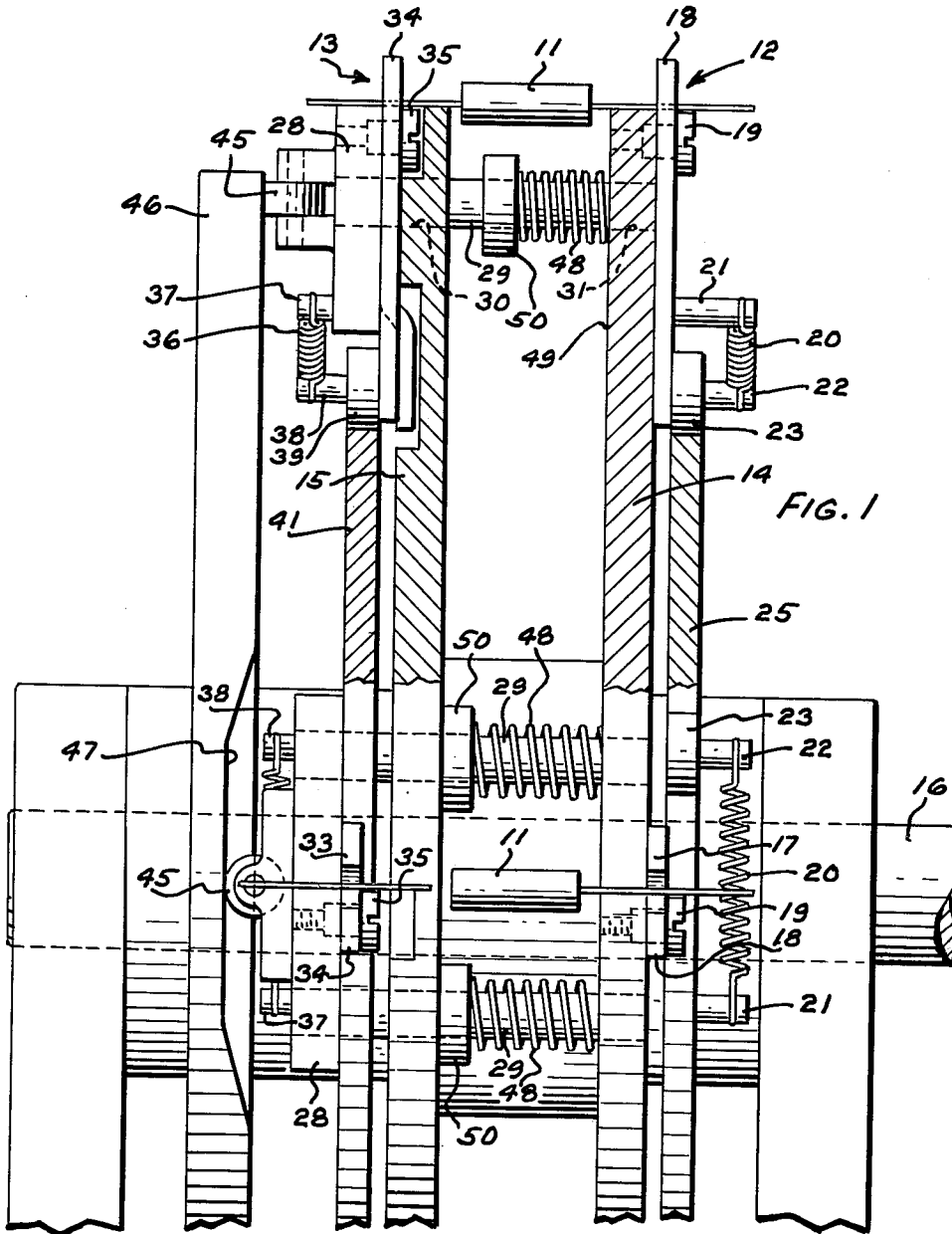


3,091,960

2 Sheets-Sheet 1



INVENTOR
J. C. HOUDA JR.
BY *[Signature]*
ATTORNEY

June 4, 1963

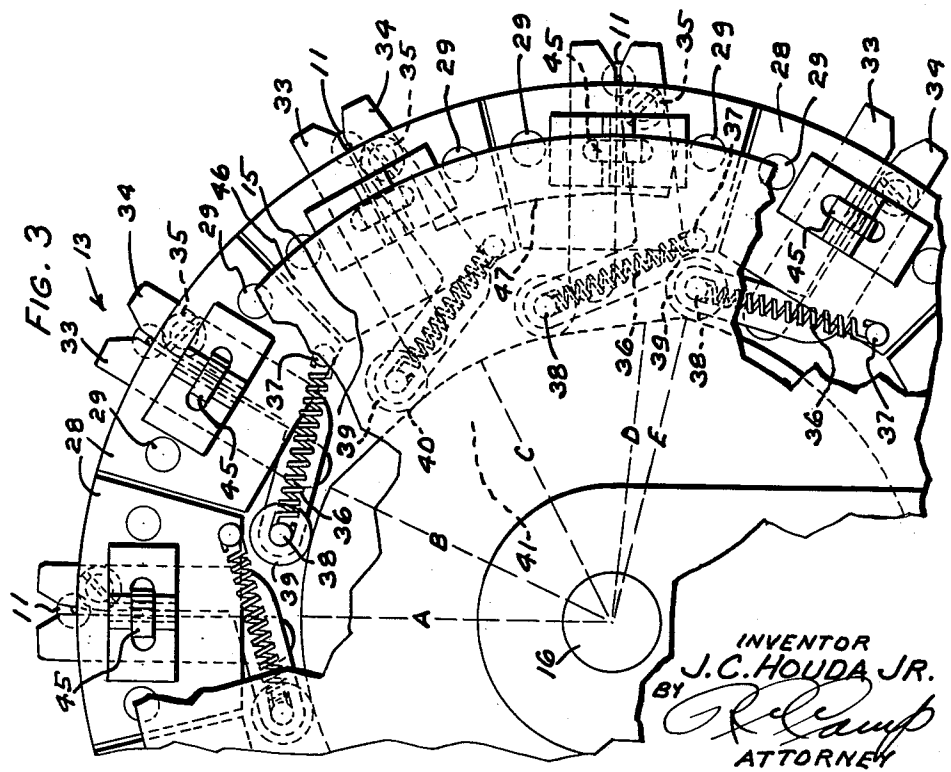
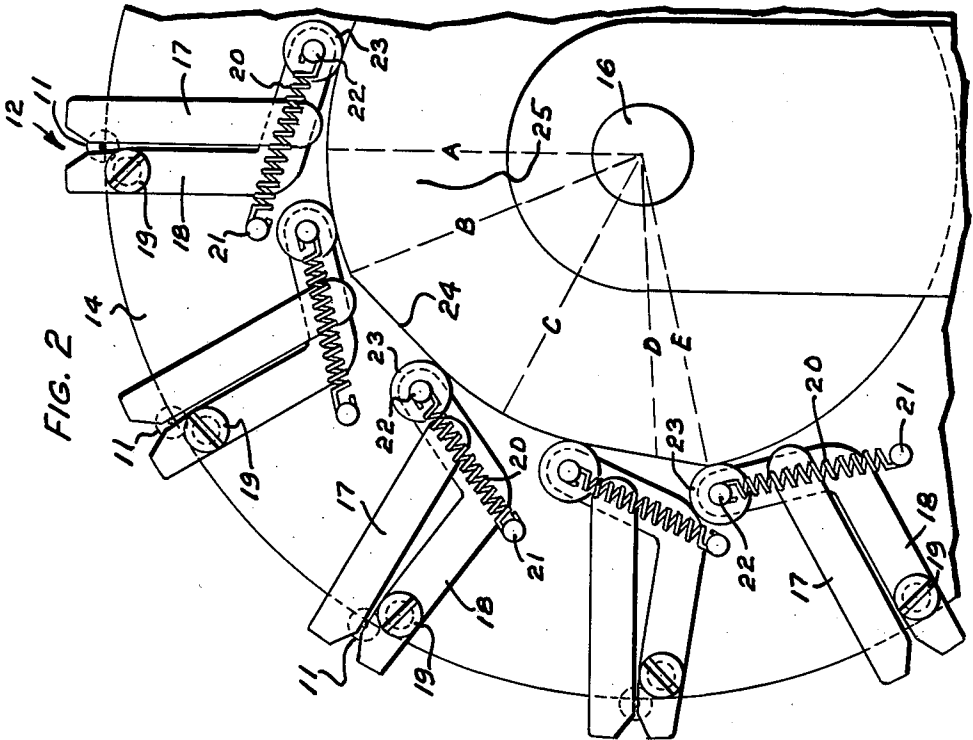
J. C. HOUDA, JR

3,091,960

ARTICLE TENSIONING APPARATUS

Filed May 4, 1961

2 Sheets-Sheet 2



INVENTOR
J. C. HOUDA JR.
BY *ReCamp*
ATTORNEY

1

3,091,960

ARTICLE TENSIONING APPARATUS

James C. Houda, Jr., Downers Grove, Ill., assignor to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York

Filed May 4, 1961, Ser. No. 107,852

5 Claims. (Cl. 73-95)

This invention relates to an article tensioning apparatus and more specifically to an apparatus for automatically gripping opposite ends of an article, applying tension to the article, removing the tension from the article, and then releasing the article. It is an object of this invention to provide an improved apparatus of this nature.

