

United States Patent

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[54] **COTTON BALE HANDLING AND COMPRESSING SYSTEM**
 5 Claims, 13 Drawing Figs.

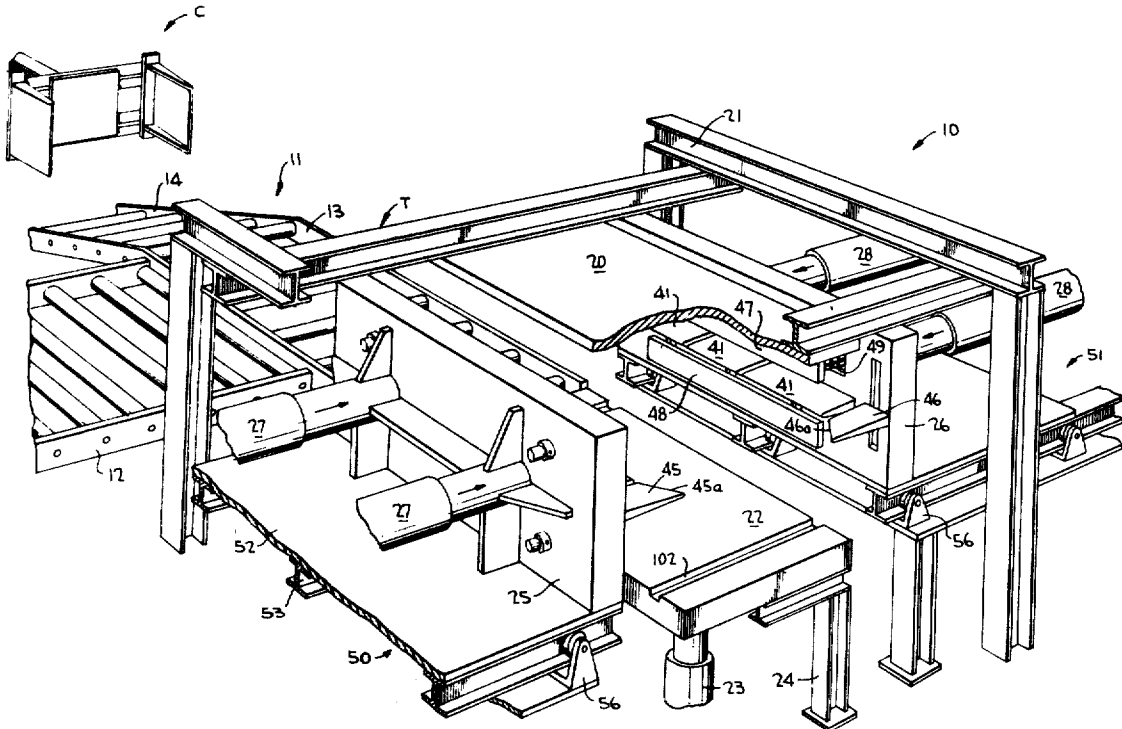
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 [50] Field of Search 214/1 BB,
 147 T, 1 BC, 1 BD; 100/215, 218; 198/19

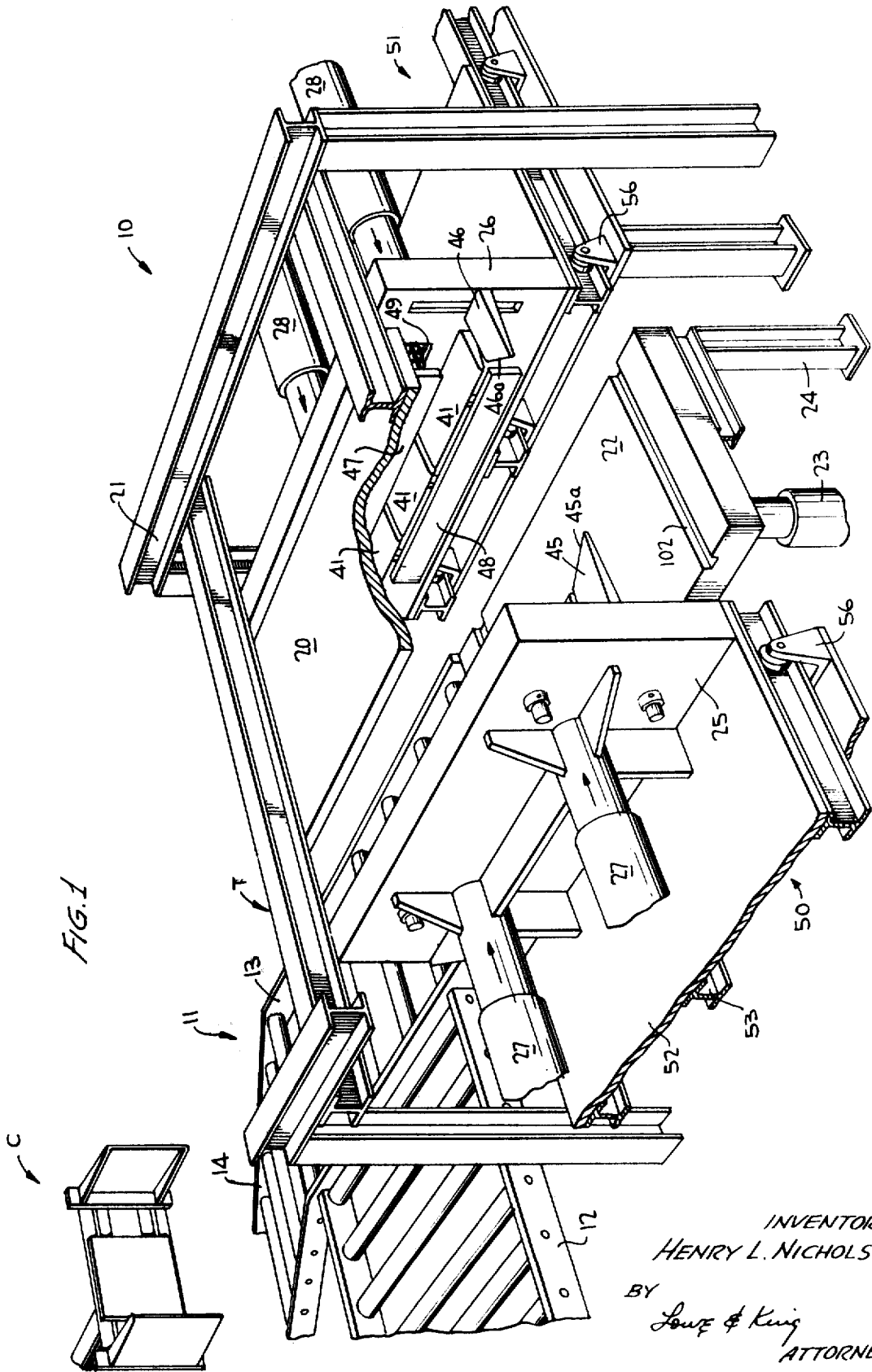
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ABSTRACT: A system is provided for automatically handling and compressing bales in which an extensible clamp is operative to transfer the bale into and out of the compressor through a single end thereof; the bale being removed from the transfer station by additional movement of the clamp away from the compressor. Blade members are provided on the side platens of the compressor to tuck the holding bands into the interior as slack is formed during the compressing operation. Additional blade segments are utilized to tuck the wrapper at the ends of the bale; both the blade members and segments being mounted for movement to accommodate for the reduction in girth in the bale as it is compressed. Spring-biased stripper plates for the blade members and segments are provided on the side platens, which plates also serve to stabilize the bale during the compressing operation. Special stabilized carriage mounting for the side platens and fluid circuitry for automatically sequencing the entire bale handling and compressing operation are provided.





