Dec. 22, 1959 J. W. O'BRIEN 2,918,226

APPARATUS FOR COILING STRIP MATERIAL

Filed Sept. 4, 1956 2 Sheets-Sheet 1

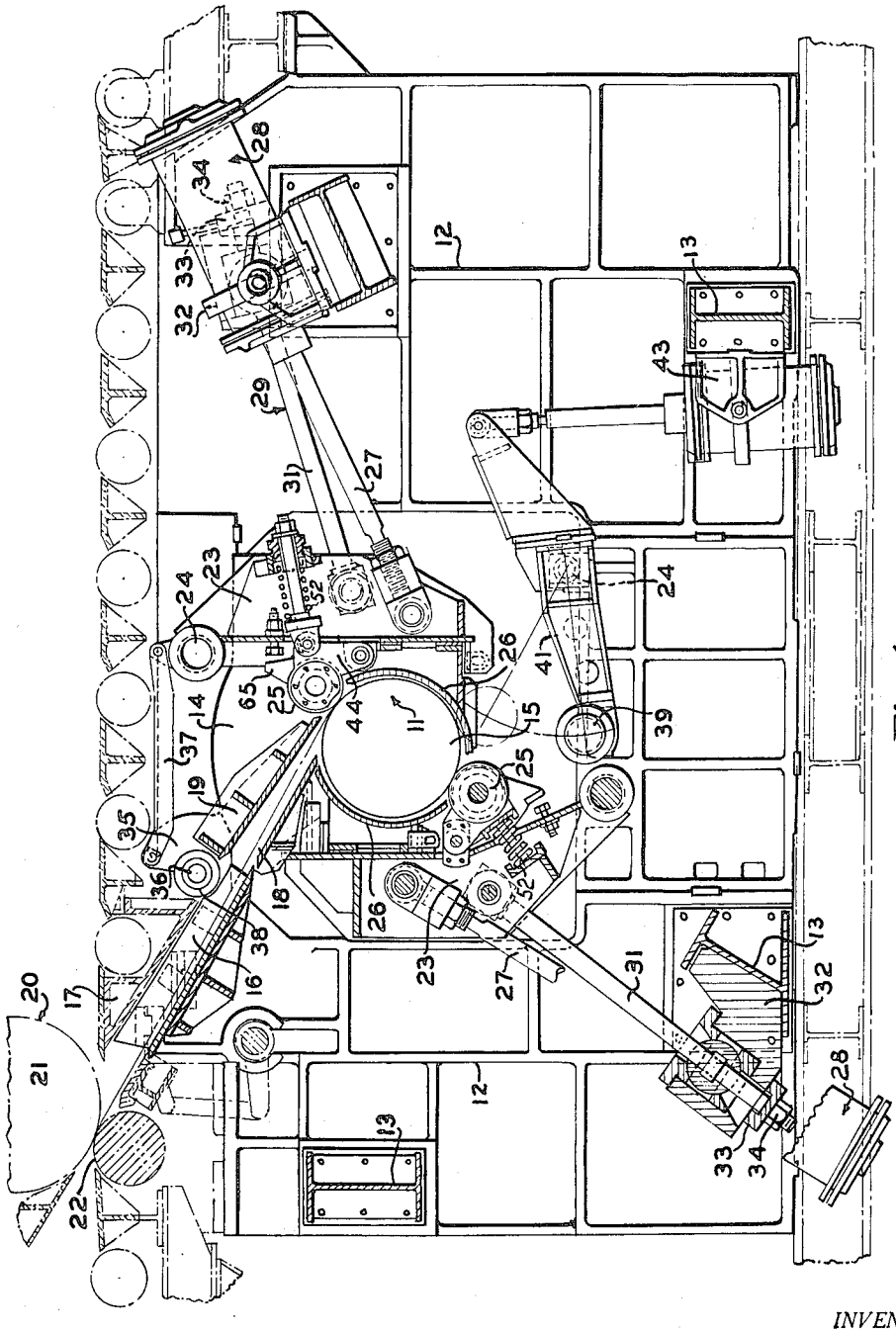


Fig. 1

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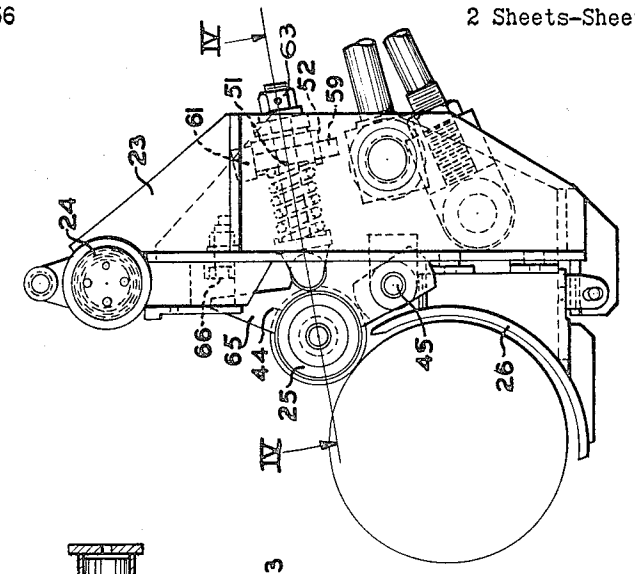


Fig. 2