In the manufacturing of electrical components having leads extending from the body portion thereof, such as resistors or capacitors, the leads must be securely connected to the body portion. It is sometimes required that such electrical components be tested by pulling the leads to determine whether they are properly anchored to the body portions of the components. The present invention is well suited to the performance of a lead pulling test on such electrical components.

In accordance with the preferred embodiment of the invention, a pair of gripping devices are provided for releasably gripping opposite ends of an article, whose leads are to have tension applied thereto. These gripping devices are mounted in facing relationship on a conveying member so that they are moved along generally parallel paths, and one of the gripping devices is mounted for movement toward and away from the other gripping device. Control elements are mounted in part at independent stationary positions along the path of movement of the conveying member for moving the gripping devices to their gripping positions, for urging the gripping devices away from each other to apply tension to an article gripped therebetween, for removing the tension from the article, and for moving the gripping devices to their released positions.

Another object of this invention resides in an improved apparatus for automatically gripping opposite ends of a sequence of articles at spaced points and momentarily applying tension thereto.

A further object of this invention resides in an improved apparatus having various of the characteristics prescribed above while being inherently reliable and efficient in operation, of rugged construction, and economical to manufacture and operate.

This invention, together with other objects and advantages thereof, will become apparent by reference to the following detailed description thereof and the accompanying drawings illustrating a preferred embodiment thereof, in which:

FIG. 1 is a fragmentary, front elevational, partially broken away view of the preferred embodiment of an article tensioning apparatus;

FIG. 2 is a reduced, fragmentary, right-side, partially broken away view of the apparatus shown in FIG. 1; and
FIG. 3 is a reduced, fragmentary, left-side, partially broken away view of the apparatus shown in FIG. 1.

Referring now in detail to the drawings and more specifically to FIG. 1, an electrical component 11, which is to be subjected to a lead pulling test, has its leads gripped by a pair of releasable gripping devices 12 and 13, which are mounted for rotation on a carrier comprising a pair of rotatable support discs 14 and 15. The gripping devices are mounted axially opposite each other so that the electrical component may be gripped therebetween. The support discs are secured to a shaft 16 for rotation therewith, and the shaft is supported and driven by suitable conventional bearings and drive mechanisms.

2

During one rotation of the support discs 14 and 15, an electrical component 11 is first gripped between the gripped devices, then one of the gripping devices 13 is urged away from the other gripping device 12 to apply tension to the leads of the component, subsequently the tensioning force is removed from the electrical component and finally the gripping devices 12 and 13 are operated to release the electrical component.

The first support disc 14 (see FIG. 2) has a plurality of gripping devices 12 attached thereto, each having a jaw portion extending radially beyond the outer edge of the support discs 14 for releasably gripping one lead of an electrical component. Each gripping member 12 includes a stationary arm 17 and an L-shaped arm 18 which is pivotable about a pivot pin 19 so that the jaw portion of the pivotable arm may be pivoted into engagement with the jaw portion of the stationary arm. A spring member 20 is connected between a pin 21, secured to the support discs 14, and a shaft 22 of a cam follower roller 23, secured to the inner end of the pivotable arm 18. This spring member exerts a pivotal force against the pivotable arm and thereby urges the cam follower roller 23 against a cam surface 24 of a stationary cam disc 25. The cam follower roller 23 is thereby caused to ride along this cam surface 24 of the cam disc 25 as the support disc 14 is rotated.

The cam surface 24 is recessed between positions designated "B" and "E" in FIG. 2, so that, when the cam follower roller 23 is moved into engagement with this portion of the cam disc surface 24, pivotal movement is imparted to the pivotable arm 18 which causes the gripping device 12 to move to its gripping position. When the cam follower roller 23 moves to another portion of the cam surface 24, pivotal movement is imparted to the pivotable arm 18 which causes the gripping device 12 to move to its released position.

