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WIPING DEVICE FOR ROLLING MILL ROLLS

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Fig. 1.

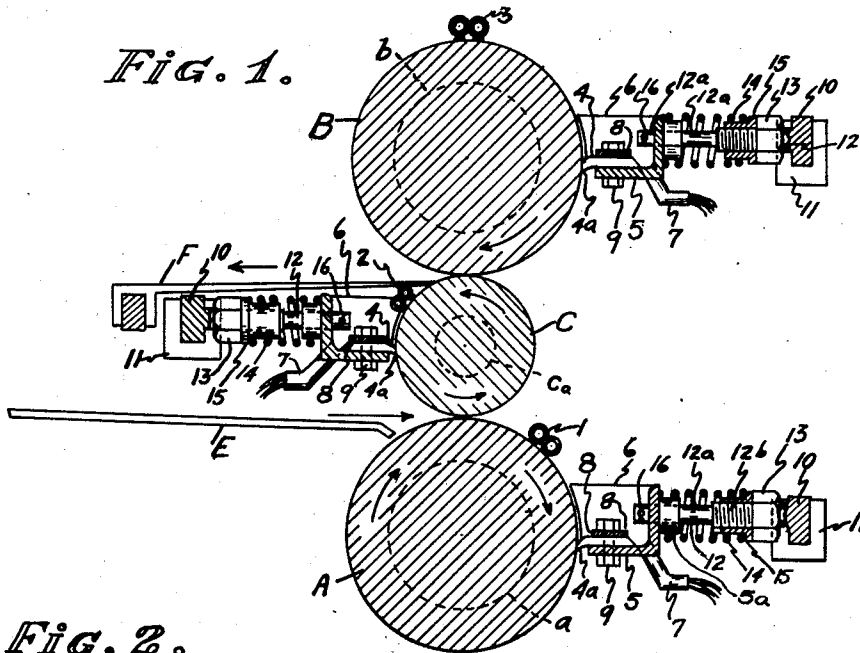


Fig. 2.

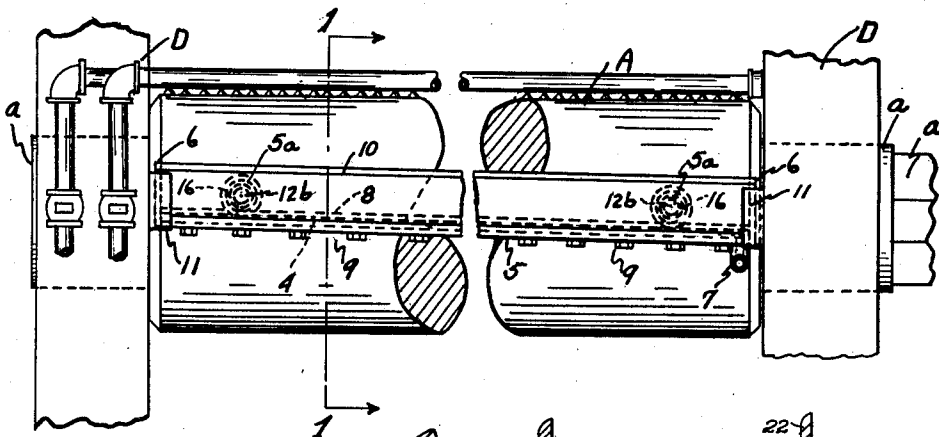


Fig. 3.

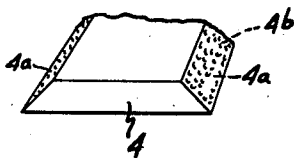
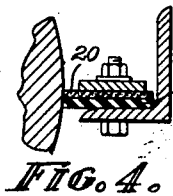


FIG. 4.

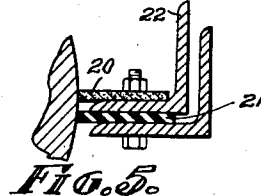


FIG. 5.

