

Jan. 5, 1943.

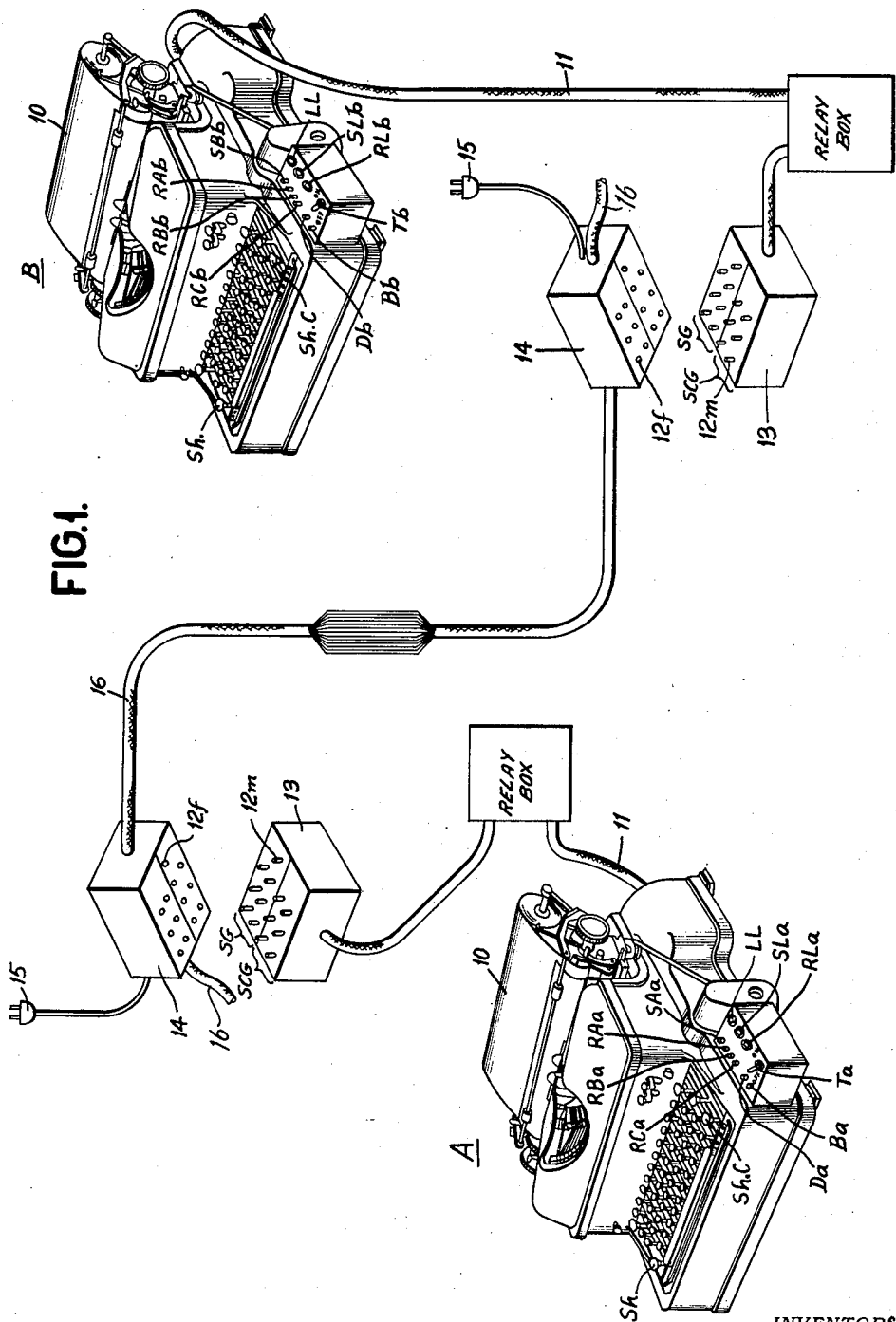
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2,307,153

COMMUNICATION SYSTEM

Filed Aug. 17, 1940

7 Sheets-Sheet 1



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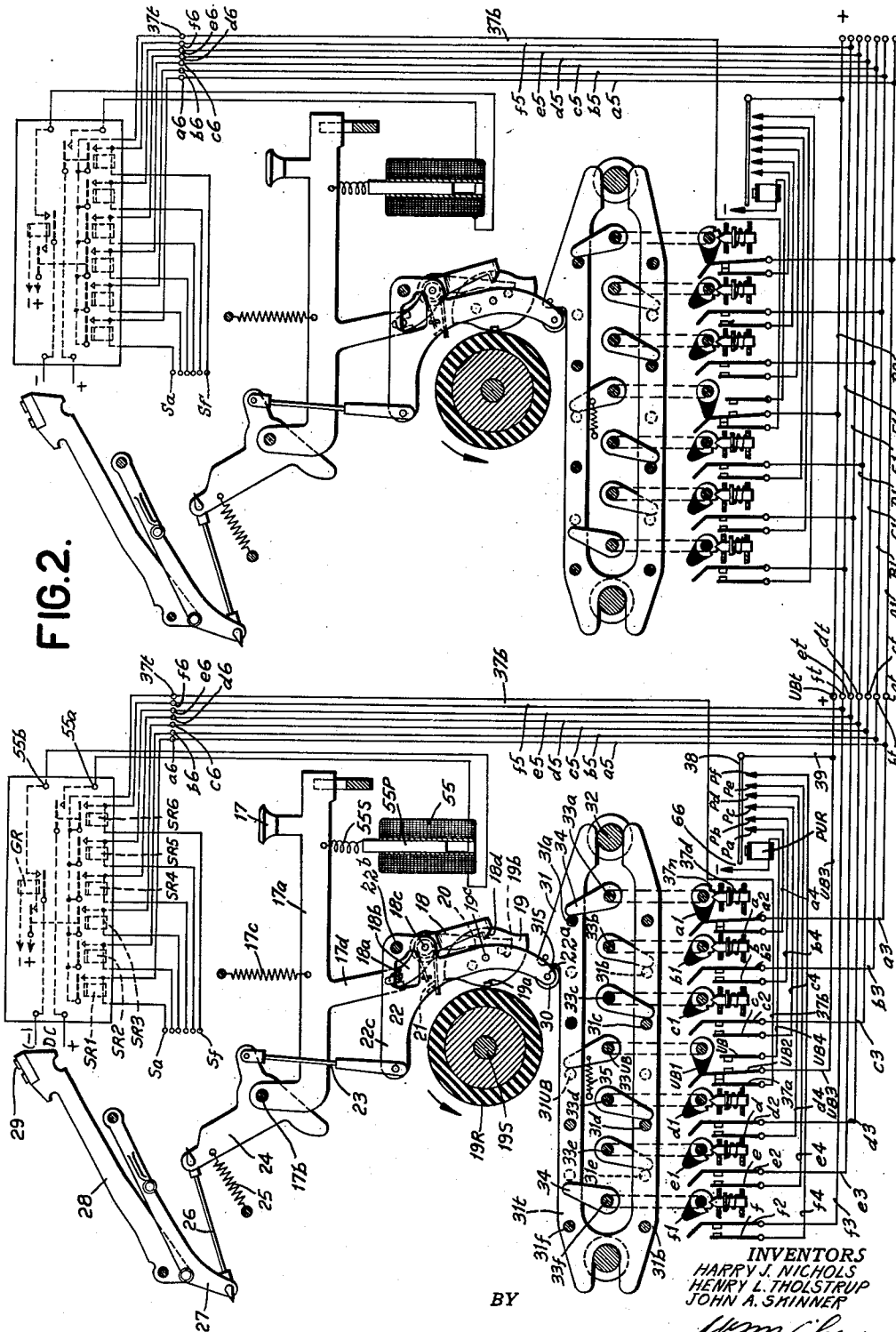
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COMMUNICATION SYSTEM

Filed Aug. 17, 1940

7 Sheets-Sheet 2

FIG. 2.



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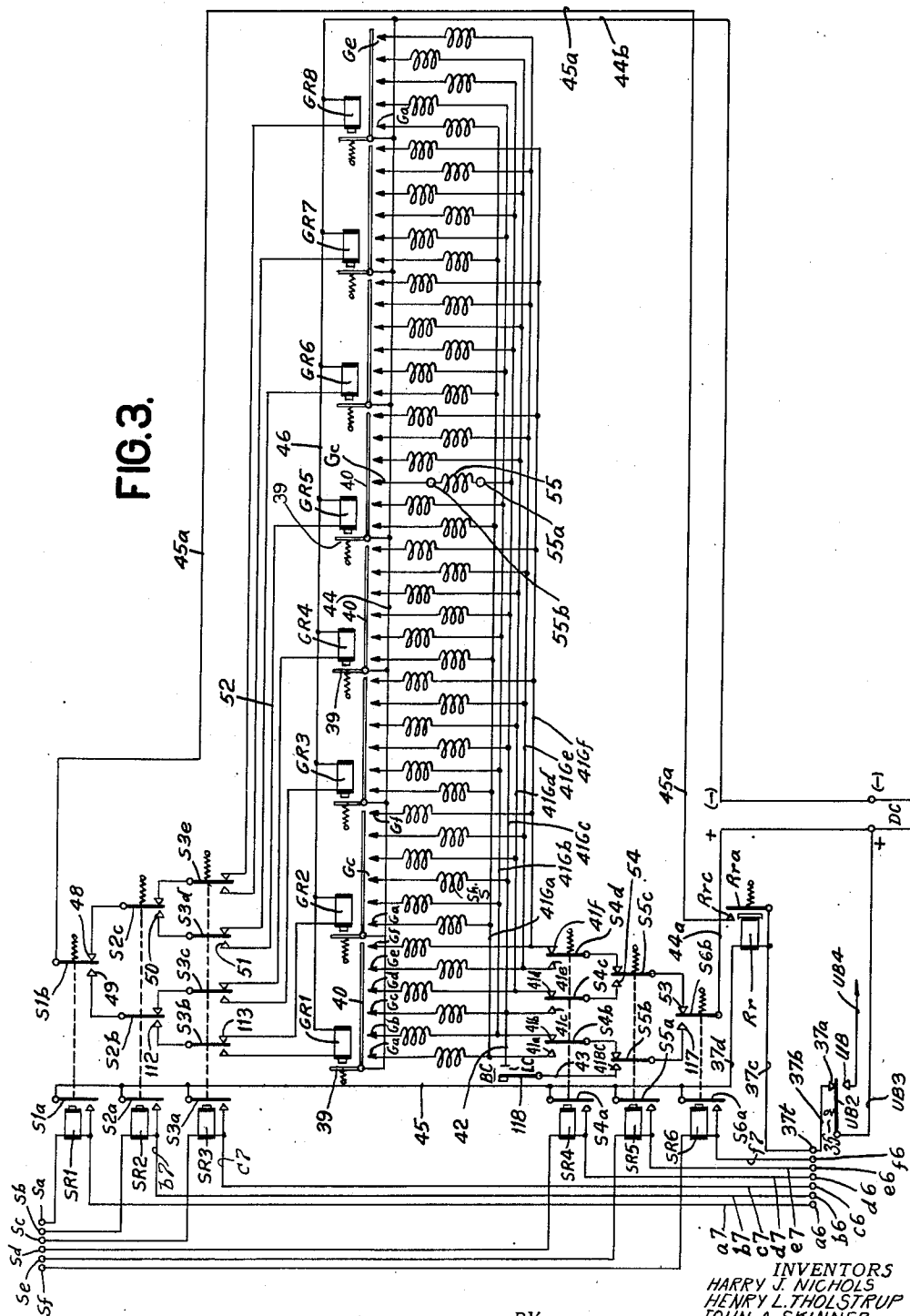
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2,307,153

COMMUNICATION SYSTEM

Filed Aug. 17, 1940

7 Sheets-Sheet 3



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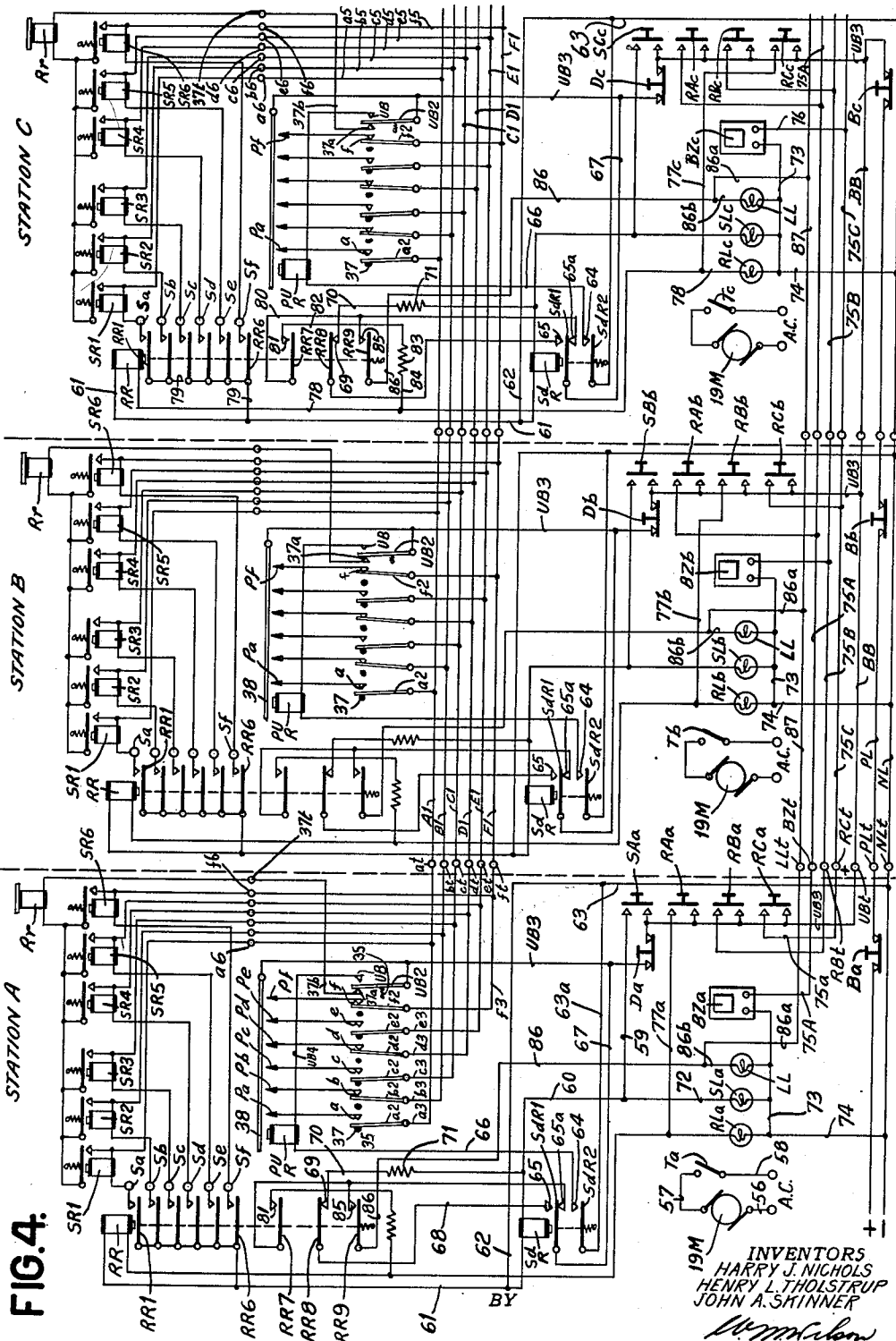
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COMMUNICATION SYSTEM

Filed Aug. 17, 1940

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Jan. 5, 1943.

