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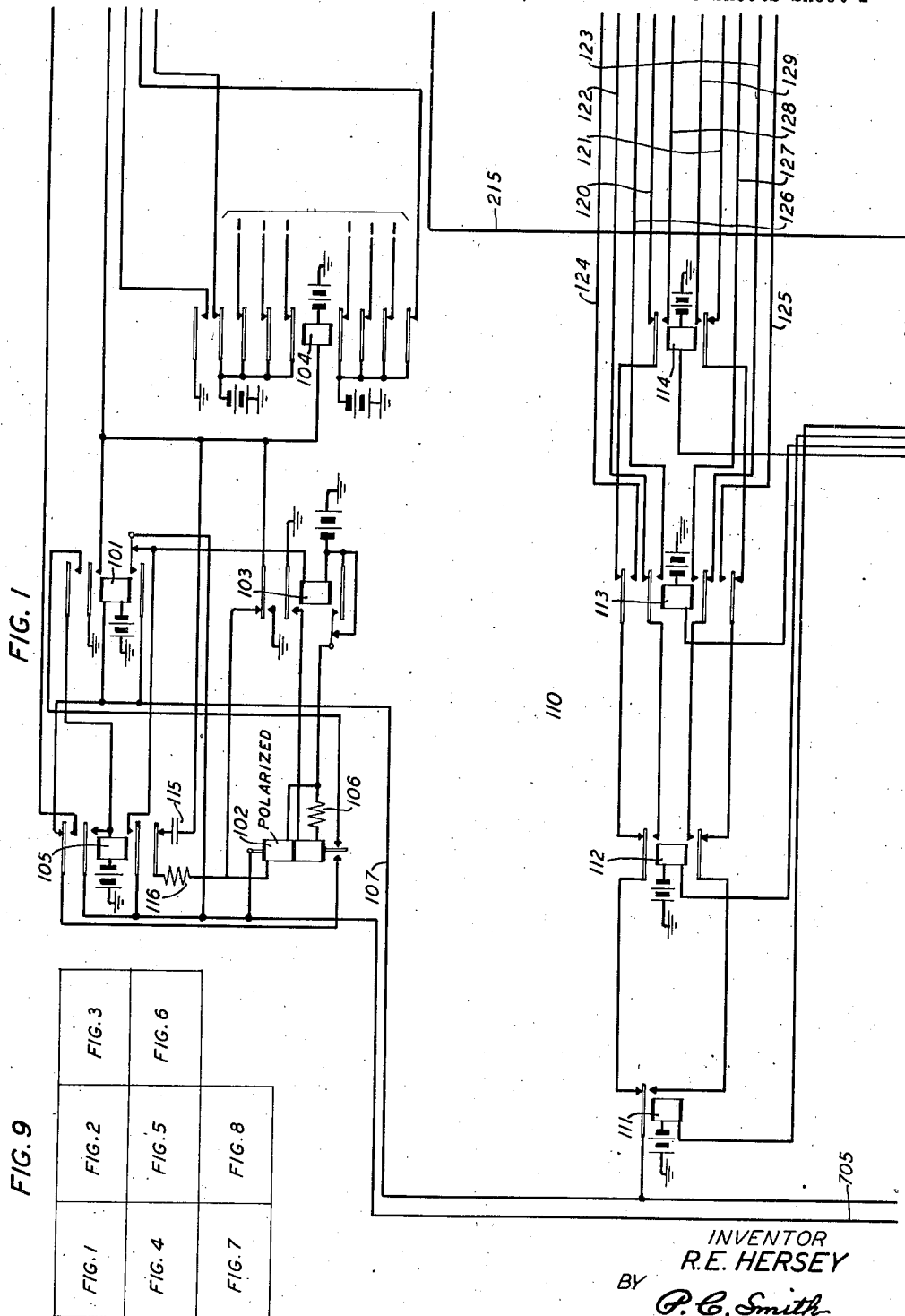
R. E. HERSEY

