

CARRIER TAPE SYSTEM AND SPROCKET FOR REDUCING JAMS**RELATED MATTERS**

[0001] This application claims priority to U.S. Provisional Patent Application 63/580,197, having a filing date of September 1, 2023, and entitled “CARRIER TAPE SYSTEM AND SPROCKET FOR REDUCING JAMS,” the disclosure of which are hereby incorporated by reference.

TECHNICAL FIELD

[0002] This invention relates to reducing potential jams indexing components into a radial feeder pick area caused by inconsistency in component taping. Further, the present disclosure relates to allowing for a pulldown mechanism to justify components against a cut and form tooling datum surface before cutting from tape in order to generate more consistent component lead lengths and/or forms.

BACKGROUND

[0003] Pick and Place equipment require components to be repeatably presented at a location where the pick head can access them. Radial components are typically provided on carrier tape that can be presented to the machine with a radial feeder.

[0004] Existing sprockets for carrier tape indexers are rigid, preventing the component from being pulled down against cut and form tooling. These rigid sprockets prevent components with wide lead spans from being pulled down to the datum surface because the carrier tape is constrained on the sprocket tooth.

[0005] Thus, methods and systems would be well received in the art.

SUMMARY

[0006] According to one aspect, a carrier tape radial feeder includes a drive sprocket having a plurality of sprocket teeth, a component cut and/or present location including a tooling datum surface, and a pulldown mechanism located proximate the component cut and/or present location. The drive sprocket is configured to rotate. The plurality of sprocket teeth engage with carrier holes in a carrier tape carrying a plurality of components to propel the carrier tape forward as the drive sprocket rotates. The pulldown mechanism is configured to pull down the carrier tape until a component of the plurality of components located at the cut and/or present location bottoms out on the tooling datum surface. Moreover, the drive sprocket is configured to flex in response to the pulldown mechanism pulling down the carrier tape.

[0007] According to another aspect, a method of feeding of components with a carrier tape radial feeder includes providing the carrier tape radial feeder, the carrier tape radial feeder including: a drive sprocket having a plurality of sprocket teeth, a component cut and/or present location including a tooling datum surface, and a pulldown mechanism located proximate the component cut and/or present location. The method further includes rotating the drive sprocket, engaging carrier holes in a carrier tape carrying a plurality of components with the plurality of sprocket teeth, propelling the carrier tape forward with the drive sprocket during the rotating and engaging, pulling down, with the pulldown mechanism, the carrier tape until the component of the plurality of components located at the cut and/or present location bottoms out on the tooling datum surface, flexing, by the drive sprocket, in response to the pulldown mechanism pulling down the carrier tape, and removing, by a pick head, the component of the plurality of components of the carrier tape at the component cut and/or present location.

[0008] According to another aspect, a pick and place system includes a carrier tape radial feeder. The carrier tape radial feeder includes a drive sprocket having a plurality of sprocket teeth, a component cut and/or present location including a tooling datum surface, and a pulldown mechanism located proximate the component cut and/or present location. The pick and place system further includes a pick head configured to pick up the component of the plurality of components of the carrier tape at the component cut and/or present location. The drive sprocket of the carrier tape radial feeder is configured to rotate, the sprocket teeth engage with carrier holes in a carrier tape carrying a plurality of components to propel the carrier tape forward as the drive sprocket rotates, the pulldown mechanism is configured to pull down the carrier tape until a component of the plurality of components located at the cut and/or present location bottoms out on the tooling datum surface, and the drive sprocket is configured to flex in response to the pulldown mechanism pulling down the carrier tape.

[0009] According to another aspect, a drive sprocket assembly for a carrier tape radial feeder includes an inner yoke, an outer sprocket surrounding the inner yoke, the outer sprocket having a plurality of sprocket teeth disposed about a circumference of the outer sprocket, and a spring plate attached to each of the inner yoke and the outer sprocket. The spring plate is configured to facilitate flexing of the outer sprocket relative to the inner yoke in response to a downward force on the outer sprocket.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The above and further advantages of this invention may be better understood by referring to the following description in conjunction with the accompanying drawings, in which like reference numerals indicate like elements and features in the various figures. For clarity, not

every element may be labeled in every figure. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

[0011] FIG. 1 depicts a carrier tape having a component carrier and denoting a component tape height, according to one embodiment.

