

March 3, 1964

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APPARATUS FOR TRANSFERRING COILS OF METALLIC STRIP

Filed Dec. 15, 1960

5 Sheets-Sheet 1

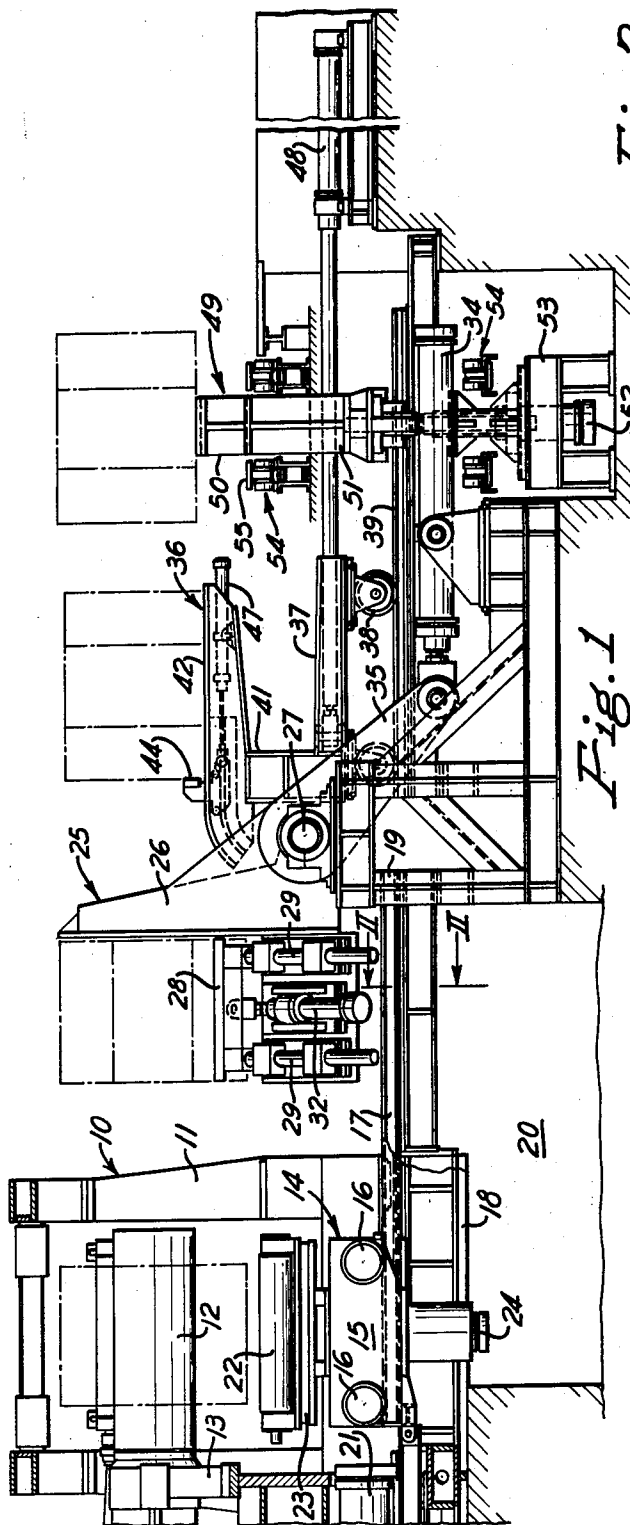
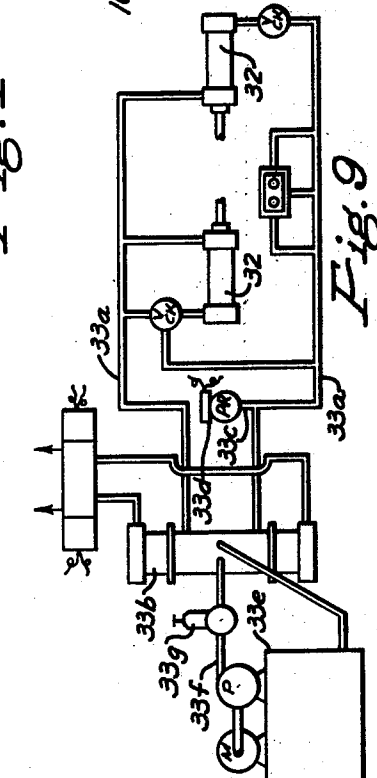
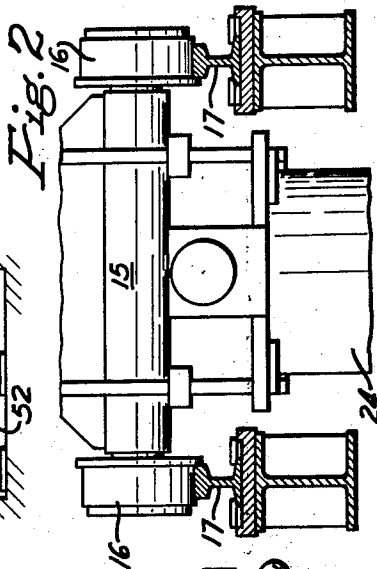


