

[54] **GAUGE DEVICE FOR ALIGNMENT OF ROLLS OF A ROLLING MILL**

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[56] **References Cited**

UNITED STATES PATENTS

2,032,584	3/1936	Lengel et al.	333/182 X
2,736,217	2/1956	Blain	33/182 X
3,488,856	1/1970	Wikland	33/178 F

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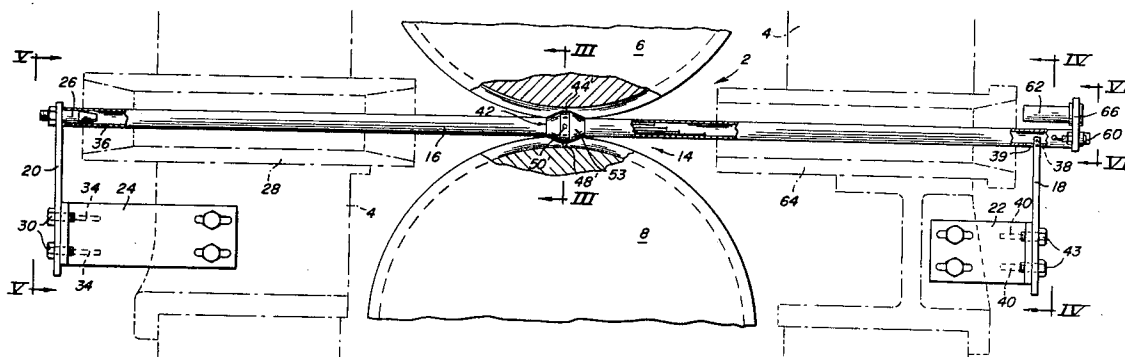
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ABSTRACT

Device includes a gauge head mounted on a tube positionable in a horizontal plane along the centerline of a rolling pass of a rolling mill including two pairs of opposed rolls disposed around a common point in the center of the roll pass. Gauge head is disposed in the mill pass and is made up of four electrical probes each having a spring-loaded contact tip projecting a uniform distance from the centerline of the tube. The contact tips are spaced 90° apart around the periphery of the tube and each is engageable by the rolling surface of one of the four rolls forming the roll pass when the roll is moved toward the centerline of the roll pass to a predetermined distance away from the centerline of the roll pass for rolling a particular size workpiece. Each of the contact tips is connected through its respective probe to an indicator light in an electrical circuit which causes the respective indicator light to light up when the contact tip is touched by the rolling surface of the roll during alignment of the mill.

6 Claims, 7 Drawing Figures



GAUGE DEVICE FOR ALIGNMENT OF ROLLS OF A ROLLING MILL

The present invention relates generally to metal rolling mills and more particularly to a gauge device for use in aligning the rolls of a rolling mill to adjust the rolling mill pass to accommodate a particular size workpiece.

The device of the invention finds particular utilization in the alignment of a rolling mill having two sets of opposed rolls or a pair of opposed rolls and a pair of opposed discs disposed in a roll housing. An example of the latter type rolling mill is the Diescher mill. The Diescher mill is commonly used for cross rolling a steel shell section over a freely rotating mandrel as described on page 858, "The Making, Shaping and Treating of Steel," Eighth Edition, published by United States Steel Corporation. The device of the invention will be hereinafter described in conjunction with realigning the rolls and discs of a Diescher mill about a common point on the pass centerline.

In the manufacture of seamless tubing, one step in the process is to reduce the wall thickness of and elongate the pierced shell. The machine most commonly used to accomplish this operation is the Diescher mill which basically consists of a mill housing containing a roll pass formed by two opposed large horizontally disposed forming rolls and two opposed large vertical narrow disc rolls having contoured rims. The two forming rolls and the two discs must be accurately positioned in the housing about a common point in the pass line. The horizontal spacing of the forming rolls and the vertical spacing of the discs are critical to the successful elongation of the pierced shell as it passes through the Diescher mill. However, in the operation of the Diescher mill, the spacings of the rolls and discs about the desired common point frequently deviate due to the large variety of sizes of product made on the mill. If the dimensions of the spacings are not accurately known and set for a given size of product, defects will be produced in the product which require costly repairs and reduce yields from the manufacturing process. In addition, the discs are subjected to excessive wear when the mill is not properly aligned which also contributes to higher maintenance costs. Prior to our invention, to eliminate the aforementioned detrimental conditions by realignment of the rolls and discs required that the mill be disassembled and then reassembled requiring several hours of downtime and maintenance. To further complicate matters, the techniques used to align and reassemble the mill were inaccurate at best.

It is, accordingly, the primary object of our invention to provide an improved gauge device for guiding alignment of the rolls of a rolling mill relative to each other to adjust the pass of the rolling mill to roll various sizes of workpieces.