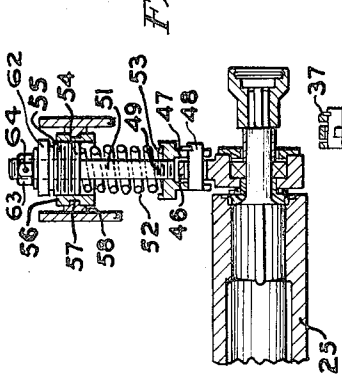


Fig. 4

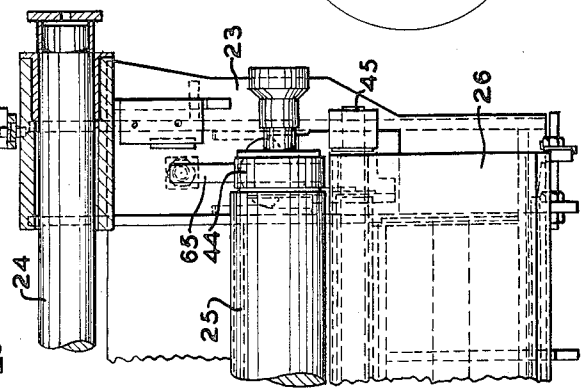


Fig. 3

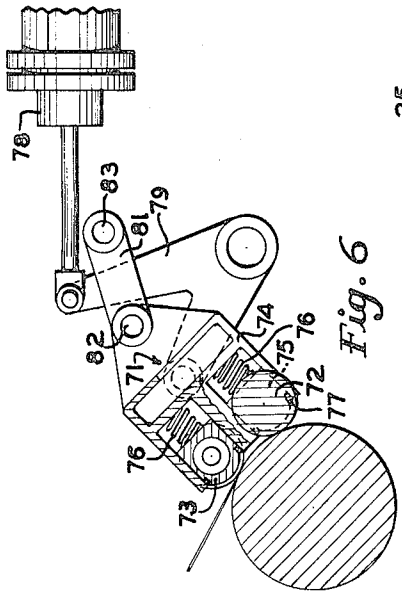


Fig. 6

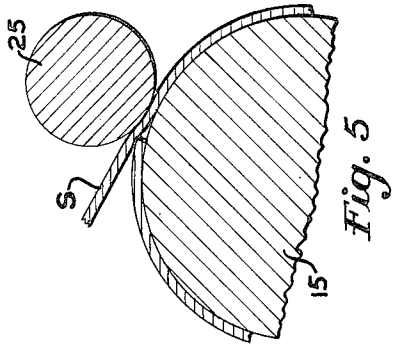


Fig. 5

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APPARATUS FOR COILING STRIP MATERIAL

