United States Patent [19]

Boehm et al.

[11] **3,710,711**

[45] **Jan. 16, 1973**

[54] **SYSTEM FOR FORMING AND HANDLING ANNULAR ROD BUNDLES**

[75] Inventors: **Walter G. Boehm,** Birmingham; **Gordon A. Torrance,** Riverview, both of Mich.

[73] Assignee: **Jervis B. Webb Company**

[22] Filed: **Aug. 24, 1971**

[21] Appl. No.: **174,318**

[52] **U.S. Cl.** .....**100/7,** 100/3, 100/12, 104/172 S, 198/20 R

[51] **Int. Cl.** **B65b 13/00**

[58] **Field of Search** .....100/3, 7, 12; 104/96, 172 S; 198/20 R; 140/2

[56] **References Cited**

UNITED STATES PATENTS

2,336,614	12/1943	Jackson	198/20
3,400,652	9/1968	Hill et al.	100/12 X
3,195,444	7/1965	McLean	100/7
3,633,492	1/1972	Gilvar	100/3
3,583,311	6/1971	Hill	100/7
3,452,785	7/1969	McLean et al.	140/2
3,314,377	4/1967	Dehne	104/96
3,229,645	1/1966	Dehne	104/172
3,498,212	3/1970	Boehm	100/7

Primary Examiner—Billy J. Wilhite
Attorney—Farley, Foster & Farley

[57] **ABSTRACT**

Rod delivered in a series of rings to an elevated gathering tub, in a conventional manner, is formed into an annular bundle around a mandrel of a rod bundle carrier having a base platform secured at right angles to the mandrel, the carrier being elevated so that the mandrel projects into the gathering tub as the bundle is formed and loaded onto the base platform of the carrier. The loaded carrier is lowered from the gathering tub, and is then detachably suspended from a load unit of an overhead power and free conveyor which transports the loaded carrier to other stations where operations are performed on the rod bundle. At each of these other stations the bundle is not separated from the carrier but the carrier is detached from the conveyor, employed as part of the apparatus for carrying out the operation, and resuspended from the conveyor, the loaded carrier eventually arriving at at an unloading station where the processed bundle is removed from the carrier.

