

April 17, 1956

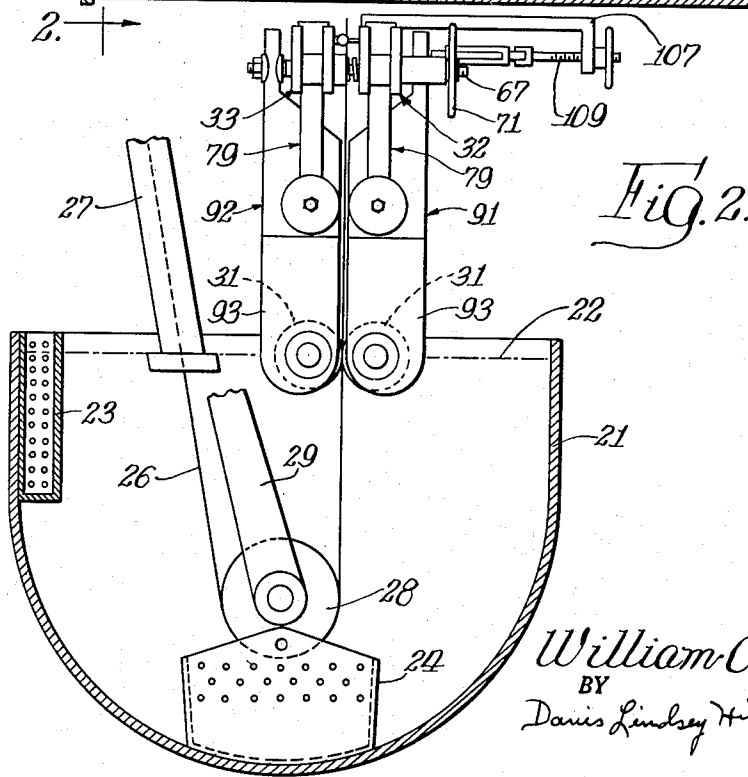
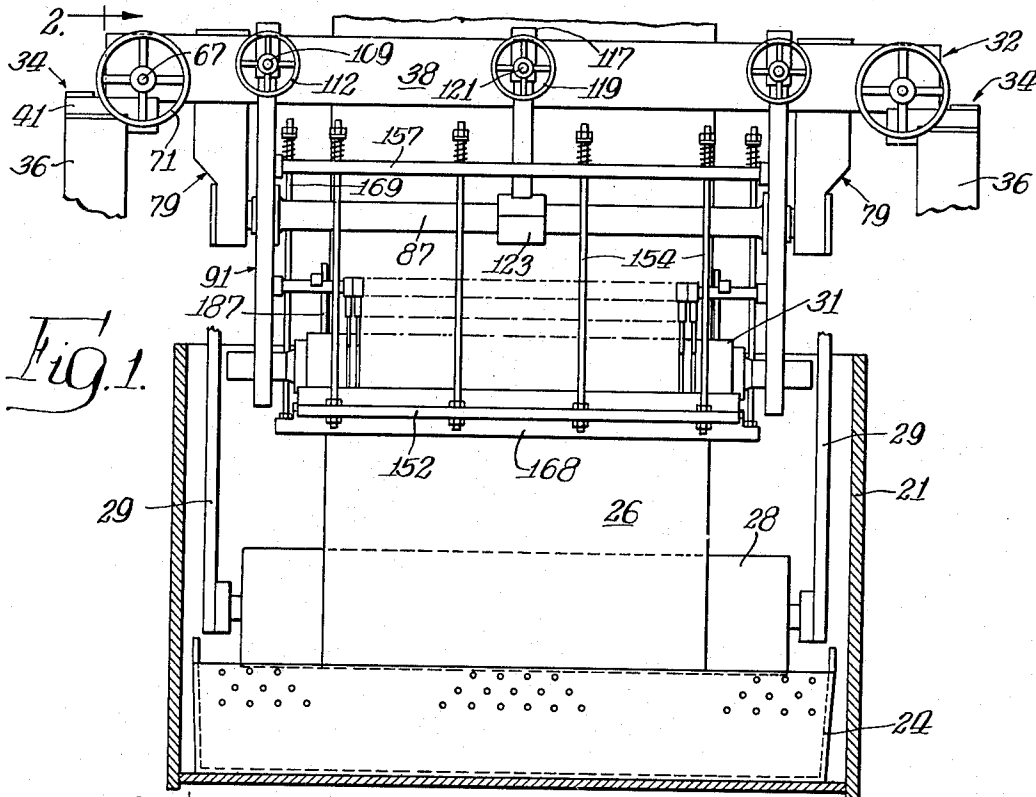
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METAL COATING APPARATUS

Filed Dec. 31, 1952

5 Sheets-Sheet 1



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METAL COATING APPARATUS

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5 Sheets—Sheet 2

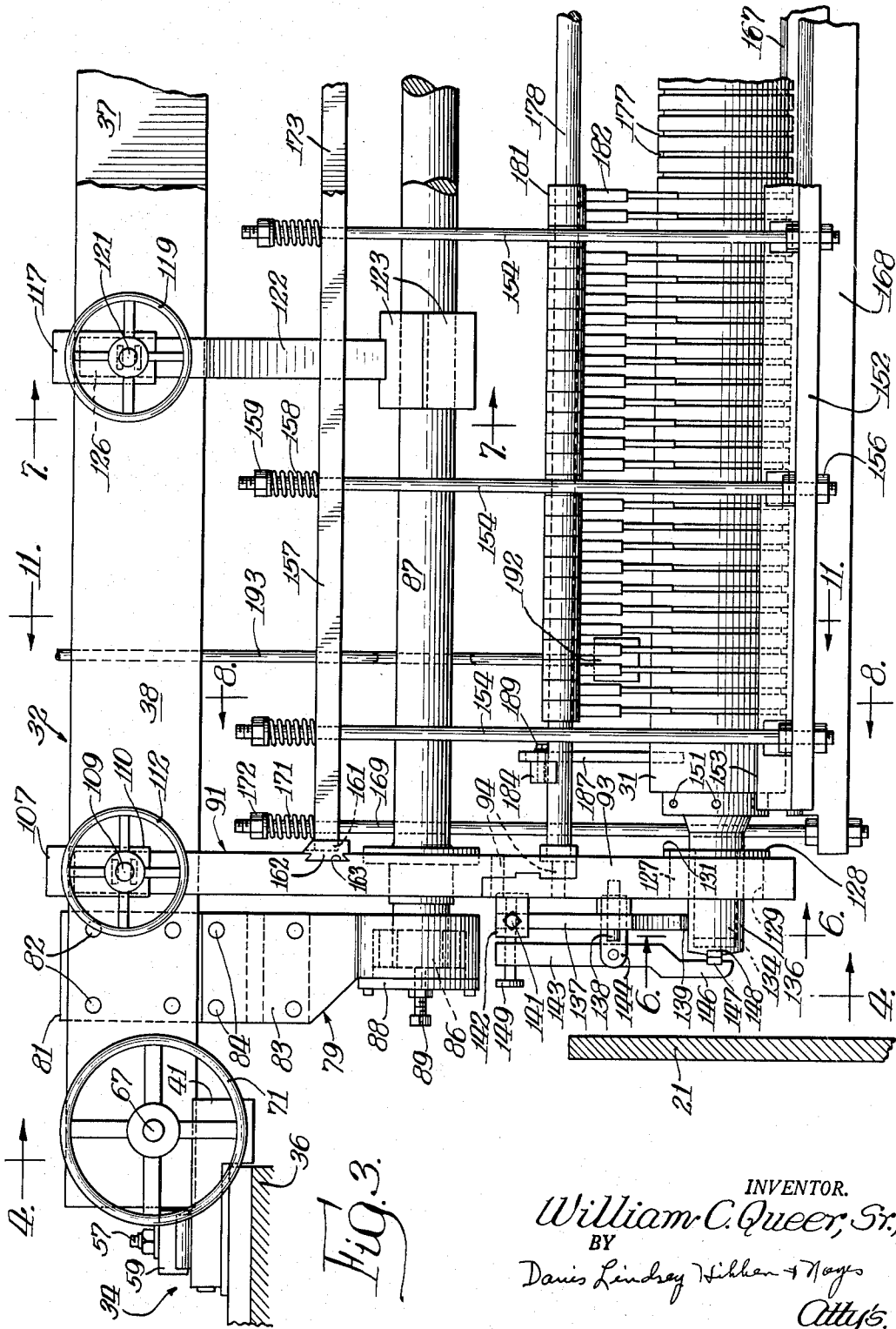


Fig. 3.

