

May 1, 1951

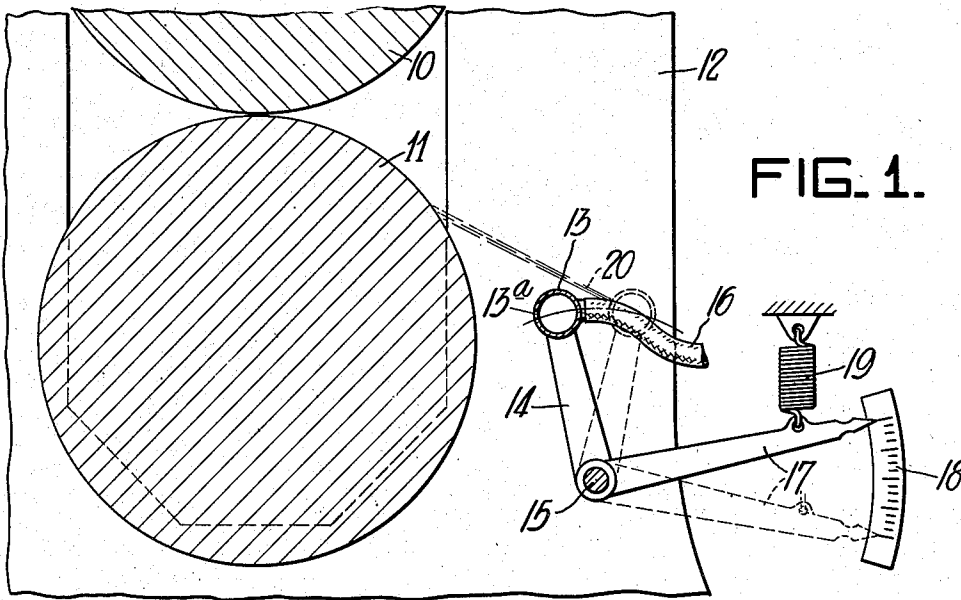
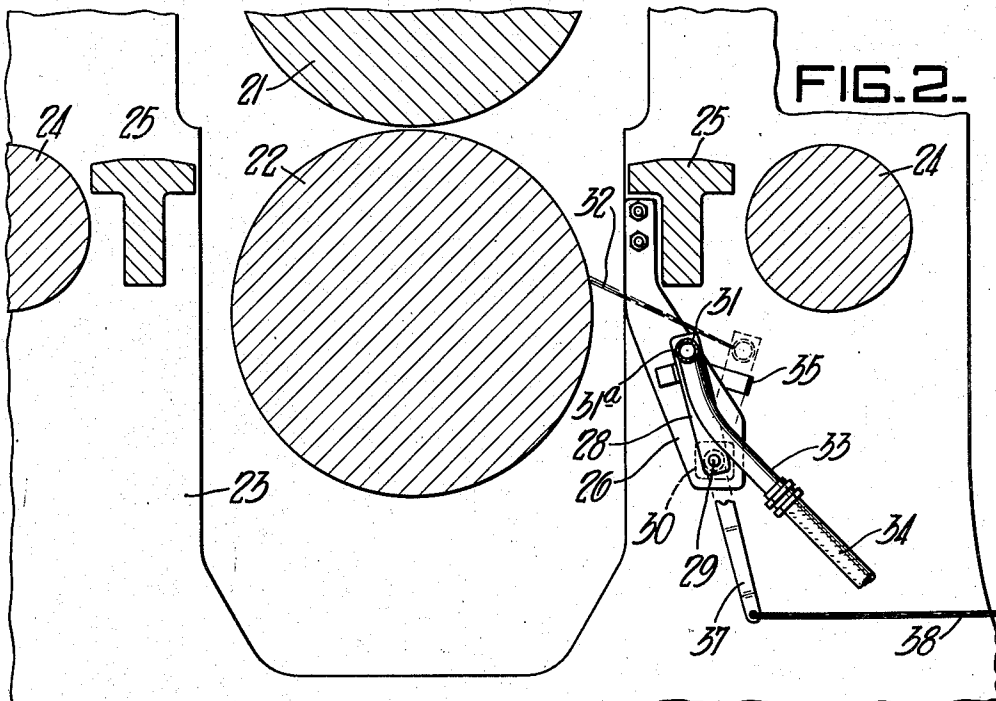
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2,550,899

APPARATUS FOR COOLING MILL ROLLS

Filed March 16, 1948

3 Sheets-Sheet 1



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FIG. 3.

