Dec. 14, 1965 J. H. HITCHCOCK 3,222,965

COILING, CUTTING, AND TRANSPORTING LARGE ROD BUNDLES

Filed Aug. 9, 1962 4 Sheets-Sheet 1

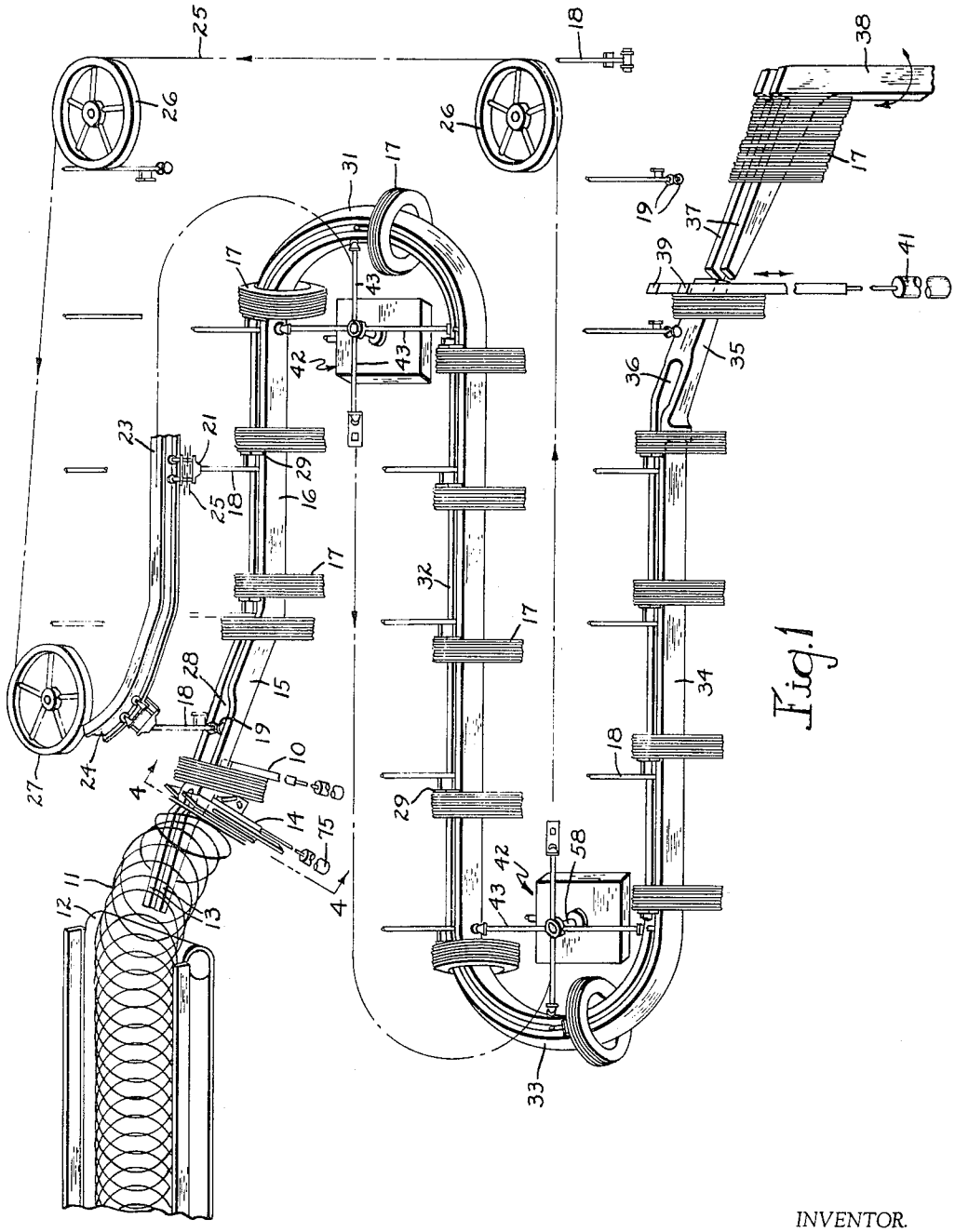

Fig. 1

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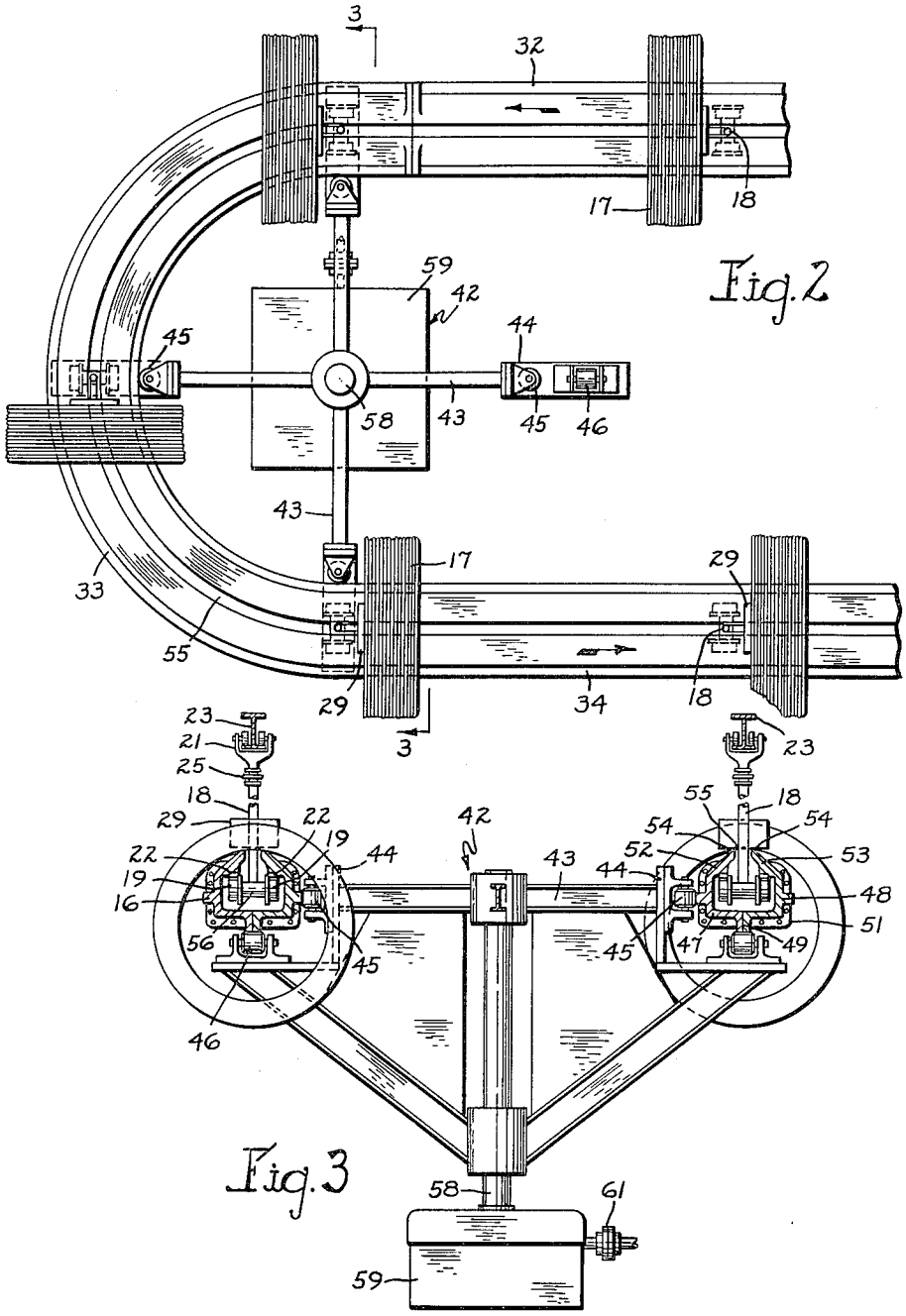