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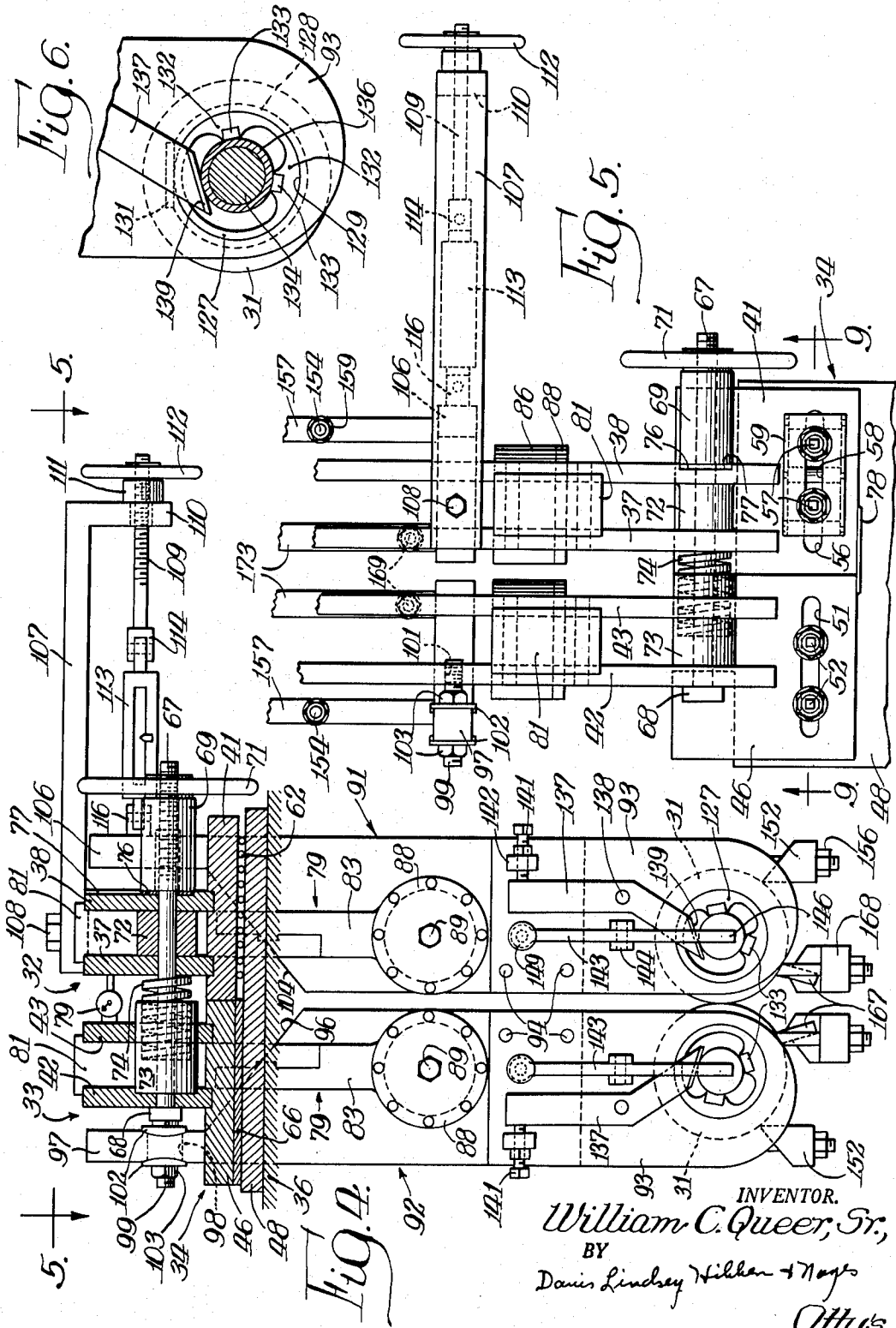
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METAL COATING APPARATUS

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5 Sheets—Sheet 3



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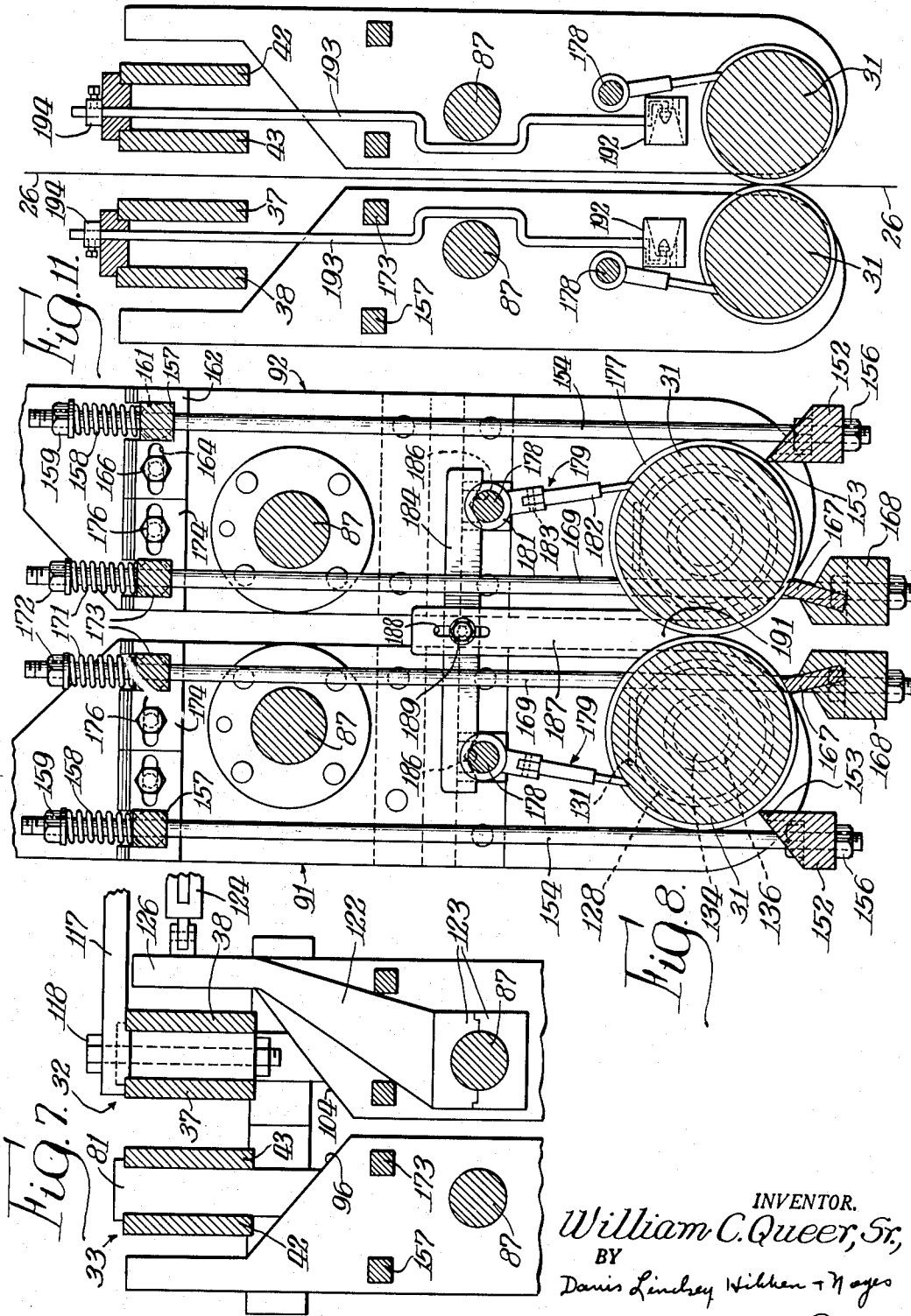
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METAL COATING APPARATUS

