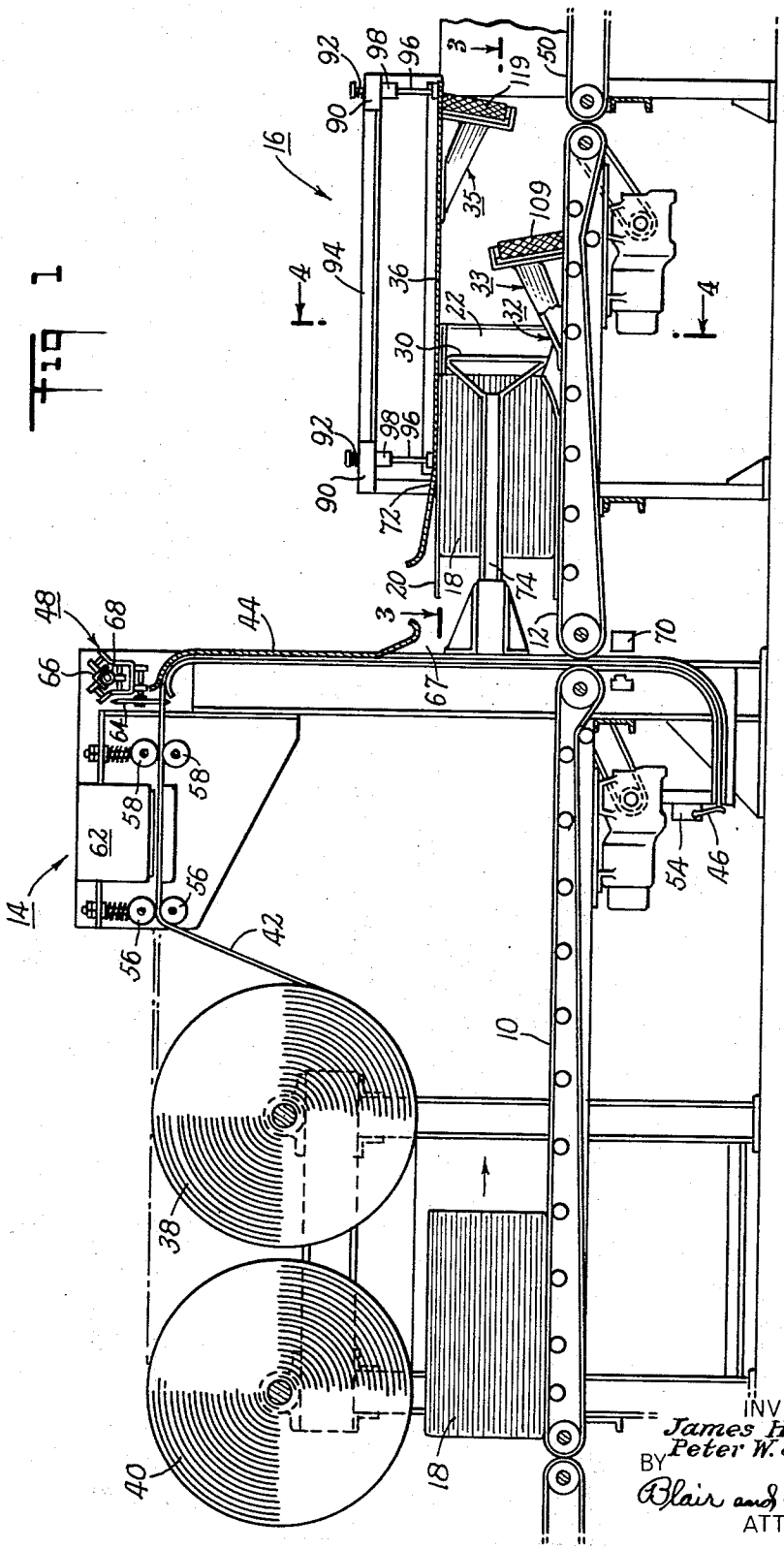
Aug. 29, 1967 J. HARRISON ETAL 3,338,025

WRAPPING APPARATUS FOR IRREGULAR BUNDLES

Filed Oct. 15, 1964 5 Sheets-Sheet 1

Fig 1



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Aug. 29, 1967 J. HARRISON ETAL 3,338,025

