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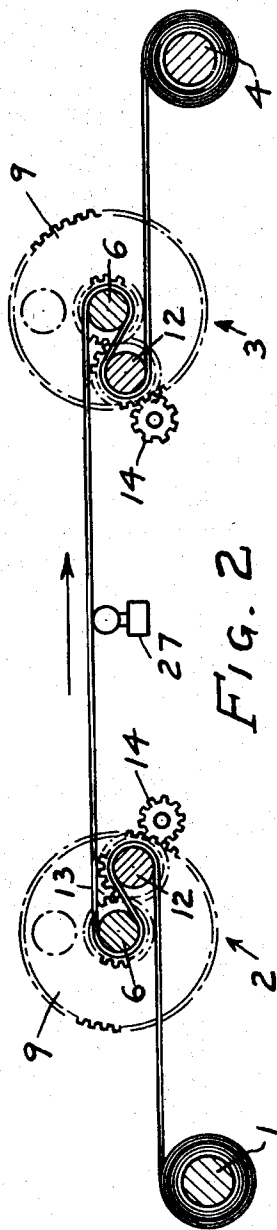
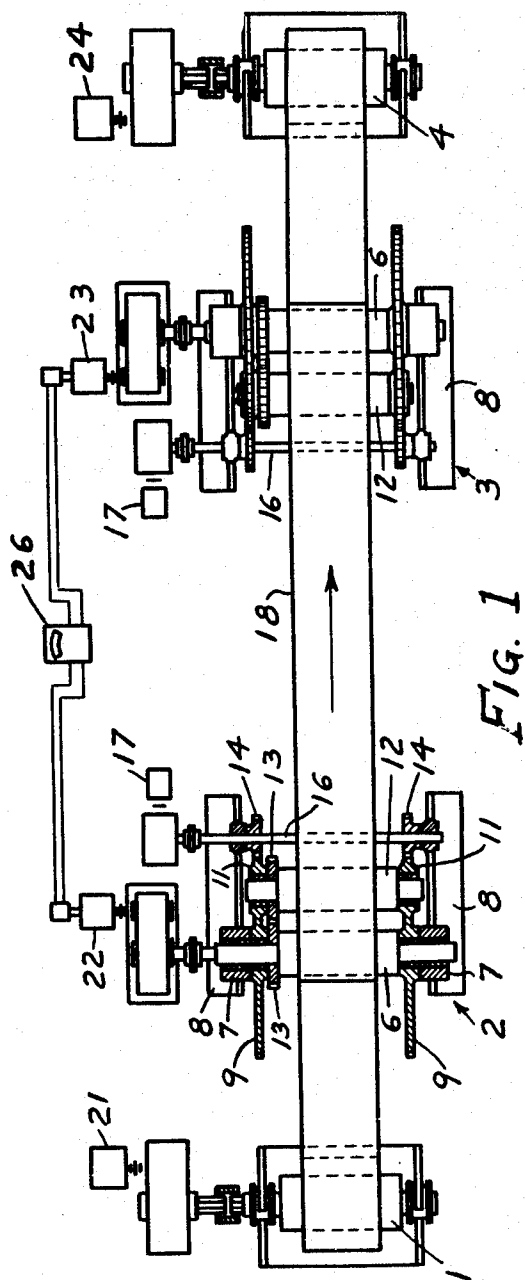
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2,432,828

