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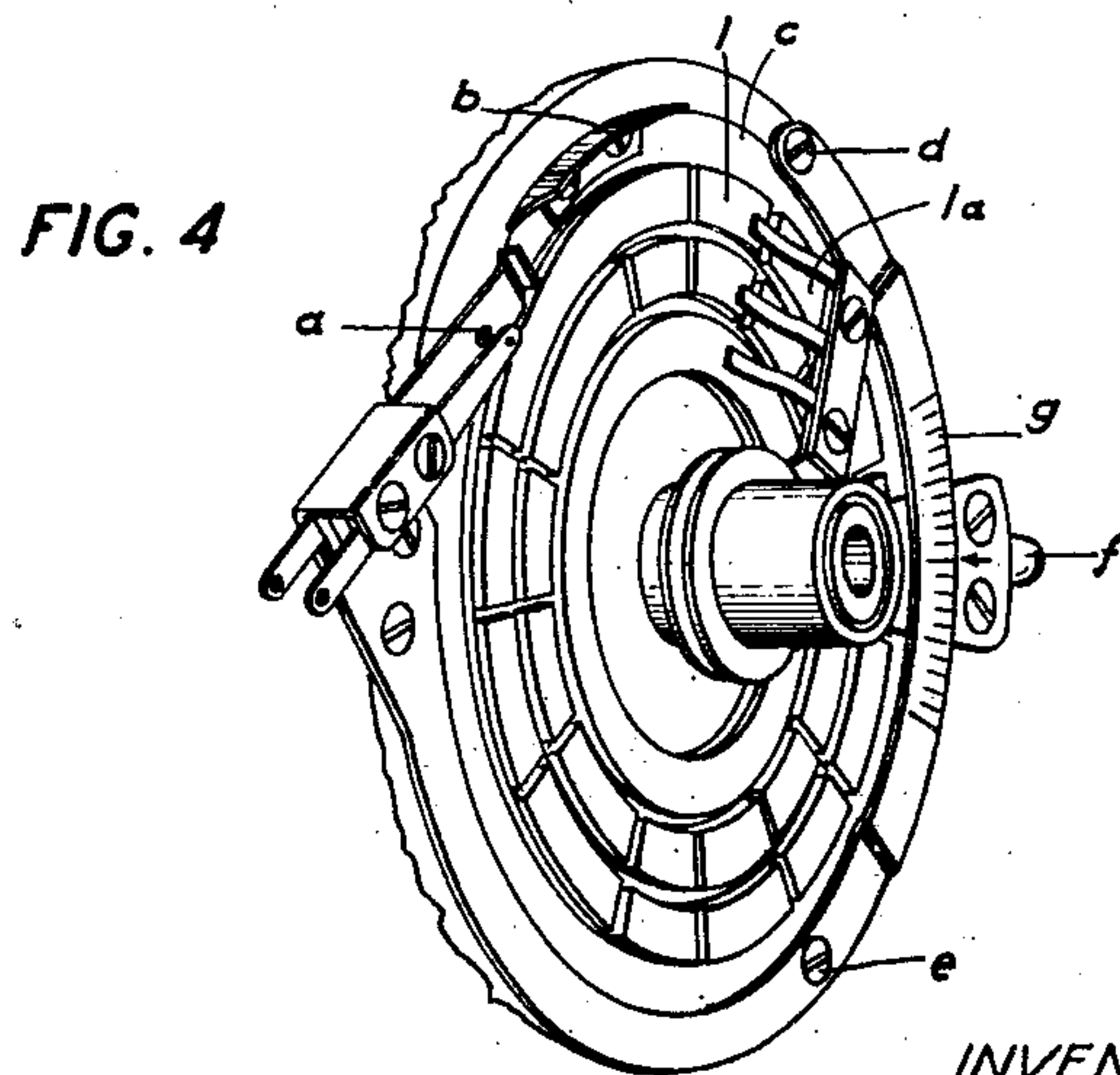
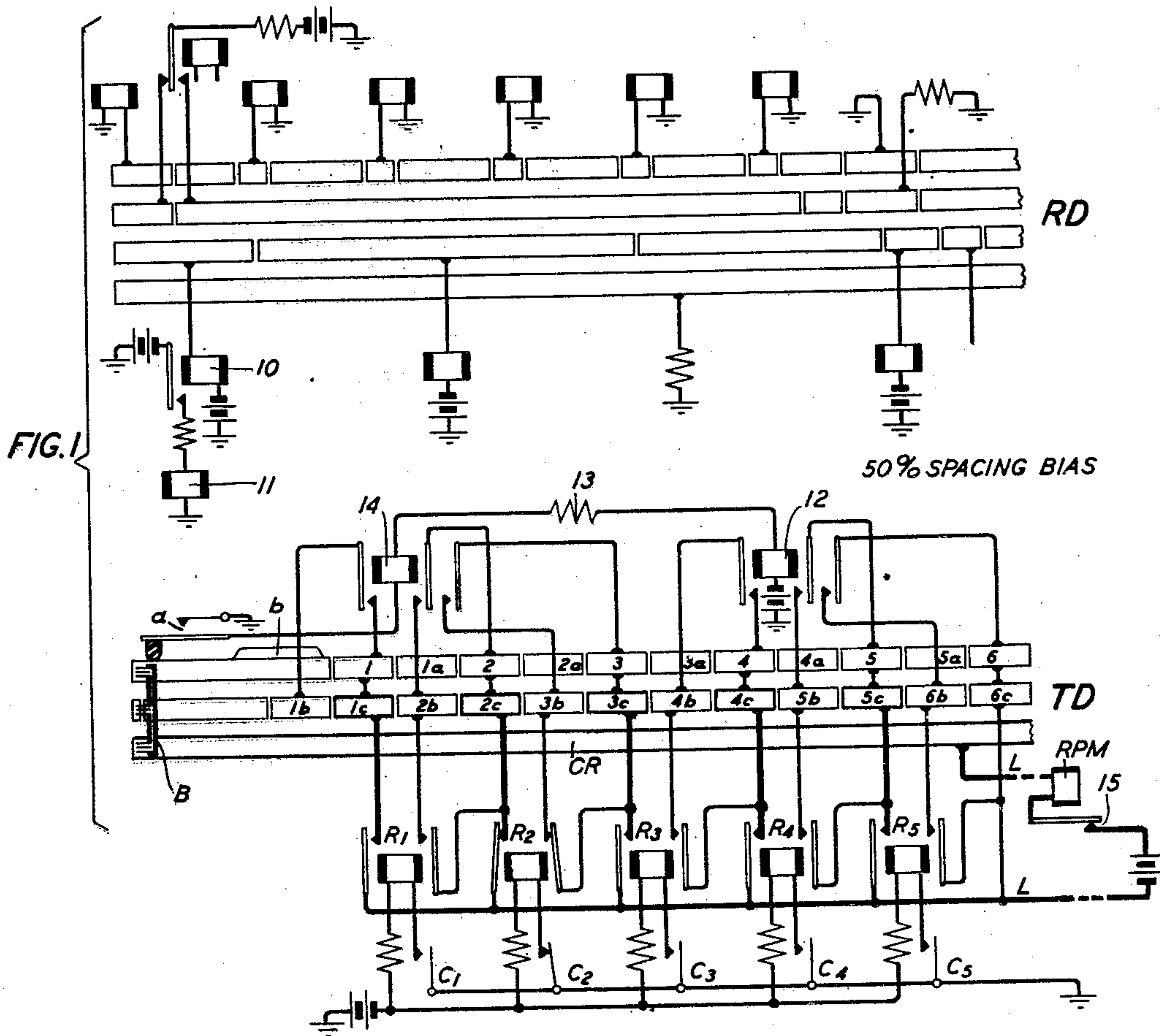
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TRANSMITTER OF VARIABLY BIASED IMPULSES