19 Claims, 4 Drawing Figures

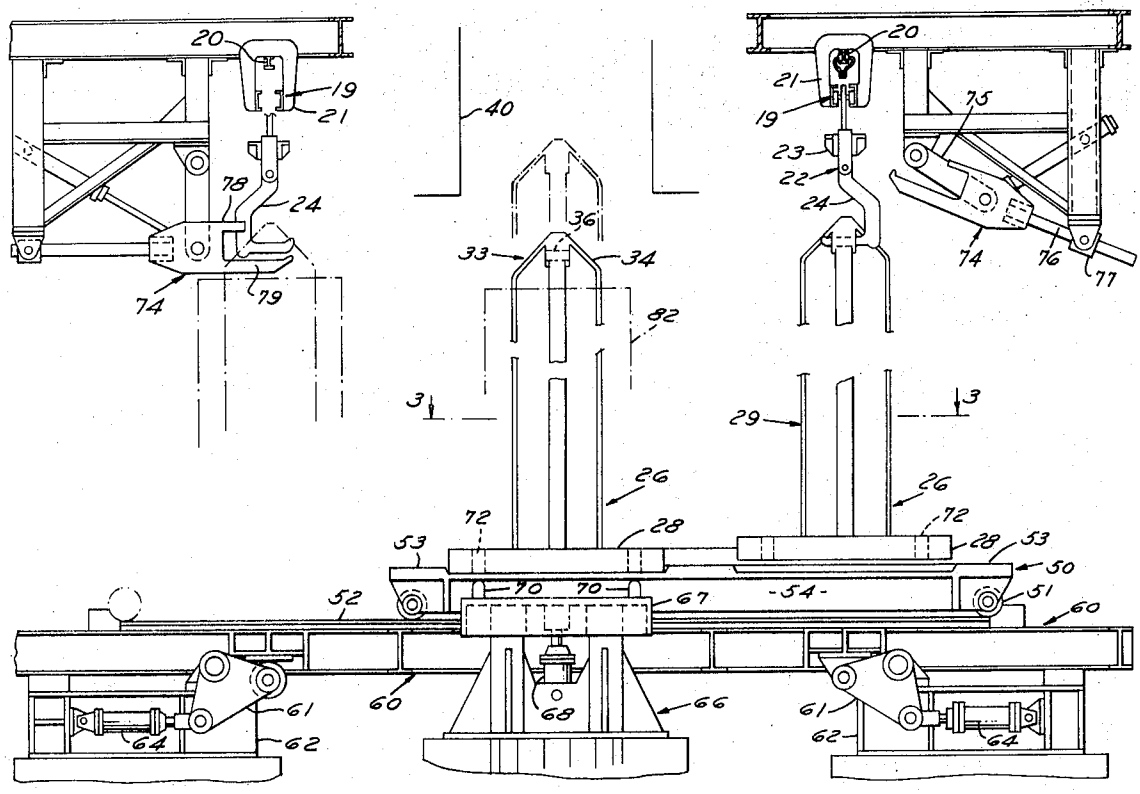


FIG. 1

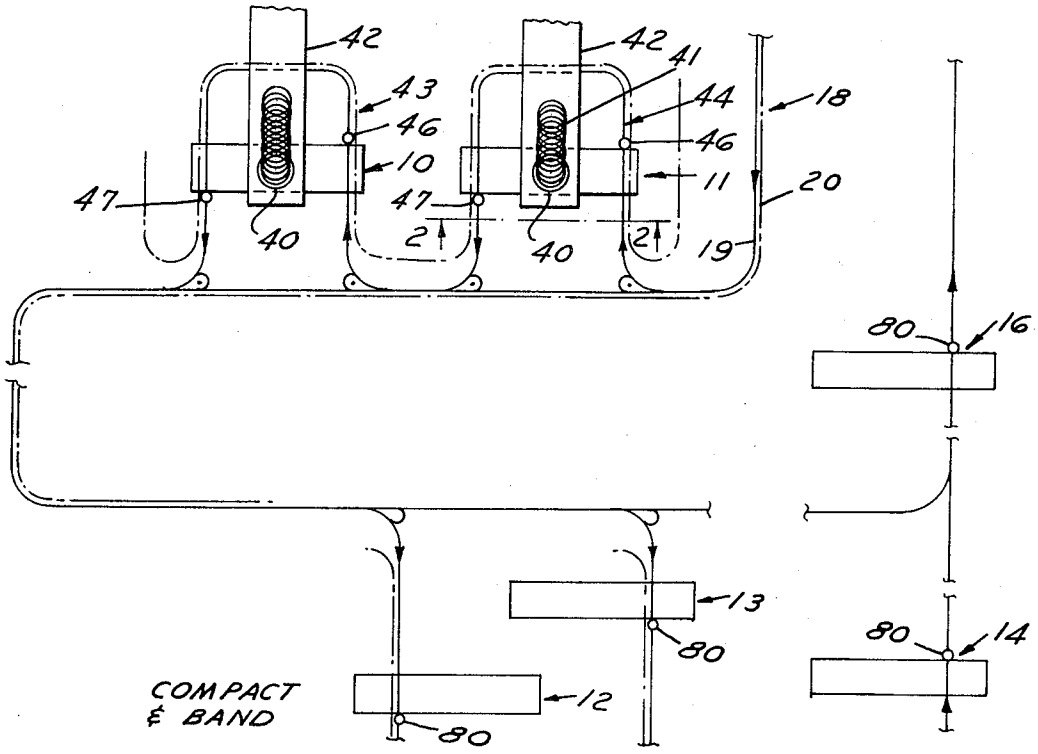
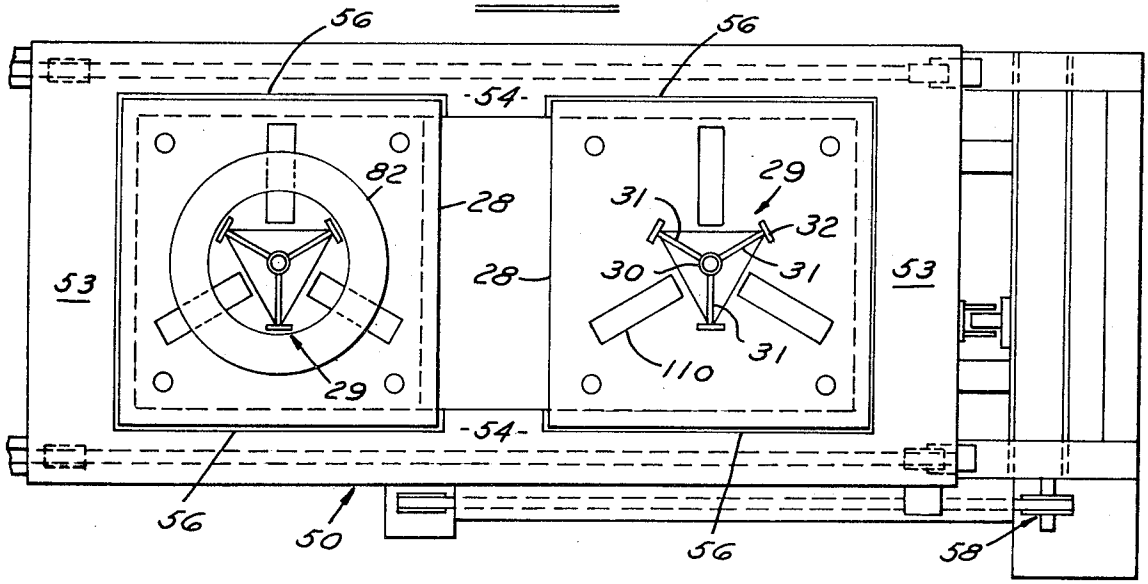


FIG. 3



INVENTORS
WALTER G. BOEHM
GORDON A. TORRANCE
BY
Farley, Forster & Farley
ATTORNEYS