[0012] FIG. 2 depicts a carrier tape having a specific hole size of 4 mm in diameter which is spaced at a standard pitch of 12.7 mm, according to one embodiment.

[0013] FIG. 3 depicts a carrier tape having a specific hole size of 4 mm in diameter which is spaced at a standard pitch of 15 mm, according to one embodiment.

[0014] FIG. 4 depicts a perspective view of a carrier tape radial feeder including a drive sprocket and a component cut and present location, according to one embodiment.

[0015] FIG. 5 depicts a perspective view of the carrier tape radial feeder shown in FIG. 4, according to one embodiment.

[0016] FIG. 6 depicts a pulldown mechanism which is installed at the feeder at the cut and/or present location which is configured to pull down on the carrier tape until the component bottoms out on a tooling datum surface, according to one embodiment.

[0017] FIG. 7 depicts a side perspective view of a component presentation of the carrier tape feeder of FIGS. 4 – 5 before pulldown, showing a component offset gap between the component and the tooling datum surface, according to one embodiment.

[0018] FIG. 8 depicts a side perspective view of the component in the carrier tape feeder of FIGS. 4 – 5 and 7 after being pulled down to the tooling datum surface without the component offset gap, according to one embodiment.

[0019] FIG. 9 depicts a perspective view of a standard sprocket.

[0020] FIG. 10A depicts a front perspective view of a drive sprocket, according to one embodiment.

[0021] FIG. 10B depicts a rear perspective view of the drive of FIG. 10A, according to one embodiment.

[0022] FIG. 11A depicts a front perspective view of an outer sprocket of the drive sprocket of FIGS. 10A and 10B, according to one embodiment.

[0023] FIG. 11B depicts a rear perspective view of the outer sprocket of FIG. 11A of the drive sprocket of FIGS. 10A and 10B, according to one embodiment.

[0024] FIG. 12A depicts a front perspective view of an inner component or yoke of the drive sprocket of FIGS. 10A and 10B, according to one embodiment.

[0025] FIG. 12B depicts a rear perspective view of the inner component or yoke of FIG. 12A of the drive sprocket of FIGS. 10A and 10B, according to one embodiment.

[0026] FIG. 13 depicts a perspective view of a spring plate of the drive sprocket of FIG. 10, according to one embodiment.

[0027] FIG. 14A depicts a side view of the drive sprocket of FIGS. 10A and 10B in a flexed position, according to one embodiment.

[0028] FIG. 14B depicts a side view of the drive sprocket of FIGS. 10A and 10B without flexing, according to one embodiment, according to one embodiment.

[0029] FIG. 15 depicts a perspective view of the carrier tape feeder shown in FIGS. 4 – 5 and 7 – 8 including the pulldown mechanism prior to pulling down the tape, according to one embodiment.

[0030] FIG. 16 depicts a perspective view of the carrier tape feeder shown in FIGS. 4 – 5, 7 – 8, and FIG. 15 including the pulldown mechanism pulling down the tape, according to one embodiment.

[0031] FIG. 17 depicts a perspective view of the carrier tape feeder shown in FIGS. 4 – 5, 7 – 8, and FIGS. 15 – 16 including a clamp in a clamped position, according to one embodiment.

[0032] FIG. 18 depicts a perspective view of the carrier tape feeder shown in FIGS. 4 – 5, 7 – 8, and FIG. 15 including a cutter in cutting position, according to one embodiment.

DETAILED DESCRIPTION

[0033] Reference in the specification to “one embodiment” or “an embodiment” means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the teaching. References to a particular embodiment within the specification do not necessarily all refer to the same embodiment.

[0034] The present teaching will now be described in more detail with reference to exemplary embodiments thereof as shown in the accompanying drawings. While the present teaching is described in conjunction with various embodiments and examples, it is not intended that the present teaching be limited to such embodiments. On the contrary, the present teaching encompasses various alternatives, modifications and equivalents, as will be appreciated by those of skill in the art. Those of ordinary skill having access to the teaching herein will recognize additional implementations, modifications and embodiments, as well as other fields of use, which are within the scope of the present disclosure as described herein.