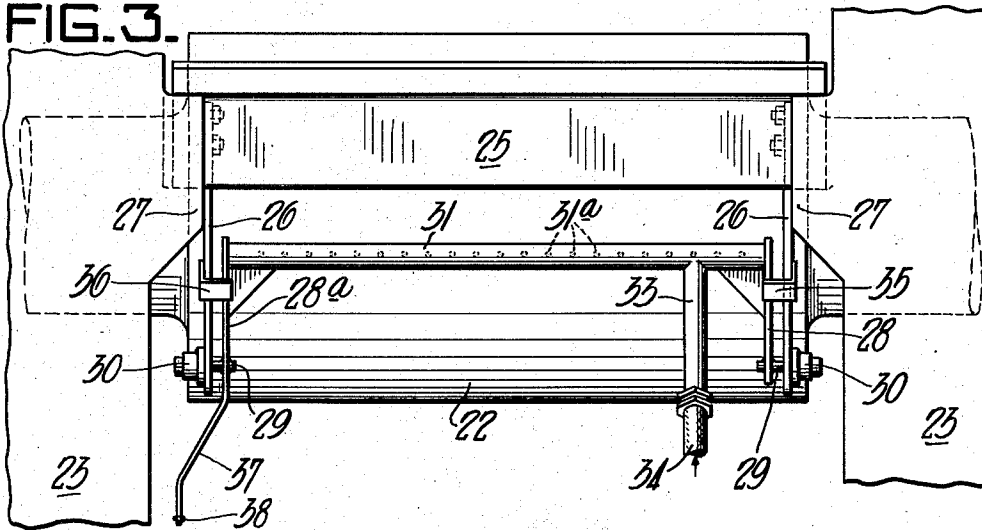


FIG. 4.

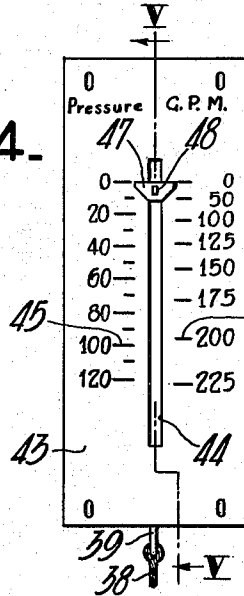


FIG. 5.

