Oct. 4, 1949. C. W. ANDERSON ET AL 2,483,867

APPARATUS FOR GAUGING JACKS

Filed May 8, 1946 9 Sheets-Sheet 1

FIG. 1

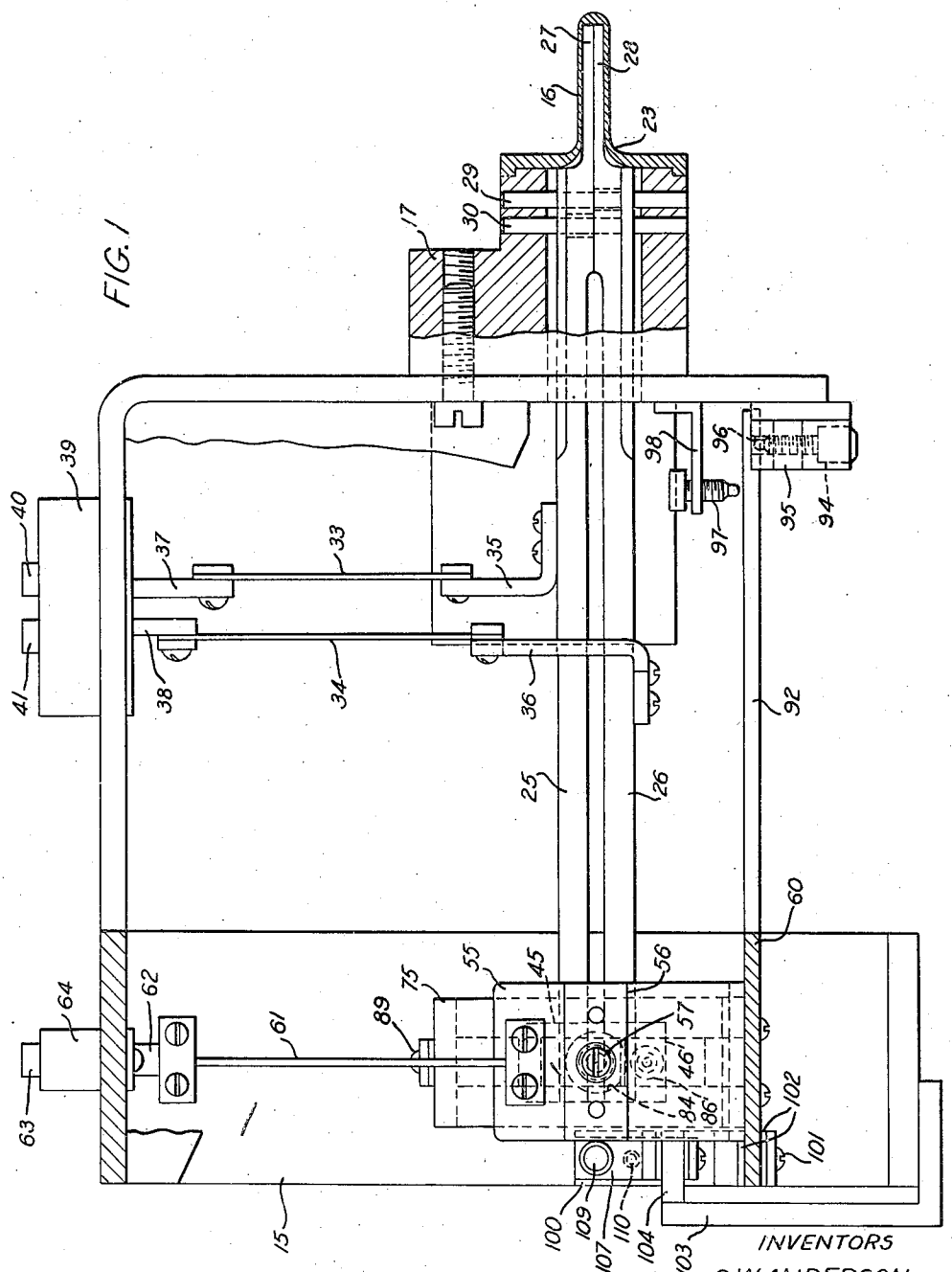

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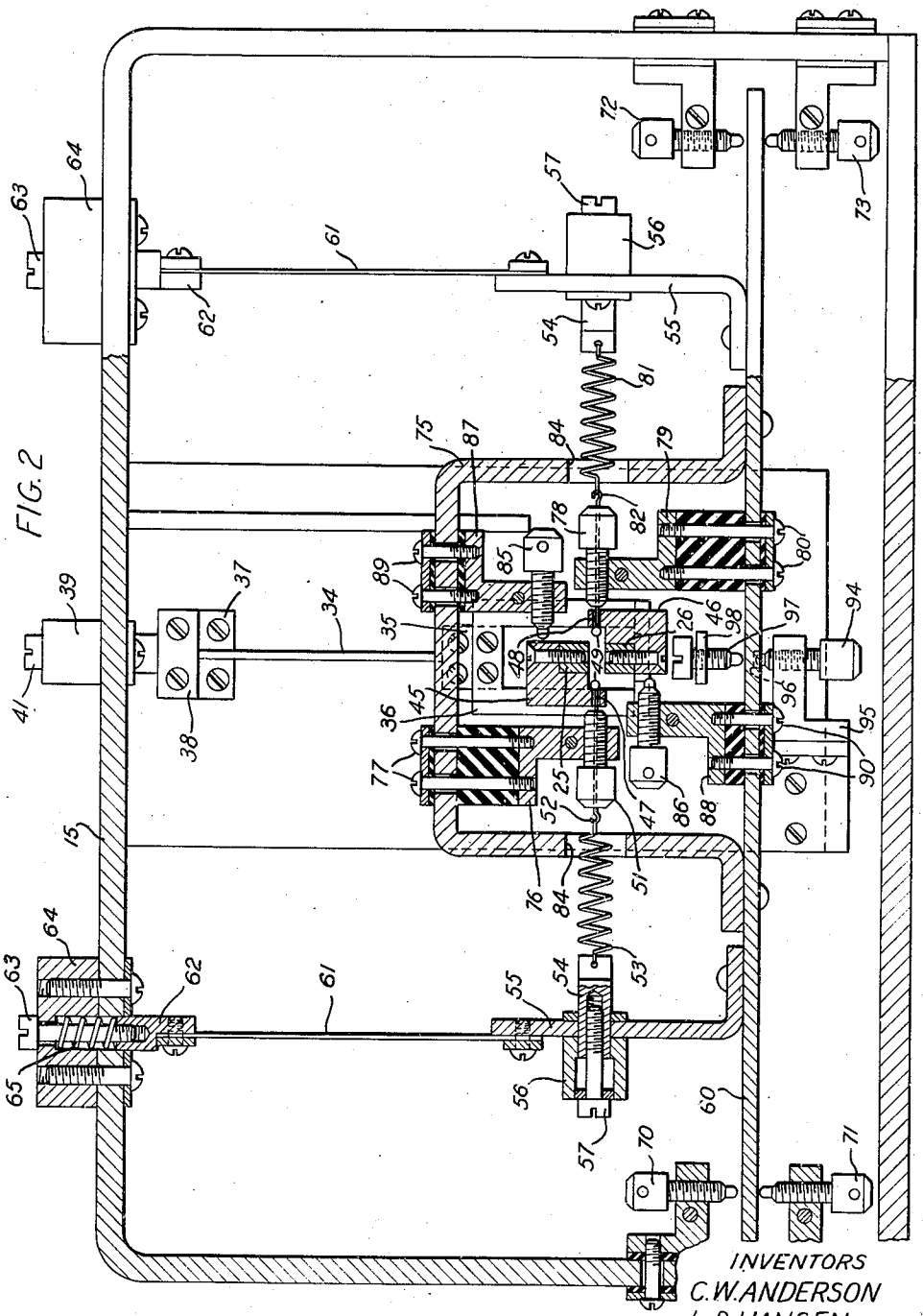
FIG. 2



