

Feb. 13, 1940.

J. M. DESMOND

2,190,540

PRINTING TELEGRAPH SYSTEM

Filed April 6, 1938

6 Sheets-Sheet 1

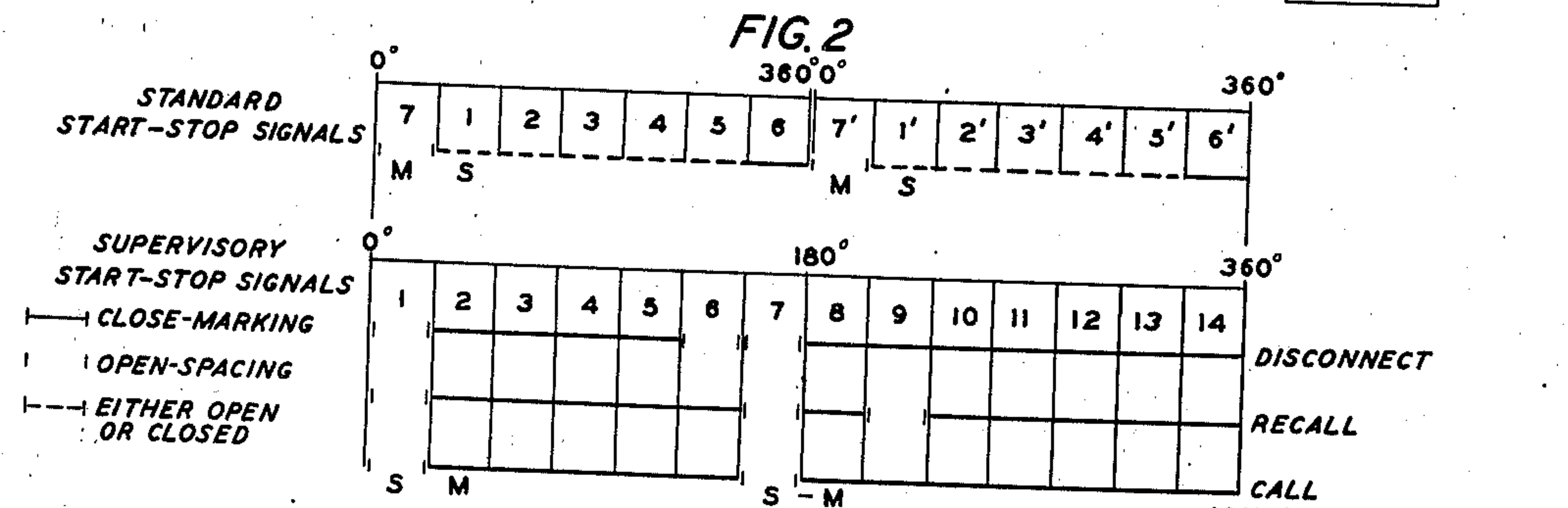
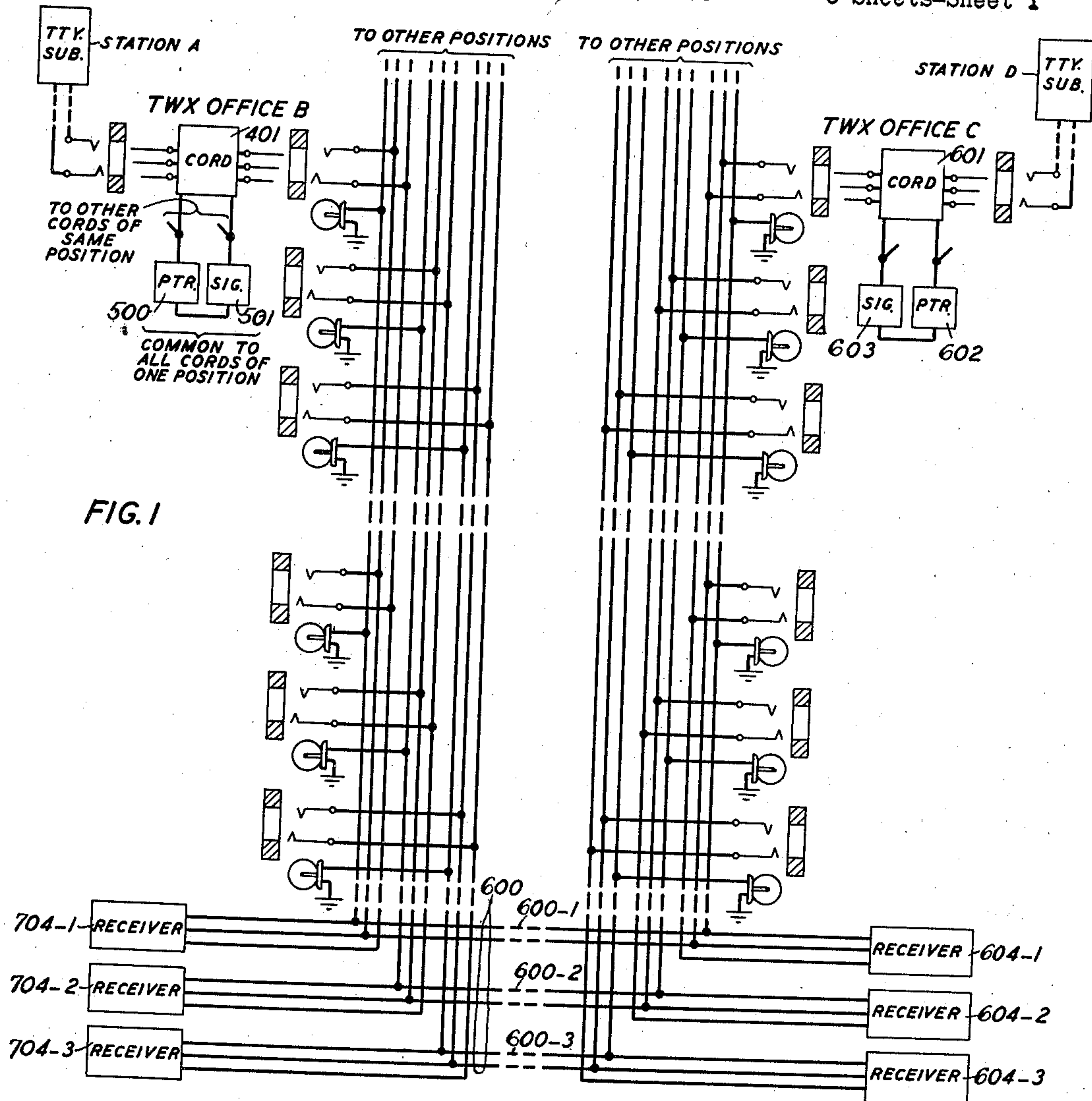
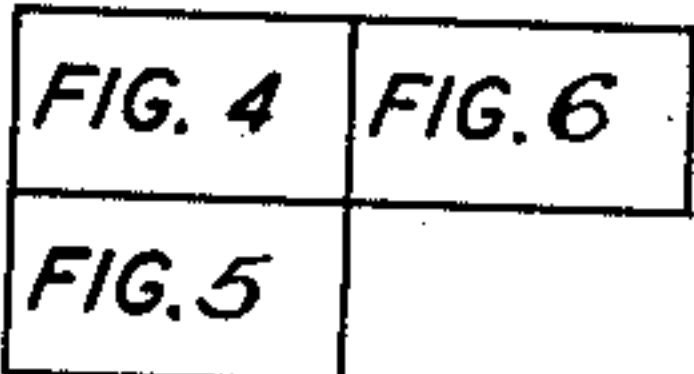


FIG. 3



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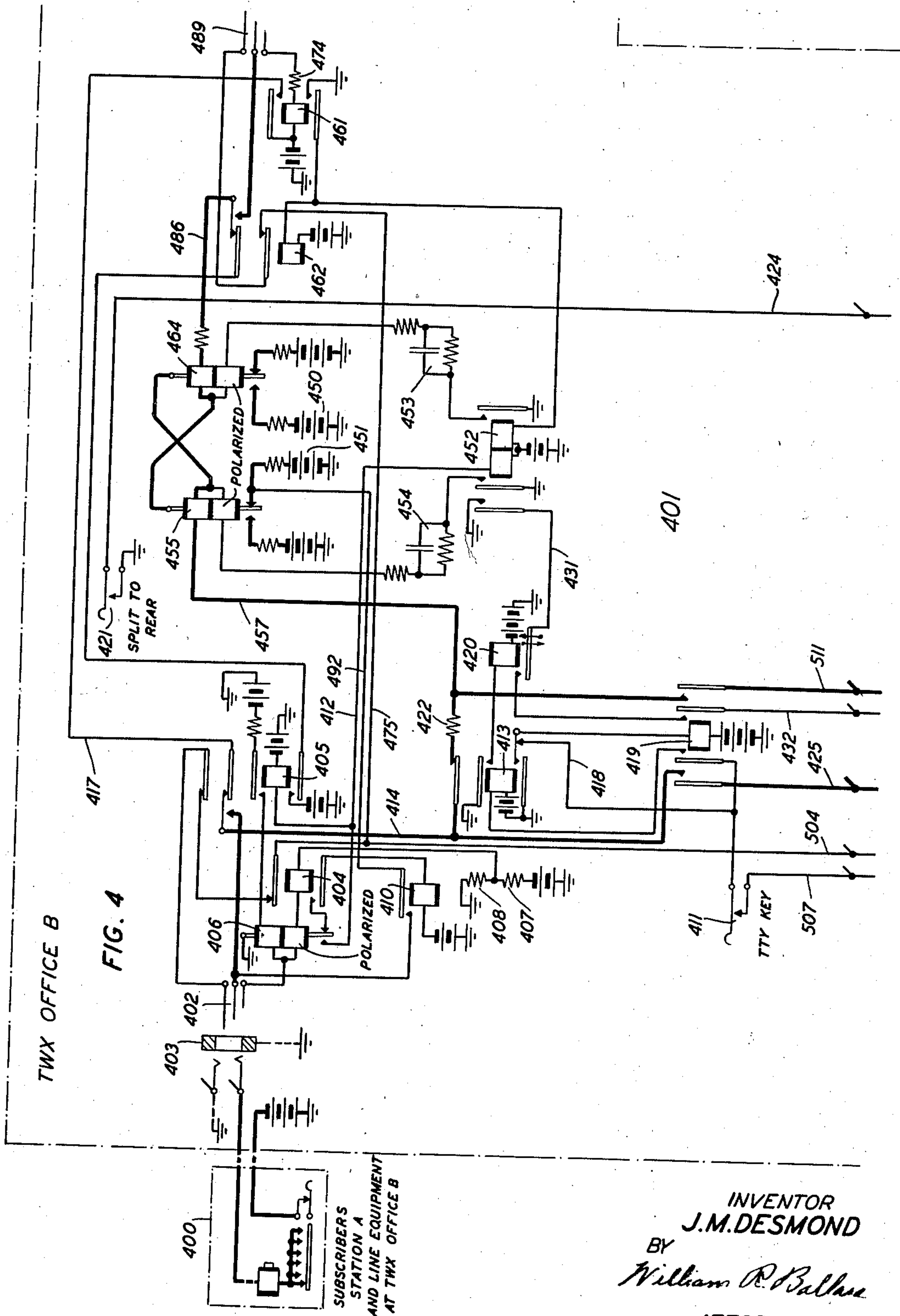
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PRINTING TELEGRAPH SYSTEM

