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Sieurin et al.

[11] **3,926,382**

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[54] **COIL FORMING AND TRANSFER APPARATUS**

[75] Inventors: **Donald Sieurin,** Northboro; **Roger Kinnicutt, Jr.,** Holden, both of Mass.

[73] Assignee: **Morgan Construction Company,** Worcester, Mass.

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[52] **U.S. Cl.** **242/79;** 242/81

[51] **Int. Cl.²** **B21C 47/24**

[58] **Field of Search** 242/81, 79; 140/1

[56] **References Cited**

UNITED STATES PATENTS

434,190	8/1890	Matteson	242/81
667,870	2/1901	Edwards	242/81
854,808	5/1907	Daniels	242/81
3,020,000	2/1962	Morgan	242/81
3,618,871	11/1971	Gilvar	242/81

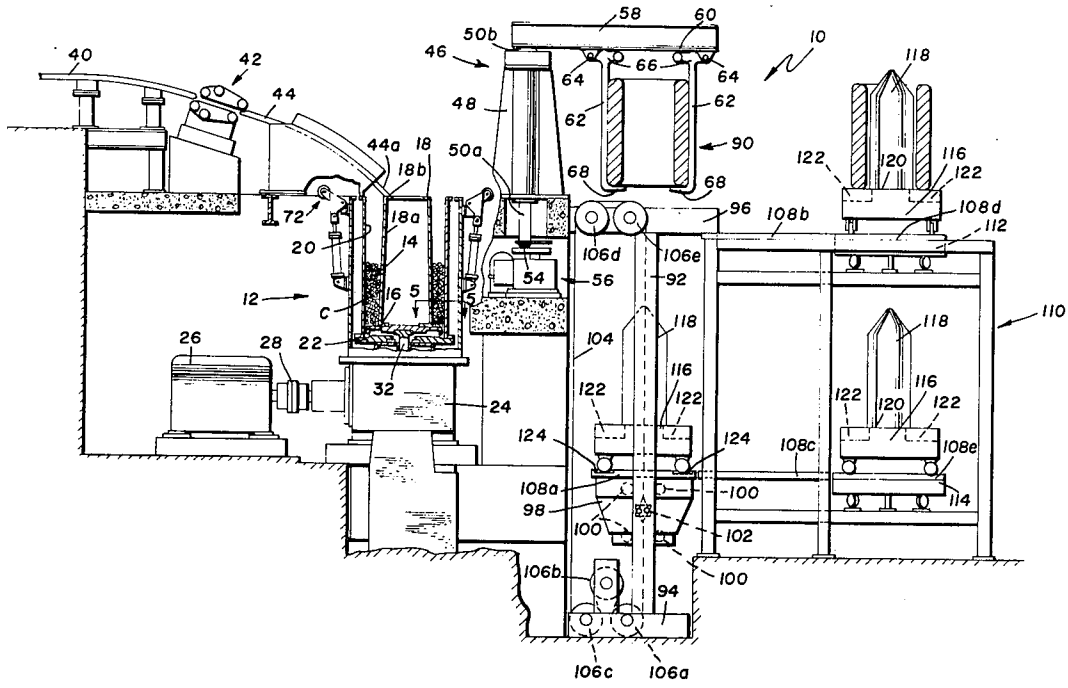
Primary Examiner—Edward J. McCarthy

Attorney, Agent, or Firm—Thompson, Birch, Gauthier & Samuels

[57] **ABSTRACT**

A coil forming and transfer apparatus is disclosed. The apparatus includes a pouring reel having a coil forming chamber defined by a peripherally notched or relieved coil support plate, an inner core fixed relative to and extending vertically from the support plate, and an outer chamber wall. These components are rotatable in unison during a coil forming operation, with the mill product being directed into the chamber where it accumulates in coil form. The support plate and core are vertically movable in relation to the outer chamber wall to remove a completed coil from the coil forming chamber to an elevated position thereabove. A transfer mechanism is provided adjacent to this elevated position. The transfer mechanism has a plurality of circularly arranged legs with inwardly protruding feet. The legs are movable from inoperative positions spaced radially from a coil at the elevated position, to operative positions radially engaging the coil, with the aforesaid feet located beneath the coil in the peripheral notches of the support plate. Once the legs are operatively positioned, the coil support plate is lowered, causing the core to be withdrawn from the coil, and further causing the coil to be deposited on the feet of the operatively positioned legs. The transfer mechanism is movable to another location at which the coil is removed therefrom onto associated handling equipment.