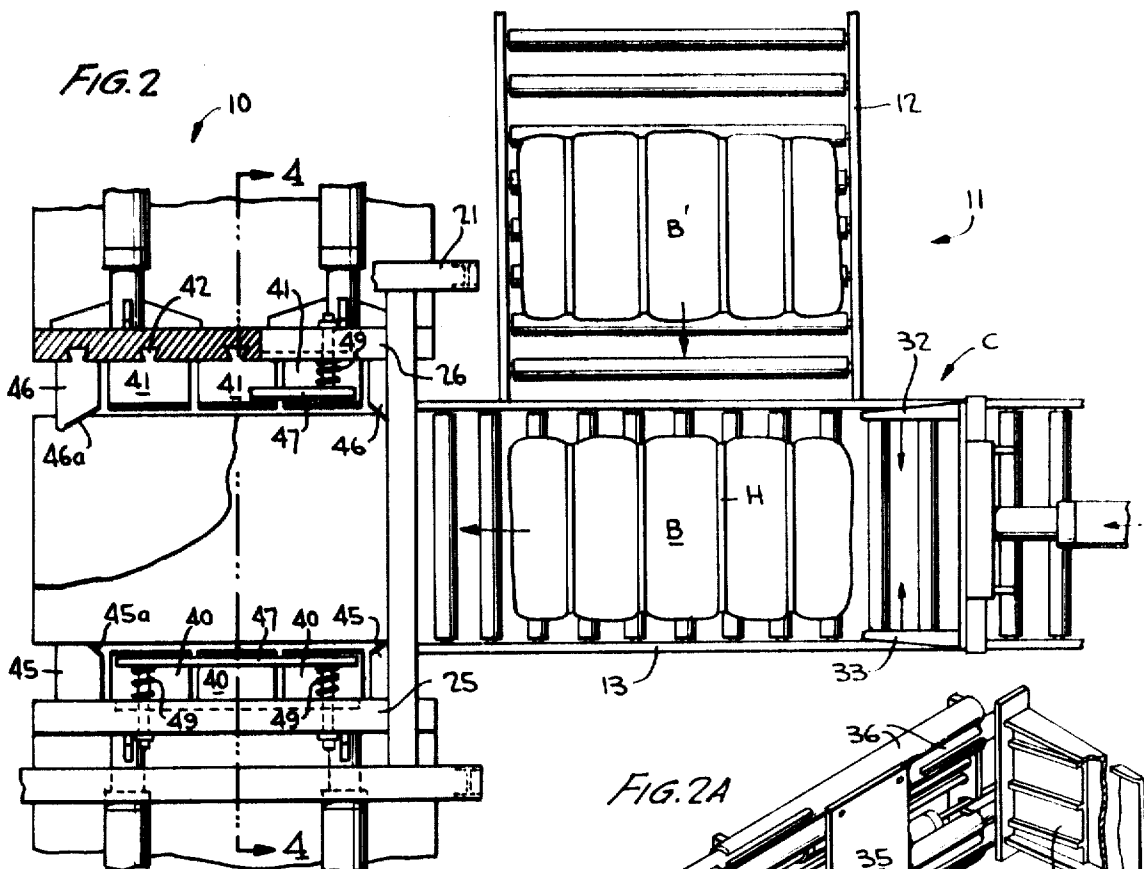


FIG. 2A

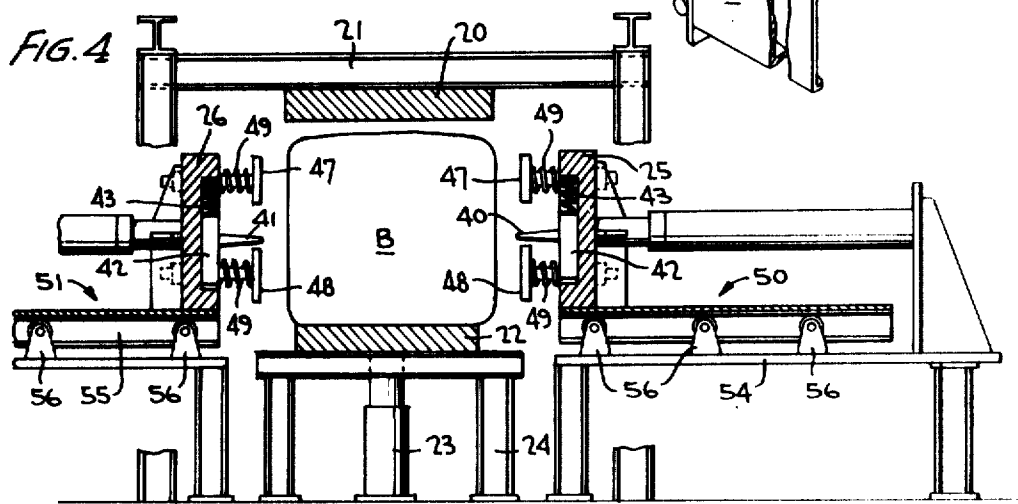
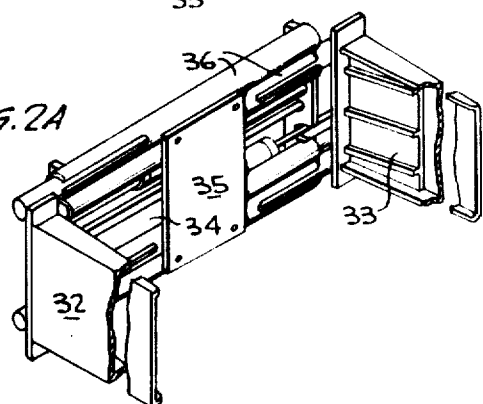
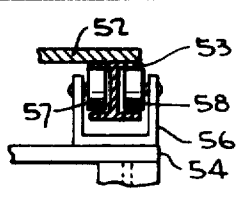