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6 Sheets-Sheet 2



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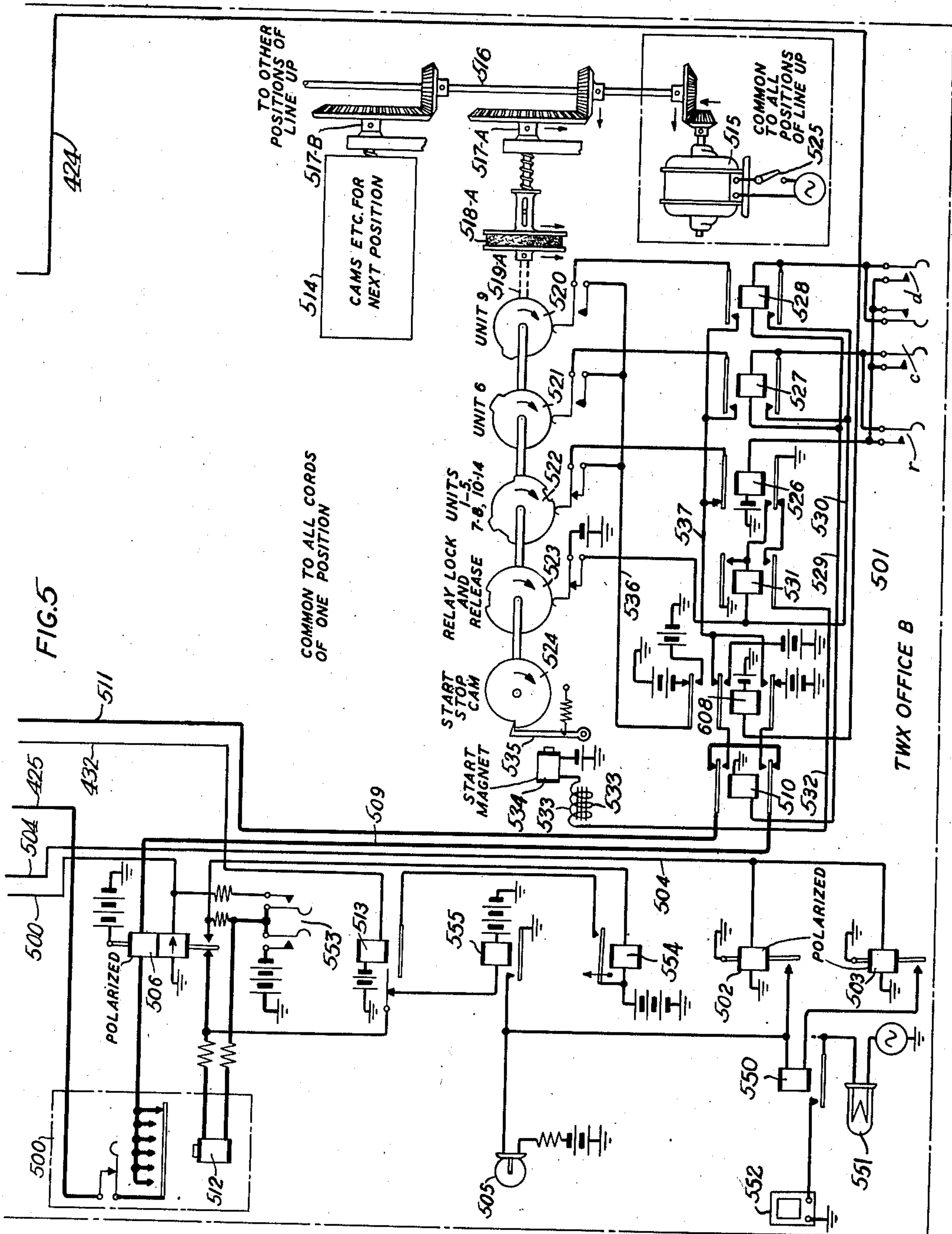
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PRINTING TELEGRAPH SYSTEM

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6 Sheets-Sheet 3



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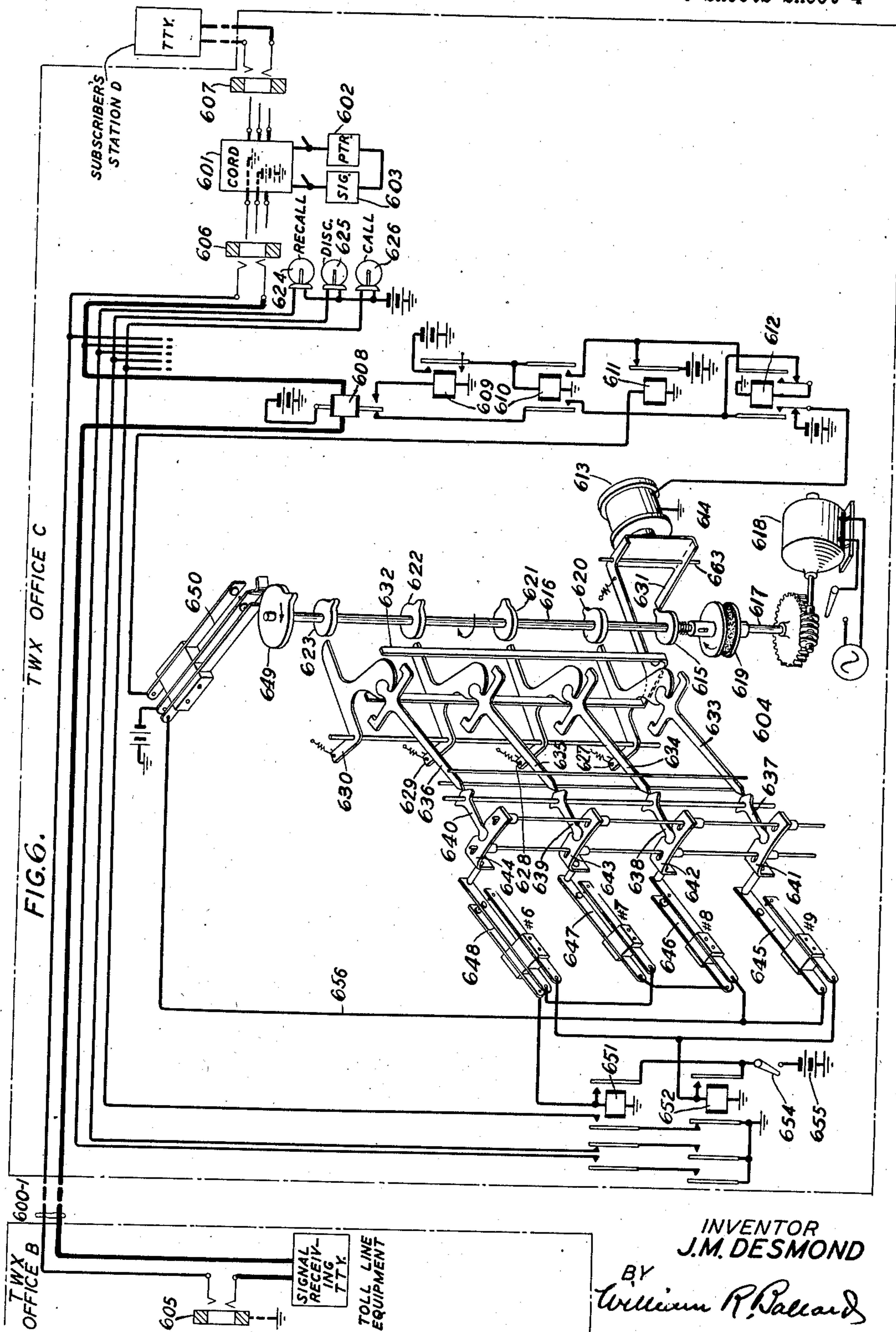
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PRINTING TELEGRAPH SYSTEM

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6 Sheets-Sheet 4



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PRINTING TELEGRAPH SYSTEM

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FIG. 7.

