Jan. 20, 1959 C. E. ROGERS, JR 2,869,129

COMPONENT INSERTING MACHINES HAVING IMPROVED FEED CONTROL

Filed June 12, 1957 4 Sheets-Sheet 1

Fig. 1

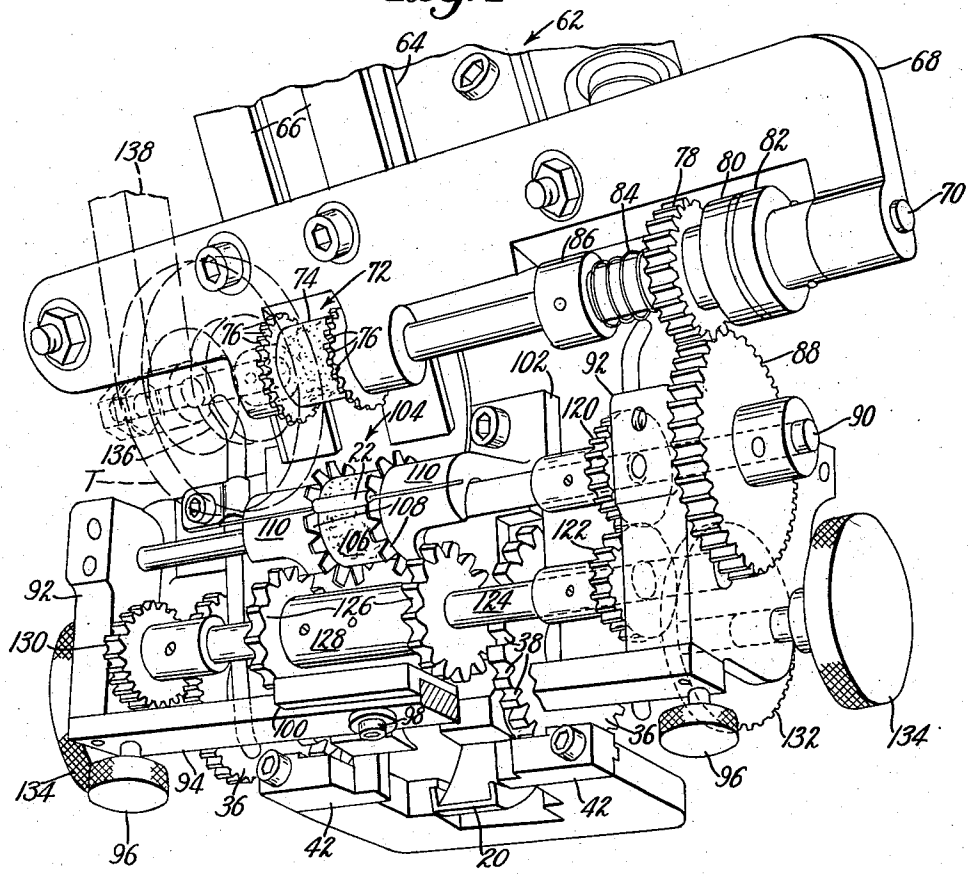


Fig. 2

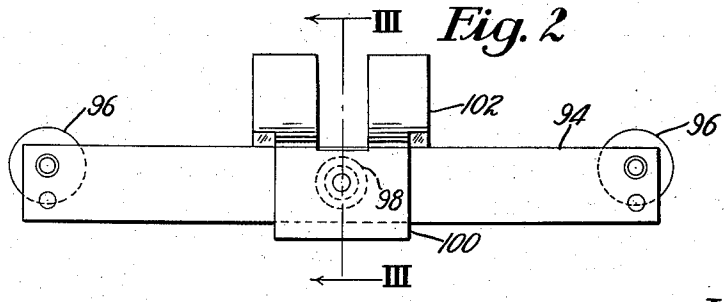
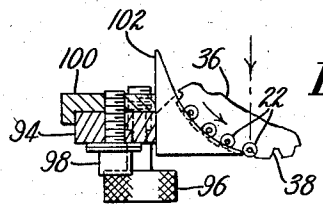