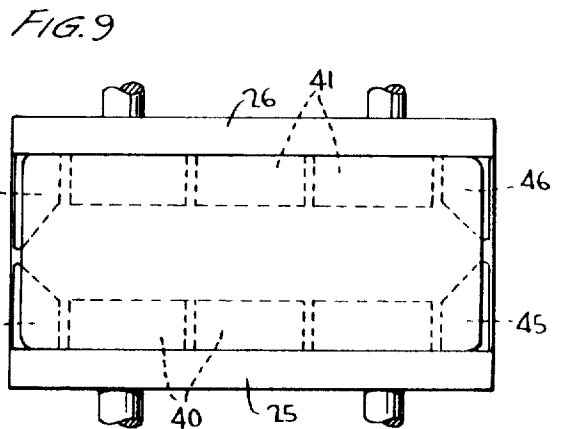
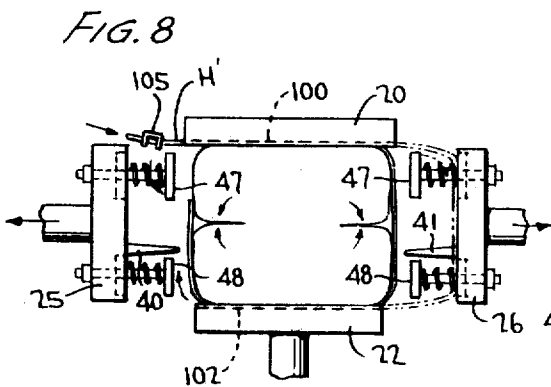
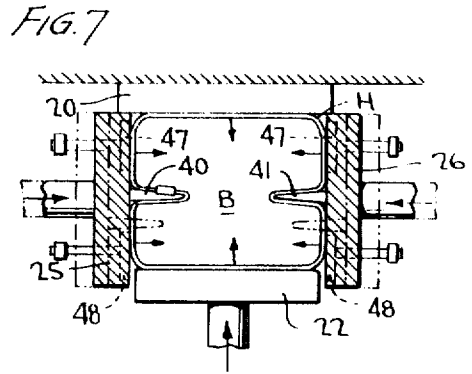
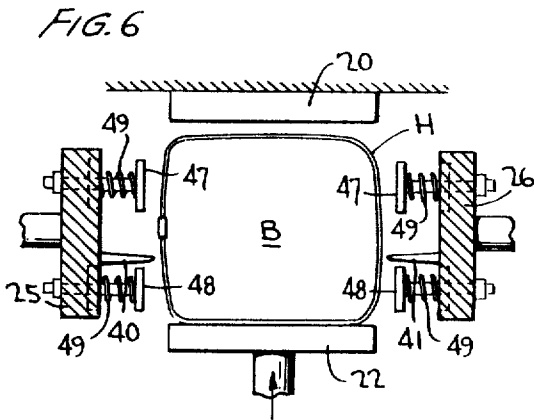
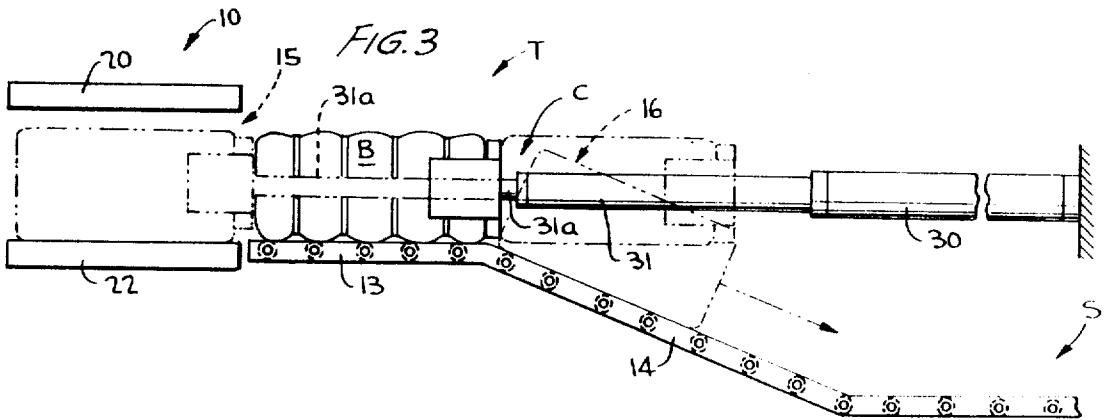


