April 23, 1963 J. T. MAYHEW 3,086,729

COILING APPARATUS

Filed June 29, 1960

FIG. 1

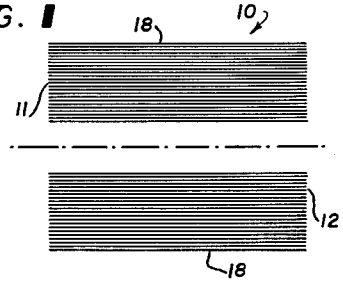


FIG. 2

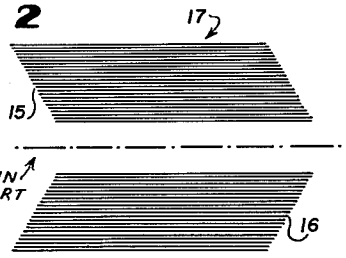


FIG. 3

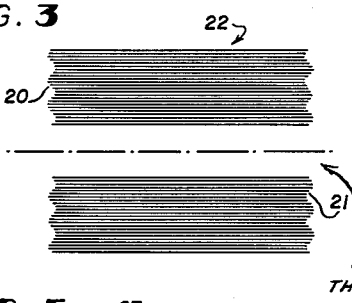


FIG. 4

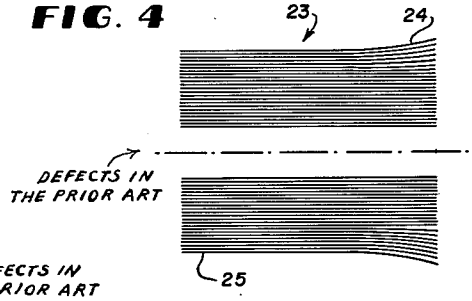
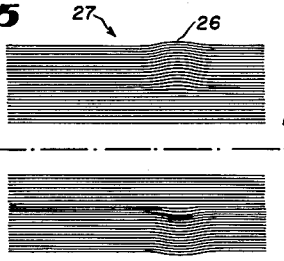


FIG. 5



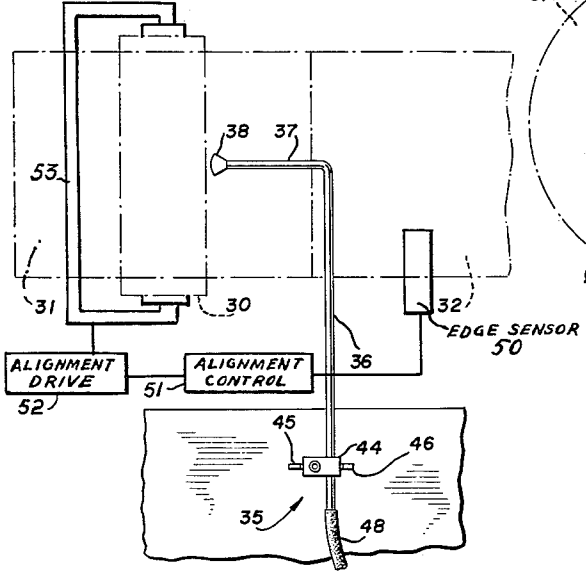


FIG. 6

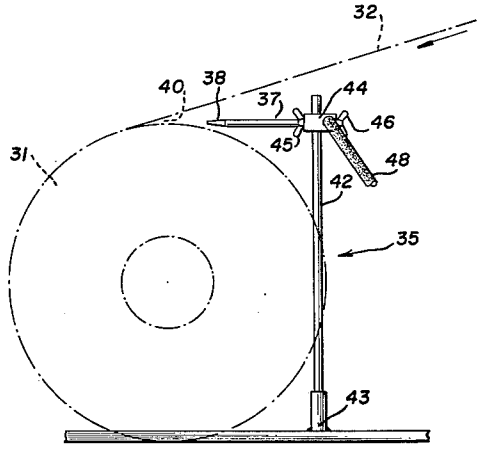


FIG. 7

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COILING APPARATUS

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The invention is concerned with an improvement in coiling strip material.