10 Claims, 6 Drawing Figures



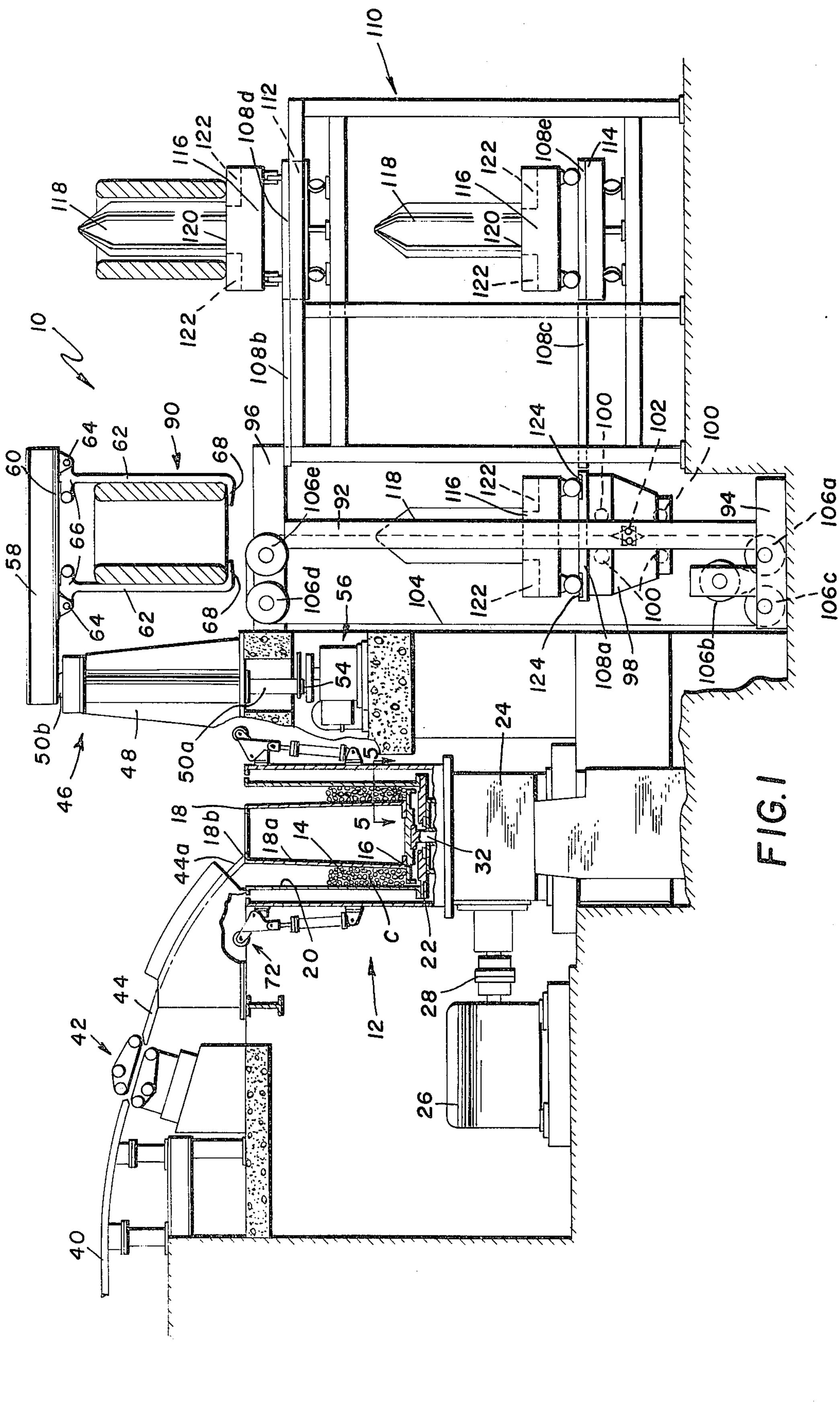
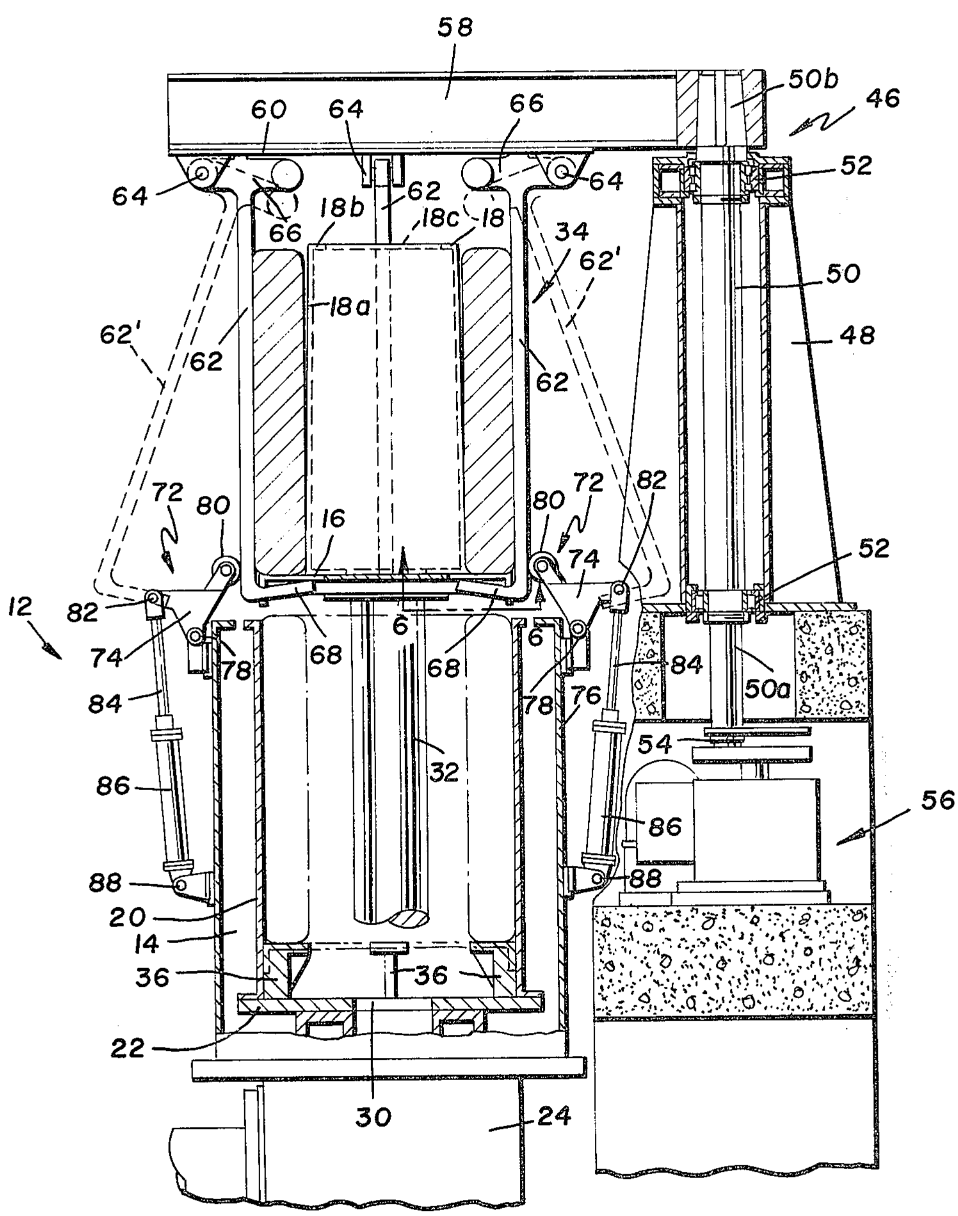