Fig. 3



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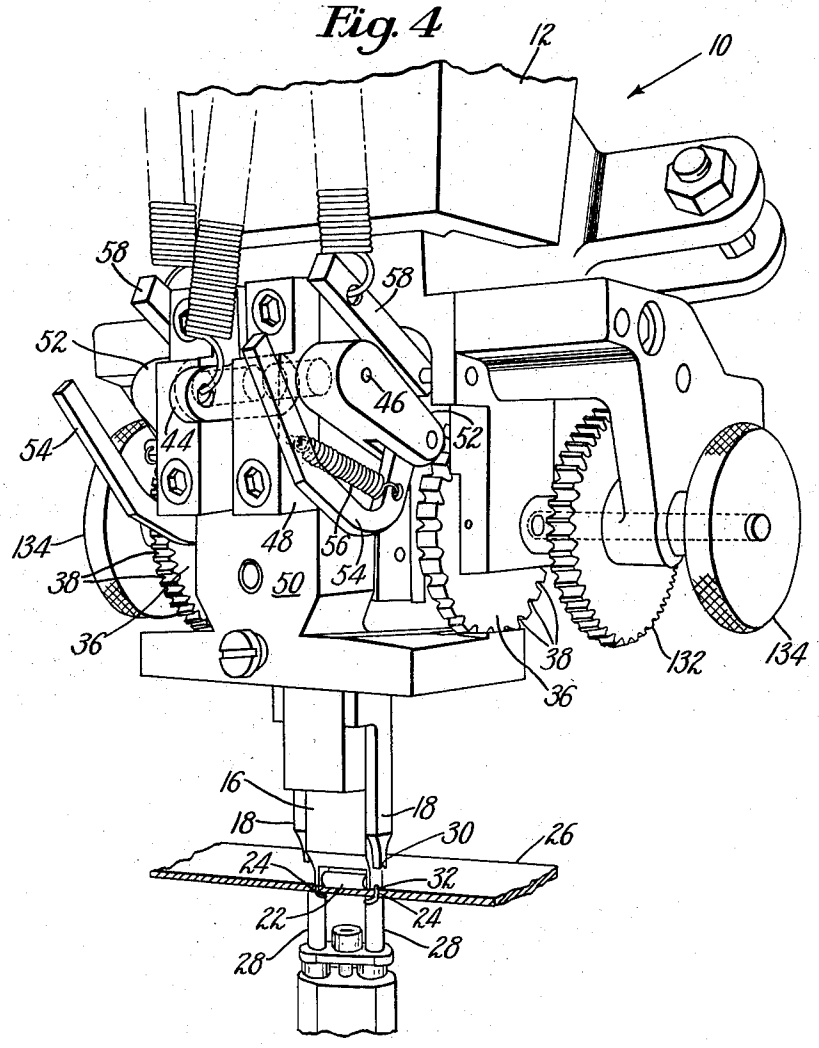
By his Attorney



