Nov. 9, 1943. W. C. McBAIN ET AL 2,334,109

ROLLING MILL COILER

Filed March 8, 1941 2 Sheets-Sheet 1

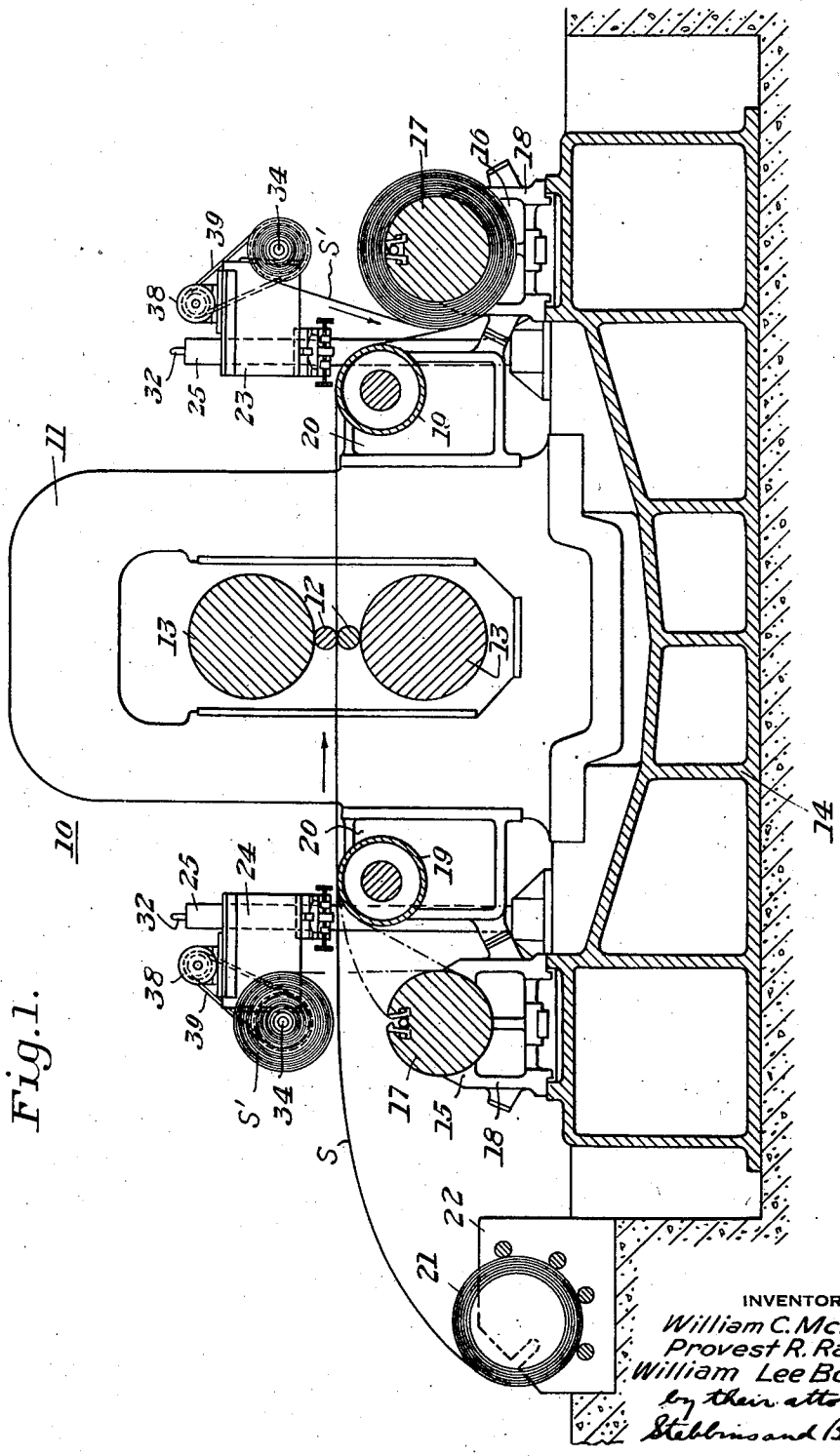

Fig. 1.

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Fig. 3.