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5 Sheets-Sheet 4



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METAL COATING APPARATUS

Filed Dec. 31, 1952

5 Sheets-Sheet 5

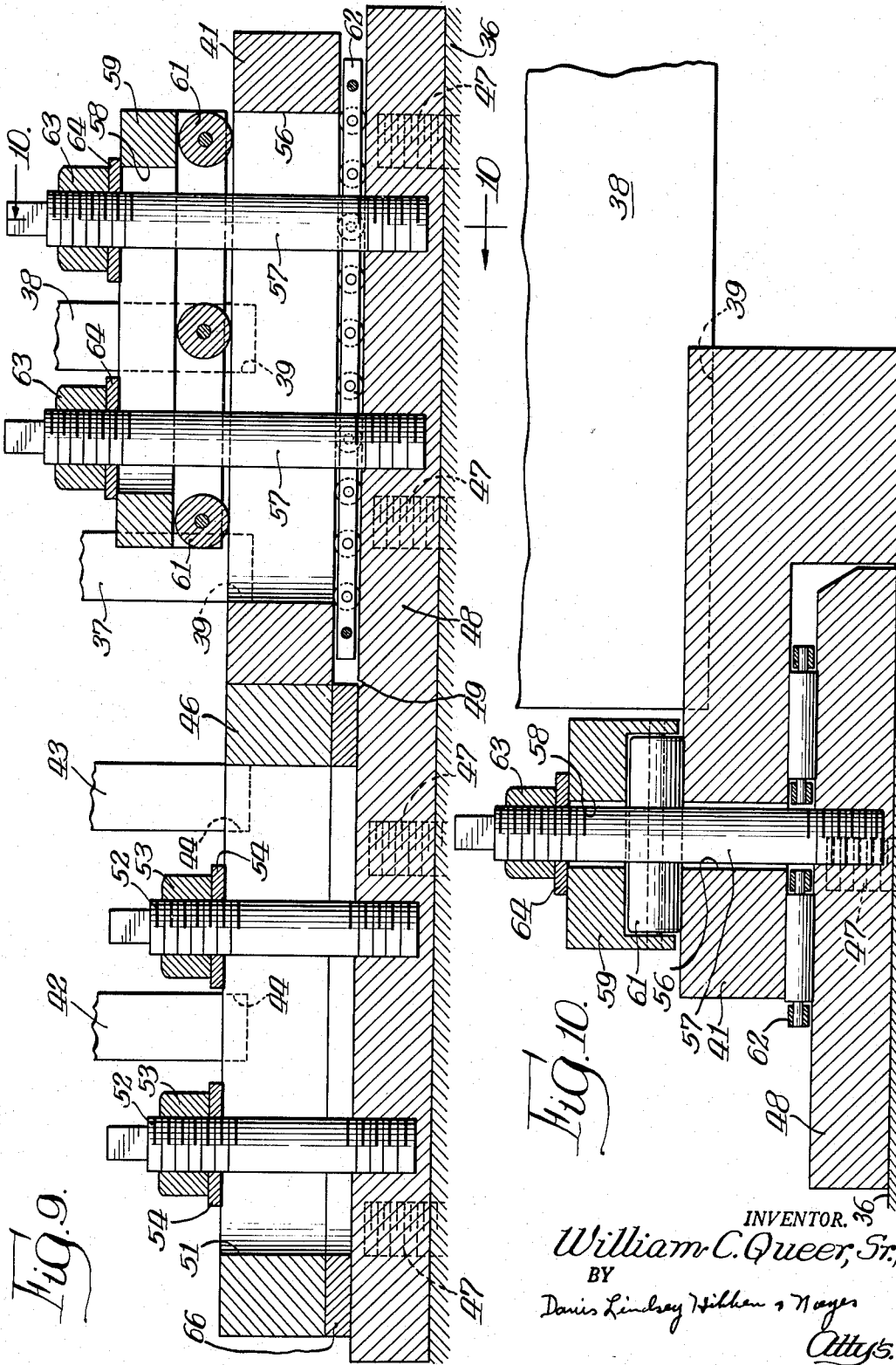


Fig. 9.

Fig. 10.

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2,742,019

## METAL COATING APPARATUS

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Application December 31, 1952, Serial No. 328,869

33 Claims. (Cl. 118—122)

This invention relates to improvements in metal coating apparatus and more particularly to the coating rolls used in such apparatus.

In the continuous coating of metal sheet or strip with molten metal, such as in the galvanizing of iron or steel, the strip or sheet metal after being subjected to the usual preliminary treatments is passed through a bath of molten metal and thence upwardly between a pair of freely rotatable coating rolls for causing the molten metal to adhere to the strip or sheet in a coating of the desired thickness. The coating rolls are mounted at the bath level and are partially immersed in the bath so that the rolls pick up molten metal during rotation. In addition, the spacing between the axes of the rolls is regulated to apply substantial pressure to the metal strip or sheet passing therebetween.

I have found that the apparatus previously used has been subject to serious disadvantages necessitating frequent and lengthy shut-downs for replacement of the rolls, the roll bearings or associated equipment. For example, I have determined that an effective yieldable relation between the rolls is highly desirable to facilitate easy passage of foreign matter which may accidentally be drawn upwardly between the rolls and the metal strip. Also, a simple arrangement for varying the roll spacing or to provide slightly non-parallel relation of the rolls has been greatly needed in order to permit the use of rolls of different diameters or metal strips of different gauges and also to compensate for uneven wear on the roll surfaces. Another major source of trouble in the apparatus heretofore known arises from the fact that the coating roll bearings operate in the molten metal bath thereby resulting in sticking and fouling of the bearings due to the high temperatures of the molten metal and also due to the accumulation of dross in the metal bath. I have also found that it is highly desirable to provide a greater degree of control over the extent of metal picked up by the coating rolls and maintained as a pool above the rolls than has heretofore been possible. Because of the foregoing difficulties and other related problems, no satisfactory roll mounting arrangement has been suggested to my knowledge which provides all of the desired operating characteristics in an apparatus of this type.

Accordingly, the general object of my invention is to provide a novel and improved arrangement for supporting a pair of coating rolls in an apparatus of the character described.

A further object of the invention is to provide an improved yieldable mounting for a pair of coating rolls with means for urging the rolls together under predetermined pressure.

Another object of the invention is to provide an improved means for adjusting the distance between the axes of a pair of coating rolls of the type described.

An additional object of the invention is to provide a novel coating roll support means which greatly facilitates the rapid removal of the rolls for repair or replacement.

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A still further object of the invention is to provide an improved bearing means for journaling a pair of coating rolls of the character described.

Still another object of the invention is to provide a novel arrangement in an apparatus of the type described for keeping the roll surfaces and grooves clean during the operation of the device.

A further object of the invention is to provide a novel means for controlling the amount of metal picked up by a pair of coating rolls in an apparatus of the type described.

A related object of the invention is to provide a novel means for maintaining a pool of metal above the coating rolls in an apparatus of the character described.

Other objects and advantages of the invention will become apparent from the subsequent detailed description taken in conjunction with the accompanying drawings wherein:

Fig. 1 is a fragmentary front elevational view of a continuous galvanizing apparatus embodying the various features of my invention;

Fig. 2 is a fragmentary side elevational view as seen along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary front elevational view on an enlarged scale showing the details of the coating rolls and related parts of the apparatus;

Fig. 4 is a sectional view with parts thereof in elevation as taken along the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary top plan view as seen along the line 5—5 of Fig. 4;

Fig. 6 is a fragmentary sectional view as taken along the line 6—6 of Fig. 3;

Fig. 7 is a fragmentary sectional view as seen along the line 7—7 of Fig. 3;

Fig. 8 is a fragmentary sectional view taken along the line 8—8 of Fig. 3;

Fig. 9 is a fragmentary cross sectional view on an enlarged scale as seen along the line 9—9 of Fig. 5;

Fig. 10 is a cross sectional view taken along the line 10—10 of Fig. 9; and

Fig. 11 is a fragmentary sectional view taken along the line 11—11 of Fig. 3.

For illustrative purposes, the invention as illustrated and described herein in detail relates to a continuous galvanizing apparatus wherein a strip of steel is coated with zinc. However, it will be understood that the principles of the invention are broadly applicable to the coating of metals generally.

Referring first to Figs. 1 and 2, the apparatus comprises a pot or vessel 21 having a curved bottom and adapted to contain a bath of molten zinc, the bath level being indicated by the broken line 22 in Fig. 2. A perforated cage 23 is secured to one side of the pot 21 for charging fresh zinc. From time to time as required, bars of zinc metal are inserted in the cage 23 for replenishing the molten bath. By depositing the fresh zinc bars in the cage 23, undesirable agitation of the bath is avoided and at the same time the perforated walls of the cage permit the fresh zinc to melt and become incorporated in the bath. An elongated basket 24 having perforated side walls is provided at the bottom of the pot 21 for collecting dross as the latter settles in the bath. When necessary the basket 24 may be removed from the pot 21 and the accumulated dross may thereby be discarded. By the use of the basket 24, heavy accumulations of dross in the bottom of the pot 21 are avoided.