COMPONENT INSERTING MACHINES HAVING IMPROVED FEED CONTROL

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Fig. 4



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Fig. 5

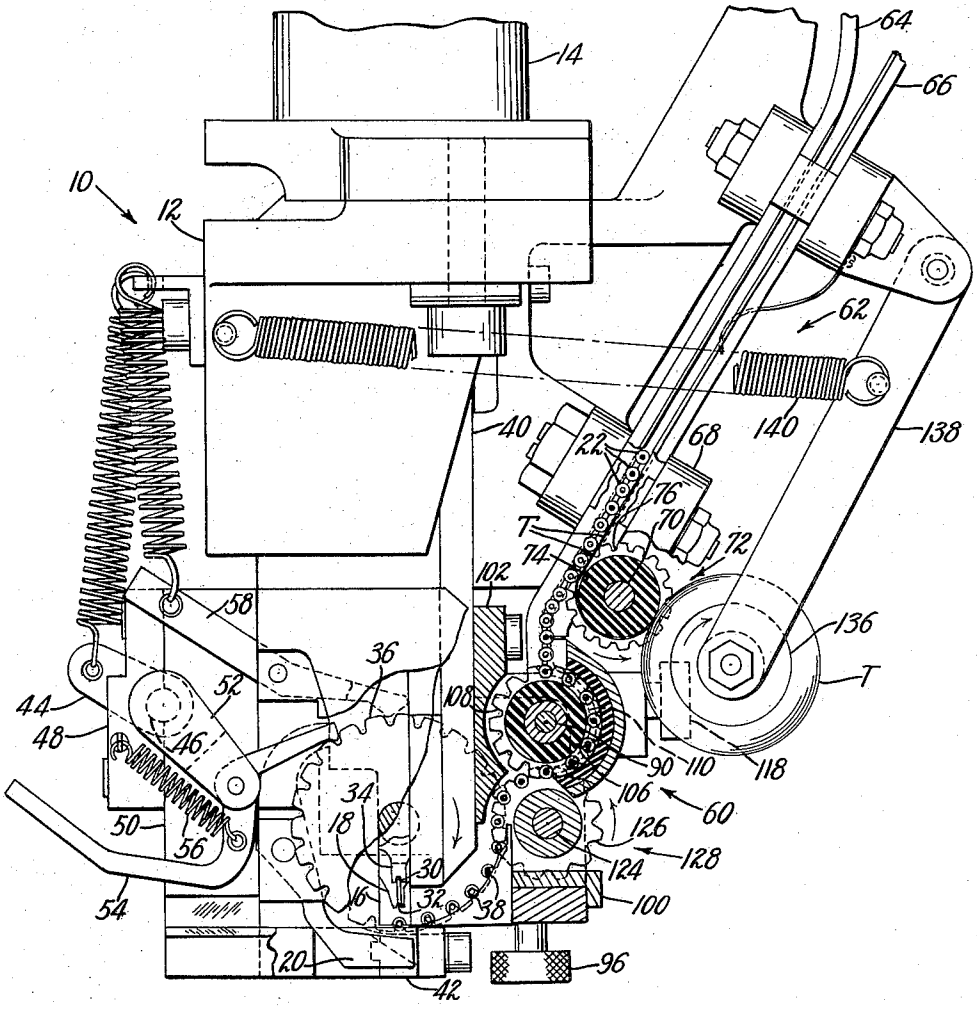
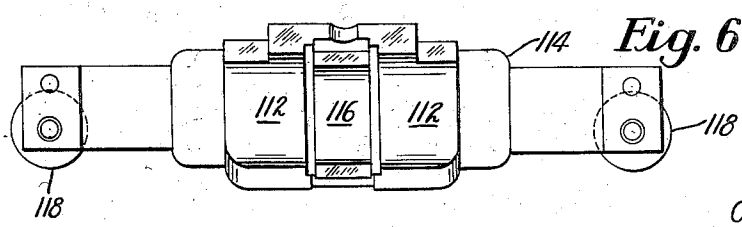