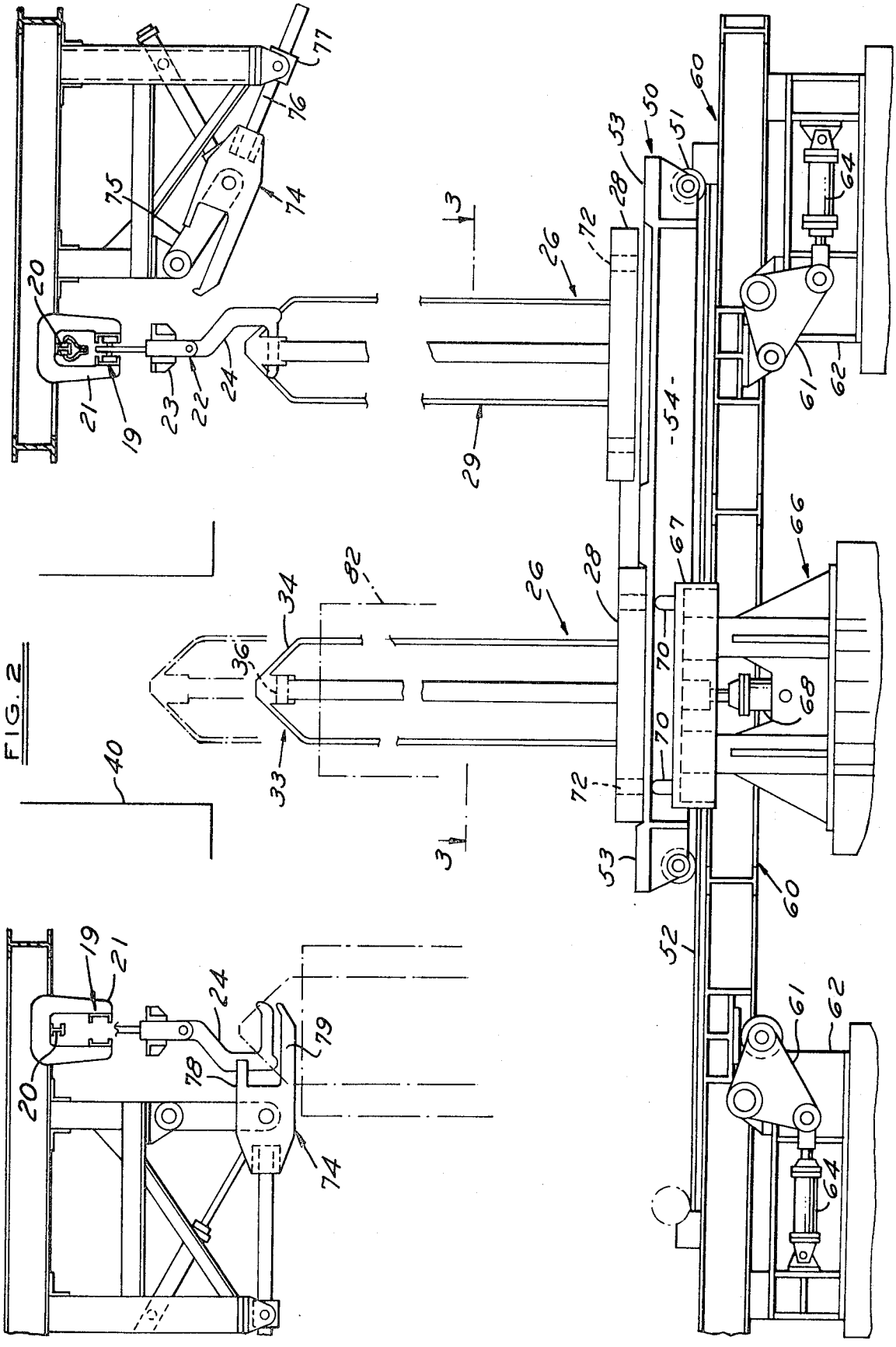

77
76
74
75
20
21
19
23
22
24
3
26
72
28
53
50
51
60
64
61
62
54
29
34
82
36
33
40
66
67
70
68
52

