# United States Patent

**Zimmermann**

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[54] **METHOD AND APPARATUS FOR PACKING VERTICALLY STACKED COINS, STAMPS AND OTHER STACKED ARTICLES IN A SHRINKING FILM**


[72] Inventor: **Gert Zimmermann,** Berlin, Germany

[73] Assignee: **Firma F. Zimmermann & Co.,** Berlin, Germany



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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **53/30,** 53/33, 53/184, 53/212

[51] **Int. Cl.** ..... **B65b 11/02**

[58] **Field of Search** ..... 53/30, 33, 184, 212



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*Primary Examiner*—Travis S. McGehee

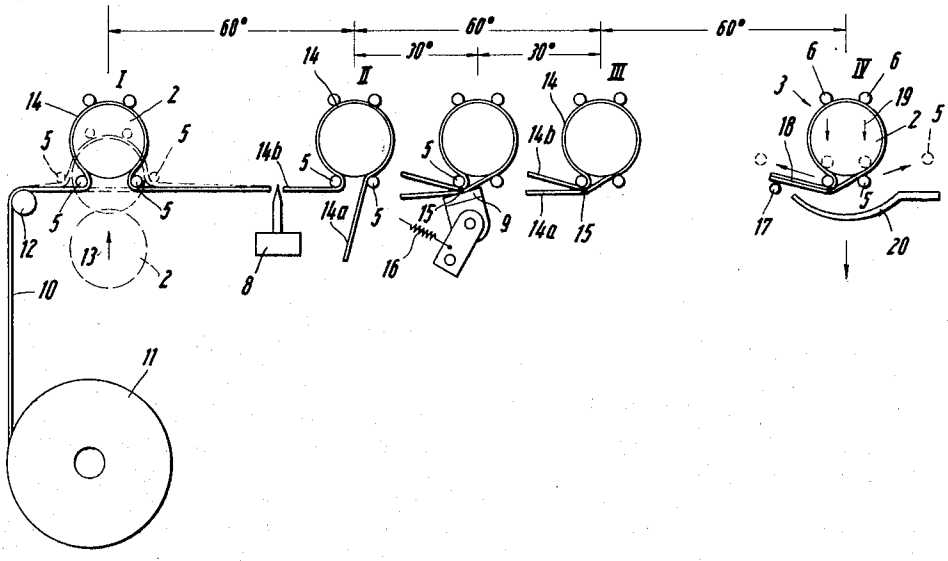
*Attorney*—McGlew & Tuttle



[57] **ABSTRACT**

The film is fed from the roll longitudinally in a direction transverse to the stack length, and the stack is pushed into the film to form a relatively large film loop corresponding to the lateral peripheral dimension of the stack, with the stack being clamped in the film loop with the free loop ends overlapped in superposition with each other and extending substantially tangentially of the loop. The free ends are formed by severing the loop from the continuous length of film after wrapping of the stack in the film. The free ends may be sealed to each other. The wrapped stack is then turned into a substantially horizontal orientation with the free loop ends down, and the film loop is shrunk around the stack while maintaining such substantially horizontal orientation of the wrapped stack. The wrapped stack is fed to a heating furnace, for shrinking of the film, by a conveyor which is inclined laterally of its direction of movement, and pivoted angle levers are provided to push against the lower ends of the stacks to align the articles in the stack in superposition with each other.


**19 Claims, 12 Drawing Figures**



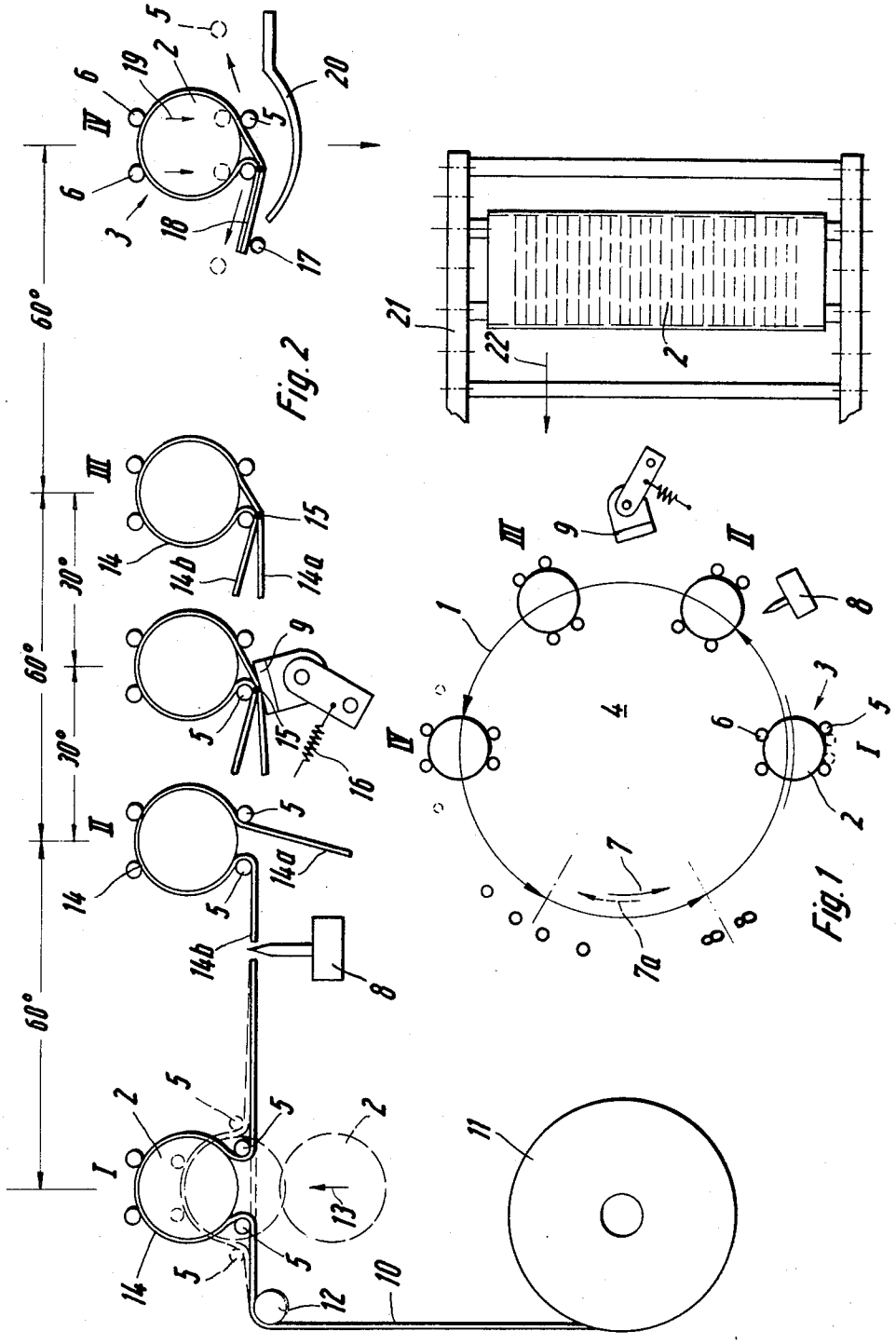
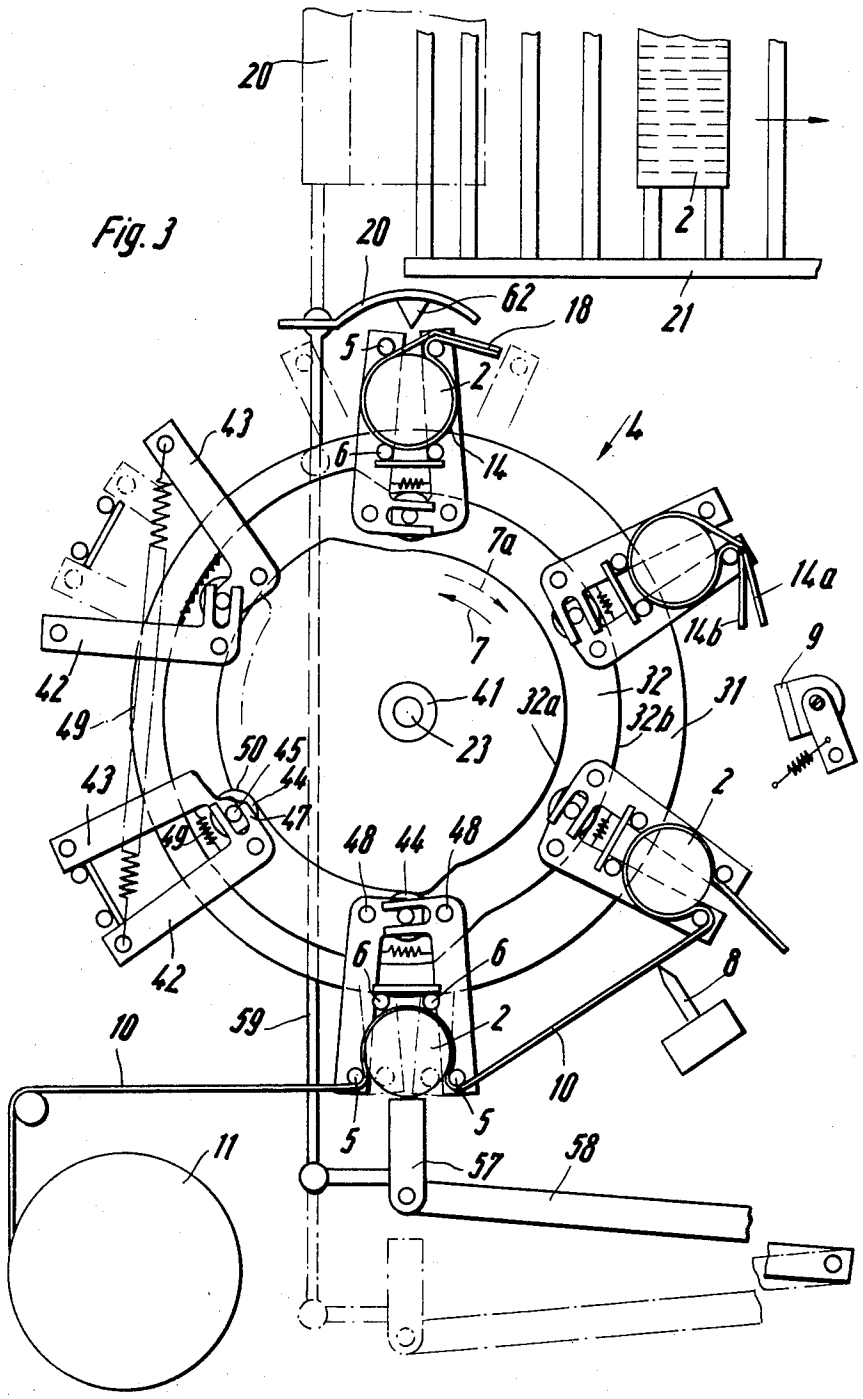