In the coiling of strip material it is important, for future handling and other purposes, that the coils formed have straight lateral edges and a smooth circumferential surface. Much effort has been expended to produce coils having straight lateral edges and various edge alignment control devices have been developed. Most of these devices sense the location of the edge of the strip being added to a coiling reel and, responsive to the location sensed, move the reel axially to keep the reel, and the coil on the reel, in alignment with the strip being added. The edge sensing means may be photo-sensitive or pneumatic and generates a signal which is directed to electro-mechanical means for moving the coiling reel axially in response to the sensed location. These systems are available commercially; one such is known as "Askania" control and has been marketed by the Askania Regulator Company.

In the steel industry, these coils may reach a weight of fifteen tons or more and may have an overall diameter of greater than six feet built up from strip material having a thickness of 0.02 inch or lower. With the thousands of revolutions necessary to build up a coil of this size, it can be seen that the speed of coiling or recoiling becomes an important factor in commercial operations.

The invention includes methods and apparatus for improving the coiling or recoiling operation when alignment controls are being used. In describing the environment for the invention and a specific embodiment of the apparatus employed by the invention, reference will be had to the following drawings, in which:

FIGURE 1 is a cross sectional view of coiled strip material of desired configuration;

FIGURES 2 through 5 are cross sectional views of coiled strip material showing defects of the prior art;

FIGURE 6 is a schematic top plan view of structure embodying the invention; and,

FIGURE 7 is a side view of a portion of the structure of FIGURE 6.

It has been found when coiling rough surface strip material, such as galvanized strip of the lighter gages, that low coiling speeds, for examples less than 100 feet per minute for 30 gage, were required in order to form coils of uniform rectangular cross section. Referring to FIGURE 1, a coil 10 of the desired configuration has a cross section with straight lateral edges 11 and 12 lying in a plane perpendicular to the axis of the coil and a smooth circumferential surface 18 so that a uniform, symmetrical, cross section results in any radial plane which includes the axis of the coil.

When attempts are made to coil faster than the aforementioned low coiling speeds, distortion of the coil results. One form of distortion known as spooling is shown in FIGURE 2. Lateral sides 15 and 16 of a coil take on a frustro-conical shape instead of the desired straight lateral edges which lie in a plane perpendicular to the axis of the coil.

Another form of distortion resulting from exceeding the presently accepted low coiling speeds is wavy edge, or "sneaky edge" to use the strip mill term. This form of distortion is shown in FIGURE 3, lateral edges 20 and 21 of coil 22 take on a wavy configuration throughout the edge length; at times this type of distortion will appear

along only a portion of the edge when speeds are varied during the coiling operation.

At other times, when the required low coiling speed is exceeded, a metal build-up at one end of a coil results. Referring to FIGURE 4, metal build-up on coil 23 causes one end 24 to have a greater diameter than the remaining end 25. Another distortion related to metal build-up, is known as ridging. Referring to FIGURE 5, a ridge 26 of increased diameter with respect to the remainder of the coil 27 is formed on the circumferential surface of the coil intermediate the lateral edges. Neither of these distortions is due to off gage strip, the strip has substantially uniform thickness across its full lateral dimension and throughout its length.

It is the general purpose of the invention to make available increased coiling speeds for rough-surface strip material while preventing distortion of the coil such as spooling, wavy edges, metal build-up, ridging, and the like.

The distortions described above have always been accepted in the metals industry; when certain set coiling speeds for certain strip materials were exceeded distortions resulted. The reason(s) remained inexplicable. A significant part of the invention is the discovery of plausible reasons for such distortions which formed grounds for a solution of the problem. It is believed that a large amount of interstitial friction between the reel, or the coil on the reel, and the strip being added is developed when alignment controls are in operation. In accordance with the invention, this interstitial friction is decreased to such a degree that coiling speeds in excess of twice the coiling speeds formerly possible with a particular material are easily attainable without distortion.

The apparatus employed to offset this interstitial friction is simple in nature, comprising essentially means for directing a gas under pressure between coil and the strip material being added to the coil.

