

Oct. 20, 1964

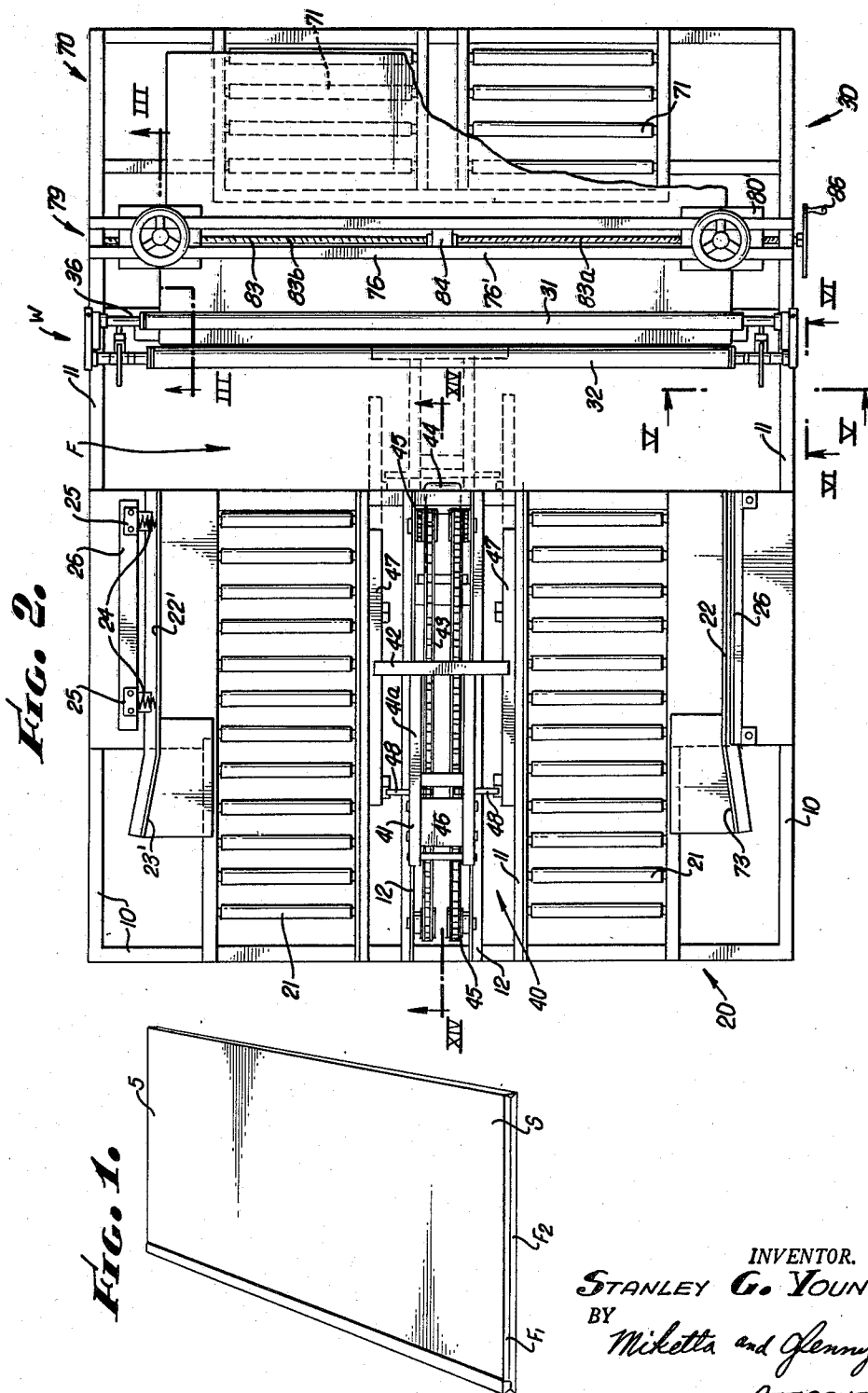
S. G. YOUNT

3,153,308

MACHINE AND METHOD FOR WRAPPING LARGE OBJECTS

Filed July 31, 1961

6 Sheets-Sheet 1



Oct. 20, 1964

S. G. YOUNT

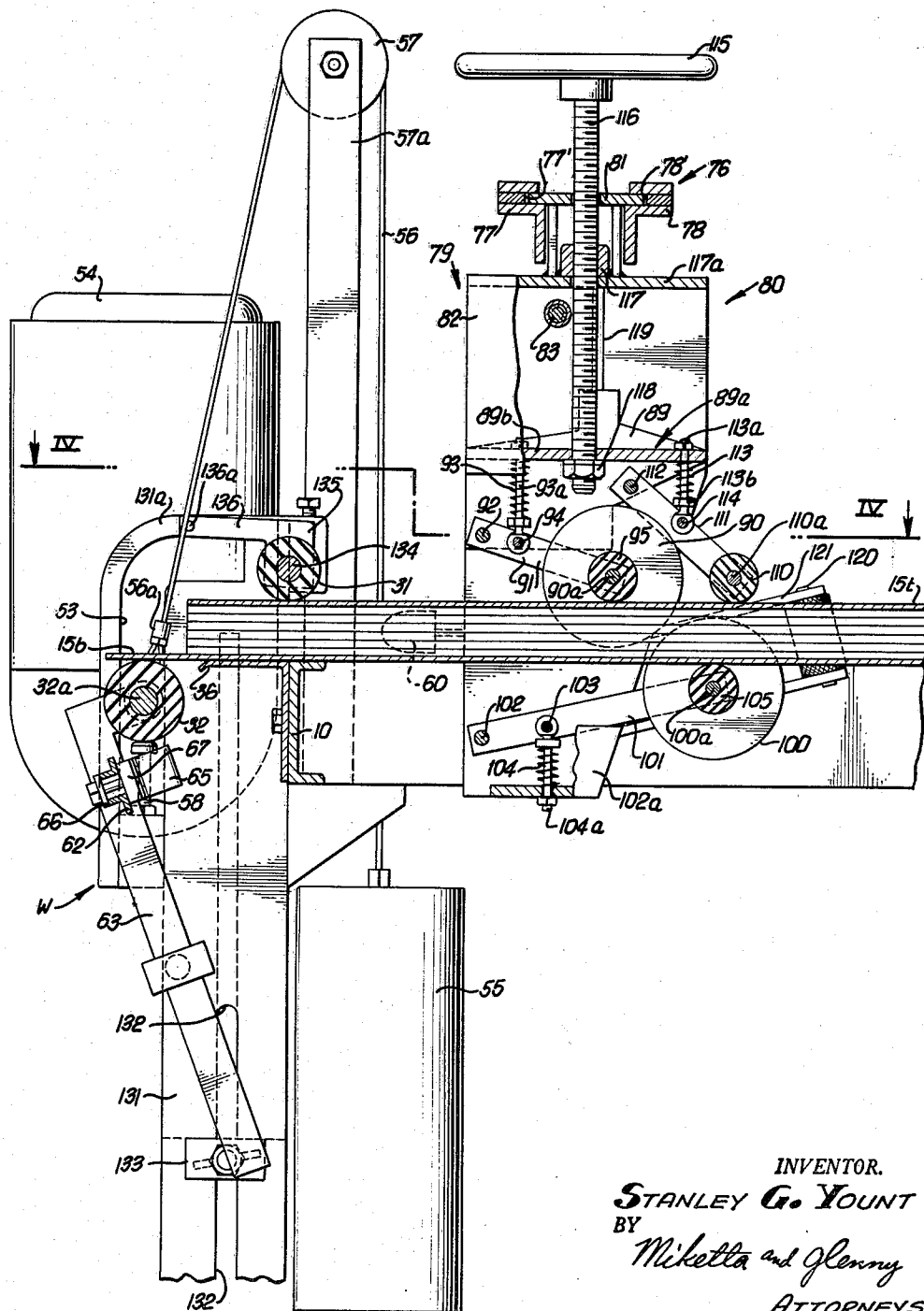
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MACHINE AND METHOD FOR WRAPPING LARGE OBJECTS

Filed July 31, 1961

6 Sheets-Sheet 2

FIG. 3.



INVENTOR.

STANLEY G. YOUNT

BY

Miketta and Glenny

ATTORNEYS.

