Dec. 19, 1939. E. W. F. HANKE ET AL 2,183,613

BIAS TRANSMITTER

Filed Sept. 3, 1937 4 Sheets-Sheet 1

FIG. 1

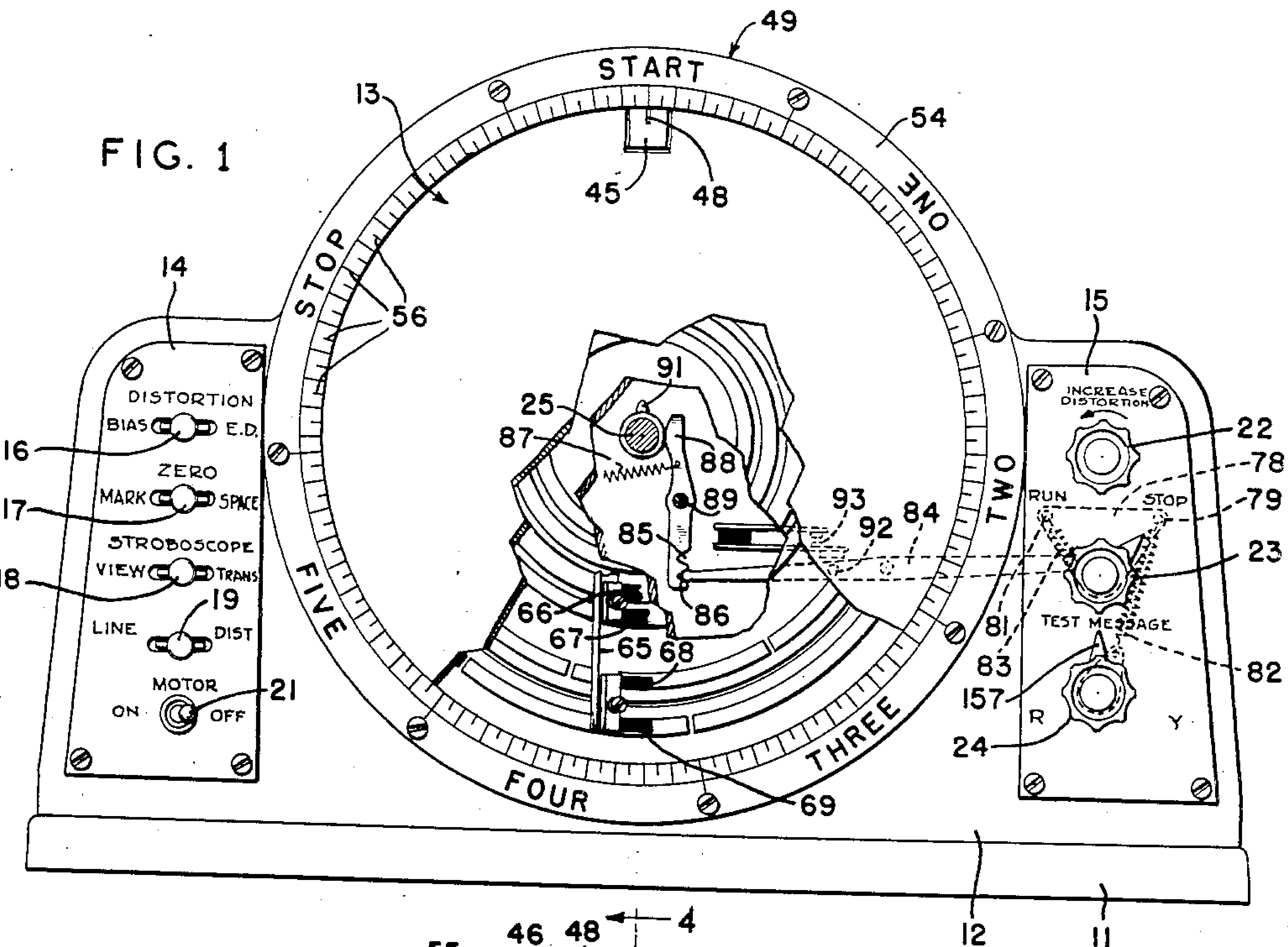
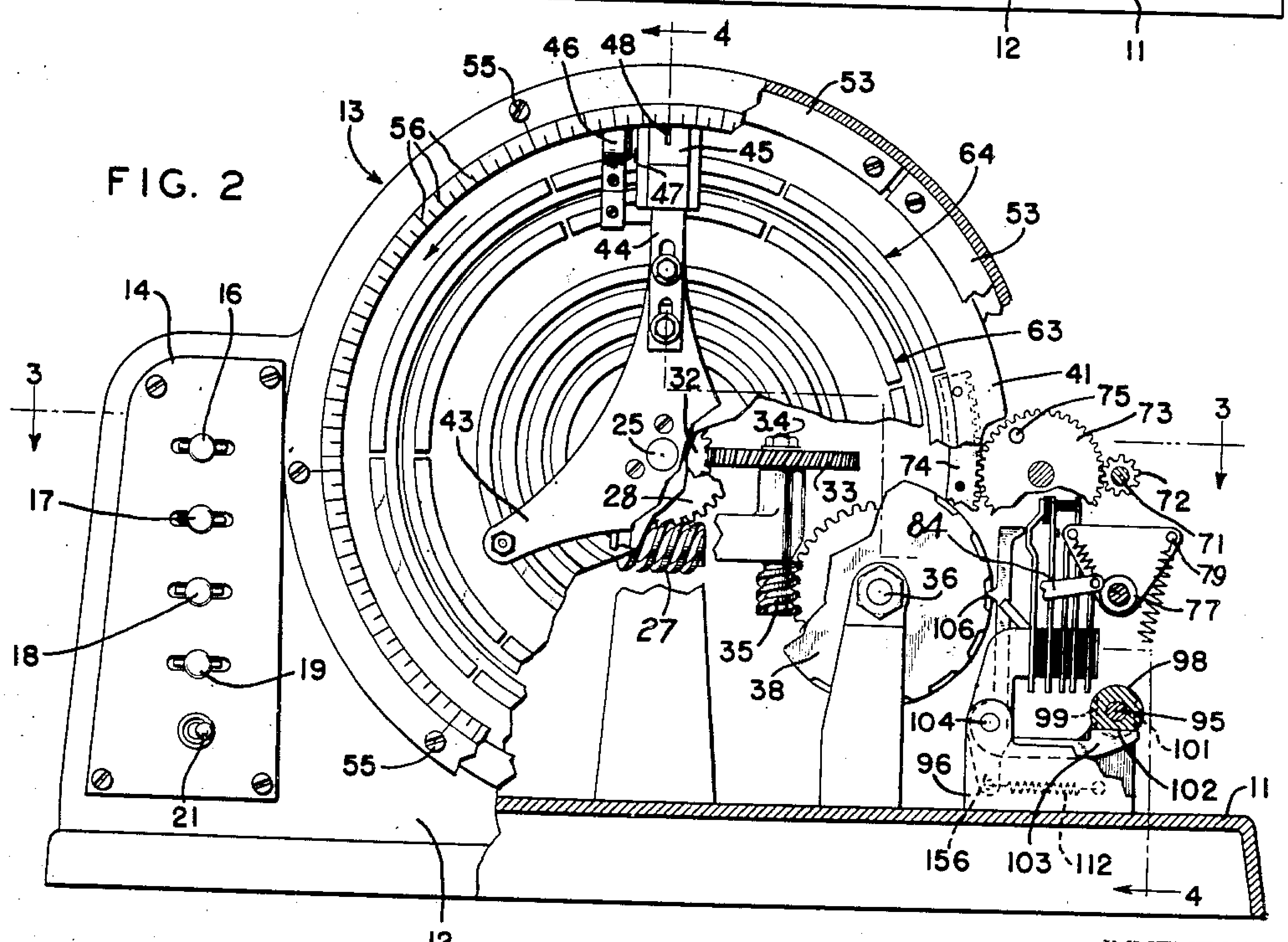