FIG. 1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66
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62
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18b
18c
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34
62'
18a
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62'
62
62
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72
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16
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72
82
52
12
82
74
74
6
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68
68
78
84
50a
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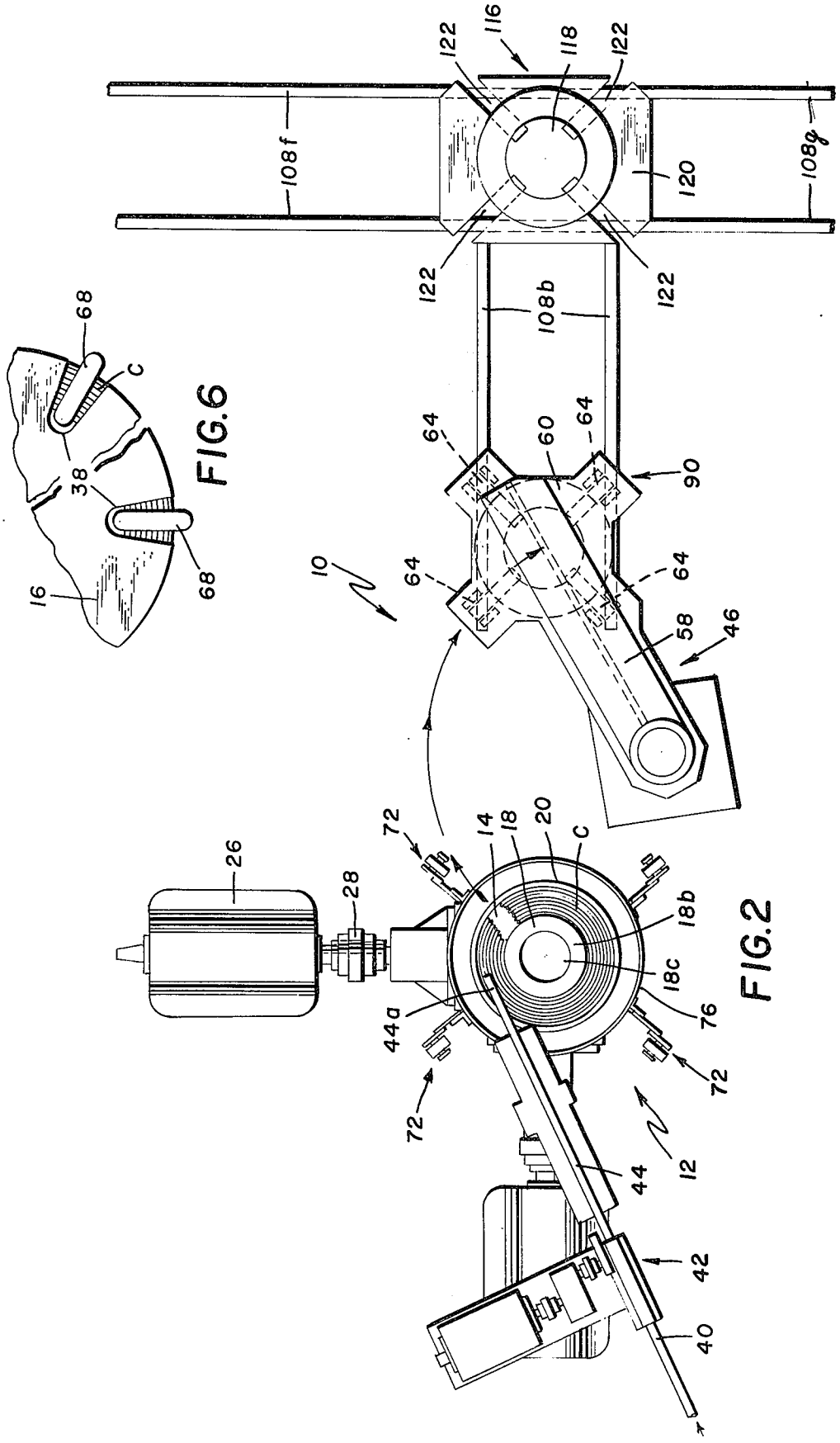
FIG.3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116
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108f
120
108g
122
122
108b
68
C
64
60
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90
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64
64
58
46
72
14
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72
12
44
42
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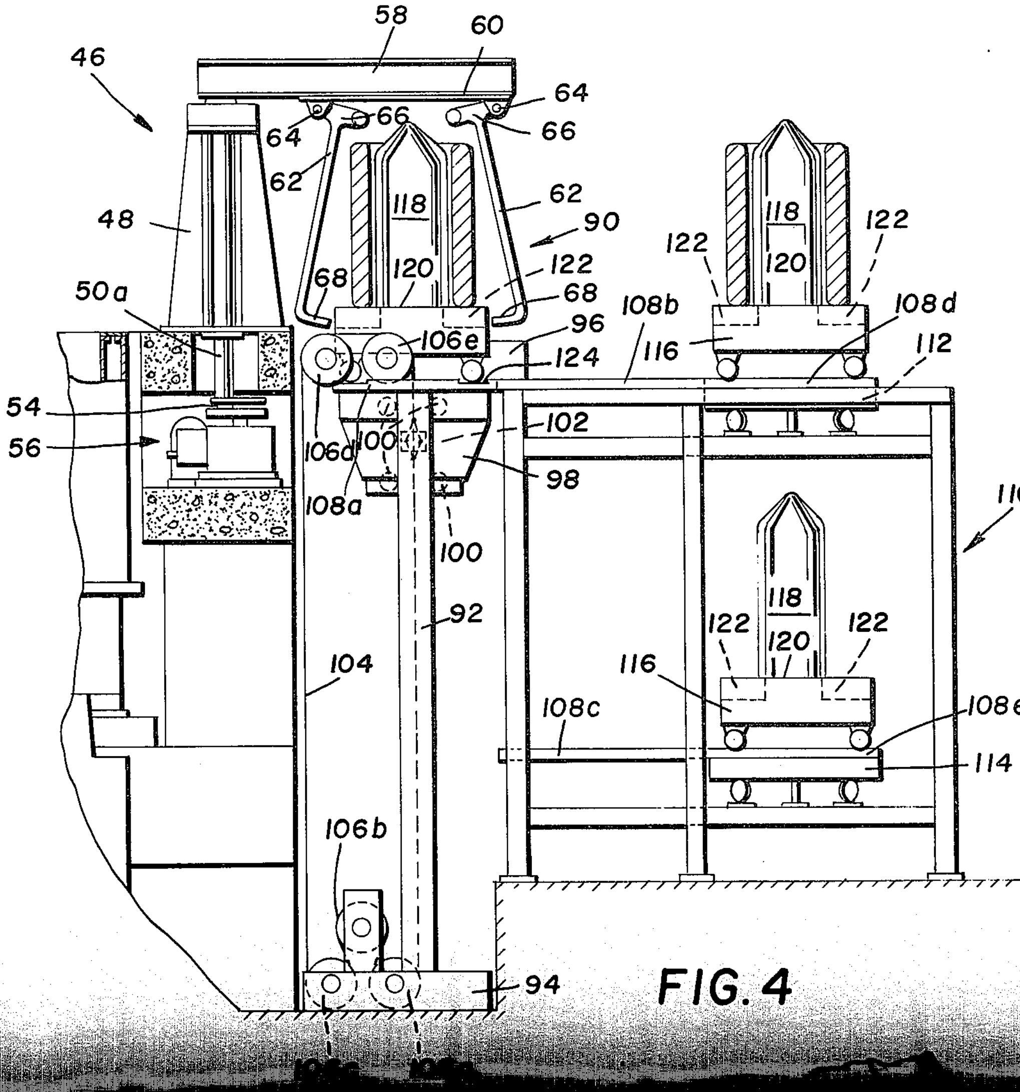
FIG.6