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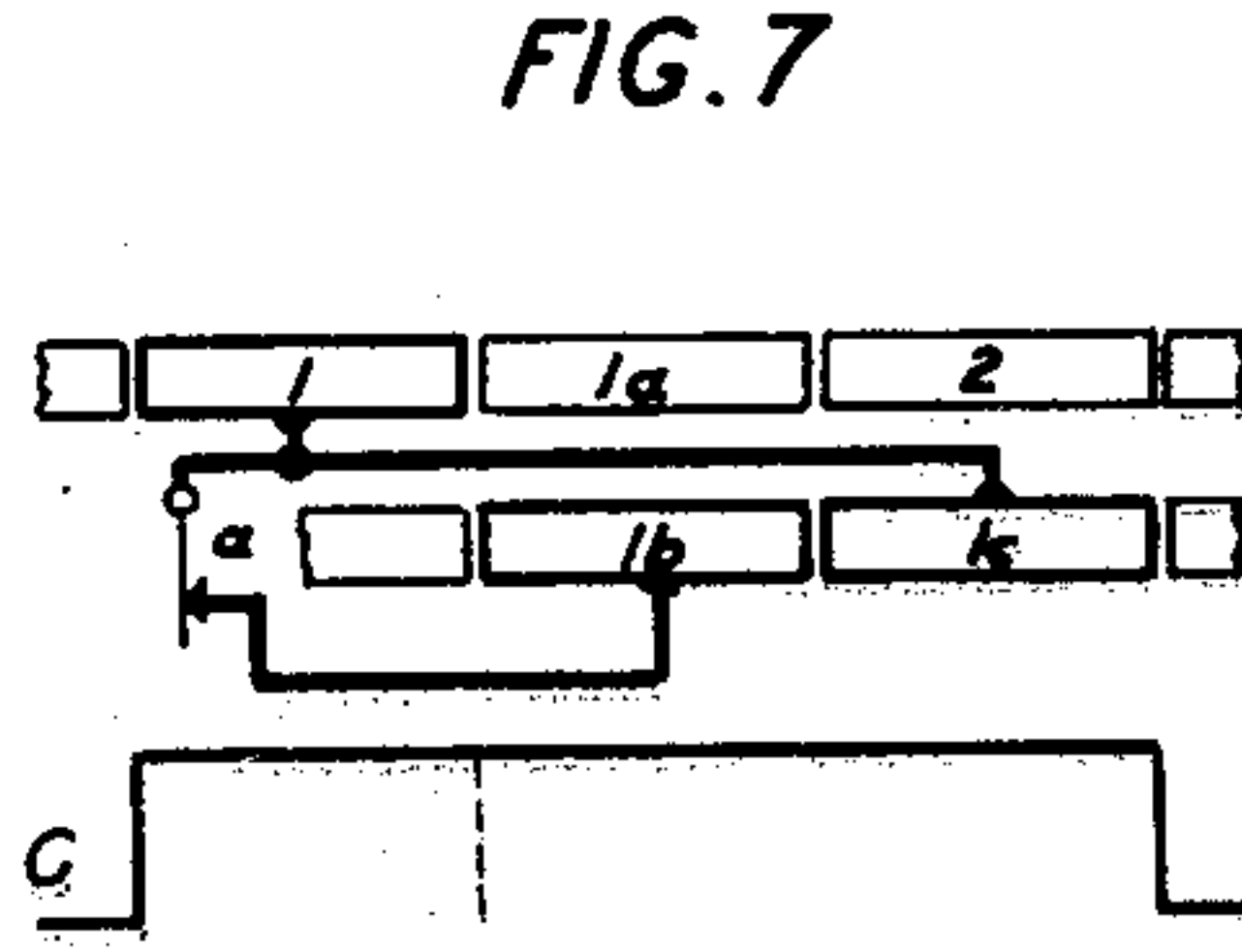
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2 Sheets-Sheet 2