FIG. 2



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BIAS TRANSMITTER

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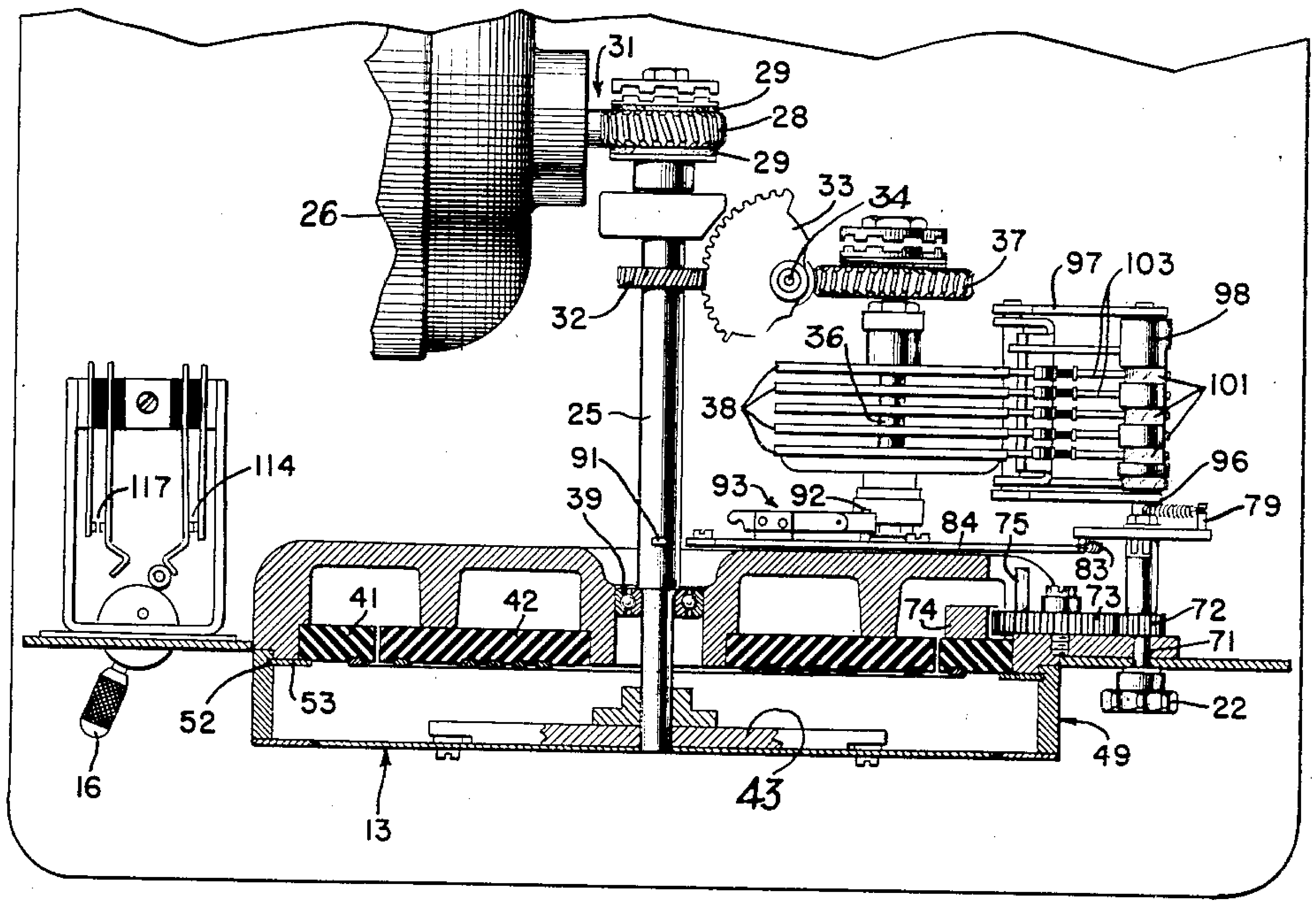

FIG. 3

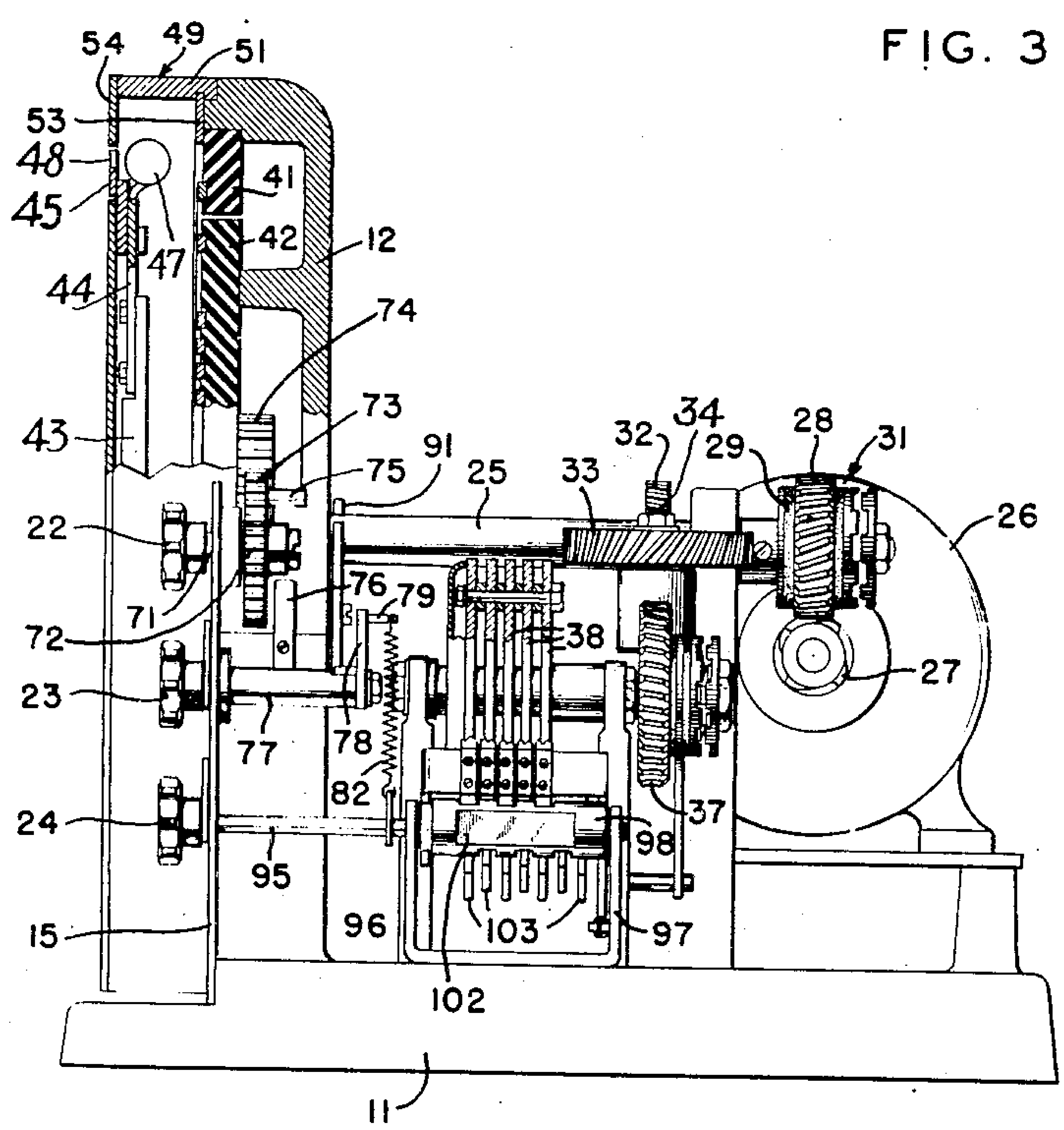

FIG. 4

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BIAS TRANSMITTER

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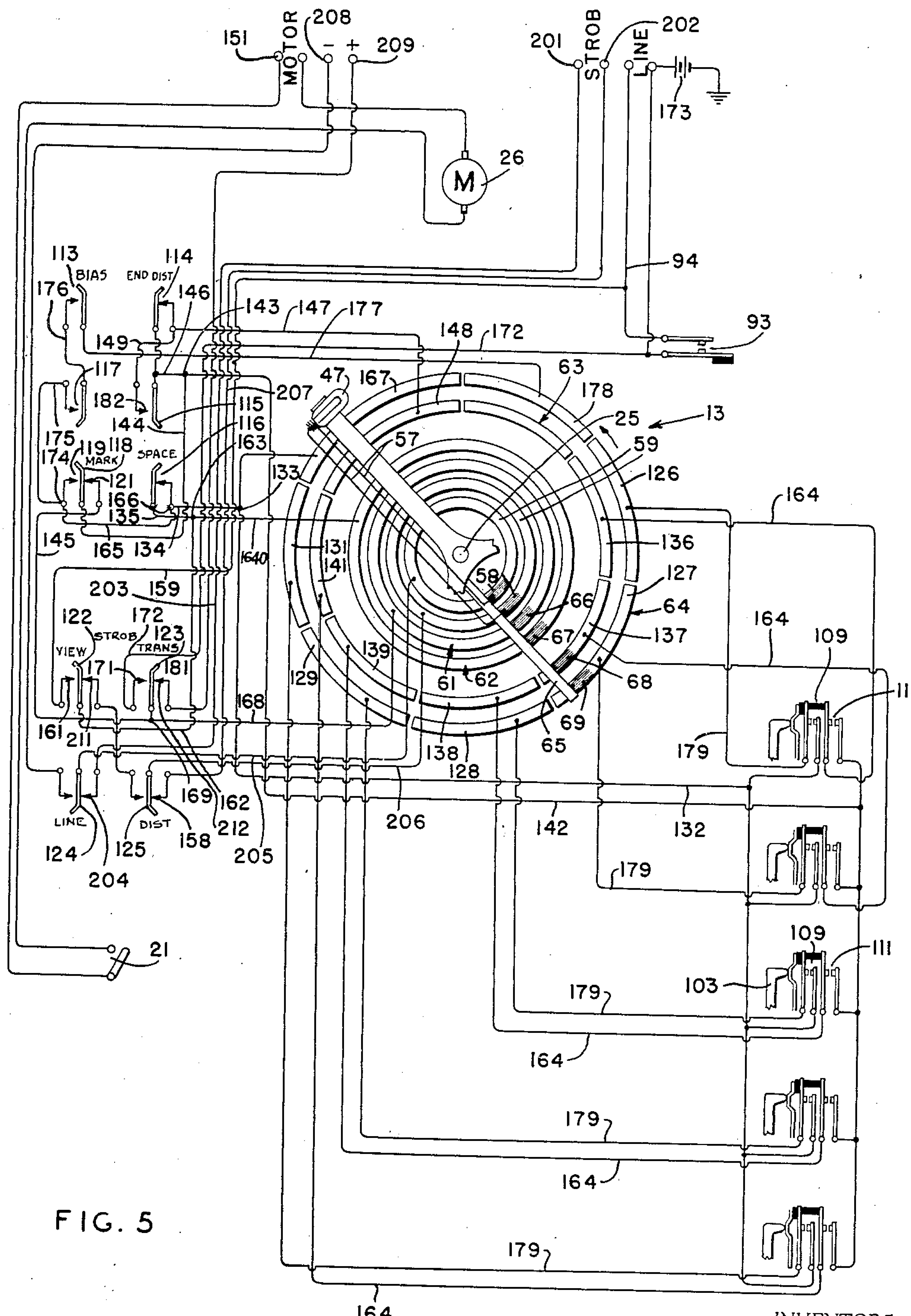

