April 16, 1968 W. J. HILL 3,377,944

COIL HANDLING APPARATUS

Filed June 22, 1966 8 Sheets-Sheet 1

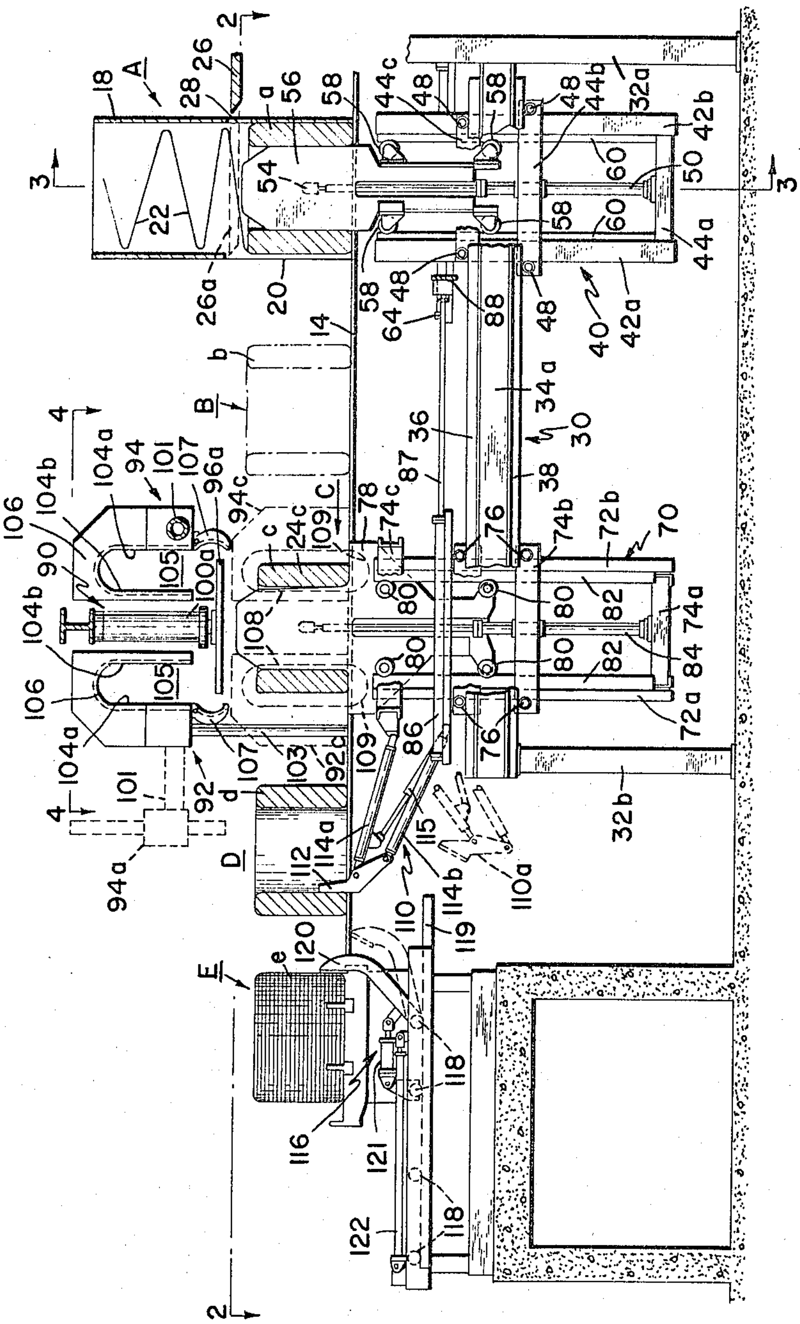


FIG. 1

INVENTOR.

