Aug. 18, 1953 E. L. HUFF 2,649,099

APPARATUS FOR TREATING CONTINUOUS PRODUCTS

Filed Feb. 28 , 1947 3 Sheets-Sheet 1

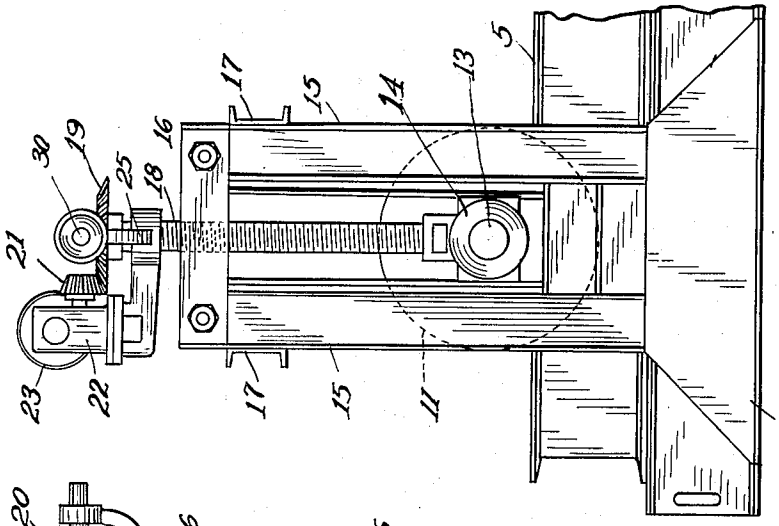


Fig. 4.

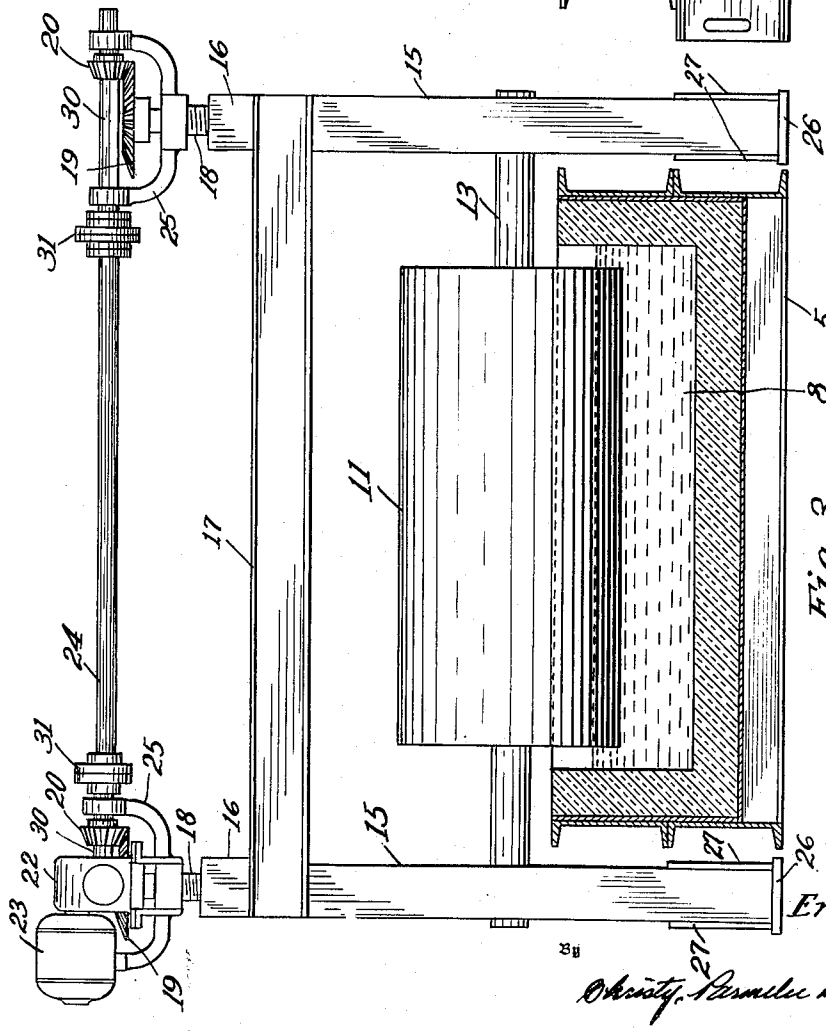


Fig. 3.