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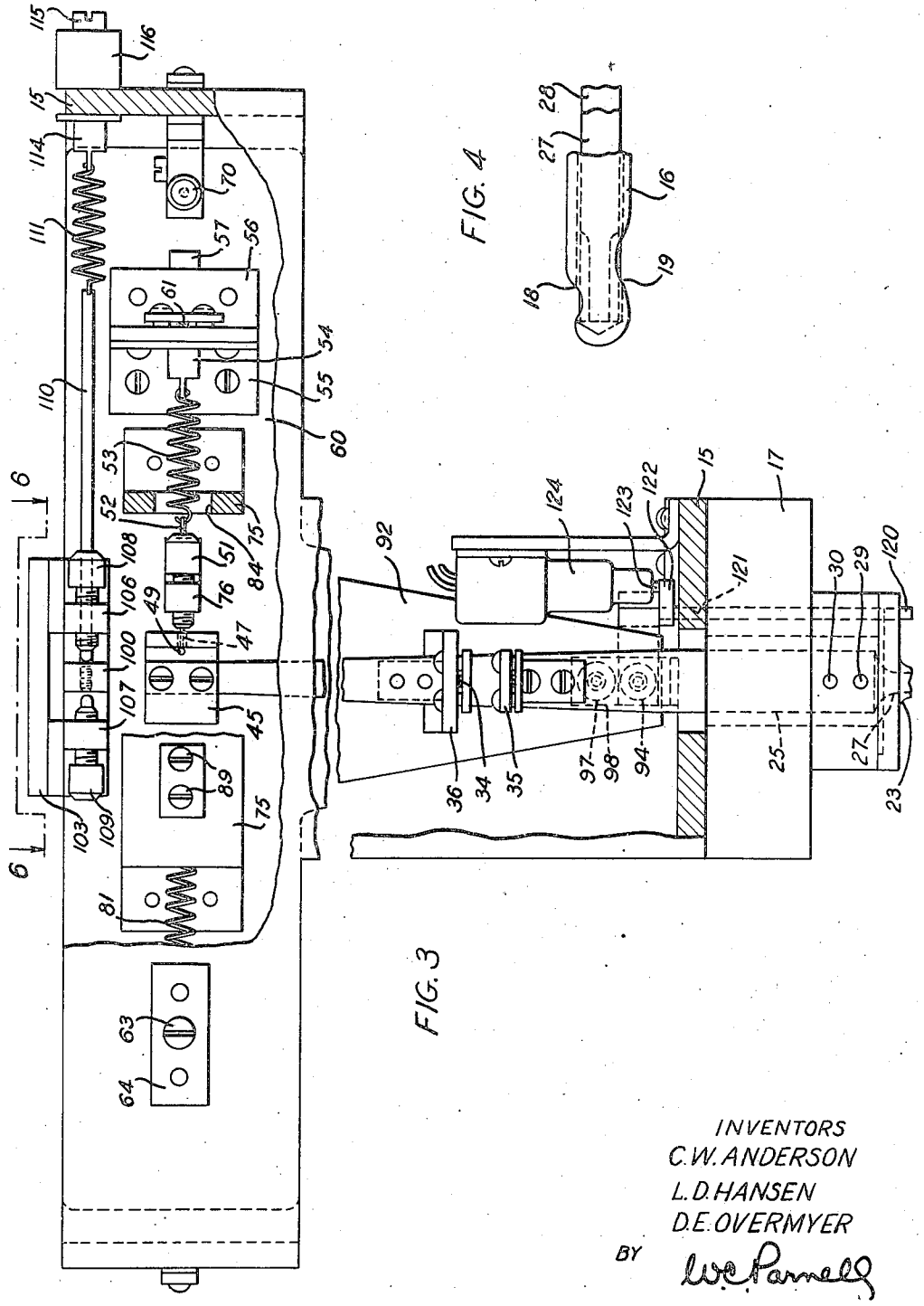

FIG. 3

FIG. 4

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APPARATUS FOR GAUGING JACKS

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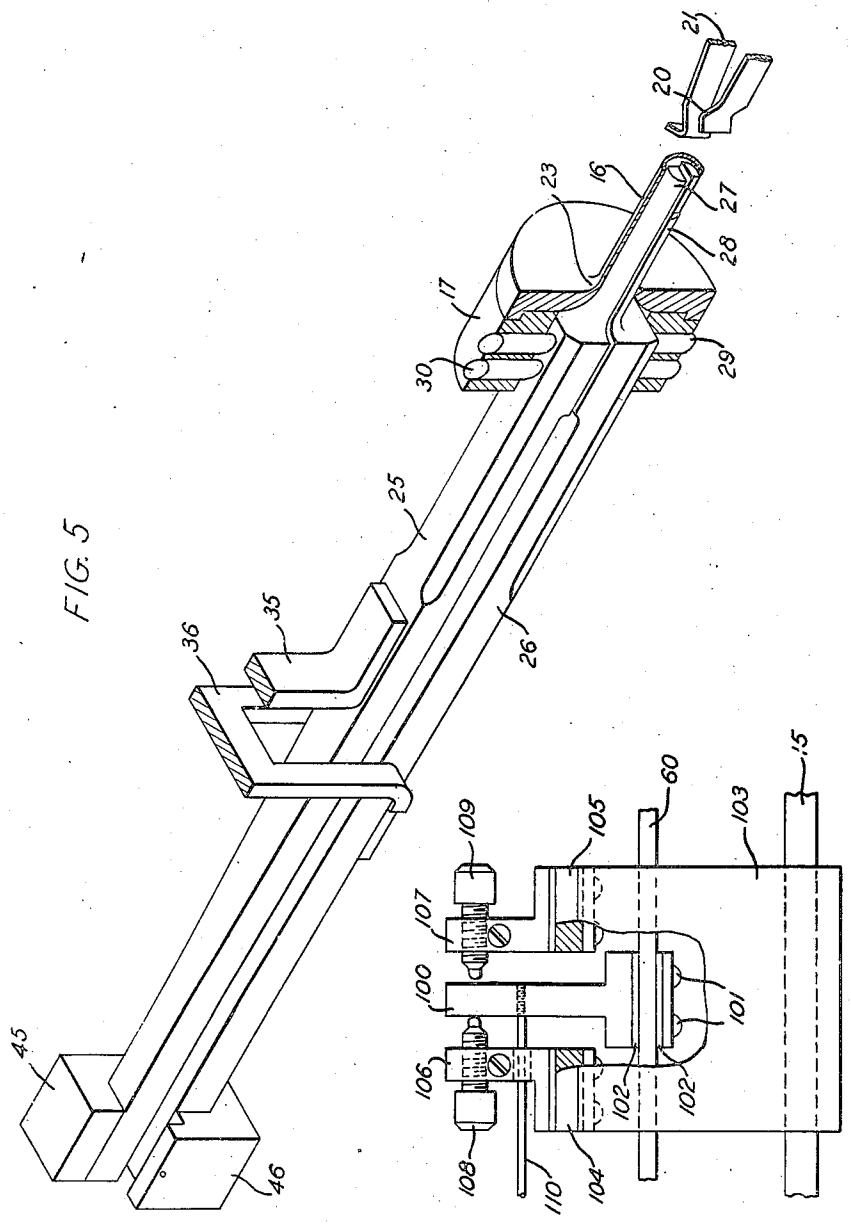

FIG. 5

FIG. 6

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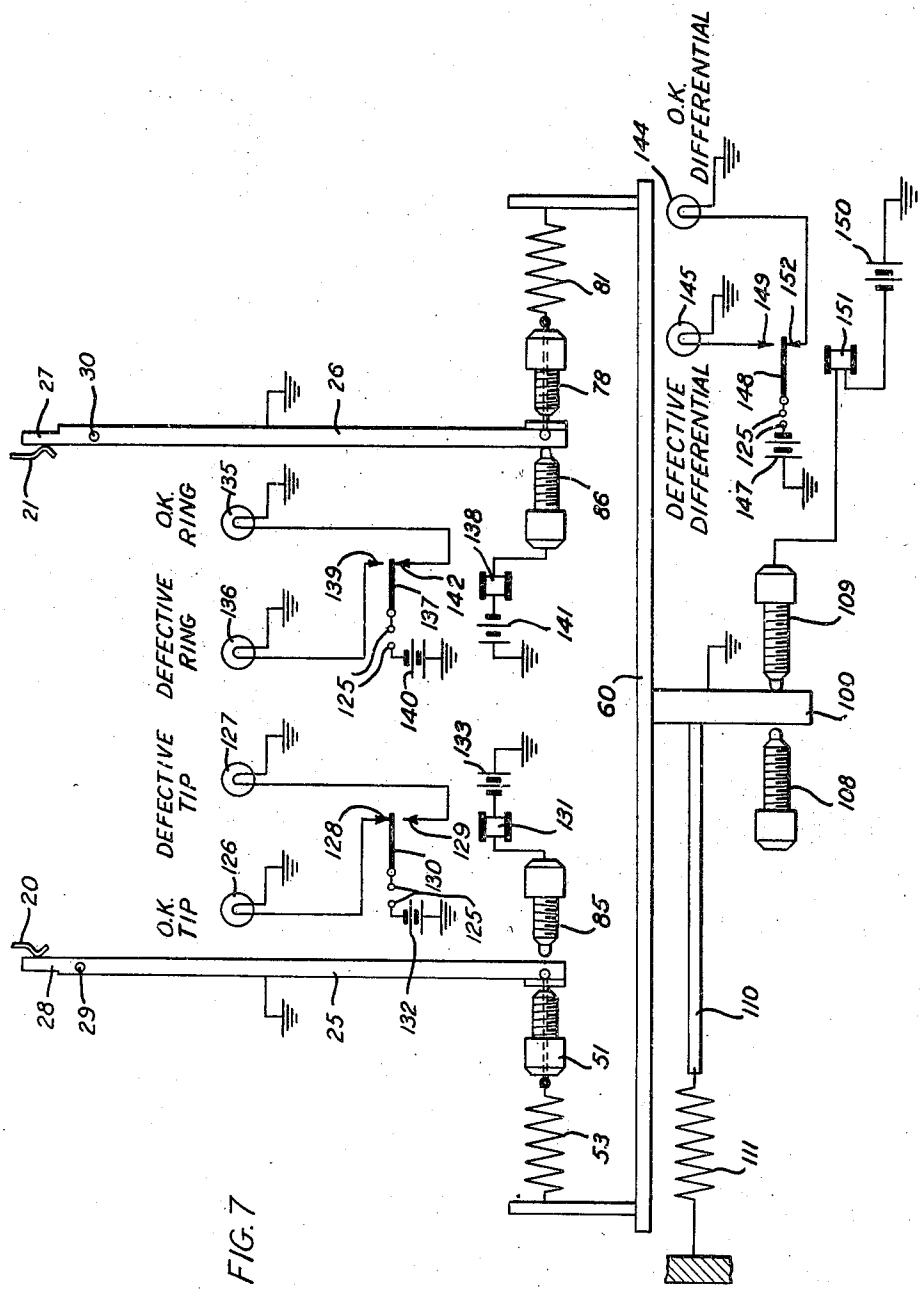