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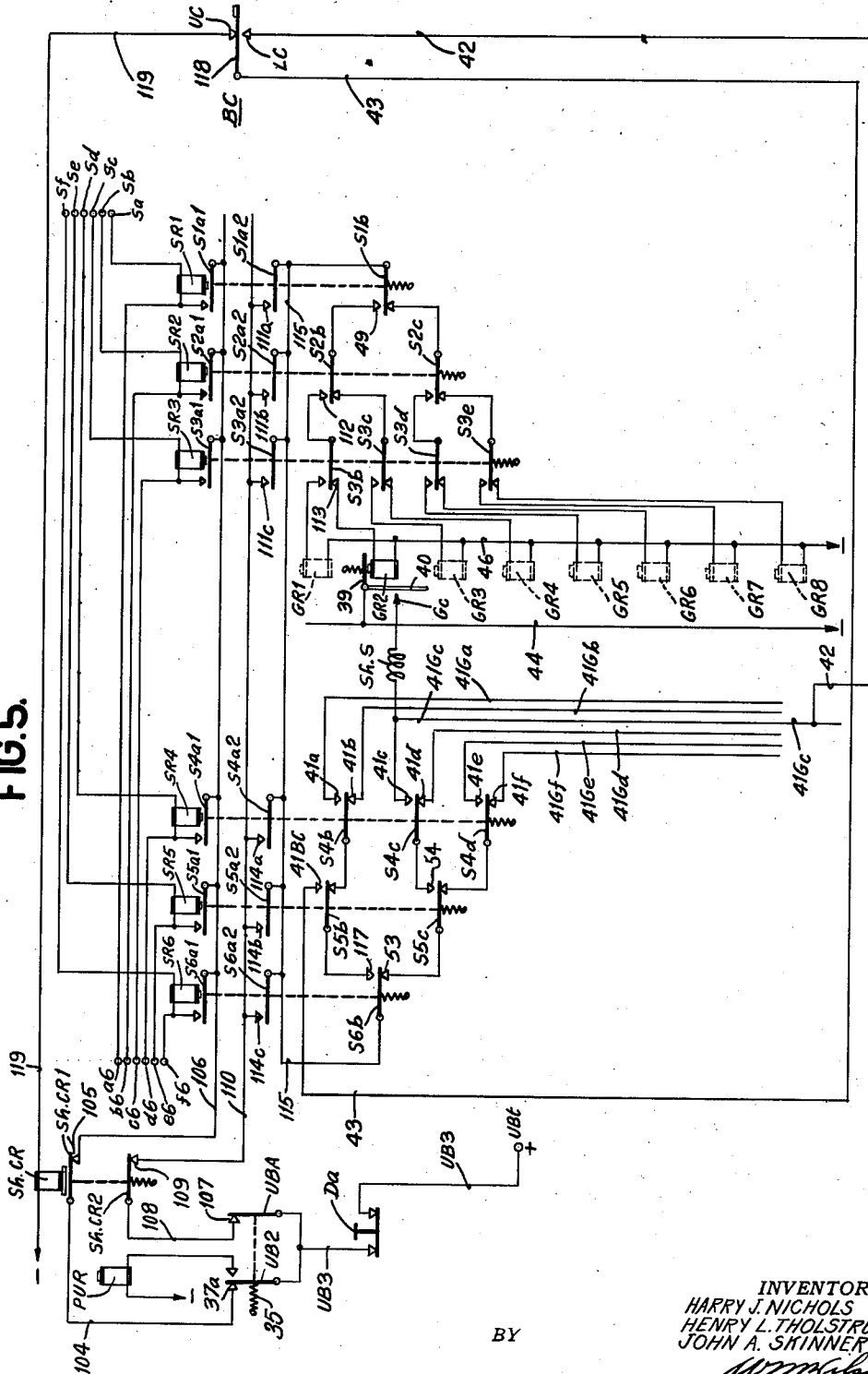
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COMMUNICATION SYSTEM

Filed Aug. 17, 1940

7 Sheets-Sheet 5

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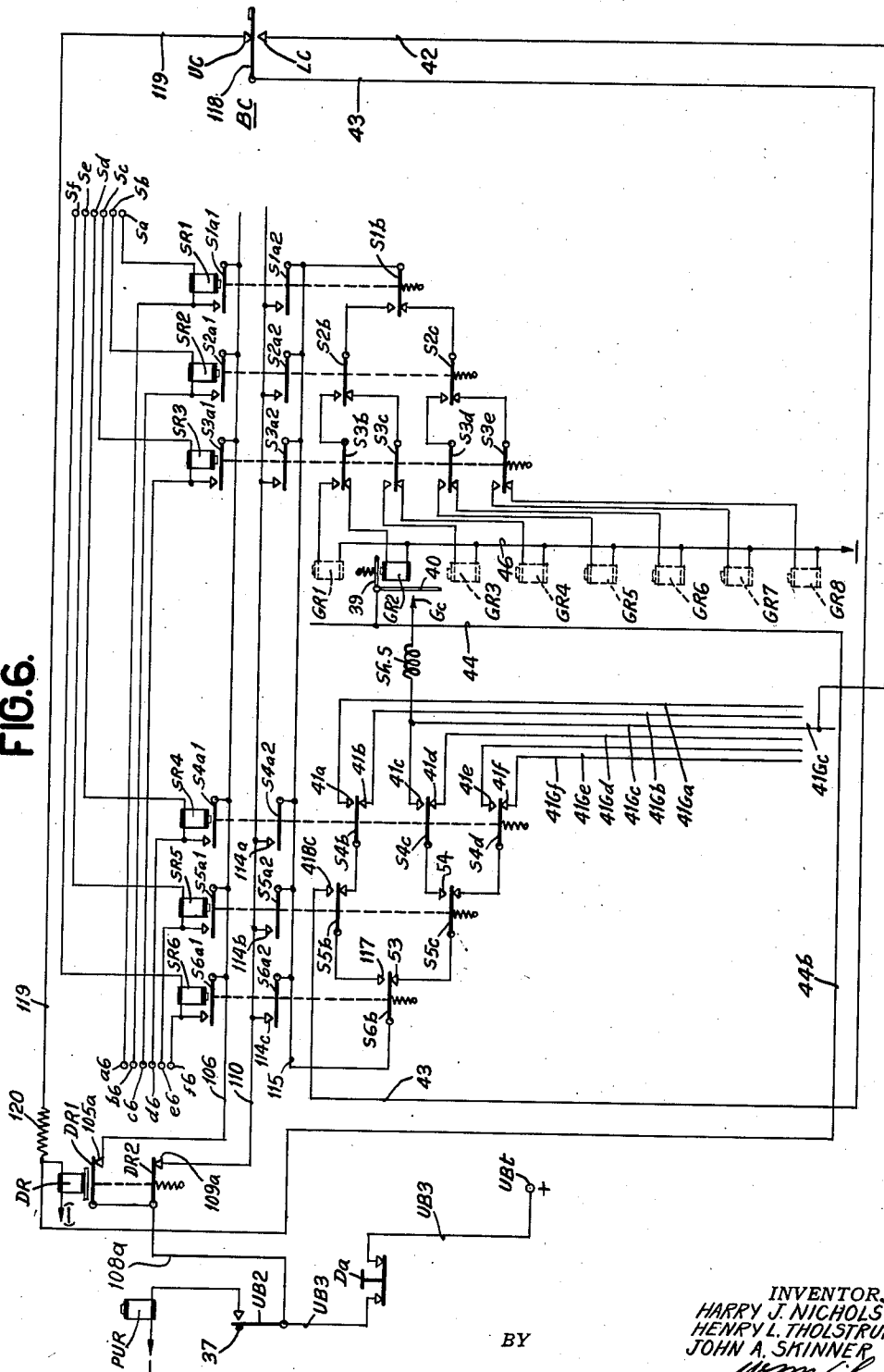
2,307,153

COMMUNICATION SYSTEM

Filed Aug. 17, 1940

7 Sheets-Sheet 6

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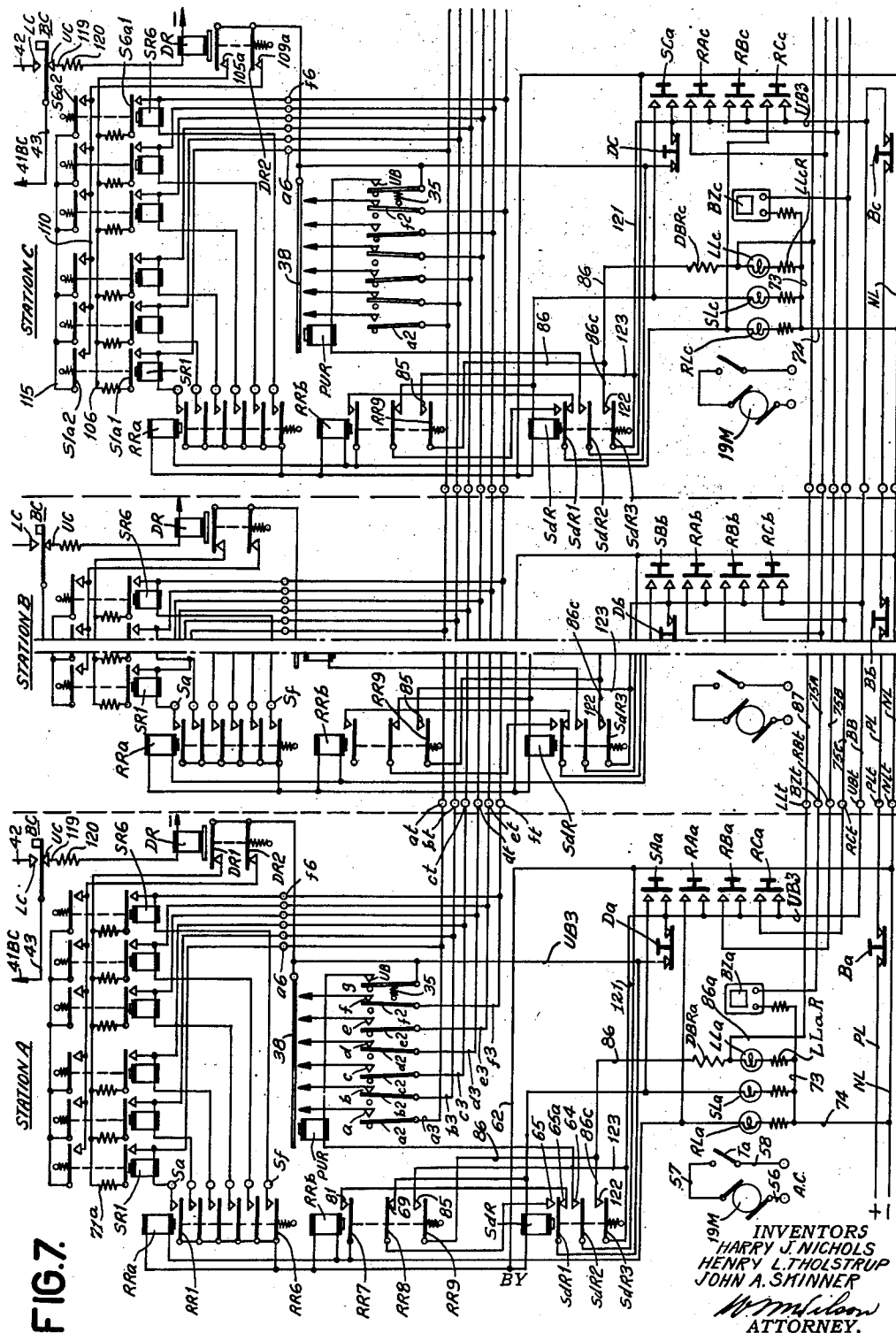
H. J. NICHOLS ET AL

2,307,153

COMMUNICATION SYSTEM

Filed Aug. 17, 1940

7 Sheets-Sheet 7



UNITED STATES PATENT OFFICE

2,307,153

COMMUNICATION SYSTEM

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Application August 17, 1940, Serial No. 353,112

24 Claims. (Cl. 178—25)

The present invention relates to interoffice or interstation communication systems and more particularly to communication systems for interconnecting separated typewriters of a certain standard construction wherein the operation of one typewriter, in a normal manner, can either be isolated, at will, from the operation of the system to permit ordinary individual operation of the typewriters or operation of the one typewriter in the normal manner can be utilized to produce a copy, at a sending station, of the intelligence to be transmitted and to simultaneously actuate a second or receiving similar typewriter or a plurality of such receiving typewriters at remote points. Likewise, each of the plurality of receiving typewriters can be utilized as sending typewriters, if and when desired, and means are provided for signaling between stations so that selected stations, connected to the system, can, upon reception of a signal, be changed from an ordinary typing condition to a receiving condition.

