United States Patent [19]

Elsner et al.

[11] **3,775,939**

[45] **Dec. 4, 1973**

[54] **ROLL BANDING MACHINE**

[75] Inventors: **Bertram F. Elsner; Frank Elsner, Jr.**, both of Hanover, Pa.

[73] Assignee: **Elsner Engineering Works, Inc.**, Hanover, Pa.

[22] Filed: **Jan. 7, 1972**

[21] Appl. No.: **216,012**

[52] **U.S. Cl.** ..... **53/198 R,** 53/182

[51] **Int. Cl.** **B65b 27/06,** B65b 13/02

[58] **Field of Search** ..... 53/182, 184, 198 R

[56] **References Cited**

UNITED STATES PATENTS

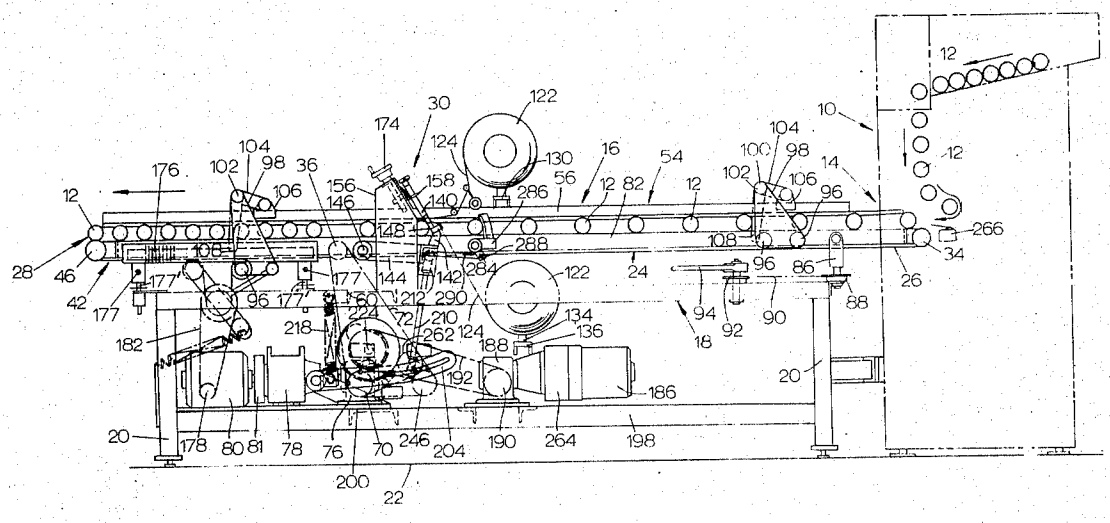
3,523,402	8/1970	West et al.	53/229 X
3,158,973	12/1964	Monaghan	53/182 X
3,577,866	5/1971	Ehrenfried	53/184
2,880,560	4/1959	Gibson	53/198 R
3,236,024	2/1966	Bradley et al.	53/198 R
2,741,885	4/1956	Allison	53/198 R
3,490,194	1/1970	Monaghan	53/182 X

Primary Examiner—Travis S. McGehee
Assistant Examiner—John Sipos
Attorney—C. Hercus Just

[57] **ABSTRACT**

A machine to apply bands of heat-shrinkable, fusible material around coiled rolls of sheet material by feeding said rolls intermittently along a path to provide stationary intervals during which one of a pair of clamping and sealing jaws moves between successive rolls to form at least one band of material around said rolls successively. Additional conveyor means move said banded rolls along heating means, while rotated continuously, to effect shrinking of said bands closely around said rolls.

28 Claims, 11 Drawing Figures



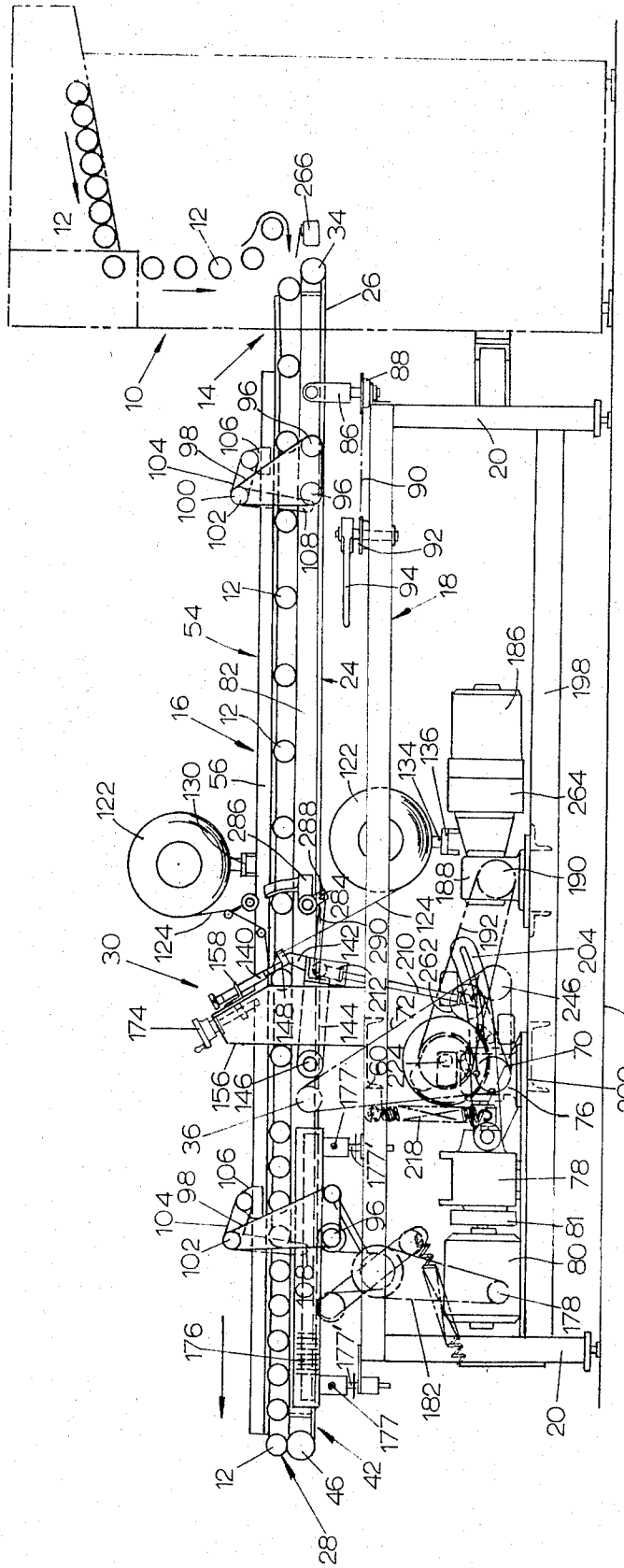


FIG. 1

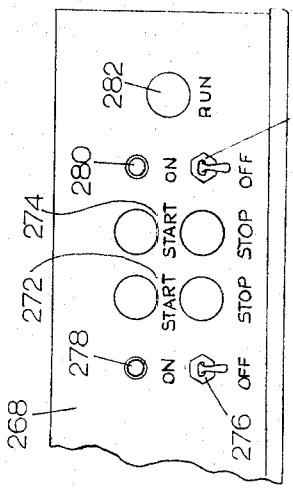


FIG. 9

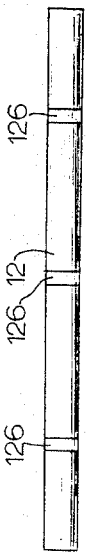


FIG. 10

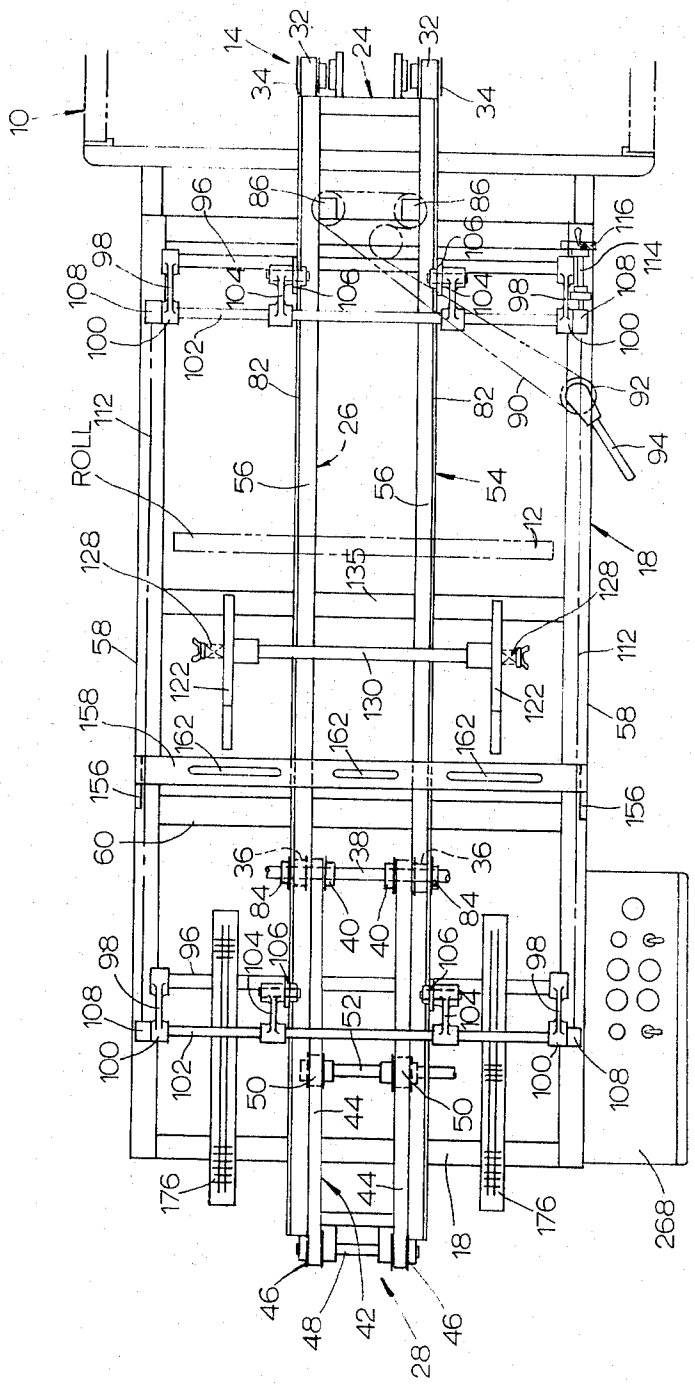

10
14
32
34
24
ROLL
26
54
56
12
18
128
135
130
122
158
162
156
60
36
38
40
84
52
50
44
46
48
42
28
176
268
96
98
100
102
104
106
108
82
86
90
92
94
112
114
116