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S. G. YOUNT

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6 Sheets-Sheet 3

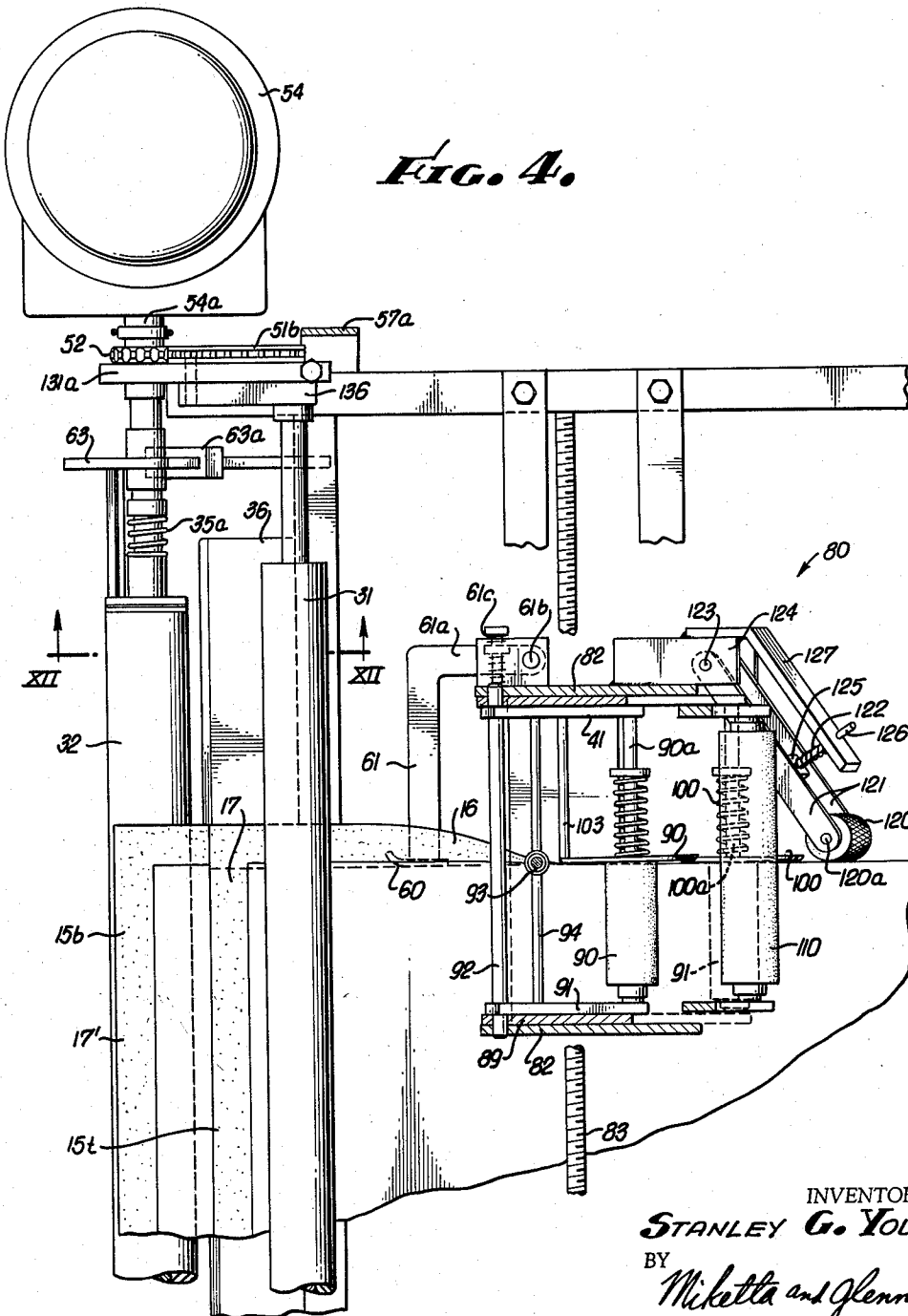


FIG. 4.

INVENTOR
STANLEY G. YOUNT
BY
Micketta and Glenney
ATTORNEYS.

Oct. 20, 1964

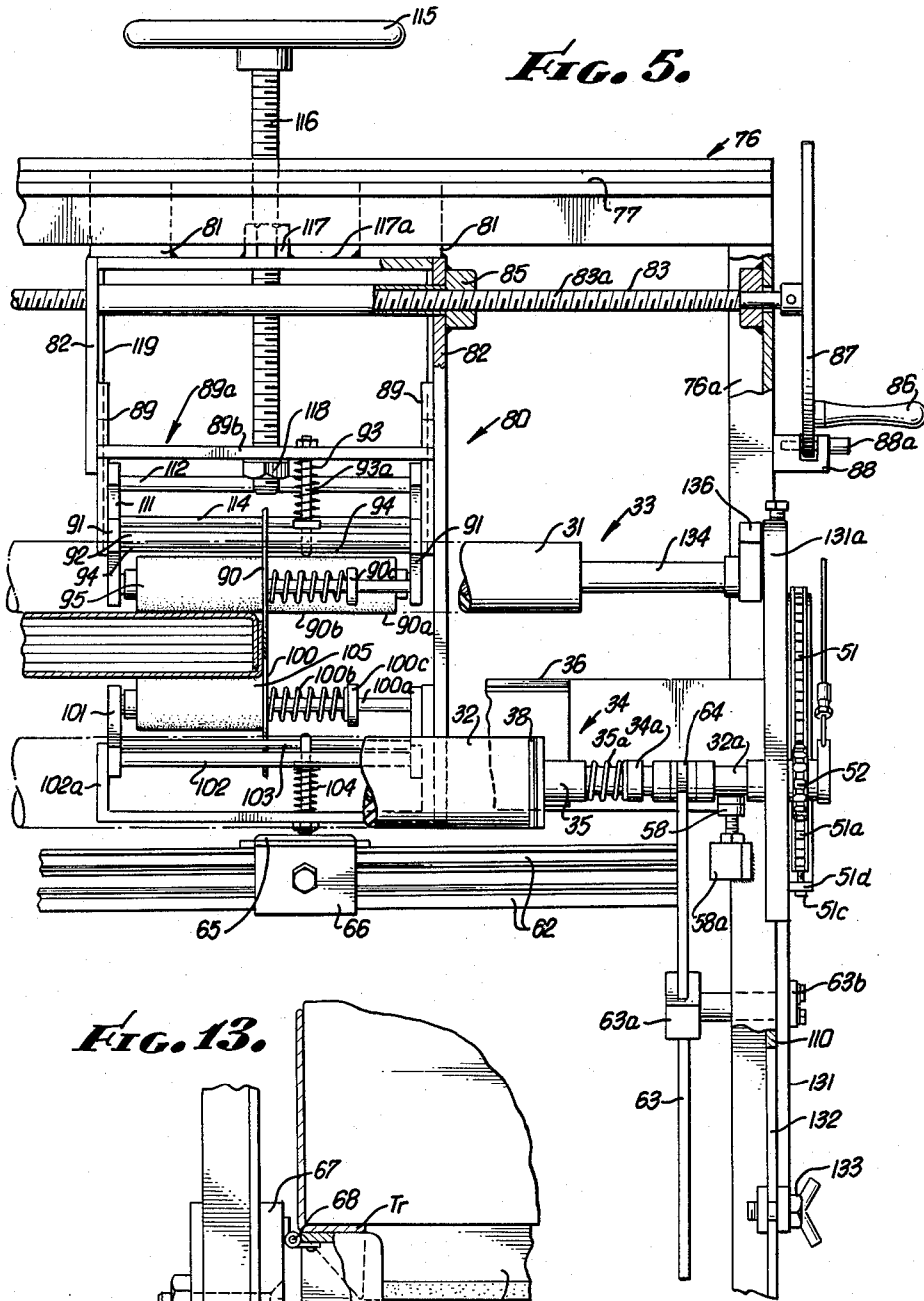
S. G. YOUNT

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MACHINE AND METHOD FOR WRAPPING LARGE OBJECTS

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6 Sheets-Sheet 4



INVENTOR.
STANLEY G. YOUNT
BY
Miketta and Glenney
ATTORNEYS.