Fig. 2

Fig. 1

Inventor:
GERT ZIMMERMANN
BY: John O. McLew
ATTORNEY

Fig. 3




Inventor:
GERT ZIMMERMANN
BY: John J. McGlew
ATTORNEY

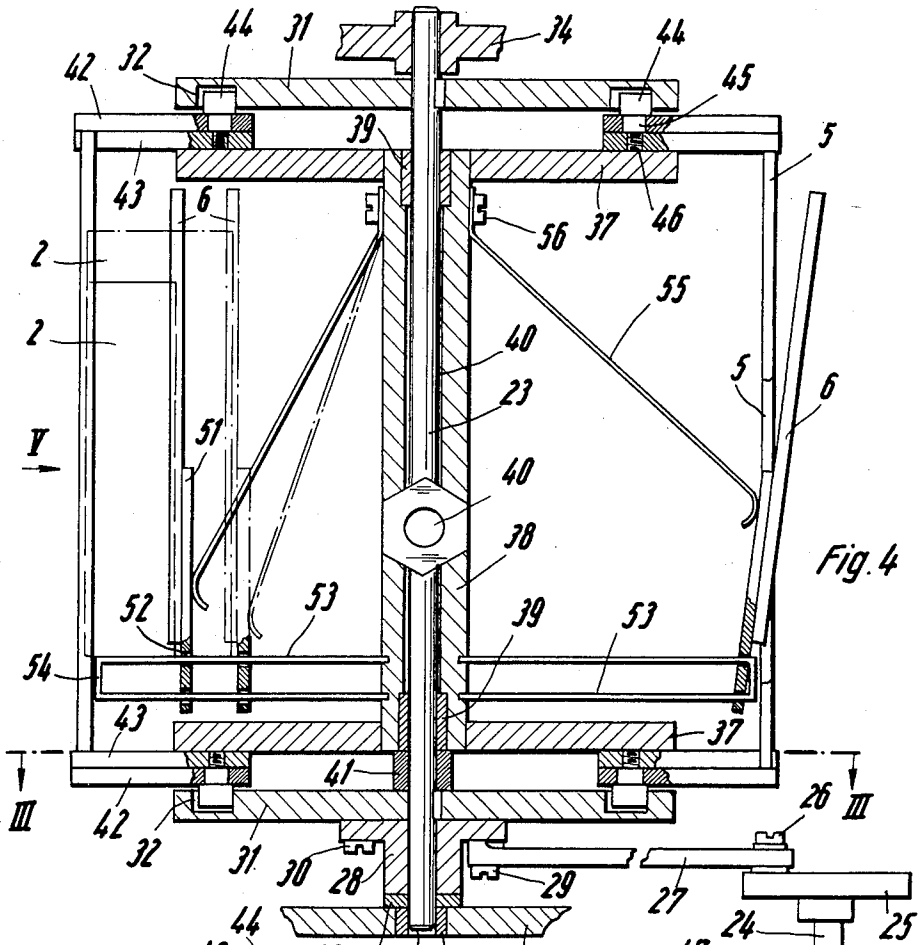



Fig. 4

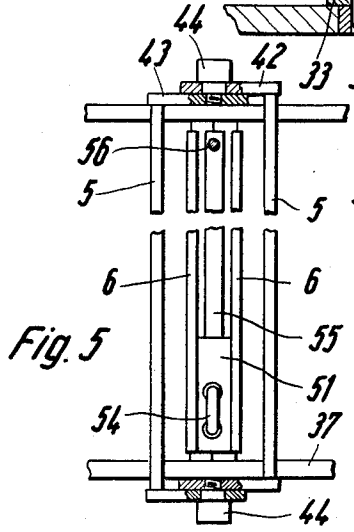



Fig. 5

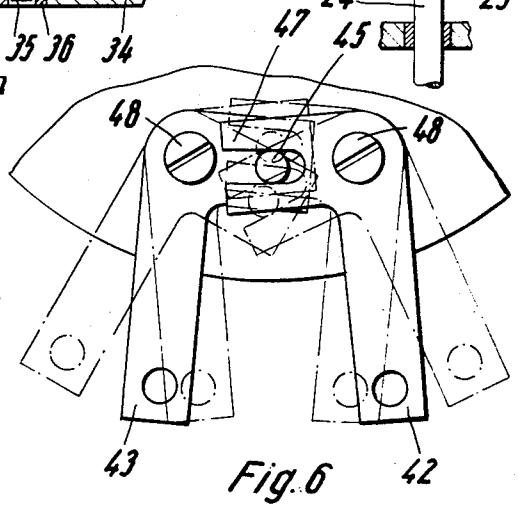



Fig. 6

Inventor:
GERT ZIMMERMANN
BY: John J. McGlew
ATTORNEY

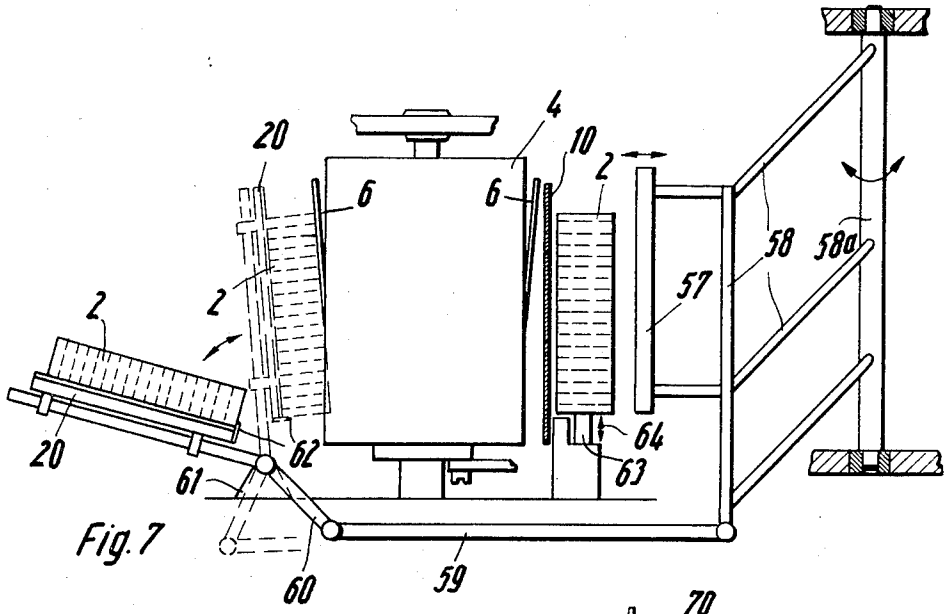
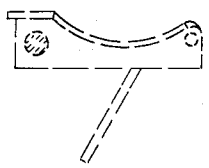