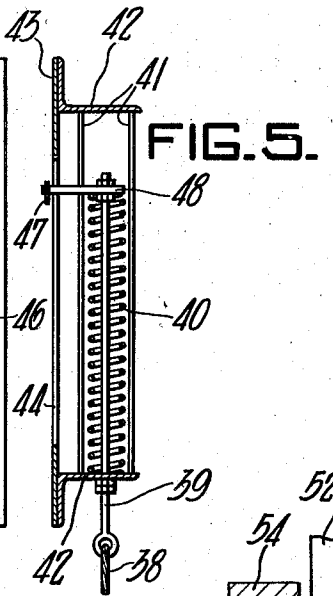
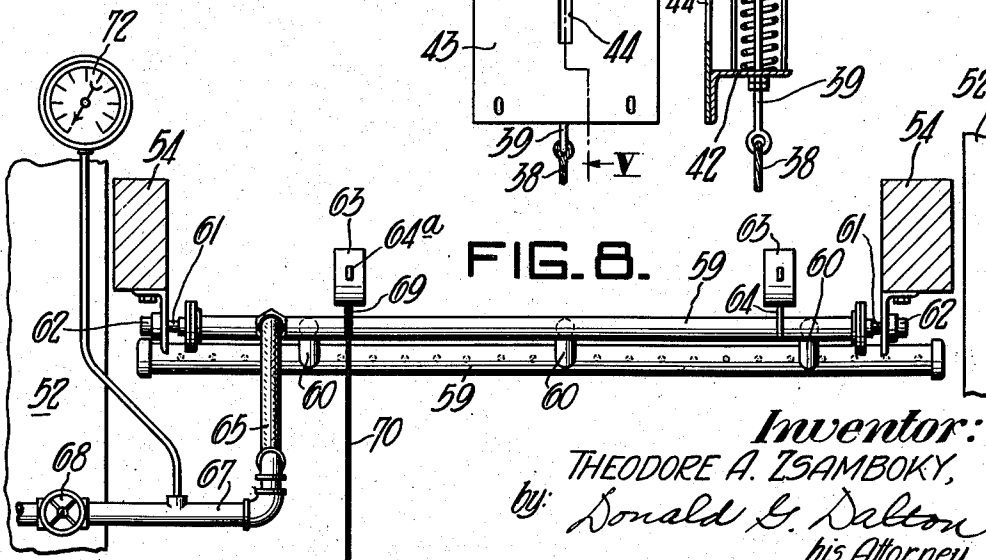


FIG. 8.



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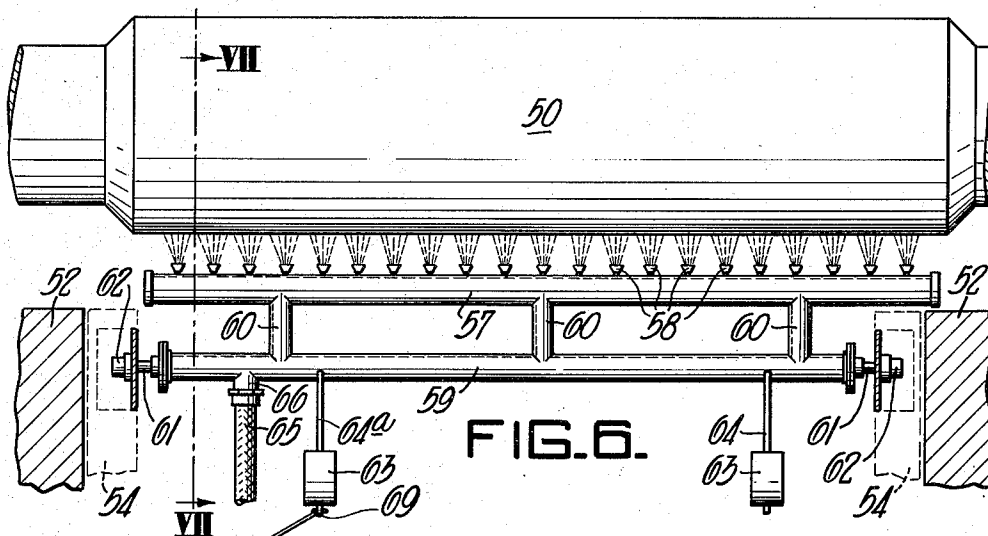
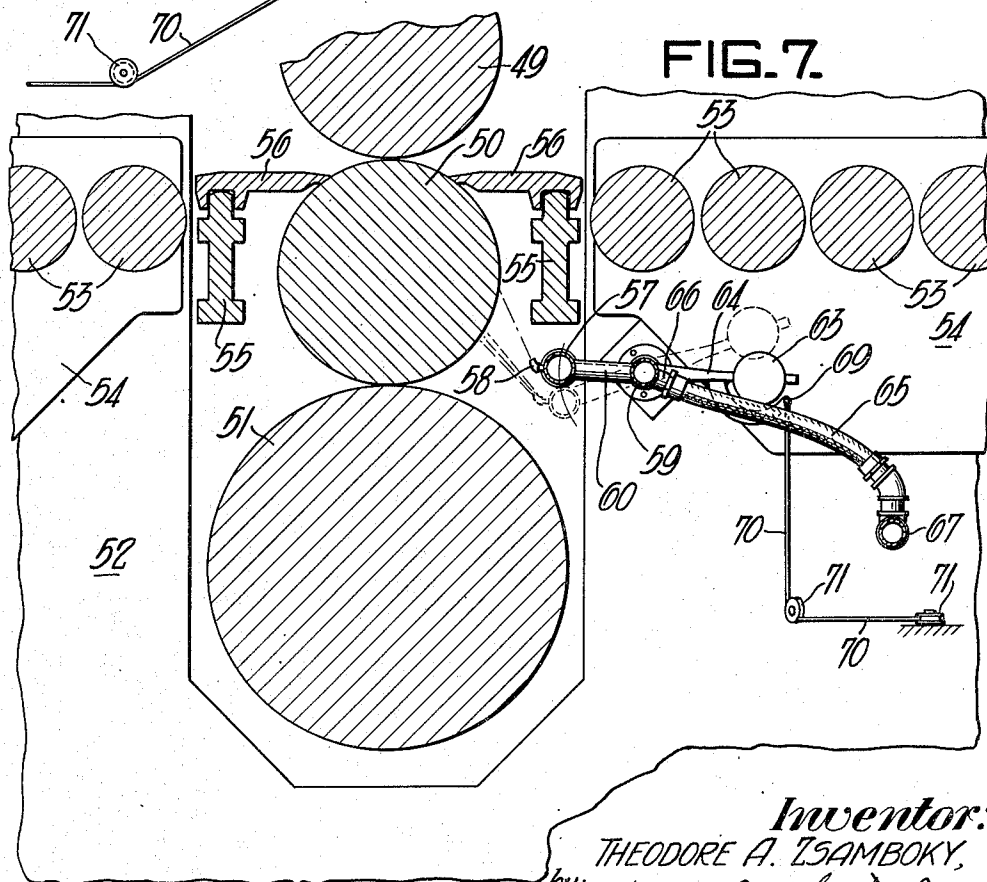
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APPARATUS FOR COOLING MILL ROLLS

