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N. D. FAY ETAL
COIL COMPACTOR

3,212,429

Filed Oct. 14, 1963

5 Sheets-Sheet 1

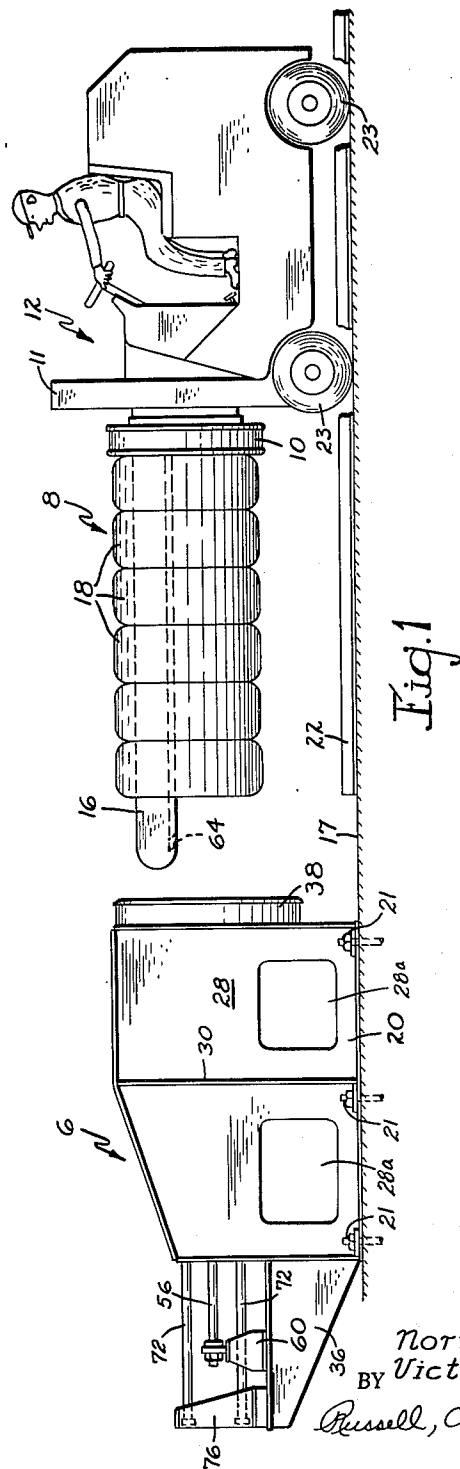


Fig. 1

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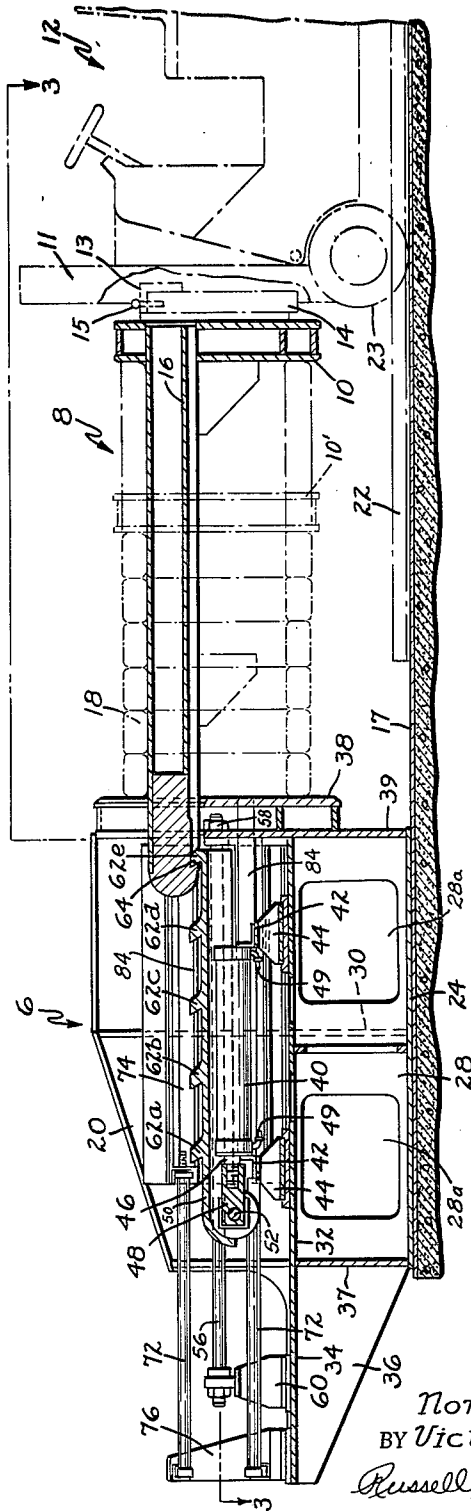