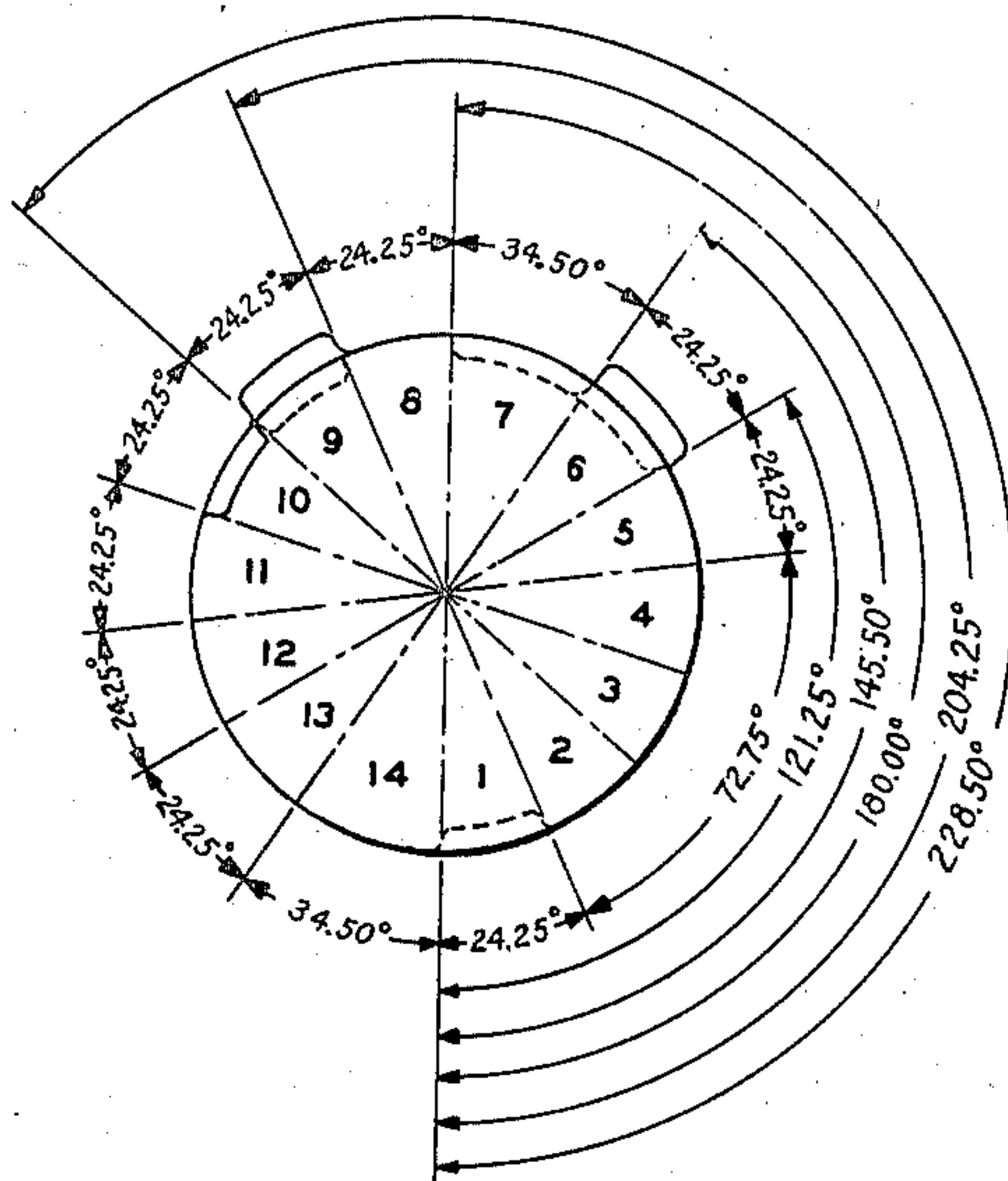


FIG. 8.

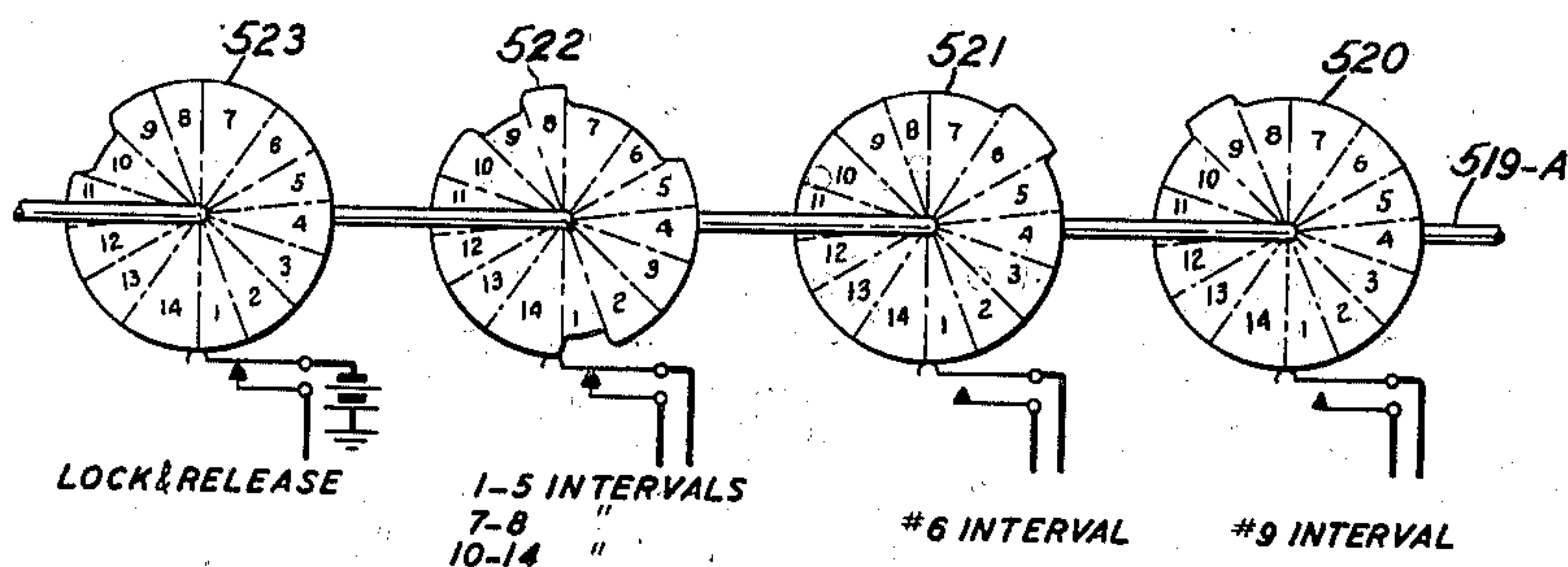
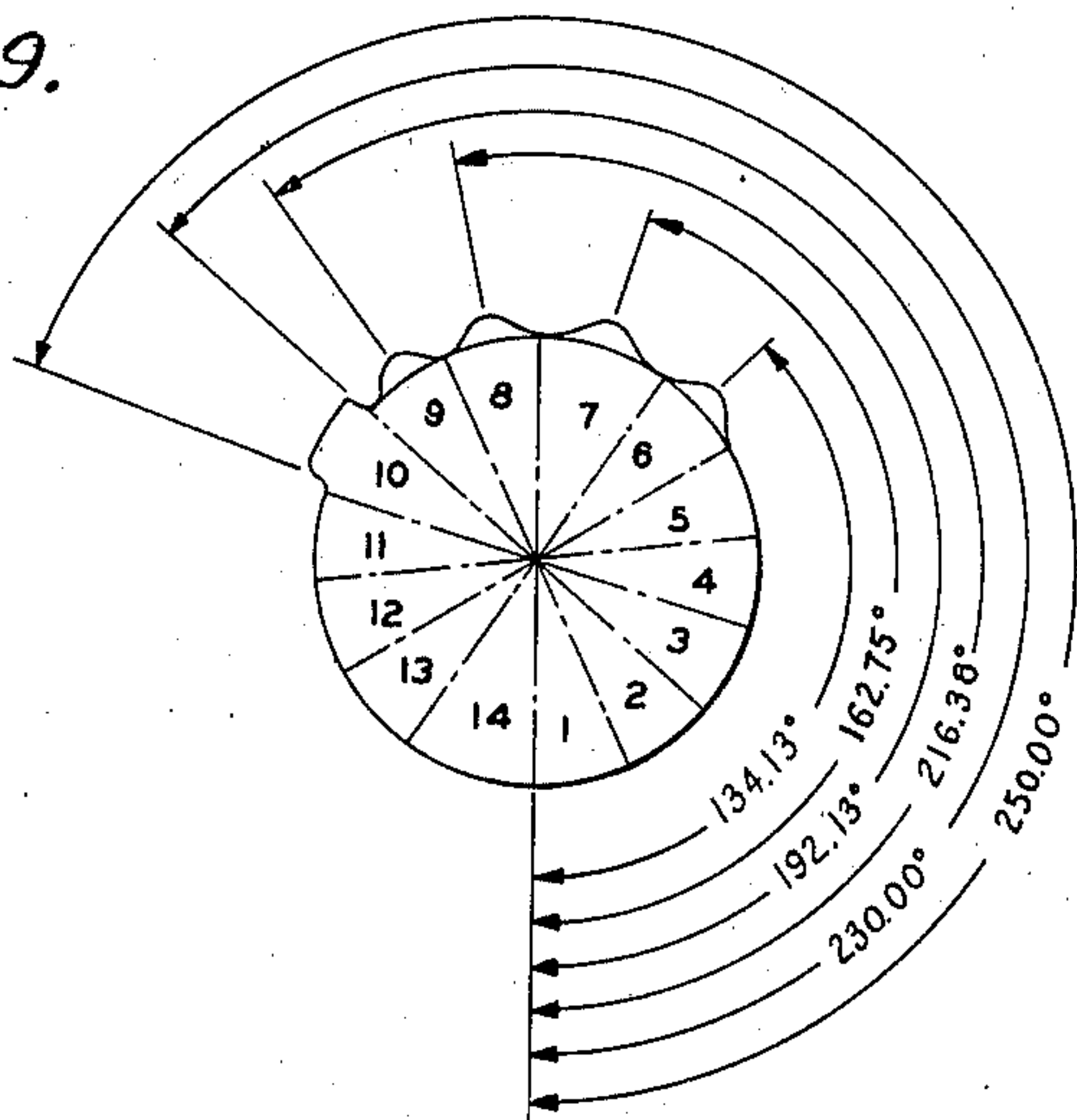


FIG. 9.



