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(54) ADJUSTABLE GIRTH FORMER
FORMER MIT VERSTELLBAREM UMFANG
FACONNEUR AJUSTABLE DE POURTOUR

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Description

[0001] This invention relates to machines for packaging rolls or groups of rolls in a film, and in particular to an adjustable girth control for a tube former in such machines.

[0002] In modern packaging machinery, rolled products, such as rolls of toilet tissue or paper towels, are conveyed individually or in groups, encapsulated in a plastic film formed into a tube, and the tube is then severed between succeeding products and sealed into individual packages. An adjustable girth control according to the first part of claim 1 is disclosed in GB-A-1267 432 and a basic packaging machine is illustrated and described in U.S. Patent No. 4, 430, 844.

[0003] In such machines, a girth former is included for forming plastic film into a tub extending about the products to be wrapped. The girth former is sized specifically to take into account the diameter and softness of the product being wrapped. Depending on softness or hardness of the product, diameter variations can occur, but those variations are limited by the sizing of the girth former. Therefore, diameter variations can cause serious production problems, particularly with harder-wrapped rolls which cannot compress sufficiently. The result is that such rolls may be too loosely wrapped with the plastic film, or the rolls may actually jam in the girth former, causing the machine to be shut down while the jam is cleared.


[0005] GB-A-1267432 discloses a manually adjustable girth control. This document describes two alternatives, mainly, manual adjustment and adjustment by an electrical motor which can be controlled by a button being provided for each product size. However, when the button is pushed for a particular product size, the apparatus will remain adjusted for that particular product size until another marked button is pushed for a different product size. The disclosed apparatus therefore requires manual intervention in order to change the product size.

[0006] This leads to two drawbacks. Firstly, a person is required to visually control the actual product size. This is only feasible for packaging sequences of products - with the requirement that the products per sequence have the same size. However, it is not suitable for packaging a large number of items with permanently varying dimensions in a high throughput. Secondly, adjusting the size using a button means that the product size can only be adjusted in certain predetermined steps and not in a continuous manner.

[0007] In the packaging machine such as depicted in U.S. Patent No. 4, 430, 844, product is introduced into the area of the girth former and is conveyed into place, often being somewhat compressed by an upstream preformer section before entering the girth former. Often, the compression set in the preformer compresses the rolls somewhat more than necessary to enter the girth former to insure that the rolls properly enter the former without interference or jamming. As the rolls enter the girth former, they are encapsulated in a tube of film, and are also contacted by pull belts which move in unison with the product and the tube, ensuring a smooth transfer for downstream sealing.

[0008] Whenever a different product is to be packaged by the machine, the girth former must be changed. That change also requires adjustment of the preformer and realignment of the pull belts to ensure that product travels smoothly through the girth forming area.

[0009] The amount of film wrapped about the product traveling through the machine is dictated by the internal dimension of the girth former, and not by the size of the product itself. Therefore, if the product is smaller in diameter than intended, a loose wrap will result, which is undesirable. To overcome this problem, and to accommodate varying diameters of product traveling through the machine, an automatically adjustable girth former is needed.

Summary of the Invention

[0010] The invention as defined in claim 1 pertains to an automatically adjustable girth control for a tube former in a packaging apparatus in which products comprising individual rolls or groups of rolls are conveyed serially and are packaged in a film. The tube former is situated to continuously form a sheet of film into a tube which encapsulates succeeding product, and the adjustable girth control comprising a forming body in the tube former, the forming body being shaped to envelope product passing therethrough. The forming body has opposite adjustable forming elements defining a variable gap between the forming elements to accommodate the adjustment of the elements. Means is provided, secured to the forming elements, for shifting the forming elements to vary the internal dimensions of the forming body. The invention is characterised by means for automatically activating a rotary actuator to rotate a rod for displacing said means for shifting the position of said forming elements, means positioned upstream of the adjustable forming body for providing a product variation signal for signalling dimensional variation of product entering said forming body, and a processor connected to and receiving signals from said means for providing a product variation signal, the processor being connected to the means for shifting the forming elements whereby the forming body is automatically adjusted accordingly to the dimensions of product entering the forming body.