William J. Hill

BY

Russell, Chittick & Pfund

ATTORNEYS

April 16, 1968 W. J. HILL **3,377,944**

COIL HANDLING APPARATUS

Filed June 22, 1966 8 Sheets-Sheet 2

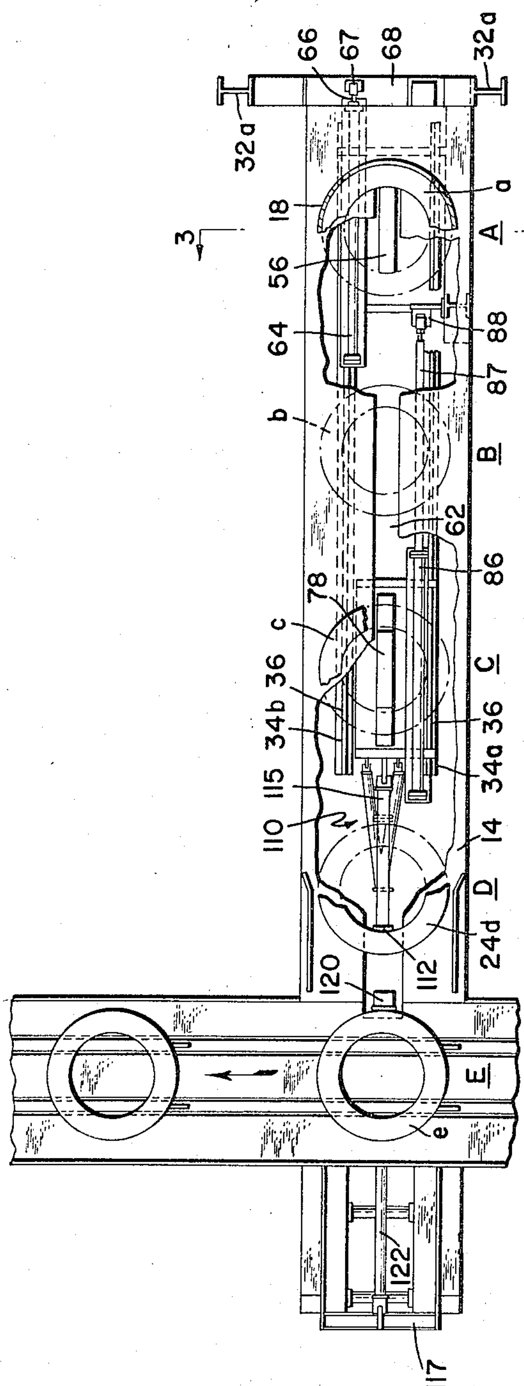


FIG.2

INVENTOR.
William J. Hill
BY
Russell, Chittick & Pfund
ATTORNEYS

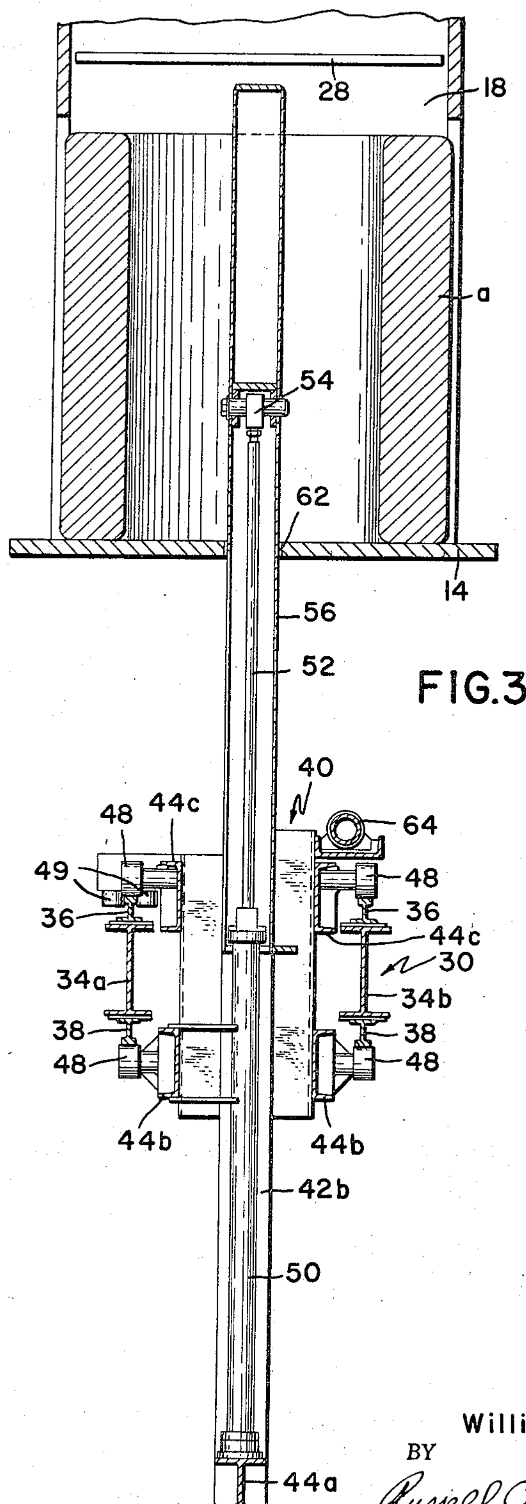


FIG.3

INVENTOR.
William J. Hill
BY
Russell, Chittick & Pfund
ATTORNEYS

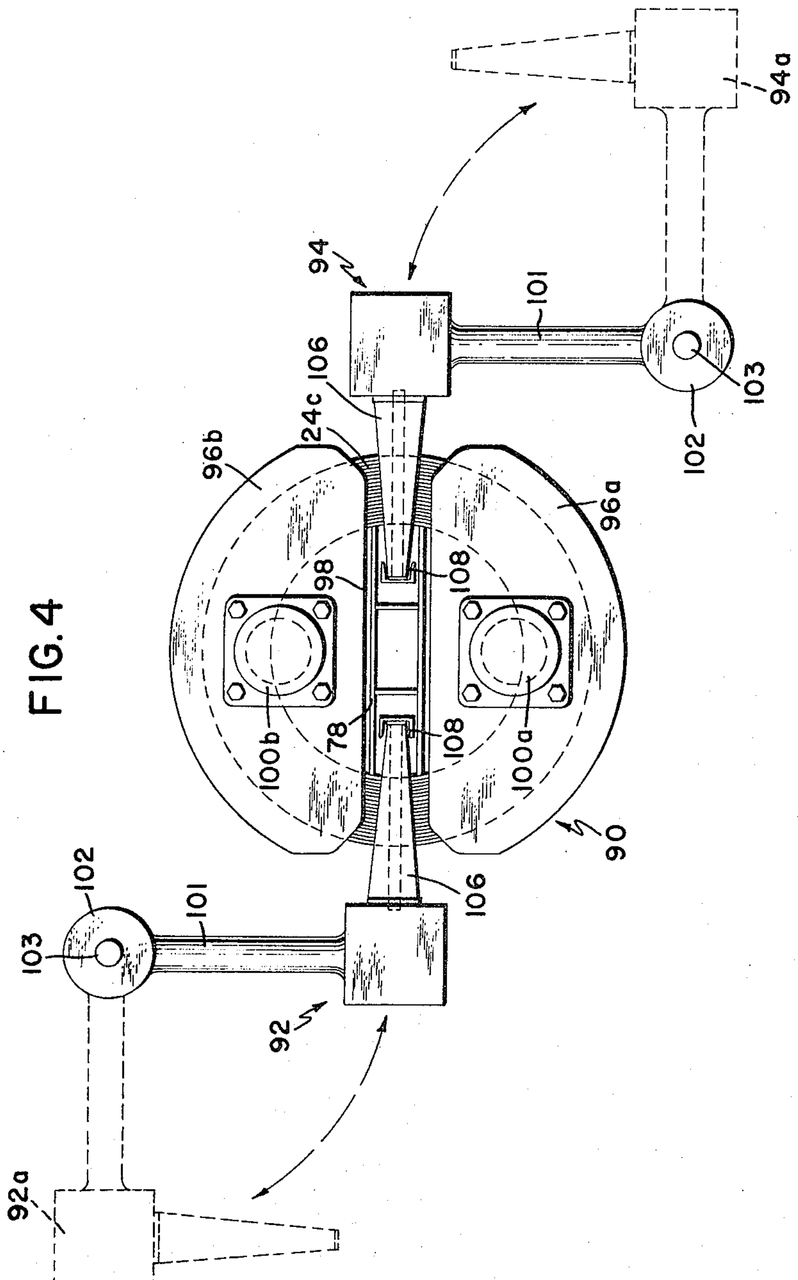


FIG. 4

INVENTOR.
William J. Hill
BY
Russell, Chittick & Pfund
ATTORNEYS

April 16, 1968 W. J. HILL 3,377,944

COIL HANDLING APPARATUS

Filed June 22, 1966 8 Sheets-Sheet

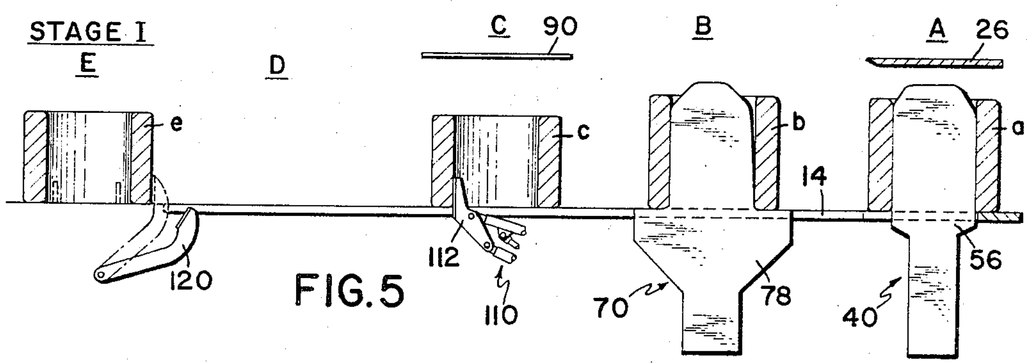


FIG. 5

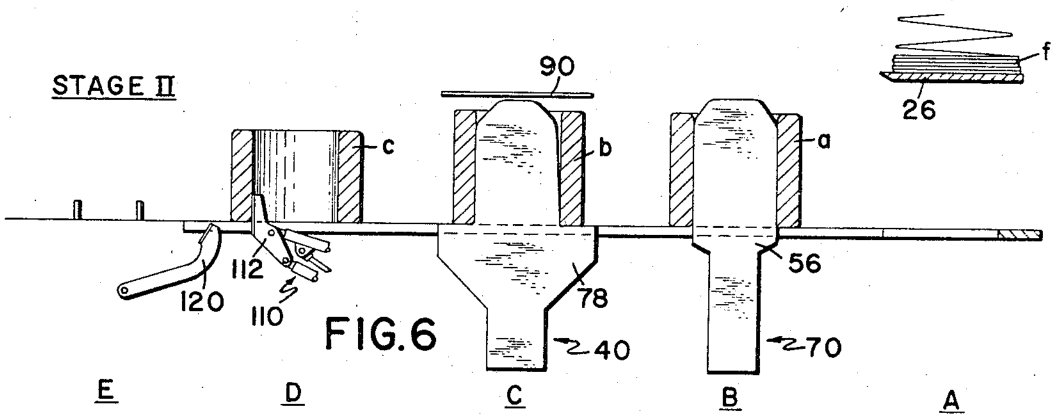


FIG. 6

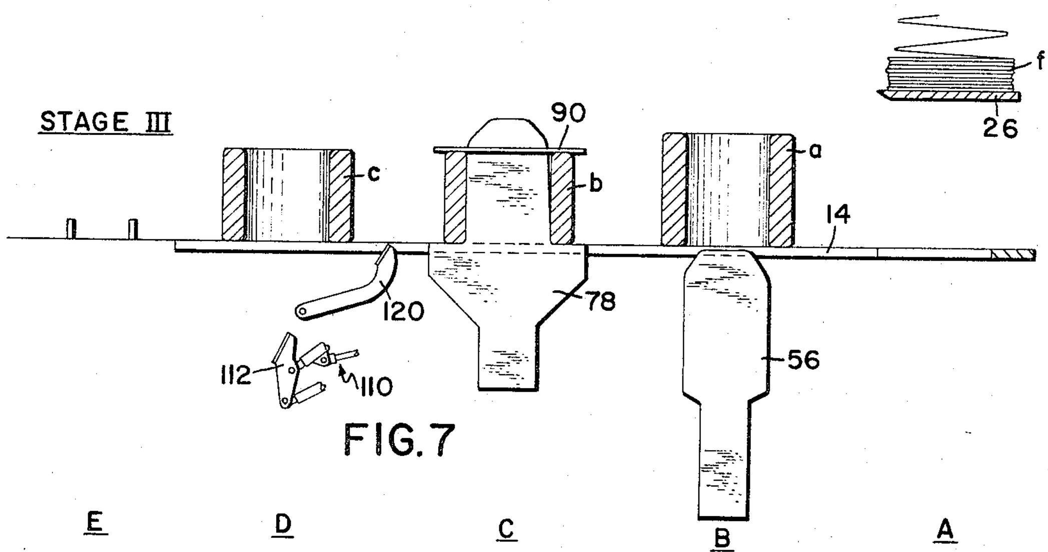


FIG. 7

INVENTOR.
William J. Hill
BY
Russell, Chittick & Pfund
ATTORNEYS

