

March 31, 1936.

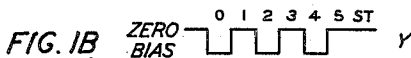
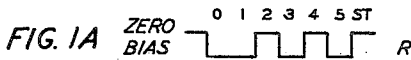
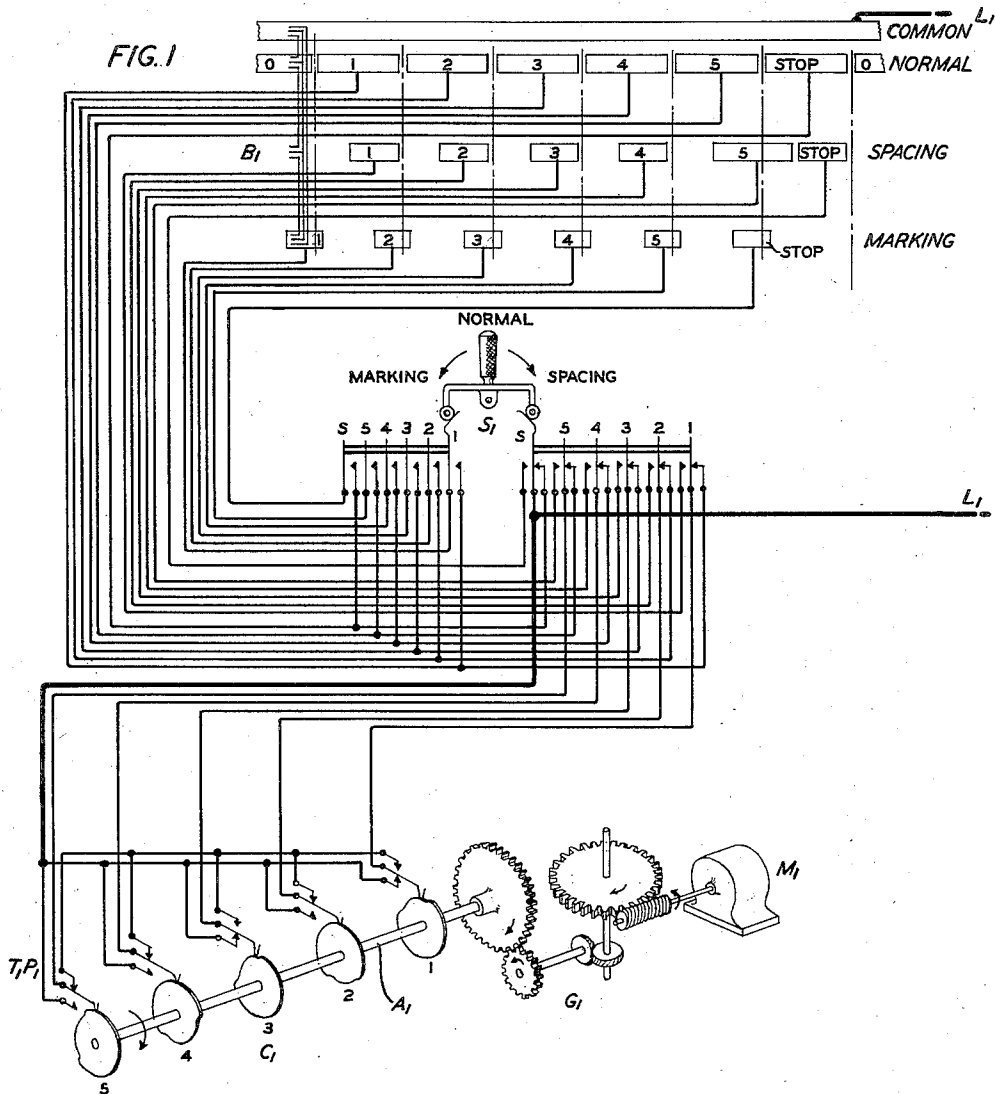
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2,036,059