FIG. 2

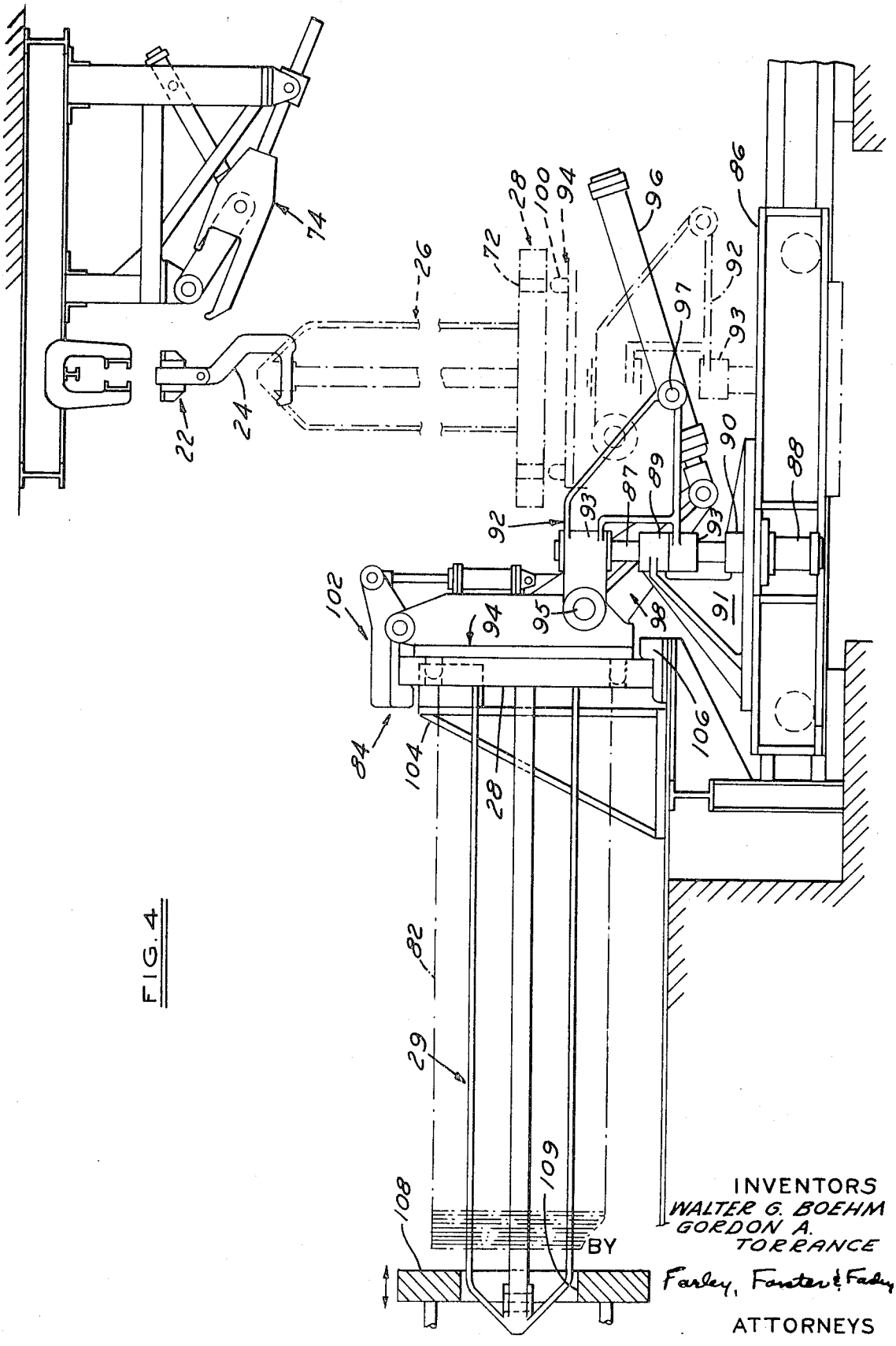


FIG. 4

INVENTORS
WALTER G. BOEHM
GORDON A. TORRANCE

BY

Farley, Forster & Farley

ATTORNEYS

SYSTEM FOR FORMING AND HANDLING ANNULAR ROD BUNDLES

SUMMARY OF THE INVENTION

This invention relates to improvements in a system for forming a strand of rod or wire into an annular bundle and for handling this bundle through successive operations involved in the processing thereof, such as compacting and banding, and inspection, until the bundle is delivered to an unloading station in condition for shipment or storage.

Prior systems of this general type have generally employed one or more operations requiring the handling or transporting of a rod bundle in a relatively unsupported condition, which operations expose the bundle to the likelihood of damage. These operations, together with the means employed for transporting a bundle in prior systems - usually a hook of a overhead conveyor on which the bundle is suspended - also impose practical limitations on the size of bundle that can satisfactorily be processed.

In present rod mills, the rod is delivered in a continuous series of overlapping rings to a gathering tub where a rod bundle is formed, as illustrated in U.S. Pat. No. 3,452,785. This rod bundle is then handled and conveyed, as mentioned above, through subsequent processing steps.

The objects of the present invention are to eliminate this handling of the rod bundle, to provide continuous support for the rod bundle from the time it is formed until the processing has been completed and the bundle is ready for shipment; and, to permit the formation and processing of rod bundles considerably larger in size than those that can be formed and handled by present systems.

The system of the present invention includes the combination of an overhead power and free conveyor arranged in a path of travel to serve a rod bundle forming station, an unloading station and any intermediate stations at which operations on the rod bundle are to be performed, the overhead conveyor having a plurality of load carrying units. Each of these load carrying units is capable of detachably suspending a rod bundle carrier having a base platform for supporting one end of a rod bundle, and mandrel structure secured to and extending outwardly from the base platform in generally perpendicular relation therewith, the mandrel structure being designed to project axially through the rings of an annular rod bundle. Each of the stations in the system includes suitable apparatus for detaching a rod bundle carrier from a load carrying unit of the conveyor, utilizing the rod bundle carrier as part of a fixture for supporting the rod bundle during the performance of the operation carried on at that station, and resuspending the rod bundle carrier from a load carrying unit of the overhead conveyor.