2,268,984

BUSY LINE RECORDER

Filed Oct. 24, 1939

8 Sheets-Sheet 1



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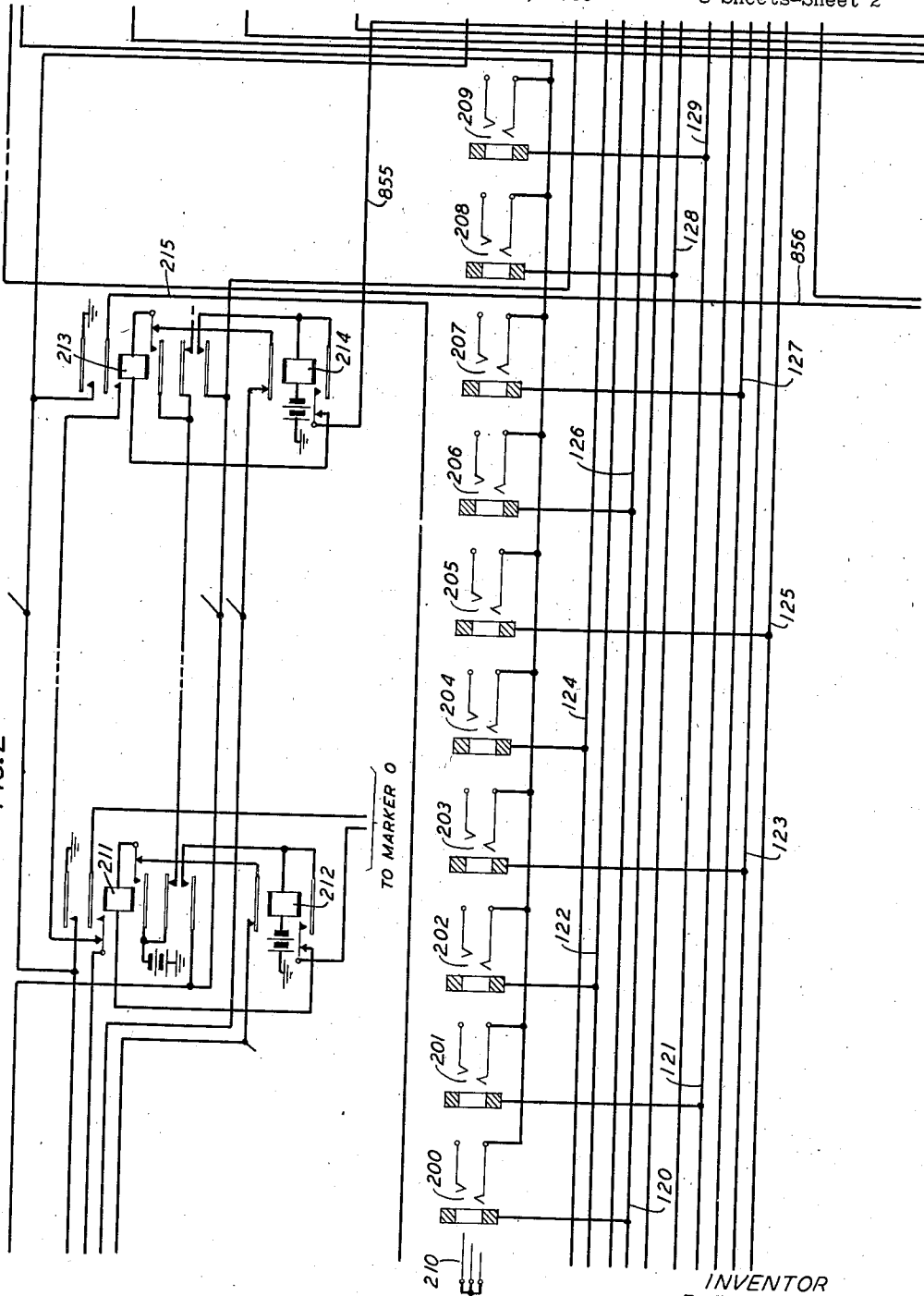
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FIG. 2



