May 24, 1960 E. ACKLEY 2,937,486

APPARATUS FOR FASTENING CARTONS

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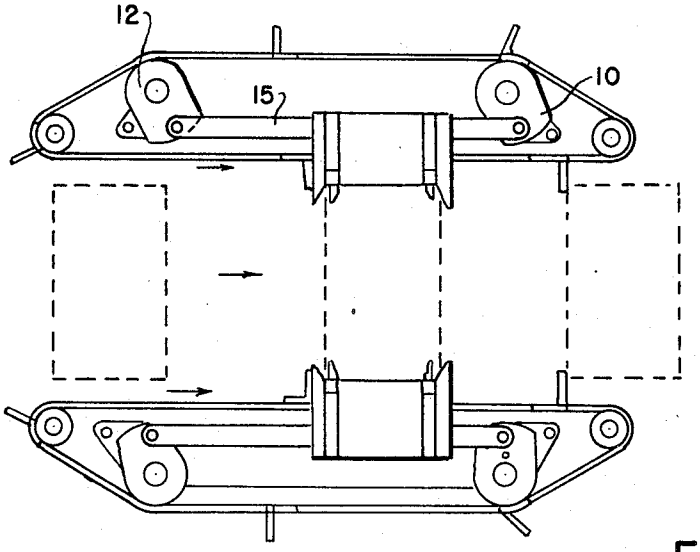


FIG.1

FIG.3

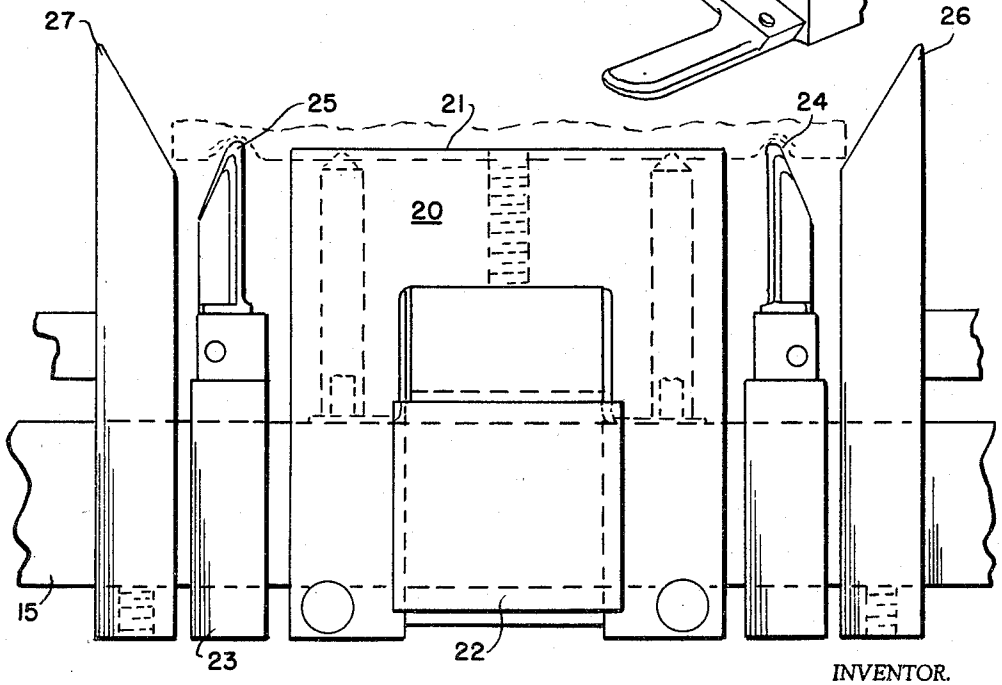


FIG.2

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APPARATUS FOR FASTENING CARTONS

