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MEANS FOR CONTROLLING TELEGRAPH BIAS

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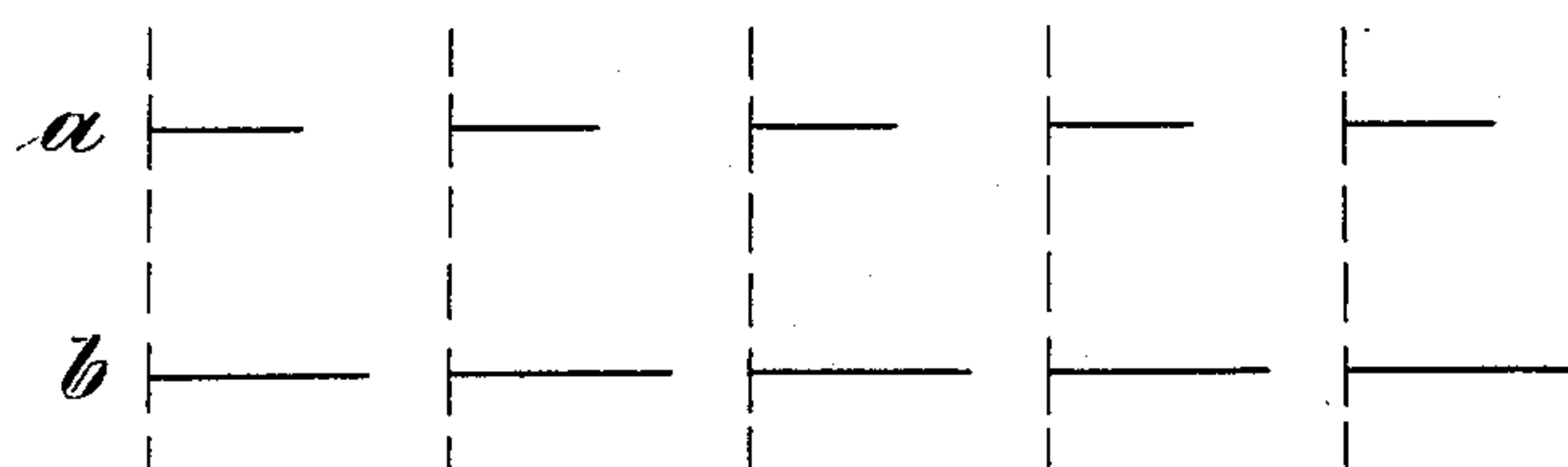
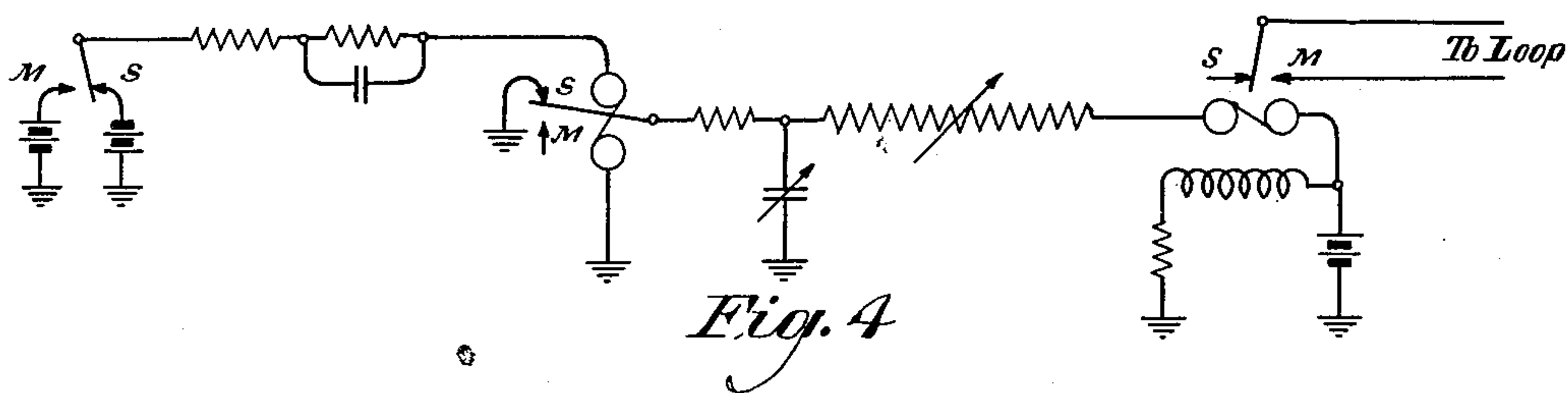
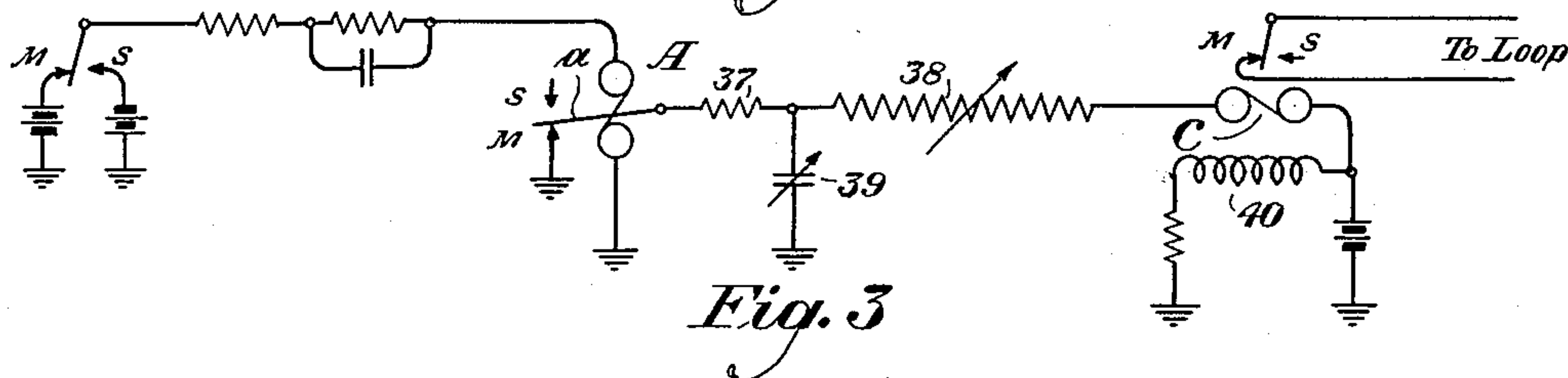