It is to be particularly noted, as will be explained in detail later, that upon conditioning a machine to send, the send conditioning means, which are electrically interlocked with the receive conditioning means, prevent operation of the receive means at a chosen sending machine and that upon conditioning the other machine or machines to receive, interlock means at said other machine or machines operate electrically to prevent operation of the sending means of the selected receiving stations, respectively.

In devices of the prior art wherein interoffice messages have been transmitted, special machines such as permutation bar printing telegraph devices, or teletype devices which are not the usual standard typing equipment of business offices, have been employed.

There have also been previously provided electrical interconnecting systems for standard typewriters but such systems have required either an extensive modification of the mechanical structure of the typewriter itself, to adapt it to such systems; have required complicated, separate mechanical permutation bar devices for producing, under control of each character key, code combinations of signal impulses characteristic of each keyboard character, along with similar devices for receiving and inverting the received code signal, to select the one, corresponding, character key bar; or have required complicated electromechanical translator systems at the receiver, to produce, from the code signal transmitted, a selection of the typebar corresponding to the typebar depressed at the transmitter.

Other systems for interconnecting typewriters have comprised means utilizing the well known start-stop principle including means producing signal code combinations in the well known Baudot code and wherein a plurality of signal

components are transmitted sequentially, or have comprised systems wherein the signal was composed of permutations of components, each different in intensity, in character, in duration, or in electrical characteristics. While such systems have each provided certain features, desired and obtained by the particular characteristic system utilized, they have not been characterized by simplicity.

Accordingly, one of the objects of the present invention is to provide a novel system of communication for interconnecting two of a certain standard type of typewriters which system shall be simple, and easily adapted to a standard instrument, such as, for example, the "Electromatic" typewriter.

Another object is to provide a novel system of communication for interconnecting two of a certain standard typewriter which shall be a simplification and improvement of the copending application of Harry J. Nichols and Henry L. Tholstrup, Serial No. 315,937, filed January 27, 1940, in that a formidable reduction in the number of conductors, interconnecting any two typewriters, is made possible.

A further object is to provide a novel system of communication for interconnecting two standard typewriters, comprising means controlled by depression of each key of the keyboard for setting up, in a simple and direct manner, a code signal combination of separate elements which combination varies with the function or character represented by the key depressed, said code combination comprising a plurality of electrical impulses or elements of identical characteristics and of equal duration, a conductor for each element of code, means for transmitting selectively and simultaneously over said conductors, the individual elements of a character representing, code combinations to thereby greatly reduce the period required for signaling, as compared to the period required by start-stop signal systems utilizing sequentially transmitted code components, and electrical translator means controlled by the individual elements of the code combination for selectively energizing, at a standard receiving typewriter, solely the operating solenoid of the key bar corresponding to the key depressed at the sending station, for operating said corresponding key bar, whereby the depression of a chosen character key of a standard typewriter, at one station, produces the typing of the selected character at a remote station or stations by means of a similar standard typewriter or typewriters.

Still another object is to provide a standard typewriter of the kind wherein power means is utilized to locally operate the typing elements, selectively, upon actuation of a chosen character key bar, means controlled by said power

means for producing a code signal combination comprising a plurality of similar electrical signal elements, simultaneously transmitted, means including a similar standard typewriter of the power driven type at a remote station, means electrically translating said code signal combination of similar signal elements to select and electrically condition the operating solenoid of the corresponding key bar at the remote station, and means including the code signal combination producing means, at the remote station, for resetting the electrical translator.

Another object is to provide means, including a standard typewriter, for setting up a code signal combination characteristic of a chosen key character of function comprising a characteristic combination of similar signal elements, simultaneously transmitted, a second standard typewriter, electrical means for individually operating the key levers of said second typewriter or producing a function thereat, switching means controlling the energization of each of said electrical means, a conductor for each element of code interconnecting said typewriters, an electrical translator comprising an electromagnet for each conductor, said magnets being selectively energized in accordance with the separate code signal elements comprising the character or function signal and said magnets selectively rendering operative, in accordance with the code signal, those switching means only which control the electric operating means of the corresponding key bar, or control performance of a desired function, and means controlled upon reception of any combination for restoring the electrical translator to the condition existing prior to reception of this code combination.

Still another object is to provide a system of communication including in combination a standard "Electromatic" typewriter wherein the power drive of the typewriter simultaneously operates a chosen character type bar to type the chosen character and sets up, for transmission, a code signal permutation corresponding to the character selected, and receiving means comprising a second standard "Electromatic" typewriter and including means controlled by the separate components of the signal permutation for electrically translating said signal to selectively operate only the character key corresponding to the character typed at the sending station and to clear the electrical translating means.

A further object is to provide a novel system of inter-office or interstation communication including at least a pair of standard typewriters having generally the usual keyboard, a series of solenoids, one for each character key, electrical connections between the respective typewriter solenoids including one conductive connection for each element of code and totaling in number less than the number of solenoids, means controlled by a selected key for simultaneously transmitting over selected ones of said conductive connections, separate elements of a signal permutation, the permutation of said elements corresponding to the character represented by the selected key, and electrical translator means comprising a relay for each conductive connection, selectively operated in accordance with the respective elements of the permutation and including a plurality of switch elements actuable into various cascade arrangements and controlled by said relays to assume a chosen cascade arrangement in accordance with the particular permutation for energizing the one key solenoid

only, corresponding to the character key depressed at the sending station.

A further object is to provide, in a novel communication system including a plurality of standard typewriters, adapted to both send and receive electrical signals to selectively operate chosen key bars under the control of a remote instrument, control means for rendering one machine operative for sending, control means for rendering said machine operative for receiving, and interlock means, electrically operated, for automatically rendering one of these control means ineffective upon operation of the other.

Still another object is to provide a novel system for interconnection of a plurality of typewriters to produce remote control of one typewriter by another typewriter and to produce all typing functions including shift and shift-check, by setting controlled elements of one typewriter in response to signals from another, and means responsive to said remote control for resetting the controlled elements of the one typewriter after performance of any function.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a diagrammatic view illustrating generally the tele-registering devices, such as typewriters, controlled by remotely originating signals, utilized in the novel system, and generally illustrating the means for electrical interconnection of the various tele-registering devices.

Fig. 2 is a diagrammatic view, partly in skeleton outline only, illustrating fundamentally how the operation of a type bar control key, at a sending station, produces a code signal permutation of separate elements, which in turn is electrically translated at a receiving station to actuate only, the corresponding type bar at the receiving station.

Fig. 3 is a wiring diagram of the novel electrical translator utilized in the present system and including the key bar solenoids and electrical connections between the translator and said solenoids.

Fig. 4 is a wiring diagram of one embodiment of a complete interconnecting system for signaling and for communication between a sending and a receiving typewriter.

Fig. 5 is a wiring diagram, partly in skeleton outline, of the receiving part of another embodiment of a communication system for interconnecting sending and receiving typewriters and including means for producing shift and shift-check and clearance of the electrical translator.

Fig. 6 is a wiring diagram of a variant of the system of Fig. 5.

Fig. 7 is a wiring diagram with a portion of one station omitted of a system embodying the several aspects of the present invention, as applied to three stations.

Referring to the drawings wherein like reference characters refer to like parts throughout the several views and more particularly to Fig. 1, the invention is illustrated in the present instance as applied to a pair of standard "Electromatic" typewriters A and B at the sending and receiving stations, respectively, but it is to be specifically understood that any type of standard typewriter can be connected, as in the

present invention, and that any number of typewriters can be so interconnected.

Typewriter A comprises a standard "Electromatic" typewriter wherein the type bars are power actuated, upon depression of a chosen character key, in the manner to be presently described.

Upon depression of any chosen character key, the character is typed on the record sheet 10, at station A, and an electrical code signal, composed of a predetermined permutation of similar components is transmitted via the respective code channel conductors of multi-conductor cable 11 and the relay box, which also contains the electrical translator, to the corresponding male contacts 12m of the multiple plug 13, segregated into a signalling or communicating group SG and a supervisory control group SCG. Contacts 12m are inserted, during inter-office or inter-station communication, into the corresponding female contacts 12f of a cable box 14. Each of the character keys of the typewriter utilizes a number of male contacts 12m, in accordance with its particular code permutation of signal components, so that when the multiple plug 13 is electrically connected to the cable box 14 and plug 15 is inserted into the ordinary power socket, a signal, comprising the respective permutation of components, is produced, upon depression of the chosen character or function keys, and these components are respectively transmitted simultaneously through the corresponding conductors comprising the several code channels, which conductors are diagrammatically illustrated, along with the necessary power and supervisory control conductors, as comprising generally an interstation multi-conductor cable 16 extending to the corresponding female contacts 12f to be connected with the male contacts 12m and the corresponding conductors, respectively, in the multi-conductor cable 11, at machine B. All components of the signal are simultaneously transmitted through the interstation multi-conductor cable 16 so that not only are distributors at the sending and receiving ends eliminated, but the signal period, as compared to the signal period with the single wire, start-stop systems of the sequentially transmitted code component type, may be definitely diminished, permitting faster operation of the sending and receiving machines or the entire time cycle is made available for signalling, each code component thereby providing a signal impulse duration, several times that of a single channel printer of equal speed with a comparable time margin advantage.

Furthermore, by the utilization of equal duration, entirely similar components of a signal permutation, all special or complicated devices for measuring, utilizing or sorting the respective signal components are eliminated and an extremely simple translator of the type such as illustrated in the copending application of Harry J. Nichols, Serial No. 353,115, filed Aug. 17, 1940, can be utilized to translate the received signal permutation, to select the corresponding key bar at the receiving machine. The various components of the signal transmitted from station A are simultaneously applied to such an electrical translator, comprising means responsive to individual signal components and movable, cascade arranged switch elements controlled thereby, whereby one chain or cascade only, of the switch elements, is selectively closed, in accordance with the particular code permutation of components corresponding to the particular

character, so that the corresponding key bar at station B will be operated, as will be explained presently.

When it is desired to operate any machine, such as machine A, in the normal manner, characteristic of a standard typewriter and disconnected from the system entirely, and assuming that the machines are all disconnected from the interstation communication system, the toggle switch Ta at the sending station A, for example, is thrown to the "on" position, which closes a circuit to the motor of the typewriter A, as will be explained in detail in connection with Fig. 4, whereby the power roller of the machine is rotated, in the manner well known in the art. Typewriter A can thereupon be operated in the normal manner by the operator at station A. Upon similar manipulation to the "on" position of the corresponding toggle switch Tb, at the machine B, the typewriter B can also be individually operated in the normal manner and neither the machine at station A nor the one at station B will interfere with or transmit to the other.

When the operator at station A, however, wishes to send a message to station B, for example, to be simultaneously typed upon both machines, the operator at machine or station A, in order to warn station B, presses the make-switch, push button RBa at station A, which closes a circuit to the buzzer at station B, in a manner that will be described in detail in connection with Fig. 4. To condition his machine to send to machine B, the operator at machine A presses the make-switch, push button SAa at station A, which conditions this machine and its associated circuits for sending, all as will be described in detail in connection with Fig. 4. The send signal lamp SLa is lighted at station A to indicate to the operator at station A that machine A is in a sending condition.

In order to place his machine in condition for receiving, the operator at station B, if his toggle switch Tb is already in the "on" position, merely presses his make-switch, push button RBb, which conditions his machine for receiving, as will be described in detail later. The line lamps LL at all stations are thereupon lighted in the system of Fig. 4 to indicate that some one machine is in a receive condition and the receive signal lamp RLb at station B is lighted, indicating to the operator at station B that his machine is now in a receive condition.

Referring now to Fig. 2, the mechanism and circuits for the operation of a chosen character key at station A with the consequent mechanical typing of the selected character at the station A and the electrical typing of the same character at station B, are illustrated diagrammatically in skeleton outline only, in order to simplify the theory of operation. The arrangement for each electrical translator at both stations, which is indicated in skeleton outline only in Fig. 2, is illustrated in detail in Fig. 3, along with the electrical connections to the respective keyboard solenoids, as will be explained in detail in connection with Fig. 3.