TESTING EQUIPMENT

Filed June 9, 1933

5 Sheets-Sheet 1



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TESTING EQUIPMENT

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5 Sheets-Sheet 2

FIG. 2

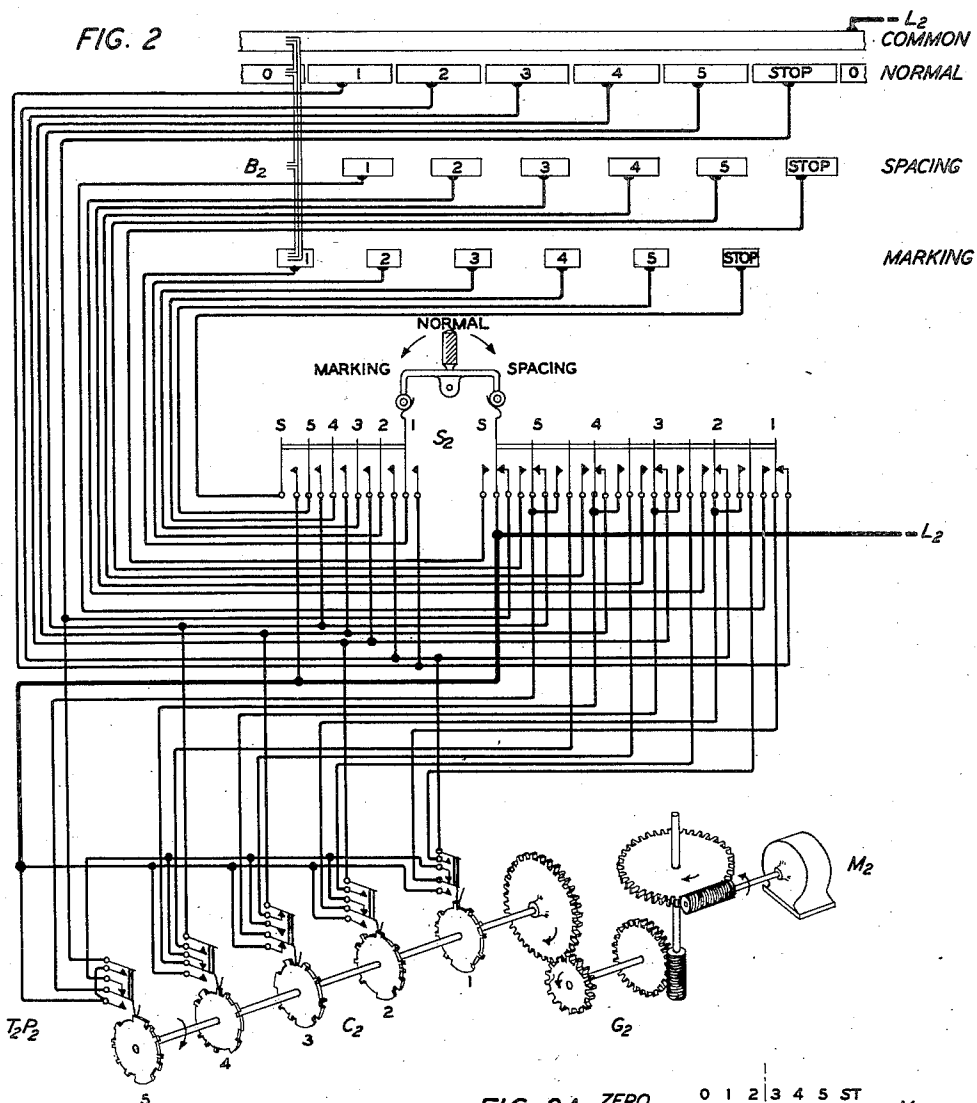


FIG. 2A ZERO BIAS

FIG. 2B IMPROPER SPACING BIAS

FIG. 2C PROPER SPACING BIAS

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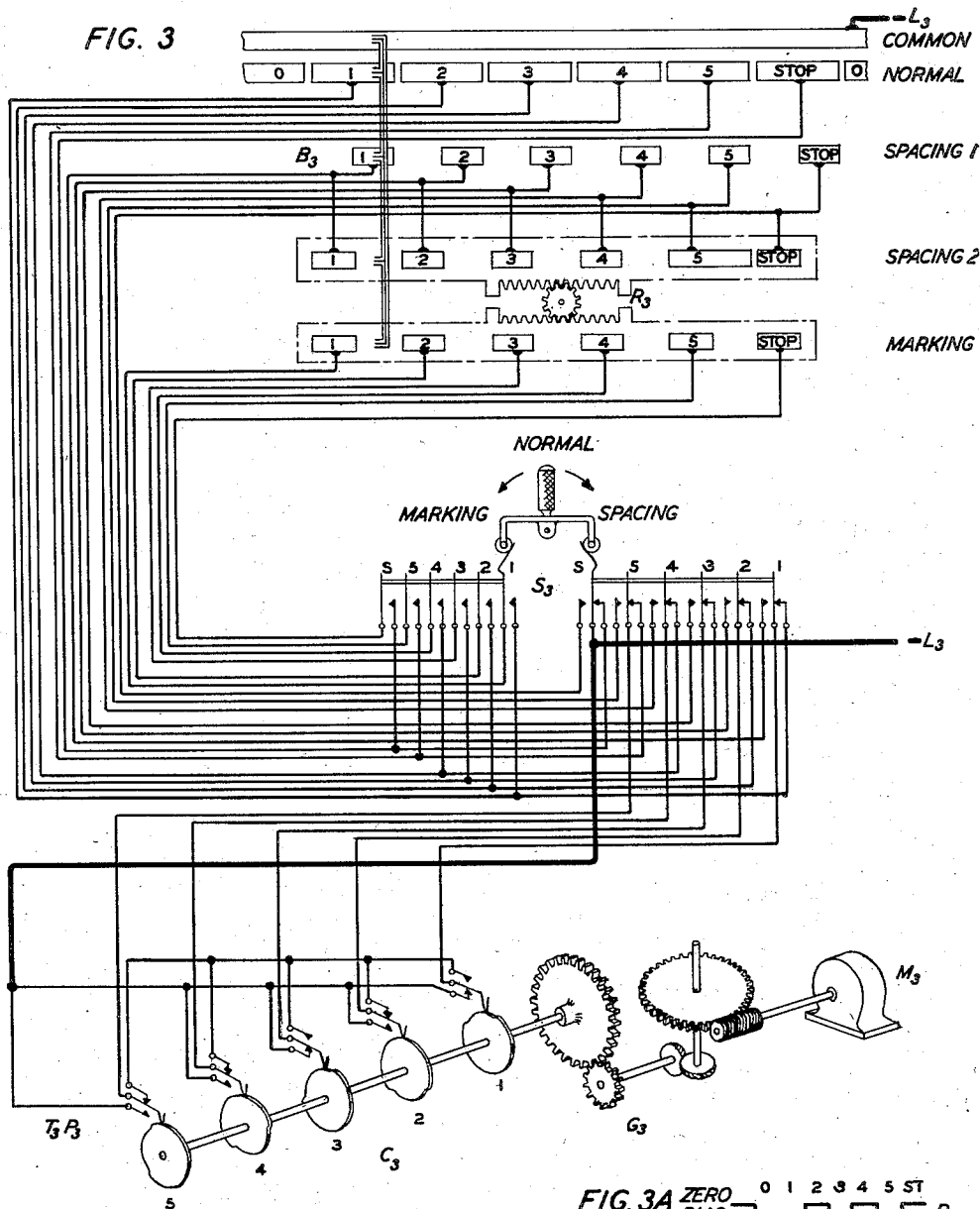
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TESTING EQUIPMENT

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5 Sheets-Sheet 3



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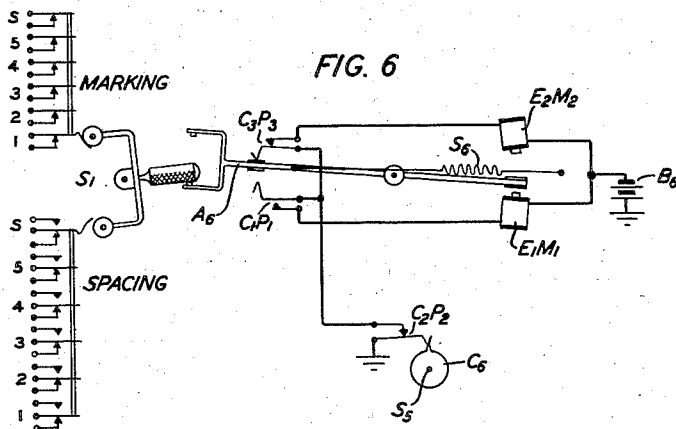
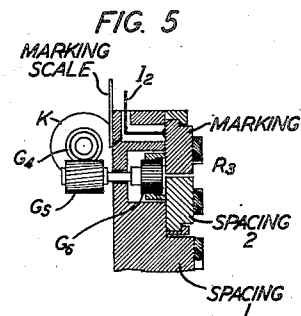
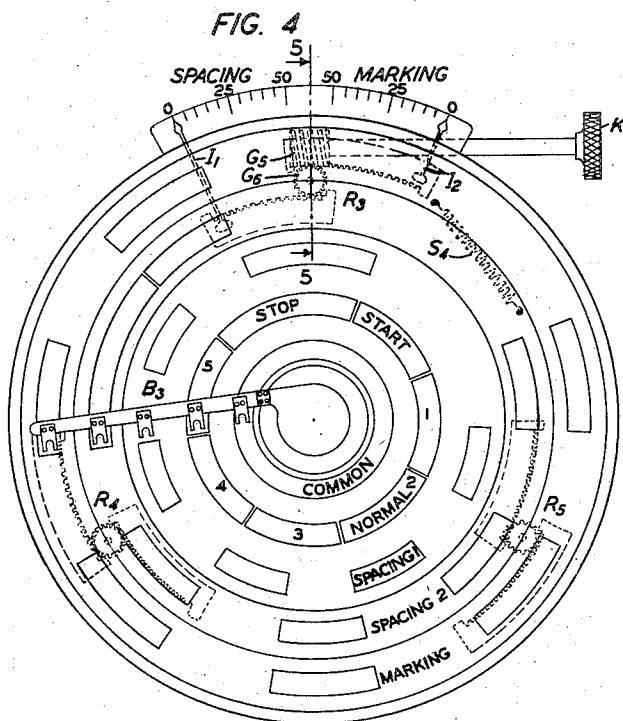
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TESTING EQUIPMENT

