# United States Patent

**Goodley**

[15] **3,691,939**

[45] **Sept. 19, 1972**


[54] **METHOD AND APPARATUS FOR BINDING PACKAGES**


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[73] Assignee: **IMC Corporation**, Philadelphia, Pa.



[22] Filed: **April 16, 1971**

[21] Appl. No.: **134,610**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 42,932, June 3, 1970, abandoned.

[52] **U.S. Cl.** .....**100/2**, 100/26, 100/29

[51] **Int. Cl.** .....**B65b 13/06**

[58] **Field of Search**.....100/2, 4, 25, 26, 29, 32, 33



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,146,695 | 9/1964 | Van de Bilt | 100/26 X |
| 3,376,807 | 4/1968 | Sterner | 100/26 |
| 3,387,556 | 6/1968 | Cranston et al | 100/26 X |
| 3,447,447 | 6/1969 | Rutty | 100/26 X |

FOREIGN PATENTS OR APPLICATIONS

| | | | |
|---|---|---|---|
| 1,176,712 | 1/1970 | Great Britain | 100/26 |



*Primary Examiner*—Billy J. Wilhite

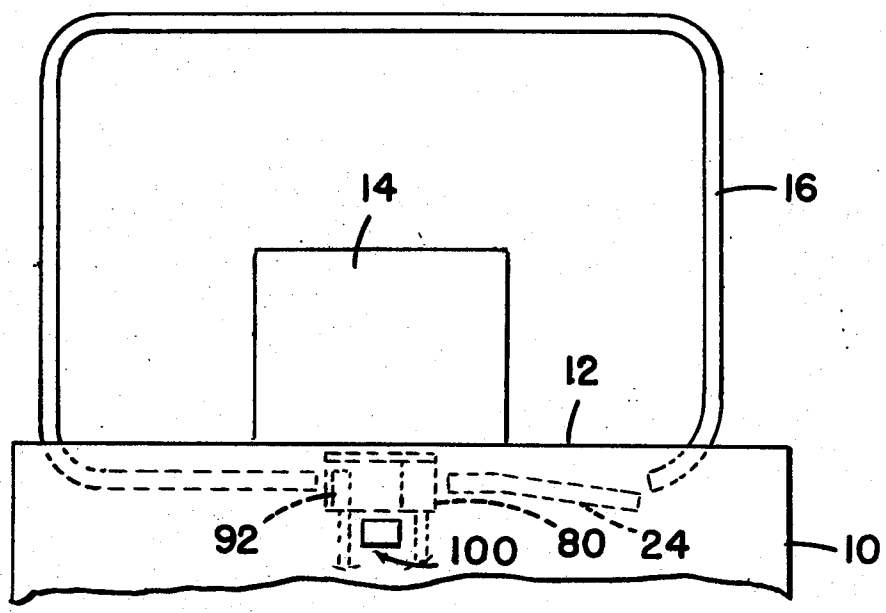
*Attorney*—Thomas R. O'Malley and Charles H. Johnson



[57] **ABSTRACT**

A method of and machine for automatically binding packages involves the formation of a loose loop of binding material at the same time that a previously formed and tightened loop is being secured about a package. This speeds the binding operation over the prior art which required the two operations to be performed sequentially.


