

July 30, 1929.

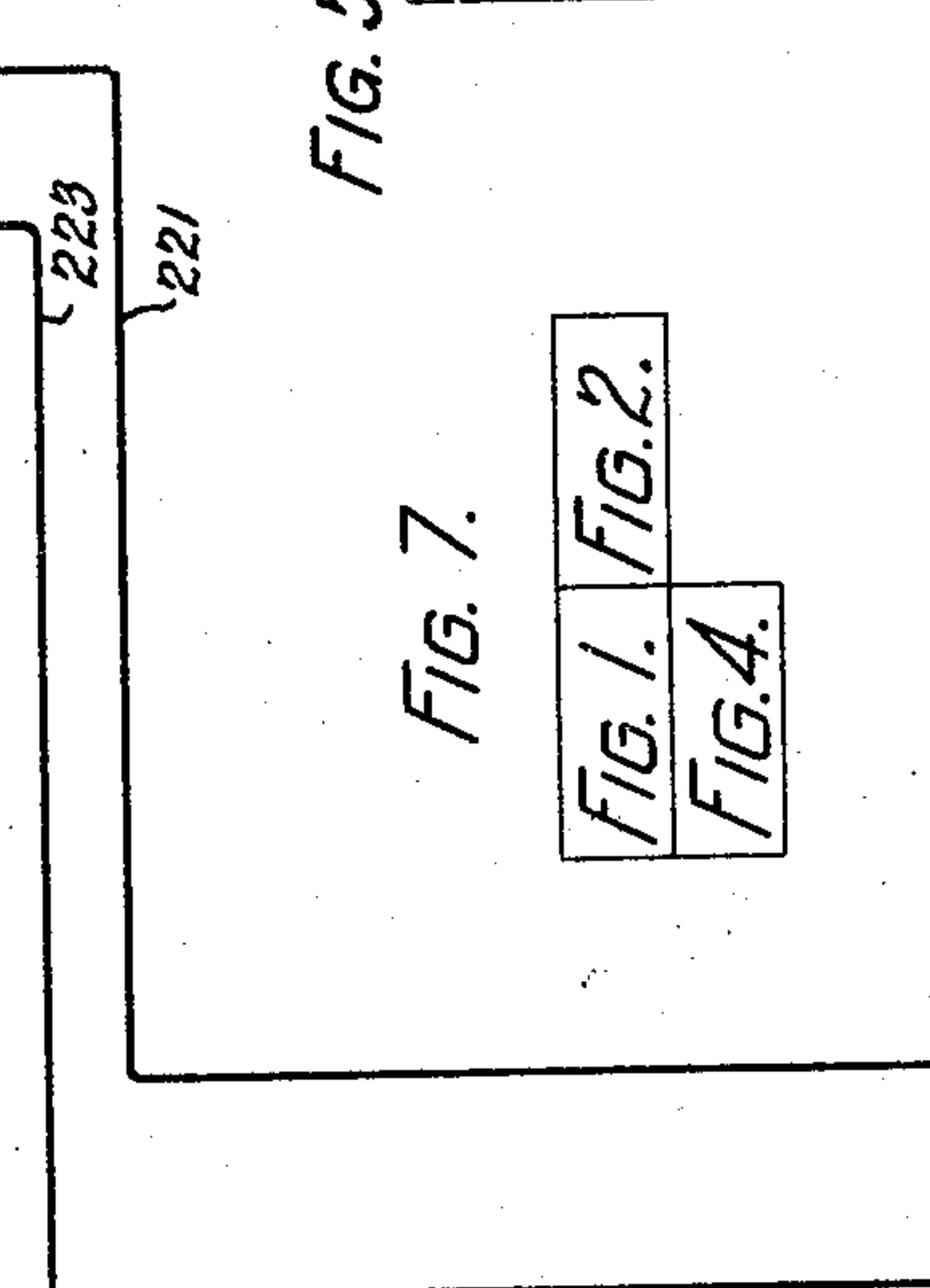