Fig. 7



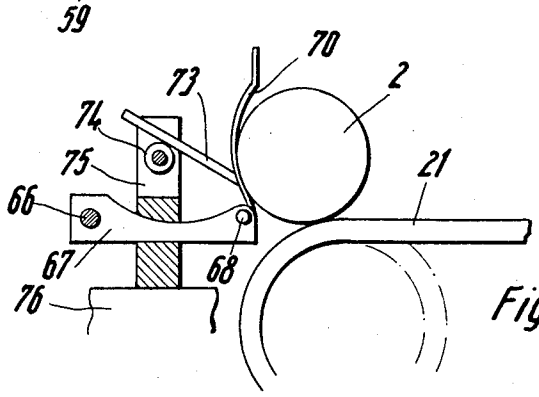



Fig. 9

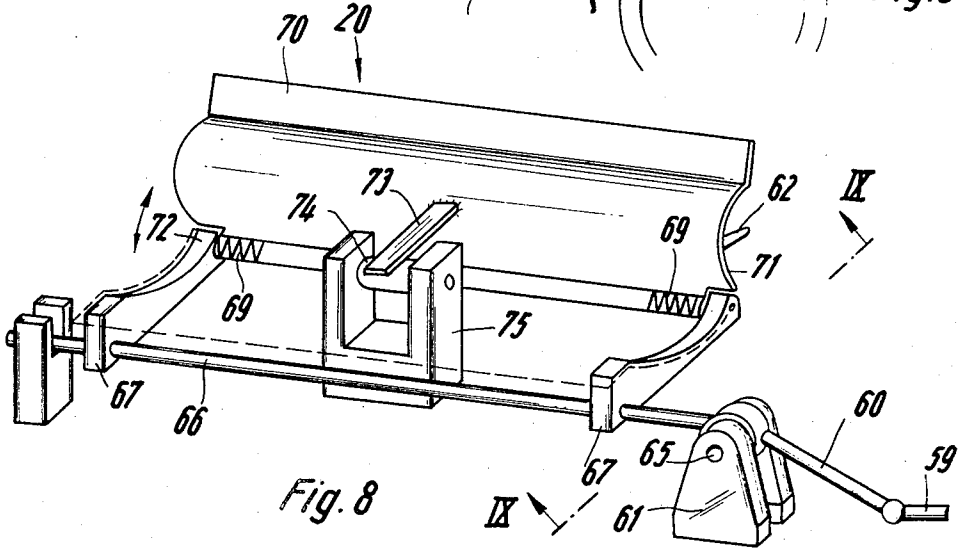



Fig. 8

Inventor:
GERT ZIMMERMANN
BY: John J. McGlew
ATTORNEY

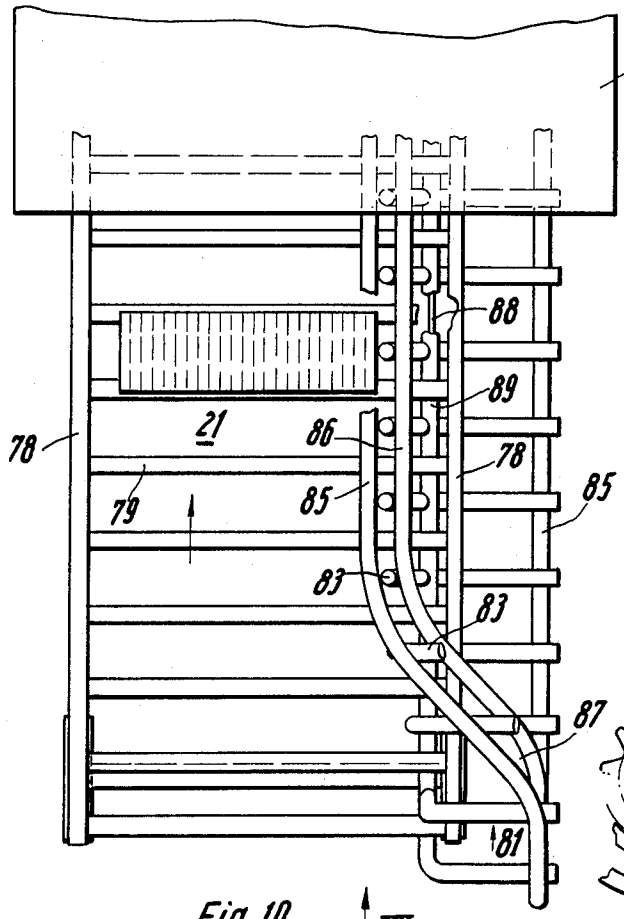



Fig. 10

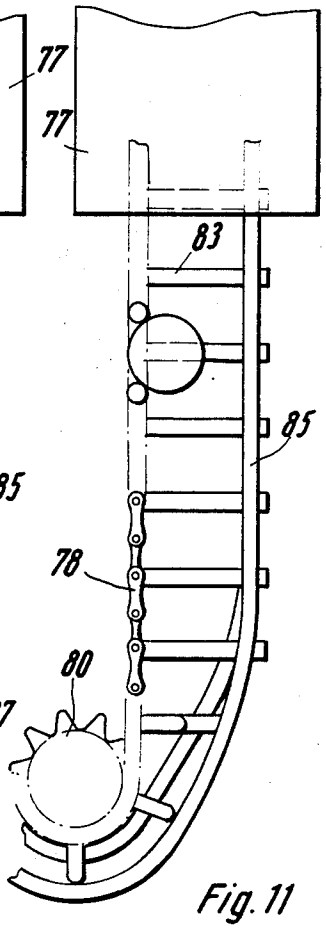



Fig. 11

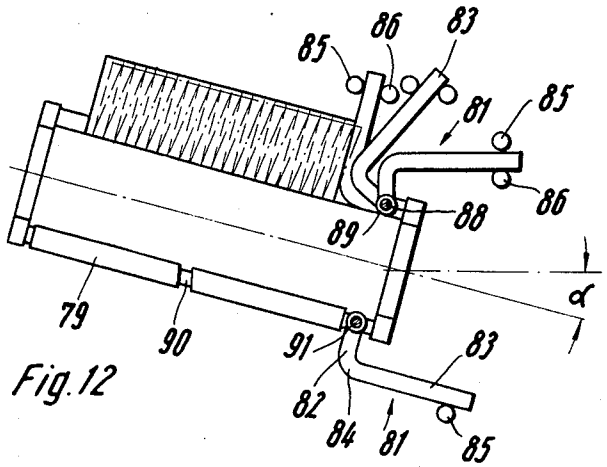



Fig. 12

Inventor:
GERT ZIMMERMANN
BY: John J. McGlew
ATTORNEY

# METHOD AND APPARATUS FOR PACKING VERTICALLY STACKED COINS, STAMPS AND OTHER STACKED ARTICLES IN A SHRINKING FILM

## BACKGROUND OF THE INVENTION

A shrinking film, used in wrapping stacked articles, has the characteristic that, by suitable treatment, it shrinks around the stack on which it has been initially loosely wrapped, with projecting parts of the film folding around the corners of the stack. The shrinking generally is effected by heating the film and, for this purpose, the film-wrapped stack is placed in a heating furnace. Such wrapping of a coin stack in a shrinking film with subsequent shrinking of the film around the stack by heating is known. Known coin packing apparatus uses, for this purpose, a tube of shrinking film whose end is flat-pressed and sealed. Such a tube, which is closed at one end, receives a predetermined number of coins, after which the open end of the tube is likewise pressed flat and welded above the coins.

In packing coins, it is also known to use a film bag which is already closed on one edge and which is welded closed on the other edge, or to enclose the coins in a cushion-like envelope and to deposit the coin rolls on endless conveyor belts and to feed them to a shrinking furnace. The above-mentioned envelopes have the effect that the coins are not always properly aligned, so that bulges can form on the bag, on the tube, or on the cushion when the film material is shrunk.

A known apparatus for aligning coins enclosed in an envelope utilizes an electromagnetically operated stop arm which intermittently and pulsatingly impacts the coin roll in the sealed bag when it passes by the arm. However, this apparatus must be arranged close to the inlet of the shrinking furnace, so that the coins have no further opportunity to assume a wrong position. The single pulsating impact, however, is generally not sufficient to maintain the coins aligned in their envelope until the film is shrunk.

Another known apparatus, and one on which the present invention is based, uses a film band or sheet which is wrapped around the stack. The wrapping is effected between three synchronously driven rollers between which the coins are stacked vertically, the coin stack turning between the rollers and being wrapped with the film. This apparatus requires, however, that the film adheres firmly on the lateral periphery of the stack. For this reason, the surface of the film facing the coin stack has been wetted with parafin oil, and shrinking is effected by a heater arranged between the rollers and during constant rotation of the wrapped coin roll. Since shrinking is effected while the coins are inside the wrapping device, the method is extremely slow. Another disadvantage is that the film must be wetted with oil in advance of each wrapping operation.

Still a further drawback of this known apparatus is that it is not easy to switch from one type or size of coin to another, and different coin diameters necessitate very considerable changes in the apparatus.

## SUMMARY OF THE INVENTION

This invention relates to the wrapping of vertically stacked coins, stamps and similar articles in shrinking film and, more particularly, to a novel, improved and simplified method and apparatus for effecting such wrapping.



The objective of the present invention is to provide a new method of wrapping which avoids rotating the coin stack or the like during wrapping, avoids the welding of bags and the like, and permits the production of a uniform packing of stacks of coins or the like even when they have different diameters and directly from the film and with the same and unchanged apparatus. This, in turn, ensures a high yield of exactly aligned stacks.

With respect to the method aspects of the invention, the stack is pushed into the film in a direction transverse to the latter and clamped in the film, a large film loop corresponding to the diameter or the lateral perimeter dimension of the stack is formed, the free loop ends are folded over substantially coextensively in superposed relation to extend tangentially to the film loop, and the wrapped stack is turned into a substantially horizontal position, with the loop tuck down, in which position the film loop is shrunk around the stack.