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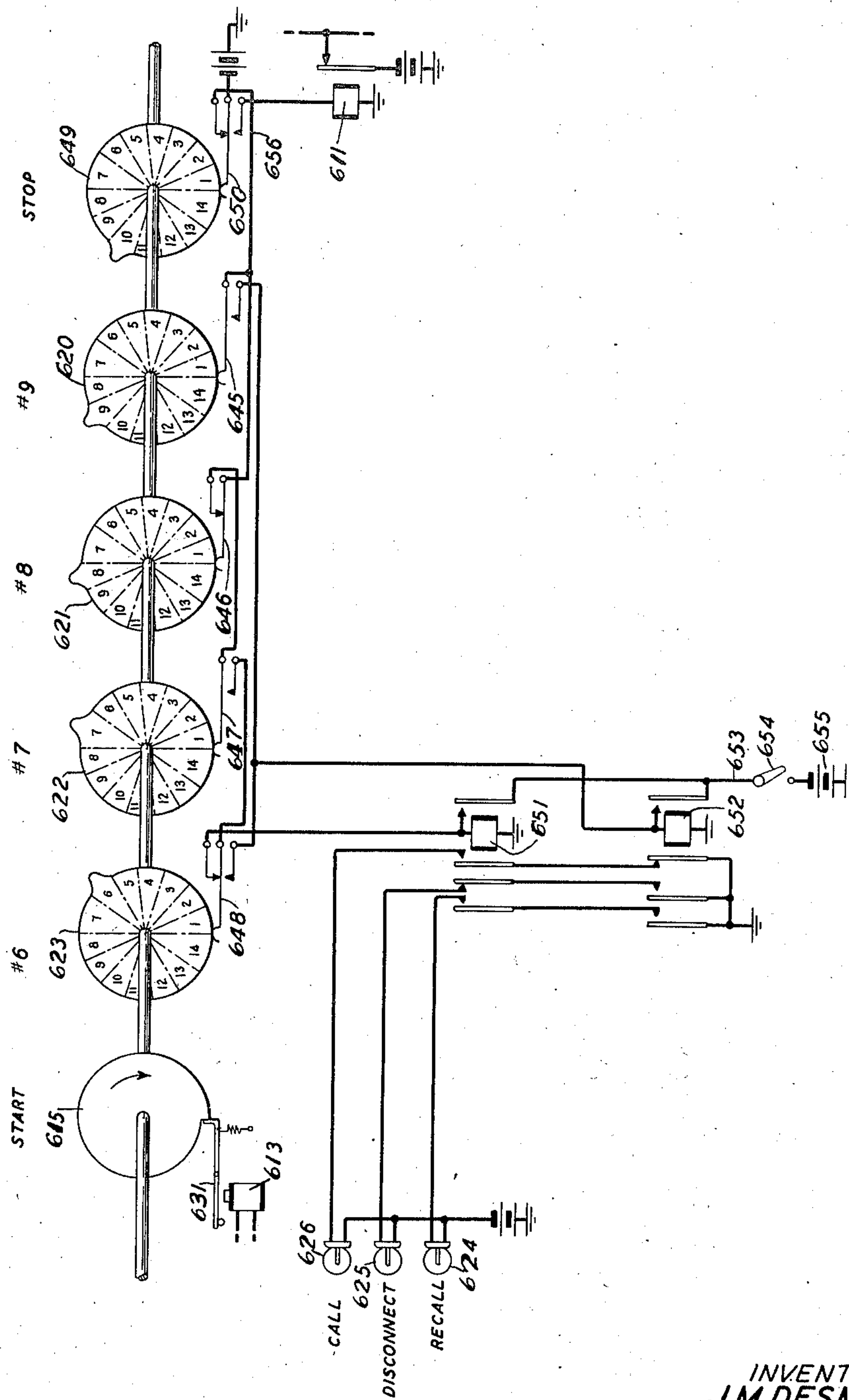
2,190,540

PRINTING TELEGRAPH SYSTEM

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6 Sheets-Sheet 6

FIG. 10.



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UNITED STATES PATENT OFFICE

2,190,540

PRINTING TELEGRAPH SYSTEM

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Application April 6, 1938, Serial No. 200,542

7 Claims. (Cl. 178--2)

This invention relates to printing telegraph systems and more particularly to signaling arrangements adapted for use therein.

5 An object of the invention is to reduce the time required for transmitting supervisory signals in printing telegraph systems. A more specific object is to employ permutation code combinations of electrical current impulses for operating supervisory signals in a teletypewriter exchange system.

10 Heretofore in teletypewriter exchange inter-toll trunk signaling arrangements the method of transmitting supervisory signals over trunk circuits between teletypewriter exchanges, employed timed open signals, for example, one to 15 two seconds for a call signal, six to eight seconds for a recall signal, and nine to ten seconds for a disconnect signal. The purpose of the call, the recall and the disconnect signals is described in U. S. Patent 1,998,086 granted to 20 F. S. Kinkead on April 16, 1935. With the use of timed open signals, the "break" signals, sudden fluctuations of current, or accidental open conditions of the transmission circuit were apt 25 to be of sufficient duration to be within the time zones set aside for supervisory signals and therefore supervisory signals were occasionally operated by mistake. Furthermore, the length of time required to send recall and disconnect signals as heretofore accomplished is considerable, 30 particularly in cases where the signaling is extended over two or more toll or trunk circuits.

35 According to the present invention the transmission of the supervisory signals is effected by means of a motor driven signaling device which is separate from the regular message printer set and which may be located at a point distant from the operator's switchboard position. The device is of the start-stop type arranged to 40 transmit current impulses in permutation code combinations. It uses a code which differs from the standard five-units start-stop teletypewriter code in that it uses fourteen units consisting of a start pulse, twelve selecting pulses and a stop 45 pulse. Combinations of the twelve selecting impulses when transmitted over a line circuit, are respectively effective to operate a call, a recall, and a disconnect signal at the receiving end of the circuit. Twelve of the fourteen pulses are 50 fixed and two are changeable for selecting purposes, that is, for selecting the desired one of the supervisory signals at the receiving end. The time required for one complete operation, or revolution, of the supervisory signaling device 55 of the present invention is twice that of the

standard five-units start-stop teletypewriter, or message code device. The device comprises four segmented cam-operated contact sets, one to transmit the fixed intervals and close the line circuit during the idle period, one each for the 5 two changeable intervals and one for locking and releasing purposes. The cams are provided with different arrangements of cuttings depending on the type of signaling current impulse that is transmitted during each unit interval. Three 10 keys are provided at the operator's position, one for each of the supervisory signals. One receiving unit is required for each transmission line and one transmitting unit for each operator's position. Transmission units for two or more 15 operators' positions may be driven by a common shaft. At the receiving end the line circuit is connected through the winding of a polarized relay arranged to operate, through auxiliary apparatus, a selecting magnet on a special printer 20 located at a point remote to the receiving operator's position and independent of the message receiving printer set at the subscriber's station or the operator's printer set. The selecting magnet and the selector mechanism of the spe- 25 cial printer is substantially that of the printer disclosed in U. S. Patent 1,745,633 granted to S. Morton et al. on February 4, 1930, except that the spacing signal impulses are effective to operate contact sets instead of the marking signal 30 impulses selecting code bars. The selector mechanism comprises four cams arranged to be respectively responsive to the sixth, seventh, eighth and ninth selecting impulses of each code combination of signaling impulses transmitted 35 from the other end of the line circuit and therefore the contact sets associated with these cams are operated in various combinations depending on the type of supervisory signal transmitted. The contact sets operated in different combina- 40 tions are effective to select and operate the call, the recall or the disconnect signal as desired.

The invention will now be described in connection with the attached drawings in which:

Figure 1 is a schematic representation of a 45 teletypewriter exchange system wherein the supervisory signaling devices at the transmitting end of the trunk circuit are shown individual to the cord circuit and the supervisory signal receiving devices are shown individual to 50 the trunk circuit;

Fig. 2 is a diagrammatic arrangement showing the relation between two revolutions of the standard five-units code start-stop distributor and one revolution of the special transmitting 55

supervisory signaling start-stop distributor having fourteen unit intervals, the special distributor being equipped for three different signaling impulse combinations;

5 Figs. 3 is a relative arrangement of Figs. 4, 5 and 6;

Fig. 4 shows a subscriber's station A in schematic form terminating at teletypewriter exchange office B, the termination being made at an operator's switchboard position, and a universal cord circuit at teletypewriter exchange office B arranged for connection at one end to the subscriber's station A and at the other end to a trunk circuit extending to teletypewriter exchange office C.

Fig. 5 shows the monitoring equipment at the operator's switchboard position and teletypewriter exchange office B, connected to the cord circuit shown in Fig. 4 and the special supervisory signaling device for sending to the receiving end of a line circuit the fourteen-units code signal impulse combinations;

Fig. 6 shows trunk line equipment at teletypewriter exchange office B and also at teletypewriter exchange office C the trunk line and trunk line equipment comprising the special supervisory signal receiving device and associated equipment, a universal cord circuit connected in multiple to a diagrammatic representation of an operator's switchboard position similar to that shown in Fig. 5, and a subscriber's line equipment, and at station D a subscriber's teletypewriter set in diagrammatic form;

Fig. 7 represents a superimposed arrangement of the signal transmitting cams employed on the signal transmitting device shown in Fig. 5. The arrangement presumes that the four cams are placed coincidentally on top of each other, and shows the angular widths of the fourteen segments for measuring the fourteen intervals;

Fig. 8 shows the four cams of the signal transmitting device and their respectively associated contact sets caused to be operated by the cam cuttings. These cams are shown superimposed on each other in Fig. 7;

Fig. 9 represents a superimposed arrangement of the signal receiving cams employed on the signal receiving device shown in Fig. 6. The arrangement also presumes that the five cams are placed coincidentally on top of each other and shows the angular widths of the fourteen segments corresponding to the fourteen measuring segments of the signal transmitting device;

Fig. 10 shows the six cams, namely, the start, four selecting and the stop cams of the signal receiving device and their respectively associated contact sets caused to be operated by the cam projections which are located approximately in the middle of the sixth, seventh, eighth and ninth segments of the successive cams of the selecting group.

Referring to Fig. 1, means are shown for connecting subscriber's station A to subscriber's station D over any one of a plurality of trunk circuits 600, respectively designated 600-1, 600-2, 600-3, etc., and extending between switchboards respectively located at teletypewriter office B and teletypewriter office C. Each of the trunk circuits is multiplied to a plurality of switchboard positions at each of the teletypewriter offices, the trunk multiple being shown, in Fig 1, as connected to two switchboard positions at each of the teletypewriter exchange offices. A plurality of cord circuits, such as that designated 401 at teletypewriter exchange of-

5 fice B and that designated 601 at teletypewriter exchange office C are provided at each switchboard position. Common to the cord circuits at each switchboard position at teletypewriter exchange office B are a teletypewriter set and a signal transmitting device, the set being designated 500 and the device designated 501. Likewise, common to the cord circuits at each of the switchboard positions at teletypewriter exchange office C are a teletypewriter set and a signal transmitting device, the set being designated 602 and the device designated 603. The teletypewriter sets are of the standard five-unit code start-stop type and are employed by the operator for establishing and monitoring calls in the usual manner. The signal transmitting devices are of a special type arranged to transmit a fourteen-unit code and conveniently locatable at points, usually in the apparatus rooms, somewhat remote to the switchboard positions with which they are associated. These devices are individual to the operator's switchboard positions and each is controlled by three keys located at an operator's switchboard position with which the device is associated. The devices are capable of transmitting to a distant station or office, a call, a recall, or a disconnect signal depending on which one of the three keys is operated. Located at each of the teletypewriter exchange offices is a special type of signal receiving device for each of the trunk circuits incoming at the office. At teletypewriter exchange office B the trunk circuits 600-1, 600-2, 600-3, etc., are respectively connected to signal receiving devices 704-1, 704-2, 704-3, etc., and at teletypewriter exchange office C the same trunk circuits are respectively connected to signal receiving devices 604-1, 604-2, 604-3, etc. The signal receiving devices at each of the teletypewriter exchange offices are individual to the trunk circuits and each is responsive to a fourteen-unit code transmitted from the signal transmitting device that happens to be connected at the distant office to the trunk circuit associated with the responding signal receiving device. The signal receiving device is adapted to close in response to a supervisory signal transmitted from the distant office, any one of the three combinations of contacts which close a circuit for operating the desired signal lamp at the receiving office. A detail description of the operation of the signal transmitting and signal receiving devices will be hereinafter given.