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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APPARATUS FOR COOLING MILL ROLLS

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Application March 16, 1948, Serial No. 15,176

7 Claims. (Cl. 80—41)

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This invention relates to a movable mounting for a jet manifold and means responsive to the reaction of the jets on the manifold for indicating the volume of fluid being discharged thereby. The invention is intended particularly for use on rolling mills to indicate any diminution or failure of the supply of cooling water normally discharged onto the rolls from a manifold by a plurality of nozzles or outlet holes spaced therealong.

The life of the rolls of a mill used for the hot-rolling of steel or other metal depends largely on the maintenance of an adequate and continuous supply of cooling water which is usually delivered directly onto the rolls in the form of a plurality of jets by a suitable manifold. Failure or diminution of the supply occurs frequently in actual operations and, if undetected, causes overheating of the rolls with resultant fire-cracking and ultimate premature breakage. Mill rolls are quite costly, particularly in the larger sizes, and besides the cost of broken rolls, there is a substantial loss of production when it is necessary to shut down a mill for roll replacement.

The upper rolls of a mill and the manifolds for supplying cooling water thereto are usually in plan view of the operator. The lower rolls and their cooling equipment, however, are almost always below floor level and are obscured from view by the mill housings, roller tables, guides, etc., so it is impossible to determine by visual inspection whether the cooling equipment is functioning properly. A pressure gauge connected to the supply line affords little or no protection since it does not reveal failure of the nozzles or breaks in the line. In such event, pressure would register on the gauge even though insufficient water or none at all were being applied to the rolls. It is the object of my invention, therefore, to provide means for indicating definitely whether cooling water is actually being discharged onto the rolls and how much.