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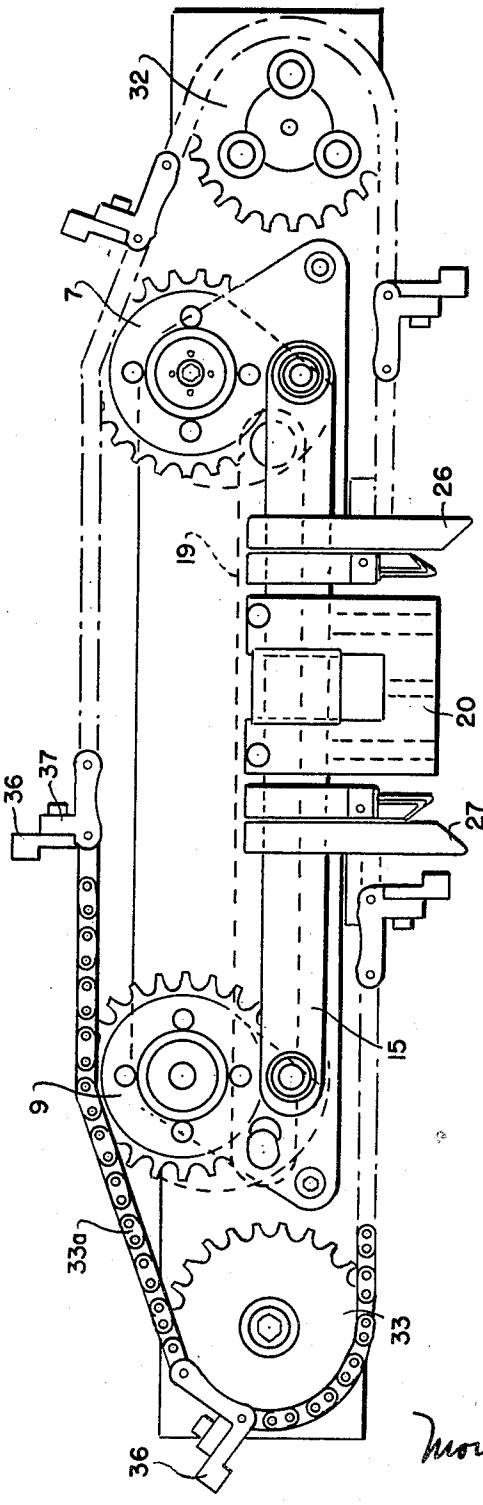


FIG. 4

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APPARATUS FOR FASTENING CARTONS