WRAPPING APPARATUS FOR IRREGULAR BUNDLES

Filed Oct. 15, 1964 5 Sheets-Sheet 2

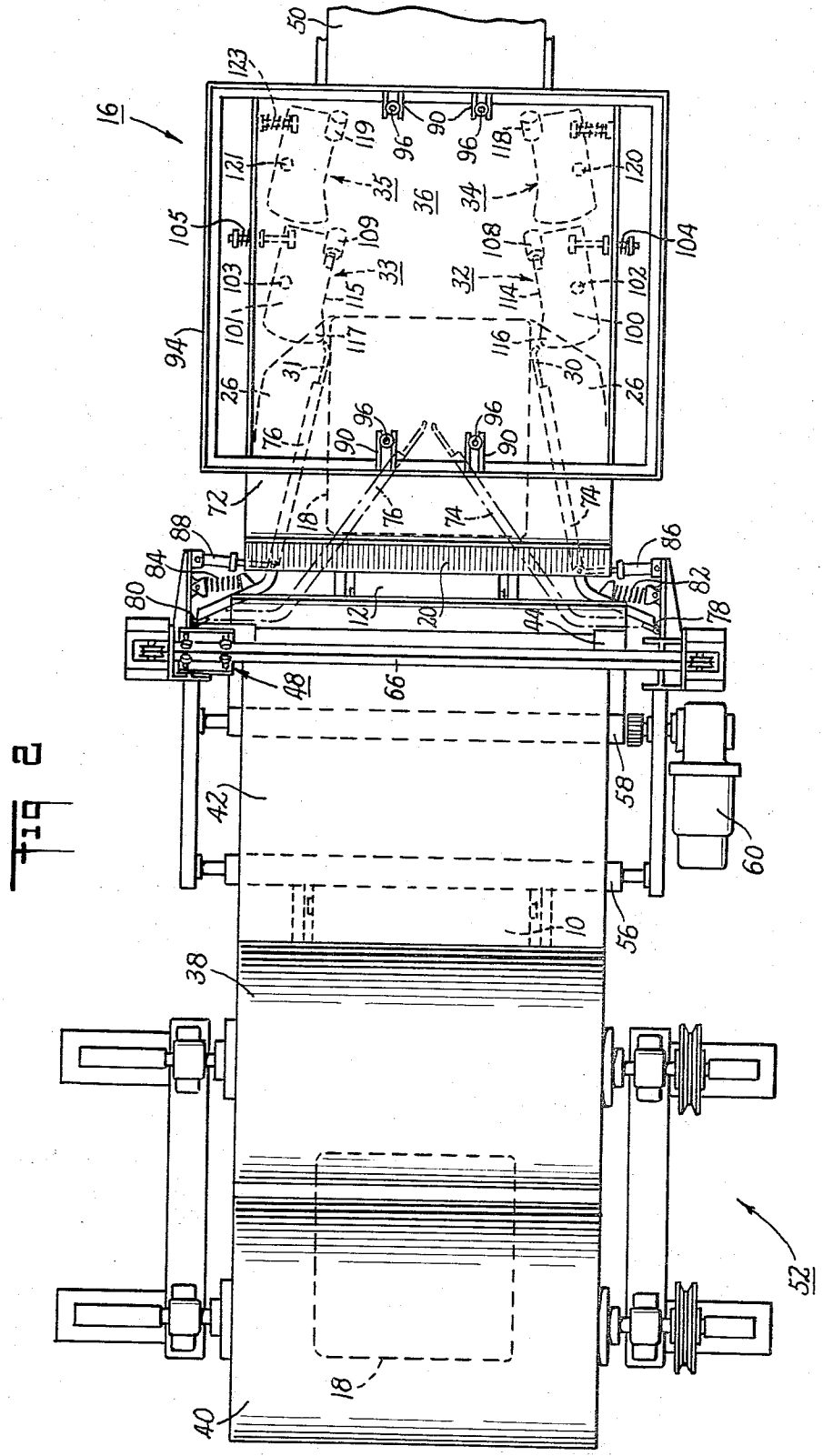


Fig 2

Aug. 29, 1967 J. HARRISON ET AL 3,338,025