[0035] Pick and place equipment require components to be repeatably presented at a location where the pick head can access them. Radial components are typically provided on carrier tape that can be presented to the machine with a radial feeder. Embodiments of the present invention described herein seek to add flexibility and reduce potential jams indexing

components into a radial feeder pick area caused by inconsistency in component taping. Further, embodiments herein further seek to provide for a pulldown mechanism to justify components against cut and form tooling datum surface before cutting from tape. This generates more consistent component lead lengths and/or forms.

[0036] Moreover, it is contemplated that certain component feeder applications require the leads of a component to be cut to a precise length or that specific forms be generated on the leads. In order to do this reliably the component needs to be registered down against the cut / form tooling. To justify the component down, embodiments described herein contemplate that a mechanism is installed in the feeder at the cut/form location that pulls down on the carrier tape until the component bottoms out on the cut/form tooling.

[0037] Existing sprockets known in the art are rigid and therefore prevent a component from being pulled down against a cut and form tooling in the manner contemplated herein. In particular, rigid sockets prevent components with wide lead spans from being pulled down to the datum surface because the carrier tape is constrained on the sprocket tooth.

[0038] FIG. 1 depicts a carrier tape 10 having a component carrier 12 and denoting a component tape height H, according to one embodiment. As shown, the carrier tape 10 is shown with a plurality of components 14 disposed thereon. Each of the plurality of components 14 includes two leads 16 attached to the component carrier 12 portion of the carrier tape 10. The component carrier 12 further includes openings 18 or holes which are disposed thereon at regular intervals (known in the art as pitch). The openings 18 or holes may include various sizes or spacings, and may be utilized by a sprocket to induce movement of the carrier tape 10. FIG. 2 depicts a carrier tape 20 having a specific hole size of 4 mm in diameter which is spaced at a standard pitch of 12.7 mm, according to one embodiment. FIG. 3 depicts a carrier tape 30 having a specific hole size of 4 mm in diameter which is spaced at a standard pitch of 15 mm, according to one embodiment. In other words, the spacing shown in the carrier tape 30 of FIG. 3 is larger than the spacing shown in the carrier tape 20 of FIG. 2. Embodiments of the present invention may accommodate carrier tapes of any size, spacing and/or dimensions.

[0039] A typical way of feeding the carrier tapes 10, 20, 30 in a feeder is with a drive sprocket that engages into the openings 18 in order to propel the carrier tape forward as the drive sprocket rotates. Methods of feeding components with a carrier tape radial feeder with flexible drive sprockets will be described herein below.

[0040] FIG. 4 depicts a perspective view of a carrier tape radial feeder 100 including a drive sprocket 101 and a component cut and/or present location 150, according to one embodiment. FIG. 5 depicts a perspective view of the carrier tape radial feeder 100 shown in FIG. 4, according to one embodiment. While FIG. 4 shows a single component 14 located at the

cut and/or present location 150 with other components of a carrier tape removed for the purposes of better revealing the drive sprocket 101, the view shown in FIG. 5 shows the carrier tape radial feeder 100 with a carrier tape 10, 20, 30 having a plurality of the components 14. As shown in FIG. 5, the component 14a is located at the component cut and/or present location. After the component 14a is cut and presented for picking, the carrier tape 10, 20, 30 is propelled, and the rest of the components move one step closer to the cut and/or present location 150. As such, the next component 14b is then presented, followed by the component 14c, etc.

[0041] As shown, the drive sprocket 101 includes a plurality of sprocket teeth 102. The drive sprocket 101 is configured to rotate in order to propel forward components 14 disposed on a carrier tape, such as the carrier tapes 10, 20, 30 shown in FIGS. 1 – 3. In particular, the plurality of sprocket teeth 102 engage with carrier holes 18 in a carrier tape 10, 20, 30 carrying the plurality of components 14 in order to propel the carrier tape 10, 20, 30 forward as the drive sprocket 101 rotates.