FIG. 5

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BIAS TRANSMITTER

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FIG. 6

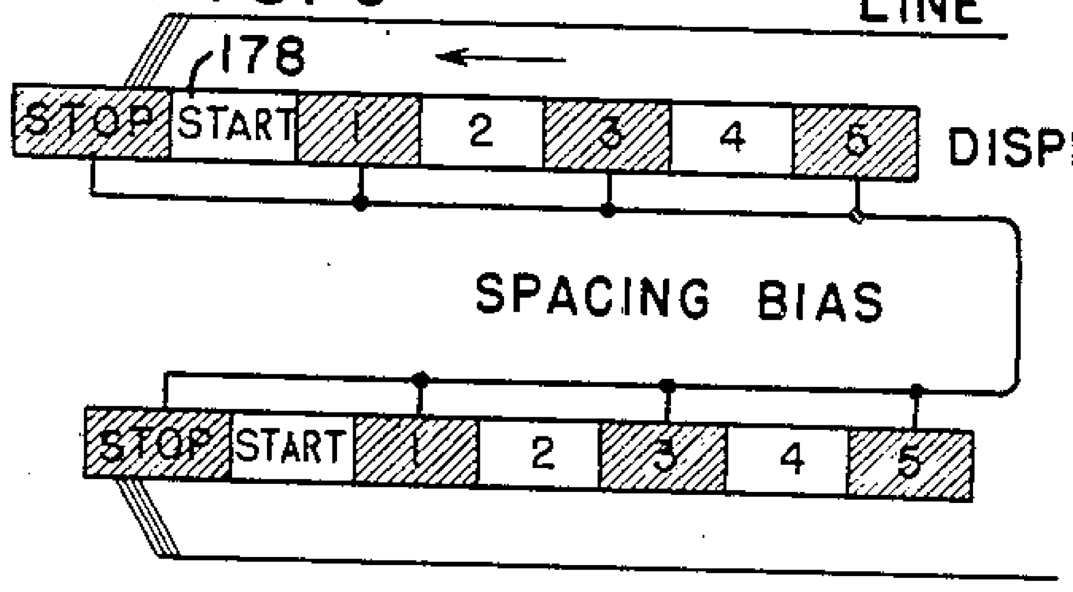


FIG. 7

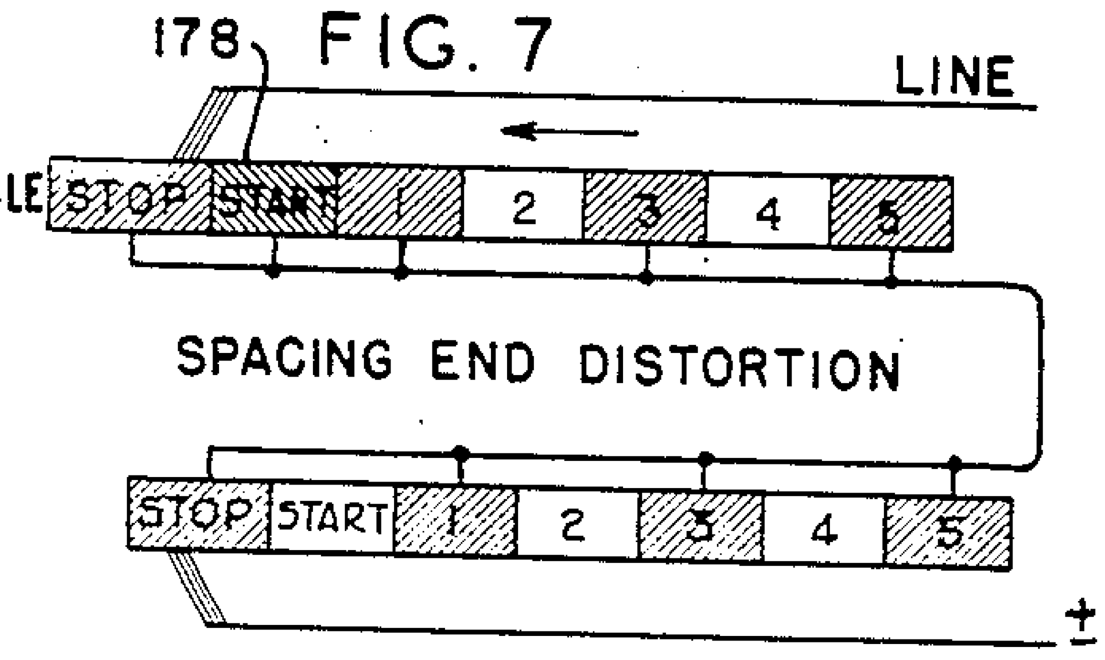


FIG. 6a

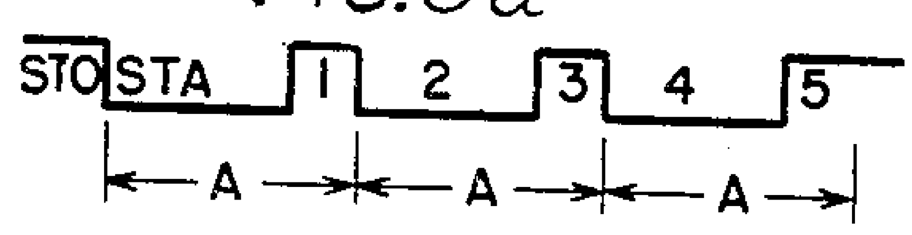


FIG. 7a

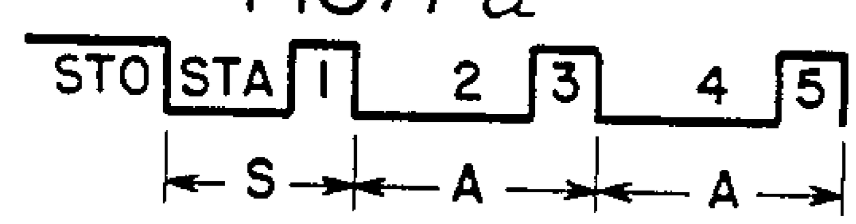


FIG. 8

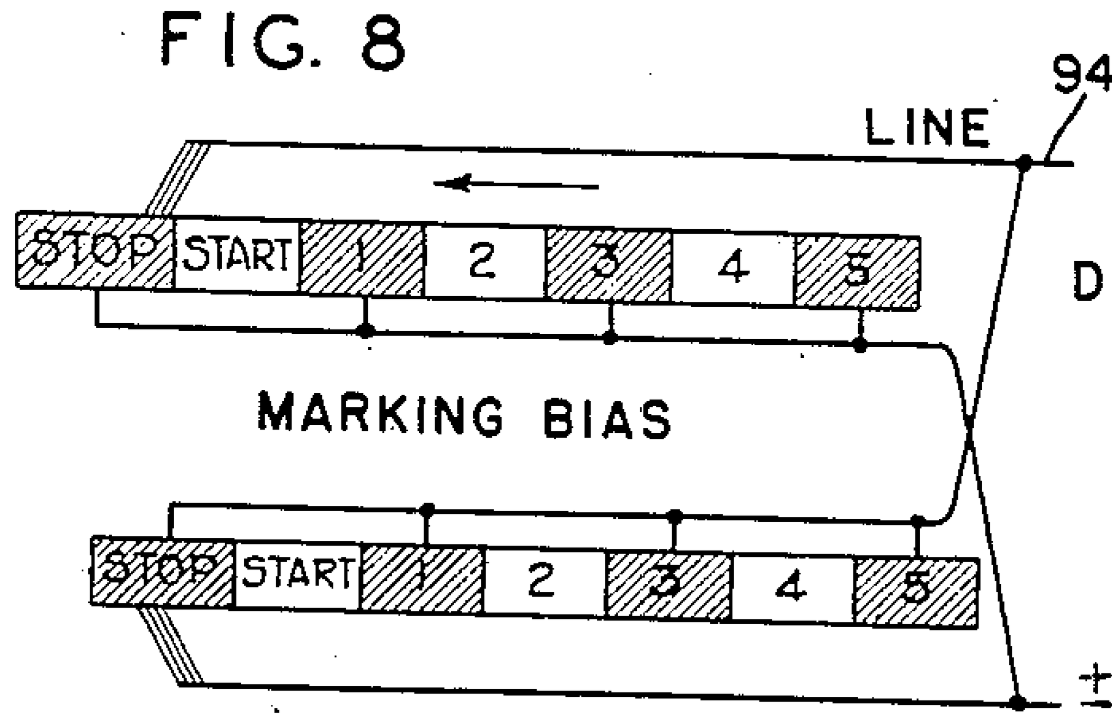


FIG. 9

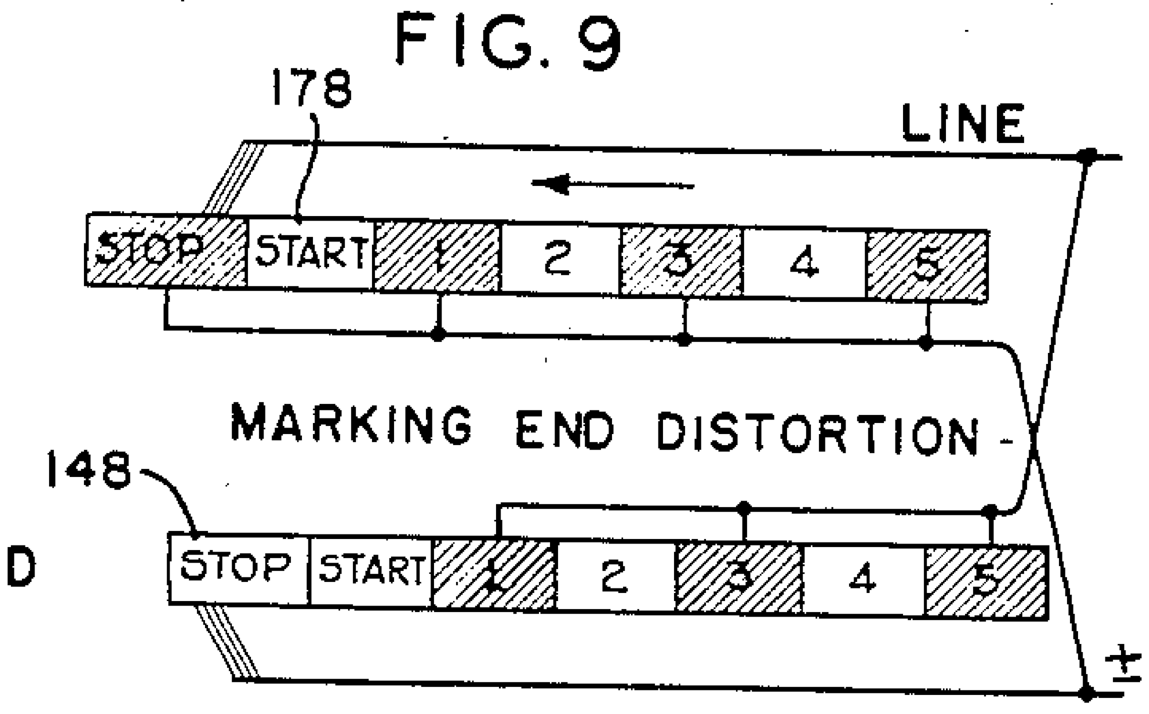


FIG. 8a

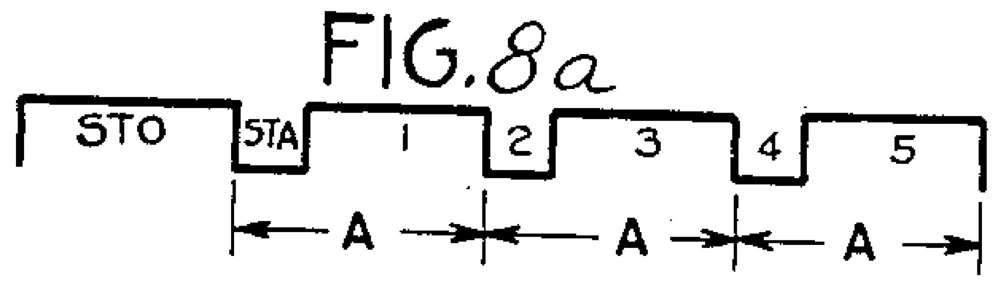


FIG. 9a

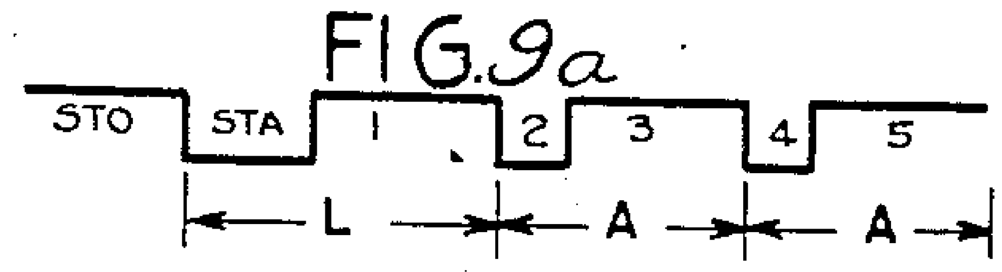
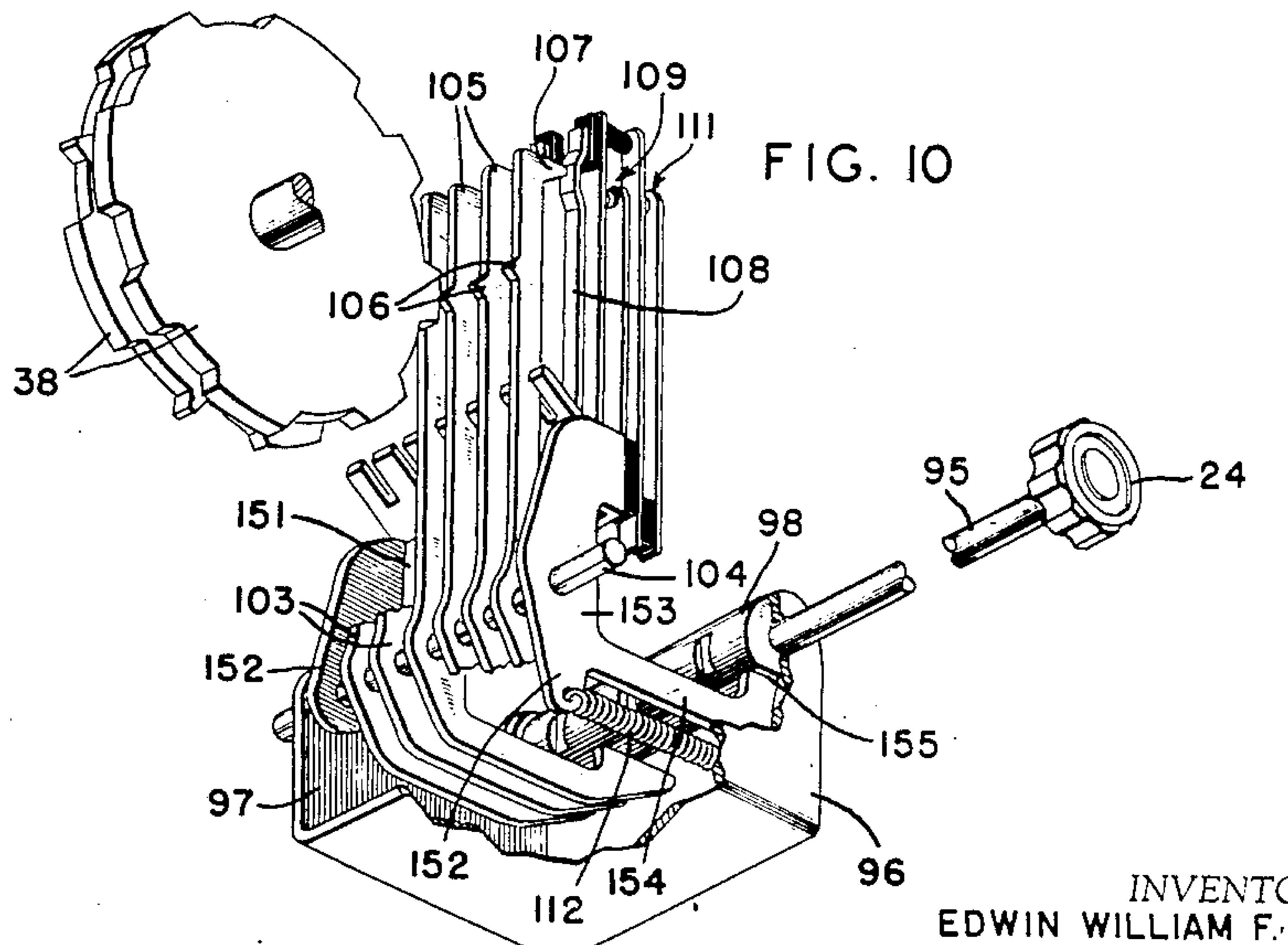


FIG. 10



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2,183,613

UNITED STATES PATENT OFFICE

2,183,613

BIAS TRANSMITTER

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Application September 3, 1937, Serial No. 162,328

16 Claims. (Cl. 178—69)

The present invention relates to telegraph systems and apparatus therefor and more particularly to testing apparatus for ascertaining the marginal operating characteristics or tolerance of printing telegraph mechanism.

Due to certain uncontrollable phenomena occuring in connection with the transmission of telegraph signals, conditions prevail which detrimentally affect signal transmission and which, due in part to inductive and capacitative influences, produce certain distortions in telegraph signals. In an endeavor to immunize telegraph receiving equipment to the usual ranges of signal distortion, terminal equipment is designed to accommodate certain degrees of signal distortion and/or bias. This margin or capacity to respond satisfactorily to certain degrees of signal distortion may be termed tolerance.

In testing terminal equipment to determine its tolerance, synthetically distorted signals are reproduced and transmitted having a known degree and direction of distortion, and the effect of said signals upon the terminal apparatus is observed until a point is reached at which an erroneous response is