Fig. 6



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COMPONENT INSERTING MACHINES HAVING IMPROVED FEED CONTROL

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Fig. 7

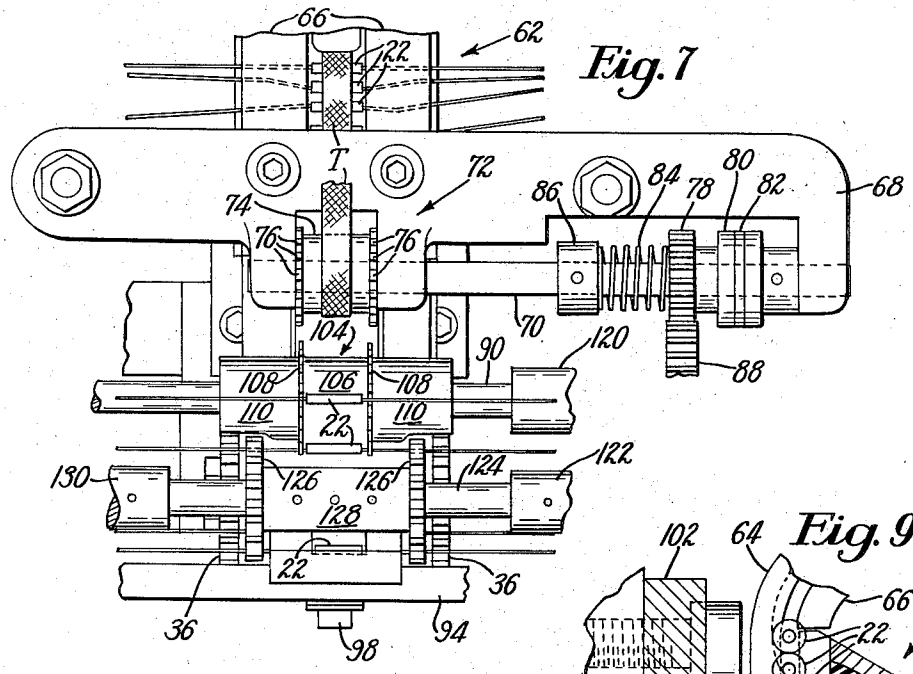


Fig. 9

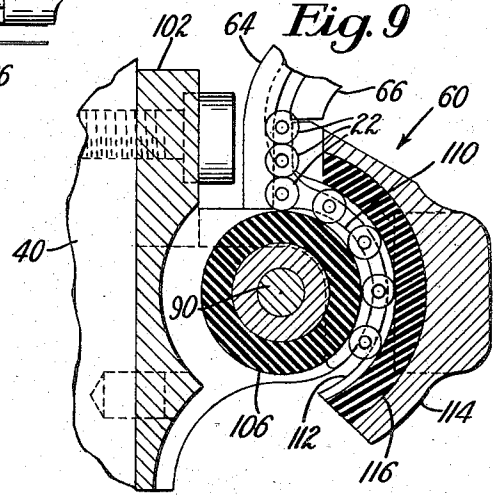
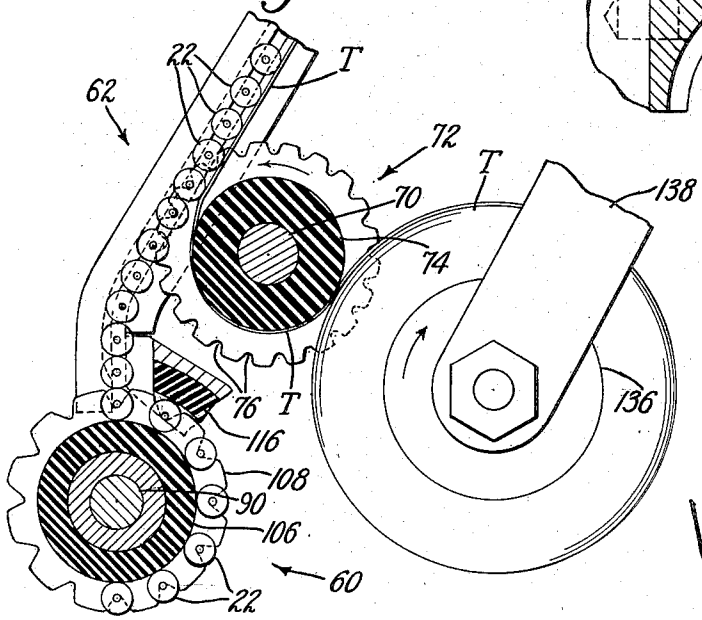


Fig. 8



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2,869,129

COMPONENT INSERTING MACHINES HAVING IMPROVED FEED CONTROL

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Application June 12, 1957, Serial No. 665,335

8 Claims. (Cl. 1—2)

This invention relates to means for feeding electrical components, and is more particularly concerned with the provision of a component inserting machine having improved mechanism for advancing successive coaxial lead components from a belted row thereof to an installation zone. Although the invention is herein illustrated as being embodied in a component inserting machine of the general type disclosed in an application filed September 27, 1954, in the names of Leon D. Alderman, Charles P. Cardani, Edwin S. Kant and Henry B. Kimball, Serial No. 458,312, it is to be understood that the invention is not limited to application in component handling machines of any particular construction and is not restricted to the feeding of electrical components of any particular size and configuration and may, indeed, have utility in the feeding of other slender, elongated articles and whether preliminarily connected by strip material or not.