APPARATUS FOR STRETCHER LEVELING STRIPS

Filed July 1, 1939

2 Sheets-Sheet 1



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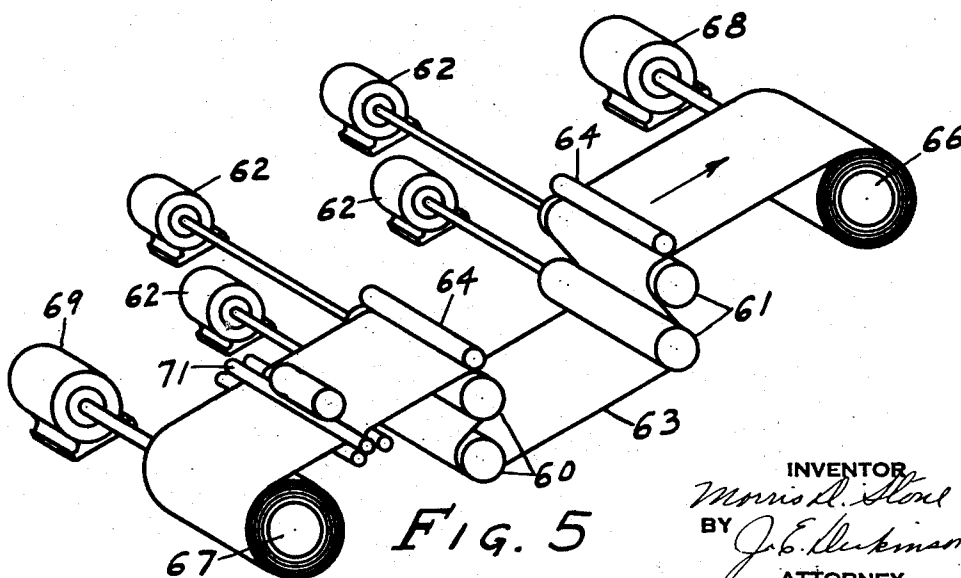
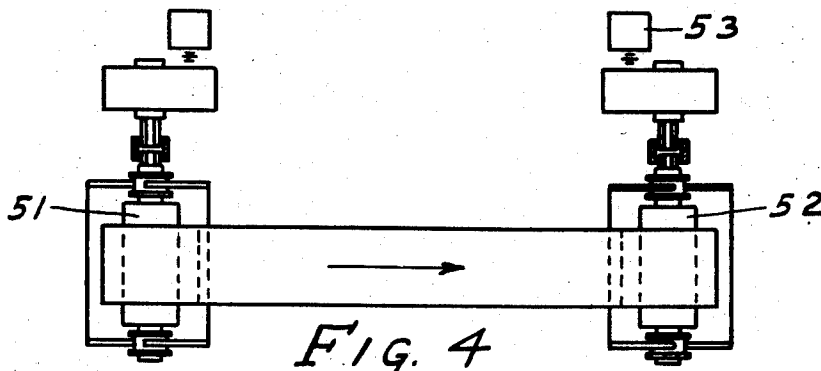
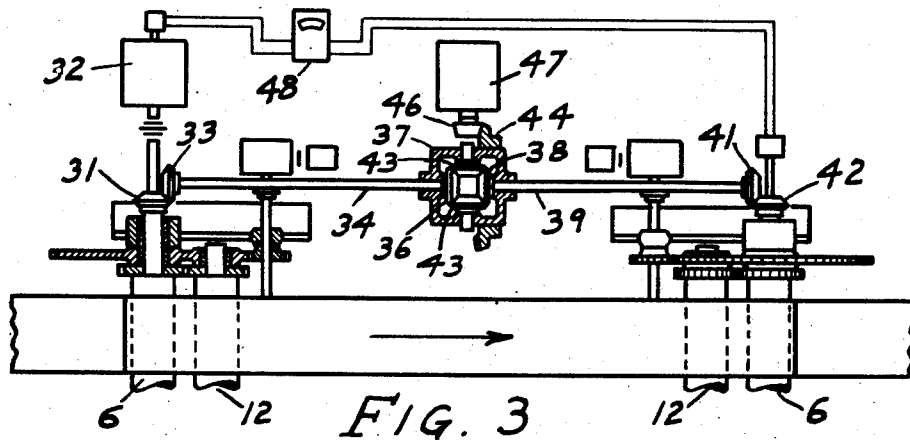
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2 Sheets-Sheet 2



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APPARATUS FOR STRETCHER LEVELING STRIPS

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3 Claims. (Cl. 205—1)

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This invention relates to the flattening of metal strip material, and more particularly to an apparatus for stretching and leveling continuously moving metal strip.

It is among the objects of this invention to provide an apparatus of this character which does not require the use of leveling rollers or the like in its operation and is at the same time capable of both working and flattening the strip and of doing so at relatively high speeds. Another object is the provision of apparatus for continuously cold working and leveling strip which is efficient in operation, simple in construction and adapted to be maintained at comparatively small cost.

In accordance with this invention metal strip is continuously acted upon by a pair of spaced tension units which are either operated at different speeds or are adapted to tend to operate in opposite directions but are so controlled that the strip is advanced after being stretched a uniform amount which is sufficient to level or flatten it. More particularly, the strip is fed between rotatable drag tension means and pull tension means which engage it and apply tension in excess of its elastic limit to the intervening portion of the strip. Tension is also preferably applied to the strip before and after it engages the drag and pull tension means, although this is not necessary where such means frictionally grip the strip sufficiently to prevent slippage. Means are provided for varying the speed of one or both of the tension means so as to obtain the desired tension on the strip and maintain it constant, or to obtain a uniform amount of stretching per lineal unit. The strip is preferably caused to travel through a zig-zag or reverse bend path as it enters the stretching zone in order to work the metal of the strip and thereby promote stretching. Before the strip reaches the drag tension means it may also be subjected to rather sharp reverse bends to cold work its surfaces so as to prevent the strip from developing stretcher strains. In one form of the invention the strip is threaded into the flattening apparatus while the stretching rollers are in a position in which they make the threading very easy, after which they are moved into operative position.