It is a more specialized object of our invention to provide an improved gauge device as set forth by the above statement of object which includes a gauge head mounted on a tube positionable in a horizontal plane along the centerline of a rolling mill pass formed by two opposed pairs of rolls, the gauge being disposed in the rolling mill pass; four electrical probes in the gauge head spaced 90° apart and each having a spring-loaded contact tip projecting a uniform distance from the centerline of the tube; one contact tip being in the path of

each roll when it is moved laterally toward the centerline of the pass during realignment; and an indicator light connected with each probe and contact tip; the indicator lights being wired in parallel and connected in a circuit with an electric energy source.

These and other objects will become more apparent after referring to the following specification and drawing in which:

FIG. 1 is an elevational view partly in section of the device of the invention installed in a Diescher mill to guide alignment of the rolls of the mill;

FIG. 2 is an elevational view looking at the right end of FIG. 1 showing the gun sight post aligned with the cone of the invention prior to placement of the gauge-head bearing tube of the invention;

FIG. 3 is an enlarged cross-sectional view taken substantially along the line III—III of FIG. 1;

FIG. 4 is an elevational view partly in section taken substantially along the line IV—IV of FIG. 1;

FIG. 5 is an elevational view taken substantially along the line V—V of FIG. 1;

FIG. 6 is an enlarged elevational view taken substantially along the line VI—VI of FIG. 1; and

FIG. 7 is a substantially schematic wiring diagram of the invention.

Referring more particularly to the drawing, reference numeral 2 designates generally a Diescher mill including a housing 4, opposed upper and lower vertically disposed disc rolls 6 and 8, respectively, opposed right and left horizontally disposed forming rolls 10 and 12, respectively. The two disc rolls and two forming rolls define the roll pass 14 of the mill.

The apparatus thus far described is conventional and is not claimed as our invention, the details of which will now be described.

Reference numeral 16 designates an elongated tube supported in a horizontal plane along the centerline of the roll pass 14 by upright plates 18 and 20 which are attached to brackets 22 and 24, respectively, which in turn are attached to the mill housing 4 adjacent the entry end and exit end of the mill, respectively.

Plate 20 has a cone 26 rigidly affixed in the upper portion thereof which extends normal to the plate inwardly of the exit guide 28. As best shown in FIG. 5, the plate 20 is adjustably attached to the bracket 24 by means of bolts 30 which pass through elongated slots 32 in the plate 20. Benchmarks on the mill and a transit (not shown) are used to determine the proper positioning and attachment of the plate 20 on the bracket so that the cone extends along the horizontal plane containing the centerline of the mill roll pass. Dowel pins 34 are attached to the bracket 24 and mating holes for the dowel pins are drilled in the plate 20 so as to insure proper positioning of the plate 20 each time it is affixed to the mill. As best shown in FIG. 1, cone 26 fits into and supports the end 36 of the tube 16 when the device is in operating position.

As shown in FIG. 2, the upper end of the plate 18 is formed with a cut-out portion in which is provided an upright gun sight post 38. The gun sight post, which projects through a slot 39 in the tube 16, is utilized in cooperation with the cone 26 and a transit (not shown) to determine proper positioning and placement of dowel pins 40 on bracket 22 so that the tube 16 will be supported truly along the horizontal centerline of the

mill pass each time the gauge device of the invention is installed in the mill when realignment of the mill is required. Bolts 43 pass through elongated slots 45 in plate 18 to secure it to the bracket 22.

The gauge head 42 of the device of the invention consists of four electrical probes 44, 46, 48 and 50 supported in the portion of the tube 16 in the center of the mill roll pass 14, as best shown in FIGS. 1, 3, and 7, spaced 90° apart. Each of the probes is supported in the tube 16 by an electrical insulator 52 made of micarta or the like. The probes are each adjustable toward and from the centerline of the tube 16 and each is provided with a captive ball contact tip in its outer end, each designated by the same reference numeral but primed as the probe it is attached to. The outer end of each of the probes contain a spring 51 which bears on its respective contact tip to constantly urge it outwardly a uniform distance. We have determined a preferable distance to be one-eighth inch to provide a suitable tolerance during alignment. A removable protective shell 53 provided with openings for the contact tips of the probes may be disposed around the portion of the tube 16 in which the probes are located. The arrangement of the gun sight post 38 fitting in the slot 39 of tube 16 insures proper radial positioning of the probes wherein each is engageable by a predetermined disc or forming roll.

As best shown in FIG. 3, during alignment of the mill rolls, contact tip 44' will be contacted by upper disc roll 6, tip 46' will be contacted by right forming roll 10, tip 48' will be contacted by lower disc roll 8 and tip 50' will be contacted by left forming roll 12 as the disc rolls and forming rolls are moved toward the center of the mill pass 14 during alignment. The probes are pre-adjusted so that each contact tip is an equal predetermined distance from the center of the tube 16.