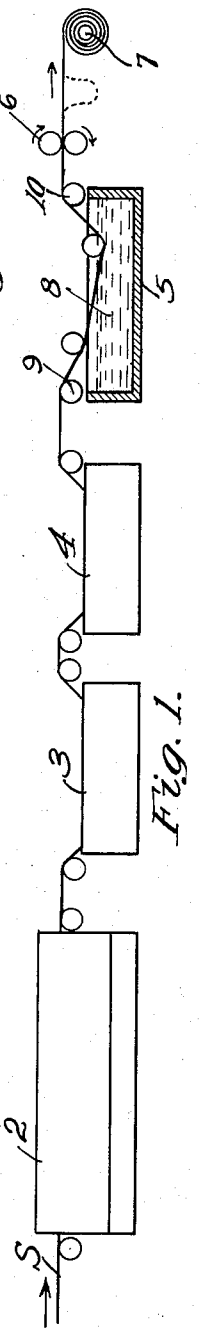


Fig. 1.

Inventor
Ernest L. Huff

By
Okrisby, Dunmire and Strickland
his Attorneys

Aug. 18, 1953 E. L. HUFF 2,649,099

APPARATUS FOR TREATING CONTINUOUS PRODUCTS

Filed Feb. 28, 1947 3 Sheets-Sheet 2

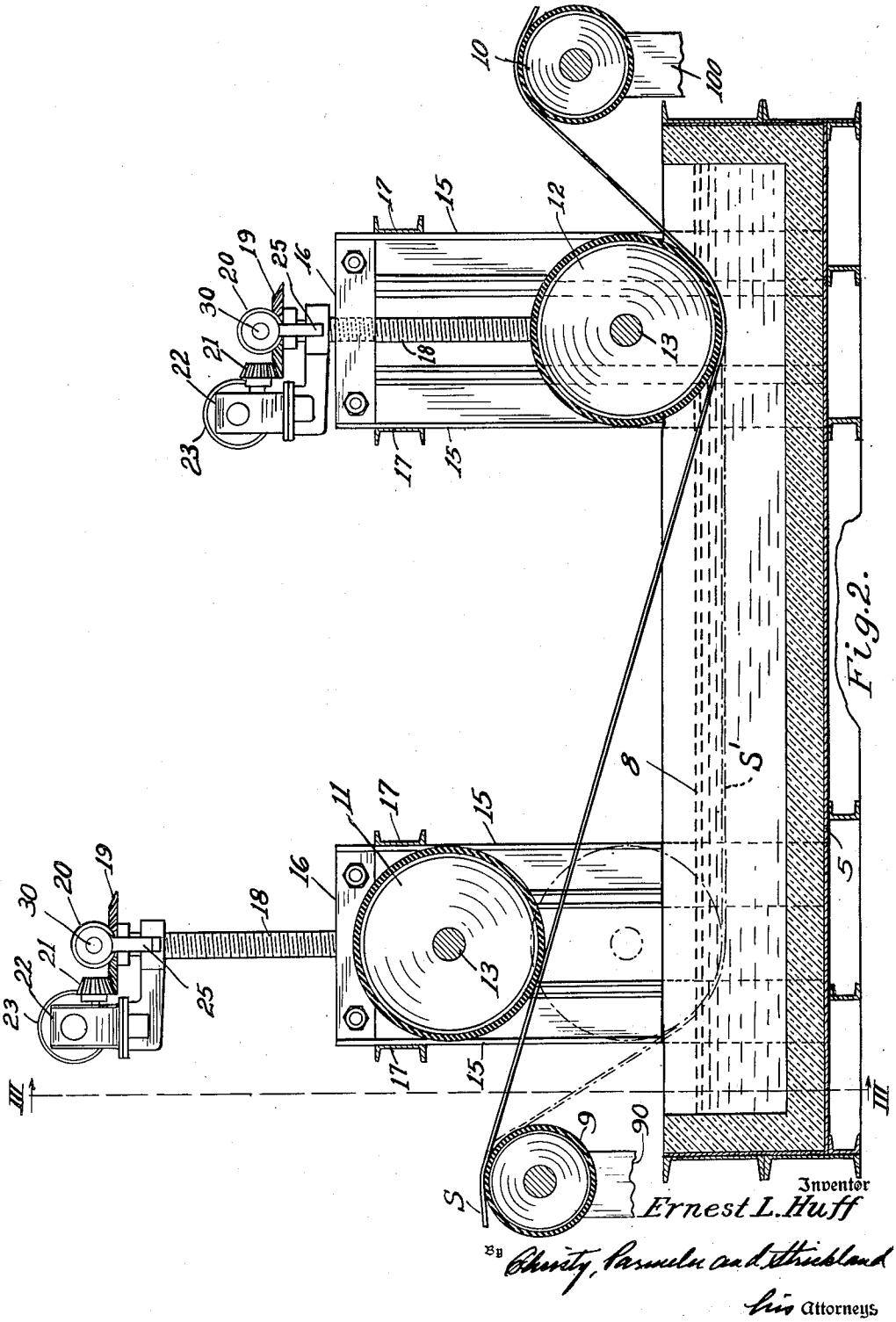


Fig. 2.