FIG. 7

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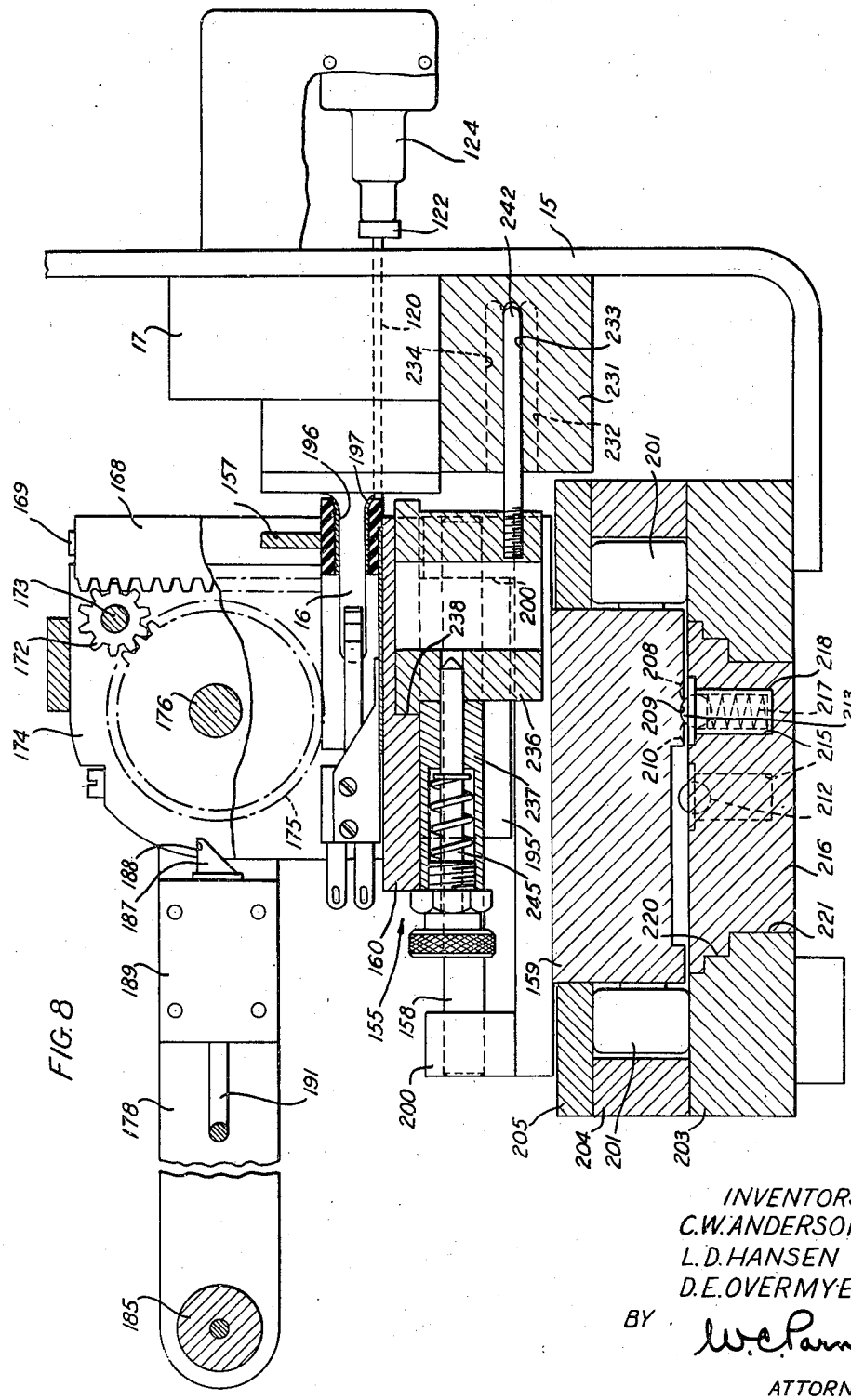

FIG. 8

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APPARATUS FOR GAUGING JACKS

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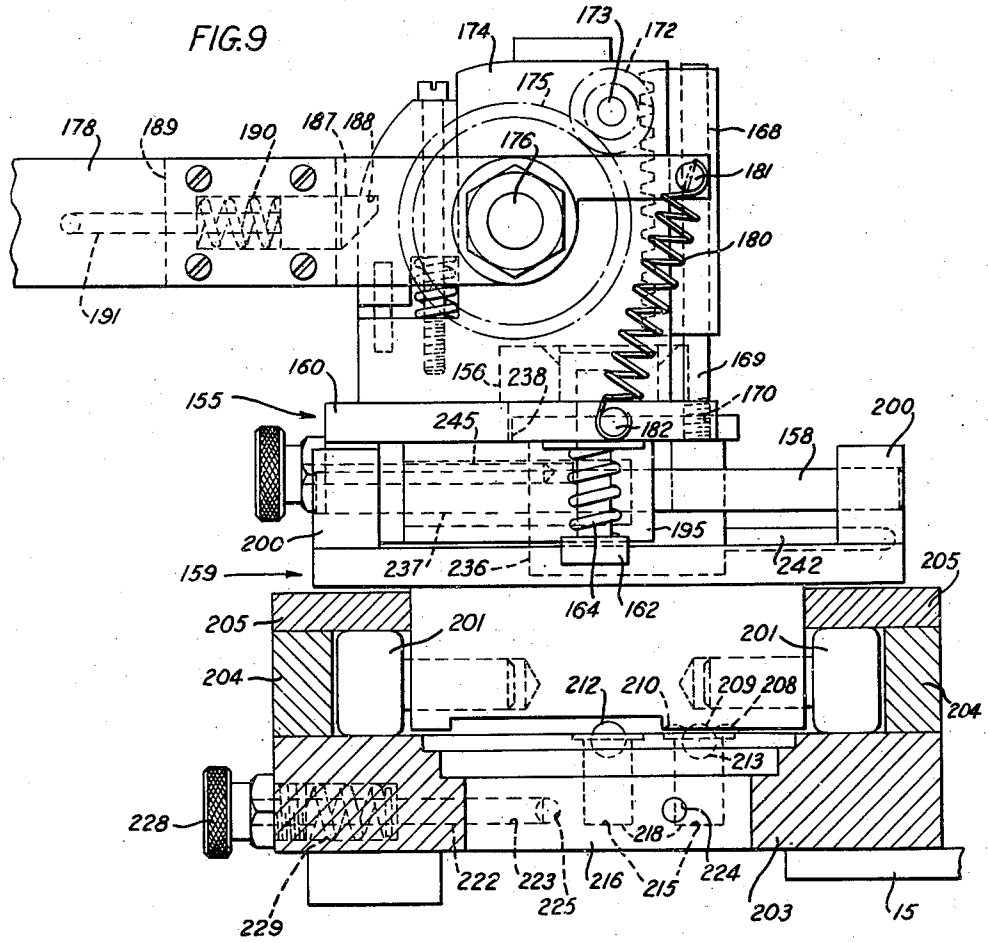
FIG. 9