**6 Claims, 10 Drawing Figures**



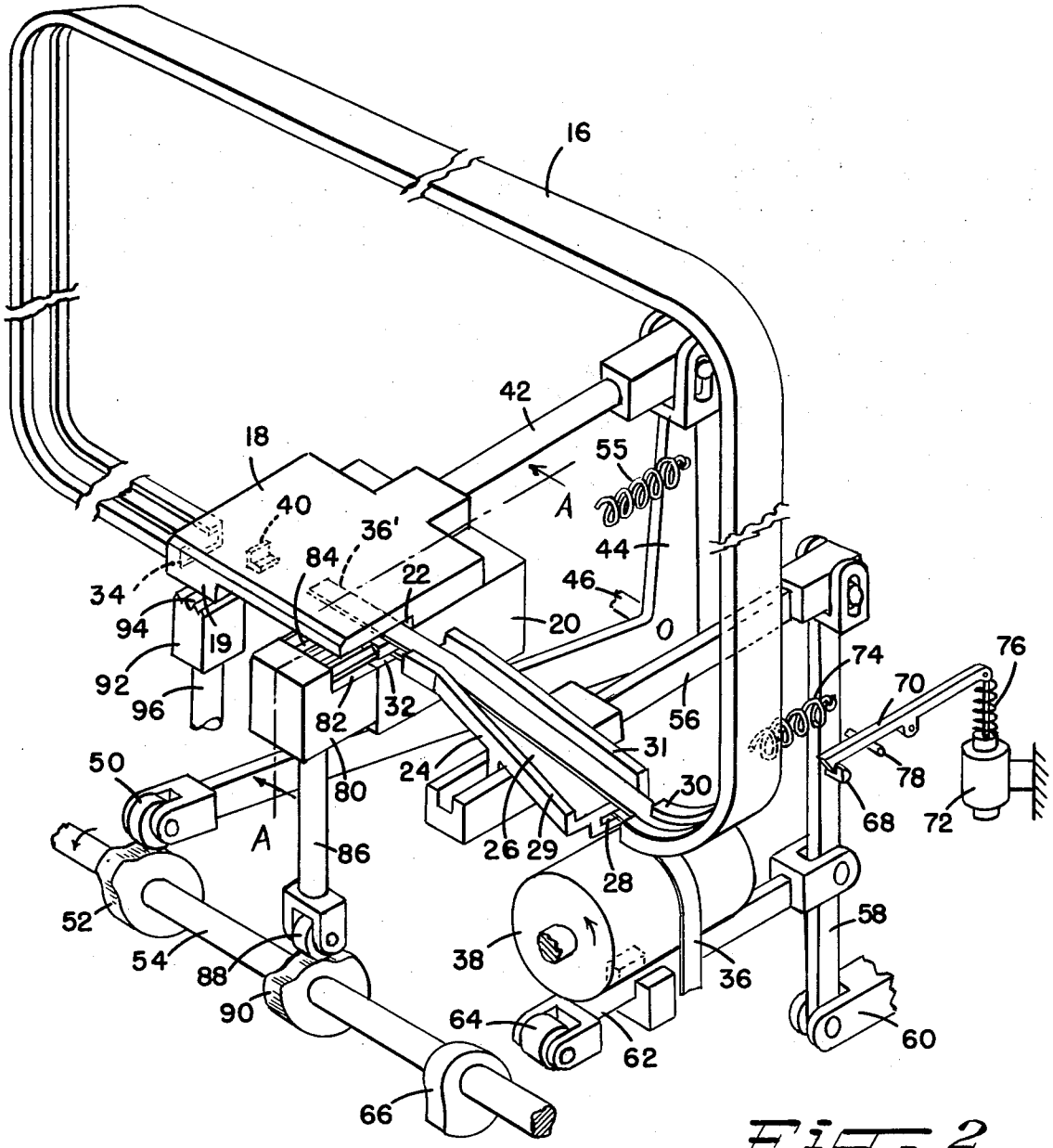

16
42
18
55
A
40
36'
84
44
34
22
46
94
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20
92
96
82
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60
66