Fig. 2

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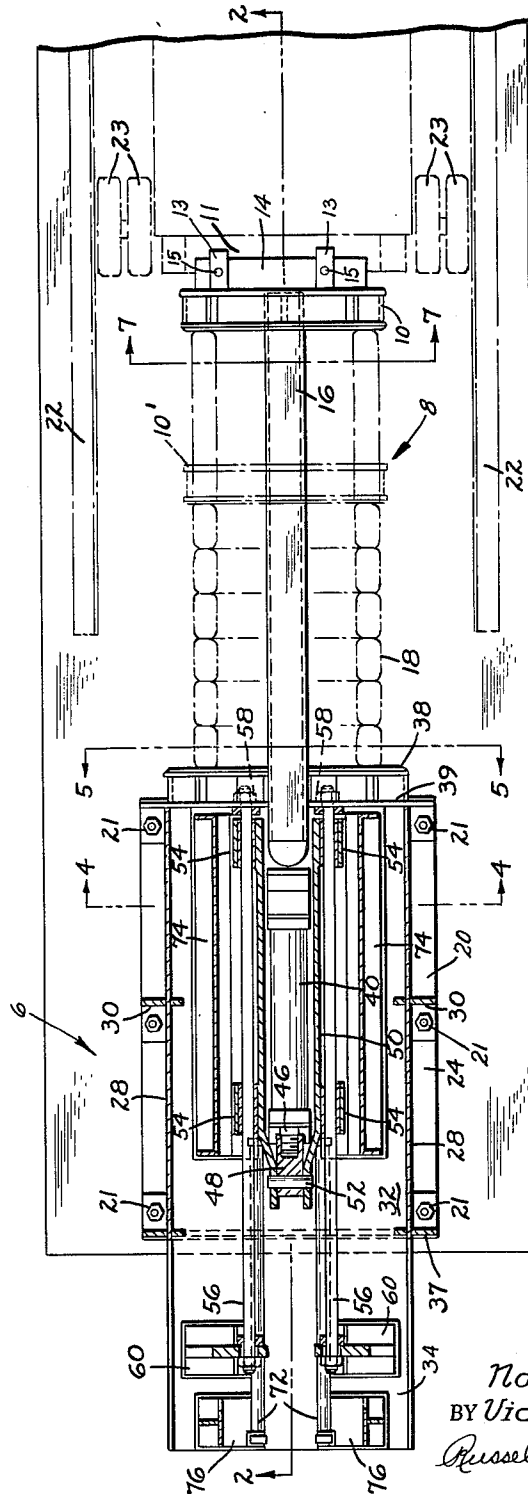