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APPARATUS FOR GAUGING JACKS

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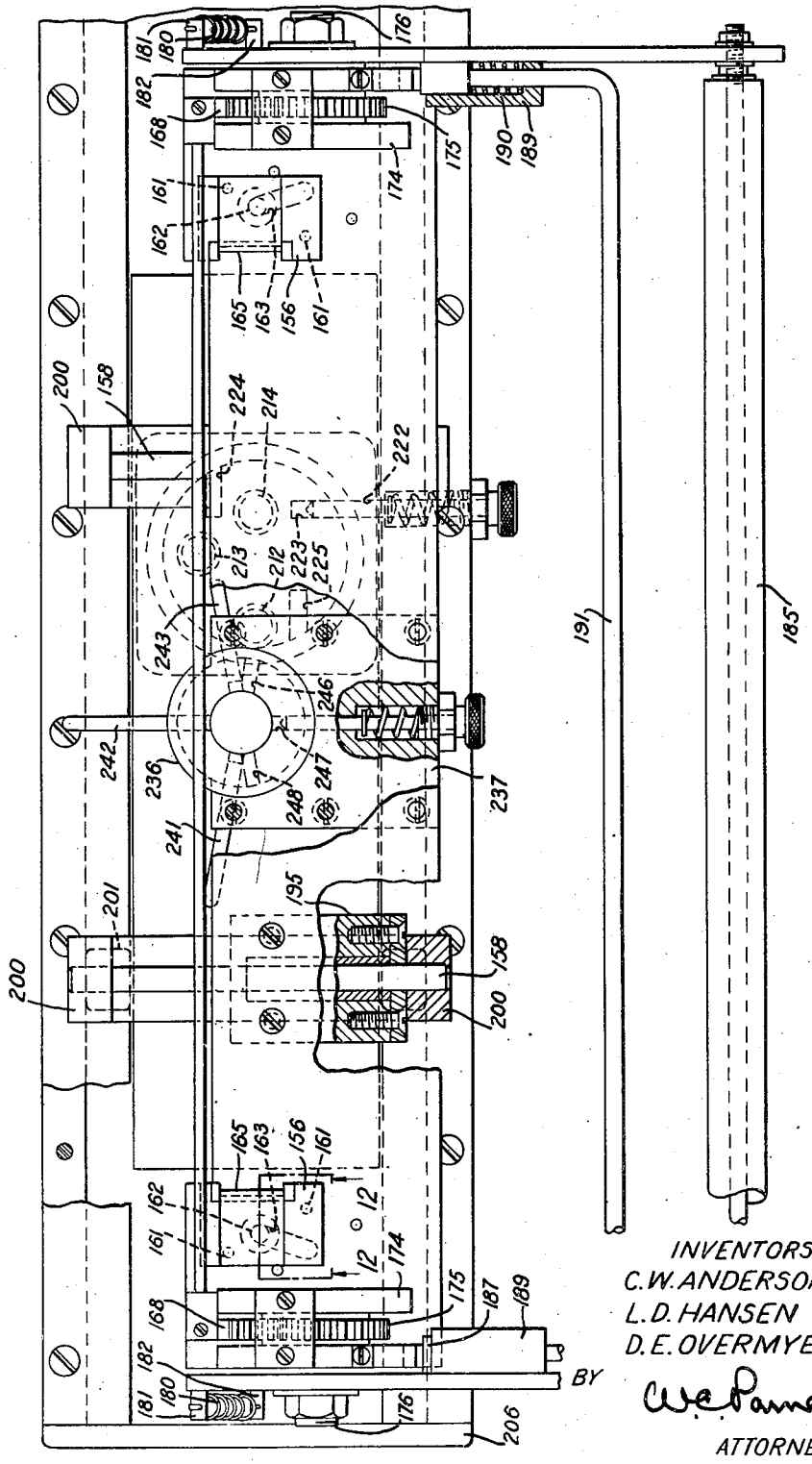

FIG. 10

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APPARATUS FOR GAUGING JACKS

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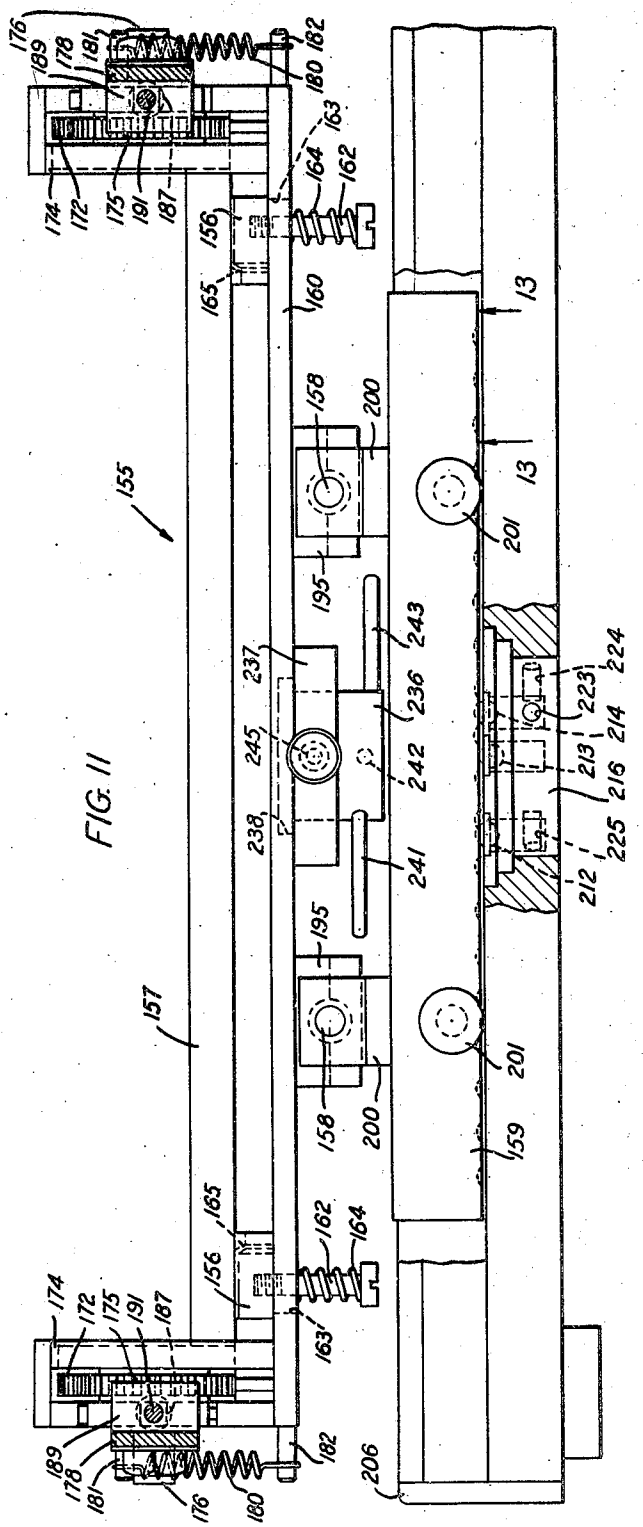

FIG. 11

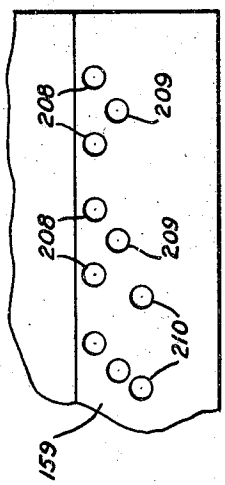

FIG. 13

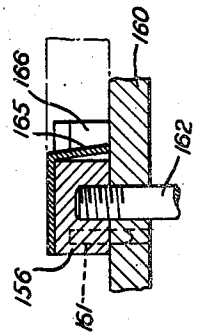

FIG. 12

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UNITED STATES PATENT OFFICE

2,483,867

APPARATUS FOR GAUGING JACKS

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Application May 8, 1946, Serial No. 668,278

17 Claims. (Cl. 73—161)

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This invention relates to apparatus for gaging jacks, and more particularly for gaging the tension of springs of jack strips employed in the art of telephony.

In the telephone art, a jack is a means for connecting two circuits together in which one circuit terminates in a plug and the other circuit terminates in the jack. Usually the jack consists of a tubular bushing of conductive material known as a sleeve and an assembly of contact springs insulated from each other and clamped to the frame of the jack at the end farthest from the sleeve. A jack strip is composed of a plurality of jacks, usually 10 or 20, assembled on a common mounting plate. In each jack there is a tip spring and a ring spring which receive their titles from the portions of the plug they are to engage. The forward or tip end of the plug has a conductive portion which is to engage the tip spring. A ring of conductive material in the plug insulated from the tip is to engage the ring spring. These springs are under little or no tension when the plug is not inserted in the jack. The insertion of a plug into the jack results in flexing the tip and ring springs away from their respective normal positions creating tensions therein.

To insure proper operation of a jack, certain spring tension requirements are specified. The tension requirement usually specified for the tip spring is that it must not be more than fifty-six ounces when a plug of standard dimensions is inserted into the jack. The tension requirements usually specified for the ring spring is that it must be at least twenty-three ounces when the plug is inserted into the jack. Since the plug must be of smaller diameter than the sleeve of the jack, there is a possibility of tip and ring spring adjustment which would cause the plug to be supported only by the tip and ring springs and float in or make unreliable electrical contact with the sleeve. To overcome this condition, the usual requirement is that the tip spring tension must be greater than the ring spring tension by at least fourteen ounces which is known as the differential requirement. A jack meeting this differential requirement will force the plug against the sleeve to insure proper electrical contact therewith, the extra force or tension in the tip spring causing a pivotal action of the plug about the ring spring to assure contact of the plug with the sleeve of the jack.

An object of the invention is to provide a gaging apparatus for articles having flexible members and which indicates whether or not the

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tensions of the members of the articles are within given limits when flexed to the positions they will assume in commercial use.

Broadly, the invention comprises an apparatus including a nose, receivable in a jack having tip and ring springs, lever elements in the nose mounted for relative movement responsive to the tension in the tip and ring springs which in turn control electrical contacts to indicate whether or not the said tensions in the springs are within given limits.

Considering the invention more specifically, the nose of the apparatus is similar in contour to a standard telephone plug and has openings in opposing sides thereof for the tip and ring springs of jacks moved successively into engagement with the nose. Elements, in the form of levers, mounted on separate pivots adjacent to the nose and individually supported by flexible tapes at their centers of gravity have their forward ends positioned in the nose to be engaged respectively by the tip and ring springs of the jacks, their rearmost ends being held normally from electrical contacts under given forces of adjustable springs. The electrical contacts, together with the springs controlling the rearmost ends of the elements are supported by a floating table suspended from flexible tapes. A contact arm fixedly mounted on the floating table is normally held against a stop by a spring which functions also to hold the table normally against movement. An electrical contact is positioned to be engaged by the contact arm when the necessary differential tension is present in the tip and ring springs, this tension differential causing lateral movement of the table against the force exerted by the spring.