BY

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WIPING DEVICE FOR ROLLING MILL ROLLS

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4 Claims. (Cl. 80—1)

My invention relates to rolling mills, and more especially to means for regulating the application of a cooling medium to the rolls of such mills and to keeping said rolls clean and polished. As illustrated herein, my invention is applied to the rolls of a three-high mill; although it will be understood that I am not necessarily limited to the use of my improvement on such a mill, this example being used because the difficulties encountered in the operation of three-high mills are especially well overcome by my improvement. The art of rolling light gauges and especially wide light gauges on a three-high mill is difficult primarily because of the difficulty of keeping the light-gauge bars or sheets sufficiently hot for a sufficient time to secure the desired elongation, and at the same time keeping the rolls cool enough to prevent damage to themselves and consequently to the material being rolled. If sufficient water is supplied to the rolls to keep them cool, the water running off the rolls falls on the pack being rolled and chills it, frequently unevenly, hardening the pack to such an extent that it can no longer be elongated in the conventional mill. It is well known in the art that the conventional mill has so much spring in the rolls, together with that in the housings, that only small elongations are possible on cold, or nearly cold, material.

It is one of the objects of my invention, therefore, to keep the rolls sufficiently cool by the proper application of the cooling liquid, yet avoid unduly rapid cooling of the pack being rolled, by keeping the cooling liquid off the pack.

Further, in rolling material of what may be termed "even heat", sufficient variation in hardness and gauge occurs to make the material affect one part of the roll more than another part; or the roll itself may be more sensitive to heat in one part of its length than in another part thereof. If this occurs, the actual effective diameter of the roll changes from time to time, often in a few minutes, with the result that elongation is uneven from side to side of the material being rolled.

The problem of keeping the roll cool, therefore, is not only one of preventing damage to the roll from heat, but that of keeping the roll cool enough for the operator of the mill to control its shape by varying the amount of cooling medium applied, as well as the point of application thereof.

It is another object of my invention, therefore, to provide for the maintenance of any desired proportion of the cooling liquid, usually water,

at any various areas along the length of the roll, in accordance with the variant application of the coolant by the operator.

Rolls of various diameters, within a limited range, will be used. Also, any given roll may change its location relative to the mill housing; as by spring of the roll, roll cross or shifting from the designed axial line for the roll, spring in the roll neck mounting, or wear in the necks of the rolls. It is another object of my invention, therefore, to provide a flexible relation of a controlling means suitable to attain the aforementioned objects, to the roll, so that the means operates with complete efficiency under all conditions of roll diameter or displacement.

In the operation of a three-high mill, on the first pass the weight of the working roll and the top roll rests on the bottom roll. Hence, due to the enormous pressure at the instant the pack hits the mill, due to overcoming the inertia of the top and bottom rolls in a vertical direction, a welding temperature may be attained unless a film of water is maintained on the bottom roll. It is a further object of my invention to apply the cooling liquid to the bottom roll especially, at an area extending along the roll length as nearly as possible opposite, along the path of travel of the pack, to that area where the pack enters the mill; together with the resultant carrying of the coolant by the lower roll around under and up to the area of entrance, to prevent welding, or formation of "stickers", as the welded packs are called; and also to provide for proper control by the operator of the amount of coolant initially supplied to the area, and for control of the amount of liquid carried around by the lower roll.

A further object is to prevent flooding of the roll necks by the cooling liquid.

In the operation of any mill, there is a tendency for the roll to accumulate grit, loose particles of metal, oil films and the like. Solid particles such as those mentioned will in time become embedded in the surface of the roll, giving it an irregular and inaccurate surface, which of course is detrimental to accurate rolling. It is a further object of my invention to promptly remove such substances from the rolls. As it is a marked advantage to have such removed substances disposed of to a place where they will not again enter into the working of the rolls on the sheets, or packs, it is a further object of my invention to provide for the removal of the substances directly in conjunction with the control of distribution of the cooling liquid on the rolls,

and thereby to carry off the removed substances, as fully as may be, by the excess of cooling liquid which flows away as a result of the controlled distribution.