In a preferred embodiment of the invention, I employ a movable mounting for the cooling jet manifold of the lower roll and utilize the movement thereof caused by the reaction of the jets on the manifold to actuate an indicator visible from the operator's position. The manifold mounting is preferably pivoted so as to permit angular movement thereof against the force of a restoring means which may conveniently be a spring engaging an indicator moving over a scale. Suitable connections are provided between the indicator and the mounting.

A complete understanding of the invention

may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating two embodiments. In the drawings,

5 Figure 1 is a partial central vertical section through a rolling mill showing an elemental form of the invention incorporated therein, solely for the purpose of explanation;

10 Figure 2 is a view similar to Figure 1 showing one form of the invention contemplated for actual installation;

Figure 3 is a side elevation thereof such as would be seen by looking from the right in Figure 2;

15 Figure 4 is a front elevation of a gauge or indicator for use in connection with the invention;

Figure 5 is a side elevation thereof;

20 Figure 6 is a plan view of a different form of the invention contemplated for actual use;

Figure 7 is a sectional view similar to Figures 1 and 2 taken along the plane of line VII—VII of Figure 6; and

Figure 8 is a side elevation similar to Figure 3.

25 Referring in detail to the drawings and, for the present, to Figure 1, the invention, as there shown, is applied to a rolling mill, such as a slab or billet mill, including rolls 10 and 11 journaled in spaced housings 12. The upper roll 10 is provided with cooling means (not shown) in the form of the conventional stationary jet manifold. For cooling the lower roll 11 I provide a jet manifold 13 mounted on arms 14 extending upwardly from a shaft 15 adjacent the roll and parallel thereto. The manifold 13 is a length of pipe having holes 13^a spaced therealong adapted to discharge jets of cooling water onto the roll 11. The shaft 15 is journaled in suitable bearings (not shown) which may conveniently be mounted on the inner sides of the housings 12. Cooling water is supplied to the manifold 13 from a convenient source by suitable connections including a flexible hose 16 connected to the manifold.

30 A pointer 17 secured to the shaft 15 cooperates with a scale 18 supported in any convenient manner. A tension spring 19 secured to the pointer tends to maintain it, the arms 14 and manifold 13 in the positions shown in solid lines. When cooling water is delivered to the manifold under suitable pressure, it is discharged through the holes 13^a in the form of jets 20. These jets cause a measurable reaction on the manifold tending to cause it to move from its solid line position to-
ward the dotted line position, against the force

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of the spring 19. The movement of the manifold away from the roll, of course, is accompanied by corresponding movement of the pointer 17 over the scale 18. So long as jets of cooling water are being discharged from the manifold, therefore, it occupies a position depending on the volume of fluid discharged. If the flow of cooling water diminishes or ceases, the reaction of the jets on the manifold decreases and the spring 19 causes a reverse movement of the pointer 17 over the scale 18. The pointer and scale thus afford a constant visual indication of the volume of cooling water being delivered onto the roll 11.

The apparatus of Figure 1 as shown, of course, is not intended for actual installation because the pointer and scale, as shown, are located in an out-of-the-way position and would not be readily observable. All that is required, however, to convert the arrangement of Figure 1 for actual use is to place the indicating means in a location within range of the operator's vision and provide an operating connection extending to an arm on the shaft 15 corresponding to the pointer 17. Such an arrangement is shown in Figures 2 and 3.

Figure 2 shows the invention applied to a rolling mill comprising rolls 21 and 22 journaled in spaced housings 23. Roller tables on opposite sides of the mill for feeding a slab or the like back and forth therethrough include rollers 24 journaled in the housings. Rest bars 25 extending parallel to the rolls are located between the latter and the inner ends of the roller tables. The upper roll 21 is provided with conventional cooling means (not shown) in the form of a stationary jet manifold mounted on suitable supports.

Cooling means for the lower roll in accordance with the invention includes brackets 26 secured to projections 27 extending inwardly from the inner faces of the housings. Arms 28 and 28^a have hinge pins 29 extending transversely thereof journaled in bearings 30 secured to the lower ends of the brackets 26. A jet manifold 31 parallel to the roll 22, extends between and is secured to the upper ends of the arms 28 and 28^a. The manifold, a length of pipe, has holes 31^a spaced therealong for discharging jets 32 of cooling water onto the roll 22. A branch 33 from the manifold 31 has a flexible hose 34 connected thereto for supplying cooling water from a convenient source. By the construction described, the manifold 31 is mounted for angular movement from the position shown in solid lines in Figure 2 to the dotted-line position. Stops 35 and 36 in the form of angles secured to the brackets, limit the movement of the manifold toward and from the roll 22.

The arm 28^a has a downward extension 37 to which is secured a flexible cable 38 extending over appropriately positioned pulleys (not shown) to a gauge or indicator, such as shown in Figures 4 and 5, mounted in a position convenient for observation by the mill operator. The indicator comprises a stem 39 having a compression spring 40 thereon, confined between spaced guides 41. Angles 42 to which the guides are secured support a face plate 43 having a central vertical slot 44 therethrough and provided with pressure and volume scales 45 and 46, respectively. A pointer 47 is mounted on a finger 48 extending from the upper end of the stem 39 through the slot 44, and is adapted to cooperate with the scales 45 and 46. The cable 38 is connected to an eye at the lower end of the stem 39. By this cable, angular movement of the jet manifold causes a

corresponding movement of the pointer 47 along the scales 45 and 46.

As in the system of Figure 1, the manifold 31 swings away from the roll under the reaction of the jets discharged therefrom as the cooling water is turned on, the final position of the manifold depending on the aggregate volume of flow in the several jets. For a given number and size of holes 31^a in the manifold, the volume of flow of the several jets may be computed for various applied pressures, and the scales 45 and 46 thus calibrated. An ordinary pressure gauge connected to the supply line is useful, as will be explained later, for interpreting the indications of the gauge shown in Figures 4 and 5.

A somewhat different form of mounting means for a jet manifold, particularly suited for a four-high mill, is shown in Figures 6 through 8. In this case, the mill includes work rolls 49 and 50, a lower back-up roll 51 and a similar upper back-up roll (not shown) journaled in spaced housings 52. Roller tables on opposite sides of the mill are composed of rollers 53 journaled in side frames 54. Rest bars 55 extend between the housings and support guide plates 56 bearing on the lower work roll 50. The upper back-up roll and work roll are provided with jet manifolds mounted in view of the operator for delivering jets of cooling water.

For cooling the work roll 50, I provide a jet manifold 57 having nozzles 58 spaced therealong, extending between the housings and parallel to the roll. The manifold is a length of pipe mounted on a hollow shaft 59 by means of tubular arms 60 extending from the latter. These arms provide communication between the shaft and the manifold. The shaft has end closures in the form of flanges fitted with pintles 61 which are received in bearings 62 secured to the side frames 54. This permits angular movement of the manifold. Counterweights 63 are adjustable along arms 64 and 64^a secured to the shaft. A flexible hose 65 is connected to a tap 66 conveniently located along the length of the shaft 59. The hose is connected to the supply of cooling water through a pipe line 67 including a valve 68. The arm 64^a has a finger 69 thereon to which is connected a flexible cable 70 traveling over appropriately located pulleys 71 and connected to the stem 39 of an indicator, such as shown in Figures 4 and 5. An ordinary pressure gauge 72 is connected to the line 67.

As in the case of the form of the invention shown in Figures 2 and 3, the manifold 57 is held in the position shown in solid lines in Figure 7 by the tension in the cable 70 when no water is being delivered from the nozzles 58. When the valve 68 is opened, the reaction of the jets discharged by the nozzles causes the manifold to move downwardly turning the shaft 59 in its bearings 62 and pulling down the pointer 49 of the indicator against the force of the spring 40 thereof, the deflection depending on the volume of liquid discharged. In case the volume decreases for any reason, the spring restores the pointer and the manifold toward the position of zero flow, the counterweights 63 being adjusted, of course, so that a comparatively light spring will suffice to effect the return movement.