Fig. 2

Fig. 3

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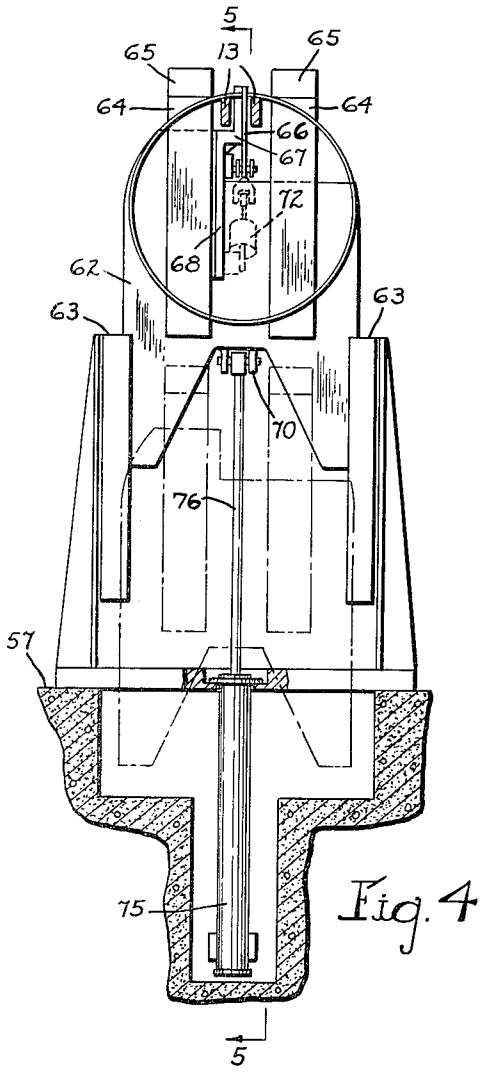

Fig. 4

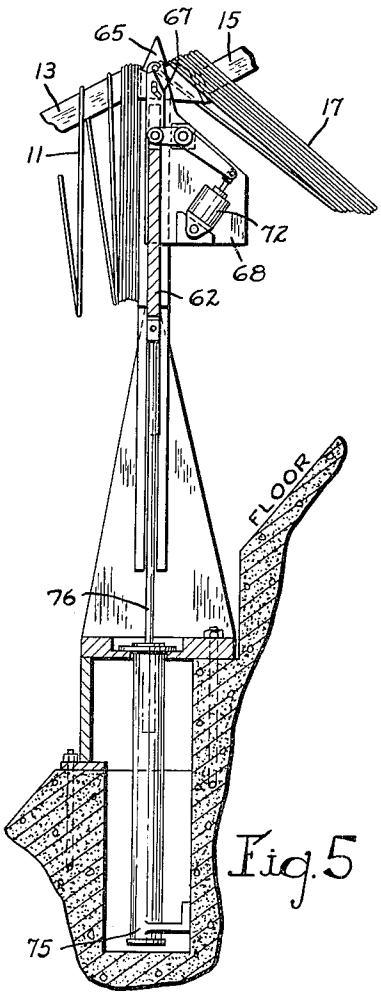

Fig. 5

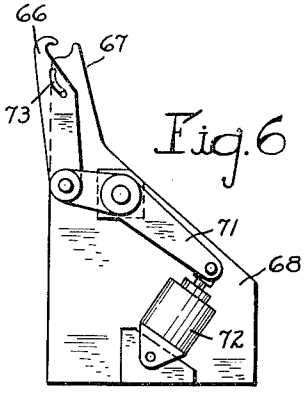

Fig. 6

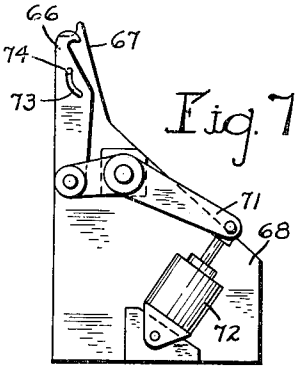

Fig. 7

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Filed Aug. 9, 1962 4 Sheets-Sheet 4