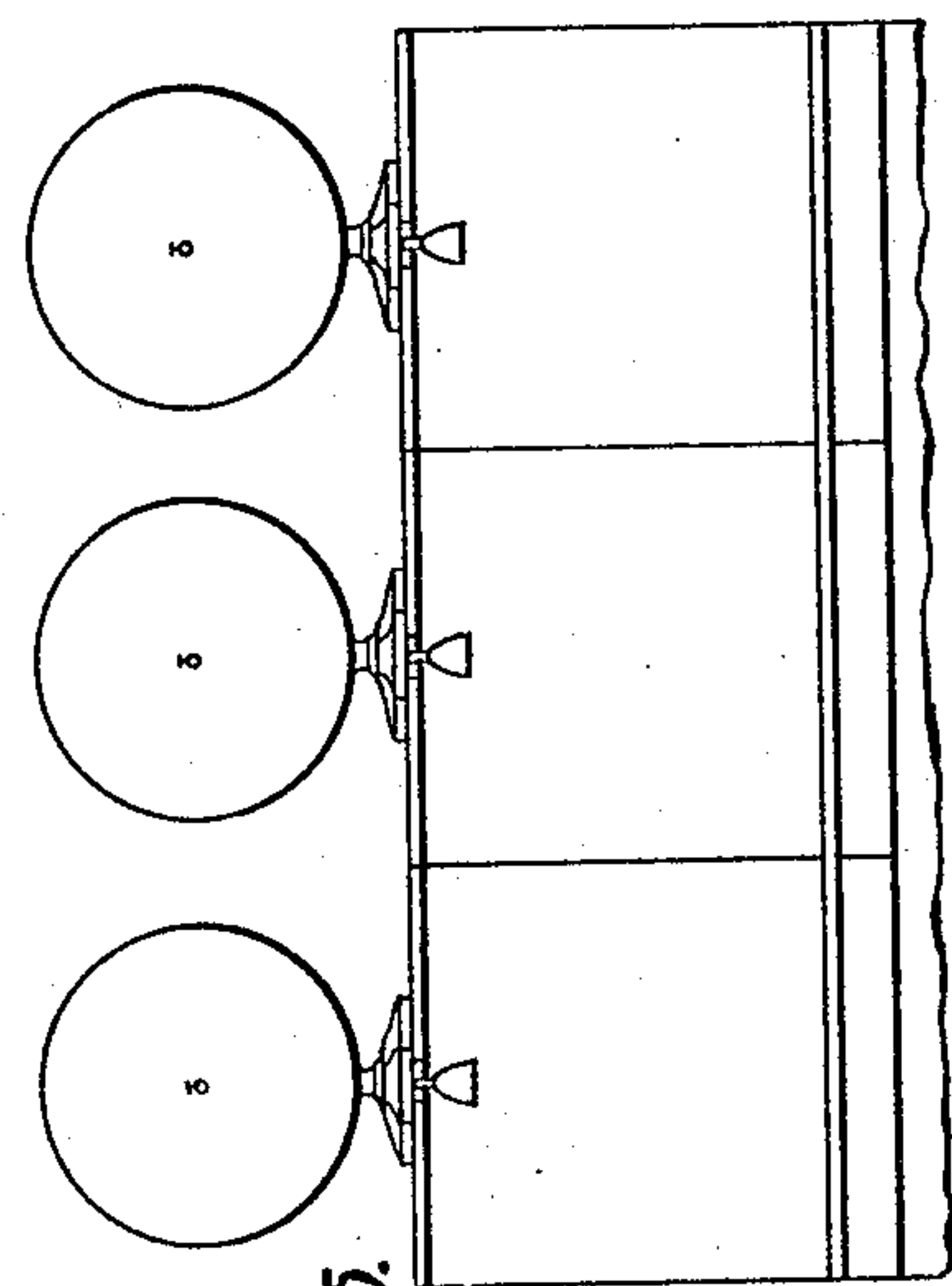
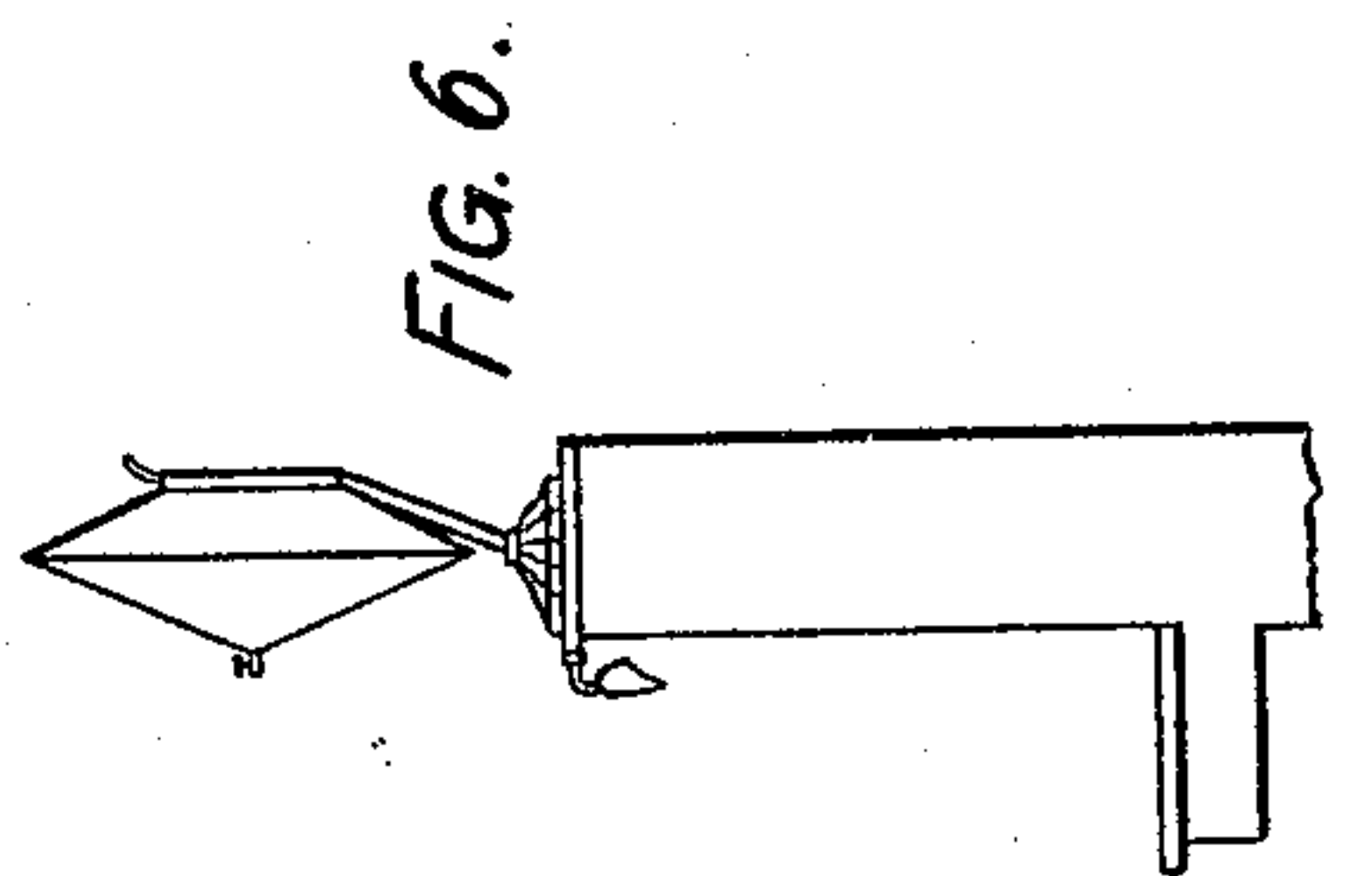