Fig. 2 is the diagrammatic arrangement showing the relations between two revolutions of the standard five-unit start-stop distributor and one revolution of the signal transmitting device, or distributor, which provides twelve selecting intervals, or units, and two synchronizing intervals, or units. The speed of the signal distributor showing the three combinations of signal impulses, namely for the disconnect, the recall and the call signals, is one-half of the standard 60 speed distributor shown at the top of Fig. 2. Each interval, or time unit, of the signal distributor is one-half the length of each unit of the standard distributor. The line speeds of the signal intervals are equal to those of the standard interval and one revolution of the signal distributor will equal, in time, two revolutions of the standard distributor.

In the distributor arrangement shown, units designated by a dash line indicate either the closed or open interval, that is, marking or spacing signal; a full, or solid, line indicates a closed,

or marking signal, interval and an open space indicates an open interval, or spacing signal. In the standard distributor there are seven intervals. The first interval transmitted in a revolution is always spacing and the last interval is always marking. In the signal distributor there are fourteen intervals. The first interval is always spacing and the last interval is always marking, but the seventh interval corresponding to the last interval of a standard distributor is always spacing and the eighth interval of the signal distributor corresponding to the first interval of a succeeding revolution of a standard distributor is always marking. The signal distributor may be connected to a standard 60 speed line circuit and will operate, but will not select on the standard 60 speed signals. If only one standard 60 speed revolution is transmitted, the situation in the signal distributor will not be materially changed.

The code selected for the call, the recall and the disconnect signal operations were chosen for simplicity of illustration and incorrect operation may be further minimized by using more of the selecting intervals available. Operation of the receiving signal distributor on all standard 60 speed signals is avoided by introducing a slow-acting relay adjusted so that it will not operate on the longest standard 60 speed spacing signal, namely, the "letters", but will operate on a spacing signal of slightly longer duration. In the code arbitrarily selected for the proposed arrangement twelve of the signal intervals are fixed and two are changeable. Cam-operated contacts are proposed for the signal transmitting distributor, one to transmit the fixed intervals and close the line circuit during idle periods, one each for the two changeable intervals and one for locking and releasing purposes. It will be noted in the diagrammatic showing of the signal distributor in Fig. 2 that the changeable intervals, that is, the sixth, seventh, eighth and ninth, are of consequence as far as the operating intervals are concerned. For example, for transmitting the disconnect signal the sixth and the seventh intervals are opened and the eighth and ninth are closed; for transmitting the recall signal and the sixth and eighth intervals are closed and the seventh and ninth are opened; and for transmitting the call signal the sixth, eighth and ninth intervals are closed and the seventh is opened. If all four intervals are employed for actual selection then only four contact sets are employed in the signal receiving distributor for effecting selection of the desired signal lamp at the receiving office. The operation of the disconnect, the recall and the call key at the transmitting operator's position selects the signal combination to be transmitted and the four sets of contacts at the receiving office operate accordingly in the desired combination to close a circuit extending to the disconnect, the recall, the call signal lamp depending on the signal impulse combination transmitted.

Method of operation—Cord circuit

Referring to Figs. 4, 5 and 6 the operation of the system will now be described. Assume that a subscriber at station A, shown in diagrammatic form, originated a call in the usual manner and that the operators at teletypewriter exchange offices B and C have, in response to such call and in turn, established a connection by means of their respective cord circuits, such as cord circuit 401 shown in detail and cord circuit 601 shown in

diagrammatic form, through to the subscriber's station D also shown in diagrammatic form. Subscribers' stations A and D, together with their respective line circuit equipments (not shown) at the teletypewriter exchange offices may be of the type disclosed in U. S. Patent 1,965,383 granted to C. C. Lane on July 3, 1934. Cord circuits 401 and 601 are of the universal type well known in the art. A brief description of the operation of cord circuit 401 when first, the answering plug of the cord circuit is inserted in the calling line jack in response to a call and then the calling plug is inserted in the trunk jack, will now be given. The subscribers' stations, the station line equipments, the cord circuits, the toll line and toll line equipments form no part of the present invention and therefore only such parts of them will be described as seem sufficient to establish a connection. A brief description of the connection is deemed necessary in order to present a system wherein the novel features of the invention, namely, the supervisory functions for an intertoll teletypewriter exchange system may be satisfactorily described in detail. For a clear understanding of the operation of the system, set forth above as not forming a part of the present invention, reference may be made to the copending application of G. A. Locke and F. S. Kinkead, Serial No. 459,684, filed January 7, 1930. Cord circuit 601 is similar to cord circuit 401 and a description of operation of one should suffice for a description of the operation of the other.

A call is answered by inserting the answering plug 402 in the calling line jack 403. The calling line may be multiplied to line jacks in other positions of the switchboard in which the jack 403 is located. A circuit is closed extending from ground, through the winding of a relay in the line circuit equipment (now shown), the sleeve conductor of jack 403 and plug 402, through the lower winding of relay 406, through the winding of relay 404 to a potentiometer consisting of resistances 407 and 408. If this cord circuit is the first to complete the sleeve circuit, the mid-point of the potentiometer will be negative with respect to the sleeve and relays 406 and 404 will operate and apply ground located at the armature of relay 406, to the winding of relay 405, thereby operating it. Relay 405, in operating, closes a circuit extending from grounded negative battery, through the winding of relay 409, innermost upper armature and contact of relay 405, through the upper winding of relay 406 to ground on the sleeve conductor of plug 402 and jack 403. The circuit last traced will constitute a locking circuit for relay 406 and the operating circuit for relay 409.

If another answering cord has preceded this cord into the multiple of the line, the sleeve will be negative with respect to the mid-point of the potentiometer and the polar relay 406 will not operate. This non-interfering feature is described in the copending application of Locke et al, supra. Relay 404 will operate closing a circuit extending from ground on the armature and right-hand contact of relay 406, contacts and lower armature of relay 404, through the winding of relay 410 to grounded negative battery. Relay 410, in operating closes a circuit extending from grounded positive battery 451, conductor 492, armature and contact of relay 410, ring conductor of plug 402 and jack 403, over the line multiple to the ring of the preceding cord. If the teletypewriter key of the preceding cord is operated, the preceding operator's set will be cut through and positive battery on the ring will shunt down a

relay in the preceding operator's set circuit which will cause that operator's teletypewriter to lock up so as to be inoperative during a double plug-in condition. The interfering operator will not receive an indication of a double plug-in condition until she operates the associated typing key. Since the ring is opened the operation of the typing key will cause a relay in the operator's set circuit to release, which in turn, causes the operator's busy lamp 505 to light. The operator's typing key is designated 411 in Fig. 4. The operator's teletypewriter will run open momentarily and then lock up and the keyboard will be inoperative. Care should be taken to avoid operating the typing key of an idle cord circuit as this will cause the busy lamp in the operator's set circuit to light. Upon receiving the busy lamp signal, the operator should remove the interfering cord. This will allow the preceding operator to proceed with the call.

However, it is usual that the interfering operator make a busy test before inserting an answering plug as is well known in both the telephone and telegraph art. This busy test is made as follows: Polar relays 502 and 503 of Fig. 5 are associated with the tip conductor of each of the cord circuits in the operator's position, through the contacts and armatures of sleeve relays, such as relays 404 and 405 at the answering plug 402 or such as relay 512 at the calling plug 489. When the cords are busy, relays 502 and 503 are disconnected by the operation of the sleeve relays 404 and 405 or sleeve relay 462. When the tip of either of plug 402 or 489 is touched to the sleeve of any one of their respectively associated jacks, that is, a line jack or a multiple thereof of a busy line or trunk, grounded negative battery (not shown) which will be connected to the sleeve of the particular busy jack, completes a circuit extending through the winding of busy relay 502 to ground. Relay 502 operates to thereby connect ground to the conductor extending to the grounded battery through the lamp 505 which lights to indicate that the line connected to the particular jack is busy. Relay 503 being poled for operation from grounded positive battery does not operate in response to a busy test.

The out-of-order test which like the busy test is also well known in the telephone and telegraph art, is made as follows: When the tip of either end of any cord in an operator's position is touched to the sleeve of a jack in whose multiple there is a jack wherein an "out-of-order" cord is inserted, grounded positive battery (not shown) will be impressed on the sleeve of all jacks of the multiple of the out-of-order line whereby a circuit is completed extending through the winding of relay 503 to ground. As stated above, relay 503 is poled to operate from grounded positive battery and relay 503 operates to close a circuit extending through the winding of an alarm relay 550, through busy lamp 505 to grounded battery. Lamp 505 lights to indicate an engaged condition. The alarm relay operates to connect a continuous ringing current through lamp 551 to a buzzer 552. Lamp 551 flashes and buzzer 552 operates to indicate an out-of-order condition and therefore differentiates from the busy condition indicated by the lighting of lamp 505 alone.

The operation of relay 406 as hereinbefore described closed a circuit extending from ground over the armature and left-hand contact of relay 406, conductor 412, through the left-hand winding of relay 452 to grounded negative battery and relay 452 operates. Relay 452 in oper-

ating applies at its right-hand armature ground for the balancing network 453 and at its inner left-hand armature and contact, ground for the balancing network 454, the balancing network being furnished for the satisfactory operation of the repeater. Relay 452 will operate when either or both the calling or answering ends of a cord circuit are inserted in their associated jacks.

After the operator inserts the answering plug in the line jack, the circuit from the answering side of the repeater to the ring conductor of the answering plug 402 is closed and may be traced from grounded negative battery in the station line circuit equipment (not shown), ring conductors of jack 403 and plug 402, make-before-break contacts of relay 405 in an operated position, conductor 417, conductor 414, outer upper armature and back contact of relay 413, resistance 422, conductor 457, through the upper winding of repeating relays 455, armature and right contact of repeater relay 464 to grounded positive battery. A second path extends through the lower winding of relay 455, network 454 to ground at the contact and inner left armature of relay 452. The biasing current flowing through the lower winding of relays 455 tends to operate the relay armature to the left contact, but the current flowing through the upper winding predominates and the relay armature remains in engagement with its right contact.

The typing keys and relays are so arranged that the operator's teletypewriter set may be connected to any cord in the immediate position and where teamwork is furnished at the operator's switchboard, the operator's teletypewriter set may also be connected to a number of cords in either of the two adjacent positions. However, the arrangements shown on the drawings do not show any provision for teamwork.