[0011] In accordance with the preferred form of the invention, each forming element comprises a section of the forming body, and the shifting means includes means for both horizontally displacing the two sections and vertically displacing the two sections. The horizontal displacing means comprises a slide assembly having a
slide element secured to each forming body's section. It also includes means for drawing the slide elements toward and away from one another to vary the gap.

[0012] In this form of the invention, the means for drawing the slide elements toward and away from one another comprises a threaded bore in each slide element. The bores are formed in alignment with one another and the threading in one bore is formed opposite to the threading in the other bore. A threaded rod is engaged in the bores, with the rod having threading complementary to the threading in the bores.

[0013] Means is provided for rotating the rod to draw the sections toward and away from one another. In the preferred form of the invention, the rotating means comprises a rotary actuator, and the invention further includes means for automatically activating the actuator to rotate the rod. That automatic activating means comprises a processor, with the processor being connected to, and receiving signals from, an upstream sensor which is positioned to sense dimensions of product entering the forming body.

[0014] For vertically displacing the sections of the forming body, it is preferred that camming means be employed for raising and lowering the slide elements as the gap is varied. In accordance with one form of the invention, the camming means comprises a pair of spaced, inclined cams, and includes a cam follower in each cam. Each cam follower is secured to an arm, with one arm being affixed to one slide element and the other arm being affixed to the other slide element.

[0015] In the preferred form of the invention, a preformer is located at and in alignment with an upstream end of the forming body. The preformer includes a pair of side forming members, and means is provided attached to the side forming members for adjusting the side forming members toward and away from one another. It is preferred that the rotary actuator be used for simultaneously adjusting the side forming members and the two sections of the forming body.

[0016] Since the two sections of the forming body move relative to the remaining portion of the forming body, each of the sections is formed extending from a flex location in the forming body. In accordance with the disclosed form of the invention, the flex location comprises a slit formed partially across the forming body.

[0017] The gap between the two sections of the forming body dictates the amount of decrease of the internal size of the forming body. It is preferred that the gap be formed in the forming body at an oblique angle to the direction of travel of product through the forming body.

Description of Examples Embodying the Best Mode of the Invention

[0019] A girth forming apparatus and the surrounding operative elements of a packaging machine according to the invention is depicted generally at 10 in Figure 1. The depicted portions of the packaging apparatus include an overhead conveyor section 12 for conveying rolls 14 in alignment and regularly into an adjustable girth forming apparatus 16, in which the rolls are encapsulated in a plastic film. The film and rolls exit the girth forming apparatus 16 in a pull belt section 20. Successive rolls or groups of rolls are then severed while encapsulated in a tubular section of the plastic film to form a partially sealed package 22. Downstream processing seals the ends of the package 22 to complete the packaging process in a conventional fashion.
will draw the two blocks 64 and 66 toward one another, and the rod is threaded in a complementary fashion. The threading of the bores are opposite; the bores being in alignment and engaging a threaded rod 68. The threading of the bores are opposite to one another, and the rod is threaded in a complementary fashion, so that rotation of the rod 68 in one direction will draw the two blocks 64 and 66 toward one another (and thus the forming sections 48 and 50 toward one another), while rotation of the rod 68 in the opposite direction spreads the blocks 64 and 66 (thus spreading the forming sections 48 and 50).

In addition to horizontal adjustment, the slide elements 60 and 62 are vertically adjustable. The blocks 64 and 66 engage an upper track 70. The track 70 is attached to a flat plate 72. A fixed frame 74 extends above the girth forming apparatus 16, and includes horizontal arms 76 and 78 carrying between them a roll 80. The roll 80 is rotatably mounted between the arms 76 and 78, and is rotatable by an actuator assembly 82. The roll 80 is also secured to upstanding brackets 84 and 86 secured to the plate 72. Therefore, by judicious revolution of the roll 80, the plate 72 is raised or lowered, raising or lowering the blocks 64 and 66, and thus the slide elements 60 and 62, raising or lowering the respective forming sections 48 and 50.

A modified form of the girth forming apparatus of the invention is shown in Figure 7. Similar elements of the invention retain the same reference numerals, and the outer forming shoulder 44 has been eliminated for purposes of clarity and illustration. The girth forming apparatus 16 of Figure 7 is formed to automatically and simultaneously shift the forming sections 48 and 50 both horizontally and vertically. The respective sections 48 and 50 are secured to slide elements 88 and 90 which are topped by blocks 92 and 94. In the same fashion as the first form of the invention, the blocks 92 and 94 are internally threaded in opposite directions, and are engaged by the rod 68, which is similarly threaded. The blocks 92 and 94 have upper portions engaged on a track 96 secured in a framework 98 which has downwardly depending legs 100 and 102 forming rotational guides for the rod 68.