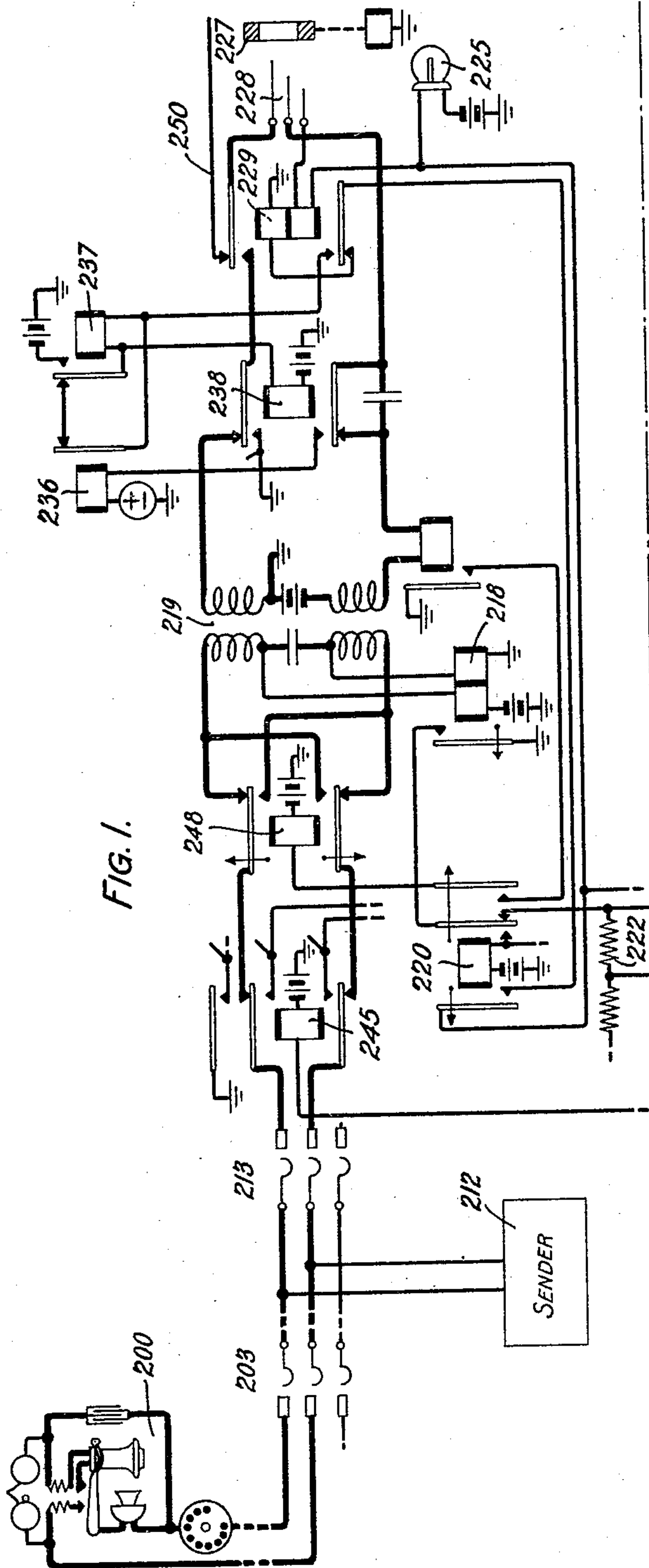
H. M. BASCOM