[0042] The carrier tape radial feeder 100 is shown including a main body 140 extending between two plates or surfaces. The main body 140 of the carrier tape radial feeder 100 is configured to house at least one motor or drive device (not shown) configured to drive a rotatable shaft 130 upon which the drive sprocket 101 is attached. Thus, the carrier tape radial feeder 100 may be configured to drive an attached carrier tape 10, 20, 30 through the feeder in order to present each component sequentially at the cut and/or present location 150. The motor system may include an indexing device which ensures accurate rotation of the rotatable shaft 130 and propelling and movement of the carrier tape 10, 20, 30. Further, within the main body 140, the carrier tape radial feeder 100 may include a feed path within which the carrier tape 10, 20, 30 is configured to travel. A portion of such a feed path is shown in FIG. 5.

[0043] The component cut and/or present location 150 includes a tooling datum surface 152. The tooling datum surface 152 is defined between at least one plate 154 configured to provide structure to the feed path of the carrier tape. Further, while hidden in the views shown in FIGS. 4 and 5 but shown in FIG. 6, the carrier tape radial feeder 100 further includes a pulldown mechanism 120 located proximate the component cut and/or present location. In particular, FIG. 6 depicts the pulldown mechanism 120 which is installed at or otherwise proximate the cut and/or present location 150. The pulldown mechanism 120 is configured to pull down on the carrier tape by pulling on the component carrier 12 (not shown in FIG. 6) until the component bottoms out on a tooling datum surface 152. The functionality of the pulldown mechanism 120 is further shown in FIGS. 15 – 18 and described in more detail herein below. In particular, the pulldown mechanism 120 includes a plurality of fingers 122 which are configured to pull down the component carrier 12 portion of the carrier tape 10, 20, 30 until the component 14 of the

plurality of components located at the cut and/or present location 150 bottoms out on the tooling datum surface 152. During this pulling action, the drive sprocket 101 is configured to flex in response to the pulldown mechanism 120 pulling down the carrier tape 10, 20, 30, as described in more detail hereinbelow and shown more specifically in FIGS. 14A – 14B.

[0044] FIG. 7 depicts a side perspective view of a component presentation of the carrier tape feeder 100 of FIGS. 4 – 5 before pulldown, showing a component offset gap 158 and between the component 14 and the tooling datum surface 152, according to one embodiment. FIG. 8 depicts a side perspective view of the component 14 in the carrier tape feeder 100 of FIGS. 4 – 5 and 7 after being pulled down to the tooling datum surface 152 without the component offset gap 158, according to one embodiment.

[0045] FIG. 9 depicts a perspective view of a standard prior art sprocket 50. The standard prior art sprocket 50 is a circular toothed sprocket made out of a single component which is not configured to flex in the contemplated manner of the drive sprocket 101 described herein.

[0046] FIG. 10A depicts a front perspective view of the drive sprocket 101, according to one embodiment. FIG. 10B depicts a rear perspective view of the drive sprocket 101 of FIG. 10A, according to one embodiment. The drive sprocket 101 may be a flexible drive sprocket assembly including a plurality of separate components, including an inner yoke 106 and an outer sprocket 104 surrounding the inner yoke 106. The outer sprocket 104 includes the plurality of sprocket teeth 102 disposed about a circumference of the outer sprocket 104. Further, the drive sprocket 101 assembly includes a spring plate 108 attached to each of the inner yoke 106 and the outer sprocket 104. The spring plate 108 is configured to facilitate flexing of the outer sprocket 104 relative to the inner yoke 106 in response to a downward force on the outer sprocket 104, as shown and described herein below.

[0047] FIG. 11A depicts a front perspective view of the outer sprocket 104 of the drive sprocket of FIGS. 10A and 10B, according to one embodiment. FIG. 11B depicts a rear perspective view of the outer sprocket 104 of FIG. 11A of the drive sprocket 101 of FIGS. 10A and 10B, according to one embodiment. As shown, the outer sprocket 104 includes a circumferential recessed portion 103. The spring plate 108 is configured to be attached to the circumferential recessed 103 portion of the outer sprocket 104.