produced. Particularly in the case of telegraph printers, tolerance standards are customarily established as a condition prerequisite to passing inspection tests and equipment to be acceptable for commercial operation and service must be capable of receiving and responding correctly to signals having predetermined ranges of distortion.

Accordingly, it has been found expedient to provide apparatus for transmitting accurately measurable distorted signals in which each factor of distortion may be independently calculated and determined and thus make possible the attainment of a basis for calibrating the tolerance rating of the receiving equipment.

The present invention is related in function to the structure described in United States Patent No. 2,036,059 issued to W. Y. Lang by reason of its provision of a rotatable annular index which carries a standard start-stop code pattern rotatable into any position for the purpose of comparison with the signals under test, the provision of a synchronizing starting apparatus for cutting in and out of the transmitter during the start impulse interval of its cycle, switching means for changing from miscellaneous message matter to R and Y test signals, and circuit arrangements for switching instantly from bias to end distortion by shunting of the stop segments. The significance of each of these features will become more apparent during the course of the following description.

The margin of distortion by which test signals of any type differ from theoretically perfect signals is here classified into two major divisions each having two subordinate varieties. For convenience, the two major types of distortion are referred to as (1) bias and (2) end distortion. Each of these types may be applied to marking or spacing signals so that bias may be considered as comprised either of marking bias or spacing bias while similarly end distortion is classifiable as marking end distortion or spacing end distortion.