An indexing or feeding mechanism including a longitudinally movable carriage and a laterally movable support on the carriage is equipped to receive jack strips of various types with different numbers of jacks therein and to accurately feed the jacks successively to the nose. Clamping means is also provided in the indexing mechanism to hold each jack strip against displacement and to straighten the jack strip for accurate alignment of the jacks with the nose should the jack strip be bowed or warped. Other means in the indexing mechanism protects the nose of the apparatus by first temporarily aligning a jack of the strip with the nose and secondly, positively aligning the jack with the nose prior to the movement of the jack strip into a position where it can engage the nose.

Other objects and advantages will be apparent from the following detailed description when

considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a side elevational view of the gaging apparatus, portions thereof being removed to illustrate certain of the detailed structures;

Fig. 2 is a fragmentary rear elevational view of the apparatus, portions thereof being shown in section;

Fig. 3 is a fragmentary top plan view of the apparatus;

Fig. 4 is a fragmentary top plan view of the nose;

Fig. 5 is a fragmentary perspective view of the lever-like elements and the nose structure;

Fig. 6 is a fragmentary elevational view taken along the line 6—6 of Fig. 3;

Fig. 7 is a schematic illustration of the indicating lamps, their electrical circuits and the associated mechanical parts;

Fig. 8 is a vertical sectional view of the indexing mechanism showing the support in the gaging position;

Fig. 9 is a side elevational view of the indexing mechanism with the support in the loading position;

Fig. 10 is a fragmentary top plan view of the indexing mechanism;

Fig. 11 is a fragmentary front elevational view of the indexing mechanism, portions thereof being shown in section;

Fig. 12 is a sectional view taken along the line 12—12 of Fig. 10; and

Fig. 13 is a fragmentary sectional view taken along the line 13—13 of Fig. 11.

Referring now to the drawings, attention is first directed to Figs. 1 to 5, inclusive, which illustrate a frame structure 15 supporting the various elements of the apparatus including the indexing mechanism. A nose 16 is fixed to the front of a bracket 17 which is mounted upon a front face of the frame 15. The outwardly projecting portion of the nose 16 is hollow and is provided with openings 18 and 19 at opposite sides thereof and in out-of-aligned positions to receive the tip and ring springs 20 and 21 respectively (Fig. 5) of jacks to be tested. The outer diameter of the nose is substantially of the same dimensions as the standard telephone plug, the outwardly curved inner portion 23 conforming to the mouths of the sleeves of the jacks to be tested.

Elements 25 and 26 in the form of long levers have reduced short ends 27 and 28 respectively receivable within the nose 16 and formed so that the tip spring 20 will engage only the portion 27 of the element 25 and the ring spring 21 will engage only the portion 28 of the element 26. The elements 25 and 26 have their respective pivots 29 and 30 which extend through both elements with a snug fit in their respective elements and clearance through their opposing elements whereby there may be free pivotal movements of the elements relative to each other for the distances required for gaging the jacks. The ends of the pivots 29 and 30 are supported in bearing-like portions of the bracket 17. The elements 25 and 26 are supported at their centers of gravity by flexible tapes 33 and 34, the tape 33 having its lower end connected to the element 25 by a bracket 35 while a stirrup 36 connects the lower end of the tape 34 to the element 26. The upper ends of the tapes 33 and 34 are connected to arms 37 and 38 which extend upwardly into a block 39 and are adjusted vertically through the aid of screws 40 and 41 in a manner similar to the illustration in the upper left hand portion of Fig. 2 as will hereinafter be described.

Members 45 and 46 are mounted at the rear most ends of the elements 25 and 26 as illustrated in Figs. 2 and 5. Aligned apertures are provided in projections of the members 45 and 46 to receive wires 47 and 48 respectively, ball-like portions 49 on the inner ends of the wires holding the adjacent ends in their respective apertures. The wire 47 extends through a central opening in a stop screw 51 where an eyelet 52 formed in the outer end of the wire is connected to the adjacent end of a spring 53. The other end of the spring 53 is connected to an internally threaded member 54 which is movably mounted in an aperture of a bracket 55 and an aligned aperture of a block 56. A screw 57 extending through the block 56 and into the member 54 may be employed to cause movement of the member to vary the tension in the spring 53 and in this manner vary the force supplied to the element 25 for testing the tip spring 20.

The bracket 55 is mounted upon a floating table 60 and helps in supporting the table through a flexible tape 61 which connects the bracket to an internally threaded member 62. The member 62 extends into an opening in the frame 15 and is held by a screw 63 in a block 64 mounted upon the frame. A spring 65 holds the member 62 downwardly in a position governed by the adjustment of the screw 63. Another structure identical with that just described including the spring 61 and its connecting mechanism for supporting one side of the table 60 is provided for the other side of the table and is given like reference numerals. The floating table 60 is thus suspended from the springs 61, its adjustments being made through the screws 63. In making adjustments of the table, the operator may determine when the table is in the desired position through the aid of contact screws 70, 71, 72 and 73 positioned in pairs, one above and one below the table at each end thereof and included in electrical circuits (not shown) to illuminate indicating lamps if so desired to notify the operator if the position of the table is not in a truly horizontal plane. For example, it is desirable that the table float freely between the contacts and if the table should touch any of the contacts, indicating circuits will be closed to notify the operator accordingly.

A substantially U-shaped bracket 75 is mounted upon the table 60 and with the table surrounds the inner or rearmost ends of the elements 25 and 26. A support 76 for the contact screw 51 is mounted upon and insulated from the bracket 75 through the aid of screws 77. A similar stop screw 78 through the center of which the wire 48 passes, is carried by a support 79 which is mounted upon and insulated from the table within the bracket by the aid of screws 80. The inner end of a spring 81 is connected to an eyelet 82 formed in the outer end of the wire 48 and through similar mechanism including the adjacent internally threaded member 54 and the adjusting screw 57. The force in the spring 81 applied to the adjacent end of the element 26 may be varied through the adjustment of its screw 57 and member 54. Openings 84 are formed in the bracket 75 for the springs 53 and 81. Contact screws 85 and 86 are supported near their respective members 45 and 46 of the elements 25 and 26 by L-shaped conductive members 87 and 88, they being respectively insulated from and connected to the floating table 60 and the bracket 75 by screws 89 and 90. The contact

screws 85 and 86 may be adjusted with respect to their members 45 and 46 depending upon the distance allowed for the movement of the elements 25 and 26 before they will complete electrical circuits to indicate the condition of the springs 20 and 21 of the jack being tested. Attention at this time is directed to Fig. 3, which illustrates the general contour of the floating table 60 including the forwardly extending portion 92 (Figs. 1 and 3) integral with the main portion of the floating table adjacent the center of the forward edge thereof. The floating table is free to move in a horizontal plane within given limits but is kept within these limits by a pivot screw 94 carried in a threaded bracket 95 of the frame 15, the upper end of the screw being receivable in a recess 96 in the forward portion of the projection 92 of the table 60. This connection is maintained through the aid of another screw or keeper 97 although it is spaced from the upper surface of the table 60 supported by a bracket 98 of the frame 15.

A contact arm 100 is mounted upon the floating table 60 and insulated therefrom by the aid of screws 101 and insulating members 102 (Fig. 6) at a position near the rearmost edge thereof in general alignment with the levers 25 and 26. A bracket 103 fixedly mounted upon the frame 15 extends upwardly above the floating table 60 and has spaced portions 104 and 105 which extend over the table at spaced positions upon each side of the contact arm 100. Brackets 106 and 107 are mounted upon and insulated from the portions 104 and 105 respectively, the vertical portions of the brackets being spaced from and parallel with the contact arm. A back stop, in the form of a screw 108 disposed in a threaded opening in the bracket 106, limits the movement of the contact arm to the left, while a contact screw 109, disposed in a threaded opening in the bracket 107, is positioned to be engaged by the contact arm upon movement of the contact arm a given distance to the right. A rod 110 (Figs. 3, 6 and 7) has its adjacent end threadedly disposed in an aperture in the contact arm 100, its opposite end being connected to a spring 111. The other end of the spring 111 is supported in the same manner as the outer end of the spring 53 in Fig. 2 to an adjustable means which includes an internally threaded member 114 extending through an aperture in the frame 15 where it is engaged by a screw 115 extending through a block 116 to cause variation in the force present in the spring.

The means to indicate the results of the gaging operations in actual structure includes a more complicated arrangement of circuits than is shown in Fig. 7 but the simplified circuits more easily illustrate the invention, which resides mainly in the mechanical features of the apparatus with identifying means of any suitable type responding to the various gaging elements. A part of the complete circuit arrangement includes a plunger 120 movable in an aperture of the bracket 17 and an aligned aperture 121 in the frame 15 where its inner end supports a projection 122 positioned to engage and actuate a plunger 123 of a switch 124. This switch is operated through its plunger 120 each time a jack strip is moved into a position to gage one of the jacks therein. This action operates the switch 124 and connects the circuits in Fig. 7 between the contacts 125.