Oct. 20, 1964

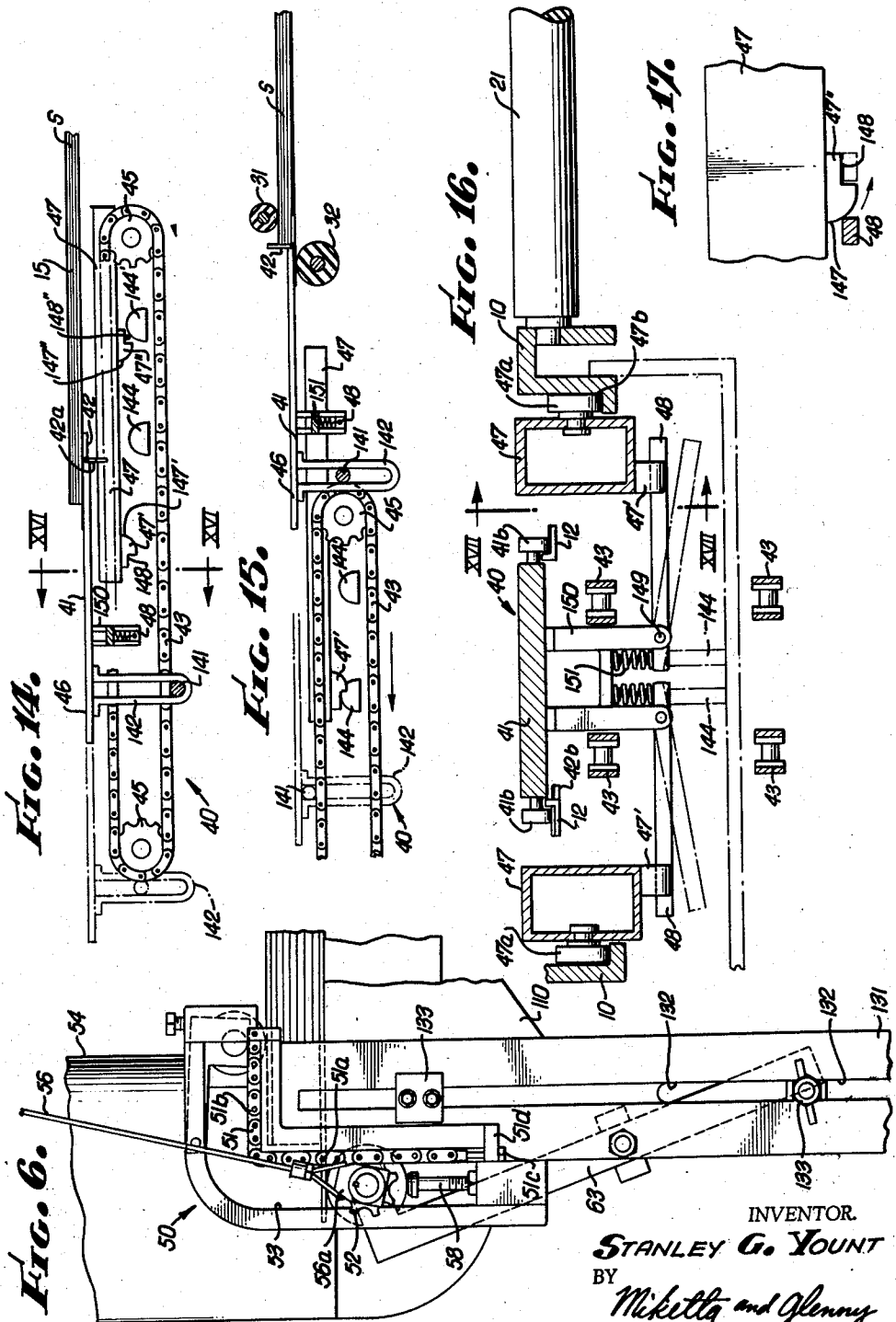
S. G. YOUNT

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MACHINE AND METHOD FOR WRAPPING LARGE OBJECTS

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6 Sheets-Sheet 5



INVENTOR.
STANLEY G. YOUNT
BY
Micketta and Glenn
ATTORNEYS.

Oct. 20, 1964

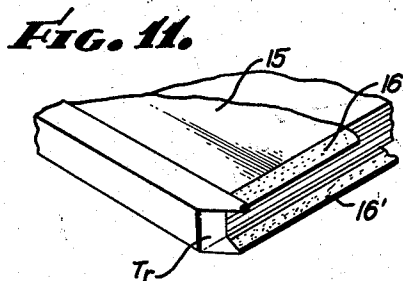
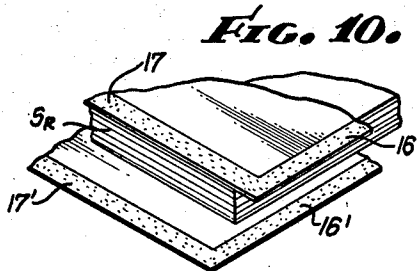
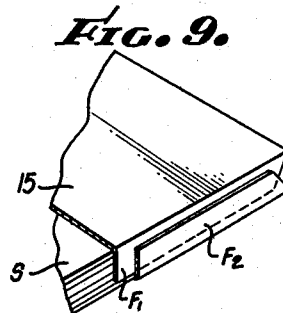
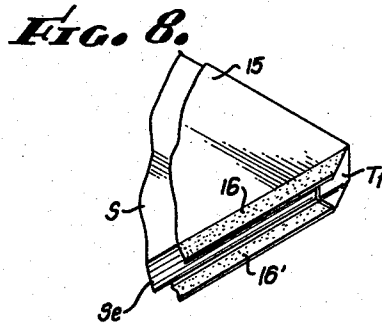
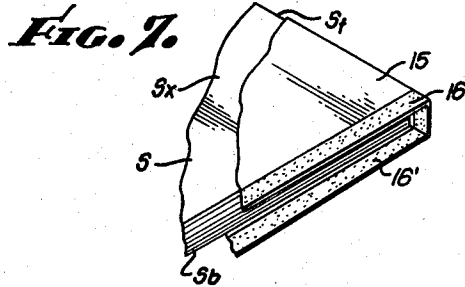
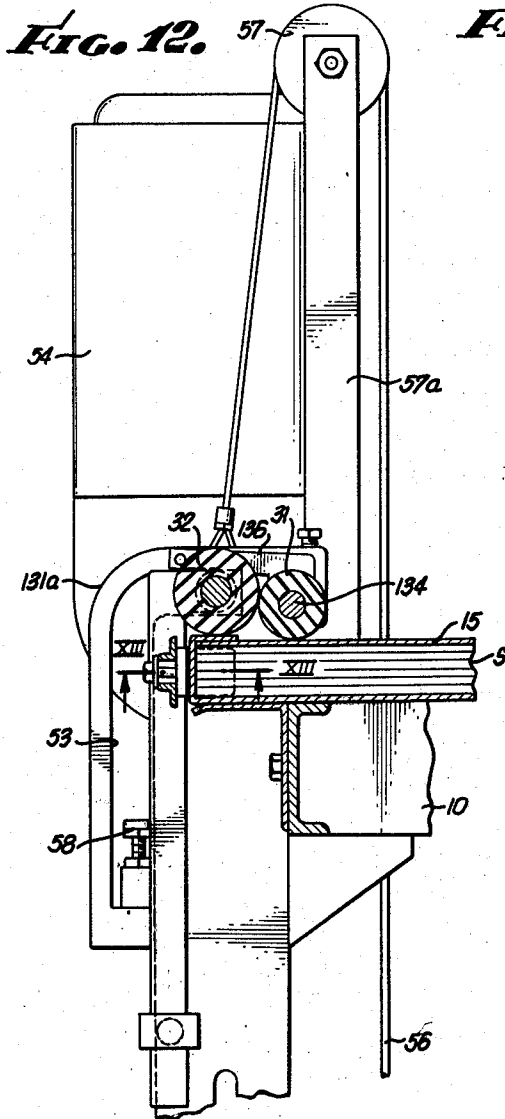
S. G. YOUNT

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MACHINE AND METHOD FOR WRAPPING LARGE OBJECTS

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6 Sheets-Sheet 6



INVENTOR.
STANLEY G. YOUNT
BY *Miketta and Glenney*
ATTORNEYS

1

3,153,308

MACHINE AND METHOD FOR WRAPPING LARGE OBJECTS

Stanley G. Yount, 4489 Bandini Blvd., Los Angeles, Calif.
Filed July 31, 1961, Ser. No. 128,185
15 Claims. (Cl. 53—32)

This invention relates generally to automatic wrapping machines and, more particularly, to a machine and method for wrapping in assembled stacked relation large flat sheet-like or plate-like rectangular articles of rigid or semi-rigid form in a sheet of compliant wrapping material.

An embodiment of this invention, which will be disclosed herein, is particularly suitable for but not limited to wrapping stacks of large flat sheet-like rectangular articles in a wrapping material having bands of pressure adhesive material selectively disposed thereon as taught by my United States Letters Patent No. 2,846,060 on "Wrapping Means for Articles of Sheet Form."

The handling and protection of stacked large flat articles during shipment and storage may be greatly facilitated by packaging such articles in an enveloping wrapping material. The packaging operation is made considerably easier by employing prepared sheets of wrapping material having bands of pressure adhesive material in preselected areas so that the wrapping means need be only positioned on a stack of articles to be packaged, folded about the stack and sealed by applying pressure to the bands. Such wrapping material and "wrapping means" is disclosed in my aforementioned United States Letters Patent No. 2,846,060. Briefly stated, the wrapping means comprises a strip of compliant sheet material folded along a longitudinal line so as to provide a top and bottom panel, the top panel having a width approximately the same as the width of the stacked articles to be wrapped and the bottom panel having a greater width, depending on the number and thickness of the articles in the stack. The present invention contemplates that the top panel be manually positioned to overlie the top of the stack with panel end portions projecting beyond the stack. The bottom panel by the machine of the present invention is folded down about the leading edge of the stack, tensioned along the bottom of the stack, and folded up around the rear edge of the stack to overlie a portion of the top panel. Projecting end portions of both panels are then folded against the stack ends to form a package. Bands of pressure adhesive material provided on marginal areas of the sheet are so arranged that the opposing surfaces of the wrapping material which carry the adhesive bands (where the bottom panel overlies a part of the top panel, and where projecting end portions are folded) may be sealed on each other by the application of pressure.