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TRANSMITTER OF VARIABLY BIASED IMPULSES

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This invention relates to signaling systems and more particularly to telegraph circuits in which the signals are subjected to distortion or bias.

5 In transmitting telegraph signals, each made up of a plurality of impulses having a definite length, distortion of the impulses and therefore of the signals may be produced by various causes inherent in the line or in the
10 apparatus connected therewith or both. The distortion with which this invention is concerned manifests itself in increasing or decreasing the duration of the impulses which constitute the signals transmitted over the
15 line. Such undesired conditions may result, for example, from the effect of the travel time of the armatures of the relays of the telegraph system, or from the transmission characteristics of the circuit.

20 Herein the expression "marking bias" will be used to describe the distorted condition of signals in which the marking impulses are of longer duration than the spacing impulses, and conversely the term "spacing bias" will
25 be applied to those signals in which the spacing impulses have a longer duration than the marking impulses.

This lengthening or shortening of the impulses may interfere with the proper recording of the signals. In printing telegraph
30 system, biasing of the signals may result in printing false characters. If marking impulses are too short (spacing bias) some of the impulses may not actuate their respective
35 receiving elements and this will result in the printing of errors. Also, if the marking impulses are too long they may improperly operate receiving elements corresponding to impulses intended to be spacing, also resulting
40 in the printing of errors. On account of this possible distortion of the signals it is desirable to design and/or to adjust the printers to correctly record signal impulses having as great a degree of bias as possible.