A characteristic feature of the invention is that the formation of the loop is effected automatically when the stack is pushed into the film, and the loop adopts itself to any diameter of the coin stack or any other stack to be wrapped, since the film is pulled around the lateral peripheral surfaces of the stack and is held tight.

If the film band used is wider than the length of the stack to be wrapped, the film band is drawn along step-by-step to form new loops after each preceding formed loop has been severed from the film band, and the length of the film band to be drawn each time is determined automatically by the lateral peripheral dimensions of the stack, such as the circumference of the stack. To close the loop, the free loop ends are folded over and superposed to form a loop tuck which is practically independent of the diameter of the stack and which is of a sufficient length. The packing or wrapping can also be effected, according to the same principle, using a film sheet which can be of standard size for different stack diameters.

The film loop embraces the stack tightly as long as clamping is maintained. The wrapping of film hardly loosens, since the stack is turned into a substantially horizontal position or orientation with the tuck down. Preferably, the loop ends are maintained closed by the weight of the stack until the film is shrunk, so that the tuck thus can hardly open during transfer of the wrapped stack to the shrinking furnace. Nevertheless, it may be of advantage to exert a pushing force against the lower end of a slightly inclined stack during movement of the stack in a substantially horizontal orientation toward the shrinking furnace, this pushing force being exerted longitudinally of the stack. In this simple manner, the coins and the like can be aligned inside the film loop and be moved closer to each other to form a compact stack in which the coins or the like are held in proper alignment until the film has been shrunk.

The loop ends also can be sealed before the stack is turned into the substantially horizontal orientation, with the sealing of the loop tuck being effected in addition. This is particularly advisable for long stacks, and assures additional security against accidental opening of the loop. With the present method, it is possible to

produce uniform wrappings of aligned coin stacks, or other stacks, in large numbers at independent of the diameter of the stacks.

The apparatus for performing the method of the invention is based on an apparatus having a stacking device whose stacking axis is arranged vertically, a holding device for the stack to be wrapped, a feeding device and a severing device for the film. In accordance with the invention, several vertically oriented stacking cages, which can be cam operated between open and closed positions, are arranged on a circular track at equal angular spacings from each other and at equal radial spacings from a central drive shaft. The stacking cages form, with the central drive shaft, a rotor which can be stepped angularly between holding positions of the stacking cages, by a suitable drive, to move each stacking cage from a loading station to an unloading station. The stacking device is arranged outside the circular path of movement of the stacking cages and in a holding position of one of the stacking cages. The film is guided between the stacking device and the stacking cage, and a stack pusher is provided to push the stack from the stacking device into the open stacking cage, entraining the film.

Preferably, each stacking cage has two vertically extending front holding bars which can be swung apart against spring pressure in correspondence with the diameter of a stack, and has, in the rear, substantially vertically extending ejector bars. Each stacking cage has, on its bottom, radial guide bars on which the ejector bars can be moved, parallel to each other, against the restoring force which corresponds to the diameter of the stack, the ejector bars being tiltable outwardly on the radial guide bars. The holding bars can be secured between upper and lower pairs of shear members pivotally interconnected for pivoting about axes extending parallel to the rotor axis, these shear members being urged into closed position by suitable elastic means, such as tension or compression springs. Two identical and in-phase cams are arranged at the top and the bottom, respectively, on the rotor, and two rollers, for each pair of shear members, are engaged with the cams to control the shear members.