The wrapping of large, rectangular articles in my aforementioned wrapping means has required manual operations including smoothing, tensioning, tucking and folding the material and then pressure sealing the bands of pressure adhesive material. Similar manual operations are required in the use of most all wrapping materials applied to large and small articles. Such manual operations present no particular problem when performed on small objects or articles. However, as applied to large, cumbersome relatively rigid sheets of plywood, Masonite, pressed board, sheet rock, plaster board, and relatively semi-rigid articles such as mattresses and the like having dimensions of 4' by 8', of individual sheet thickness of 1/4" through 1", arranged in stacks of a selected number of sheets, and having an aggregate weight much greater than that capable of being conveniently manually handled, it is apparent that there is a definite need for an apparatus or machine which will wrap such unwieldy articles in a rapid, effective foolproof manner. The present invention

2

contemplates such a novel machine and method which is capable of receiving a stack of large sheet-like articles and moving said stack in association with a wrapping means of the type described in Letters Patent 2,846,060, but not limited thereto, to perform said wrapping operations by machine. The invention also contemplates a method of wrapping large bulky and generally awkward to handle polygonal articles in a sheet of suitable pliant wrapping material such as wrapping paper, sheet plastic or other suitable wrapping material in roll or sheet form.

It is therefore an object of my invention to disclose and provide a device and method for automatically in a predetermined progressive manner smoothing, tucking, folding and sealing flexible wrapping material about rigid or semi-rigid articles of sheet form having large lateral and longitudinal dimensions as compared to thickness.

It is another object of my invention to disclose and provide a machine and method to package or wrap large, generally flat polygonal articles in stacked relation in a compliant wrapping material having bands of pressure adhesive material selectively disposed thereon whereby such wrapping material is placed under tension, smoothed and spread, tucked and folded about the stack, and sealed to form a tight enveloping package about the stack of articles.

It is also an object of my invention to disclose and provide a wrapping machine which is adapted to receive stacks of large flat rectangular articles of rigid or semi-rigid form, convey such stacks through a wrapping means feed station to a wrapping table and to wrap a sheet of compliant wrapping material about such stacks to package them for storage or shipment.

Another object of my invention is to provide a wrapping machine for employing said wrapping means including means readily adjustable to accommodate stacks of articles of different length, width and thickness.

A further object of this invention is to disclose a novel wrapping machine for relatively large heavy polygonal articles wherein such an article or stack of articles is supported for movement in a horizontal plane and wherein wrapping of the article is substantially completed during one continuous movement of the article, the wrapping being completed upon displacement of such article by the advancement of the following article.

A still further object of the invention is to disclose a wrapping machine for articles of the type abovementioned wherein means are provided for advancing and supporting said articles in such a manner that the performance of wrapping operations is not interfered with and wherein the means for supporting the articles cooperates with the wrapping material for performing one of the wrapping operations.

A more specific object of the invention is to provide a wrapping machine wherein the stock of articles to be wrapped are passed between transversely arranged rollers in pressure contact with opposite sides of the stack of articles whereby said stack is subjected to compressive forces while said wrapping material between surfaces of the stack and said rollers is drawn and smoothed against surfaces of the stack by said rollers.

Another specific object of the invention is to provide a wrapping machine as above described wherein means for making the trailing or back end edge tucks is cooperably associated with one of the transverse rollers.

Generally stated, my invention comprises the provision of a conveyor table having conveyor surface adapted to receive and convey stacks of large flat rectangular articles, a wrapping table adapted to receive said articles from the conveyor surface and spaced from the conveyor surface to provide therebetween a wrapping material feed station, and means associated with the wrapping table to: tension and draw the wrapping material about

3

such stack of articles as by smoothing and stretching the top and bottom panels; tuck leading and trailing edges of wrapping material projecting beyond the ends of the stack; fold inwardly against the stack ends projecting end portions of said wrapping material intermediate said edges; and apply pressure to opposing bands of pressure adhesive material to seal the wrapping material on itself and form a package about said articles.

A more detailed description to an exemplary embodiment of a wrapping machine, according to my invention, will now be presented, a consideration of which will facilitate further understanding of my invention. Further objects and advantages will also be apparent. Reference will be made to the several drawings on the appended sheets of drawings of which:

FIG. 1 is a perspective view of a finished wrapped large flat rectangular article including the aforesaid patented wrapping means and wrapped on a machine made in accordance with my invention.

FIG. 2 is a plan view of an exemplary embodiment of a wrapping machine made according to my invention.

FIG. 3 is a sectional view of said machine taken in the planes indicated by line III—III of FIG. 2.

FIG. 4 is a horizontal sectional view taken in the planes indicated by line IV—IV of FIG. 3.

FIG. 5 is a vertical sectional view of said machine taken in a transverse vertical plane indicated by line V—V of FIG. 2.

FIG. 6 is a fragmentary side view of said machine taken from the vertical plane indicated by line VI—VI of FIG. 2.

FIG. 7 is a perspective view of a front corner portion of a stack of articles being wrapped showing a wrapping means folded about the leading transverse edge of the stack.

FIG. 8 is a view similar to FIG. 7 and shows the wrapping means after a forward tuck has been made.

FIG. 9 is a view similar to FIG. 7 showing end portions of the wrapping material intermediate of the leading and trailing edges of the stack folded and sealed upon each other.

FIG. 10 is a perspective view of a trailing corner portion of a stack with a top and bottom panel of wrapping material positioned thereon prior to the operation of a bottom tensioning roller upon the bottom panel to effect a rear fold.

FIG. 11 is a perspective view of the corner portion shown in FIG. 10 after the rear fold and rear tuck has been made.

FIG. 12 is a vertical sectional view taken in the plane indicated by line XII—XII of FIG. 4.

FIG. 13 is a horizontal sectional view taken in the plane indicated by line XIII—XIII of FIG. 12.

FIG. 14 is a fragmentary vertical sectional view of said machine taken along the plane XIV—XIV of FIG. 2 showing the carriage in a start position.

FIG. 15 is a sectional view of the portions of the machine shown in FIG. 14 with the carriage in forward position.

FIG. 16 is a transverse sectional view taken along the plane XVI—XVI in FIG. 14; and

FIG. 17 is a sectional view taken in the plane indicated by line XVII—XVII of FIG. 16.

The novel method of this invention is described in relation to and may be practiced by an exemplary embodiment of a machine shown in the drawings. To facilitate understanding of the method and of the machine a general description is first made of the operation of the exemplary machine. A stack S of articles to be wrapped such as sheets of plywood, Masonite, pressboard and the like, is placed upon a conveyor table 20, aligned with respect to the longitudinal center line of the machine, and the top surface of the stack is then covered by a top panel or portion of wrapping material fed from a material feed station F located between the conveyor table 20 and

4

an associated wrapping table 30 spaced from table 20 and aligned therewith. At a wrapping station W adjacent the feed station initially vertically spaced top and bottom transversely arranged rollers 31 and 32 are positioned to receive therebetween stack S and to contact under selected pressure the top panel and bottom panel of the wrapping material so that as stack S is advanced onto the wrapping table the wrapping means is smoothly drawn and tensioned against the leading edge Sf and top and bottom surfaces St and Sb of the stack. As the trailing edge Sr of the stack moves onto the wrapping table the bottom roller 32 moves upwardly to lay the bottom panel of wrapping material against the trailing edge and then forwardly to overlap the bottom panel margin on the top margin of the top panel. The pressure contact of the bottom roller 32 against the overlapped edge margins pressure seals the wrapping material across the back top surface portion of the stack S and the rollers 31—32 are now disposed in adjacent side-by-side horizontal relation. As the stack advances onto the wrapping table and edge faces Se are covered by first making a front tuck at the leading corners of the stack, overfolding edge portions of the wrapping material and then after the end margins of the wrapping material have been sealed as mentioned above, forming a rear tuck and then completing the overfolding of the end portions of the wrapping material. The sequence of the several steps described above is illustrated schematically in FIGS. 7—11, inclusive, and the ultimate wrapped product is shown in FIG. 1.

The wrapping means 15 may be made of any suitable pliant, flexible paper stock, laminated or non-laminated, reinforced or non-reinforced, or may comprise suitable plastic composition sheet material or paper stock coated with plastic composition materials. In the example illustrated, the wrapping means 15 may be made in accordance with my Patent 2,846,060 and may include bands of self-sealing adhesive material of pressure type such as a rubber latex compound. Longitudinally disposed bands are indicated at 16, 16' and transversely disposed bands are indicated at 17 and 17', the disposition of the bands being indicated in relation to the longitudinal and transverse dimensions of the machine. It will be understood that the method of this invention contemplates that wrapping means in roll form instead of sheet folded form may be employed, that preapplication of bands of adhesive material may be omitted, and that the method contemplates securement of the wrapping means by other suitable means as for example, heat sealing means.