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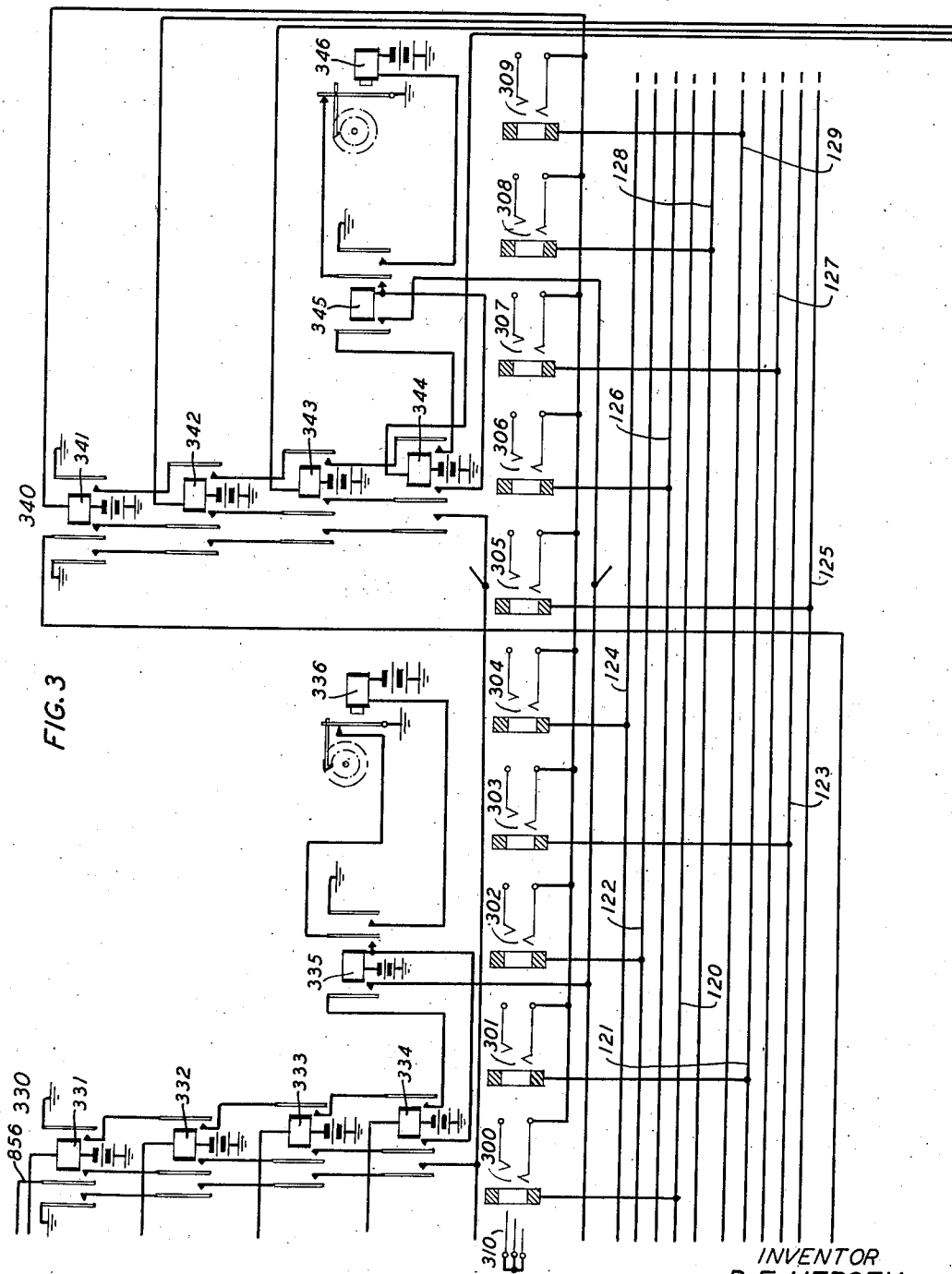
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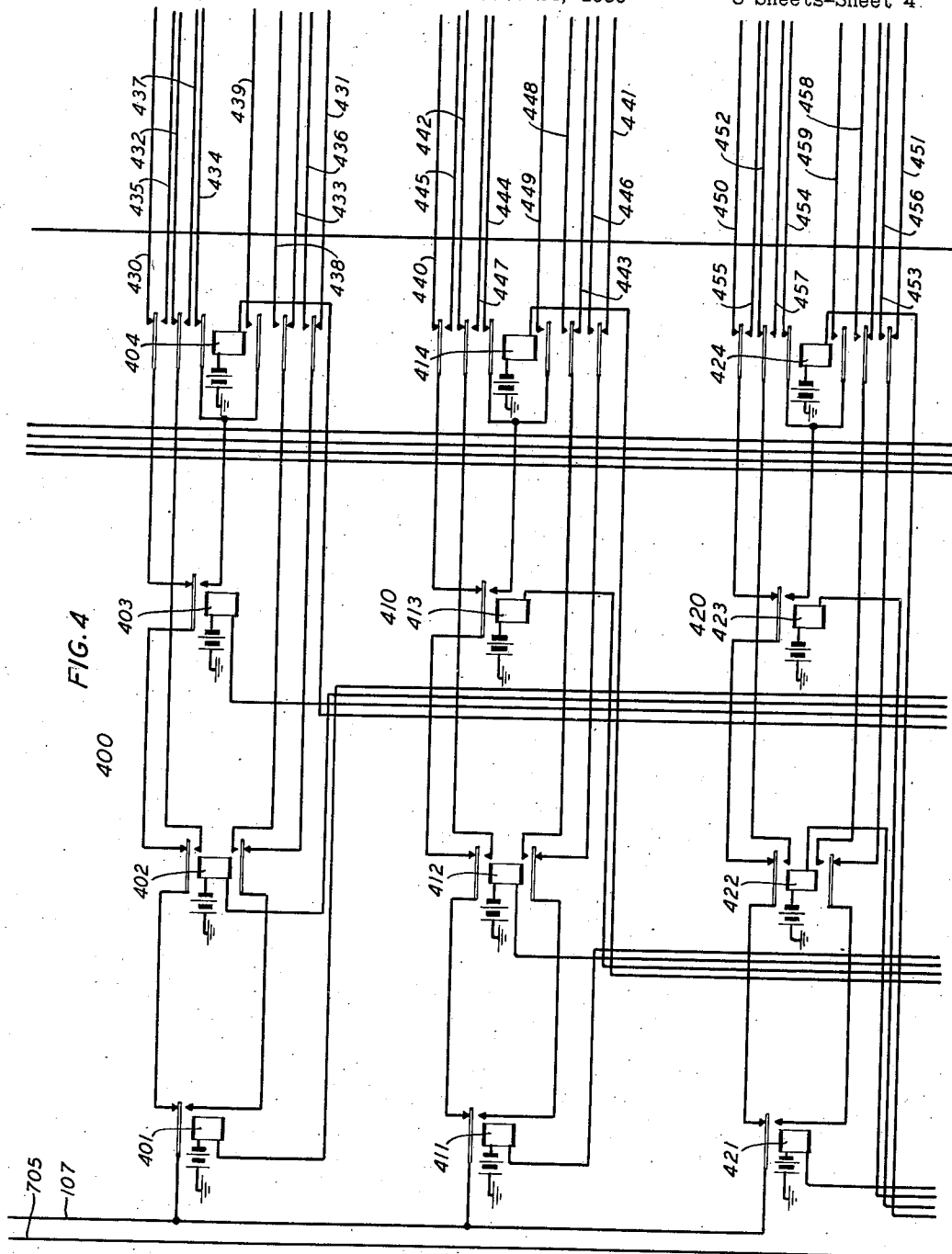
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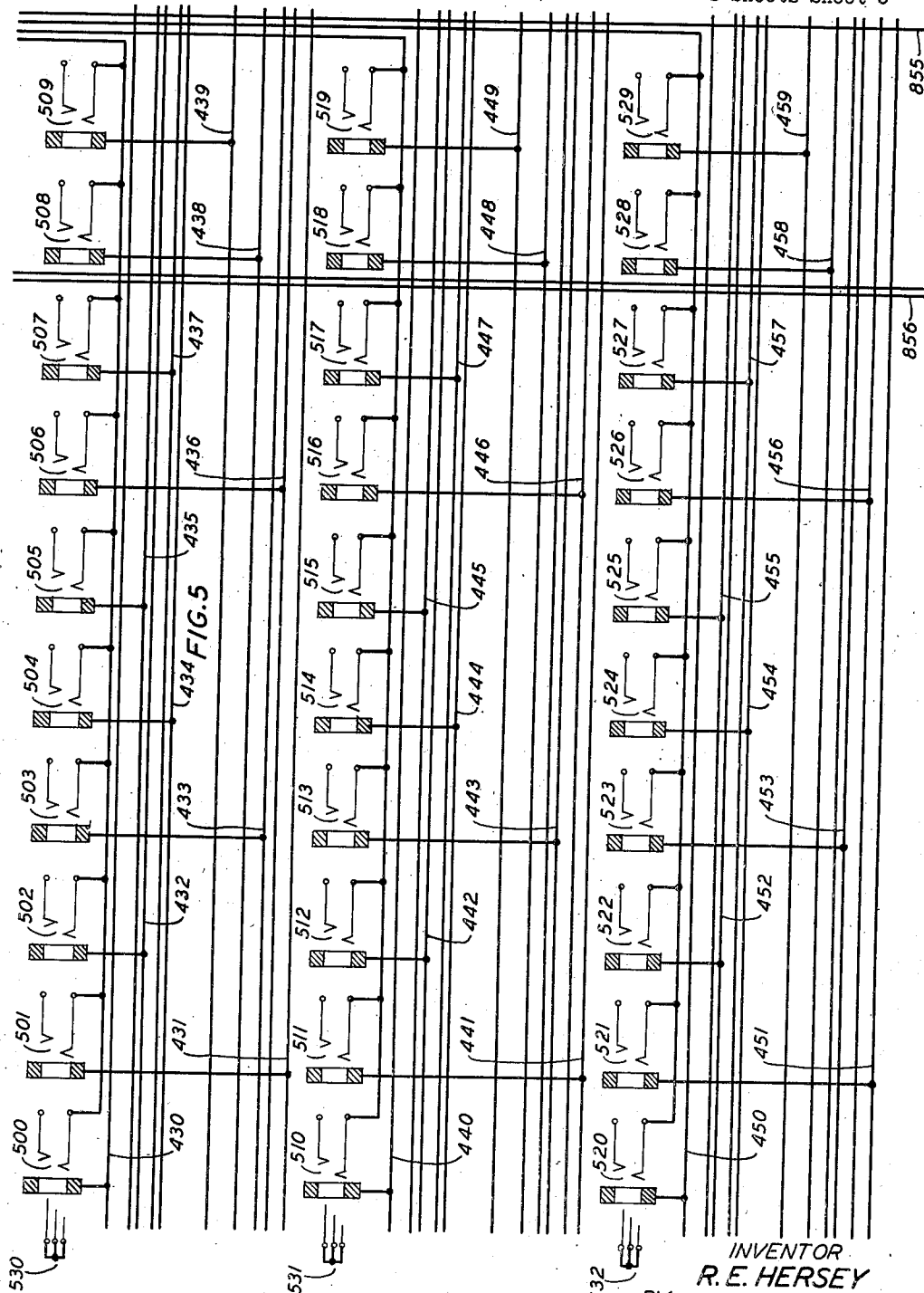
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BUSY LINE RECORDER