The operation of a send conditioned machine to produce a signal for remote operation of a receive conditioned machine is as follows: upon depression of a character key 17 representing, for example, the letter v whose corresponding code permutation, in accordance with the selected code, comprises the second, third, fourth and fifth code elements or components, the key bar 17a is oscillated about its pivot point 17b against the

force of a return spring 17c to move an extension arm 17d, downwardly. Upon such downward movement, the bifurcated lower end of arm 17d engages a pin 18a on arm 18b, integral with a pivoted stop lever 18, to rotate stop lever 18 counterclockwise about its pivot 18c. This rotation disengages a channel shaped lug 18d of a stop lever 18 from one of a pair of detents 19a on power cam 19. A pivoted impeller arm 20, in contact with an impeller lug 19b on power cam 19, is constantly urged in a clockwise direction by means of a spring 21 and upon the disengagement of the channel shaped lug 18d of the stop lever, from a detent 19a of the cam, the impeller arm 20, by means of its contact with impeller lug 19b, rotates the cam 19 slightly, in a clockwise direction, until it engages the constantly rotating power roller 19R which is rotated about the stationary shaft 19S by means of the typewriter motor 19M (see Fig. 4) in a manner well known in the art. The cam 19 by means of its contact with power roller 19R is thereupon rotated a full half revolution, clockwise, until the second detent 19a of the pair on cam 19 engages the channel shaped lug 18d of stop lever 18, in a well known manner. Cam 19 is pivotally mounted by its axis 19c upon one arm 22a of a bell-crank 22, in turn mounted for oscillation about pivot 22b, and upon such rotation of cam 19, its eccentric contour causes a lateral movement of the cam axis 19c to thereby oscillate bell-crank 22 in a counterclockwise direction. Such oscillation causes a downward movement of the arm 22c of bell-crank 22 to in turn pull down a link 23 to rotate bell-crank 24 against the force of spring 25, to actuate link 26 to oscillate bell-crank 27 to in turn actuate the type bar 28 to strike one of the type characters 29 against the record 10 (see Fig. 1), in a manner well known in the art.

Operation of the power cam 19 is utilized to control the operation of a permutation unit, which unit may be of the type as illustrated in the copending application of Harry J. Nichols, Serial No. 353,114, filed Aug. 17, 1940. The operation of the permutation unit upon operation of the cam is briefly as follows: Upon the rotation of cam 19 and consequent lateral movement of the cam axis 19c, a roller 30, carried on the lower end of arm 22a, is moved laterally to the right, as viewed in Fig. 2. Roller 30 is in engagement with a shoulder 31s on a slidable selector member 31, mounted on suitable slotted guide bars 32 secured to the frame (not shown) of the typewriter unit. Each slidable selector member is provided with a plurality of spaced studs carried by the top and bottom bars 31t and 31b of selector 31 and extending outwardly and alternately from one side and the other of the selector member, successive studs on alternate sides being equally spaced. A complete set of seven out of a greater number of such studs, provided on any one selector member, is designated respectively as 31a, 31b, 31c, 31UB, 31d, 31e and 31f in Fig. 2. Rotatably mounted on each of the code rock shafts 33a, 33b, 33c, 33UB, 33d, 33e, 33f and alternately on opposite sides of the selector member, are the diagrammatically represented rock-shaft actuating clips 4. These clips are removably attached as disclosed in said copending application Serial No. 353,114, filed Aug. 17, 1940, the relative disposition of the clips in the assembly for each slider being dependent upon the particular code value of the character, whose key controls the respective slider member. Upon depression of the chosen character key 17, the

rock-shafts will be selectively rotated and in such a direction that switches controlled by the rock-shafts, respectively, will be set up in accordance with the chosen character code value. It is to be particularly noted that the universal ball rock-shaft 33UB is always actuated, to thereby move one pair of its control contacts, momentarily out of engagement, while another pair is momentarily moved into engagement, rock-shaft 33UB being diagrammatically illustrated as spring biased by a spring 35 acting through its associated clip so that the rock-shaft is returned to its original position upon completion of the half revolution of cam 19.

Upon the above described lateral movement of the cam axis 19c, therefore, the roller 30 moves slider 31 to the right against the force of spring 35 acting through the universal ball clip and stud 31UB, whereby the studs selectively actuate the associated clips, respectively, and rotate the universal ball rock-shaft 33UB and selectively rotate the remaining rock-shafts as required by the signal to be set up. Such selective actuation of the clips to rotate the associated rock-shafts selectively, actuates the diagrammatically represented switch elements or fingers a1, b1, c1, UB1, d1, e1 and f1, to move the self-spring-biased universal ball switch arm UB2 out of engagement with one of its coacting contacts 37a and into engagement with the other coacting contact UB, and to selectively move the switch arms a2, b2, c2, d2, e2 and f2 into or out of engagement with the cooperating contacts a, b, c, d, e and f, respectively. It is to be particularly noted that all code signal permutation settings are differentially produced and only those rock-shafts are actuated which require a change from the setting for the previously typed character. If the same letter is typed twice in succession the corresponding slider is twice actuated but only the universal ball rock-shaft is rotated a second time, since the remaining rock-shafts are retained in their previously set position by an associated detent pin 37d coacting with notches 37n in the actuating elements and diagrammatically representing the lock means, as illustrated in Fig. 2, the actual construction and operation of the locking means being as described in detail in said copending application Serial No. 353,114, filed Aug. 17, 1940.

As diagrammatically illustrated in Fig. 2, the rock-shafts have been positioned by actuation of another slider into the positions as shown, in order to set up the code permutation representative of the letter e while upon actuation of the slider shown in Fig. 2 with its particular clip arrangement, as shown, the rock-shafts and associated switches will set up the switches in a permutation, representative of the letter v.

Each of the switch contacts a, b, c, d, e, and f, respectively, are connected by the associated conductors a4, b4, etc. to the permutation contact points Pa, Pb, etc., respectively. A relay armature gang switch blade 38 is controlled by a permutation unit relay PUR to close a circuit from all the permutation contact points, respectively, through line 39 and terminal UBt, to the plus side of a D. C. source, via the bus bar BB, upon energization of the permutation unit relay, in a manner to be subsequently described.

Closure of a circuit through contact point Pa and switch contact a is arbitrarily chosen as setting up the No. 1 element of the code permutation, while closure of a circuit through contact

point P/ and switch contact / sets up the No. 6 element.

The switch arm UB is connected via line UB4 to one side of the coil of the permutation unit relay PUR while the other side of said coil is connected, as shown in detail in Fig. 4, to the negative side of a D. C. power source, while switch contact 37a of the universal bail switch is electrically connected, via line 37b, to the terminal 37t of the electrical translator.

Each of the switch arms a2, b2, etc., and the universal bail contact UB2 are connected via conductors a3, b3, etc. and conductor UB3 to the terminals at, bt, etc. and UBt, respectively, to which the code channel conductors A1, B1, C1, etc. and the bus bar BB, respectively, are connected. Each of the lines a3, b3, etc. respectively are connected via lines a5, b5, c5, etc., respectively, to terminals a6, b6, etc., respectively, of the electrical translator.

The details of the electrical translator system in conjunction with the individual key solenoids of every character key, respectively, which may be of the type as illustrated in the above mentioned copending application, Serial No. 353,115, filed Aug. 17, 1940, are illustrated in Fig. 3 and it is believed that a detailed description of the specific type, as shown, will clarify the operation of the system, as illustrated in skeleton outline only, in Fig. 2.

Referring to Fig. 3, it is to be noted that basically, in the system disclosed, selection of a particular item is secured, not by a step by step, successive halving method whereby one item only is selected from a given number, but in contradistinction to this, a given number of items is divided into a number of groups, and one group of items, for example, is selected, generally by successive halving, and thereafter, one item from the chosen group is selected, by successive halving, or conversely, the selection of one item only, from each group, is tentatively selected, generally by successive halving, and thereafter, one item is chosen by selecting the particular group by successive halving. Such a system is characterized by great versatility, in that the number of groups of relays can be varied, as desired, within the scope of the particular code.

As disclosed in Fig. 3, a plurality of eight group relays GR1 to GR8, inclusive, respectively, is provided, each relay having a pivoted armature 39 controlling a multiple contact controlling blade 40 for simultaneously opening and closing circuits through the relay contact points Ga, Gb, Gc, Gd, Ge, Gf, respectively, of the several group relays. Each relay contact point is illustrated as connected directly to a key bar solenoid, one solenoid being provided for each of the key characters of the keyboard and one for each key of the keyboard controlling a desired function. Corresponding key solenoids of each of the different groups are connected to the same bus bar, for example, the key solenoid connected to relay contact point Ga, of relay GR1, is connected to the bus bar 41Ga, and the key solenoid connected to relay contact point Ga of GR2 is likewise connected to bus bar 41Ga, etc. Each of the bus bars terminates in the cascade switch contacts 41a, 41b, 41c, etc., respectively. Also connected to bus bar 41Gc, is the line 42, which in turn is connected to one of the fixed contacts, namely, LC of a typebasket contact switch BC, a movable blade 118 of which (see Fig. 5) is connected by line 43 to a switch contact 41BC. The purpose

of the typebasket contact switch is to enable a chosen permutation of signal elements to produce either a case shift or shift-check, a specific example of which will be explained in detail, in connection with Fig. 5. All of the multiple contact blades 40 (Fig. 3) are conductively connected via bus bar 44 and 44b to one side of a D. C. power source, as indicated in Fig. 3. The other side of the D. C. power source is connected to the blade S6b, comprising one of a series of gang operated chain switch arms, grouped in a chain or cascade arrangement, and controlled by the respective selector relays SR6, SR5 and SR4, as illustrated in Fig. 3.

Each of the selector relays SR4, SR5 and SR6, respectively, simultaneously controls its armature and one or more gang connected chain switch arms, the corresponding armature closing a holding circuit through its associated relay upon energization of the relay. For example, upon reception of a plus, code signal component at terminal /6, transmitted by a remote machine, as will be described in detail in connection with Fig. 4, a circuit is closed from terminal /6 to the selector relay SR6, through the coil of this relay, thereby energizing the same, to the binding post or terminal Sf and then (Fig. 4) to the negative side of the D. C. power source. Energization of the coil of SR6 causes it to attract its corresponding armature S6a to close the following holding circuit: From the positive side of a D. C. power source, line UB3 (Figs. 2 and 3), universal bail switch arm UB2 (diagrammatically illustrated as biased against contact 37a via the spring 35 of the universal bail), contact 37a, line 37b to terminal 37t, line 37c to slow acting, retard relay Rr (Fig. 3 only) thereby energizing this relay, line 37d to the bus 45 thereby applying plus to this bus. Since the coil of relay SR6 is energized, its armature S6a closes a holding circuit from bus bar 45 through the coil of this relay to the terminal Sf, thereby holding the relay SR6 energized after the signal component is removed from terminal /6. Relays SR4 and SR5 may or may not be energized at the same time as SR6, depending upon the particular permutation of signal components of the signal representing the character to be typed or of the function to be performed. Selective energization of relays SR4, SR5 and SR6 produces selective actuation of the gang connected chain switch arms to thereby close a chosen chain or cascade arrangement of switch arms to pick, in accordance with the particular code permutation, a certain key solenoid from each one of the different groups controlled by the respective group relays.

During the selective energization of relays SR4, SR5 and SR6, the selector relays SR1, SR2, SR3 may be simultaneously selectively energized to control their associated gang operated chain contacts to close a certain cascade arrangement of switch blades through the corresponding contacts in accordance with the particular code permutation. By the operation of the selector relays SR1, SR2 and SR3, a circuit is closed from terminal 37t, line 37c, armature Rra of the energized retard relay Rr, contact point Rrc, line 45a to contact S1b, thence through the certain cascade arrangement of switch blades and contacts and the particular line corresponding to a certain chosen one of the group relays, as determined by the selective energization of selector relays SR1, SR2 and SR3, respectively, through the chosen group relay and via bus bar 46 and line 44b to the negative side of the D. C. source,

thereby selectively energizing and operating one of the group relays. Since one associated key solenoid of each group relay has been selected, by successive halving, by operation of selector relays SR4, SR5 and SR6, respectively, and since, as stated above the selector relays SR1, SR2 and SR3 have also, by successive halving, selected one group only, a circuit is closed from the plus side of the D. C. source to switch blade S6b, through the particular cascade of switch arms selected by relays SR6, SR5 and SR4, to the selected one of the contacts 41a to 41f, inclusive, respectively (or through 41BC with shift or shift check), through the corresponding key solenoid of the particular group relay energized, to the particular one of the relay points Ga to Gf, inclusive, the armature switch blade 40 of the selected group relay, bus bar 44, line 44b to the negative side of the D. C. power source thereby energizing the selected key solenoid and operating the associated key bar, as will now be described.

Referring to Fig. 2, the operation of the device will be explained in connection with the selection and operation of a particular key. Assuming that the operator at station A wishes to type the lower case character *v*, having a code permutation comprising the No. 2, No. 3, No. 4 and No. 5 signal components, and to transmit this code permutation of signal components to station B whereby the same character *v* will be typed on a machine at station B. The typewriters at both stations A and B are assumed to be in lower case position, the circuits to terminals Sa to Sf, inclusive, at station B, conditioned for receiving (see Fig. 4), are closed, so that relays SR1 to SR6, inclusive, may be selectively energized at station B by the signal components received from station A, and the circuits to terminals Sa to Sf, inclusive, at station A, conditioned to send, are open, so that the relays SR1 to SR6, inclusive, at station A cannot be operated by the signals emitted by station A, all as will be explained in detail in connection with Fig. 4. In accordance with the particular 6 unit code adopted, the letter *v* is represented by simultaneous, similar, electrical signal components, respectively designated as components or units No. 2, No. 3, No. 4 and No. 5 of the 6-unit code signal. Upon depression of the selected character key 17 of the keyboard, which key is representative of the letter *v*, the letter *v* is typed at the local station A, as previously described, by means of the power driven cam 19 corresponding to the letter *v*. Simultaneously, the corresponding roller 30 moves the associated selector member 31 to the right. It is assumed, for purposes of simplicity in explanation, that the selector member 31, corresponding to the letter *v* is provided with the clips arranged as diagrammatically illustrated in Fig. 2, so that code signal components Nos. 2, 3, 4 and 5 will be produced by closure of the proper switches upon movement of selector 31 to the right while the universal ball will also be operated. Stud 31UB mounted on selector element 31 rotates the switch actuating finger UB1 counterclockwise against the bias of spring 35 to thereby permit switch arm UB2 to move into engagement with switch contact UB. A circuit is thereupon closed (Fig. 2) from the positive side of the D. C. power source to bus bar BB, terminal UBt, line UB3, switch arm UB2, contact UB, line UB4, permutation unit relay PUR to the negative side of the D. C. power source (see Fig. 4). Energization of the relay PUR attracts its armature 38 to close the armature against all the contact points

Pa to Pf, inclusive, thereby supplying plus to these contact points from bus bar BB.