April 16, 1968 W. J. HILL 3,377,944

COIL HANDLING APPARATUS

Filed June 22, 1966 8 Sheets-Sheet 6

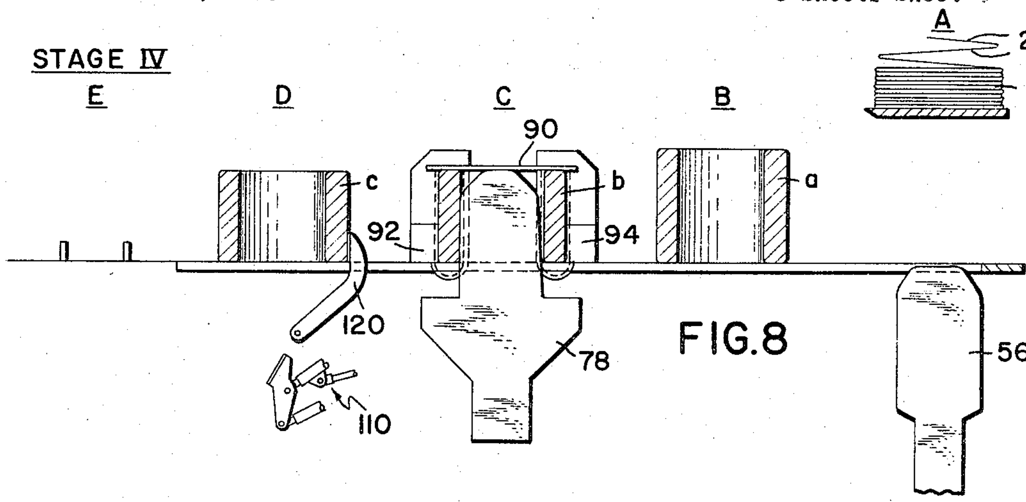


FIG. 8

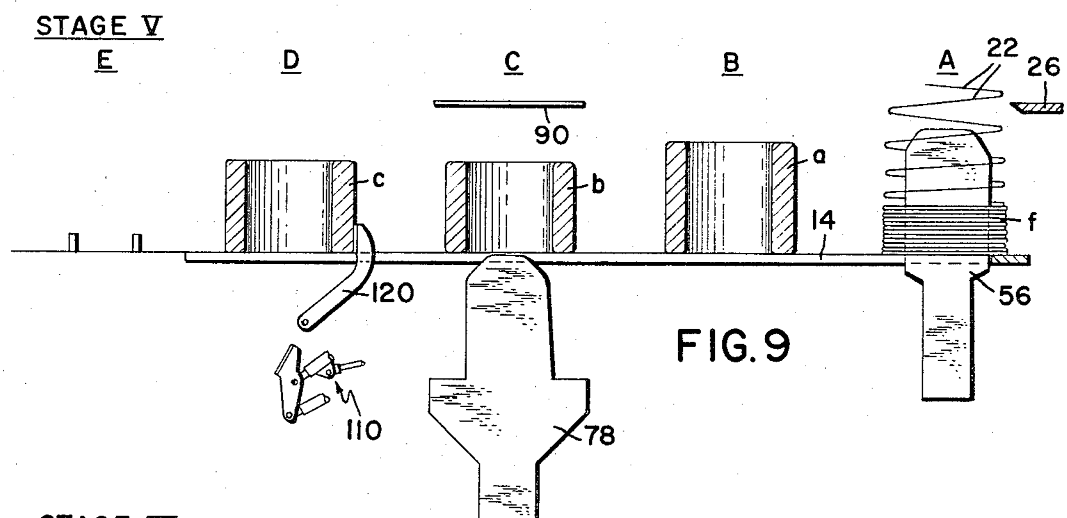


FIG. 9

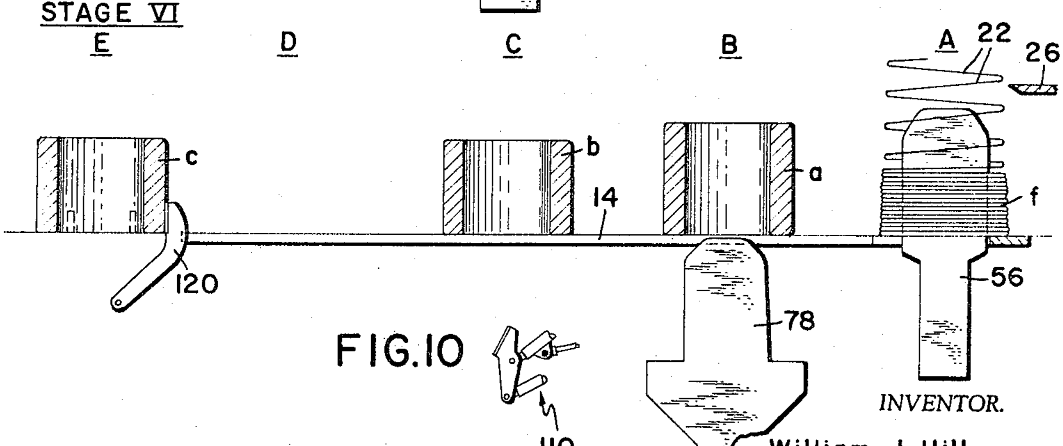


FIG. 10

INVENTOR.
William J. Hill

BY

Russell, Chittick & Pfund

ATTORNEYS

COIL HANDLING APPARATUS

Filed June 22, 1966

8 Sheets-Sheet 7

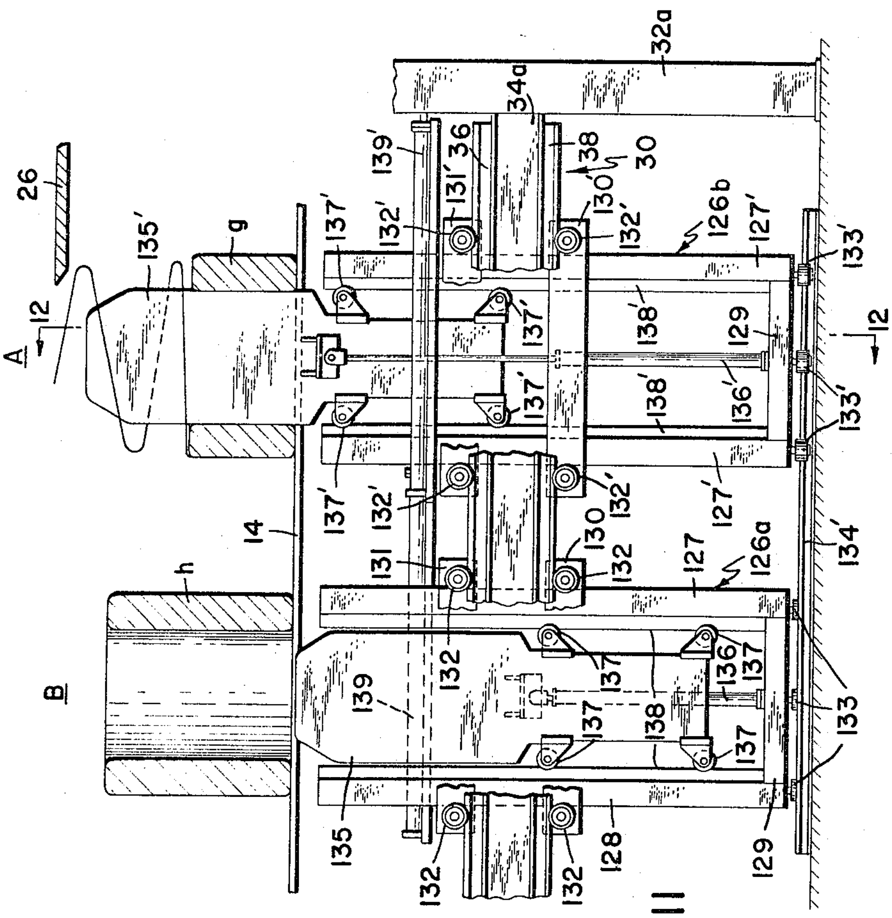


FIG. 11

INVENTOR.

William J. Hill

BY

Russell, Chittick & Pfund

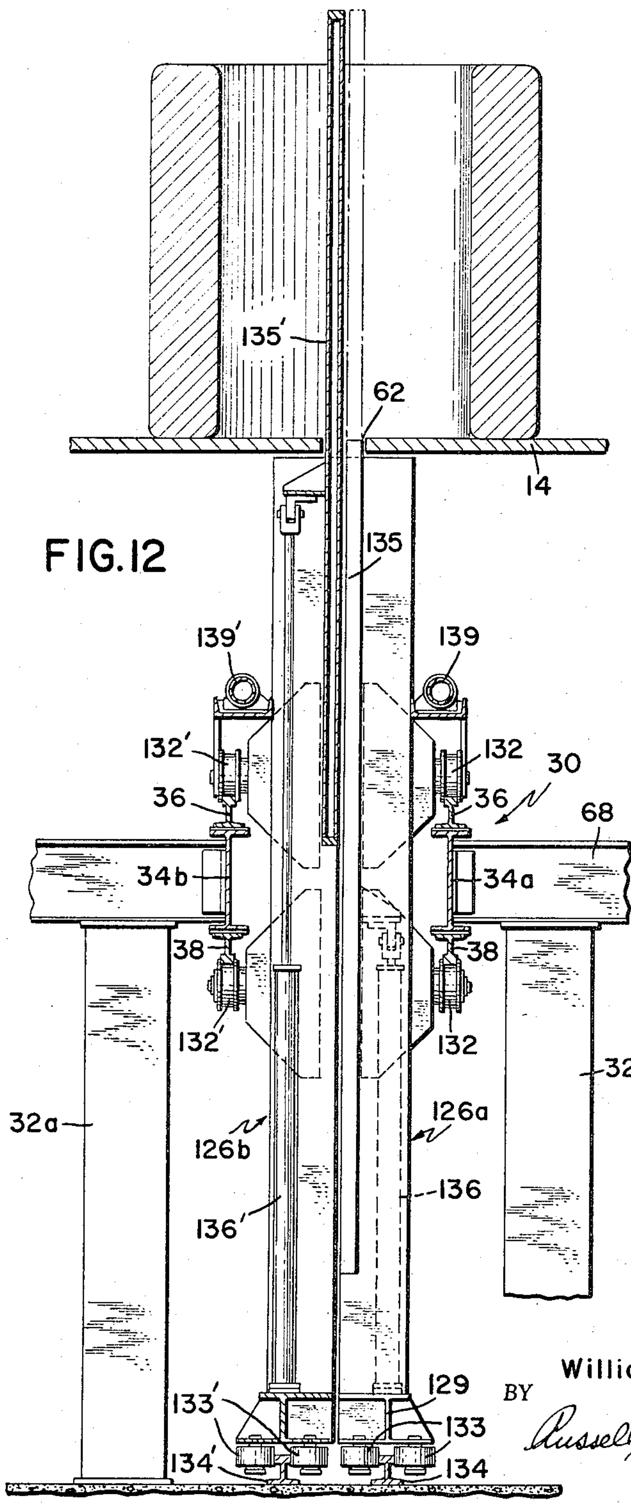
ATTORNEYS

April 16, 1968 W. J. HILL 3,377,944

COIL HANDLING APPARATUS

Filed June 22, 1966 8 Sheets-Sheet 8

FIG. 12



INVENTOR.
William J. Hill
BY Russell, Chittick & Pfund
ATTORNEYS

United States Patent Office

3,377,944
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3,377,944

COIL HANDLING APPARATUS

William J. Hill, Holden, Mass., assignor to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts

Filed June 22, 1966, Ser. No. 559,603
14 Claims. (Cl. 100—7)

ABSTRACT OF THE DISCLOSURE

An apparatus for transferring coils from a first coil forming station to a second laterally adjacent compacting and tying station. The apparatus includes a support surface extending between both stations. The support surface is provided with an elongated slot extending along substantially its entire length. Carriages movable in both forward and rearward directions parallel to said slot are positioned beneath the support surface, each carriage carrying a mandrel which is adjustable vertically through said slot from a lowered inoperative position beneath the support surface to a raised operative position extending axially through a coil on the support surface.