Inventor
Ernest L. Huff
By Christy, Parsons and Strickland
Its Attorneys

Aug. 18, 1953 E. L. HUFF 2,649,099

APPARATUS FOR TREATING CONTINUOUS PRODUCTS

Filed Feb. 28, 1947 3 Sheets-Sheet 3

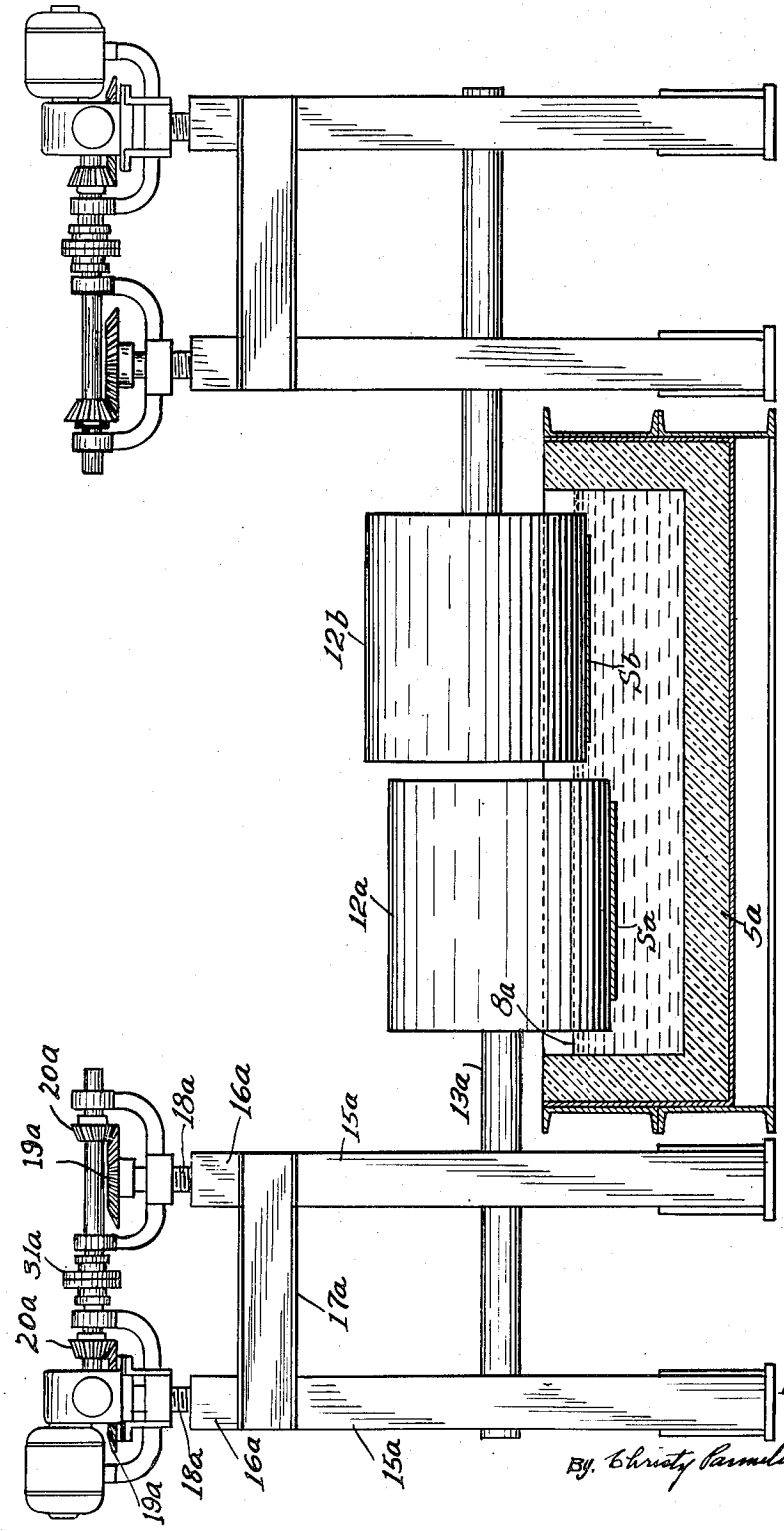


Fig. 5.

Inventor
Ernest L. Huff
By Christy Parmelee and Strickland
his Attorneys

Patented Aug. 18, 1953

2,649,099

UNITED STATES PATENT OFFICE

2,649,099

APPARATUS FOR TREATING CONTINUOUS PRODUCTS

Ernest L. Huff, Tarentum, Pa.

Application February 28, 1947, Serial No. 731,662

4 Claims. (Cl. 134—64)

1

My invention relates to the apparatus for processing of continuous products, such as continuous rolled steel sheet or strip, wire, rods, and other elongate products which, after they have been formed, are passed in continuous course through a series of treating units.

In the case of steel strip the treating units normally include one or more pickling baths, and sometimes a degreasing unit, an annealing unit, a tinning unit, or a galvanizing unit, etc. In such apparatus for treating strip or other product, it is desirable to regulate the effect of one of the units on the product while retaining the effects of other units on the product at determined values. For example, it may be desirable to vary the time during which the traveling product is exposed to a molten sodium bath, or to a pickling bath, without substantially altering the time during which the product is exposed to the metallurgical effects of one or another of the other treating units in the installation. With this circumstance in mind, it is to be understood that my invention consists in the provision of improved apparatus for varying the time during which the product, traveling continuously, is exposed to or immersed in a liquid bath, typically a molten sodium bath or a pickling bath, whereby the metallurgical effect of said bath may be readily and accurately regulated relatively to the metallurgical effect of another treating unit in the series.