Fig. 2

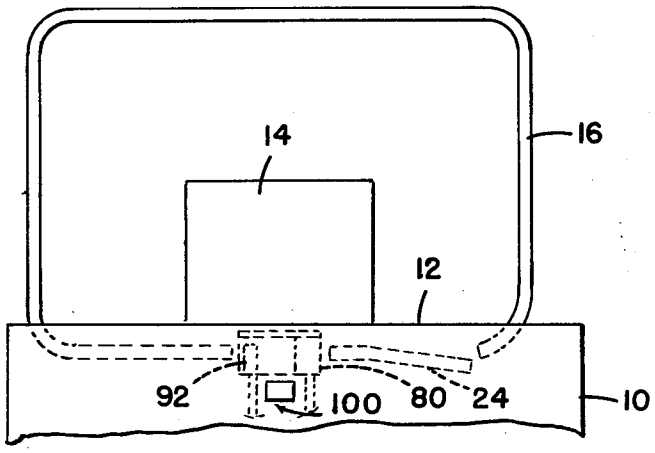

14
16
12
92
100
80
24
10

Fig. 1

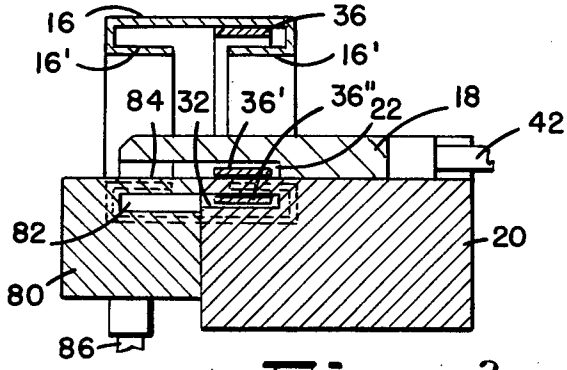



Fig. 3

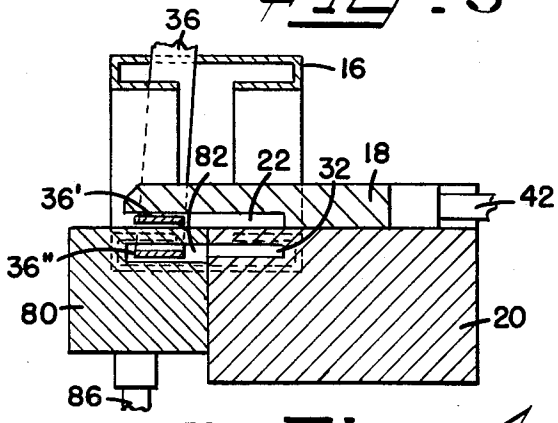



Fig. 4

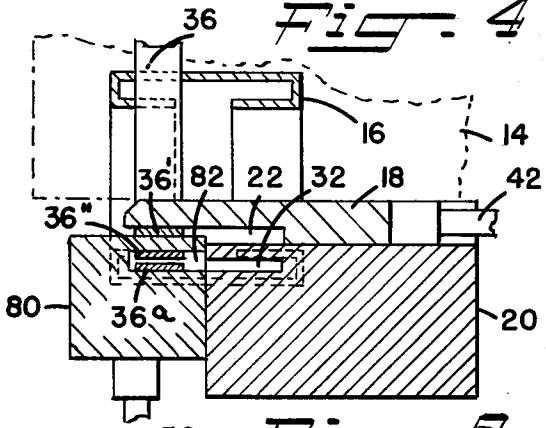



Fig. 5

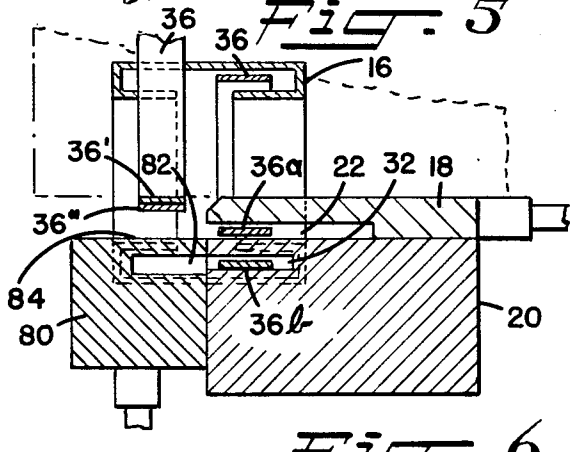



Fig. 6

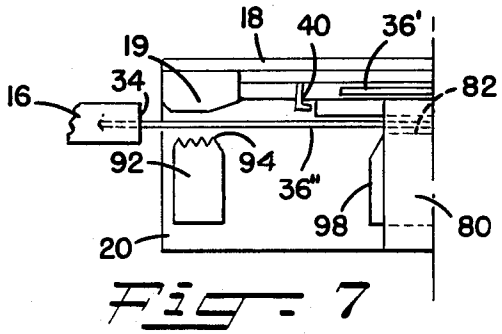



Fig. 7

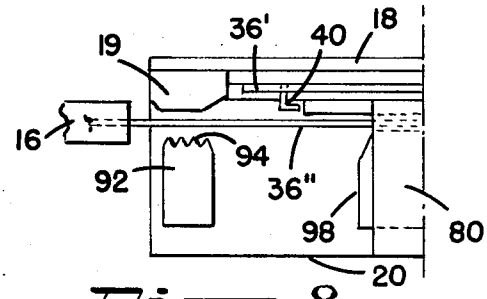



Fig. 8

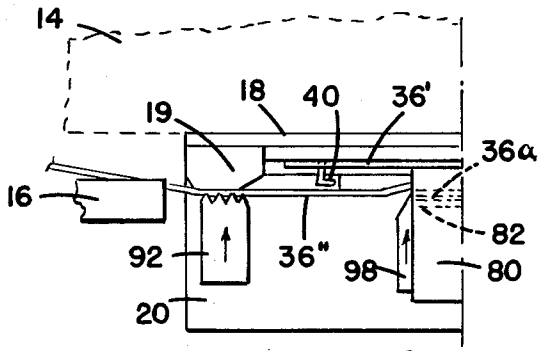



Fig. 9

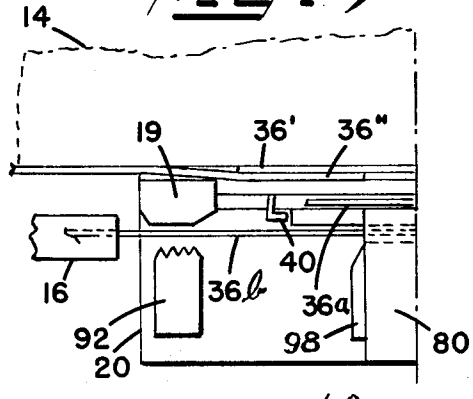



Fig. 10

# METHOD AND APPARATUS FOR BINDING PACKAGES

This application is a continuation-in-part of application Ser. No. 42,932, filed June 3, 1970 (now abandoned).

The present invention relates to an improved method of rapidly binding packages, boxes and other objects and to a machine for carrying out the method. In its more particular aspects, the invention relates to an automatic strapping machine having provision for forming a loose loop of strapping about a package at the same time that a previously tensioned loop is being secured about the package, whereby the machine is conditioned for tensioning a new loop immediately upon or very soon after the securing of a prior loop to thus provide a machine capable of performing multiple strapping operations in a reduced amount of time.

While machines for binding packages with flexible metal or non-metal strapping differ greatly in details of construction they have certain basic features in common. Thus, such machines frequently provide a relatively large loop of strapping within which is positioned the package to be bound. With the package in position, a cycle of operation is instituted, the complete cycle generally involving shrinking or tightening the loop about the package, cutting the tightened loop from a supply of strapping, securing together overlapping strap portions so as to hold the loop tight and finally forming a new relatively large loop of strapping for use in a subsequent cycle. Most usually the large loop is formed by push-feeding the strapping endwise around a loop forming track but with some machines the loop is formed by pulling the end of the strapping through a loop, this latter type of operation sometimes being necessitated by a particularly flexible or limp binding material such as twine and the like. In any event, or common feature of most, if not all, prior art machines is that at least the sealing or binder securing mechanism while in operation occupies the path taken by the strap in forming the large loop, thus making it necessary to complete the sealing operation before starting to form the loop to be used for the next binding operation. Therefore, the time required for sealing or securing the binder about the package has been a limiting factor in the over-a-l operation.