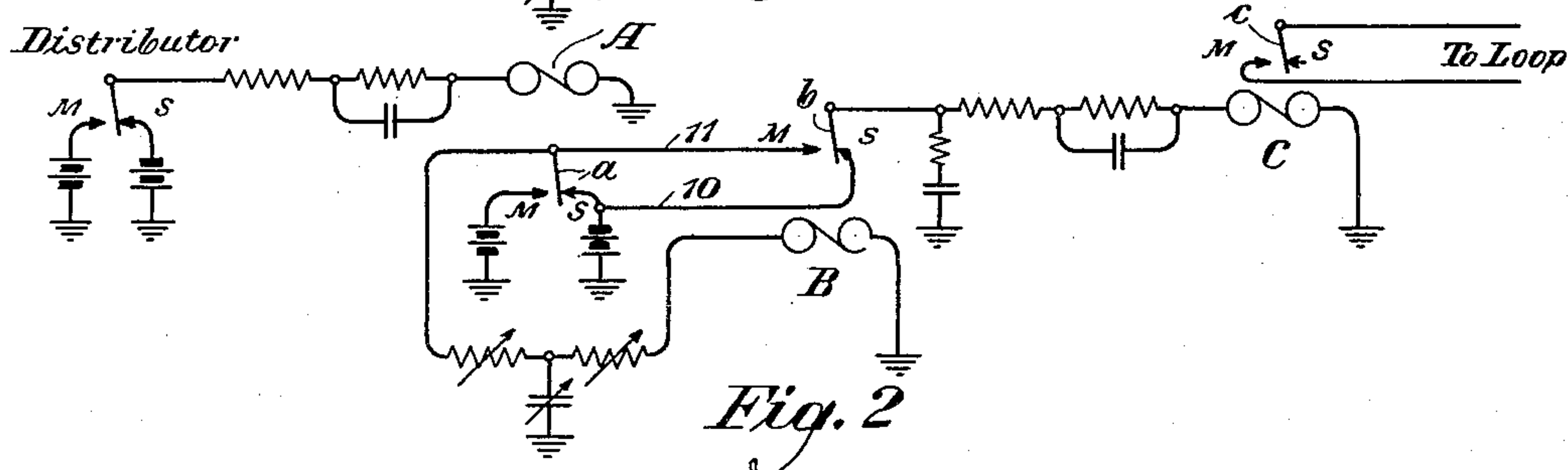
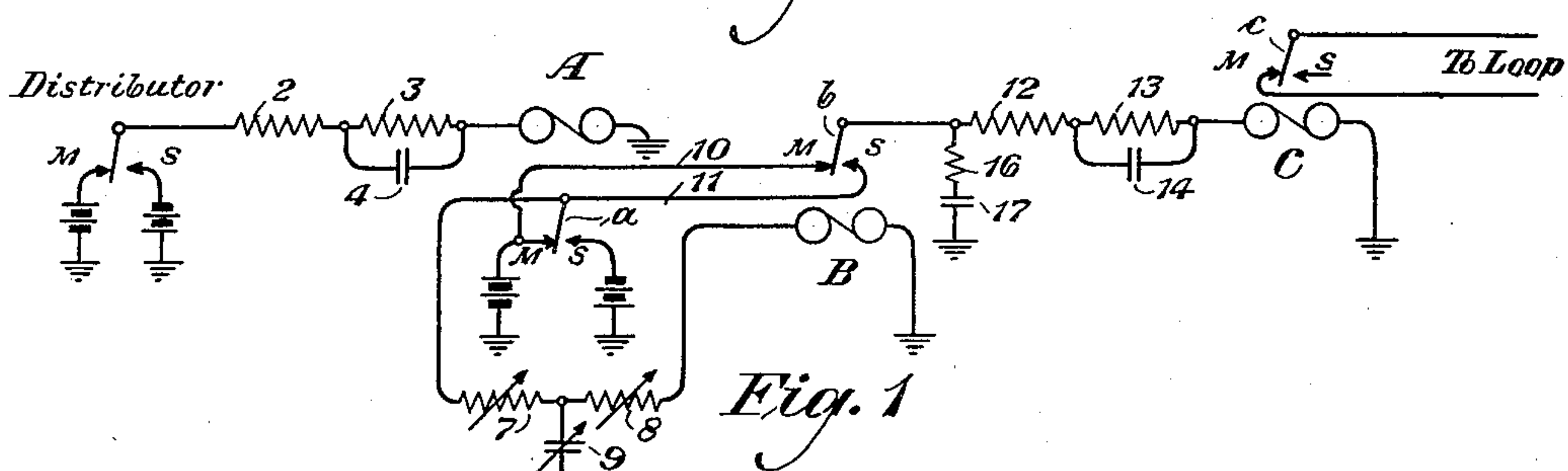
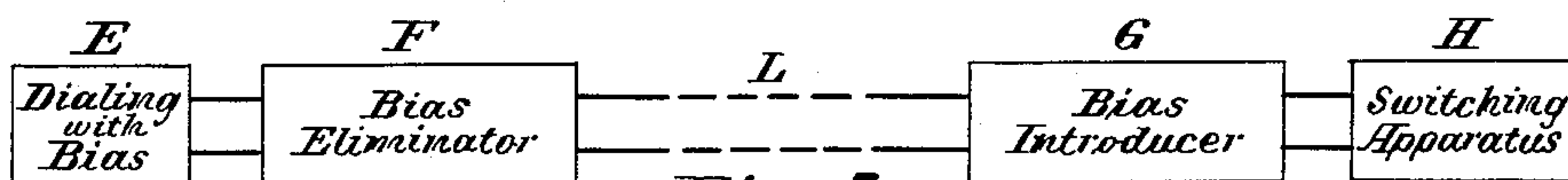