In the ensuing specification, I shall describe the invention as it is practiced in controlling the time of immersion of steel strip in a pickling bath, with the understanding that the invention manifestly may be applied in controlling the effect of other liquid baths upon the steel strip, or upon other continuous products processed therein.

The invention will be understood upon reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic view, showing partly in side elevation and partly in vertical section a typical installation of a plurality of treating units for steel strip;

Fig. 2 is a view to larger scale and in longitudinal vertical section of a pickling unit included in the series, this pickling unit being selected and herein shown for the purpose of illustrating the invention;

Fig. 3 is a view in cross section of the pickling unit, as seen on the plane III—III of Fig. 2; whereas a certain strip-guiding roll is shown in an elevated position of adjustment in Fig. 2; in Fig. 3 it is shown in a lowered position of adjustment;

Fig. 4 is a fragmentary view showing the structure of Fig. 3 in side elevation; and

Fig. 5 is a view comparable with Fig. 3, illustrating a modification in the structure of the invention.

2

Referring to Fig. 1 of the drawings, an installation for the treatment of strip steel is diagrammatically illustrated. The installation is shown as including a series of four strip-treating units—an annealing furnace 2, a molten sodium bath 3, a rinse tank 4 and a pickling tank 5. The arrangement of the four units here shown is for purposes of illustration only, it being understood that there may be a greater number of units or a lesser number, and the kinds or types of units may vary in keeping with the treatment required for the particular product. Suffice it to say that the strip is advanced in continuous lineal course through the several units of the apparatus, say by means of power-driven rolls 6 and/or a mechanical reel 7. The invention will be described as it is applied to the pickling unit 5.