Also upon movement of slider element 31 to the right, stud 31a engages the associated clip 34 so that switch actuating member a1 releases switch arm a2 from engagement with contact a so that the No. 1 code component is not supplied. Stud 31b engages its associated clip so that switch actuating member b1 closes switch arm b2 against the contact b. A circuit is thereupon closed as follows: from the plus side of the D. C. power source, bus bar BB, terminal UBt, line 38, armature 38, contact point Pb, line b4, contact b, arm b2, line b3 to terminal bt thereby supplying a positive signal component at terminal bt, or in other words, the No. 2 code component is set up. Operation of switch actuating elements c1, d1 and e1 likewise set up the No. 3, No. 4 and No. 5 code components, respectively.

Stud 31f, however, upon movement to the right due to actuation of slider 31, does not operate the clip 34, so that the switch arm f2 remains out of engagement with its cooperating contact f and the No. 6 code element is not supplied, the permutation unit, therefore, being differentially operated, as stated above.

Upon depression of key 17 at station A, therefore, four signal components of equal intensity and similar characteristics are simultaneously transmitted from terminals bt, ct, dt and et, respectively, over code channel conductors B1, C1, D1 and E1, respectively, thereby supplying the No. 2, No. 3, No. 4 and No. 5 code signal components to the lines b5, c5, d5 and e5, respectively, at station B. These No. 2, No. 3, No. 4 and No. 5 components, respectively, are therefore transmitted to terminals b6, c6, d6 and e6, respectively, of the electrical translator, at station B.

Referring to Fig. 3, the code signal component at terminal b6 energizes, via line b7, the coil of selector relay SR2, the circuit continuing from terminal Sb, to the negative side of the D. C. source, as will be described later in connection with Fig. 4. Energization of SR2 attracts its armature S2a to thereby close a holding circuit from the bus bar 45 through armature S2a, the associated contact point, the coil of SR2 to the terminal Sb. Upon attraction of the armature S2a at station B, the associated, gang operated chain switch blades S2b and S2c are moved from engagement with one contact point into engagement with the other of the respective pairs. Selector relay SR3 is likewise energized in response to the code signal permutation corresponding to character *v* but, as noted above, the No. 1 code signal element is not supplied and therefore selector relay SR1 remains deenergized. Upon energization of relays SR2 and SR3 with consequent transfer of their relay armatures and associated gang switch blades, and the switch blade S1b of relay SR1 remaining in contact with contact point 48, the following circuit, including the selected cascade circuit, is closed as follows: from the bus bar BB to line UB3 at station B, switch arm UB2 in its unoperated position (Fig. 3), contact 37a, line 37b, terminal 37t, line 37c, through retard relay Rr, energizing this slow-acting relay, to bus bar 45, thereby supplying holding current, as above described, to the operated selector relays SR2 and SR3. Energization of relay Rr closes a circuit from terminal 37t, line 37c, armature Rr/a, contact point Rrc, line 45a, switch blade S1b, contact 48, switch blade S2c, contact 50, contact blade S3d, contact 51, line 52, the coil of group relay

GR5, bus bar 46, line 44b, to the negative side of the D. C. power source. Group relay GR5 is thereupon energized attracting its armature 39 and moving the gang switch arm 40 into engagement with the associated contact points Ga to Gf, respectively, of group relay GR5.

Similarly, the simultaneous code signal component at terminal d6, via line d7, energizes the selector relay SR4, corresponding to the No. 4 unit of the signal code, attracting its armature S4a, closing its holding circuit and operating the associated gang switch blades S4b, S4c and S4d so that these blades are each moved out of engagement with one associated contact point and into engagement with the other contact point of its respective pair. Likewise the code component at terminal e6 energizes selector relay SR5, corresponding to the No. 5 unit of signal code, so that its armature S5a is attracted and its gang operated switch blades are transferred. Since the relay SR6 is not energized in response to the code signal permutation, representative of the letter v, the following circuit, including the selected cascade circuit, is closed: From the plus side of the D. C. source to switch blade S6b, contact 53, switch blade S5c, contact 54, switch blade S4c, contact 41c, bus bar 41Gc, terminal 55a, to the key solenoid 55 of group relay GR5, terminal 55b, contact point Gc, group relay switch arm 40 of group relay GR5, bus bar 44, line 44b, to the negative side of the D. C. power source. In order to coordinate the circuits of Fig. 3 with the schematic skeleton diagram of Fig. 2, the solenoid 55 is illustrated as provided with the terminals 55a and 55b, it being noted that the selector relays SR1, SR2 and SR3 select, in response to the No. 2 and No. 3 code components, only the group relay GR5, to energize this relay to thereby move its arm 40 into engagement with the contact point Gc to thereby connect terminal 55b of solenoid 55 to the negative side of the D. C. power source. The relays SR4, SR5 and SR6, in response to the No. 4 and No. 5 code components, close a predetermined cascade arrangement of switch arms to connect terminal 55a of solenoid 55 to the positive side of the D. C. power source.

Referring to Fig. 2, the closure of the circuits to connect the terminals 55a and 55b of the electrical translator at station B to the D. C. power source by means of the selector relays and group relay chosen, as explained above, closes a circuit through selected solenoid 55 to thereby energize the solenoid. The closure of these circuits to so connect these terminals is indicated generally only, in Fig. 2, the selector relays SR1, SR2 and SR3 being diagrammatically illustrated as controlling the energization of one group relay designated generally as GR to connect a terminal 55b to one side of the D. C. source and the selector relays SR4, SR5 and SR6 selectively controlling the selection of and connection of a terminal 55a to the other side of the D. C. source.

Energization of key solenoid 55, at station B, attracts the solenoid plunger 55p to pull down on a plunger mounting spring 55s attached to the key bar 17a at the station B. Downward movement of the plunger 55p depresses a key bar 17a against the force of spring 17c to cause rotation of the power cam 19 and consequent typing of the chosen lower case character v at station B. The rotation of the power cam 19, moves the roller 30 laterally to the right, at station B, thereby moving the associated selector member 31 laterally to the right to actuate its coacting switch operating fingers. It is to be particularly noted, however,

as will be explained in detail in connection with Fig. 4, that upon such actuation of the operating fingers, no signals are transmitted from the station B since the PUR relay at station B cannot be energized while this station is conditioned to receive and, therefore, the armature 38 at station B cannot move into contact with the points Pa to Pf, inclusive, and therefore no power is available for signal transmission upon the actuation of the switch operating fingers to move their respective switch arms selectively into engagement with the associated contacts, respectively.

Upon the above described movement of the selector slide 31, at station B, to the right, the stud 31UB, however, oscillates the operating finger UB1 in a counterclockwise direction against the bias of spring 35 to thereby permit the switch arm UB2 to move out of engagement with contact 37a (Fig. 3) whereupon the holding circuits through selector relays SR2, SR3, SR4 and SR5 are broken thereby deenergizing the chosen group relay GR5 and disconnecting the terminals 55a and 55b of the selected key solenoid 55 from the source of D. C. energy. The electrical translator at station B, therefore, maintains all circuits for operating the type bars of the machine at station B, until the selected type bar is operated, whereupon the electrical translator is cleared or returned to normal, to condition it for receiving the next signal. Although switch arm UB2, at station B, is moved into engagement with contact UB, a circuit is not closed through the permutation unit relay PUR, since station B is in a receive condition and the circuit leading from PUR to the negative side of the D. C. source is open at contact 64 as will be explained in connection with Fig. 4.

A chosen degree of overlap between the signal reception and the process of translation may be provided, as will be explained in detail in connection with Fig. 6, whereby the signal may be stored at the electrical translator at station B for a chosen period, as desired.

One embodiment of the novel system, for interconnecting a plurality of typewriters of standard construction utilizing one conductor for each element of code, is illustrated in Fig. 4. Various inter-station signaling lines are also provided whereby the operator at a first station can selectively warn the operators at other stations, that the first station desires to transmit a message to be typed on the machines at the selected other stations, in order that the stations warned can condition their machines for receiving. Means are also provided whereby upon conditioning the first station for sending, the receiving mechanism thereat is automatically rendered ineffective, and at the second or other stations the conditioning thereof for receiving, automatically renders the sending apparatus at these receiving stations, ineffective.

The electrical translator, utilized in connection with the system of Fig. 4 is merely indicated in outline in Fig. 2 to indicate the system and translator interconnections, it being noted that the complete electrical translator system, including a diagrammatic representation of the controlled key bar solenoids, is disclosed in Fig. 3, as explained in detail above.

Referring to Fig. 4, the system is illustrated as applied to a three station system but it is obvious that any desired number of stations may be interconnected in the manner shown. Each station is provided with means for placing it in condition for sending, means for rendering its

receiving means inoperative upon such conditioning of the sending means, means for selectively calling a desired other station or stations, means for indicating that some one station is receiving, means at each station to indicate that the machine at the station is in a send or in a receive condition, a permutation sending unit, such as was described in detail in connection with Fig. 2, the order of the code permutation switch elements, however, being reversed and the universal bail transposed to simplify the illustration, successive code switches being conventionally illustrated as alternately open and closed and an electrical translator is provided, of the type as was described in connection with Fig. 3. Various other elements and connections are provided, as will now be described in detail.

Each station is provided with a typewriter driving motor 19M for continuously driving in a well known manner the power roll 19R (see Fig. 2). Motor 19M is shown as connected to a source of A. C. power. (Although D. C. can be utilized by slight changes in the set up.) The motor connection is as follows: One side of the A. C. power source, line 56, motor 19M, line 57, type switch Ta of station A, line 58 to the opposite side of the A. C. power source.

To place his machine in the typing condition, "A" operator merely closes the switch Ta. This energizes the motor 19M to rotate the power roll (Fig. 2), so that upon depression of any character key, the selected character can be mechanically typed at station A and a corresponding code permutation of signal components, representative of the character, will be produced, as previously described, ready for transmission over the respective code channel conductors, in a manner now set forth.

In order to condition his machine for sending, the operator at station A presses a make switch SAa thereby completing the following circuit: from plus on bus bar BB, terminal UBt at station A, line UB3, make switch SAa, line 59, line 60, through the coil of sending relay SdR, a short portion of line 61, line 62, line 63 to the negative line NL thereby picking up the relay SdR and actuating the following circuits: The switch blade SdR2 controlled by SdR engages the contact point 64 thereby closing a partial circuit only, from the line NL, line 63, line 63a, switch blade SdR2, point 64, line 66, the coil of permutation unit relay PUR, line UB4, to contact UB; so that upon actuation of the switch arm UB2, brought about by depression of any character or function control key, the coil of PUR will be energized by connection of contact UB to switch arm UB2, line UB3, break switch Da, line UB3 continued, terminal UBt, to plus on bus bar BB which bus bar is connected to the plus power line PL, as illustrated in Fig. 4.

The contact SdR1 of SdR is moved into engagement with contact point 65 to close the following holding circuit for the relay SdR: From plus on bus bar BB, terminal UBt, line UB3, the break push button switch Da for disconnecting the machine at station A only, line 67, the normally open armature switch blade SdR1, point 65, line 68, normally closed, gang operated switch blade RR8, point 69, line 70, resistor 71, to the left on line 60, coil of SdR, a short portion of line 61, line 62, line 63, to minus on line NL, thereby holding SdR energized on a reduced current.

A send signal lamp SLA is wired in parallel to the coil and holding circuit of SdR via the following circuit: From coil SdR, line 60, line 72,

lamp SLA, to the left in line 73, line 74 to the negative line NL. The signal lamp SLA, therefore, is lighted whenever the coil of SdR is energized, thereby indicating to the operator at station A that his machine is in a sending condition.

In order for the operator at station C, for example, to be warned to condition his machine to receive the message to be transmitted from station A, the operator at A merely presses the make button of switch RCa, thereby completing the following circuit: From plus on bus bar BB, terminal UBt, switch RCa, line 75a, terminal RCt, line 75C from station A to station C, line 76 at station C, buzzer BZc at station C, line 73 at station C, line 74 to the negative power line NL. The buzzer at station C is actuated to warn the operator at this station that another station wishes to communicate with him so that he will immediately place his machine in a receiving condition.

In order to condition his machine for receiving, "C" operator presses the make button of switch RCc which completes the following circuit: From plus on bus bar BB, line UB3 at station C, switch RCc, line 77c, up line 78, coil of receive relay RR at station C, line 61, line 62, line 63 to minus on the negative power line NL, thereby picking up the receive relay RR at station C. When relay RR picks up, the following circuits are closed: Normally open switch blades RR1 to RR6, inclusive, of the receive relay, move into engagement with their corresponding contact points, connecting the binding posts Sa to Sf, inclusive (connected, as shown to one side of each of the coils of the selector relays), to the negative power line NL via the following circuit: From the relay switch blades, common line 79, down line 61, line 62, line 63 to the negative power line NL.

Relay switch blade RR7 also closes, completing the following holding circuit for relay RR: from plus on bus bar BB, line UB3 at station C, break button switch Dc in the line UB3, along a short portion of line UB3 to line 67, normally engaged switch blade SdR1 and contact 65a, line 80, normally open switch blade RR7 (now closed) contact 81, line 82, resistor 83, line 84, up line 78, to the coil of RR, line 61, line 62, line 63 to the negative line NL, thereby holding the coil of RR energized on a reduced current.