1,722,262

TELEPHONE EXCHANGE SYSTEM

Filed Dec. 15, 1927

3 Sheets-Sheet 1



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BY

George
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July 30, 1929.

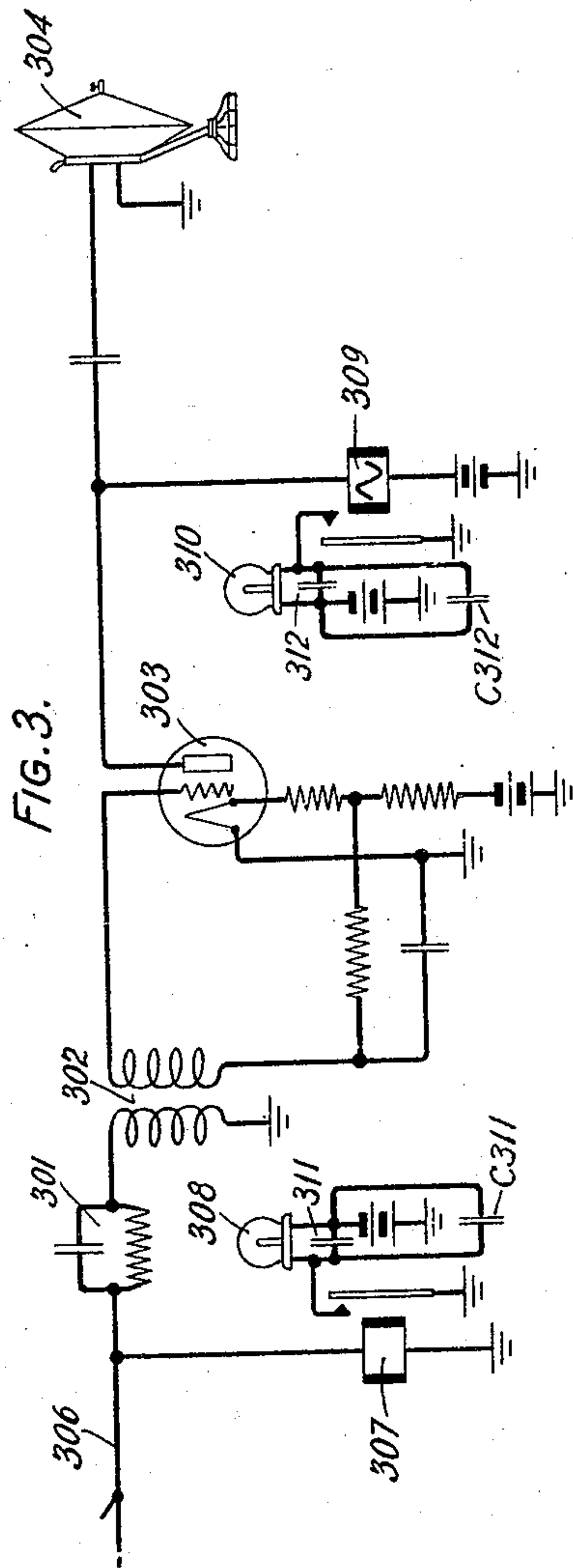
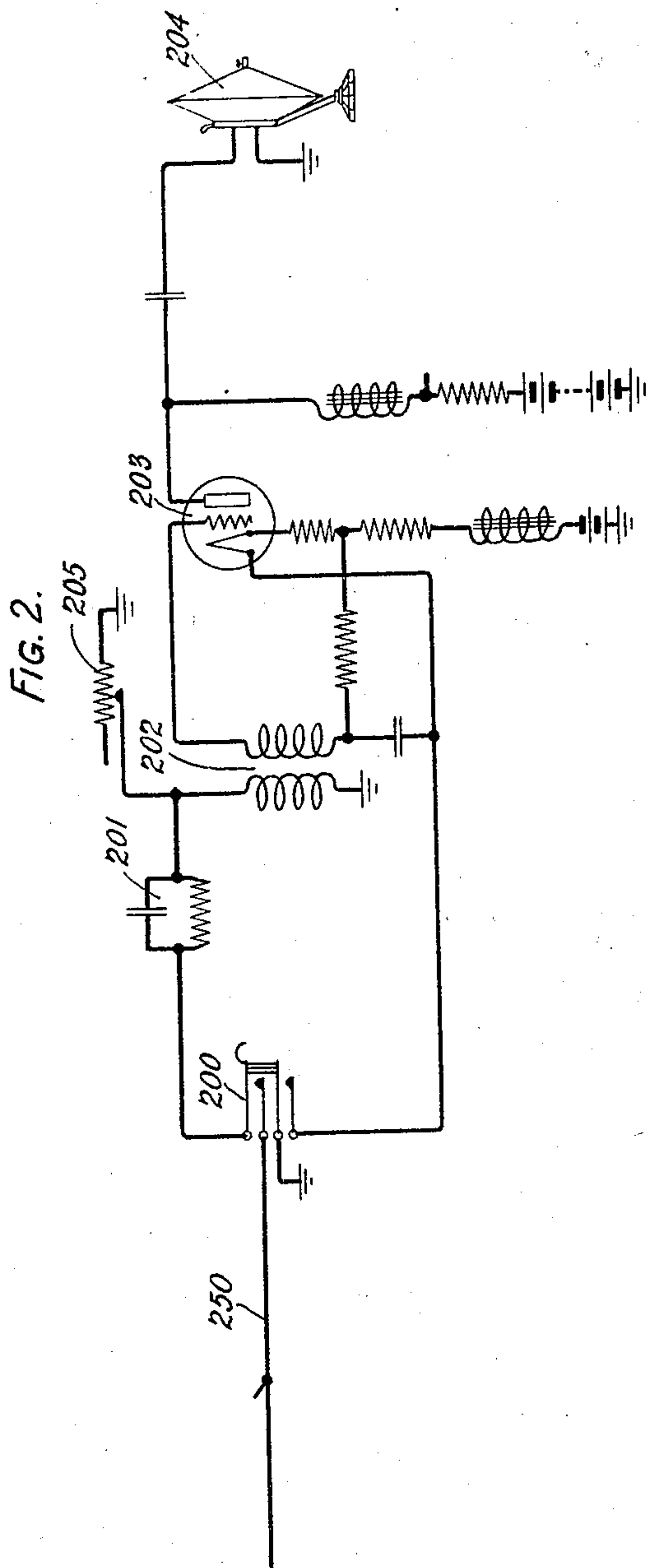
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3 Sheets-Sheet 2