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5 Sheets-Sheet 4



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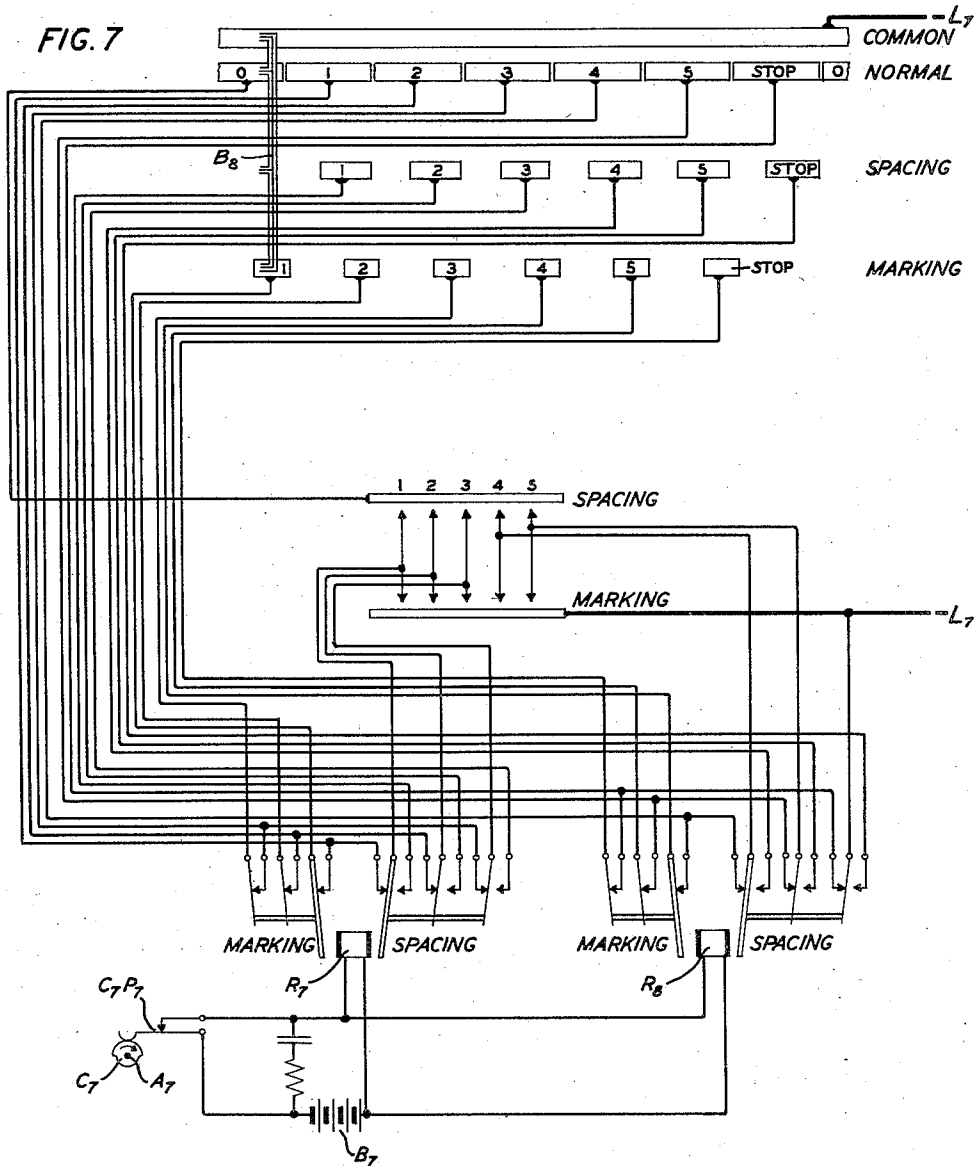
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TESTING EQUIPMENT

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,036,059

TESTING EQUIPMENT

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Application June 9, 1933, Serial No. 675,027

15 Claims. (Cl. 178—69)

This invention relates to improved testing equipment to be used for testing apparatus for receiving telegraph signals which have been subjected to distortion or bias.

5 In transmitting telegraph signals, each of which is 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 telegraph circuit or in the apparatus connected thereto. The distortion or bias with which this invention is concerned manifests itself in increasing or decreasing the duration of the impulses which constitute the signals transmitted over a telegraph circuit. 10 This undesirable distortion may be the result of irregularities in the travel time of the armatures of the relays in a telegraph circuit or may be due to irregularities in the transmission characteristic of a telegraph circuit.

20 The expression "marking bias" will be used herein to describe the distorted condition of signals which have their marking impulses of longer duration than their spacing impulses. Conversely, the term "spacing bias" will be applied to those signals in which the spacing impulses have been distorted so that they have a longer duration than the marking impulses.

This lengthening and shortening of the signal impulses may interfere with the proper reception of the signals. In printing telegraph systems, biasing of the signals may result in the printing of false characters. If the marking impulses are too short, some of them may not actuate their respective receiving elements thereby 35 resulting 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 impulses which would also result in the printing of errors. 40 Because of this possible distortion of the signal impulses, it is desirable to design and to adjust receiving printing telegraph apparatus to correctly receive signal impulses having as great a degree of bias as possible, such as 40% marking or 40% spacing.

45 An object of this invention is to test apparatus for receiving telegraph signals by transmitting thereto signal impulses which have been distorted a known amount by an improved bias sending transmitter distributor.