5 Other objects will appear in the course of the following description of a preferred example of my invention, illustrated by the drawing, in which—

10 Figure 1 is a vertical section in a plane along the path of rolling, corresponding to the plane of the line I—I of Fig. 2, showing my invention applied to a three-high mill.

Figure 2 is a side elevation of the lower roll and parts of its housings, conventionally indicated, and part of its driving stub at one end, showing my invention as applied to said lower roll, the view being to the left in Fig. 1.

Figure 3 is a fragmentary perspective view of an end part of one of the wiping strips.

20 Figure 4 is a fragmentary view of a modification.

Figure 5 is a fragmentary view of another modification.

As more completely shown in Fig. 1, the three-high mill has, as well known in the art, the 25 bottom roll A, the top roll B, and the intermediate or working roll C. These rolls have, suitably mounted by means not shown in detail because well known in the art, the necks a, b and c, respectively, in the housing D as seen in Fig. 2, where part of the driving stub end of the roll there shown is seen at a'. The feed-in table E is seen in Fig. 1 at the left, leading to the entrance between the bottom and intermediate 30 rolls A and C; and above this, leading from the exit between the intermediate roll C and the top roll B, is the receiving table F for the return pass. The construction and arrangement of these tables E and F being well known, their details are not shown. It will be understood that the illustration of the three-high mill in Figs. 1 and 2 is conventional only, with only such indication of its structure as is necessary to illustrate the association of my invention therewith; and 35 that I am not limited to any particular type of mill, in the use of my invention, which is susceptible of modification in accordance with varying details of design of different mills.

Means for supplying coolant to the rolls of 40 course also is well known in the art, and I have conventionally indicated such means, without full detail; the important aspect of the provision of such means, in conjunction with my invention, being the relative location of it. In accordance 45 with one of my objects above stated, I prefer to locate the coolant supply means 1 just below the plane of passage of the material between the bottom roll A and intermediate roll C at the side of exit of the material from between these rolls, 50 where the roll surface is traveling downward as indicated by the arrow, and will carry a portion of the coolant under and then up to the entrance from the table E, where the material makes impact with the rolls at its first pass, as before 55 mentioned.

I prefer also to locate the coolant supply means 2 for the intermediate or working roll C in the same position relative to the return passage of the material between this roll C and the top roll B, 60 for similar reasons. The supply means for coolant for the top roll B is, as here shown, located substantially at the top of this top roll, at 3; although it will be understood that its relative position may be varied; and if so, preferably toward the right as seen in Fig. 1. 65

The location of the coolant supply devices at areas remote from the areas of entrance of the material between the respective pairs of rolls permits effective control to apply coolant in proper quantity and evenness of distribution at the entrance areas, yet without risk of excessive coolant at such areas such as would unduly cool the material; that is, this is attained by having the location remote from the entrance area, measured around the roll in the direction opposite to 10 that of the rotation of the roll, from the entrance area to the location of the supply of coolant. It is near the entrance area, measured in the opposite direction; but the direction of the roll surface is such that the coolant does not materially travel in this shorter measured direction. The considerations of this location of coolant supply are largely dictated by the requirements of the wiping devices in accordance with my invention, and in so far as they enter into association with 15 my wiping devices in this way, the coolant supply means are, though old and known, per se, elements of my invention, in respect of their relative locations. Also, in principle, so far as I am aware, the location of the coolant supply means 1 and 2, relative to the entrance and exit areas of the mill, is original with me, with the improved results in accordance with my object of avoiding occurrence of welded packs or "stickers", as 20 above set forth.

