Dec. 2, 1941. I. BRYN 2,264,872

STEEL MILL COILING REEL

Filed Aug. 22, 1939 2 Sheets-Sheet 1

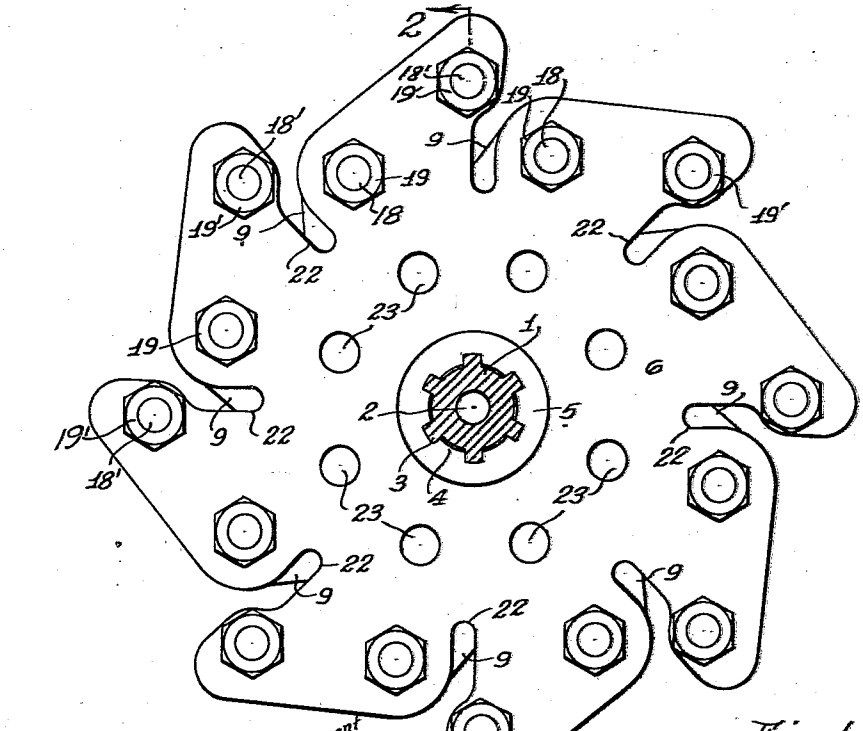


Fig. 1.