The second support disc 15 (see FIG. 3) has a plurality of support blocks 28 mounted on its outer surface. Each support block 28 is mounted on the second support disc 15 by a pair of pins 29, which extend through a pair of axially extending bores 30 in the second support disc 15 and extend into a pair of axially extending bores 31 in the first support disc 14. The support blocks 28 are axially movable away from the support disc 15 as well as the support disc 14, and each support block has a gripping device 13 attached thereto for releasably gripping a lead of an electrical component, in a jaw portion extending radially beyond the outer edge of the support disc 15.

The gripping devices 13 are substantially identical to the previously described gripping devices 12. Each device 13 includes a stationary arm 33 and an L-shaped pivotable arm 34 which is pivotable about a pivot pin 35 so that the jaw portion of the pivotable arm may be pivoted into engagement with the jaw portion of the stationary arm. A spring member 36 is connected between a pin 37, secured to the support block 28, and a shaft 38 of a cam follower roller 39, secured to the inner end of the pivotable arm 34. This spring member exerts a pivotal force against the pivotable arm and thereby urges the cam follower roller 39 against a cam surface 40 of a stationary cam disc 41. The cam follower roller 39 is thereby caused to ride along this cam surface 40 of the cam disc 41 as the support disc 15 is rotated.

Similar to the cam surface 24, the cam surface 40 is recessed between positions designated "B" and "E" in FIG. 3, so that, when the cam follower roller 39 is moved into engagement with this portion of the cam surface 40, pivotal movement is imparted to the pivotable arm 34 which causes the gripping device 13 to move to its gripping position. When the cam follower roller 39 moves

to another portion of the cam surface 40, pivotal movement is imparted to the pivotable arm 34 which causes the gripping device 13 to move to its released position.

The support blocks 28 are so positioned on the second support disc 15 that the gripping devices 13 are axially opposite corresponding ones of the gripping devices 12. Thus an electrical component may be gripped therebetween and an axial tensioning force may be applied thereto.

Each support block 28 has a roller member 45 (FIG. 1) mounted on its outer surface, and the roller member 45 is adapted to ride along the surface of a stationary cam track disc 46 mounted adjacent the outer surface of the support disc 15. The cam track disc 46 causes the support block 28 to be retained in engagement with the second support disc 15 and prevents the support block from moving axially away from the support discs 14 and 15, during a predetermined portion of the rotational movement of the support discs. A recessed portion 47 is formed in the surface of the cam track disc 46 along the path of movement of the roller member 45 and, when the roller member 45 is axially opposite the recessed portion 47, the support block 28 and the gripping devices 13 are free to move as a unit axially away from the support discs 14 and 15.

Coil springs 48 are mounted about the pair of pins 29 of the support block 28 and, when the support block is retained in engagement with the second support disc by the cooperation between the cam track disc 46 and the roller member 45, each spring is compressed between the inner surface 49 of the first support disc 14 and a collar 50 mounted on each pin 29. These springs 48 urge the support block 28 away from the support discs 14 and 15, and thus urge the gripping device 13 away from an axially opposite gripping device 12, so that tension is applied to an article gripped therebetween when the roller member 45 of the support block 28 is axially opposite the recessed portion 47 of the cam track disc 46.

The gripping devices 12 and 13 are maintained in their gripping positions between positions designated "B" and "E" along the cam surfaces 24 and 40 of the cam discs 25 and 41 in FIGS. 2 and 3 so that an electrical component may be gripped therebetween, and the gripping devices 13 are urged away from axially opposite gripping devices 12 between positions designated "C" and "D" along the cam surfaces of the cam discs so that tension may be applied to an electrical component gripped therebetween. At position designated "E" along the cam surfaces of the cam disc, the gripping devices 12 and 13 are moved to their released positions so that an electrical component previously gripped therebetween may be removed therefrom.

In operation, an electrical component 11, such as a capacitor or resistor to have tension applied to its lead connections, has its leads positioned within the jaw portions of a pair of the gripping devices 12 and 13 when the cam follower rollers 23 and 39 of that pair of gripping devices are in engagement with the cam surfaces 24 and 40 of the cam discs 25 and 41 at positions designated "A" in FIGS. 2 and 3.

When the support discs 14 and 15 have rotated so that the cam follower rollers 23 and 39 are in engagement with the cam surfaces 24 and 40 at positions designated "B" in FIGS. 2 and 3, the cam follower rollers begin moving along the recessed portions of the cam surfaces and pivotal movement is imparted to the pivotable arms 18 and 34, which causes the gripping devices 12 and 13 to move to their gripping positions so that the electrical component 11 is gripped therebetween.