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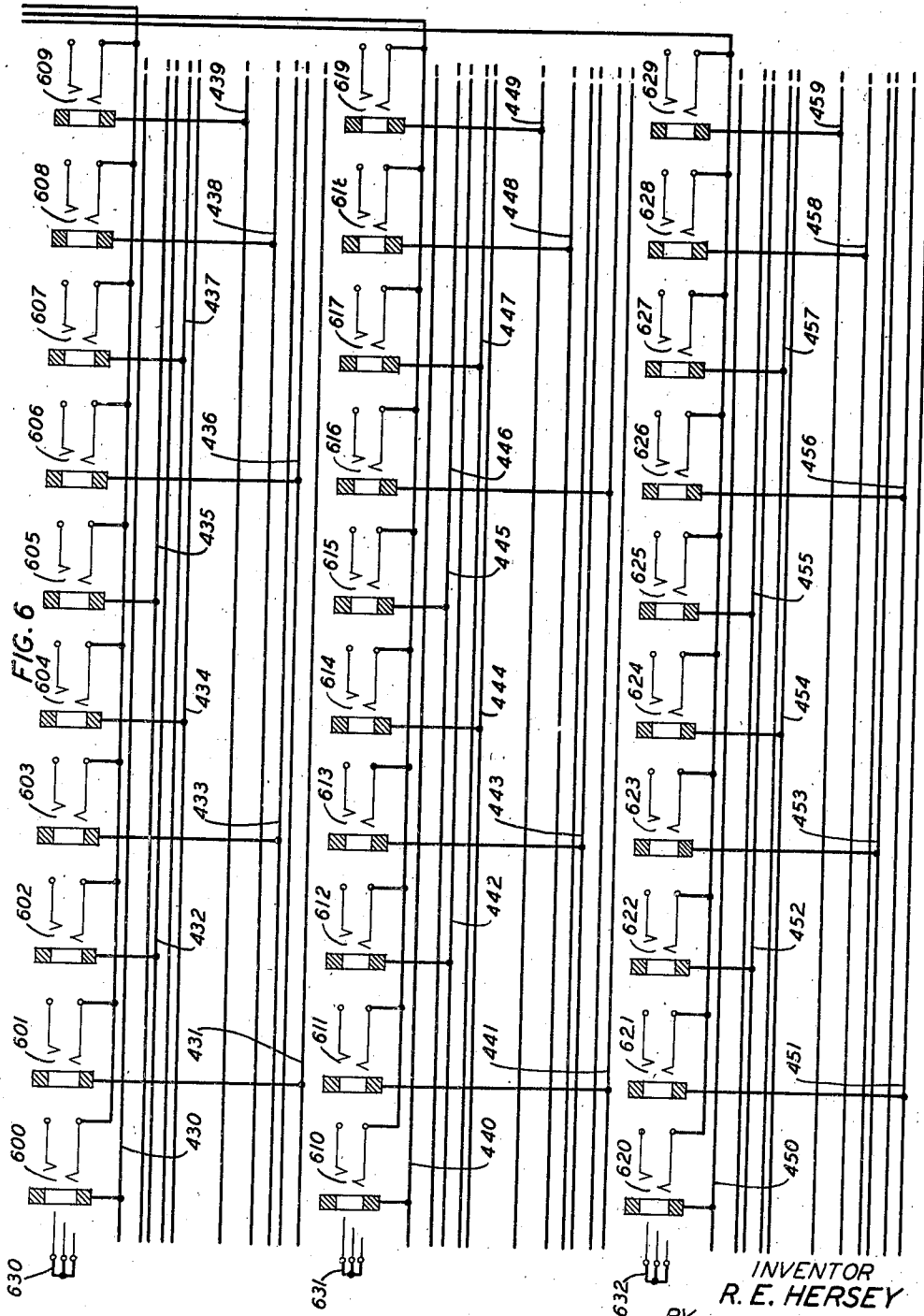
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BUSY LINE RECORDER