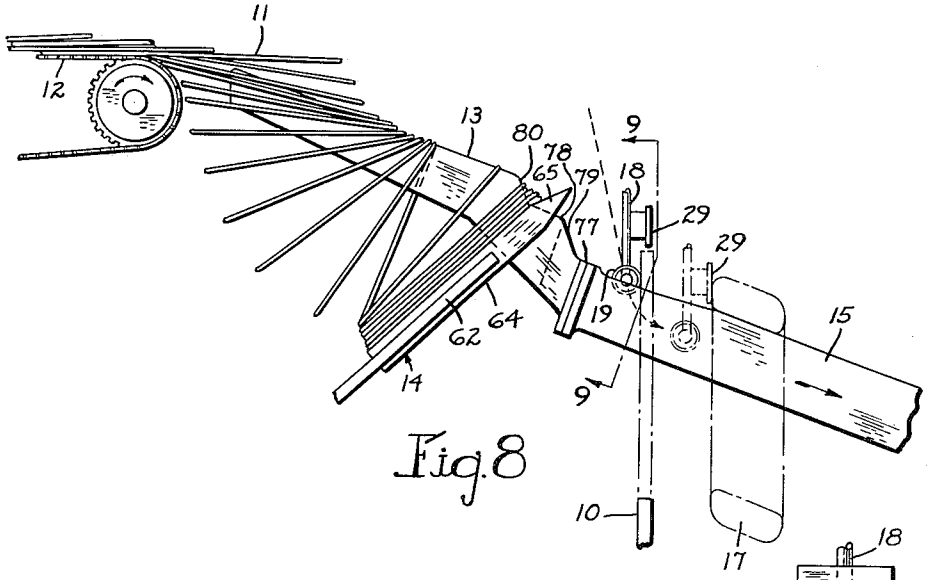

Fig. 8

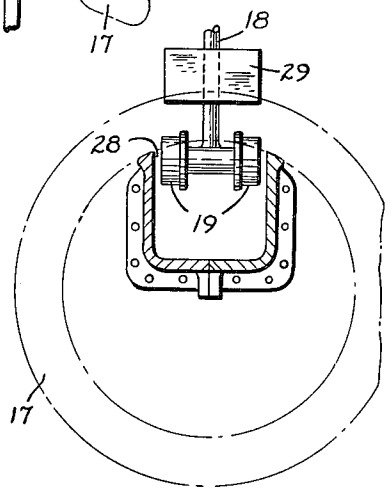

Fig. 9

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COILING, CUTTING, AND TRANSPORTING LARGE ROD BUNDLES

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13 Claims. (Cl. 83—27)

This invention relates generally to novel method and apparatus for coiling rod or wire and is particularly useful for handling rod from #5 gauge (.207" diameter) to ½" diameter when coiled into bundles of any desired size including continuous coils weighing 3,000 pounds or more. In particular this invention relates to an arrangement for assembling a continuously coiled rod into bundles or coils of any desired size with each coil being in the form of a compact stack containing many rings of the coiled rod and having provision for transporting the coils so formed to be deposited on a transfer arm where the coils can be engaged by a hook carrier for further transport.

Coiling rod in a conventional laying reel has many disadvantages especially where large bundles are to be assembled since such large bundles tend to be unstable after discharge from the laying reel and the large mass of material prevents rapid and uniform cooling of the rod. Furthermore, where the rod is delivered coiled to a running conveyor upon which it appears as a continuous series of overlapping rings, which is well adapted to rapid and uniform cooling, means not previously available are required for collecting the successive rings into a compact coil.

It is the primary object of the present invention to provide a coil forming method and conveyor system for accepting a continuous succession of rings from a conveyor system and assembling the succession of rings into a compact bundle in coil form. Since the rod is received by the transport system of the present invention in ring form and transported in coils consisting of a plurality of such rings, one of the features of the invention is to provide a transport system which is suspended by means of the coil transporting carriers thereby to permit the system to be supported and at the same time being capable of accepting and delivering the closed rings which pass through the transport system. Since the rings of rod are delivered to the transport system on a continuous basis, it is essential that the transport system be capable of receiving the rod rings at all times while it is transporting and delivering the assembled coils to their destination. Another feature of the invention is the provision of a movable separator and shear assembly which can be introduced to cut the rod and provide coil bundles of predetermined weight while permitting the oncoming rings of rod to accumulate during the cutting operation. A similar feature provides for the discharge and disposal of groups of coils at the end of the conveyor without regard to the arrival of subsequent coils.

Other objects and features of the invention will become apparent from the following detailed description taken in conjunction with the acompanying drawings wherein:

FIG. 1 is a view from above in perspective of a coil forming transport system in accordance with the invention;

FIG. 2 is a plan view of a portion of the conveyor system showing a turnstile lateral support therefor;

FIG. 3 is a sectional view taken along the lines 3—3 of FIG. 2 showing the turnstile lateral support in elevation;

FIG. 4 is a view taken in the direction indicated by the line 4—4 of FIG. 1;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 4;

FIGS. 6 and 7 are detailed views in side elevation of the shear which is mounted on the separator shown in FIGS. 4 and 5;

FIG. 8 is a side elevation detail of the portion of the conveyor which receives the continuous looped rod from the belt conveyor; and

FIG. 9 is a sectional detail of the conveyor track as it is constructed to allow entrance and exit of the supporting truck at each end thereof.