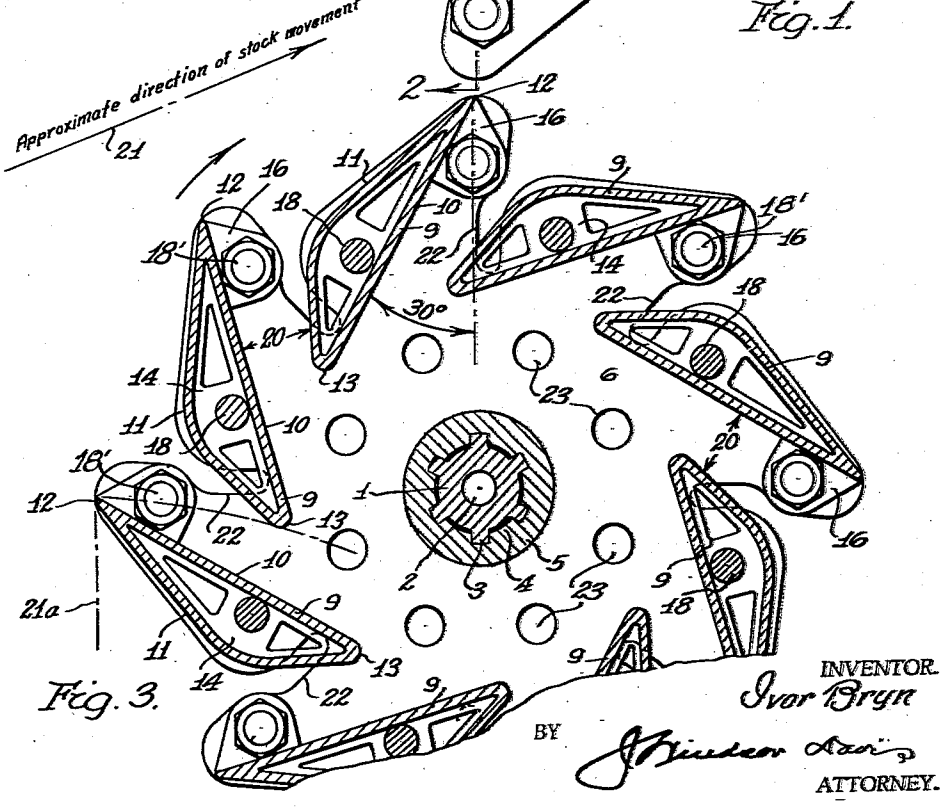


Fig. 3.

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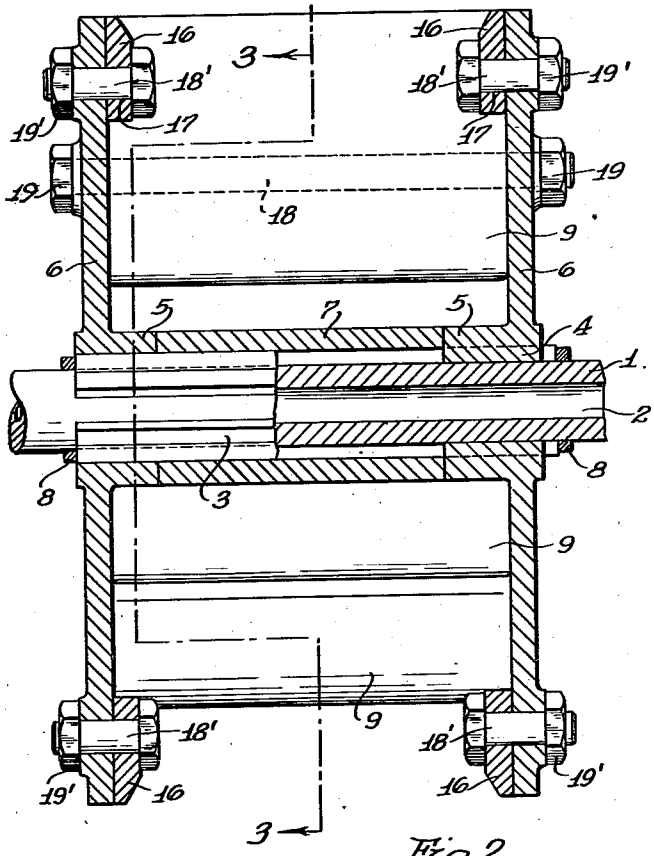


Fig. 2.

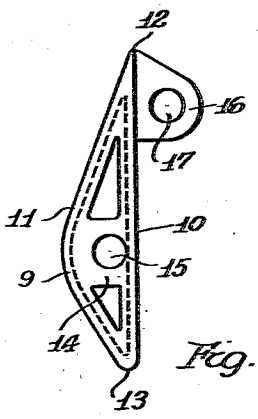


Fig. 5.

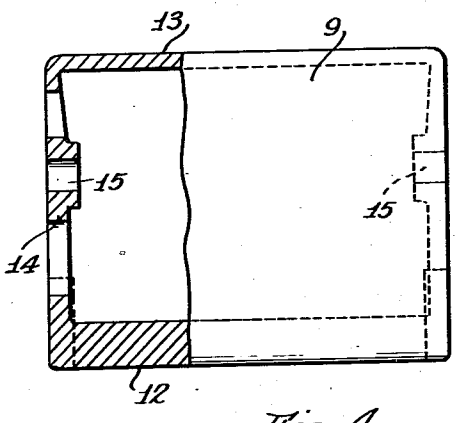


Fig. 4.