Automatic component inserting machines have lately come into use in good numbers in the electronics assembly field. They are recognized as being especially valuable, for example, in forming and inserting the leads of components in preformed holes of printed wiring boards. Because of the fact that rapid, reliable assembly work normally requires huge quantities of physically uniform components and all too often the soft wire leads of the components are prone to become irregularly bent in the course of the usual storage and handling prior to installation, various efforts have been made to insure better component control and consequently a low order of "misses" incident to mechanical processing. Thus, auxiliary machines of the type disclosed in United States Letters Patent No. 2,771,206, issued November 20, 1956, in the name of R. W. Daniels et al., have been provided to straighten the leads of components and then bind them in evenly spaced row formation on a storage reel subsequently to be loaded in an inserting machine. Another approach directed toward causing the leads to be formed in an inserting machine with their ends in accurate register with lead-receiving holes is the provision of V-notched lead cutters as taught in United States Letters Patent No. 2,748,388, granted June 5, 1956, upon an application filed in the name of Charles P. Cardani. From the cost standpoint, it is usually preferable to employ but a single strip of material, such as tape, for binding the components to be fed and mounted, although two or more parallel, spaced tapes are at times employed in lead-engaging relation to package components in belted row formation.

In view of the foregoing observation it is a primary object of this invention to provide in an inserting machine of the type adapted to receive a row of belted components to be mounted in a work piece, simple yet reliable mechanism for positively controlling and feeding successive components from their belted condition to the operating zone of the inserting instrumentalities, this feeding mechanism to include means for insuring that the leads of the successive components arrive in parallel relation and uniformly spaced apart.

To the end just stated, and in accordance with one feature of the invention, there is provided, in combination with means for forming and inserting components to be mounted on a work piece, mechanism for advancing and presenting successive components in evenly spaced, parallel relation to the means mentioned, this mechanism including means operable to straighten the leads of the advancing components for uniformly precise register with the forming and inserting means.

In accordance with another feature of the invention, a component inserting machine of the type comprising means for indexing successive components in register with an inserting tool is fitted with a raceway for guiding belted components toward the tool, rotary means for receiving and transferring successive components from the delivery end of the raceway to the indexing means, impositively operative means cooperative with the raceway above its delivery end to separate the successive components from their belted relation, and mechanism tending ents from their belted relation, and mechanism tending to operate the last-mentioned means at a rate faster than the rate of transfer of components by the transferring means. This organization makes certain that, despite occasional irregularity in the spacing of components on their feeding strips, successive components arrive with regularity in appropriate position to be formed and then acted on by the inserting tool.

The above and other features of the invention, including novel means for progressively exercising control over the positioning of the leads of the components right up to the zone in which they are to be formed and other details of construction, will now be more fully described in connection with an illustrative embodiment in which they reside and with reference to the accompanying drawings thereof, in which:

Fig. 1 is a perspective view, as seen from the back, of the lower portion of a head of a component inserting machine of the general type disclosed in the above-cited Alderman et al. application, portions being removed more clearly to show modified construction;

Fig. 2 is a plan view of a lead-supporting shelf partly shown in Fig. 1;

Fig. 3 is a section taken on the line III—III in Fig. 2 and showing the means for mounting the shelf shown in Fig. 2;

Fig. 4 is a perspective view, as seen from the front of the machine head shown in Fig. 1, and at that subsequent stage in a cycle of operations when a component is being inserted and its leads clinched;

Fig. 5 is a view largely in side elevation of the head of the component inserting machine, portions being broken away and parts of component feed mechanism being indicated in section;

Fig. 6 is a view in front elevation of a lead straightening part shown in Fig. 5 and which intentionally has been omitted in Fig. 1;

Fig. 7 is a view in rear elevation of component feeding and lead straightening elements shown in Fig. 1 and indicating progressive positions of components as they are engaged at points successively farther from their bodies;

Fig. 8 is a vertical section showing on an enlarged scale certain parts of the feeding mechanism shown in Fig. 5; and

Fig. 9 is a view corresponding to Fig. 8 and showing leads being spun and straightened as they are fed.

Since the present invention is primarily concerned with the provision of means for suitably advancing components to a forming zone in a component inserting machine, it will suffice if only such portions of the machine fully disclosed in the Alderman et al. application are herein described as are necessary to a complete understanding of the instant invention.