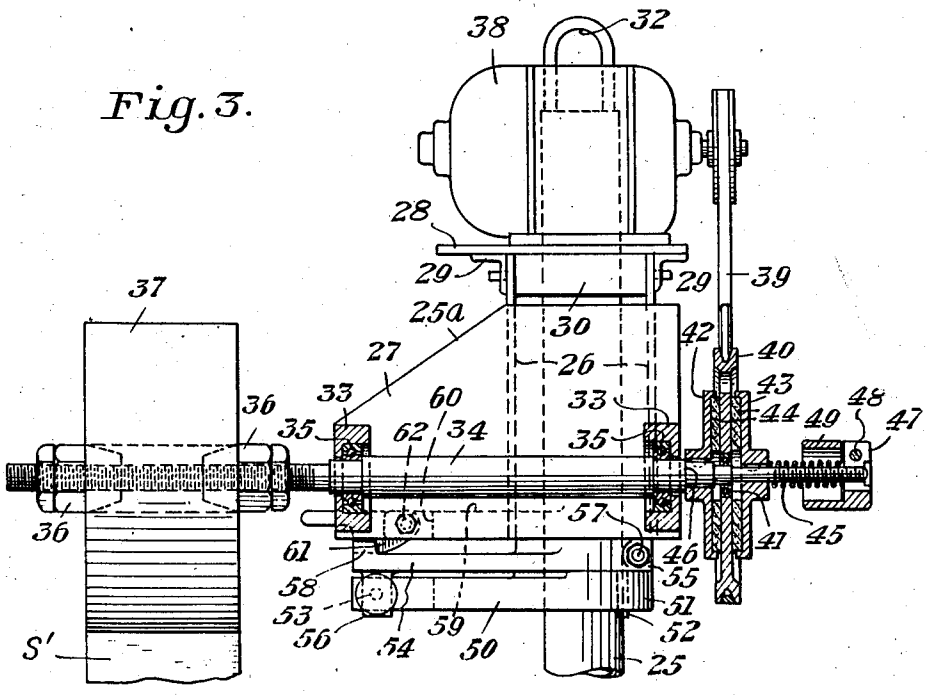


Fig. 4.

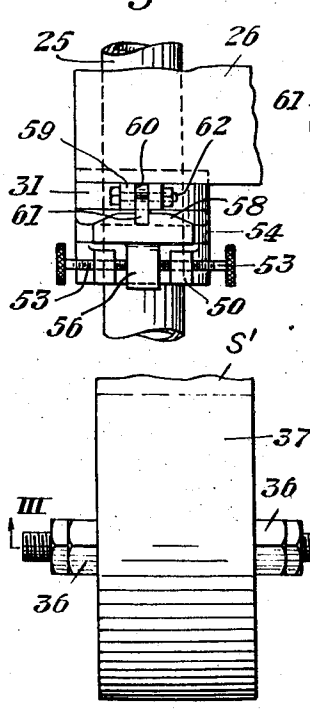
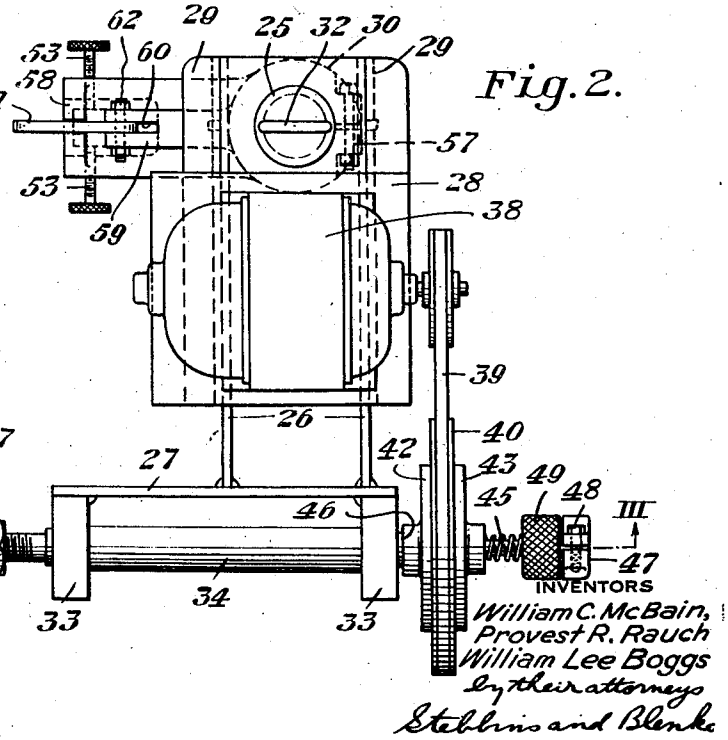


Fig. 2.