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TELEPHONE EXCHANGE SYSTEM

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3 Sheets-Sheet 3

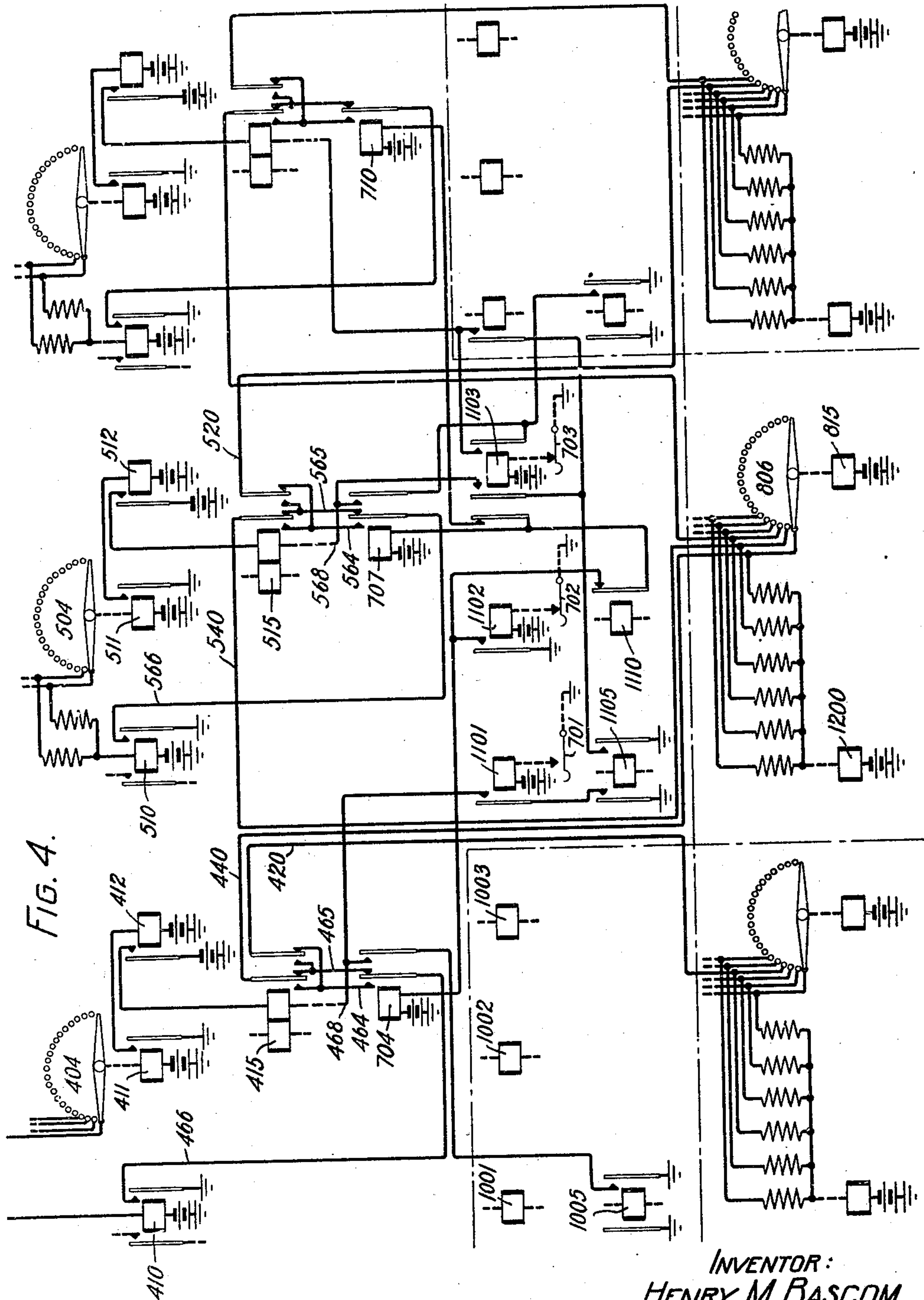


FIG. 4.