The ejector bars preferably are secured, at their base, on a carrier plate which is biased by a leaf spring and which has two superposed bores spaced apart a distance equal to the spacing of the guide bars and whose inside diameter is greater than the outside diameter of the guide bars. The latter are U-shaped and extend parallel to each other, and the guide bars are interconnected by a web extending substantially in the plane of the associated holding bars.

The springs engaged between the shear members of each pair permit pushing stacks of different diameters into each stacking cage. However, the shear member closing forces are provided by the cams, which positively close the stacking cages after the latter have been opened in the loading station, and at the start of the succeeding step. The cams reopen the cages positively only at the unloading station, while permitting, at the loading station, a pivotal swinging apart of the holding bars in correspondence with the diameter of the stack to be pushed into the respective stacking cage.

In accordance with further features of the invention, the stacking cages are diametrically opposite each other on the rotor, when in the loading station and in the unloading station, a severing device is arranged between the loading station and a following severing station, further away from the loading station than from the severing station, and a spring biased pivotal sealing bar is arranged at a half-step distance beyond the severing station and in the contact range of the stacking cages, this sealing bar serving as an abutment for sealing of the free loop ends during their passage from the severing station. The formation of the film loop around the stack thus is effected during passage of each stacking cage through the distance of one-half a revolution of the rotor, after which the empty stacking stages are supplied again to the loading station. With a total of six stacking cages, the stepping interval is 60° and, with each such step of the rotor, a stack tucked into a film loop is ejected, turned from the vertical orientation into a substantially horizontal orientation, and fed to a conveyor belt.

In accordance with the invention, such turning of the wrapped stack into the horizontal orientation is effected by a rocker arranged in the unloading station outside the rotor, and this rocker can be turned about a horizontal axis from a vertical orientation into a horizontal orientation and vice versa. The rocker is mechanically connected by a guide rod with a stack pusher, and carries a stack trough which can be tilted about a longitudinal axis and against a spring bias. A stationary stop is provided on the trough beneath the latter in the substantially horizontal position of the rocker, and this stop engages the stack trough and tilts the latter during its descending movement, transferring the stack, received by the trough, together with its film loop to the conveyor belt which feeds the stack, in a substantially horizontal orientation, to the heating furnace.

To provide for any necessary subsequent alignment of the stacked articles within the film wrapper, in accordance with the invention, the conveyor belt is inclined transversely of its direction of movement. The conveyor belt, which comprises longitudinally spaced rollers receiving and supporting wrapped stacks therebetween, is provided with stop angle members each having a shorter arm pivoted between a respective pair of adjacent rollers, these stop angle members extending along the entire length of the conveyor belt and each having a longer arm extending between guide bars of a curved track. The curved track is arranged only on the upper side of the endless conveyor belt, which latter passes through the heating furnace, and raises the stop angle members from an initially horizontal position into a vertical position to align the coins, or similar articles, within the film wrapping by pushing the coins or other articles closer together. The alignment of the coin stack is not effected by a brief impact, as in the prior art, but rather by a pushing action. In combination with the slightly inclined orientation of the conveyor belt transversely of its direction of movement, the raised longer arms of the stop angles effect a perfect alignment of the stacked articles, such as coins, and this alignment is maintained during passage of the wrapped stacks through the heating furnace.

An object of the invention is to provide an improved method for wrapping vertically stacked articles, such as coins and the like, in a shrinking film.

Another object of the invention is to provide improved apparatus for performing the method.

A further object of the invention is to provide such a method and apparatus which avoids rotation of the stack during wrapping of a shrinking film therearound.

Another object of the invention is to provide such a method and apparatus which permits the production of uniform wrapping of stacks of different diameters directly with the shrinking film and without any change in the apparatus.

A further object of the invention is to provide such a method and apparatus which assures a high yield of exactly aligned stacks wrapped in shrinking film.

For an understanding of the principles of the invention, reference is made to the following description of typical embodiments thereof as illustrated in the accompanying drawing.

## BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a diagrammatic illustration of the course of travel of the stacks during wrapping with a shrinking film;

FIG. 2 is a diagrammatic illustration of the course of movement of the stacks between the loading station and the unloading station;

FIG. 3 is a horizontal sectional view of the wrapping apparatus taken along the line III—III of FIG. 4;

FIG. 4 is a radial and diametric sectional view of the apparatus shown in FIG. 3;

FIG. 5 is an outside elevation view, looking in the direction of the arrow V, of the rotor shown in FIG. 4;

FIG. 6 is an enlarged plan view of the shear members of a stacking cage;

FIG. 7 is a side elevation view of the wrapping apparatus shown in FIG. 3;

FIG. 8 is a perspective view of a rocker incorporated in the wrapping apparatus;

FIG. 9 is a transverse sectional view of the rocker taken on the line IX—IX of FIG. 8;

FIG. 10 is a top plan view of the endless conveyor belt leading to the shrinking furnace, together with the aligning device arranged thereon;

FIG. 11 is a right side elevation view corresponding to FIG. 10; and

FIG. 12 is a somewhat schematic end view of the conveyor belt looking in the direction of the arrow XII of FIG. 10.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following, the invention will be described, solely by way of example, as applied to the wrapping of stacks of coins, and the general operation of the method, as well as of the apparatus for wrapping or packing coin stacks will be described with particular reference, initially, to FIGS. 1 and 2.

Referring to FIGS. 1 and 2, the movements of the coin stacks, required for wrapping or packing thereof, occur on a circular path 1. Coin stacks 2 are arranged in stacking cages 3 of a rotor 4, the stacking cages being vertically oriented and each consisting of two front holding bars 5 and two rear ejector bars 6. Rotor 4 has a drive which is oscillated as indicated by the arrows 7 and 7*a*, and which advances the rotor, in steps, from one holding position to another. With six stacking cages 3, rotor 4 is stepped angularly through 60° during each oscillation of its drive. While the drive is oscillatable, it moves rotor 4 only in the direction of arrow 7, the return movement of the oscillatable drive occurring during the standstill period of the rotor in its holding positions. Such return movement, which is performed as an idle stroke of the oscillating drive, is indicated by the broken arrow 7*a*.

The movement of each stack 2 to be packed takes place on a semi-circular track between the holding positions I to IV, and which will be termed "stations." Loading station I and unloading station IV are diametrically opposite each other. In advance of station II, there is a severing device 8, and a sealing device 9 is positioned at approximately one-half step between stations II and III. With each angular stepping of rotor 4, a coin stack 2 is pushed into station I and, at the same time, a wrapped stack is ejected from unloading station IV. From station IV, the now empty stacking cages 3 arrive on the other semi-circular track on which they are returned to loading station I.

FIG. 2 represents a development of the semi-circular section of track 1 between loading station I and unloading station IV. An elongated shrinking film 10, which is wider than the length of coin stack 2 to be wrapped, is wound on a delivery spool 11 from which film 10 runs over a guide roller 12 and in front of the stacking stage at station I. Coin stack 2, which is at the level of the stacking cage, is pushed into film 1 transversely of the film, as indicated by the arrow 13, and is clamped, together with the film, inside the stacking cage. A large film loop 14, corresponding to the diameter, or to the lateral peripheral dimension, of stack 2 is formed, holding bars 5 opening to an extent corresponding to the diameter of the pushed-in stack and moving toward each other again. Upon leaving station I, the holding bars 5 are moved into the closing position, as represented at station II.