[0048] FIG. 12A depicts a front perspective view of the inner component or yoke 106 of the drive sprocket 101 of FIGS. 10A and 10B, according to one embodiment. FIG. 12B depicts a rear perspective view of the inner component or yoke 106 of FIG. 12A of the drive sprocket 101 of FIGS. 10A and 10B, according to one embodiment. The inner yoke 106 includes a circumferential body 107 and a cylindrically extending portion 105 having an inner

opening 109 configured to receive the rotatable shaft 130 driven by the motor of the carrier tape radial feeder 100, described herein above. The inner yoke 106 further includes an outer radial portion 111 and a stepped portion 113 located between the outer radial portion 111 and the cylindrically extending portion 105. The spring plate 108 is attached to the stepped portion 113 of the inner yoke 106 of the assembly of the drive sprocket 101.

[0049] FIG. 13 depicts a perspective view of the spring plate 108 of the drive sprocket 101 of FIG. 10, according to one embodiment. The spring plate 108 includes a center opening 110 receiving and extending around the cylindrically extending portion 105 of the inner yoke 106 described herein above. Further, the spring plate 108 includes a first circumferential portion 112 defining an inner radius portion of the spring plate 108. The body of the spring plate 108 further extends to a second circumferential portion 116 defining an outer radius portion of the spring plate 108. Further, the spring plate 108 includes flexible connecting portions 118 extending between and connecting the first circumferential portion 112 and the second circumferential portion 116.

[0050] The spring plate 108 is attached to each of the inner yoke 106 and the outer sprocket 104 in order to define the assembly of the drive sprocket 101. In particular, the first circumferential portion 112 is attached to the stepped portion 113 of the inner yoke 106. The second circumferential portion 116 is attached to the circumferential recessed portion 103 of the outer sprocket 104. The spring plate 108 may be flexible and may provide for a downward movement of one side of the outer sprocket 104 relative to the inner yoke 106 when the outer sprocket 104 is exposed to a downward force or pressure. While spring plate 108 may flex in response to a downward force or pressure, the spring plate 108 may also facilitate flexing or movement of the outer sprocket 104 relative to the inner yoke 106 in response to an upward force or pressure. This upward flexing may further help prevent jams and allows the initial setup of the component feed height to be closer to the height of the tooling datum surface 152 in order to allow for greater taping height variation.

[0051] FIG. 14A depicts a side view of the drive sprocket 101 of FIGS. 10A and 10B in a flexed position, according to one embodiment. FIG. 14B depicts a side view of the drive sprocket 101 of FIGS. 10A and 10B without flexing, according to one embodiment. Since the carrier tape 10, 20, 30 is constrained on the drive sprocket 101 (as shown above), allowing the outer sprocket 104 of the drive sprocket 101 to comply and flex downward relative to the inner yoke 106 as shown in FIG. 14A makes registering the component onto the tooling much easier. In particular, the rotatable shaft 130 and the inner yoke 106 are configured to remain in an unflexed position. However, the outer sprocket 104 is configured to flex downward or upward relative to this fixed position, in order to allow the carrier tape 10, 20, 30 to also move downward

in response to the pulldown mechanism 120 activation. For example, the view shown in FIG. 14A includes the right side of the outer sprocket 104 lower than the left side of the outer sprocket 104. Such flexing can be achieved by either a downward force on the right side of the outer sprocket 104, or alternatively by an upward force on the left side of the outer sprocket 104. Thus, the spring plate 108 and the outer sprocket 104 may be configured to respond to both upward and downward forces through upward and downward flexing.

[0052] Referring now to FIGS. 15 – 18, various stages of a contemplated process are shown. In particular, FIG. 15 depicts a perspective view of the carrier tape feeder 100 shown in FIGS. 4 – 5 and 7 – 8 including the pulldown mechanism 120 prior to pulling down the carrier tape 10, 20, 30. As shown, a component 14 is located above the tooling datum surface 152. The pulldown mechanism 120 is in a retracted position. The component carrier 12 is shown, as well as the leads 16 of the component 14 located at the cut and/or present location 150. Moreover, shown in this view, a clamp 160 and a cutter 162 remain retracted prior to activation.