I have illustrated a preferred embodiment of my improved wiping device, one of which devices is applied to each roll A, B and C as shown in Fig. 1; although it may be stated that a wiper, in its function of controlling and distributing the coolant, one of the functions of my device, is not 25 so necessary on the bottom roll A as it is on the two upper rolls B and C, since coolant applied at 1 may run off the bottom roll A as it is carried around thereby to the entrance area, leaving a sufficiently reduced and uniform film of coolant to reach said entrance area for the purposes before explained. The wipers for the two upper rolls B and C are more essential in their function of preventing the coolant falling on the material 30 being rolled, and excessively cooling it, as also has been previously explained as one of the objects of my invention.

As here shown, all three wiping devices are alike in construction and mounting, as well as in size, 35 which is preferable from the viewpoint of economy of construction; although it will be understood that this uniformity in size and detail of construction may be departed from under certain conditions. As, shown, therefore, a description 40 of one wiping device will apply to all three; and in Fig. 2, the side elevation of the device is in conjunction with its application to the bottom roll A, which may be viewed in conjunction with the sectional view of any one of the devices in 45 Fig. 1.

The wiping strip 4 has beveled edges 4a as most clearly seen in Fig. 3; and it is of such length as to extend from end to end of the working diameter of the roll to which it is applied. 50 The outer acute edge of the bevel is in contact with the roll; the inclination of the bevel being in the direction of travel of the roll surface at the area of contact. Since the wipers are located at those sides of the rolls where the roll surface travel is downward, the wide side of the strip accordingly is downward. It has bevels 4a at both edges, so that when one edge is excessively worn, the strip may be reversed and the other edge applied to the roll. The preferred location of 55

each wiper is such that the strip edge 4a contacts the roll along an area slightly below the horizontal plane of the roll axis; and the strip has its width substantially parallel with that plane. Consequently, the drag of the roll surface tends to bend the thin edge 4a downward, as indicated to a somewhat exaggerated degree in Fig. 1.

The strip 4 being of a resilient material, and having its edge thin by the bevel 4a, and this edge being bent down, or in the direction of roll surface travel, the restoring force of this resilient bent down edge or lip is sufficient to maintain the required uniformity of passage for coolant between the strip 4 and the roll, at all points along its length, notwithstanding any slight variations in roll diameter, or other surface variations on the roll, at any of the points. This is an improvement in a wiper in its function of controlling distribution of coolant in the manner and for the objects before explained.

A further improvement resulting from my invention, is the performance of the other wiping function, that of keeping the roll surface as free as may be of foreign substances, as before explained, directly at the area of coolant film control; preferably, as shown, by means included in the wiping strip 4 itself, whereby the maximum coincidence of coolant-regulating and roll-cleaning locations is attained. This has the advantage of carrying away the substances cleaned from the roll along with the excess of coolant liquid over that allowed to remain as a film on the roll, as before explained. One result of this is that the substances do not again deposit on the work or part of some other roll, to give trouble again; and no attention or labor is necessary to dispose of the substances. A further result is that as soon as the film of coolant liquid is determined by the control wiping, it is formed on a surface of the roll freshly cleaned, so that the uniformity of film, for the purposes before fully explained, is further guaranteed than were the control of film to be effected at an area substantially displaced from the area at which the cleaning is done. It will be seen that this latter object is attained if the areas of control and cleaning are not exactly coincident; and the disposal of the cleaned-off substances also may be well done under such lack of coincidence; and therefore I am not limited to exact coincidence of areas in which these functions are carried out, but deem it within the scope of my invention to have the areas so close together that the above objects are substantially attained.

In Figure 4, I have shown one such modifications, where the wiping and abradant materials are discrete but placed close together. The abradant material is indicated at 20, and the wiping material at 21. In Figure 5 the members 20 and 21 are shown slightly separated by a member 22.