Referring now more particularly to FIGS. 6 and 7 of the drawing, it will be seen that probes 44, 46, 48 and 50 are connected with indicator lights 54, 56, 58 and 60, respectively. The indicator lights are wired in parallel and connected to a source of electrical energy, such as a battery 62. Battery 62, tube 16, disc rolls 6 and 8, and forming rolls 10 and 12 are grounded to the mill housing 4.

During alignment of the mill, the tube 16 is supported in the mill as described above and best shown by FIGS. 1, 4, and 5 in the drawing. Initially during the alignment procedure, the disc and forming rolls are spaced away from the center of the roll pass and the contact tips of the probes and all the indicator lights are dark. The roll alignment procedure can begin by lowering the upper disc roll 6 (by manually turning a handwheel in the housing conventionally provided for this purpose) until the rim thereof contacts the contact tip 44' of the probe 44 thus activating indicator light 54. Actuation of light 54 indicates that upper disc roll 6 is in the proper position spaced from the center of pass 14 the desired predetermined distance within the one-eighth inch tolerance caused by the outwardly urged spring-loaded contact tip 44'. The lower disc roll 8, the forming rolls 10 and 12 are then accurately positioned in similar manner which results in both disc rolls and both forming rolls being accurately aligned about a fixed point on the pass line of the mill. This condition is shown by broken lines in FIG. 7.

Upon completion of the alignment procedure, the gauge device of the invention is removed by removing supporting plate 18 from the entry side of the mill, withdrawing the tube 16 from the exit guide 28 and through the entry guide 64. It will be noted that the spring-loaded contact tips facilitate withdrawal of the device from the mill. Plate 20 with cone 26 intact is then removed from bracket 24 by removing bolts 30. The tube 16, gauge head 42, plate 18 and plate 20 are stored until realignment is next required.

As best shown in FIG. 6, the indicator lights 54, 56, 58 and 60 are conveniently mounted on a plate 66 which is mounted on the end of tube 16 adjacent the entry end of the mill. It has been found desirable to use indicator lights of different colors so as to be able to distinguish which light is connected with which probe and consequently which roll. Further, we have found it convenient to use twin lamp holders. The two lights in one holder connected to the upper and lower disc rolls being in superposed position and the two lights in the other holder connected with the forming rolls being in side-by-side position to further facilitate distinguishing which lights are connected with which probes. Wires extend from each probe through the tube 16 and emerge from openings in the side of the tube 16 behind the plate 66, as shown in FIG. 1.

It will be obvious that use of the gauge device of the invention reduces the time for aligning the rolls of a rolling mill to a matter of minutes rather than the several hours involved in disassembling and reassembling the mill for alignment as was done heretofore.

While we have shown but one embodiment of our invention, other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. In a metal rolling mill having a pass formed by two pairs of opposed rolls in a mill housing, said rolls being positioned about a common point in said pass, the improvement therewith of gauge means for guiding alignment of said rolls relative to each other to adjust said pass to roll various sizes of workpieces, said gauge means comprising an elongated tube, means for supporting said tube in a horizontal plane along the pass centerline of the mill, four probes mounted on the portion of said tube in the center of said pass, said probes being spaced substantially 90° apart around said tube, a captive contact tip on the outer end of each of said probes each adapted to be contacted by one of said rolls, spring means in each of said probes constantly urging said contact tips outwardly, said probes being so dimensioned that the contact tips are each the same predetermined distance from the center of the tube, each of said probes being connected with an indicator and said indicators being connected with an electrical energy source whereby the indicator connected with a probe is actuated when the contact tip of the probe is touched by a roll being adjusted toward the centerline of the pass.

2. Apparatus as defined by claim 1 in which said means for supporting said tube includes a pair of upright support plates mounted on said mill housing one adjacent the entry end and one adjacent the exit end thereof, one of said plates having a cone affixed to the upper portion thereof extending normal thereto in-

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wardly of the mill dimensioned to fit into and support one end of said tube, said cone being aligned with the centerline of said pass, the other of said plates having a gun sight post in its upper end fitting into a slot in the end of said tube opposite said one end, said other of said plates being adjustably mounted on said mill housing whereby proper positioning of said tube along the centerline of said pass is achieved by adjusting said last-named plate by visually aligning said cone and said gun sight post before said tube is placed in position.

3. Apparatus as defined by claim 1 in which each of said probes is surrounded by an electrical insulator around the portion thereof passing through the wall of said tube.

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4. Apparatus as defined by claim 1 in which each of said indicators is an electric light, said lights being connected in parallel and connected to said electrical energy source.

5. Apparatus as defined by claim 4 in which said lights are each a different color so as to readily indicate which probe contact tip is touched by its respective roll.

6. Apparatus as defined by claim 1 in which said probes are protected by a guard shield surrounding said portion of said tube, said guard shield having radial holes therethrough for passage of said contact tips therethrough.

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