WRAPPING APPARATUS FOR IRREGULAR BUNDLES

Filed Oct. 15, 1964 5 Sheets-Sheet 3

Fig 3

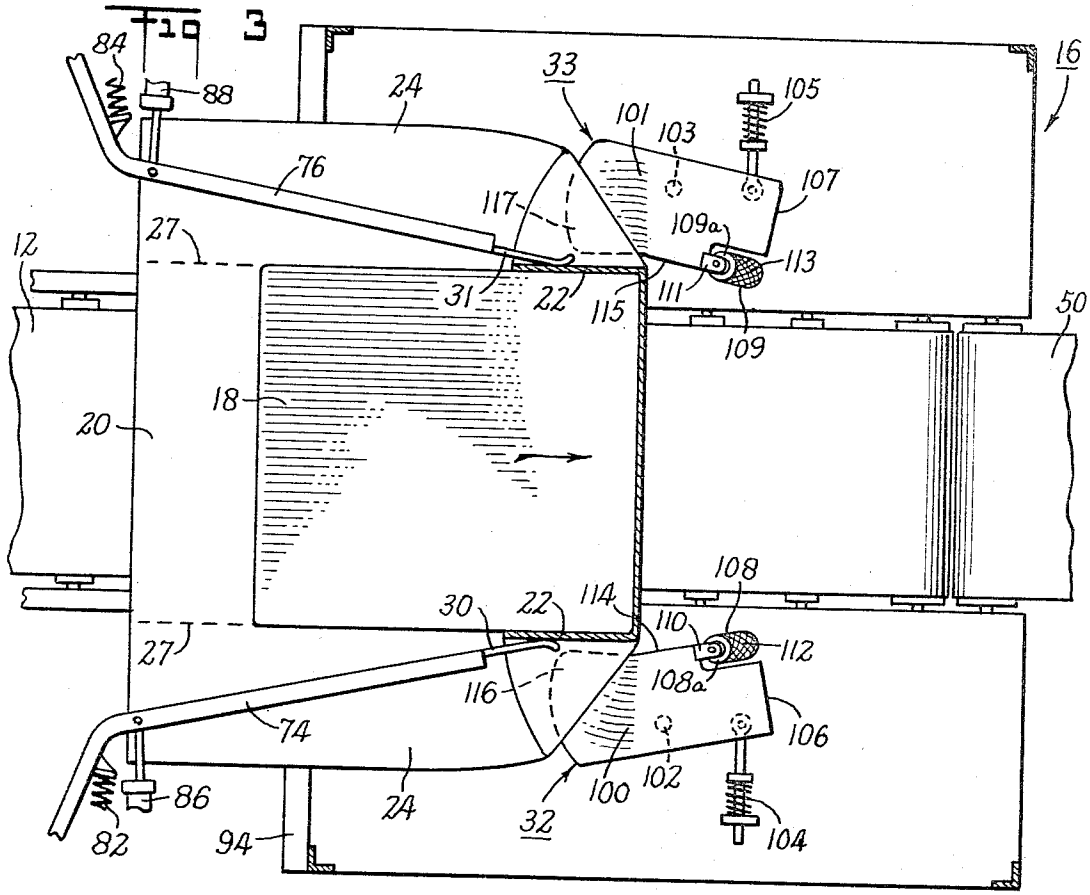
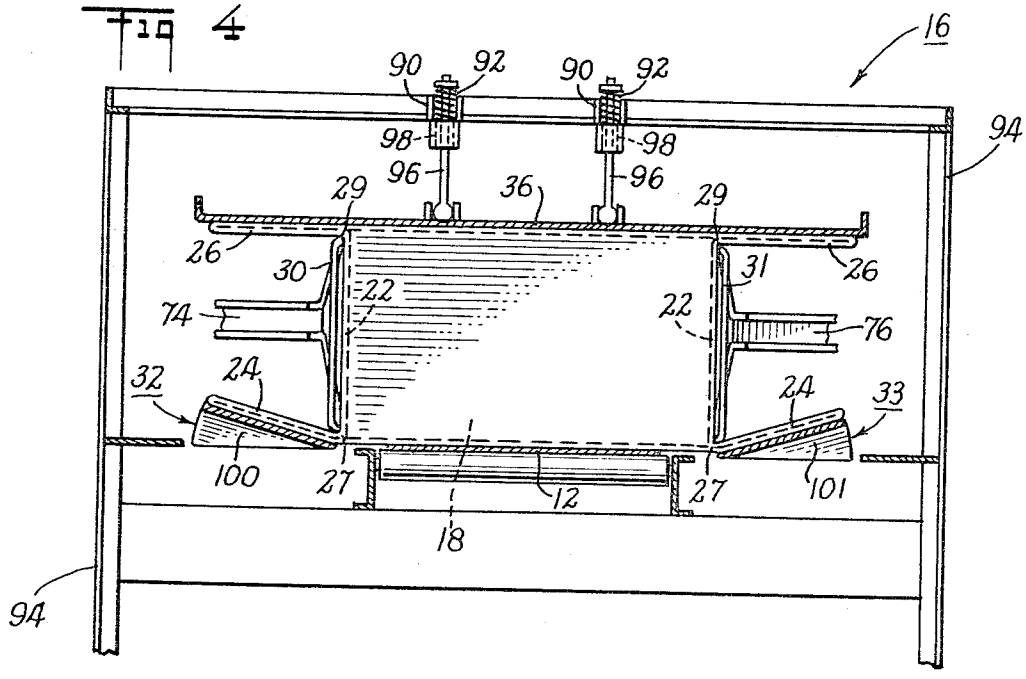