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8 Sheets-Sheet 6



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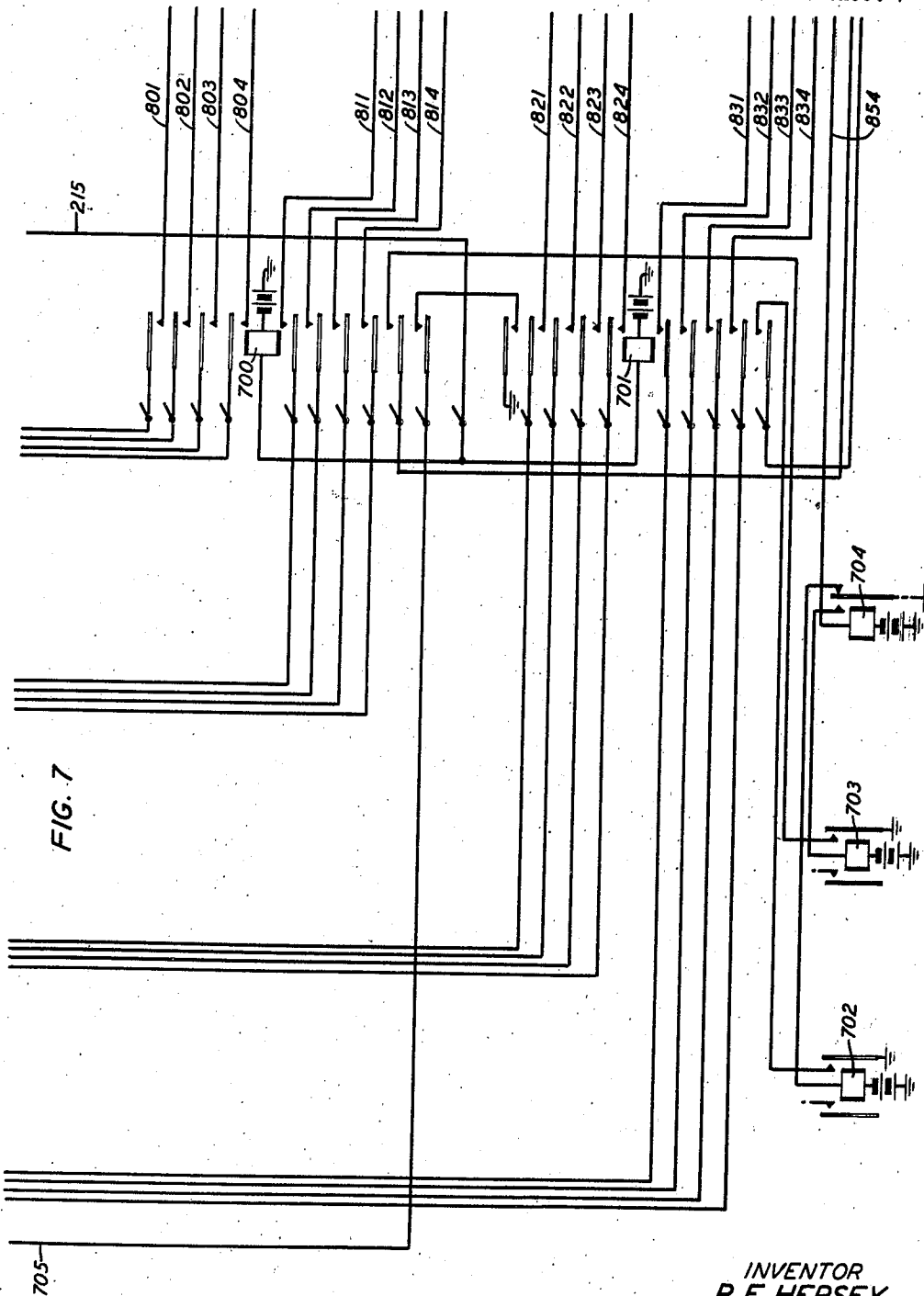
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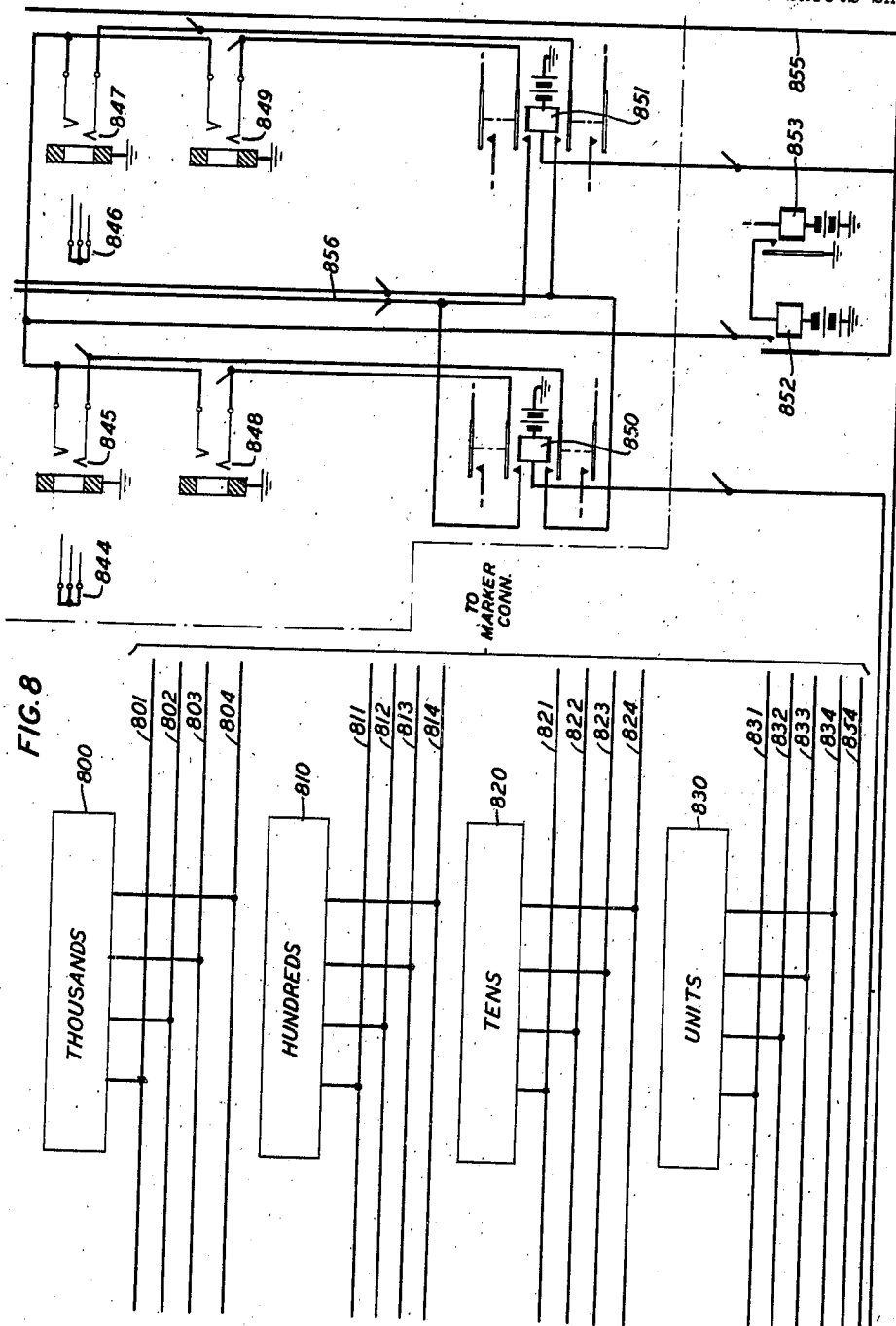
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2,268,984