Fig. 3

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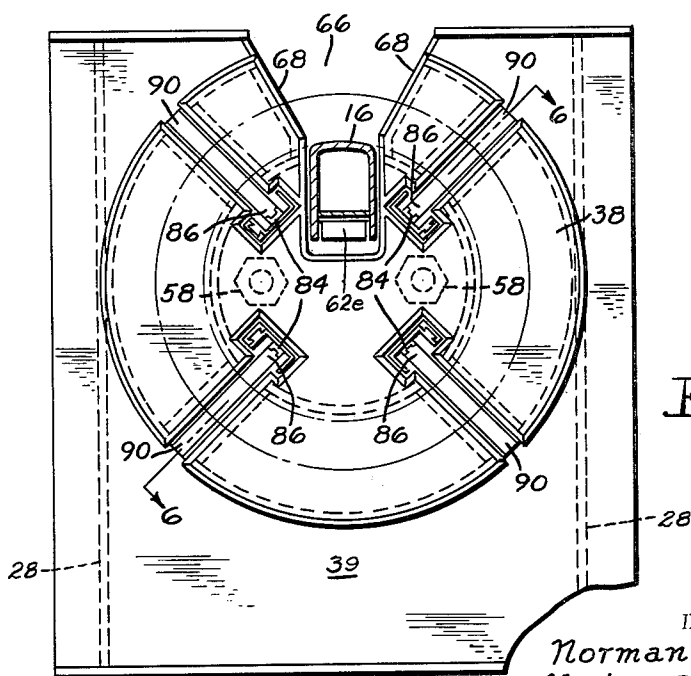
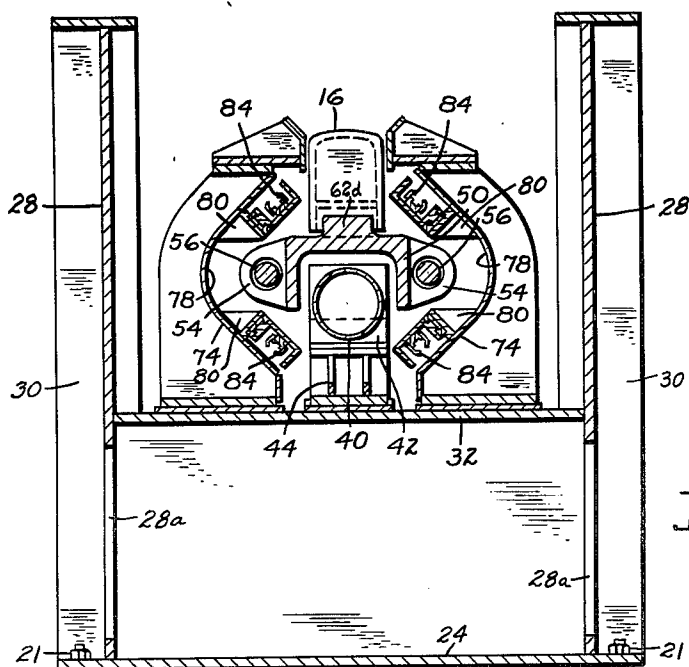
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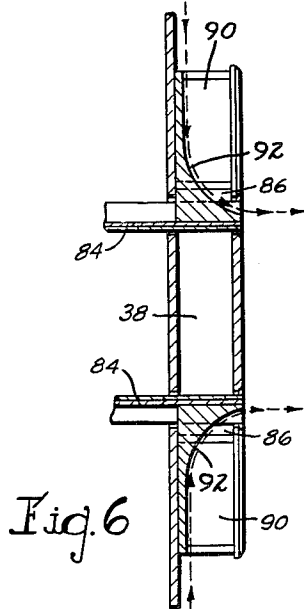


Fig. 6

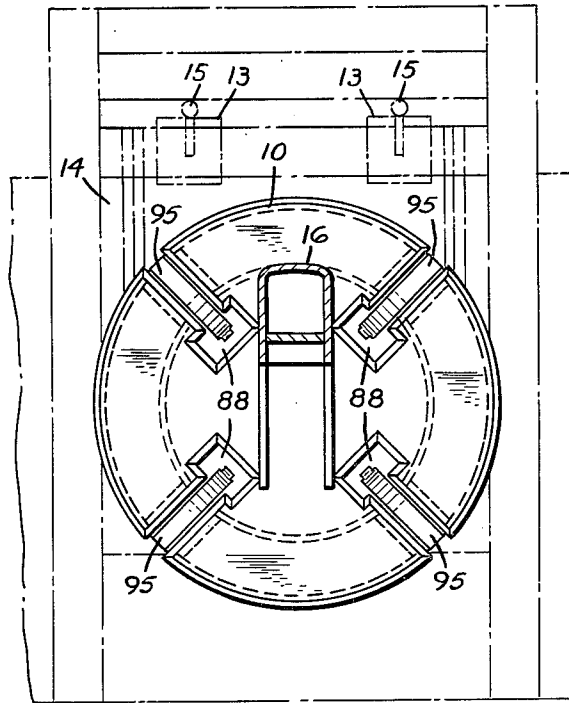


Fig. 7

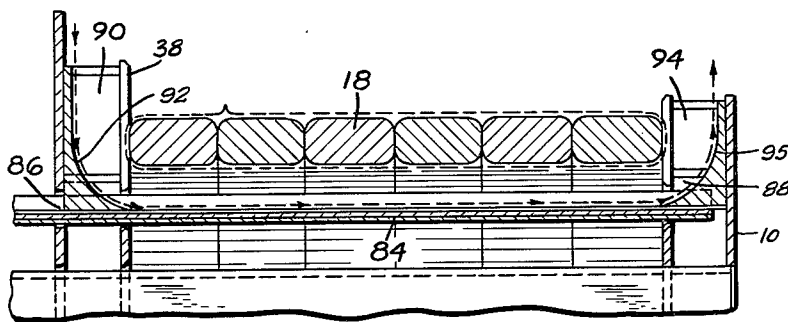


Fig. 8

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COIL COMPACTOR

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7 Claims. (Cl. 100—7)

This invention relates generally to material handling equipment and more particularly to a mobile device for compacting and strapping a plurality of annular resilient members into an axially aligned unitized bundle.

It should be noted at the outset that the invention will hereinafter be described in connection with the steel industry and the solution of problems encountered in efficiently handling wire and rod coils. However, this association with a particular phase of industry is not intended as a limitation upon the spirit and scope of the invention, but rather as an illustration of one of several possible applications of the apparatus to be described.