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FIG. 5

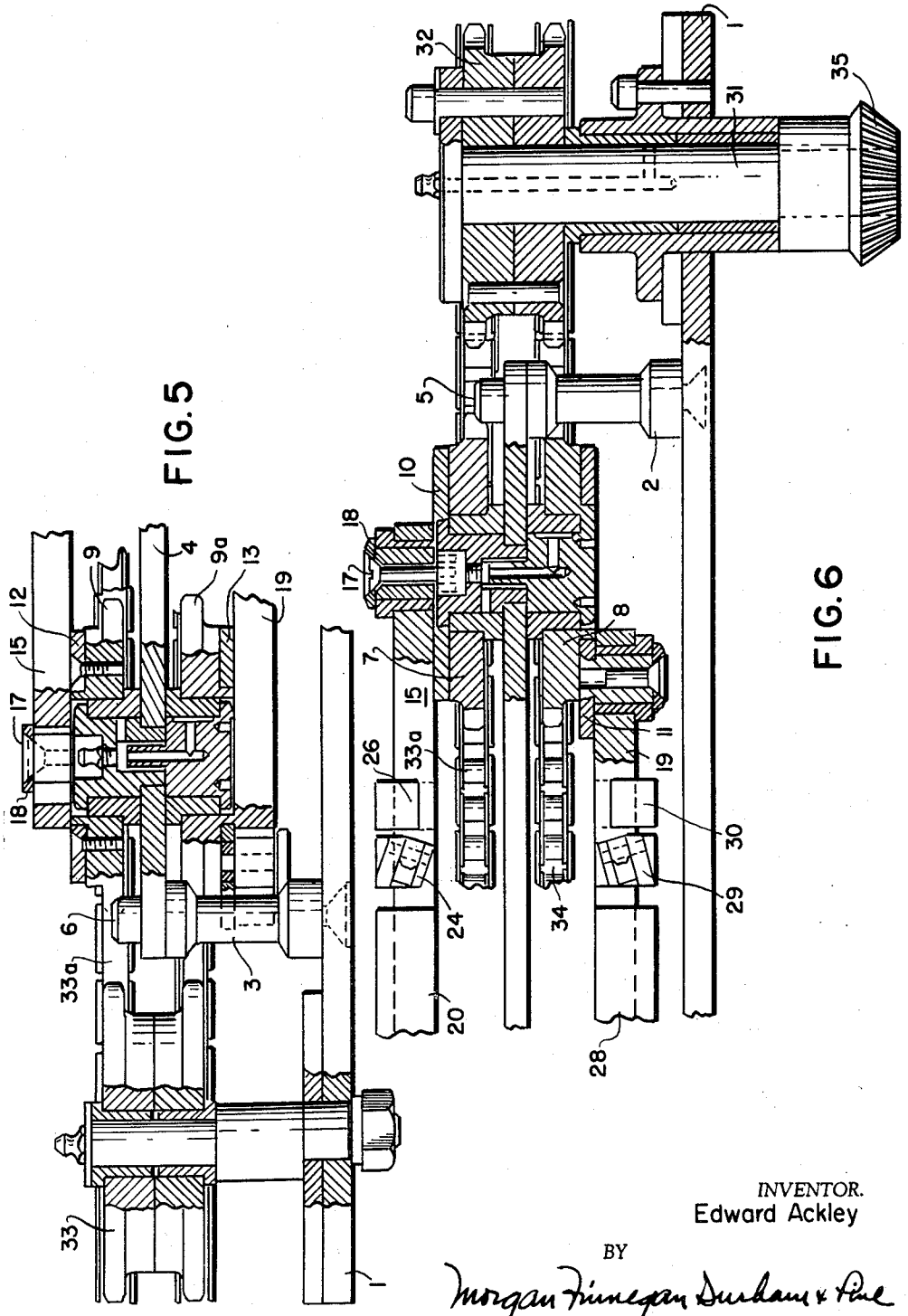


FIG. 6

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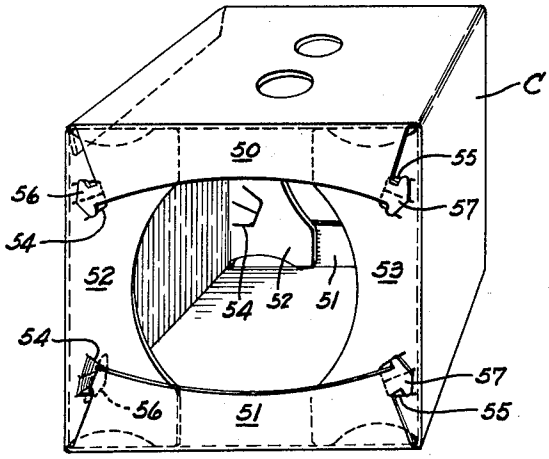
ATTORNEYS.