As stated before, for a given supply pressure, the total volume of flow may be computed from the number and size of the nozzle orifices. The volume of flow is controlled by the valve 68 and the pressure for any given valve setting is shown by the gauge 72 as well as the position of the

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pointer 47 relative to scale 45. If these pressure indications agree, the actual volume of flow will be that indicated by the position of pointer 47 relative to scale 46. If the pointer 47 indicates a pressure lower than that shown on gauge 72, that signifies a reduction in the volume of flow such as might result from clogging of one or more of the nozzle orifices. On the contrary, if the reading of scale 45 indicates a pressure higher than that shown on gauge 72, it signifies an enlargement of one or more of the nozzle orifices such as might result from the eroding action of the water jets discharged thereby. In either case of disagreement between the gauge 72 and the indicator 47, the actual flow under the existing abnormal conditions may be determined from the ratio of the pressures indicated. If exact information is desired, the operator may be provided with a curve or chart showing the actual flow for various differences between the readings of the gauge and the indicator.

It will be apparent from the foregoing that the invention provides a constant indication visible to the mill operator showing the actual flow of liquid in the jets directed onto the lower roll of the mill. Being thus warned immediately of any cessation or diminution in the flow of cooling liquid onto the roll, the operator may take the necessary precautions and thereby protect the roll from overheating as a result of continued operation without cooling water. It will be evident that the operation of the indicating mechanism is independent of leaks in the supply line, even up to the jet manifold itself, since the actuation of the latter is responsive solely to the reaction of the jets discharged therefrom. In the case of the four-high mill shown in Figures 6 through 8, the lower back-up roll may be provided with a jet manifold similar to that shown for the bottom work roll or it may be provided with a fixed manifold similar to that used for the upper rolls since the back-up roll is not as likely to overheat as the work roll and is cooled by the liquid discharged onto the latter as it descends therefrom.

Although I have illustrated and described but two preferred embodiments of the invention, it will be recognized that changes in the details and arrangement disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. Apparatus for cooling a rolling-mill roll comprising a pipe having an outlet for directing a jet onto the roll, a connection to said pipe for supplying fluid thereto, means mounting said pipe for movement toward and from the roll, an indi-

cator actuated by such movement and means urging the pipe toward the roll.

2. The apparatus defined by claim 1 characterized by said mounting means being pivoted on an axis parallel to and spaced from the pipe.

3. In an apparatus for cooling a rolling-mill roll, the combination with a pipe having jet outlets spaced therealong and a connection to said pipe for supplying fluid thereto, of bearings spaced along an axis parallel to said pipe, arms journaled in said bearings supporting said pipe for angular movement about said axis, an indicator, a connection transmitting movement of said pipe to said indicator and means urging said arms and pipe toward the roll.

4. Apparatus for cooling a rolling-mill roll comprising a pipe having outlets spaced therealong, bearings spaced along an axis parallel to said pipe, a shaft journaled in said bearings for rotation, arms extending from said shaft supporting said pipe for angular movement about said axis and indicating means actuated by movement of said pipe.

5. The apparatus defined by claim 4 characterized by said shaft and arms being tubular and a connection to said shaft for supplying fluid thereto.

6. The apparatus defined by claim 4 characterized by an additional arm on said shaft and a flexible tension member connected to said last-mentioned arm and said indicating means for actuating the latter.

7. Apparatus for cooling a rolling-mill roll comprising a pipe adjacent the roll and substantially parallel thereto having a plurality of outlets spaced therealong for discharging jets of cooling liquid, pivotally mounted arms supporting said pipe for oscillation toward and from the roll, a connection to said pipe for supplying cooling fluid thereto, and indicating means actuated by movement of said pipe.

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