The steel strip to be galvanized is indicated at 26, the strip passing downwardly from a chute or housing indicated fragmentarily at 27. As is well known in the galvanizing art, the metal strip is subjected to a reducing atmosphere prior to galvanizing, and the housing 27 encloses the strip 26 and extends into the bath to protect

the strip from oxidation. Upon entering the bath, the strip 26 passes underneath a sinker roll 28 journaled between a pair of suitable supports or arms, indicated fragmentarily at 29, and thence passes upwardly between a pair of coating rolls 31 mounted at the bath surface. It will be understood that the sinker roll 28 and the coating rolls 31 are freely rotatable under the influence of the moving strip 26 which is driven or pulled by suitable winding devices not shown.

As hereinbefore explained, a primary feature of my invention resides in the means for supporting the coating rolls 31 and the various adjustments and auxiliary equipment for said rolls. Broadly speaking, the principal advantages of my invention are realized by journaling the coating rolls between pairs of pivotally mounted arms so as to permit limited rocking or swinging movement of the rolls toward and away from each other. As hereinafter described in detail, the invention also involves adjustable means for applying yieldable pressure to the roll arms or pivotal supports therefor so that the metal strip is subjected to a predetermined roll pressure and so that the rolls can spread apart slightly when necessary to accommodate the passage of foreign matter between the rolls. Also, as will hereinafter appear, the pivotal support means for each of the coating rolls is suspended from a carrier beam and I have provided suitable adjusting means for regulating the spacing of the carrier beams whereby to vary the distance between the axes of the rolls.

Referring particularly to Figs. 1, 3, 4, 5, 9 and 10, I will first describe in detail the carrier beams and the adjustments therefor.

The entire coating roll apparatus is suspended over the zinc pot 21 by means of a pair of elongated front and rear beam structures, indicated generally at 32 and 33 respectively. The ends of the beam structures 32 and 33 are received in adjustable supports, designated generally at 34 and described hereinafter in detail, the supports 34 being mounted on a pair of stationary upright stands 36.

Each of the beam structures 32 and 33 is composed of a pair of flat parallel carrier bars rigidly held in spaced relation. Thus, the front beam structure 32 has a pair of carrier bars 37 and 38 with the end portions of the bars being received in suitable grooves 39 (Fig. 9) in a pair of front base members or supports 41. In similar fashion, the rear beam structure 33 has a pair of spaced carrier bars 42 and 43 having their end portions likewise received in cooperating grooves 44 (Fig. 9) in a pair of rear base plates or supports 46.

The front and rear base plates 41 and 46 together constitute the adjustable supports hereinbefore referred to generally by the reference numeral 34. Referring particularly to Figs. 5, 9 and 10, it will be seen that each of the stationary stands 36 has secured thereon, by means of a plurality of studs 47, an elongated mounting plate 48 with a shallow transverse groove 49 (Fig. 9) or other suitable indicia for designating the center line of the plate 48. The rear base member 46 has an elongated slot 51 with a pair of adjusting studs 52 extending upwardly therethrough from the mounting plate 48. By means of suitable nuts 53 and washers 54, the base member 46 is secured in any desired adjusted position relative to the center line 49 of the mounting plate 48. The front base member 41 is also provided with an elongated slot 56 similar to the slot 51, and a pair of upright studs 57 extend upwardly from the mounting plate 48 through the slot 56 and also through a registering slot 58 in a top clamp member 59 which carries a plurality of rollers 61 bearing against the upper surface of the base member 41 and spanning the slot 56. A nest of rolls 62 is interposed between the base member 41 and the mounting plate 48 so that the base members 41 at each end of the front beam structure 32 can be readily adjusted toward or away from the rear beam structure 33. Suitable nuts

63 and washers 64 are provided on the upper ends of the studs 57 for clamping the base members 41 in any desired adjusted position. A slotted filler plate or spacer 66 is interposed between the mounting plate 48 and the rear base plate 46 at each end of the rear beam structure 33.

A manually operable adjusting device is provided at each end of the generally parallel beam structures 32 and 33 so that the latter may be positioned in desired parallel or non-parallel spaced relation. The details of this device are best seen in Figs. 4 and 5 wherein an elongated bolt or screw 67 is shown extending loosely through suitable openings in the respective carrier bars 42, 43, 37 and 38. The bolt 67 has a rear head portion 68 engaging the rearwardmost carrier bar 42, and the forward end portion of the bolt 67 is threaded for receiving a nut 69 having a manually operable hand wheel 71. A filler block 72 is interposed between the carrier bars 37 and 38, and a cup-shaped spring box 73 is seated in the rearwardmost carrier bar 42 and extends forwardly through the carrier bar 43, the take-up screw 67 extending loosely through the spring box 73 and the filler block 72. The filler block 72 and the spring box 73 are rigidly secured, as by welding, to their respective carrier bars whereby to retain the latter in rigid spaced relation as will be readily understood. A coil spring 74 is disposed in the spring box 73 having its rear end bearing against the bottom of the spring box and its forward end coacting with the carrier bar 37 at the rear of the beam structure 32. It will thus be understood that the springs 74 at each end of the beam structures tend to urge the latter apart, and the adjusting nuts 69 may be operated by means of the hand wheels 71 to hold the front beam structure 32 in predetermined spaced relation from the rear beam structure 33. The inner end of each adjusting nut 69 bears against a thrust washer 76 which is received in a groove 77 (Fig. 4) at the front face of the carrier bar 38. A scale 78 (Fig. 5) is provided on the end edges of the base members 41 and 46 for measuring the spacing between the respective front and rear base members. For close adjustment, I also provide at each end of the beam structures a dial indicator 79 (Fig. 4) coacting between the carrier bars 37 and 43.

As hereinbefore mentioned, the coating rolls 31 are pivotally or rockably suspended below the beam structures 32 and 33. For this purpose, I provide for each roll 31 a pair of spaced brackets, indicated generally at 79 (Fig. 4), which are rigidly suspended adjacent the opposite ends of each of the beam structures. Each bracket 79 has an upper portion 81 secured between the respective carrier bars 37—38 and 42—43, as by a plurality of screws 82 (Fig. 3). Each bracket 79 also has a detachable lower portion 83 connected to the upper portion 81 by means of screws or bolts 84, and the lower bracket portion 83 includes a journal or bearing 86 (Fig. 3). An elongated rock shaft 87 is journaled between the bearings 86 of the respective pairs of brackets 79 below each of the beam structures. A cover plate 88 is secured to each bracket 79 adjacent the bearing 86 and carries an adjusting screw 89 for retaining the rock shaft 87 in axially adjusted position.

Each of the front and rear rock shafts 87 has a pair of generally upright roll-supporting arms rigidly mounted adjacent the ends of the shaft, the arms being secured to the shafts 87 for rocking movement therewith and having upper and lower end portions extending above and depending below the shafts 87. In the drawings, the roll support arms for the front coating roll 31 are designated at 91, and the corresponding arms for the rear coating roll 31 are designated at 92. Each of the arms 91 and 92 is provided with a detachable lower end portion 93 connected by suitable screws or bolts 94 (Fig. 3) to the remainder of the roll support arms. In each case, the coating roll 31 is journaled between the detachable lower portions 93 of the respective pairs of arms 91 and 92

thereby greatly facilitating easy and rapid removal of the coating rolls and bearings for repair and replacement.

As previously mentioned, the primary objective of the pivotal mounting of the coating rolls 31 in my invention is to provide an arrangement whereby the rolls may be yieldably urged together under predetermined pressure. It will readily be understood from the invention as thus far described that the pivotal or rotatable mounting of the rock shafts 87 in the rigidly held brackets 79 provides for corresponding rocking movement of the arms 91 and 92 so that the rolls 31 have a limited swinging movement toward and away from each other about the axes of the rock shafts 87. However, in accordance with the illustrated embodiment of my invention, I provide adjustable means for retaining the rear arms 92 and their coating roll 31 against rocking movement and I also provide means for applying predetermined yielding pressure to the forward roll 31 for urging the same toward the rear roll 31.

Referring to Figs. 4 and 5, it will be seen that the upper ends of the rear roll support arms 92 are cut away at an angle, as at 96, and are formed with relatively narrow uppermost extensions or end portions 97 which project above the beam supports 34 adjacent the rear beam structure 33. For retaining the arms 92 in pivotally adjusted relation, the end extension or narrow portion 97 of each arm 92 is formed with an enlarged aperture 98 through which a screw 99 extends and is threadedly received in a threaded opening 101 in the rear carrier bar 42 of the beam structure 33. The opposite surfaces of the narrow extension 97 around the aperture 98 are cut away to receive a pair of swivel washers 102, and the screw 99 is secured in fixed relation to the extension 97 by means of a pair of lock nuts 103 bearing against the swivel washers 102. It will be understood that by advancing or retracting the screw 99 at its threaded connection with the carrier bar 42, the roll support arm 92 can be positioned in desired angular or rockable relation and rigidly retained in such position. The enlarged aperture 98 and the swivel washers 102, of course, permit relative angular movement of the screw 99 with respect to the end extension 97.