May 24, 1960 E. ACKLEY 2,937,486

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FIG. 7



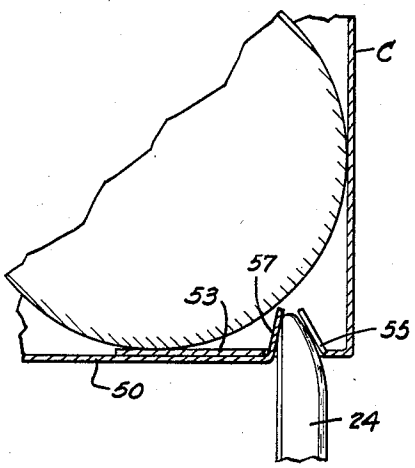


FIG. 9

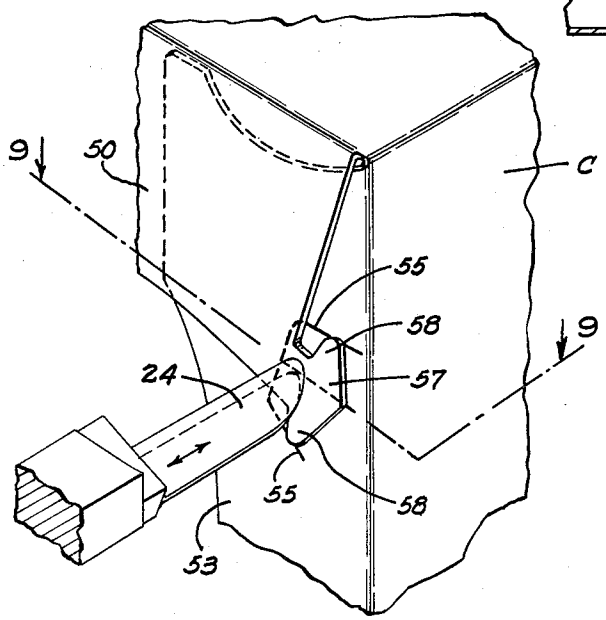


FIG. 8

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2,937,486

APPARATUS FOR FASTENING CARTONS

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Filed Jan. 13, 1959, Ser. No. 786,614

3 Claims. (Cl. 53—374)

This invention relates to apparatus for fastening the end panels of rectangular cartons moving along a path, and particularly to apparatus for such fastening by punching tongue and notch connecting means on the cartons.

In the modern practice of packaging cans in rectangular cartons it is customary to move the empty cartons along a path on some type of conveyor system or by gravity on a chute. The cartons customarily are provided with closed integral side walls and open end flaps. As the cartons proceed along the path, the cylindrical cans are placed in the carton, the end flaps of the carton are folded to make closed end walls, and the end flaps are then fastened to each other to seal the carton. It is highly desirable that this loading, closing and fastening operation proceed at a large rate of production.

Continuous and reliable high speed loading of the cartons and closing of the end flaps can be achieved in present practice, but the fastening step slows down the entire operation.

For example, it is common in the present practice to fasten the flaps by gluing them one to the other or by gluing them to the side walls of the carton. In addition to the start up and break down delays involved in handling glue (which is sticky and susceptible of change in viscosity during periods of inactivity), a large amount of space must be provided along the loading path to permit adequate time for the glue to set and cure. This results in a lower production rate and presents a problem in connection with installations having space limitations.

In order to overcome the disadvantages of gluing, cartons have been devised with tongues on certain flaps for cooperation with notches or grooves in other flaps. The tongues are engaged and forced into a locking fit in the grooves or notches by means of punches on associated fastening apparatus. This decreases some of the difficulties associated with gluing but magnifies other difficulties, and introduces new problems. A punching procedure frequently tends to bruise or buckle the cartons because of misalignment of the punches and also because of the required speed of the punches necessary to fasten the cartons as they move along the path. The punching apparatus itself is subjected to abuse and wear and frequently requires repair and maintenance with consequent shut down of the production line. A ruggedly built apparatus requires less repair but is slow and prevents flexibility sufficient to permit adjustment to varying positions of the cartons on the loading path relative to the punches.

Speaking generally, the present invention obviates the above difficulties. It provides punches which engage and force the tongues on end flaps of the carton into locking fit in notches on the other end flaps with great certainty and without buckling or bruising the carton. The apparatus is capable of carrying on the fastening step during continuous linear motion of the cartons along the path at speeds comparable to those obtainable during the loading and flap closing steps of the operation. The apparatus of the invention is of rugged character capable of

operation over extended periods of time without interruption of the operation to effect repairs or maintenance, and it adjusts to variations in the carton position.