At the rod bundle forming station, which has an elevated gathering tub receiving rings of rod as mentioned above, the apparatus positions an empty rod bundle carrier with the mandrel thereof projecting within the gathering tub to guide the rings of rod onto the carrier and form a rod bundle supported on the base platform of the carrier. This apparatus in the form to be described herein includes the combination of a shuttle carriage operable between a station on the conveyor at one side of the gathering tub at which a load carrying unit is stopped and an empty rod bundle carrier is removed therefrom, and a station on the other side of the gathering tub at which a load carrying unit is stopped and a loaded rod bundle carrier is placed thereon. An elevator device located beneath the gathering tub registers with and raises the base platform of a rod bundle carrier to place the mandrel portion thereof within the gathering tub and utilize the carrier in the formation of a rod bundle. This rod bundle and carrier become a unit in the system and remain together until the processing of the rod bundle has been completed.

The unity of the rod bundle and carrier is made possible at least in part by employing the base platform of the carrier not only as a support for the rod bundle, but as a fixture in the processing operations, the base platform being provided with handling or registry elements engageable by complementary elements of the apparatus of the system, and with suitable means such as apertures to cooperate with apparatus for applying bands to the bundle supported on the carrier. The mandrel structure of the carrier is preferably capable of supporting a rod bundle with the axis thereof extending either substantially vertically or substantially horizontally, and this structure consists of a plurality of beams secured at one end to the base platform and arranged in radially spaced relation to an axis perpendicular to the base platform, the outer ends of the beams forming a tapered nose portion.

Apparatus at an intermediate station, such as a compacting and banding station, or an inspection and testing station, includes a table moveable into engagement with the base platform of a rod bundle carrier suspended from a stopped load carrying unit of the conveyor to detach the rod bundle carrier therefrom. This table is preferably moveable transversely to the path of travel of the overhead conveyor, and is also rotatable between a position in which the base platform of the carrier is horizontal and a position in which the base platform is substantially vertical.

Other features and advantages of the invention will appear from the description to follow of the presently preferred embodiments thereof illustrated in the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic plan view of the system of the invention in-cluding an overhead power and free conveyor and stations at which a rod bundle is formed and processed;

FIG. 2 is an enlarged sectional elevation taken as indicated by the line 2—2 of FIG. 1 showing the apparatus of the system at a rod bundle forming station;

FIG. 3 is a plan view of the apparatus of FIG. 2, taken substantially as indicated by the line 3—3 thereon; and,

FIG. 4 is an elevation of apparatus provided at one of the other stations of the system for removing a rod bundle carrier from a load carrying unit of the overhead conveyor, performing an operation on the rod bundle supported by the carrier and resuspending the rod bundle carrier from the load carrying unit of the overhead conveyor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 schematically illustrates representative portions of a rod bundle forming and handling system incorporating the features of the invention. These portions include rod bundle forming stations **10** and **11**, compacting and banding stations **12** and **13**, an inspection and testing station **14** and an unloading station **16**, it being understood that the number and relative location of these stations in this view is not intended to be represenative to any particular installation. The stations of the system are served by an overhead power and free conveyor **18** having load supporting tracks shown in solid line **19** and power line tracks **20** for supporting a propelling chain and pushers.

As shown in FIG. **2**, the construction and arrangement of the load supporting and power line tracks **19** and **20** is conventional, the track **20** being formed by an I-beam and the track **19** being formed by a pair of facing channels supported below the track **19** by track hangars **21**. Load carrying units **22**, supported on the track **20**, are mainly of conventional construction and hence have not been shown in detail. Each of these load carrying units consists of a front driving trolley connected to a rear trolley by a load bar **23**, a comparable load carrying unit being illustrated in U.S. Pat. No. 3,498,212. The driving trolley will ordinarily be equipped with a retractable driving dog as illustrated in U.S. Pat. No. 3,044,416, and the load carrying unit may be transferred from one power line to another and stopped where desired as illustrated in U.S. Pats. Nos. 3,314,377 and 3,229,645. In the present construction, the load bar **23** is equipped with a depending hook **24** capable of detachably suspending a rod bundle carrier **26** (FIGS. **2** and **3**).

Each rod bundle carrier **26** has a base platform **28** and a mandrel **29** secured thereto, the mandrel extending outwardly from the base platform in generally perpendicular relation therewith. The structure of the mandrel **29** includes a longitudinally extending member **30** defining the axis of the mandrel and a plurality of beams **31** arranged radially about the member **30** and secured thereto, each beam being provided along its outer edge with a wear or guide plate **32**, and the beams and wear plates being tapered inwardly at the outer end **33** of the mandrel to form a tapered nose section **34**. A transversely extending aperture **36** is provided adjacent the outer end **33** of the mandrel and is detachably engageable with the hook **24** of a load carrying unit.