Arms 104 and 106 are bolted to the blocks 92 and 94, and extend upwardly to respective cam followers 108 and 110 located within respective inclined cam tracks 112 and 114 in a cam 116. As the rod 68 is rotated to adjust the blocks 92 and 94 horizontally, the fixed arms 104 and 106 cause their cam followers 108 and 110 to traverse the inclined cam tracks 112 and 114. This raises or lowers the entire framework 98, thus raising or lowering the forming sections 48 and 50 at the same time as the sections are horizontally displaced. The inclinations of the cam tracks 112 and 114 determine the amount of vertical adjustment of the forming sections 48 and 50.

In either form of the invention, the rod 68 is secured through a quick disconnect 118 to a further rod section 120 extending from a rotary actuator 122. The actuator 122 is therefore utilized to rotate the rod 68 via the disconnect 118 and rod section 120 to alter the positions of the forming sections 48 and 50, and therefore alter the internal dimensions of the forming body 46.

The preformer 42 as best shown in Figure 4 includes a pair of side forming members 124 and 128 which are laterally adjustable. A bracket assembly 130...
is attached to an outer side of the forming member 124, and a similar bracket assembly 132 is attached to an outer side of the forming member 128. The respective bracket assemblies 130 and 132 carry rods 134 and 136 which extend to respective braces 138 and 140. The braces 138 and 140 are, in turn, threadedly engaged on a rotatable rod 142. The rod 142 extends to a belt 144 which, as illustrated in Figures 3 and 4, passes about the rod section 120. Thus, when the rotary actuator 122 is activated, rotation of the rod 120 also rotates the rod 142, drawing the braces 138 and 140 and attached bracket assemblies 130 and 132 toward and away from one another, thus adjusting the side forming members 124 and 128 in the same fashion. Preferably, the belt 144 is in the form of a chain extending about sprockets mounted on the rods 120 and 142.

[0031] The pull belt section 20 comprises a pair of pull belts 146 and 148. The pull belts 146 and 148 extend into longitudinal cuts in the forming body 46, and are laterally adjustable (means not illustrated) to accommodate varying sizes of rolls passing therebetween. As shown in Figure 1, the pull belts have spaced holes in them, and vacuum apparatus 150 and 152 is utilized in a conventional fashion when necessary to aid in conveying of encapsulated rolls 14.

[0032] The rotary actuator 122 is automatically activated depending on the sizes of upstream rolls 14 entering the girth forming apparatus 16. To this end, a sensor 154 (Figure 1) is located to sense the dimensions of rolls 14. The sensed dimensions are transmitted to a microprocessor 156 connected to operate the actuator 122. The microprocessor 156 can be programmed in a conventional fashion in many manners to actuate the rotary actuator 122 dependent upon the sizes of the rolls sensed by the sensor 154. For example, the microprocessor 156 can compute a running average of the sizes of the rolls 14, and based upon that running average, activate the actuator 122 to increase or decrease the internal dimension of the forming body 46. Other means of sensing and activation of the rotary actuator 122 can also be used.

[0033] In operation, in the illustrated form of the invention pairs of rolls 14 are introduced by the overhead conveying apparatus 12 to the preformer 42. The rolls 14 are slightly compressed in the preformer 42, and are then introduced into the forming body 46. At the same time, the film 18 emanates from a source in a conventional fashion (not illustrated), extending about and being formed by the shoulder 44, and also entering the forming body 46, encapsulating the rolls 14 therebetween. A heat sealer 158 seals the overlapping film into a tube. The pull belt section 20 pulls the rolls and film through the forming apparatus 16, sending the now-sealed tube between a pair of rotary paddles 160. Preferably, the film 18 is pre-perforated as at 162 (Figures 2 and 3), and the paddles 160 are synchronously operated to contact the tube at the perforations 162. Downstream pull belts 164 and 166, operating at a slightly greater surface velocity than that of the pull belts 146 and 148, work in conjunction with the rotary paddles 160 to severe succeeding partial packages 22 from the oncoming tube. The partial package 22 is then end sealed downstream (means not illustrated) in a conventional fashion.