50 Another object of this invention is to provide an improved bias sending transmitter distributor which may be quickly changed from transmission of signals having a known amount of marking bias to transmission of signals having a known

amount of spacing bias and vice versa. This improved bias sending transmitter distributor may also be quickly changed from transmission of signals having either marking or spacing bias to transmission of signals having zero bias.

5 Another object of this invention is to supply an improved bias sending transmitter distributor with a mechanical patching arrangement, which does not include any relays, for filling in the gaps between adjacent closed impulses when signals having spacing bias are being transmitted. 10

Still another object of this invention is to supply an improved bias sending transmitter distributor with a cam arrangement for the transmission of a preassigned series of biased signal impulses which may either be complete reversals of each other or else may constitute a test list of characters. 15

An additional object of this invention is to provide an improved arrangement for varying the position of the spacing and marking rings on the face plate of a bias sending transmitter distributor in order to supply a variable amount of spacing and marking bias. 20

A further object of this invention is to provide a mechanical arrangement for alternately and repeatedly shifting a bias sending transmitter distributor from transmission of signals having marking bias to transmission of signals having spacing bias and vice versa. 25

This invention is somewhat related to testing equipment described in Patent 1,847,151 granted March 1, 1932 to E. F. Watson and A. E. Hunt. This patent describes a bias sending distributor having a plurality of segmented rings on its face plate, the rings being adjustable with respect to each other. Connected to the segmented rings are five so-called "patching" relays which are used to prevent an interruption in the intermediate portion of the long impulse caused by the transmission of two or more consecutive closed impulses when signals having spacing bias are being transmitted. 30 35 40

The present invention differs from and is an improvement of the invention described in the above patent in that one form of the present invention employs a bias sending transmitter distributor having a plurality of segmented rings which are fixed in position on its face plate. One set of segmented rings is used when marking bias is desired, another set is used when spacing bias is desired, and a third set is used when zero bias is desired. A control switch is used to switch circuit connections from one set of segmented rings to another. The use of fixed rings precludes 45 50 55

any possibility of human error in setting the amount of bias and also saves the time which would otherwise be spent in adjusting the position of the rings.

5 Modifications of this invention include mechanical instrumentalities in the form of a double set of selecting contacts with their associated circuit connections for taking the place of patching relays thereby doing away with the expense
10 and space requirements of such relays. A cam arrangement may be used to transmit a succession of signal impulses which may either be complete reversals of each other or else may constitute a test list of characters. An improved
15 arrangement for varying the position of the spacing and marking segmented rings on the face plate of the distributor may be employed in order to supply a variable amount of spacing and marking bias, if desired. A mechanical arrangement
20 may be supplied for alternately and repeatedly shifting the distributor from operation with marking bias to operation with spacing bias and vice versa.

These and other objects of the invention will be more fully described in connection with a detailed description of the invention with reference to the drawings in which:

Fig. 1 represents an improved bias sending transmitter distributor having a cam arrangement for transmitting two sets of signals which are complete reversals of each other

30 Figs. 1—A and 1—B show the nature of the signals transmitted by the distributor shown in Fig. 1;

35 Fig. 2 represents an improved bias sending transmitter distributor which, in addition to having a cam arrangement for transmitting a test list of signals, has an improved mechanical patching arrangement for filling in the gaps between adjacent closed impulses when signals having
40 spacing bias are being transmitted;

Figs. 2—A, 2—B, and 2—C are all of the same signal but Fig. 2—A shows the form of the signal when it is not deformed by any bias, Fig.
45 2—B represents the same signal foreshortened and having gaps in it caused by improper spacing bias, and Fig. 2—C represents the same signal foreshortened by proper spacing bias and having the gaps filled in by means of this invention;

50 Fig. 3 represents an improved bias sending transmitter distributor which, in addition to having a cam arrangement similar to that shown in Fig. 1, has an improved arrangement for varying the position of the spacing and marking segmented rings on the face plate of the transmitter distributor;

55 Figs. 3—A and 3—B are like Figs. 1—A and 1—B and show the nature of the signals transmitted by the transmitter distributor shown in Fig. 3;

60 Fig. 4 is a top view of the face plate of the distributor shown in Fig. 3 and illustrates the improved arrangement for varying the position of the spacing and marking segmented rings;

65 Fig. 5 is a cross-sectional view of the arrangement shown in Fig. 4 as taken along the line 5—5 indicated in Fig. 4;

Fig. 6 represents an electromechanical arrangement for alternately and repeatedly shifting a bias sending transmitter distributor from transmission of signals having marking bias to transmission of signals having spacing bias and vice versa; and

75 Fig. 7 represents an electrical arrangement for alternately and repeatedly shifting a bias sending

transmitter distributor from transmission of signals having marking bias to transmission of signals having spacing bias and vice versa.

According to this invention, the adjustment of receiving teletypewriter apparatus to correctly
5 receive biased signals may be tested by alternately transmitting over a telegraph line to the teletypewriter apparatus two biased signals, the signal impulses of which are complete reversals of each other, and by moving the orientation
10 range finder arm of the teletypewriter apparatus for determining the position of the arm for the reception of the biased signals. The bias sending transmitter distributor represented in Fig. 1
15 has one segment of its normal segmented ring on the distributor face plate provided for a start impulse, five segments for code impulses, and one segment for a stop impulse. However, this type of transmitter distributor is shown only for the purpose of illustrating the invention and it is to
20 be understood that the principles of this invention are applicable to distributors of other types. The ordinary details of the distributor used are so familiar to those skilled in the art that, for the purpose of describing this invention, it is
25 necessary to show in the drawings only the segmented rings located on the face plate of the distributor.

One side of a transmission line L_1 is connected to the ring marked "Common". Since this ring is
30 used in common with all of the other rings, it is not segmented.

The ring marked "Normal" is similar to an ordinary segmented ring used for normal transmission purposes with no intentional biasing of
35 the signals. Its segment marked "O" is the start segment. This start segment is shown in two parts because, in actuality, instead of the segments for any of these rings being in straight strips, they are curved into the shape of a ring
40 as is shown in Fig. 4. In order to simplify Figs. 1, 2, and 3, the rings have been straightened out and made into straight strips although the ends of each strip are really connected to each other. Thus, the start segment is really in one part, as
45 is shown in Fig. 4, instead of two parts as might appear from the cursory study of Fig. 1.

The ring marked "Spacing" has segments comparable to those of the normal ring except that the front (left) end of the segments is cut off in
50 order to foreshorten the signal impulses. Its fifth segment is elongated (to the right) in order to patch up the gap between the fifth segment and the stop segment.