Briefly, this is accomplished by providing an apparatus having a set of four punches on one side of the path along which the cartons move and another set of four punches on the other side of the path. Each set of four punches is aranged in pairs of upper and lower punches. Each pair of punches is mounted in fixed position on an inflexible link member, the upper pair mounted at the mid-point of the link member and the lower pair mounted in advance of the mid-point. The punches protrude toward the path. Each link member is mounted at its ends on the cam surfaces of a set of eccentric cam plates. Each cam plate of a set is rotatably supported on a support plate tandem to the other cam plate of the set and adjacent to the loading path. This longitudinally positions each link member parallel to the loading path. The set of cam plates for the upper punches on one side of the path is rotatably oriented in opposition to the set of cam plates for the upper punches on the other side of the path. Similarly, the sets of cam plates for the lower punches are rotatably oriented in opposition to each other but rotationally lagging the upper sets. Pushers are mounted on support plate for movement along the path to push a carton along the path in desired relation to the punches for each rotation of the cam plates. Power means are also provided to rotate the cam plates and to drive the pushers. The cam surfaces of the plates are eccentrically shaped to describe a path of movement during rotation that carries the punches on the inflexible link members toward the path to engage the tongues of a carton and press the tongues into locking fit within cooperating notches of the carton followed by linear motion of the link members along the path followed by movement of the link members and the punches thereon away from the carton back to original position—the lower link members and punches thereon lagging behind the upper link members with their punches.

Preferably, a yoke is resiliently mounted on each link member within the punches of the pair of punches thereon to engage the ends of the carton and resist movement of the carton transverse to the path.

More preferably, a pair of beveled guides is fixedly mounted on each link member outside of the punches and separated by a distance equal to the width of the carton. These engage the corner edges of the carton to adjust its position relative to the punches.

An illustrative embodiment of the invention is shown in the drawings, in which—

Figure 1 is a plan view of the entire apparatus of the invention showing a series of cartons on the loading path in dotted lines;

Figure 2 is an enlarged plan view of one set of the punches of the invention and the associated parts of the apparatus of Figure 1 partly broken away with one end corner of a carton to be punched represented in dotted lines;

Figure 3 is an enlarged view of one of the punches of the invention;

Figure 4 is an enlarged view of a portion of the apparatus disposed on one side of the loading path;

Figure 5 is an enlarged side view, partly in section and broken away, of that portion of the apparatus shown on the left of Figure 4; and

Figure 6 is similar to Figure 5 of the apparatus on the right in Figure 4.

Figure 7 is a perspective view illustrating one of the cartons in position ready for final fastening by the punching apparatus of the invention. For purposes of illustration, the lower left hand corner of the carton is shown as fastened by the punching apparatus.

Figure 8 is a fragmentary perspective view of a corner of one of the cartons showing the tongue of the carton in position ready for locking and with a punch of the apparatus of the invention in position to lock the tongue in the corner of the carton.

Figure 9 is a section view taken along the lines 9—9 of Figure 8 with the punch and the tongue inserted in the associated notch in the corner of the carton.

Referring now to the illustrative embodiment of the invention shown in the drawings, the apparatus of the invention generally consists of two portions which are disposed facing each other across the path along which the cartons move in series on a conveyor system. See the dotted line representations of the cartons passing in the direction of the arrow between the two portions of the apparatus of the invention in Figure 1. The two portions of the apparatus are mirror images of each other, and only one of the portions will be described in detail since understanding of the other will follow therefrom.

Hereinafter, the word "forward" will designate elements of the apparatus located in positions more advanced in the direction of the arrow on Figure 1 than elements designated with the word "rear."