FIG.2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50a
68
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124
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118
122
122
120
108d
116
112
54
56
102
106d
100
98
108a
100
110
92
104
118
122
122
120
116
108c
108e
114
106b
94

FIG. 4

COIL FORMING AND TRANSFER APPARATUS

BACKGROUND OF THE INVENTION

This invention relates generally to rolling mills wherein rolled products are formed into coils by means of pouring reels.

In modern high-speed mills, the size of the coils being produced by the pouring reels is constantly on the increase. Due to their increased height, these larger coils are unstable, and difficult to handle. This problem becomes particularly acute after the coils have been stripped from the pouring reels and they are in transit to other equipment.

The object of the present invention is to provide a coil forming and transfer apparatus having an improved capability for maintaining coil stability while handling the larger coils produced by modern high-speed mills.

SUMMARY OF THE INVENTION

According to the invention, there is provided a pouring reel having a coil forming chamber defined by a peripherally notched or relieved coil support plate, an inner core fixed relative to and extending vertically from the support plate, and an outer chamber wall. These components are all rotatable in unison during the coil forming operation, and the mill product is directed into the chamber by known means to accumulate therein in coil form.

A typical example of this type of installation is a bar mill producing ½ inch round stock at a delivery speed of 4,000 feet/min. The coils formed by the pouring reels would have a 44 inch I.D., a 54 inch O.D., a height of approximately 7 feet and a density of approximately 0.065 lbs./in.^{3}. It will be appreciated that coils of this size and density are unstable and likely to deform or topple if not properly handled. To this end, at the completion of a coil forming operation, the present invention contemplates raising the coil support plate and its vertically extending core relative to the outer chamber wall to an elevated position in order to strip the coil from the pouring reel. At this stage, coil stability is maintained due to the internal radial support provided by the core.

A transfer mechanism is located adjacent to the aforesaid elevated position. The transfer mechanism includes a plurality of legs which depend from an overlying support. The legs are arranged generally in a circle surrounding the elevated position, and each leg has an inwardly protruding foot. The legs are movable from inoperative positions spaced radially from a coil at the elevated position to operative positions radially contacting the coil with the aforesaid feet located under the coil in the peripheral notches of the coil support plate. Once the legs have been operatively positioned, the coil support plate is lowered back into the pouring reel. The coil is thus deposited on the aforesaid feet as the core is axially withdrawn from the coil. At this point, coil stability continues to be maintained due to the fact that the coil is now radially confined externally by the operatively positioned legs.

The coil is then transferred to another lateral location by simply moving the overlying support. During this transfer, the coil is maintained in a stable condition by the confining action of the operatively positioned legs. Additional handling equipment is provided at the lateral location for removing the coil from the transfer mechanism, after which the overlying support and its depending legs are returned to the pouring reel in preparation for receipt of the next coil.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention will now be described by way of example only, with reference to the accompanying drawings, wherein;

FIG. 1 is a somewhat schematic view in side elevation, with portions broken away, of an apparatus embodying the concepts of the present invention;

FIG. 2 is a plan view of the apparatus shown in FIG. 1;

FIG. 3 is a sectional view on an enlarged scale of a portion of the apparatus shown in FIG. 1, showing the overlying support of the transfer mechanism over the pouring reel, with its depending legs operatively positioned around and elevated fully formed coil;

FIG. 4 is another somewhat schematic view in side elevation showing a means for removing a coil from the transfer mechanism;

FIG. 5 is a sectional view on an enlarged scale taken along lines 5—5 of FIG. 1; and,

FIG. 6 is a bottom view on an enlarged scale taken along lines 6—6 of FIG. 3.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to the drawings, there is generally depicted at **10** an apparatus embodying the concepts of the present invention. The apparatus includes a pouring reel **12** having a coil forming chamber **14** defined by a coil support plate **16**, an inner core **18** fixed relative to and extending vertically from the support plate, and an outer chamber wall **20**. The outer chamber wall extends vertically from a base **22** which underlies the coil support plate **16**. Base **22** is rotatably driven through gear means (not shown) in housing **24** by means of a motor **26** and coupling **28**.

The base **22** is further provided with a central opening **30** through which extends the piston rod **32** of a heavy duty hydraulic cylinder (not shown) also located in the underlying housing structure **24**. The piston rod **32** acts through its cylinder to vertically manipulate the coil support plate **16** and its inner core **18** between a lowered coil forming position as shown by the solid lines in FIG. **1** and an elevated coil stripping position as shown at **34** in FIG. **3**.

As can best be seen by a combined reference to FIGS. **3** and **5**, a number of tooth-like elements **36** are provided at the juncture between the chamber outer wall **20** and the base **22**. The elements **36** are received in peripheral notches **38** in the coil support plate **16** when the latter is in the lowered coil forming position as shown in FIG. **1**. It will thus be seen that by virtue of the interengagement of the projections **36** with the notches **38**, the coil support plate **16** and its inner core **18** will be rotatably driven in unison with the outer chamber wall **20** and its base **22** during a coil forming operation.

The inner core **18** has a slightly tapered truncated conical wall **18***a* and a top **18***b* with a hole **18***c* extending centrally therethrough. As will hereinafter be described, the tapered wall **18***a* facilitates axial removal of the core from a coil, and the hole **18***c* provides a means for exhausting heat from the core interior. Individual pins may be substituted for the inner core **18**. As hereinafter employed, the term "core means" is intended to encompass the core **18** as shown, individual pins, and any other like or equivalent components.

is directed from the mill (not shown) through pipe **40**, chain guide **42** and delivery pipe **44** into the coil forming chamber **14**. As previously noted, the chamber **14** is defined by components **16**, **18** and **20** which are all rotating in unison, with the result that the product is formed into rings which accumulate in coil form as at C. The delivery end **44***a* of pipe **44** is either retractable in accordance with the teachings of U.S. patent application Ser. No. 424,852 filed Dec. 14, 1973 now U.S. Pat. No. 3,873,040 and assigned to the assignee of this invention, or is movable in some other known way at the end of a coil forming operation, so as to provide clearance for the vertical removal of a coil from the coil forming chamber **14**.

As soon as a coil C has been fully formed, and the delivery end **44***a* of the pipe **44** has been retracted or otherwise cleared from the top of chamber **14**, piston rod **32** is actuated to raise the coil support plate **16**, core **18** and fully formed coil C to the elevated position **34** shown in FIG. **3**. A transfer mechanism generally indicated at **46** is located adjacent to the elevated position **34**. Transfer mechanism **46** includes a vertically extending support **48** in which is journalled a shaft **50** rotatable between bearings **52**. The lower end **50***a* of shaft **50** is connected as at **54** to a drive mechanism **56** of conventional design which operates to rotate the shaft **50** in either a clockwise or counter clockwise direction. The rotational axis of shaft **50** is parallel to that of the rotating components of the pouring reel **12**.

A cantilevered boom or overlying support **58** is connected to the upper end **50***b* of shaft **50**. The boom **58** has a head **60** carrying a plurality of depending legs **62**. The legs **62** are pivotally connected to the boom head **60** as at **64** and are arranged in a generally circular arrangement surrounding the upper position **34** when the overlying support or boom **58** is in the position shown in FIG. **3**. Each leg **62** has a counterweight section **66** adjacent to its upper end, and an inwardly protruding foot **68** adjacent to its lower end. The counterweight sections **66** urge the legs **62** to outwardly inclined inoperative positions indicated at **62'** by the phantom lines in FIG. **3**. When the overlying support **58** is located over the pouring reel **12** and the legs are in their inoperative positions as indicated **62'**, a completed coil C may be stripped from the pouring reel **12** and raised to the upper position **34**. The legs are thereafter pivoted to their operative positions as shown by the solid lines in FIG. **3**. This is accomplished by operating assemblies generally indicated at **72**. The operating assemblies **72** each comprise a bell crank **74** pivotally mounted on the outer pouring reel housing **76** as at **78**. Each bell crank **74** is provided at one end with a leg engaging roller **80**, and is pivotally connected at the other end as at **82** to the upper end of a piston rod **84**. The piston rod **84** extends outwardly from a double acting pneumatic cylinder **86** which is pivotally mounted at its lower end as at **88** to pouring reel housing **76**. The bell cranks **74** and their arm engaging rollers **80** operate to pivotally adjust the legs **62** inwardly to their operative positions as shown by the solid lines in FIG. **3**. When this is accomplished, as can best be seen in FIG. **6**, the feet **68** on the legs **62** enter the notches **38** in the coil support plate **16**. The feet thus underlie the coil bottom which at this stage is still supported on the coil support plate.

and core **18** are lowered back into the pouring reel **12**. The coil C remains supported at the upper position **34** on the feet **68**. The gradual taper of the core wall **18***a* facilitates axial withdrawal of the core **18** from the coil. Coil stability continues to be maintained due to the radial confining action of the legs **62**. As soon as the coil C has been transferred from coil support plate **16** to the feet **68**, the weight of the coil overcomes the combined weight of the counterweight section **66**, and thus maintains the legs in their operative positions. Consequently, the operating assemblies **72** may be pivoted outwardly to their inoperative positions as shown in FIGS. **1** and **2**, their retaining function now in effect having been assumed by the weight of the coil.

After the core **18** has been fully withdrawn from the coil C and the operating assemblies **72** have been opened, shaft **50** is rotated to pivot the overlying support or boom **58** to another lateral transfer location shown in the drawings at **90**. This can be followed immediately by a repositioning of the delivery end **44***a* of pipe **44** and commencement of the next coil forming operation.

One embodiment of an apparatus which may be employed to remove a coil from the transfer mechanism **46** will now be described with reference to FIGS. **1**, **2** and **4**. This apparatus includes vertically extending track means **92** extending between a base **94** and an upper transverse structural support **96**. An elevator **98** is mounted for vertical movement along the track means **92** by means of wheels **100**. The elevator **98** is attached as at **102** to a chain **104** which runs over sprockets **106***a*, **106***b*, **106***c*, **106***d* and **106***e*, it being understood that sprocket **106***b* is driven in a conventional manner (not shown) for rotation in either a clockwise or counter clockwise rotation as viewed in FIG. **1**. The upper surface of the elevator **98** is provided with track sections **108***a* which may be aligned horizontally with either upper or lower fixed track sections **108***b*, **108***c* on an adjacent support structure generally indicated at **110**. The upper fixed track sections **108***b* extend laterally (to the right as viewed in FIG. **1**) from location **90** to an upper turntable **112** which has short track sections **108***d* on its upper surface. Likewise, the lower fixed track sections **108***c* extend laterally to a lower turntable **114** which is also provided with short track sections **108***e* on its upper surface. Additional fixed upper tracks **108***f* (FIG. **2**) extend laterally away from the upper turntable **112**, and lower fixed tracks **108***g* extend in the opposite direction from lower turntable **114**.

The tracks **108***a*–**108***g* are adapted to guide and support carrier means in the form of wheeled carriages **116**. Each carriage **116** has a core or mandrel **118** extending vertically from a support surface **120** which is slotted as at **122**. In operation, this portion of the apparatus performs as follows: an empty carriage **116** is moved along tracks **108***g* onto the tracks **108***e* of the lower turntable **114**. Turntable **114** is then rotated through 90° to align its tracks **108***e* with the lower fixed tracks **108***c*. The elevator **98** is lowered to the position shown in FIG. **1**, and thereafter the carriage is moved from lower turntable **114** along tracks **108***c* and onto the tracks **108***a* of the elevator **98**. Preferably, the tracks **108***a* have slight depressions as at **124** in order to positively locate the wheels of the carriage **116** on the elevator **98**. Once this has been accomplished, the

elevator **98** is raised to its uppermost position as shown in FIG. **4**. The support surface **120** of the carriage **116** contacts the lower surface of a coil at transfer location **90**, as the mandrel **118** is axially inserted into the coil. The slots **122** in the support surface **120** of the carriage accommodate the feet **68** of the legs **62**. As the weight of the coil is shifted from the feet **68** to the support surface **120** of the carriage **116**, the legs **62** are pivoted outwardly to their inoperative position under the influence of the counter-weight sections **66**. At this stage of the operation, it will be understood that when the legs are pivoted outwardly to their inoperative positions, a sufficient clearance is provided between adjacent legs so as to permit lateral movement of a coil therebetween. Thus, once loaded, a carriage **116** can be removed laterally from elevator **98** along fixed upper tracks **108***b* and onto the tracks **108***d* of upper turntable **112**. The upper turntable **112** is then rotated through 90° to align its tracks **108***d* with tracks **108***f*, after which the loaded carriage is moved along tracks **108***f* to another location. While this is taking place, the elevator **98** is lowered back to the position shown in FIG. **1**, and the transfer mechanism **46** is returned to the position shown in FIG. **3**.

In light of the foregoing description, the advantages provided by the present invention will now be more readily understood by those skilled in the art. Among these advantages is the ability to impart stability to the coil during the coil forming operation, and thereafter throughout all subsequent handling operations. More particularly, it will be seen that coil stability is maintained during coil formation as a result of the inner and outer radial support provided respectively by the core **18** and outer chamber wall **20**. As a completed coil is thereafter stripped from the pouring reel and elevated to position **34**, stability continues to be maintained by virtue of the fact that the core **18** remains axially inserted in the coil. Stability is not jeopardized when the coil is shifted onto the transfer mechanism **46** because the legs **62** are operatively positioned to radially confine the coil before the core **18** is axially withdrawn. Similarly, coil stability continues to be maintained during and after removal of a coil from the transfer mechanism **46** due to the fact that the mandrel **118** of a carriage **116** is axially inserted into the coil before the legs are allowed to pivot outwardly to their inoperative positions.

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

We claim:

1. Apparatus for forming a longitudinally moving elongated product length into an upstanding cylindrical coil, and for transferring the thus formed coil to another location, comprising:

a pouring reel having a coil support plate, an inner core means fixed to and extending vertically from said support plate, and an outer wall means surrounding said support plate and said core means and cooperating therewith to define a chamber, the combination of said support plate, core means and outer wall means being rotatable whereby the introduction of the longitudinally moving elongated product length into said chamber will result in the product length being formed into an upstanding cylindrical coil;

means for elevating said support plate and said core means relative to said outer wall means to vertically remove the coil to an elevated position above said pouring reel; transfer means overlying said pouring reel, said transfer means being adapted to engage the coil at said elevated position, whereby when said support plate and said core means are lowered towards said pouring reel, the coil will remain supported at said elevated position on said transfer means; and means for moving said transfer means to another lateral location.

2. The apparatus as claimed in claim **1** wherein said transfer means includes a plurality of leg members depending from an overlying support, said leg members being arranged to surround the coil at said elevated position, said leg members having inwardly protruding feet, the periphery of said coil support plate being suitably adapted to accommodate positioning of said feet beneath a coil at said elevated position.

3. The apparatus as claimed in claim **2** wherein said leg members are pivotally carried on said support for movement between outwardly inclined inoperative positions radially spaced from a coil at said elevated position and operative positions at which said leg members are in radial contact with the coil at said elevated position and said feet are positioned beneath the coil.

4. The apparatus as claimed in claim **3** further characterized by counterweight means associated with said leg members for urging said leg members towards said inoperative positions.

5. The apparatus as claimed in claim **4** further characterized by operating means on said pouring reel for engaging and pivotally manipulating said leg members from said inoperative positions into said operative positions.

6. The apparatus as claimed in claim **5** wherein said pouring reel is further characterized by a fixed housing surrounding said outer wall means, and wherein said operating means is comprised of a plurality of crank members mounted on said housing, each of said crank members having roller means adapted to engage said leg members, and piston-cylinder units for manipulating said crank members.

7. The apparatus as claimed in claim **2** wherein said support is mounted for rotation about an axis which is parallel to the axis of rotation of said coil support plate, core means and outer wall means.

8. The apparatus as claimed in claim **1** further characterized by a carrier means at said lateral location, said carrier means having a second support plate with a second core means extending vertically therefrom, and means for elevating said carrier means from a lowered position underlying a coil supported on said transfer means at said lateral location to a raised position at which said second core means extends axially through the coil and said second support plate is in engagement with the bottom of said coil, thereby freeing said transfer means for return to said elevated location.

9. A coil forming and transfer apparatus comprising: a pouring reel having a coil forming chamber defined in part by a coil support plate and a central core fixed relative to and extending vertically from said support plate; means for elevating said support plate and central core to remove a coil from said pouring reel to an elevated position thereabove; transfer means having leg members adapted to radially confine the coil at said elevated location, said leg members having inwardly protruding feet adapted to vertically support the coil

upon lowering of said bottom support plate and said central core; and, means for moving said transfer means to another location at which the coil may be removed therefrom to other associated carrier means.

10. The apparatus as claimed in claim **9** wherein said coil support plate is suitably notched to accommodate positioning of said feet beneath a coil at said elevated position.

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