The clamped film band 10 is drawn from delivery spool 11 and severed by the knife of severing device 8 while the rotor is held with the wrapped stack in station II. However, at this time, the following stack has already been pushed into the stacking cage 3 then present at loading station I. The free loop ends 14a and 14b, remaining after loop 14 has been severed, are superposed and pressed against each other when they pass by the electrically heated sealing device 9, and are sealed. The movement of a stacking cage between station I and station III can be effected with delay, and a short holding time can be provided before movement of a cage from station II to station III.

The sealing bar of sealing device 9 bears, against the bias of a restoring spring 16, on the film and produces a seam 15 between the two free loop ends. After formation of this seam, the loop ends are folded over substantially coextensively to extend tangentially of the film loop and arrive in this fashion at station III and proceed from there to station IV. At unloading station IV, the sealed free loop ends are engaged by a deflector 17 in their path of movement, and the wrapped coin stack is ejected from stacking cage 3 with a loop tuck 18 extending downwardly. For this purpose, the front holding bars 5 are opened and moved into the position indicated by broken line circles, so that ejector bars 6

swing in the direction of arrows **19** to eject coin stack **2** onto rocker **20**. This rocker is in the waiting position and, after receiving the wrapped coin stack, turns from the assumed vertical orientation into a horizontal orientation and transfers the wrapped coin stack **2**, with its tuck **18** downwardly, onto a conveyor track **21**. On this conveyor, the stack which is embraced by the film loop **14**, is fed, in the direction of arrow **22**, to a shrinking furnace, which has not been illustrated in FIG. **2**, and in which the loop is shrunk.

Since loop tuck **18** is at the bottom and the loop **14** thus formed is held closed during transfer in transportation of the wrapped stack by the weight of the stack until the film is shrunk, the sealing at sealer **9** can be omitted, if desired. The apparatus, with respect to its details, is illustrated in FIGS. **3** through **12**.

Referring to FIGS. **3** through **12**, rotor **4** includes a vertically extending central drive shaft **23** which is oscillated in the direction of arrow **7** and **7a** in FIG. **1**. For the sake of simplicity, the drive is illustrated as a crank drive, but the drive can also be effected by a cam disk. The crank drive includes a shaft **24** carrying a crank disk **25**, and which is continuously rotated by an electric motor, which has not been shown, and which drives shaft **24** through a reduction gear. A guide link **27** has one end pivotally connected to disk **24** by a screw **26**, and its other end pivotally connected to the flange of a bearing bush **28** by a screw **29**. Screws **30** fixedly connect this flange with a cam disk **31** having a cam groove **32** and fixedly connected, as by keying, to shaft **23**. Bearing bush **28** is designed as an axial bearing for rotor **4** and its end face engages a bearing disk **33** interposed between bearing bush **28** and machine casing **34** having a bore **35** receiving a bearing ring **36** in which drive shaft **23** is mounted. The upper end of drive shaft **23** also is rotatably mounted in casing **34**, and a second cam disk **31**, identical with the lower cam disk **31** and having a cam groove **32** identical with the cam groove **32** of lower cam disk **31**, is fixedly connected to the upper end of drive shaft **23**, as by a key. The two cams **31** are designed as self-contained grooved cams, being arranged in phase with each other and facing toward each other. Rotor **4** proper is disposed between cam disks **31** and is mounted on drive shaft **23**.

Rotor **4** includes two axially spaced end disks **37** which are fixedly connected with a hexagonal sleeve **38** having, at its opposite ends, bearings **39** engaged with drive shaft **23**. The inside diameter **40** of sleeve **38** is greater than the outside diameter of drive shaft **23** and, between lower end disk **37** and cam disk **31** a spacer ring **41** embraces shaft **23**.

The holding bars **5** of the individual stacking cages **3** extend between shear members **42** and **43** which are arranged as upper and lower pairs. Each pair of shear members has a roller **44** which is engaged in a cam groove **32** and is moved by cam groove **32** in a substantially radial direction. Each roller **44** is arranged on a screw **45** which is secured by a threaded extension **46** in the associated shear member **43**. The cylindrical portion of screw **45** is arranged in a fork **47** of the associated shear member **42**. The two shear members, **42** and **43**, of each pair, are designed as angle levers having lever arms extending at right angles to each other, with the shorter lever arms being directed toward each other and coupled with each other by roller **44**. The two shear members of each pair are mounted in a respective end disk **37** of rotor **4** by means of respective screws **48**, for pivotal movement.

Tension springs **49** are connected between the shear members of each pair, and bias the shear members in the closing direction. For the sake of clarity, these tension springs are represented in FIG. **3** as acting on each pair of shear members. However, and in order to give each tension spring a greater effective length, it can extend between the shear members of adjacent cages, as represented at the left of rotor **4** in FIG. **3**. All together, six of these longer tension springs **49** are provided. The tension springs permit the shear members **42**, **43** to open, in correspondence with the diameter of the coins, when a coin stack is pushed into a stacking cage.

Each cam groove **32** comprises a radially inner cam surface **32a** and a radially outer cam surface **32*b***, and is so designed that it permits the associated rollers **44** to perform, at the loading station, an outwardly directed movement so that the stack may be pushed in against the action of a tension spring **49**. In this position, each roller **44** bears on an inner cam **32*a***, while the space necessary for the movement is provided between the roller **44** and the associated outer cam **32b**. The opening of each pair of shear members, in the unloading station, is effected by the associated rollers **44** engaging the bevel of the associated inner cam **32a** during the return oscillation of the cam disks **31** in the direction of arrow **7*a***. In the position illustrated in FIG. **3**, the cam disk is at the limit of its movement in the direction of arrow **7**.

Stepping of roller **4** is effected by a driving nose **50** on each inner cam **32*a*** of a cam groove **32**. This nose engages the respective rollers **44** of a stacking cage **3**, and pushes the latter, together with the entire rotor, to advance in the direction of arrow **7**. During return movement of the cam disks **31** in the direction of arrow **7*a***, noses **50** disengage the associated rollers **44** and engage the next following rollers **44** at the end or limit of the cam return movement in the direction of arrow **7*a***. The oscillation of the drive is so selected that the cam disks are oscillated through an angle of 60°. Return movement of the cam disks is effected during the holding time of the stacking cages **3** in the various stations.

Ejector bars **6** are arranged side-by-side in pairs to form what may be called the rear wall of each stacking cage **3**, and the lower ends of each pair are secured to a respective carrier plate **51** which has two vertically spaced and aligned bores or passages **52** which receive the two legs of a respective U-shaped guide bar **53**. These legs extend parallel to each other at the spacing of bores **52**, and their outer ends are interconnected by a web **54** located substantially in the plane of the associated holding bars **5**. The inner ends of guide bars **53** are inserted in recesses in hexagonal sleeve **38**, into which they are firmly pressed and additionally secured by soldering or welding. Guide bars **53** form the bottom of each stacking cage **3**, and are the supporting device for each stack to be wrapped, which is supported on the upper leg of each guide bar.

Each carrier plate **51** and associated ejector bar **6** is guided on the respective guide bar **53** for radial movement, and can be moved radially inwardly, against a biasing force, in dependence on the diameter of a coin

stack 2. FIG. 4 shows, at its left portion, two different positions of ejector bar 6 with respect to two coin stacks 2 of different sizes. Bores or apertures 52 have diameters larger than those of the guide bars, so that ejector bar 6, as shown on the right side of FIG. 4, can tip outwardly while the associated carrier plate 51 bears on the respective web 54.

In the illustrated embodiment, each carrier plate has its rear surface engaged by a compression spring, in the form of a leaf spring 55 whose upper end is secured by screws 56 on hexagonal sleeve 38. Hexagonal sleeve 38 corresponds, in position and arrangement, to the hexagonal surfaces of the six stacking cages 3. In place of compression springs 55, there can also be used tension springs, which have not been shown. Additionally, it is possible to effect ejection of a wrapped coin stack magnetically, for example, by means of a pull magnet. Such constructional modifications are within the scope of the invention, and other arrangements also could be used.