The exemplary wrapping machine (FIG. 2) may comprise a frame 10 which includes and forms the conveyor table 20 and wrapping table 30. The tables may be of the same height and may be spaced apart by longitudinal frame bars 11 a selected distance to provide suitable space for the feed station F to introduce a prefolded wrapping means 15 from a supply source of such wrapping means preferably located below one or the other of the tables 20 or 30.

Conveyor table 20 may include spaced rows of a plurality of transversely oriented rollers 21 providing a conveyor surface upon which a stack S to be wrapped may be placed. The stack S may be preassembled or may be assembled on the conveyor table.

Means for receiving, aligning and guiding a stack S on table 20 may comprise a pair of longitudinally extending angle section guide members 22, 22' having end portions outwardly flared as at 23, 23' to facilitate reception of stack S. Guide member 22 is spaced a preselected distance from the longitudinal center line of the machine in accordance with the long dimension of the stack S to be wrapped and member 22 may be secured to table 20 in any suitable manner. The guide member 22' is mounted in movable relation to table 20 by any suitable means such as pin and slot means (not shown) and may be biased by a pair of spaced springs 24 toward the center line of the machine. Springs 24 may be carried by spring support sockets 25 on a bar 26 movably mounted on table 20 in

5

suitable manner. Thus the biased guide member 22' positively urges a stack S against the fixed guide member 22 and serves to positively position the stack with respect to the machine center line.

Adjacent guide member 22 may be provided a parallel longitudinally extending angle section alignment member 26 for aligning one edge of wrapping means 15 as a top panel of a wrapping means is positioned over the top surface of stack S. Alignment member 26 is fixed a selected distance from member 22 and has a top edge disposed above the top edge of member 22. The spacing of members 22 and 26 may be varied depending upon the thickness of stack S so as to provide sufficient end edge wrapping material to cover edges Se of the stack.

Stack advancing means are provided between the spaced rows of rollers 21 on the conveyor table 20, such stack advancing means being indicated at 40 (FIGS. 2, 14, 15 and 16). A carriage 41 including transversely interconnected side carriage members 41a may be provided with wheels 41b for rolling engagement with inboardly flanged way members 12 extending the length of and carried by the conveyor table 20. A stack pusher plate 42 may be hingedly connected to the front end of carriage members 41a, said plate 42 having a depending leg 42a, when plate 42 is in horizontal down position. The top surfaces of carriage 41 and plate 42 when it is in down position, lie below the top conveyor surfaces of the rollers 21 so that said carriage 41 may be reciprocally moved longitudinally of the machine beneath a stack S.

Means to reciprocally move carriage 41 along way members 12 may comprise a pair of longitudinally disposed endless chains 43 engaged with and supported by pairs of end sprockets 45 supported from stub shafts carried by way members 12. A motor 44 may have a driving connection with the stub shafts of the sprockets 45 at one end of the conveyor table 20. Means for connecting carriage 41 with the pairs of chains 43 may include a transverse bar 141 connected across and welded to external faces of said chains so that bar 141 may move around the end sprockets 45. Carriage 41 may be provided with a central plate 46 from which may depend a yoke 142, the lower end of which receives bar 141 for a driving connection therewith. Yoke 142 provides a vertically extending slot along which the bar 141 may vertically move as bar 141 passes over sprockets 45. The use of stub shafts to support sprockets 45 provides an open space between end sprockets to permit passage of yoke 142.

In starting position (FIG. 14) carriage 41 is intermediate ends of chains 43 and bar 141 is disposed at the bottom lay of chains 43. A stack S on conveyor table 20 will overlie carriage 41 at least partially as shown in FIG. 14 or entirely. When motor 44 is energized chains 43 are driven in a clockwise direction, bar 141 moves rearwardly and drives the carriage 41 rearwardly until it reaches its rearmost position as shown in phantom lines (FIG. 14). During such rearward movement of carriage 41, pusher plate 42 clears the trailing edge of stack S and may be positively moved to upright position by engagement of leg 42a with a stop 42b provided on way member 12. The hinge connection of pusher plate 42 to the carriage may also include a spring whereby the pusher plate 42 is normally biased into upright position. As the carriage 41 now advances toward stack S, pusher plate 42 is in upright position to engage the trailing edge face of stack S and bar 141 now moves along the top lay of chains 43 to drive the carriage forwardly. Pusher plate 42 thus abuts against stack S and pushes stack S forwardly across conveyor rollers 21, across the feed station of the wrapping means 15 and onto the wrapping table 30. Carriage 41 is limited in its forward travel by bar 141 and the location of the front sprockets 45. Chains 43 are not stopped at this point but instead continue to drive the carriage so that the bar 141 moves vertically downwardly in yoke 142 and then moves the carriage

6

backwardly to its starting position as shown in FIG. 14. Reciprocation for one cycle may be controlled by a limit switch in well known manner.

Means may be provided to support a stack S while it is being transferred between tables 20 and 30. A pair of parallel arms 47 slidably mounted on longitudinal members of frame 10 are cooperably associated with carriage 41 for movement into the space between tables 20 and 30 as indicated by dotted lines in FIG. 2. In this example, arms 47 may be provided with rollers 47a in engagement with track means 47b on the frame 10. Each arm 47 may be provided with a depending cam follower element 47' adjacent its back end, said cam element having a forwardly facing convex cam surface 147' and a rearwardly facing notch 148. Cam elements 47' are adapted to be simultaneously engaged by sidewardly extending pick-up arms 48 pivoted about a longitudinal horizontal axis at 149 provided on a depending support bracket 150 carried by carriage 41 forwardly of yoke 142. The inner ends of arms 48 may provide seats for springs 151 for normally biasing said arms 48 into horizontal position. Arms 47 also carry cam elements 47'' spaced forwardly of cam elements 47' and reversed in position, that is, cam convex face 147'' is rearwardly directed and notch 148'' is forwardly directed.

When the carriage 41 moves forwardly normally horizontally disposed arms 48 engage notch 148 on the rearmost cam element 47' and move the arms 47 forwardly with the carriage. Just before arms 47 have advanced to the position shown in dotted lines in FIG. 2, arms 48 are disengaged from cam elements 47' by laterally spaced cam members 144 having convex cam surfaces for lifting engagement with the inner ends of arms 48 to compress springs 151 and to disengage the outer ends of arms 48 with the recess 148 provided in cam elements 47'. Thus forward movement of the arms 47 is stopped. The carriage 41 may progress further forward in order to properly push the stack S onto the wrapping table and upon its return the horizontal arms 48 engage the recesses 148'' of the forward cam elements 147'' and cause the arms 47 to be retracted to its initial position where the arms 47 are again disengaged from the carriage 41 by another set of laterally spaced cam members 144'. Thus the arms 47 are retracted to their initial starting position and do not extend into the feed station F.

When a stack S is positioned on conveyor table 20, a wrapping means 15 may be drawn from the station F and a top panel portion 15a may be placed over the top surface of the stack and longitudinally aligned by alignment member 26. A bottom panel portion 15b depends from the leading edge of the stack. When my patented wrapping means is used, the fold line thereof may be registered with the top front edge of stack S to facilitate alignment. Forward movement of carriage 41 advances the stack S with the wrapping means 15 thereon substantially through the wrapping station W.

At the wrapping station, the stack S is pushed between top and bottom transverse friction or tensioning rollers 31 and 32 which smooth, tension, and draw the top and bottom panel portions 15a and 15b against the top and bottom surfaces of the stack. The wrapping means is thus simultaneously tensioned and drawn against the major large top and bottom surfaces of the stack.

Both rollers 31 and 32 may be mounted from side support members 131 vertically adjustably mounted on vertical side frame members 110 of the wrapping table 30 adjacent the wrapping station W. Each support member 131 may include a slot 132 and suitable clamp means 133 may engage said frame member 110 and said support member 131 through slot 132 for selectively positioning the rollers 31 and 32 with respect to the top surface of the wrapping table in accordance with the height of the stack to be wrapped. Roller 31 includes a shaft 134 freely rotatably mounted in suitable bearings carried in downwardly directed end portions 135 on roller support

trail arms 136 pivoted at their opposite ends to the top portions of support members 131. The top roller 31 is spaced from the edge of table 30 adjacent feed station F and the weight of the roller 31 provides pressing contact with the top panel on stack S.