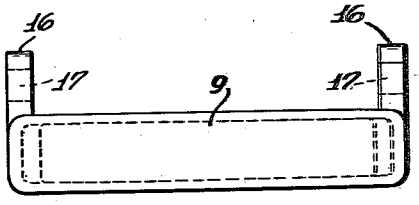


Fig. 6.

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UNITED STATES PATENT OFFICE

2,264,872

STEEL MILL COILING REEL

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Application August 22, 1939, Serial No. 291,387

6 Claims. (Cl. 242—78)

This invention relates to apparatus for the hot rolling of strip metal and particularly concerns the construction of reels such as are used in conjunction with mills wherein the metal is rolled back and forth through single or multiple mill stands, for the purpose of coiling the strip metal as it leaves the stand and, alternately, for uncoiling the strip metal to permit it to enter the stand. An example of the type of mill here concerned is disclosed in United States Patent No. 1,977,214.

In continuous mills, where the strip of metal is rolled back and forth through the mill stands, reels are provided at opposite sides of the stands for alternately coiling and uncoiling the strip stock, to receive the strip metal as it passes through the stands, and to supply it to the stands again for the reverse operation. The purpose of the reels is to economize on space because of the obvious necessity of providing an exceptionally long space for the lengthening strip metal, and also to enable heating of the strip metal to a temperature best suited for efficient rolling operations. As the strip lengthens the heat loss becomes more rapid, and in order to maintain the strip at a desired temperature the reels are disposed in furnaces.

Mounting the reels in furnaces and winding highly heated metal thereon requires that the shafts which support and rotate the reels be cooled, and it is the usual practice to cool the shafts by forming them hollow and circulating water therethrough. The result of these conditions is that a wide variance in temperature is present between the central region of the reels and regions radially outward, and the internal pressure developed because of different conditions of expansion and contraction causes destruction of the reels through cracking and checking thereof.

The primary object of this invention is to provide a reel construction in which expansion and/or contraction resulting from the zones of varying temperature are so controlled that the useful life of the reel is prolonged indefinitely as far as the source of trouble is concerned.

More specifically, the main object of the invention is to provide a reel embodying a pair of disc-like elements mounted upon a hollow shaft and having a multiplicity of circumferentially spaced bars, uniting the two disc-like elements, and extending parallel to the shaft is radially spaced relation thereto. The disc-like elements, being connected directly to the shaft, are cooled in their central regions when water is circulated through the shaft, whereas the outer regions, being subject both to the heat of the furnace and of the heated strip metal, is in a highly heated condition. In order to avoid cracking or checking of the disc-like elements, such as is ordinarily caused by the internal pressures resulting from unequal expansion and contraction conditions in different regions, the disc-like elements are so formed that the destructive stresses are relieved.

When the reels are in use they are rotated at a comparatively high speed and the end of the sheet metal is fed thereto in a direction almost tangential to the path which the transverse bars describe as they are revolved. The direction of movement of the sheet metal is opposite to the direction of movement of the bars, and as the end passes between two adjacent bars it is abruptly bent, to hook over one of the bars, and is then wound about the reel. This operation obviously imposes a sudden load on the reels, which must necessarily operate under the adverse conditions above mentioned, and necessitates a special construction and assembly of the disc-like elements and cross bars. It is a further object of this invention to provide a reel so constructed that, in addition to overcoming the problem resulting from heat conditions, it is capable of long service under the adverse or sudden loading conditions.

In the hot rolling of sheet metal the removal of scale is an important factor and this invention has as a still further object to provide a reel construction which assists in the removal of scale without creating a source of trouble in the passage of the sheet metal through the mill stand. In this respect, the sheet metal is coiled about the circumferentially spaced bars, and in the case of a reel having eight bars, as shown, the coiled metal takes an octagonal form, or, in other words, is bent to provide eight creases. These creases assist in raising the scale.