For applying predetermined yielding pressure to the forward roll 31 in order to urge the same rearwardly toward the rear roll 31, I employ in this instance a plurality of manually adjustable pressure applying devices. The upper ends of the forward roll support arms 91 are also cut away at an angle, as at 104, so as to form upper end extensions 106 similar to the extensions 97 on the rear roll support arms 92. Adjacent each of the upper end extensions 106 is a forwardly extending bracket or holder 107 which is rigidly secured at its inner end, as by a bolt 108, to the forward beam structure 32, and projects outwardly therefrom over the top of the extension 106. The outer end of the bracket 107 has a downturned portion 110 having a take-up screw 109 extending therethrough. An adjusting nut 111 with an attached hand wheel 112 is operatively mounted on the forwardly projecting end of the take-up screw 109. A spring scale 113 is pivotally attached by a swivel connection 114 to the inner end of the screw 109 and has a similar swivel connection 116 with a bracket rigidly secured to the upper extension 106 of the arm 91. Thus, by retracting or advancing the take-up screw 109 by manipulation of the hand wheel 112, a predetermined spring pressure can be exerted on the upper end of each rockable arm 91 for urging the forward coating roll 31 toward the rigidly held rear roll 31. The magnitude of the spring pressure exerted on the arms 91 can be observed readily by means of the scales 113. At the same time, if for any reason an abnormal thickness of metal strip is drawn between the rolls 31 or if foreign matter such as dross enters the space between the rolls, the forward roll 31 can readily be forced outwardly away from the rear roll 31 and against the action of the spring scales 113 in order to accommo-

date the deviation from normal operating conditions, and thereafter the forward roll 31 will automatically return to its predetermined spring pressed relation with the rear roll 31.

In order to supplement the adjustable spring pressure devices which act on the upper ends of the arms 91 as just described, I may also provide an intermediate pressure applying device which acts directly on the forward rock shaft 87. As best seen in Figs. 3 and 7, this intermediate device comprises a forwardly extending bracket or holder 117, similar to the holders 107, which is rigidly attached to the forward beam structure 32 by means of a bolt 118 and which carries at its outer end a hand wheel 119 for operating a similar take-up screw 121. A central arm 122 is rigidly attached to the forward rock shaft 87 by means of a pair of clamping portions 123, the arm 122 extending angularly toward the front of the machine and thence upwardly in front of the forward beam structure 32. The take-up screw 121 is operatively connected through a pivotally attached spring scale 124 to the upper end extension, indicated at 126, of the arm 122 in the same general manner as the spring pressure devices hereinbefore described. Thus, by manipulating the hand wheel 119, a predetermined torque or twisting action is exerted through the arm 122 on the forward rock shaft 87 for urging the forward roll 31 rearwardly under spring pressure.

Although I have shown three separate adjustable pressure applying devices for applying yieldable spring pressure to the forward roll 31, it will be understood that it is not always necessary to use all of these devices. For example, in suitable instances I may omit the central pressure applying device which acts directly on the shaft 87 and may rely solely on the pressure applying means acting on the upper ends of the arms 91. On the other hand, in some cases I can omit the spring pressure devices which operate on the arms 91 and may rely solely on the central mechanism for directly rotating the forward shaft 87. Also, it is within the scope of my invention to employ other mechanisms, such as hydraulic means, for applying yieldable pressure tending to urge the front roll 31 rearwardly.

An important feature of my invention is the provision of novel and improved bearing means for journaling the ends of the coating rolls 31 in the detachable end portions 93 of the roll support arms 91 and 92. As previously mentioned, the rolls 31 operate while immersed at least partially in the molten metal bath and as a result the bearings for the rolls are subject to all the problems arising from high temperature expansion and from the presence of dross in the metal bath. Great difficulty has been experienced previously with binding and sticking of such roll bearings. In order to overcome these problems, I employ a special type of bearing which may best be described by reference to Figs. 3, 4, and 6. Each such bearing arrangement comprises an annular bearing member or sleeve 127 having a flanged end 128 which is received with an aperture 129 in the detachable end 93 of each of the roll support arms and is held therein by means of a key 131. The interior of the bearing member or sleeve 127 is free and open except for two radially extending projections or humps 132 which carry a pair of flat-surfaced bearing elements 133 in the form of bars or strips of a special hard alloy such as Carboloy or the like. Each of the rolls 31 has an end shaft portion 134 extending axially through the bearing member 127 and fitted with a special alloy sleeve or bushing 136 of Stellite or the like. The cylindrical sleeve 136 contacts the flat-surfaced bearing elements or inserts 133, which are located substantially at the bottom and outer side of each shaft portion 134; so that there is substantially only line contact between the coating bearing portions.

During operation of the apparatus, the metal sheet 26 is drawn upwardly between the rolls 31 with the result that there is frequently a tendency to lift the rolls and

their end shafts 134 from the respective pairs of circumferentially spaced bearing blocks or elements 133 disposed below and at the outer sides of the shafts. Accordingly, I provide an adjustable hold-down arm for each bearing in order to hold the rolls 31 in proper journaled relation. For this purpose, an angular arm 137 is pivotally mounted, as by a pin 138, on each of the detachable end portions 93 of the roll supporting arms 91 and 92. The lower end of the arm 137 has a flat hard surface 139 formed from a special wear resistant alloy such as Carboloy or Stellite, and this surface 139 makes substantially line contact with the journal sleeve 136 at the top or upper portion of each bearing so as to provide a third circumferentially spaced bearing point intermediate the bearing inserts 133. An adjusting screw 141 is mounted on a bracket 142 secured to the detachable arm portion 93 and coacts with the upper end of the hold-down arm or lever 137 whereby the bearing surface 139 on the hold-down arm may be held in contact with the roll shaft at the top thereof. Obviously, the adjusting screws 141 may be regulated to accommodate differences in dimensions of the various parts, and to compensate for wear of the bearing surfaces and expansion of the various parts under the high operating temperatures.

For holding the rolls axially in place in the bearings, I also provide at each end of the rolls a hold-in arm or lever 143 which is pivotally supported on a bracket 144 attached to the arm portion 93, the lower end of the lever 143 having an offset portion 146 adapted to be disposed slightly beyond the corresponding end of the roll shaft 134. The lower end 146 of the lever 143 has a thrust bearing insert or button 147 of Carboloy or the like which makes contact with a similar thrust member or insert 148 at the end of the shaft sleeve or bushing 136. The upper end of the hold-in lever 143 is adjusted by means of a screw 149 which coacts with the outer surface of the arm portion 93 whereby to retain the rolls 31 in desired axially adjusted position.

As will be evident from the end views of the apparatus in Figs. 4 and 6, the bearing member 127 by reason of the construction described above affords a substantial arcuate clearance or space between the bearing member and the roll shaft 134. Because of this construction it will be seen that molten metal can flow freely through this arcuate space thereby avoiding restrictions or pockets tending to cause accumulation of dross or other foreign matter in the bearing areas. Furthermore, the bearing contact being substantially only a line contact at three circumferentially spaced points, tendency toward obstruction of the proper operation of the bearing by dross or the like is further minimized.

It may also be mentioned that the rolls 31, which are normally hollow, are formed with a plurality of apertures or openings 151 (Fig. 3) adjacent their opposite ends in order to permit free flow of molten metal into the hollow interior of the rolls. Thus, there is no buoyant effect tending to urge the rolls upwardly and thereby complicating the bearing problem. By adjustment of the hold-down arms 137 and the hold-in levers 143, adequate provision may be made for thermal expansion of the various metal parts and also the proper bearing relations may be maintained to meet different operating conditions and to compensate for wear of the various bearing parts.

As previously mentioned, an important advantage of the invention resides in the detachable construction of the lower end portions 93 of the roll support arms 91 and 92. This detachable relation permits the rolls 31 and their bearings to be removed rapidly from the apparatus and with minimum inconvenience thus facilitating repair and replacement. It will be noted further that the bearing adjustments comprising the levers 137 and 143 are all mounted on these detachable lower arm portions 93 so that the bearings and their associated elements are removable as a unit along with the arm portions 93 and the rolls 31 journaled therebetween.