Bottom roller 32 may be movably mounted from support member 131 and driven between a bottommost position below the surface of the wrapping table to a topmost and forwardly directed position adjacent top roller 31. Bottom roller 32 may include a shaft 32a which extends through an angle-shaped guide slot 53 provided in a flanged portion 131a of the support member 131 adjacent the top thereof. Each end of shaft 32a may carry a sprocket 52 which has meshed engagement with a ladder chain 51 secured to support member 131 adjacent flange portion 131a and following the contour of the inner wall of slot 53. The ladder chain thus has a vertical leg chain 51a and a top horizontal chain leg 51b which may terminate just below shaft 134 of top roller 131. An adjustable tensioning bolt 51c connected to the bottom end of chain 51 may have threaded engagement with a lug 51d for tightly seating the chain legs 51a and 51b against their respective seating surfaces on member 131. A threadably adjustable stop member 58 may be carried by a lug 58a on member 131 for limiting downward movement of bottom roll 32 and for adjusting the roll 32 in proper relationship with the top surface of the wrapping table 30.

Means for controllably raising and lowering bottom roller 32 through the angle-shaped path defined by slot 53 may include a motor means 54 supported at one side of the wrapping table 30 and having a shaft connected with an extension of the shaft 32a of roller 32 as at 54a (FIG. 4). Motor means 54 may preferably be of relatively small size and small horsepower and to facilitate driving bottom roll 32 counter balance means are provided so that the driving force required from motor means 54 is reduced to a minimum. Such counter balance means may include a counter balance weight 55 connected to a cable 56 which engages and passes over a pulley 57 supported from an upstanding column 57a secured to the wrapping table. The cable 56 may be connected to shaft 32a by a suitable connector 56a. When energized, motor means 54 will drive the sprocket 52 along the chain path first upwardly and then forwardly over the back margin of stack S. The chain and sprocket described above provide a means for controlling and directing the path of movement of the bottom roller 32 during a wrapping operation.

Each roller 31 and 32 may include a rubber composition material covering in order to facilitate frictional contact of the roller with the wrapping means 15. In order to smoothly draw and tension the top and bottom panel portions 15t and 15b of the wrapping means each roller 31 and 32 may be provided with friction brake means 33 and 34, respectively (FIG. 5), for retarding free rolling motion imparted to the rollers by the advancement of a stack upon the wrapping table 30. Each friction brake means 33 and 34 may be identical and may comprise a slidably axially mounted friction plate 35 biased against an end plate 38 carried by roller 32. An adjustable collar 34a carried by shaft 32a may be provided for adjusting the biasing force of the spring 35a. It will thus be apparent that the rollers 31 and 32 may provide a selected dragging force acting on the top and bottom panel portions of the wrapping means.

When a stack S is advanced across the wrapping station the leading edge of the stack is first received upon a transversely extending apron 36 defining a top surface of the wrapping table. The depending panel portion of the wrapping means 15 will be urged upwardly against the bottom surface of the stack by the bottom roller 32. The top roller 31 spaced from the bottom roller 32 in the direction of advancement of the stack will later engage the top panel portion 15t. Thus the two

rollers will draw the wrapping means against the leading edge of the stack. After the stack has advanced to its ultimate position by the pusher plate 42 the motor means 54 may be energized by suitable switch means so that the bottom roller 32 will climb the ladder and simultaneously lift the bottom transverse edge margin of the bottom panel portion 15b upwardly over and against the trailing edge of the stack and then as the roller reaches the horizontal portion of path 53 it will be moved forwardly into proximate relation with the top roller 31. As the bottom roller moves forwardly, the transverse edge margin of the bottom panel portion 15b is overlapped with the top panel portion and is pressed thereagainst. When the wrapping means 15 of my patent is employed, it will be apparent from a consideration of FIGS. 10 and 11 that the self-sealing adhesive bands 17 and 17' are brought into sealing pressure contact with each other to secure the wrapping means along the back top edge margin of the stack S.

Means are provided for tucking and folding portions of the wrapping means at ends of the stack. As best seen in FIG. 7-11, inclusive, a front tuck Tf is made as the stack first advances under the wrapping table. Overlapped end folds F1 and 2 are then made progressively as the stack advances and finally a rear tuck Tr is made. Overfolding of the folds F1 and F2 is not completed until the stack is pushed from its place on the wrapping table by a succeeding stack.

The formation of the rear tuck Tr will be first described because it is associated with the action of the bottom roller 32. Adjacent each end of shaft 32a a side arm 63 may be connected as at 64 said side arm having a longitudinal sliding connection with a guide block 63a pivotally mounted as at 63b to the support member 131. The side arms 63 support transversely extending angle section members 62 in parallel offset relation to the bottom roller 32. Slidably mounted on members 62 adjacent each end of roller 32 may be slide plates 66 and 67 secured as by a nut and bolt assembly. Plate 67 may have hingedly connected thereto as at 68 a forwardly extending tucking shoe 65 which may be biased forwardly and inwardly by a spring 69. Thus as the roller reaches the top of the ladder and advances horizontally the tucking shoe 65 is brought into opposed relation with the end corner of the stack and is moved forwardly between the horizontally projecting end margins of the top and bottom panel portions 15t and 15b so as to press a tuck Tr against the side edges of the stack. It will be understood that the tucking shoes 65 are precisely adjusted so as to be aligned with the edge of the stack and that the pivoted flexibility of the shoes 65 permits the shoe to further adjust itself to possible discrepancies in alignment and to firmly press the rear tuck against the stack. It will be apparent that the tucking shoe 65 may be readily adjusted laterally to accommodate stacks of different widths.

A stack S advanced upon the wrapping table 30 may pass through the wrapping station W described above and then through an adjacent zone wherein the forward tuck and the end folds are made, such zone being generally indicated at 79, and then finally to a discharge zone generally indicated at 70. The wrapping table 30 may include spaced rows of transversely extending conveyor rollers 71 for facilitating movement of the stack in well known manner.

At zone 79 an overhead bridge-like support means 76 may extend transversely of said machine and may comprise a pair of parallel spaced beam means 77 and 78 defining opposed channels or grooves 77' and 78' for slidably guiding engagement with a plate 81 forming a hanger support for each of end tuck and fold assemblies generally indicated at 80. Each assembly 80 may be of substantially the same construction and only one of such assemblies will be described. The beam means 77 and 78 may be supported at their ends from upstanding frame

members 76a carried by the frame means of the wrapping table 30.

Means are provided for moving the assemblies 80 toward and away from each other with reference to the center line of the machine upon which the stack is referenced. Such means may comprise a drive screw member 83 supported adjacent its center by a bearing block 84 and at its ends in bearings mounted on the upstanding frame members 76a. The screw member 83 is provided with oppositely pitched screw threaded portions 83a and 83b which are provided threaded engagement with suitably threaded nuts or blocks 85 secured to a wall 82 of assembly 80. Screw member 83 extends through spaced housing walls 82 on each assembly 80 and said housing walls 82 are connected by a top wall connected with hanger plate 81. At one end of screw member 83 is provided a crank wheel 87 having a handle 86. When the crank wheel 87 is turned, rotation of the screw member will cause the assemblies 80 to either advance toward each other or away from each other, depending upon the direction of rotation. The assemblies are thus uniformly advanced or retracted with relation to the center line of the machine. A slotted bracket 88 may be carried by frame member 76a to receive the circumferential margin of the crank wheel 87, said margin being preferably perforated with spaced holes through which a lock pin 88a carried by bracket 88 may extend to positively retain the crank wheel and screw member against rotation once a selected position has been determined.

Each assembly 80 may be provided with a front tuck shoe 60 carried at the inner end of a horizontal arm 61 provided with a longitudinally extending portion 61a pivotally connected at 61b to a bracket carried by the outer surface of the outer wall 82. The arm 61 may be normally biased inwardly by a spring 61c ensleeved over a bolt carried by the bracket and seated against the head of the bolt and a lug on the arm portion 61a. The shoe 60 will thus engage under pressure the end edge faces of the stack at a point just behind the top roll 31.

While shoe 60 is illustrated as a single shoe plate, it will be understood that shoe 60 may be made of two sections adjustable to vary the height of the shoe to accommodate the shoe to stacks of different thickness in order to positively form a front tuck. Moreover, the front tuck forming shoe 60 may be located at other places along the path of movement of the stack. For example, such a shoe 60 may be located adjacent the bottom roller 32 to initiate the front tuck as the stack advances onto the wrapping table. For this purpose, the shoe 60 may be supported from the transverse members 62 and may be located above the bottom roller 32 to initially form the front tuck as the leading edge of the stack is advanced onto the wrapping table.