With the above and other ends in view the invention is more fully disclosed with reference to the accompanying drawings, in which—

Fig. 1 is a side elevation of the reel,

Fig. 2 is a section taken on the line 2—2 of Fig. 1,

Fig. 3 is a section taken on the line 3—3 of Fig. 2,

Fig. 4 is a plan view, partly broken away and in section, illustrating the construction of one of the transverse bars,

Fig. 5 is an end view of one of the bars, and

Fig. 6 is a side view of one of the bars.

More particularly, 1 designates a shaft having an axial passage 2 extending therethrough and through which a cooling liquid is circulated when the reel is placed in use. The shaft 1 has ex-

ternal splines 3 thereon with which the internal splines 4 in the hub portions 5 of a pair of disc-like elements 6 engage. The two hub portions 5 are spaced axially of the shaft by a sleeve 7, and are prevented from separating by collars 8 which are secured to the shaft 1.

The construction above described may best be seen with reference to Fig. 3, wherein the assembly is illustrated in a cool or contracted condition. The splines 3, as may be observed, project outwardly of the right hand disc-like element. This clearance is important in that it provides for the relatively high degree of expansion which takes place when metal at a temperature higher than 1500° is coiled thereon.

A multiplicity of bars 9 connect the two disc-like elements. These bars extend parallel to the shaft 1, are circumferentially spaced equal distances one from another, and each bar is spaced radially from the shaft. As is more clearly shown in Figs. 4, 5 and 6, each bar as viewed in end elevation or transverse section has a straight wall 10 and convex or arched wall 11, the two walls being joined by the rounded forward and rear edge portions 12 and 13. Between the edge portions 12 and 13 the walls 10 and 11 are united at each end thereof by a web 14, and each web has a bolt hole 15 therein. At each end of the wall 10 and adjacent the forward edge 12 thereof are formed lugs 16 having bolt holes 17 therein.

The web portions 14 at opposite ends of the bars 9 are secured to respective disc-like elements 6 by bolts 18 which extend through the bars and have nuts 19 on their outer ends, and the lugs 16 are secured to respective discs by bolts 18' and nuts 19'. After the assembly is completed the nuts 19 and 19' are welded in place. As may best be seen with reference to Fig. 3 the bolts 18 and 18' are so positioned that the flat faces 10 of the bars 9 are disposed at an angle of approximately 30° with respect to a radial line touching the forward edge 12 thereof, with the result that a portion of the arched wall 11 of each bar is placed in outwardly diverging relationship with the flat wall 10 of the next adjacent bar, as indicated by the numeral 20 on Fig. 3. When in operation, the strip metal is fed in the direction of the arrow on Fig. 1 and the end thereof enters the comparatively large mouth of one of the diverging spaces 20 as the reel is rotated in the direction of the arrow on Fig. 2. As the reel is revolved, one of the bars engages the end of the sheet metal, causing it to be bent over the forward edge of the bar. The extremity of the sheet metal tends, of course, to pull away from the bar it engages, and the next adjacent bar acts to retain the sheet metal in hooked relation with the first bar.

The arrow 21 on Fig. 1 illustrates the approximate line of movement of the sheet metal as it moves into engagement with the reel. The broken line 21*a*, on Fig. 3, illustrates the condition of the sheet metal after it has engaged the reel, and after the reel has been moved through part of a revolution.

Reels constructed as above described are quite massive, the weight of the metal exceeding two tons, and experience has taught that the extremely high temperatures of the metal being coiled and of the furnaces in which the reels are mounted, necessitates cooling of the shaft 1 in order that the heat shall not reduce the strength thereof below a safe degree. When the shaft is cooled, however, the disc-like elements crack and check, due to internal stresses created by unequal heat and expansion. The cracks are irregular in form but extend generally radially inward, from the periphery of the disc-like elements and finally to the hub, thus rendering the reels useless and resulting in hazardous conditions of operation in view of the high speed movement of the reels.