[0053] FIG. 16 depicts a perspective view of the carrier tape feeder 100 shown in FIGS. 4 – 5, 7 – 8, and FIG. 15 including the pulldown mechanism 120 pulling down the carrier tape 10, 20, 30 and/or the component carrier 12 thereof. As a result of this pulldown mechanism 120 activation, the component 14 located at the cut and/or present location 150 is pulled down to the tooling datum surface 152 where the clamp 160 and cutter 162 can engage therewith.

[0054] FIG. 17 depicts a perspective view of the carrier tape feeder 100 shown in FIGS. 4 – 5, 7 – 8, and FIGS. 15 – 16 including the clamp 160 in a clamped position, according to one embodiment. As shown, the clamp 160 is configured to move forward toward the leads 16 in order to contact and/or clamp the leads 16 of the component 14 that is in the component cut and/or present location 150. This clamping by the clamp 160 may maintain the leads 16 in a retained or fixed position so that the cutter 162 can then be activated in order to cut the leads 16 in order to separate the component 14 from the component carrier 12.

[0055] FIG. 18 depicts a perspective view of the carrier tape feeder 100 shown in FIGS. 4 – 5, 7 – 8, and FIG. 15 including the cutter 162 in cutting position, according to one embodiment. As shown, the cutter 162 may be configured to cut the leads 16 of the component 14 in the component cut and/or present location 150 to isolate the component 14 from the carrier tape 10, 20, 30 and/or the component carrier 12 thereof.

[0056] As contemplated herein the drive sprocket 101 may be close to the pick point (i.e. the cut and/or present location 150) to maintain as much positional control of the carrier tape 10, 20, 30 as possible to ensure that the leads 16 are presented to the clamp 160 and cutter 162 accurately. Thus, a potential drawback of having the drive sprocket 101 close to the pick point is that such proximity prevents the pulldown mechanism 120 from moving the tape down because

it is constrained by the sprocket teeth. However, this drawback is avoided and the flexible sprocket 101 contemplated herein solves this proximity issue by allowing the individual teeth 102 to flex downward as needed when the pulldown mechanism 120 actuates.

[0057] It is contemplated that the present embodiments are robust enough to feed the components 14 forward without damage to the spring plate. Further, methods described herein and the described drive socket 101 have shown improved feeding performance with less carrier tape jams in the tape feed path.

[0058] Embodiments described herein also allow for multiple spring plates 108 and plate thicknesses to be used as needed to create the desired spring force needed for the application.

[0059] Methods of feeding the components 14 with the carrier tape radial feeder 100, are further contemplated. According to various methods contemplated herein, the components 14 are loaded into the carrier tape radial feeder 100 and then the position of the drive sprocket 101 is adjusted so that the components 14 are precisely lined up with the cut/form tooling 160, 162 and then the drive sprocket 101 is locked into position. The component at the cut and/or present location 150 is then cut and removed. The carrier tape radial feeder 100 will index the next component into position. The pulldown mechanism 120 will then grab the component carrier 12 of the carrier tape 10, 20, 30 and register the next component 14 against the cut/form tooling 160, 162. The drive sprocket 101 will flex as needed allowing the component 14 to fully seat against the tooling datum surface 152. The clamp 160 will contact the leads 16 above the cutter 162, controlling the component 14 at the cut and/or presentation location 150. The cutter 162 (i.e. cutter/former) will activate and process the leads 16, isolating the component 14 from the component carrier 12. The carrier tape radial feeder 100 will notify the pick and place machine (not shown) that the component 14 is ready for picking. The pick and place machine will then grab the component and notify carrier tape radial feeder 100 to release the clamp 160. The carrier tape radial feeder 100 will retract the clamp 160, the cutter/former 162 and the pulldown mechanism 120. After a short delay, the machine pick and place head will remove the component 14 from the carrier tape radial feeder 100. Once the carrier tape radial feeder 100 senses the component 14 has been removed, it will index in the next component and repeat the cycle.