It is an object of the present invention to provide a speeded up method of automatically binding packages whereby the step of forming a loose loop for subsequent shrinking and securing about a package can be and is performed, or at least begun, while a previously shrunken loop is being secured about a package.

A further object of the invention is to provide an automatic strapping machine having provision for forming, or a least starting to form, a loose of strapping for subsequent tightening or shrinking and securing about a package while a previously shrunken loop is in the process of being secured about a package.

Other and further objects, features and advantages of the invention will become apparent as the description of a preferred embodiment thereof proceeds.

Referring now to he drawings:

FIG. 1 is a schematic view of a strapping machine showing an article located in position to be strapped;

FIG. 2 is a perspective view partially broken away showing strapping machine mechanism in accordance with the present invention;



FIGS. 3, 4, 5 and 6 are sectional views taken on the line A—A of FIG. 2 at different times during a cycle of operation of the machine; and

FIGS. 7, 8, 9 and 10 are elevational views taken at right angles to FIGS. 3, 4, 5 and 6, respectively.

As indicated schematically in FIG. 1, the machine comprises a base portion 10 containing the various operating mechanisms and providing a surface 12 for supporting an article such as a package 14 to be strapped or otherwise bound. The term "package" is used herein tin a generic sense to indicate either a single item or a number of juxtaposed items. Supporting surface 12 need not necessarily be physically a part of base 10 but may be part of a roller conveyor, for example. Supported by base 10 and extending about the position where the package is located is a yoke or guide 16 for guiding a strap through a relatively large loop having an end portion located beneath the package and overlapping a portion of the strapping extending back to a supply, not shown. The aforementioned parts are common to ordinary package strapping machines and are referred to primarily to establish the environment of the invention.