Attention is now directed to Fig. 7 and it is recommended that the mechanical features of Figs. 2, 3 and 6 also be considered. In one of the

circuits associated with the lever 25 there is a lamp 126 identified as O. K. Tip and a lamp 127 further identified as Defective Tip. These lamps are respectively under the control of a break contact 128 and a make contact 129 of an armature 130 of a relay 131. Normally the lamp 126 will light upon operating the switch 124, including its contacts 125, completing a circuit from grounded battery 132 through contacts 125, armature 130, break contact 128, lamp 126 to ground. However, if the tension in the tip spring 20 is great enough to move the lever 25 about its pivot and against the force of the spring 53 to cause it to engage the contact screw 85, a circuit including a relay 131 is completed from grounded battery 133 through the relay 131, the contact screw 85 and through the lever 25 to ground. Energization of the relay 131 will operate its armature 130, closing contact 129 to complete a circuit through the lamp 127. A similar arrangement of circuits is provided for the lever 26 including a lamp 135 identified as O. K. Ring and a lamp 136 identified as Defective Ring. In the present illustration, the lever 26 is shown moved about its pivot by the ring spring 21 against the force of the calibrated spring 81 away from its stop 78 and into engagement with the contact screw 86. Prior to this action, or during the normal arrangement of the circuit, the armature 137 of the relay 138 is against its break contact 139 to complete a circuit from grounded battery 140 through the lamp 136 until the lever 26 engages the contact screw 86. This action has, however, completed a circuit from grounded battery 141 through the relay 138, contact screw 86 and lever 26 to ground, energizing the relay and completing a circuit through make contact 142 and the lamp 135 to ground. The circuits are shown in this arrangement to illustrate a perfect jack wherein the tip spring has not more than fifty-six ounces of tension when in the flexed position assimilating its normal position when in use, while the ring spring in its flexed position has a tension of more than twenty-three ounces.

To complete the requirements, there must be a differential of fourteen ounces between the tensions of the tip and ring springs. This condition is indicated by either one of the lamps 144 or 145 respectively identified as O. K. Differential and Defective Differential. These lamps are under the control of the contact arm 100 and the associated structure shown in Figs. 3, 6 and 7. It will be realized that the contacts and stops for the levers 25 and 26, as well as their springs are supported by the floating table 60. If the pressures on the levers 25 and 26 determined by the tensions in the springs 20 and 21 were equal, these pressures would cancel each other as the levers have equal multiplications and as the pressures are equally applied in opposite directions to their respective levers. In this instance there would be no force tending to move the floating table in either direction. However, due to the required difference in the tensions of the springs under test, the force of the tip spring exceeding the opposing force of the ring spring would tend to move the table (Fig. 7) to the right. This force up to a given limit is counteracted by the spring 111. The force present in the spring 111, however, is such that the contact arm 100 will be held against its stop screw 108 and will not be moved into engagement with the contact screw 109 until the differential force between the tip and ring springs equals or exceeds fourteen ounces. The lamp 145 will be lit if the differential tension is

less than fourteen ounces, this lamp being in a circuit which may be traced from grounded battery 147, through closed contacts 125, armature 148, break contact 149 and lamp 145 to ground. In the present illustration, with the contact arm 100 engaging the contact screw 109, a circuit has been completed from grounded battery 150 through relay 151, contact screw 109 and contact arm 100 to ground. Energization of the relay 151 has made contact 152 to complete a circuit from the grounded battery 147, through closed contacts 125 of switch 124, armature 148, make contact 152 and lamp 144 to ground.

The indexing mechanism of the apparatus is shown in Figs. 8 to 13, inclusive, and broadly includes a supporting unit 155 on which the jack strips are supported between locating elements 156 and clamped in position by a holding bar 157. The work support 155 is mounted for lateral movement on parallel rods 158 which are supported by a carriage 159, the carriage being movable in a direction to move the support and the jack strip longitudinally, these movements being relative to the nose 16.

The supporting unit 155 includes a table 160 upon which the locating elements 156 are mounted at adjusted positions depending upon the size of the jack strip to be gaged. Screws 162 extending through diagonal elongate openings 163 in the table 160 and supporting springs 164, hold the locating elements 156 in either one of the sets of locating positions, the diagonal openings permitting movement of the locating elements laterally on the table and also longitudinally toward or away from each other. Pairs of locating pins 161 mounted in the locating elements 156 at diagonally spaced positions are receivable in spaced pairs of openings or holes in the table 160 (Figs. 10 and 11). Although the pins serve to positively locate their elements 156 in either position, the elements may be easily shifted from one position to the other by upward movement of the screws 162 against the forces of their springs to move the pins free of one set of openings and transfer them to the other set of openings. Resilient members 165 positioned in recesses 166 of the locating elements will engage mounting lugs at the ends of the jack strips to accurately locate the jack strips on the table 160.

The holding bar 157 is supported at its ends by racks 168 which are longitudinally apertured to slide upon supporting rods 169, the lower ends of which are threadedly disposed in apertures 170 (Fig. 9) of the table 160. The racks 168 interengage pinions 172 which are rotatably mounted upon stub shafts 173 supported by vertical end brackets 174 mounted upon the table 160. Gears 175 interengage their respective pinions 172 and are fixedly mounted upon stub shafts 176 suitably journalled in their brackets 174. Levers 178 mounted upon the outer ends of their respective shafts 176 are normally urged in a clockwise direction (Fig. 9) by their individual springs 180, extending from pins 181 in projections of the levers 178, to pins 182 in the adjacent edges of the table 160. A handle 185 connects the outer ends of the levers as illustrated in Figs. 8 and 10. With the handle and its levers fixed to the shafts 176, movement thereof from a vertical position, which may be termed a loading position, to the horizontal position (shown in Figs. 8 and 9) will rotate the gears 175 counterclockwise to rotate the pinions 172 clockwise and move the racks 168 downwardly moving with them the holding bar 157 until it engages and firmly holds the jack strip in place on the table. The formation of the bar and its relationship to the table will also straighten any of the jack strips being tested prior to the testing operations, should they be warped. Movement of the handle and its levers 178 to the vertical position will move the gears 175, their pinions 172 and the racks 168 in the reverse directions from those previously described to lift the holding bar 157 free of the jack strip after the jack strip has been gaged so that it may be removed and another jack strip inserted in place. Means is provided to latch this mechanism in the holding position which includes a latch 187 adjacent each of the brackets 174 and having its projecting end receivable in a notch 188 in its respective bracket. The latches 187 are supported in housings 189 on their respective levers 178 wherein springs 190 (Fig. 9) normally urge the latches toward the brackets 174 so that they will be automatically forced into their notches 188 when moved to register therewith. A latch operating handle 191 connects the latches 187 and is positioned to be gripped by the hand of the operator while gripping the handle 185. The combined forces of the springs 180 are not sufficient to operate the clamping or holding mechanism but assist the operator in moving the mechanism to the open or loading position.

Longitudinally apertured bearing members 195 are mounted on the under surface of the table 160 and are longitudinally apertured to ride upon their respective rods 158. The support 155 is therefore free to move laterally upon the rods between given limits; one, wherein the jack strip is spaced from the nose 16; the other being the gaging position into which any selected jack of the jack strip may be moved on to the nose to locate the leading ends of the tip and ring springs in the apertures of the nose and locate the sleeve 196 (Fig. 8) to engage the rounded base 197 of the nose 16.

The carriage 159 has upright portions or brackets 200 which carry the ends of the rods 158. Spaced pairs of rollers 201 support the carriage for its longitudinal movement, these rollers riding upon a base 203 between vertical guides 204 and beneath lateral guides 205. End plates 206, only one of which is shown in Figs. 10 and 11 close the ends of the guides 204 and 205 to limit movement of the carriage.

As previously described, the standard jack strips are of different sizes. The usual overall length of these jack strips is either $11\frac{1}{8}''$ or $11\frac{9}{16}''$. This variation can be taken care of through the adjustment of the locating elements 156. The spacing between the centerlines of adjacent jacks in different types of jack strips are within three dimensions, namely $\frac{1}{2}''$, $\frac{11}{16}''$ or $1''$. It is not only important but advantageous in lengthening the life of the apparatus, particularly that of the nose 16, and in relieving the operator of the strain of accurately aligning each jack centrally with the nose, to provide first temporary locating means by which the operator may realize that the selected jack is in general alignment with the nose and with an associated positive means to align each jack with the nose prior to moving the jack into engagement therewith.

The first locating means includes rows of recesses 208, 209 and 210 in the under surface of the carriage 159. All of these recesses are concaved to partially conform to their respective ball members 212, 213 and 214. The recesses 208 are in alignment and spaced $\frac{1}{2}''$ apart between their centers, the recesses 209 being spaced $1''$ apart,

while the recesses 210 are spaced 1 1/16" apart. It depends upon the type of jack strip under test as to just which row of recesses will be employed. In the present illustration, the recesses 209 are employed, the ball member 213 being shown in position to be received in the recesses. The balls 212, 213 and 214 are disposed in cutaway portions 215 of a cylindrical support 216 and are backed by springs 217 normally urging the ball members upwardly limited by their apertured cover plates 218 so that, as each recess is brought into registration therewith, the force in the associated spring 117 would tend to stop the carriage at that position. This stopping force is not sufficient to disturb longitudinal movement of the carriage but will definitely indicate to the operator that the jack at that position is in general alignment with the nose 16. The operator may then move the supporting unit 155 laterally to move the jack at the gaging position on to the nose. The cylindrical support 216 has stepped enlarged flange portions 220 near its upper end to nest in an aperture 221 of a similar contour in the base 203. The support 216 is free to rotate in its aperture when released by a holding pin 222 which is receivable in anyone of three apertures 223, 224 and 225 depending upon whether or not the retaining ball members 213, 212 or 214 are to be held at the operating position. The ball members are located different distances from the center of the support 216 to register with their respective rows of recesses. The pin 222 carries a knurled handle portion 228 at its outer end so that the operator may move the pin outwardly against the force of a spring 229, the spring serving to hold the pin in its selected aperture.