FIG. 2

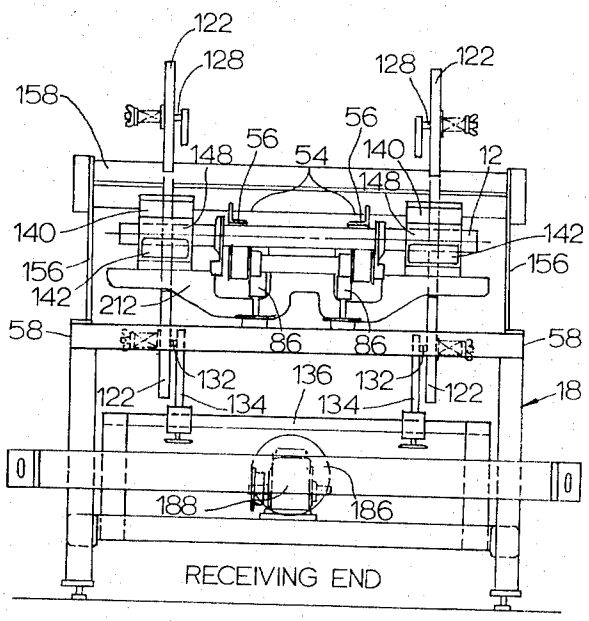

122
128
128
122
158
56
56
148
54
140
148
12
140
142
156
156
142
212
58
86
86
58
132
136
132
122
122
134
134
18
188
186
RECEIVING END

FIG. 3

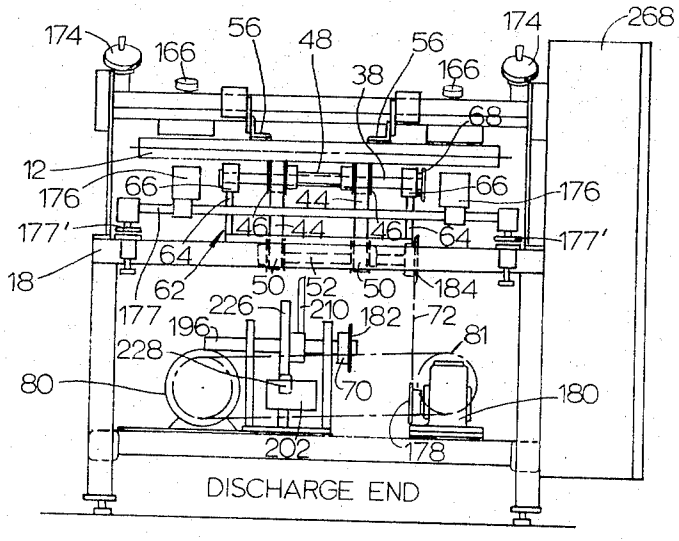

174
166
56
48
56
174
268
38
166
68
12
176
66
44
66
176
177'
46
44
46
64
177'
64
18
62
50
52
50
184
177
196
226
210
182
72
81
228
80
70
180
202
178
DISCHARGE END

FIG. 4

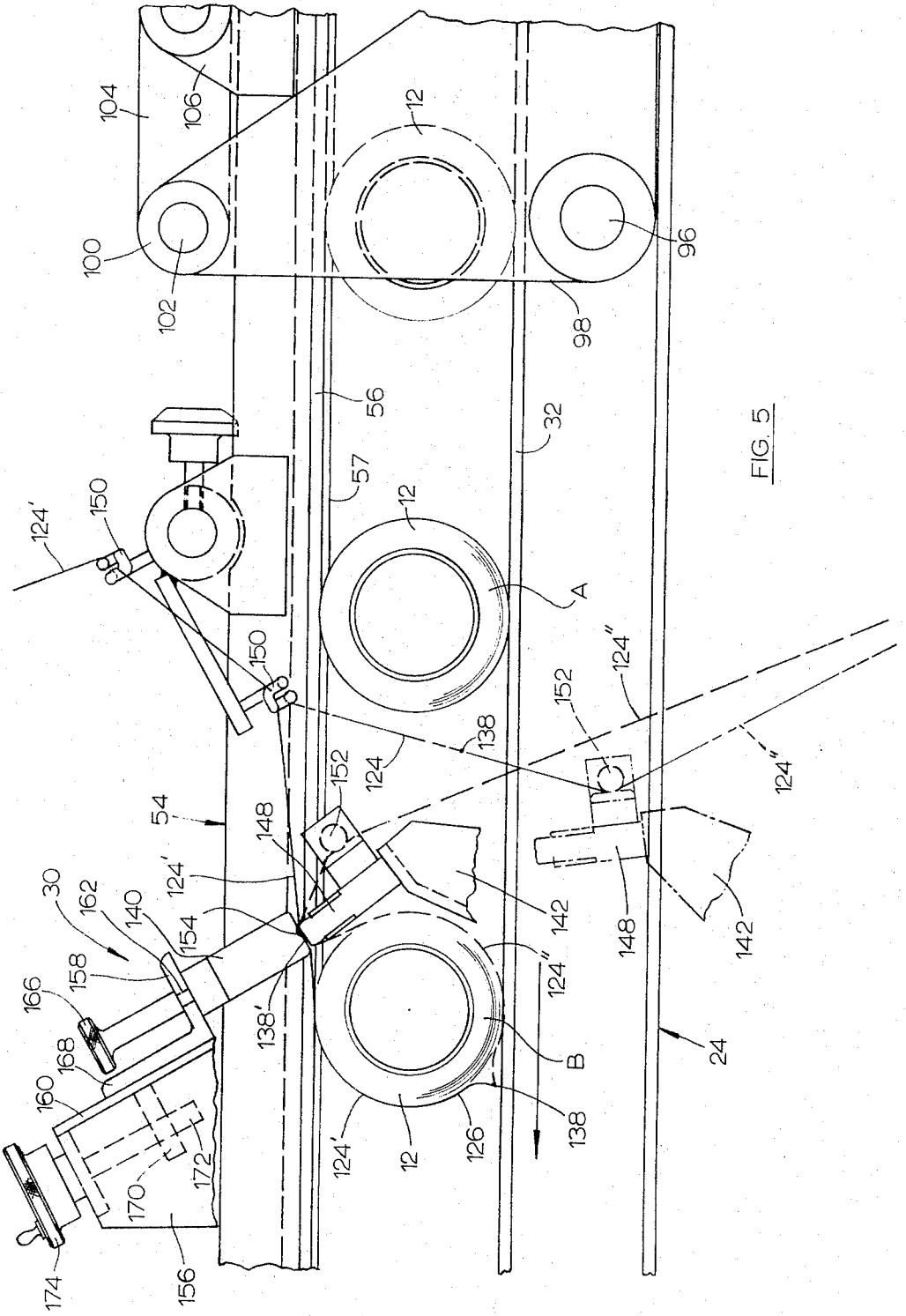

104
106
12
100
102
96
98
56
32
57
12
150
124'
A
150
124"
152
138
124
152
54
148
124'
30
162
140
154
142
148
142
124"
158
166
168
160
138'
B
24
172
170
126
138
124'
12
156
174

FIG. 5

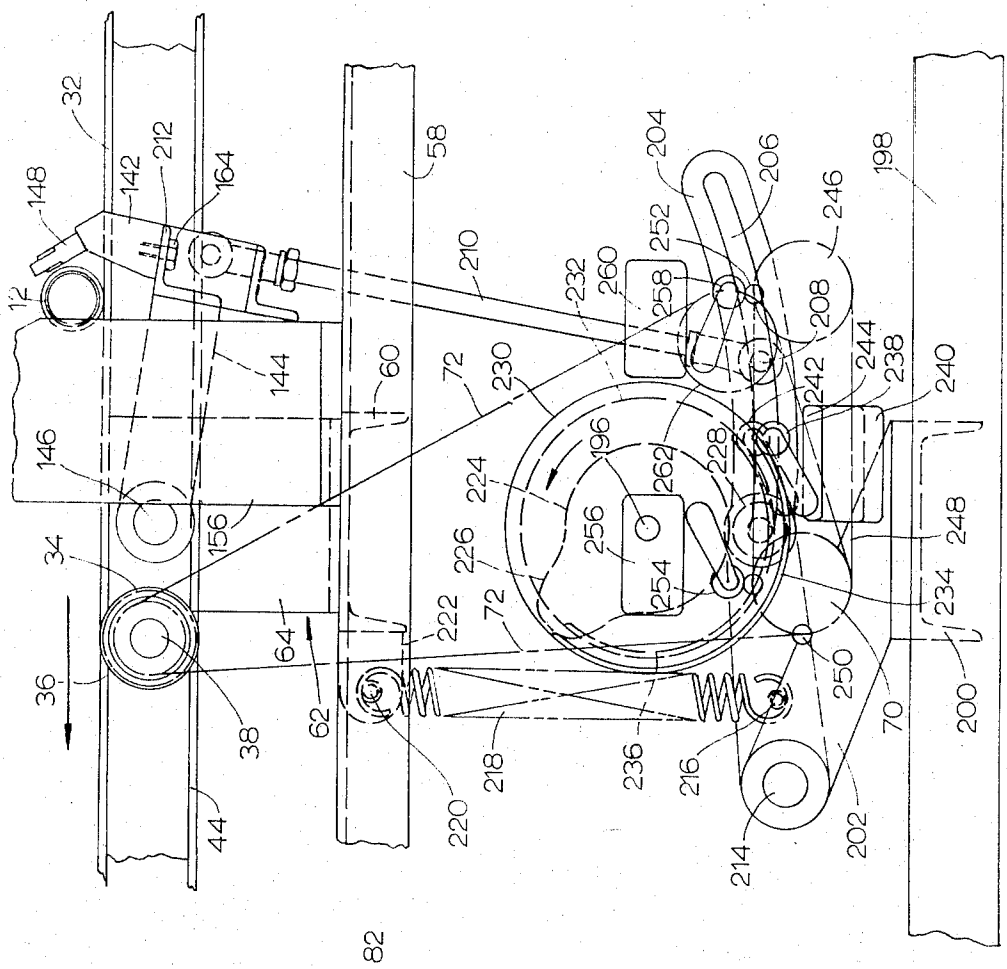

32
148
142
212
164
58
204
206
198
12
210
232
260
252
246
144
60
72
230
258
208
244
238
240
146
196
242
262
228
224
256
248
34
156
226
254
234
72
222
64
250
36
62
38
218
236
216
70
200
220
214
202
44