The disc-like elements 6 are provided with a multiplicity of stress relieving slots 22 which, as may be observed upon reference to Fig. 3, are disposed with one extending inwardly between each pair of bars 9. The slots 22 extend inwardly a distance approximately one-half the radial distance from the inner splined surface of the hubs 5 to the largest radial dimension of the disc-like elements. The elements 6 are also provided with a multiplicity of stress relieving apertures 23 of a number equal to the number of slots, and offset from the radial line upon which the slots 22 are formed. The outer portions of the slots diverge in a direction such that one wall parallels the convex walls of the adjacent bars, and the other walls follow around the other ends of the adjacent bars.

When the radially outward portions of the elements 6 are highly heated its natural tendency is, of course, to expand circumferentially and radially. However, with the hub portions comparatively cool, the inner regions do not expand at the same rate and result in a tendency for the outer metal to pull away from the inner metal. With the stress relieving slots 22 and apertures 23 present the outer layer of metal may expand circumferentially without setting up destructive stresses.

Although a specific embodiment of the invention has been illustrated and described it will be understood, of course, that various changes may be made within the scope of the appended claims without departing from the spirit of the invention, and such changes are contemplated.

What is claimed is:

1. A reel for coiling hot strip metal comprising a shaft, axially spaced disc-like elements mounted on said shaft for rotation therewith and for sliding movement axially thereof, a multiplicity of receiving bars for the hot strip metal extending parallel to the shaft and radially spaced therefrom, said bars having their ends rigidly attached to respective disc-like elements, said disc-like elements each having stress relieving cut outs extending to the periphery thereof between the points of attachment of adjacent bars.

2. A reel for coiling hot strip metal comprising a shaft having axially spaced disc-like elements mounted thereon for rotation therewith and for sliding movement axially thereof, said shaft having a cooling passage therethrough, and a multiplicity of strip metal receiving bars extending parallel to the shaft and radially spaced therefrom, said bars having their opposite ends rigidly attached to respective elements, said elements each having stress relieving slots extending substantially radially outwardly to the peripheries thereof between all adjacent bars.

3. A reel for coiling hot strip metal comprising an externally splined shaft, axially spaced internally splined disc-like elements on said shaft, bars extending parallel to the shaft and radially spaced therefrom, means securing opposite ends of said bars to respective elements, and means retaining said elements on the splines

of said shaft for limited axial movement relative to the shaft.

4. A reel for coiling hot strip metal comprising an externally splined shaft, axially spaced internally splined disc-like elements on said shaft, bars extending parallel to the shaft and radially spaced therefrom, means securing opposite ends of said bars to respective elements, said means comprising bolts and nuts with the nuts welded in place, and means retaining said elements on said shaft for limited axial movement relative to the shaft.

5. A reel for coiling hot strip metal comprising a shaft, axially spaced disc-like elements mounted on said shaft, a multiplicity of spaced bars radially spaced from the shaft, said bars each having a substantially straight front wall and a convex rear wall as viewed in transverse section, an elongate bolt extending internally through each bar and secured at its ends to said elements, and external means comprising external lugs on said bars and bolts extending through respective lugs and elements and securing said bars to said elements with the straight walls angularly related to an imaginary radial line touching the forward tip thereof.

6. A reel comprising a splined shaft having a passage therethrough for a cooling fluid, internally splined disc-like elements mounted on said shaft and free to move axially thereof, means restricting axial movement of said elements on said shaft, a multiplicity of spaced bars spaced radially from the shaft, each bar having a comparatively flat wall and a convex wall with the two walls integrally united at their forward and rear edges, means securing the ends of said bars to respective elements for rigidly spacing said elements, and stress relieving slots extending inwardly from the peripheries of said elements and between adjacent pairs of bars.

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