, at predetermined angular settings of the shaft, will cause the setting up of code characters on the distributor segments in predetermined sequence.

The tape stop unit TS is provided with a dialing member 14 for special transmission of a series of code signals. The extent of movement of the dialing member 14 is determined by placing a finger in any one of the holes 15 and moving the member in the direction indicated by the arrow until the finger strikes a stationary stop 16.

The operator then withdraws his finger from the selected hole 15 thereby releasing the dialing member 14 for restoration to its normal position under the influence of a coiled spring 17, this spring having been tensioned by the previous manual dialing operation. A gear 18 is loosely mounted on the shaft 19 and has projecting therefrom a pivot pin 20 for supporting a pawl 21 which is adapted to engage with the teeth of a ratchet wheel 22 fixedly mounted on shaft 19. The dialing member 14 and a switch controlling dog 23 are also fixedly mounted on the shaft 19. During the dialing operation, the teeth of the ratchet wheel 22 slip under the pawl 21 but during the return motion of the shaft 19 the pawl 21 is engaged by a tooth of the ratchet wheel 22 and caused to rotate backward with the shaft 19 and with the latter locked to gear 18 thereby imparting rotation to the pinion 24 fixedly mounted on the shaft 25. This shaft 25 also carries the series of code impulsing cams C1 to C6 inclusive and a ratchet wheel 26 all fixedly mounted thereon.

In conventional tape stop units only 5 cams are employed; however in carrying out the present invention an additional cam C6 is provided.

The cam shaft 25 can rotate only as permitted by the operation of an escapement 27 whose arms 27*a* and 27*b* are integral with an armature 28 which is under control of a pulsating magnet 29. The impulses for actuating the magnet 29 are derived from the source B fed through distributor ring R4 and across brush 12 to segments 8, 9, 10 of ring R2. This circuit may be further traced through conductors 30 and 31 to contact springs 32 and 33 and thence to the windings of magnet 29 and finally returning to the negative side 10 of source B.

In the transmission of ordinary traffic signals, the perforated tape 11 is fed at a cyclic rate through the transmitter T in accordance with a step-by-step feeding thereof as indicated by the use of ratchet wheel 60 and associated driving mechanism under the control of the operating magnet 35. This magnet is energized by the closing of a circuit through the two coils of a differential relay 36 which, when both coils are energized, provides no attraction upon the relay armature 39. However, the energizing impulse for magnet 35 is derived from positive potentials through ring R4 and certain segments of ring R2 when they are bridged by the brush 12.

The relay 36 is designed to operate when one only of its windings is energized but will not operate when both windings are energized;

normally, the local pulses which are derived from segments 8, 9 and 10 in distributor ring R2 will be branched so that both windings of relay 36 will be simultaneously and equally energized. The branch for the left hand winding of relay 36 may be traced from conductor 30 through conductor 31 to contact 32 and a companion contact 34 and thence over conductor 50 to the left hand winding of relay 36. The branch for the right hand winding may be traced from conductor 30 through the co-operating contacts 38, 40 of relay 36 to the right hand winding. From the center tap of the winding of relay 36 the currents from both halves of the relay flow through a common conductor 51 and the winding of relay 35 to the negative terminal 10 of the B supply.

When auxiliary service signals are to be transmitted the operating impulses are transferred from the magnet 35 of the transmitter T to the magnet 29 of the TS unit upon the operation of dial member 14.

When the dial member 14 is manipulated the dog 23 is withdrawn from pressure against the resilient spring 32. The tension on this spring 32 urges it, when released, out of contact with spring 34 and into contact with spring 33 which is in circuit with the winding of magnet 29. The operating impulses from the distributor ring R2 are therefore transferred from the operating magnet 35 of the transmitter T to the escapement magnet 29 of the auxiliary signalling device TS.

Depending upon the hole 15 which is fingered, from one to five strokes of the bell will be produced at the receiver. However, the shift signal, the bell signal, and the unshift signal are required for each stroke of the bell. Consequently, the code determining cams C1 to C5 inclusive are normally provided for setting up these code signals and for transmitting the same. When the dialing member 14 is operated for the transmission of auxiliary or "Service bell" signals, operation of the tape stop unit TS occurs in the following sequence:

Upon each revolution of the brush 12 an impulse will be transmitted to the escapement magnet 29. Each impulse causes the escapement wheel 26 to move one step. Each movement of the escapement wheel 26 causes a different set of code characters to be applied to the segments 2 to 7 inclusive of the distributor ring R1, the nature of the characters depending upon which of the control springs associated with the individual cams is operated by the code character on the periphery of the cam. The code characters on the peripheries of the cams C1 to C5, the arrangement of said cams, and the associated circuit wiring, is normally such that the successive code characters transmitted to the distributor R1 correspond with the signals "Shift," "Bell signal," "Unshift" in that order for each bell signal to be transmitted.