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UNITED STATES PATENT OFFICE.

HENRY M. BASCOM, OF BROOKLYN, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEPHONE-EXCHANGE SYSTEM.

Application filed December 15, 1927. Serial No. 240,168.

This invention relates to telephone exchange systems, and more particularly to simplifying the equipment employed by operators in the completion of connections.

5 In large exchange areas incoming telephone calls are usually received by one operator, called the "A" operator and extended by her to one of a plurality of trunks appearing before one of a plurality of operators known
10 as the "B" operators, who complete the connection to the wanted subscriber. Similarly, calls initiated in a machine switching office for termination in a manual office are extended to trunks terminating at the positions
15 of "B" operators. In very busy offices the number of "B" operators is large and the load irregular so that team work means have been provided by which adjacent operators may assist each other in the completion of
20 calls. An example of such an arrangement is the system disclosed in application Serial No. 213,506, filed Aug. 17, 1927, in the name of W. A. Rhodes et al., in which the trunks terminate in plugs at the various positions
25 and automatically operable apparatus is provided to associate the head set of an idle one of a plurality of operators with such plug, whereby she is enabled to answer the call and complete the connection by means of
30 that plug.

To determine whether or not a called line is free to receive a call, the operator tests the line by touching the tip of the plug, to which the call has been extended, to the sleeve of
35 the subscriber's line jack. This operation completes a circuit through her head set causing a click in her receiver if the line is busy. This plug is normally associated with the head set of the operator at the position in
40 which the plug is located. However, where team work arrangements are used, it is necessary to provide means for transferring this busy test circuit from one operator's head set to another, since in completing a team
45 work call the operator uses a plug at the adjacent position.

In systems of the character shown in the above mentioned application of W. A. Rhodes, et al., considerable equipment is nec-
50 essitated merely for the extension of the busy test circuit to the proper operator's head set. Great economy could, therefore, be effected if the multiplicity of interconnecting conductors and transferring apparatus could be
55 eliminated from such a system.

In accordance with the present invention a test circuit from all trunks appearing at each position extends to a loud speaking telephone individual to that position and oper-
able by any operator. This test circuit re- 60
mains the same no matter whether the call is handled by the operator located at the position, by one of the operators adjacent to that position, or by an even more remote
operator. 65

This testing equipment is also of value where automatic listening or straightforward trunking is employed whether on a team work basis or not. In rapid operation as
plugs are removed from jacks they may acci- 70
dentally come into contact with busy jacks thus making unnecessary noises in the operator's receiver and possibly masking the instructions which the operator may be receiving.
In straightforward operation such 75
clicks may even be transmitted over the trunk to the operator at the distant end. The testing equipment of the present invention leaves the path over which instructions are received
80 clear of all such extraneous noises.

The invention has been disclosed in connection with a portion of the disclosure of the above mentioned application of W. A. Rhodes, et al., Figure 1 being a copy of Fig. 2 of that application with the exception of 85
the apparatus eliminated by reason of the present invention. Fig. 2 shows one arrangement of the loud speaking telephone circuit. Fig. 3 shows an alternative arrangement of that circuit. Fig. 4 shows a portion of three 90
adjacent positions outlining the manner of transferring trunks from one operator to another. Fig. 5 shows a front view of several positions equipped with loud speakers and Fig. 6 shows the side view of a position. Fig. 95
7 shows the manner in which Figs. 1, 2 and 4 should be arranged. Where Fig. 3 is used it is substituted for Fig. 2.

Referring first to Figs. 1 and 4 these drawings show portions of the disclosure of the 100
above identified application of W. A. Rhodes et al. and the same numbers are applied to corresponding pieces of apparatus. Reference is made to that disclosure for a more complete description of the operations out- 105
lined herein. Let it be assumed that a call is originated at the subscriber's substation 200 and extended by line finder 203, sender 212 and district selector 213 to the trunk circuit shown in Fig. 1. A circuit will there- 110

upon be established from battery through the left winding of relay 218, upper left winding of repeating coil 219, upper back contact of relays 248 and 245, through the district selector 213 to the sender 212, back through the district selector 213, lower back contacts of relays 245 and 248, lower left winding of repeating coil 219, right winding of relay 218 to ground. The operation of relay 218 connects ground over the right back contact of relay 220 to conductor 221 directly and through resistance 222 to conductor 223. The connection of ground to conductor 223 completes a circuit for relay 410 which initiates the operation of the switch indicated by brush 404 to hunt for the trunk. When the trunk is found a circuit is completed from ground over conductor 221, brush 404, winding of relay 411 to battery. Relay 411 is effective to bring the switch to rest in engagement with the trunk and to initiate other operations.