The pickling unit 5 comprises a tank formed of suitable material to contain a bath of pickling solution 8, in which the continuously advancing strip S is immersed. The quick and easy regulation or variation of the time of immersion of the strip, and the control of the metallurgical effect of the bath upon the strip, without necessarily modifying the speed of travel of the strip, are the prime concerns of my invention, and these objects are obtained by the provision of two vertically adjustable immersion guides—in the form of two immersion-controlling rolls 11 and 12—arranged in longitudinally spaced-apart relation between two end guides—in the form of two rolls 9 and 10.

Each of the rolls is coated with rubber, as indicated, to resist the effect of the pickling solution 8, and to prevent the rolls from defacing the strip. The guide rolls 9 and 10 are rotatably supported upon pedestal bearings 90 and 100, respectively, and the strip S is trained upon these guide rolls as shown in Fig. 2. The immersion-controlling rolls 11 and 12 are each mounted upon a shaft 13 which is journaled at each of its opposite ends in a bearing 14 (Fig. 4), and these immersion-controlling rolls, arranged between the guide rolls 9 and 10, are spaced apart a distance exceeding the roll diameter, as shown, and are adapted to bear downwardly upon the advancing strip, and to regulate the length of the submerged travel of the strip in the bath, as will presently appear.

The bearings 14 for the two ends of the shaft 13 of each roll 11 and 12 are vertically slidable in ways provided by a pair of H-beams 15, 15; the beams 15 of each pair are rigidly united at their upper ends by a bar 16, and at their lower ends are welded upon a base plate 26 and reinforced by gusset plates 27; and the two pairs of beams 15, 15 that form the vertical slideways for the bearings at the two ends of each shaft 13 are rigidly cross connected by beams 17. The two pairs of cross connected beams 15, 15 provide a gantry-like support that is independent

of the tank walls 5, which is a feature of notable value. It will be understood, therefore, that each immersion-controlling roll 11 and 12 is journaled in a pair of bearings that are vertically adjustable in an independently supported gantry-like structure.

Means are provided for adjusting the two bearings 14 of each roll in unison, and such means comprise threaded rods or screws 18 rotatably secured at their lower ends to the bearings 14 severally. Each screw 18 extends upwardly through, and in threaded engagement with, the bar 16 at the top of the paired beams 15, 15 of associate bearing 14. Secured to the upper end of each screw 18 is a bevel gear 19, with which a bevel pinion 20 meshes, each pinion 20 being mounted upon a jack shaft 30 journaled in a floating yoke 25 upon the upper end of the associate screw 18. The two jack shafts are coupled by means of a connecting shaft 24 (Fig. 3), whereby the two pinions 20, the two gears 19, and the two screws 18 of the bearings 14 of each roll (11 and 12) must rotate in unison, and by virtue of threaded engagement of the screws 18 with the cross members 16 this common rotation is adapted to effect in unison the vertical movement of the two bearings of the supported roll. Each roll 11 and 12 may be vertically adjusted, either upwardly or downwardly, with its axis in precise parallelism with the surface of the bath 8.

If, because of unequal wear, or for other reason, a vertical adjustment of one bearing relatively to the other is required, one of the couplings 31 that unite the cross shaft 24 to the pinion shafts 30 may be disengaged and the screw 18 of the bearing in question may be manually rotated to obtain the desired adjustment. Then, the coupling is reconnected to provide identical vertical movements of the two bearings of the roll.

Advantageously, the vertical adjustment of each roll 11 and 12 may be effected quickly and simply by means of an electric motor subject to a suitable push-button control or switch. More particularly, a pinion 21 may be connected through a gear-box 22 with an electric motor 23 mounted on a lateral extension of the yoke 25 on one of the screws 18. The pinion 21 meshes with the bevel gear 19 on the adjacent screw 18, and, by energizing the motor to rotate the pinion 21 in one direction or the other, the two screws 18 may be turned in unison to raise or lower the roll. Either roll 11 or 12 is thus subject to quick vertical adjustment relatively to the surface of the bath 8.

It is to be noted that the two immersion-controlling rolls 11 and 12 may be arranged to hold the entire length of the strip traveling between them below the surface of the bath, thereby providing maximum time of immersion, or maximum submerged travel of the strip, as indicated by the broken-line S' in Fig. 2. However, the horizontal distance between the centers of the two immersion-controlling guides or rolls 11 and 12 is so determined that, for a specified speed of travel of the strip through the series of treating units 2 and 5, the length S' of the traveling strip will normally be greater than that needed to give the strip the required time of exposure to the bath. In order to establish and maintain such required time of exposure, provision is made to regulate the submerged length of the traveling strip at various values less than the length S' indicated.