FIG. 6

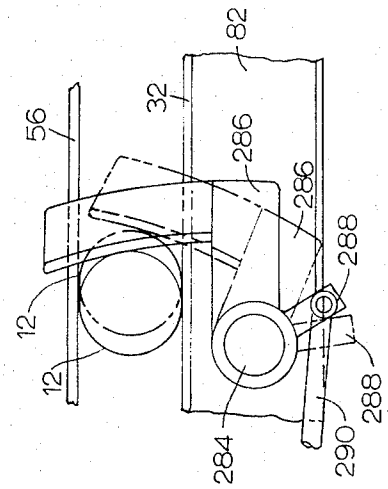

82
32
56
286
286
288
12
12
288
284
290

FIG. 11

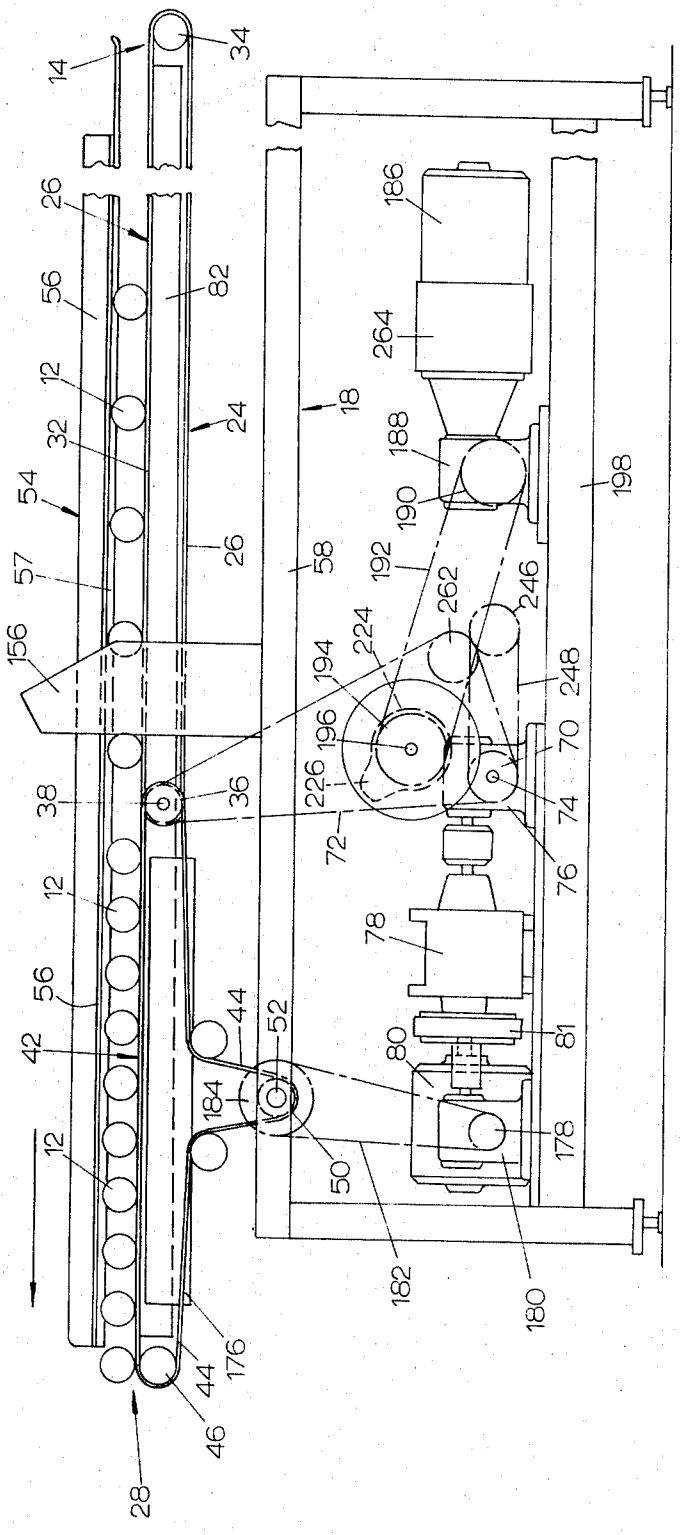

14
34
26
56
82
12
24
32
18
54
57
58
156
38
36
72
74
76
78
56
44
52
42
80
81
184
178
12
50
182
180
176
44
46
28
186
264
188
198
190
192
262
246
224
194
248
196
70
226

FIG. 7

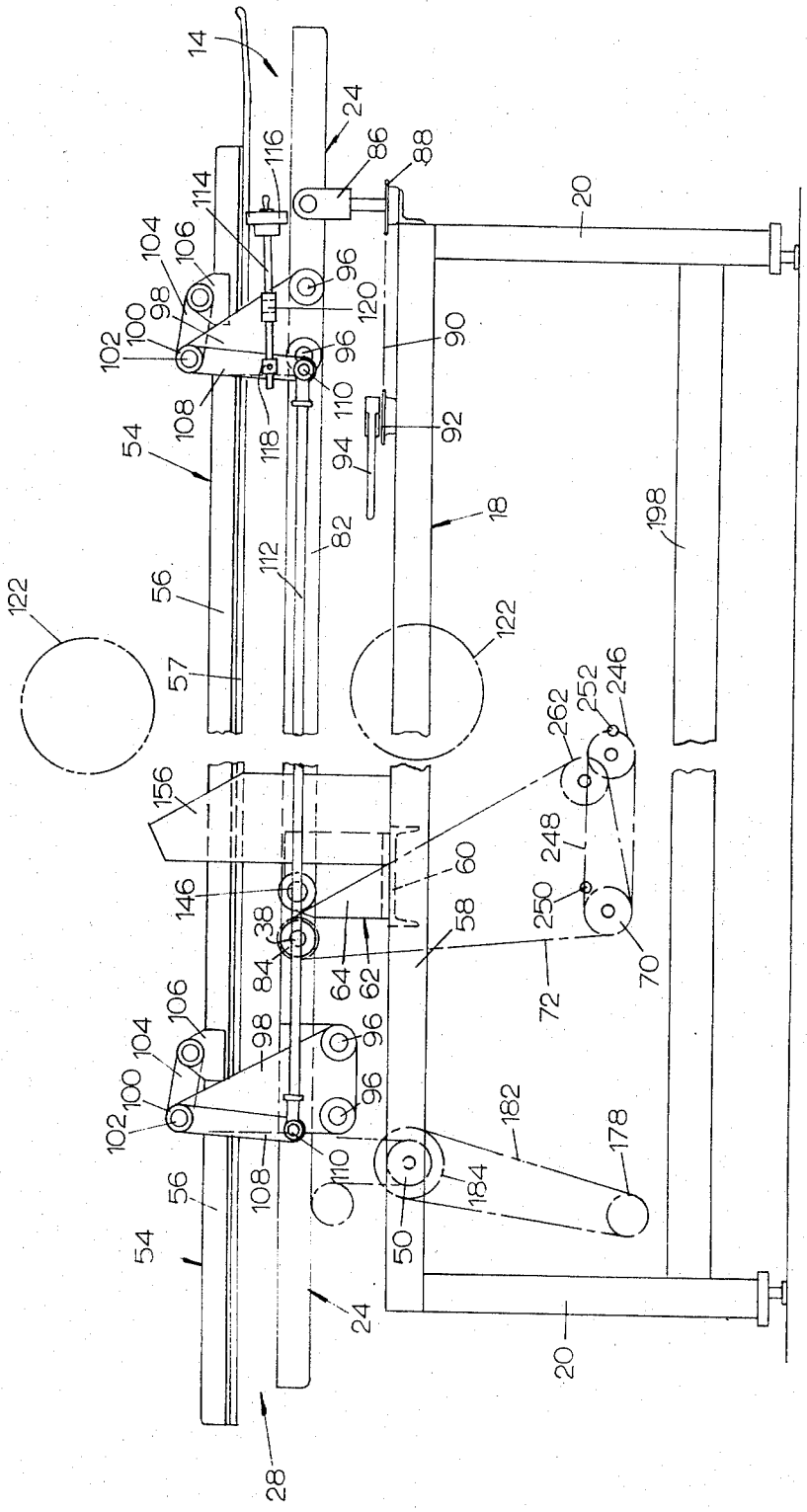

14
24
116
86
88
20
114
104
106
96
120
98
100
102
96
90
110
108
118
94
92
54
82
18
198
112
56
122
122
57
262
252
246
156
248
60
146
38
58
250
64
62
84
72
70
106
104
98
96
96
100
102
182
178
110
108
184
56
54
50
24
20
28

FIG. 8

ROLL BANDING MACHINE

BACKGROUND OF THE INVENTION

Domestic wrapping materials and other forms of similar sheet material usually are manufactured in strips of indefinite length which are coiled into large rolls completely unsuitable for use especially for domestic and many types of commercial purposes. Accordingly, it is common practice to utilize rewinding machines which accommodate large supply rolls of said sheet material and automatically wind upon inexpensive tubes of suitable length usable shorter lengths of said material, or coreless coiled lengths thereof, whereby a large supply roll thereof is capable of forming a large number of such smaller rolls of material. When the smaller rolls of material are formed however, preventing unwinding of the material frequently presents problems unless the material is immediately disposed within cartons such as those having a serrated tearing strip along one edge as are commonly used in connection with merchandising many forms of domestic wrapping material including metal foil, waxed paper, synthetic resin wrapping material, and the like.