Likewise switch blade RR8 is operated to break its engagement with contact point 69 so that the holding circuit for the coil of SdR is opened and the coil is deenergized, provided that it was, previously, energized and held closed. It is to be specifically noted that the sending relay SdR, which conditions a station for sending, and the receiving relay RR, which conditions a station for receiving, are electrically interlocked at any one station to render one inoperative whenever the other is operative. Relay RR is maintained energized provided that the relay SdR is deenergized and its switch blade SdR1 is, therefore, in engagement with its contact point 65a whereby the holding circuit of relay RR, as traced above, is maintained closed. As soon as relay SdR is energized, the holding circuit for RR is broken at contact point 65a and the relay RR is deenergized.

On the other hand, if SdR is energized, it is maintained energized, provided that relay RR is deenergized and its switch blade RR8 is therefore in engagement with its contact point 69, whereby the holding circuit of relay SdR is maintained closed. Upon energization of either one of the relays SdR or RR, by means of its respective directly connected push button switch,

the other relay is automatically dropped out and rendered inoperative.

Novel electrical interlock means are therefore provided whereby upon energization of the sending relay, the receive apparatus at a station is automatically rendered inoperative, and vice versa.

Further, upon energization of relay RR at station C, contact blade RR3 engages its contact point 35 to thereby complete the following circuit: From plus on bus bar BB, line UB3 at station C, drop out or break-switch Dc, individual to station C, line 67, normally engaged contact blade SdR1 and contact point 65a, line 80, contact point 35, blade RR3, line 36; part of the current passing through line 36b and signal lamp LL, line 73, line 74 to the negative line NL; and the other part passing to line 36a, cable wire 37 to all of the other signal lamps LL in parallel with the lamp LL at station C by means of the respective lines 36a connected to cable 37 thereby lighting all the signal lamps LL at all stations to indicate to all the operators that at least one station, having been called, has been conditioned to receive. In order to indicate to operator "C" that his station is conditioned to receive, the receive signal lamp RLc at station C is connected in parallel to the coil and holding circuit of relay RR as follows: From line 84 (from which plus is fed to the coil of RR through its holding circuit), down line 78, lamp RLc, line 74 to the negative line NL, thereby lighting lamp RLc to indicate that station C is in a receive condition.

In exactly the same manner, A can call any other station, such as station B, or station B can call either or both of stations A and C etc. After station A is placed in a sending condition and station C is placed in a receiving condition as described above, the message is communicated from station A to station C by the depression of the individual character keys at station A whereby the message is typed locally at station A and the respective code permutations of signal components are transmitted from station A over the respective cable line conductors A1, B1, C1, D1, E1 and F1, all as described in detail in connection with Figs. 2 and 3, the respective components of the signal energizing, selectively, the selector relays SR1 to SR6, inclusive, at station C, in accordance with the particular code permutation, whereby the corresponding character or the corresponding function solenoid is energized and the character key bar at station C or the function key bar thereat is depressed to type the chosen character on the record 10 (see Fig. 1) at station C or to produce the result desired.

When the key bar at station C is depressed under the control of the corresponding solenoid, the universal bail contact UB2 is shifted away from contact 37a (see Fig. 2, station B, for example) to thereby interrupt the holding circuit for the selector relays, as previously described in connection with Fig. 3. Also, while movement of the switch arm UB2 from contact 37a to contact UB partly closes a circuit which extends to one side only of relay PUR, since the station C is in a receive condition and hence, the relay SdR (Fig. 4) is deenergized and switch blade SdR2 therefore is not in contact with point 64, the line 66 (see also Fig. 2) leading to relay PUR will be open and relay PUR remains deenergized even though the arm UB2 engages contact UB. Armature 38 at station C, therefore, is not attracted by PUR and remains in an unoperated

position and any operation of the permutation signal switch arms a2—/2, inclusive, at station C does not close any circuits to any of the cable conductors A1 to F1, inclusive, so that back circuits are eliminated.

If any operator, at any station, wishes to isolate his machine from the system without affecting the others, he merely presses his local drop out or break-switch button D, whereby the holding circuits for both relays RR and SdR are interrupted and the station is disconnected from the interstation communication system but remains in local typing condition, as long as its typing switch remains closed.

If the operator desires to clear the entire system relay set up, to interrupt all communication, he merely presses his system drop-out or break-switch button B, the buttons Ba, Bb and Bc being connected in series in the positive power line PL, whereby upon depression of any selected breakswitch button, all relays at all stations are dropped and all of the stations return to a local typing condition only, provided that the typing switches at the respective stations remain closed.

It is seen, therefore, that station A can call station C, that station C can be placed in a receive condition, that station A can transmit its message and at the completion thereof either station A or station C can disconnect its machine from the line or the entire communication system can be cleared, in preparation for any other desired interconnection among the stations.

Referring to Fig. 5, there is disclosed therein the receive station of a system; illustrated partly in skeleton outline only, and including generally the circuits and construction utilized in conjunction with a system such as that of Fig. 4, for example; whereby shift and shift-check are produced and whereby the machine at the receive station is completely cleared after reception of signals and performance of the function represented by the signal, including that condition when a shift-check signal is transmitted and the machine at the receive station is already in proper case so that no slidable selector member is operated. Under this set of conditions the receive machine is nevertheless cleared, after performance of the shift-check function.

The system of Fig. 5 is intended to be utilized with shift mechanism such as disclosed in the patent to Harry J. Nichols No. 2,049,468 granted August 4, 1936, wherein one depression of the shift key, produced for example, as in the present application, by one energization of its key solenoid, produces a shift of the typewriter carriage from one case to another case, as for example, depression of the shift key by the shift key solenoid operates the shift mechanism to shift the type basket from the normal or lower case position to the upper case position, while a later, second energization of the same shift key solenoid will cause a subsequent depression of the same shift key bar whereby the associated shift mechanism is operated to return the type basket to the normal or lower case position.

The shift-check key on the other hand, has no associated key solenoid and is manually operative only, to shift, at the send station, its associated slidable selector member 31 (Fig. 2) to thereby produce, by operation of the associated switch arms, the particular code permutation of signal components indicative of the shift-check function, which components are transmitted over the code channel conductors, respectively, to a receive machine.

The code signal permutation for the shift function, under the code utilized, comprises the following code components or units; Nos. 1, 2, 4 and 5 only, while the code signal permutation for the shift-check function comprises code components Nos. 1, 2, 4, 5 and 6 only.

Referring to Fig. 5, in addition to the novel shift-check and shift means utilized in these functions, an electrical translator generally similar to that disclosed in Fig. 3 is utilized, the electrical translator of Fig. 5, however, including an extra switch blade for each selector, relay, and a special circuit, including an extra or auxiliary switch arm controlled by the universal bail switch arm, is provided, whereby an additional holding circuit for the chosen group relay is supplied and the utilization of the retard relay of Fig. 3 is eliminated.

Assuming that a code permutation of signal components representative of the shift function has been produced by depression of the shift key at a distant station and consequent operation of the associated selector member and associated switch arms, thereupon the respective code signal components Nos. 1, 2, 4 and 5 comprising the shift signal are transmitted over the corresponding code channel conductors and received at the terminals *a6*, *b6*, *d6* and *e6*, respectively, of Fig. 5. The selector relays *SR1*, *SR2*, *SR4* and *SR5*, respectively, are thereupon energized so that their gang operated switch arms are selectively operated to select one group relay and to close the particular cascade circuit connection which produces selection of the shift solenoid. Upon energization of the selector relays *SR1* and *SR2* the following circuits are closed: From plus on terminal *UBt*, line *UB3*, break switch *Da*, line *UB3* continued, the universal bail switch arm *UB2*, contact *37a*, line *104*, shift-check relay armature *Sh.CR1*, contact point *105*, bus bar *106*, through the armatures *S1a1* and *S2a1* now attracted and their cooperating contact points, respectively, to close the holding circuits for selector relays *SR1* and *SR2*, respectively, in a manner now well understood. Energization of selector relays *SR1* and *SR2* having operated their respective gang operated switch blades and these blades being now held in position by the holding circuits of the selector relays, the following circuits are closed:

From plus on terminal *UBt*, line *UB3*, break switch *Da*, line *UB3* continued, the universal bail auxiliary switch arm *UBA*, contact point *107*, line *108*, shift-check switch blade *Sh.CR2*, contact point *109* to bus bar *110*. Since armatures *S1a2* and *S2a2*, respectively, are now connected to bus bar *110*, the following cascade circuit is closed:

From bus bar *110*, contact points *111a* and *111b*, and switch blades *S1a2* and *S2a2* in parallel, to bus bar *115*, switch blade *S1b*, contact point *49*, switch blade *S2b*, contact point *112*, switch blade *S3b*, contact point *113*, to group relay *GR2*, through the coil of this relay to bus bar *46*, to the negative side of the D. C. power source. Group relay *GR2* is therefore energized and its armature *39* is attracted to operate its gang switch blade *40*.

Energization of the selector relays *SR4* and *SR5* closes their holding circuits in the same manner as those of relays *SR1* and *SR2* thereby operating their respective gang operated switch blades and closing the following cascade circuit: From bus bar *110*, contact points *114a*, *114b* and switch blades *S4a2* and *S5a2*, respectively, in parallel, bus bar *115*, switch blade *S6b*, contact point *53*, switch blade *S5c*, contact point *54*, switch

blade *S4c*, contact point *41c*, bus bar *41Gc*, the shift solenoid *Sh.S*, contact point *Gc* of group relay *GR2*, gang switch blade *40* of the group relay *GR2*, bus bar *44* to the negative side of the D. C. source. Energization of the shift solenoid *Sh.S* operates the shift key once, so that the shift mechanism changes the position of the type basket from the existing position to the other position. Upon the operation of the shift key, its associated selector element *31* (Fig. 2) is operated and the universal bail switch arm *UB2* and the universal bail auxiliary switch arm *UBA* are moved from the position shown in Fig. 5, to the opposite position, thereby opening the printing circuit and the holding circuits for the selector relays and for the chosen group relay and completely clearing the electrical translator. The receive machine is therefore ready to receive the next function or type signal.

The machine at the distant station, for the next operation to be described, is assumed to be in upper case position. Upon operation of the shift-check key at the distant station, the associated selector element *31* (Fig. 2) is operated and the code permutation signal corresponding to the shift-check function is set up. This permutation comprises the Nos. 1, 2, 4, 5 and 6 code signal components which are transmitted over the corresponding code channel conductors to the receive station. Referring to Fig. 5, components Nos. 1, 2, 4, 5 and 6 are received at terminals *a6*, *b6*, *d6*, *e6* and *f6*, respectively, whereby the selector relays *SR1*, *SR2*, *SR4*, *SR5* and *SR6* are operated and their holding circuits are closed, as set out above. Energization of selector relays *SR1* and *SR2* again closes a cascade circuit to select the group relay *GR2* whereby its gang switch blade *40* is operated and moved into engagement with the contact point *Gc*. The machine at the remote station, it is noted, has been assumed to be in the upper case position while the machine at the receive station, it is seen by reference to Fig. 5, is also in the upper case position. Energization of the selector relays *SR4*, *SR5* and *SR6* closes the following circuits: from plus on bus bar *110*, through the three contact points *114a*, *114b*, *114c* and switch blades *S4a2*, *S5a2* and *S6a2*, respectively, in parallel, bus bar *115*, switch blade *S6b*, contact point *117*, switch blade *S5b*, contact point *41BC*, line *43*, switch blade *118* of the basket, contact group *BC*, upper case contact *UC*, line *119*, the coil of the shift-check relay *Sh.CR* to the negative side of the D. C. power source. It is to be particularly noted, that the receive machine, being also in upper case, there is an agreement in case between the remote machine and the receive machine and therefore no circuit is closed through any solenoid associated with the gang switch blade *40* of group relay *GR2* or in other words the shift solenoid *Sh.S* is not energized. Since the shift solenoid is not energized, its associated selector element *31* (Fig. 2) is not operated and the universal bail contact *UB2* and the universal bail auxiliary contact *UBA* are not operated. In the absence of a device such as the shift-check relay *Sh.CR*, the electrical translator, therefore, would not be cleared.

As stated above, however, the shift-check relay is energized when the send machine and the receive machine are both in the upper case position or in other words when there is an agreement in case between the sending and receive stations, and upon such energization of the shift-check relay *Sh.CR*, the switch blades *Sh.CR1* and *Sh.CR2* thereof are moved out of engagement

with the contact points 105 and 100, respectively, so that the printing circuit and the holding circuits for the selector relays and the chosen group relay are opened and the electrical translator is entirely cleared and made ready for reception of the next signal.

Assuming, however, that the type basket at the receive station, instead of being in the upper case position, as shown in Fig. 5, is in the lower case position, the following operation thereupon ensues: Upon reception of the code signal components Nos. 1, 2, 4, 5 and 6, selector relays SR1 and SR2 are energized and their holding circuits are closed so that group relay GR2 is selected and energized, as before, to thereby move its gang operated switch blade 40 into contact with the contact point Gc. Energization of selector relays SR4, SR5 and SR6, closes their respective holding circuits and operates their associated switch blades and the following circuits are thereupon closed: from plus on bus bar 110, through the three contact points 114a, 114b, 114c, and switch blades S4a2, S5a2 and S6a2, respectively, in parallel, bus bar 115, switch blade S6b, contact point 117, switch blade S5b, contact point 41BC, line 43, switch blade 118 of the basket contact group BC, lower case contact LC, line 42, bus bar 41Gc, to the shift solenoid Sh.S, contact Gc of group relay GR2, blade 40, to the bus bar 44 and to the negative side of the D. C. power source. Energization of the shift solenoid Sh.S operates the shift key and its associated selector element 31 (Fig. 2) whereby the universal bail switch arm UB2 and the universal bail auxiliary arm UBA are moved, from the positions as illustrated in Fig. 5 to the opposite positions, thereby opening the printing circuit and the holding circuits to the selector relays and the chosen group relay GR2, so that the receive machine is cleared in preparation for reception of the next signal.