The means for positively aligning the jack at the gaging position with the nose 16 prior to the movement of the jack on to the nose, includes a locating block 231 mounted upon the frame 15 and having three rows of apertures 232, 233 and 234 at different levels therein. The apertures 232 are spaced 1 1/16" apart and correspond to the recesses 210, while the apertures 233 are spaced 1" apart and correspond to the recesses 209 and the apertures 234 are spaced ½" apart and correspond to the recesses 208. A turret 236 rotatably supported in a mounting plate 237 and in a recessed portion 238 of the table 160 is cylindrical in general contour and carries three locating pins 241, 242 and 243 at different levels to register with and be receivable in their respective apertures 232, 233 and 234. The turret 236 is held in any one of the three positions to present the selected one of the three locating pins in the operating position by a holding pin 245 carried by the mounting plate 237 and receivable in any one of the apertures 246, 247 or 248 which correspond to their respective pins 241, 242 and 243.

During the operation of the apparatus the operator usually leaves the apparatus set for one type of jack strip until all jack strips of that particular type have been gaged after which the apparatus is adjusted to gage one or the other types of jack strips. With the apparatus in its present adjusted position, the jack strips to be tested are placed singly on the table 160 while the levers 178 are in their upward positions, the locating elements 156 will accurately locate the jack strip with respect to the pin 242 (Fig. 10) and the operator may lock the jack strip in place by moving the handle 185 downwardly, moving the levers 178 counterclockwise until the latches 187 are received in their recesses 188. During this

movement of the levers, their gears 175 will rotate the pinions 172 in a direction to move the racks 168 downwardly until the holding bar 157 extends across the jack strip and holds it firmly on the table. The operator may gage the jacks of the jack strip in any given order, it being customary, however, to start with the first jack at the right hand end of the jack strip with the supporting unit 155 and the carriage 159 near the left end of the base 203. In this position the ball member 213 may be nested in the first recess 209 at the extreme left temporarily locating the leading jack in alignment with the nose 16.

The supporting unit 155 is then moved laterally toward the nose, the pin 242 first entering the adjacent aperture 233 to positively align the first jack with the nose. Subsequent to the pin 242 entering the aperture 233, during the lateral movement of the supporting unit 155, the jack to be gaged is moved over the nose 16 to the position shown in Fig. 8 where the tip and ring springs will enter the respective apertures in the nose and contact their leading ends of the levers 25 and 26. During the last portion of the lateral movement of the supporting unit with the jack strip, the leading surface of the jack strip will engage the plunger 120 and move it inwardly to operate the switch 124, conditioning the indicating circuits shown in Fig. 7 by closing their circuits 125 only when the jack strip is stopped by the portion 197 of the nose. While the tip and ring springs move over the leading end of the nose 16, the springs are flexed so that, as they come to rest on their respective levers within the nose, they will be in the positions they will assume when in commercial use in engagement with their parts of a plug. As previously described, it is important that there be a differential tension of fourteen ounces in the springs, the ring spring having a tension, when in the operated position of not less than twenty-three ounces and the tip spring having a tension of not more than fifty-six ounces. These springs can be accurately gaged only by moving them into the positions they will attain when in commercial use.

If the tensions of the springs are within the required limits, the results will be indicated by the lamps shown in Fig. 7. The tensions in the springs of the jack being gaged are translated through the associated mechanism travelling through the levers 25 and 26, their differential tension causing movement of the floating table 60. The ring spring 21 to be acceptable must move the lever 26 about its pivot against the force of the spring 81 and into contact with the screw 86. Unless this happens, the normally closed or break contact 139 will complete a circuit through the lamp 136 showing that the ring spring is defective and definitely indicating that the tension therein is below twenty-three ounces. If, however, the tension in the ring spring is sufficient to move the lever 26 into contact with the contact screw 86, the relay 138 will be energized opening the circuit through the lamp 136 and closing the circuit through the lamp 135. Due to the fact that the tension in the tip spring must not exceed fifty-six ounces the spring 53 is calibrated to hold the lever 25 away from the contact screw 85 unless the tension in the tip spring exceeds fifty-six ounces. If the tension of the tip spring is within the required limits the normally closed or break contact 128 will complete a circuit through the O. K. Tip lamp 126. Should the tension in the tip spring 20 exceed fifty-six ounces the force

applied to the lever 25 through the spring will overpower the force of the spring 53, move the lever into engagement with the contact screw 85 energizing the relay 131, and operating its contact to complete a circuit through the lamp 127 indicating that the tip spring is defective. Conditions may exist wherein the tension in the tip spring is under fifty-six ounces and the tension in the ring spring is over twenty-three ounces, yet there may exist a defect which would render the jack unsatisfactory, this fact being due to the lack of a differential of fourteen ounces between the tensions in the springs. This condition, however, will be indicated by the lamp 145 whose circuit is normally closed unless there exists the differential of more than fourteen ounces sufficient to move the floating table 60 laterally against the force of the spring 111 to move the contact arm 100 away from its stop 108 and into engagement with the contact screw 109. When this occurs a circuit is completed through the contact screw 109 and the relay 151 to open the circuit through the lamp 145 and close the circuit through the lamp 144 indicating that there is a satisfactory differential tension in the springs.

The levers 25 and 26 are of the multiplying type and so arranged that the ratio of the short arm of the lever 25 to its long arm is the same as the ratio of the short arm of the lever 26 to its long arm, these relationships being determined from their pivots or fulcrums to the points of contacts with their jack springs for the short arms and from their pivots or fulcrums to their wires 47—48 for the long arms. Furthermore, the horizontal forces applied to the short ends of the levers cause the opposite or long ends of their levers to move limited but multiplied distances in parallel, horizontal planes with respect to connections with their calibrated springs which lie in a common horizontal plane. These levers although they appear to be supported by their pivots employ their pivots only as fulcrums, their actual supports being the metal tapes 33 and 34 from which they are suspended. The floating table which provides the supporting means for the contact screws, the calibrated springs and the back stops or screws for the levers 25 and 26 is also suspended from the metal tapes 61 so that it may float and be moved by the relative forces or tensions in the tip and ring springs without affecting the results of the gaging operations. The main horizontal movement of the table adjacent the contact arm 100 is .002". Furthermore, the movements of the levers are small so that the tip and ring springs of the jack may be accurately gaged with the springs flexed into the positions they will assume when in commercial use. The multiplying nature of the levers 25 and 26 increases the horizontal travel of the long arms thereof with respect to the travel of the short arms. It is further important to note that the calibrated springs 53, 81 and 111 are of sufficient length that their expansion the small distance by their respective levers or the lateral movement of the table will have negligible effect.

The testing of the first jack has been described. The operator has observed the indicating lamps and from them he has determined what should be done to the springs of the "O. K." lamps have not all been illuminated. If the lamp 127 lights to indicate the tip spring defective, the operator may change the tip spring, through the aid of a pair of pliers, to reduce the tension therein moving the contact portion of the tip spring away from the ring spring 21. If the ring spring 21 should have less than twenty-three ounces tension therein resulting in the lighting of the lamp 136, similar adjustments may be made in the ring spring not to decrease its tension, but to increase it. When these adjustments have been made, and the first jack springs prove satisfactory, the operator may then remove the first jack from the nose and prepare for gaging the second jack. To do this, the operator moves the supporting unit 155 with the carriage 159, longitudinally until he feels the carriage being stopped by the ball 213 entering the next recess 209 at which time the supporting unit may be moved laterally causing the pin 242 to enter the next aperture 233 in advance of the second jack extending on to the nose 16. If the operator should be careless and attempt to move the supporting unit 155 toward the nose prior to the preliminary aligning of the jack with the nose by the entrance of the ball member 213 into the proper recess 209, the pin 242 will strike the solid face of the block 231 and prevent further movement of the supporting unit 155 laterally. Also the same protection is provided should the operator attempt simultaneous longitudinal and lateral movement of the supporting unit. In this instance the pin 242 will first strike the solid face of the block 231 and move along in this position holding the supporting unit against further lateral movement until the pin reaches the next adjacent aperture 233 at which time the supporting unit may be moved laterally but the jack at the gaging position will be aligned with the nose and the carriage will be held against further longitudinal movement.

When all of the jacks in this jack strip have been gaged and all of the jack strips of this type have been gaged, the operator may make the necessary adjustments for the next type of jack strips adjusting the locating elements 156 as well as the cylindrical member 216 holding the ball members 212, 213 and 214 and adjusting the turret 236 to select the pin which should be employed for the type of jack strips next to be gaged.