The code elements 3—4—5 have been arbitrarily chosen as the upper case shift of Figure shift signal. When the figure shift signal is transmitted the peripheral code characters (humps) of the cams C1 to C5 are such as to cause the operation of the associated tongues of switches S2—S3—S4 whereby a positive pulse is applied to each of the segments 3—4—5 of the distributor R1.

The bell signal (following the figure shift signal) usually corresponds with the signal for the letter "J" but if preferred it may be the same

signal as chosen for the letter "S" or any other lower case character on the keyboard and when the escapement wheel 26 moves the cams C1 to C5 into position for the transmission of the bell signal the peripheral humps of said cams operate the appropriate associated tongues T1 to T4 to cause positive pulses to be applied to the distributor segments of R1 which correspond with the code characters of the particular letter arbitrarily chosen for the bell signal.

In the next position of the escapement wheel 26 cams C1, C2 and C3 are in position to elevate their tongues T1, T2, T3 respectively thereby to impress positive current on distributor segments 2, 3 and 4. This is a signal arbitrarily chosen to designate the unshift or letter shift function.

The steps of operation of the cams as thus far described are those which would be performed if the operator wished to transmit a single stroke bell signal. It will therefore be appreciated that for the transmission of five bell signals the peripheral characters on the cams must be such as to enable the above signals to be repeated five times with a normal or no signal condition separating each set of signals during each revolution of the cams.

When the number of strokes of the bell is to be greater than one, the extent of the motion of the dialing member 14 is determined by the hole 15 which is fingered by the operator, and accordingly any selected arc of revolution of the cams may be traversed for transmitting a proper sequence of signals necessary to produce the desired number of taps of the bell. Usually from one to five strokes are sufficient for all of the usual service signals such as start, re-run, repunch, stop and regulate.

It is to be understood that the procedure outlined above it purely arbitrary and that if character designations of the different code signals were to be altered, corresponding changes would be made in the circuit diagram.

During the transmission of the auxiliary shift, bell, and unshift signals it will, of course, be appreciated that the operation of the transmitter T is temporarily interrupted. This interruption is attained by opening contacts 32 and 34 which are included in the circuit to the left hand winding of the relay 36.

As the code characters for a bell signal correspond with those of an arbritrarily chosen letter in the lower case the necessity for preceding and following the bell signal with shift and unshift signals respectively in order to differentiate between the two functions of the same code characters will be obvious.

Because of this requirement there is a distinct possibility, as already pointed out, that if upper case characters such as figures are being sent when transmission is interrupted for the purpose of sending bell signals with the auxiliary device TS, the letter shift signal which follows the bell signal is likely to cause the receiver to wrongly transcribe the code characters when the message signal transmission is resumed.

The modification necessary in accordance with this invention to avoid the difficulties previously outlined and the manner in which these modifications affect the operation of the auxiliary signalling device will now be described.

The additional apparatus employed in carrying out the present invention comprises an additional cam C6, a relay 37 having two separate windings, 37*a*, 37*b* and polarized relays 42, 43, 44 and 45.

The additional cam C6 is provided with the

same peripheral characters as cam C1 and is fixedly mounted on the cam shaft 25 in such a manner that its peripheral characters coincide at all times with the peripheral characters of cam C1.

The relays 42, 43, 44 and 45 are respectively connected between the code character tongues 2, 3, 4 and 5 of the unit 8 and earth 10. Each of the relays 42, 43, 44 and 45 is provided with a movable contact member 52, 53, 54 and 55 respectively and which, in the operated position, is adapted to make contact with an associated fixed contact 62, 63, 64 and 65 respectively. The fixed and movable contacts of the relays 43, 44 and 45 are energized by the positive potentials simultaneously set up on tongues 3, 4 and 5 of the unit 8 by tape perforations corresponding to the figure shift or upper case signal and a circuit is completed from the +B supply source through the contacts of relays 43, 44 and 45 and the winding 37*a* of relay 37 to earth 10 whereby relay 37 is caused to operate.