There are other types of wrapping material however which do not readily lend themselves to being merchandised in boxes or cartons, such as rolls of gift wrapping material, including Christmas wrapping paper or laminated foil which frequently are of relatively short lengths, as little as 10 or 12 feet or even less. Heretofore, it has been common practice to utilize small dots of adhesive between the inner surface of the outer end of such coils and the next convolution, or utilizing small pieces of strips of pressure sensitive adhesive tape of common type which is disposed against the inner surface or which extends across the outer surface of the end of the coil of sheet material and is adhered to the adjacent surface of the next convolution. In particular however, these adhesive types of arrangements for preventing the uncoiling of rolls of sheet material have not been satisfactory, especially under circumstances where the adhesive has a tendency to bleed through or into the sheet material in a manner to discolor the same or, where pressure sensitive adhesive tape has been used, it is not uncommon for such adhesive not only to possibly bleed through or into the material but also adhere to the decorative coating and peel some of the same from the sheet material incident to removing the adhesive tape and thereby cause damaged or unusable material.

Recently, it has been proposed to prevent the uncoiling of rolls of sheet material of the type referred to by applying bands of non-reactive material around such rolls. Depending upon the slitted width of the material being coiled, either a single band is applied centrally between opposite ends of a coil of relatively narrow material, while two or even three bands of such securing material are applied to coils of wider material, such as adjacent opposite ends and/or in the middle of the rolls between said ends. One very suitable type of banding material comprises heat-shrinkable synthetic resin such as polyvinylchloride and other resins having similar characteristics. Such material has been used for some period of time to effect a seal between the neck of a jar or a bottle and a cap connected thereto by screw threads. In utilizing such heat-shrinkable material for application in the form of bands around coiled rolls of sheet material of the type referred to however,

very thin strips of heat-shrinkable material may be employed. While this material has been known as being available however, applying bands thereof to rolls of coiled sheet material, fusing the ends of such bands together, and subsequently shrinking the same by subjection to heat has presented a number of difficult problems, especially when it is considered that the diameters and widths of such rolls of material vary widely and it is of course preferable that any machine for applying such bands to rolls of said material should be capable of being adjusted to accommodate rolls of a reasonably wide range of diameters and widths.

Attempts to apply bands of securing material to coiled rolls of sheet material comprises the subject matter of several prior patents; U.S. Pat. No. 3,325,966 dated June 20, 1967, in the names of Bruce et al., and U.S. Pat. No. 3,523,402, dated Aug. 11, 1970, in the names of West et al. These machines are relatively complex, due primarily to the fact that they are predicated upon the principle of moving the banding unit of each machine with the coiled rolls of material as the same move along a path while disposed upon different kinds of conveyors. The rolls of material are rotated in the direction of the coil of the sheet material in order to prevent the same from unrolling while moving along said path incident to the securing bands being applied to said rolls.

It is therefore the principal object of the present invention to provide a banding machine operable upon different principles from those employed in said prior patents, especially for purposes of simplifying the conveying means for the rolls of material and dispensing with anything resembling a rectilinear movement of the band-applying unit as employed in said patented structures referred to above. These objectives are achieved by employing the following general principles.

SUMMARY OF THE INVENTION

It is the principal object of the present machine to feed coiled rolls of sheet material by means of a conveyor which effects intermittent feeding of the coiled roll, interspersed with short stationary periods to provide an opportunity for one of a pair of relatively movable anvil and clamping jaws to extend between a pair of rolls of said material which are spaced longitudinally apart along the path of movement thereof and thereby simplify the successive positioning of said rolls with respect to the banding unit of the machine as well as permit the utilization of relatively simple additional means to effect accommodation of rolls of material of various diameters and thereby under the machine reasonably universal in character.

It is another object of the invention to provide relatively simple heat-shrinking means which are traversed by the rolls after bands of securing material have been loosely formed therearound, the conveyor by which such traversing movement is effected being adapted to continuously rotate the rolls and the loose bands thereon to assure even heating for all sections of the band to effect desired uniform shrinking thereof around said roll.

It is a further object of the invention to provide support and operating means for disposing bands of said securing material around said rolls of coiled material at desired longitudinal locations along said roll, the means by which said bands are disposed around said rolls being transversely adjustable relative to the conveyor,

said band-applying mechanism including a pair of relatively movable anvils and one of the same preferably being stationary but vertically adjustable toward and from the conveyor in order to adapt the same to satisfactory functioning upon rolls of a substantial range of different diameters, it being understood that when the machine is initially set up to accommodate a run of coiled rolls of material, all of said rolls are of uniform diameter for any given run thereof.

It is still another object of the invention to provide means to vertically adjust the receiving end of the conveyor relative to the exit or delivery end, for example, of a machine in which said rolls of material are formed, such as by being coiled around inexpensive, disposable tubes or forming coreless rolls.

It is a still further object of the invention to provide power type drive means to effect continuous drive of the conveyor which moves the loosely banded rolls past the heat-shrinking means, while the unbanded rolls are moved intermittently by another conveyor to deliver the rolls sequentially to the banding unit.

It is still another object of the invention to employ sequentially operable clutch and brake means which are interconnected to electric motor power means to effect such intermittent feeding movement of the rolls of material to the banding unit.

One further object of the invention is to provide an additional electric motor power unit for driving cam means by which a clamping jaw is moved toward and from the anvil jaw and one of said jaws having electrical resistance heating means which is energized only momentarily to effect the sealing of a band of securing material around each roll of coiled material and, simultaneously, connect the ends of two strips of said banding material which have been severed by said heating means from the loose coil applied around said roll while said severed ends of the supply strip of banding material are fused together to reestablish a continuous band applicable around the next successive roll of material.

Details of the foregoing objects and of the invention, as well as other objects thereof, are set forth in the following specification and illustrated in the accompanying drawings comprising a part thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a banding machine embodying the principles of the present invention and illustrated in association with a rewinding machine which is illustrated in phantom and operable to deliver rolls of coiled sheet material to said banding machine.

FIG. 2 is a top plan view of the banding machine illustrated in FIG. 1 but from which certain details of the machine have been omitted in order to simplify the view and clearly illustrate certain adjustable mechanism of said machine.

FIGS. 3 and 4 respectively are vertical elevations showing the inlet and discharge ends of the machine shown in FIGS. 1 and 2, but from which views of certain details of the driving mechanism have been omitted in order to simplify the illustrations.

FIG. 5 is an enlarged, fragmentary side elevation of an intermediate portion of the machine shown in FIGS. 1 and 3 to illustrate details of the banding unit thereof.

FIG. 6 is another enlarged, fragmentary side elevation of a portion of the machine shown in FIG. 1 and illustrating details of part of the driving mechanism, including the portion which drives the banding unit.

FIG. 7 is a side elevation of the machine shown in FIG. 1 and illustrated in a slightly larger scale than utilized in FIG. 1, a number of the details of the machine being omitted in FIG. 7 for purposes of primarily illustrating, somewhat in diagramatic form, the basic principles of the drive mechanism of the machine, said view being partly foreshortened to accommodate the same to the sheet.

FIG. 8 is a view similar to FIG. 7 from which many of the details of the machine have been omitted to simplify the illustration and said view primarily showing the supporting and adjusting means for the guide rails associated with the conveyors of the machine, said view also being foreshortened intermediately of its end to accommodate the same to the sheet.

FIG. 9 is an exemplary layout view of the control panel which is otherwise illustrated in FIG. 2.

FIG. 10 is a side elevation of an exemplary roll of coiled material with securing bands attached thereto as applied by the machine comprising the present invention.

FIG. 11 is a fragmentary side elevation of a detail of the mechanism which effects precise positioning of the rolls relative to the banding unit of the invention.

DETAILED DESCRIPTION

Referring to FIG. 1 in particular, it will be seen that the banding machine comprising the present invention is shown in association with a rewinding machine **10** of an industrial type, which does not comprise part of the present invention and therefore is illustrated in phantom. Primarily the machine **10** illustrates an exemplary path of movement of cylindrical tubes or cores upon which predetermined lengths of sheet material have been coiled to form rolls **12** of such coiled material, or coreless rolls of such material. The rolls **12** are delivered sequentially, in a timed sequence, to the receiving end **14** of the banding machine **16** which embodies the principles of the present invention. The rolls **12** are delivered in substantially evenly spaced sequential position from rhe rewinding machine **10**, the spacing illustrated in FIG. 1 being substantially exemplary and of a practical nature.

The banding machine **16** comprises a plurality of frames which are identified herein as a base frame **18** which is provided with a plurality of legs **20**, the lower ends of which rest upon a suitable supporting surface such as a floor **22**. Conventional leveling means are provided in the ends of the legs **20** to permit the machine to be set in level condition upon the floor in accordance with customary practice.

Another frame, which for purposes of identity if termed main frame **24**, extends longitudinally along the machine between opposite ends thereof in spaced relationship above the upper members of the base frame **18**. The principal purpose of the main frame is to support an endless conveyor **26** which extends from the receiving end **14** of the banding machine toward the exit end **28** thereof, passing through the banding unit **30** and terminating a short distance there beyond.

Referring to FIG. 2, it will be seen that the endless conveyor **26** comprises a pair of transversely spaced endless belts **32** which extend around idler pulleys **34**, supported by frame **24**, adjacent the receiving end **14** of the banding machine, and the opposite ends of said

endless belts extend around drive pulleys **36**, details of which are best shown in FIG. **6** but are also somewhat diagramatically shown in FIG. **2**. The drive pulleys **36** are mounted upon and fixed to a drive shaft **38** upon which a pair of idler pulleys **40** are rotatably mounted which support one end of endless belts of an additional conveyor **42** comprising a pair of such endless flexible belts **44** which extend around additional idler pulleys **46** mounted upon a shaft **48** which is supported by the main frame **24** adjacent the exit end **28** of the banding machine. From FIG. **2**, it will be seen that the belts **44** are displaced inwardly toward each other from the main frame **24**. Belts **44** also extend around a pair of drive pulleys **50** which are connected to a drive shaft **52**, as shown in FIGS. **2**, **4**, and especially FIG. **7**. The drive shaft **52** is driven by power means described hereinafter.