Although specific improvements of the invention have been shown and described, it will be understood that they are but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined by the appended claims.

What is claimed is:

1. In an apparatus for gaging jacks having tip and ring springs the tensions of which are to be gaged, a hollow nose to flex the springs mounted at a fixed position and having spaced openings therein to receive the tip and ring springs respectively, levers pivotally supported adjacent the nose and having long and short arms, the short arms extending into the nose to positions adjacent the openings therein to be engaged by their respective tip and ring springs, the tension in the flexed springs tending to rock the levers about their pivots, stops for the long arms of the levers, biasing springs having given forces comparable with the required tensions in the tip and ring springs to hold the long arms of the levers against the stops until known forces resulting from the tensions in the tip and ring springs are applied to the short arms of the levers, and means under the control of the levers to indicate whether or not the tip and ring springs have their required tensions.

2. In an apparatus for gaging jacks having tip

and ring springs the tensions of which are to be gaged, a hollow nose to flex the springs mounted at a fixed position and having spaced openings therein to receive the tip and ring springs respectively, levers pivotally supported adjacent the nose and having long and short arms, the short arms extending into the nose to positions adjacent the openings therein to be engaged by their respective tip and ring springs, the tension in the flexed springs tending to rock the levers about their pivots, stops for the long arms of the levers, biasing springs having given forces comparable with the required tensions in the tip and ring springs to hold the long arms of the levers against the stops until known forces resulting from the tensions in the tip and ring springs are applied to the short arms of the levers, means under the control of the levers to indicate whether or not the tip and ring springs have their required tensions, and means actuable by the relative movements of the levers to indicate the difference between the tensions in the tip and ring springs.

3. In an apparatus for gaging jacks having tip and ring springs the tensions of which are to be gaged, levers pivotally mounted at fixed positions and having long and short arms upon opposite sides of their pivots, the short arms being positioned to be engaged by their respective tip and ring springs, means to support a jack for movement with its tip and ring springs relative to the short arms of the levers for engagement of the springs therewith, a spring flexing member mounted adjacent the short arms of the levers to be engaged by the tip and ring springs as they are moved relative to the levers to flex the springs over the ends of the said short arms for engagement with the outer surfaces of the short arms of their respective levers, the tensions in the flexed springs tending to rock the levers about their pivots, biasing means for the long arms of the levers to hold the levers against movement about their pivots unless the tensions in the springs exceed given limits, and means under the control of the levers to indicate whether or not the springs have their required tensions.

4. In an apparatus for gaging jacks having tip and ring springs the tensions of which are to be gaged, levers pivotally mounted at fixed positions and having long and short arms upon opposite sides of their pivots, the short arms being positioned to be engaged by their respective tip and ring springs, means to support a jack for movement with its tip and ring springs relative to the short arms of the levers for engagement of the springs therewith, a spring flexing member mounted adjacent the short arms of the levers to be engaged by the tip and ring springs as they are moved relative to the levers to flex the springs over the ends of the said short arms for engagement with the outer surfaces of the short arms of their respective levers, the tensions in the flexed springs tending to rock the levers about their pivots, biasing means for the long arms of the levers to hold the levers against movement about their pivots unless the tensions in the springs exceed given limits, means under the control of the levers to indicate whether or not the springs have their required tensions, and means under the control of the levers to indicate the difference between the tensions in the tip and ring springs.

5. In an apparatus for gaging articles having flexible members each having adjacent ends fixedly mounted, means to flex the members to create tensions therein by moving their free ends relative to their fixed ends to given positions, gaging levers having adjacent ends positioned to be engaged by the free ends of their respective flexible members, fulcrums for the gaging levers disposed intermediate their ends, biasing means for the gaging levers connected to the ends thereof opposite those engaged by the flexible members to hold the levers against movement unless the tensions in the flexed members are beyond given values, indicating means for each gaging lever, separate means rendered effective upon movement of their gauging levers by the tensions in the flexible members exceeding the effect of the biasing means to operate their respective indicating means, a floating table supporting the biasing means, means applying a given force tending to hold the table in a given position, and means operated by movement of the floating table to indicate a given differential tension in the flexible members.

6. In an apparatus for gaging articles having flexible members each having adjacent ends fixedly mounted, means to flex the members to create tensions therein by moving their free ends relative to their fixed ends to given positions, gaging levers having adjacent ends positioned to be engaged by the free ends of their respective flexible members, fulcrums for the gaging levers disposed intermediate their ends, flexible tapes to support the gaging levers adjacent their centers of gravity, biasing means for the gaging levers connected to the ends thereof opposite those engaged by the flexible members to hold the levers against movement unless the tensions in the flexed members are beyond given values, indicating means for each gaging lever, and separate means rendered effective upon movement of their gaging levers by the tensions in the flexible members exceeding the effect of the biasing means to operate their respective indicating means.

7. In an apparatus for gaging articles having flexible members each having adjacent ends fixedly mounted, means to flex the members to create tensions therein by moving their free ends relative to their fixed ends to given positions, gaging levers having adjacent ends positioned to be engaged by the free ends of their respective flexible members, fulcrums for the gaging levers disposed intermediate their ends, variable biasing means for the gaging levers connected to the ends thereof opposite those engaged by the flexible members to hold the levers against movement unless the tensions in the flexed members are beyond given variable values, indicating means for each gaging lever, and separate means rendered effective upon movement of their gaging levers by the tensions in the flexible members exceeding the effect of the biasing means to operate their respective indicating means.

8. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging elements extending into the nose to be engaged by the said springs, a table to support a jack strip, means to locate the jack strip on the table, and means to support the table for movement thereof with the jack strip to singly position the jacks on the nose with their springs contacting the gaging elements.

9. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging

elements extending into the nose to be engaged by the said springs, a table to support a jack strip, means to locate the jack strip on the table, and a carriage to support the table for lateral movement toward and away from the nose to move the jacks of the jack strip onto and off of the nose, and for longitudinal movement of the table to successively position the jacks in alignment with the nose.

10. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging elements extending into the nose to be engaged by the said springs, a table to support a jack strip, means to locate the jack strip on the table, a carriage to support the table for lateral movement toward and away from the nose to move the jacks of the jack strip onto and off of the nose, and for longitudinal movement of the table to successively position the jacks in alignment with the nose, and means tending to stop movement of the carriage to align the jacks with the nose.

11. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging elements extending into the nose to be engaged by the said springs, a table to support a jack strip, means to locate the jack strip on the table, a carriage to support the table for lateral movement toward and away from the nose to move the jacks of the jack strip onto and off of the nose, and for longitudinal movement of the table to successively position the jacks in alignment with the nose, means tending to stop movement of the carriage to align the jacks with the nose, and positive means to align the jacks singly with the nose prior to movement of the jack onto the nose.

12. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging elements extending into the nose to be engaged by the said springs, a table to support a jack strip, means to locate the jack strip on the table, a carriage to support the table for lateral movement toward and away from the nose to move the jacks of the jack strip onto and off of the nose, and for longitudinal movement of the table to successively position the jacks in alignment with the nose, and means to hold the carriage against lateral movement during longitudinal movement thereof.

13. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging elements extending into the nose to be engaged by the said springs, a table to support jack strips of various types having jacks therein spaced varied distances between their plug engaging centers, variable means to locate the jack strips singly on the table, and means to support the table for movement thereof with the jack strip to singly position the jacks on the nose with their springs contacting the gaging elements.

14. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging elements extending into the nose to be engaged by the said springs, a table to support jack strips of various types having jacks therein spaced varied distances between their plug engaging centers, variable means to locate the jack strips singly on the table, a carriage to support the table for lateral movement toward and away from the nose to move the jacks of the jack strip onto and off of the nose, and for longitudinal movement of the table to successively position the jacks in alignment with the nose, and variable means selectively actuable for the various types of jack strips to singly align the jacks thereof with the nose.

15. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging elements extending into the nose to be engaged by the said springs, a table to support jack strips of various types having jacks therein spaced varied distances between their plug engaging centers, variable means to locate the jack strips singly on the table, a carriage to support the table for lateral movement toward and away from the nose to move the jacks of the jack strip onto and off of the nose, and for longitudinal movement of the table to successively position the jacks in alignment with the nose, variable means selectively actuable for the various types of jack strips to singly align the jacks thereof with the nose, and to limit lateral movement of the table to hold the selected jack strip against movement into engagement with the nose until a jack thereof is in alignment therewith.

16. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging elements extending into the nose to be engaged by the said springs, a table to support a jack strip, means to locate the jack strip on the table, means to support the table for movement thereof with the jack strip to singly position the jacks on the nose with their springs contacting the gaging elements, and means to clamp the jack strip against relative movement on the table.

17. In an apparatus for gaging jack strips particularly the plug engaging spring in the jacks thereof, a gaging unit including a hollow nose having apertures at spaced positions and gaging elements extending into the nose to be engaged by the said springs, a table to support a jack strip, means to locate the jack strip on the table, means to support the table for movement thereof with the jack strip to singly position the jacks on the nose with their springs contacting the gaging elements, indicating lamps in electrical circuits controlled by the gaging elements responsive to the tensions in the jack springs, and a switch operated to render the circuits effective by the jack strip each time a jack thereof is disposed in gaging position on the nose.

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