45 An object of this invention is to vary, between approximately 50% marking and 50% spacing, the bias of transmitted signal impulses.

50 A further object of this invention is to transmit signals having a bias which can be

adjusted between the limits stated to practically any desired degree. A feature of this invention resides in an arrangement for indicating the degree and kind of bias of the transmitted signals.

Another object is to test receiving apparatus for telegraph signals to determine the maximum bias of the received signals which the apparatus will tolerate.

To attain the above and other objects of this invention, a distributor adapted to transmit biased signals, with the bias variable over a wide range, is connected to the receiving apparatus to be tested. If between the distributor and the receiver there are no repeaters or other equipment liable to cause further bias of the signals, the capability of the receiver to record biased signals may quite accurately be determined.

In the distributor two segmented ring having corresponding segments connected in parallel are traversed by a brush for the simultaneous transmission of the same signal from each ring. The rings may be adjustable relatively to each other so as to change the phase relation between the impulses transmitted from one ring and those transmitted from the other. If the rings are so adjusted that the transmission of an impulse from one segment is immediately followed by an impulse from the corresponding segment of the other ring, the spacing and marking impulses will be of equal length and the signals will therefore have zero bias. If the impulses overlap in whole or in part, the marking impulses become shortened and the signals transmitted have a spacing bias. When a signal having a marking bias is transmitted, an impulse from one ring is commenced at some interval subsequent to the termination of an impulse from the other ring. During this interval, a separate arrangement operates to maintain the impulse.

The two segmented distributor rings may conveniently be viewed as being two transmitters each transmitting the same impulses to the line. One of the transmitters may be adjusted as to phase with respect to the other. This viewpoint may serve to classify the operation of the distributor.

In the accompanying drawings, which disclose the details of one embodiment of the invention, Fig. 1 represents a schematic circuit diagram of a conventional distributor having transmitting and receiving rings in which the transmitting rings and their associated elements have been modified in accordance with the invention. With the adjustment indicated signal impulses of approximately 50% spacing bias are transmitted;

Fig. 2 is a similar diagram of the transmitting segments only of Fig. 1 in their adjustment for transmitting signals of approximately 0% bias;

Fig. 3 is a similar diagram of the apparatus of Fig. 2 adjusted to transmit similar impulses of approximately 50% marking bias;

Fig. 4 is an approximately perspective view of certain mechanical details of the elements for adjusting the movable segments of the distributor; and

Figs. 5, 6 and 7 are detail views of a portion only of the transmitting segments of Figs. 1, 2 and 3 corresponding respectively to their positions in Figs. 1, 2 and 3.

Referring more particularly to Fig. 1, the receiving distributor RD is of a known type and is mounted on the same rotating shaft or to otherwise rotate in synchronism with the transmitting distributor TD which is modified in accordance with the invention. The principles of the invention are inherent in the transmitting distributor TD whether it is associated with, or disassociated from the receiving distributor. The distributor shown is of the type commonly known as "start-stop" in which one segment is provided for a starting impulse, five segments for code impulses, and one segment for a stop impulse. However, the principles of the invention are applicable to distributors of other types. In Fig. 1 a sending start relay 10 and a sending start magnet 11 controlled thereby serve to control the starting of the distributor for each rotation thereof. These elements constitute the sole features of the receiving distributor RD necessary to be here discussed or described.

Referring to Figs. 1, 2 and 3 (distributor TD), the segments 1, 1a, 1b, 1c, etc. are one-half the usual length, that is, one-half the length necessary for the transmission of uniform impulses with 0% bias. In the description herein given it will be assumed that the insulating space between the segments is of negligible circumferential dimension. In practice this space need be but small to secure satisfactory insulation between adjacent segments. For this reason the figures relating to percentages of bias or percentages of full-length impulses herein given will be approximate to the extent necessitated in a practical structure by giving a finite dimension to the insulating spaces between the segments. The

