Aug. 20, 1940. G. F. PAUL 2,212,243

STRIP COILER

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Fig. 3.

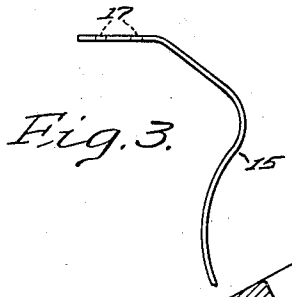
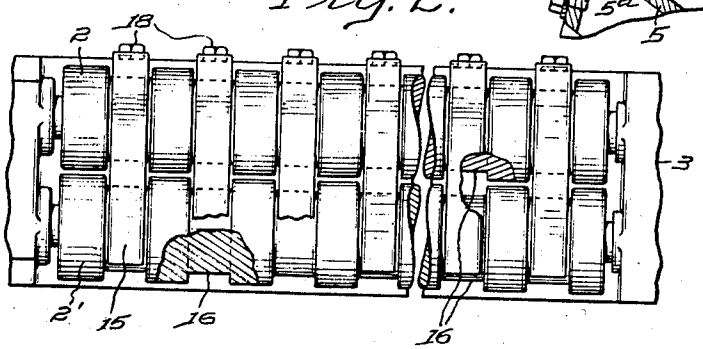


Fig. 1.

Fig. 4.

Fig. 2.



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STRIP COILER

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7 Claims. (Cl. 242—78)

This invention relates to machines for coiling thin elongated strips of steel or other metal as they are delivered from the strip mill in which a slab or billet of steel is progressively reduced to the desired width and thickness. These machines or "coilers" consist essentially of a central stationary mandrel on which the coil of strip is formed and a plurality of rollers disposed thereabout in cage-like formation adapted to progressively wind the strip about the mandrel, the rollers being arranged to gradually recede therefrom as the diameter of the coil increases. As the strip is discharged from the last stand of rolls of the mill proper, it is usually received on a runout table along which it travels toward the coiler and as it approches the latter the leading end of the strip is directed thereinto and then progressively carried about the mandrel by the rollers so as to form the coil. Customarily the coiler is positioned below the level of the runout table so the strip follows a downwardly sloping path as it moves thereto but so far as the present invention is concerned the position of the coiler with respect to the table or other apparatus comprised in the mill is immaterial.

In practice, however, it sometimes happens that the leading end of the strip instead of tending to follow the cylindrical surface of the mandrel during the formation of the first turn thereon, moves outwardly in a more or less tangential direction and ultimately passes between two of the surrounding rollers, and when this occurs the succeeding portion of the strip bunches or "cobbles" between the coiler and the last stand of mill rolls necessitating immediate shutting down of the entire mill until the strip can be cleared from the coiler, which often can be done only by cutting off and discarding several feet of the strip, and the cobbles straightened out preparatory to again putting the mill into operation. As strip mills including their auxiliary equipment and the furnaces from which the hot billets are supplied to them represent a very large investment, the time that the mill and its operatives are standing idle during these operations results in a material monetary loss in addition to that incident to actual waste of the strip itself and correspondingly increases the cost of the product.

It is therefore an object of my invention to incorporate in a strip coiler means adapted to guide the leading end of the strip about the mandrel and prevent it from departing from its proper course while the first turn of the coil is being made, thereby obviating the aforesaid difficulties and delays.

A further object of the invention is the provision in a coiler of means satisfactorily operative for the performance of this function which are of simple character and may be readily applied to existing coilers as well as those hereafter constructed at slight expense and without the necessity for material alteration of their design.

A still further object is the provision in a coiler of means facilitating the consecutive formation upon the same mandrel of two or more coils, one outside the other.

Other objects, advantages and novel features of construction and arrangement of elements comprehended by the invention are hereinafter more particularly pointed out or will be apparent to those skilled in the art from the following description in which reference will be had to the accompanying drawing.

As the invention is applicable to many different types of coilers, I have therefore shown in the said drawing only so much of a typical coiler of well known construction as is essential for a proper understanding of the invention and of different ways of applying it to a coiler of that general type, all as hereinafter more fully described.