Each assembly 80 also carries end fold forming discs 90 and 100 which are brought into general alignment with the end edges of the stack by the selective transverse positioning of the assemblies 80. The top disc 90 may be rotatably mounted intermediate ends of a shaft 90a having its ends carried in parallel side members 91 inclined forwardly and downwardly and having their upper ends interconnected by a shaft 92 pivotally carried in side walls 89 of an inner vertically adjustable carrier frame 89a. The shaft 90a also carries a hold-down roller 95 inwardly of disc 90, said roller 95 being adapted to rollingly contact the top panel portion of the wrapping means. The disc 90 is biased against the outer end face of roller 95 by a spring 90b ensleeved over shaft 90a and seated against a collar 90c thereon. Shaft 90a is slightly angularly disposed with respect to the transverse axis of the machine so that the disc 90 is canted slightly outwardly and forwardly to facilitate initial receiving and down-folding of the end margin of the top panel portion of the wrapping means. The hold-down rollers 95 at opposite sides of the stack thus tend to stretch laterally the top panel portion of the wrapping means.

The roller 95 is biased downwardly against the stack S by means of an intermediate bar 94 connecting side members 91 and a spring 93 ensleeved over a bolt 93a and having one end seated against the top wall 89b of the carrier frame and its bottom end seated on a collar carried by the bolt adjacent the bar 94, the bolt and bar being welded in any suitable manner.

The bottom fold forming disc 100 includes a somewhat similar arrangement comprising a shaft 100a carrying disc 100 and connected to upwardly and forwardly inclined side members 101 interconnected at their lower ends by a bar 102 pivotally connected to an inwardly extending channel section member 102a secured as by welding to the inner surface of the outer wall 82 which extends below the surface of the wrapping table in the space outwardly of the roll of rollers 71. The shaft 100a also carries an upwardly pressing roller 105 for rolling engagement with the end margin of the bottom panel portion of the wrapping means. The disc 100 is biased against the end face of the roller 105 by a spring 100b ensleeved over shaft 100a and seated against a collar 100c. The roller 105 and the disc 100 may be biased upwardly by a spring 104 ensleeved over a bolt 104a having a rocking connection with the bottom wall of the member 102a and secured at its top to a transverse rod 103 interconnecting side members 101. The upper end of spring 104 may be seated against a collar carried by bolt 104a. The disc 100 thus serves to upwardly fold the end margin of the bottom panel portion of the wrapping means after the top down fold has been made.

Adjustment of the inner carriage 89a may be made by means of a vertical threaded shaft 116 having threaded engagement with a nut 117 secured as by welding to the top wall 117a interconnecting the side walls 82. The lower end of the threaded shaft 116 may extend through a port in the wall 89b of the inner carrier means 89a and may be secured thereto by a bottom nut 118. Side walls 82 may be provided with guide ribs 119 on inner surfaces thereof which guidably cooperate with grooves provided in outer surfaces of walls 89 on the carrier 89a. A top hand wheel 115 connected to threaded shaft 116 may be turned to vertically adjustably position the inner carrier means 89a and the top disc 90 and hold-down roller 95.

The inner carrier means 89a is also provided with a forward holding roll 110 which extends outwardly beyond disc 90 and which may be mounted on a shaft 110a supported from forwardly and downwardly inclined side members 111 pivotally connected at their top ends by a rod 112 to walls 89 of the carrier means. The holding roll 110 may be biased downwardly by a spring 113 ensleeved over a bolt 113a carried by top wall 89b and secured as by welding to a crossbar 114 interconnecting the side members 111. A collar 113b may seat the lower end of spring 113.

The holding roll 110 is provided to positively retain the top marginal portion of the wrapping means against the top surface of the stack as a pressure sealing roll 120 is rollingly engaged with the upfolded end portion of the wrapping means to press the self-sealing bands 16 and 16' into sealing contact with each other. The pressure sealing roll 120 may be best seen in FIG. 4 and is carried on a shaft 120a interconnecting a pair of arms 121 pivotally supported at their outer ends by an interconnecting shaft 123 carried by spaced bracket walls 124 secured as by welding to the outer surface of outer wall 82. The pressure sealing roll 120 is biased against the edge of the stack by a spring 122 seated against a cross bar 125 interconnecting arms 121 and ensleeved over a bolt 126 carried by an outwardly disposed spaced member 127 secured at its outer end to the bracket walls 124.

Preferably the pressure sealing roll 120 may be provided with a roughened or knurled surface to frictionally engage the end upfold F2. The axis of pressure roll 120

11

may be upwardly and rearwardly inclined as shown, however, it may be disposed vertically or at another selected angle depending upon the folding relationship of end folds F1, F2.

It will be understood that while top discs 90 and 100 have been shown for accomplishing the downfolding and upfolding of end folds F1, F2, respectively, other means may be employed to accomplish such folds. For example, longitudinally extending elongated shoes may be positioned at each end of stack S for guiding the end margins of the top and bottom panel portions of the wrapping means into the folded relationship. Such shoes may be biased toward the end edge faces of the stack so that the folds are pressed against such edge faces. Similarly, it is understood that in place of the hold-down rollers 95 and 110 there may be substituted longitudinally extending hold-down skids or parallel runners which may frictionally slidably engage the top surface of the top panel portion of the wrapping means and which may be disposed at a slight angle to the direction of advancement of the stack so as to provide a slight lateral tensioning component of force to the top panel portion. It will also be understood that the assemblies 80 at each end which are adjustable relative to each other by the overhead bridge support means 76 may be modified so that such relative movement may be controlled by means provided beneath the surface of wrapping table 30.

When a stack is to be wrapped and has been placed upon the conveyor table surface and a sheet of pliant wrapping means 15 has been oriented on the top large surface area and with the remaining portion of the sheet of wrapping means 15 depending from the leading edge of the stack into the space at the in-feed station F, advancement of the stack between the top and bottom tensioning rolls 31 and 32 will simultaneously tension and smooth both top and bottom panel portions of the wrapping means against the top and bottom surfaces of the stack. The bottom panel portion is fed by the bottom tensioning rollers into covering relation with the stack bottom surface. When the stack S is no longer advanced by the pusher plate 42, the bottom tensioning roller 32 upfolds a remaining portion of the bottom panel portion of the wrapping means over the back edge of the stack and then forwardly over the top free edge margin of the top panel portion of the wrapping means. In such operation the bands of self-sealing adhesive 17 and 17' are thus brought into sealing contact with each other and the pressure of the bottom tensioning roll 32 upon the overlapped portions provides a positive continuous seal across the back edge of the stack.

In some instances at this point in the wrapping operation the wrapping operation may be considered complete. For example, the width of the wrapping means may not include sufficient material to project over end edges of the stack. Some articles may not require end protection. The wrapping band has been drawn snug and tight against the surfaces of the stack and will secure the parts of the stack against relative movement. The method of the invention described immediately above permits the use of wrapping means 15 which may include heat-sealable plastic bands or plastic coatings so that a heated bottom roller will provide a pressure and heat-seal for the overlapped end margins of the top and bottom panel portions. In such instance, the bottom tension roller may include a transverse bar of metal material capable of being readily heated to a selected temperature for providing continuous application of heat to a heat-sealable band of material provided on the wrapping means.

The formation of the front tuck Tf does not bring into engagement sealing bands 16 or 16'. Immediately after the front tuck Tf is formed, the projecting end portion carrying the sealing bands 16 is downfolded and progressively the bottom end margin is upfolded so that the band of adhesive 16' is brought into pressure sealing contact with the band 16. It will be noted that when the rear

12

tuck Tr is formed the adjacent back portions of the downfold F1 and the upfold F2 are not completed because the stack has stopped its advancement. The folding of F1 and F2 is completed when the second stack S is advanced onto the wrapping table. Such advancement pushes the first stack past the fold forming discs 90 and 100 and completes the end folding operation. It will also be apparent that the pressure sealing roller 120 which in the present example provides the application of force to pressure seal the bands 16 and 16', may be a heated roller so that bands of heat-sealing plastic composition or the like may be pressure and heat sealed in virtually the same type of operation. It will thus be understood that this invention is not intended to be limited to self-sealing adhesive bands but the wrapping method contemplates other types of sealing means and arrangements.

It will be understood that the exemplary apparatus described above may be modified and changed and still come within the spirit of the invention and that the method described above may be performed by other types of machines as generally described above. All changes and modifications coming within the scope of the appended claims are embraced thereby.

I claim:

1. A machine for wrapping large rectangular packages, comprising: a frame having a work receiving surface, a discharge surface spaced forwardly from the lying in the same plane as said work receiving surface, and an overhead bar support member positioned above and between said surfaces; and a pair of folding means assemblies adjustably mounted on said overhead bar support member for vertical and horizontal adjustment relative to said surfaces adapted to fold wrapping material about a work piece advanced therebetween along said surfaces, each folding means assembly including: a top tucking disc to fold projecting marginal end portions of a panel of wrapping material overlying the top of said work piece against one end of said work piece, and a bottom tucking disc spaced below said top tucking disc to fold projecting marginal end portions of a panel of wrapping material underlying the bottom of said work piece against said one end of said work piece.