Fig 4



WRAPPING APPARATUS FOR IRREGULAR BUNDLES

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5 Sheets-Sheet 4

Fig 5

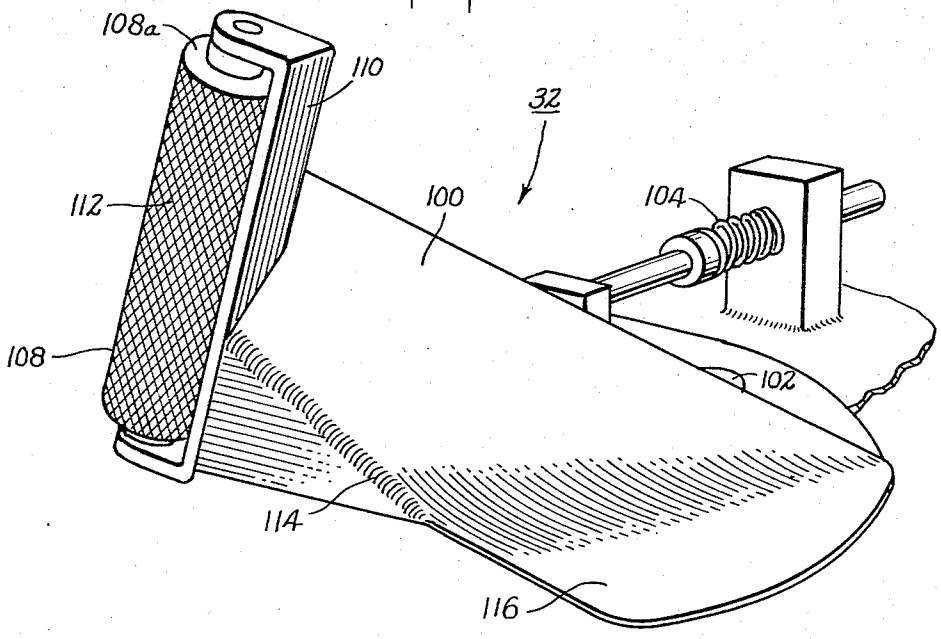


Fig 6

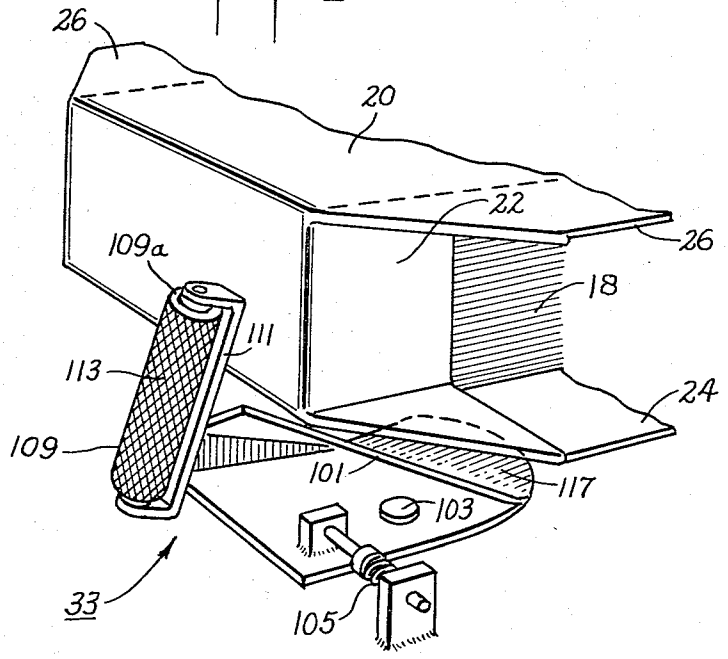


Fig 7A

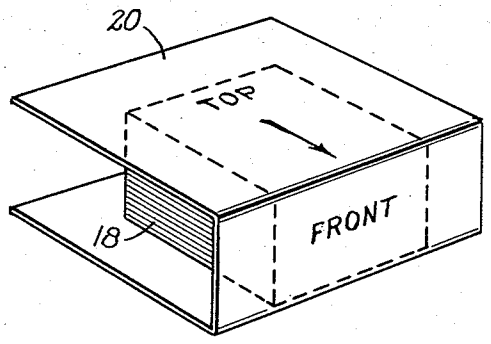


Fig 7B

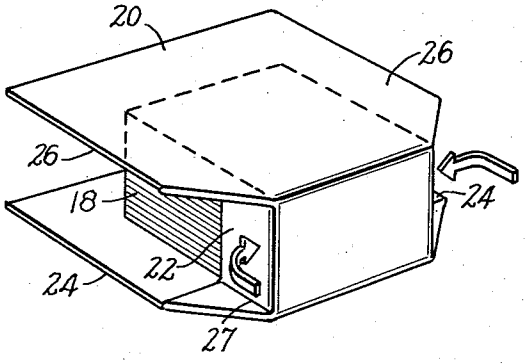


Fig 7C

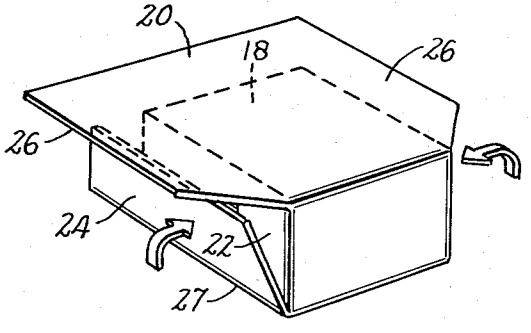
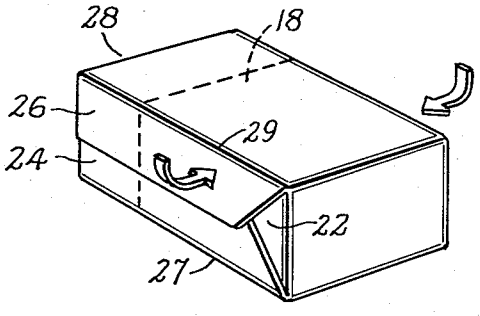