When a typing key, such as key 411, in the operator's position is not operated, a line relay 606 of the operator's position circuit will be operated to its left-hand contact by virtue of a holding current which flows in a circuit extending from ground through the lower winding of the relay, closed right-hand contacts of the battery key 553 to a point in a potentiometer including the grounded negative battery at the left-hand contacts of the battery key and the grounded positive battery connected to the winding of the slow release relay 554. Printer magnet 512 is normally held energized by current flowing in a circuit extending from grounded positive battery, armature and left-hand contact of relay 506, through the winding of magnet 512, left-hand closed contacts of the battery key to grounded negative battery. The holding current prevents the teletypewriter running open during the idle condition of a transmission period.

When the operator's position typing key 411 is operated a circuit is closed from ground through the lower winding of relay 506, conductor 607, closed contacts of the teletypewriter key, conductor 418, make-before-break contact of relay 413 in an unoperated position, through the winding of relay 419 to grounded positive battery to form a circuit with the potentiometer hereinbefore described, thereby maintaining a biasing circuit extending through the lower winding of relay 506. Relay 419 operates and closes at its inner left armature and contacts a path extending through the winding of relay 413 to grounded positive battery. Relay 413 operates and closes at its lower armature and contacts a holding circuit for relay 419. Also, relay 413, 75

in operating, closes at its inner upper armature and front contact an obvious circuit for operating slow-acting relay 420. A communication circuit is now closed extending from grounded negative battery at the subscriber's station line equipment, not shown, ring conductors of jack 403 and plug 402, make-before-break contact of relay 405 in an operated position, conductor 417, conductor 414, contact and outer left armature of relay 419, conductor 425, through the operator's teletypewriter set 500, through the upper winding of polarized relay 506, conductor 509, armatures and their respective back contacts, in series, of relay 510, conductor 511, outer right armature and contact of relay 419, conductor 457, and as hereinbefore traced to grounded positive battery at the right contacts of relay 464 in one path and to ground at the inner left armature and contacts of relay 452 in the other path as hereinbefore traced. However, should it be desired, for some reason, that the typing key 411 be restored to normal at this time, relay 413 would release before relay 419, and resistance 422 would be replaced in the circuit between the ring conductor of answering plug 402 and the winding of repeater relay 455 before the operator's teletypewriter set is disconnected. This is done to insure that the transmission through the repeater will not be interrupted by the introduction or removal of the operator's set.

The line relay 506 at the operator's teletypewriter set is normally held closed by a local negative 48-volt circuit and the printer magnet 512 is held operated by another local circuit from negative 34-volt battery. Current through the conductor 507 is applied to the biasing winding of the operator's set line relay 506 in the direction opposite to the local holding current. This current in the conductor 507 is greater than the local current and will therefore act as a biasing current for the operation of the line relay. When the typing key 411 is operated, the subsequent operation of relays 419 and 413, hereinbefore described, might cause a sufficiently large current in conductor 507 to over-power not only the local holding current, but the line current as well. If the printer magnet 512 were under control of the line relay 506 at this time, false characteristics might be recorded in the operator's set. This condition is prevented by the fact that the second local circuit in the operator's set holds the printer magnet closed until relay 420 operates. Relay 420 which is slow-acting will operate when relay 413 has operated and will then supply ground through conductor 431, lower armature and contact of relay 420, contact and inner right armature of relay 419, conductor 432, through the winding of relay 513 to grounded battery. Relay 513 operates and thereby opens the second holding circuit for relay magnet 512. When typing key 411 is restored to normal the biasing current for the operator's line relay 506 will be opened and the local holding current will be established before the line circuit is opened.

In a case where two operators attempt to answer the same call, both will be prevented from accepting the call and will be informed of the double connection by signals. The first operator who completes the sleeve circuit of an answering cord will have her teletypewriter locked as an indication. The second operator will receive a busy lamp signal in her position and will have her teletypewriter locked as an indication. The second operator may disconnect and the

first operator may proceed with the business of answering the call. The circuit arrangement for performing this operator lock-out feature at the second operator's position comprises a relay 506 which because of the discriminative feature in the cord sleeve circuit at this time prevents closure of the transmission circuit, is operated to its spacing contact. Relay 506 is operating to its spacing contact releases relay 654 without effect and causes the second holding circuit of printer magnet 512 to be energized sufficiently to hold the magnet operated, the latter circuit being traceable from grounded positive battery of 48 volts through the winding of relay 555, make-before-break contact of relay 513, through the winding of magnet 512 to grounded negative battery of 48 volts at key 553. Relay 555 operates to light busy lamp 505. The lighted busy lamp 505 and the locked teletypewriter indicate to the second operator that her position is locked out of the line circuit and that she should disconnect. Relays 554, 555 and 513, printer magnet 512, key 553 and busy lamp 505 correspond respectively to those parts similarly designated in Fig. 5 of the drawings.

When the operator at teletypewriter exchange office B challenges the subscriber at station A, relay 506 will respond to the teletypewriter signal by virtue of the signaling current in the upper winding of relay 506 which current is approximately twice that of the biasing current in the lower winding of the relay. Relay 506 responding to the teletypewriter signals will in turn operate the printer magnet 512. Relay 554 is normally energized when the battery key 553 is operated and being of the slow-release type remains operated during the message signaling but is shunted and therefore releases when the armature of relay 506 remains on its spacing, or right, contact. Relay 513 operates in a circuit traceable over conductor 432 extending to the associated cord circuit over the inner right armature and contact of relay 419, contact and armature of relay 420 to ground at the outer left armature and contact of relay 452, when the answering plug 402 is inserted into line jack 403, provided the answering plug 402 is the first to be connected to the calling line terminating in jack 403. The relay corresponding to relay 513 of an operator's position circuit associated with a second answering plug to be inserted in a multiple jack of the calling line will not operate because of the discriminative feature of the cord sleeve circuit.

The operator upon challenging the subscriber at station A and, then, upon receiving the called number from the calling subscriber first tests an intertoll trunk jack for an idle condition and if the trunk is idle then inserts the calling plug 489 of cord circuit 401 into an intertoll trunk jack indicated as idle by the idle line indicator, lamp 505, which intertoll trunk jack is shown in the drawings as being jack 605. The normally closed intertoll trunk circuit is arranged to remain closed during the time that plug 489 is being inserted into jack 605. When calling plug 489 is in jack 605 a circuit is completed from ground which is present on the sleeve of the jack and extends through the sleeve of plug 489, resistance 474, through the winding of relay 461 to grounded battery. Relay 461 operates and at its lower armature connects ground in an obvious operating circuit for relay 462. Relay 462 operates and completes a circuit from grounded negative battery in the toll line equipment (not shown)

at teletypewriter office B over the ring conductors of jack 605 and plug 489, conductor 486, through the upper winding of repeater relay 464, armature and right contact of repeater relay 455 to grounded positive battery. A parallel path extends through the lower winding of relay 464, network 453 to ground at contact and right armature of relay 452. Relay 462, in operating, also disconnects the tip conductor of plug 489 from the tip busy test conductors 475 and 504. The equipment at teletypewriter exchange office C is well known in the art and a description of it may be had by referring to the copending application Serial No. 459,684, supra.

As soon as plug 489 is inserted in jack 605, the operator at the teletypewriter exchange office B sends a call signal to the operator at the teletypewriter exchange office C, the typing key 411 being in an operated position at this time. The call signal is transmitted by the special printer, or distributor, shown in Fig. 5, which is part of the present invention and its effect on the equipment at the teletypewriter exchange office C will be hereinafter described.

The operator at teletypewriter exchange office C answers by plugging in the answering end of a cord circuit such as that designated 601, into jack 606, and challenges the operator at the teletypewriter exchange office B.

The operator at teletypewriter exchange office B upon being challenged by the operator at the teletypewriter exchange office C, transmits the code number of the called subscriber. The operator at teletypewriter exchange office C will by means of the calling end of cord circuit 601 complete the connection through to the subscriber's station B in a manner as hereinbefore described for completing the connection to the toll line. Now that the connection is established the function constituting the present invention will be described.

The present invention, as hereinbefore stated, resides in the supervisory function proposed for use between operators at teletypewriter exchange offices when operating over toll circuits. The supervisory functions and equipments heretofore used at teletypewriter exchange offices will be used only for the subscribers' stations that are local to the teletypewriter exchange offices, and inasmuch as they are well known in the art, they will not be described herein. In the arrangement herein described, it is assumed that the operator at teletypewriter exchange office B is sending and that the operator at teletypewriter exchange office C is receiving. Each office is provided with three keys for intertoll office supervision. These keys at office B are shown as call key *c*, recall key *r* and disconnect *d*. As hereinbefore stated, the special printer is a modification of the standard printer disclosed in U. S. Patent 1,745,633, supra, whereby the standard cam arrangement is replaced by the cam arrangements shown in Figs. 5 and 6. The cam arrangement in Fig. 5 is under the control of any one of the keys designated *c*, *r* and *d*. In neither of the cam arrangements shown in Figs. 5 and 6 are the type bars or code selecting bars, as used in the standard printer, employed.

Supervisory signaling equipment at office B which will herein be assumed to be the sending end, will first be described. There is associated with each of the operator's cord circuits a signaling distributor 501. The signaling distributor 501 and other signaling distributors such as that indicated diagrammatically by box 514 are pro-

vided in the arrangement shown as being driven from a motor, through a common driving shaft 516. On shaft 516 is provided gear arrangements for each of the signaling distributors. The signaling distributors are controlled by individual driving shafts 517—A, 517—B, etc., friction clutches 518—A, etc. and driven shafts 519—A, etc. The signaling distributor 501, shown in detail, will now be described.

Fixedly mounted on driven shaft 519—A are five cams 520, 521, 522, 523 and 524, four of which, namely, 520 to 523, control contact sets. Cams 520 to 523 are shown superimposed in Fig. 7 and individually in Fig. 8. Cam 522 transmits the first to the fifth, seventh, eighth, and tenth to the fourteenth interval impulses which are fixed, that is, unchangeable, of the 14-unit code and also maintains the line circuit closed during idle periods. Cams 521 and 520 respectively transmit the sixth and the ninth interval impulses which are changeable. Cam 523 transmits no interval impulses to the line circuit but is employed for locking and release purposes. An additional cam 524 is not of the contact closing type but serves, together with friction clutch 518—A, to effect the starting and stopping operation of driven shaft 519—A.