2. A machine as in claim 1 wherein said frame is provided with a pair of tensioning rollers rearward of said folding means assemblies, said pair including a top tensioning friction roller adapted to bear on said top panel of wrapping material and a bottom tensioning friction roller adapted to bear on said bottom panel of wrapping material to draw and smooth said material along the top and bottom and about the leading edge of said work piece as said work piece is advanced between said rollers.

3. A machine as in claim 2 including means to move said bottom tensioning roller upwardly against and about the trailing edge of said work piece as the work piece passes over said roller in its forward advance to form a rear fold of said bottom panel about the trailing end of said work piece.

4. A wrapping machine adapted to package stacks of large, flat, rectangular articles in a compliant wrapping material having bands of pressure adhesive material selectively disposed thereon comprising: a conveyor surface adapted to receive and convey thereon a plurality of large flat rectangular articles in stack form; a wrapping table adapted to receive articles from said conveyor surface and spaced from said surface to provide a wrapping material feed station therebetween where wrapping material may be cooperatively positioned relative to said stack before it is advanced onto said wrapping table; means associated with said wrapping table to tension and fold said wrapping material tightly about said stack and to seal said bands of pressure adhesive material upon each other as said stack is advanced along said table to form an envelope of wrapping material about said stack; said means to tension and fold said wrapping material

including top and bottom tensioning friction rollers adapted to bear on said wrapping material against said stack to draw said wrapping material along said stack about said stack leading edge as said stack is advanced between said tensioning rollers; said tension and folding means including a pair of hold-down rollers, each disposed above a bottom tucking disc to hold marginal portions of said wrapping material against said stack during the bottom tucking disc's folding action on said wrapping material at the bottom of the stack; said means to tension and fold said wrapping material also including a pair of opposed top folding members spaced from the top tension roller and receiving the stack therebetween, whereby end portions of the wrapping material are folded downwardly against ends of the stack; and a pair of bottom folding members spaced below said top folding members and along the direction of advancement of the stack to also receive the stack therebetween whereby end portions of the wrapping material positioned against the bottom of the stack are upfolded over said top downfolded end portions of wrapping material positioned over the top of the stack.

5. A method of wrapping an article of polygonal shape having at least two surfaces lying in parallel spaced planes in a sheet of pliant wrapping material; the article being advanced in a path defined by said parallel planes and including the steps of: positioning one portion of said sheet over one of the surfaces and another portion of the sheet extending across the direction of advancement of the article; moving said article in one direction along said path; holding said one sheet portion on said one surface during movement of the article while progressively laying said other sheet portion against said other surface and simultaneously tensioning said sheet material against said surfaces and against the leading edge of said article; folding an end margin of said other sheet portion upwardly over the trailing edge of the article and then forwardly over the end margin of the one sheet portion during a pause in the movement of the article; and securing said end margin while the portions are held under tension.

6. A method as stated in claim 5 wherein side margins of the sheet of wrapping material extend beyond the surfaces and including the step of: progressively folding the side margins of the sheet against side edge faces of the article for a major portion of the length of said article during movement of the article, and completing said folding of the remainder of the side margins upon commencement of movement of the article and after the end margins of said sheet have been secured.

7. A machine for wrapping an article of polygonal shape having parallel top and bottom faces comprising: means including an article positioning surface for initially positioning an article for receiving a sheet of wrapping material having a top portion covering said top face and a portion initially depending from the front edge of the article below said positioning surface; wrapping table means including an article wrapping surface for supporting the article during the wrapping, said surfaces providing a space therebetween for the depending sheet portion; means on the article positioning means for moving the article onto the wrapping surface; top transverse roller means on the wrapping table means for frictionally transversely engaging the top portion of the sheet during movement of the article; bottom transverse roller means on the wrapping table means for engaging the bottom sheet portion to guide and position said depending bottom sheet portion against the bottom article face whereby the top and bottom roller means draw said sheet against the leading edge of the article and tension said sheet; and means on the wrapping table operable to move said bottom roller means upwardly and forwardly over the transverse edge of the article to lay the free edge margin of the bottom portion of the sheet over and against the free edge margin of the top portion of the sheet, said overlapping edge margins being adapted to be

secured while said sheet portions are held under tension.

8. A machine as stated in claim 7, including guide means on the opposite sides of said wrapping table for said bottom roller, said guide means defining a vertical path extending above the wrapping surface and a horizontal path extending in spaced relation and above said wrapping surface to position said bottom roller adjacent said top roller in one position thereof.

9. A machine as stated in claim 8, including means for vertical adjustment of said guide means for said bottom roller whereby articles of different height may be accommodated for wrapping.

10. A machine as stated in claim 7 wherein said means for moving said bottom roller includes a tucking element for forming a side edge tuck at the trailing edge portion of the article.

11. A machine as stated in claim 7 wherein said means for moving said article onto said wrapping surface includes reciprocally operable means carried by said initial article positioning means, said reciprocally operable means including a push member movable across the space between said positioning surface and the wrapping surface.

12. A machine as stated in claim 11 wherein said reciprocally operable means includes an endless chain means, and means interconnecting said push member and said chain means whereby reciprocation is provided while said chain means moves in one direction.

13. A wrapping machine adapted to package stacks of large, flat, rectangular articles in a compliant wrapping material having bands of a pressure adhesive material selectively disposed thereon, comprising: a conveyor surface adapted to receive and convey thereon a plurality of large, flat rectangular articles in stack form; a wrapping table adapted to receive articles from said conveyor surface and spaced from said surface to provide a wrapping material feed station therebetween; a supply source of discrete sheets of wrapping material below said feed station whereby wrapping material drawn through the feed station across the leading edge of the stack is positioned over the top face of the stack and the leading edge thereof; and means associated with said wrapping table to tension and fold a sheet of wrapping material tightly about said stack and to seal said bands of pressure adhesive material on each other as said stack is advanced along said table to form an envelope of wrapping material about said stack; said means to tension and fold said sheet of wrapping material including top and bottom tensioning friction rollers adapted to frictionally bear on said sheet of wrapping material against said stack to draw a top panel and a bottom panel of said sheet of wrapping material along said stack about said stack leading edge as said stack is advanced between said tensioning rollers; said means to tension and fold said sheet of wrapping material including a pair of pivotally mounted tuck forming shoes supported from said table to receive a stack therebetween and biased forwardly toward said stack to tuck end portions of said sheet of wrapping material, projecting beyond the ends of said stack leading edge, rearwardly and inwardly toward said stack ends as said stack is advanced past said shoes.

14. A wrapping machine adapted to package stacks of large, flat, rectangular articles in a compliant wrapping material having bands of a pressure adhesive material selectively disposed thereon, comprising: a conveyor surface adapted to receive and convey thereon a plurality of large, flat rectangular articles in stack form; a wrapping table adapted to receive articles from said conveyor surface and spaced from said surface to provide a wrapping material feed station therebetween; a supply source of discrete sheets of wrapping material below said feed station whereby wrapping material drawn through the feed station across the leading edge of the stack is positioned over the top face of the stack and the leading edge thereof; and means associated with said wrapping table to tension and fold a sheet of wrapping

15

material tightly about said stack and to seal said bands of pressure adhesive material on each other as said stack is advanced along said table to form an envelope of wrapping material about said stack; said means to tension and fold said sheet of wrapping material including top and bottom tensioning friction rollers adapted to frictionally bear on said sheet of wrapping material against said stack to draw a top panel and a bottom panel of said sheet of wrapping material along said stack about said stack leading edge as said stack is advanced between said tensioning rollers; means fixed with respect to said wrapping table and adjacent to the feed station for guiding said bottom tension roller first upwardly against a trailing edge of said stack as the bottom surface of said stack clears said bottom tension roller, and then forward over a rear portion of the top surface of said stack to fold said bottom panel upwardly about the trailing edge of said stack so as to seal a marginal portion of said bottom panel on a marginal portion of said top panel, said marginal portions having opposed bands of a pressure adhesive material disposed thereon.

15. A method of wrapping an article of polygonal shape having at least two surfaces laying in parallel spaced planes in a sheet of pliant wrapping material; the article being advanced in a path defined by said parallel planes and including the steps of: positioning one portion of said sheet over one of the surfaces and another portion of the sheet extending across the direction of

16

advancement of the article; moving said article in one direction along said path; holding said one sheet portion on said one surface during movement of the article while progressively laying said other sheet portion against said other surface and simultaneously tensioning said sheet material against said surfaces and against the leading edge of said article; folding an end margin of said other sheet portion upwardly over the trailing edge of the article and then forwardly over the end margin of the one sheet portion during a pause in the movement of the article; and securing said end margins while the portions are held under tension; progressively folding side margins of the sheet against side edge faces of the article along a portion of the length of the article until said article comes to said pause, further advancing said article by advancing a successive article thereagainst, and progressively folding the remainder of the side margins upon said further advancing of the article.

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