The finished products of wire and rod mills are usually formed into coils of a relatively low density by conventional coiling apparatus such as pouring or laying reels. The coils are then removed from the reels and stored individually for subsequent processing or shipping. However, it has been found that when removed from the reels, the coils present rather unstable structures capable of being easily distorted and damaged by rough handling in transit. In addition, since the coils are usually heavy and cumbersome, it can readily be seen that their efficient handling is to a considerable extent complicated by a combination of these factors. It should also be noted that when received from the coiling apparatus, the loosely formed coils have a relatively low density per unit volume. When stored or shipped in this state, the coils tend to occupy unnecessarily large amounts of valuable space with an accompanying increase to the manufacturer in shipping and storage expenditures.

In view of the above-mentioned difficulties in handling individual coils, it has been found desirable to compress or compact a series of axially aligned coils into a single relatively rigid unitized bundle. In this manner, the resultant bundle is not liable to be distorted and damaged during transit and will of course occupy less storage space. This in turn will result in substantial cost savings to the manufacturer. Although devices have been developed in the past to perform this function, their use has failed in several respects to adequately meet the demands of the industry. For example, devices presently in use are not readily adaptable to the efficient handling of successive bundles containing varying numbers of coils. Stated in the alternative, the prior art devices can only exert maximum compressive forces on the coils when compacting bundles containing a constant maximum number of coils. Thus it can be seen that where bundles are required containing less than this given maximum number of coils, the resultant bundle is often insufficiently compacted.

In addition, many of the devices presently in use lack structural rigidity and are not capable of exerting a compacting force of unvarying magnitude on each successive bundle. This of course results in the production of bundles having the same number of coils but with varying axial lengths, thereby further complicating the problem of efficient and orderly handling and storage.

As should be evident to one skilled in the art, these and similar problems occur in many phases of industrial activity and are not only peculiar to the handling of finished products in a wire or rod mill.

It is therefore a general object of the present invention to provide an improved means of compacting and strap-

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ping a plurality of annular resilient members into a unitized damage resistant bundle.

Another object of the present invention is to provide a coil compacting and strapping apparatus capable of exerting a constant maximum compressive force on each succeeding bundle containing a given number of coils, the magnitude of said compressive force capable of being readily adjusted to accommodate bundles containing varying numbers of coils.

Another object of the present invention is to provide a coil compacting and strapping apparatus capable of being utilized in connection with conventional material handling equipment.

Another object of the present invention is to provide a coil compacting and strapping apparatus having increased structural rigidity with an accompanying increase in its ability to exert maximum compressive forces on the axially aligned coils.

A further object of the present invention is to provide a coil compacting and strapping apparatus capable of providing continuous axial alignment for the individual coils during the compacting and strapping operation.

A still further object of the present invention is to provide a compacting and strapping apparatus comprised in part of a stationary assembly containing the primary compacting and strapping mechanism, said stationary assembly designed to cooperate with relatively inexpensive coil transporting and aligning assemblies removably mounted on the lift carriages of conventional material handling trucks.

These and other objects of the present invention will become more apparent as the description proceeds with the aid of the accompanying drawings in which:

FIG. 1 is a view in side elevation of a compacting and strapping apparatus according to the present invention illustrating its use in connection with a conventional industrial truck having a vertically movable lift carriage;

FIG. 2 is an enlarged sectional view in elevation of the compacting and strapping housing with the coil supporting and aligning arm in locked engagement therewith;

FIG. 3 is a plan view in section taken along line 3—3 of FIG. 2;

FIG. 4 is a sectional view in elevation taken along line 4—4 of FIG. 3;

FIG. 5 is an end view in elevation of the compacting and strapping housing taken along line 5—5 of FIG. 3;

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5;

FIG. 7 is a sectional view taken along line 7—7 of FIG. 3 through the coil supporting and aligning arm showing an end elevation of the truck mounted compacting face;

FIG. 8 is a diagrammatic sketch showing the retaining strap travel within the coil bundle following the extension of the hydraulic strap guides.

Referring now to the drawings, it can be seen from FIG. 1 that the invention resides in a device basically comprised of a stationary assembly and a mobile truck-mounted assembly generally indicated in the drawings by the reference numerals 6 and 8. The mobile assembly 8 is comprised in turn of a truck mounted compacting head 10 removably mounted on the lift carriage 11 of a conventional industrial truck generally indicated by the reference numeral 12.

As can best be seen in FIGS. 2 and 7, the truck mounted compacting head 10 is provided with two hook-shaped brackets 13 extending from its back plate 10a and designed to engage the movable face plate 14 of the truck's lift carriage 11. Accidental disengagement of the truck mounted compacting head 10 is prevented by locking pins 15 extending through the hook-shaped bracket 13 into vertically disposed receiving passages in the face plate 14.

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With this construction, it can readily be seen that the mobile truck mounted assembly 8 may be quickly and easily mounted on the truck 12 when needed during compacting and strapping operation. The hook-shaped brackets 13 are simply engaged on the face plate 14 and the locking pins 15 inserted. When the compacting and strapping operation has been completed, the mobile truck mounted assembly 8 can be just as easily removed by reversing this procedure, thereby enabling the industrial truck 12 to be utilized for other purposes.

The truck mounted compacting head 10 is further provided with an elongated coil supporting and aligning arm 16 extending outwardly therefrom in a substantially horizontal relationship to the surface of the mill floor 17. As shown in FIG. 1 the arm 16 serves as a means of supporting and axially aligning a plurality of individual rod or wire coils indicated typically at 18. It should be understood that the coils 18 may be collected individually from a remote position adjacent the coiling apparatus for transportation to the compacting and strapping station as shown in FIG. 1.

As will hereinafter be more particularly described, the mobile truck mounted assembly 8 comprised of compacting head 10 and coil supporting and aligning arm 16 is designed to be utilized in connection with the stationary assembly generally indicated at 6. Stationary assembly 6 is in turn comprised basically of a compacting and strapping housing 20 bolted by bolts indicated typically at 21 in a fixed position to the mill floor 17 at some convenient point in the mill intermediate the coiling apparatus and the storage and shipping area. The approach of the truck 12 to the housing 20 is controlled by parallel tracks 22 bolted to the mill floor and spaced to cooperate with the truck wheels 23. With this construction, the truck operator need only steer the truck between tracks 22 in order to insure proper horizontal alignment between the outwardly extending coil supporting and aligning arm 16 and the compacting and strapping housing 20.

Referring now to FIGS. 2-6, the compacting and strapping housing 20 will be more particularly described. As can be seen in FIGS. 2 and 3, the basic housing structure is comprised of a base plate 24 bolted to the mill floor 17 by bolts indicated typically at 21. Upwardly disposed side plates 28 cut away as at 28a are attached as by welding to base plate 24 and are braced externally by vertical bracing members indicated typically at 30. A horizontally disposed intermediate support plate 32 is fixed between side members 28 with a portion thereof generally indicated at 34 extending to the rear of the housing 20 beyond side plates 28. The rearward portion 34 of intermediate support plate 32 receives additional support and strength from vertically disposed bracing members 36 extending outwardly from a transversely disposed rear end plate 37. The housing 20 is further provided at its forward end with a front plate 39 welded between upwardly disposed side plates 28 and having attached thereto a stationary compacting head 38.

As can be best seen in FIGS. 2 and 4, a single hydraulic compacting cylinder 40 is mounted in a horizontally disposed position within housing 20 by means of angular cylinder brackets 42 extending upwardly from raised platforms 44 in turn mounted on intermediate support plate 32. Cylinder 40 is in turn provided with an extensible piston arm 46 having a piston head 48 threaded to its exposed end. Cylinder 40 is further provided with downwardly disposed ports 49 to which are connected hydraulic lines (not shown) leading from a hydraulic fluid pump (not shown). By controlling the flow of hydraulic fluid to cylinder 40 through the use of a suitably designed valving arrangement, the stroke of extensible piston arm 46 having piston head 48 threaded thereto can be carefully controlled.

As can be best seen in FIGS. 3 and 4, piston head 48 is pivotally attached to the clevis-shaped end of an elongated

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compacting sleeve 50 by means of a transversely disposed pivot pin 52 extending through both the sleeve and the piston head. Compacting sleeve 50 is provided along most of its length with a substantially U-shaped cross-section having opposed guide brackets 54 extending outwardly from either side thereof at selected intervals. The guide brackets on either side of the compacting sleeve 50 are in turn provided with axially aligned passageways having spaced parallel guide rods 56 extending therethrough. The guide rods 56 are threaded at their extremities and bolted at one end within the stationary compacting head 38 by means of nuts 58. The opposite ends of the guide rods are supported and bolted in a similar manner to guide rod support brackets 60 extending upwardly from the rearward portion 34 of intermediate support plate 32.

Compacting sleeve 50 is further provided along its upper surface with a rack comprised of a series of upwardly disposed integrally fabricated locking teeth herein after collectively referred to by the reference numeral 62 and individually indicated in the drawings at 62a, 62b, 62c, 62d and 62e. Although five locking teeth have been shown in the drawings, it should of course be obvious to one skilled in the art that any number of teeth can be provided at any selected interval.

In view of the above, it should now be apparent that introduction of pressurized hydraulic fluid into compacting cylinder 40 will result in the horizontal displacement of its extensible piston arm 46 having piston head 48 threaded thereto. Because of the pivotal connection between piston head 48 and locking sleeve 50, a corresponding sliding displacement of the sleeve along the horizontally disposed guide rods 56 will result. With this construction, it can readily be seen that the compacting sleeve 50 can be moved towards or away from the rear surface of the stationary compacting head 38 by simply controlling the flow of hydraulic fluid to compacting cylinder 40.

Turning for the moment to the truck mounted components of the apparatus, it can be seen that the end of the coil supporting and aligning arm 16 terminates in a hook-shaped locking nose forming a partially enclosed downwardly disposed locking shoulder 64. As illustrated in FIG. 2, locking shoulder 64 is designed to cooperate in locked engagement with one of the aforementioned series of upwardly disposed locking teeth 62 forming a part of compacting sleeve 50.

When so positioned, it is therefore evident that movement of sleeve 50 along guide rods 56 will result in a corresponding axial displacement of arm 16.

As can best be seen in FIG. 5, when positioned in locked engagement on sleeve 50, the arm 16 extends through an arm receiving channel 66 in stationary compacting head 38. The lower portion of channel 66 is provided with a somewhat rectangular cross-section, its sides 68 rising vertically and then diverging outwardly to form a gradually enlarged upper portion. This construction permits the coil supporting and aligning arm 16 to be inserted through the stationary compacting head 38 in an elevated position with its downwardly disposed locking shoulder 64 spaced above the upwardly disposed locking teeth 62 on the compacting sleeve 50. The tracks 22 on the mill floor will of course cooperate with the truck wheels 23 in guiding the truck 12 during its forward movement towards the compacting and strapping housing 20. This in turn will prevent the coil supporting and aligning arm 16 from striking the outwardly diverging sides 68 of the arm receiving passageway 66. As shown in FIG. 1, when approaching the compacting and strapping housing 20, the arm 16 will be loaded with a plurality of annular coils generally indicated at 18. Insertion of arm 16 through passageway 66 into housing 20 will of course result in these coils being positioned between the stationary compacting head 38 on housing 20 and the truck mounted compacting head 10 on the

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lift carriage 11 of truck 12. Thus it can be seen that as the stationary and truck mounted compacting heads 38 and 10 come into contact with the coils, the forward motion of the truck will be slowed and eventually checked by an opposing force as coil compaction begins to take place. At this point, depending on the number of coils axially positioned on arm 16, locking shoulder 64 will come into approximate vertical alignment between two of the upwardly disposed locking teeth 62. It can of course be appreciated that at this point the forward momentum of the truck will have imparted some slight compaction to the coils. The truck operator will then apply the truck's brakes and thereafter lower the vertically movable lift carriage 11, thereby causing arm 16 to be lowered through a corresponding vertical distance until the end of locking shoulder 64 is contacted by the flat surface of the compacting sleeve 50 between the locking teeth 62. The operator will then take the truck out of gear and release the brake. The slight compaction of the coils caused by the original forward momentum of the truck will cause the truck 12 to move backward slightly, thereby resulting in the locking shoulder 64 being brought into locked engagement with locking tooth 62e as shown in FIG. 4.

The positioning of locking nose 64 in locked engagement on any particular locking tooth 62 is of course controlled by the number of coils axially supported on the coil supporting and aligning arm 16. When a maximum number of coils is positioned on the arm, the locking shoulder will be locked in engagement on the end tooth 62e. A decrease in the number of coils to be compacted will simply result in a further advancement of arm 16 into channel 66, the locking shoulder thereafter being engaged on a different locking tooth as for example, 62a or 62b.

Having placed the coil supporting and aligning arm 16 in locked engagement with compacting sleeve 50, compacting cylinder 40 is then actuated in order to extend piston arm 46 and thereby effectuate a corresponding axial displacement of the compacting sleeve. This in turn will result in the forward displacement of industrial truck 12 as the coil supporting and aligning arm 16 is pulled through arm receiving channel 66. The coils 18 axially supported by arm 16 between the stationary compacting head 38 and the truck mounted compacting head 10 will therefore be compacted, their total axial length being decreased by an amount corresponding to the stroke of compacting cylinder 40. As shown in FIGS. 2 and 3, this will result in movable compacting head 10 being pulled to a position indicated at 10'.

As compared with the prior art devices, several significant advantages are gained from the aforementioned construction. More particularly, by providing a plurality of upwardly disposed locking teeth 62 along the upper surface of compacting sleeve 40, the coil supporting and aligning arm 16 is always placed in locked engagement therewith at a point when the coils 18 are slightly compacted by the forward momentum of the truck. In this manner, extension of hydraulic piston arm 46 results in immediate coil compaction. This in turn insures maximum coil compaction regardless of the number of coils being compressed by avoiding wasted piston motion. In addition, by providing for immediate coil compaction as the piston arm 46 is initially extended, the time required for the entire compacting cycle is considerably shortened.

Having thus described the compacting cycle, the description will now proceed with a discussion of the means contained within the apparatus for strapping the compacted coils in order to produce a unitized bundle. Generally speaking, the coils may be strapped by any number of straps at any selected interval. For purposes of this disclosure, an apparatus capable of applying four straps at 90° intervals has been disclosed. It should be noted however that the apparatus can be easily modified to apply any desired number of straps to the compacted coils without departing from the spirit and scope of the invention.

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Referring initially to FIGS. 2-4, four hydraulic strapping cylinders indicated typically by the reference numerals 72 are shown mounted in a horizontally disposed fashion within compacting and strapping housing 20.

The strapping cylinders contain extensible pistons and are supported at each end by means of suitably disposed front and rear cylinder support brackets 74 and 76 extending upwardly from intermediate support plate 32. As can be seen from FIGS. 3 and 4, the front cylinder support brackets 74 are elongated in shape and provided with curved cross-sections having opposed concave inner surfaces 78. The inner concave surfaces 78 of both brackets 74 are further provided with inwardly disposed extensions indicated typically at 80 having conventional elongated sliding strap tracks 84 mounted thereon. The strap tracks 84 are attached at one end to the extensible pistons of strapping cylinders 72 and in this manner, may be readily extended by a corresponding extension of said pistons.

As can be seen in FIG. 5 the stationary compacting head 38 is provided with four strap track passageways 86 axially aligned with the extensible sliding tracks 84 mounted within housing 20. With this construction, the strap tracks 84 may be extended through the stationary compacting head 38 into the tubular structure formed by the compacted coils. The strap tracks will continue to be extended until they enter similarly positioned passageways 88 in the truck mounted compacting head 10 (see FIG. 7). It can therefore be seen that once the coils 18 have been compacted between the stationary compacting head 38 and the truck mounted compacting head 10, the strap tracks 84 are extended through the former to the latter. The limit of the strap track extension will again be governed by the number of coils being compacted in any one bundle.

As can be seen in FIGS. 5 and 6, each of the strap track passageways 86 is further provided with a radial extension 90 extending outwardly therefrom to the edge of the compacting head 38. Each extension 90 contains a curved inner guide surface 92 designed to cooperate with an extended strap track 84 in providing a continuous retaining strap guiding channel (see FIG. 8). Similarly, as shown in FIGS. 7 and 8, the strap track passageways 88 in truck mounted compacting head 10 are also provided with radial extension indicated typically at 94 and curved inner guide surfaces 95.

With this construction, once the strap tracks 84 have been fully extended, a continuous guided path is provided for the axial insertion of retaining strap through the compacted coils 18. As indicated in FIG. 8, each retaining strap may then be manually inserted through radial extension 90 into extended strap track 84 to again emerge through radial extension 94. The ends of the strap can then be drawn together, tightened and crimped. By so doing, the straps are pulled from the guide passageway provided by the strap tracks and extensions and brought into tight contact surrounding the compacted coils 18. This being accomplished at 90° intervals as provided for by the apparatus, the compacted coils 18 are now tightly contained in a single unitized bundle.

Following the strapping operation, the compacting cylinder pressure is released and the compacting sleeve 50 pulled back a small distance in order to disengage the locking shoulder 64 from the upwardly disposed locking tooth 62e on the compacting sleeve 50. The operator then elevates the industrial truck's lift carriage 11 and thereafter withdraws the coil supporting and aligning arm 16 from the arm receiving channel 66 in the stationary compacting head 38. This being done, the compacted bundle of coils is ready to be transported to the storage area by the truck.

It should of course be noted that during the time that it takes to transport the bundle to the storage area, another industrial truck with a second mobile truck mounted assembly 8 mounted thereon can be utilized in connection with the same compacting and strapping housing 20.

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It is our intention to cover all changes and modifications of the invention herein chosen for purposes of disclosure which do not depart from the spirit and scope of the invention.

It is claimed:

1. Means for compacting and strapping a plurality of resilient annular members into an axially aligned unitized bundle comprising the combination of: a movable compacting head having associated therewith supporting and aligning means, said supporting and aligning means adapted to receive a plurality of said individual annular members suspended in axial alignment therefrom; a fixed compacting head; interlocking means adjustable in response to variations in the number of annular members suspended from said supporting and aligning means, said interlocking means operable to lock said supporting and aligning means to said fixed compacting head in order to tightly position said annular members between said fixed and movable compacting heads, compacting means associated with said interlocking means for drawing said movable compacting head towards said fixed compacting head in order to compact said resilient annular members by decreasing their combined axial length; and strap guide means cooperating with said fixed and movable compacting heads for strapping said compacted resilient members into a unitized damage resistant bundle.

2. For use with an industrial truck having a vertically movable lift carriage, means for compacting and strapping a plurality of resilient annular members into an axially aligned unitized bundle comprising the combination of: a movable compacting head mounted on the lift carriage of said industrial truck, said movable compacting head having associated therewith supporting and aligning means, said supporting and aligning means being adapted to have suspended in axial alignment therefrom a plurality of said individual annular members, a stationary compacting and strap guide housing, one end of said housing terminating in a fixed compacting head; receiving means extending through said fixed compacting head into said housing for accepting said supporting and aligning means in axial insertion therein; interlocking means for locking said inserted supporting and aligning means within said housing with said annular members tightly positioned between said fixed and movable compacting heads; compacting means within said housing associated with said interlocking means for exerting a force on said supporting and aligning means in order to draw said movable compacting head towards said fixed compacting head and thereby immediately compact said annular members by decreasing their combined axial length; and strap guide means on said housing for strapping said annular members held between said fixed and movable compacting heads into a single unitized bundle, said interlocking means being capable of being quickly disengaged to permit said strapped bundle carried by said supporting and aligning means to be transported by said truck to an alternate storage position.

3. The apparatus as set forth in claim 2 wherein said supporting and aligning means is comprised of an elongated cantilever arm fixed at one end to said movable compacting head and extending outwardly therefrom.

4. The apparatus as set forth in claim 2 wherein said receiving means is comprised of a horizontally disposed passageway, said passageway being closed at the bottom and open at the top.

5. For use with an industrial truck having a vertically movable lift carriage, means for compacting and strapping a plurality of resilient annular members into an axially aligned unitized bundle comprising the combination of: a movable compacting head mounted on the lift carriage

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of said industrial truck, said movable compacting head being provided with an elongated supporting and aligning cantilever arm extending outwardly therefrom, said arm being adapted to have a plurality of said annular resilient members suspended in axial alignment therefrom; a stationary compacting and strap guide housing, one end of said housing terminating in a fixed compacting head; receiving means extending through said fixed compacting head into said housing for receiving the end of said loaded arm in axial insertion therein, said receiving means comprising a horizontally disposed passageway, said passageway being open at the top and closed at the bottom; interlocking means for locking said inserted arm within said housing with said annular members suspended therefrom and tightly positioned between said fixed and movable compacting heads; compacting means within said housing associated with said interlocking means for exerting an axial force on said arm in order to draw said movable compacting head towards said fixed compacting head, thereby compacting said annular members by decreasing their combined axial length; and strap guide means in said housing capable of cooperating with said fixed and movable compacting heads in order to strap said compacted annular members into a single unitized bundle, said interlocking means being capable of being quickly disengaged to permit said bundle supported by said arm to be carried by the truck to an alternate storage position.

6. The apparatus as set forth in claim 5 wherein said interlocking means is comprised of an elongated locking member provided with a plurality of teeth extending upwardly therefrom in spaced horizontal alignment, said locking member being slidably mounted for axial displacement within said housing in a direction parallel to the longitudinal axis of said receiving passageway, a locking shoulder extending downwardly from the end of said supporting and aligning arm, said shoulder being designed to cooperate in locked engagement with one of said upwardly disposed teeth when said arm is axially inserted within said receiving passageway with said resilient annular members tightly positioned between said fixed and movable compacting heads.

7. The apparatus as set forth in claim 6 wherein said compacting means is comprised of a hydraulic cylinder mounted within said housing in substantially parallel relationship to both said receiving passageway and said elongated locking member, said cylinder being provided with an extensible piston connected at one end to said locking member, the extension of said piston resulting in said movable compacting head being drawn towards said fixed compacting head when said arm is in locked engagement with one of said teeth on said locking member, said piston arm when retracted resulting in the automatic disengagement of said arm from said locking member.

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