series of segments 1, 1a, 2a, etc. are adjustable to a total extent of the length of two segments to the left from their position in Fig. 1. The other segments and the common ring CR are fixed. A cam b is conveniently mounted upon the member carrying the adjustable segments 1, 1a, etc. When the cam b is moved to the left it closes the contact a at a point corresponding to about 5% spacing bias. Contact a, when closed, closes a circuit from battery, through relay 12, resistance 13, relay 14, contact a to ground. This operates relays 12 and 14. When they are operated they connect segment 1 with segment 1b, segment 2 with segment 2b etc. through their several contacts. One contact is provided for connecting the segment 6 with the segment 6b. Segments 6, 6b, 6c are stop segments and always transmit a marking impulse. The transmitting contacts, which are set up in a known manner by selecting apparatus to control the sequence of impulses representing the particular character to be transmitted, are designated c1, c2, etc. These contacts control relays R1, R2, etc., whose left-hand contacts are respectively caused to be opened when the controlling transmitting contacts c1, etc., respectively are opened and closed when the respective transmitting contacts are closed. The relays R1, R2, etc. also have right-hand contacts which are closed when their left-hand contacts are closed. The purpose of these right-hand contacts is to prevent an interruption in the intermediate portion of the long impulse caused by the transmission of two or more consecutive marking impulses when the rings are adjusted for the transmission of marking bias as indicated in Fig. 2. The segment 6 is slightly shortened on its right hand end so that its length is but 45% of a perfect impulse. One object of this is that when the movable segments are adjusted to the extreme spacing bias condition shown in Fig. 1, the segment 6 will not bend the edge of the brush.

Referring to Fig. 4 the contact a is controlled by the cam b which is carried by a hard rubber or other suitable circular ring c on which are mounted the segments 1, 1a, etc. By loosening the adjusting screws, d, e, etc., the ring c carrying adjustable segments may be moved by the handle f, the extent of the movement being indicated by a scale g. Approximately such means for adjusting segments is known in the art, the new mechanical feature of the present construction being contact a and the arrangements whereby it is controlled by cam b.

In Figs. 1, 2 and 3 is shown a line L in which is included a conventional representation of a receiving printer in the form of a magnet RPM, and a sending transmitter which, when idle, normally closes the line at the contact 15. It will be assumed that it

is desired to test the ability of the printer RPM to operate on biased signals.

The operation will now be discussed in connection with Figs. 1, 2, 3, 5, 6 and 7.

5 Figs. 1 and 5 represent the adjustment of the apparatus for the transmission of impulses with 50% spacing bias. The length of a normal impulse would cover two segments such as 1b, 1c. However, the brush B
10 in passing over the segment 1b closes no circuit. In passing over segment 1c a circuit is closed from the left-hand contact of relay R1, through segment 1c, brush B and ring CR. When contact c1 is closed a marking
15 impulse of 50% length is transmitted as indicated in Fig. 5. The relay R1 also closes its right-hand contact. This closes a path from the segment 2b, through the right-hand contact of R1, to the left-hand contact of R2.
20 If the second impulse transmitted under the control of the contact c2 is a marking impulse, a path will be closed from ring cR, through brush B, segment 2b, right-hand contact of relay R1, and left-hand contact of re-
25 lay R2, thus preserving the continuity of the impulses as in actual transmission. If, however, the next impulse is a spacing impulse the relay R2 will not be operated and the path closed by the right-hand contact of
30 relay R1 will be without effect.

The ring of segments 1, 1a, etc. may be adjusted to the left to decrease the spacing bias until finally a position of 0% bias is reached as indicated in Figs. 2 and 6. Referring to
35 those figures it will be seen that at a point corresponding to about 5% spacing bias the contact a is closed by the cam b. There may be a small region between 0% bias and 5% spacing bias in which the segment 1 will be
40 ineffective to increase the length of the transmitted impulse. This will not be important because it will practically never be necessary in testing to send signals having a bias between 0 and 5% spacing. When the adjusta-
45 ble segments have reached the position shown in Figs. 2 and 6 the contact a will cause the relays 12 and 14 to be operated. Their contacts will close circuits connecting segment 1 with segment 1b, segment 2 with segment 2b, seg-
50 ment 3 with segment 3b, etc. From inspection of the drawings it will be clear that the length of the marking impulse under the influence of relay R1 will be equal to the length of segment 1 plus the length of the segment
55 1c and so likewise for the impulses controlled by the other relays R2, R3, etc.

If the adjustable ring of segments 1, 1a, etc. is adjusted still further to the left, the condition shown in Figs. 3 and 7 is ap-
60 proached. Contact a remains closed and the segment 1 remains connected to the segment 1b. A marking impulse, transmitted by the closure of the left-hand contact of relay R1, under this condition, is equal to the combined
65 lengths of the segments 1, 1b and 1c. Here

likewise the right-hand contacts of the relays R1, R2, etc. will serve to preserve the continuity of successive marking impulses whenever the segments 1b, 2b, etc. are slightly
70 to the left of the respective segments 1a, 2a, etc., that is, for conditions of just less than 50% bias marking. However, the right-hand contacts of the relays R1, R2 will be ineffective whenever the succeeding impulse
75 is a spacing impulse.