Referring now to FIG. 1, the general layout of a preferred arrangement of apparatus in accordance with the invention will be described. The system is adapted to receive rod or wire product **11** delivered in the form of continuous overlapped rings at the end of a suitable belt conveyor **12** or other delivery means. The delivery end of the conveyor **12** is preferably elevated to a point above floor level which will permit the product **11** to fall upon a bifurcated stem **13** which is inclined upwardly to terminate at approximately the level of the conveyor **12**. The bifurcated stem **13** extends downwardly beyond the position of a separator and shear mechanism **14** where the stem **13** is attached to an upwardly inclined extension **15** of a tubular track **16**. Below the junction of the stem **13** and the extension **15**, a disappearing stop **10** is located. The stop **10** is adapted to move transverse to the extension **15** to a ring restraining position for the accumulation of any desired number of rings into a coil **17**. One suitable form for the stop **10** comprises a U-shaped plate having spaced parallel members straddling the extension **15**.

The tubular track **16**, as well as the rod coils **17** carried thereby, is supported from above solely by means of trolley rods **18** which have a pair of flanged rollers **19** at the lower end thereof and a wheeled truck **21** at the upper end thereof. The rollers **19** support the tubular track **16** by rolling engagement with an interior track **22** more specifically shown in FIG. 3 while the truck **21** is supported from the flanges of an H-beam **23** which is supported above the tubular track **16**. The H-beam **23** follows a path which is directly above the tubular track **16** and is generally parallel thereto and a fixed distance therefrom over the entire length of the track **16** except for an initial portion **24** which slopes upwardly at a greater angle than the corresponding upwardly inclined section **15**. Associated with the H-beam **23** is a chain conveyor **25** which is driven over a series of guide sheaves **26, 27** adapted to engage the links of the chain and apply driving force to the chain to power the conveyor system. The chain **25** is discharged from the last guide pulley **27** which is slightly elevated with respect to the preceding pulley **26** in order that the trucks **21** can be discharged into running engagement with the flanges of the H-beam **23** at the upward end of the extension **24**. Upon engagement of a truck **21** with the section **24** of the H-beam **23**, the rapid descent of the portion **24** permits the rollers **19** at the lower end of the rod **18** to drop through a cut away portion **28** in the section **15** thereby permitting the rollers **19** to enter the interior of the tubular track **16**. The coils **17** are pushed along the track **16** in sliding engagement therewith and supported thereon by means of a plate **29** which is carried by each of the rods **18**.

The entire assembly is stabilized with respect to displacement in the horizontal plane by means of a series of bends or turns in the path of the track **16** and a cooperating series of turnstiles which engage the bottom and side walls of the track **16** without interfering with the passage of the coils **17**. For this purpose the tubular track **16** is formed with a first 180° bend **31** followed by a straight run **32** and a second 180° bend **33**. Fol-

lowing the bend 33, a straight run 34 proceeds to the vicinity of a discharge point where the tubular track terminates in a downwardly sloping stem 35. The stem 35 has an enlarged opening 36 to permit the exit of the wheel supports 19 and terminates aligned with an inclined bifurcated support 37. The support 37 extends from a post 38 which is adapted to be revolved to a position where a hook carrier can engage the coils 17 thereon by passing through the central opening in the support 37. For the purpose of permitting coils to be delivered down the discharge stem 35 when the support 37 is not in position to receive coils, a disappearing stop 39 is positioned at the end of the discharge stem 35. The stop 39 may be moved vertically into and out of bundle restraining position by means of a suitable actuator 41. In FIG. 1 the stop 39 is shown in coil restraining position.

While the entire weight of the tubular track 16 is supported from above by means of the travelling rods 18, lateral constraint in all directions in the horizontal plane is achieved by means of a pair of turnstiles 42 which are driven in synchronism with the speed of the conveyor chain 25 and arranged to engage the side and bottom wall of the tubular track 16 between adjacent coils 17. In this arrangement the turnstiles 42 provide horizontally extending arms 43, at least two of which are always in engagement with the track 16 at each of the 180° bends 31 and 33. The entire assembly is therefore stabilized with respect to two perpendicular directions in the horizontal plane corresponding to the directions of the rotatable arms 43 then in contact with the track 16.

Referring now to FIGS. 2 and 3 further details of the construction will be described. The turnstile 42 has four horizontal arms 43 on the end of which are secured roller brackets 44. The roller backets 44 have journaled thereon a vertical roller 45 and a horizontal roller 46 positioned to engage side and bottom extensions of the tubular track body 16. The tubular track 16 may be fabricated from mating halves 47 and 48 which are joined at their lower flange extensions 49 and successive longitudinal sections are connected by means of bolting flanges 51. The two halves 47 and 48 have upwardly extending inclined walls 52 and 53 which terminate in opposed edges 54 which define a slot 55 in which the rod 18 freely passes.