Fig 7D



United States Patent Office 3,338,025 Patented Aug. 29, 1967

3,338,025

WRAPPING APPARATUS FOR IRREGULAR BUNDLES

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Filed Oct. 15, 1964, Ser. No. 404,134
5 Claims. (Cl. 53—230)

ABSTRACT OF THE DISCLOSURE

The disclosed apparatus for wrapping irregular bundles includes a conveyor for moving the bundle through successive wrapping operations wherein rolled sheet material is cut to the proper length by a timed transverse cutter. With the cut sheet in a U-shape around the bundle the sheet is urged tightly over the top and around the bundle by a sled-like top plate which is suspended for freely conforming the bundle top. Spring urged side paddles pull the wrapper along the sides of the bundle to form upper and lower flaps. The lower flaps on each side of the bundle are then cammed upwardly by curved flap folders each having a knurled roller inclined in the direction opposite to the path of movement of the bundle to urge the bottom flaps upwardly about the bundle as the side flaps are folded up into position. Similar top flap folders with rollers inclined opposite to the bundle movement similarly fold and urge the top flaps downwardly about the bundle. The bundle is thus folded on five sides and may be bound by a wire or rope tying machine with the extending wrapper material on the sixth side being folded by hand or by subsequent apparatus.

This invention relates to apparatus for wrapping and more particularly to such apparatus which will tightly wrap bundles having rectangular proportions or having one or more sides slightly varying from rectangular.

This invention relates to improvements in the apparatus disclosed in copending application, Ser. No. 233,406 filed Oct. 26, 1962 now Patent No. 3,238,697 issued Mar. 8, 1966 and assigned to the assignee of the instant application.

There are a number of prior art wrapping machines for wrapping bundles, cartons or objects of varying sizes. Such prior art machines, however, have been designed to wrap a bundle or object having uniform shape with the bottom, top and sides of each succeeding bundle having the same regular rectangular sides. For certain bundles, however, the shape of the bundles may vary so that one or more sides of a bundle will be trapezoidal in shape. Thus the bundle may vary in height from front to back, or in width from side to side. Such bundles are difficult to wrap tightly in prior art automatic wrapping machines.

If the bundles are loosely wrapped the wrappings tend to tear much more readily when the bundles are handled. Loosely wrapped bundles are also more difficult to handle and stack.

Accordingly it is an object of the invention to provide apparatus for wrapping bundles.

Another object of the invention is to provide wrapping apparatus of the above character wherein wrapping operations may be continuously performed.

A further object of the invention is to provide wrapping apparatus of the above character wherein wrapping material is urged around the bundle as it is wrapped.

Another object of the invention is to provide apparatus of the above character for wrapping bundles which may be only approximately rectangular on one or more sides.

A further object of the invention is to provide wrapping apparatus of the above character which is more efficient in operation and relatively inexpensive to manufacture and maintain.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the apparatus embodying features of construction, combination of elements and arrangements of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

FIGURE 1 is a side view in partial section of a bundle wrapping apparatus made in accordance with the invention.

FIGURE 2 is a top view of the apparatus shown in FIGURE 1.

FIGURE 3 is an enlarged top sectional view taken along lines **3—3** of FIGURE 1 and looking in the direction of the arrows.

FIGURE 4 is an enlarged end sectional view taken along lines **4—4** of FIGURE 1 and looking in the direction of the arrows.

FIGURE 5 is an enlarged partial view of a side flap folder.

FIGURE 6 is a schematic perspective view of a side flap folder engaging a side flap on a partially wrapped bundle.

FIGURES 7*a–d* are schematic sequential views of a bundle in succeeding stages undergoing wrapping.

Like reference characters refer to like parts throughout the several views of the drawings.

Referring now to FIGURES 1 and 7*a–d*, it will be seen that the apparatus of the present invention comprises conveyor means **10**, **12** for moving a bundle **18** through the apparatus, a wrapper feed assembly **14** and a wrapping station **16** for wrapping a bundle on five sides as shown in FIGURES 7*a–d*.