Referring to Fig. 6, there is illustrated therein a modification of the system of Fig. 5 wherein the shift check relay is replaced by a drop relay, the universal bail auxiliary contact UBA of Fig. 5 is eliminated and an overlap between signal reception and translation is provided. Furthermore, it is to be particularly noted that the clearance of the electrical translator, in the system as illustrated in Fig. 6, is performed entirely by the drop relay and that the utilization of both the universal bail switch arm and its auxiliary switch arm, for this purpose, is completely eliminated.

Referring to the system of Fig. 6, and assuming again that the remote station is in upper case and that the code permutation of signal components corresponding to shift check is produced at the remote station so that these components are transmitted over the respective code channel conductors and that the code components Nos. 1, 2, 4, 5 and 6, respectively, are received at terminals a6, b6, d6, e6 and f6, respectively, of the receive station, as indicated in Fig. 6, and that selector relays SR1, SR2, SR4, SR5 and SR6 are selected and energized. The following circuits are closed:

From plus on terminal UBt, line UB3, break-switch Da, line UB3 continued, to the universal bail switch arm UB2. It is to be particularly noted that in the system of Fig. 6, the universal bail switch arm UB2, in its unoperated position, rests against an insulated stop 37, such as is diagrammatically illustrated for all the other switch arms controlled by a selector member (Fig. 4). A circuit is also closed from line UB3 continued, line 108a, the drop relay switch arm DR1, con-

tact point 105a to bus bar 106 whereby a holding circuit is closed, in a manner now well understood, for each of the operated selector relays SR1, SR2, SR4, SR5 and SR6.

A circuit is also closed from line UB3 continued, line 108a, drop relay switch arm DR2, contact point 109a to the bus bar 110.

Operation of selector relays SR1 and SR2 produces selection of and energization of the group relay GR2, in the same manner as described in connection with Fig. 5.

The energization of the selector relays SR4, SR5 and SR6 closes the following circuits: From bus bar 110, contact points 114c, 114b, 114a and switch blades S6a2, S5a2, S4a2, respectively, in parallel, bus bar 115, switch blade S6b, contact point 117, switch blade S5b, contact point 41BC, line 43, center switch blade 118 of the basket, contact group BC, upper case contact UC, line 119, resistor 120, through the coil of drop relay DR to the negative side of the D. C. power source. The drop relay is a slow acting, slow release type of relay so that it operates slowly only, to attract the relay arms DR1 and DR2, respectively, whereby the holding circuits for the selector relays and the chosen group relay, are slowly opened thereby providing an overlap between the transmitted code signal and code signal storage. The electrical translator is, therefore, cleared and the receive station is in readiness to receive the next signal. It is to be particularly noted that the drop relay was energized via the circuit just traced because of the fact that the receive machine was in the same case position as the sending machine, namely, upper case, and that no further operation of the receive machine was needed and that the electrical translator was nevertheless cleared.

Assuming that the remote station is in upper case position but that the receive station, instead of being in the upper case position as shown in Fig. 6, is in lower case position so that the switch blade 118 is in contact with the lower case contact point LC, and hence that the receive machine and the remote machine are in disagreement as to case position. Upon transmission and reception of the shift check code permutation of signal components and consequent energization of the selector relays SR1 and SR2, the group relay GR2 is energized, as before, and the armature 40 of the group relay GR2 is moved against the contact point Gc. Upon operation of the selector relays SR4, SR5 and SR6 the following circuits are closed: From bus bar 110, points 114c, 114b, 114a, and blades S6a2, S5a2, S4a2, respectively, in parallel, bus bar 115, blade S6b, contact point 117, blade S5b, contact point 41BC, line 43, center switch blade 118, contact point LC, line 42, bus bar 41Gc, the shift solenoid Sh.S, contact point Gc, gang switch blade 40 of group relay GR2, bus bar 44, line 44b and through the coil of the drop relay DR to the negative side of the D. C. power source.

Upon energization of the shift solenoid Sh.S the shift key at the receive station is operated and the receive station is thereby shifted to the upper case position and is thereby brought into agreement with the case position of the remote machine. While the selector element 31 (Fig. 2) at the receiving station is also operated to thereby move the universal bail switch arm UB2, this operation does not open the holding circuits on the selector relays or on the chosen group relay, as in the system of Fig. 5. Energization of

the slow acting drop relay DR however, slowly operates the associated arms DR1 and DR2 to subsequently open the printing circuit and the holding circuits of the selected relays and of the chosen group relay, so that an overlap between code signal transmission and storage is provided and the electrical translator is completely cleared in preparation for reception of the next signal.

It is to be noted that upon reception of any typing signal at the receive station, in the system of Fig. 6, the proper cascade circuits are closed to select the corresponding character key solenoid and simultaneously the drop relay DR is energized through the circuit extending from the selected solenoid, its associated contact point and group relay gang switch arm 40, bus bar 44, line 44b and through the coil of the drop relay DR to the negative side of the D. C. source thereby energizing the drop relay so that the printing circuit and the holding circuits of the selector relays and the chosen group relay are opened, but only after the chosen solenoid has been energized to operate its associated key bar.

Novel means are therefore provided which operate independently of the mechanical operation of the typewriters, to produce, in an efficient manner, both overlap and clearance of the electrical translator under any conditions of operation.

Referring to Fig. 7, there is disclosed therein a wiring diagram of a system utilizing the several aspects of the present invention. The system as disclosed in Fig. 7 is closely patterned after the system illustrated in Fig. 4, with the interconnection between the system and the electrical translator generally as illustrated in Fig. 6.

In the system as disclosed in Fig. 7, the receive relays of Fig. 4 are replaced, respectively, by two receive relays, RRA and RRB, relay RRA controlling the switch blades RR1 to RR6, inclusive, and relay RRB controlling the switch blades RR7 to RR9, inclusive, the number of blades controlled by one relay being limited to produce the best operation as disclosed by actual experiment.

The send relays SdR of Fig. 4, wherein said relays control two movable switch arms only, are replaced by generally similar send relays controlling however, three movable switch arms, the additional switch arms controlling, in cooperation with the receive relays RRB, a circuit constituting a novel dim-bright, status indicating system whereby the selective conditions of the respective station circuits are indicated at any one station, as will be described in detail presently.

The resistors 71 of Fig. 4 are omitted, in the system of Fig. 7, so that the sending relay is held under full current instead of on reduced current, as in Fig. 4. On the other hand, each of the holding circuits for the selector relays SR1 to SR6, inclusive, respectively, is provided with a resistor 71a, whereby the selector relays are held on reduced current, after energization thereof in response to received signals, instead of on full current, as previously described in connection with the other figures.

The novel dim-bright status indicating system comprises an individual line lamp LLa, LLb (not shown), LLc, respectively, at each one of the stations, each of these lamps being provided with a dim-bright resistor DBRa, DBRb (not shown), DBRc, respectively, in series therewith. Each circuit, including this resistor and one of the lamps in series, is controlled by a pair of con-

tacts, which in turn are controlled by the send relay SdR, as will be explained presently. A pair of contacts controlled by the receive relays RRB on the other hand, control the combination of a plurality of said series circuits, into parallel circuits, to produce a variation in the brightness of illumination of the respective lamps LLa, LLb and LLc, as will now be explained.

When the device at station A is conditioned for sending, the following circuit is closed through the lamp LLa at this station: from plus on bus bar BB, terminal UBt, line UB3, line 121, switch blade SdR3 closed against contact 122, line 86c, down line 86, through resistor DBRa, lamp LLa, resistor LLaR, line 73, line 74 to the negative line NL. A similar circuit is closed through each of the lamps LLb and LLc at stations B and C, respectively, by means of line 86a at station A, terminal LLt, line 87, line 74 to the negative line NL at stations B (not shown), and C, respectively. It is seen, therefore, that each of the lamps LLa, LLb and LLc is lighted at a dimmed brilliancy, since current is fed to each of the lamps through the single resistor DBRa at station A. This indicates, by the lowered brilliancy of the line lamps at all stations, that some one of the stations has been conditioned for sending, which is in direct contradistinction to the system of Fig. 4, wherein illumination of the line lamps indicate that some one station has been conditioned to receive.

When the receive relay RRB at station C, for example, is energized, as described above in connection with Fig. 4, a circuit in the system of Fig. 7 is closed as follows: from plus on bus bar BB, line UB3 at station C, line 121, line 123, contact 85, switch blade RR9 of receive relay RRB, line 86, resistor DBRc, lamp LLc, resistor LLcR, line 73, line 74 to the negative line NL. The lamps LLa, LLb and LLc are therefore now connected in parallel with the power source, through a pair of resistors DBRa, DBRc in parallel, instead of a single resistance as above, so that the total effective resistance is reduced and the line lamps LLa, LLb and LLc glow with increased brilliancy to indicate that one of the stations has been connected to the system, in a receive condition.

If station B is now switched to a receiving condition, the resistor DBRb (not shown), will be placed in parallel with resistors DBRa and DBRc, so that the total effective resistance through the lamps LLa, LLb and LLc is further reduced, thereby producing a higher intensity of illumination of the indicating lamps and indicating that the three stations are interconnected; one being connected in the send condition and the other two being connected in the receive condition.

Novel means are therefore provided whereby an indication is presented that one station is conditioned to receive and the same means are also utilized to indicate that another station or stations have been connected to the first station and in condition to receive a message from the first station.

Novel systems are therefore provided for interconnecting a plurality of standard construction typewriters of the power driven type, for example, for send and receive, comprising a minimum number of code element channels with maximum signaling time whereby upon actuation of a chosen key at one typewriter, in the ordinary manner, a key solenoid of the corresponding key at receive typewriters, can be selectively energized, to actuate the corresponding key bar

at each of the connected stations, and upon such actuation, repeat back is prevented and multiple back circuits are completely avoided.

Novel electrical interlock means are also provided whereby upon conditioning of one machine for sending, its receive mechanism is rendered ineffective and multiple back circuits are prevented, and upon conditioning another machine for receiving, its sending mechanism is rendered ineffective and repeat back is prevented.

Novel means are also provided for producing an overlap between translation and the operating signal transmission, and no el means are provided for producing a shift-check and clearance of the shift-check circuits or consequent operation of the shift mechanism to perform the function and to clear the circuits. Novel means are also provided for clearing the electrical translator upon performance of any function or typing operation.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a plurality of modifications, it will be understood that various omissions and substitutions and changes in the form and details of the devices illustrated and in their operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the invention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a system of the character described, a first tele-printing device at one station, a plurality of other tele-printing devices at other stations, respectively, motor means for locally operating each of said devices, respectively, means for interconnecting said stations for interstation control, and means at each of said stations and operative at any chosen station for either selectively disconnecting said chosen station only, from said system, while maintaining said station locally operative or for simultaneously rendering all of said stations inoperative for all interstation control except from said chosen station.

2. In a system of the character described, a first tele-printing device at one station, a plurality of tele-printing devices at other stations, respectively, motor means for rendering each of said devices locally operative, means for selectively transmitting a warning signal from one station to each of the other stations, to call said stations, means for rendering said called stations operative to receive messages from said first tele-printing device and interconnecting all of said stations into a system for system message transmission and reception, means for rendering said first device operative for transmitting to said other devices, means controlled at each station for selectively disconnecting each station from said system while maintaining the remaining stations connected for interstation communication, and means at each station for simultaneously disconnecting all interconnections among all stations.

3. In a system of the character described, a typewriter including means adapted to send signals for remotely operating a similar typewriter and means for receiving remotely originating signals to control the operation locally, means for conditioning said typewriter for sending, means for conditioning said typewriter to receive, independently operated manually manipulated means for respectively operating said con-

ditioning means, and electrical interlock means interconnecting said sending and receive conditioning means, said interlock means being electrically controlled to render said receive conditioning operating means inoperative upon manual operation of said send conditioning operating means.

4. In a system of the character described, a plurality of typewriting machines at separate stations, each machine including means adapted to send signals for controlling the individual keys of a remotely situated similar machine and means to receive remotely originating signals to locally, individually operate the keys of said machine in response to received signals, and each machine including a keyboard, said first means comprising means at each station for producing electrical signals comprising code combinations of signal elements, the particular combinations of which correspond respectively to different characters, said second means comprising electrical means for individually controlling the operation of the several keys of the keyboards, respectively, a plurality of conductive connections between all of said typewriters, means for placing each of said machines in a send condition and for connecting said machine, respectively, and selectively to said conductive connections, means for placing each of said machines in a receive condition and for connecting said machines, respectively and selectively to said conductive connections, means for respectively operating said conditioning means, and electrical means interlocking said send and said receive conditioning means at each station, respectively, said interlock means being electrically operated to render said receive conditioning operating means inoperative upon operation of said send conditioning operating means.

5. In a system of the character described, a plurality of typewriting machines at separate stations, each machine including means adapted to send signals for controlling individual keys of a remotely situated, similar machine, and each including a keyboard, means to locally, individually operate the keys of said machine under the control of remotely originating signals, said first means comprising means at each station for producing electrical signals comprising code combinations of signal elements, the particular combinations of which represent different characters, electrical translator means at each typewriter adapted to be controlled by received signal elements for selectively energizing the individual key operating means, a plurality of conductive connections between said typewriters, means for placing each of said machines in a send condition and for connecting each machine selectively to said conductive connections, respectively, means for placing each of said machines in a receive condition and for connecting each machine to said conductive connections, and including signal element controlled means for operating said electrical translator means and completing the connection of said machine to said conductive connections, means for operating said send and receive conditioning means, respectively, and means electrically controlled upon operation of said send conditioning operating means at one machine for rendering inoperative said receive conditioning operating means.