In accordance with my invention, the required variation in the length of submerged travel of the strip, or the required variation in the time of immersion, is obtained by positioning one of the immersion-controlling rolls (roll 11 in this case) above bath level and the other roll (roll 12) below bath level, as shown in Fig. 2, whereby the reach of strip traveling between such rolls is inclined at an acute angle, as shown in Fig. 2, to the surface of the treating bath 8. Variation in the time of immersion of the traveling strip is obtained by varying the angle of inclination of the strip to the surface of the bath. Such variation of the angle is effected by regulating the relative vertical positions of the two rolls 11 and 12. The roll 12 may be raised or lowered to decrease or increase the length of the strip submerged in the bath; alternately, the roll 11 may be raised or lowered to decrease or increase the submerged length of the strip; and, of course, both rolls may be vertically adjusted to obtain precisely the proper time of immersion, or submerged travel, of the strip. It will be perceived that this essential variation in the exposure of the traveling strip to the treating bath may be effected readily and without arresting the travel of the strip, and without interfering with the other treating units in the line or series. And if it proves desirable at any time to bypass the pickling bath 8, without shutting down the line, it is merely necessary to raise both rolls 11 and 12 to a level at which the travel strip clears the bath.

Whereas a single electric motor 23 is arranged to rotate both of the bearing-adjusting screws 18 of each roll, it will be perfectly apparent to the mechanic, in view of the foregoing disclosure, that an electric motor 23 may be arranged with each screw 18; that is, the motor drive shown at the upper end of the left-hand screw 18 in Fig. 2 may be duplicated at the upper end of the right-hand screw 18. The two motors may be squirrel-cage motors arranged to operate in synchronism, whereby the torsion on shaft 24 may be minimized or substantially eliminated, and a uniform distribution of rotative stress applied to both of the adjusting screws of each roll, this being particularly desirable in the case of large installations for the treatment of heavy strip.

In Fig. 5 a modified unit is illustrated for the processing of two continuous strips simultaneously. One strip may be of different gauge than the other, wherefore one strip will travel faster than the other, and may require a different time of immersion than the other. This modified unit includes two sets of rolls in lieu of the single set of rolls 9, 11, 12, 10 of the apparatus of Figs. 1 to 4, and the two sets of rolls are arranged side by side for guiding the two strips S*a* and S*b* through one and the same tank 5*a*. The rolls in each set will be mounted for independent rotation, whereby each strip, while traveling beside the other, may move at a speed independent of the speed of the other. More particularly, in place of the single roll 9 in Figs. 1 to 4, two rolls may be mounted in axial alignment for free rotation on a common shaft borne by a pedestal bearing such as the bearing 90 in Fig. 2. Similarly, two rolls may be provided in place of the single roll 10. However, in the modified structure of Fig. 5 the intermediate immersion-controlling rolls which are provided in place of the two rolls 11 and 12 of Fig. 2, comprise two pairs of rolls, with each roll of each pair mounted on an independent shaft. That is to say, the two rolls 12*a* and 12*b* (Fig. 5) form the counterpart of the

single roll 12 of the structure of Figs. 1 to 4, and it will be understood that the two rolls which form the counterpart of the roll 11 of Figs. 1 to 4 may be identical with the rolls 12*a* and 12*b*.