Fig. 6

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BIASRoy B. Shanck, Flushing, N. Y., assignor to
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This invention relates to methods and means for controlling telegraph bias, and its object is to afford means for changing the relative time given to marking and spacing of telegraph signals. One purpose of the invention is to devise a simple and effective means for receiving signals with a certain bias of marking and spacing intervals, removing that bias, transmitting this unbiased signal and then restoring the bias, the whole being adapted for use in connection with dialing over long distance lines. Another purpose is to devise a system for testing or measuring telegraph transmission quality in which one increases the bias of telegraph signals in one direction or the other until failure occurs at the receiving end and thus obtains useful information regarding the characteristics of a telegraph signaling channel. Still another purpose of this invention is to devise a system for changing the bias of telegraph signals without introducing the additional distortions which usually accompany such bias changers as are now in use.

The invention will be better understood by reference to the following specification and accompanying drawing in which Figure 1 shows a circuit arrangement for increasing the marking bias of telegraph signals; Fig. 2 shows a circuit for increasing the spacing bias; Figs. 3 and 4 show modified circuits for accomplishing the same results; Fig. 5 shows the application of such circuits to dialing over long distances where one desires to take advantage of the better transmission characteristics of unbiased signals; and Fig. 6 is a comparison between biased and unbiased signals.

The term "biased signal" is used in connection with signals in which the marking and spacing intervals are unequal. Thus, if the length of a unit marking interval is the same as that of a unit spacing interval, there is no bias, but if the length of the marking interval is increased by 50 per cent., the total interval of marking and spacing remaining the same, there is said to be a 50 per cent. marking bias. This is illustrated in Fig. 6, in which the portion *a* represents unbiased signals and *b* represents the same signals but with 50 per cent. marking bias.

The basic arrangement of the present invention, so far as the control of bias is concerned, is to have a distributor or other transmitter sending signals operating a relay with very good wave shape, so as to start each marking (or spacing) impulse, the termination of each marking (or spacing) impulse being effected by an

auxiliary slow-acting relay. The delay in terminating each impulse may be controlled by any one of several methods for changing the operating time of a slow-release relay. The methods and circuits for accomplishing this are illustrated in Figs. 1 to 4.

Referring more specifically to Fig. 1, the relay A is of a type which will follow faithfully signals sent by the distributor shown at the left of the circuit, the wave shape being of excellent quality due to the network comprising resistances 2 and 3 and the shunting condenser 4. When the armature of A moves from marking to spacing, a spacing impulse is transmitted through an artificial line to a slow-release relay B. This artificial network comprises variable resistances 7 and 8 and condenser 9. After an interval which may be varied by adjusting the artificial line, the armature *b* of the relay B moves to spacing and sends a spacing impulse of good wave shape to relay C, which repeats it faithfully to the loop of the telegraph circuit. However, when the distributor goes from spacing to marking it will be seen that the relay A immediately repeats the marking impulse directly to relay C so that it is sent out to the loop with substantially no delay. This impulse, it will be noted, passes over the wire 11 on to the relay C while the tongue *b* is on spacing contact, and at the time under consideration this tongue *b* will still be on spacing contact. At the same time the marking impulse is sent to relay B, and after an interval the tongue moves from spacing to marking, this having no effect except to interrupt momentarily the current in C. Thus it is seen that this arrangement will lengthen the interval that the tongue *c* of relay C is on marking contact and so will impress marking bias by delaying the termination of each marking impulse. In the circuit of relay C there is shown the network comprising the resistances 12 and 13 and the capacity 14, these performing a function similar to that of the resistances 2 and 3 and capacity 4. Also, a device for minimizing the interruption of current in relay C due to movement of armature *b* from S to M is shown in the resistance 16 and condenser 17 connected to ground.