The stack pusher comprises, essentially, a pusher bar 57 which is articulated on a loading arm 58 pivotal about a pivot 58*a*. Pusher bar 57 is connected by a coupling rod or link 59 to swivel arm 60 of rocker 20, which is mounted in a bearing block 61 as shown in FIGS. 7 and 8. Oscillation of loading arm 58 can be effected by crank disc 25 of FIG. 4, which controls movement of the loading arm. The movement of loading arm 58 is coupled with the movement of rocker 20, which assumes a substantially vertical orientation when pusher bar 57 is in the solid line position of FIG. 3 in which it has pushed a coin stack into a stack cage.

Pushing movement of pusher bar 57 and of loading arm 58 is effected during the holding period during which the shear members 42, 43 at the loading station are closed and the shear members 42, 43 at the unloading station are opened, during return of cam disk 31, as described above. This means that, at the time a new stack 2 is pushed into a stack cage, the wrapped stack 2 is ejected by ejector rods 6 when the shear members, and thus the holding bars, open, as shown at the right side of FIG. 4, and the stack is transferred to rocker 20 waiting in a substantially vertical orientation. For holding the ejected coin stack, rocker 20 has a nose 62 which extends beneath the transferred coin stack which comes to lie on rocker 20 with loop tuck 18 down.

In the position of FIG. 7, pusher bar 57 is retracted and rocker 20 has been turned, by coupling rod 59, into the substantially horizontal position. In this position of pusher bar 57, the new coin stack 2 rests on a lifting plate 63 which can be vertically reciprocated in the direction of double arrow 64. In its upper position, lifting plate 63 is loaded with the new coin stack 2, and moves it into the loading station, in front of rotor 4, when lifting plate 64 assumes its lower position as illustrated in FIG. 7. This vertical reciprocation of lifting plate 63 is coupled mechanically with vertical reciprocation of severing device 8 whose knife cuts shrinking film 10 from the bottom to the top during ascent of lifting plate 63. The film sheet forming the loop in severing station II is thus severed from the film band drawn from delivery spool 11.

FIGS. 8 and 9 illustrate the details of rocker 20. As illustrated therein, rocker 20 turns about the horizontal pivot 65 of bearing block 61. A bar 66 is arranged as an extension of swivel arm 60 and rigidly connected thereto, and two cross beams 67 are secured to bar 66. A longitudinal pivot 68 extends between cross beam 67, and is embraced by restoring spring 69 of a stack dish or trough 70 which is tiltable about the axis of pivot 68. Trough or stack dish 70 is concave on top, in order to hold a coin stack 2 firmly, the concave trough being indicated at 71. Arcuate recesses 72 on the upper sides of cross beams 67 correspond in shape to the trough.

Normally, stack dish 70, with trough 71 is in a hinge-back position, due to the bias of spring 69, in which it receives the wrapped stack of coins, this position being shown in FIG. 8 in broken lines. The solid lines in FIG. 8 indicate the tilted position of stack dish 70 which, for this purpose, carries, on its underside, a stop pin 73 extending angularly therefrom and rigidly connected thereto. In the path of stop pin 73, there is arranged a stop 74 in the form of a roller which is rotatably mounted in a block 75 in turn secured on the bottom 76 of the machine casing. During movement of rocker 20 from the vertical position into the horizontal position, stop roller 74 is engaged by stop pin 73 shortly before the end of this movement and, during the further downward movement of rocker 20, stack dish 70 is tipped, as represented in FIG. 8. Due to such tipping, coin stack 2 lying in trough 71 with loop tuck 18 down, is transferred downwardly to endless belt 21. The tilted position is also apparent in FIG. 9.

Conveyor track 21, which extends from rocker 20 to heating furnace 77, comprises two endless conveyor chains 78 between whose chain links there are arranged, at equally spaced intervals, receiving rollers 79. The drive of the conveyor chains is effected continuously by sprockets 80. Such endless conveyor belts are known in coin packing or wrapping machines, and the known conveyor belts are arranged either horizontally or longitudinally inclined. By contrast, the conveyor belt of the invention is inclined at an angle $\alpha$ transversely of its longitudinal direction of movement, and the angle of inclination can be about 15°.

On the lowered side of the inclined conveyor there are arranged, along the entire conveyor belt, stop angles 81 each having a short arm 82 and a long arm 83. The two arms extend at an angle of 90° to each other, to form a right-angle knee indicated at 84. Short arms 82 are pivotally mounted between adjacent receiving rollers 79, and the long arms 83 extend between guide bars 85 and 86 which extend, on the top side of conveyor track 21, parallel to the sprocket 80 on a track curve 87. Guide bars 85 and 86 raise stop angles 81 from the initial position in which the longer arms are horizontal into a position in which the longer arms are vertical, the knee 84 of each stop angle 81 engaging the coin stack deposited on the conveyor belt at the end of the stack and aligning and pushing together, inside the film wrapping, the coins which are slightly inclined in the film wrapping as shown, for example, in FIG. 12.

The aligned position of the stack is maintained during the passage of the stack through shrinking furnace 77, and guide bars 85 and 86 extend, as do the conveyor chains, completely through the heating furnace. The inclination of the conveyor belt transversely of its direction of movement also is maintained during its passage through heating furnace 77. The combination

of this inclination and stop angles **81**, acting as displacers, assures a satisfactory alignment of the coin stack inside the enveloping film loop, and this alignment is maintained during shrinking of the film.

Support of stop angles **81** between adjacent receiving rollers **79** can be effected with any available means. Thus, the stop angles can be mounted, for example, on an oscillatable flexible wire **88**, with the individual stop angles being secured on respective sleeves **89** through which the flexible wire extends. Receiving roller **79** can be sleeves which rotate freely on chain bolts or pins **90**, leaving the bearing points of angle levers **81** free. At these points, bolts **90** are drilled transversely parallel to the conveyor track, and the endless flexible wire **88** extends through the resulting bores and has sleeves **89** of stop angles **81** mounted thereon.

Guide bar **85** also extends on the underside of the endless chain horizontally, so that the stop angles can bear thereon and guide themselves properly into it during the descending movement along track curve **87**.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

**1**. In a method for packing vertically stacked coins, stamps and similar articles in a shrinking film which is wider than the stack length and which is shrunk after it has been wrapped around the stack, the improvement comprising the steps of pushing the stack into the film transversely of the latter to form a relatively large film loop corresponding to the lateral peripheral dimension of the stack; clamping the stack in the film loop with the free loop ends overlapped in superposition with each other and extending substantially tangentially of the loop; turning the wrapped stack into a substantially horizontal orientation with the free loop ends down; and shrinking the film loop around the stack while maintaining the substantially horizontal orientation of the wrapped stack.

**2**. The improved method, as claimed in claim **1**, in which an initially substantially continuous strip of film is fed longitudinally in a direction transverse to the stack length; and, after clamping the stack in the film loop, severing the film loop from the film strip to provide such free loop ends overlapped in superposition with each other and extending substantially tangentially of the severed loop.

**3**. The improved method, as claimed in claim **1**, in which the free loop ends are held closed by the weight of the stack until the film loop is shrunk around the stack.

**4**. The improved method, as claimed in claim **1**, in which the loop ends are sealed before the wrapped stack is turned into such substantially horizontal orientation.

**5**. The improved method, as claimed in claim **1**, in which, after turning of the wrapped stack into a substantially horizontal orientation, and before shrinking of the film loop around the stack, the wrapped stack is transported along a longitudinal path in a direction perpendicular to the stack length, and with the wrapped stack substantially inclined laterally of its direction of travel; and, during such travel of the inclined wrapped stack, exerting a push against an end of the wrapped stack upwardly in the direction of inclination of the wrapped stack and longitudinally of the stack.