Referring to Figs. 4 and 5, the illustrative machine comprises a head casing generally designated **10** secured to a sleeve **12** rotatably supported in a clamp-type cylindrical bearing **14** (Fig. 5) constituting an overhanging portion of a main C-frame of the machine. The head **10** includes a vertically reciprocable inserter **16** (Fig. 4) and a pair of outside formers **18, 18** which cooperate with a pivotal inside former **20** (Fig. 5) to form the leads in staple fashion and then install successive components **22**, as indicated in Fig. 4. As there shown, the inserted leads have been thrust through preformed holes **24, 24** in a wiring board **26** and clinched by means of anvils **28, 28**, and accordingly the formers **18** and the inserter **16** have their lead engaging ends formed with alined V-shaped wire receiving grooves **30, 32**, respectively. Preferably, a pair of vertically reciprocable lead cutters **34** (one only shown partially in Fig. 5) also have alined V-shaped positioning notches, as taught in the Cardani Patent No. 2,748,388 above mentioned, for the purpose of severing the leads of each component to proper length just before they are formed.

The illustrative machine, as disclosed in said Alderman et al. application, further includes a pair of rotary, toothed indexing wheels **36, 36** for registering the successive leads of components to be mounted with the grooves **30, 32**. Experience has shown, however, especially in the case of smaller bodied components having more pliant leads, or where the components to be installed are mounted on only a single strip of tape T, that the leads of a component may not be sufficiently straight and parallel to be received in corresponding lowermost notches **38, 38** of the wheels **36**, or otherwise be fed consistently in alinement with the notches **30, 32**. As a consequence, so-called "cross overs" may occasionally occur, i. e., the leads of a component are then advanced by non-corresponding notches **38, 38** in skewed relation to the lead receiving notches **30, 32** and hence out of parallel to a line connecting the holes **24, 24**. There thus results not only a possible failure to insert a component, which in itself may be serious, but also the parts of the head may become jammed by the crossed-over leads so that continued operation becomes impossible without dismantling, clearing, and then reassembling the head, the ensuing delay in production being costly, particularly when the machine happens to be one in an automatic conveyorized system. For enclosing the mentioned instrumentalities in the casing **10** and supporting feeding mechanism to be hereinafter described, the casing has its walls extending vertically and in U-shaped arrangement, the open side in front normally being bridged by a cover plate **40** (Fig. 5). Secured to the bottom of the casing **10** is a pair of spaced shear blocks **42, 42** (Figs. 1, 5) for cooperating, respectively, with the cutters **34** when corresponding lowermost notches **38, 38** have registered the component to be formed and mounted.

The indexing wheels **36** are operated in a manner much like that disclosed in said Alderman et al. application, having operative connection with the reciprocable inserter **16**, and the feeding mechanism about to be explained derives its actuation from the indexing wheels. The arrangement is such that no feeding occurs during the downstroke of the inserter but only during its upstroke in returning from its position shown in Fig. 4 to that shown in Fig. 5. An arm (not shown) of a spring-biased lever **44** is disposed to be engaged by the inserter to move the lever counterclockwise, as viewed in Fig. 5, the lever being formed integral with a horizontal pivot shaft **46** journaled in semi-cylindrical bearings formed in confronting blocks **48, 50** secured to the rear of the casing **10**. A pair of arms **52** also integral with the lever **44** and respectively arranged at the ends of the shaft **46** pivotally support pawls **54, 54**, respectively. The latter, under the influence of tension springs **56, 56**, yieldingly engage corresponding upper notches **38** of the wheels **36**. The consequent raising of the pawls **54** by the lever **44** is sufficient to rotate the wheels **36** clockwise, as seen in Fig. 5, to advance the leads of the next component to be formed substantially into register with the grooves **30, 32**. Spring backed detents **58, 58** pivotally supported on the casing **10** are accordingly dislodged from one pair of corresponding notches **38** and reseated in a succeeding pair of corresponding notches **38** to maintain the newly positioned bottommost leads in register with the grooves **30, 32**, any counterclockwise movement of the pawls **54** beyond that necessary properly to index the wheels being without effect on them.