In the said drawing Fig. 1 is a vertical section through the coiler mandrel and associated parts, illustrated more or less diagrammatically, showing one embodiment of the invention in operative combination and association therewith.

Fig. 2 is a fragmentary front view of the first pair of coiling rollers shown in Fig. 1;

Fig. 3 is an end view of one of the guide fingers removed from the coiler; and

Fig. 4 is a fragmentary view similar to Fig. 1 but showing a slightly modified embodiment of the invention.

Throughout the several figures like characters are used to designate corresponding parts.

Referring now more particularly to Fig. 1, the coiler therein shown comprises the usual stationary mandrel 1 about which the coil of strip is formed and a plurality of coiling rollers disposed thereabout. All but one of these rollers are arranged in pairs and each pair are journaled at their ends in brackets extending generally outward from the mandrel and serving to hold them with their axes parallel to its axis. Thus the first pair of rollers 2, 2' are mounted in the bracket 3, the second pair 4, 4' in bracket 5, the third pair 6, 6' in bracket 7 and the fourth pair 8, 8' in bracket 9, while a single roller 10 in a bracket 11 is disposed near the top of the man-

drel so as to bear more or less downwardly on the strip. Moreover the several brackets are so supported and arranged that they can move outwardly in generally radial directions from the fully closed-in position in which they are illustrated against a yielding pressure applied by suitable means (not shown), so that as the diameter of the coil on the mandrel increases the rollers, which are suitably driven, will constantly bear on the outer surface of the strip and progressively wind it about the mandrel. Before entering the coiler the strip S, whose thickness is somewhat exaggerated for clearness of illustration, generally passes through a pair of pinch rolls 12, 12 journaled in suitable housings 13 which draw it from the runout table and assist in projecting it towards the coiler which is supplied with a suitable chute 14 for receiving it from the pinch rolls, and as the several parts to which reference has been made are of well known form and construction and customarily found in various embodiments in the types of coilers to which my invention particularly relates, further description thereof would be superfluous.

It will thus be understood that after the leading end of the strip S passes through pinch rolls 12, 12 and down chute 14, it ultimately reaches the single roller 10 and moves toward the space between the rollers 2 and the mandrel, and should then, if it follows its proper path, curve downwardly and generally follow the surface of the mandrel in a counter-clockwise direction as it is progressively moved ahead by the operation of the coiling rollers. However, it sometimes happens that the end of the strip departs from this course or path and passes outward through the space or gap between any two adjacent rollers though its principal tendency in this regard is to pass through the space between the rollers 2, 2' or that between the roller 2' and the adjacent roller 4, since the farther around the mandrel it is moved the more it tends to follow and conform to its surface, while of course after it has made a full lap of the latter the end of the strip is pinched between the mandrel and under face of the succeeding part of the strip so that it is thereafter constrained to closely hug the mandrel.

To prevent any such departure of the strip from its proper course I provide, in accordance with my invention, a plurality of fingers 15 each preferably formed of sheet metal of sufficient thickness to insure its retaining its shape and dispose them at transversely spaced intervals adjacent the rollers in such manner that the fingers will bridge or substantially bridge all or certain of the gaps or spaces therebetween and so prevent the end of the strip from passing thereinto, the fingers being also preferably so shaped as to assist in directing the end of the strip in its proper path about the mandrel. As the principal function of the rollers is to propel the strip around the coiler it is essential that they contact its outer surface and I therefore form in each roller with which the fingers are associated a plurality of similarly axially spaced peripheral grooves 16 corresponding in number to the fingers and each slightly wider than the latter and somewhat deeper than the thickness thereof whereby when the fingers are operatively assembled in the machine each finger will partially extend in the said grooves so as to lie beneath the level of the operating surfaces of the rollers adjacent the areas in which they are designed to contact the strip. Consequently those portions of the rollers between the grooves are free to engage and propel the strip at all times.