The operating mechanisms are shown more or less diagrammatically in FIG. 2 in which figure the parts are shown greatly out of proportion, the yoke guide 16 usually being many times larger than shown in proportion to the rest of the mechanism. An anvil 18 is slidably or reciprocatably mounted on a stationary member 20 in a position such that a package to be strapped will overlie it. A portion of the bottom of anvil 18 is cut away to provide a space 22 between the anvil and member 20 to accommodate an end portion of the binding material, as will presently be explained.

Reciprocatably mounted alongside member 20 is a strap shuttle 25 having an open-topped strap track 26 and a closed or tunnel-like strap track 28. Track 28 is only a little wider than the strapping to be used with the machine but track 26 is provided with sides 29 and 31 which at the entrance end of the track are spaced apart substantially the width of the exit end 30 of yoke guide 16. Side 29 converges toward side 31 toward the exit end of the track so as to definitely locate the path of the strap as it leaves track 26. With shuttle 25 in the position showing in FIG. 2, the discharge end of track 28 is aligned with a slot 32 in member 20 and with the entrance end 34 of yoke 16.

In initially conditioning the machine for operation, the binding material in the form of flexible strapping 36 is pulled from a supply, not shown, and led over a suitable feeding and tensioning roller 38 and then shoved endwise through guide tunnel 28, slot 32 and into the entrance end 34 of yoke guide 16. Further endwise movement of the strapping causes it to move around the yoke guide, emerge from the guide exit 30 and move across strap track 26 and into the space 22 between anvil 18 and member 20. It will be observed that guide yoke 16 is very considerably wider than the strapping, the reason for this being that the strapping is normally not perfectly straight so that particularly where the yoke guide is a long one it is desirable to permit some sideways movement of the strapping to prevent it from jamming in the yoke. The track 26 of shuttle 24 is relatively short and there is no difficulty in guiding the end of the strapping over to the narrow

discharge end of said track should the strapping emerge from the yoke guide on the side of the yoke not directly aligned with the discharge end of the yoke not directly aligned with the discharge end of the track. When the end of the strap contacts a switch operating arm **40** located beneath anvil **18** further endwise movement is prevented and at this time a leading end portion of the strapping directly overlaps a portion of the strapping extending back to the strap supply, this direct overlap being brought about by the fact that the narrow end of strap track **26** directly overlies strap track **28** of the shuttle **24**. This initial lace-up may be entirely manual or may be aided by operating the strap feeding and tensioning roller **38** in strap feeding direction. At any rate, such lace-up is necessary only infrequently, as when starting a new roll of strapping.

Anvil **18** is movable back and forth between a home or normal position shown in FIGS. **2, 3, 4** aNd **5** and the position shown in FIG. **6** and toward this end a link **42** is connected at one end to said anvil and at its other end is articulated to one arm of a bell crank **44** pivotally mounted on a pin **46** secured to a stationary part of the machine. The other arm of bell crank **44** is provided with a cam follower roller **50** engaged with a cam **52** secured to a cyclically rotatable shaft **54**. During one rotation of shaft **54**, anvil **18** is moved from the position shown in FIGS. **2, 3, 4** and **5** to the position shown in FIG. **6** and back again, a spring **55** acting on bell crank **44** serving to hold follower roller **50** engaged with the cam **52**. Thus a high segment of cam **52** moves anvil **18** to the position shown in FIG. **6** and the spring **55** moves the anvil to the position shown in FIGS. **2, 3, 4** and **5** when a low segment of cam **52** permits said spring to rock bell crank **44** in a counterclockwise direction.

Shuttle **24** is shown only in FIG. **2** but during one revolution of shaft **54** it moves back and forth parallel to the path of movement of anvil **18**, although its movement takes place at a different time than the anvil. A link **56** is connected at one end to the shuttle and at its other end is articulated to one end of a lever **58** pivotally mounted at its other end on a stationary part **60**. Pivotally connected to lever **58** is one end of a slidably mounted link **62** having on its other end a roller **64** aligned with a cam **66** secured to shaft **54**. Lever **58** is provided with a tab **68** engaged by a latch **70** when a high point of cam **76** moves said lever and the shuttle **24** to the position shown in FIG. **2** to hold the shuttle in the FIG. **2** position after rotation of shaft **54** moves the high point of the cam away from follower **64**. A solenoid **72** in a circuit with switch **40** has its armature connected to latch **70** and when the end of the strap contacts switch **40** solenoid **72** is energized and rocks latch **70** to release lever **58** and shuttle **24** to the action of a spring **74**. A compression spring **76** acting between the body of solenoid **72** and latch **70** normally holds the latch against a stop **78** so that it is in a position to engage tab **68** when lever **58** is rocked as aforesaid by the high point of cam **66**. Upon energization of solenoid **72** and release of latch **70** spring **74** moves follower **64** into engagement with a low section of cam **66** and moves shuttle **24** forward form the position shown in FIG. **2**, this forward position being explained in more detail later in this specification.