The ring marked "Marking" has its segments
55 shifted ahead (to the left). Neither the spacing nor the marking rings have a start segment because this signal is always an open signal.

The segments on the spacing and marking rings are arranged so as to give a certain pre-
60 assigned amount of distortion to signal impulses. For the purpose of illustration, this may be assumed to be $\pm 40\%$ because that appears to be the maximum amount of distortion practicable for testing purposes.

In accordance with this invention, the adjustment of receiving teletypewriter apparatus may be tested by alternately transmitting two signals to it which are complete reversals of each other both horizontally and vertically, such as the signals shown in Figs. 1—A and 1—B. According to the Baudot code, such signals would be those for R and Y.

For the purpose of transmitting alternately and repeatedly the signals R and Y, the distributor is
75

provided with a cam arrangement C_1 . The cams C_1 are all mounted on a common axle A_1 which is rotated by a gear arrangement G_1 connected to the distributor motor M_1 . In the preferred embodiment of this invention, the gears G_1 are designed to cause the cams C_1 to rotate once every time the brush B_1 for the distributor face plate rotates twice, although the speed may be varied if desired by varying the gear ratio. Since the cams C_1 cause the transmission of only two signals, R and Y, there is only one depression cut in the periphery of each cam C_1 . Therefore, during the time that the cams C_1 rotate once, the transmitting pins $T_1 P_1$, which rest on the peripheries of cams C_1 , will move up and down once.

Control switch S_1 is provided for switching the transmission circuit from the normal ring having zero bias to either the spacing ring or the marking ring.

When switch S_1 is in the position shown in the drawings, the normal ring is connected into the transmission circuit and no bias will be intentionally given to signal impulses. As is shown in Fig. 1, the transmission circuit leads from line L_1 (in the upper right corner of Fig. 1), through the common ring, and then to brush B_1 . As brush B_1 rotates, it passes from the start segment to the first of the code impulse segments. The transmission circuit will then lead from line L_1 through the common ring and over brush B_1 to the first of the code impulse segments of the normal ring. Then it will pass down and around to the outside right set of contacts of switch S_1 , and then down to the first of the transmitting pins, or springs, $T_1 P_1$, which is shown to be resting in the depression in the periphery of the first of the cams C_1 . The result is that a closed signal will be transmitted over line L_1 to the apparatus being tested. When the cams C_1 rotate, the first of the transmitting pins, or springs, $T_1 P_1$ will be raised up on the rim of the first of the cams C_1 and an open signal will be transmitted.

When brush B_1 passes over the other code impulse segments, the transmission circuit will follow paths similar to that just described. It should be kept in mind that, during this time, cams C_1 are rotating so that, by the time brush B_1 arrives at the fifth segment, the fifth of cams C_1 will have rotated enough to cause the fifth set of transmitting pins $T_1 P_1$ to be resting in the depression in the periphery of the fifth of the cams C_1 so that a closed signal will be sent out over transmission line L_1 .

When brush B_1 comes to the stop segment, the circuit will lead to the inside right set of contacts of switch S_1 , and without passing to transmitting pins, or springs, $T_1 P_1$ will lead directly out over line L_1 .

In this manner, the signal impulses for R and Y will be alternately and repeatedly sent out over line L_1 as long as brush B_1 and cams C_1 rotate.

If it is desired to test the adjustment of receiving teletypewriter apparatus from the standpoint of receiving signal impulses which have been foreshortened by reason of being distorted by the application of spacing bias, switch S_1 should be thrown to the right.

Now, when brush B_1 rotates, the transmission circuit will be the same while brush B_1 is on the stop segment, but will be somewhat different while brush B_1 is on the other segments.

When brush B_1 is on the first code impulse segment of the spacing ring, the transmission circuit will lead from line L_1 , through the common ring, over brush B_1 to the first code impulse seg-

ment of the spacing ring, and then down and around to the outside right set of contacts of control switch S_1 . However, this right set of contacts is not quite the same as the set used for the first code impulse segment of the normal ring.

In Fig. 1 each set of right contacts of switch S_1 is made up of two contact points with a movable lever between them. When these levers are touching their right contact points, as is shown in Fig. 1, the segments of the normal ring are connected into the transmission circuit. When switch S_1 is thrown to the right, the movable levers of the right portion of switch S_1 will be swung to the left so as to touch their left contact points, thereby switching the segments of the normal ring out of the transmission circuit and connecting the segments of the spacing ring into the circuit. Alternate and repeated transmission of the signal impulses for R and Y may now take place but with the signal impulses distorted by the intentional application of spacing bias.

To test the adjustment of a teletypewriter from the standpoint of receiving signal impulses which have been distorted by marking bias, switch S_1 is thrown to the left. This will cause the left levers of switch S_1 to touch their contact points. The transmission circuit now leads from line L_1 through the common ring, over brush B_1 to the segments of both the marking ring and the normal ring. Then it will lead down and around to both the left sets of contacts of switch S_1 and the corresponding right sets of contacts of switch S_1 , down to the transmitting pins $T_1 P_1$, and then, if the signal is a closed signal, out over line L_1 . The electrical combining of the segments of the marking ring with the segments of the normal ring produces an overlapping of the signal impulses which is known as marking bias.

If, instead of transmitting just two signals which are complete reversals of each other, it is desired to transmit a test sentence or a test list of characters, this may be done by means of the arrangement shown in Fig. 2. As can be seen in Fig. 2, cams C_2 have a variety of indentations in their peripheries for causing transmitting pins, or springs, $T_2 P_2$ to send out a list of several test characters. It can also be seen that the gear assembly G_2 for enabling motor M_2 to cause the rotation of cams C_2 is somewhat different from the gear assembly G_1 . The reason for this is that cams C_2 should only rotate once during the period that brush B_2 rotates once for every signal which the cams C_2 are to send.

Some of the signals sent by cams C_2 may comprise two or more successive closed impulses. Such a signal in the Baudot code is the letter M which is represented in Figs. 2—A, 2—B, and 2—C. When switch S_1 is in its normal position, the signal representing the letter M would not be intentionally biased and should be as is represented in Fig. 2—A. If the signal were sent from the bias sending transmitter distributor shown in Fig. 1 with switch S_1 thrown to the right in its position for causing the application of spacing bias, the signal now representing M would be improperly biased by having gaps between adjacent closed impulses as is represented in Fig. 2—B.