Each of the rod bundle forming stations **10** and **11** of FIG. **1** includes an elevated gathering tub **40** to which rod is delivered in a continuous series of overlapping rings **41** on suitable conveying structure **42**. A gathering tub **40** is schematically illustrated in FIG. **2** and the mandrel **29** of the rod bundle carrier **26** is designed to project axially through the rings of rod **41**.

Referring to FIG. **1**, load carrying units **22** of the power and free conveyor circulate around the system in the directions indicated by the arrows. Load carrying units each supporting an empty rod bundle carrier **26** and returning from the unloading station **16** are diverted to one of the rod bundle forming stations **10** or **11** served by branch portions **43** or **44** respectively of the overhead power and free conveyor. Each of these branch portions **43** and **44** is arranged with a stopping station **46** adjacent to one side of the gathering tub **40** at which a load carrying unit **22** can be stopped for detaching an empty rod bundle carrier **26** therefrom, and with a second stopping station **47** adjacent to the opposite side of the gathering tub **40** at which a load carrying unit **22** can be stopped to resuspend a loaded rod bundle carrier **26** thereon. Between these stations **46** and **47**, the overhead conveyor passes underneath the conveying structure **42** for the rings of rod **41**. A load carrying unit leaving one of the rod bundle forming stations **10** or **11** supports as a unit, a rod bundle carrier **26** loaded with a rod bundle, and conveys this unit to one of the stations **12** or **13** where a compacting and banding operation is performed thereon, to any subsequent station such as the inspection and testing station **14** where other operations are performed thereon, and eventually to the unloading station **16** where the completely processed bundle is separated from the rod bundle carrier.

Representative apparatus for carrying out such a sequence of operations will now be described, beginning with the apparatus provided at the rod bundle forming stations **10** and **11**, and shown in FIGS. **2** and **3**.

This apparatus consists of a carriage **50** having wheels **51** supported on rails **52** and an open frame having ends **53** and sides **54** capable of supporting the base portions **28** of two rod bundle carriers **26** in positions defined by recesses **56** in the carriage frame. The carriage is movable back and forth on the rails **52**, in shuttle fashion, by a suitable reversing drive mechanism **58** (FIG. **3**), and the rails **52** are carried by suitable frame structure **60** which can be reciprocated in a vertical direction by bell cranks **61** mounted on a suitable base **62** and movable by fluid pressure cylinders **64**.

An elevator device **66** is located beneath the gathering tub **40** and includes a table **67** moveable in vertical directions by an actuating cylinder **68**, the table being located within the sides and ends of the open frame of the carriage **50**, and being provided with upwardly projecting handling elements or pins **70** which are registerable in complementary elements or holes **72** in the base platform **28** of a rod bundle carrier **26**.

A load carrying unit **22** arriving at the stopping station **46** with an empty rod bundle carrier **26**, is stopped and engaged by a stablizer device **74** (FIG. **2**). This stablizer device **74** is suspended by a link **75** and by a rod **76** slidably engaging a pivoted bearing **77**, and is moveable from a retracted position shown at the right hand side of FIG. **2** to an operative position shown at the left hand side thereof in which an upper projecting portion **78** of the device is engageable by the hook **24** and a lower projecting portion **79** is engageable by the mandrel **29** of the rod bundle carrier **26**.

With the carriage **50** in the position shown in FIG. **2**, the frame **60** is raised by operation of the bell cranks **61** and actuating cylinder **64** a distance sufficient to engage the base platform **28** of the rod bundle carrier **26** and raise the carrier relative to the hook **24** suspending it. The carriage **50** is then moved by the drive mechanism **58** to place the rod bundle carrier **26** under the gathering tub **40** and over the elevator table **67** which is moved upwardly, the elements **70** on the table **67** registering in the holes **72** of the carrier base plat-

form, raising the carrier to a position in which the mandrel 29 thereof projects well within the gathering tub 40. Moveable baffles or gates (not shown) are conventionally provided in the gathering tub to separate one bundle from the next, and these gates would be retracted as the mandrel 29 is projected into the gathering tub, permitting the mandrel to collect any rings of rod that may have accumulated therein and guide these rings into the beginning of a bundle supported on the base platform 28 of the carrier 26. Rings of rod 41 delivered to the gathering tub while the carrier is positioned therein are guided into bundle formation by the mandrel 26 thereof until a bundle 82 of the desired size is formed on the bundle carrier 26.

While this bundle forming operation on the carrier 26 is being carried out, the frame 60 supporting the carriage 50 is lowered, and the carriage 50 is shuttled back to the right hand position, and, when the bundle formation has been completed, the elevator table 67 is lowered depositing a rod bundle carrier 26 and bundle 82 on the carriage 50. At this instant in the cycle of operation, the parts of the apparatus will assume the approximate positions shown in FIG. 2. The next upward movement of the frame 60 results in an empty rod bundle carrier being engaged by the carriage 50 and raised from the hook 24 of a load carrying unit as described above, and the ensuing shuttle movement of the carriage to the left places this empty carrier 26 under the gathering tub 40 and places the loaded carrier 26 on the hook 24 of an empty load carrying unit waiting at the stopping station 47. When the frame 60 is next lowered, the loaded rod bundle carrier is transferred to this load carrying unit of the conveyor and is transported to the next station of the system where an operation is to be formed upon the rod bundle.