Located in a position juxtaposed member **20** is a strap gripper member **80** having an open sided slot **82** therein communicating with the slot **32** of member **20** and having a serrated, knurled or otherwise roughened strap gripping surface **84**. When anvil **18** is in the position shown in FIGS. **2,3, 4** and **5** it overlies said strap gripping surface. Member **80** has connected thereto a lifter rod **86** having on its lower end a cam follower roller **88** engaged with a cam **90** secured on cam shaft **54** whereby said member may be raised to cause the gripping surface **84** thereof to squeeze an end portion of the strap against the bottom of anvil **18** as will presently be explained. A second strap gripping member **92** having a serrated, knurled or otherwise roughened strap engaging surface **94** is located in alignment with but spaced from gripping member **80**. Secured to member **92** is an operating rod **96** which at its lower end has a follower engaged with a cam (not shown) secured to cam shaft **54** whereby member **92** is lifted at an appropriate time, as will be explained to grip the strap against a lug **19** on the bottom of anvil **18**.

The operation of the mechanism will now be described, first assuming that the strapping **36** has been initially laced into the machine to provide an end **36'** of strapping located within space **22** and overlying a portion **36''** located within slot **32** as shown in FIG. **3**. At this time the end **36'**, as may be seen in FIGS. **2** and **7**, has not quite reached switch **40** or if it has been pushed against the switch it must be assumed that power is not being applied to the circuit containing switch **40** and solenoid **72**. At any rate, when the end **36'** of the strap engages switch **40** and power is on the circuit containing said switch, operation of the switch is effective as previously mentioned to energize solenoid **72** and cause latch **70** to release lever **58** to he action of spring **74**, whereupon said spring moves shuttle **24** forward. During this movement of the shuttle the side **31** thereof shoves the strap end **36'** sideways out of space **22** so as to overlie gripper member **80** and the track **28** moves strap portion **36'** of the strap extends beyond or to the left of switch **40**, this indicating that the strap end has moved from the FIG. **7** position far enough to have operated the switch and has hen been shoved sideways off of the switch, thereby permitting the switch to be moved back to its unoperated position by a suitable spring. In the embodiment of the machine as shown, operation of switch **40** is also effective to start a motor (not shown) which drives cam shaft **54** and after said shaft has turned far enough to cause cam **90** to raise gripper **80** so as to squeeze and anchor the strap end portion **36'** between the gripper and the bottom of the anvil, any suitable means such as a switch operated by the cam shaft becomes effective to either stop the motor or declutch the cam shaft form the motor. Since the stopping of shaft **54** after a small portion of a revolution may be accomplished by a variety of means known in the prior art and since no particular means is of the essence of the present invention, no particular means has been illustrated. This then, is the normal or at rest condition of the machine and strap, the anvil **18** being in its forward position so as to overlie grippers **80** and **92**, the shuttle **24** being forward of the position shown in FIG. **2** so as to have positioned portions of the strap between the grippers and the anvil and gripper **80** being raised to anchor the end portion **36'** of the strap.

With the machine in normal condition, package **14** is positioned on surface **12** on top of anvil **18** within the confines of the large loop of strapping practically confined in yoke **16**. As is common in strapping machines, a cycle of operation is then instituted, either by the placement of the package or by an independent action on the part of an operator. As is true with many strapping machines, the first thing that happens during the cycle is that strap feeding and tensioning roller **38** is driven in strap tensioning direction and since the end **36040** of the strapping is anchored this causes the loop of strapping to be pulled out of yoke **16** and shrunk about the package. When the desired strap tension is achieved, roller **38** is stopped and rotation of cam shaft **54** is automatically caused to resume and this rotary movement continues until the shaft completes the full revolution already having progressed far enough to have raised gripper **80**.