When the support discs 14 and 15 have rotated so that the gripping devices 12 and 13, having an article gripped therebetween, are opposite positions designated "C" along the cam surfaces 24 and 40, the roller member 45 of the support block 28 is axially opposite the recessed portion 47 of the cam track disc 46 and the support block 28 is

free to move axially. The compressed coil springs 48 exert axial forces between the inner surface 49 of the first support disc 14 and the collars 50 of the support block pins 29, which urge the support block 28 axially away from the support discs 14 and 15. Thus the gripping device 13 is urged away from the gripping device 12, whereby a tension force equal to the spring forces is applied to the lead connections of the electrical component 11 gripped between the gripping devices.

When the support discs 14 and 15 have further rotated so that the gripping devices 12 and 13 are opposite positions designated "D" along the cam surfaces of the cam discs, the roller member 45 of the support block 28 again is engaged by the cam track disc 46 to move and retain the support block 28 in engagement with the second support disc 15, and thus the tension force is removed from the lead connections of the electrical component 11.

When the support discs 14 and 15 have still further rotated so that the cam follower rollers 23 and 39 are opposite positions designated "E" along the cam surfaces of the cam discs, the cam follower rollers move out of the recessed portions of the cam surfaces and pivotal movement is imparted to the pivotable arms 18 and 34, which causes the gripping devices 12 and 13 to be moved to their released position. Since the electrical component is no longer gripped by the gripping devices, it may be removed therefrom.

As illustrated in FIGS. 2 and 3 and as previously discussed, each support disc has a plurality of gripping devices associated therewith which are always opposite different positions along the cam surface of the associated cam disc. Thus, this apparatus permits automatic testing of a sequence of electrical components; while one electrical component is being gripped, another component is having tension applied thereto, and still another component is being released by the apparatus. During operation of this apparatus, electrical components are continuously being moved through this cycle.

The embodiment of the invention described above may now be seen to provide an improved article tensioning apparatus, which is inherently reliable and efficient in operation, is of rugged construction, and is economical to manufacture and operate. This article tensioning apparatus readily lends itself to the automatic testing of the lead connections of a sequence of electrical components wherein the lead connections are required to meet prescribed strength requirements. Leads extending from opposite ends of an electrical component are gripped by this apparatus and tension is applied to the lead connections by urging a gripped lead on one end of the electrical component axially away from a gripped lead on the other end of the electrical component. If one of the lead connections does not meet the prescribed strength requirement, the lead connection is broken. Subsequently, the tensioning force is removed, the electrical component is released, and the electrical component is removed from the apparatus.

Also, it may now be seen that this apparatus is not limited to the performance of lead pulling tests but lends itself to the performance of various other tests and manufacturing operations. This apparatus may be readily utilized to perform such operations as removing part of a crimp from a wire or a metal strip and also may be readily utilized to perform such other tests as applying tension to spring elements or other articles to have a tensioning test performed thereon.

It is to be understood that the above-described arrangements are simply illustrative of the application of this invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An article tensioning apparatus comprising a pair of spaced gripping devices, a carrier for supporting said devices thereon for movement along a first path and

5

for supporting one of said gripping devices for movement relative thereto toward and away from said other gripping device along a second path perpendicular to said first path, means on said carrier for urging said gripping devices to closed positions for gripping an article at spaced points, resilient means for urging said one gripping device along said second path away from the other gripping device and from a normal first position on said carrier for applying tension to the article, a stationary cam arranged to permit axial movement of said one gripping device under the influence of said resilient means from the first position during a portion of the movement of said gripping devices along said first path and for returning said one gripping device to the first position and for maintaining it therein during another portion of the movement of the gripping devices along said first path, and stationary cam means mounted in the path of movement of said gripping devices for moving said gripping devices to open position during a portion of the movement of said gripping devices along said first path when said one gripping device is in said first position.

2. An article tensioning apparatus comprising a carrier mounted for rotation about an axis, a first article gripping device fixedly mounted on said carrier for rotation therewith and against axial movement relative thereto, a second article gripping device mounted on said carrier for rotation therewith and for axial movement relative thereto and in substantial axial alignment with and spaced relation to said first gripping device, resilient first means for stressing said gripping devices to a closed position to grip an article at spaced points, resilient second means on said carrier for urging said second gripping device for axial movement away from said first gripping device and from a normal retracted position to apply tension to the article in said gripping devices, a stationary cam track for moving said second gripping device axially toward said first gripping device to said retracted position and for maintaining said second gripping device in said retracted position during a prescribed portion of the rotary movement of said carrier and for permitting axial movement of said second gripping device from said retracted position and said first gripping device during a prescribed portion of rotation of said carrier, and stationary cam means mounted in the path of movement of said gripping devices for effecting the actuation of said gripping devices to open position and for maintaining them in such open position for a prescribed portion of the rotary movement thereof while said second gripping device is in said retracted position.