The operation of the signaling distributor 501 will now be described. Switch 525 is operated to its closed position to start the motor 515. Then the switchboard operator closes any one of the supervisory signal keys *c*, *r* or *d*, depending on the type of supervisory signal that is to be transmitted to teletypewriter exchange office C, and a corresponding sequence of circuits are operated. First, assume that call key *c* is operated to close the circuit extending from grounded battery through the winding of prepare relay 526, then over parallel paths, one extending over the left-hand contact of key *c*, through the winding of selector relay No. 6, designated 527, and the other extending over the right-hand contact of key *c*, through the winding of selector relay No. 9, designated 528, over a common conductor 529, through the winding of toll transfer relay 510 to ground. Relays 526, 527, 528 and 510 operate. Relays 527 and 528 lock up in a circuit extending from grounded conductor 529, through their windings and lower armatures in parallel, common conductor 530 to grounded battery at the closed contacts of cam 523. Relay 526, in operating, closes at its lower armature and front contact an obvious operating circuit for final prepare relay 531 which operates and locks over the upper armature and contact. The prepare relay 526 in operating in response to the operation of key *c* allows the line circuit to be opened at its upper armature and contact to transmit a spacing signal of sufficient duration to operate slow-acting relay 609 at teletypewriter exchange office C to the position opposite to that shown in the drawing. The duration necessary to operate relay 609 is slightly longer than one-sixth second. Subsequent transmission is not affected by the duration of this spacing signal due to the operation of relay 526 and the normal use of the key for supervision by the operator seems adequate. Relay 526 is restored to the unoperated condition upon the release of key *c*. The purpose of the slow-acting feature of relay 609 will be hereinafter described. Final prepare relay 531 having operated, and relay 526 having been restored to the unoperated condition, a circuit is closed extending from ground at the lower armature and back contact of relay 526, contact and

lower armature of relay 531, conductor 532, through the windings of inductance coil 533 and start magnet 534, in series, to grounded battery. The inductance coil 533 is included in the start magnet circuit to insure that a marking signal is transmitted to the toll line following the spacing signal transmitted by the opening of the upper armature and contact of relay 526. This marking signal will be long enough to permit the receiving circuit to become established for the following spacing or synchronizing signal. Normally, the signal is transmitted on the calling cord but a splitting relay 508 associated with the cord circuit splitting key 421 permits signaling on the answering cord also. Start magnet 534 operates and withdraws detent 535 from engagement with start-stop cam 524 to permit shaft 519—A to rotate through one revolution only, under the influence of friction clutch 518—A.

Immediately following the first spacing impulse transmitted over the line circuit due to the operation of relay 526, the line circuit closes with the release of relay 526 and the line circuit is maintained closed while start magnet 534 is building up sufficient current to become operated. As soon as the shaft 519—A begins to operate the line circuit at the contact set in engagement with the first segment of cam 522 is opened for the first spacing signal to be transmitted. Subsequently, during the single revolution of shaft 519—A, a series of closures and openings of the line circuit depends on the cuttings of cams 520 to 522 and these cuttings control their respectively associated contact sets all of which are included in the line circuit. The line circuit is traceable from grounded negative battery at the back contact and outer upper armature of relay 508, conductor 536, through the closed contacts in parallel of the sets respectively associated with cams 522, 521 and 520, and the contacts and upper armatures in parallel of relays 526, 527 and 528, conductor 537, back contact and upper armature of relay 508, front contact and upper armature of relay 510, conductor 511, outer right armature and contact of relay 419, conductor 457, through the upper and lower windings in series with repeater relay 455, network 454 to ground at the contact and inner left armature of relay 502. The repeater relay 455 in turn repeats the closures and openings of the line circuit, that is, the marking and spacing signals to the receiving circuits at teletypewriter exchange office C.

When shaft 519—A starts to rotate, cam 522 opens at its contacts the line circuit to transmit the first interval of the 14-unit code, the open impulse being transmitted over the closed contact at the upper armature of relay 526. During the second, and extending through to and including the fifth interval the impulses transmitted are closed, or marking, because the contacts of cam 522 are closed. During the sixth interval the contacts of cam 522 open but because of the operated condition of selector relay 527 and the closure of the contacts at cam 521, the impulse transmitted is still marking. During the seventh interval the contacts of cam 522 remain open and the contacts of cam 521 return to an open position the impulse transmitted is now open. During the eighth interval the contacts of cam 522 close and the contacts of cam 521 open so that the impulse transmitted is marking. During the ninth interval, the contacts of cam 522 are opened but because of the operated condition of selector relay 528 and the closure of the

contacts of cam 520, the impulse transmitted is marking. During the tenth interval, the contacts of cam 522 close, those of cam 520 remain open and those of cam 520 open and the impulse transmitted is marking. Also, during the tenth interval contacts of cam 523 open to thereby open the holding circuit for relays 531, 527, 528 and 510 whereby the relays release. The opening of the line circuit due to the release of relay 510 is not of sufficient duration to affect the receiving end of the line circuit. The release of relay 531 releases start magnet 534 so that when the shaft 519—A completes a single revolution it will be stopped by detent 535. During the eleventh interval and to the fourteenth interval marking impulses are being transmitted but the effective operation of the receiving signal distributor had been completed during the ninth interval and no further description of the operation of the sending distributor is necessary. The transmitted call signal is shown in Fig. 2 of the drawings.

Assume that key *r* is operated by the operator at teletypewriter exchange B to send a recall signal, and the resulting operation is much the same as that described above when the call key *c* was assumed to be operated except that selector relay 528 does not operate and the closure of the contacts of cam 520 during the ninth interval is ineffective. The closing of the contact of cams 522 and 521 respectively are the same as described above for transmitting the call signal and the resulting signal for the fourteen units will be the same except that the ninth interval will be opened instead of closed. The recall signal is transmitted as shown in Fig. 2 of the drawings.

Assuming that key *d* is operated by the operator at teletypewriter exchange office B to transmit a disconnect signal, the resulting operation is also much like that described above when call key *c* was assumed to be operated except that relay 527 does not operate and the closure of the contacts of cam 521 during the sixth interval is ineffective. The closing of the contacts of cams 522 and 523 respectively are the same as described above for transmitting the call signal and the resulting signal for the fourteen units will be the same except that the sixth interval will be open instead of closed. The disconnect signal as transmitted is shown in Fig. 2 of the drawings.

At the incoming end of the toll circuit 600—the line winding of polar relay 603 is connected in the toll circuit at all times. The preliminary opening of the line circuit due to the operation of the supervisory signaling key *c*, *r* or *d*, as hereinbefore described, operates relay 609 to its spacing contact to close an obvious operating circuit for prepare relay 609. Relay 609 is slow-acting and is designed to operate on a signal slightly longer than the "letters" signal of a 60 speed circuit and its purpose is to screen, or protect, the receiving signal distributor from the normal teletypewriter, or message, signals. Relay 609 in operating after a predetermined duration closes an obvious operating circuit for lock-up prepare relay 610. Relay 610, in operating, locks up in a circuit extending over its right armature and contact, contact and armature of relay 611 to grounded battery, and over its left armature and contact, closes a circuit extending from grounded battery, armature and left-hand, or marking, contact of relay 608, to the right make-before-break contact and through the winding of final prepare relay 612 to ground.

When the toll line is subsequently closed, the circuit, just traced, operates relay 612. Relay 612, in operating, locks up through its front contact and right armature to grounded battery at the armature of relay 611 and at its left armature and make-before-break contact substitutes a circuit to the line relay for the holding circuit for normally operated selecting magnet 613 which remains operated. Selecting magnet 613 is now prepared to operate in accordance with the 14-unit impulses transmitted by the transmitting signal distributor 501. The preliminary spacing signal and the marking signal impulse which immediately follows are of sufficient duration to insure the operation and locking of relay 612.

Selector magnet 613 in its normal position holds its armature extension 631 in engagement with cam 615 and in this position prevents the rotatable shaft 616 from rotating under the influence of driving shaft 617 driven by motor 618, the influence being effected by friction clutch 619. In response to the first spacing impulse received by relay 608, the relay operates to its right-hand, or spacing, contact to open the operating circuit for magnet 613 and the armature 614 is released thereby disengaging cam 613 to permit shaft 616 to rotate. Frictionally mounted on shaft 616 are cams 620 to 623. Integrally formed on each of the cams is a projection. These projections are spaced with respect to each other, angular differences which correspond to the angular differences between the cutting of the segment No. 6 of cam 521, segments Nos. 7 and 8 of cam 522 and segment No. 9 of cam 520. Inasmuch as the sixth, seventh, eighth and ninth intervals only of the 14-unit code are effective to operate the supervisory signal lamps 624, 625 and 626 the cams corresponding to the cuttings for the remaining intervals are not necessary and therefore are not employed. Respectively arranged in engageable relation with the projections on cams 620, 621, 622 and 623 are code bar operating levers 627, 628, 629 and 630. Each operating lever, when operated, initiates a chain of movement through a sword member, a T lever and a code bar somewhat similar to those employed in the printer disclosed in U. S. Patent 1,745,633, supra. In the particular arrangement shown in Fig. 6 the code bar in being operated to an operated or a non-operated position, accordingly closes or opens contacts in a combination depending on the supervisory signal that is received. A second armature extension 632 is operated in either of two positions by magnet 613 depending on whether the incoming signal impulse is closed or open and in cooperation with code bar operating levers positions the sword members and finally the code bars. The code bars operate the contact sets in combination corresponding to intervals Nos. 6, 7, 8 and 9 in which open or closed impulses depending on whether the signal transmitted is call, recall or disconnect, are received.

Assume as hereinbefore that a call signal is transmitted, that is, a signal in which the first and seventh intervals are open and the second to the sixth and the eighth to the fourteenth are closed, relay 608 in response to the first impulse operates to its right-hand or spacing position. The circuit previously closed when relay 612 was operated and locked in response to the preliminary open impulse and which furnishes the operating current for magnet 613, is opened at the left-hand contact of relay 608. Magnet 613 re-

leases and the armature extensions 631 and 632 operate, or rotate slightly about pivotal rod 663. Extension 631 disengages cam 615 to thereby permit driven shaft 616 to rotate under the joint influence of friction clutch 619, driving shaft 617 and motor 618. Extension 632 also in being released rotates slightly to make effective the operation of any of the code bar operating levers 627 to 630. The code bar operating levers operate every time they come into engagement with their respectively associated cams, but the operation is ineffective to perform any further function unless the armature extension 632 is in its released position at the time. For each supervisory signal received from teletypewriter exchange office B start-stop rotatable shaft 616 makes one complete revolution and the operation of the shaft is synchronized with the start-stop shaft 519—A at teletypewriter exchange office B so that cams 623, 622, 621 and 620 engage their respectively associated operating levers 630, 629, 628 and 627 during the sixth, seventh, eighth and ninth intervals, respectively. However, only those T levers of those designated 637 to 640 are operated by their respectively associated code bar operating levers, when such operating levers are actuated only while armature extension 632 is in its released position. Should the armature extension 632 remain in its operated position, an actuation of the operating lever would have no effect on the T lever and consequently no effect on the code bars. Respectively arranged in juxtaposition to code bars 641 to 644 are sets of contact springs 645 to 648. Each of contact sets 645, 646 and 647 have two spring leaves and contact set 648 has three spring leaves. Also fixedly mounted on shaft 616 is cam 649 arranged to close at the end of the revolution of shaft 616, a contact set 650 which has three spring leaves.