BUSY LINE RECORDER

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8 Sheets-Sheet 8



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UNITED STATES PATENT OFFICE

2,268,984

BUSY LINE RECORDER

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Application October 24, 1939, Serial No. 300,928

7 Claims. (Cl. 179—8.6)

This invention relates to telephone systems and has for its object to facilitate the recording of certain traffic conditions.

It is frequently desirable to determine whether an excessive number of calls fail because of a busy condition on a subscriber's line. Arrangements for this purpose have, in the past, required that one or more conductors, individual to the called line, be opened to permit the insertion of the recording equipment.

In accordance with the present invention, a register is provided, operated in accordance with the designation recorded, which register is rendered effective when a busy condition is found. The registration is then compared with the numbers being observed and a meter operates if an agreement occurs.

More specifically a set of digit registers is connected in parallel with the marker registers. Each register controls ten outgoing circuits which are connected individually to jacks corresponding to the ten digits 0 to 9. When a line is to be observed, plugs are inserted in the jacks corresponding to the line number, thereby preparing circuits for a set of relays, one for each digit register. A set of jacks, a set of relays and a meter are provided for each line to be observed. When the marker finds a line busy it connects with the recording mechanism and the registers are set in accordance with the wanted line designation. If the registered designation corresponds to one of the designations plugged up on the sets of jacks, the set of relays is operated and a circuit closed for the corresponding meter. If the registered designation does not match any of the designations being observed, a timing means releases the marker from the recording mechanism. When a plurality of offices is served by the same markers, means is also provided for identifying the office.

The invention will be more clearly understood from a consideration of the following description in connection with the drawings in which:

Fig. 1 discloses the timed release means and one register;

Fig. 2 shows the connecting relays and a set of jacks corresponding to the register of Fig. 1;

Fig. 3 shows two sets of checking relays and their meters as well as a second set of jacks;

Fig. 4 shows the remaining registers;

Figs. 5 and 6 show the sets of jacks corresponding to the registers of Fig. 4 for observing on two lines;

Figs. 7 and 8 show portions of a decoder marker

as well as the office relays and jacks of the recorder; and

Fig. 9 shows the manner in which Figs. 1 to 8 should be arranged.

A terminating marker with which the present invention would function is disclosed in U. S. Patent 2,089,921, granted August 10, 1937, to W. W. Carpenter.

As set forth in the above-identified patent, when a wanted line number has been recorded in a terminating sender, the marker connector associates the sender registers with the registers of an idle marker. The sender transmits the designation to the marker by grounding conductors leading to the marker register relays. The marker connects with the wanted line to test whether it is busy or idle and if the line is busy operates a busy-back relay which controls the transmission of a busy signal to the calling subscriber.

Assuming that the wanted line number 0298 is to be recorded in the marker, none of the conductors 801 to 804 leading to the thousands register 800 will be grounded, but conductor 812 leading to the hundreds register 810, conductors 823 and 824 leading to the tens register 820 and conductors 831, 832 and 834 leading to the units register 830 will be grounded.

If this number represents a line on which it is desired to record the number of lost calls, the number will be set up on the line overflow recorder. To do this, plugs will be inserted in one of the sets of jacks associated with the recorder. For example, plug 210 will be inserted in jack 200, plug 530 in jack 502, plug 531 in jack 519 and plug 532 in jack 528.

The present disclosure shows the overflow recorder as used in a building which houses two offices where the markers are common to both. This arrangement is shown in Patent No. 2,261,370, granted Nov. 4, 1941, to R. E. Hersey et al. Such markers receive an indication of the office in which the called line terminates by the presence or absence of ground on conductor 854 resulting in the operation or non-operation of relay 704. With relay 704 normal the A office is indicated and relay 702 is operated, while with relay 704 operated, to denote a call for the B office, relay 703 is operated. These relays, in addition to other functions, prepare circuits for relays 850 and 851.