Each portion of the apparatus is carried by a base **1** which is attached to the supporting structure of the conveyor upon which the cartons move. The base **1** carries a forward upright member **2** (Fig. 6) and a rear upright member **3** (Fig. 5) in fixed position extending upwardly. A horizontal support plate **4** is attached at its ends on the upright members **2** and **3** by cap screws **5** and **6**. Forward upper idler sprocket **7** and forward lower idler sprocket **8** and their associated bushings are concentrically mounted one above the other for rotation on support plate **4**. Similar rear upper sprocket **9** and rear lower sprocket **10** are rotatably mounted adjacent the rear end of the support plate **4**. Cam plates **10**, **11**, **12** and **13** having eccentric cam surfaces are fixedly mounted on the upper faces of the upper sprockets and on the lower faces of the lower sprockets for rotation therewith; e.g. rear upper cam plate **12** is mounted on rear upper sprocket **9** by screws **14** (see Fig. 5).

A link member formed of a solid inflexible bar **15** is fixedly supported at its ends on the cam surfaces of forward upper cam plate **10** and rear upper cam plate **12** by flat head screws **17** in lugs **18**. A lower link member **19** is similarly supported at its ends on the cam surfaces of forward lower cam plate **11** and rear lower plate **13**.

Link **15** is longitudinally positioned parallel to the path of movement of the cartons by rotationally orienting the set of upper cam plates **10** and **12** in tandem (see Fig. 4). This parallel relationship of the link **15** is maintained during complete rotation of the cam plates as will be understood. Similarly, lower link **19** is maintained in a longitudinally parallel position with respect to the path of the carton movement during rotation of lower cam plates **11** and **13** by rotational orientation thereof.

Mounted in fixed position on upper link **15** at about the mid-point thereof and protruding toward the path is a group of punches and guide parts which are the tools of the apparatus that center the cartons and lock the end flaps. See Figure 2 for an enlarged view thereof. In the center of the group is a slide yoke **20** mounted on link **15** for sliding movement toward and away from the path. Yoke **20** has a smooth vertical face **21** most adjacent to the path and parallel thereto. A spring clip and spring assembly **22** also mounted on link member **15** resiliently urges the slide yoke **20** toward the path. Fixed to the link member **15** on either side of the slide yoke **20** by holders **23** are a forward punching tool **24** and a rear punching tool **25** having the shape of a flat finger which is slightly tilted off the horizontal. See Figure 3. The punching tools **24** and **25** protrude toward the path and terminate in a smooth tip which thereby is adapted to engage the tongue of a flap and press it into locking fit within a notch in a complementary

flap in the end corner of a carton. A figurative representation of the end corner of a carton with a tongue on one flap and a notch in another flap aligned with a punching tool is shown in the lower left hand portion of Figure 2 by a dotted line representation. The cartons to be fastened are provided with such a tongue and notch arrangement in each of the four corners at each end of the carton. A detailed illustration showing a typical carton C, which illustrates the type of locking carton used with the invention, with its tongue and associated notches on the flaps, is shown in Figures 7, 8 and 9. The carton is formed from a blank with side panels and a top panel and a bottom panel having end flaps. The top and bottom panels have short laterally extending flaps **50** and **51**, respectively, which comprise a pair of outer end flaps. A similar pair of inner end flaps **52** and **53** extend from the side panels of the carton respectively. Similar pairs of inner flaps and outer flaps are provided at the opposite end of the carton. Each of the inner end flaps **52** and **53** have extending corner portions with notches **54** and **55**, formed by slits in the panel material. Each of the outer end flaps **50** and **51** has a tongue, such as tongues **56** and **57**, which extend from the corners of the outer flaps. Each of these tongues has small side extensions **58**, which permit the tongue to be locked into its associated notch after its insertion therein. The side extensions **58** give the tongue an arrowhead shape, the head portion being wider than the shank or base portion. Preferably, the notches **54** and **55** have a corresponding size with the width slightly narrower than the arrowhead of the tongues. If the tongue be punched into the notch, the notches bend to accommodate the tongues, and the arrowhead of the tongues locks into position within the notch in such a manner as to prevent the outer flaps from moving away from the inner flaps.

The upper link member **15** also carries a front guide **26** fixedly mounted thereon forward of front punch **24**, and a rear guide **27** located rearwardly of rear punching tool **25**. Both of the guides terminate in surfaces beveled towards the punches. They are separated on the link member by a distance equal to the width of the carton.