The invention is illustrated in the accompanying drawings in which Fig. 1 is a plan view, partly in section, of one embodiment; Fig. 2 is a vertical section of Fig. 1 taken through the center of the strip; Fig. 3 is a fragmentary view similar to Fig. 1, but illustrating another type of roller drive; Fig. 4 is a plan view of a modified embodiment of this invention; and Fig. 5 is an isometric view of another modification.

Referring to Figs. 1 and 2, continuous metal strip is fed from an unwinding reel or uncoiler 1 through a back or drag tension unit 2 and a pull tension unit 3 to a winding-up reel or coiler 4, the

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two tension units applying sufficient tension to the strip between them to stretch it beyond its elastic limit. The two tension units are constructed substantially alike, each one including a roller 6 the necks of which are journaled in bearings 7 supported by laterally spaced side frames 8. Rotatably mounted on each roller neck between its body and its bearing is a large toothed disc 9 which is provided at one side of its axis with a bearing 11 for receiving one neck of an outer roller 12. The latter roller is driven by the roller 6 by means of gears 13 mounted on their necks. To rotate the toothed discs so that the roller 12 can be swung laterally in an arcuate path around the fixed roller for a purpose about to be described, the disc teeth mesh with pinions 14 keyed on a shaft 16 journaled in the side frames 8 and turned by a motor 17.

This mounting of the rollers permits the accomplishment of one of the features of this invention; namely, easy initial threading of the strip through this apparatus. Accordingly, when it is desired to prepare this apparatus for operation the discs 9 are first rotated by pinions 14 to swing the outer rollers 12 of the two tension units around the fixed rollers 6 to the broken line positions shown in Fig. 2, where they are above rollers 6. The leading end of the strip from the uncoiler 1 is then drawn through each set of rollers and connected to the uncoiler 4. This threading of the strip is very easy because each pair of rollers is spaced apart and forms a wide horizontal pass through which the strip passes in a generally straight line from the uncoiler. The discs 9 are then rotated to swing rollers 12 outwardly toward the adjacent reels and then inwardly and upwardly to the positions shown in full lines in Fig. 2. This movement causes rollers 12 to loop the strip beneath the portion between rollers 6 so that it will travel around two reverse bends as it passes through each tension unit. It also causes the strip to engage over half of the surface of each roller, whereby it is frictionally gripped by the rollers without being pinched between them. This frictional grip is increased to the point where there is no danger of slippage, and the strip between the tension units and adjacent reels is held taut, by applying tension to the strip by means of the reels.

After the apparatus has thus been prepared for operation, the various rollers and reels are set in rotation to pass the strip through the tension units from the uncoiler to the coiler. As indicated above, the uncoiler 1 is rotated at a slower rate than the drag tension rollers. This may be done by dynamically or regeneratively braking motor 21 that drives the uncoiler, or by connecting it so that it will function as a generator when the strip is pulled from the uncoiler. Although the tension thus put on the strip between un-

coiler and drag tension unit is material for the reasons previously mentioned, it is not sufficient to stretch the strip beyond its elastic limit. On the other hand, the pull tension rollers are driven by a motor 23 at a peripheral speed sufficiently in excess of that of the other set of rollers, connected to a motor 22 operated in the same manner as motor 21, to stretch the strip between the two tension units beyond its elastic limit and thereby level or flatten it. Material tension, although insufficient to stretch the strip, is applied to it as it leaves the pull tension unit by coiler 4 driven by a motor 24. The amount of elongation of the strip taking place between the tension units is automatically indicated by a speed ratio meter 26 controlled by the torque on the tension unit motors 22 and 23. If desired, the tension may be maintained uniform by a suitable loop tension control 27 of conventional type engaging the strip between the tension units.

On the other hand the tension may be automatically varied by the mechanical means shown in Fig. 3 in order to effect a uniform amount of stretching per lineal unit. In this embodiment of the invention the neck of drag tension roller 6 is provided with a bevel gear 31 and the roller is driven by an electric motor 32. Meshing with this gear is a bevel gear 33 mounted on one end of a shaft 34 the opposite end of which carries a bevel gear 36 disposed in a differential cage 37. At the opposite side of the cage is a bevel gear 38 mounted on one end of a shaft 39 carrying at its outer end a bevel gear 41 meshing with a similar gear 42 mounted on the end of the neck of pull tension roller 6. Meshing with the two bevel gears in the differential cage are oppositely disposed idler gears 43, and the entire cage is rotated by a ring gear 44 encircling it and meshing with a pinion 46 driven by a variable speed motor 47.