Referring to FIGURE 6, a coiling reel 30 supports a coil 31 to which strip material 32 is being added. The reel 30 is subject to axial motion effected by alignment controls which may be of the conventional type such as the "Askania" controls referred to earlier. The alignment controls are shown schematically and include an edge sensor 50 for sensing the edge location of strip material 32 being added to coil 31. The edge sensor 50 generates a signal which is delivered to alignment control 51 which controls alignment drive 52. The alignment drive 52, through bar 53, moves the reel 30 axially to maintain the coil 31 in alignment with strip 32 so that a straight edge coil may be formed. A stand 35 supports gas tubing 36 which extends from an area exterior to the coil and the strip toward the center line of the strip. At right angles to tubing 36, tubing 37 extends along, or near to, the center line of the strip 32 toward crevice 40 between the strip 32 and the coil 31. A flattened nozzle 38 directs gas under pressure into the crevice 40.

Referring to FIGURE 7, the stand 35 includes an upright rod 42 and a foundation 43. Mounted on rod 42 is a sliding block 44 which may be secured at various positions along the rod 42 by wing bolt 45.

The gas tubing 36 passes through the sliding block 44; its position may be adjusted and is held by a wing bolt 46. Gas is supplied under pressure to tubing 36 via a flexible hose 48 from any conventional source (not shown).

In accordance with the invention, a method is provided for preventing distortion of a coil, such as spooling, wavy edges, metal build-up, ridging, and the like, when coiling at high speeds. To carry out the method, a gas, preferably a moisture-free gas, is blown under pressure between a coil being formed and strip material being added

to the coil. The gas is blown along a path having the same general direction as the movement of the strip material being added which may or may not be tangential to the coil. The gas is directed into the crevice between the strip being added and the coil to form a cushion of of the gas between the strip being added and the coil which extends along substantially the full length of the crevice as the gas exits with a near lateral direction relative to the strip being added.

Referring again to FIGURE 7, as the coil diameter increases, the position of the sliding block **44** is adjusted on the rod **42** so that gas is blown directly into the crevice **40** substantially tangential to the coil **31**. The adjustment means is manual, however automatic adjustment means may readily be employed. For example, an automatic adjustment means which is purely mechanical could be had by placing a rider on the coil **31** which raises the sliding block **44** as the coil diameter grows; or an electrical coil diameter sensing means, such as a photo-cell system, could actuate an electro-mechanical follow up system to adjust the height of the sliding block **44**.

In employing the method of the invention with the apparatus shown, dry compressed air has been used as the lubricating gas to reduce the friction between the coil and the strip being added. However neither the method nor the apparatus of the invention are to be limited to the use of compressed air. The dry compressed air is supplied at a pressure between 70 and 80 pounds per square inch through ⅜" tubing **36** and **37** to the flattened nozzle **38** having a ⅛" slot. The compressed air flows axially outwardly from the center line of the strip along the entire crevice **40**. In practice, one nozzle has been sufficient to reduce the interstitial friction sufficiently that any desired coiling speeds could be obtained, however, a plurality of nozzles may be used. In coiling galvanized strip of 24 gage, the top speed formerly available was 100 feet per minute whereas when the invention is employed this strip material may be coiled at speeds in excess of 200 feet per minute without the former distortion such as spooling, ridging, and metal build-up occurring.

Obviously many modifications and variations of the

present invention are possible in the light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. Apparatus for forming straight edge coils of metallic strip material comprising coiling reel means, alignment control means for axially aligning the coiling reel means with strip material being coiled, means for supplying a gas under pressure to the area of strip material being coiled, and means for directing the gas between the coil being formed and the strip material along a path having the same general direction as the movement of the strip material being coiled.

2. Apparatus for coiling strip material comprising coil reeling means, alignment control means for moving the coiling reel means axially to maintain alignment of the coil reeling means with strip being added during coiling operations, means for supplying gas under pressure to the area of coiling operations, and means for directing the gas between a coil being formed and strip material being added to the coil along a path which follows the general direction of movement of the strip being added.

3. Apparatus for preventing distortions such as ridging, spooling, wavy edges, and metal build up in high speed coiling of galvanized strip material comprising coiling reel means, alignment control means for axially aligning the coiling reel means with galvanized strip material being coiled, means for supplying compressed air under pressure to the area of the coiling operation in which a coil is being formed from galvanized strip material, and means for directing the compressed air between the coil and the galvanized strip material being added to the coil along a path which follows the general direction of movement of the galvanized strip material being added.

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