**6**. In apparatus for packing vertically stacked coins, stamps and similar articles in a shrinking film which is wider than the stack length and which is shrunk after it has been wrapped around the stack, and of the type including a stacking device whose stacking axis is oriented substantially vertically, a holding device for the stack to be wrapped, a feeding device, and a severing device for the film, the improvement comprising, in combination, plural vertically oriented stacking cages arranged at substantially equal angular intervals along a circular path of movement; driving means operable to step said stacking cages, intermittently and conjointly, along said circular path of movement between holding positions of the stacking cages and from a loading station into an unloading station; cam means operatively associated with said stacking cages and operable to open and to close such stacking cages at preselected locations along said circular path of movement; said stacking device being arranged outside the path of movement of such stacking cages at a holding position of a stacking cage; means guiding said film between said stacking device and a then opened stacking cage at the holding position adjacent such stacking device; and stack pusher means adjacent said stacking device operable to push a stack from said stacking device into the opened stacking cage then adjacent said stacking device; the stack pushed into the opened stacking cage by said stack pusher means carrying the film along with it, as a film loop, into the opened stacking cage.

**7**. The improved apparatus, as claimed in claim **6**, including a rotatable vertically oriented drive shaft at the center of said circular path of movement; said shaft and said stacking cages conjointly forming a rotor which is stepped by said driving means.

**8**. The improved apparatus, as claimed in claim **7**, in which each stacking cage comprises two vertically oriented front holding bars, substantially vertically oriented ejector bars rearwardly of said holding bars, and radial guide bars adjacent its lower end; means mounting said front holding bars for movement toward and away from each other to close and open the respective stacking cage; means biasing said front holding bars to a stack closing position; said front holding bars being displaceable away from each other, upon pushing of a stack into an opened stacking cage, in correspondence with the lateral dimensions of the stack; said ejector bars being displaceable, in parallel relation to each other, along said radial guide bars; and restoring force means biasing said ejector bars toward said front holding bars; said ejector bars being displaceable along said radial guide bars in a direction away from said front holding bars in accordance with the lateral dimensions of a stack pushed into the respective stacking cage; said ejector bars being mounted on said radial guide bars for radially outwardly and downwardly tilting of said ejector bars by said restoring force means when the respective stacking cage is opened.

**9**. The improved apparatus, as claimed in claim **8**, in which each stacking cage includes upper and lower pairs of shear members; respective vertically oriented pivots on said rotor for each shear member; each hold-

ing bar extending between and being connected to respective upper and lower shear members; respective spring means biasing the shear members of each pair in a stacking cage closing direction; two identical in-phase cams, one mounted at the top and the other mounted at the bottom of said rotor; and respective rollers operatively interconnecting the shear members of each pair and each engaged with the adjacent respective cam.

**10**. The improved apparatus, as claimed in claim **8**, including respective carrier plates each secured to the lower ends of the ejector bars of a respective stacking cage; the radial guide bars of each cage including respective upper and lower vertically aligned radial guide bars; each carrier plate having a pair of vertically spaced and aligned apertures therethrough each receiving a respective guide bar, the diameter of said apertures being in excess of that of the associated guide bars to provide for tilting of each carrier plate on its associated radial guide bars; said restoring force means comprising respective leaf springs each engaging an associated carrier plate and biasing the latter to tilt radially outwardly and downwardly.

**11**. The improved apparatus, as claimed in claim **8**, in which said radial guide bars are elongated U-shaped radial guide bars having their legs lying in the same vertical plane and interconnected by a web bight disposed substantially in the plane of the front holding bars of the associated stacking cage.

**12**. The improved apparatus, as claimed in claim **9**, in which said upper and lower cams have cam surfaces cooperable with the rollers of the adjacent pairs of shear members to positively close the stacking cages, after they have been opened at the loading station, at the start of the following stepping of the cages, and to open such stacking cages positively only at the unloading station; said cam surfaces providing, at the loading station, pivotal separation of said holding bars in correspondence with the lateral dimension of the stack pushed into the stacking cage then at the loading station.

**13**. The improved apparatus, as claimed in claim **7**, in which the stacking cages are arranged on said rotor in pairs, with the stacking cages of each pair being diametrically opposite each other; said loading station being diametrically opposite said unloading station along said circular path of movement; whereby, when one stacking cage of a pair is at said loading station, the other stacking cage of the pair is at said unloading station; said severing device being positioned between said loading station and a following severing station and being spaced further from said loading station then from said severing station; and a spring biased pivotally mounted sealing bar positioned substantially one-half step beyond said severing station and in a position to contact the stacking cages moving along said circular path of movement; said sealing bar acting as an abutment for the sealing of the free film loop ends during their passage past said sealing bar.

**14**. The improved appratus, as claimed in claim **7**, including a rocker positioned at said unloading station in radially spaced relation to said rotor; means mounting said rocker for reciprocal pivoting about a horizontal axis between a vertical position and a horizontal position; a trough carried by said rocker; and an endless conveyor belt extending from said rocker to a heating furnace for shrinking the film loop; said trough, in the vertical position of said rocker, receiving a wrapped stack ejected from an opened stacking cage at said unloading station and, in the horizontal position of said rocker, transferring the wrapped stack, with the film loop ends down, onto said endless conveyor belt.

**15**. The improved apparatus, as claimed in claim **14**, in which said stacked pusher means comprises a stack pusher at said unloading station; means interconnecting said stack pusher and said rocker and operable to pivot said rocker from a vertical position into a horizontal position responsive to operation of said stack pusher in a direction to push a stack into an opened stack cage then at said loading station; means mounting said trough on said rocker for tilting, against the bias of restoring spring means, about a pivot axis extending longitudinally of said trough; a fixedly positioned stop beneath said trough in the substantially horizontal position of said rocker, and means on said trough engageable with said stop to tilt said trough during movement of said rocker into its horizontal position to transfer the stack on the trough to said endless conveyor belt.

**16**. The improved apparatus, as claimed in claim **14**, in which said endless conveyor belt is inclined transversely of its direction of movement; said conveyor belt comprising longitudinally spaced and substantially parallel stack receiving rollers rotatably supported by a pair of laterally spaced endless conveyor elements; stop angles mounted along the entire length of said endless conveyor belt; each stop angle including a short arm and a long arm; means pivotally mounting each short arm, at its free end, between a respective pair of adjacent stack receiving rollers for pivoting about an axis extending longitudinally of said conveyor belt; said endless conveyor extending through the heating furnace; and a curve track extending along only the upper run of said endless conveyor and through the heating furnace; the longer arms of said stop angles engaging said curve track as said stop angles move from the lower run of said endless conveyor belt into the upper run thereof; said curve track pivoting said stop angles from an initially horizontal position into a vertical position adjacent the lower lateral edge of said endless conveyor to engage, align and push together the articles in wrapped stacks on the upper run of said endless conveyor belt.

**17**. The improved apparatus, as claimed in claim **14**, in which the two arms of each lever are joined at a right-angled knee engageable with the lower end of a wrapped stack on the upper run of said endless conveyor belt.

**18**. The improved apparatus, as claimed in claim **16**, in which said stop angles are pivotally mounted on a twistable flexible wire extending longitudinally of said endless conveyor belt adjacent the lower side edge thereof.

**19**. The improved apparatus, as claimed in claim **16**, in which said curve track is a portion of an angle guiding track including a pair of spaced parallel guide rails extending completely through the heating furnace and coextensive with said endless conveyor; said guide rails maintaining said longer legs in the vertical position throughout the travel of the stop angles through the heating furnace to maintain the stacked articles aligned

and pushed together during shrinking of the film loops thereon.

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