The distributor as described is capable of adjustment to send out signal impulses with any desired degree of bias for ascertaining the precision of adjustment of receiving
80 printers under repair, for sending variably biased signal impulses to subscribers' sets for testing and adjusting their receiving printers, for testing lines and circuits to be used for printer operation, and for other purposes.
85 It may also serve in emergency for the actual transmission of signals. The principles of the invention are not limited in the application to start-stop distributors, but may be employed in distributors of the continuously
90 rotating type. Certain modifications in the circuit arrangements may be made in modifying distributors of slightly different design to incorporate embodiments of the present invention.

What is claimed is:

1. In a distributor for the transmission of biased signals, a plurality of sets of distribu-
tor transmission segments and means for ad-
justing one set of segments with respect to
100 the other whereby any normal combination of impulses may be transmitted with any desired degree of bias within certain limits.

2. In a distributor in accordance with claim 1 a circuit controller effective under
105 the control of the adjustment of one of said sets of segments with respect to the other to connect another set of segments to at least one of the first named sets of segments to fill in gaps between adjacent marking im-
110 pulses.

3. In a communication system, the method of testing recording apparatus which method
115 comprises transmitting signal characters at a known rate to said apparatus, said characters consisting of code combinations of spacing and marking impulses, gradually varying the length ratio of the spacing and marking impulses whereby to determine
120 within what limits the signal is correctly recorded, and simultaneously with the transmission indicating the ratio of the impulse lengths at which incorrect recording occurs.

4. A distributor for impulse transmission and reception systems in which a solid ring
125 cooperates with a plurality of segmented rings, the segments of the segmented rings being of a length less than a normal unit impulse to be transmitted, means whereby at least one of the segmented rings may be ad-
130 justed with respect to another to vary the

length of the impulses transmitted, and a brush conductively bridging all of said rings.

5. A distributor having a plurality of series of segments, one series of which is adjustable with respect to another, a contact controlled by the position of adjustment of said adjustable segments, circuits controlled by said contact to connect or disconnect certain segments of one of said series to or from certain segments of another of said series.

6. A transmitter for the transmission of spacing and marking impulses of variable length comprising a series of segments spaced apart by a distance greater than the necessary dimension of an insulating space between segments and of a length suitable for the transmission of minimum length impulses, another series of segments adjustable beyond the ends of said first series of segments respectively, and a conductive brush bridging both of said series of segments to the common ring.

7. In an arrangement in accordance with the immediately foregoing claim, a relay arrangement for connecting certain segments located between the ends of one of said first series of segments and the ends of the other series of segments with certain segments of one of said series of segments.

8. In a distributor, a series of segments of a length adapted for minimum marking, another series of segments adjustable to extend the length of impulses transmitted by the first series from a minimum marking length to a length of approximately unbiased signals, contacts controlled by further adjustment of said adjustable series of segments to control the connection of still other segments to further increase the length of transmitted impulses up to the maximum marking bias, whereby substantially any degree of biased signals between a minimum marking and a maximum marking may be transmitted.

9. A distributor having fixed segments and movable segments, a scale adjacent to the movable segments to indicate the bias of the signals corresponding to a particular condition of adjustments.

10. A distributor having fixed segments and movable segments, a contact controlled by movement of the movable segments to certain positions to control the connection of certain of the fixed segments to certain of the movable segments.

11. A distributor of the rotary type having segments adjustable to transmit to a line signal impulses variable as to bias within a certain range of bias, the degree of bias of impulses as transmitted to the line being solely dependent upon the adjustment of the adjustable segments, in combination with an indicator to indicate the exact degree of bias for which the segments are adjusted.

12. A distributor for transmitting to a line

a succession of marking impulses and spacing impulses adjustable as to duration and being arranged in accordance with a code to indicate a desired character, said distributor comprising a segment for transmitting a start impulse, a segment for transmitting a stop impulse, and a double series of segments for transmitting code impulses, said double series of segments being adjustable with respect to each other from a normal position of zero bias in one direction to apportion a part of the time of spacing impulses to marking impulses and in another direction to apportion a part of the time of marking impulses to spacing impulses.

In testimony whereof, we have signed our names to this specification this 11th day of August, 1930.

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ARTHUR E. HUNT.