As shown in FIGURES 1 and 7*a–d*, a bundle **18** is moved into a wrapping paper **20** by conveyors **10**, **12** to form the wrapper in a U-shape around the bundle as shown in FIGURE 7*a*. As the bundle and wrapper are moved through wrapping station **16**, first folds **22** are made along the sides of the bundle as shown in FIGURE 7*b*, leaving lower and upper flaps **24** and **26**, respectively. As shown in FIGURES 7*c* and *d*, the bottom flaps **24** are then folded upwardly and top flaps **26** are folded downwardly to enclose the bundle on five sides with the wrapper. The open end **28** is then closed either manually or by further apparatus (not shown).

Referring again to FIGURE 1, it will be seen that the first folds **22** are made at wrapping station **16** by spring urged paddles **30**, **31** on each side of the bundle as it moves on conveyor **12**. Lower flaps **24** are folded

upwardly by lower flap folders **32, 33** on either side of the bundle and upper flaps **26** are folded downwardly by upper flap folders **34, 35** in like manner. A top plate **36** is suspended over the folding station to apply a predetermined amount of pressure to the top of the wrapper for tightening the wrapper around the bundle during the folding operations. Thus the top plate **36**, first folding paddles **30, 31**, and flap folders **32, 33** and **34, 35** all coact to tighten the wrapper around the bundle as it moves through the wrapping station **16** of the apparatus.

In general, the operation of the wrapping machine is as follows. As shown in FIGURE 1, rolls **38, 40** supply a double paper wrapper **42** which is fed downwardly through wrapper guide **44**. The end of the wrapper actuates limit switch arm **46** to operate cutter assembly **48** to cut the wrapper at the desired length. Although the machine is shown applying a double wrapper, a single wrapper is fed, cut and folded in the same manner.

As the bundle **18** is moved on conveyor **10**, it is passed through an opening **67** in the wrapper guide **44** to pull the cut wrapper sheets from the guide as the bundle is transfered to conveyor **12**. Thus initially, the wrapper is disposed about the bundle in a U-shape from front to back as shown in FIGURE 7*a*.

The bundle and wrappers are then moved by conveyor **12** through the wrapping station **16** and the front of the U-wrapped bundle is engaged by first folding paddles **30, 31** as seen in FIGURES 3 and 4. The folding paddles **30, 31** are spring urged against the bundle to pull in the first folds **22** as seen in FIGURE 7*b*.

As shown in FIGURE 1, the top plate **36** has already engaged the top of the U-wrapped bundle at this point and tightens the wrappers around the bundle in its U-shaped configuration as the bundle and wrappers are moved under the top plate. Thus as the bundle is moved through wrapping station **16**, the top plate **36** and forming paddles **30, 31** all pull the wrapper more tightly around the bundle as it is moved by conveyor **12**.

With the bundle and wrapper in the configuration shown in FIGURE 7*b*, the lower flaps **24** are folded upwardly about the bundle, as shown in FIGURE 7*c*, by the camming action of flap folders **32, 33** (FIGURES 1 and 3). The top flaps **26** are then folded downwardly in like manner by the camming action of flap folders **34, 35** as the bundle continues to be moved by conveyor **12** to assume the configuration shown in FIGURE 7*d*. Durthe folding of flaps **24** and **26** the bundle is under the pressure of top plate **36** and the wrapper is being urged tightly around the bundle from front to back by friction of the top plate against the wrappers on the bundle top. The side flaps **24** and **26** are also urged tightly around the bundle as they are folded and held in a manner which will be described more fully hereinafter. After the bundle is wrapped as shown in FIGURE 7*d*, a conveyor **50** carries the bundle into tying apparatus (not shown) and then to further apparatus (not shown) for closing the open end **28**.

The invention will now be described in more detail. Referring to FIGURES 1 and 2, the wrapper feed assembly **14** supplies individual sheets of wrapper from one or more rolls of wrapper material, such as paper, cuts the wrapper to the desired length and positions the wrapper for engagement with a bundle. The wrapper rolls **38, 40** are driven by drive assembly **52** which is operated in synchronism with the conveyors **10, 12** and in response to switch **54** and photocell switch **70**. From the rolls **38, 40** the paper wrapper passes between roller pairs **56, 58** which may be driven by drive motor **60** in synchronism with the conveyors **10, 12** and also controlled by switches **54** and **70**. Between the roller pairs **56, 58** is a printing device **62** for printing identification or shipping data on the bundle wrap.

A wrapper cutter assembly **48** comprises a rotatable cutter wheel **64** which is driven transversely across the wrapper to cut it to desired length in response to actuation

of switch **54**. Cutter wheel **64** is slidable along a track **66** by a pneumatic cylinder **68** and cuts the wrapper or wrappers when moving in either transverse direction.