During an early part of this second stage of rotation of the cam shaft, a cam thereon raises gripper **92** to squeeze and anchor strap portion **36''** against lug **19** of anvil **18** as shown in FIG. **9**. The two grippers **80** and **92** thus hold the tensioned strap under tension and it is no longer necessary to keep the strap engaged with the tensioning mechanism. With the strap thus held under tension about the package, the tensioned loop can be cut or otherwise severed form the strap extending from the overlapped portions back to the supply. The art knows of many ways for accomplishing this function and it is not believed to be necessary to describe herein the details of a particular cutter but in FIGS. **7, 8, 9** and **10** a blade **98** is shown alongside gripper member **80** and after the strap has been drawn tight and gripped by gripper member **92**, blade **98** is raised from the position shown in FIG. **8** to the position shown in FIG. **9** and during this movement the strap is cut by a scissors action between the blade and the top edge of slot **82** in the member **80**. At the time of the cut, that portion of the strapping between roller **38** and gripper **92** is free of tension so that the tensioning mechanism does not pull the newly formed strap end out of the slot **82**. In FIGS. **5, 6, 9** and **10** said new end portion is designated **36$^a$**. In FIG. **9**, the new end **36$^a$** has just been created and is still located within slot **82** of the gripper, whereas FIG. **10** shows the new end after it has been fed around the yoke and just before it reaches switch **40**, this latter position being the same as shown in FIG. **7** for the original end **36'**.

As previously indicated, the present invention is applicable to machines employing various known methods of securing the overlapping strap portions **36'** and **36''** together. With previously known machines the sealing takes place with the overlapping strap portions located as shown in FIGS. **2** and **3**; the strap grippers such as **80** and **92** also being normally located in this plane. In accordance with the present invention the strap sealing takes place with the overlapping portions **36'** and **36''** located as shown in FIGS. **4** and **5** which is sideways out of the position shown in FIG. **3**. Since the invention does not require any particular type of sealing mechanism, a conventional sealing mechanism has been only generally indicated at **100** in FIG. **1**. After the gripping of the tightened strap by gripper **92**, the sealing mechanism **100** becomes effective to secure together the overlapping strap ends **36'** and **36''**.

Shortly after the strap is cut by cutter **98** and either before or during the operation of the sealing mechanism, cam **66** operates to move shuttle **25** back to the FIG. **2** position, and as shaft **54** continues to rotate, latch **70** holds the shuttle in the FIG. **2** position after the high point of cam **66** has moved past roller **64**. This movement of the shuttle is effective to move the new end portion **36$^a$** of the strap into the slot **32** in member **20**. Then while the sealing mechanism is operating to secure the strap portions **36'** and **36''** together, continued rotation of shaft **54** causes a cam thereon to operate a switch which is effective to start roller **38** to turn in strap feeding direction to push the strap around the yoke guide until the new end **36$^a$** contacts the switch arm **40**. Operation of the switch that starts roller **38** is so timed that the sealing operation is completed and cam shaft **54** has completed its full revolution and has come to a stop shortly before the new strap end **36$^a$** reaches switch. During that portion of the revolution of cam shaft **54** taking place after completion of the strap sealing operation the cams that control the grippers **80** and **92** permit said grippers to move downward to release the strap and cam **52** becomes effective to momentarily move anvil **18** to the position shown in FIG. **6**. When the anvil moves to the FIG. **6** position, the tensioned and sealed strap snaps up against the bottom of the package and just before cam shaft **54** stops, cam **52** presents a low portion to follower **50** thus permitting spring **55** to restore the anvil to its normal position overlying the grippers **80** and **92**. Very quickly after the cam shaft completes its full revolution the tip end of the strap reaches the switch **40** to institute the beginning of a new revolution of said shaft. As previously explained, operation of switch **40** is also effective to cause shuttle **24** to shove the overlapping strap portions sideways and the early portion of the revolution of cam shaft **54** after which said shaft comes to a stop, is effective to cause the end portion of the strap to be gripped by gripped by gripper **80**, thus conditioning the machine for a new strapping cycle. During this preparation for a new cycle of operation, the previously strapped package can be moved to have another strap applied thereto at a different place or the strapped package can be replaced by another. In either case, the present invention enables certain preliminary steps of a particular cycle to be performed while the immediately preceding cycle is in progress, thus effecting a saving of time during multiple strapping operations.