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3 Claims. (Cl. 242—78.4)

This invention relates to apparatus for coiling continuous strip material as it issues from a rolling mill or other strip processing apparatus and, in particular, to coiling apparatus employing strip guiding elements which are instantaneously displaceable relative to their supporting frames in a direction away from the strip material at the point of each change in diameter as successive convolutions of the strip are coiled in thereby to prevent marking of the strip at the points of overlap of the strip leading end.

As hot rolled metallic strip material issues from a hot strip rolling mill it is usually directed to coiling apparatus including a driven reel or mandrel about which guiding elements are spaced thereby defining a confined path along which the strip leading end is passed for coiling upon the reel. These guiding elements usually include a series of rolls, which may or may not be driven, arranged circumferentially around the reel to form a substantially continuous channel along which the strip material is guided around the reel. In some of the coilers of more recent design the rolls are usually driven and at a peripheral speed slightly greater than the speed at which the strip is traveling so that the rolls urge the strip onward to the next adjacent roll. These guiding elements may take various forms for as many as nine rolls may be arranged circumferentially around the reel but a single roll may be employed in combination with a series of curved aprons.

In present day coilers the rolls are mounted which are connected either to a linkage system common to two or more frames having a common actuating means, or the frames are mounted in radial guideways and connected to individual piston-cylinder assemblies. In still another arrangement, the frames in which the rolls are mounted may be connected to individual bell cranks which in turn are connected to a single common piston-cylinder assembly. In any of these arrangements the frames, links, guides or cranks with their interconnecting cylinders represent a large mass to be moved rapidly away from the reel. The reel, being a very rigid member, does not yield under the repeated thrust force developed by the cold strip end portion when it comes into each successive point of contact of the rolls. Although the rolls normally are retracted from the reel with the yielding of their piston-cylinder assemblies if a sudden appreciable force is imposed on the rolls, the rolls and the assembly upon which they are carried will not yield to any appreciable extent as the force is suddenly imposed by the leading end portion of the strip by reason of the fact that the inertia of the roll assembly is so great and the rotation of the reel so rapid. The rolls when contacted by the strip which is directly over the end of the coil act as a temporarily stationary mass and therefore it can be readily appreciated that the rolls will deform each succeeding wrap in the area of the strip overlap.

The apparatus embodying the features of the invention herein disclosed avoids the aforementioned difficulties in the coiling of relatively narrow strip having a substantial thickness for it provides, as one of its objects, a coiling apparatus having guide elements which are displaceable relatively instantaneously in a direction away from the reel on each change in diameter as the successive convolutions of the strip are coiled and without imposing extreme forces on the strip at the point of overlap.

It is another object of the present invention to provide a strip coiling apparatus having a resilient means interposed between the frames and rolls which permit the rolls to be displaced momentarily relative to the frames at each point of overlap of the coil convolutions.

It is a further object of this invention to provide a coiling apparatus in which compression springs are placed closely adjacent to the rolls for permitting the rolls to be displaced momentarily relative to the frames and in a direction away from the reel on encountering abnormally high forces in order to provide the proper clearance required at the instant a new lap is added to the coil and without imposing extremely high loading conditions upon the roll actuating mechanism or a heavy hammering action upon the strip itself.

It is another object of this invention to provide apparatus for coiling hot strip material in which there are two or more guiding rolls mounted in supporting frames and so arranged as to permit instantaneous displacement thereof relative to the frames at the point at which a new lap is added to a coil during a coiling operation and thereafter to permit the rolls and frames to assume their normal positions relative to each other.

These objects, as well as the various other novel features and advantages of the present invention, will be apparent from the following description and accompanying drawings of which:

Fig. 1 is a sectional elevational view of a coiling apparatus embodying the features of the invention herein disclosed;

Fig. 2 is an enlarged partial front elevation view of one of the guide elements as shown in Fig. 1;

Fig. 3 is a partial end view of the guiding element shown in Fig. 2;

Fig. 4 is a sectional view of the spring assembly taken on lines IV—IV of Fig. 2;

Fig. 5 is a diagrammatic view showing the completion of the first convolution on the reel, and

Fig. 6 is a partial side elevation view of a modified form of the guiding elements embodying the herein disclosed invention.

With reference to Fig. 1 there is illustrated therein a hot strip coiling apparatus **11** comprising two spaced parallel vertical frames **12** made up in several sections connected together by the necessary horizontal supports and separators in the form of beams **13** thereby constituting a very rigid supporting structure for the other component parts of the coiler. The frames are provided with corresponding central openings **14** through which extends a horizontally disposed mandrel or reel head **15**, supported externally of the frames in the usual manner and connected to suitable driving means, not shown, which means are adapted to rotate the reel at a peripheral speed at or slightly greater than the lineal speed of the strip as it is delivered for coiling on the reel head. The strip leading end is directed downward to the reel **15** by inclined guides **16** which form a throat between a rolling mill runout table **17** and the upper surface of the reel **15**. A guide section **18** at the lower extremity of the guide **16** is connected to and movable with certain other component elements of the coiler and will be more fully described hereinafter whereas the upper or cooperating section **19** of the guide **16** is pivotally mounted so that it may be positioned either in a

horizontal or an inclined position by appropriate means, not fully shown since this feature forms no part of the invention, whereby the strip issuing from the mill may be directed either to the reel **15** or passed thereover to another coiler if desired. A pinch roll unit **20**, shown in its closed strip engaging position, is provided with an upper vertically adjustable roll **21** which is offset from the vertical for urging the leading end of the strip in a downward direction over the smaller pinch roll **22** to the coiler adjacent thereto.

Supported by the coiler frames **12** there are two parallel wrapper frames **23** located on diametrically opposite sides of the reel **15** and pivotally mounted on trunnion shafts **24** carried by the coiler frames. Each wrapper frame is provided with driven wrapper rolls **25** extending approximately the length of the reel head, the rolls **25** being so arranged that when they are brought into close proximity to the peripheral surface of the reel for engaging with the reel the wrapper rolls are then substantially diametrically opposite one another. Also mounted on the wrapper frames there are diametrically opposed guide aprons **26**, curved so that they are concentric with the reel and extending approximately for the full axial length of the reel. These aprons cover substantially the space between the rolls so as to form essentially a continuous channel through which a strip is confined for passage around the reel periphery. The leading end of the strip to be coiled is urged around the reel by the driven rolls thereby to form a tight coil. The roll **25** at the entry side of the reel will receive the strip leading end in cooperation with the guide **26** adjacent thereto and will bend the strip and force it around the reel.

Connected to each of the frames there are piston rods **27** extending from individual piston-cylinder assemblies **28** by means of which the wrapper roll assemblies are moved into and out of their operative positions. It will be observed that the frames pivot about the shafts **24** on actuation of the piston-cylinder assemblies so that they are moved toward and away from the reel **15** and when in their coiling position, any movement of the frames is resisted by a constant predetermined pressure acting on the cylinders. The wrapper rolls are adjustable outward of the reel and preferably a very slight clearance is provided between them and the reel when there is no strip on the reel, a pair of adjustable stop rod assemblies **29**, of which a pair of rods **31** form a part, being provided for each wrapper roll assembly. One end of the rods **31** is connected to the frame and the other end passes through openings provided in the support **32** of the piston-cylinder assemblies **28**. They are provided with adjustable stop plates **33** of a diameter larger than the openings and retained on the rods by nuts **34** so that the plates, on actuation of the piston-cylinder assembly **28**, come into contact with the cylinder support **32** and hence prevent any further travel of the frame **23** in the direction of the reel.

The wrapper assembly on the left hand side as one views Fig. 1 has the lower bottom section **18** of the inclined guide **16** secured thereto so that as the coil builds up on the reel and the wrapper assembly is withdrawn, the section **18** moves along with it. The other section **19** of the inclined guide **16** is provided with a segmental portion **35** pivotally connected to a shaft **36** and connected by links **37** to the wrapper frame **23**. When the wrapper assemblies are moved outward of the reels, the lower section of the guide moves outward with the wrapper frame shown to the left of Fig. 1 and the upper guide section **19** pivots upward thereby clearing the reel to permit the completion of a coiling operation. On the shaft **36** a deflector roll **38** is mounted which prevents the strip from bending too sharply when the last several convolutions of the maximum diameter coil are being wound upon the reel. At the bottom of the coiler a crimping roll **39** is provided which is mounted

on a pivotal arm **41** centrally carried on a shaft **42** having its outer end connected to a piston-cylinder assembly **43**. This roll is employed to press the last wrap firmly against the reel to prevent flapping of the trailing end of the strip as the reel is brought to a stop. It is noted from the drawings that the wrapper roll assemblies must first be removed before the crimping roll **39** is free to be moved into engagement with the strip on the reel. Although not shown there is included in combination with the coiler apparatus suitable stripping means for engaging with and pushing the coils from the reel onto a transfer car or other conveyor apparatus provided for the quick and efficient removal of the coils from the coiler.

With reference now to Figs. 2, 3 and 4, there are shown therein enlarged partial views of the wrapper roll assemblies and inasmuch as both roll assemblies are essentially of the same construction only one of them will be described. The two ends of the rolls **25** are mounted in brackets **44** pivotally connected to the wrapper frame **23** by pins **45**. The brackets have horizontal outwardly extending projections **46** which fit between the forks of a pair of clevises **47** to which they are pivotally secured by pins **48**. The clevises **47** each have a threaded central opening **49** into which there is received the end of a shaft **51** upon which there is secured a compression spring **52**, each clevis being provided with an annular recess **53** forming a seat for the one end of the spring **52**. On the other end of the shaft **51** an annular spring seat **54** is mounted which is adjustable axially therealong by a sleeve **55** threadably received in a chock **56** and movable axially relative to shaft **51**. The chock **56** is so formed as to fit between and be supported by the wrapper frame and comprises a thick plate with its two vertical surfaces indented at **57** into which projections **58** of the wrapper frames **23** are received. In this construction the bottom of the chocks rests upon horizontal bar **59** affixed to the wrapper frame. Keeper plates **61** are bolted on the inside of the wrapper frame and overhang the top surfaces of the chock **56** thereby securing the chock firmly in place. It will be noted that the spring assembly is so arranged that the spring will receive the direct thrust along its length from the roll and by reason of the fact that a loose connection is provided between the brackets and the shaft **51** this action maintains under all conditions. The outer end of the sleeve **55** is engaged by a washer **62** backed by a separate nut **63** threadably engaged with the outer end of the shaft **51** and is provided with a number of radial holes **64** around its periphery in any of which a bar may be inserted for rotating it in order to adjust the tension of the spring **52**. In order to make an adjustment to increase the spring's tension it is necessary to rotate the sleeve **55** until the spring is compressed to an amount a little less than the desired spring tension after which the nut **63** is tightened thereby further compressing the spring and repositioning the roll **25** which was moved out of its proper position during the initial adjustment of the spring. Each bracket **44** is provided with a vertically extending projection **65** which, when the roll is displaced to any great extent, serves as a stop by contacting the head of an adjustable bolt **66** mounted on the wrapper frame. This is a precautionary measure to protect the spring in the event the roll **25** tends to be displaced too far in a direction toward the spring. From the foregoing it can be appreciated that by arranging the yieldable means, such as the springs, in close proximity with the wrapper rolls, the thrust of the roll caused by the sudden impact on the roll at each point of overlap of the coil, is instantaneously but momentarily displaced in a direction outward of the reel and relative to the wrapper frame. With the inertia inherent in the cumbersome roll frame arrangement employed heretofore, it is apparent that due to the small inertia of the roll spring arrangement dis-

closed herein, no marking will take place on the strip at the point of overlap inasmuch as the mass to be accelerated at the point of impact is reduced considerably. As the rolls are successively displaced in a direction away from the reel at the point of overlap, the compressed spring will have sufficient force to overcome the constant pressure of the piston-cylinder assembly so that the wrapper frame to which the particular roll and spring are attached will gradually move away from the reel thereby restablishing the original relative position of the roll with respect to the wrapper frame, which action will be accomplished during the completion of the wrap and before the point of overlap again passes beneath the wrapper roll. Under normal conditions the operator will retract the wrapper assembly after three or four wraps have been placed upon the reel.

With reference to the modified form of the present invention as shown on Fig. 6, there is illustrated therein a double roll type wrapper assembly **71** comprising a pair of rolls **72** and **73** mounted in a common frame **74**, the roll ends individually being supported in slidable bearing-chock assemblies **75** in order to permit movement of the rolls relative to the frame. The upper surfaces of the chocks are engaged by compression springs **76** and the chocks are retained in the frame by projections **77** extending outward from the frame.

The frame **74** is retracted from its coiling positon by means of a piston-cylinder assembly **78** connected to the frame by bell cranks **79**. The path of movement of the wrapper assembly is controlled by a link **81** pivotally connected by a pin **82** at one end to the wrapper frame assembly and at the other end by a pin **83** to the main frame which may be of the type shown in Fig. 1. It will be appreciated that any number of roll assemblies embodying the features of the invention herein disclosed may be employed in coiling apparatus for coiling strip, and in particular of heavy gage, without having abnormally high forces imposed upon the rolls at each point of overlap. By cutting down on the mass to be accelerated outward of the reel each time the point of overlap or added strip thickness strikes the roll, it is evident that the force is reduced proportionally.

It is apparent in Fig. 5 that where the strip S being coiled is relatively thick, the wrapper roll **25** must jump a short distance substantially instantaneously at the point of overlap and that the force developed by such action depending upon the speed of coiling will cause the sharp edge of the leading end to cut into and mark the portion of the next wrap at the point of overlap.

In accordance with the provisions of the patent statutes, I have explained the principle and operaton 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. In combinaton with a rotatable reel upon which strip like material of relatively heavy gauge is to be coiled, strip guiding elements substantially surrounding said reel including at least one roll arranged closely adjacent to and displaceable away from said reel, means including a pivotal arm connected to and for urging said roll at constant pressure toward said reel and a spring engaged at one of its ends with said arm and so disposed that the other end thereof is in close proximity and operatively connected to said roll with the longitudinal axis of said spring substantially passing through said roll, said spring permitting said roll to be displaced momentarily in a direction away from said reel and independently of movement of said pivotal arm and thereafter causing said pivotal arm to move relative to said roll thereby to re-establish the respective relative positions between said roll and said arm.

2. In combination with a rotatable reel upon which strip like material of relatively heavy gauge is to be coiled, strip guiding elements substantially surrounding said reel according to claim 1 including a curved guide secured to said pivotal arm and which during a normal coiling operation forms a channel closely adjacent to and for directing the strip around said reel.

3. In combination with a rotatable reel upon which strip like material of relatively heavy gauge is to be coiled, strip guiding elements substantially surrounding said reel according to claim 1 in which means are included for adjusting said spring.

References Cited in the file of this patent

UNITED STATES PATENTS

383,686	Bansen	May 29, 1888
1,141,771	Carpenter	June 1, 1915
1,492,954	Biggert	May 6, 1924
2,161,076	Morgan	June 6, 1939
2,693,919	Wutscher	Nov. 9, 1954