Apparatus of the design herewith contemplated finds many uses and applications in the testing of telegraph signaling equipment. A typical use for which it is appropriate is in testing telegraph printers for signal tolerance. Bias and end distortion signals of both marking and spacing types are transmitted to a printer, the degree of distortion being increased until the failing point is obtained. In each instance a stroboscopic device may be cut in after the failing point is attained and in so doing, there will be produced a visual portrayal of the signal. From this the technician or adjuster may be apprised of special apparatus characteristics not otherwise discernible. The information thus obtained not only indicates the existent tolerance, but also any adjustment which may equalize or distribute more evenly any available surplus when such surplus is preponderous.

The present invention is directed to apparatus consisting of a transmitting distributor having means for introducing calibrated variations of any of the aforementioned classes of end distortion and bias and of determining accurately the degree of distortion or variation of each signal from a known standard. In addition, the apparatus embraces a unique type of visible index comprising a rotatable neon lamp and an annularly rotatable scale capable of being adjusted to afford a reading throughout 360°. This index is utilized not only for measuring the signal distortion of the transmitted test signals but it may also be used for determining the distortion or any other visible characteristics of incoming line signals received from a remotely located transmitter. When employed in the latter manner, the unit does not perform as a transmitter but instead as a receiver having a visual index for inspecting the characteristics of incoming line signals.

Accordingly, the main object of the present invention is the provision of testing equipment for printing telegraph apparatus, which is comparatively simple and highly efficient, and which is capable of producing signals of varying types and degrees of distortion to simulate signal characteristics which might be expected under various operating conditions.

Another object of the present invention is the provision of a transmitter for producing eccentric permutation code signals, and means for determining accurately various classes and degrees of distortion.

Another object of the present invention is to provide a rotatable neon tube carrier whose speed of rotation may be synchronized in accordance with known standard forms of transmission, and in which an annular index comprising a rotatable inscribed scale may be employed for observing variations in the visual pattern characteristics of transmitted signals.

In addition to the aforegoing objects, other features which have been developed include a transmitting mechanism having a synchronizing starter, which comprises a manually controllable device released at any time but effective to cut in and out of the transmission line the transmitting apparatus only during the occurrence of the stop impulse interval regardless of the particular instant at which the manual operation is initiated.

In its preferred embodiment, the present device comprises a unitary structure having a large disc dial constituting an index from which the aforedescribed variations in signal characteristics may be observed. At each side of the index dial is located a tier of control devices or switches. As will be described, these switches control the transmitter so that it may be adapted to several conditions of signal distortion.

The neon tube is carried upon the rotating arm and as marking signals are received and impressed upon the electrode of the tube, luminous patterns are produced upon a dark background. Since the transmitting shaft is rotating in accordance with standard start-stop frequency, these patterns may be made to recur in the same relative position for corresponding signal intervals of consecutive signals. If any variation in speed is noticeable, means are provided in accordance with the present embodiments for introducing correction. A ring is mounted so that its annular inner surface lies just outside the path described by the rotating neon lamp. Engraved markings on the ring are arranged so as to coincide with a standard start-stop signal. By adjusting the relative position of the ring to the visual image of the incoming signal, the degree and precise nature of distortion of incoming signals may be ascertained by noting the difference or differences between the incoming signal and the standard which is symbolized by the markings on the ring.

In the present embodiment an arbitrary standard test message is formed upon the peripheral surface of a set of discs. This message may be employed for ordinary testing, but as an alternative method there is also provided a means for rendering the standard test message mechanism ineffective for transmission and for substituting therefor a transmitting arrangement for sending solely either the letter R or the letter Y, two characters especially adapted to test signaling.

For a more comprehensive understanding of the present invention, reference should be had to the accompanying drawings and to the specification following hereinafter wherein corresponding parts have been indicated by similar reference characters, and wherein:

Fig. 1 is a front elevation of the present invention having a portion of the transmitter broken away to reveal the distributor arm and phasing arrangement;

Fig. 2 is a view taken similar to Fig. 1 but wherein additional fragments of the mechanism have been broken away to reveal the test message apparatus, contact, and a portion of the driving train;

Fig. 3 is a transverse sectional view taken approximately on line 3—3 of Fig. 2;

Fig. 4 is a vertical sectional view with the lower portion of the apparatus shown in side elevation and is taken approximately on line 4—4 of Fig. 2;

Fig. 5 is a circuit drawing illustrating the electrical connections of the apparatus featured in Figs. 1 to 4;

Figs. 6 to 9 inclusive are diagrammatic detail views illustrating in a simplified manner the multiple circuit arrangements which may be obtained by the use of the toggle control switches illustrated in Figs. 1 and 2 and featuring particularly the relative positions of the segmented distributor rings;

Figs. 6*a* to 9*a*, inclusive, are curve charts each located beneath an associated figure described in the preceding paragraph and illustrating diagrammatically the signal formations associated therewith; and

Fig. 10 is a detailed perspective view of the switching mechanism for shifting the control of transmission between the set of coded discs associated with the test message and the apparatus employed for straight R and Y signal transmission.

In the accompanying drawings, the reference character 11 denotes a base casting with the fore portion of which there is integrally formed a flanged face 12, Fig. 4. The contour of face 12 is designed to conform with that of a circular dial indicated generally by the reference character 13 and escutcheon plates 14 and 15. Plate 14 is located at the left of the dial 13, as viewed in Fig. 1, and through it there extend toggle switch handles 16, 17, 18, and 19 as well as motor switch 21. Plate 15, which is symmetrical to and opposite plate 14, forms a background to three rotatable knobs 22, 23, and 24.

A main distributor shaft 25, concentric of dial 13, is frictionally driven by an electric motor 26, whose driving worm 27 meshes with a worm wheel 28 frictionally supported between slip washers 29 of a friction clutch 31, Figs. 3 and 4. Distributor shaft 25 carries forward the rotation through a tributary train which includes a driving gear 32, a driven wheel 33, and a stub shaft 34, best indicated in Fig. 2. A worm 35, connected to the lower end of stub shaft 34, imparts reduced speed rotation to an assembly on shaft 36 consisting of a driven gear 37 and a plurality of coded discs 38.

As indicated best in Fig. 3, the foremost portion of shaft 25 is journaled in a bearing 39 and protrudes through the plane occupied by segment supporting discs 41 and 42. To the protruding section is secured a triangular plate 43, Fig. 2, one of whose extremities carries a supporting bracket 44. The latter has integrally associated with it a mask 45 and a receptacle 46 into which is fitted a neon tube 47. Mask 45 is slotted as at 48 and through this slot is visible a linear light beam during the time that the neon tube 47 is lighted. Since the assembly is rotatable together with shaft 25, intervals during which the light beam is visible cause to appear arcuate glow images in a circular path and because isochronous telegraph signals are passed through the neon tube filament coincident with the cyclic rotation of shaft 25, signal impulse intervals of repeated character signals having definite positions in cycle may be made to occur during successive cycles in substantially the same relative position. When a character signal is repeated for a definite period, the repeated occurrences of arc glow images may be observed as a relatively constant condition and may be compared with a standard 49 for determining the constancy of its characteristics. The standard 49 is so called because its radial markings are so spaced from each other as to be accurately representative of an ideal signal, that is to say, of a signal which is entirely free of any distortion factor.

Circular standard or index 49 is constructed of an annular ring 51 having a groove 52 internally thereof within which are fitted component segments 53, Fig. 2, secured to the front face 12. A fascia 54, fastened to the annular ring 51 by means of screws 55, has inscribed on its exposed surface, spaced radial gradations 56, which are predeterminedly plotted to agree, in major angular markings, with the divisions of a theoretically perfect code signal.

Current is supplied to the neon tube 47 over a pair of conductors 57, Fig. 5, which connect the terminals of said tube with distributor brushes 58 that wipe across continuous rings 59—59. Concentric with the rings 59—59 and also with the distributor shaft 25 are a pair of continuous rings 61 and 62 and a pair of segmented rings indicated generally 63 and 64. All of the concentric rings, except ring 64, are set into the supporting disc 42, as best indicated in Figs. 3, 4, and 5, while segmented ring 64 alone is set into the face of the outer supporting disc 41. However, all of the rings 59 to 64 are disposed in a single plane and they are conveniently traversed by the brushes of a single distributor arm 65.

Rings 61 to 64 are traversed by brushes 66, 67, 68, and 69, respectively, with brush 67 electrically connected to the brush 68 and brush 66 electrically connected to brush 69. Accordingly, brushes 66 and 69 bridge rings 61 and 64 while brushes 67 and 68 bridge rings 62 and 63. In the position indicated in Figs. 2 and 5, the segments of rings 63 and 64 are in radial alignment with respect to each other, but it is to be understood that supporting disc 41 and hence ring 64, whose segments are imbedded in said disc, is rotatable in the instant embodiment, through a limited degree of movement in a counterclockwise sense, from the position indicated in Figs. 2 and 5, under the control of knob 22.

Shaft 71, Figs. 2 and 4, of knob 22 extends through escutcheon plate 15, and at its inner end there is splined a driving pinion 72, which, through an intermediate idler gear 73, Figs. 2 and 3, is capable of imparting counterclockwise movement to an arcuate rack 74 integrally associated with the supporting disc 41. The extent to which supporting disc 41 may be rotated is limited by a stop pin 75 anchored in the idler gear 73, which is designed to encounter stop lug 76 carried by a stationary portion of the frame as idler gear 73 is rotated both in clockwise and counterclockwise directions.

The extent of movement permitted to supporting disc 41, and hence to its segmented ring 64, is sufficient so that the normal sized segments (start, 1, 2, 3, etc., but preferably not the stop segment) may overlap their adjacent segments in ring 63 in a counterclockwise direction to an extent of at least fifty to one hundred per cent. The electrical significance of this adjustment will be considered hereinafter during the explanation of Figs. 6*a* to 9*a*. Mechanically, this adjustment produces the aforedescribed overlap of the stationary segmented ring 63 by the displaceable ring 64 and the precise degree of overlap is calculable by observing the radial alignment of corresponding ends of any pair of segments in rings 63 and 64 with the graduated index or standard 49.