[0034] The invention solves a vexing problem of the prior art, and that is accommodation of varying sizes of the rolls 14 as the apparatus 10 is operated. Depending on the size of the gap 52, the forming sections 48 and 50 can be adjusted over a relatively large range to accommodate varying roll sizes.

[0035] While a preferred form of the invention has been shown in the drawings and described above it will be evident that the invention can assume different forms. Various widths and lengths of packages can be accommodated, not just individual packages of two rolls as shown.

Claims

1. An adjustable girth control (16) for a tube former in a packaging apparatus in which products (14) comprising individual rolls or groups of rolls are conveyed serially and are packaged in a film (18), the tube former being situated to continuously form a sheet of film (18) into a tube encapsulating succeeding product (14), the adjustable girth control (16) comprising

a. a forming body (46) in the tube former, said forming body (46) being shaped to envelope product (14) passing therethrough, said forming body (46) having opposed adjustable forming elements (48,50) defining a variable width gap (52) between said forming elements (48, 50), and

b. means (60, 62, 64, 66, 68, 70, 80) secured to said forming elements (48, 50) for shifting the position of said forming elements (48, 50) to vary internal dimensions of said forming body (46);

c. characterised by means (156) for automatically activating a rotary actuator (122) to rotate a rod (68) for displacing said means (60, 62, 64, 66, 68, 70, 80) for shifting the position of said forming elements (48, 50), means (154) positioned upstream of the adjustable forming body (46) for providing a product variation signal for signalling dimensional variation of product (14) entering said forming body (46), and a processor (156) connected to and receiving signals from said means (154) for providing a product variation signal, the processor being connected to the means (60, 62, 64, 66, 68, 70, 80) for shifting the position of said forming elements whereby the
forming body (46) is automatically adjusted according to the dimensions of product (14) entering the forming body (46).

2. An adjustable girth control according to claim 1 in which each forming element (48, 50) comprises a section of said forming body, and in which said shifting means includes means (60, 62, 64, 66, 68) for horizontally displacing said sections and means (60, 62, 64, 66, 68, 70, 80) for vertically displacing said sections.

3. An adjustable girth control according to claim 2 in which said means for horizontally displacing said sections comprises a slide assembly (60, 62, 64, 66, 68) having a slide element (60, 62) secured to each forming body section, and including means (64, 66, 68) for drawing said slide elements toward and away from one another to vary the width of said gap.

4. An adjustable girth control according to claim 3 in which said means for drawing said slide elements comprises a threaded bore in each slide element, said bores being in alignment and threading in one bore being formed opposite to threading in the other bore, and in which said rod (68) engaged in said bores has threading complementary to the threading in said bores.

5. An adjustable girth control according to claim 5 in which said means for vertically displacing said sections includes camming means (108, 110, 112, 114) for raising and lowering said slide elements as said gap is varied.

6. An adjustable girth control according to claim 5 in which said camming means comprises a pair of spaced inclined cams (112, 114), and including a cam follower (108, 110) in each cam, each follower being secured to an arm (104, 106), with one arm being affixed to one slide element and the other arm being affixed to the other slide element.

7. An adjustable girth control according to claim 1 including a preformer (42) located at and in alignment with an upstream end of said forming body.

8. An adjustable girth control according to claim 7 in which said preformer includes a pair of side forming members (124, 128), and including means (142) attached to said side forming members for adjusting said side forming members toward and away from one another.

9. An adjustable girth control according to claim 8 including means (122) for simultaneously activating said means for shifting and said means for adjust-
tikel (14) signalisiert, und einen Prozessor (156), der mit der ein Produktveränderungssignal liefernden Einrichtung (154) verbunden ist und Signale aus ihr empfängt, wobei der Prozessor mit den Einrichtungen (60, 62, 64, 66, 68, 70, 80) zum Versetzen der Position der Formungselemente verbunden ist, wodurch der Formungskörper (46) entsprechend den Abmessungen der in ihn einlaufenden Produktartikel (14) selbsttätig verstellt wird.

