

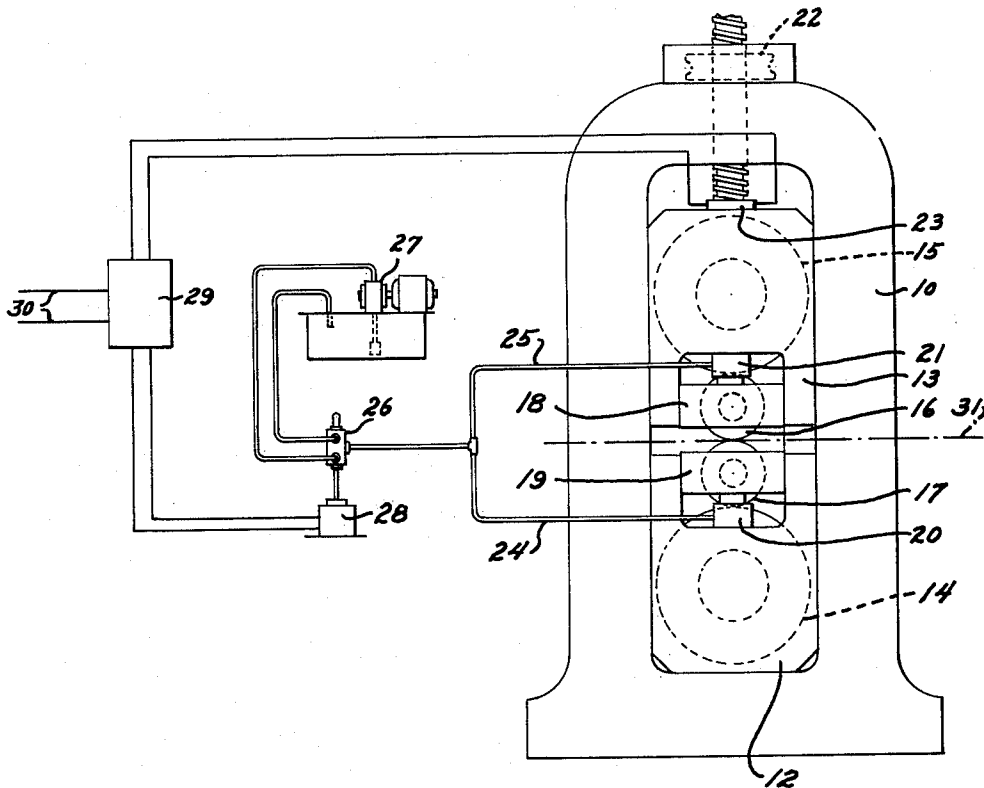
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ROLLING MILL STRUCTURES

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ROLLING MILL STRUCTURES
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This invention relates to rolling mill structures and more particularly to an automatic rolling mill structure for maintaining a desired contour in the work rolls and in the ultimate strip. This application is a continuation in part of my copending application Serial No. 668,989 filed July 1, 1957, issued as Patent No. 3,024,679, March 13, 1962.

In the rolling of metal strip the control of contour has been and is one of the greatest problems to the art. Work rolls in contact with the metal tend to change their shape because of the heat engendered during the rolling operation or heat picked up from the work in those cases where the work has been preheated before rolling. The result is that the strip of metal produced by the rolls may vary from time to time even over relatively short lengths of strip. In the past these variations have been virtually impossible to control. Variations in the roll contour as well as variations in the physical character of the strip, the width of the strip and various other physical conditions have made it necessary to go to extreme lengths in an effort to gain some type of control over the working contour. This has meant many roll changes with a large supply of rolls of different contours for any given mill. Roll changes are expensive and together with the loss of product for being out of gauge or for other reasons based upon lack of roll contour have added to the cost of operating such mills.

I have invented a rolling mill structure which will eliminate these problems. The rolling mill of my invention will permit continuous change in work roll contour to follow changing conditions at the mill so that a constant substantially unvarying contour can be maintained in the product.

I provide a rolling mill housing, a pair of work rolls in the housing on opposite sides of a pass line, said work rolls being adapted to receive strip therebetween and exert a working force transversely to the path thereof, journals for each end of said work rolls, a backup roll journaled in the housing adjacent each work roll and bearing on said adjacent work roll, pressure means at the ends of each of said work rolls acting on and moving the journals of said work rolls substantially perpendicular to the path of the strip to cause the ends of the work rolls to move toward each other so as to cause a portion of the work roll intermediate the ends thereof to engage a strip being rolled as a fulcrum and to bend said work rolls about said fulcrum to provide a desired strip contour and pressure sensitive means in the vertical system made up of the journals of the work rolls and backup rolls sensitive to the overall pressure on the roll journals acting on the pressure means at the end of each of said work roll to maintain a constant pressure at said journals.

Preferably the pressure sensitive means is a load cell placed between the screwdown and the backup roll journal and acting on a pressure control device to control the pressure on the work roll ends.

In the foregoing general description I have set out certain objects, advantages and purposes of my invention. Other objects, advantages and purposes will be apparent from a consideration of the following description and accompanying drawing which illustrates an end elevation of a rolling mill embodying the structure of my invention.