This invention relates generally to coil handling apparatus for a rolling mill and more particularly to an improved means for laterally transferring upstanding cylindrical coils from one location to the next, such as from a coil forming station to a compacting and tying station.

Following completion of the rolling operation and any additional "in-line" processing steps such as for example controlled cooling to produce predetermined metallurgical properties, the rolled mill product is usually gathered into upstanding cylindrical coils at a coil forming station. The coils, which will vary in weight and size depending on the capacity of the mill and customer requirements, are then transferred to a second station where they are compacted and tied, the net result being an increase in coil density which improves the ability of the coils to withstand damage and deformation during subsequent transit.

With modern mill installations, coils weighing 3,000 pounds or more are no longer uncommon and it has been found that these larger coils present certain handling problems. These problems are due in particular to the fact that prior to being compacted, large free-standing coils have a relatively unstable structure, thus exhibiting a tendency to readily deform and topple over if not carefully handled. Although care must be exercised when transferring these large coils from one location to the next, a rapid transfer is also essential if the mill output is to be adequately taken care of. To illustrate this point, a rolling mill producing .218" diameter rod and running at a delivery speed of 10,000 feet per minute can produce a 3000 lb. coil in approximately 120 seconds. After formation, this coil must be removed from the coil forming station, inspected, trimmed, transferred to a laterally adjacent compacting and tying station, compacted, tied and finally delivered to an awaiting coil carrier, all in the time it takes to form the next coil. Thus it can be seen that in addition to the requirement of careful handling, speed is also of the essence.

Conventional coil handling devices have failed to satisfy the above-mentioned requirements, either because they operate too slowly or because they are unable to avoid deformation of larger size coils. It is therefore an object of the present invention to provide an improved means for handling the coiled product of a rolling mill, which means is capable of rapid operation without causing coil deformation. This is accomplished by providing axial support for the coils being handled whenever the

coils are moved or operated upon prior to and during the compacting and tying operation. By axially supporting the coils in this manner, coil deformation is completely avoided while at the same time permitting a much more rapid lateral transfer than was heretofore possible with conventional apparatus.

Another object of the present invention is to provide axial support for the coils during substantially the entire coil forming operation, the said axial support taking the form of a mandrel movable vertically from a lowered inoperative position beneath the support surface on which the coil is being formed to a raised operative position protruding thereabove. The mandrel cooperates with the surrounding wall of the coil forming apparatus to produce an improved coil having a more uniform and stable structure.

A further object of the present invention is to provide means for laterally displacing the raised mandrel following completion of the coil forming operation, thus enabling each completed coil to be rapidly displaced laterally by the mandrel without any danger of the coil deforming or toppling over.

Another object of the present invention is to provide means for quickly positioning a fresh mandrel at the coil forming station, thus minimizing the period during which product rings are allowed to accumulate without axial support.

Another object of the present invention is to provide means for clearing coils from the compacting and tying station, the said means operating in conjunction with the means employed to transfer coils between the coil forming station and the compacting and tying station.

A still further object of the present invention is to provide one or more coil support mandrels movable laterally between the coil forming station and the compacting and tying station, each mandrel being retractable to an inoperative position beneath a generally horizontal coil supporting surface extending between both stations.

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 vertical sectional view taken through one embodiment of a coil handling apparatus constructed in accordance with the present invention;

FIG. 2 is a horizontal sectional view taken along line 2—2 of FIG. 1 with portions of the horizontally extending coil supporting surface broken away to better illustrate structural details of components located therebelow;

FIG. 3 is a sectional view on an enlarged scale taken along lines 3—3 of FIG. 2;

FIG. 4 is a sectional view on an enlarged scale taken along line 4—4 of FIG. 1;

FIGS. 5–10 are schematic illustrations depicting the operational sequence of the embodiment illustrated in FIGS. 1–3;

FIG. 11 is a vertical sectional view on an enlarged scale showing an alternate embodiment of the means employed to transfer coils from the coil forming station to the adjacent delay station; and,

FIG. 12 is a sectional view taken along line 12—12 of FIG. 11.

In the description of the invention to be hereinafter provided, reference will be had to the coiled product of a rod rolling mill. It is to be understood, however, that this reference to a particular type of rolling operation is for illustrative purposes only and is not to be considered as a limitation upon the scope of the claims appended hereto. In actual practice, the concepts of the present invention may be applied to any situation where coiled product is to be laterally transferred from one location to another.

Referring initially to FIGS. 1 and 2 wherein are best shown general features of one embodiment of the present invention, there is provided a coil forming station generally indicated at A having spaced laterally therefrom a compacting and tying station C. Stations A and C are joined by a horizontal floor 14 which continues beyond compacting and tying station C to a point adjacent a transversely extending conveyor E.

Coil forming station A is comprised basically of a cylindrical housing 18 overlying one end of floor 14 and having an opening 20 in the housing wall at its lower end to permit lateral removal of a completed coil therefrom. The mill product, which has herein been shown as having been previously formed into a continuous series of rod rings 22, is dropped under the influence of gravity into housing 18 to accumulate in coil form as at *a* on floor 14.

As soon as the coil *a* has been completely accumulated, a horizontally disposed gate 26 is advanced by conventional means (not shown) through a second opening 28 to an operative position extending across housing 18 and indicated in dotted line in FIG. 1 by the reference numeral 26*a*. By advancing gate 26, the lower portion of housing 18 containing the completed coil *a* is completely separated from the upper portion of the housing, thus enabling the next continuous series of rings 22 to accumulate temporarily on the upper surface of the gate. It should be noted at this point that where desired, gate 26 can be made to cooperate with an appropriately positioned shear to cut an intercepted rod ring and thus sever the completed coil *a* from a continuous supply of descending rings. This concept is disclosed in U.S. Patent No. 3,176,385. As will hereinafter be described in greater detail, following advancement of gate 26 across housing 18, each completed coil *a* is shifted laterally through opening 20 along floor 14 to a position indicated at *c* at the compacting and tying station C. The coil is then compacted and tied prior to being laterally transferred to a position indicated at *e* on conveyor E. From here, each coil is transported to a remote storage area.

The means employed to laterally transfer each completed coil from the coil forming station A through the the compacting and tying station C to conveyor E will now be described. As can be best seen by a combined reference to FIGS. 1–3, there is provided beneath floor 14 a horizontally extending support structure 30 mounted on spaced upstanding vertical legs 32*a* and 32*b*. Support structure 30 includes a pair of spaced parallel beams 34*a* and 34*b*, each beam being provided with a pair of upper and lower guide rails 36 and 38. The guide rails extend from a point beneath station A to a point beneath station C.