FIG. 4A



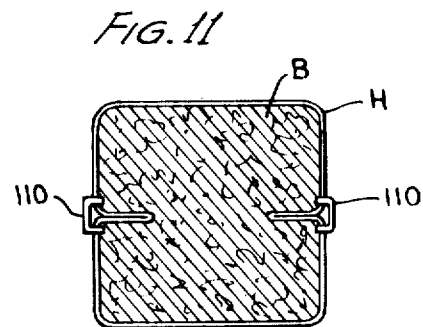
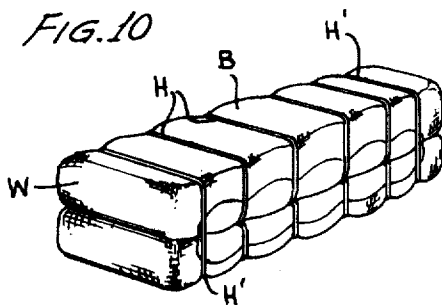
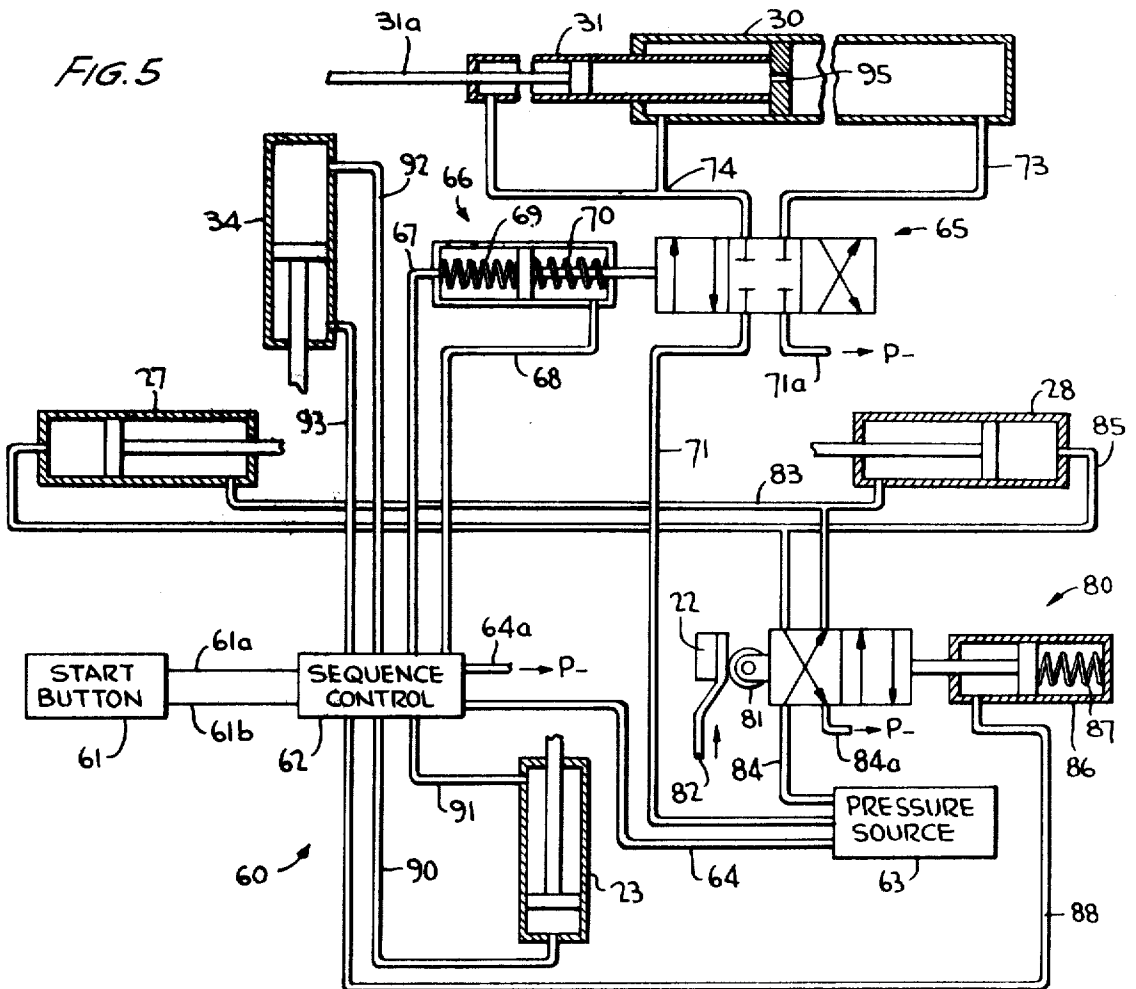
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COTTON BALE HANDLING AND COMPRESSING SYSTEM

The present invention relates to apparatus, methods and articles of manufacture concerning compressing bales of material, and more particularly to a handling and compressing system and the resulting product involved in transforming gin bales of cotton into bales of reduced size.

In the processing of cotton from the gin to the final user, it is necessary to compress the bale to a relatively high density for economical shipping. That is, the gin bales which are generally formed by the grower as the cotton is removed from the gin are usually pressed to a density of only about 10 pounds per cubic foot, which leaves the dimensions of the bale at about 28 inches wide, 48 inches high and 54 inches long. Then, the final or high density compressing operation is performed at central warehouses or shipping points to a standard density of about 26 pounds per cubic foot and standard dimensions of about 28 inches by 20 inches by 56 inches for domestic shipments. If the bale happens to be destined for export, the bale is compressed further to occupy even less space; the parameters being approximately 34 pounds per cubic foot and about 22 inches by 20 inches by 60 inches.

In the past, it has involved a considerable amount of manpower and time to effect this recompressing operation. First, the gin bale is loaded into a small prepress, or, as commonly known in the art, a "dinky" press, wherein a compression is applied sufficient to loosen the bands that hold the bale together. The next step involves the manual cutting and removing of the bands whereupon the bales are delivered to the high compression press. At the press, the operator must open the side doors to receive the bale, and finally operate the press to apply the pressure to perform the compressing operation. After the bale has been compressed and rebanded, at least one of the doors of the press must be reopened and the bale removed manually. Lastly, the jute bagging which surrounds the bale and extends over the bale ends is sewn together to take up the slack caused by the compressing of the bale to a smaller size.

Several attempts have been made to automate the above bale handling and compressing operation to obtain an increase in efficiency. While these attempts have generally been successful in reducing the manual labor required, much has been left to be desired in terms of obtaining a genuine increase in efficiency over the method described, in that the arrangements are unusually complicated and expensive to build and subject to high maintenance costs. For example, one system that has been suggested employs a plurality of cages which are utilized to transfer bales along a conveyor track in an endless path past separate operating stations where the various functions are performed. Because of the reasons given, warehouse operators have found it difficult to justify the cost of such an automated system, especially since the system is usually utilized only a few months of the year after the cotton harvesting season.

Furthermore, in the prior art automated systems such as the one described, there is still required the separate step of delivering the bale to the dinky press wherein the holding bands of the gin bale are loosened and removed as well as the step of sewing the slack portion of the wrapper together at the end of the bale. This retaining of these steps in the operation not only adds to the overall cycle time, but is further undesirable and inefficient in that workmen are required to perform these functions.

Thus, it is one object of the present invention to provide an improved system for handling and compressing bales of compressible material, such as cotton.

It is another object of the present invention to provide a simplified bale handling and compressor arrangement characterized by automated feed and discharge for increased efficiency and relatively low initial cost and maintenance requirements.

It is another object of the present invention to provide a bale compressor apparatus and method which allows the elimination of the step of loosening and removing the holding bands prior to the compressing operation.

It is still another object of the present invention to provide an improved apparatus, method and article of manufacture wherein the holding bands are retained on the gin bale during the compressing operation and wherein there are no protrusions from the outer confines of the finished bale.

Briefly describing the main concepts of the simplified bale handling and compressor system, there is provided an infeed conveyor which is operative to receive the gin bales from any source, such as a conventional forklift, and transport the same to a transfer station adjacent one end of the compressor apparatus. At this point a clamp carried by a double fluid cylinder is operative to positively engage the sides of the bale to perform the loading operation through the adjacent end of the compressor. Upon completion of the compressing operation, the bale is once again engaged by the clamp for unloading through the same end of the press and immediately shifted through the transfer station for removal by gravity on an inclined conveyor so that the next bale in line may be received at the transfer station without delay. The side gripping members of the clamp are actuated by opposed fluid cylinders and the bodily movement of the clamp through the transfer station is performed by a double fluid cylinder, all of which cylinders are controlled by a fluid circuit to perform the loading, unloading and removal operations in rapid sequence. Since the operations are performed in a straight line and through a single end of the compressor, a minimum amount of floor space is needed for accommodating the handling system of the invention.