[0060] In other embodiments, methods contemplated herein include providing a carrier tape radial feeder, such as the carrier tape radial feeder 100. Methods may include rotating the drive sprocket 101, engaging the carrier holes 18 in the carrier tape 10, 20, 30 carrying a plurality of components 14 with the plurality of sprocket teeth 102. Methods may further include propelling the carrier tape 10, 20, 30 forward with the drive sprocket 101 during the

rotating and engaging, and pulling down, with the pulldown mechanism 120, the carrier tape 10, 20, 30 until the component 14 of the plurality of components 14 located at the cut and/or present location 150 bottoms out on the tooling datum surface 152. Methods may include flexing, by the drive sprocket 101, in response to the pulldown mechanism 120 pulling down the carrier tape 10, 20, 30 and/or the component carrier 12 thereof. Methods may include removing, by a pick head of a pick and place machine, the component 14 of the plurality of components 14 of the carrier tape 10, 20, 30, at the component cut and/or present location 150.

[0061] Still further, the flexing by the drive sprocket may further include flexing of the outer sprocket 104 relative to the inner yoke 106 in response to a downward force on the outer sprocket 104.

[0062] Methods may further include contacting, by the clamp 160, leads 16 from the component 14 of the plurality of components 14 located at the cut and/or present location 150, and cutting, by the cutter 162, the leads 16 from the component 14 of the plurality of components 14 located at the cut and/or present location 150 to isolate the component 14 from the carrier tape 10, 20, 30 and/or the component carrier 12 thereof.

[0063] Methods may further include presenting the component 14 to the pick head of a pick and place system at the component cut and/or present location 150 after the cutting, and retracting the clamp 160, the cutter 162, and the pulldown mechanism 120, after the presenting and before the removing.

[0064] Elements of the embodiments have been introduced with either the articles “a” or “an.” The articles are intended to mean that there are one or more of the elements. The terms “including” and “having” and their derivatives are intended to be inclusive such that there may be additional elements other than the elements listed. The conjunction “or” when used with a list of at least two terms is intended to mean any term or combination of terms. The terms “first” and “second” are used to distinguish elements and are not used to denote a particular order.

[0065] While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Additionally, while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

CLAIMS

What is claimed is:

1. A carrier tape radial feeder comprising:
a drive sprocket having a plurality of sprocket teeth;
a component cut and/or present location including a tooling datum surface; and
a pulldown mechanism located proximate the component cut and/or present location,
wherein the drive sprocket is configured to rotate,
wherein the plurality of sprocket teeth engage with carrier holes in a carrier tape carrying
a plurality of components to propel the carrier tape forward as the drive sprocket rotates,
wherein the pulldown mechanism is configured to pull down the carrier tape until a
component of the plurality of components located at the cut and/or present location bottoms out
on the tooling datum surface, and
wherein the drive sprocket is configured to flex in response to the pulldown mechanism
pulling down the carrier tape.
2. The carrier tape radial feeder of claim 1, wherein the drive sprocket is an assembly
including:
an inner yoke;
an outer sprocket surrounding the inner yoke, the outer sprocket having a plurality of
sprocket teeth disposed about a circumference of the outer sprocket; and
a spring plate attached to each of the inner yoke and the outer sprocket.
3. The carrier tape of claim 2, wherein the spring plate is configured to facilitate flexing of
the outer sprocket relative to the inner yoke in response to a downward or upward force on the
outer sprocket.
4. The carrier tape radial feeder of claim 2, wherein the inner yoke includes a
circumferential body and a cylindrically extending portion having an inner opening configured to
receive a rotatable shaft.
5. The carrier tape radial feeder of claim 4, wherein the spring plate includes a center
opening receiving and extending around the cylindrically extending portion of the inner yoke,
and wherein the spring plate includes a first circumferential portion having an inner radius, a
second circumferential portion having an outer radius, and flexible connecting portions

extending between and connecting the first circumferential portion and the second circumferential portion.