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Patented Nov. 9, 1943

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UNITED STATES PATENT OFFICE

2,334,109

ROLLING MILL COILER

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Application March 8, 1941, Serial No. 382,362

4 Claims. (Cl. 242—78)

This invention relates to the rolling of metal strip and, in particular, to the rolling of strip having a highly polished surface generally designated "mirror finish."

Metal strip is ordinarily reduced to the desired gauge by passing it back and forth through a reversing four-high mill or by passing it in one direction only through a multi-stand continuous mill. In either case, the strip is recoiled after reduction, under considerable tension. The recoiling operation frequently causes longitudinal scratches on the strip surfaces resulting from slippage of the successive turns of the coil as it is wound up under tension. For most uses, these scratches are not objectionable, particularly where the metal is to be coated as by galvanizing or tinning. A certain amount of low-carbon steel strip, however, must have a "mirror finish", particularly that intended for nickel-plating or the like. A "mirror finish" has heretofore been imparted to certain grades of material, such as stainless steel or other similar alloys, by polishing or buffing the strip after rolling, but this is an expensive operation and is justified only in the case of the more costly alloy steels. A large variety of metal articles are now manufactured from "mirror finish" steel strip, in both the stainless and low-carbon analyses.

Our invention provides a mechanism and method whereby a so-called "mirror finish" may be produced on steel strip, regardless of the composition, without the necessity of buffing or polishing after rolling with the minimum of cost. The invention is based on the principle of avoiding the production of scratches in the strip as it is recoiled, by coiling a protective strip between the successive layers of metal strip. This prevents the scratching of one layer by adjacent layers, thereby preserving the high polish imparted to the material by the rolls of the mill, and rendering unnecessary any subsequent polishing or buffing. In a preferred practice of our invention, we utilize paper in strip form as the protective material, and deliver the paper strip to the reel on which the strip is coiled after rolling. In the case of a reversing mill, the paper strip is recoiled as the metal strip makes a reverse pass through the mill.

The preferred embodiment of our invention comprises an auxiliary reel mounted adjacent a reel of conventional design for handling metal strip. We provide an adjustable mounting for the auxiliary reel whereby its axis may be positioned in exact parallelism with that of the metal strip reel with which it is associated. We also provide means for driving the auxiliary reel when operating to recoil the paper strip, the drive including a slippage-permissive element such as a friction pulley whereby the motor may be driven constantly at a speed sufficient to take up the paper strip at its maximum rate of delivery, the drive permitting the reel to slow down as the rate of delivery of the paper strip decreases, without necessitating a reduction in the speed of the reel motor.

The preferred embodiment of our invention outlined above is illustrated in the accompanying drawings and the preferred practice will be explained with reference thereto. In the drawings,

Fig. 1 is a diagrammatic central section through a reversing 4-high mill having a strip reel on each side thereof, showing the invention incorporated therein;

Fig. 2 is a plan view of the auxiliary reel;

Fig. 3 is a view partly in section along the line III—III of Fig. 2 and partly in elevation; and

Fig. 4 is a partial side elevation illustrating certain details.

Referring now in detail to the drawings and, for the present, to Fig. 1, a 4-high reversing mill 10 comprises housings 11 having work rolls 12 and backing rolls 13 journaled therein. The housings are disposed on a base casting 14. Reels 15 and 16 are disposed on opposite sides of the mill 10, each comprising a mandrel 17 journaled in a supporting frame 18 and provided with a suitable driving motor (not shown). Between the reels and the mill, cooling and guiding sheaves 19 are journaled in suitable bearings carried in castings 20 secured to the mill housings 11.

In accordance with the usual practice, metal strip S of steel or the like is passed back and forth through the mill and between the rolls 12 thereof, being alternately unwound from and coiled on one or the other of the reels 15 and 16. When the strip is first started through the mill, is unwound from a coil indicated at 21, disposed in a coil box 22 and the leading end is attached to the mandrel of reel 16. When the entire length of the coil has been wound up on the reel 16, the other end is attached to the mandrel of the reel 15. Ordinarily, the strip rolled in the mill 10 will be that produced by the rolling of a slab is a multi-stand continuous mill and may vary from about .065" to about .109" in thickness. This material is reduced by cold-rolling in the mill 10 to finished gauge, i. e., from about .015" to .040", depending on the requirements

of the specific application for which the material is to be used.