The banding machine **16** also includes a third frame which, for purposes of identity, is termed an auxiliary frame **54** which primarily comprises a pair of guide rails **56** which are parallel to and vertically spaced above the upper courses of the endless belts **32** which are supported by the main frame **24**. For purposes of distinguishing the relative locations, at least in a vertical direction, of the base frame **18**, main frame **24**, and auxiliary frame **54**, attention is directed to FIG. **8** wherein it will be seen that the guide rails **56** are continuous between the receiving and exit ends of the machine. To accommodate incidental limited variations in the diameters of rolls **12** produced by the rewinding machine **10**, and also to provide suitable friction, the lower surfaces of rails **56** preferably are provided with strips **57** of compressible material such as foam rubber or equivalent media such as foam resins and the like. These strips may be cemented or otherwise affixed to said rails.

FIG. **8** illustrates in simplified manner the means by which the various frames are supported in relationship to each other. In said view, it will be seen that the upper horizontal beams **58** of the main frame **18** have a supporting channel extending transversely between the beams **58** and the ends of the channel are secured by welding or otherwise thereto. The channel **60** supports a U-shaped frame **62** having opposite parallel vertical side plates **64** which are provided in the upper ends thereof with anti-friction bearing **66** which support the drive shaft **38**. Said shaft is driven by a sprocket gear **68** which is fixed to one end thereof and the sprocket gear **68** is driven by a powered sprocket gear **70** by means of a sprocket chain **72**. Sprocket gear **70** is mounted upon a drive shaft **74** which extends from a gear reduction unit **76** shown in FIG. **7**. The input shaft of the unit **76** is driven through a clutch-brake unit **78** which is driven by power means comprising an electric motor **80** through pulley **81** as also shown in FIG. **7**. Details of the function of the clutch-brake unit **78** are described hereinafter.

The main frame **24** extends substantially continuously from the receiving end **14** to the exit end **28** of the banding machine, as best shown in FIG. **8**. As indicated above, the principal function thereof is to support the endless conveyor **26** which terminates at its inner end at the axis of drive shaft **38**, and the additional conveyor **42** continues from the axis of drive shaft **38** to the exit end **28** of the machine. These conveyors are not illustrated in FIG. **8** but are shown in FIGS. **1** and **2**. The main frame comprises a pair of parallel side plates **82** which, in cross section, may either be angle irons, channels, or tubes so as to impart rigidity to the frame. The side plates **82** are coincident with the endless conveyor **26** comprising the endless belts **32** and extend vertically between the upper and lower courses of said belts. Intermediately of the ends thereof, the side plates **82** are provided with antifriction bearings **84**, see FIG. **2**, through which the drive shaft **38** extends, said shaft being supported by U-shaped frame **62** and bearings **66** thereon. Incidently, the main frame **24** is adapted for limited pivotal movement about the axis of the transverse shaft **146** in order to adjust, in particular, the receiving end **14** of the endless conveyor **26** with respect to the discharge means of the rewinding machine **10**. Vertical adjustment of the receiving end of the main frame **24** is effected by a plurality of screw jacks **86**, see FIGS. **1** and **2**. Said jacks include rotary adjusting nuts **88** which have sprocket gears thereon surrounded by sprocket chain **90** which also extends around a driving sprocket **92** operable by a ratchet handle **94** readily accessible at one side of the machine, as shown best in FIG. **2**.

In order that a pathway of even vertical height will be provided between the lower surfaces of the guide rails **56** and the upper courses of the feed belts **32** and **44**, the auxiliary frame **54** which supports the guide rails **56** is interconnected to the main frame **24** by means of a plurality of transverse bars **96** which extend through appropriate openings in the side plates **82** or appropriate brackets connected thereto. As will be seen especially from FIG. **2**, the bars **96** project laterally in opposite direction from the auxiliary frame **54** substantial amounts so that the outer ends thereof are approximately in vertical alignment with the upper horizontal beam **58** of the base frame **18**. Triangular shaped brackets **98** project upwardly from the outer ends of the pairs of bars **96** and terminate in bearings **100** through which the opposite ends of actuating shafts **102** extend.

The shafts **102** support short crank arms **104** intermediately of the ends thereof and the outer ends of said crank arms are pivotally connected to brackets **106** which are fixed to and extending upwardly from the guide rails **56** comprising auxiliary frame **54**.

For purposes of vertically adjusting the guide rails **56** toward and from the upper courses of the endless belts **32** and **44** of the feed conveyors on main frame **24**, the opposite outer ends of the actuating shafts **102** have depending crank arms **108** affixed thereto, as best shown in FIG. **8**, but also are illustrated somewhat diagramatically in FIG. **2**. The lower end of the crank arms **108** have crank pins **110** thereon between which elongated connecting rods **112** extend. Referring to FIGS. **2** and **8**, it will be seen that adjacent one side of the main frame **24**, an adjusting shaft **114** is suitably supported by a bearing on one of the brackets **98**. A hand wheel **116** is affixed to the outer end thereof and the opposite end is threaded through a block **118** which is pivotally connected to one of the depending crank arms **108**. The shaft **114** is prevented from axial movement by the bearing and collar unit **120** on said bracket **98**. Accordingly, upon rotation of the hand wheel **116**, the depending crank arms **108** are all moved simultaneously in the said direction for purposes of either raising or lowering the auxiliary frame **54** toward and from the conveyors on the main frame **24**.

The foregoing description pertains to the principal frame structure and the conveyors of the banding machine **16.** The mechanism thus described is operable by power means to be described in detail hereinafter for purposes of feeding coiled rolls **12** of coiled sheet material from the receiving end **14** of the machine to the exit end **28** thereof. Intermediately of said path of movement, securing bands of preferably heat-shrinkable, fusible type are applied to the rolls **12,** either one or a plurality of bands being applied thereto, depending upon the width of the coiled rolls of material and the degree of closure desired for such rolls. The mechanism by which such bands are applied to the rolls is described as follows.

BANDING UNIT

The banding unit **30** has been broadly referred to in the description of FIG. **1.** Details thereof are best shown in FIGS. **1** and **3,** but particularly in FIG. **5.** Referring to said figures, it will be seen that especially in FIGS. **1, 2** and **4,** coiled rolls **122** of banding material **124** of suitable width are supported respectively at opposite sides of the auxiliary frame **54,** particularly for purposes of encircling the rolls **12** of coiled sheet material with a pair of bands **126,** shown specifically in FIG. **5.** It is to be understood however that, especially if relatively narrow rolls of material are to be banded, a single pair of such coils **122** are utilized and the same would be mounted intermediately of the guide rails **56,** as viewed in FIG. **2** in particular, the same being mounted upon the shafts **128** which extend outwardly from uprights on bar **130** to support the upper rolls of each pair of coiled rolls **122,** while additional short shafts **132,** on upright members **134,** which are adjustably supported by a transverse bar **136** provided in base frame **18,** as seen in FIG. **3,** support the lower rolls **122.**

Referring to FIG. **5,** the bands **126** of banding material which come from the upper roll **122** of each pair are identified as band **124',** while the band **124** of material which leads from the lower roll **122** of each pair is identified as **124''.** By means to be described hereinafter, the ends of said bands are fused together at a joint **138** shown in FIG. **5.** As the rolls **12** of coiled material roll along in a rotary direction which maintains the coiled material in coiled condition, as distinguished from uncoiling direction, it will be seen that roll A which moves in the direction of the arrow shown thereon, is approaching the transversely extending, continuous strip of banding material **124.** By means to be described hereinafter, the feed belts **32** move the rolls **12** intermittently in the direction of the arrow shown in FIG. **5.** The periods of intermittent movement are interspersed by a stationary period, and during these periods, the banding process is effected. Details of the same are described hereinafter.

It will be assumed that, as viewed in FIG. **5,** the roll A is advancing in the direction of the arrow. When it engages the bands or strips **124** of connected banding material, continued rotation of roll A toward the left, as viewed in FIG. **5,** will cause the band or bands **124** of material to be moved toward the left in said figure until roll A is disposed in the position shown with respect to roll B. At this location in the path of movement of the rolls, roll B will be stationary as a result of periodic stopping of the supporting conveyor belts **32.** During such stopped condition of roll B, it will be seen that the connected band or bands **124** of the banding material will be extended around roll B, the portion **124'** thereof being in engagement with the lower surface of a stationary upper anvil jaw **140.** Upon the roll B reaching the position shown in FIG. **5,** mechanism, to be described, will be activated to cause transverse bar **142,** which is supported adjacent opposite ends by a pair of arms **144,** which are connected at one end to transverse shaft **146,** see FIGS. **1** and **6,** is caused to move upwardly about the axis of shaft **146** for purposes of carrying clamping jaw **148** into abutting engagement with stationary anvil jaw **140.** The initial, inoperative position of clamping jaw **148** is shown in phantom in FIG. **5,** while the clamping position thereof is shown in full lines in said figure.

Incident to the movement of the band strips **124'** and **124''** from the initial position thereof, to the position in which the same encircle the roll B, the banding strips are guided respectively such as by the strip **124'** being guided through a pair of guides **150** and the strip **124''** being guided through a single guide **152** carried by the clamping jaw **148.**

As soon as the continuous strip of banding material **124** has been formed in encircling condition around the roll B, for example, it will be seen that one of the jaws, and preferably the upper anvil jaw **140** is provided with electrical resistance heating means in the form of a resistance wire **154,** current to which is controlled by means to be described hereinafter. As soon as the clamping jaw **148** has been brought into clamping engagement with the operative face of anvil jaw **140,** the resistance wire **154** is "fired," to initially heat the same instantaneously to a temperature which is adequate to both sever and re-fuse the abutting strips of securing or banding material **124'** and **124''** into sealed connection at the side of the roll B which is opposite the initial joint **138** between said strips, thereby forming a new joint **138'** and, simultaneously, fusing the ends of the strips **124'** and **124''** together to form a subsequent continuous strip **124** with respect to each pair of coils **122** of such banding material wherever they are disposed with respect to the path of movement of the rolls **12.**

Immediately upon the firing of the fusing means **154** of the banding unit, the clamping jaw **148** is retracted to the phantom position thereof shown in FIG. **5,** thereby carrying the connected band **124** of banding material to the irregular broken line position thereof shown in FIG. **5** which is the initial, starting position of said band, which then is in position, for example, to be engaged by the roll A during its advancing movement toward its banding position B shown in FIG. **5.** Meanwhile, the banded roll B moves to the left, for traverse through a heat-shrinking area of the machine, details of which are described hereinafter.

In the preferred construction of the machine comprising the invention, and with reference to FIG. **1,** the base frame **18** is provided with a pair of upright plates **156** which respectively extend upwardly from he opposite ends of the horizontal beam **58** of the base frame **18.** As shown in FIG. **5,** a support in the form of an angle bar **158** extends transversely between the plates **156** adjacent the upper ends thereof. One web of the angle bar **158** slides upon the angular forward faces **160** of the plates **156** and it will be seen from FIG. **2** that the other web of the angle bar **158** is provided with a plurality of slots **162.** Said slots are for purposes of receiving respectively individual upper anvil jaws **140** for each of the strips **124** of banding material. Correspond-

ingly, the transverse bar **212**, which is arcuately movable, is similarly provided with individual clamping jaws **148** which respectively are supported by blocks **142** on bar **212** and are cooperable with the individual anvil jaws **140** with respect to each strip **124** of banding material. For this purpose, the transverse bar **212**, shown in FIG. **6**, likewise is provided with slots corresponding to the slots **162** of angle bar **158**, whereby clamping bolts **164**, shown in FIG. **6**, secure the blocks **142** and clamping jaws **148** to the transverse bar **212** in opposition to the individual anvil jaws **140** on bar **158**. The individual clamping jaws **140** are secured to bar **158** by means of readily engageable, threaded clamping members **166**.

For purposes of varying the position of the anvil jaws **140** and the resistance wire **154** thereon relative to guide rail **56**, particularly in a substantially vertical direction, the flange **168** of angle bar **158** has projections **170** extending rearward, adjacent opposite ends thereof, for engagement by threaded adjusting screws **172** which are manipulated by hand crank wheels **174**, shown in FIG. **5**, to effect such adjustment.

HEAT-SHRINKING UNIT

Referring to FIG. **5**, it will be seen that when the encircling band or bands **124** are disposed around the coiled rolls of sheet material **12**, identified as roll B, said bands are not taut. Preferably, the banding material **122** is of a heat-shrinkable type of synthetic resin. One appropriate resin composition comprises polypropylene. Other types of plastics having similar heat-shrinkable material may be used. The specific type of material is not essential to the present invention, as long as it is capable of being shrunk during a relatively short period of time and by the use of reasonable ranges of heat.

One form of heating means to effect such shrinking of the encircling bands of securing material **124** are electrical resistance bars or coils **176** which are supplied with current by conventional means. Referring to FIG. **2**, it will be seen that an exemplary pair of such resistance means **176** are shown, the same being in longitudinal alignment with the coils of banding material **122** and, correspondingly, with the encircling bands **124** of such material as shown in FIG. **5**. After the encircled rolls B, for example, leave the banding unit **30**, they continue to move intermittently by the propelling movement of the endless conveyors **32** until they reach the end thereof adjacent transverse shaft **38** shown in FIG. **2**. At that point, the belts **44** continue propelling the coiled rolls **12** of material with the loosely encircling bands of securing material **124** there around, such movement causing the rolls **12** and the bands **124** to be moved over the upper surface of the heat-shrinking members **176**, in suitably spaced relatioship thereto, for purposes of shrinking the bands **124** of securing material in taut condition around the olls **12**. The resistance, and correspondingly, the current, which is furnished to the heat-shrinking means **176** is adequate to effect such shrinking of the bands of securing material by the time the bands reach the outer ends of the heat-shrinking means as viewed in FIG. **2**. It is to be noted that the belts **44** which effect the movement of the rolls **12** relative to the heat-shrinking elements **176** are driven at a constant, uninterrupted speed, as distinguished from the intermittent feed of the belts **32** of the endless conveyor **26**. Such feed is effected by means of a drive sprocket or a pulley **178** which extends outwardly from gear reduction unit **180** which is connected to and driven by electric motor **80**. An endless sprocket chain or belt **182**, see FIG. **7**, extends around drive sprocket or pulley **184** which is fixed to drive shaft **52** upon which drive pulleys **50** are mounted which respectively engage the feed belts **44** of the additional conveyor **42**, all of which is shown in FIG. **7**.

The purpose of continuously rotating the banded rolls **12** while traversing the heat-shrinking area, wich is subtended longitudinally by the heating units **176**, is to permit the loosely encircling bands of securing material **124** to be subjected evenly throughout the entire circumference thereof to he heat generated by the heating means **176** and, in addition, to prevent any one portion thereof from being heated more extensively than any other portion which, if permitted to occur, conceivably could damage the bands and possibly even sever the same by melting the material. By the time the rolls **12** reach the exit end **28** of the machine, the one or more bands **124** which have been secured there around are taut and effectively prevent uncoiling the sheet material comprising said rolls.

The heater bars **176** which are specifically illustrated in FIGS. **1**, **2** and **4** are supported by exemplary means comprising a pair of transverse bars or rods **177** which extend between heads in the upper end of vertically adjustable screw jacks **177'** which are supported by suitable brackets on the upper members of base frame **18**, as shown in FIGS. **1** and **4**. By adjusting the screw jacks **177'** vertically in the directions required, the amount of heat directed against the securing bands which have been applied to rolls of coiled material **12** may be regulated so as, correspondingly, to control the shrinking of said bands. Such arrangement, if desired, also permits the leading or trailing ends of the heater bars **176** to be disposed at different vertical levels relative to the path of movement of the rolls **12**. In addition, the heater bars **176** also may be adjusted in transverse direction relative to the path of the rolls **12**, longitudinally of rods **177**, such as in regard to varying the positions at which the securing bands **126** have been applied to the rolls **12**, as shown in exemplary manner in FIG. **10**. Suitable rheostat or equivalent temperature control means, not shown, also may be employed.

DRIVE MECHANISM

The drive mechanism for the machine is best shown in overall condition in FIGS. **1** and **7**, while certain details thereof are illustrated to better advantage in FIG. **6**. Further, FIG. **4** also affords a different view of some of the drive mechanism from that provided by the aforementioned figures. Essentially, in addition to the electric motor **80**, the drive means for the machine preferably includes a second electric motor **186** which is driven intermittently by control means which are described in detail hereinafter. Motor **186** drives a gear reduction unit **188** which is provided with an output sprocket gear or pulley **190**. A sprocket chain or belt **192** extends around the gear or pulley **190** and an additional sprocket gear or pulley **194** which is connected to shaft **196**.

Base frame **18** also includes a pair of parallel lower beams **198** respectively adjacent opposite sides of the machine. Extending between the lower beams **198** is a transverse channel member **200**, see FIG. **6**, the opposite ends of which are welded to the beams **198**. Inter-

mediately of the ends of the channel member 200 is a bracket which has an angularly extending arm 202 which, at its outer ends, pivotally supports a cam-following arm 204, the outermost portion of which is provided with an arcuate slot 206. Adjustably mounted in slot 206 is a pivot bolt 208 which connects one end of a connecting rod 210 pivotally to the transverse bar 212 which supports blocks 142 for the clamping jaw 148, for purposes of actuating the arms 144 which support said transverse bar 212.

Radially spaced from the pivot 214 for arm 204 is a pin 216 to which one end of a tension spring 218 is connected, the opposite end of the spring extending around another connecting pin 220 carried by bracket 222 which is connected to one side of channel 60 as shown in FIG. 6. The spring 218 is relatively powerful in view of the leverage involved relative to pivot 214 for purposes of moving the connecting rod 210 upwardly to effect engagement of the clamping jaws 148 on transverse bar 212 with the anvil jaws 140.

Movement of the arm 204 is effected by means of a cam 224 which has a lobe 226 thereon. The cam is fixed to the shaft 196 which is driven by gear or pulley 194. Such movement is controlled so that the shaft 196 makes one complete revolution only each time the same is actuated by motor 186. Such movement is controlled by mechanism described in detail hereinafter. Intermediately of the ends of the arm 204 is a cam-follower roll 228 which is best shown in FIG. 6. Said follower roll engages the periphery of the cam 224 and also is engaged momentarily by the lobe 226 during each single excursion thereof for one revolution. When the lobe 226 engages the follower 228, the outer end of arm 204 is moved downwardly and, correspondingly, the arms 144 which support the bar 212 upon which the clamping jaws 148 are mounted likewise move downwardly below the level of the upper course of the endless belts 32, thereby permitting a roll 12 to move against the strip or strips 124 of banding material which extend across the path of movement of said rolls as viewed in FIG. 5.

Immediately after the oncoming roll 12, identified as roll A in FIG. 5, has moved to the position shown by roll B, where the movement of the roll is stopped, the rotation of shaft 196 will cause lobe 226 to disengage the follower roll 228 and thereby permit the bar 212 upon which the clamping jaws 148 are mounted to effect engagement thereof with the anvil jaws 140. The normal idle position of lobe 226 between each single rotation thereof, is in engagement with the follower roll 228, whereby the clamping jaws 148 do not obstruct the passage of rolls 12 during movement to the position of roll B shown in FIG. 5.

Also mounted upon and fixed to drive shaft 196 are a pair of cam discs 230 and 232 which are adjacent to each other in side by side relationship and respectively are provided with peripheral face cam grooves 234 and 236 which are of uniform depth for the peripheral extent thereof. These grooves are shown in FIG. 6. In the actual preferred construction, the cam discs 230 and 232 are of equal diameter but for purposes of illustration, to distinguish the same apart, disc 232 has been illustrated as being of a slightly smaller diameter than disc 230.

Cooperating with the cam groove 234 is a cam follower 238 mounted on the end of an actuating arm for electric switch 240. Cam groove 236 coacts with cam follower 242 which is connected to and actuates electric switch 244.

An idler sprocket gear 246 is suitably supported by the main frame 18 in the same vertical plane as powered sprocket gear 70. A sprocket chain 248 extends around the sprocket gear 70 and 246. Said sprocket chain is provided with a plurality of laterally extending lugs 250 and 252 which are clearly shown in FIG. 6. These lugs successively engage follower roll 254 on switch 256 and follower roll 258 on switch 260.

The switches 256 and 260 are connected suitably in a circuit, not shown, with the electrical means which actuate the magnetically operated clutch mechanism of the clutch-brake unit 78 shown in FIGS. 1 and 7. As indicated above, when the operation of the machine is initiated, by means to be described, the motor 80 is energized and operates continuously. The same continuously drives the belts 44 to move the rolls past the heat-shrinking means 176 of the machine. The clutch-brake unit 78 however effects intermittent movement of the driving sprocket gear 70 on gear reduction unit 76. As a consequence, sprocket chain 248 is moved intermittently, as is also the sprocket chain 72 which passes around drive pulley 36 on shaft 38 which actuates the feed belts 32 which move the rolls 12 to the banding unit 30. Sprocket chain 72 also passes around idler sprocket 262, as shown in FIGS. 6 and 7.

The motor 186 has an electric clutch unit 264 connected thereto. Said motor operates continuously, but, because of the functioning of the electric clutch unit 264, the sprocket gear 190 on gear reduction unit 188 sequentially operates one revolution at a time in order to drive the shaft 196 for cam 224 only a single revolution at a time for purposes of moving the clamping jaws 148 into engagement with the anvil jaws 140.

Referring to FIG. 1, adjacent the right hand end thereof, there is an initiating switch 266 which is engaged successively by the rolls 12 as they are discharged from the rewinding unit 10. Said switch has an appropriate actuating arm thereon which may be of a relatively sensitive nature and may be engaged by the rolls 12 as delivered to the receiving end 14 of the banding machine 16 or actuated cyclically by the rewinding machine 10. For purposes of describing the overall operation of the machine as controlled by the various switches referred to, the following sequence of operations is set forth.

ELECTRICAL CONTROL SYSTEM

It is not believed that a detailed wiring diagram is necessary in order to illustrate the functioning of the electrical control system. Referring to FIG. 9 the control panel 268 is shown with appropriate legends indicated thereon. Said panel includes a master switch 270 which controls the entire electrical circuit. Start and Stop buttons of switch 272 connect or disconnect the bander unit 30 into the system. Similar start and stop buttons of switch 274 are mounted upon the panel 268 for controlling the operation of the conveyor mechanisms. The heat-shrinking units are controlled by a further switch 276. In addition, a signal light 278 indicates if the heat-shrinking members 176 are functioning. Similarly, an additional signal light 280 is connected in circuit with the resistance wire 154 which fuses the banding strips in the manner described above.

At the completion of banding a run of rolls 12 from the rewinder 10, it will be seen that after the last roll

from the rewinder has entered the band-ing machine and has actuated switch **266**, re-cycling means in the rewinding machine will cause the banding machine to function so as to clear it of banded rolls. However, the control panel **268** includes a switch directly behind push button **282** which can be repeatedly closed, if necessary, by pressing the button and thereby simulate the action of switch **266** for purposes of clearing the banding machine if the rewinding machine has been stopped. Likewise, the switch or button **282** may be used to manually cycle the banding machine, such as for hand feeding of rolls **12** to said machine.

The cycle of operation of the banding machine **16** starts by closing switch **270** and also pushing the start buttons of **272** and **274**, as well as closing switch **276** for the heater unit. Upon the switch **266** being engaged by a roll **12** delivered from the rewinder **10** for example, the clutch of unit **78** is engaged to initiate operation of sprocket gear **70** which drives the switch-actuating chain **248** and also chain **72** to cause the belts **32** to advance. This operation initiates driving movement of the feed belts **32** and after the rolls **12** have been advanced thereby a short distance, the lug **252** on chain **248** engages switch **260** to declutch unit **78** and apply the brake thereof which causes the feed belts **32** to stop. Meanwhile, lug **250** on chain **248** has actuated switch **256** which is connected in circuit with the clutch unit **264** of motor **186** and thereby causes the same to drive sprocket gear **190** sufficiently to effect a single rotation of cam **224** which results in the spring **218** elevating the connecting rods **210** to move the clamping jaws **148** against the stationary anvil **140.**

During the rotation of cam **224**, the cam discs **230** and **232** have been rotated during the single revolution of cam **224.** The cam grooves **234** and **236** in said cam discs sequentially operate switches **238** and **240**, one of which is connected in circuit with and controls the "firing" of resistance wire **154** on each of the anvil jaws **140.** The current as well as the resistance of said wires is such that the wires instantly heat to fusing temperatures in order to simultaneously seal portions of the encircling band or bands **124** around the roll **10** as well as fuse the ends of the two strips of band together to form a joint **138** therein and thereby disposed the connected band **124** in position to be engaged by the next oncoming roll **12** as viewed in FIG. **5.** The current being furnished to the resistance wire **154** is controlled by a cam groove and lobe sequence which actuates a control switch in a commercial thermal impulse unit, not shown, which regulates this "firing" duration. The other cam groove operates the other switch of the pair **240** and **244** to open the clutch unit **264** at the completion of a single revolution of the cam **224**, while the motor **186** continues to operate. All the while, the motor **80** has been operating continuously to correspondingly move the belts **44** of additional conveyor **42** by which the banded rolls **12** are moved through the band-shrinking cycle which is effected by the heating members **176.** At the completion of such cycle of operation of the various switches, the operation of the feed belts **32** and the banding unit **30** momentarily stops until the next roll discharged from the rewind machine **10**, for example, actuates switch **266**, whereupon the above-described cycle is repeated.

For purposes of precisely controlling and re-orienting the position of the rolls **12** as they are presented to the banding unit **30**, attention is directed to FIG. **1** where it will be seen that a transverse shaft **284** extends through and is supported by the side plates **82** of the main frame **24.** A pair of L-shaped arms **286** are supported in longitudinally spaced relationship upon shaft **284**, the upstanding portions of said arms being arcuate. A short lever **288** extends downwardly from shaft **284** and is suitably interconnected by a link **290** to transverse bar **212** which supports the clamping jaws **148.** The arcuate movement of bar **212** which is effected by connecting rod **210** is of limited extent but, due to the shortness of the lever **288**, is sufficient to cause the L-shaped arms **286** to move clockwise when the connecting rod **210** moves downwardly by operation of cam **224.** Such movement is adequate to dispose the upper end of the L-shaped arms **286** below the path of movement of the rolls **12.** However, the shape of the arcuate upstanding portions of the arms **286** and the movement thereof is adequate that when clamping jaws **148** are moved upward into engagement with the anvil jaws **140**, the next oncoming roll **12** will be engaged by said upstanding arcuate portions of the levers **288** and accurately position the same by camming the said roll slightly forward and thereby precisely determine the position thereof so that upon the next intermittent advancing movement of the belts **32**, said roll will be disposed precisely as desired with respect to the stationary anvil jaws **140** and the clamping jaws **148**, such as approximately into position of the roll **12** which is illustrated as being banded in FIG. **5.**

An exemplary illustration of how such precise positioning is effected by arms **286** is illustrated in FIG. **11**, wherein an intermediate position of the upstanding camming portion of the arms is shown in phantom, while the final position of the roll **12** and such camming portions of arms **286** are shown in full lines. It will be understood that a pair of such arms **286**, levers **288**, and links **290** are utilized at positions spaced longitudinally of shaft **284** to insure even movement of the roll **12** to maintain the same perpendicular to the path of movement thereof through the machine.

While the invention has been described and illustrated in its several preferred embodiments, it should be understood that the invention is not to be limited to the precise details herein illustrated and described since the same may be carried out in other ways falling within the scope of the invention as illustrated and described.

We claim:

1. A banding machine to apply one or more bands around a sheet of material coiled about an axis to form a roll thereof, said machine comprising in combination, conveying means adapted to receive coiled rolls of said material in randomly spaced relationship and feed the same into said machine while maintained in coiled condition, power means to drive said conveyor unidirectionally, and control means for said power means operable to drive said conveyor intermittently for substantially even intervals of time to effect stopping of said rolls between periods of movement thereof; a band-applying unit arranged to receive said coiled rolls from said conveying means and comprising an anvil jaw and a clamping jaw, means to support said jaws for relative movement toward and from engagement with each other between two of said rolls upon said conveying means, and means to support at least one coil of banding material of fusible and heat-shrinkable type adjacent said band-applying unit, one of said jaws having

heating means operable to fuse together strips of said banding material when extended around said coiled rolls to form endless bands therearound, said intermittent operation of said conveyor resulting in interrupting movement of said rolls at said banding unit when such relative movement of said jaws as aforesaid is effected and thereby permit at least one of said jaws to move between a pair of successive rolls to effect banding thereof; heated band-shrinking means, and means to move banded coiled rolls of material relative to said band-shrinking means while maintained in coiled condition to shrink bands contiguous to said rolls prior to discharge from said machine.

2. The banding machine according to claim **1** in which said machine further includes means to drive said conveying means intermittently to effect successive movements of said rolls in feeding direction between short periods of non-movement of said rolls by said conveying means, and said application of bands around said rolls occurring while said rolls are stopped between said movements thereof in feeding direction.

3. The banding machine according to claim **1** in which said conveying means comprises an endless conveyor driven intermittently to support rolls of said material, and said machine including elongated, stationary members parallel to said conveyor and spaced therefrom to define a feeding space within which said rolls of material engage the surfaces defining said space and thereby are caused to rotate during movements of said conveyor in a direction to maintain the material on said rolls coiled.

4. The banding machine according to claim **1** in which said means to move said rolls relative to said band-shrinking means comprises a conveyor and a parallel stationary member spaced thereform adequately to receive said rolls therebetween and engage the same, and means to drive said conveyor continuously in a direction to cause said rolls to rotate continuously in a direction to maintain the same in coiled condition.

5. The banding machine according to claim **1** in which said conveying means comprises an endless conveyor driven intermittently and said means to move said rolls relative to said band-shrinking means comprises a constantly driven endless conveyor, and said machine also including elongated stationary means parallel to said conveyors and spaced therefrom sufficiently to receive said rolls therebetween to effect rotation of said rolls relative to said stationary means by said conveyors in directions to maintain the rolls in coiled condition.

6. The banding machine according to claim **1** further including a transverse supporting bar extending across said machine above said conveying means and having means thereon to support said anvil jaw stationarily relative to said conveying means and adjustable longitudinally of said transverse supporting bar, and an additional transverse supporting bar extending across said machine below said conveying means and movable toward and from the same, said clamping jaw being carried by said additional transverse supporting bar for movement therewith toward and from said stationary anvil jaw.

7. The banding machine according to claim **6** further including means to adjust said stationary anvil jaws substantially vertically upon said transverse supporting bar therefore to adapt the machine to accommodate coiled rolls of material of different diameters at the initiation of a run of rolls of said material of uniform diameter through said machine.

8. The banding machine according to claim **1** further including a stationary frame in which said anvil jaw is supported stationarily by said frame in operative position above said conveying means and said machine including a movable arm positioned below said conveying means and supporting said clamping jaw for movement toward and from said stationary anvil jaw, cam means interengageable with said movable arm to oscillate it, and power means interconnected to said cam means to actuate the same.

9. The banding machine according to claim **8** further including an actuating lever pivotally supported by said stationary frame of said machine, said cam means operable by said power means being engageable with said actuating lever to move one end thereof through an arc, and said machine including a connecting rod extending between said lever and movable arm for said clamping jaw.

10. The banding machine according to claim **9** in which said actuating lever is provided with a slot at one end of said connecting rod being adjustably and pivotally interconnected to said lever along said slot and adjustable relative to the slot to vary the length of the oscillatory path of movement of said movable arm and clamping jaw thereon.

11. The banding machine according to claim **1** in which said conveying means comprises a pair of parallel endless belts supported upon rollers supported by a main stationary frame, said belts being spaced transversely a predetermined distance adequate to support coiled rolls of material without tilting, said machine also including an auxiliary frame adjustably supported above said main stationary frame, a pair of parallel guide rails supported by said auxiliary frame in vertically spaced relationship to one course of said belts and in vertical alignment therewith, and pairs of bell cranks supported by said main stationary frame and interconnected to said auxiliary frame at spaced location, and operable to vary the height of the vertical space between said belts and the guide rails within which coiled rolls of material are moved along a path parallel to said belts and rails.

12. The banding machine according to claim **11** further including pairs of said bell cranks pivotally supported by said upwardly extending supports on said main frame and one end of said bell cranks being pivotally connected to said auxiliary frame, a pair of said auxiliary supports and bell cranks respectively being mounted adjacent opposite sides of said main frame, a shaft extending transversely across said auxiliary frame in alignment with the pivotal connections for said bell cranks and fixedly connected to said pivotal connections for simultaneous actuation of transversely aligned pairs of said bell cranks, and a rod extending along one side of said machine between said bell cranks on said one side thereof and operable to simultaneously actuate all of said bell cranks in unison to effect vertical adjustment of said auxiliary frame and guide rails supported thereby relative to said endless belts upon said main frame of said machine.

13. The banding machine according to claim **11** in which said machine includes a base frame adapted to be supported above a floor surface and said main frame extends longitudinally along and above said base frame, and said machine including pivot means supported by

said base frame and interconnected to said main frame intermediately of the ends thereof, and vertically adjustable positioning means supported by said base frame and connected to the main frame adjacent the receiving end of said conveying means thereon to adjust the height of said receiving end of the conveying means relative to supply means for feeding coiled rolls of material to said conveyor.

14. A banding machine to apply one or more bands around a coiled sheet of material to form a coiled roll thereof and prevent uncoiling thereof, said machine comprising in combination, a conveyor adapted to receive coiled rolls of said material and rotate said rolls in the direction in which the material is coiled thereon to prevent uncoiling thereof while moving along a path in said machine, means adapted to apply at least one band of heat-shrinkable fusible material around said rolls at a predetermined position located in said path, means to move said conveyor intermittently between successive short periods of non-movement of said rolls to permit attachment of at least one of said bands loosely around each of said rolls, while stationary between movements thereof heating means downstream in said path for said rolls and extending longitudinally therealong a sufficient distance to shrink said band closely around each roll, additional conveyor means supporting said rolls for movement along said heating means and adjacent thereto to effect such shrinking of said bands around said rolls, and means to effect continuous rotation of said rolls as moved by said additional conveyor along said path in proximity to said heating means.

15. The banding machine according to claim **14** in which said heating means are elongated and positioned beneath said additional conveyor means, and said machine further including means interconnected to and operable to adjust said heaters vertically toward and from said additional conveyor to assist in controlling the shrinking of said bands of banding material.

16. The banding machine according to claim **14** in which said band-applying means for said heat-shrinkable material comprises a stationary anvil mounted above said first-mentioned conveyor and a movable clamping jaw supported for movement from below said first-mentioned conveyor toward and from said stationary anvil to form bands around said coiled rolls of material, said bands being fused therearound while said rolls are momentarily supported stationarily by said first-mentioned conveyor.

17. The banding machine according to claim **16** further including guide rails extending longitudinally along said machine substantially continuously between the opposite ends thereof and above said first-mentioned and additional conveyors for cooperation therewith to effect rotation of coiled rolls of material as moved through said machine by said conveyors, said rolls of material engaging the lower surfaces of said guide rail.

18. The banding machine according to claim **16** further including power means interconnected to and operable to drive said additional conveyor continuously, and clutch and brake means connected to said power means and interconnected to said first-mentioned conveyor to operate the same inter-mittently, and cam means operable during each cycle of operation of said band-applying and sealing means to effect sequential operation of said clutch and brake means to cause said intermittent movement of said first-mentioned conveyor.

19. The banding machine according to claim **16** in which said banding material also is fusible and said machine also including heat sealing means supported on one of said jaws and comprising electrical resistance means, switch means controlling the supply of current to said sealing means, and cam means operable by power means to control the actuation of said switch means.

20. The banding machine according to claim **19** in which said power means is operable jointly to drive said conveyors as aforesaid and also drive said cam means.

21. The banding machine according to claim **20** further including clutch and brake means driven by said power means and interconnected to said cam means to effect sequential operation thereof.

22. A banding machine to apply one or more securing bands around a coiled sheet of material in the form of a roll to prevent the same from uncoiling, said maching comprising in combination, conveyor means operable to receive and advance such coiled rolls in spaced relationship to each other, band-applying means positioned relative to said conveyor to apply at least one securing band around the leading roll of a series thereof when advanced to said band-applying means by said conveyor, means to drive said conveyor at a predetermined rate and manner, and re-orienting cam means positioned in advance of said band-applying means relative said conveyor and operable to engage said rolls sequentially adjacent said band-applying means and prior to being banded thereby to position said rolls in precise relationship to said band-applying means, thereby to insure relatively uniform application of securing bands to said rolls as successively engaged by said applying means.

23. The banding machine according to claim **22** in which said drive means for said conveyor is operable to move the same intermittently and said re-orienting cam means comprising a cam element mounted for movement transverse to the path or movement of said rolls by said conveyor and into engagement with the trailing surface of said rolls prior to said rolls being banded.

24. The banding machine according to claim **22** in which a pair of said cam elements are mounted in transversely spaced relationship relative to the path of movement of said rolls for engagement with longitudinally spaced portions of said rolls to prevent cocked engagement of said rolls by said banding means.

25. The banding machine according to claim **23** in which said securing bands are composed of fusible material, said banding means comprise a pair of relatively movable anvil and clamping jaws, and said machine also including heating means on one of said jaws to fuse said bands around said rolls when said jaws are moved into engagement between adjacent rolls when said rolls are not being advanced by said conveyor, and means to move said jaws relative to each other as aforesaid.

26. The banding machine according to claim **25** further including actuating means connected to said cam element to move the same toward and from camming engagement with said rolls, and means connecting said actuating means to said means to move said jaws to provide coincident movement of said cam element and clamping of said securing bands by said jaws to fuse the same.

27. The banding machine according to claim 26 in which said anvil jaw is stationary and positioned immediately above said path of movement of said rolls and said clamping anvil is moved toward and from engagement therewith to effect said fusing of said securing bands by passing between adjacent rolls on said conveyor which are precisely spaced by the action of said cam element.

28. A banding machine to apply one or more bands around a sheet of material coiled about an axis to form a roll thereof, said machine comprising in combination, roll receiving means, a banding unit, a heat-shrinking unit, and control means; said receiving means including a conveyor for sequentially receiving rolls to be banded and operable to rotate said rolls to maintain the material thereon coiled, and deliver said coiled rolls to said banding unit; said banding unit including means for supporting a width of heat-shrinkable material in intercepting relationship with the rolls conveyed thereto by said receiving means, and a heated anvil and clamping jaw combination operative in cyclic movement between an opened position to permit passage of said rolls through said banding unit and a closed position to dispose a section of said heat-shrinkable material around the periphery of an intercepted roll and also sever and seal the same, thereby forming an endless band around said roll and reconstituting the width of heat-shrinkable material for interception by the next sequential roll; said heat-shrinking unit including conveyor means operable to move said banded roll from said banding unit to discharge while rotating said rolls to continue to maintain the material thereon coiled, and heating means mounted in proximity to the band on said roll for shrinking said band contiguous to said roll; said control means cyclically operating said anvil and clamping jaw between said open and closed positions wherein said anvil and jaw are maintained in said closed position for a fixed period of time, and further including means for interrupting movement of said roll at said banding station during said fixed period of time, whereby said rolls are moved sequentially from said receiving means to said banding unit and into intercepting relation with a width of said heat-shrinkable material and are maintained stationary for a fixed period of time in said banding unit during which time a band of the heat-shrinkable material is formed around said roll and severed from a supply roll thereof and sealed to form simultaneously a band and a reconstituted width of heat-shrink material, said banded rolls then being moved from the banding unit to the heat-shrinking unit to effect said shrinking of the bands contiguous to the periphery of the roll of sheet material.

* * * * *