Such a station is schematically illustrated in FIG. 4. One of the stabilizer devices 74 and a load carrying unit stop 80 (FIG. 1) aid in positioning a load carrying unit 22 and bundle carrier 26 relative to the apparatus 84 shown, which is capable of removing the rod bundle carrier 26 and bundle 82 as a unit from the hook 24, tilting the rod bundle carrier from a position in which the base platform 28 thereof is horizontal to a position in which the base platform is vertical and the axis defined by the mandrel extends horizontally, returning the rod bundle carrier to the original position and resuspending it from the hook 24. As part of this operation, the rod bundle carrier 26 may also be moved transversely out of the path of load carrying units on the conveyor.

The apparatus 84 includes a horizontally reciprocatable base 86 provided with a pair of vertically extending rods 87 of pressure cylinders 88, one of which is shown, slidably supported by vertically spaced bearings 89 and 90 of base structure 91. A carriage 92 has collars 93 fixed on the rods 87 and a table 94 connected to the carriage 92 by a pivot 95 is moveable by a fluid pressure cylinder unit 96 pivoted at 97 to the carriage 92 and connected to a crank 98 secured to the table 94. The table 94 is equipped with pins 100 registerable with the holes 72 in the base platform 28 of the rod bundle carrier 26, and with a fluid pressure actuated clamp 102 for securing the base platform 28 to the table. The apparatus may also be provided with fixed abutments 104 and 106 engageable by the base platform 28 when pivoted to the vertical position shown in full line.

A load carrying unit 22, when stopped at the station illustrated in FIG. 4, is engaged and stablized by a stabilizer device 74, as previously described. The table 94 of the apparatus 84 is in a horizontal, lowered position beneath the base platform 28 of the rod bundle carrier 26, as shown in broken line. Upward movement of the rods 87 and carriage 92 by the fluid pressure cylinders 88, moves the table 94 into engagement with the base platform 28 of the carrier 26, the table pins 100 into registry with the holes 72, and the platform is engaged by the lock 102. This upward movement of the carriage 92 raises the mandrel 29 of the carrier 26 off of the hook 24 and when the base 86 is moved toward the full line position, the carrier 26 is disengaged from the hook 24. Operation of the fluid pressure cylinder 96 then tilts the table 94 and carrier 26 to the horizontal position shown in full line in which inspection and testing operations can be performed on the rod bundle 82 while supported by the carrier.

Apparatus of the general type illustrated in FIG. 4 can be combined with a horizontally moveable ram 108, having a central aperture 109 for clearance with the mandrel 29 of the carrier, for compacting and banding the rod bundle 82. The banding operation is facilitated by the provision of band applying openings 110 (FIG. 3) in the base platform 28 of the carrier 26. Alternately, the compacting and banding apparatus can be arranged with the ram 108 moveable vertically and with the base platform 28 of the carrier 26 supported in a horizontal position. With either arrangement, the base platform acts as a compacting member on the rod bundle 82 which is positioned during the compacting operation by the mandrel 29 of the carrier 26.

We claim:

1. A system for handling annular rod bundles wherein the improvement comprises;

an overhead power and free conveyor arranged in a path of travel which serves a rod bundle forming station, an unloading station and at least one intermediate station at which an operation on a rod bundle is to be performed, the overhead conveyor having a plurality of load carrying units;

a rod bundle carrier having a base platform adapted to support one end of a rod bundle, mandrel structure secured to the base platform and extending outwardly therefrom in generally perpendicular relation therewith, the mandrel structure being adapted to project axially through an annular rod bundle;

means for detachably suspending the rod bundle carrier from a load carrying unit of the overhead power and free conveyor;

and carrier handling apparatus at each of said stations operable to detach and resuspend the rod bundle carrier from a load carrying unit for the performance of the operation carried on at each of said stations.

2. A system according to claim 1 wherein the rod bundle forming station includes a gathering tub to which the rod is delivered in the form of a series of rings, said apparatus at the rod bundle forming station including means for positioning an empty carrier with the mandrel thereof projecting within the gathering tub

to guide said rings of rod onto the carrier and form a rod bundle supported on the base platform of the carrier.

3. A system according to claim 2 wherein the means for positioning an empty carrier includes a shuttle carriage for moving an empty carrier under the gathering tub, an elevator device for raising the empty carrier into rod bundle forming position, and means on the base platform of the carrier for registry with the elevator device.

4. A system according to claim 1 wherein the rod bundle forming station includes an elevated gathering tub to which the rod is delivered in a series of rings, said overhead power and free conveyor being arranged at the rod bundle forming station with means for stopping a load carrying unit in a carrier detaching position and in a carrier resuspending position, said apparatus at the rod bundle forming station including means for detaching and moving a empty carrier beneath the gathering tub, elevator means for raising the empty carrier to a rod bundle forming and receiving position in which the mandrel of the empty carrier projects within the gathering tub and guides rings of rod onto the carrier to form a rod bundle supported on the base platform of the carrier, and for lowering the loaded carrier.