To obtain spacing bias a similar arrangement is used, as shown in Fig. 2 in which, it will be noted, the only change over the circuit arrangement of Fig. 1 is the interchange of the connections 10 and 11, the wire 10 which formerly went between the marking contacts of A and B now being between the spacing contacts, and the wire 11 which formerly connected the tongue *a*

to the spacing contact of B now going from this same tongue to the marking contact of relay B. By following through the circuit as in the case of Fig. 1, it will be seen that the circuit of Fig. 2 will delay the termination of spacing impulses without materially affecting the beginning of such impulses.

Fig. 3 is an alternative arrangement of that of Fig. 1 and makes use of a two-stage repetition. The first stage, by means of the relay A, which corresponds to the relay A of Fig. 1, repeats with very good wave shape, and the second relay C makes use of the open-and-close method with prompt build-up and slow decay of current. This relay C is of the polar type with electrical bias 40. The movement of the tongue *a* to marking position will initiate a marking signal to the telegraph loop very promptly, but the termination of the marking interval when the tongue *a* moves to spacing contact is delayed because of the network comprising the resistances 37 and 38 and the grounded condenser 39. This circuit arrangement thus introduces a marking bias.

Fig. 4 is a circuit corresponding to Fig. 3 but adapted for introducing spacing bias. The only change over Fig. 3 required for this purpose is the interchange of the connections to the contacts of the two relays.

It is to be pointed out that, whereas and so far as I am aware, the various electrical and mechanical biasing circuits or devices now in use introduce more or less distortion characteristics, the circuits herein described introduce practically pure bias and I consider that feature an important part of my invention.

The arrangements shown have been thus far described in terms of receiving an unbiased signal and introducing bias of desired amount in either direction, and the amount of bias can be varied over wide limits. As such it is especially well adapted for testing the transmission qualities of a telegraph channel in the manner spoken of above since it introduces practically pure bias without other distortion. It is apparent, however, that these circuits may be used in the reverse process of receiving a signal with bias in either direction and removing this completely or to such extent as desired. In this connection it lends itself especially well to the first mentioned purpose of this invention. It should be noted that in present dialing of telephone numbers it is the established practice to send out signals which have a spacing bias of about 35 per cent., this being especially suited for the type of apparatus now used in machine switching. While there are certain advantages to this for short distances, it should be borne in mind that over long distances, as between cities, the transmission of such biased dialing signals is not so readily accomplished as would be the case if the signals were unbiased. Referring, for example, to the signals *b* of Fig. 6, it is apparent that the frequencies of the essential harmonics which must be transmitted in order to have satisfactory wave shape at the receiving end are higher than for the signals *a*. This implies that either the signals must be sent at a lower rate or a signaling channel of a wider frequency band width must be used. As a matter of fact, an increase in rate of about 50 per cent. in speed of signaling is possible if unbiased signals are used instead of signals with 35 per cent. bias.

A part of my invention then resides broadly in taking dialing signals with a bias, removing the bias, transmitting these signals over the long

transmission line, reintroducing the bias and using them on the standard switching mechanism to make connection to the subscriber's station. This is shown in Fig. 5, in which there appears a station for dialing with the usual bias. This dialing might originate at a subscriber's station E or might be initiated at the central station. In any event, at the central station they are then impressed upon a bias eliminator F and in turn are impressed on the transmission line L. At the receiving end they pass through a bias introducer G and from there go to the switching apparatus H. The bias eliminator and the bias introducer may be of any suitable form, but in particular may be of the form described in connection with Figs. 1 to 4.

While my invention as illustrated in Figs. 1 to 4 has been described in connection with two specific applications, it is to be understood that it may find application in other fields such, for instance, as in adjusting the amount of bias in telegraph signals other than those mentioned thus far.

What is claimed is:

1. In a system for dialing between remote stations, means for producing normal biased dialing signals, means for removing the said bias, a transmission line on which the unbiased dialing signals are impressed, means at the receiving end for reintroducing the bias and switching mechanism on which the resultant biased signals are impressed.