Beneath the slot 55, the internal track 22 is formed by two parallel flats which may be secured in a corner recess in each of the half sections 47 and 48. The track 22 may be made of a hard steel strip which is capable of withstanding the traverse of the rollers 19 without excessive wear. The rollers 19 are supported by suitable bearings on a transverse shaft 56 secured to the bottom end of the rod 18. Directly above the slot 55, the push plate 29 is connected to the rod 18 for the purpose of pushing the bundle 17 in sliding contact with the upper surface of the inclined walls 52 and 53.

The turnstile assembly 42 is supported for rotation on a vertical shaft 58 which is driven by means of a set of bevel gears contained in gear box 59 at a speed and position synchronized with the moving trucks 21 on the chain drive 25. For this purpose a suitable power coupling 61 is provided for driving the turnstiles 42 from the main drive for the chain conveyor 25.

Whenever a billet of material is formed into the sequence of overlapped rings 11 in greater number than is desired to be assembled into the individual coils 17, the separator assembly 14 and its associated rod shear may be used to subdivide the product into coils of desired weight. The details of this mechanism are shown in FIGS. 4–7, with FIG. 4 being a view in the nature of an elevation in the plane of operation of the separator assembly. The assembly comprises a plate 62 slidable in parallel guide-ways 63 which engage the edges thereof, the guide-ways being supported by any suitable means

from the floor 57. The plate 62 has secured thereto a pair of spaced shield prongs 64 which in the extended position of the mechanism straddle the collecting stem 13. The prongs 64 may have tapered ends 65 to facilitate the entry of the prongs 64 and the separator plate 62 between two successive rings 11. When the separator assembly is extended, the wire rings 11 which are resting on the upper surface of the collecting stem 13 will have the connecting portion of the adjacent rings on opposite sides of the shield 64 passing across the stem 13 diagonally and constrained between the extensions 64. In this position a portion of the rod will drop between open jaws 66, 67 of a shearing tool shown in open and closed positions in FIGS. 6 and 7 respectively. This shearing tool is mounted on the plate 62 by means of a mounting bracket 68 which extends beneath the plate 62. The shear comprising the stationary blade 67 and the movable blade 66 is actuated through a suitable bell crank lingage 71 by means of an electromagnetic or hydraulic actuator 72. The movable blade 66 has a cam slot 73 therein in which a pin 74 mounted on the stationary blade 67 extends. Upon extension of the actuator 72, the linkage 71 moves the blade 66 from the position shown in FIG. 6 to that shown in FIG. 7 and shears the rod 11 which lies between the shearing blades.

The separator assembly 14 is operated by a hydraulic actuator 75 which has an extendable rod 76 pivoted at 70 to the plate 62. During the normal delivery of overlapped rings 11, the plate 62 is in the retracted position indicated by phantom lines in FIG. 4 and the rings freely pass over the collecting stem 13 and accumulate against the stop 10. When the plate 62 is extended, as shown in FIGS. 4 and 5, it interrupts the sequence of rings 11 and accumulates those which are delivered until the shearing operation is completed. When shearing is completed the previously delivered rings form a free coil 17 which proceeds down the inclined section 15 of the track 16. This motion down the inclined section 15 occurs upon the withdrawal of the disappearing stop 10 against which the bundle 17 accumulates. Upon withdrawal of the separator plate 14, the rings accumulated during the shearing operation slide down to the stop 10 which has meanwhile returned to ring restraining position and the rings forming the next coil continue to accumulate against stop 10.

The foregoing action may be best seen in FIG. 8 where the rings 11 from the conveyor 12 extend horizontally beyond the end of the conveyor due to the weight of the overlapping rings still on the conveyor. Thus the rings 11 proceed in the horizontal position until the open area of the ring is over the end of the collecting stem 13. When the rings 11 fall free, they encircle the collecting stem 13 and proceed down to the position of the disappearing stop 10 which is erected to restraining position. As the next trolley rod 18 decends to a position where rollers 19 enter the opening 28 in the section 15 of the track 16 the disappearing stop 10 is retracted to permit the coil accumulated thereagainst to proceed down the inclined section 15. When the coil has reached the bottom of the inclined section 15, it is engaged by the pusher plate 29 carried by the rod 18 to be transported along the horizontal track 16. Operating in synchronism with the foregoing operations is the operation of the separator support 14 which acts to sever the ring at the end of a complete bundle as previously described.