A first carriage assembly generally indicated by the reference numeral 40 is shown mounted at one end of support structure 30 at a point beneath the portion of floor 14 underlying coil forming station A. Carriage assembly 40 includes a pair of vertically disposed structural members 42*a* and 42*b* interconnected by a plurality of laterally extending cross braces 44*a*, 44*b* and 44*c*. Wheels 48 carried by cross braces 44*b* and 44*c* engage the upper and lower guide rails 36 and 38, thus permitting the carriage assembly 40 to be rolled horizontally along support structure 30. Additional guide wheels 49 (see FIG. 3) bear against the edges of the upper guide rail 36 carried by beam 34*b*, thus providing a means of preventing the carriage assembly 40 from tipping in a direction transverse to the length of support structure 30.

A vertically disposed double acting cylinder 50 is mounted on lower cross brace 44*a*, its extensible piston rod 52 being in turn pivotally connected as at 54 to a mandrel 56. The lower portion of mandrel 56 is provided with laterally extending wheels 58 suitably arranged to roll along vertically disposed guide rails 60, the latter being carried by the structural members 42*a* and 42*b*. As shown in the drawings, when raised to its uppermost position, mandrel 56 extends vertically through an elongated opening or slot 62 in floor 14, it being understood (see FIG. 2) that slot 62 extends along floor 14, from coil forming station A to conveyor E.

Carriage assembly 40 is further provided with a horizontally disposed double acting hydraulic cylinder 64 having its extensible piston rod 66 connected as at 67 to a stationary cross brace 68 on support structure 30. By actuating cylinder 64 to extend and retract piston rod 66, carriage assembly 40 can be moved between a position beneath the coil forming station A and an alternate position underlying an intermediate delay station B.

A second carriage assembly 70 is shown positioned at the compacting and tying station C. Carriage assembly 70 is basically comprised of two vertically disposed structural members 72*a* and 72*b* interconnected by transverse horizontally disposed braces 74*a*, 74*b* and 74*c*. Braces 74*b* and 74*c* are provided with wheels 76 adapted to roll along the guide rails 36 and 38 of support structure 30 in much the same manner as the wheels 48 of carriage assembly 40.

Carriage assembly 70 is further provided with a mandrel 78 having wheels 80 suitably spaced to engage vertically disposed guide rails 82 carried by structural members 72*a* and 72*b*. Mandrel 78 is movable vertically from a lowered position beneath floor 14 to a raised position protruding vertically thereabove (as shown in FIG. 1), this movement being accomplished by means of a double acting cylinder 84 carried by cross brace 74*a*. Carriage assembly 70 is movable between stations B and C along guide rails 36 and 38 of support structure 30 by means of a horizontally disposed double acting cylinder 86 having an extensible piston rod 87 connected as at 88 to a stationary brace on support structure 30. As can be best seen by a combined reference to FIGS. 1 and 4, compacting and tying station C includes the combination of a platen assembly 90 which operates in conjunction with conventional strapping machines 92 and 94 to first compact and then tie free-standing coils previously formed at the coil forming station A. Platen assembly 90 is comprised of two press plates 96*a* and 96*b* spaced to provide an opening 98 therebetween. Each press plate is connected to the extensible piston rod of a heavy duty hydraulic cylinder, there being two cylinders 100*a* and 100*b* provided, one to drive each press plate.

With a free-standing fully formed coil positioned as indicated at *c* at the compacting and tying station C, compaction is achieved by simply actuating both cylinders 100*a* and 100*b* to drive the press plates 96*a* and 96*b* downwardly against the top of the coil. The space 98 permits the press plates to straddle mandrel 78 during this downward stroke. When the press plates 96*a* and 96*b* have reached the lowermost point of the compacting stroke, the strapping machines are swung from remote inoperative positions shown in dotted lines at FIG. 4 at 92*a* and 94*a* to the operative position shown by the solid lines in FIGS. 1 and 4. Each strapping machine is carried on an arm 101 which extends radially from a collar 102, the latter being slidable vertically on a fixed support post 103.

The strapping machines are each further provided with a pair of vertically extending strap tracks 104*a* and 104*b* suitably spaced to define an opening 105 therebetween slightly wider than the width of the coil walls. The vertically extending strap tracks 104*a* and 104*b* are connected at their upper ends by a fixed intermediate section 106 and at their lower ends by a pivotal section 107.

After being pivoted to the operative positions indicated in FIG. 4, the strapping machines are lowered until the vertical strap track sections 104*a* and 104*b* straddle the walls of coil *c*. Grooves 108 in the side edges of mandrel 78 permit downward vertical displacement of strap tracks 104*b* along the inside of the coil walls. When the strapping machines have been lowered to the positions 92*c* and 94*c* (see FIG. 1), the pivotal strap track sections 107 are swung inwardly through suitably shaped groves 109 in mandrel **78** to provide a connection between the lowermost ends of the vertical strap tracks **104***a* and **104***b*. This having been accomplished, the strapping machines are actuated to feed two length of strap around the walls of the compacted coil. The above-described operation is then reversed and then the strapping machines raised and pivoted to the inoperative positions shown at **92***a* and **94***a* prior to raising the press plates **96***a* and **96***b*. This results in coil *c* being fully compacted and strapped at 180° intervals.

Carriage assembly **70** is further provided with an auxiliary pusher mechanism generally indicated by the reference numeral **110**. This mechanism is comprised of a coil engaging member **112** pivotally connected to the carriage assembly **70** by means of upper and lower links **114***a* and **114***b*. A double acting acting cylinder **115** provides a means for pivotally raising and lowering the coil engaging member **112** from an upwardly disposed position protruding through the elongated slot **62** in floor **14** to a lowered position as shown in dotted lines in FIG. 1 at **110***a*. As will hereinafter be described in greater detail, auxiliary pusher mechanism **110** provides a means of moving compacted tied coils from the compacting and tying station C to a second delay station D located between station C and the transversely extending coil conveyor E.

A coil pulling mechanism generally indicated by the reference numeral **116** is also provided for finally moving coils from the delay station D onto the conveyor E. Mechanism **116** is comprised basically of a carriage **117** having wheels **118** adapted to roll along relatively short parallel guide rails **119**. Carriage **117** is further provided with a coil pulling member **120** which is pivoted by means of a short double acting cylinder **121** between a raised operative position protruding upwardly through the slot **62** in floor **14** and a lowered inoperative position as indicated by the dotted lines in FIG. 1. A second double acting cylinder **122** provides the means for moving the coil pulling mechanism **116** between the delay station D and a position underlying the coil conveyor E.

Having thus provided a description of each of the basic components comprising the coil handling apparatus shown in FIGS. 1–4, the operation of this apparatus will now be described with further reference to the schematic illustrations provided by FIGS. 5–10.

Stage I

Referring initially to FIG. 5, a stage in the operation of the coil handling apparatus is illustrated wherein a coil *a* has just been completely formed at coil forming station A and the gate **26** moved across the station. The mandrel **56** of carriage assembly **40** is in the raised position protruding upwardly through the slot **62** in floor **14** into an axially inserted position through coil *a*. A previously formed free-standing coil *b* is at delay station B with the mandrel **78** of carriage assembly **70** extending axially therethrough. A third compacted and tied coil *c* is at compacting and tying station C. The platen assembly **90** has been raised and the strapping machines (see FIGS. 1 and 4) moved to their inoperative positions. Coil *c* has been engaged by the raised coil engaging member **112** which forms a part of the auxiliary pusher mechanism **110** carried by carriage assembly **70**. A fourth compacted and tied coil *e* has been pulled onto conveyor E by a coil pulling member **120**, the latter then having been pivotally lowered beneath floor **14**. At this point, it should be noted that both coils *a* and *b* are in the free-standing state and are thus vulnerable to deformation if not carefully handled. The axial insertion of mandrels **56** and **78** into these coils prevents this possibility by imparting stability to the coils.

Stage II

The next step in the operation of the apparatus is shown in FIG. 6 wherein it can be seen that both carriage assemblies **40** and **70** have been moved simultaneously to the left, resulting in the positioning of coil *a* at delay station B and coil *b* at the compacting and tying station C. It is important to note that this lateral tranfer of the free-standing coils *a* and *b* is accomplished by the motion of mandrels **56** and **78**, the latter providing an uninterrupted measure of coil stability. The compacted and tied coil *c* which had previously been located at compacting and tying station C has now been pushed to delay station D by the coil engaging member **112** of auxiliary pusher mechanism **110**, the latter being carried as an integral part of carriage assembly **70**. The compacted and tied coil *e* has now been carried away from the centerline of the coil handling apparatus by conveyor E. Also, during this operational phase, rod rings **22** from the next oncoming billet have begun to accumulate temporarily as at *f* on the upper surface of the advanced gate **26**.

Stage III

During this stage in the operational sequence of the apparatus (see FIG. 7), mandrel **56** is axially withdrawn from coil *a* through slot **62** to a position beneath the surface of floor **14**. This gives operating personnel an opportunity to inspect coil *a* and trim any off-gauge rings located at the top of the coil. Mandrel **78** remains in a raised position as the platen assembly **90** is pushed downwardly to compact coil *b*. At the same time the auxiliary pusher mechanism **110** is lowered to an inoperative position and the coil engaging member **120** of coil pulling mechanism **116** advanced from station E to a point extending slightly beyond delay station D. During this period of time, rod rings continue to temporarily accumulate as at *f* on the upper surface of gate **26**.

Stage IV

As shown in FIG. 8, the lowered mandrel **56** has now been returned to a position underlying coil forming station A as rings continue to temporarily accumulate on the upper surface of gate **26** as at *f*. Free-standing coil *a* remains stationary at delay station B. The platen assembly **90** at station C remains lowered, maintaining coil *b* in a compacted condition as the strapping machines **92** and **94** run through a strapping cycle. The coil engaging member **120** of coil pulling assembly **116** has been raised through slot **62** in floor **14** to engage coil *c* at delay station D.

Stage V

At this point, mandrel **56** has been raised through slot **62** in floor **14** and the gate **26** withdrawn, thus allowing the rings temporarily accumulated thereon to fall to floor **14** for the continued accumulation of the next coil *f*. Simultaneously, at compacting and tying station C, the strapping machines **92** and **94** have been returned to their inoperative positions, platen assembly **90** raised and the mandrel **78** lowered through slot **62** beneath the surface of floor **14**.

Stage VI

During this stage, rings **22** continue to accumulate in a coil *f* at the coil forming station A. Mandrel **78** has been moved laterally to a position underlying and axially aligned with the coil *a* at delay station B. This lateral movement of the carriage **70** carrying mandrel **78** has also resulted in the auxiliary coil pusher mechanism **110** being moved to a position underlying the compacted and tied coil *b* at station C. At the same time, coil *c* has been moved from delay station D onto the conveyor E. The next stage in the operation of the apparatus will return all components to the Stage I positions illustrated in FIG. 5.

In viewing of the foregoing, it should now be apparent to those skilled in the art that a number of advantageous features are incorporated in the above-described apparatus. More particularly, it is important to note that the lateral transfer of free-standing coils between stations A and C is always accompanied by axial support for the coils provided by either mandrel **56** or **78**. This in turn permits rapid lateral acceleration and deceleration of the coils without any resulting deformation or toppling. In addition, it should also be noted that mandrel **56** only travels a relatively short distance between station A and delay station B. With this arrangement, mandrel **56** can be returned quickly to station A, thus minimizing the time during which rod rings are allowed to temporarily accumulate on gate **26** without the benefit of axial support.

Referring now to FIGS. 11 and 12, an alternate embodiment of the invention is shown wherein means are provided for further decreasing the time during which rod rings **22** are allowed to accumulate at coil forming station A without the benefit of axial support from a raised mandrel. More particularly, two independent and opposite hand carriage assemblies **126*a*** and **126*b*** are mounted on support structure **30** for movement between coil forming station A and delay station B. As will hereinafter become apparent, these carriage assemblies are positioned on opposite side of the centerline of the apparatus, thus permitting one carriage assembly to by-pass the other.

Carriage assembly **126*a*** is comprised basically of spaced vertical support members **127** and **128** interconnected by cross braces **129, 130** and **131**. Wheels **132** carried by cross braces **130** are incorporated in the above-described apparatus. More particularly, it is important to note that the lateral transfer of free-standing coils between stations A and C is always accompanied by axial support for the coils provided by either mandrel **56** or **78**. This in turn permits rapid lateral acceleration and deceleration of the coils without any resulting deformation or toppling. In addition, it should also be noted that mandrel **56** only travels a relatively short distance between station A and delay station B. With this arrangement, mandrel **56** can be returned quickly to station A, thus minimizing the time during which rod rings **22** are allowed to temporarily accumulate on gate **26** without the benefit of axial support.

Referring now to FIGS. 11 and 12, an alternate embodiment of the invention is shown wherein means are provided for further decreasing the time during which rod rings **22** are allowed to accumulate at coil forming station A without the benefit of axial support from a raised mandrel. More particularly, two carriage assemblies **126*a*** and **126*b*** are mounted on support structure **30** for movement between coil forming station A and delay station B. As will hereinafter become apparent, these carriage assemblies are positioned on opposite sides of the centerline of the apparatus, thus permitting one carriage assembly to by-pass the other.

Carriage assembly **126*a*** is comprised basically of spaced vertical support members **127** and **128** interconnected by cross braces **129, 130**, and **131**. Wheels **132** carried by cross braces **130** and **131** ride on the upper and lower guide rails **36** and **38** of structural member **34*a***. Additional wheels **133** engage the edges of a third guide rail **134**, thus providing a measure of stability for the carriage assembly by preventing tipping in a direction transverse to the length of support structure **30**. Carriage assembly **126*a*** is further provided with a mandrel **135** movable vertically under the influence of a double acting cylinder **136** mounted on lower cross brace **129**. Mandrel **135** is guided in its vertical movement by wheels **137** suitably positioned to run along vertical tracks **138** carried by support members **127** and **128**. Carriage assembly **126*a*** is propelled between stations A and stations B by means of a second double acting cylinder **139**.

Carriage assembly **126*b*** is positioned on the opposite side of support structure **30** and is provided with a construction substantially identical to that of carriage assembly **126*a***. More particularly, carriage assembly **126*b*** is carried on the upper and lower rails **36** and **38** of structural member **34*b*** by means of wheels **32′** carried on cross braces **130′** and **131′**. Additional wheels **133′** grip

the edges of a lower guide rail **134′**, and, a second double acting cylinder **139′** provides a means of propelling carriage assembly **126*b*** between stations A and B. Carriage assembly **126*b*** is also provided with a mandrel **135′** movable vertically under the influence of a double acting cylinder **136′**.

As illustrated in FIGS. 11 and 12, carriage assembly **126*b*** is positioned beneath coil forming station A with its mandrel **135′** extending upwardly through the slot **62** in floor **14** to thus provide a means of axially supporting a coil being accumulated at *g*. Carriage assembly **126*a*** is located beneath delay station B with its mandrel **135** lowered to the inoperative position beneath floor **14**. A previously formed free standing coil *h* is at rest at delay station B. Since the carriage assemblies **126*a*** and **126*b*** are positioned on either side of support structure **30** and are thus able to by-pass each other, after lowering mandrel **135**, carriage assembly **126*a*** can be moved immediately to a position underlying coil forming station A. This will permit a third carriage assembly such as that referred to in FIGS. 1–10 by the reference numeral **70** to move coil *h* to the compacting and strapping station C. As soon as coil *g* has been completely accumulated, the intercepting gate **26** is advanced and carriage assembly **126*b*** moved from coil forming station A to delay station B. Immediately after the coil *g* has been cleared from station A, the mandrel **135** of carriage assembly **126*a*** is raised through the slot **62** in floor **14** and the gate **26** again withdrawn, thus permitting the formation of the next coil to continue with the benefit of axial support from the raised mandrel **135**. It can therefore be seen that by operating two carriage assemblies **126*a*** and **126*b*** between stations A and B, a mandrel can be quickly positioned at the coil forming station with the only delay being that required to laterally displace a completed coil outwardly through the opening **20** in the side wall of housing **18**.

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

I claim:

1. Apparatus for laterally transferring coils from a first station to a second laterally adjacent station, said apparatus comprising; a support surface for a coil at said first station, said support surface extending from said first station to said second station, said support surface having an elongated opening extending along substantially the entire length thereof; carriage means beneath said support surface; mandrel means carried by said carriage means, said mandrel means being adjustable vertically through said opening from a lowered inoperative position beneath said support surface to a raised operative position extending axially through a coil on said support surface; and operating means for moving said carriage means in both a forward and rearward direction parallel to said elongated opening, thus enabling a coil at said first station to be moved by said raised mandrel means, along said support surface to said second station.

2. The apparatus as set forth in claim **1** wherein said carriage means is movably mounted on a stationary support structure extending from a position underlying said first station to a position underlying said second position.

3. The apparatus as set forth in claim **2** further characterized by means at said first station for collecting a continuous series of descending product rings into a coil on said support surface.

4. The apparatus as set forth in claim **3** further characterized by means at said second station for compacting and tying coils transported thereto from said coil forming station by said raised mandrel means.

5. In a rolling mill, apparatus for laterally transferring coils from a coil forming station to a compacting and tying station, said apparatus comprising: a support floor for coils being formed at said coil forming station, said support floor extending from said coil forming station to said compacting and tying station, said support floor being further provided with an elongated slot extending along the length thereof between said stations; carriage means beneath said support floor; mandrel means carried by said carriage means, said mandrel means being adjustable vertically through said slot from a lowered inoperative position beneath said support floor to a raised operative position extending axially through a coil on said support floor; and operating means for moving said carriage means in both a forward and rearward direction parallel to said elongated slot, thus enabling a coil to be moved by said raised mandrel means along said support floor from said coil forming station to said compacting and tying station.

6. The apparatus as set forth in claim **5** wherein said carriage means is comprised of at least two carriage assemblies, one of said carriage assemblies being movable beneath said support floor between said coil forming station and a first delay station located between said coil forming station and said compacting and tying station, the other of said carriage assemblies being movable beneath said support floor between said first delay station and said compacting and tying station, each said carriage assemblies being provided with mandrels adjustable vertically through said elongated slot between inoperative positions located beneath said support floor and operative positions protruding thereabove.

7. The apparatus as set forth in claim **6** further characterized by guide means carried by the mandrel on said other carriage assembly, the said guide means being adapted to cooperate with tying means at said compacting and tying stations in tying coils at 180° intervals.

8. The apparatus as set forth in claim **6** further characterized by conveyor means spaced laterally from said compacting and tying station on the side thereof opposite to that facing said coil forming station, a second delay station positioned between said compacting and tying station and said conveyor means, each said stations being aligned along a common axis with said conveyor means extending in a direction transverse to said axis, and an extension of said support floor joining said compacting and tying station to said conveyor means, the elongated slot in said floor extending along said axis from said coil forming station to said conveyor means.

9. The apparatus as set forth in claim **8** further characterized by coil pusher means carried by said other carriage assembly, means for vertically adjusting said pusher means from a depressed inoperative position beneath said support floor to a raised operative position protruding upwardly through said slot, the said pusher means being operative when in a raised position to engage and move compacted tied coils from said compacting and tying station to said second delay station when the said other carriage assembly is moved from said first delay station to said compacting and tying station.

10. The apparatus as set forth in claim **9** further characterized by coil pulling means for transferring compacted tied coils from said second delay station to said conveyor means, said coil pulling means including a coil engaging member adjustable vertically through said slot from a depressed inoperative position beneath said support floor to a raised operative position protruding thereabove.

11. In a rolling mill, apparatus for transferring free-standing cylindrical coils from a coil forming station to a compacting and tying station, at which station the free-standing coils are compacted and tied, and for thereafter transferring said compacted tied coils from said compacting and tying station to a delivery conveyor, said apparatus comprising: a support floor for coils being formed at said coil forming station, said support floor extending from said coil forming station through said compacting and tying station to said conveyor, said support floor being further provided with an elongated slot extending along substantially the entire length thereof; a first carriage means movable beneath said support floor between said coil forming station and a first delay station located at a point intermediate said coil forming station and said compacting station, a first mandrel means carried by said first carriage means, said first mandrel means being adjustable vertically through said slot between a lowered position beneath said support floor and a raised position extending axially through a free-standing coil at said coil forming station, operating means for moving said first carriage means in a direction parallel to said elongated slot, thus causing said free-standing coil to be moved by said raised first mandrel means along said support floor to said first delay station; a second carriage means movable beneath said support floor between said first delay station and said compacting and tying station, a second mandrel means adjustably mounted on said second carriage means for movement through said elongated slot between a lowered position beneath said support floor and a raised position extending axially through a free-standing coil at said first delay station, operating means for moving said second carriage means in a direction parallel to said elongated slot, thus causing the free-standing coil axially engaged by said second mandrel means to be moved to said compacting and tying station, at which station said coil is compacted and tied; coil pusher means carried by said second carriage means for pushing compacted tied coils from said compacting and tying station to a second delay station located between said compacting and tying station and said conveyor; and coil pulling means for pulling compacted tied coils from said second delay station onto said conveyor.

12. The apparatus as set forth in claim **11** further characterized by a support structure underlying said support floor, said support structure extending from said coil forming station to said compacting and tying station, said first and second carriage means being mounted on said support structure for movement along the length thereof in a direction parallel to said elongated slot.

13. The apparatus as set forth in claim **12** wherein said first carriage means is comprised of two carriage assemblies mounted on said support structure for movement between said coil forming station and said first delay station, each said carriage assemblies being provided with independently operable vertically adjustable coil supporting mandrels.

14. The apparatus as set forth in claim **13** wherein said carriage assemblies are positioned on opposite sides of the longitudinal axis of said support structure, thus enabling said carriage assemblies to by-pass each other when moving along said support structure between said coil forming station and said first delay station.

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BILLY J. WILHITE, *Primary Examiner.*