The structure of the novel bale compressor is characterized by the provision of a blade member on at least one of the platens of the compressor; said blade member serving to apply localized pressure to the holding bands of the bale and tuck the slack portion caused by the compressing operation into the bale and out of the way. With this arrangement, it will be realized that the separate step of applying the bale to the dinky press and removing the bands has been completely eliminated for an increase in efficiency of the overall operation. In addition, it has been discovered that the pressure of the bands on the bale as they are pushed inwardly actually aids in the compressing process by exerting an inwardly gripping pressure on the upper and lower halves of the bale as the blade members move inwardly.

Preferably, opposed blade members are mounted on the side platens and extend substantially along the length of the bale so as to form a crease along the sides of the bale. The blade members are preferably wedge-shaped to aid in insertion and withdrawal from the compressible material and are mounted on slidable mounts so as to allow for slight movement transverse to the longitudinal axis of the bale upon reduction in the size of the girth of the bale during the compressing operation. To further aid in inserting the blade members into the bale, said members may be formed as a plurality of independently movable sections so that each can independently seek the point of entrance of least resistance, such as between two of the layers of cotton. The tucked portion of the holding bands inside the bale resist being removed since the adjacent cotton on the interior of the bale tends to interlock with the edges of the band and since the opposed faces of the tucked portion are maintained in contiguous relationship by the additional holding bands or equivalent once the blade members are withdrawn. Spring-actuated plates on the side platens engage the sides of bale B adjacent the tucking blades to stabilize the bale during compression and then to strip the bale from said blades.

Also provided on the side doors or platens are blade segments which engage the end portions of the bale to effect an extension of the crease around the full circumference of the bale whereby any slack in the wrapper or jute bagging on the bale will also be tucked into the bale and the previously

required sewing operation mentioned above is eliminated. Additionally, the side platens are mounted for straight line movement rather than pivotal movement as in most prior art arrangements; the carriages for the platens including I-beam runners which are supported on pairs of rollers positioned on opposite sides of the web of the I-beams for greater stability. Alternatively to applying additional holding bands to retain the bale in compressed condition upon removal from the compressor, the holding bands which have been tucked into the bale may serve as the sole means for retaining the bale in the compressed condition by provision of a clip engaging the bands across the opening where the tucked portion enters the bale. Of course, a combination of these two alternatives could be utilized if desired or necessary in situations where the bale is compressed a maximum amount.

The finished compressed bale has distinct advantages as a new article of manufacture in that it is easier and safer to handle as compared to prior art compressed bales. That is, all of the bands retained on the bale are maintained in a taut condition with no slack protruding to catch parts of the machine and thereby hinder removal or to present a hazard to the workmen by presenting sharp edges. Further, with the extension of the characteristic crease along the ends of the bale to tuck the wrapper into the interior, there are no loose parts on the bale whatsoever, thereby presenting a neater product and increasing customer satisfaction.

Still other objects and advantages of the present invention will become readily apparent to those skilled in this art from the following detailed description, wherein I have shown and described only the preferred embodiment of the invention, simply by way of illustration of the best mode contemplated by me of carrying out my invention. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of modification in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

In the drawings:

FIG. 1 is a perspective view of a handling and compressor assembly which is constructed in accordance with the principles of the present invention;

FIG. 2 is a top view of the assembly illustrated in FIG. 1 with certain parts broken away and with bales in the transporting positions for clarity;

FIG. 2a is a detailed perspective view of the clamp utilized in the bale-handling arrangement of the assembly shown in FIG. 2;

FIG. 3 is a side view of a portion of the handling system illustrating the movement of the clamp to perform the transfer and removal operations;

FIG. 4 is a cross-sectional view taken along line 4-4 of FIG. 2;

FIG. 4a is a detailed cross-sectional view of the mounting system for the wide door carriages;

FIG. 5 is a schematic diagram of a fluid control system for automatically operating the bale handling and compressor apparatus shown in FIGS. 1-4;

FIGS. 6-8 are end views of the bale compressor apparatus showing the sequence of the compressing operation thereby illustrating the action of the compressing platens;

FIG. 9 is a top view of the bale with the side platens positioned in the inward or compressing position;

FIG. 10 is a perspective view of a finished bale which has been compressed by the apparatus and method of the invention; and

FIG. 11 is a cross-sectional view of the bale showing the tucked portions of the holding bands with the alternative means for retaining the bale in the compressed condition.

Making reference now to FIGS. 1-4 for a more specific description of the concepts of the present invention, there is shown a compressor assembly 10 and a handling system 11 which are interrelated in accordance with principles of the present invention as illustrated and particularly adapted for

operation on conventional size bales of cotton. It will, of course, be realized by those skilled in the art, and as will be apparent from the discussion of the principles of the invention stated herein, that the compressor 10 and the handling system 11 of the present invention could be utilized to process other types of baled compressible material without significant or substantive modification to the structure disclosed herein.

The handling system 11 comprises an infeder conveyor 12 extending at a 90° angle to a transfer platform 13 positioned at one end and at the horizontal level of the compressor 10 and forming a transfer station T, as best shown in FIGS. 1 and 3. Extending from the transfer platform 13 on the opposite side from the end of the compressor 10 and in line therewith is an inclined removal conveyor 14. Preferably the conveyors 12, 14 and the transfer platform 13 are made of idler rollers extending perpendicular to the intended line of travel of a bale B (FIG. 2) to be processed so as to allow for freer movement of the same.

As shown in FIGS. 2 and 3, the bale B positioned at the transfer station T on the transfer platform 13 is ready to be loaded by clamp C into the compressor 10 to a compressing station, generally indicated by the dash-dot outline 15 of FIG. 3. After the compressing operation has been completed, the bale B is removed by the clamp C through the same end of the compressor 10 back through the transfer station T and released for movement by gravity down the inclined conveyor 14, as denoted by the dashed-dot outline 16 also shown in FIG. 3. The bale B then is positioned at a suitable pickup station S where it can be removed by any conventional means, such as by a clamp-equipped forklift. If necessary or desirable, the movement of the bale B along the conveyor 14 could be positively controlled by suitable motorized means serving to drive said bale B forwardly to the station S. Once the bale B has been so processed, the next bale B' positioned on the infeder conveyor 12 (FIG. 2) is in readiness to be handled and compressed in the same manner.