The method of operation of signal receiving distributor 604 will now be described. When the call signal is received, the start, or spacing impulse starts shaft 616 rotating. The shaft continues to rotate while impulses corresponding to the second and up to and including the sixth interval are being received. These impulses which are marking, reoperate and maintain in an operated position magnet 613. In the sixth interval cam 623 operates lever 630, but inasmuch as extension arm 632 is in its operated position cam 623 is ineffective. When the seventh impulse which in the "call" signal is spacing, is received magnet 613 deenergizes to position its extension arm 632 in a released position. At the same time cam 622 corresponding to the seventh interval operates lever 629 which operates and cooperates with the extension arm 632 in its released position to move code bar 643 to the right so that contact set 647 becomes closed. When the eighth impulse which in the "call" signal is closed, is received, magnet 613 reoperates and moves extension arm 632 to its operated position. At the same time cam 631 is ineffectively operating lever 628. When the ninth impulse which in the "call" signal is also closed, is received, magnet 613 remains operated and the engagement of cam 620 with lever 627 is ineffective on the associated contact set 645.

It is shown then that in response to the "call" signal only one set of contacts, namely 647 which corresponds to the seventh interval, is operated. Referring to Fig. 10, the circuit operated by the operation of contact set 647 may be described as being traced from grounded battery, the upper, or normally closed contacts of set 650, conductor

656, the normally closed contacts of set 646, contacts of set 647 which, now being operated, are closed, upper, or normally closed, contacts of set 648, through the winding of relay 651 to ground. Relay 651 operates and at its right armature and contact closes for itself a locking circuit which extends over conductor 653, manually operated switch 654 to grounded battery 655. At its innermost left armature and contact an obvious operating circuit for "call" lamp 626 is closed. Lamp 626 lights indicating that a "call" signal is being received. The lamp remains lighted until the operator opens switch 654. During the tenth interval cam 649 operates contact set 650 to close at its lower contacts a circuit for operating relay 611. Relay 611 operates to open the locking circuit for relays 610 and 612 (shown in Fig. 6) which release. The impulses received during the tenth to the fourteenth intervals are marking and have no effect on the signal receiving distributor 604. At the end of each revolution of shaft 616 magnet 613 is in its operated position and cam 615 is stopped by extension arm 631 in its operated position.

Assuming that a disconnect signal is being received the impulses received during the first, sixth and seventh intervals are open, or spacing, and those received during the other intervals are in response to the first impulse and in response closed, or marking. Shaft 616 starts to rotate to the sixth and seventh impulses magnet 613 releases to position armature extension 632 so that the engagement of cam 623 with lever 630 and cam 622 with lever 629 cause code bars 644 and 643 to move to the right. Code bars 644 and 643 in their operated positions close the circuit shown in Fig. 10 as extending from grounded battery over the upper, or normally closed contacts of set 650, conductors 656, normally closed contacts of set 646, closed contacts of set 647, lower contacts of set 648 through the winding of relay 652 to ground. Relay 652 operates and at its right armature and contact closes a locking circuit for itself and at its middle left armature and contact closes an operating circuit for disconnect lamp 625. Lamp 625 lights and remains lighted until switch 654 is opened. The impulses during the remaining intervals are received, but inasmuch as all are closed, or marking, they have no effect on the distributor 604. During the tenth interval the normally open contacts of set 650 are closed to cause the release of relay 611 and at the end of its revolution shaft 616 is stopped by cam 615.

Assuming that a recall signal is being received the impulses received during the first, seventh and ninth intervals are open, or spacing, and those received during the other intervals are closed, or marking. Shaft 616 starts to rotate in response to the first impulse and in response to the seventh and ninth impulses magnet 613 releases to position armature extension 632, so that the engagement of cam 622 with lever 629, and cam 620 with lever 627 cause code bars 643 and 641 to move to the right. Code bars 643 and 641 in their operated position close the circuit shown in Fig. 10 as extending from grounded battery, over the upper, or normally closed, contacts of set 650, conductor 656, then over two parallel paths, one extending over the closed contacts of set 645, through the winding of relay 652 to ground and the other extending over the closed contacts of set 646, closed contacts of set 647, upper, or normally closed contacts of set 648, through the winding of relay 651 to

ground. Relays 651 and 652 operate and at their right armatures and contacts close locking circuits for themselves to battery 655 and at their outermost left armatures and contacts close an operating circuit for recall lamp 624. Lamp 624 lights and remains lighted until the operator opens switch 654. During the tenth interval the release of relays 610 and 612 is effective and at the end of its revolution shaft 616 is stopped by armature extension 631 as hereinbefore described.

Split key 421 when operated closes an obvious operating circuit for splitting relay 508. Relay 508 operates and at its upper and lower armatures and their respectively associated front contacts reverses the polarity of the signaling battery so that signaling may be permitted on the answering cord 412 for the purpose of signaling to an operator that may be in some cases connected to a trunk circuit extending to another teletypewriter exchange office instead of to a line circuit as shown in the drawings.

It is understood that neither sending device 501 nor receiving device 604 are restricted to the cam arrangements shown in the drawings, but that they may be adapted for other uses by providing additional cams for making effective additional or other signal unit intervals to accomplish other results, without deviating from the scope of the invention. The cams are usually arranged in juxtaposition on the shaft as shown in U. S. Patent 1,745,633, supra. Also, the devices may be equipped with an armature lever locking wedge such as is shown in Fig. 7 of U. S. Patent 1,931,672 granted to S. Morton et al. on October 24, 1933.

What is claimed is:

1. A communication system comprising a single signaling channel of transmission, a permutation code sending device connected thereto for sending out code combinations in definitely timed groups, a permutation code receiving device connected to said channel and responsive to said sending device, a second permutation code sending device connected to said channel for sending code combinations in groups of definitely different timing than those of the first-mentioned sending device, a second permutation code receiving device responsive to the code combinations sent by said second sending device, and instrumentalities whereby transmission of code combinations from the first-mentioned sending device is prevented from setting up selections in the second-mentioned receiving device.

2. In a communication exchange system, a plurality of main stations, branch stations respectively connected to said main stations, a trunk circuit interconnecting said main stations, means at each of said stations for transmitting and receiving permutation message code signals for message purposes over any one of said trunk circuits, and additional means at each of said main stations for transmitting and means for receiving permutation code signals for supervisory purposes over said one of said trunk circuits, said last-named means being non-responsive to message code signals.

3. In a communication system, a plurality of main stations, a plurality of branch stations, message signaling means at said stations, signaling means at each of said main stations for sending supervisory signals in permutation code, a local circuit connecting each of certain of said branch stations with one of said main stations,

a trunk circuit interconnecting said main stations for communicating messages between said main stations and between said branch stations at opposite ends of said trunk circuit, means whereby said trunk circuit is also adapted to transmit supervisory signals between said main stations, a start-stop device at one of said main stations for transmitting and a start-stop device at the other of said main stations for receiving over said trunk circuit permutation code supervisory signals, slow-acting means in the receiving end of said trunk circuit for selecting the supervisory signals only and directing said supervisory signals to said start-stop receiving device.

4. In a communication system, according to claim 3, wherein said start-stop device for transmitting supervisory signals comprises rotatable cams, a plurality of circuits arranged to be closed in various combinations, circuit closing means controlled by said cams, a source of signaling current for energizing said plurality of circuits, and keys for selectively operating said plurality of circuits to send from said source a permutation code combination of current impulses peculiar to the operated key of said keys.

5. In a communication system, according to claim 3, wherein said start-stop device for receiving supervisory signals comprises a plurality of groups of operating levers, rotatable cams for successively operating said plurality of groups, groups of operating members respectively controlled by said plurality of groups and responsive to supervisory signals of a permutation code, circuits operative in various combinations and controlled by said groups of operating members, means for starting and stopping the rotation of said cams, said means being responsive to said supervisory signals to selectively operate said groups of operating members through said cams and said plurality of groups of operating levers to close any one of said circuits as desired, and indicating signals responsive to the operation of said circuits.

6. In a communication exchange system, a plurality of stations, a transmission circuit interconnecting said stations, means at each of said stations for transmitting and receiving permutation code message signals, other means at each of said stations for transmitting and receiving permutation code supervisory signals, a manually operated switchboard at each of said stations, a start-stop transmitting and a start-

stop receiving device at each of said stations, means at each of said switchboards for establishing a connection over said transmission circuit, a plurality of supervisory keys at each of said switchboards, supervisory circuits respectively controlled by said keys, supervisory indicators at each of said switchboards, other circuits for respectively operating said indicators in response to the operation of said start-stop receiving device, a device at the receiving end of said transmission circuit for differentiating between incoming message signals and incoming supervisory signals received over said transmission circuit by directing said supervisory signals only to said start-stop receiving device, permutation code selecting equipment forming part of said start-stop receiving device responsive to said incoming supervisory signals, circuit closing means responsive to said code selecting equipment in operated position for selecting and operating any one of said other circuits to operate one of said supervisory indicators at the receiving station which corresponds to the supervisory key operated at the transmitting station.

7. In a printing telegraph exchange system wherein permutation code signals are employed, a plurality of main stations, a transmission circuit interconnecting said main stations, a manually operated multiposition switchboard at each of said stations, a printer set at each of said positions arranged to transmit start-stop signals, a plurality of supervisory keys at each of said positions, circuits controlled by each of said keys, a start-stop device controlled by said keys for transmitting over said transmission circuit permutation code supervisory signals comprising impulses of longer duration than the permutation code signal impulses from said start-stop printer set, a slow-acting device at the receiving end of said transmission circuit responsive to the supervisory signals only, other circuits arranged to be conditioned by the initial operation of said slow-acting device, a selective device responsive to said supervisory signals over said other conditioned circuits, a plurality of signal lamps corresponding in number to said keys at each of said switchboard positions and responsive to the operation of said selective device, the signal lamp operated depending on which of said keys is operated at one of said switchboard positions.

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