The operation of the paper feed assembly is thus as follows. With the wrapper guide **44** empty and cutter wheel **54** at one end of track **66**, the roll drive assembly **52** and roller pair drive motor **60** are energized by photocell switch **70** to move one or more sheets of wrapper through the wrapper guide **44** until the switch arm **46** of switch **54** is actuated. At this time the drive assembly **52** and drive motor **60** are deenergized and the wrapper cutting assembly is actuated. Cutter **64** is rapidly moved transversely of the wrapper to cut a wrapper piece to the proper length. The cut piece of wrapping paper is then removed from the wrapper guide **44** by a bundle **18** through opening **67** in the guide **44**. As the cut wrapper is removed from the guide, the reinsertion of a wrapper sheet from rolls **38, 40** is instituted by actuation of drive assembly **52** and drive motor **60** by release of switch arm **46** of switch **54** and by photocell switch **70**.

As shown in FIGURE 1, the bundle **18** moving from left to right has moved through opening **67** of the wrapper feed assembly and is now surrounded on three sides, top, front and bottom, by a wrapper in a U-shaped configuration. As shown in FIGURE 1, the wrapper engages the front portion **72** of top plate **36** and the first folding paddles **30, 31** at about the same time as the bundle is being moved from left to right on conveyor **12**. Folding paddles **30, 31** are supported by arms **74, 76** pivoted at **78, 80**, respectively. Springs **82, 84** and shock absorbers **86, 88**, respectively, provide pressure on paddles **30, 31** to fold the wrapper tightly about the bundle to make the first fold as shown in FIGURE 7*b*.

As shown in FIGURE 4, the first fold paddles **30** and **31** are approximately the same height as that of the bundle to be wrapped. Thus, as the bundle carrying the U-shaped wrapper passes through the first forming paddles **30, 31** and under top plate **36**, the creases **27, 29** will be adjacent the bundle edges to define lower flaps **24** and upper flaps **26**. As shown in FIGURE 4, the lower flap folders **32, 33** are just beginning to fold lower flaps **24** upwardly about the bundle.

As shown in FIGURES 1 and 2, the top plate **36** is suspended from four points **90**, with springs **92** resiliently supporting the top plate from frame work **94** by rods **96** passing through enlarged openings **98** in framework **94** (FIGURE 2). It is important that the openings **98** be sufficiently large to permit universal vertical movement of the top plate **36** as the bundle moves thereunder, without binding of rods **96**. This is particularly important if the bundles to be wrapped are of uneven height from front to back or from side to side, or if both such irregularities should be present in the bundle. In the event of such an irregular bundle, the top plate **36** will conform to the position of the bundle top surface to urge the paper tightly over the bundle top and up across the bundle front. Conformation of the top plate to the bundle top also positions the upper flap folders **34, 35** as will be more fully explained hereinafter. The top plate **36** thus rides on the wrapper with some friction which tugs the wrapper around the bundle and conforms the wrapper to the plane of the bundle top.

As the bundle proceeds from left to right, as shown in FIGURES 1 and 2, lower flap folders **32, 33** are next encountered to upwardly fold flaps **24** as shown in FIGURE 7*c*.

As best seen in FIGURES 1, 3, 5 and 6, flap folders **32, 33** have upswept plow-shaped plates **100, 101**, respectively, which are pivoted at **102** and **103**, respectively. Spring assemblies **104, 105** urge the end **106, 107** of the flap folders into engagement with the bundle and wrapper as the bundle is moved past the folder. Each flap folder is provided with a roller **108, 109** journalled from supports **110, 111** so that the knurled surface **112, 113** of the roller protrudes toward the bundle beyond the edges **114, 115**

for engagement with the lower flaps **24** after the flap is initially turned upwardly by a front portion **116, 117** of the folder as shown in FIGURE 6. The flaps **24** are also pulled upwardly around the bundle by the urging of rollers **108, 109** since the roller tops **108***a*, **109***a* are inclined 10 to 15 degrees from the vertical in a direction opposite to the movement of bundle **18** as it passes through the wrapping station. Due to this roller inclination and the fact that the rollers protrude from edges **114, 115**, the rollers ride on the side flaps **24** after initial creasing by front portions **116, 117**, to urge the flaps upwardly and pull them tightly around the bundle. The knurled surfaces **112, 113** provide gripping as the flaps **24** are urged upwardly around the bundle. The rollers also greatly reduce friction on the flaps **24** and reduce the pushing of flap **24** backwardly, which would tend to open the flap and result in a loosely wrapped bundle.

As shown in FIGURES 1 and 2, upper flap folders **34, 35** having rollers **118, 119** operate in the same manner on the top flap **26** (FIGURES 7*c, d*) and are encountered after the folding of lower flaps **24** has begun. The rollers **118, 119** of the upper flap folders are both inclined 10 to 15 degrees from the vertical with the lower end of the roller inclined toward the approaching bundle. Thus the inclination of rollers **118, 119** urges flaps **26** downwardly around the bundle in the same manner that the rollers **108, 109** urge lower flaps **24** upwardly around the bundle as the respective flaps are folded.