The fingers are preferably of uniform construction so a description of one of them, for example one of those shown as disposed adjacent the rollers 2, 2' will suffice. Thus each finger is arranged for detachable connection with a suitable part of the roller supporting bracket such as the transversely extending web 3^a thereof, conveniently by providing a pair of spaced holes 17 in the outer end of the finger for the reception of cap screws 18 threaded in the correspondingly threaded holes in the web, the adjacent portion of the finger being formed to lie flat thereon. Considering the finger as when in operative position, beyond this flat it is preferably directed generally inwardly toward the center of the mandrel and thence so shaped it will snugly hug the bottom of groove 16 in roller 2 through a considerable arc and beyond this arcuate portion will conform to an arc of somewhat greater radius than that of the mandrel until it finally terminates quite close to the roller 4 in the next succeeding pair and thus will also extend for a short distance in and seat against the bottom of the groove 16 of roller 2'. The finger thus bridges the space or gap between the first and second rollers 2, 2' and substantially bridges that between the second and third rollers 2', 4 as clearly shown in Fig. 1.

The series of fingers when assembled on the bracket therefore prevent the leading end of the strip from entering the spaces between the rollers with which they are associated while since those parts of the fingers which actually overlie the rollers are seated in the grooves therein below the surface of their ungrooved parts or lands, the fingers in no way interfere with the frictional engagement of said parts with the surface of the strip and thus with the principal function of the rollers, namely that of winding the strip around the mandrel.

As has been explained, under normal conditions the end of the strip is more likely to pass through the gap between rollers 2, 2' or that between roller 2' and the adjacent roller 4 than through the gaps between any of the succeeding rollers and a single series of the fingers arranged adjacent these rollers as shown in Fig. 1 will therefore usually be adequate to prevent diversion of the strip from its proper path about the mandrel, but to positively insure against the strip departing from that path at any point therealong while the first turn about the mandrel is being made, additional series of fingers may be provided as shown in Fig. 4 so as to bridge all or certain of the gaps between the other rollers. Thus, for example, in Fig. 4 a second series of fingers 15^x are shown in association with rollers 4, 4' and the adjacent roller 6, this series being secured to web 5^a of bracket 5 and the rollers 4, 4' being grooved similarly to rollers 2, 2' and of course a still further series of fingers may be mounted on brackets 7 and 9 or either of them if desired.

It is often desirable from the standpoints of economy and efficiency of operation to form two or more coils on the mandrel one about the other, the inner coil usually comprising all the strip made from a single billet and the outer one all the strip made from the succeeding billet. This practice facilitates subsequent handling operations by substantially decreasing the labor involved therein and where the strip is to be annealed for deep drawing also contributes mate-

rially toward eliminating strip waste since whenever a coil is so annealed the outer and inner turns which have been exposed to the air during the annealing operation have to be cut off and either thrown away or sold as lower grade sheets as these turns cannot be used for deep drawing. Consequently when two coils are formed one outside the other, this wastage is halved for only the inner turn of the inner coil and the outer turn of the outer coil have to be discarded. However, it has been impracticable with coilers as heretofore constructed to form more than one coil at a time about the coiler mandrel since when the effective diameter of the latter has been increased by the completion of one coil thereon with corresponding backing off and resultant increase of the spaces between the pairs of the coiling rollers, the leading end of a succeeding strip has a much greater tendency to pass between the latter in the manner hitherto explained than when there are no turns of strip upon the mandrel preparatory to the formation of the first coil.

Since in accordance with my invention the leading end of any strip is effectively prevented from passing between the coiling rollers and directed into its proper course about the mandrel irrespective of the effective diameter of the latter, it is possible with a coiler equipped with the invention to very readily form two coils on the mandrel one about the other when desired, for the fingers function to properly direct the leading end of the succeeding strip about the inner coil while the first turn of the outer coil is being made even though the coiling rollers have been backed off from the mandrel by an amount substantially equal to the thickness of the inner coil.

The adaptation of the coiler for the reception of the fingers is a simple matter involving only the grooving of one pair of rollers per each set of fingers and the drilling and tapping of the bracket web for the reception of the cap screws 18 while the fingers themselves can be readily formed from suitable sheet metal at a low cost; moreover they are preferably arranged, as shown, so as to bridge the gap between the rollers with which they are associated at intervals substantially throughout its length and are thus effective to deflect the ends of strips of any width within the capacity of the coiler.