The lower link **19** carries a similar group of tools and carton guides (see Fig. 6)—slide yoke **28**, forward lower punching tool **29**, a rear punching tool (not shown), a front guide **30** and a rear guide (not shown). In this instance, however, the group of lower carton punching tools, etc. are advanced on lower link **19** beyond the mid-point thereof. And, the lower cam plates **11** and **13** are oriented with respect to the upper cam plates **10** and **12** to lag behind the upper cam plates rotationally by about an angle of 30° so that the lower group of punching tools and guides occupy the same linear position along the path directly below the upper group of carton punching tools and guides.

Base **1** also carries at its forward end thereof a vertical drive shaft **31** on which is mounted at its upper end a drive sprocket **32**. Mounted on the rear end of base **1** is a vertical idler shaft with an idler feed sprocket **33** mounted thereon for rotation. Both the drive sprocket **32** and the feed sprocket **33** have two sets of parallelly disposed sprocket teeth positioned in the same planes as the upper sprockets **7** and **9** and the lower sprockets **8** and **10**. An upper chain **33** connects all of the upper sprocket teeth and a lower sprocket chain **34** connects all of the lower sprocket teeth for common movement of the sprockets and the cam plates. A bevel gear **35** is fastened to the lower end of drive shaft **31** for coupling with a power source to drive all of the sprockets and to rotate the eccentric cam plates.

Pushers **36** are mounted on the sprocket chains by holders **37** to protrude outwardly at spaced intervals corresponding to the preselected distance desired between the cartons as they move along the path. It should be understood that the pushers **36** on one side of the path

are positioned in opposition to those on the other side of the path.

As will be seen from Figure 6 and as follows from the nature of the construction described above, the pair of upper punching tools 24 and 25 are vertically separated from the pair of lower punches 29 by a distance slightly smaller than the height of the cartons so that the punches face the points in the corners of the cartons where the tongues are to be inserted in the notches in the flaps. Similarly, the pairs of upper guides 26 and 27, the upper pushers 36, and the upper yoke 20 are vertically separated from the pairs of lower guides 30, lower pushers 36, and lower yoke 28, respectively, slightly less than the height of the carton.

In operation of the apparatus of the invention, the cartons approach the apparatus from the left (as viewed in Figure 1), and are carried by the conveyor system or other means not shown to a position between the feed sprockets 33 of the two portions of the apparatus. The pushers 36 travelling on the chains engage the rear wall of the carton and adjust the position of the carton so that the rear wall is normal to the chains. The pushers 36 are placed on the chains in position relative to the rotational position of the upper cam plates to position the carton linearly on the path so that the carton is at a position opposite to the rear cam plates when the cam surfaces of the upper cam plates have moved the upper link 15 and the group of punching tools and slide yokes and guide members toward the path and engage the ends of the carton from both sides of the path. During this movement toward the path, the upper guide members 30 engage the end edges of the carton and further align the carton with respect to the punching tools. The upper slide yokes 20 engage the end walls of the carton and resiliently hold the carton in a firm grip. The pairs of opposed upper punches on upper links 15 engage the tongues on the upper end flaps of the carton and press the tongues into and through the notches in the upper corners of the carton at both ends thereof simultaneously. Full insertion of the upper punches and tongues is completed by the time the rotation of the upper cam plates has carried their cam surfaces and the upper link members 15 most adjacent to the path. At this moment, the lower link members 19 on lower cam plates 11 have moved the groups of lower punches thereon directly underneath the upper punches but not close enough to the path to engage the carton.