As the strip S is coiled on the coiler 16 during the loading pass or on the winding-up reel, whether the reel 15 or 16, on any subsequent pass, we coil a protective strip S' of any suitable material, for example paper, between successive thicknesses of the metal strip S. The protective strip S' is delivered to the coil of metal strip by an auxiliary reel indicated generally at 23 mounted adjacent the reel 16. A similar auxiliary reel 24 is mounted adjacent the metal strip reel 15. The reels 23 and 24 are identical and the details of the construction thereof are shown in Figs. 2 through 4. The reels 23 and 24 are mounted on vertical standards or posts 25 extending upwardly from the base casting 14 on opposite sides of the mill and on one side of the path of the strip S therethrough.

Each of the reels 23 and 24 includes a frame indicated generally at 25*a* and comprising spaced side plates 26, an end plate 27 welded thereto, and a base plate 28 supported on the side plates and secured thereto through angle bars 29 by riveting or welding. Hubs 30 and 31 are disposed in alinement between the side plates 26, are welded thereto and are bored to receive the standards 25 which may conveniently be steel pipe having a suitable base or footing attached thereto and a lifting eye or loop 32.

Bearing blocks 33 are secured to the end plate 27 of the frame 25. A spindle 34 journaled in bearings 35 seated in the blocks 33 is threaded at one end to receive cone nuts 36 adapted to engage a coil 37 of protective strip S' therebetween.

The spindle 34 is driven by a motor 38 mounted on the base plate 28, through a belt 39 and a pulley 40. The pulley 40 is rotatably carried on the spindle by a bearing 41. The driving torque is transmitted to the shaft through friction disks 42 and 43 keyed thereto and having a lining of suitable frictional material 44 engaging the web of the pulley 40. A compression spring 45, on the end of the spindle 44 opposite that on which the coil 37 is mounted, urges the disk 43 against the pulley and the pulley against the disk 42. Axial movement of the latter is limited by a shoulder 46 on the spindle. The outer end of the spring 45 bears against a split nut 47 adjustable along the threaded end of the spindle and having a clamping screw 48 for securing it in position and a knurled sleeve 49 facilitating manual adjustment thereof.

It will be clear from the foregoing description that the pulley 40 and the friction disks 42 and 43 constitute a slippage-permissive drive connecting the spindle 34 to the motor 38.

A radial arm 50 has a hub 51 surrounding the standard 25 and secured thereto against movement angularly or longitudinally thereof by any suitable means such as a key 52. The end of the arm 50 is bifurcated and has adjusting screws 53 threaded into opposite sides thereof. A radial arm 54 has a split hub 55 surrounding the standard 25 and a lug 56 depending from the outer end thereof between the portions of the bifurcated end of the arm 50. The screws 53 engage the lug 56 and by adjusting them one way or the other, the arm 54 may be given a slight rotary movement about the axis of the standard 25. A clamping bolt 57 is tightened when the proper adjustment is obtained as will be described hereinafter. An upwardly projecting lip 58 at the end of the arm 54 has sloping side portions and a centrally disposed notch for a purpose which will appear shortly.

The hub 31 forming part of the frame 25 has a radial arm 59 projecting therefrom. The end of the arm 59 is bifurcated as at 60 to receive a detent 61 pivoted thereto on a bolt 62. The lower edge of the detent 61 is adapted to enter the notch in the lip 58 when the frame 25 is so positioned that the spindle 34 is precisely parallel to the axes of the reels 15 and 16. The outer end of the detent is shaped for manual operation and when the detent is lifted, the frame 25 is free to turn on the standard 25, for the purpose of disposing the coil 37 of protective strip in an out-of-the-way or non-operating position. When the frame 25 is turned back to the operating position illustrated, the detent 61 rides up one of the inclined sides of the lip 58 and falls into the central notch thereof. The arm 54 thus serves to insure that the frame 25 is restored to the proper position after it has been shifted therefrom. As already explained, minor adjustments of the arm 54 may be effected by the adjusting screws 53.