Flap folders **34, 35** are mounted on the underside of top plate **36** at pivots **120, 121** and are urged by spring assemblies **122, 123** into engagement with the upper bundle flap. Thus the upper flap folders **34, 35** ride with the top plate **36**, and if the bundle varies in height from front to back, these folders **34, 35** will conform to the bundle irregularity and fold the wrapper along the upper bundle edges while urging the wrapper flaps downaround each side of the bundle. Even if the bundle varies in height from side to side the suspended top plate **36** will conform to the upper surface of the bundle, carrying the upper flap folders with it so that the upper flap crease on the low side will conform to the bundle edge.

After leaving upper flap folders **34, 35**, the bundle is wrapped as shown in FIGURE 7*d* and is then moved on conveyor **50** (FIG. 1) to a wire tying machine (not shown) which ties flaps **24, 26** in place. The open end **28** is then closed and sealed either manually or by further automatic wrapping apparatus (not shown).

The machine is particularly adapted to handling large and bulky bundles, such as bundles of paper pulp. Such bundles of pulp may weigh, for example, 300 to 500 pounds and are composed of stacks of pulp sheets. Since the dimensions of the pulp sheets are not closely maintained, the bundles vary in height or width from bundle to bundle or from end to end or side to side of the same bundle. Because of the urging of the wrapper more tightly around the bundle by the top plate **36**, paddles **30, 31** and by the upper and lower flap folders **32, 33, 34, 35** machine of my invention will wrap such bundles having one or more irregularly shaped sides, as well as wrapping regular and uniformly shaped bundles.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in carrying out the above method and in the construction set forth without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention which, as a matter of language, might be said to fall therebetween.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. Wrapping apparatus for folding a wrapper sheet about a bundle at a wrapping station, comprising, in combination:

(A) conveyor means for moving a bundle through a wrapping station;

(B) a wrapper guide positioned adjacent the wrapping station,

(1) and having means forming an opening for permitting a bundle to be conveyed therethrough;

(C) wrapper feed means for intermittently advancing wrapper sheet material through said wrapper guide;

(D) a wrapper cutter positioned adjacent said wrapper guide comprising,

(1) a cutter member mounted for movement across a wrapper in said wrapper guide, and

(2) timed means for moving said cutter member to cut said wrapper to the proper length;

(E) a top plate suspended at the wrapping station,

(1) said top plate being universally vertically movable by a bundle passing thereunder;

(F) first fold paddles urged against each side of the bundle as it passes into the wrapping station;

(G) a lower side flap folder on each side of the bundle at the wrapping station,

(1) said lower flap folders being resiliently urged into engagement with lower flaps on each side of the bundle formed after engagement with said first fold paddles,

(2) means on said lower flap folders for continually urging the lower flaps of the bundle upwardly about the bundle during engagement therewith;

(H) an upper side flap holder mounted on said top plate on each side of the bundle at the wrapping station,

(1) said upper flap folders being resiliently urged into engagement with the upper flaps on each side of the bundle formed after engagement with said first fold paddles,

(2) and means on said upper flap folders for continually urging the upper flaps of the bundle downwardly around the bundle during engagement therewith.

2. The wrapping apparatus defined in claim **1** wherein said top plate has a lower bundle-contacting surface extending over the bundle during successive engagement with said first folding paddles and during engagement with said lower and upper side flap folders.

3. In wrapping apparatus for folding a wrapper sheet about a bundle at a wrapping station, the combination of:

(A) conveyor means for moving a bundle through a wrapping station;

(B) wrapper positioning means for initially placing a wrapper around a bundle in a U-shaped position;

(C) a top plate suspended at the wrapping station,

(1) said top plate being universally vertically movable by a bundle passing thereunder;

(D) first fold paddles urged against each side of the bundle as it passes into the wrapping station;

(E) a lower side flap folder on each side of the bundle at the wrapping station,

(1) said lower flap folders being resiliently urged into engagement with lower flaps on each side of the bundle formed after engagement with said first fold paddles,

(2) means on said lower flap folders for continually urging the lower flaps of the bundle upwardly about the bundle during engagement therewith;

(F) an upper flap folder mounted on said top plate on each side of the bundle at the wrapping station,

(1) said upper flap folders being resiliently urged into engagement with the upper flaps on each

side of the bundle formed after engagement with said first fold paddles,

(2) and means on said upper flap folders for continually urging the upper flaps of the bundle downwardly around the bundle during engagement therewith.

4. The combination defined in claim 3 wherein the means on said lower and upper side flap folders for urging the side flaps about the bundle comprises:

(G) a rotatable roller,

(1) positioned to bear against a side flap after an initial fold is made,

(2) said roller being inclined in a plane parallel to the path of bundle movement,

(a) with the roller end toward the bundle center inclined in the direction opposite to the bundle movement.

5. The combination defined in claim 4 wherein said rollers are provided with a gripping surface for urging the bundle side flaps around the bundle as the bundle moves in contact with the inclined rollers.

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