In order to correctly transmit and receive signals, such as the signal for M, it is necessary to patch up, or fill in, these gaps. This has heretofore been accomplished by means of relays as is described in Patent 1,847,151, mentioned above. However, by means of the present invention, 75

such relays with their expense and space requirements may be done away with. The present invention patches up gaps, such as those shown in Fig. 2—B, by the use of an extra set of contacts for each of the transmitting pins $T_2 P_2$, as is shown in Fig. 2, so that the resulting signal for letters, such as the letter M, when affected by spacing bias is as is represented in Fig. 2—C. Also, when Fig. 2 is compared with Fig. 1, it will be observed that the distributor face plates are similar but that the right portion of switch S_2 has more contacts than the right portion of switch S_1 .

When control switch S_2 is in the position shown in Fig. 2, the normal ring is connected into the transmission circuit and no bias will be intentionally given to signal impulses. The transmission circuit is about the same as that of Fig. 1 under similar conditions, except that it is somewhat complicated by reason of the extra sets of contacts in switch S_2 and in transmitting pins $T_2 P_2$.

The transmission circuit of Fig 2 for the letter M, as an example, would lead from line L_2 to the common ring, over brush B_2 to the first of the code impulse segments of the normal ring, down and around to the first set of right contacts of switch S_2 and then down to the first set of transmitting pins, or springs, $T_2 P_2$. The first of cams C_2 happens to be in such a position as to cause the first set of transmitting pins $T_2 P_2$ to be opened so that an open signal will be transmitted over line L_2 . A similar circuit is followed for the second code impulse. For the third code impulse the circuit leads from line L_2 to the common ring, over brush B_2 to the third code impulse segment of the normal ring, down and around through the third set of right contacts of switch S_2 , and then down to the third set of transmitting pins $T_2 P_2$. The third of cams C_2 is in such a position that the contacts for the third set of transmitting pins $T_2 P_2$ are closed so that a closed signal will be sent out over line L_2 . Similar circuits are followed for the transmission of the fourth and fifth code impulses. The result is that a signal, such as that represented in Fig. 2—A, will be received at the distant end of line L_2 .

To transmit signal impulses affected by marking bias, switch S_2 is thrown to the left. The transmission circuit will be about the same as that just described above except that the marking ring will be included in it in addition to the normal and common rings. Also the circuit will extend through the left sets of contacts of switch S_2 before passing to the right sets of contacts, as was the case with the circuit of Fig. 1.

To transmit signal impulses affected by spacing bias, switch S_2 is thrown to the right. If it is assumed that the letter M is being transmitted, then, since the first two code impulses are open, no closed impulse is transmitted until brush B_2 arrives at the third code impulse segment. At this time, the transmission circuit will lead from line L_2 to the common ring, over brush B_2 to the third of the code impulse segments of the spacing ring, down and around to the third right set of contacts of switch S_2 , and then down to the third set of transmitting pins $T_2 P_2$. Since the third set of transmitting pins $T_2 P_2$ is closed by the third of cams C_2 , a closed signal will be sent out over line L_2 . As was stated above in the description of Fig. 1, it must be remembered that the cams C_2 are rotating so that, by the time the brush B_1 arrives at the fourth segment, the

fourth of cams C_2 will have rotated enough to cause the fourth set of transmitting pins $T_2 P_2$ to be in an indentation in the rim of the fourth of the cams C_2 so that a closed signal will be transmitted over the transmission line L_2 . Likewise, the fifth of cams C_2 will have rotated enough to cause the fifth set of transmitting pins $T_2 P_2$ to be in an indentation in the rim of the fifth of cams C_2 so that another closed signal will be transmitted over line L_2 . With this in mind, it will be understood that, when brush B_2 arrives at the fourth code impulse segment of the spacing ring, the transmission circuit will lead from line L_2 to the common ring, over brush B_2 to the fourth of the code impulse segments of the spacing ring, down and around to the fourth right set of contacts of switch S_2 , and then over two paths. One path leads through the fourth set of transmitting pins $T_2 P_2$, and, since they are closed by the fourth of cams C_2 , then out over line L_2 . The other path leads to a right set of contacts of switch S_2 which is located between the regular fourth and regular third sets of contacts, then down through the third set of transmitting pins $T_2 P_2$, and then up and back to the fourth code impulse segment of the normal ring. The fifth code impulse will follow a similar path. The result is that the gaps, shown in Fig. 2—B are filled in, or patched up, so that a signal similar to the one represented in Fig. 2—C will be received at the distant end of line L_2 .

Up to this point it has been assumed that it would be desirable to transmit fixed amounts (such as 40%) of either spacing or marking bias. However, it is sometimes necessary, due to the transmission characteristics of a line, to use various amounts of bias. Also, in testing some types of apparatus under some conditions, it is desirable to use a range of bias from 0 to 40% graduated in steps of 5%. To accomplish this, it is convenient to have adjustable segmented rings for introducing the bias and, at the same time, to have both the marking and the spacing segmented rings capable of being adjusted simultaneously so that, when a bias sending transmitter distributor is adjusted for a certain amount of one kind of bias, it will also be adjusted for the same amount of the other kind of bias when the control switch is thrown in the opposite direction.

This can be done by using the arrangement shown in Fig. 3. As can be seen, the circuit arrangement of Fig. 3 is somewhat similar to that of Fig. 1 except that an additional segmented spacing ring is added. Another difference is that the position of the marking ring and one of the spacing rings may be varied by means of an arrangement of racks and gears R_3 operated by a knob K (shown in Figs. 4 and 5). It is necessary to use both spacing #1 and spacing #2 rings because each of these rings has its segments cut for 50% of a perfect unbiased impulse. Thus, when these two rings are in their normal position, none of their segments will overlap and no bias will intentionally be given to signals transmitted. When knob K is turned, it will cause the segments of these spacing rings to overlap and signals may be transmitted with spacing bias, the amount of which depends upon the amount the spacing segments overlap.

Under normal conditions, that is, for the transmission of signals with zero bias, the transmission circuit of Fig. 3 is similar to that of Fig. 1. It will be noticed that the cam C_3 arrangement is similar to that of Fig. 1. Therefore, transmitting pins, or springs $T_3 P_3$ will cause the trans-

mission of signals, such as those shown in Figs. 3—A and 3—B, which are the same as those shown in Figs. 1—A and 1—B.

For marking bias, control switch S_3 is thrown to the left and the transmission circuit is then similar to the transmission circuit in Fig. 1 under similar conditions. However, it will be observed that the marking ring in Fig. 3 is movable by means of the rack and gear arrangement R_3 which is shown in more detail in Figs. 4 and 5 and which will be discussed later. Variations in the position of the marking ring cause variations in the amount of marking bias which may be transmitted.