The collecting stem 13 is formed with an upper surface in stepped levels comprising flats 77 and 78 and risers 79 and 80. This contour permits the continuously delivered rings 11 to form into a multi-layer bundle as the individual rings pass over the edge and fall down the incline provided by the risers 80 or 79. Thus the bundle will initially form against the stop 10 and accumulate to a depth and width roughly determined by the cross-sectional area provided by the space between the riser 79 and the stop 10

and the depth provided by the vertical dimension of the riser 79. During the shearing operation stop 10 is retracted permitting the complete coil to start down the incline 15 and a multi-layer bundle starts to accumulate against the separator plate 62 in cooperation with the notch formed by the riser 80. When the separator plate 62 is retracted, this partial bundle drops over the riser 79 against the erected stop 10 and continues to accumulate until the desired coil weight is reached at which time the sequence is repeated.

In FIG. 9 a detail of the modification of the tubular track 16 at the entrance 28 and the exit 36 is shown. At each of these positions the upwardly inclined walls 52 and 53 of the tubular track 16 are removed and the track has an ample access opening for the roller supports 19 to enter the interior of the tubular track 16. The tracks 22 are faired into this opening so that the flange wheels 19 make engagement therewith due to the alignment of the track 16 with the path of the supporting rods 18. The coils of rod are supported at the entrance 28 and the exit 36 by the side walls of the track adjacent to the enlarged openings.

Many modifications of the particular embodiment of the present invention herein disclosed may be made without departing from the scope of the invention which is defined by the scope of the appended claims.

I claim:

1. A coil transport system comprising an overhead conveyor with continuous drive means extending over a path including a plurality of horizontal turns, a rigid tubular track extending over substantially the same path and vertically spaced below said conveyor, said track having a longitudinal slot in the top surface thereof, a plurality of depending trolley carriers spaced along said conveyor and transported by said drive means, a roller assembly secured to the bottom end of each of said carriers and adapted to support said tubular track by rolling engagement with the interior surfaces of said track adjacent said slot, an extension at each end of said track which includes a flared extension of said slot to provide openings for the entrance and exit of said roller assemblies to and from the interior of said tubular track, a horizontal turnstile at each of said turns having rotating arms extending to contact the outer wall of said tubular track over a substantial portion of the arc of each turn, and means for driving said turnstiles in fixed relation to said drive means for said trolley carrier.

2. Apparatus according to claim 1 in which said extensions support projections beyond the flared extension of said slot at each end of said track to form collection and discharge stems for coiled product carried on said track.

3. A coil forming and transporting system comprising an overhead conveyor with continuous drive means extending over a path including a plurality of horizontal turns, a rigid tubular track extending over substantially the same path and vertically spaced below said conveyor, said track having a longitudinal slot in the top surface thereof, a plurality of depending trolley carriers spaced along said conveyor and transported by said drive means, a roller assembly secured to the bottom end of each of said carriers and adapted to support said tubular track by rolling engagement with the interior surfaces of said track adjacent said slot, an extension at each end of said track which includes a flared extension of said slot to provide openings for the entrance and exit of said roller assemblies to and from the interior of said tubular track, a horizontal turnstile at each of said turns having rotating arms extending to contact the outer wall of said tubular track over a substantially portion of the arc of each turn, means for driving said turnstiles in fixed relation to said drive means for said trolley carriers, an upwardly extending collection stem connected to said extension at the entrance end of said track, and means for discharging a series of continuous rings of elongated product in the form of a helix over the upper end of said stem.

4. Apparatus according to claim 3 and including a separator plate movable transverse to said stem into and out of a position in which said platform intercepts the rings of said product collected by said collection stem, said platform positioned at the base of said stem ahead of the entrance end of said track, and a shear carried by said platform and operable to sever the said product to form said coils.