Since, under the above condition, the same number may appear in the two offices, relays 850 and 851 each control a circuit for each meter, these circuits each extending through a jack such

as jack 845, whereby the meter and its associated equipment is individualized to a particular office. Assuming that the line 0298 being observed is in office A, plug 844 will be inserted in jack 848. When this line is called relay 704 will be normal and relay 702 operated.

By way of further illustration, assume that plugs 310, 630, 631 and 632 are inserted in jacks 301, 602, 619 and 628, respectively, and that plug 846 is inserted in jack 847 in order to observe on line 1298 of office B.

Assume now that the marker finds line 0298 of office A busy. This results as detailed in the above-mentioned Carpenter patent in the operation of busy-back relay 853. Relay 853 in turn operates relay 852 which closes a circuit to call in the overflow recorder. This circuit may be traced, if the recorder is idle, from ground on the sleeve of jack 848, plug 844, tip of jack 848, front contact of relay 852, conductor 855, normal contacts of relay 214, winding and normal contacts of relay 213, upper back contact of relay 214 to battery at the lowermost back contact of relay 104. Relay 213 operates locking over its lower alternate contacts and the outer lower back contacts of similar relays corresponding to other markers, outer lower back contact of relay 211 to battery. Relay 213 closes a circuit from ground at its uppermost contact to the winding of relay 104 and that relay operates, removing battery from the windings of relays 211, 213, etc., to prevent any other marker from seizing the recorder.

Relay 104 also closes a circuit from ground at its uppermost contact, upper normal contacts of relay 211 and the intermediate marker relays, upper front contact of relay 213, conductor 215 to the windings of relays 700 and 701 in the marker. Relays 700 and 701 connect the marker registers to the recorder registers. In the present case they extend grounded conductor 812 to the winding of relay 402 in the hundreds register 400, conductors 823 and 824 to the windings of relays 413 and 414 in the tens register 410 and conductors 831, 832 and 834 to the windings of relays 421, 422 and 424 in the units register 420, causing these relays to operate.

Relay 700 also transfers the office identification to the recorder by closing a circuit from ground at the right contact of relay 703, next to lowermost contact of relay 700, winding of relay 850 and battery.

With both relays 700 and 701 operated, a circuit is closed from ground over the uppermost contact of relay 701, lowermost contact of relay 700, conductor 705, normal contacts of relay 101, winding of relay 103 and battery. Relay 103 connects ground to the winding of relay 104 to hold that relay operated.

With relay 103 normal, when relay 213 operates a circuit is closed from battery, over the lower normal contacts of relay 103, upper winding of relay 102, back contact of relay 103 to ground at the uppermost contact of relay 213. Relay 102 which is a polarized relay is energized in this circuit to hold its armature against its right contact. When relay 103 operates, it opens, at its upper back contact, the shunt around condenser 115 and resistance 116 whereby a charging circuit for condenser 115 is effective from battery over the lower alternate contacts of relay 103, through the upper winding of relay 102 through resistance 116, lower back contact of relay 105, condenser 115 to ground at the upper front contact of relay 103. At the same time it closes a circuit from battery over its lower alternate con-

tacts, resistance 106, lower winding of relay 102 to ground at the inner upper front contact of relay 103. This circuit energizes relay 102 in a direction to close its left contact, but because of the closure of the charging circuit of condenser 115, the charging current for the condenser delays the closure of that contact for a definite minimum interval. When this contact is closed, ground on conductor 705 is extended over the left contact of relay 102, upper back contact of relay 105 and conductor 107 to the armatures of relays 111, 401, 411 and 421, thereby grounding the sleeves of certain jacks as determined by the registration set up.

Since none of the relays of thousands register 100 were operated, the circuit may be traced over the back contacts of relays 111, 112, 113 and 114 to conductor 120 and the sleeves of jacks 200, 300, etc. Since plug 210 is in jack 200, the circuit extends over the ring of jack 200 to the winding of relay 331 and battery. No plug being in jack 300, no circuit is completed for relay 341.

With relay 402 of the hundreds register 400 operated ground is extended over the back contact of relay 401, upper front contact of relay 402, middle upper back contact of relay 404 to conductor 432, through jack 502 and plug 530 to the winding of relay 332 and through jack 602 and plug 630 to relay 342, relays 332 and 342 operating.

Similarly, the tens register 410 extends ground to conductor 449 and through jacks 519 and 619 to relays 333 and 343, respectively, while the units register 420 extends ground to conductor 458 and through jacks 528 and 628 to relays 334 and 344, respectively.

Since relays 331, 332, 333 and 334 are all operated, an additional holding circuit is closed for relay 104 over the outer left contacts of relays 331 to 334. In addition, a circuit is closed from ground on the sleeve of jack 848, plug 844, ring of jack 848, inner upper front contact of relay 850, conductor 856, inner left front contacts of relays 331 to 334, winding of relay 335 and battery. Relay 335 locks over its inner right contact to the normal contact of meter 336 and closes an obvious circuit for that meter, thereby insuring the complete operation of the meter. At its left contact, relay 335 closes a circuit from ground over the right contacts of relays 331 to 334, left contact of relay 335, outer lower front contact of relay 213 to the winding of relay 214 and battery. Relay 214 operates and locks over its lower alternate contact to conductor 855, therefore remaining operated until released by the marker. When operated, relay 214 opens the circuit of relay 213, which restores the preference circuit permitting other markers to seize the recorder. Relay 213 in releasing opens the circuit of relays 700 and 701 which in turn remove ground from conductor 705, thereby restoring the register relays.

Since relay 341 was not operated, the operation of relays 342, 343 and 344 was ineffective and no record was made on meter 345.

If the call had been for line 0298 in office B, relay 851 would have been operated. Conductor 856 also extends to relay 851, but the circuit is open at jack 849 and therefore no record would be made.