Fig. 1



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5 Sheets-Sheet 2

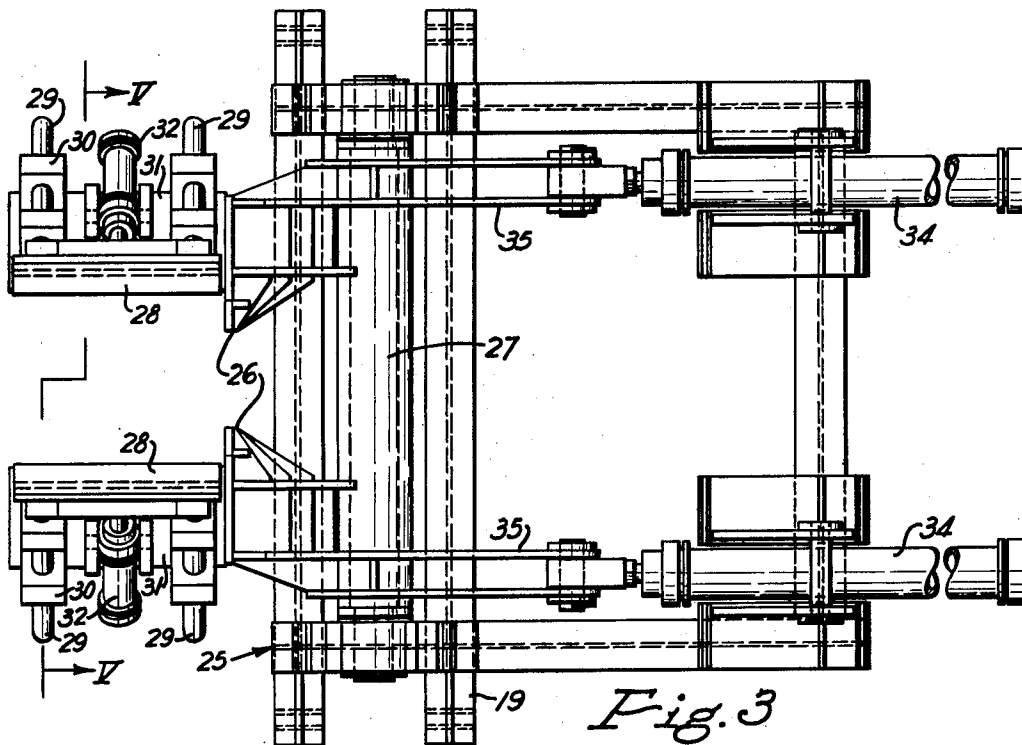


Fig. 3

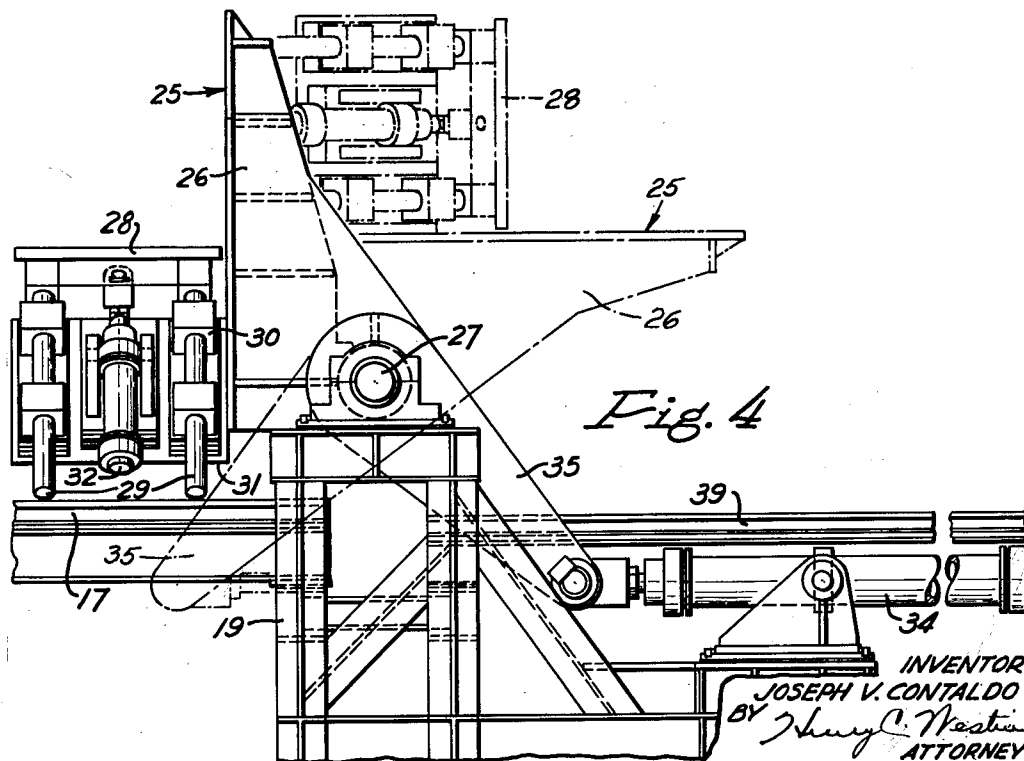


Fig. 4

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5 Sheets-Sheet 3

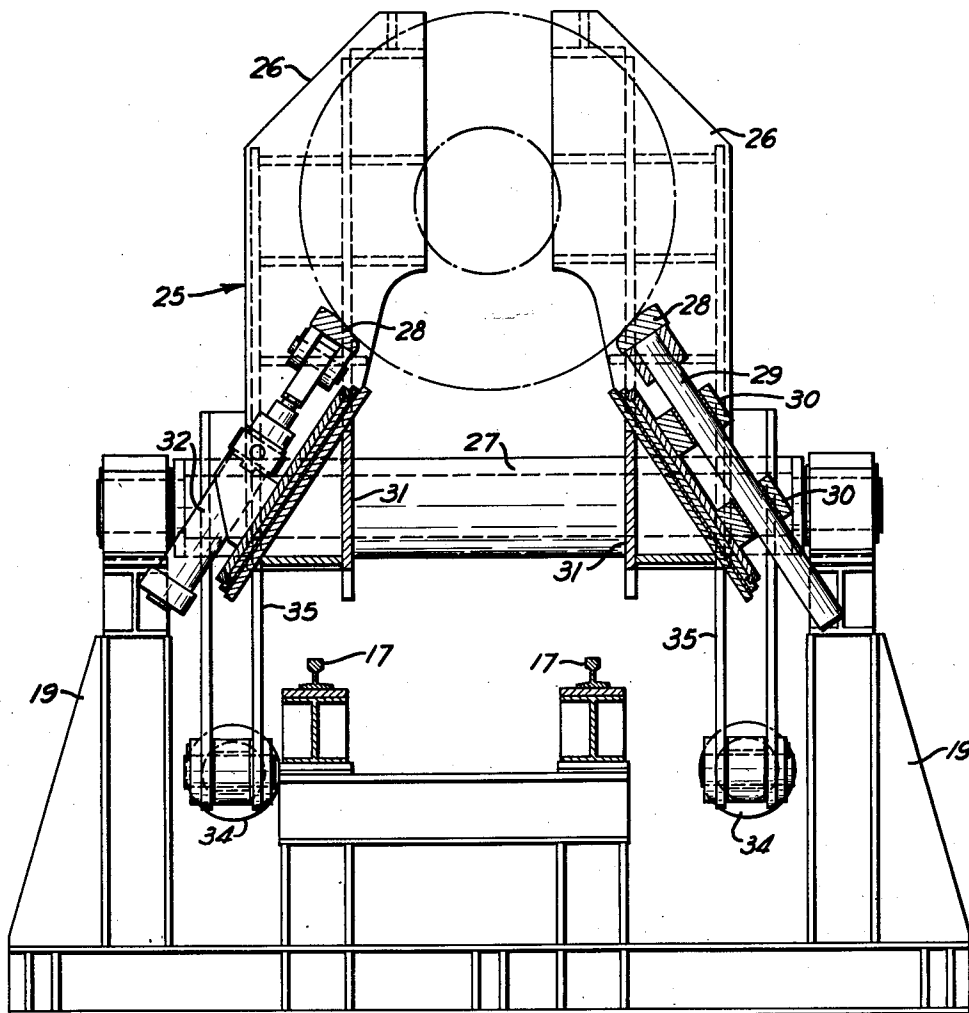