6. The carrier tape radial feeder of claim 5, wherein the first circumferential portion is attached to the inner yoke, and wherein the second circumferential portion is attached to the outer sprocket.
7. The carrier tape radial feeder of claim 6, wherein the inner yoke further includes an outer radial portion and a stepped portion located between the outer radial portion and the cylindrically extending portion, wherein the first circumferential portion of the spring plate is attached to the stepped portion.
8. The carrier tape radial feeder of claim 6, wherein the outer sprocket includes a circumferential recessed portion, wherein the second circumferential portion of the spring plate is attached to the circumferential recessed portion of the outer sprocket.
9. The carrier tape radial feeder of claim 1, further comprising:
a clamp configured to contact leads from the component in the component cut and/or present location.
10. The carrier tape radial feeder of claim 9, further comprising:
a cutter configured to cut the leads of the component in the component cut and/or present location to isolate the component from the carrier tape.
11. A method of feeding of components with a carrier tape radial feeder comprising:
providing the carrier tape radial feeder, the carrier tape radial feeder including:
a drive sprocket having a plurality of sprocket teeth;
a component cut and/or present location including a tooling datum surface; and
a pulldown mechanism located proximate the component cut and/or present location;
rotating the drive sprocket;
engaging carrier holes in a carrier tape carrying a plurality of components with the plurality of sprocket teeth;
propelling the carrier tape forward with the drive sprocket during the rotating and engaging;

pulling down, with the pulldown mechanism, the carrier tape until the component of the plurality of components located at the cut and/or present location bottoms out on the tooling datum surface;

flexing, by the drive sprocket, in response to the pulldown mechanism pulling down the carrier tape; and

removing, by a pick head, the component of the plurality of components of the carrier tape at the component cut and/or present location.

12. The method of claim 11, wherein the drive sprocket is an assembly including: an inner yoke; an outer sprocket surrounding the inner yoke, the outer sprocket having a plurality of sprocket teeth disposed about a circumference of the outer sprocket; and a spring plate attached to each of the inner yoke and the outer sprocket, wherein the flexing by the drive sprocket further comprises:

flexing of the outer sprocket relative to the inner yoke in response to a downward or upward force on the outer sprocket.

13. The method of claim 11, further comprising:

contacting, by a clamp, leads from the component of the plurality of components located at the cut and/or present location.

14. The method of claim 13, further comprising:

cutting, by a cutter, the leads from the component of the plurality of components located at the cut and/or present location to isolate the component from the carrier tape.

15. The method of claim 14, further comprising:

presenting the component to the pick head of a pick and place system at the component cut and/or present location after the cutting.

16. The method of claim 15, further comprising:

retracting the clamp, the cutter, and the pulldown mechanism, after the presenting and before the removing.

17. A pick and place system comprising:

a carrier tape radial feeder, the carrier tape radial feeder including:

a drive sprocket having a plurality of sprocket teeth;

a component cut and/or present location including a tooling datum surface; and
a pulldown mechanism located proximate the component cut and/or present location.

wherein the drive sprocket is configured to rotate,

wherein the sprocket teeth engage with carrier holes in a carrier tape carrying a plurality of components to propel the carrier tape forward as the drive sprocket rotates,

wherein the pulldown mechanism is configured to pull down the carrier tape until a component of the plurality of components located at the cut and/or present location bottoms out on the tooling datum surface, and

wherein the drive sprocket is configured to flex in response to the pulldown mechanism pulling down the carrier tape; and

a pick head configured to pick up the component of the plurality of components of the carrier tape at the component cut and/or present location.

18. The pick and place system of claim 17, wherein the drive sprocket is an assembly including:

an inner yoke;

an outer sprocket surrounding the inner yoke, the outer sprocket having a plurality of sprocket teeth disposed about a circumference of the outer sprocket; and

a spring plate attached to each of the inner yoke and the outer sprocket.

19. The pick and place system of claim 18, wherein the spring plate is configured to facilitate flexing of the outer sprocket relative to the inner yoke in response to a downward or upward force on the outer sprocket.

20. A drive sprocket assembly for a carrier tape radial feeder comprising:

an inner yoke;

an outer sprocket surrounding the inner yoke, the outer sprocket having a plurality of sprocket teeth disposed about a circumference of the outer sprocket; and

a spring plate attached to each of the inner yoke and the outer sprocket,

wherein the spring plate is configured to facilitate flexing of the outer sprocket relative to the inner yoke in response to a downward force on the outer sprocket.