Energization of the differential relay 37 causes the operation of associated contacts of switch section S8 which functions to complete a holding circuit from the +B supply through the winding 37*a* of the differential relay 37 to the earth or negative terminal 10 of the B supply. The completion of this circuit ensures that the relay will remain energized irrespective of subsequent polarity variations of the tongues 3, 4 and 5 until de-energized in a manner hereinafter to be defined. The operation of switch section S8 also serves to transfer positive battery from the contact BC1 of switch S1 to the contact BC6 of switch S6.

The operation of the differential relay 37 serves also to operate the moving contact arm of the associated switch section S7. When relay 37 is energized, the closing of contacts at S7, provides a path for a spacing impulse to pass to number 2 segment, of the transmitting distributor R1, every time the third step of each bell ringing cycle is transmitted. As the positive supply has been removed from switch S1, and applied to switch S6, and as the contacts T1 and T6 respectively controlled by cam C1 and cam C6 both lift at the same instant, then number 2 segment of the distributor R1 would be left open if contact S7 were not provided.

The modifications required to carry out the present invention are completed by connecting the cam contact spring T4 of switch S4 to the normally closed contact FC6 of switch S6 while the cam contact spring T6 of switch S6 is connected to No. 5 segment of the distributor R1. The impulses of cam C4 now pass through switch S6 to segment 5 of the distributor R1.

The operation of the modified tape stop unit or auxiliary signalling device TS in accordance with the present invention is as follows:

In the normal signalling conditions involving the transmission of letters of lower case characters the normal operation of the apparatus is not affected, the code characters set up on the tape controlled tongues 1 to 7 being applied to the correspondingly designated segments of the distributor R1. In the present example the tongues 1 and 7 are directly connected to their associated distributor segments whilst tongues 2, 3, 4, 5 and 6 are connected to the corresponding segments of the distributor R1 through contact members associated with cams C1, C2, C3, C4, C5 respectively, when said cams are in their normal positions. When a figure shift signal is set

up on the tape controlled tongues 3, 4 and 5, by perforations in the tape and for the purpose of transmitting the signal required to condition the receiver to receive upper case characters, positive potentials are applied simultaneously to the segments 3, 4 and 5 of the distributor D and to the relays 43, 44 and 45, causing said relays to operate their associated contacts 53, 54 and 55 to close onto contacts 63, 64 and 65. The closure of these pairs of contacts results in the energization of the differential relay 37 and the operation of switches S7 and S8. As already explained, switch S7 functions to transfer negative battery to No. 2 segment of the distributor R1 when switch S1 is in the open position, and switch S8 transfers positive battery from switch S1 to switch S6, also completing a holding circuit from +B supply through winding 37*a* to earth.

The normal transmission of the code characters, set up on the code controlled tongues 1—7 by the perforated tape 11 to the correspondingly designated segments of the distributor R1 is not affected by the circuit alterations brought about by the operations of the relays 43, 44, 45 and the differential relay 37 so long as the auxiliary signalling device TS is not operated to cause the transmission of service bell signals.

If however the auxiliary signalling device TS is operated for the purpose of transmitting bell signals during the transmission of signals of upper case characters, such as figures, the transmission is interrupted by the opening of the contacts 32, 34 which causes the transmitter 11 to stop. Closure of the contacts 32, 33 completes the energizing circuit of the escapement magnet 29 and when the dialing member 14 has been moved to the position corresponding to the number of bell signals it is desired to transmit, the cams C1 to C6 will be actuated by the escapement wheel 26 for the purpose of transmitting the desired signals in the manner and sequence already described, through switches S1 to S6.

However, due to the operation of the differential relay 37, positive current has been removed from switch S1 and applied to switch S6; therefore signal characters requiring a positive pulse on segment 2 of the distributor R1, such as the unshift or letter shift signal which comprises positive pulses on segments 2, 3 and 4 cannot be transmitted. As the cam C6 is an exact duplicate of cam C1, when the peripheral code characters on cam C1 are in position to lift the associated contact spring T1, the peripheral characters of cam C6 are similarly positioned to lift the associated contact spring T6 and cause positive current to be applied to segment 5 of the distributor R1.