Below the knob 22 there is found a control knob 23 whose spindle 77 terminates with a crank arm 78 triangularly shaped, as best indicated in Figs. 1 and 2, and provided in each of its corners remote from the pivotal corner with an anchor pin 79 and 81. Anchor pin 79 supports one end of a coiled tension spring 82, the other end of which is fastened to a stationary portion of the frame. Anchor pin 81 is received through a looped end of tension spring 83, the other end of which is articulated to one end of a pivoted lever 84, as best indicated in Figs. 1 and 3. The opposite end of lever 84 narrows down to a lug projection of sufficient size to be received within one or the other of a pair of adjacent apertures 85 and 86 of which said lever is shown in engagement with the lowermost aperture 86. These apertures serve as locking means for lever 84, and they are formed at the lower extremity of a latching lever 88, which is urged by a spring 87 in a counterclockwise direction about the pivot member 89.

The upper end of lever 88 is curved so as to be gradiently engaged by a minute cam apex 91 secured upon main distributor shaft 25. When latching lever 88 is engaged by cam 91, there results a clockwise rotation of the former against its spring 87, causing to be withdrawn its lowermost end from engagement with the lug extremity of pivoted lever 84 and depending upon whether crank arm 78 is disposed in the position indicated in Fig. 1 or in its alternative position (about 90° counterclockwise therefrom), lever 84 will accordingly be tensioned by spring 83 counterclockwise or clockwise respectively. As a result, upon the release of latching lever 88, as aforementioned, lever 84 will be permitted to move from one of its positions to the other as influenced by spring 83.

When in its counterclockwise position as illustrated, a pin 92 carried by lever 84 is withdrawn from the insulated extremity of a contact pair 93, but when said lever 84 is in its clockwise position, the pin 92 abuts said insulated extremity, effecting the closure of the contact pair 93 for shunting the transmission line with battery 173.

The alternative control of knob 23 causes a tension to be applied to lever 84 in one direction or another, but the consummation of the control operation is transferred to the apex 91 of main distributor shaft 25, the occurrence of which is coincident with the stop impulse of a permutation code signal. Accordingly, no changeover may be effected except during the transit of this signal impulse, which is an inert or non-active impulse so far as a signal selection is concerned. This assures the transmission of complete signals rather than signal fragments such as might otherwise result where a control switch is directly operated by manual supervision.

Knob 24 is secured to and rotatable with a shaft 95 which extends through and is journaled in a pair of side frames 96 and 97, Figs. 2, 3, and 10. To shaft 95 is keyed sleeve 98, the periphery of which is studded with variously distributed flat spots. Noting particularly Fig. 2, it will be observed that these flat spots or areas are arranged in three aligned groups angularly separated from each other. Those indicated by the dotted line 99 are at the left of sleeve 98, as viewed in Fig. 2, those indicated 101 at the right of said sleeve, while at 102 is a continuous flat area shown in this illustration as being engaged by the extremities of a set of bell cranks 103. In Figs. 3 and 4, shaft 95 is shown as having been rotated counterclockwise throughout 90° from Fig. 2, in which case the flat area 102 is disposed to the foreground in Fig. 4, or to the right in Fig. 3, displaying in the latter case the particular distribution of the flat spots 101.

Bell cranks 103 are similar in contour and the several of them are pivotally supported upon a shaft 104, which is secured at its extremities in the side frames 96 and 97. Each bell crank lever 103 includes an upstanding arm 105 provided with a cam lug 106 which extends sidewardly and is adapted to engage the periphery of an associated one of the coded discs 38. Another lug formation 107 on each of said upstanding arms 105 is projected in an opposite direction and engages with its extremity an associated flat tension spring 108, as may be seen in Fig. 10. Each tension spring 108 maintains its bell crank in a counterclockwise position with its cam lug 106 urged against the periphery of an associated code disc 38. With each tension spring 108 is provided two pairs of contact elements 109 and 111 the several assemblies including in each case a tension spring 108, and the two aforedescribed pairs of contacts are mounted upon a transverse bail 151, which is formed with the downwardly extending sides 152 and 153.

The latter side has integrally associated with it a follower arm 154, which rests against the endmost portion of the periphery of sleeve 98. A special flat spot 155 in sleeve 98 is adapted to be presented opposite the contacting surface of follower arm 154 when shaft 95 is in the angular position indicated in Fig. 2. During this condition, a tensioning spring 112, one end of which is anchored to the side frame 96, pulls with its other end against an ear 156 also integrally formed with the downwardly extending side 153, and causes the entire assembly, including bail 151 and the several contact assemblies to be rocked about shaft 104, until the cam lugs 106 are engageable by the peripheries of the code discs 38. At other times during the rocking of shaft 95, either clockwise or counterclockwise 90°, the periphery of sleeve 98 in the proximity of feeler arm 154 causes transverse bail 151 to be rocked clockwise, Fig. 2, through a limited degree of movement but to a sufficient extent to withdraw the cam lugs 106 so that they are free from engagement by the code discs 38.

It has been noted that the peripheries of the coded discs 38 are preferably cut so as to afford permutatively a succession of signals constituting a test message. As the code discs are rotated in timed relation to shaft 25, through the gear train including elements 33, 35, etc., code signals are impressed by the peripheries of said discs 38 through the bell cranks 103 upon the contact pairs 109 and 111, but this is possible only during the aforementioned intermediate position when bail 151 and its appurtenances are in their counterclockwise extreme position. The rotation of shaft 95, 90° in either direction from this position so that the pointer 57 of knob 24 indicates straight R or Y transmission, results in the withdrawal of all contact assemblies from association with the test message code discs 38.

During either of said R or Y conditions of transmission, the flat spots 99 and 101 are effective to displace certain ones of the bell cranks 103 clockwise about shaft 104 and against the tension of their individual springs 108 effecting the closure of their associated contact pairs 109 and 111. In the particular embodiment, the counterclockwise extreme position of shaft 95 causes to be installed a code combination corresponding to the character R, while the clockwise extreme position of shaft 95 causes to be installed on the contact assemblies the code combination corresponding to the character Y.

The foregoing described mechanism concerning the changeover switch between R, Y, and test message apparatus forms the subject of a separate application filed October 18, 1937, Serial No. 169,625.

At the left of the unit, as viewed in Fig. 1, is found an escutcheon plate through the face of which extend the several toggle switch arms indicated 16, 17, 18, 19, and 21 already described. Mechanically, switches 16 to 19 are of a type capable of assuming three positions, two extreme and one intermediate, during the latter of which contact elements under supervision are permitted to assume their normal relationship, but during either of their extreme positions each switch arm effects the closure of one or more sets of contacts. In Fig. 5, contacting elements only of said switches are shown, it being understood that to effect their closure, an associated one of said switch arms need but be thrown to the proper one of said extreme positions. In comparing Fig. 1 or 2 with Fig. 5 it is to be borne in mind that when the foremost portions of any of the toggle levers are shown to the right in Figs. 1 and 2 then their inner ends are effecting a contact closure toward the left, Fig. 5, and vice versa. The illustrations are in this respect actual and the reader should avoid the suggestive conclusion that the direction of the toggle levers in the mechanical views is the same direction as the contact closure in the disclosure of the electrical connections.

In the use of the terms bias and end distortion, cognizance is given to the uniformity or non-uniformity of signal impulse alterations. That is to say, those changes which affect all impulses equally throughout a signal are referred to as signal bias whereas those alterations which affect the start impulse in a different manner from that in which other impulses are affected are referred to as distortion. In order to provide regularity in making the observations, a signal has been employed in which impulses are of alternate characteristics successively. Thus, it may be observed that in the examples illustrated in each of the Figs. 6*a* to 9*a*, the signal curve starting with the stop impulse has been arbitrarily designated as one of alternate line characteristics, which corresponds incidentally to the character Y. Any other signal might be employed but not with the same utility in affording a wide field of comparison.

It is to be noted, for example, in Fig. 6*a*, that in the distance between the starting point of the start impulse and the termination point of the No. 1 impulse, which distance constitutes a complete signal impulse pattern, there is occupied the same space as is occupied by each succeeding pair of impulses constituting a complete signal pattern. These distances are indicated by the dimensional index A. In the case of Fig. 1*a*, which is an example of spacing end distortion, the distance between the starting point of the start impulse and the termination of the No. 1 impulse is less than that between the starting point of the No. 2 impulse and the termination of the No. 3 impulse. Accordingly, the pattern in the case of spacing end distortion is not uniform, hence the term distortion.

Also, it is to be noted in Fig. 9*a* that the distance between the starting point of the start impulse and the termination point of the No. 1 impulse is greater than that between the starting point of the No. 2 impulse and the termination point of the No. 3 impulse. Thus also there is lacking the uniformity which is noted in the two examples of bias signal transmission. Hence here too the condition is described as a distortion because as between one impulse pattern (comprised of a consecutive marking and spacing impulse pair) and another pattern of the signal there is a variation in their lengths.

The importance of this variation is best understood when viewed in terms of a receiving selector which is started into its cycle of operation the instant that the start impulse is received. Thus, in the case of bias signals, the sole effect upon a receiving selector is to delay the instant of starting each signal as a result of which the time displacement affects equally the receiving selector and the reception of the ensuing selector impulses, but in the case of end distortion signals, there is introduced in fact an unequal displacement between the period of starting of the receiving selector and the periodicity of succeeding impulses.