5. A coil forming and transporting system comprising an overhead conveyor with continuous drive means extending over a path including a plurality of horizontal turns, a rigid tubular track extending over substantially the same path and vertically spaced below said conveyor, said track having a longitudinal slot in the top surface thereof, a plurality of depending trolley carriers spaced along said conveyor and transported by said drive means, a roller assembly ecured to the bottom end of each of said carriers and adapted to support said tubular track by rolling engagement with the interior surfaces of said track adjacent said slot, an extension at each end of said track which includes a flared extension of said slot to provide openings for the entrance and exit of said roller assemblies to and from the interior of said tubular track, a horizontal turnstile at each of said turns having rotating arms extending to contact the outer wall of said tubular track over a substantial portion of the arc of each turn, means for driving said turnstiles in fixed relation to said drive means for said trolley carriers, an upwardly extending collection stem connected to said extension at the entrance end of said track, means for discharging a series of continuous rings of elongated product in the form of a helix over the upper end of said stem, a separator plate movable transversely to said track at the base of said collection stem, a shear carried by said separate plate and operable to sever said product when said separator plate is moved to interrupt the passage of said loops along said track, a disappearing stop movable transversely to said collection stem at the base thereof, and means for controlling the motion of said separator plate and operation of said shear in relation to the motion of said stop to assemble and sever coils of substantially equal weight.

6. Apparatus according to claim 5 and including a downwardly inclined discharge stem at the end of said track, a second disappearing stop located at the end of said discharge stem, and means for erecting said second disappearing stop periodically for a predetermined interval after each group of a predetermined number of said coils is discharged on said discharge stem.

7. Apparatus according to claim 6 and including a bifurcated support arm aligned with said discharge stem and movable to a position for disposing of the coils collected thereon while said second stop is erected.

8. A coil forming and transporting system comprising an overhead conveyor with continuous drive means extending over a path including a plurality of horizontal turns, a rigid tubular track extending over substantially the same path and vertically spaced below said conveyor, said track having a longitudinal slot in the top surface thereof, a plurality of depending trolley carriers spaced along said conveyor and transported by said drive means, a roller assembly secured to the bottom end of each of said carriers and adapted to support said tubular track by rolling engagement with the interior surfaces of said track adjacent said slot, an extension at each end of said track which includes a flared extension of said slot to provide openings for the entrance and exit of said roller assemblies to and from the interior of said tubular track, a horizontal turnstile at each of said turns having rotating arms extending to contact the outer wall of said tubular track over a substantial portion of the arc of each turn, means for driving said turnstiles in fixed relation to said drive means for said trolley carriers, an upwardy extending collection stem connected to said extension at the entrance end of said track, means for discharging a

series of continuous rings of elongated product in the form of a helix over the upper end of said stem, a separator plate movable transversely to said track at the base of said collection stem, a shear carried by said separator plate and operable to shear said product when said plate is moved to interrupt the passage of said rings along said track, a stop movable to interrupt the passage of said rings after said rings have passed the location of said plate but ahead of said flared extension forming said entrance opening, and means for operating said stop in time sequence with the operation of said plate and shear to assemble and sever coils of predetermined weight from the continuously delivered rings of said product and deliver said predetermined weight coils periodically to a position on said tracks where they will be propelled therealong by one of said carriers.

9. Apparatus according to claim **8** and including a downwardly inclined discharge stem at the end of said track, a second disappearing stop located at the end of said discharge stem, and means for erecting said second disappearing stop periodically for a predetermined interval after each group of a predetermined number of said coils is discharged on said discharge stem.

10. Apparatus according to claim **9** and including a bifurcated support arm aligned with said discharged stem and movable to a position for disposing of the coils collected thereon while said second stop is erected.

11. Apparatus for collecting successive overlapping rod rings delivered by a conveyor comprising a collecting stem supported at one end and upwardly inclined to have the free end terminate in position to be encircled by said rings as they leave said conveyor, a stop movable into and out of position on said stem for collecting a bundle of said rings on said stem, a separator movable into and out of position on said stem for intercepting the passage of said rings to the bundle on said stop, and shear means associated with said separator for severing said rod and separating said bundle.

12. The method of collecting into bundles successive, nonconcentric overlapping rod rings as they are delivered from a conveyor, comprising the steps of impaling successive rings as they leave the conveyor on an inclined stem, allowing the impaled rings to slide along the stem to a movable stop, separating the rings, and shearing the rod at said separation to form divided rod bundles of preselected weight.

13. The method of collecting into bundles successive, nonconcentric overlapping rod rings as they are delivered from a conveyor, comprising the steps of impaling successive rings as they leave the conveyor on an inclined stem, allowing the impaled rings to slide along the stem to a movable stop, separating the rings and shearing the rod at said separation to form divided rod bundles of preselected weight, removing said stop, and moving said divided bundles along a tubular track.

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