Fig. 5

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5 Sheets-Sheet 4

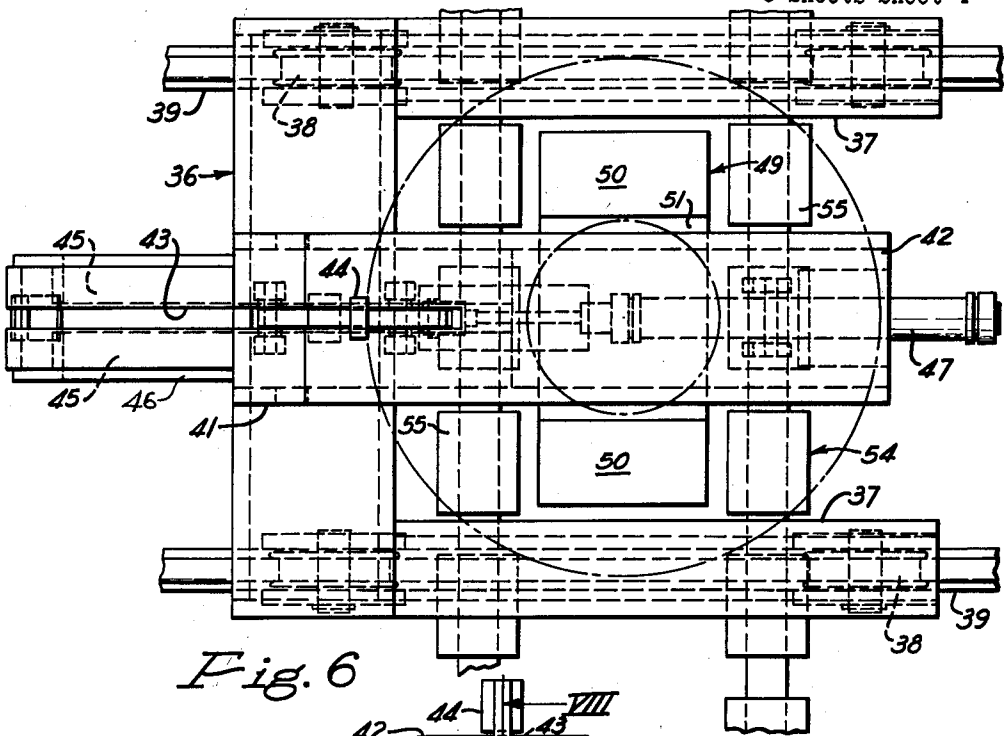


Fig. 6

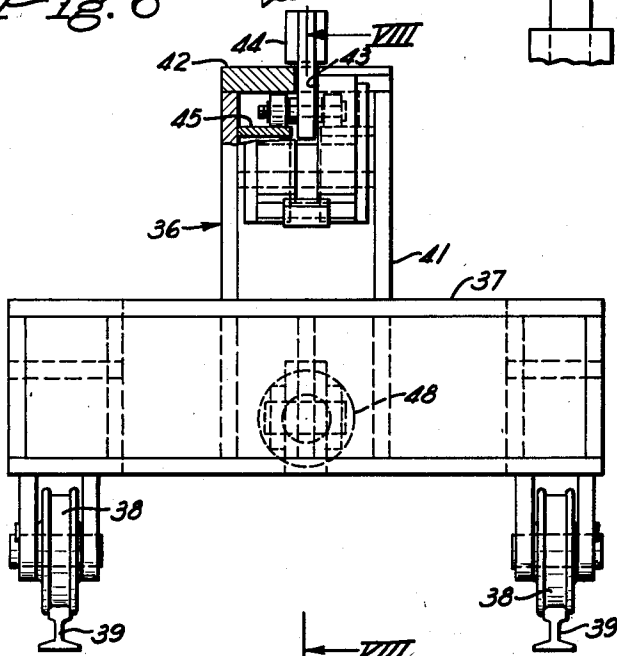


Fig. 7

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APPARATUS FOR TRANSFERRING COILS OF METALLIC STRIP

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5 Sheets-Sheet 5

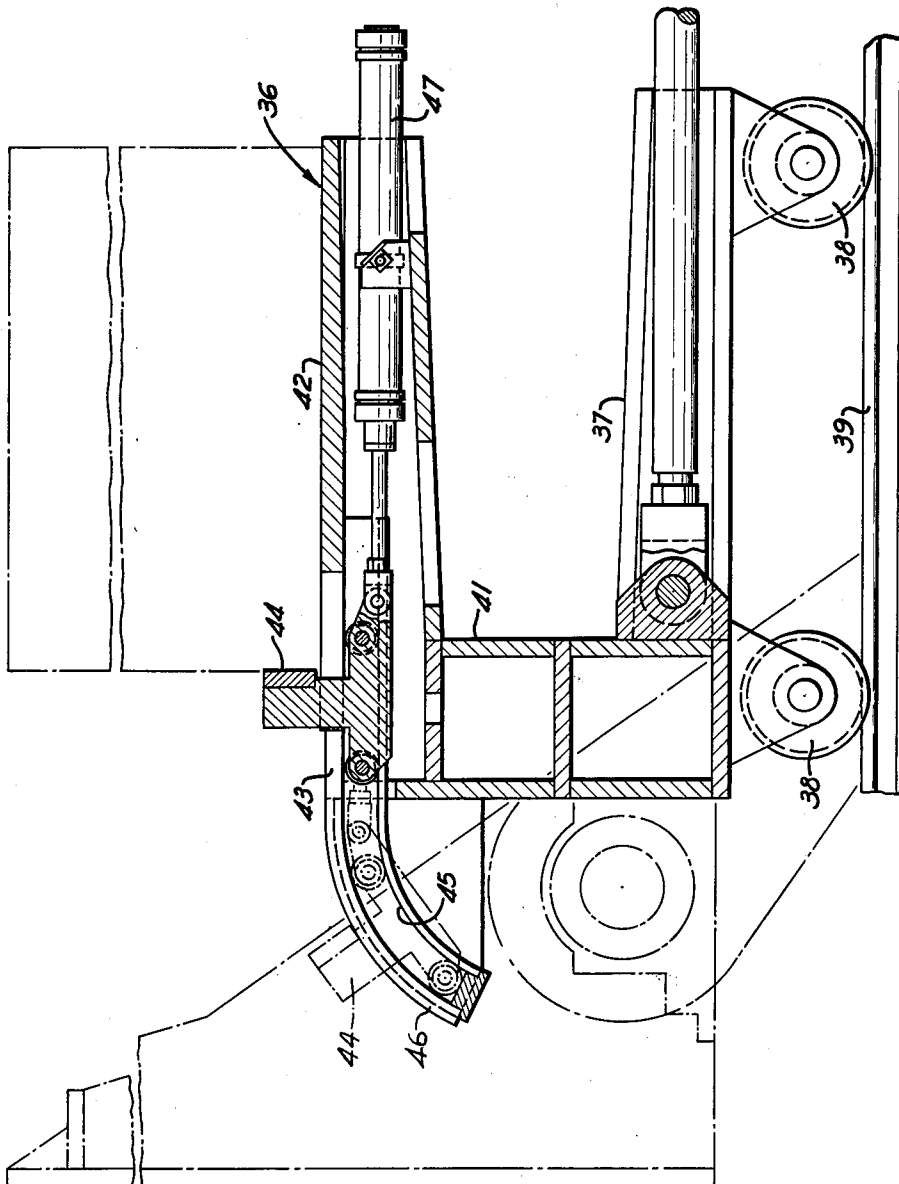


Fig. 8

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1

3,123,236

APPARATUS FOR TRANSFERRING COILS OF
METALLIC STRIP

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6 Claims. (Cl. 214-130)