2. Umfangsverstellsteuerung (16) nach Anspruch 1, bei der die Formungselemente (48, 50) jeweils ein Abschnitt des Formungskörpers sind und die Verschiebeeinrichtung Mittel (60, 62, 64, 66, 68) zum horizontalen sowie Mittel (60, 62, 64, 66, 70, 80) zum vertikalen Verschieben der Abschnitte aufweisen.

3. Umfangsverstellsteuerung nach Anspruch 2, bei der die Einrichtung zum horizontalen Verschieben der Abschnitte eine Gleitblockanordnung (60, 62, 64, 66, 68) mit jeweils an den Formungskörperabschnitten befestigten Gleitelementen (60, 62) sowie eine Einrichtung (64, 66, 68) aufweist, mit der die Gleitelemente zueinander hin und voneinander weg ziehbar sind, um die Breite des Spalts zu verändern.

4. Umfangsverstellsteuerung nach Anspruch 3, bei der die Einrichtung zum Ziehen der Gleitelemente eine Gewindebohrung in jedem Gleitelement aufweist, wobei die Bohrungen miteinander fluchten und ihre Innengewinde gegenläufig sind und wobei die in die Bohrungen eingeschraubte Spindel (68) zu den Innengewinden in den Bohrungen komplementäre Außengewinde trägt.


6. Umfangsverstellsteuerung nach Anspruch 5, bei der die Steuerkurveneinrichtung ein Paar bestandeter, schräg verlaufender Steuerflächen (112, 114) sowie in jeder Steuerkurveneinrichtung eine Laufrolle (108, 110) aufweist, die jeweils an einem Arm (104, 106) befestigt ist, von denen ein Arm an das eine und der andere Arm an das andere Gleitelement angesetzt ist.

7. Umfangsverstellsteuerung nach Anspruch 1 mit einem Vorformer (42), der an einem stromaufwärts gelegenen Ende des Formungskörper angeordnet und mit ihm ausgerichtet ist.

8. Umfangsverstellsteuerung nach Anspruch 7, bei der der Vorformer ein Paar seitlicher Formungselemente (124, 128) sowie eine an letztere angesetzte Einrichtung (142) aufweist, um die seitlichen Formungselemente zueinander hin und voneinander weg zu verstellen.


10. Umfangsverstellsteuerung nach Anspruch 1, bei dem die Formungselemente jeweils einen bewegbaren Abschnitt aufweisen, der sich jeweils von einer im Formungskörper ausgebildeten Biegestelle (56, 58) her erstreckt.

11. Umfangsverstellsteuerung nach Anspruch 10, bei der die Biegestellen (56, 58) jeweils einen Schlitz aufweist.

12. Umfangsverstellsteuerung nach Anspruch 1, bei der Spalt (52) sich im Formungskörper unter einem schieben Winkel zur Laufrichtung der Produktartikel durch den Formungskörper erstreckt.

13. Umfangsverstellsteuerung nach Anspruch 1 mit einer dem Formungskörper zugeordneten festen Folienformfläche (44), die mit dem Zulaufende des Formungskörpers ausgerichtet ist.

Revendications

1. Commande de pourtour ajustable (16) pour un gabarit de tube dans un appareil d'emballage dans lequel des produits (14), comportant des rouleaux ou des groupes de rouleaux individuels, sont transportés en série et sont emballés dans un film (18), le gabarit de tube étant positionné pour former en continu une feuille de film (18) en un tube enfermant des produits successifs (14), la commande de pourtour ajustable (16) comportant : a. un corps de mise en forme (46) situé dans le gabarit de tube, ledit corps de mise en forme (46) étant façonné pour envelopper un produit (14) qui le traverse, ledit corps de mise en forme (46) ayant des éléments de mise en forme ajustables opposés (48, 50) définissant un espace à largeur variable (52) entre lesdits éléments de mise en forme (48, 50), et b. des moyens (60, 62, 64, 66, 68, 70, 80) fixés sur lesdits éléments de mise en forme (48, 50) pour déplacer la position desdits éléments de mise en forme (48, 50) pour faire varier les dimensions intérieures dudit corps de mise en forme (46).
caractérisée par des moyens (156) pour activer automatiquement un actionneur rotatif (122) pour mettre en rotation une tige (68) pour déplacer lesdits moyens (60, 62, 64, 66, 68, 70, 80) pour déplacer la position desdits éléments de mise en forme (48, 50), des moyens (154) positionnés en amont du corps de mise en forme ajustable (146) pour fournir un signal de variation de produit pour signaler une variation de dimension du produit (14) entrant dans ledit corps de mise en forme (46), et un processeur (156) connecté auxdits moyens (154) pour fournir un signal de variation de produit et recevant des signaux de ceux-ci, le processeur étant connecté aux moyens (60, 62, 64, 66, 68, 70, 80) pour déplacer la position desdits éléments de mise en forme, de sorte que le corps de mise en forme (46) est ajusté automatiquement selon les dimensions du produit (14) entrant dans le corps de mise en forme.