2. In a signaling system, a circuit for changing the bias of a telegraph signal comprising a repeating relay, a second repeating relay, an operating circuit for said second relay completed over the armature of said first relay, electrical delay means in said operating circuit, means for connecting one of the contacts of said second relay to the corresponding contact of said first relay, and means for connecting the other contact of said second relay to the armature of said first relay.

3. In a signaling system, a circuit for changing the bias of a telegraph signal comprising a repeating relay, a second repeating relay, an operating circuit for said second relay completed over the armature of said first relay, electrical delay means in said operating circuit, means for connecting the marking contact of said second relay to the marking contact of said first relay, and means for connecting the spacing contact of said second relay to the armature of said first relay.

4. In a signaling system, a circuit for changing the bias of a telegraph signal comprising a repeating relay, a second repeating relay, an operating circuit for said second relay completed over the armature of said first relay, electrical delay means in said operating circuit, means for connecting the spacing contact of said second relay to the spacing contact of said first relay, and means for connecting the marking contact of said second relay to the armature of said first relay.

5. In a telegraph signaling system, a circuit for changing the bias of marking and spacing signals comprising a source of signals of a certain degree of bias, a relay of faithful reproduction controlled by said signals, a second relay having an operating circuit completed over the armature of said first relay, means for connecting one of the contacts of said second relay to a corresponding contact of said first relay, means for connecting the other contact of said second relay to the armature of said first relay, and a variable artificial line in said operating circuit of said second relay

to delay the time of termination of the individual signal elements transmitted by said second relay and thus increase the bias.

5 6. In a telegraph signaling system, a circuit for changing the bias of marking and spacing signals comprising a relay to receive telegraph signals of a given amount of bias, a second relay controlled by the first to repeat to the telegraph loop, a network associated with the relays to delay
10 termination of either the marking or spacing signals and so change the degree of bias, means for varying the network to vary the bias, means for connecting one of the contacts of said second relay to a corresponding contact of said first relay,
15 and means for connecting the other contact of said second relay to the armature of said first relay.

7. In a signaling system, a circuit for changing the bias of a telegraph signal comprising a repeating relay, a second repeating relay adjacent thereto and controlled by the first, and an artificial line associated with the relays operative on the signals coming from the first relay to change the ratio of marking to spacing interval as desired.
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8. In a telegraph signaling system, a circuit for changing the bias of marking and spacing signals comprising a distributor giving signals of a certain degree of bias, a relay of faithful reproduction, the armature of which repeats to a second relay adjacent to the first which in turn repeats to the telegraph loop and a variable artificial line between the relays to delay the time of termination of one of the signals and thus increase the bias.
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9. In a telegraph signaling system, a circuit for changing the bias of marking and spacing signals comprising a relay to receive telegraph signals of a given amount of bias, a second relay adjacent to and controlled by the first to repeat to the telegraph loop, a network associated with the relays
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to delay termination of either the marking or the spacing signals and so introduce bias and means for varying the network to vary the bias.

10. In a signaling system, a circuit for changing the bias of marking and spacing signals comprising a relay to receive telegraph signals of a given amount of bias, a second relay adjacent to and controlled by the first to repeat to the telegraph loop, a network comprising variable resistance and condensers associated with the relays to delay the termination of one only of said marking and spacing signals and so introduce variable bias.
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11. In a signaling system operating on telegraph signals of different degrees of bias in different parts of the system, means at one point for producing signals of one degree of biasing, means at another point in the system for changing the degree of biasing, said means comprising a relay and a delay network for delaying the time of termination of either the marking or the spacing signals and hence changing the ratio of marking to spacing interval.
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12. In a signaling system, a circuit for changing the bias of a telegraph signal comprising a repeating relay, a second relay adjacent thereto and controlled by the first, a variable artificial line associated with the second relay and so controlled by the first relay as to cause the second relay to be slow acting in one direction to change the bias of the signal from said second relay.
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13. Means to be interposed in a transmission line for changing the bias of telegraph signals without distortion thereof consisting of a relay to begin a signaling element, another relay to terminate such element and adjustable delay means to determine the operation of the second relay at a proper time after the operation of the first relay.
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