Better to insure that the leads being successively advanced by the wheels **36** can and will arrive in precise register with the grooves **30, 32** and without danger of jamming, the illustrated machine includes later-described lead straightening means generally designated **60** (Figs. 5, 9) as a part of its component feeding mechanism, and the latter mechanism is designed to present, without hiatus, one component to each of the successive pairs of corresponding indexing notches **38**, although the components be initially borne by strip material in spacing that may have been irregular. A raceway **62** (Figs. 1, 5, 8), comprising spaced, parallel inner tracks **64** and outer tracks **66**, is mounted on the cover plate **40** and adapted to guide a row of components, detachably mounted in side-by-side relation on a tape T, downwardly toward the forming and inserting tools. The spacing of the outer tracks **66** from the inner tracks **64** is adequate to accommodate the descending leads at each side of their component bodies, the latter being impositively pulled downwardly by frictionally actuated tape stripping means now to be explained. Secured to the raceway **62** is a yoke **68** (Figs. 1, 5, 7) in which is rotatably journaled a horizontal shaft **70**. A stripper roll **72** secured on this shaft is formed with a hub portion **74** of rubber arranged to engage the tape T oppositely to the bodies of successive components carried thereby and provided with uniformly spaced, corresponding pairs of peripheral lead receiving notches **76, 76** which have their lead engaging walls disposed adjacent to the respective ends of the component bodies. The roll **72** and its shaft are driven through a simple, friction type slip clutch. For this purpose, a gear **78** (Fig. 1), freely rotatable on the shaft **70**, is integral with a collar **80** arranged to bear axially on a clutch friction plate **82** fast on the shaft **70**, a compression spring **84** on the latter being backed by a stop collar **86** and arranged to engage the gear to urge it axially into driving relation with the clutch plate **82**. Successive components are thus separated from the tape T and urged downwardly one upon another toward the delivery end of the raceway.

The gear **78** is driven by a larger gear **88** (their ratio being shown herein as 1:2) fast on one end of a horizontal shaft **90** constituting a part of the lead straightening means **60**. This shaft **90** is rotatably supported in bearings formed in a pair of upright brackets **92, 92** (Fig. 1) that are secured on the respective ends of a crossbar **94** by thumbscrews **96**. This crossbar is connected centrally by a capscrew **98** to a forwardly extending tongue portion **100** (Figs. 1, 3 and 5) of an irregularly shaped lead-supporting member **102** fixed on the cover plate **40**. For straightening the leads of the components after they have passed through the lower end of the raceway, a straightening roll **104**, comprising a body-engaging portion **106** and a pair of rotary, evenly notched lead receiving disks **108, 108**, is mounted on the shaft **90** and immediately beneath the tracks **64, 66**, as shown at Fig. 8. In being metered from the raceway and then advanced by engagement of the disks **108** with the leads adjacent to their components' bodies, the leads are caused to traverse a semi-circular course defined by smooth convex projections **110, 110** (Fig. 1) integral with the member **102** and by corresponding concave surfaces **112, 112** of a cooperating lead straightening member generally designated **114** (Figs. 6 and 9). The passageway between a projection **110** and cooperating surface **112** is preferably only slightly more

in depth than the diameter of each lead to be accommodated therein.

Straightening is facilitated by the leads being spun axially as they advance, each component body for this purpose being rotated axially as it is engaged by the portion 106 and a coacting stationary rubber faced portion 116 of the member 114. The latter is detachably secured at each end by thumbscrews 118, 118 respectively threaded into the brackets 92. For driving the shaft 90, clockwise as viewed in Fig. 5, a gear 120 (Fig. 1) fast thereon is arranged to mesh with a similar gear 122 fixed on a shaft 124 journaled in the brackets 92.