2. Commande de pourtour ajustable selon la revendication 1, dans laquelle chaque élément de mise en forme (48, 50) comprend un 'tronçon dit corps de mise en forme, et dans lequel lesdits moyens de déplacement comportent des moyens (60, 62, 64, 66, 68) pour déplacer horizontalement lesdits tronçons, et des moyens (60, 62, 64, 66, 70, 80) pour déplacer verticalement lesdits tronçons.

3. Commande de pourtour ajustable selon la revendication 2, dans laquelle lesdits moyens pour déplacer horizontalement lesdits tronçons comportent un ensemble de coulissement (60, 62, 64, 66, 68) ayant un élément de coulissement (60, 62) fixé sur chaque tronçon du corps de mise en forme, et comportant des moyens (64, 66, 68) pour tirer lesdits éléments de coulissement l'un vers l'autre et à l'écart l'un de l'autre pour faire varier la largeur dudit espace.

4. Commande de pourtour ajustable selon la revendication 3, dans laquelle lesdits moyens pour tirer lesdits éléments de coulissement comportent un alésage fileté dans chaque élément de coulissement, lesdits aléages étant alignés et le filetage d'un alésage étant formé à l'opposé du filetage de l'autre alésage, et dans laquelle ladite tige (68) en prise dans lesdits aléages a un filetage complémentaire au filetage desdits aléages.

5. Commande de pourtour ajustable selon la revendication 3, dans laquelle lesdits moyens pour déplacer verticalement lesdits tronçons comportent des moyens de came (108, 110, 112, 114) pour élever et abaisser lesdits éléments de coulissement lorsque ledit espace est modifié.

6. Commande de pourtour ajustable selon la revendication 5, dans laquelle lesdits moyens de came comportent une paire de cames inclinées espacées (112, 114), et incluant un suiveur de came (108, 110) dans chaque came, chaque suiveur étant fixé sur un bras (104, 106), un premier bras étant fixé sur un premier élément de coulissement, et l'autre bras étant fixé sur l'autre élément de coulissement.

7. Commande de pourtour ajustable selon la revendication 1, comportant un pré-gabarit (42) situé à une extrémité amont dudit corps de mise en forme et aligné avec celle-ci.

8. Commande de pourtour ajustable selon la revendication 7, dans laquelle ledit pré-gabarit comporte une paire d'éléments de mise en forme latéraux (124, 128), et comportant des moyens (142) reliés auxdits éléments de mise en forme latéraux pour ajuster lesdits éléments de mise en forme latéraux l'un vers l'autre et à l'écart l'un de l'autre.

9. Commande de pourtour ajustable selon la revendication 8, comportant des moyens (122) pour activer simultanément lesdits moyens de déplacement et lesdits moyens d'ajustement.

10. Commande de pourtour ajustable selon la revendication 1, dans laquelle chaque élément de mise en forme comporte un tronçon mobile, chaque tronçon s'étendant à partir d'un emplacement de flexion (56, 58) formé dans ledit corps de mise en forme.

11. Commande de pourtour ajustable selon la revendication 10, dans laquelle chaque emplacement de flexion (56, 58) comporte une fente.

12. Commande de pourtour ajustable selon la revendication 1, dans laquelle ledit espace (52) s'étend dans ledit corps de mise en forme selon un angle oblique par rapport à la direction de déplacement du produit à travers ledit corps de mise en forme.

13. Commande de pourtour ajustable selon la revendication 1, comportant une jupe fixe de direction de film (44) associée audit corps de mise en forme, alignée avec une extrémité d'entrée dudit corps de mise en forme.