3. An apparatus for applying tension to an article which comprises, a pair of cyclically operable gripping devices, having gripping positions and released positions, for gripping opposite ends of an article, conveying means for moving said gripping devices along generally parallel paths and for supporting said gripping devices in generally facing relationship, one of said gripping devices being mounted for movement toward and away from the other of said gripping devices, first control means mounted in part on said conveying means and in part at a stationary position along the path of movement of said conveying means for moving said gripping devices to their gripping positions and for maintaining them in gripping positions during a predetermined portion of the movement of said conveying means, second control means mounted in part on said conveying means and in part at a second stationary position along the path of movement of said conveying means for urging said movably mounted gripping device away from said other gripping device to stress an article during a part of said predetermined portion of the movement of said conveying means when said gripping devices are in their gripping positions, and third control means mounted in part on said conveying means and in part at a third stationary position along the path of move-

6

ment of said conveying means for moving said gripping devices to the released positions and for maintaining them in released positions during a predetermined portion of the movement of said conveying means.

4. An apparatus for applying tension to an article which comprises, a pair of cyclically operable gripping devices, each having a stationary arm and a pivotable arm and each having a gripping position and a released position, for gripping opposite ends of an article, conveying means for moving said gripping devices along generally parallel paths and for supporting said gripping devices in generally facing relationship, one of said gripping devices being mounted for movement away from and toward the other of said gripping devices, cam surfaces on the non-gripping ends of said pivotable arms, first cam means positioned along the path of movement of said conveying means and cooperable with said cam surfaces of said pivotable arms for maintaining said pivotable arms in gripping positions and in released positions during different predetermined portions of the movement of said conveying means, first resilient means for retaining said cam surfaces of said pivotable arms in engagement with said first cam means, second resilient means mounted between said one gripping device and said conveying means for urging said one gripping device away from said other gripping device, a second cam surface on said one gripping device, and second cam means positioned along the path of movement of said conveying means and cooperable with said second cam surface of said one gripping device for prohibiting movement of said one gripping device away from said other gripping device during a prescribed portion of the movement of said conveying means and for permitting movement of said one gripping device away from said other gripping device to stress an article during a part of the portion of the movement of said conveying means when said gripping devices are in their gripping positions.

5. An apparatus for applying tension to an article which comprises, a pair of rotatable support discs secured to a rotatable support shaft for rotation therewith, each having a plurality of gripping devices mounted thereon, said gripping devices each having a stationary arm and a pivotable arm and each having a gripping position and a released position, each gripping device on one of said support discs being mounted thereon so that it is axially opposite a gripping device on the other one of said support discs whereby the gripping devices move along generally parallel paths and an article may be gripped therebetween, said gripping devices on said one support disc being mounted for movement away from and toward said gripping devices on said other support disc, cam surfaces on the non-gripping ends of said pivotable arms, a pair of cam discs stationarily mounted adjacent said support discs and cooperable with said cam surfaces of said pivotable arms for maintaining said pivotable arms in gripping positions and in released positions during different predetermined portions of the movement of said support discs, first resilient means associated with said gripping devices for retaining said cam surfaces of said pivotable arms in engagement with said cam discs, second resilient means positioned between said movably mounted gripping devices and said other support disc for urging said movably mounted gripping devices away from said gripping devices on said other support disc, second cam surfaces on said movably mounted gripping devices, and a third cam disc stationarily mounted adjacent said one support disc and cooperable with said second cam surfaces of said movably mounted gripping devices for independently prohibiting movement of each of said movably mounted gripping devices away from the axially opposite one of said other gripping devices during a prescribed portion of the movement of said support discs and for independently permitting movement of each of said movably mounted gripping devices away from the axially opposite one of said other gripping devices to stress an

article during a part of the portion of the movement of said support discs when said gripping devices are in their gripping positions.

References Cited in the file of this patent

UNITED STATES PATENTS

2,068,725 Wilson ----- Jan. 26, 1937

2,994,512

406,071
491,483

Franke ----- Aug. 1, 1961

FOREIGN PATENTS

Germany ----- Nov. 15, 1924
Italy ----- Mar. 5, 1954