5. A system according to claim 1 wherein the rod bundle forming station includes an elevated gathering tub to which the rod is delivered in a strand formed into a series of rings; the overhead power and free conveyor being arranged with a station adjacent to one side of the gathering tub at which a load carrying unit can be stopped to detach an empty rod bundle carrier therefrom and with a second station adjacent to the opposite side of the gathering tub at which a load carrying unit can be stopped to resuspend a loaded rod bundle carrier thereon; said apparatus at the rod bundle forming station including carrier shuttle mechanism transversely moveable between said stopping stations, the shuttle mechanism including means for supporting a pair of rod bundle carriers in side-by-side relation with one of said supported carriers located at one of said stopping stations and the other supported carrier located beneath the gathering tub; and elevator means beneath the gathering tub for raising an empty carrier from the supporting means of the shuttle mechanism to a rod bundle forming and receiving position in which the mandrel of the empty carrier projects within the gathering tub and guides rings of rod onto the carrier to form a rod bundle supported on the base platform of the carrier, and for lowering the loaded carrier back onto the supporting means of the shuttle mechanism for movement thereby to said second stopping station.

6. A system according to claim 5 wherein said shuttle mechanism includes means for raising and lowering the supporting means for detaching and resuspending a rod bundle carrier from a load carrying unit.

7. A system according to claim 6 wherein said shuttle mechanism is operable while a carrier is held in said rod bundle forming and receiving position by the elevator means.

8. A system according to claim 1 wherein the means for detachably suspending the rod bundle carrier includes a suspension element at the outer end of the mandrel structure.

9. A system according to claim 1 wherein the rod bundle carrier is provided with handling elements on the base platform thereof engageable by complimentary handling elements forming part of the carrier handling apparatus.

10. A system according to claim 1 wherein the mandrel structure comprises a plurality of beams extending longitudinally of the mandrel axis and arranged radially about the mandrel axis, the outer ends of the beams forming a tapered nose portion.

11. A system according to claim 1 wherein the carrier handling apparatus includes a table, means for moving the table into engagement with the base platform of a rod bundle carrier suspended from a load carrying unit to detach the carrier therefrom, means for securing the base platform of the carrier to the table, and means for rotating the table and carrier between a position in which the base platform of the carrier is horizontal and a position in which the base platform is substantially vertical.

12. A system according to claim 11 wherein the table and the base platform of the carrier are provided with interengageable elements for fixing the position of the carrier relative to the table.

13. A system according to claim 11 wherein the table is mounted on a base moveable transversely to the path of travel of the overhead conveyor.

14. A system according to claim 11 wherein the intermediate station is for performing a compacting and banding operation and the apparatus thereof includes a compacting head moveable relative to the base platform of a rod bundle carrier engaged by the apparatus, and banding apertures in the base platform of the carrier to facilitate the application of bands to a rod bundle supported thereby.

15. A system for handling annular rod bundles wherein the improvement comprises,

an overhead power and free conveyor arranged in a path of travel which serves a plurality of processing stations, one of such stations being a station at which a rod bundle is formed, the overhead conveyor having a plurality of load carrying units;

a rod bundle carrier having a base platform adapted to support one end of a rod bundle, mandrel structure secured to the base platform and extending outwardly therefrom in generally perpendicular relation therewith, the man-drel structure being adapted to project axially through an annular rod bundle,

means for detachably suspending the rod bundle carrier from a load carrying unit of the overhead power and free conveyor;

and carrier handling apparatus at each of said processing stations, said apparatus including means for utilizing the rod bundle carrier in the performance of the operation of such processing station whereby the carrier supports and protects the rod bundle from the formation thereof until the processing of the rod bundle is complete.

16. A system for handling annular rod bundles wherein the improvement comprises:

an overhead power and free conveyor arranged in a path of travel which serves at least one processing station, the overhead conveyor having a plurality of load carrying units;

a rod bundle carrier having a base platform adapted to support one end of a rod bundle, mandrel structure secured to the base platform and extending outwardly therefrom in generally perpendicular relation therewith, the mandrel structure being adapted to project axially through an annular rod bundle;

means for detachably suspending the rod bundle carrier from a load carrying unit of the overhead power and free conveyor;

and carrier handling apparatus at said processing station operable to detach and resuspend the rod bundle carrier from a load carrying unit for the performance of the operation carried on at said station.

17. A system according to claim 16 wherein the means for detachably suspending the rod bundle carrier includes a suspension element at the outer end of the mandrel structure.

18. A system according to claim 16 wherein the rod bundle carrier is provided with handling elements on the base platform thereof engageable by complementary handling elements forming part of the carrier handling apparatus.

19. A system according to claim 16 wherein the mandrel structure comprises a plurality of beams extending longitudinally of the mandrel axis and arranged radially about the mandrel axis, the outer ends of the beams forming a tapered nose portion.

* * * * *