The operation of relay 410 also closes a circuit from ground at its front contact to conductor 466. The operator who will be summoned by this call is determined by two conditions; the manner in which the trunks have been grouped and the busy or idle condition of the operators. Three trunk groups appear at each physical position, each group served by a group selector, such as that indicated by brush 404 or brush 504. Each position is equipped with three keys such as keys 701, 702 and 703. These keys are so arranged that the operation of one disables the two keys to the left of it, but with this limitation the keys may be operated in any desired combination and when operated serve to arrange the trunk groups in larger groups of any desirable size. If the key 701 is operated at each position an operator will be located at each position and the trunks incoming to each position are normally directed to the operator located thereat. For example, with key 701 operated relay 1101 is operated and the connection of ground to conductor 466 completes a circuit over the back contact of relay 704, inner back contact of relay 415, conductor 440 to the winding of relay 1200 and to a contact of master switch brush 806. Master switch 806 is individual to the physical position at which the trunk shown terminates and serves to connect the operator's telephone of that position with the calling trunk. If the operator at that position is busy, relay 1105 is operated and the operation of relay 412 following the operation of relay 411 closes a circuit from battery over the front contact of relay 412, through the right winding of relay 415, front contact of relay 1101, front contact of relay 1105 to ground. With relay 415 operated conductor 466 is extended over the back contact of relay 704, outer front contact of relay 415, conductor 420 to the master switch at the posi-

tion to the left of the position at which the trunk terminates.

If key 702 were operated, in turn, operating relay 1102, relay 704 would be operated and conductor 466 would normally be extended over the front contact of relay 704, outer back contact of relay 415 to conductor 420 and the master switch at the left-hand position. If the operator at the left-hand position, who is now the home operator, were busy, relay 1005 would be operated and, a circuit would be closed from ground at the front contact of relay 1005, outer front contact of relay 704, right winding of relay 415 to battery at the front contact of relay 412. Therefore, conductor 466 would be extended over the front contacts of relays 704 and 415 to conductor 440 and the master switch of the position at which the trunk is located. For a disclosure of the effect of other key combinations reference is made to the above identified application of Rhodes et al.

When an operator has been associated with the trunk and has ascertained the number of the wanted subscriber from the recorder (not shown) she proceeds to test the wanted line to determine whether that line is busy or idle.

An idle subscriber's line has ground connected to the sleeve thereof through the cut-off relay individual thereto. If the line is busy battery is connected to the sleeve of the line. This battery is supplied if a plug has just been inserted in a multiple jack through a lamp such as lamp 225 and in parallel therewith over a circuit similar to that which may be traced through the winding of relay 238, over the back contacts of relays 236 and 237, lower front contact of relay 229 and the left contact of relay 220. If the called subscriber has answered, battery is supplied to the sleeve of the line through a lamp, such as lamp 225, and over a circuit similar to that which may be traced from battery over the front contact of relay 237 and its winding, lower front contact of relay 229, left contact of relay 220 and the lower winding of relay 229. If the line is busy because a plug has been left in one of the multiple jacks after the calling subscriber has released the calling end of the connection, battery is supplied to the line through the lamp alone.

Assuming that the line represented by jack 227 is busy when the operator tests the line by touching the tip of plug 228 to the sleeve of jack 227, a circuit will be closed from the battery connected in one of the above mentioned ways to the sleeve 227, tip of plug 228, upper back contact of relay 229 to conductor 250. In the system of the Rhodes disclosure, conductor 250 must be extended to the head set of the operator to whom the call has been directed. It is necessary therefore to provide means controlled by the operation of the grouping keys and also by the busy or idle

condition of the various operators which will direct the busy testing lead to the head set of the proper operator. This requires the service of a number of relays. In accordance with the present invention conductor 250 is extended to the contact of key 200, through the network 201, primary winding of transformer 202 to ground. With the key 200 operated the filament circuit of the amplifier tube 203 is completed and the induced current in the secondary winding of transformer 202 is amplified by tube 203 to cause a pronounced click in the loud speaker 204. Resistance 205 is used to regulate the volume of the sound emitted by the speaker.