For spacing bias, control switch S_3 is thrown to the right. The transmission circuit is now somewhat similar to that of Fig. 1 under similar conditions except that it includes both the spacing #1 ring and the spacing #2 ring. The spacing #1 ring is fixedly located in a manner similar to the spacing ring of Fig. 1. The spacing #2 ring is movable, as has been stated above, by means of the rack and gear arrangement R_3 in a manner similar to the marking ring also shown in Fig. 3. As was explained above, it is necessary to use both spacing #1 and spacing #2 rings in the arrangement shown in Fig. 3 in order to obtain a variable overlap of their segments which will result in the giving of a variable amount of spacing bias to signals, the amount of spacing bias being proportional to the amount of overlap of the segments.

Therefore, by varying the adjustment of the rack and gear arrangement R_3 of Fig. 3, any desired amount of spacing and marking bias up to 50% may be applied to the signal impulses transmitted by the bias sending transmitter distributor shown in Fig. 3.

As was stated above, the rack and gear arrangement R_3 , used with the bias sending transmitter distributor of Fig. 3, is shown in Fig. 4 in more detail. In Fig. 4 it can be seen that there are three sets of rack and gear arrangements, R_3 , R_4 , and R_5 which are spaced equally around the circumference of the distributor face plate between the marking ring and the spacing #2 ring. The rack and gear arrangements R_4 and R_5 are used as idlers while arrangement R_3 is used as the adjuster. The arrangement R_3 may be adjusted by turning knob K , which causes the gears G_4 , G_5 , and G_6 to rotate. The rotation of gears G_4 , G_5 , and G_6 causes the movement, or adjustment, of the marking ring and the spacing #2 ring. A spacing scale and a marking scale, with indicators I_1 and I_2 , are provided in order to indicate the amount of bias for which the spacing #2 ring and the marking ring are set. A small helical spring S_4 tends to pull the marking ring clockwise and the spacing #2 ring counter-clockwise. This spring S_4 serves to reduce backlash and play of gears G_4 , G_5 , and G_6 .

Fig. 5 shows a cross-sectional view of the rack and gear arrangement R_3 , as well as knob K , gears G_4 , G_5 , and G_6 , the marking scale, indicator I_2 , and a portion of the marking ring, the spacing #2 ring, and the spacing #1 ring.

For some testing purposes it is desirable to send out test signals which are affected alternately and repeatedly by marking and spacing bias. A mechanical arrangement for alternately and repeatedly shifting a bias sending transmitter distributor, such as that shown in Fig. 1, from transmission of signals having marking bias to the transmission of signals having spac-

ing bias and vice versa, is shown in Fig. 6. This arrangement may readily be applied to the distributor of Fig. 1 and may be considered as being a modification of the arrangement shown in Fig. 1.

In Fig. 6, control switch S_1 is the same as control switch S_1 in Fig. 1. Cam C_6 is located on a shaft S_5 which is arranged to rotate once during every two rotations of the axle A_1 shown in Fig. 1. When cam C_6 passes into the position shown in Fig. 6, current from battery B_6 travels through the windings of electromagnet $E_2 M_2$, contact points $C_3 P_3$ and $C_2 P_2$, and then to ground. Under these conditions, electromagnet $E_2 M_2$ will be energized but electromagnet $E_1 M_1$ will not be energized. Therefore, armature A_6 will be attracted by electromagnet $E_2 M_2$ and an over-the-center spring S_6 will hold armature A_6 in a position opposite to that shown in the drawings. In going into this position, the left end of armature A_6 will force control switch S_1 into its spacing position which is opposite to its marking position which is shown in Fig. 6. At the same time armature A_6 will also close contact points $C_1 P_1$ thus allowing contact points $C_3 P_3$ to open and thereby opening the path from battery B_6 through electromagnet $E_2 M_2$ to ground. Although electromagnet $E_2 M_2$ now becomes deenergized, armature A_6 will be held in this position by spring S_6 as was stated above.

When cam C_6 rotates, contact points $C_2 P_2$ will be opened; then, as cam C_6 rotates further, they will be closed again. When they close this time, battery B_6 will follow a path through electromagnet $E_1 M_1$, contact points $C_1 P_1$ to contact points $C_2 P_2$, and then to ground. When electromagnet $E_1 M_1$ thus becomes energized, it will attract armature A_6 , the left end of which will force switch S_1 to its marking position shown in Fig. 6. At the same time, contact points $C_1 P_1$ will be opened, as shown in Fig. 6, and contact points $C_3 P_3$ will be closed as is also shown in Fig. 6. This will cause electromagnet $E_1 M_1$ to become deenergized, but armature A_6 will still be held against it by means of over-the-center spring S_6 .

As long as shaft S_5 rotates, this procedure will be repeated with the result that the bias sending transmitter distributor of Fig. 1 will be alternately and repeatedly shifted from transmission of signals having marking bias to transmission of signals having spacing bias and vice versa. By using the arrangement of Fig. 6 with the arrangement of Fig. 1, signals having marking bias will be transmitted for two trains of impulses (R and Y) and then signals having spacing bias for the two trains of impulses (R and Y) will be alternately and repeatedly transmitted.

Fig. 7 shows a different arrangement for performing the same function as the arrangement of Fig. 6. As can be seen in Fig. 7, this arrangement uses two relays, R_7 and R_8 , instead of switch S_1 for alternately and repeatedly closing and opening first the marking sets of contacts and then the spacing sets of contacts. Cam C_7 opens and closes a set of contact points $C_7 P_7$ thereby opening and closing an energizing circuit leading from battery B_7 through relays R_7 and R_8 . Cam C_7 is mounted upon an axle A_7 which is preferably located directly above axle A_1 , shown in Fig. 1, and which is so geared to axle A_1 as to rotate once for every two rotations of axle A_1 . The periphery of cam C_7 is so cut as to cause contact points $C_7 P_7$ to be opened during half of a rotation of axle A_7 and closed for the other

half. Thus, as long as axle A₇ rotates, cam C₇ will cause the bias sending transmitter distributor of Fig. 1 to be alternately and repeatedly shifted from transmission of signals having marking bias to transmission of signals having spacing bias and vice versa.

The arrangements shown in the drawings and described above are given to illustrate the operation of the invention and to assist in interpreting the claims appended hereto. Furthermore, the claims are not to be restricted to the precise construction disclosed above, but are intended to include all changes and modifications employing the principles and features of operation of the invention.