Referring to the drawing I have illustrated a mill housing 10 having a journal window 11 carrying backup roll chocks 12 and 13 in which are journaled backup rolls 14

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and 15 which bear upon work rolls 16 and 17 journaled in bearing chocks 18 and 19. Hydraulic cylinders 20 and 21 are provided between backup roll chocks 12 and work roll chocks 19 and backup roll chocks 13 and work roll chocks 18 respectively. A conventional screwdown device 22 is provided to bear on backup roll chock 13. Load cell 23 is placed between the screwdown 22 and the backup chock 13. Hydraulic fluid is delivered to the cylinders 20 and 21 through lines 24 and 25 from a pressure regulator 26 receiving hydraulic fluid from a hydraulic pump 27. The pressure regulator 26 is controlled from a standard setting by an electric motor 28 which moves in one direction or the other depending on the direction of current flow delivered to it. Current is delivered to the motor 28 from a motor controller 29 from a source of current 30. The controller 29 is controlled by the load cell 23 so that the direction of current flow to motor 28 will depend upon the variations in output of load cell 23 from a standard value.

The operation of this mill is as follows. Strip 31 to be rolled is passed between the work rolls 16 and 17 under a fixed pressure from the screwdown 22. Hydraulic fluid from pump 27 is fed to the cylinders 20 and 21 through the pressure regulator 26 at a standard value which will bend the work rolls about the work 31 as a fulcrum to provide a fixed desired work roll contour. If the rolls enlarge in diameter by heating through friction or through heat derived from the work itself an increase in pressure will occur on load cylinder 23. This will be communicated to motor controller 29 which will cause the motor 28 to rotate in a direction to decrease the pressure of the hydraulic fluid through pressure regulator 26 and thus to lessen the pressure on the cylinders 20 and 21. If the roll cools and decreases in diameter so that the pressure on the load cell decreases then the reverse happens and the pressure through the regulator 26 is increased so that a greater pressure is exerted on cylinders 20 and 21.

It is obvious from the foregoing description that other devices besides the motor 28 might be used for controlling the pressure regulator. Any electrical differentiation device might be so used. For example, an electronic integrator might be used to control the pressure regulator 26. Such expedients are well known in the art and will not be described in detail here.

While I have illustrated and described certain preferred embodiments and practices of this invention it will be understood that this invention may be otherwise embodied within the scope of the following claims.

I claim:

1. A rolling mill comprising a housing, a pair of work rolls in the housing on opposite sides of a pass line, said work rolls being adapted to receive strip therebetween and exert a working force transversely to the path thereof, journals for each end of the work rolls, a backup roll journaled in the housing adjacent each work roll and bearing on said adjacent work roll, pressure means at the ends of each of said work rolls acting on and moving the journals of said work rolls substantially perpendicular to the path of the strip to cause the ends of said work rolls to move toward each other so as to cause a portion intermediate the ends thereof to engage a strip being rolled as a fulcrum and to bend said work rolls about said fulcrum to provide a desired strip contour, and pressure sensitive means in the vertical system made up of the journals of the work rolls and backup rolls sensitive to the overall pressure on the roll journals and acting on the pressure means at the ends of each of said work rolls to maintain a constant pressure at said journals.

2. A rolling mill comprising a housing, a pair of work rolls in the housing on opposite sides of a pass line, said work rolls being adapted to receive strip therebetween and exert a working force transversely to the path thereof,

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journals for each end of the work rolls, a backup roll journaled in the housing adjacent each work roll and bearing on said adjacent work roll, pressure means at the ends of each of said work rolls acting on and moving the journals of said work rolls substantially perpendicular to the path of the strip to cause the ends of said work rolls to move toward each other so as to cause a portion intermediate the ends thereof to engage a strip being rolled as a fulcrum and to bend said work rolls about said fulcrum to provide a desired strip contour, drive means selectively varying the pressure exerted by said pressure means and a load cell in the vertical system made up of the journals of the work rolls and backup rolls sensitive to the overall pressure on the roll journals and acting on the pressure means at the ends of each of said work rolls to maintain a constant pressure at said journals.

3. A rolling mill comprising a housing, a pair of work rolls in the housing on opposite sides of a pass line, said work rolls being adapted to receive strip therebetween and exert a working force transversely to the path thereof, journals for each end of the work rolls, a backup roll journaled in the housing adjacent each work roll and bearing on said adjacent work roll, hydraulic pressure means at the ends of each of said work rolls acting on and moving the journals of said work rolls substantially perpendicular to the path of the strip to cause the ends of said work rolls to move toward each other so as to cause a portion intermediate the ends thereof to engage a strip being rolled as a fulcrum and to bend said work rolls about said fulcrum to provide a desired strip contour, a source of hydraulic fluid under pressure, means delivering said hydraulic fluid to the hydraulic pressure means, pressure regulator means in the delivery means, a load cell in the vertical system made up of the journals of the work rolls and backup rolls and sensitive to the overall

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pressure on the roll journals acting on the pressure regulator means to control the pressure of the pressure means at the ends of each of said work rolls to maintain a constant pressure at said journals.

4. A rolling mill comprising a housing, a pair of work rolls in the housing on opposite sides of a pass line, said work rolls being adapted to receive strip therebetween and exert a working force transversely to the path thereof, journals for each end of the work rolls, a backup roll journaled in the housing adjacent each work roll and bearing on said adjacent work roll, pressure means at the ends of each of said work rolls acting on and moving the journals of said work rolls substantially perpendicular to the path of the strip to cause the ends of said work rolls to move toward each other so as to cause a portion intermediate the ends thereof to engage a strip being rolled as a fulcrum and to bend said work rolls about said fulcrum to provide a desired strip contour, a screw down means acting on the back up rolls urging them toward the work rolls, and pressure sensitive means between the screwdown means and the backup roll journals sensitive to the overall pressure on the roll journals and acting on the pressure means at the ends of each of said work rolls to maintain a constant pressure at said journals.

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