According to a modification of the invention shown in Fig. 3 two lamps are provided by means of which discrimination may be made between the busy signal placed on lines which have been removed from service because of trouble and that placed on a group of private branch exchange trunks when all trunks of the group are busy. In the latter case a tone current is applied to the sleeves of all trunks of the group, while in the former case a combined direct current potential and tone is connected to the sleeve of the line. When the arrangement of Fig. 3 is used to test an ordinary busy line, the direct potential present on the sleeve of such line causes the operation of relay 307 over conductor 306 which in turn lights lamp 308 as a visual signal that the line is busy. In the same manner as in the circuit of Fig. 2 an audible click is produced in the speaker 304. However, when a group of private branch exchange trunks are tested and are all busy, the alternating current of the tone will have no effect on relay 307 but will be inductively transmitted through the transformer 302, amplified by the amplifier 303 and be effective to operate alternating current relay 309 to light lamp 310. At the same time a tone will be produced in the loud speaker. When the line tested has been made busy artificially because of a trouble condition, both direct potential and tone will be received and both lamps 308 and 309 will light while probably only a tone will be apparent from the loud speaker since the click, although present, may be masked. Lamps 308 and 310 may be of any suitable kind which will respond quickly enough, such as tungsten or neon lamps. Condensers 311 and 312 in parallel with lamps 308 and 309 maintain the lamps illuminated after the release of the corresponding relay 307 or relay 309. Either of these relays may be operated very briefly but, even so, the use of the condenser permits a distinct signal on either or both of the lamps. By the suitable selection of colors for the lamps, for example blue and yellow, the combination color, which would in this case be green, would be indicative of a line in trouble.

Figs. 5 and 6 give an idea of how the loud

speakers and lamps may be arranged. Although the cone type loud speaker has been shown, any suitable type might be employed.

The use of the arrangement of the present invention in conjunction with such a system as disclosed in the above mentioned application of W. A. Rhodes et al., permits the omission of one relay from each trunk circuit, forty to fifty of which appear at each operator's position, five relays from each splitting key circuit and one or more relays from each master switch circuit. It is therefore apparent that the use of a loud speaking telephone common to all of the trunks of a position for making the busy line test effects great economies in complex telephone systems. As pointed out before, it improves operating conditions when applied to other manual systems, although the monetary saving is less.

What is claimed is:

1. In a telephone exchange system, an operator's position, lines terminating at said position, a plurality of cords for connection with said lines, and an amplifying unit and loud speaker common to said cords and associable with any one of said lines for conveying information regarding the condition of said lines.
2. In a telephone exchange system, an operator's telephone, lines terminating at said position, a plurality of cords for connection to said lines, means responsive to an incoming call for connecting said operator's telephone with a cord, and an amplifying unit and loud speaker common to said cords and independent of said telephone, for conveying information regarding the condition of said lines to the operator at said position.
3. In a telephone exchange system, a switchboard position, lines terminating thereat, a plurality of cords for connection with said lines, means to operate said position on a team work basis, a signal common to said cords, associable with any cord and responsive to the busy condition of any line, said signal being available for the use of any operator at said position who, by reason of the grouping of said cords for team work, may have used the cord.
4. In a telephone exchange system, a switchboard position, lines terminating thereat, means for applying different busy conditions to said lines, a plurality of cords for connection with said lines, means to operate the position on a team work basis, an amplifying unit and loud speaker common to said cords, associable with any cord and variously responsive to the busy condition on any line, said speaker being audible to any operator at said position who, by reason of the grouping of said cords for team work, may have used the cord.
5. In a telephone exchange system, a switchboard position, a plurality of cords at said position, an operator's telephone set at

said position, operators' telephone sets at adjacent positions, means automatically responsive to the extension of a call to one of said cords to connect any one of a plurality of
5 said operators' telephone sets with said cord, and a signal common to said cords and independent of said telephone sets for conveying information to the operators.

6. In a telephone exchange system, a switch-
10 board position, a plurality of cords at said position, an operator's telephone set at said position, operators' telephone sets at adjacent positions, means automatically responsive to the extension of a call to one of said cords to
15 connect any one of a plurality of said operators' telephone sets with said cord, means to vary the operation of said connecting means to cause the connection of any one of a different plurality of said operators' telephone
20 sets with said cord, and a signal common to said cords and independent of said telephone sets and of said varying means for conveying information to the operators.

7. In a telephone exchange system, a
25 switchboard position, lines in various conditions, a plurality of cords at said position, an operator's telephone set at said position, operators' telephone sets at adjacent positions, means automatically responsive to the extension of a call to one of said cords to connect
30 any one of a plurality of said operators' telephone sets with said cord, and a signal com-

mon to said cords and independent of said telephone sets for conveying information to the operators regarding the condition of said
35 lines.

8. In a telephone exchange system, a switch-
board position, a plurality of cords at said position, an operator's telephone set at said position, operators' telephone sets at adjacent
40 positions, means automatically responsive to the extension of a call to one of said cords to connect any one of a plurality of said operators' telephone sets with said cord, and an amplifying unit and loud speaker common to
45 said cords and independent of said telephone sets for conveying information to the operators.

9. In a telephone exchange system, a switch-
board position, lines in various conditions, a
50 plurality of cords at said position, operators' telephone sets at adjacent positions, means automatically responsive to the extension of a call to one of said cords to connect any one of
55 a plurality of said operators' telephone sets with said cord, and an amplifying unit and loud speaker common to said cords and independent of said telephone sets for conveying information to operators regarding the condition of said lines.
60

In testimony whereof, I have signed my name to this specification this 13th day of December, 1927.

HENRY M. BASCOM.