As the carton continues to move linearly down the path and all of the cam plates continue to rotate, the upper link members 15 move along parallel to the carton with their upper punches remaining inserted therein. However, after 30 degrees of such rotation, the lagging cam surfaces of the lower cam plates 11 move link members 19 toward the path and the lower sets of punches 29 press the tongues into the notches in the lower end corners of the carton simultaneously from both sides of the path. The carton is guided by lower guides 30 and held by yoke 28. Shortly after the carton has proceeded further down the path, the cam surfaces of the upper cam plates begin to move away from the path, thereby withdrawing the upper punches from the upper notches of the carton leaving the tongues wedged therein. The cam surfaces of the lower cam plates do not begin to move their lower punches and yokes, etc. away from the path until full withdrawal of the upper punches, because of their rotational lag, but continue to hold the carton firmly. Thereafter, they do so, thereby withdrawing the lower punches from the carton.

As the cam plates continue to rotate, the link members are moved completely away from the path and longitudinally to the rear to the original position from where they are then moved towards the path and longitudinally to the rear to the original position from where they are then moved towards the path to engage the next carton. Longitudinal spacing between series of cartons on the conveyor system and between the punches is arranged to coincide with the time differential involved in the complete eccentric motion of the cam plates with their supporting link members and associated groups of punches thereon. The operation is repeated until all of the desired cartons are fastened and sealed.

By this arrangement, the opposite ends of the carton are first simultaneously fastened in their upper corners, next simultaneously fastened in their lower corners, the upper punches are withdrawn, and then the lower punches are withdrawn. The carton is held in a firm grip throughout. Pressures due to the punching are not placed on the carton as a whole at one time. Pressures brought to bear on the carton are equal and opposite. The operation proceeds at high speed without damage to the carton or damage to the apparatus. For example, apparatus of the present invention has been used to seal and fasten rectangular cartons or carriers containing six cylindrical cans of beer on a loading and production line in excess of 70 cartons a minute without misses or bruising of either the carton or the apparatus.

The apparatus of the invention is relatively small. It is easy to carry and install. It can be moved from one production line to another and from one place to another on the same production line with little difficulty. Further, it is automatic and requires only occasional inspection during operation.

Since variations may be made from the preferred embodiment of the invention illustrated and described above without departing from the invention, it should be understood that the invention is not limited to the details thereof except as may be expressed hereafter in the claims.

Since the apparatus of the invention may be used with cartons from a construction varying from the specific details of the carton C shown in the drawings, it should be understood that the invention is not limited to use of the apparatus with the carton having such details.

I claim:

1. Apparatus for fastening the ends of a rectangular carton moving along a path, the carton having end flaps with tongues in the corners thereof adapted to enter into and lock in notches in the corners of cooperating end flaps, said apparatus comprised of a support plate, four punches on each side of the path arranged in opposed pairs of upper and lower punches, each pair of punches being mounted in fixed position on an inflexible link member to protrude toward the path, the upper pairs of punches being mounted mid-way of the ends of their link members and the lower pair of punches being mounted in advance thereof, each link member being mounted at its ends on eccentric cam surfaces of a set of cam plates, each cam plate of a set being rotatably mounted on said support plate tandem to the other cam plate of the set and adjacent to the path to longitudinally position said link member parallel to the loading path, the set of cam plates for the pair of upper punches on one side of the path being rotatably oriented in opposition to the set of cam plates for the pair of punches on the other side of the path, and the sets of cam plates for the pairs of lower punches being similarly rotatably oriented in opposition to each other but lagging the sets of cam plates for the upper pairs of punches, pushers to move a carton along said path in aligned position relative to said punches for each rotation of said cam plates, and power means to drive said pushers and to rotate said cam plates to carry said punches toward said path to engage and press said tongues into locking fit within said notches followed by movement of said punches along said path followed by movement of said punches away from said path and back to original position with the upper punches lagging the lower punches throughout.

2. The subject matter of claim 1 characterized by the fact that a yoke protruding toward the path is resiliently mounted on each link member between the punches

thereon to engage the carton and to resist movement of the carton transverse to the path.

3. The subject matter of claim 2 characterized by the fact that a pair of guides with beveled surfaces protruding toward the path and separated by a distance equal to the width of the carton is fixedly mounted on each

link member outside and adjacent to the punches to engage corner edges of the carton and adjust its position relative to the punches.

No references cited.