6. In a system of the character described, a plurality of typewriting machines at separate stations, each machine including means adapted to send signals for controlling the individual keys

of a remotely situated, similar machine, and each including a keyboard, means to locally, individually operate the keys of said machine under the control of remotely originating signals, said first means comprising means at each station for producing electrical signals comprising code combinations of signal elements, the particular combinations of which represent different characters, and transmitting means including circuits for transmitting said signals, electrical translator means at each typewriter adapted to be controlled by received signal elements for selectively energizing the individual key operating means, a plurality of conductive connections between said typewriters, means for placing each of said machines in a send condition and for connecting each machine selectively to said conductive connections, respectively, means for placing each of said machines in a receive condition and for connecting each machine to said conductive connections and including signal element controlled means for operating said electrical translator means and completing the connection of said machine to said conductive connections, respectively, means for operating said send and receive conditioning means, respectively, and means electrically controlled upon operation of said receive conditioning operating means at one machine for rendering inoperative said send conditioning operating means.

7. In a system for interconnecting a plurality of typewriters, having keyboards, for reciprocal control of the respective corresponding character key bars, the combination of means for setting up code combinations of signal elements in accordance with the character to be typed, a solenoid for each key bar for controlling the operation of said key bar, circuits connected to said solenoids, respectively, a conductor for each element of code, an electromagnet connected to each conductor, and contact means selectively controlled by said electromagnets in accordance with the signal elements, respectively, of different code combinations and controlling said circuits selectively for effecting selection of one character solenoid in accordance with the particular code combination.

8. In a system for interconnecting a plurality of typewriters, having keyboards, for reciprocal control of the respective corresponding character key bars, the combination of means, controlled by each key, respectively, for setting up code combinations of similar signal elements in accordance with the code value of the selected key character, a solenoid for each key bar for controlling the operation of said key bar, a power source for rendering operative said solenoids, circuits for connecting said power source and solenoids, respectively, a conductor for each element of code, an electromagnet connected to each conductor, and switch means controlled by said electromagnets, respectively, and controlling said circuit connections between said respective solenoids and said power source in accordance with the respective elements of the different code combinations, said electromagnets connecting said switch means in different cascade connections, in accordance with different combinations, to electrically connect solely the corresponding solenoid to said power source.

9. In a system for interconnecting a plurality of typewriters, having keyboards, for reciprocal control of the respective corresponding character key bars, the combination of means, controlled by each key, respectively, for producing code

combinations of similar signal elements in accordance with the code value of the selected key character, a solenoid for each key bar for controlling the operation of said key bar, a power source for rendering said solenoids operative, circuits for connecting said source and solenoids, respectively, a conductor for each element of code, means for simultaneously transmitting said similar signal elements over said conductors, selectively, in accordance with the particular combination corresponding to the selected character key, an electrical translator including a plurality of solenoids, one for each conductor and means selectively controlled by said solenoids under control of the respective signal elements, for closing one circuit only, between said power source and that solenoid corresponding to the selected character key.

10. In a system for interconnecting a plurality of typewriters, having keyboards, for reciprocal control of the respective corresponding character key bars, the combination of a series of solenoids, one for each character key, circuits connected to said solenoids, respectively, electrical conductors for interconnecting corresponding ones of said solenoids at different typewriters and totaling less than the number of solenoids, means controlled by a selected key for selectively producing and transmitting to selected ones of said conductors, separate elements of a signal, the combinations of said elements corresponding, respectively, to the selected key character, said separate elements being simultaneously transmitted over the selected conductors, and electrical translator means comprising a relay for each conductor, and connectable to said conductor for selective operation in accordance with the selectively produced elements transmitted by selected conductors, a plurality of switches associated in groups with respective relays and mounted for cascade arrangements in different permutations in accordance with the selective operation of chosen relays for closing the circuit to the corresponding key character solenoid only, in accordance with the corresponding signal element combination.

11. In a system of the character described, a typewriter adapted to send signals for remotely operating a similar typewriter and for receiving remotely originating signals to control the operation locally, means for conditioning said typewriter for sending, means for conditioning said typewriter for receiving, means for respectively operating said conditioning means, a second similar typewriter, and means at each typewriter controlled by the conditioning of its sending means to indicate said sending condition, and means controlled by the conditioning of the receive means at the other typewriter for controlling said means at each typewriter, to further indicate that said other typewriter has been conditioned to receive.

12. In a system of the character described, a first communication device at one station, a second communication device at another station, means for interconnecting said stations and including an electrically operated indicating element at each station, means for conditioning each of said devices for sending, means for conditioning each of said devices for receiving, a resistance in series with each of said indicating elements at each station, means controlled upon operation of said send conditioning means for connecting one of said resistances in series with said two indicating elements in parallel, and

means controlled upon operation of said receive conditioning means for connecting both of said resistances in parallel and in series with both of said indicating elements in parallel.

13. In a system of the character described, a first communication device at one station, a second communication device at another station, means for conditioning each of said devices for sending and means for conditioning each of said devices for receiving, means for interconnecting said stations and including means for indicating at both stations one status of one of said stations and means controlling said same indicating means to indicate a cooperative status of the other of said stations.

14. In a system of the character described, a first communication device at one station, a second communication device at another station, means for interconnecting said stations, means for conditioning each of said devices for sending and means for conditioning each of said devices for receiving, means at each station for indicating the status of one of said stations and including a lamp and a resistance in series with said lamp, means controlled by said send conditioning means for closing a circuit through said lamp and resistor in series and through the lamp at the other station in parallel with said first lamp only, and means controlled by said receive conditioning means at the other station for connecting a circuit through the lamp and its resistor, in series at said first station, in parallel with the lamp and its resistor, in series at said other station.

15. In combination, a keyboard of different characters, means controlled by the keys of said keyboard, respectively, for producing signals having a chosen code permutation of signal components in accordance with the selected key character, a plurality of solenoids, one for each key, for controlling the operation of said key in response to a received electrical signal, means for receiving code permutations of signal components and selectively energizing one of said solenoids only, in accordance with the respective permutations, and comprising a first relay for each element of code, a plurality of group relays, a group of contacts controlled by each group relay, respectively, and each of said contacts respectively controlling a circuit to a corresponding solenoid, a plurality of switches controlled by certain of said first relays, mounted to be selectively connected in cascade arrangements in variable permutations to select one of said group relays in accordance with respective permutations of said signal elements which selectively control certain of said first relays, and a second plurality of switches controlled by certain others of said first relays, mounted to be selectively connected in cascade arrangements in variable permutations to select a certain one of the group contacts of the selected group, whereby one solenoid only is selected in accordance with a code permutation of signal components corresponding to a chosen character.

16. In a system for remote control of typewriter key bars, a keyboard of different characters, a solenoid for each character of the keyboard, switch elements controlled by each key for producing a signal comprising a code permutation of signal elements characteristic of a selected character key, a plurality of selector relays, and means controlled by said selector relays in accordance with selective energization thereof by respective elements of different code

permutations and including a plurality of group relays, a group of contacts, controlled by each group relay and each respectively controlling a circuit to one of said solenoids, a plurality of switches controlled by certain of said selector relays and mounted for cascade arrangement in varying permutations, in accordance with the selective energization of said certain relays for selectively energizing one of said group relays, a second plurality of switches controlled by the others of said selector relays and mounted for cascade arrangements in varying permutations in accordance with the selective energization of said others of said selector relays for selectively controlling one of the group contacts of the chosen group relay, to energize the associated solenoid in accordance with the code permutation characteristic of a selected character key, one of said pluralities of switches being arranged in an arithmetical progression and the other in a geometrical progression.

17. A communication system comprising in combination a typewriter at one station including a keyboard, switch elements controlled by each key adapted to produce, in a line circuit when each key is operated, a code combination of simultaneous similar line current conditions comprising signal elements and corresponding to said key, a typewriter at another station, including a keyboard, a plurality of solenoids, one for each key and adapted to operate the associated key, and means for selectively rendering said solenoids operative in accordance with the respective code combinations and including a conductive connection, one for each element of code, between said first typewriter and said second and comprising said line circuit, a first relay for each conductor and selectively controlled by the corresponding line current condition, a plurality of group relays, a group of switch elements, one group for each group relay, and each element controlling, respectively, the energization of a corresponding solenoid to render the same operative and controlled as a group upon selective operation of the respective group relays, switching means, mounted for cascade arrangements in certain permutations to select one of said group relays in response to selective energization of certain of said first relays, and switching means, mounted for cascade arrangements in certain permutations in response to selective energization of the others of said first relays, to select one out of the group of switch elements pertaining to the selected group relay.

18. In a system for remote control of typewriter key bars, a keyboard of different characters, a solenoid for each character key bar for electrical operation thereof upon energization of the corresponding solenoid, switch elements controlled by each key for producing a signal comprising a code permutation of signal components characteristic of a selected character key, a plurality of selector relays, means controlled by said selector relays in accordance with selective energization thereof by respective elements of different code permutations for selecting one only of said solenoids in accordance with the corresponding code permutation, and slow-acting relay means controlled by the received signal for maintaining said selector relays energized for a predetermined period after discontinuance of the received signal.

19. In a system for remote control of typewriter key bars, a keyboard of different characters, a solenoid for each character key bar for

electrical operation thereof under energization of a corresponding solenoid, switch elements controlled by each key for producing a signal comprising a code permutation of signal components characteristic of a selected character key, a plurality of selector relays, means controlled by said selector relays in accordance with selective energization thereof by respective elements of different code permutations for selecting one only of said solenoids in accordance with the corresponding code permutation, and slow-acting relay means controlled by the received signal for maintaining said chosen solenoid energized after discontinuance of the received signal.

20. In a system for remote control of typewriter key bars, a typewriter including positionable case shift mechanism, a keyboard, a solenoid for each character key bar for electrical operation thereof upon energization of said solenoid and also including a key bar for producing case shift and a key bar for producing case shift-check, a solenoid for controlling said case shift key bar, switch elements controlled by said case shift-check key bar for producing a signal comprising a code permutation of similar electrical signal components characteristic of a case shift-check function, a plurality of circuit control elements, one pair of said elements being rendered operative when said typewriter is in one case position and another pair being rendered operative when said typewriter is in the other case position, a plurality of selector relays, and means controlled by said relays in accordance with selective energization thereof by the separate, signal components, respectively, comprising the case shift-check code permutation and cooperating with one operative pair only, of said control elements, to produce selection of the case shift key bar solenoid upon reception of a case shift-check function, code permutation.

21. In a system for remote control of typewriter key bars, a typewriter including positionable case shift mechanism, a keyboard, a solenoid for each character key bar for electrical operation thereof upon energization of said solenoid and also including a key bar for producing case shift and a key bar for producing case shift-check, a solenoid for controlling said case shift key bar, switch elements controlled by said case shift-check key bar for producing a signal comprising a code permutation of similar electrical signal components, characteristic of a case shift-check function, a plurality of circuit control elements, one pair of said elements being rendered operative when said typewriter is in one case position and another pair being rendered operative when said typewriter is in the other case position, a plurality of selector relays and means including means controlled by said relays in accordance with selective energization thereof by the separate, signal components, respectively, comprising the case shift-check code permutation, and cooperating with one pair only, of said control elements, to return said selector relays to a deenergized condition after reception of a shift-check function, code permutation, and consequent energization of the selector relays.

22. In a system for the remote control of typewriter key bars, a typewriter including a keyboard, a solenoid for each character key bar for electrical operation thereof upon energization of said solenoid, means controlled by operation of the respective keys for producing electrical signals comprising code combinations of signal ele-

ments corresponding to different characters, electrical translator means at each typewriter rendered operative by received code combinations for selectively energizing the individual solenoids and including electrical switch means mounted for connection into different cascades in conformance with a particular code combination and means responsive to the received separate signal elements of a certain combination to arrange said switches in a certain cascade to thereby select the corresponding solenoid, and means including said electrical signal producing means and controlled by the operation of the associated key of the selected solenoid, for restoring said electrical translator to its condition, existing prior to reception of the code combination signal.

23. In a system for the remote control of typewriter key bars and performance of typing functions, a typewriter, a keyboard, a solenoid for each key bar, except one, for electrical operation thereof upon energization of said solenoid, a function performing circuit, means controlled by operation of the respective keys, including said excepted one, for producing electrical signals comprising code combinations of signal elements corresponding to different characters or functions, electrical translator means at each typewriter rendered operative by received code combinations for selectively energizing the key solenoids or for closing the function performing circuit and including electrical switch means mounted for connection into different cascades in conformance to the particular code combination and means responsive to received separate signal elements for arranging said switches in a certain cascade to select the corresponding solenoid or to close the function performing circuit, and means controlled upon reception of the particular code combination for closing said circuit, for also restoring said electrical translator to its condition existing prior to reception of this code combination.

24. In a system for the remote control of typewriter key bars and performance of all typing functions including case shift-check, a typewriter including positionable case shift mechanism, a keyboard including a case shift-check key, a solenoid for each key bar except the case shift-check key bar, for electrical operation thereof upon energization of said solenoid, a circuit for performance of case shift-check, means controlled by operation of the respective keys, including said case shift-check key, for producing electrical signals comprising code combinations of signal elements corresponding to different characters or typing functions, electrical translator means at each typewriter rendered operative by received code combinations for selectively energizing the key solenoids or for closing the case shift-check circuit, and including electrical switch means mounted for connection into different cascades in conformance with the particular code combination, and means responsive to received separate signal elements for arranging said switches in a certain cascade to select the corresponding solenoid or to close said case shift-check circuit, and means controlled upon reception of any code combination for restoring said electrical translator to its condition existing prior to reception of the code combination.

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