The path of movement of the bale B once positioned at the transfer station T is thus in a compact straight line arrangement at only one end of the compressor 10 wherein a minimum amount of floor space is required for the complete operation. Also, since the clamp C performs both the loading and unloading of the compressor 10 and also the positioning of the bale B on the conveyor 14 for removal, the system is highly economical in terms of cost of equipment.

The preferred embodiment of the compressor assembly 10 comprises an upper platen 20 which is supported above the compressing station 15 by a suitable welded superstructure 21. Lower platen 22 is movable upwardly toward said upper platen 20 in response to fluid power cylinders 23 (only one shown) to cause the compressing of the bale B; said lower platen 22 normally resting on a subframe 24 in alignment with the transfer conveyor 13 so that said bale B can be loaded and unloaded in a horizontal plane (see FIG. 4). Opposed side platens or doors 25, 26 which are also movable inwardly during the compressing operation are operated by pairs of fluid-actuating cylinders 27, 28, respectively. As denoted by the arrows in FIG. 1, the platens 22, 25, 26 thus all move inwardly to perform the compressing operation from three sides with the upper platen 20 serving as a stationary backup. It should be noted that the upper platen 20 could equally well be movable with respect to the lower platen 22 to carry out the compressing operation if desired, without departing from the principles of the present invention.

The clamp C is also preferably movable by the use of a fluid cylinder arrangement and, in particular, a double fluid cylinder 30 is provided for this purpose having an extensible piston cylinder 31 and an inner piston 31a. As shown in FIG. 3, the piston cylinder 31 is operative upon extension to place the clamp C into engagement with the bale B at the transfer station T. The compressing station 15 is reached in turn by the clamp C through extension of piston 31a (note dotted line position in FIG. 3) and it follows that the removal position 16 is reached by return of both the piston cylinder 31 and the piston 31a into the cylinder 30.

The construction of the clamp C comprises a pair of opposed side members 32, 33 (note FIGS. 2 and 2a) which perform a gripping function along the sides of the bale B in response to the inward operating action of cylinders 34. To properly guide the side members 32, 33, frame 35 of the clamp C includes suitable telescopic slide supports 36. With this construction, the bale B is positively gripped during the transferring and removing operation so as to accurately position the bale B at the various stations and to insure against slippage so that rapid shifting of the clamp C can be employed.

Proceeding with a detailed description of one of the salient features of the compressor assembly 10, reference is made to FIGS. 1, 2 and 4, wherein are shown horizontal blade member sections 40, 41 mounted on the side platens 25, 26, respectively, and adapted to apply localized pressure to bands H (FIG. 2) retained on the bale B during the compressing operation so as to tuck the slack portion of said bands H into the interior of the bale B and thus out of the way. Each of the blade member sections 40, 41 is mounted for limited upward movement by integral dovetail slides 42 (FIGS. 2 and 4) held within companion slots formed in the face of the side platens 25, 26. Springs 43 (FIG. 4) are provided in the slots above the blade member sections 40, 41 to normally bias the same to the lower position. Thus, upon the inward movement of the side doors 25, 26, the blade member sections 40, 41 are allowed the slight upward movement that might be required for each section to find the desired point of entry of least resistance. Also, additional upward movement necessitated by the reduction in the height and the girth of the bale B caused by the simultaneous compression of said bale B by the lower platen 22 is allowed by this arrangement.

In addition, the respective side doors 25, 26 include blade segments 45, 46 at both ends thereof. These blade segments 45, 46 by their orientation are positioned to engage the end portions of the bale B when positioned in the inward position. Operative edges 45a, 46a of the respective blade segments are angled inwardly at an acute angle with respect to the bale B for two important reasons. First, the edges 45a, 46a are operative to cause a slight self-centering operation on the bale B as the platens 25, 26 move inwardly; this function being by virtue of the opposed edges 45a, 46a acting with differential pressure on the respective ends of the bale B if said bale B is closer to one end than the other, with this continuing until equal amounts of force are tending to shift the bale endwise at which point the centered position has been reached. Secondly, and more importantly, the blade segments 45, 46 extend into the bale B to form an extension of the side creases across the ends to effect a tucking of wrapper W, such as jute bagging (see FIGS. 4 and 10), into the interior of the bale B, which eliminates the step of sewing the slack wrapper together as has always been necessary in the past. As illustrated, both the blade member sections 40, 41 and the blade segments 45, 46 are wedge shaped in cross section to allow easy entry and removal into and from the compressible material of the bale B. Also, the blade segments 45, 46 are mounted for independent upward movement so as to seek an area of reduced resistance for entering and to allow shifting as compression takes place.

Upper and lower stripper plates 47, 48, respectively, are mounted on the side platens 25, 26 by compression springs 49 so as to engage the sides of the bale B as said platens move inwardly on the compressing stroke. Because of the side support thus afforded to the bale B, an tendency for said bale B to S, that is, squirm, between the upper and lower platens 20, 22 upon applying pressure is abated. Upon withdrawal of the platens 25, 26 the plates 47, 48 serve the equally important function of stripping the bale B from the blade member sections 40, 41 and the blade segments 45, 46 so as to keep said bale B centered on the lower platen 22 for removal by the clamp C. While upper and lower plates 47, 48 are preferred, in some instances it may be found that a single plate on each platen 25, 26 may suffice to carry out the desired objectives.

A special mounting arrangement for the doors 25, 26 to stabilize the same against the reactive forces during compression is provided in the form of carriages 50, 51 (FIGS. 1 and 4),

each of which comprises a base 52, to which respective doors 25, 26 are affixed, and a plurality of I-beam runners 53 on the underneath side thereof. To support these carriages 50, 51 are a pair of tables 54, 55 (FIG. 4) upon the upper surface of which are mounted a plurality of rows of aligned U-shaped supports 56 (FIGS. 1 and 4); each support 56 carrying a pair of opposed rollers 57, 58, the side faces of which embrace the web of the I-beam runners 53, as shown in FIG. 4a. As illustrated, the rollers 57, 58 support the carriages 50, 51 by engaging the underneath side of the upper crosspiece with just sufficient clearance to allow counter movement between said rollers 57, 58 and the lower crosspiece. It can be seen that the substantial forces applied during the compressing operation are checked by the captive rollers 57, 58 along the length of the carriages 50, 51.

Before considering the operation of the bale compressor 10 and handling system 11, reference is made to FIG. 5 wherein is shown a fluid circuit 60 which will now be described. A start button 61 is interconnected through lines 61a, 61b to a sequence control 62 that serves to actuate the various cylinders of the bale compressor 10 and handling system 11 in an automatic fashion. The specific construction of the sequence control 62 does not form any part of the present invention and may comprise a conventional motorized step valve, for example. In any case, the sequence control 62 is operative to provide timed pressure and exhaust to connected control or output lines in sequence from pressure source 63 via supply line 64 and vent 64a.

To control the operation of the double cylinder 30 which carries the clamp C, a three-position valve 65 is controlled by an actuator 66 connected to the sequence control 62 through control lines 67, 68. The valve 65 is normally in the closed position illustrated due to the self-centering action of opposed springs 69, 70 incorporated within the actuator 66. This means that supply line 71 from pressure source 63 and vent 71a are not connected to either the power side of the cylinder 30 through feedline 73 or to the return side of the cylinder 30 through branched feedline 74.

In accordance with an auxiliary feature of the invention, the opposed actuating cylinders 27, 28 for the side platens 25, 26 are operated in unison in response to the initial upward movement of the lower platen 22. This is effected through a two-position valve 80 having a roller follower actuator 81 which is responsive to cam track 82 carried by the lower platen 22. In the position shown in FIG. 5, the return sides of the cylinders 27, 28 are connected to the pressure source 63 through branched feedline 83 and supply line 84. To actuate the side doors 25, 26, branched feedline 85 is connected to supply line 84 and the feedline 83 to vent 84a as the lower platen moves up so that the low portion of the cam track 82 allows the valve 80 to shift to the left as viewed in FIG. 5. Auxiliary actuator 86 is provided on the opposite end of the valve 80 with a spring 87 being provided to normally bias the valve to the left-hand position but with a pressure chamber on the opposite side for actuation through output line 88 connected to the sequence control 62. The actuating cylinder 23 for the lower platen 22 is connected directly to the sequence control 62 through output lines 90, 91 as are the operating cylinders 34 for the clamp C through output lines 92, 93.

In the operation of the bale compressor 10 and handling system 11, assuming that the bale B is in position on the transfer platform 13 as shown in FIG. 2, the operator pushes the button 61 which activates the sequence control 62 to start the operation. First, the line 68 is pressurized so as to shift the valve 65 to the left and thereby interconnect the supply line 71 to the feedline 73 connected to the power side of the double cylinder 30. The piston cylinder 31 is responsive to the pressure and is shifted rapidly to the left until its limit of movement at the end of the cylinder 30 has been reached; this shifting being under no load conditions so that fluid pressure does not build up sufficiently to enter small aperture 95 to the piston 31a. At this point, the output line 68 is exhausted through the vent 64a and the valve 65 is returned to the neutral position.

The clamp C has now moved to the position shown in FIG. 3 wherein it embraces the end of the bale B and is ready to deliver the same to the compressor 10.

To do this in accordance with the principles of the invention, the cylinders 34 of the clamp C are next actuated through pressurization of one side of each of the cylinders 34 via the output line 93 which causes the side members 32, 33 to move inwardly (as denoted by the arrows in FIG. 2) and firmly grip the bale B to assure positive handling and delivery of the bale B. With the pressure held on the side members 32, 33 through the cylinders 34, pressure is again applied to the double cylinder through feedline 73 via the valve 65 and upon a build up of substantial pressure on the power side of the cylinder 31, pressurized fluid is now effective to enter the aperture 95 to operate the piston and thereby transfer the bale B to the position 15 shown in FIG. 3. Once in the position 15, the side members 32, 33 of the clamp C are released by operation of the sequence control 62 through pressurization of the line 92 to the cylinders 34 and venting of the line 93 via the vent 64a so that the clamp C can be removed from the compressing station for the compressing operation. The latter is accomplished by briefly applying pressure through the line 67 to shift the valve 65 to the right and apply pressure through the branched feedline 74 on the return side of the pistons 31, 31a.

The compressor apparatus 10 is now ready for actuation and accordingly sequence control 62 is programmed to at this point apply pressure through the feedline 90 to cause the piston of the cylinder 23 to raise the lower platen 22 (note start of compressing sequence in FIG. 6). As the lower platen is raised a predetermined amount the lower portion of the cam track 82 shifts the valve 80 to the left thereby applying pressure to the power side of the cylinders 27, 28 through branched feedline 85 to move the side doors 25, 26 inwardly against the bale B. As the blade member sections 40, 41 engage the sides of the bale B, localized pressure is applied to the holding bands H and the slack portions caused by the continuing compressing of the bale B against the upper platen 20 by the lower platen 22 are tucked into the inside of the bale along the crease formed (note FIGS. 7 and 9).

As the girth of the bale B, or more particularly the height of the same, is reduced by compression between the upper and lower platens 20, 22, said blade member sections 40, 41 move upwardly through the intermediate dotted line positions in FIG. 7 until the full line positions are reached. It will be realized that as the holding bands H are drawn tighter and tighter from the position of first engagement in FIG. 6 through the dotted line position of FIG. 7 and finally to the full line position of FIG. 7, a considerable amount of compression is applied to the upper and lower halves of the bale B through the action of the bands H themselves, as denoted by the inwardly directed force arrows in FIG. 7. In other words, as the crease is formed in the bale B, the bands are exerting an inward pressure from three sides so that the compression of the bale B is accomplished widthwise and is materially aided heightwise. The pressure of the cotton has been found to be relatively constant throughout the bale B due to the several points of force provided by this arrangement.

Once the desired amount of compression has been reached, the sequence control 62 next transmits a pressure signal through the output line 88 to the actuator 86 to shift the valve 80 to the right even though the lower platen 22 remains in its upper position. This allows pressure to be applied to the return side of the cylinders 27, 28 through the branched feedline 83 and the power side to be vented through vent 84a. The relationship of the operative platens 22, 25, 26 is at this point, as shown in FIG. 8. Here, the side platens 25, 26 are withdrawn and the blade member sections 40, 41 are lowered in response to the action of the springs 43 in readiness for the next compressing operation.

As shown in FIG. 8, when the blade member sections 40, 41 have been withdrawn, the force of compression in the bale B by the upper and lower platens 20, 22 pushes the opposed

sides of the V-shaped tucked portions into contact (note arrows, FIG. 8). As thus positioned, one side of the tucked portion resists being withdrawn and is held against outward forces that would tend to loosen the bands H by action of the other side of said tucked portion which is held in a stiffened condition by the face-to-face contact. Also, the frictional contact between the edges of the tucked portion and the surrounding cotton aid in preventing deleterious loosening of the bands H in this mode. Advantageously, both the mutual resistance of the sides of the tucked portions and the frictional resistance with the cotton are of help in maintaining the compression of the bale B in its final mode, now to be described.

Thus, the bale B receives a number of additional holding bands H' which may be manually inserted through suitable guide slots 100, 102 in the respective platens 20, 22 along the path of movement denoted in FIG. 8. It should be noted that with the platen 26 withdrawn during installation of the additional holding band H', the dotted line path is followed past said platen 26 and then upon the lead end of the band H' reaching the left-hand side of the bale as shown in FIG. 8, the band will be drawn tight to the solid line position shown. Next, the trailing end of the band H' with a suitable clip 105 may be brought down into engagement with the leading end and fastened thereto to complete the operation. It should be noted that because the original holding bands H remain on the bale B (see FIG. 7) the removal of the pressure of the side door 25 does not allow release of the widthwise compression since these bands are performing a holding function through the mutual resistance and frictional engagement of the tucked portion just described.

Before proceeding with the remainder of the operation, it is important to note that with the finished bale having the additional straps H' applied thereto and removed from the compressor 10 (to be described), the bale B is held under compression with certain results and advantages not heretofore attainable. First, in the finished bale B or article of manufacture shown in FIG. 10, the bands H continue to perform a holding operation of the bale B along the center thereof through the mutual resistance and frictional engagement between the opposing sides of the V-shaped tucked portion. Secondly, and of particular advantage, is the fact that there are no protrusions of the bands H from the bale B which might cause hindrance or injury to anyone during further handling of the bale B. Also, the wrapper or jute bagging W has been neatly tucked into the extension of the crease along the ends of the bale B as clearly illustrated in this figure. With this combination of additional holding bands H' and the original holding bands H to retain the bale B under compression after being removed from the compressor 10, when the final destination is reached and the cotton is to be released from the bale B, it is contemplated that only two bands H' must be cut whereupon the bands H can, because of their slackness, be conveniently slipped over one end of the band B. In cases of particularly resilient material being baled, it may be necessary to also cut the bands H; however, since the bands H are not in any case returned to a taut condition, the bands H are more easily cut and removed than before.

If desired, an alternative manner of maintaining the finished bale B under compression after being removed from the compressor 10 may be used, as illustrated in FIG. 11. This involves the installation of clips 110 on the holding bands H while the bale B is still in the compressor 10 so as to span the opening at the point where the tucked portion of said holding band H enters the bale B. With the clips 110 firmly attached, the opposed sides of the tucked portions remain in contact with each other and the bale B is held securely without the use of the additional bands H'.

Proceeding with the remainder of the operation of the handling system, once the pressure on the power side of the cylinder 23 has been lowered through application of pressure through the output line 91 and release of pressure through the output line 90 in response to the sequence control 62, the bale B is once again positioned at the level of the transfer platform

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13 and in readiness for removal by the clamp C. Thus, pressure is momentarily applied to the power side of the double piston 30 through the valve 65 by operation of the actuator 66 in response to the sequence control 62. In position within the compressor 10 the cylinders 34 of the clamp C are once again actuated by pressurizing lines 93 to bring the side members 32, 33 into firm engagement with the sides of the bale B. Thus held, the bale B is pulled from the compressor 10 by applying return pressure to the pistons 31, 31a of the double piston 30 through shifting of the valve 65 by the sequence control 62 so that the supply line 71 pressurizes the branched feed line 74. The clamp C then moves directly and in a straight line to the more remote dotted line position of FIG. 3 where the bale B is positioned above the removal conveyor 14. Once the side members 32, 33 of the clamp C are released by appropriate action of the sequence control 62, the forward end of the bale drops to the conveyor 14 and the position 16 where the bale B is preferably delivered by gravity to pickup station S below the cylinder 30 for receipt by a forklift truck or other suitable means. At this point, the sequence control 62 is reset for the next cycle for operation exactly as above on the next bale B' in line.

Outstanding results and advantages should now be clear to those skilled in the art with regard to the new concepts set forth relating to bale handling and compressing. The compact and efficient handling system centered around the extensible clamp C is operative to load and unload the bale through a single end of the compressor 10 which means a savings in equipment cost as well as the amount of floor space required for installation of an automated system. Secondly, with the use of blade members 40, 41 or their equivalent to apply localized pressure to the holding bands H to tuck the slack portion of said bands H into the interior of the bale B, a substantial amount of efficiency is gained in that a complete step in the process of the prior art is eliminated and the need for men to perform this function is also eliminated. Furthermore, with the employment of blade segments 45, 46 to engage the end portions of the bale to tuck in the wrapper W, another step is eliminated and similar savings are realized.

In this disclosure, there is shown and described only the preferred embodiment of the invention, but, as aforementioned, it is to be understood that the invention is capable of various changes or modifications within the scope of the in-

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ventive concept as expressed by the accompanying claims.

I claim:

1. In a bale-handling and compressor system for operating on an elongated bale to reduce the size thereof, the combination of a compressor including relatively movable upper and lower platens and side doors to perform the compressing operation, said platens and said doors being elongated to engage the sides of said bale parallel to the longitudinal axis thereof, a conveyor for transporting bales to a transfer station adjacent one end of said compressor, clamp means for engaging each bale at said transfer station to transfer the same in the direction of said longitudinal axis into said compressor through said one end thereof and to return said bale through said one end to said transfer station upon completion of the compressing operation, and means to remove each compressed bale from said transfer station in readiness for receipt of the next bale to be compressed.

2. The combination of claim 1 wherein said clamp means includes movable side members to engage the sides of the bale and fluid means for actuating said side members to positively grip said sides of the bale during the transfer operation.

3. The combination of claim 1 wherein is provided a horizontal platform at said transfer station and said removing means comprises a second conveyor extending at an angle to said platform at said transfer station, said second conveyor being positioned on the opposite side of said transfer station from said compressor and extending in the direction of travel of said clamp means, whereby the bale is received from said clamp means after passing through said transfer station subsequent to the compressing operation.

4. The combination of claim 3 wherein said platform and said second conveyor include a continuous line of idler rollers extending transverse to the direction of travel of the bale for support of the same during the transfer and removing operations, respectively.

5. The combination of claim 4 wherein said clamp means is carried by a double fluid cylinder having first and second pistons extending concentrically and in the direction of travel of said bale along said platform and said second conveyor, said first piston extending sufficiently to perform the removing operation and said second piston extending sufficiently to perform the transfer operation, and control circuit means for operating said first and second pistons in sequence.

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