The present invention concerns itself in one of its features with providing a novel means for introducing a distortion factor which permits the generation of distortion type signals and of switching instantly and conveniently from the transmission of this class of signals to the class aforedescribed as bias signals. In the illustrations of Figs. 6 to 9, there is portrayed fundamentally this novel principle of signal transmission and the circuit arrangements whereby the change-over is effected expeditiously. During the course of the following description, it may be noted that the general principle that is illustrated in Figs. 6 to 9, is also to be found in Fig. 5 but that in the detailed disclosure of Fig. 5, there are contained several additional control devices.

As indicated by the applied legends (bias and end distortion), the upper switching arm 16 is assigned to the closure control of contact pairs 113 and 114 the tension of the contact springs themselves sufficing to separate them when the effect of the toggle lever is withdrawn. In this connection, attention is directed also to Figs. 6 to 9 where diagrammatically there is shown in a simplified form the effect of operating certain ones of the switch arms located on the escutcheon plate 14.

In the same manner as aforedescribed, switch arm 17, during its extreme settings (the intermediate one in all cases being neutral) effects the closure of contact pairs 115 and 116 in one position and contact pair 117 with contact spring 118 in its other position. Contact spring 118 will be noted as movable between a pair of contact points 119 and 121. Switch arm 118, during one of its positions, engages a contact spring 122, and during the other of its positions it engages contact spring 123, while switch arm or lever 19 in the same manner is reciprocable between control of contactor springs 124 and 125 each of which is engageable with a pair of associated contacts.

Referring for the moment again to the various rings of the distributor dial 13, Figs. 2 and 5, it will be observed that in displaceable ring 64 the selector segments 126, 127, 128, 129, and 131 each are connected over an individual line 179 to one of the contact elements of the aforedescribed set of contact pairs 109, while the other element of each of said pairs 109 are connected parallelly over a common line 132, to the junction point 133, thence on the one hand over line 134 to one contactor of contact pair 116, the other contactor of which communicates over a line 135 with the continuous distributor ring 62 and thereafter over the pair of bridged distributor brushes 67 and 68 which connect the collector ring 62 with the segments of fixed ring 63. The selecting segments of ring 63 indicated 136, 137, 138, 139, and 141 each are connected over an individual path 164 to one contactor of an associated pair 111 aforedescribed, while the other contactors of each of said pairs 111 are connected parallelly over the common circuit 142 which leads to the junction point 143. From here one path is traceable over line 144, contact pair 118–121, line 145 to the continuous collector ring 61, while another course is traceable from junction point 143, over line 146, to either of the contact pairs 114 or 115. During the closure of contact pair 114, the course is traceable over the continuation line 147, which leads to the stop segment 148 in ring 63, and upon the closure of contact pair 115, the continuation circuit is traceable over path 149, which also connects with line 147 and stop segment 148.

In Figs. 6 to 9, it will be noted that the segmented rings 63 and 64 have been indicated conventionally as linear elements rather than as circular elements, but it is to be understood that this variation is employed only for the purpose of simplifying the explanation to follow. The reference character 63 represents the stationary segmented ring, and the reference character 64 the movable segmented ring which, in the simplified illustrations, has been indicated as offset rightwardly to an extent of less than a complete minimum segment overlap. To obtain a condition such as illustrated in Fig. 6, toggle switch 16 must be operated to the left in order to close contact pair 114 and toggle switch 17 to the left in order to close contact pairs 115 and 116 (which are simultaneously operated). In order to produce a visual image of the generated signal, toggle switch 19 is operated to the left causing to become engaged contact spring 125 with its contact point 158.

Spacing bias

The term bias is also to be construed a signal variation in which signal impulses of a certain current type are lengthened to the detriment of succeeding impulses of the other type where two types such as marking and spacing are employed in signal transmission. A hindermost lengthening of marking impulses is termed a marking end distortion, see Fig. 9*a*, while a spacing end distortion correspondingly affects the spacing signals as portrayed in Fig. 7*a*. For classification purposes, a differentiation is recognized between front and rear distortion, termed "bias" and "end distortion." In addition to this classification, however, there is also to be recognized one affecting the types of impulses, as "marking" and "spacing." Thus, a bias favoring a marking signal may be specifically classified as a marking bias or, where an end distortion constitutes a hindermost lengthening of marking signals, the condition is referred to as marking end distortion as distinguished from spacing end distortion, which accordingly would refer to a hindermost lengthening of spacing signals. In each instance of bias affecting one class of signal impulses, it is to be borne in mind, as has already been noted above, that there results a shortening in the forward portion of ensuing signals of the opposite type. The foregoing classification will prevail whether the alternative current conditions be constituted of positive and negative signals or current no-current conditions, etc.

Fig. 6 illustrates a simplified transmitter circuit adjustment which would result in the generation of spacing bias signals.

In Fig. 5, the completed circuit is traceable from signaling line wire 94 as a starting point, thence over branch line 159, contact 161, and its shiftable contact spring 122 (which is now in its left-hand position because toggle switch 18 is moved rightwardly to the side of the escutcheon plate marked "transmit") over line 162 to the junction 163, thence over line 164 to continuous collector ring 62. Here the line circuit is introduced to each of the segments 136 to 141 of fixed ring 63 by brushes 67—68 during the rotation of distributor arm 65, parallel lines 164, through an associated contact pair 111 to the common circuit 142 which leads to the junction point 143. From this point, the circuit is traceable over line 144, contact spring 118, and its left-hand contact point 119 (because toggle switch 17 it at this time directed towards spacing) line 165 to the junction point 166, line 134 to the junction point 133, which leads to the common circuit 132 connected to one of the contacts of each contact pair 109 as well as to the movable distributor ring stop segment 167. During the closure of certain contact pairs 109, and in all cases as to segment 167, the circuit is extended to the movable segments of ring 64 over branch wires 179 and then by brushes 69—66 to continuous collector ring 61. Thereafter the path is traceable over line 168 to the junction point 169, spring 123, and its left-hand contact 171 (because the stroboscopic toggle switch 19 is now directed to transmitting), thence out over line 172 to supply battery 173 and ground.

Spacing end distortion

Fig. 7 illustrates a simplified circuit condition under which there may be generated signals having spacing end distortion impulses. This circuit is traceable on Fig. 5 beginning with line wire 94, over branch line 159, contact pair 161—122 (because at this time the stroboscopic switch is thrown to transmit), lines 162 and 164 to the continuous collector ring 62. Thereafter, the circuit continues over brushes 67 and 68, any one or ones of the several segments of fixed segmented ring 63, and their corresponding code contact pairs 111 over collector circuit 142 to the junction 143, line 144, contact pair 118—119 (because the toggle key 17 is directed toward spacing) but because the distortion switch 16 is at this time directed towards end distortion rather than as in the former example to bias, an additional path is traceable from junction point 174, over a line 175, contact pair 117, line 176, contact pair 113, line 177, to the start segment 178 of the displaceable segmented ring 64. Thus, as indicated in Fig. 7*a*, the principal characteristic of this adjustment is to apply current to the start segment of the displaceable segmented ring 64. Beyond junction point 174 and continuing over line 165, the circuit resembles the one aforetraced in connection with the conditions prevailing in Fig. 6.

Marking bias

In Fig. 8 there is illustrated the marking bias condition. This circuit is traceable in Fig. 5 as follows: From line 94, over branch 159, through the contact pair 161—122 (because the stroboscopic switch is directed toward transmit), over line 162, to the junction point 163, thence on the one hand over line 1640 to the continuous ring 62 and on the other hand over line 135, contact pair 116 (because switch 17 is directed towards marking), line 134 to the junction 133, thence to stop segment 167 of the movable segmented ring 64 and also over the collector circuit 132 in the operated ones of the contact pairs 109 and their individual segment lines 179 to the associated ones of the movable segmented ring segments 126 to 131.

During the operation of the distributor arm 65, the aforedescribed circuits are continued over brushes 67—68, the corresponding segments of fixed ring 63, and their contact points 111 to the collector circuit 142, thence to the junction 143 and on the one hand over line 146, through the contact pair 114, line 147, to the stop segment 148 of ring 63, and on the other hand over line 144, contact pair 118—121 (because switch 17 is now directed towards the marking position), line 145, to junction 169, thence on the one hand over line 168, to the collector ring 61 thereby bridging over brushes 66 and 69 with the circuits whose description was interrupted at segments 126 to 131, and on the other hand through contact pair 123—171, line 172, to battery 173. The signals generated in accordance with this arrangement are exemplified by the curve illustrated in Fig. 8*a*, whose pattern as may be noted, is uniform. Because the increase favors the marking signals (where followed by spacing signals) this classification is termed marking bias.

Marking end distortion

In the illustration of Fig. 9, there is exemplified the fundamental circuit for generating marking end distortion signals, which as has been explained are characterized by an elongation of the initial impulse pattern comprising the signal impulses of the start and No. 1 selecting impulse positions. In Fig. 5, this circuit is traceable from line 94, over branch 159, through the contact pair 161—122 (because stroboscopic switch 18 is directed towards transmit), line 162, to the junction point 163, thence on the one hand over line 164 to continuous ring 62 and on the other hand over line 135, through contact pair 116 (because switch 17 is directed towards marking) to the junction point 166, thence over line 134 to the junction point 133 continuing on the one hand to the stop segment 167 of movable ring 64, and on the other hand over collector circuit 132, operated ones of the contact pairs 109, their individual paths 179 to their corresponding segments 126 to 131.

Battery is traceable over line 172, through the contact pair 171—123 (because stroboscopic switch is directed to transmit) to the junction point 169. From this point the circuit is traceable on the one hand over line 168 to the collector ring 61 completing the circuits whose description was interrupted above in the segments 126 to 131, while on the other hand the circuit is traceable from junction point 169, over line 145, to the contact pair 121—118, line 144 to the junction point 143. From here the circuit is traceable on the one hand over collector circuit 142, through the operated ones of the contact pairs 111 and their individual circuit paths 164 to the associated ones of the segments 133 to 141 completing the aforedescribed circuits whose description was interrupted, over the brushes 68—67, but because switch 17 is directed towards marking and contact pair 115—132 is held ajar, the circuit may not continue over line 149, while because contact switch 16 is directed to end distortion, contact pair 114 is permitted to come ajar so that the circuit may not continue on to line 147. As a result, line is withheld from the stop segment 148, as indicated in Fig. 9*a*, elongating the start interval and also the pattern represented by the dimension index L. This produces a variation in the pattern as is the characteristic of an end distortion signal.