As a further important feature of my invention, I also provide a plurality of elements operatively supported from the arms 91 and 92 for contacting the roll surfaces in order to improve and facilitate extended operation thereof. One such means consists of a pair of roll scrapers in the form of elongated members or bars 152 (Figs. 3 and 8) each having a relatively sharp or tapered scraping edge 153 adapted to contact and clean the roll surface at the outside thereof beyond the roll axis. These scraper bars 152 are resiliently suspended by means of a plurality of upright hanger rods 154 secured at their lower ends to the scrapers 152, as by nuts 156, and extending at the upper ends through suitable transverse support bars 157. As shown in this embodiment, the bars 157 have a substantially square cross section and the hanger rods 154 are suspended therefrom by means of a plurality of coil springs 158 surrounding the upper ends of the rods 154 and coacting between the bars 157 and a plurality of adjustable retaining nuts 159 affixed to the upper threaded ends of the rods 154. In addition the end portions of the transverse supporting bars 157 are round in cross section, as at 161, to permit free rotation of the bars 157. The round end portions 161 are journaled in U-shaped slots provided in a pair of slidably adjustable plates or brackets 162. As seen in Fig. 3, the brackets 162 have a dovetail construction and are received in complementary keyways or grooves 163 at the inner faces of the arms 91 and 92. The brackets 162 each have an elongated slot 164, and a retaining screw 166 extends through the slot 164 into the corresponding roll support arm so that each bracket 162 can be clamped in any desired adjusted position relative to its keyway 163.

By means of the foregoing construction, it will be seen that the cross supports 157 and the hanger rods 154 with the scraper bars 152 may be shifted away from and toward the rolls 31 in order to position the scraping edges 153 properly for rolls of different diameters. In addition, the support rods 157 being freely rotatable permit the scrapers 152 to swing outwardly away from the rolls in the event that unusually resistant deposits of dross or other protuberances or obstructions on the roll surfaces should come into contact with the scrapers. Normally, the hanger rods 154 are suspended substantially vertically with the weight of the scraper bars 152 being sufficient to hold the scraping edges 153 in proper operating contact with the roll surfaces. Moreover, the provision of the springs 158 permits each of the scraper bars 152 to be deflected downwardly against the spring action for the same general purpose of accommodating stubborn dross accumulations or other protuberances or obstructions which occasionally are found on the roll surfaces. It will be apparent that by adjustment of the retainer nuts 159 and by proper positioning of the brackets 162, the scrapers may be regulated to conform to any particular operating conditions or changes in roll diameter.

At the inner sides of each of the roll surfaces, i. e. inwardly of the roll axes, I provide an additional surface conditioning means for the coating rolls in the form of a pair of elongated wiper bars 167. These wiper bars 167 are preferably made from a relatively soft non-metallic material, such as soap stone, which will wear during use to give a close wiping contact with the roll surfaces. These bars 167 of soap stone or the like are rigidly set at a slight angle in a pair of elongated carriers or body members 168 which are suspended in the same general manner as the scrapers 152 described above. Thus, the carriers 168 are secured to the lower ends of a plurality of hanger rods 169 which are in turn resiliently suspended by means of a plurality of coil springs 171 and adjustable retainer nuts 172 from a pair of cross bars 173. The bars 173 are similar to the bars 157 hereinbefore described and are journaled at their

ends in pairs of transversely adjustable supporting plates or dove-tail brackets **174** having suitable clamping screws **176**. As before, the wipers **167** can thereby be adjusted to bear against the surfaces of the rolls **31** under desired pressure while at the same time being swingable outwardly and also deflectable downwardly against the action of the springs **171** to accommodate unusual obstructions or protuberances on the roll surfaces.

As will be quite apparent from the drawings, the carriers or body members **168** having the soap stone wipers **167** therein are substantially coextensive in length with the rolls **31** so as to provide in effect a valve or metal displacer for exercising a certain degree of control over the quantity of metal which is drawn upwardly between the outwardly rotating rolls **31**. By regulating the spacing of the body members or carriers **168** through the adjustable brackets **174**, a variation in the volume of molten metal between the wiper bar assemblies can readily be obtained since it will be understood that the molten metal which is drawn upwardly between the rolls **31** comes predominantly from the restricted or partially confined volume of metal between the wiper bar assemblies adjacent the undersides of the rolls. The close wiping contact of the bars **167** against the roll surfaces serves effectively to prevent any substantial quantity of molten metal from being drawn up between the rolls from the portion of the bath lying outside of the wiper bar assemblies. Thus, I am able to obtain a substantial degree of control over the quantity of molten metal which is made available to be drawn upwardly between the rotating rolls and to be adhered to the metal strip **26**. Consequently, it will be seen that the present apparatus affords a somewhat greater degree of control over the coating thickness applied to the metal strip than has heretofore been possible.

Another important roll conditioning means constituting a feature of the present invention resides in the provision of a plurality of groove cleaners adapted to extend into the plurality of parallel circumferential grooves, indicated at **177** (Fig. 3), which are normally provided in a coating roll of the present character. Grooves of this type in the roll surface serve to enhance the pick up of molten metal by the rotating rolls. However, for maximum operating effectiveness of the grooves **177** it is desirable to keep these grooves relatively clean and free of dross accumulations. To this end, a pair of support rods **178** extend between the respective roll support arms **91** and **92** closely adjacent the upper sides of the rolls. A plurality of adjustable slot cleaners, indicated generally at **179**, are mounted on the rods **178**, one such cleaner being provided for each slot **177** of the roll. The slot cleaners **179** each consist of an attaching portion or hub **181** having a rotatable fit on the rod **178** and adapted to be secured in any desired rotative or angular position by means of suitable set screws not shown. A cleaning element or finger **182** having its operating end adapted to be received in one of the slots **177** has a pivotal connection **183** with each of the attaching portions **181** so as to permit movement of the cleaning finger **182** axially or longitudinally of the roll in order to accommodate slight variations in the contour or width of the roll grooves **177**. Obviously, by fixing the attaching portions **181** at various angles relative to the rods **178**, the cleaning elements **182** may be adjusted to conform to different roll diameters. As will readily be understood, the continuous scraping action of the slot cleaners serves to keep the slots or grooves **177** free of accumulation of dross or the like.

Still another feature of the invention which contributes to the improved operation of the machine is illustrated in Figs. 3 and 8. As previously explained, the rotation of the rolls **31** draws metal upwardly in the grooves **177** so that there is an accumulation of molten metal between the rolls and above the bite or line of contact thereof.

It is believed, particularly in the galvanizing art, that this accumulation or pool of metal above the point of contact between the two coating rolls plays an important function in controlling the amount of metal coating which is adhered to the strip being drawn therebetween. Heretofore, however, no deliberate control has been exercised as to the size of this pool or metal and it will be apparent that there will be a marked tendency for the accumulation in the pool to be greater adjacent the centers of the rolls than at the opposite ends where the metal can overflow and fall back into the molten bath. This lack of uniformity in the distribution of molten metal in the pool above the bite of the coating rolls is in many cases responsible for a difference in the thickness of the applied coating between the edges of the metal strip or sheet and the center thereof.

In order to counteract the foregoing difficulty, I provide a pair of generally T-shaped dams disposed adjacent the opposite ends of the rolls for obstructing the overflow of the metal pool and thereby retaining a substantially uniform pool of metal across the entire length of the rolls. Each such dam consists of a cross bar **184** having a pair of notches **186** adapted to fit over the spaced rods **178**. A depending member **187** having a slotted upper end **188** is adjustably affixed by a screw **189** to the central portion of the cross member **184**. The lower end of the vertical member **187** has a generally tapered and curved configuration, as at **191**, so as to fit closely into the bite between the rotating rolls **31**. Thus, by adjusting the elevation of the members **187** relative to the cross members **184**, an effective dam or end obstruction is provided at each end of the rolls so that a substantially uniform pool of metal is retained therebetween by limiting the endwise overflow of metal from between the rolls.

In Fig. 11 I show a set of gas burners **192** which are suspended from elongated rods or elements **193** extending upwardly and between the various cross shafts and bars and thence between the respective sets of carrier bars **37-38** and **42-43** constituting the front and rear beam structures. Suitable retaining collars **194** are provided above the beam structures for holding the burners **192** at any desired elevation. As will be evident, the apparatus hereinbefore described lends itself very readily to the suspension and positioning of the burners **192** at the desired locations adjacent the opposite sides of the metal sheet or strip **26**. Although only one pair of such burners is illustrated in Figs. 3 and 11 of the drawings, it will be understood that a plurality of burners is normally provided extending across the entire width of the sheet, the purpose being to retard somewhat the cooling and hardening of this coating whereby to effect evening and uniformity of the metal coating, as is well understood in the art.