When starting a pass of the strip S through the mill 10, e. g., the loading pass, the free end of the coil 37 of protective strip S' on the auxiliary coiler 23 is introduced between the starting "wraps" of the metal strip around the mandrel 17 and that portion of the strip moving from the adjacent sheave 20 on to the coil. After the free end of the protective strip has been started into the coil of metal strip, the remainder of the coil of paper, or as much thereof as is required by the length of the metal strip being rolled, will be coiled on the mandrel 17 with the metal strip. The motor of the reel 23 is so energized that it tends to drive the reel in a direction opposite that in which it is actually driven by the unwinding protective strip and thus tensions the strip through the frictional, sliding contact between the web of pulley 40 and the friction plates 44. The motor rotates in the same direction whether the strip is being unwound or recoiled.

On the next pass of the strip S through the mill, i. e., from right to left, the metal strip is recoiled on the mandrel 17 of the reel 15 and the auxiliary reel 24 supplies paper strip between the successive turns of the metal strip in the manner just described. During this pass, the reel 16 serves as a pay-out reel. The motor 38 of the reel 23, furthermore, is energized to drive the spindle 34 in such direction as to rewind the paper strip as the metal strip is unwound, in order that it may be re-used.

The metal strip passes through the mill at a substantially uniform speed and the paper strip S' is thus delivered from a coil of metal strip at this same speed. Since the size of the coil of paper strip on the spindle 34 increases during the pass, the angular velocity of the spindle decreases correspondingly. The motor 38 is designed to drive the spindle 34 at a speed equal to or greater than that necessary to wind up the paper strip under tension when the coil thereof on the spindle 34 is of minimum size. The motor continues to run at substantially the same speed, despite the building up of the coil on the spindle 34, and the slowing down of the spindle, the friction drive including the pulley 40 and the disks 42 and 43 permitting the necessary slippage.

It will be apparent from the foregoing description that the invention provides a simple yet highly effective method and apparatus for handling a protective strip used to separate succes-

sive turns of a coil of metal strip as it passes through a reducing mill. As already stated, the angular adjustment of the arm **54** by the screws **53** permits the axis of the spindle **34** to be made precisely parallel with that of the reels **15** and **16**. Accurate coiling of the paper strip between the turns of the metal strip may thus be obtained. The coil of paper strip, of course, may be adjusted longitudinally of the spindle **34**, into exact alinement with the coil of metal strip, by changing the setting of the cone nuts. Since the paper coiled between the turns of the coil of metal strip represents a considerable item of expense in manufacturing "mirror finish" material, the recoiling of the paper for further use represents a substantial economy. The use of the slippage-permissive drive including the friction pulling and driving disks makes it unnecessary to control the speed of the auxiliary reel motor accurately. The auxiliary reels may be easily swung out of the way when not in use and quickly restored to precisely the desired operating position, once proper adjustment has been made.

Although we have illustrated and described a preferred embodiment and practice of the invention, it will be recognized that changes in the apparatus and procedure disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. For use in combination with a reel adapted to handle metal strip adjacent a rolling mill, an auxiliary reel adapted to handle a protective strip coiled with the metal strip, a substantially vertical standard on which said auxiliary reel is rotatable, a radial arm on said standard, a detent on said auxiliary reel engageable with said arm, and means for adjusting said arm about said standard.

2. For use in combination with a reel adapted to handle metal strip adjacent a rolling mill, an auxiliary reel adapted to handle a protective strip coiled with the metal strip, said auxiliary reel comprising a frame rotatable on a substantially vertical standard, a spindle journaled in said frame, a radial arm adapted to be secured in adjusted position on said standard, and means on said frame cooperating with said arm to insure accurate repositioning of said frame after it has been swung out of normal position.

3. For use in combination with a reel adapted to handle metal strip adjacent a rolling mill, an auxiliary reel adapted to handle a protective strip coiled with the metal strip, said auxiliary reel comprising a frame rotatable on a substantially vertical standard, a spindle journaled in said frame, a radial arm adapted to be secured in adjusted position on said standard, means on said frame engageable with said arm, and means for adjusting said arm angularly about said standard.

4. Apparatus for feeding protective strip between the turns of a coil of metal strip during the formation of such coil comprising a post, a frame rotatable on said post, a spindle journaled in said frame and adapted to receive a roll of protective strip, an arm extending laterally from the post and fixed relative thereto, means determining the operating position of said frame, and means on said arm for adjusting said positioning means.

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