The toggle switch keys 18 and 19 jointly supervise the cutting in and out of the stroboscopic lamp 47, and, incidentally, the switching between control line 94 and a local circuit about to be described.

When the key head of switch 19 is moved to the extreme left-hand position in a direction indicated by the legend "line," there is established a local circuit effecting solely the stroboscopic lamp and communicable with the two binding posts 201 and 202 of Fig. 5. This circuit is traceable beginning at the terminal post 201 and continuing over line 203, contact point 204, flexible contact blade 124, line 205 to the inner distributor ring 59, the brushes 56, outer distributor ring 59, line 206, flexible contact blade 125 and its right-hand contact 153, line 207 to the binding post 202. Thus, it is to be observed that in this manner switch 19 subjects the stroboscopic lamp entirely to an independent circuit which may be connected to any transmitting device for producing a visual image upon the stroboscopic lamp as it is rotated in synchronism with the transmitting apparatus, and that this image may be compared with the standard of measure exemplified by the circular plate 49 which carries the engraving 50. The correctness of the incoming signals may thereby be ascertained both as to their length, bias, or other signaling characteristics.

By moving switch 19 to the right so that its key head is nearest the legend "dist." however, stroboscopic lamp 47 is connected with a local distributor apparatus subject, however, to the secondary control which is exercised by the stroboscopic switch 18. This switch must be moved so that its key head is to the left and nearest the legend "view" in order to establish a circuit whereby a special current supply indicated by the terminals 208 and 209 is introduced through the stroboscopic lamp and through the marking-spacing and bias-end distortion arrangement as already described. The effect of operating switch 18 is to produce a closure of switch blades 122 and 123 with their right-hand contact points 211 and 212. The effect of this latter described operation is to introduce local current supply from the source 208—209 in lieu of a line circuit connection and battery 94 and 173. In all other respects the marking-spacing and bias-end distortion signaling characteristics remain under the sole supervision of their respective toggle keys 16 and 17.

After the bias or end distortion characteristics have been gauged by visual comparison with the circular standard, a transmitting operator moves toggle key 18 from the left or "view" position to the right or "transmit" position. This operation disconnects the stroboscopic switch from the transmitter circuit and reestablishes the connection, as aforedescribed, with the line 94. In this manner the operator is apprised of the exact signaling characteristics which are being issued over the line without regard to any artificial or natural inductive or capacitative effects inherent in the line.

From the foregoing, it will be evident that the present invention contemplates a permutation code transmitter having means for variously distorting the impulse components from their normal or ideal proportions in order to provide test signals for determining the tolerance of subjective mechanism such as printers, receiving selectors, etc. In addition, there is also provided a visual index and an annular scale in association therewith. This apparatus affords a convenient and highly accurate checking medium for observing at once the characteristics of issued test signals.

For the purpose of attenuating and distorting permutation code signals, there is embodied herewith novel means for switching readily from bias to end distortion, which terms have been specifically defined above, and for switching readily from marking to spacing varieties of either of the aforedescribed signal classifications each variation being established independently.

There is also provided herewith a novel mechanism for switching between straight R or Y signal transmission and an integrally associated test message transmitter, the aforedescribed switching being under the control of a single manual control knob. Another single control knob supervises the performance of an automatically executed changeover switch for cutting in and out the transmitting mechanism in a transmission line. In the execution of the run-stop switch knob, line battery is shunted in ahead of the transmitter apparatus at an instant always coincident with the stop impulse interval.

While the present invention has been explained and described in contemplation of a specific embodiment, it is to be understood that numerous modifications and variations may be instituted without departing from the spirit of the present invention. Accordingly, it is to be understood that the present invention is not restricted by any of the specific features disclosed in the accompanying drawings nor the ones described in the foregoing specification except as defined by the hereunto appended claims.

What is claimed is:

1. In a telegraph transmitter, a pair of segmented rings, collector rings associated with said segmented rings, a single brush carrier common to all of said collector and segmented rings, means for displacing one of said segmented rings with respect to the other angularly, means for projecting transmission signals through said segmented rings parallelly, and switch controlled apparatus for varying the timing between impulse intervals of each signal.

2. In a telegraph transmitter, a pair of seg-

mented rings, the segments of each of which are spaced in accordance with a standard unit isochronous signal, means for displacing one of said segmented rings with respect to the other one angularly for the purpose of overlapping corresponding segments, transmission apparatus for propagating isochronous code signals over the segments of said rings parallelly, and means for distorting the consecutive signal pattern comprising a breaker and circuit connection through certain ones only of the segments of said rings.

3. In a telegraph transmitter, a pair of segmented rings, means for passing a signaling current through both of said rings parallelly, adjustable mechanism for displacing said rings angularly for the purpose of elongating certain signal impulses by the overlap of their corresponding segments, and means for switching out of circuit certain segments only of one of said rings to prevent the elongation of corresponding impulses.

4. In a telegraph transmitter, a rotary distributor having a plurality of segmented rings, a common brush carrier and brushes secured to said carrier for traversing said plurality of segmented rings concurrently, switching means for connecting the segments of certain ones only of ones of said rings in a circuit with segments of others of said rings, and means for displacing said rings radially with respect to one another.

5. In a distributor, a plurality of segmented rings, means for displacing said rings to effect signal impulse attenuations, circuit connections associated with said rings to effect signal impulse distortion, a rotatable brush carrier, a stroboscopic lamp associated with said carrier, a rotatable index having markings thereon corresponding to an isochronous signal standard, and means for switching said stroboscopic lamp to associate it alternatively with said segmented rings or with an incoming line so that a visual pattern may be produced from incoming or outgoing signals.

6. In a distributor, a pair of segmented rings each segment of which corresponds to an impulse of a unit code signal, a distributor arm and brushes on said arm for traversing said rings simultaneously, means for displacing said rings with respect to each other so as to effect an overlapping of corresponding segments, circuit connections for conditioning electrically certain ones of said segments of each ring in series with corresponding segments of the other ring, circuit connections for conditioning electrically certain ones of said segments in each ring parallelly with corresponding segments of the other ring, and control means for alternatively establishing one or the other of said two circuit connections.

7. The combination set forth in claim 6 including means for switching out of circuit certain segments only of one of said rings for thereby effecting a signal distortion.

8. In a start-stop distributor, a frictionally powered shaft, a plurality of signal impulse segments certain of which are allocated to permutation code impulses and certain others of which are allocated to synchronizing impulses, means for associating a communication line with each of said segments successively, and means for connecting and disconnecting said associating means with a line comprising a manual spring tensioning member, a switch controlling member urged into alternative positions by said tensioning member, and a dual position latching pawl for said switch controlling member under the supervision of said shaft and operated by said shaft at a definite period only in its rotation.

9. In a start-stop distributor, a rotatable shaft, a stroboscope lamp carried by said shaft, a set of transmitting segment rings, a set of stroboscope lamp rings, means for associating said transmitting rings with said lamp, means for associating an incoming line with said lamp, said two associating means being operative alternatively, and an annular index having markings in accordance with a signal standard thereon to compare with the visual pattern produced by said lamp for either incoming or outgoing signals of said line of said distributor.

10. In a transmitting distributor, a fixed segment ring, a displaceable segment ring, the number and relative proportion of the segments of one of said rings being the same as that of the other, means for rotating said displaceable ring to cause its segments to overlap their corresponding ones in said fixed ring, and reversible circuit connections for conveying signals through corresponding segments of said rings serially or parallelly.

11. The combination set forth in claim 10 including means for cutting out of circuit certain segments only of one of said rings to produce a special variation in a particular signal component.

12. In a transmitting distributor, a fixed segmented ring, a displaceable segmented ring, the number and relative proportion of segments of one of said rings being the same as that of the other, means for rotating said displaceable ring to cause its segments to overlap their corresponding ones in said fixed ring, and circuit connections for projecting signals through corresponding segments of said fixed and displaceable rings serially.

13. A distributor having a fixed segment ring, a displaceable segment ring, the number and relative proportion of the segments of one of said rings being the same as that of the other, means for rotating said displaceable ring to cause its segments to overlap their corresponding ones in said fixed ring, and circuit connections for projecting signals through corresponding segments of said fixed and displaceable rings parallelly.

14. In a telegraph selecting system, instrumentalities for determining the degree of tolerance to signal distortion to which a receiving apparatus is capable of responding correctly comprising a pair of segmented rings, the segments of which are similarly spaced each to each in accordance with a standard unit isochronous signal, means for displacing one of said rings with respect to the other one angularly for thereby producing an overlap of corresponding segments, means for projecting code signals over said corresponding segmented rings parallelly, and means for distorting a single impulse in a signal comprising a circuit breaker associated with a corresponding impulse segment and manual means for operating said breaker.

15. A distributor for issuing bias signal impulses comprising a plurality of segmented rings certain of which are displaceable with respect to others to effect an overlap of corresponding segments, a brush carrier for bridging all of said rings with associated collector rings, a manually conditionable switch, and a control cam associated with said brush carrier for operating said switch at a definite angular position with re-

spect to said plurality of segmented rings after it has been conditioned manually.

16. A machine for issuing bias and end distortion signals comprising a rotary distributor having a pair of similarly segmented rings, means for displacing said rings angularly from each other to effect signal attenuation by overlap, circuit connections for controlling the characteristic of bias, and manually controllable switch means for effecting end distortion by cutting out of circuit certain ones only of the segments of said rings.

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