Upon emerging from the lead straightening means 60, successive components have their leads transferred into corresponding uppermost peripheral notches of toothed disks 126, 126 of a feed roll 128 secured on the shaft 124. The disks 126 are axially spaced apart more than the disks 108, and hence the positioning of each component can now be controlled via its straightened leads to effect reliable transfer of the leads of each component to the even more widely spaced pair of corresponding indexing notches 38 as shown in Fig. 7. The shaft 124 carries a gear 130 for meshing with one of the indexing wheels 36 and the gear 122 is arranged to be driven by a gear 132 carried by the shaft of the other indexing wheel 36. Incidentally, an extension of each of the shafts carrying the indexing wheels is fitted with a knurled hand wheel 134 (Figs. 1, 4) conveniently to enable one manually to load or unload the serpentine feed channels. It will thus be clear that each upstroke of the inserter 16 operates to insure that the wheels 36 can, without hiatus or likelihood of jamming, accurately index a pair of coaxial leads for forming, the stripped leads of successive components being urged to occupy each successive corresponding pair of feeding notches of the straightening roll 104 and of the feeding roll 128. Upon the tape T being separated from successive composite bodies it is led around and beneath the hub portion 74 and then up and over an accumulator roll 136. The latter, though restrained against free rotation, is rotatably supported on the lower end of a lever 138 pivotally secured to the raceway 62. A tension spring 140 (Fig. 5) connecting the casing 10 and the lever 138 tends to hold the wound and spent tape T in frictional engagement with the rubber hub portion 74, the latter accordingly causing the tape T to be accumulated and enabling substantially uniform, though impositive, tape stripping forces to operate regardless of the size of the roll of accumulated tape.

From the foregoing it will be apparent, in the novel inserting head provided, that body-taped components, even though their leads are not prestraightened and their bodies are nonuniformly spaced, may be automatically fed at an appropriate rate and with great precision to meet the requirements of cyclically operative forming and inserting tools.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a machine for mounting coaxial lead components, a head including means for forming and inserting the leads of successive components, and mechanism actuatable by said head for feeding and indexing the successive components to be mounted with respect to said means, said mechanism including means operative throughout the length of the leads of the successive components to straighten and maintain the leads in substantially parallel relation during their feeding to enable them to be engaged in uniformly similar manner by the forming and inserting means.

2. In a machine for mounting coaxial lead components and having means for cutting, forming and inserting the leads of successive components, mechanism operable by said means for indexing the successive components to be mounted with respect to said means, a guideway for advancing the components in side-by-side relation toward the indexing mechanism, and means intermediate to the guideway and said indexing mechanism and controlled by the latter for straightening the leads of the successive components throughout their lengths while transferring them in parallel relation to the indexing mechanism whereby the leads are enabled to be uniformly operated upon by the cutting, forming and inserting means.

3. In a component inserting machine of the type having a reciprocable inserter, a reciprocable former, and means for indexing the leads of successive components to be mounted with respect to the inserter and former, a guideway for advancing tape-carried components in succession toward the indexing means, transfer mechanism mounted adjacent to the guideway and driven by the indexing means for positively moving successive components from the delivery end of the guideway to said indexing means, and lead-engaging means ahead of said transfer mechanism and cooperative with the guideway for stripping successive components from taped relation to urge them toward said delivery end of the guideway, said lead-engaging means having yieldingly operative connection with the transfer mechanism.

4. A component inserting machine as set forth in claim 3 and further characterized in that said transfer mechanism includes lead straightening means adapted to operate on the leads throughout their lengths.

5. A component inserting machine as set forth in claim 3 and further characterized in that said stripping means is adapted to be operated at a rate tending to exceed the rate of operation of said transfer mechanism.

6. A component inserting machine as set forth in claim 3 and further characterized in that said positively acting transfer mechanism and said stripping means are operatively connected to said indexing means.

7. In a machine for inserting coaxial lead components and having a head provided with indexing wheels for registering successive components by their leads relatively to forming and inserting tools, a raceway on said head having a delivery end in the vicinity of said wheels and adapted to guide tape-mounted components in row formation, a rotary, toothed wheel formed and mounted to strip the leads of the successive components from taped relation ahead of the raceway delivery end, lead straightening means operative throughout lengths of the stripped leads comprising cooperative members one of which is rotatably mounted beneath the raceway to transfer components in spaced relation from said delivery end, and a peripherally notched lead-engaging wheel having its axis parallel to that of said rotatable lead straightening member for presenting successive straightened leads from said straightening means to said indexing wheels in parallel relation, said stripping wheel, lead straightening means and lead presenting wheel being operatively connected to said indexing wheels to insure that the latter are supplied with components at a rate at least equal to the operating rate of said tools.

8. A machine as set forth in claim 7 and further characterized in that the rotatably mounted member of said straightening means, the peripherally notched lead-presenting wheel, and said indexing wheels are disposed successively to engage the leads at points progressively further from the component bodies.

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