It will thus be seen that a positive potential is applied to segment 5 whenever a positive potential is required on segment 2. The unshift or letter shift signal 2, 3, 4 is therefore transmitted as 3, 4, 5 which is the code character arbitrarily chosen as the case shift or figure shift signal.

From the foregoing it will be seen that so long as the differential relay 37 remains energized the letter shift signal 2, 3, 4 which follows the bell signal will be changed to the figure shift signal 3, 4, 5 and that when the bell signals are completed and transmission from the perforated tape 11 is resumed the receiver will continue to transcribe figures or upper case characters.

This condition will continue whenever the auxiliary signalling device TS is operated until such time as a lettershift signal corresponding with

the code character 2, 3, 4 is set up on the code controlled tongues 2, 3, 4 of the keyer 8 by the perforated tape 11.

When positive potential appears on the tongues 2, 3 and 4 the relays 42, 43 and 44 close their associated contacts. The operation of these contacts completes a circuit which can be traced from the +B supply through the contacts of relays 43, 44, 45 and 42, the second winding 37*b*, of the differential relay, to the earth or negative terminal 10 of the B supply.

Completion of this circuit causes current to flow through the second winding 37*b* of the differential relay 37. The direction of current flow through the second winding 37*b* of the differential relay 37 is such as to create an opposite magnetic field to neutralize the field produced by the current flowing through the first winding 37*a*, and allow the contact switches S7 and S8 to open or resume their normal unoperated condition.

The opening of switch S7 again allows the impulses to normally pass through switch S1 controlled by cam C1. The return of the switch S8 to the normal position removes the positive battery from switch S6, and restores it to switch S1 and removes the holding current through the windings of the coil 37*a*.

If the differential relay 37 is not operated when letter characters on the perforated tape 11, set up code controlled tongues 2, 3, 4 in the unit 8, then the positive potential from the transmitter tongues 2, 3, 4 causes relays 42, 43 and 44 to operate their associated contacts. Now, although a circuit is formed from +B supply through coil 37*b* to earth, the relay 37 is not energized because the current is so regulated (by resistors 66, 67) that it is not sufficient to energize coil 37*b*, yet it is sufficient to release the energized coil 37*a*.

When the differential relay 37 is not operated and letter characters are being transmitted when the transmission is interrupted by the auxiliary signalling device TS, the normal functioning of the auxiliary signalling device TS is not affected. Bell signals preceded by the shift signal and followed by the unshift or letter shift signal will be transmitted by the device TS in conventional manner. In this case since the letter shift signal follows the final bell signal the receiver will continue to transcribe letters or lower case characters when transmission from the perforated tape is resumed.

I claim:

1. A code signalling system comprising a tape controlled transmitter unit, a code element keyer, a distributor, an auxiliary signalling device interposed between said keyer and said distributor, said device constituting means for transmitting a train of code signals which includes an "upper-case" shift signal, a bell signal and a "lower-case" shift signal in succession; a plurality of cams and associated switch contacts located in said auxiliary signalling device for producing said train of code signals, one of said cams being effective in cooperation with a differential relay to reverse the sense of a certain case shift signal, means including storage relays operable in response to the keying of an "upper-case" shift signal by said keyer for nullifying the effect of a "lower-case" shift signal subsequently keyed by said auxiliary signalling device, and means for de-energizing said relays in response to a "lower-case" shift signal initiated by said tape controlled transmitter.

2. A code signalling system according to claim 1 wherein there are provided an even number of polarized storage relays.

3. A code signalling system according to claim 1 wherein there are provided a differential relay in the means for de-energizing the storage relays.

4. A code signalling system comprising a tape controlled transmitter unit, a code element keyer, a distributor, an auxiliary signalling device transposed between said keyer and said distributor, said device constituting means for transmitting a train of code signals which includes an "upper-case" shift signal, a bell signal and a "lower-case" shift signal in succession; means including storage relays, each of said storage relays being provided with a moving contact which, when operated, is adapted to make contact with an associated fixed contact, three of said fixed contacts being energized by positive potentials set up on selected elements of said code element keyer by means of tape perforations corresponding to figure shift or "upper-case" signals, means including a differential relay having a locking circuit effective upon closure to retain the effects of operation of said storage relays notwithstanding subsequent polarity variations caused by said auxiliary signalling device.

IAN N. McBAIN.

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