If the number of the busy line had differed from all of those plugged up, the operation would have proceeded as above described until relay 102 operated. When relay 102 grounded conductor 107 this ground extended through the winding

of relay 101 to battery and relay 101 operated. At its inner upper contact, relay 101 closes a supplementary holding circuit for relay 104. At its lower alternate contact, it closes a locking circuit for itself to grounded conductor 705 and opens the circuit of relay 103. Relay 103 opens the circuit through the lower winding of relay 102 and recloses the circuit through the upper winding, causing relay 102 to close its right contact. The closure of this contact completes a circuit from grounded conductor 705, right contact of relay 102, upper front contact of relay 101, winding of relay 105 and battery.

Relay 105 locks to conductor 705 and reoperates relay 103. Relay 103 again closes the circuit to cause relay 102 to close its left contact, but since relay 105 has opened the charging circuit through condenser 114, this closure takes place without delay. A circuit is now closed from ground on conductor 705, left contact of relay 102, outer upper front contact of relay 105, outer lower front contact of relay 213 to the winding of relay 214 and battery. Relay 214 functions as previously described to release the recorder from the marker.

Where a record is made, the operation of relay 214 by relay 335 takes place before these operations are completed and, by causing the removal of ground from conductor 705, releases these relays before their operation is completed.

While the present disclosure shows the recorder registers connected to the same conductors as set the marker registers, it is within the contemplation of the invention to supply appropriate registers and connect them with the conductors outgoing from the marker registers to other marker equipment.

If used where only a single office is served, relays 850 and 851 and the office jacks may be omitted, direct ground being supplied where required.

What is claimed is:

1. In a telephone system in which connections between subscribers' lines are made by switching equipment under the control of a control device, said control device having means for registering the designation of a called line and means responsive to said registration for testing said line to determine its busy or idle condition, duplicate designation registering means, a set of conductors, manual means for marking said conductors in accordance with a particular line designation, means controlled by said testing means if said called line is busy to connect said control device to said duplicate registering means and to register the called line designation thereon, means under the control of said duplicate registering means to mark said conductors in accordance with said called line designation, indicating means, and means effective if said duplicate registering means marks the manually marked conductors to operate said indicating means.

2. In a telephone system in which connections between subscribers' lines are made by switching equipment under the control of a control device, said control device having means for registering the designation of a called line and means responsive to said registration for testing said line to determine its busy or idle condition, means for recording the number of times that said control device finds a particular line busy comprising duplicate designation registering means, a set of conductors, manual means for marking said conductors in accordance with a particular line designation, means under the control of said

duplicate registering means to mark said conductors in accordance with said called line designation, a meter, and means effective if said duplicate registering means marks the manually marked conductors to operate said meter.

3. In a telephone system in which connections between subscribers' lines in a plurality of offices are made by switching equipment in each of said offices under the control of a control device common to said offices, said control device having means for registering the designation of a called line and the office in which said line terminates and means responsive to said registration for testing said line to determine its busy or idle condition, means for recording the number of times that said control device finds a particular line busy comprising duplicate designation registering means, a set of conductors, manual means for marking said conductors in accordance with a particular line designation, means for individualizing said manual means to the office in which said line terminates, means under the control of said duplicate registering means to mark said conductors in accordance with said called line designation, a meter, means effective if said registering means marks the manually marked conductors and the proper office to operate said meter, and means independent of said meter operating means to release said recording means.

4. In a telephone system, means for recording the number of times a line is called while busy, comprising a set of jacks for each digit of a line designation, means for individually grounding the sleeves of said jacks in accordance with the designation of a called busy line, relays connected in parallel to the ring contacts of each set of jacks, plugs for connecting the sleeve and ring contacts of a jack in each set corresponding with the designation of a particular line, and indicating means controlled by said relays when the designation of the called busy line coincides with that of said particular line.

5. In a telephone system in which connections between subscribers' lines are made by switching equipment under the control of a control device, said control device having means for registering the designation of a called line and means responsive to said registration for testing said line to determine its busy or idle condition, means for recording the number of times that said control device finds a particular line busy comprising duplicate designation registering means, a set of conductors, manual means for marking said conductors in accordance with a particular line designation, means controlled by said testing means if said called line is busy to connect said control device to said duplicate registering means and to register the called line designation thereon, means under the control of said duplicate registering means to mark said conductors in accordance with said called line designation, a meter, means effective if said duplicate registering means marks the manually marked conductors to operate said meter, and means under the control of said meter operating means to release said recording means.

6. In a telephone system in which connections between subscribers' lines are made by switching equipment under the control of a control device, said control device having means for registering the designation of a called line and means responsive to said registration for testing said line to determine its busy or idle condition, means for recording the number of times that said control

device finds a particular line busy comprising duplicate designation registering means, a set of conductors, manual means for marking said conductors in accordance with a particular line designation, means controlled by said testing means if said called line is busy to connect said control device to said duplicate registering means and to register the called line designation thereon, means under the control of said duplicate registering means to mark said conductors in accordance with said called line designation, a meter, means effective if said duplicate registering means marks the manually marked conductors to operate said meter, means under the control of said meter operating means to release said recording means, and means independent of said meter operating means to release said recording means.

7. In a telephone system, means for recording the number of times any one of a plurality of

lines is called while busy, comprising a plurality of sets of jacks, each set including a row of jacks for each digit of a telephone designation, each row including a jack for each possible value of that digit, an indicating device and a set of relays for each of said sets of jacks, one of said relays connected in multiple to the ring contacts of each jack in a row, plugs for connecting the ring and sleeve of one jack in each row of each set in accordance with the designations of said plurality of lines, means for grounding the sleeves of one jack in each row of each set in accordance with the designation of a called busy line to operate the relays connected thereto and means under the control of said sets of relays to operate the corresponding indicating device when the designation of the called busy line coincides with the designation of any one of said plurality of lines.

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