Whereas each of the rolls 11 and 12 (Figs. 1 to 4) are supported by a gantry-like supporting frame 15, 16, 17, each of the rolls in the modified structure (Fig. 5) is supported as a cantilever. Referring to Fig. 5, each of the rolls 12*a* and 12*b* is supported by an independent stand comprising two pairs of vertical H-beams 15*a*, 15*a* united at their tops by bars 16*a*, and cross connected by beams 17*a*. The roll shaft 13*a* is supported by two bearings (not shown) that are vertically adjustable in the two pairs of vertical beams 15*a* exactly as the bearings 14 are adjustable in paired beams 15, Figs. 2 to 4, and two screws 18*a* are provided, one for each of said bearings of the shaft 13*a*. Bevel gears and an electric drive are organized at the tips of the two screws 18*a* in the same way that the gears and motor drive of Figs. 2 to 4 are organized with the screws 18, and it only need be noted that the close assembly of the screws 18*a* eliminates the necessity of the connecting rod 24 shown in Fig. 3. The coupling 31*a* in Fig. 5 directly unites the shaft of the two bevel pinions 20*a*. This structure provides for the vertical adjustment of the shaft 13*a* and of the roll 12*a* mounted thereon. Each of the immersion-controlling rolls of the modified structure of Fig. 5 is adjustably mounted in this manner, whereby the time of immersion or the submerged length of travel of each of the strips 8*a* and 8*b* may be indepedently determined. In this modified apparatus one strip may travel at a different speed than the other, and the method inherent in the operation of the apparatus of Figs. 1 to 4 on one strip may be simultaneously yet selectively practiced on two strips.

As mentioned in the foregoing specification, the invention may be practiced with other continuous products than steel strip, and it may be applied to the treatment of such products in other liquid baths than pickling baths. These and other modifications will occur to the engineer without departing from the spirit of the invention defined in the appended claims.

I claim:

1. Apparatus for processing a continuous product advancing in lineal course through a treating bath comprising a container, a treating bath in said container, two guiding rolls upon which the advancing product is adapted to be trained, bearings for rotatably mounting said rolls above bath level and in spaced-apart relation in the general direction of travel of the product, two horizontally spaced immersion-controlling rolls, two gantries straddling said container and borne substantially independently of the container walls for severally supporting said immersion-controlling rolls, bearings for the opposite ends of said rolls, the vertical elements of said gantries including slideways for said bearings, a screw mounted in the gantries for each bearing, and means connecting the screws of the two bearings of each roll for rotation in common independently of the bearing screws of the other roll.

2. The structure of the next-preceding claim, and an electric motor mounted at the top of each of said gantries and geared immediately to said connecting means.

3. Apparatus including a series of metallurgical units for processing a continuous metal product advancing in lineal course through a metallurgical bath, said apparatus comprising a container for said bath, means for directing the product through a path of immersion in said bath comprising two rolls, two horizontally adjustable gantries for severally supporting said rolls substantially independently of said container and spaced apart a center-to-center distance greater than the length of the path of immersion required between the rolls to give the product advancing at a given speed the essential time of exposure to the metallurgical effect of the bath, bearings for rotatably mounting said rolls in said gantries, the bearings of one roll being vertically positioned in one gantry relatively to the bearings of the roll in the other gantry, to incline the line of advance of the product between the rolls, and means for vertically adjusting the bearings of one roll relatively to the bearings of the other roll to modify the inclination of the product advancing between the rolls, whereby for said given speed of advance the length of said path of immersion is modified and the time of exposure of the product to the effect of said bath is correspondingly regulated.

4. Apparatus for the treatment of a continuous metal product comprising a series of units in which the product is subject to metallurgical treatment, at least one of said units comprising a metallurgical bath, means for advancing the product in a lineal course through said series of units at a given speed of advance, said apparatus comprising a container for said bath, means for directing the product through a path of immersion in said bath comprising two rolls, two horizontally adjustable gantries for severally supporting said rolls substantially independently of said container and spaced apart a center-to-center distance greater than the length of the path of immersion required between the rolls to give the product advancing at a given speed the essential time of exposure to the metallurgical effect of the bath, bearings for rotatably mounting said rolls in said gantries, the bearings of one roll being vertically positioned in one gantry relatively to the bearings of the roll in the other gantry, to incline the line of advance of the product between the rolls, and means for vertically adjusting the bearings of one roll relatively to the bearings of the other roll to modify the inclination of the product advancing between the rolls, whereby for said given speed of advance the length of said path of immersion is modified and the time of exposure of the product to the effect of said bath is varied relatively to the exposure of the product to the effect of other units of said series.

ERNEST L. HUFF.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,932,105	Hinnekens	Oct. 24, 1933
2,197,011	Ross	Apr. 16, 1940
2,212,219	Wood	Aug. 20, 1940
2,234,593	Ferm	Mar. 11, 1941
2,259,277	Theiss	Oct. 14, 1941
2,276,605	Andrews	Mar. 17, 1942
2,348,232	Trautman	May 9, 1944