From the foregoing it will be seen that my invention provides primarily an important novel arrangement for supporting the coating rolls in adjustable and yieldable relation with special provisions being made to obtain long operating life for the roll bearings and for facilitating rapid replacement and repair of the rolls and their bearings. Furthermore, the invention is characterized by the provision of a plurality of different means for conditioning and cleaning the roll surfaces and grooves, the various arrangements being suspended from the roll support arms. In addition, the invention also affords novel means not heretofore available for exercising a beneficial degree of control over the quantity of metal drawn upwardly between the rolls as well as the quantity of metal retained momentarily as a pool between the rolls. These various features of the invention taken singly or in various combinations thereof contribute very materially to a vastly improved metal coating apparatus having a considerably longer period of useful operation than has heretofore been realized in the metal coating art.

Although the invention has been described with par-

particular emphasis on the specific structural embodiment illustrated herein, it will be understood that various modifications and equivalent structures may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of coating rolls, support means for rotatably supporting said rolls in substantially parallel relation, the support means for at least one of said rolls comprising a rock shaft and a pair of support members rigidly carried adjacent the ends of said shaft and having said one roll journaled therebetween, said rock shaft being rotatable about its axis for movement of said one roll toward and away from the other roll, and means operatively coating with said support means for said one roll for yieldably urging said one roll toward the other roll under predetermined pressure.

2. The apparatus of claim 1 further characterized in that said last-named means comprises an adjustable spring means for yieldably urging said one roll toward the other roll under predetermined spring pressure.

3. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of rock shafts, bracket means rotatably supporting said shafts in substantially parallel spaced relation, a pair of support members rigidly mounted adjacent the opposite ends of each of said shafts for rocking movement therewith, a coating roll journaled between each pair of said support members, and means operatively coating with the support members for at least one of said rolls for yieldably urging said one roll toward the other roll under predetermined pressure.

4. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of coating rolls, support means for rotatably supporting said rolls in substantially parallel relation, the support means for at least one of said rolls comprising a pair of generally upright arms pivotally supported intermediate their ends for rocking movement about a common axis and having said one roll journaled between the lower portions of said arms, bracket means rigidly disposed in outwardly spaced relation from the upper end portions of said arms, adjustable pressure-applying means operably mounted on said bracket means, and spring means interposed between and resiliently interconnecting said pressure-applying means and the upper end portions of said arms for yieldably urging the lower portions of said arms and said one roll toward the other of said rolls.

5. The apparatus of claim 4 further characterized in that said pressure-applying means comprises an elongated threaded member adapted to undergo longitudinal adjustment forwardly and rearwardly of said bracket means for regulating the spring pressure applied to the upper portions of said arms.

6. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of rock shafts, bracket means rotatably supporting said shafts in substantially parallel spaced relation, a pair of generally upright arms rigidly secured intermediate their ends adjacent the opposite ends of each of said shafts for rocking movement therewith, a pair of coating rolls journaled between the lower portions of each pair of said arms below said shafts, and means operatively connected to the upper portions of at least one pair of said arms for yieldably urging the roll carried between said one pair of arms toward the other roll under predetermined pressure.

7. The apparatus of claim 6 further characterized in

that the lower end portions of each pair of said arms having the coating rolls journaled therebetween are detachable from the remainder of the arms whereby to facilitate easy removal of the rolls for repair and replacement.

8. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of coating rolls, support means for rotatably supporting said rolls in substantially parallel relation, the support means for at least one of said rolls comprising a rock shaft and a pair of support members rigidly carried adjacent the ends of said shaft and having said one roll journaled therebetween, said rock shaft being rotatable about its axis for movement of said one roll toward and away from the other roll, and means operatively connected to said rock shaft for yieldably and rotatably urging said shaft in a direction to urge said one roll toward the other roll under predetermined pressure.

9. The apparatus of claim 8 further characterized in that said last-named means comprises a radially extending lever rigidly secured to said rock shaft intermediate said support members and means for applying yieldable pressure to said lever for rotatably urging said shaft in said direction.

10. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of elongated beam structures, adjustable means coating with said beam structures for positioning the latter in predetermined spaced relation, roll support means suspended from each of said beam structures, and a pair of coating rolls journaled in said support means below said beam structures, the distance between the axes of said rolls being adjustable by variation of the spacing between said beam structures whereby to accommodate rolls of different diameter, and the support means for at least one of said rolls including pivotal means for permitting swinging movement of said one roll toward and away from the other roll.

11. The apparatus of claim 10 further characterized in that spring means is provided in coating relation between said beam structures tending to urge the beam structures apart but permitting limited non-parallel positioning of the beam structures with consequent non-parallel relation of the coating rolls.

12. The apparatus of claim 10 further characterized in that said adjustable means includes a pair of manually operable devices mounted at the opposite ends of said pair of beam structures, each such device comprising an elongated threaded member engaging one of the beam structures and extending loosely through the other beam structure and an adjustable nut carried on said threaded member and engaging said other beam structure for altering the spacing of the respective ends of the beam structures, and spring means coating between the respective ends of the beam structures and tending to urge the latter apart.

13. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of elongated beam structures, roll support means suspended from each of said beam structures, a pair of coating rolls journaled in said support means below said beam structures, a pair of beam supports at the opposite ends of one of said beam structures adapted to be secured in predetermined fixed position, a pair of shiftable beam supports at the ends of the other of said beam structures and adapted to move toward and away from said first-named beam supports, and adjustable means coating between said beam structures adjacent the opposite ends thereof for positioning said other beam structure in predetermined spaced relation from said one beam structure whereby to permit variation of the distance between the axes of said coating rolls for accommodating rolls of different diameter.

mounted in each bearing support with the shaft portion extending therethrough, a pair of flat-surfaced bearing elements rigidly mounted in said bearing member in circumferentially spaced relation and engaging the shaft portion at two spaced points in substantially line contact therewith, the remainder of said bearing member being spaced from the shaft portion to permit free fluid flow through the bearing member, a pivoted lever arm mounted on the bearing support adjacent said bearing member and having a flat-surfaced bearing element adapted to engage the shaft portion at a third circumferentially spaced point and in substantially line contact therewith, and adjustable means coaxing with said lever arm for holding the shaft portion against said pair of bearing elements.

23. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a coating roll having end shaft portions, a pair of swingable roll support arms having said shaft portions journaled therein, and bearing means for each of said shaft portions comprising a bearing member in the form of a sleeve rigidly mounted in the roll support arm and surrounding the corresponding shaft portion, a pair of flat-surfaced bearing elements rigidly mounted in said bearing member in circumferentially spaced relation and engaging the shaft portion at two spaced points in substantially line contact therewith, the remainder of said sleeve being spaced from the shaft member, a hold-down lever pivotally mounted on the roll support arm adjacent said bearing member, a flat-surfaced bearing element carried at one end of said lever and engaging the shaft portion at a third circumferentially spaced point and in substantially line contact therewith, and adjustable means coaxing with the opposite end portion of said lever for holding said last-named bearing element against the shaft portion.

24. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a coating roll having end shaft portions, a pair of swingable roll support arms having said shaft portions journaled therein, and bearing means for each of said shaft portions comprising a bearing member in the form of a sleeve rigidly mounted in the roll support arm and surrounding the corresponding shaft portion, a pair of flat-surfaced bearing elements rigidly mounted in said bearing member in circumferentially spaced relation and engaging the shaft portion at two spaced points in substantially line contact therewith, the remainder of said sleeve being spaced from the shaft portion to permit free fluid flow through the bearing member, an adjustable hold-down lever pivotally mounted on the roll support arm and having a flat-surfaced bearing element adapted to engage the shaft portion radially at a third circumferentially spaced point in substantially line contact therewith, and an adjustable end lever pivotally supported on the roll support arm for axial bearing engagement with the end of the shaft portion.

25. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a coating roll having end shaft portions, a pair of swingable roll support arms for rotatably supporting said shaft portions, removable end portions on said arms having said shaft portions journaled therein, bearing means for each of said shaft portions comprising a bearing member rigidly carried in the removable end portion of the roll support arm and surrounding the corresponding shaft portion, said bearing member having a pair of flat bearing inserts engaging the shaft portion at circumferentially spaced points with the remainder of the bearing member being spaced from the shaft portion for permitting free fluid flow through the bearing

member, a hold-down lever pivotally mounted on said removable end portion adjacent said bearing member for radially engaging the shaft portion at a third circumferentially spaced point, and an end lever also pivotally supported on said removable end portion for axial engagement with the end of the shaft portion, the detachable relation of said end portions of the roll support arms facilitating easy removal of the roll for repair and replacement.

26. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of generally parallel coating rolls, support means for each of said rolls comprising a pair of generally upright arms having the coating roll journaled between the lower end portions thereof, elongated scraper means adapted to engage the roll surfaces outwardly from and below the roll axes for cleaning said surfaces, and means for resiliently suspending said scraper means from said arms comprising an elongated member extending between said pair of arms above each roll, a plurality of hanger elements suspended from said member and carrying said scraper means, and resilient means operatively co-acting between said member and said hanger elements for yieldingly holding said scraper means in engagement with the roll surface.

27. The apparatus of claim 26 further characterized in that bracket means are provided on said arms for rotatably supporting the ends of said elongated member whereby to permit the scraper means to swing outwardly from the roll upon encountering obstructions on the roll surface, said bracket means being adjustable laterally on said arms for engagement of the scraper means with rolls of different diameter.

28. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of generally parallel coating rolls, support means for each of said rolls comprising a pair of generally upright arms having the coating roll journaled between the lower end portions thereof, elongated wiper bar means engaging the surface of each roll inwardly of and below the axes of the rolls for limiting the metal drawn upwardly between the rolls, and suspension means for resiliently suspending said wiper bar means from said arms.

29. The apparatus of claim 28 further characterized in that said wiper bar means comprises a pair of laterally spaced body members each carrying an elongated insert of relatively softer material adapted to bear against the roll surfaces for wiping molten metal therefrom whereby metal is carried upwardly between the rolls predominantly from the region between said spaced body members, and said suspension means comprises a rod extending between each pair of roll support arms above the roll, hanger means resiliently suspended from said rod and carrying said wiper bar means, and adjustable bracket means mounted on said arms and rotatably supporting said rod, the spacing between said body members being adjustable by said bracket means.

30. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of generally parallel coating rolls having circumferentially extending grooves, support means for each of said rolls comprising a pair of generally upright arms having the coating roll journaled between the lower end portions thereof, an elongated member extending between each pair of arms above the respective rolls, a plurality of cleaning elements pivotally suspended from said elongated member and extending into contact with the grooved portions of said rolls for cleaning the same and a pair of brackets slidably mounted on said arms for lateral adjustment thereon whereby to regulate the contact of said cleaning elements with the rolls for rolls of different diameter.

31. In an apparatus for coating a metal strip with mol-

14. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of elongated beam structures, roll support means suspended from each of said beam structures, a pair of coating rolls journaled in said support means below said beam structures, a pair of spaced stationary supports disposed at the opposite ends of said beam structures, a pair of base members disposed on said supports and secured to the opposite ends of one of said beam structures, fastening means for securing said base members in predetermined fixed position on said supports, a pair of shiftable base members disposed on said supports and secured to the opposite ends of the other of said beam structures, roller means interposed between said shiftable base members and said supports for facilitating adjustment of the shiftable base members toward and away from said first-named base members, means for clamping said shiftable base members in adjusted position, and adjustable spacing means coacting between said beam structures adjacent the opposite ends thereof for positioning said other beam structure in predetermined spaced relation from said one beam structure whereby to permit variation of the distance between the axes of said coating rolls for accommodating rolls of different diameter.

15. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of elongated beam structures, roll support means suspended from each of said beam structures, a pair of coating rolls journaled in said support means below said beam structures, adjustable means coacting with said beam structures for positioning the latter in desired spaced relation whereby to vary the distance between the axes of said rolls for accommodating rolls of different diameter, the support means for one of said rolls comprising a pair of pivotal support members having said one roll journaled therebetween, said support members being rigidly interconnected for rocking movement in unison about a common axis for movement of said one roll toward and away from the other roll, and adjustable pressure-applying means mounted on the beam structure supporting said one roll and operatively coacting with said support members for yieldably urging said one roll toward the other roll under predetermined pressure.

16. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of elongated beam structures, roll support means suspended from each of said beam structures, a pair of coating rolls journaled in said support means below said beam structures, the support means for one of said rolls comprising a pair of generally upright arms rigidly interconnected and pivotally supported intermediate their ends for rocking movement in unison about a common axis and having said one roll journaled between the lower portions of said arms, and adjustable pressure-applying means mounted on the beam structure supporting said one roll and operatively connected to the upper portions of said arms for yieldably urging said one roll toward the other roll under predetermined pressure.

17. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of elongated beam structures, roll support means suspended from each of said beam structures, a pair of coating rolls journaled in said support means below said beam structures, the support means for one of said rolls comprising a rock shaft and a pair of support members rigidly carried adjacent the ends of said shaft and having said one roll journaled therebetween, said rock shaft being rotatable about its axis for movement of said one roll toward and away from the other roll, and adjustable pressure-applying means mounted on the beam

structure supporting said one roll and operatively connected to said rock shaft for yieldably and rotatably urging said shaft in a direction to urge said one roll toward the other roll under predetermined pressure.

18. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of elongated beam structures, bracket means rigidly mounted on said beam structures and depending therefrom, pivotal support means carried by said bracket means, a pair of coating rolls journaled in coacting relation in said pivotal support means below the respective beam structures, said pivotal support means comprising for each of said rolls a pair of pivotal support members having the respective roll journaled therebetween and being rigidly interconnected for rocking movement in unison about a common axis whereby said rolls are supported for swinging movement toward and away from each other, adjustable means coacting between one of said beam structures and the pivotal support means for one of said rolls for rigidly holding the latter in predetermined position, and adjustable pressure-applying means coacting between the other of said beam structures and the pivotal support means for the other of said rolls for yieldably urging the latter toward said one roll under predetermined pressure.

19. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of elongated beam structures, roll support means suspended from each of said beam structures, a pair of coating rolls journaled in said support means below said beam structures, the support means for one of said rolls comprising a pair of pivotal support arms having said one roll journaled therebetween and being rigidly interconnected for swinging movement in unison about a common axis for swinging movement of said one roll toward and away from the other roll, bracket means rigidly mounted on the beam structure supporting said one roll and extending outwardly therefrom, manually operable screw means carried on said bracket means, and spring means resiliently interconnecting said screw means and said pivotal support arms whereby to apply adjustable spring pressure to the latter for yieldably urging said one roll toward the other roll.

20. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a coating roll having end shaft portions, a pair of movable roll support arms having said shaft portions journaled therein, and bearing means for each of said shaft portions comprising a circular bearing member rigidly mounted in each arm and surrounding the corresponding shaft portion in radially spaced relation therefrom, a pair of flat-surfaced bearing elements fixed in said bearing member and engaging the shaft portion at two circumferentially spaced points and in substantially line contact therewith, the remainder of said bearing member being spaced from the shaft portion to permit free fluid flow through the bearing member, a third bearing element engaging the shaft portion for holding the latter in bearing engagement with said pair of bearing elements, and a support for said third bearing element pivotally mounted on said arm.

21. The apparatus of claim 20 further characterized in that said pair of bearing elements engage the shaft portion substantially at the bottom and outer side thereof and said third bearing element engages the shaft portion at the top thereof.

22. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a coating roll having end shaft portions, a pair of bearing supports having said shaft portions journaled therein, and bearing means for each of said shaft portions comprising a bearing member rigidly

ten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of generally parallel coating rolls, support means for each of said rolls comprising a pair of generally upright arms having the coating roll journaled between the lower end portions thereof, a pair of adjustable dam members extending downwardly into the bite of the rolls adjacent each end thereof for maintaining a pool of metal between the rolls, and elongated bar means extending between and connected to the arms above the rolls for supporting said dam members.

32. The apparatus of claim 31 further characterized in that said dam members are in the form of generally T-shaped elements with the horizontal portions of said elements being supported on said bar means and the vertical portions of said elements being adjustable relative to the horizontal portions and extending downwardly into the bite of the rolls.

33. In an apparatus for coating a metal strip with molten metal by passing the strip through a coating bath and thence between a pair of coating rolls, the combination of a pair of generally parallel coating rolls having circumferentially extending grooves, support means for each of

said rolls comprising a pair of generally upright arms having the coating roll journaled between the lower end portions thereof, an elongated member extending between each pair of arms above the respective rolls, a plurality of cleaning elements carried on each elongated member for cleaning the roll grooves, and a pair of dams suspended from said elongated members at the ends of the rolls, said dams extending downwardly into the bite of the rolls for maintaining a pool of metal therebetween.

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