What is claimed is:

1. In a printing telegraph system, instrumentalities for testing the adjustment of receiving teletypewriter apparatus to correctly receive biased signals, said instrumentalities comprising in combination a bias distributor having a plurality of segmented rings on its face plate for transmitting signals with any one of a plurality of different amounts of bias, some of said segmented rings being normally disconnected from the transmission circuit, and a control switch for connecting some of the segmented rings into the transmission circuit.

2. In a printing telegraph system, instrumentalities for testing the adjustment of receiving teletypewriter apparatus to correctly receive biased signals, said instrumentalities comprising in combination a bias distributor having a plurality of segmented rings fixedly located on its face plate for transmitting signals with any one of a plurality of different fixed amounts of bias, some of said segmented rings being normally disconnected from the transmission circuit, and a control switch for connecting some of the segmented rings into the transmission circuit.

3. In a printing telegraph system, instrumentalities for testing the adjustment of receiving teletypewriter apparatus to correctly receive biased signals, said instrumentalities comprising in combination a distributor having a plurality of segmented rings fixedly located on its face plate for transmitting signals with fixed amounts of bias and also having a plurality of segmented rings adjustably located on its face plate for transmitting signals with variable amounts of bias, some of said segmented rings being normally disconnected from the transmission circuit, and a control switch for connecting some of the segmented rings into the transmission circuit.

4. In a printing telegraph system, instrumentalities for testing the adjustment of receiving teletypewriter apparatus to correctly receive biased signals, said instrumentalities comprising in combination a bias sending transmitter distributor having a plurality of segmented rings on its face plate for transmitting signals affected by either spacing or marking bias, some of said segmented rings being normally disconnected from the transmission circuit, a control switch for connecting some of the segmented rings into the transmission circuit, and a cam arrangement for causing the distributor to alternately transmit preassigned signals the signal impulses of which are complete reversals of each other.

5. In a printing telegraph system, instrumentalities for testing the adjustment of receiving teletypewriter apparatus to correctly receive biased signals, said instrumentalities comprising in combination a bias sending distributor having a plurality of segmented rings on its face plate

for transmitting signals affected by either spacing or marking bias, some of said segmented rings being normally disconnected from the transmission circuit, a control switch for connecting some of the segmented rings into the transmission circuit, a cam arrangement for causing the distributor to transmit a preassigned series of signal impulses to the teletypewriter apparatus to be tested, and instrumentalities for patching up the gaps between adjacent closed signal impulses affected by spacing bias.

6. A bias sending distributor having a plurality of segmented rings on its face plate for transmitting signals affected by predetermined amounts of either spacing or marking bias, some of said segmented rings being normally disconnected from the transmission circuit, a control switch for connecting some of the segmented rings into the transmission circuit, and instrumentalities for alternately and repeatedly shifting the distributor from transmission of signals having marking bias to transmission of signals having spacing bias and vice versa, said instrumentalities including electromagnetic means for moving the control switch back and forth.

7. In a printing telegraph system, instrumentalities for testing the adjustment of receiving teletypewriter apparatus to correctly receive biased signals, said instrumentalities comprising in combination a bias sending distributor having a common ring connected to a telegraph line, a normal segmented ring for use in the transmission of signals having no intentional bias given to them, a spacing segmented ring for giving spacing bias to signals transmitted by the distributor, and a marking segmented ring for giving marking bias to signals transmitted by the distributor.

8. In a printing telegraph system, instrumentalities for testing the adjustment of receiving teletypewriter apparatus to correctly receive biased signals, said instrumentalities comprising in combination a bias sending distributor having a common ring connected to a telegraph line, a normal segmented ring for use in the transmission of signals having no intentional bias given to them, a spacing segmented ring for giving spacing bias to signals transmitted by the distributor, a marking segmented ring for giving marking bias to signals transmitted by the distributor and a control switch for connecting some of the segmented rings to the telegraph line and for disconnecting some of the other segmented rings from the telegraph line.

9. A bias sending distributor for impulse transmission and reception systems in which a common ring cooperates with a plurality of segmented rings, some of the segments of the segmented rings being of a length less than that of a normal unit impulse to be transmitted, means whereby at least one of the segmented rings may be adjusted with respect to another to vary the length of the impulses transmitted, a brush for conductively bridging all of said rings, and a cam arrangement for causing the distributor to transmit a preassigned series of signal impulses.

10. A bias sending distributor having a common ring, a normal segmented ring for use in the transmission of signals having no intentional bias given to them, two spacing segmented rings for giving spacing bias to signals transmitted by the distributor, and a marking segmented ring for giving marking bias to signals transmitted by the distributor.

11. A bias sending distributor having a common ring, a normal segmented ring for use in the transmission of signals having no intentional bias given to them, two spacing segmented rings for giving spacing bias to signals transmitted by the distributor, a marking segmented ring for giving marking bias to signals transmitted by the distributor, and instrumentalities for varying the amount of bias given to the signals transmitted by the distributor.

12. A bias sending distributor having a common ring, a normal segmented ring for use in the transmission of signals having no intentional bias given to them, two spacing segmented rings for giving spacing bias to signals transmitted by the distributor, a marking segmented ring for giving marking bias to signals transmitted by the distributor, and instrumentalities for varying the amount of bias given to the signals transmitted by the distributor, said instrumentalities including an arrangement for varying the position of one of the spacing segmented rings and the marking segmented ring.

13. In a printing telegraph system, a device for testing the adjustment of receiving teletypewriter apparatus to correctly receive biased signals, said device comprising in combination a distributor having a plurality of segmented rings on its face plate for transmitting signals affected by either marking or spacing bias, some of said segmented rings being normally disconnected from the transmission circuit, a control switch for connecting some of the segmented rings into the transmission circuit, a plurality of transmit-

ting springs, and apparatus for patching up the gaps between adjacent closed signal impulses affected by spacing bias, said apparatus including extra contact points for the control switch and transmitting springs.

14. A distributor connected into a transmission circuit, said distributor having a plurality of segmented rings on its face plate for transmitting biased signals, some of said segmented rings being normally disconnected from the transmission circuit, a control switch for connecting some of the segmented rings into the transmission circuit, and instrumentalities for repeatedly moving the control switch back and forth whereby certain of the segmented rings are alternately and repeatedly connected into the transmission circuit and disconnected therefrom.

15. A distributor connected into a transmission circuit, said distributor having a plurality of segmented rings on its face plate for transmitting biased signals, some of said segmented rings being normally disconnected from the transmission circuit, a control switch for connecting some of the segmented rings into the transmission circuit, a relay for repeatedly moving the control switch back and forth whereby certain of the segmented rings are alternately and repeatedly connected into the transmission circuit and disconnected therefrom, said relay having an energizing circuit and a rotating cam for repeatedly closing and opening the energizing circuit.

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