This invention relates to apparatus for handling coils of metal strip formed in a coiler and, more particularly, to an apparatus adapted to receive coils of varying diameters having their axes in a horizontal plane, to rotate the coils 90° and to transfer them in such a manner that the axes of the coils will always be oriented in the same plane irrespective of coil diameters.

As a normal function of a hot strip rolling mill, the rolled strip is directed to a coiler where it is wound up in coil form about a horizontal axis. The lengths of the strips issuing from the mill vary substantially, which is primarily due to the fact that they are formed of slabs of different thicknesses and lengths or scrap losses may vary from slab to slab. Accordingly, when the strips are coiled, the coils when formed are of substantially different diameters.

To facilitate efficient handling in the removal of coils from the coiler, it is the usual practice to rotate the coils from the horizontal, which is normally the position in which coiling takes place, into a vertical position, i.e., disposed 90°. In many cases, notwithstanding the varying diameters thereof, it is mandatory that the coils when rotated must assume a predetermined position, i.e., with the axes thereof always arranged in the same plane. There are two reasons for this requirement namely: that the coils are to be placed on a conveyor having a fixed center line, in which it is desired not to manipulate the coils relative to the conveyor in placing the coils thereon, and that the coils are usually stopped momentarily in a desirable predetermined position before a processing station.

A correlative problem involved in the handling of coils of such a nature under such circumstances is provoked by the necessity that the outer convolutions of the coils be held tight against the bodies thereof from the time they are removed from the coiler until bands have been placed therearound. Thus, there is a need for an automatic clamping device that will cooperate with the coil handling apparatus in a manner to engage the outer convolutions of the coils, during the period of the handling thereof when the coils are in such a position that without the clamping means their outer convolutions will tend to unwind.

It is therefore one of the objects of this invention to provide coil handling apparatus adapted to receive coils of varying diameters from a coiler with their axes extending in a horizontal direction, rotate the coils and transfer them so that their axes will extend in a vertical direction and be arranged at a predetermined location.

It is another object of this invention to provide coil transferring means adapted to adjust itself to receive coils of varying diameters and automatically support the coils so that their axes will always be coincidently maintained.

It is still a further object of this invention to provide means adapted to engage the outer convolutions of coils of varying diameters when the coils have been rotated from the horizontal to the vertical.

These objects as well as the other novel features and advantages of this invention will become apparent from the following description and accompanying drawings of which:

FIG. 1 is a side view, partly in section, having several

2

portions broken away for clarity, of a strip coiler and coil handling arrangement incorporating the features of the subject invention;

FIG. 2 is an enlarged sectional end view taken on lines II—II of FIG. 1;

FIG. 3 is an enlarged plan view of the coil upender shown in FIG. 1;

FIG. 4 is a side view of the coil upender shown in FIG. 3;

FIG. 5 is an end sectional view of the coil upender taken on lines V—V of FIG. 3;

FIG. 6 is a plan view of the coil transfer car and of the coil clamping device shown in FIG. 1;

FIG. 7 is an end view, with a portion broken away for clarity, of the coil transfer car and clamping device shown in FIG. 6;

FIG. 8 is a side sectional view of the coil transfer car and clamping device taken on lines VIII—VIII of FIG. 7, and

FIG. 9 is a schematic diagram of the hydraulic system including the control means for the upender shown in FIGS. 3, 4 and 5.

For convenience of description, the various cooperative elements illustrated in the foresaid drawings will be described under the following sub-headings: "Coiler and Coil Stripper Car," "Coil Upender," "Coil Transfer Car" and "Coil Lift and Coil Conveyor."

Coiler and Coil Stripper Car

The coiler 10, illustrated only in FIG. 1, is one of several such coilers which are arranged in tandem fashion to receive strip issuing from a rolling mill, not shown, and consists, in part, of a pair of parallel upright rigid frame members 11, only the most remote one being seen in FIG. 1. The frames are connected together in such a manner that the front and bottom of the coiler are open and through the rear of the coiler there is arranged an extendable collapsible type mandrel 12 of a length sufficient to coil the widest strip produced by the rolling mill. The mandrel is rotatably supported at its inboard end by a frame 13. It will be appreciated that many of the component elements of the coiler are not illustrated in the drawings, their disclosure being unnecessary for an understanding of the present invention.

Shown in FIGS. 1 and 2 directly below the mandrel 12, is a stripper car 14 including a frame 15 to which is rotatably secured two pairs of wheels 16 which run in parallel tracks 17. One end of the tracks extend into the coiler 10 where they are supported by a frame 18 and their other ends extend outward from the coiler where they terminate and are supported by an elevated structural frame 19. Directly under the tracks 17 is a pit 20 which permits unrestricted movement of the coil stripper car 14 on the operation of a piston cylinder assembly, not shown. In this particular construction, the piston is connected to a structural extension 21 by which means the piston cylinder assembly is connected to the car. Hereinafter, the reference to the member 21 will be meant to include the entire piston cylinder assembly. The coil stripper car 14 is provided with a pair of rollers, the nearest one 22 only being shown in FIG. 1 for supporting the completed coil when the mandrel is stopped. The rollers are mounted in a frame 23 which is slidably received in the stripper car frame 15 and move vertically by a piston cylinder assembly 24 secured to the bottom of the frame 15.

Coil Upender

Directly in front of the coiler 10 adapted to receive the coils transferred by the coil stripper car 14 is an inverted L constructed coil upender 25, shown in detail in FIGS. 3, 4 and 5. The vertical leg of the upender, is

3

viewed in FIG. 1, and as best shown in FIG. 5, comprises symmetrical coil supporting members 26 securely mounted on a rigid turning shaft 27, the outer adjacent end of the members 26 separated from each other so as to provide a substantial opening, the reason for which will be explained hereinafter. The turning shaft 27 is rotatably journaled in the rigid structural frame 19.

The horizontal leg of the coil upender, as one views FIG. 1, and as can best be seen in the detail drawings of FIGS. 3, 4 and 5, comprises horizontal coil engaging members or platforms 28 adapted to engage the opposite lower sides of the coils, each being connected to radial disposed guide rods 29 received in a block guiding member 30 of frame members 31. As best shown in FIG. 5 the frame members 31 are rigidly secured to the turning shaft 27. Midway between each of the guide rods 29 are piston cylinder assemblies 32, which serve to move the coil engaging members 28 radially into engagement with a coil when a coil is brought from the coiler 10. As shown in FIG. 3, the frames 31 of the coil engaging members 28 are spaced apart an ample distance to allow the maximum diameter coil to be brought by the coil stripper car 14 to a position directly above the coil engaging members 28.

It is a feature of this invention to provide for the automatic positioning of the coil engaging members 28 so that on the operation of the cylinder assemblies 32 the members will be raised to engage a coil supported by the stripper car 14 but will not lift the coil from the stripper car. The coil is only lifted off the stripper car on the rotation of the upender 25.

To accomplish this feature, the movement and hence the ultimate coil supporting position of the piston cylinder assemblies 32 is adapted to be coordinated with the particular diameter of the coil being transferred from the coiler 10. This action is obtained by certain hydraulic elements which are illustrated in FIG. 9. With reference to this figure, there are shown the cylinders 32 which are connected by piping 33a to a 4-way pilot valve 33b, to which is connected by piping 33c, intermediate the cylinder and valve, a pressure switch 33d. Between the valve and tank-pump assembly 33e there is located in piping 33f a pressure reducing regulator 33g. The various other hydraulic elements which are shown will not be particularly referred to since such is not believed necessary for an understanding of the automatic control system.

As will be more fully appreciated hereinafter, the regulator 33g will be set to discharge fluid into the pilot valve 33b under a relatively low pressure which in turn will be admitted to the back of the cylinders 32. The pressure switch 33d will be set to operate on the experience of predetermined higher pressure than the pressure of the fluid admitted into the cylinders 32, which will be created upon the coil engaging members 28 contacting the coil. In this event the pressure switch 33d will signal the pilot valve 33b to move to its block position which action will interrupt the movements of the pistons of the cylinders 32 and hold them against any further movement in either direction.

The upender is adapted to be rotated 90° from the full line position to the out line position shown in FIG. 4 on the operation of a pair of parallel piston cylinder assemblies 34 to which are connected to the inner ends thereof a pair of downwardly extending parallel arms 35, the upper ends of the arms being rigidly connected to and adapted to rotate the turning shaft 27.

Coil Transfer Car

Immediately to the right of the coil upender 25, as one views FIG. 1, there is provided a C-shaped coil transfer car 36 which is shown in detail in FIGS. 6, 7 and 8. The transfer car comprises a U-shaped horizontally arranged base member 37, carried by two pairs of wheels 38 which ride on a pair of tracks 39, the tracks being supported

4

by the frame 19 at one end and at the other end by the foundation, shown only in FIG. 1. At the left hand side of the U-shaped base 37, as one views the drawings, there is a centrally located vertically extending upright member 41 having a horizontally extending coil supporting member 42, the latter member being of sufficient length to adequately support the maximum diameter coil. The width of the coil supporting member 42 of the coil transfer car 36 is such that the opening between the members 26 of the upender 25 will permit the members 26 to pass freely over the member 42 when the upender is rotated, and a coil carried by the upender will be deposited on the coil supporting member 42.

The coil supporting member 42 of the transfer car is constructed in the form of a hollow rectangular box and is provided with a slot 43 in its upper surface, through which extends a projection in the form of a clamping element 44. The base of the clamping element has rollers rotatably secured thereto which are received in and supported by internal tracks 45, best shown in FIG. 7, which run from a point at approximately the center of the member 42 to one end thereof. As shown in FIGS. 1, 6 and 8 the tracks 45 are constructed to extend past the transfer car to the left thereof at which place they take the form of curved sections 46 extending gradually downwardly. By reason of this construction, the clamping element 44 can be moved away from the coil supporting member 42 of the transfer car 36 and lowered, thereby to avoid any interference with the coils when they are rotated and transferred to the car 36 by the upender 25. The clamp is advanced through the agency of a piston cylinder assembly 47 which extends into the member 42, having its cylinder internally secured to the member and its piston secured to the one end of the clamp. It will be appreciated that in view of the incorporation of the improved upender, the axes of the varying diameter coils handled will always assume the same respective positions on the transfer car 36, so that the effective clamping movement of the clamp for the entire range of coil sizes will be relatively small, representing the difference between the radii of the largest and of the smallest coils.

The coil transfer car 36 is advanced over the tracks 39 by means of a piston cylinder assembly 48, shown only in FIG. 1. In order to cooperate fully with the upender 25, the transfer car will always be brought into the same position adjacent to the upender. In this manner, since the axes of the varying diameter coils are maintained in the same coincident position when received by the upender, the axes of the coils when rotated will always be located on the same plane when they come to rest on the transfer car 36.

Coil Lift and Coil Conveyor

Spaced from the upender 25 and separated therefrom by the transfer car 36 is a coil lift 49, shown only in FIGS. 1 and 6. This lift is designed to receive coils supported by the transfer car 36 and for which reason it is constructed to take the form of an upright U-shaped member 50 having a lower center member 51. The top surfaces of the U-shaped member 50 serve as coil supporting surfaces and accordingly the opening of the U is made wide enough so that these surfaces will move freely past the vertical surfaces of the coil supporting member 42 of the coil transfer car 36. The coil lift center member 51 is received in and supported by a frame, not shown in the drawings, and at its lower end is connected to the piston of a vertically arranged piston cylinder assembly 52 supported in a frame 53 beneath the coil lift 49.

As best illustrated in FIG. 1, the coil lift is arranged to extend between the parallel chains of a coil conveyor 54, which includes coil supporting pallet members 55. This conveyor is of the usual heavy industrial continuous-ly driven type for which reason there is seen no need to

5

describe its particular construction. In the arrangement of elements illustrated, the conveyor is located at a right angle to the direction of movement of the coils from the coiler 10 to the coil lift 49. As shown in FIG. 1, the coil supporting member of the transfer car 36 is at a higher elevation than the elevation of the conveyor 54 so that the car can position a coil directly over the conveyor.

The operation of the coil handling elements heretofore discussed will now be briefly described. Prior to the completion of the coiling operation in the coiler 10, the coil stripper car 14 is brought into a position beneath the mandrel 12 by the actuation of the piston cylinder assembly 21, the piston cylinder assembly 24 of the stripper car 14 having been previously operated to lower the coil engaging rollers 22 of the car so that the rollers will clear the coil. Upon the completion of the coiling of the strip, the mandrel 12 is stopped and collapsed. In this particular design, the piston cylinder assembly 24, is adapted to be operated to raise the rollers 22 into an engaging position with the coil under a relatively low pressure thereby to assist in the final coiling step and also to hold the outer convolution snugly against the coil. Once the mandrel 12 is stopped, the fluid in the cylinder 24 is blocked thereby preventing the axis of the coil from being displaced vertically, and yet maintaining coils of varying diameters at the same elevation.

Once the fluid in the cylinder 24 is blocked, the piston cylinder assembly 21 is operated to move the stripper car 14 and the coil carried thereby from the coiler 10 to a position adjacent to the upender 25. The stripper car will be automatically stopped prior to the adjacent end of the coil coming into contact with the members 26 of the vertical leg of the upender by a means not shown. The stripper car, having passed between the frames 31 and the coil engaging members 28, will position the coil above the members 28, which, of course, at this instance will be in their lowest positions by operating the piston cylinder assemblies 32.

With the coil so positioned, the piston cylinder assemblies 32 will be operated to raise the members 28 into engagement with the lower surface of the coil, in which connection when the pressure in the cylinders 32 reaches the predetermined value by reason of the resistance of the coil, the pressure switch 33d will effect operation of the pilot valve 33b to block the pressure in the cylinders 32. The blocking of the pressure will maintain the coil in the elevation it assumed when supported by the stripper car 14. After this, the piston cylinder assemblies 34 are operated to rotate the upender and the coil carried thereby 90° so that the axis of the coil will be moved from a horizontal to a vertical position.

The transfer car 36 will have previously been brought into the coil receiving position on the operation of the piston cylinder assembly 48, the clamp 44 advanced to its out of the way position by the operation of the piston cylinder assembly 47. Hence, as the upender is rotated the weight of the coil will be transferred from the members 28 to the supporting members 26 so that as the members 26 pass over the coil supporting member 42 of the coil transfer car 36, the coil will come to rest on the car. As previously explained, since the axes of the coils are always maintained on the same elevation, their axes, when the coils are rotated and transferred to the transfer car 36, will always be located on the same plane. As soon as the coil is placed on the transfer car 36, the piston cylinder assembly 47 is operated to bring the strip clamping device 44 into contact with the outermost convolution of the coil and to thereby prevent the convolution from tending to unwind when the coil is moved away from the upender 25 and before a band has been placed around it.

After the coil is supported by the transfer car, the piston cylinder assembly 48 is operated to advance the coil to a position over the conveyor 54. Before this happens the coil lift 49 will have been lowered on the operation of

6

the piston cylinder assembly 52 to allow the coil to be brought into position directly over the conveyor. To remove the coil from the transfer car 36, the piston cylinder assembly 52 is operated to raise the coil lift 49 whereby the surfaces of the coil supporting member 50 will lift the coil from the transfer car 36, after which the transfer car 36 may be retracted on operation of the piston cylinder assembly 48. Once the transfer car has been retracted, the piston cylinder assembly 52 can be again operated to lower the coil lift and the coil carrier thereby will come to rest on the conveyor 54 for its removal from the coiling zone.

In accordance with the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof. However, I desire to have it understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A coil handling mechanism for carrying varying diameter coils of strip steel and the like from a coiling mandrel to a coil conveyor comprising:

a first coil transfer for receiving and supporting a coil formed on the mandrel in a manner that the axis of the coil is maintained in substantially the same horizontal plane containing the axis of the mandrel, means for moving said first coil transfer away from the mandrel,

a second coil transfer for receiving a coil from said first coil transfer and rotating it to position its axis in a vertical plane,

said second coil transfer including a coil engaging member movable into a supporting position with a coil while the coil is still supported by said first transfer, means for rotating said second coil transfer about a pivot,

means connected to and for moving said coil engaging member relative to said pivot,

a third coil transfer for receiving and supporting a coil rotated by said second coil transfer, and

a control means connected to said means for moving said coil engaging member, including means operative upon the coil engaging member engaging the varying diameter coils to interrupt the movement of said means for moving said coil engaging member to effect automatic positioning of said coil engaging member relative to the varying diameter coils so that when the varying diameter coils are supported by said coil engaging member, their axes will be maintained substantially in a first plane and when transferred to said third coil transfer, their axes will be located substantially in a second plane.

2. A coil handling mechanism according to claim 1, wherein said means operative upon said coil engaging member engaging the varying diameter coils includes a means responsive to the pressure developed between said coil engaging member and the varying diameter coils upon their engagement, and

said pressure responsive means being operatively connected to said means for moving said coil engaging member.

3. An apparatus for individually receiving coils of strip material of varying diameters with their axes in a first disposition and rotating them to position their axes in a second disposition comprising:

a frame having a pivot;

a first leg pivotally connected to said frame adjacent to which one of the ends of the coils are positioned when received by the apparatus;

said first leg serving to support the coils when they are rotated;

a second leg pivotally connected to said frame extending away from the first leg, having a movable platform which includes a coil supporting surface ar-

7

ranged at substantially a right angle to said first leg;
 means for moving said platform relative to said pivot
 to bring said coil supporting surface into a support-
 ing relationship with the coils when received by said
 apparatus;
 control means connected to said means for moving said
 platform, including means operative upon the mov-
 able platform engaging the varying diameter coils
 to interrupt movement of said means for moving said
 platform to effect automatic positioning of said plat-
 form in relationship to the particular diameter coil
 received by said apparatus in a manner such that
 the axes of the coils will always be maintained in a
 common first plane and when rotated their axes will
 be positioned in a common second plane; and
 means so arranged and operative to rotate said legs
 about said pivot.
 4. An apparatus in accordance with claim 3 wherein
 said platform comprises a pair of coil supporting members;
 individual piston cylinder assemblies connected to said
 members;
 means for supplying fluid to said piston cylinder assem-
 blies;
 said control means including a pressure regulating
 means connected to said fluid supplying means for
 controlling the pressure of the fluid supplied to said
 piston cylinder assemblies and a pressure switch op-
 erative at a predetermined pressure to effect inter-
 ruption of the movement of the piston cylinder as-
 semblies when they are operated to cause said coil
 supporting members to engage the coils, and to block
 the fluid in the piston cylinder assemblies thereby
 to maintain the coil supporting members in the inter-
 rupted positions.
 5. A coil supporting means comprising:
 a coil supporting platform having a surface on which
 a coil is adapted to be placed;
 a clamping means associated with said platform having
 a projection protruding beyond the surface thereof;
 means connected to said clamping means and adapted to
 bring said projection against a portion of the outer
 convolution of a coil supported by said platform,

8

said platform having a curved portion extending
 away from the coil supporting surface thereof; and
 said clamping means adapted to be advanced along
 said curved portion in which portion the projection
 of said clamping means will be displaced away from
 the coil supporting surface of the platform.
 6. In an apparatus for handling coils of strip material
 comprising:
 a coil upender for receiving coils having their axes in
 one position and rotating the coils so as to position
 the axes of the coils in a second position;
 said upender including means engageable with the
 outer convolutions of the coils to hold them close
 to the bodies thereof;
 a coil transfer car arranged to receive the rotated coils
 from the upender;
 a clamping means associated with said platform having
 a projection protruding beyond the surface thereof;
 means connected to said clamping means and adapted
 to bring said projection against a portion of the
 outer convolution of a coil supported by said plat-
 form, said platform having a curved portion extend-
 ing away from the coil supporting surface thereof;
 and
 said clamping means adapted to be advanced along
 said curved portion in which portion the projection
 of said clamping means will be displaced away from
 the coil supporting surface of the platform.

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