In practice it has been found that as the invention effectively prevents cobbling of the strip because of departure of its leading end from its proper path about the mandrel it eliminates mill shutdowns as well as loss of finished strip from this cause, the operating time losses necessarily incident to the operation of any strip mill being in one instance decreased approximately 4% through the use of the invention, while by enabling two or more strips to be successively coiled one outside the other, it materially facilitates subsequent handling of the coils and minimizes wastage under certain conditions as hitherto explained.

While I have herein described certain embodiments of the invention with considerable particularity it will be understood that I do not thereby desire or intend to confine myself thereto or to restrict its use to any particular type of coiler, and furthermore that the various elements and instrumentalities which I employ in carrying out the invention are capable of modification and variation in numerous particulars without departing from its spirit and scope as defined in the appended claims.

Having thus described my invention I claim and desire to protect by Letters Patent of the United States:

1. A strip coiler for rolling mills comprising a mandrel, rollers adjacent thereto adapted to urge a strip progressively thereabout in forming a coil thereon, one of said rollers having a peripheral groove, means for supporting the rollers, and a finger carried by and extending from said means into said groove and partially about the roller in the direction of its operative rotation and thence bridging the gap between said roller and an adjacent roller to thereby deflect the leading end of the strip away from said gap and toward the mandrel.

2. A strip coiler for rolling mills comprising a mandrel, a series of rollers arranged in proximity thereto adapted to progressively urge a strip about the mandrel to form a coil thereon, and a series of spaced fingers extending over one of said rollers in the direction of its operative rotation and across the gap between it and an adjacent roller, the rollers each having a series of axially spaced peripheral grooves respectively receiving the fingers and of greater depth than the thickness of the latter.

3. A strip coiler for rolling mills comprising a mandrel, a series of rollers disposed thereabout adapted to progressively urge a strip around the mandrel to form a coil thereon, one of said rollers having a plurality of axially spaced peripheral grooves, means for supporting the rollers, and a series of fingers extending from the roll supporting means respectively into said grooves and partially encircling said roller in the directionof its operative rotation and thence extending across the gap between said roller and an adjacent roller of the series to thereby direct the leading end of said strip away from said gap and towards the mandrel, the ungrooved portion of the roller lying at a greater radial distance from its axis than the portions of the fingers which extend in the grooves.

4. A strip coiler for rolling mills comprising a mandrel and a series of rollers disposed thereabout adapted to progressively urge a strip around the mandrel to form a coil thereon, two adjacent rollers in the series having a plurality of aligned axially spaced peripheral grooves, means supporting the rollers, and a series of fingers carried by and extending from the supporting means towards the mandrel, each finger crossing both of said rollers in aligned grooves to thereby bridge the space between said rollers to inhibit the entrance therein of the leading end of the strip, the thickness of the fingers adjacent the rollers being less than the depth of the grooves, whereby the ungrooved portions of the rollers are free to engage the surface of the strip.

5. A strip coiler for rolling mills comprising a cylindrical mandrel and a series of rollers disposed thereabout adapted to progressively urge a strip around the mandrel to form a coil thereon, two adjacent rollers in the series having axially spaced aligned peripheral grooves, means supporting said rollers, and a series of fingers respectively extending from said means into said grooves, a part of each finger conforming to an arc of radius similar to that of the bottom of the grooves in one roller and another part substantially conforming to the curvature of the surface of the mandrel, said last mentioned portion overlying the other roller and extending towards a third roller in the series.

6. A strip coiler for rolling mills comprising a

cylindrical mandrel and a series of rollers disposed thereabout adapted to progressively urge a strip around the mandrel to form a coil thereon, two adjacent rollers in the series having aligned grooves, means supporting said rollers, and a finger of less thickness than the depths of the grooves extending from said means into the groove in one roller, partially about the latter in the direction of its operative rotation and thence into the corresponding groove in the other roller.

7. A strip coiler for rolling mills comprising a cylindrical mandrel and a series of rollers disposed thereabout adapted to progressively urge a strip around the mandrel to form a coil thereon, two adjacent rollers in the series having aligned grooves, means supporting said rollers, and a finger of less thickness than the depths of the grooves extending from said means into the groove in one roller and thence into the groove in the other roller, the finger conforming to the bottom of the groove in the first roller where it crosses the latter and thence substantially conforming to the curvature of the surface of the mandrel.

GEORGE F. PAUL.