With the drag tension unit motor 32 operating at a predetermined speed, the bevel gear 36 in the differential is rotated at a uniform rate. The differential motor 47 is driven faster than this gear, and therefore causes the opposite gear 38 to rotate faster likewise. Thus, the pull tension rollers are driven at higher speed than the drag tension rollers. The amount of elongation of the strip is automatically indicated by the electrical speed ratio meter 48 connected with the two tension units.

It will thus be seen that the apparatus described thus far is relatively simple in construction and operation. The mounting of the outer tension rollers 12 greatly facilitates threading of the strip through the apparatus before it is set in operation. The reverse bending of the strip as it passes over the rollers in the drag tension unit works the metal sufficiently to promote stretching. Furthermore, as the strip merely passes over instead of forming coils on the tension rollers 6 between which it is stretched, the thick center of strip that is thinner at its edges does not become cumulative on these rollers and thereby cause the strip to be bowed transversely instead of leveled.

On the other hand, if the strip is of substantially the same thickness throughout its width, the embodiment disclosed in Fig. 4 may be used. The tension rollers have been entirely omitted from this embodiment, and tension is applied to the strip solely by the drag and pull of the uncoiler 51 and the coiler 52. The coiler is driven by a motor 53 at a peripheral speed sufficiently in excess of the speed of the uncoiler to apply

sufficient tension to the strip to stretch it beyond its elastic limit, and thereby level it. The tension on the strip may be controlled in a suitable automatic manner, such as previously described in connection with Figs. 1 and 3.

In the modification shown in Fig. 5 the drag tension rollers 60 and the pull tension rollers 61 are rotatably mounted in fixed position and each one is driven by a separate motor 62 which may be automatically controlled to function in the manner described in the preceding embodiments. The separate drive for each roller makes it unnecessary that the rollers in each set have diameters which are exactly the same. This is important because it is difficult to keep the rollers of equal diameter, especially after they have been reground. The separate drive for each roller does away with this trouble and expense, for the motor for each roller drives that roller at a speed that compensates for the difference in diameter between it and the adjacent roller.

The rollers in each set are preferably mounted one above the other, and the strip 63 passes through each set preferably by extending across the top of the upper roller, back between both rollers, and across the bottom of the lower roller. This gives the strip a zig-zag path of travel through each tension unit and causes it to frictionally engage a material portion of the surface area of each roller. To increase the grip of the rollers on the strip, a billy roll 64 presses the strip down against the top of each upper roller, and the coiler 66 and uncoiler 67 are driven at such speeds by their motors 68 and 69, respectively, as to apply tension to the strip which is material but insufficient to stretch it beyond its elastic limit. The pull tension rollers 61 are driven faster than the drag tension rollers 60 so that the strip between them will be stretched beyond its elastic limit in order to flatten it. On the other hand, the speeds of the various rollers may be effected as in the first embodiment. Also it is not necessary to restrict each tension unit to these rollers, as shown, because it may be desirable to use four or more if the material is heavy and high tension is required. Also, if sufficient rollers are provided to avoid any possibility of slippage in case the tension exerted by the coiler and uncoiler is eliminated, then this machine may be used in any continuous processing line.

Another feature of this embodiment is the use of a plurality of small backed-up bending rolls 71 mounted between the uncoiler and the drag tension rollers. As the strip passes between these bending rolls it is reversely bent rather sharply whereby its surfaces are cold worked sufficiently to prevent stretcher strains developing during the stretching of the strip between the two sets of tension rollers. This feature is especially advantageous with strip that has been soft annealed.

According to the provisions of the patent statutes, I have illustrated and described what I now consider to be the preferred embodiments of my invention. However, I wish to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically shown and described.

I claim:

1. Stretcher-leveler apparatus for continuously-moving strip material, comprising a drag tension unit and a pull tension unit, each of said units including a roller journaled in fixed position, a roller adapted to be adjusted laterally in an arcuate path around said fixed roller, and a power element for driving said rollers.

2. Stretcher-leveler apparatus for continuously-moving strip material, comprising a drag tension unit and a pull tension unit, each of said units including a roller journaled in fixed position, a power element for driving said roller, a second roller journaled beside said fixed roller, a power element for adjusting said second roller in an arcuate path around said fixed roller, and a power element for driving the second roller from said fixed roller.

3. Stretcher-leveler apparatus for continuously-moving strip material, comprising a drag tension unit and a pull tension unit, each of said units including a roller journaled in fixed position, a rotatable member mounted at each end of said roller on substantially the same axis, a second roller journaled at its ends in said members, an actuating element for turning said members for moving said second roller in an arcuate path around said fixed roller, and an operative connection between the two rollers whereby to drive the second from the first.

MORRIS DENOR STONE.

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