There has been described a preferred embodiment of the invention but it will be apparent that many specific changes in construction can be made without departing form the spirit of the invention. Thus, instead of having the sealing take place beneath the package, anvil **18** and the gripping and sealing mechanisms associated therewith can be located along one of the vertical extensions of the yoke guide so that the sealing takes place at the side of a package rather than underneath it. While it is preferred to have the anvil **18** movable to the FIG. **6** position so as to free the sealed strap and permit it to snap up tight against the package, if desired said anvil can be made stationary in the FIG. **2** position in which case the package must be moved after the strap is sealed in order to free the strap from the anvil. Likewise, while it i Like wise, while it is preferred to

have the shuttle move the overlapping strap portions sideways from the FIG. 3 to the FIG. 4 position immediately upon the strap end contacting switch 40, it is within the purview of the invention to provide an arrangement whereby the forward movement of the shuttle is not dependent entirely upon contact of the strap with the switch so that the strap feed can be entirely completed before the completion of the sealing operation.

Having thus described a preferred embodiment of the invention, what is claimed is:

1. The method of binding a package comprising forming a loose loop of a binding material having at a predetermined location an end portion lapping a portion of the material extending back toward a supply, moving the portions of the binding material sideways out of the predetermined location, tightening the loop about a package positioned therewithin, severing the tightened loop from the binding material extending back to the supply to thus form a new end portion of the binding material, at least starting to form a new loose loop of binding material which will have overlapping portions at said predetermined location while securing together the lapping portions of the tightened loop.

2. The method of binding set forth in claim 1 wherein the binding material is in the form of a strap, said method comprising moving the new end portion of the strap back into said predetermined location and forming the new loose loop by directing the strap endwise through a loop forming path.

3. A package strapping machine comprising means for forming a relatively large loop of strapping having at a predetermined location an end portion lapping a portion extending back to a supply, means for supporting a package within the loop of strapping, means for moving the lapping portions sideways out of said predetermined location, means for tightening the loop about a package, means for severing the tightened loop from the strapping extending back to the supply to thereby form a new end portion for strapping, means for securing together the lapping portions of the tightened loop, and means for simultaneously operating said last-mentioned means and said first-mentioned means whereby to form a new large loop at the same time that a previously formed and tightened loop is being secured about a package.

4. A machine as set forth in claim 3 wherein the means for forming a relatively large loop of strapping comprises a guide having a spaced apart entrance and exit located on opposite sides of said predetermined position, and means for directing strapping endwise through said guide.

5. A machine as defined in claim 4 wherein the means for moving the lapping portions sideways out of said predetermined location comprises shuttle means having a first strap track and a second strap track, said shuttle means having a position wherein said first strap track is aligned to direct strapping from the supply through said predetermined location toward the entrance of said guide and said second strap track is aligned to direct strapping to said predetermined location from the exit of said guide, and said shuttle means having another position wherein said strap tracks are out of alignment with said predetermined location.

6. A machine as defined in claim 5 wherein said second strap track is open longitudinally on the side facing the package whereby the strapping is readily displaced therefrom when the loop is tightened about the package.

* * * * *

PO-105
(5/69)

# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,691,939 Dated September 19, 1972

Inventor(s) George F. Goodley

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On Abstract page, left column, assignee "IMC" should read --FMC--. Col. 1, line 36, "or" should read -- a --; line 45, "over-a-l" should read -- over-all --; line 55, after "loose" insert -- loop --; line 62, "he" should read -- the --. Col. 2, line 11, "tin" should read -- in --; line 37, "25" should read -- 24 --; line 45, "25" should read -- 24 --; line 46, " showing" should read -- shown --. Col. 3, lines 2 and 3, delete "not directly aligned with the discharge end of the yoke"; line 18, "aNd" should read -- and --; line 49 "76" should read -- 66 --; line 66, "form" should read -- from --. Col. 4, line 6, after "in" insert -- FIG. 6 gripping surface 84 is out of vertical alignment with the anvil but when the anvil is in its normal position shown in --; line 35, "he" should read -- the --; line 42, after "portion" insert -- 36" out of slot 32 into the slot 82 of said gripper member, as shown in FIG. 4, the lower portion 36" also now overlying gripper member 92. From FIG. 8 it may be observed that the tip of end --; line 45, "hen" should read -- then --; line 56, "form" should read -- from --. Col. 5, line 3, "practically" should read -- partially --; line 11, "36040" should read -- 36' --; line 27, "form" should read -- from --. Col. 6, line 3, "25" should read -- 24 --; line 40, delete "by gripped"; line 67, delete "while it i Like wise,". Col. 7, line 16, after "moving the" insert -- lapping --. Col. 8, Claim 3, line 6, "for" should read -- of --

Signed and sealed this 3rd day of April 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents