

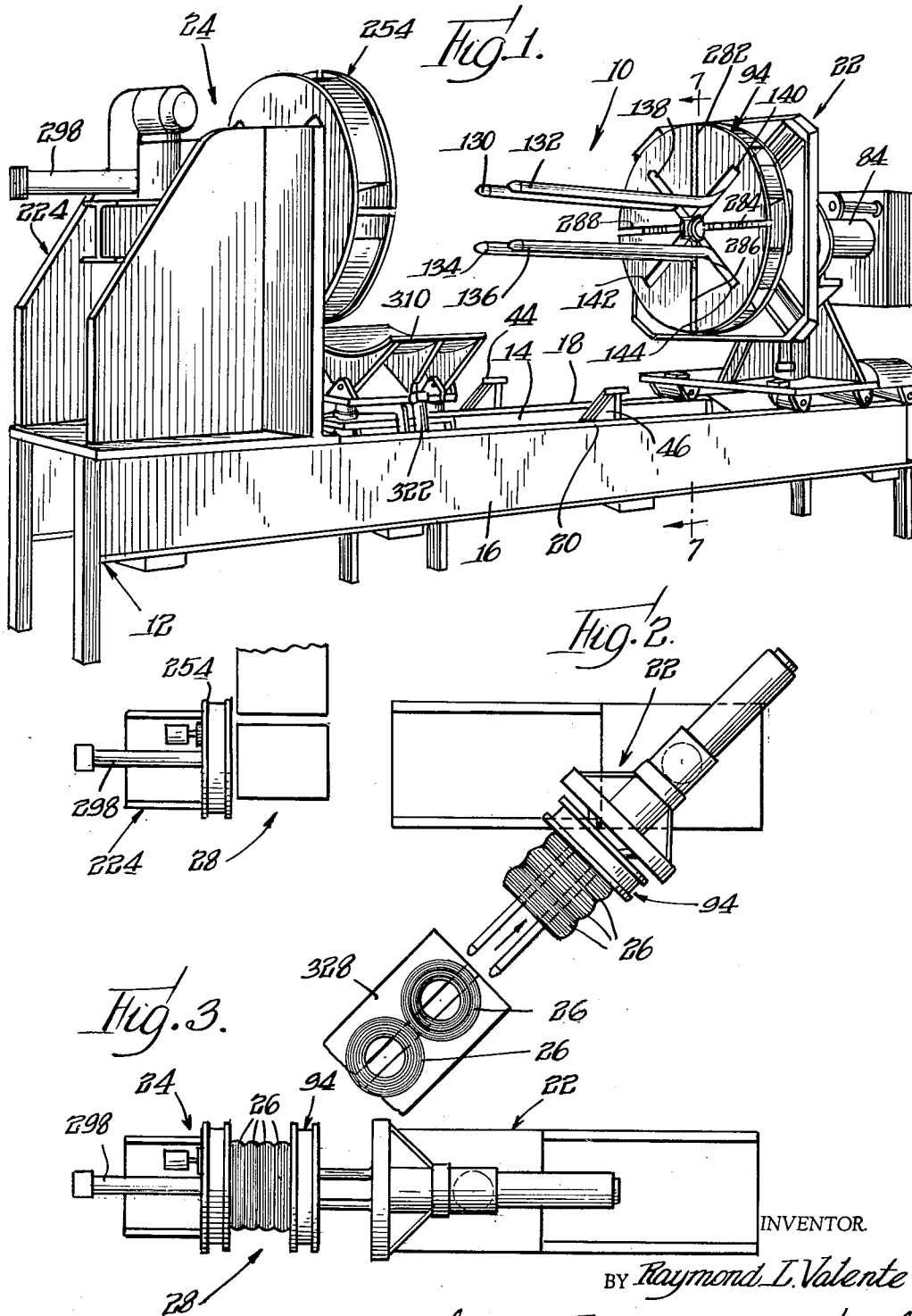
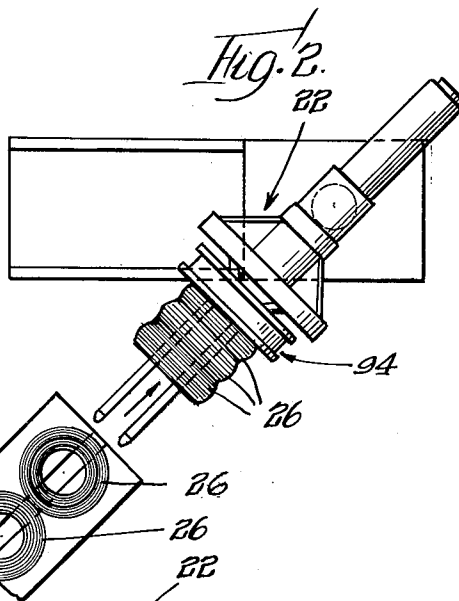
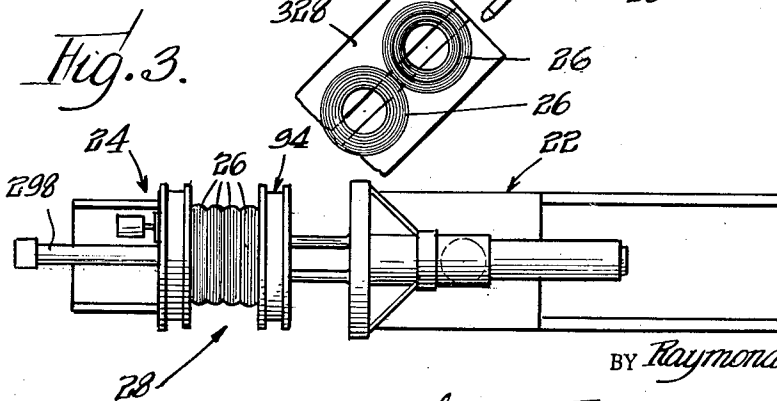
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R. L. VALENTE
COMPACTING APPARATUS

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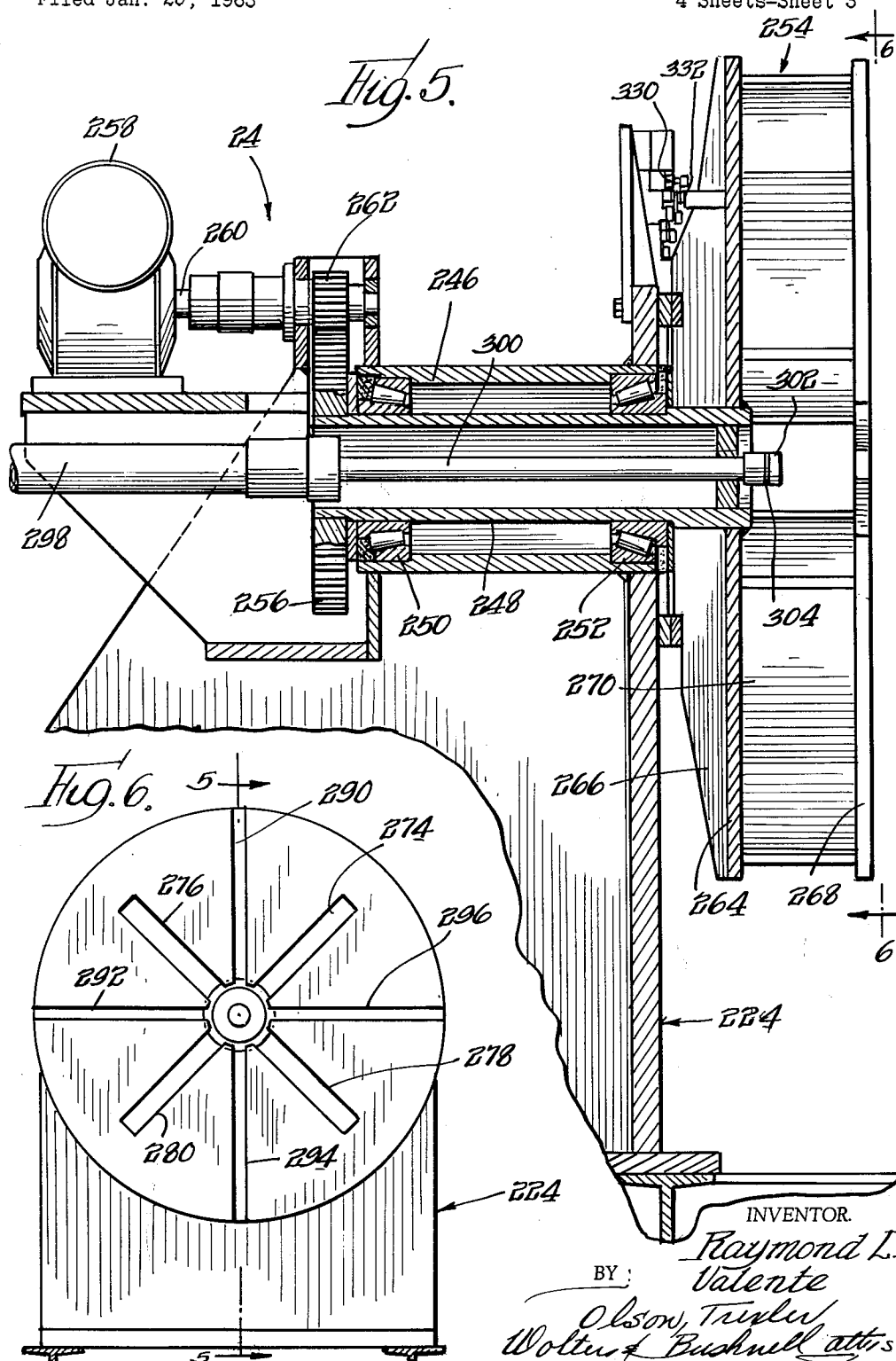
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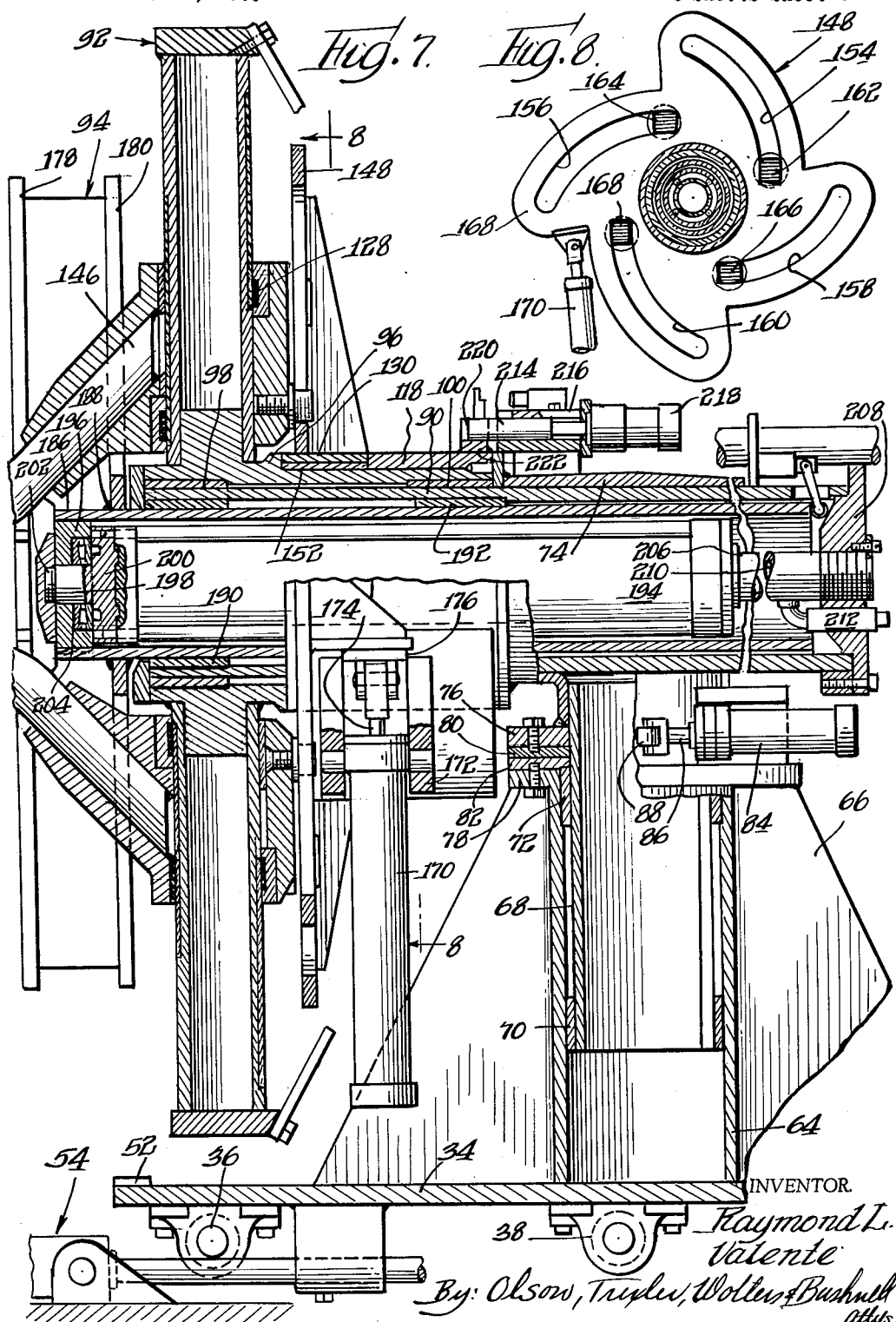
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R. L. VALENTE
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3,129,658

COMPACTING APPARATUS

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12 Claims. (Cl. 100-218)

The present invention relates to a novel apparatus for packaging workpieces, and more specifically to a novel apparatus especially suitable for compacting and packaging workpieces such as coils of wire and the like.

As is well known, wire producers frequently form the wire into relatively large and heavy and rather loose coils for shipment or storage. In order to facilitate handling of such coils and minimize space requirements for shipping or storing, it is frequently desirable to compress the loops of one or more of such coils together and restrain the compressed coils with one or more tie wires or straps or other suitable means in order to provide a relatively compact package.

It is an important object of the present invention to provide a novel apparatus for enabling one or more wire coils or similar workpieces to be compacted and packaged relatively easily, quickly, and economically.

Another object of the present invention is to provide a novel apparatus capable of supporting and forming one or more relatively loose coils of wire or the like in a manner so as to provide packages of generally uniform size and shape.

A further object of the present invention is to provide a novel apparatus of the above described type which is capable of rotating or indexing the wire coils or workpieces while maintaining compacting pressure for enabling an operator at a single work station to secure the wire coils with a plurality of tie wires, straps or other suitable means.

Still another object of the present invention is to provide a novel apparatus of the above described type which is constructed for facilitating loading and unloading operations.

A further object of the present invention is to provide a novel apparatus of the above described type which is of rugged and dependable construction.

Other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings wherein:

FIG. 1 is a perspective view showing an apparatus incorporating features of the present invention;

FIG. 2 is a simplified plan view of the apparatus with a portion of the apparatus turned for facilitating loading of a plurality of wire coils or the like to be compacted and packaged;

FIG. 3 is a simplified plan view showing the manner in which the apparatus is actuated for compacting one or more wire coils or workpieces;

FIG. 4 is an enlarged side perspective view showing the manner in which the apparatus is actuated for compacting one or more wire coils or similar workpieces;

FIG. 5 is an enlarged fragmentary sectional view taken generally along line 5-5 in FIG. 6;

FIG. 6 is a view taken along line 6-6 in FIG. 5;

FIG. 7 is an enlarged partial vertical sectional view taken generally along lines 7-7 in FIG. 1; and

FIG. 8 is a reduced fragmentary sectional view taken generally along line 8-8 in FIG. 7.

Referring now more specifically to the drawings wherein like parts are designated by the same numerals throughout the various figures, an apparatus 10 incorporating features of the present invention is shown in FIGS. 1 through 4. The apparatus comprises a frame structure 12 preferably including a pair of horizontally

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extending frame members 14 and 16 respectively providing upwardly facing tracks 18 and 20. A head unit 22 which will be described in detail below is mounted on the tracks 18 and 20 for movement toward and away from a back-up and indexing unit 24. The unit 24 is also mounted on the frame members 14 and 16 but is fixed against axial movement relative to the frame members.

As indicated in FIG. 2, it is contemplated that the head unit 22 may be turned to a laterally extending position for facilitating the loading of a plurality of wire coils 26 or similar workpieces thereon. The unit 22 is then turned so as to be axially aligned with the unit 24 and the apparatus is actuated for compacting the wire coils as shown in FIGS. 3 and 4 and as will be described in detail below.

It is further contemplated that the back-up and indexing unit 24 is adapted to rotate the compacted wire coils while the coils are maintained under pressure as shown in FIGS. 3 and 4 for enabling a single operator standing at a work station 28 at one side of the apparatus to apply a plurality of tie wires or straps 30 shown in FIG. 4 to circumferentially spaced areas of the coils in order to bind the coils into a compact well supported package 32.

As shown best in FIGS. 1, 4, and 7, the head unit 22 comprises a carriage or slide plate 34 supported by rollers 36 and 38 engageable with track 18 and additional rollers 40 and 42 which ride on the track 20. The carriage is adapted to be shifted between a retracted position shown in FIG. 1 and an advanced position shown in FIG. 4. When the carriage is in the advanced position, its forward edge engages stop members 44 and 46 fixed on the frame members 14 and 16. The stop members are provided with projecting portions 48 and 50 which are adapted to overlie a forward marginal portion of the carriage plate and engage wear pads 52 fixed thereon for holding the carriage down against the track members during a workpiece compacting operation.

Any suitable means may be provided for advancing and retracting the carriage 34 such for example as a hydraulic cylinder and piston means 54 partially shown in FIG. 7 and connected between the frame structure 12 and the carriage. In order to lock the carriage in position and absorb the thrust during a workpiece compacting operation, a latch lock 56 is slidably supported by a guide means 58 on the frame structure 12 for releasable engagement with an abutment member 60 fixed to a back end portion of the carriage plate 34. Suitable fluid pressure actuated cylinder and piston means 62 is connected between the frame structure and the latch block 56 for shifting the latch block into and out of engagement with the abutment member 60.

An upstanding tubular pedestal 64 is fixed on the carriage plate 34 and supported by a plurality of reinforcing webs 66. A pivot member 68 is rotatably disposed in the pedestal 64 and supported by bearings 70 and 72. A horizontally disposed tubular sleeve 74 is welded to and supported by the upper end of the member 68. An annular flange 76 is also welded to an upper end portion of the pivot member 68 for overlying another flange 78 fixed to the upper end of the tubular pedestal 64. Annular bearing plates 80 and 82 are respectively fixed to the flanges 76 and 78 for facilitating pivotal movement of the pivot member 68 and the sleeve 74 carried thereby.

In order to rotate the pivot member 68 and sleeve 74 between the positions shown in FIGS. 2 and 3, a hydraulic cylinder 84 is provided. In the embodiment shown, the cylinder 84 is pivotally supported by suitable bracket means on the flange 78 and a piston rod 86

extends from the cylinder and is pivotally connected with a bracket 88 secured to the flange 76.

An elongated tube 90 extends through and is fixed within the sleeve 74, which tube has portions projecting substantially forwardly and rearwardly from the sleeve 74. A radially expandable mandril assembly 92 is supported on a forward end portion of the tube 90 for receiving and supporting one or more coils of wire as will be described more in detail below, and a coil compacting disk or head structure 94 is also supported at a forward end portion of the tube 90. The head 94 is adapted to be moved axially relative to the mandril assembly for compacting the wire coils as shown in FIGS. 3 and 4.

The mandril assembly 92 comprises a hub member 96 supported by bearings 98 and 100 on a forward end portion of the fixed tube 90 for rotation relative to the tube. Radially extending guide bars or spokes 102, 104, 106 and 108 have inner ends fixed to the hub member 96 and outer ends supported by a frame structure 110. The frame structure 110 includes frame members 112 extending between outer ends of the guide bars 102 and welded to plate like reinforcing webs 114 which extend to the hub member between the guide bars. In addition braces 116 extend from fittings at the outer ends of the guide bars 102, 104, 106 and 108 rearwardly and inwardly for connection to a sleeve 118 mounted around and fixed with respect to an end portion of the hub member 96.

Slide members or bearing blocks 120, 122, 124 and 126 are respectively slidably disposed on the guide members 102, 104, 106 and 108. Each of the slide or bearing blocks is constructed so as to incorporate a plurality of recirculating roller bearings 128 shown in FIG. 7 for facilitating radial movement of the slide or bearing block along its associated spoke or guide bar.

Elongated finger members or tines 130, 132, 134 and 136 are respectively fixed to and carried by the slide members 120, 122, 124 and 126 for providing an expandable mandril adapted to receive and support the wire coils 26. As shown best in FIGS. 1 and 4, major portions of the tines extend parallel to each other and are relatively close together when the mandril is in a contracted condition for facilitating the placement of coils of wire thereon. The tines respectively extend through radial slots 138, 140, 142 and 144 in the head member 94 and, as shown best in FIG. 7, an end portion 146 of each tine is directed diagonally outwardly for connection with its associated bearing or slide block.

In order radially to expand and contract the mandril, a cam plate 148 is provided, which cam plate is shown in FIGS. 4, 7 and 8. The cam plate 148 is fixed on a hub member 130 which in turn is supported by a bearing 152 for rotation relative to the hub member 96. In other words the cam plate is adapted to rotate relative to the generally radially extending spokes or guide members of the expandable mandril structure. The cam plate is provided with a plurality of arcuate cam slots 154, 156, 158 and 160. Cam followers or lugs 162, 164, 166 and 168 extend into the cam slots and are respectively connected to the slide or bearing blocks 120, 122, 124 and 126. Thus the cam followers acting in the slots cause the bearing or slide blocks to move radially for expanding or contracting the tine members when the cam plate is selectively rotated in opposite directions relative to the spoke or guide bar elements. In order to rotate the cam plate in this manner, a hydraulic cylinder 170 is provided which cylinder is pivotally connected to bracket means 172 secured to the sleeve 118. A piston rod 174 associated with the cylinder 170 is pivotally connected to a bracket 176 which in turn is welded or otherwise secured to the cam plate 148.

The compacting head structure 94 comprises plate members 178 and 180 which are axially spaced from each other and welded to spacer plates 182. The above

mentioned slots 138, 140, 142 and 144 extend through both of the plate members 178 and 180 for accommodating the tines and the spacer plates 182 extend generally radially at positions offset from these slots. It is further to be noted that the spacer plates 182 are offset from each other so as to define access openings 184 which serve a function described below.

The disk or plate member 180 and inner ends of the spacer plates 182 are welded to an end portion of a tubular slide member 186 as at 188 (see FIG. 7). The tubular slide member 186 is slidably supported within the fixed tube 90 by bearings 190 and 192. The slide member 186 supports the head 94 for movement between the retracted position shown in FIGS. 1 and 7 and the extended position shown in FIGS. 3 and 4.

In order to actuate the head 94 between its extended and retracted positions, a hydraulic cylinder 194 is disposed within the tubular slide 186. One end of the cylinder is connected with an annular abutment or plug member 196 fixed within the forward end of the tubular slide 186. More specifically, a stud 198 extends from an end 200 of the cylinder 194 through the apertured plug 196. A nut 202 is threaded onto the outer end of the stud 198 in a manner so as to leave a slight clearance between the nut and the plug member for enabling the slide member 186 and the parts carried thereby to rotate relative to the cylinder 194. This relative rotation is further promoted by the provision of a thrust bearing 204 between opposing portions of the plug or abutment member 196 and the end member 200 of the cylinder.

A piston rod 206 associated with the cylinder 194 extends rearwardly from the cylinder and is fixed to an end fitting 208 which in turn is fixed to the non-rotatable tube 90. The piston rod 206 has a passageway 210 formed therein which passageway is connected by conduit means 212 with a suitable source of hydraulic fluid under pressure not shown so that the fluid is introduced into the cylinder 194 through the piston rod.

In order releasably to lock the expandable mandril structure 92 and the head 94 against rotation, a latch member 214 is slidably mounted in suitable guide means 216 fixed on the sleeve 74. The latch member or plunger 214 is adapted to be extended or retracted by means of a single acting spring return hydraulic cylinder 218. The plunger 214 is adapted to project into a notch 220 formed in a ring member 222 fixed on the tubular sleeve 118 for locking the mandril structure and the head 94 against rotation. Of course when the latch member 214 is withdrawn from the notch 220, the mandril structure in the head 94 are free to rotate.

The back-up and indexing unit 24 is shown best in FIGS. 1 and 4-6 and comprises an upstanding pedestal or support structure 224 fixed on the frame 12. The support structure 224 includes a horizontally disposed tube 246 which is axially aligned with the tube 90 of the head unit 22. A hollow spindle 248 is rotably supported within the tube 246 by bearing assemblies 250 and 252 and projects outwardly from opposite ends of the tube 246. The forward end of the spindle 248 carries a head structure 254 similar to the head structure 94 described above while the opposite end of the spindle 248 has a gear 256 fixed thereto.

In order to rotate or index the head 254 for the purpose described below, a combination motor and speed reduction unit 258 is provided on the support structure 224. An output shaft 260 of the unit carries a pinion 262 which meshes with and drives the gear 256. Suitable control means, not shown, is provided for the motor and speed reduction unit 258 for enabling an operator to rotate the spindle 248 the desired amount, preferably in 90° or 180° increments.

The head structure 254 comprises a first annular plate 264 having reinforcing ribs 266 welded thereto. The plate 264 and ribs are welded to a projecting end portion

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of the spindle 248. The head 254 comprises a second annular plate 268 secured to and spaced from the plate 264 by spacer plates 270. As shown best in FIG. 4, the spacer plates 270 are disposed so as to define radially open access spaces 272 which correspond to and are adapted to be aligned with the similar openings 184 of the head 94. It is further to be noted that the plate member 268 of the head structure 254 is provided with radially extending slots 274, 276, 278 and 280 corresponding to and adapted to be aligned with the slots 138, 140, 142 and 144 of the head 94. The slots in the plate member 268 are adapted to receive ends of the tines 130, 132, 134 and 136 when the head unit 22 is shifted to its advanced position shown in FIG. 4. The tines thus serve to lock the head structures 94 and 254 and the expandable mandril structure together for rotation or indexing movement. Of course, when the parts are to be rotated or indexed, the above mentioned latch element 214 is withdrawn so as to release the expandable mandril structure and head 94 for rotation. When, however, the head unit 22 is moved to its retracted position so that the tines are disengaged from the head structure 254, the latch element 214 is re-engaged in order to assure proper alignment of the tines with the slots in the head structure 254.

In addition to the previously mentioned slots, the annular plate member 178 of the head structure 94 is provided with relatively narrow slots 282, 284, 286 and 288 which extend completely between inner and outer margins of the plate. The plate member 268 of the head structure 254 is provided with similar slots 290, 292, 294 and 296. These last mentioned slots in the opposing plates of the head structures are provided for enabling the previously mentioned tie wires or straps 30 to be assembled around selected portions of the compacted wire coils. In the embodiment shown it will be appreciated that the tie wires or bands may be applied to the wire coils at 90° intervals, if desired.

Referring to FIGS. 1-3 and 5, it is seen that an elongated hydraulic cylinder 298 is suitably fixed on the support structure 224 in axial alignment with the spindle 248. A piston rod 300 extends from the cylinder 298 through the spindle 248. A fitting 302 is fixed on the outer end of the piston rod 300, which fitting is provided with a slot 304 or any other suitable means for engaging and retaining an end portion of a tie wire or band which may be inserted into the slot by an operator. As shown in FIG. 4, the fitting 302 is exposed by one of the side openings 272 so that an operator may manually insert an end of a tie wire or strap through the opening 272 and into the slot or retaining means of the fitting 302. It is contemplated that the operator will then actuate the cylinder 298 for advancing the piston rod 300 for carrying the end portion of the tie wire or band centrally through the wire coil supported on the expandable mandril and into alignment with one of the side access openings 184 in the head structure 94. The operator may then grasp the end portion of the tie wire or band and pull the tying element through the aligned narrow slots in the opposing plates of the head structures such as the slots 284 and 292 shown in FIG. 4. The ends of the tying element may then be secured together in any suitable manner as indicated at 306 in FIG. 4.

After a finished package 32 has been formed, it is adapted to be removed from the mandril structure and dumped from the apparatus with the aid of unloading means 308 shown best in FIGS. 1 and 4. This unloading means comprises a trough like member 310 shaped to conform with the side of the package. The trough like member is pivotally supported as at 312 and 314 to brackets extending upwardly from a cross-member 316 which in turn is connected to and supported by upper ends of piston rods extending upwardly from hydraulic cylinders 318 and 320. The cylinders 318 and 320 are adapted to be actuated for raising the lifting pad or trough like member 310 into engagement with the package 32

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for supporting the package when the expandable mandril is contracted and axially withdrawn from the package. Another cylinder 322 is connected with the cross-head 316 and has its associated piston 324 connected with a bracket 326 extending from the lifting pad. The cylinder 322 is adapted to be actuated for extending the piston rod 324 and thereby tilting the lifting pad and dumping the finished package from the apparatus.

While the manner in which one or more workpieces such as wire coils and the like may be compacted and packaged with the apparatus of the present invention is believed to be clear from the above description, a brief resume of the operation of the apparatus is as follows:

The wire coils 26 are supplied to a position adjacent the apparatus 10 by any suitable means such as an endless conveyor 328 shown in FIG. 2, and the cylinder 84 is actuated to turn the mandril to the laterally extending position shown in FIG. 2 for facilitating loading of the wire coils onto the mandril. Then the cylinder 84 is actuated for turning the mandril back to a position in alignment with the back-up and indexing unit 24. The hydraulic cylinder 54 is then actuated for advancing the carriage 34 against the stops 44 and 46 and the cylinder 62 is actuated for positioning the locking bar or plate 56 for locking the carriage against reverse movement. During this time the locking or latching element 214 has been engaged in the notch 220 so that the mandril tines are properly positioned in alignment with the slots in the head member 254 of the back-up and indexing unit 24. Thus the tines are advanced into these slots when the carriage is moved to its advanced position.

After the carriage has been advanced and locked into position, the cylinder 194 is actuated for advancing or shifting the head structure 94 along the mandril tines and at the same time or, if desired, prior to the operation of the cylinder 194, the hydraulic cylinder 170 is actuated for turning the cam plate 148 and thereby radially expanding the mandril tines. As the mandril is expanded, the wire coils are straightened and expanded to a generally more uniform diameter. Of course movement of the head structure 94 along the mandril and toward the head structure 254 causes the coils to be axially compacted so that the individual wires thereof are brought into firm contact with each other. Upon completion of the compacting operation, the tie wire or band 30 is inserted through the center of the coils and wrapped around the coils in the manner described above. Then the operator actuates the motor unit 258 for indexing the heads, the mandril and the package thereon, but before this is done the cylinder 218 is, of course, actuated for releasing the latch element 214. Control switch means 330 may be located for engagement by a cam element 332 on the head structure 254 for stopping the motor unit 258 after the head structure has been indexed or rotated the desired amount. As indicated above, the package may be indexed for enabling an operator standing at the work station 28 to apply separate tie wires or bands 30 at 90° intervals around the coils. Of course the apparatus may be modified for enabling the operator to apply the tying elements at any desired interval around the coils. In any event, after the indexing operation has been completed, the motor 258 is actuated for reversing the direction of rotation and returning the heads 94 and 254 and the mandril to their original positions. Then the unloading or lifting pad 310 is raised into engagement with the package and the head 94 and mandril structure are withdrawn for enabling the package to be unloaded in the manner described above. It is understood, of course, that the apparatus includes a suitable source of fluid under pressure and the necessary fluid conduits and control valves connecting the source with each of the above described cylinders. Furthermore, suitable electrical control means is provided, particularly for the indexing motor unit 258. Since the elements of the hydraulic and electrical control circuits comprise

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known elements and arrangements, they need not be disclosed or described in detail.

While the preferred embodiment of the present invention has been shown and described herein, it is obvious that many details may be changed without departing from the spirit and scope of the appended claims.

The invention is claimed as follows:

1. An apparatus of the type described comprising first and second opposing head means, mandril means extending between said first and second head means for supporting a workpiece to be processed, means for relatively moving said head means toward each other for compacting a workpiece under pressure on the mandril means therebetween, means connected with said head means for indexing both of said head means while the workpiece is supported therebetween, said mandril means comprising a plurality of generally axially extending elements mounted for general radial movement for providing an expandable mandril, and means connected with said elements for radially shifting said elements and selectively expanding and collapsing the mandril.

2. An apparatus, as defined in claim 1, which includes means disposed axially outwardly of one of said head means and supporting said mandril elements, said one of said head means having radially extending slots therein, and said mandril elements projecting through said slots in said one of said head means toward the other of said head means.

3. An apparatus, as defined in claim 1, wherein said head means and said mandril means define a central opening through which an element for tying the workpiece may be inserted, said head means and said mandril also having laterally exposed openings for enabling the tying element to be passed through said openings for engagement around the workpiece.

4. An apparatus, comprising first and second opposing head means mounted for relative movement toward and away from each other and for rotative movement, means for selectively relatively moving said head means toward and away from each other, said head means having generally radially extending slots therein, expandable mandril means including a plurality of generally axially extending elements disposed between said head means and extendable in said slots for interlocking the head means for rotation with each other, and mounted for generally radial movement, means connected with said elements for radially shifting said elements and selectively expanding and collapsing the mandril means, and drive means connected with one of said head means for indexing both of said head means and said mandril means when said elements extend into the slots in both of said head means.

5. An apparatus, of the type described, comprising first head means, a carriage mounted for movement toward and away from said first head means, a mandril mounted on said carriage for movement therewith and extending toward said first head means, a second head means supported on said carriage in alignment with said mandril and in opposing relationship with respect to said first head means, means for moving one of said head means toward the other and relative to the mandril for compacting a workpiece supported on the mandril, means mounting said first and second head means for rotation, and drive means connected with one of said head means for indexing said head means when said workpiece is compacted between said first and second head means.

6. An apparatus, as defined in claim 5, which includes means supporting said mandril on the carriage for pivotal movement between a first position extending toward said first head means and a second position extending at an angle with respect to said first position, and means for pivoting the mandril between said positions.

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7. An apparatus, as defined in claim 5, which includes means mounted between said first head means and said carriage for lifting a workpiece which has been compacted between the first and second head means and discharging the workpiece from the apparatus after said carriage has been moved away from said first head means.

8. An apparatus comprising a frame structure, a first head mounted adjacent one end of the frame structure, a carriage on an opposite end portion of the frame structure movable toward and away from said head, a mandril mounted on said carriage and movable therewith, said mandril including a free end portion extending toward said head, a second head supported on said carriage in axial alignment with said first head and said mandril, said free end portion of said mandril extending through said second head, means for moving said second head relative to said first head and said mandril for compacting a workpiece disposed between said heads and on said mandril, said mandril comprising a plurality of elongated generally parallel elements, and means located at a side of said second head opposite from said first head and connected with said elements for radially shifting the elements for expanding and contracting the mandril.

9. An apparatus, as defined in claim 8, wherein said first and second heads and said mandril are mounted for rotation about a common axis, said apparatus including means for indexing said heads and said mandril about said axis.

10. An apparatus, as defined in claim 8, wherein said last named means comprises a plurality of guide bars extending generally radially with respect to said axis, and slide members respectively on said guide bars and connected with said mandril elements.

11. An apparatus, as defined in claim 10, which includes a cam plate rotatable about said axis adjacent said and relative to said guide bars, and cam followers respectively connected to said slide members and engaging said cam plate for actuating the slide members along said guide bars upon rotation of said cam plate.

12. An apparatus comprising a frame structure, a first head mounted adjacent one end of the frame structure, a carriage on an opposite end portion of the frame structure movable toward and away from said head, a mandril mounted on said carriage and movable therewith, said mandril including a free end portion extending toward said head, a second head supported on said carriage in axial alignment with the said first head and said mandril, said free end portion of said mandril extending through said second head, means for moving said second head relative to said first head and said mandril for compacting a workpiece disposed between said head and on said mandril, tubular means rotatably mounted at a side of said second head opposite from said first head and connected to and supporting said mandril, and an elongated slide member axially slidably disposed within said tubular means and connected and supporting said second head for enabling said second head to be axially shifted relative to said mandril and said first head.

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