Of course exact coincidence of the areas is preferable, and by my invention this is attained in the most economical manner by the inclusion in the material of the wiping strip 4 of a suitable abrasive and polishing substance indicated by the stippling on the bevels 4a, as at 4b in Fig. 3. In order that the abrasive 4b may have a sufficiently effective action in cleaning the roll surface, it is preferable that the material of the wiping strip 4 be of such softness as to wear substantially more rapidly than the abrasive material 4b in the areas of contact with the roll. An example of such material, preferably used, is hard rubber for the strip 4; while the abrasive

may be any well known material having sufficient abrasive properties to remove the foreign substances from the roll surface, as for example emery, carborundum or the like. By the term hard rubber I do not mean that form of rubber which is brittle like bakelite, but live rubber which is resilient, although relatively hard. The combination of base material such as hard rubber, and the abrasive, thus resembles the construction of abrasive tools, such as emery wheels and the like; although it is necessary that the base material should be considerably more resilient and preferably softer, than the materials usually employed as binders for abrasives in such tools. Hard rubber of usual quality answers this purpose. Its softness permits it to function fully as a coolant wiper, and to wear readily relative to the abrasive particles 4b; and its resiliency permits it to conform its thin beveled edge 4a to the roll as before mentioned.

To support the strip 4, as well as conduct away the excess of coolant, I provide in the example shown an angle bar 5 disposed with one member under the strip 4 and its other member upstanding beyond the strip 4 from the roll surface, so that, with the aid of the roll surface itself, a trough is formed along the roll. Walls 6 are provided to close the trough at each end of the angle bar 5; and the mounting of the bar 5 is such that it slopes from one end of the roll to the other as seen in Fig. 2. A spout 7 leads from the lower end of the trough thus formed, and inclines out away from the path of travel of the material being rolled, to discharge the excess of coolant, as well as the scraped-off foreign substances washed along with this excess of coolant. The wiping strip 4 is clamped to the angle bar 5 by a clamp strip 8, with bolts 9 through the strips 8 and 4 and the bar 5.

As before noted, the roll may vary its alignment, or the rolls may vary, one compared with the one it replaces as the rolls become too much worn; requiring flexible mounting of the wiper. This I provide as here shown by guiding the bar 5 horizontally and holding it toward the roll under adjustable spring pressure. The primary support is a bar 10, with its ends held in stirrup brackets 11, on the opposite mill housings D as seen in Fig. 2. In a short distance from each end of the angle bar 5, this bar has bosses 5a with openings, through its upright member; and support rods 12 with their outer ends fixed to the support bar 10, have their inner end parts 12a reduced in diameter, with sliding fit in the openings of the bosses 5a, so that the angle bar 5, carrying the wiping strip 4, may slide toward or from the roll. The larger part 12b of each support rod 12, near the support bar 10, is threaded, with an adjusting nut 13 thereon compressing a spring 14 between it and the angle bar 5; this spring 14 being helical and fitting around the angle bar boss 5a and around a collar 15 that has a flange between the spring and the nut 13. The wiping strip 4 thus may be pressed to the roll with the desired firmness, according to different degrees of control of the coolant film desired; and the spring will yield to allow the strip to preserve its relation to the roll surface if the latter varies as before mentioned. So that the spring 14 may not entirely displace the angle bar 5, carrying the wiping strip 4, from the mounting, the support rod 12 has near its inner end a stop pin 16 extending through and fixed in it.

The above described mounting structure, while preferred, is exemplary; and it will be understood

that I am not limited to the exact description and illustration of this; and that other details of the embodiment disclosed may be departed from, as may occur in practice.

5 What I claim as new and desire to secure by Letters Patent is:

10 1. A combined coolant wiper and foreign-substance remover for a rolling-mill roll, comprising a member of softness and resiliency, having embedded in its surface that acts on the roll particles of abrasive material to effect the removal of the foreign substance from the roll.

15 2. A combined coolant wiper and foreign-substance remover for a rolling-mill roll, comprising a member of hard rubber, having embedded in its surface that acts on the roll particles of abrasive material to effect the removal of the foreign substance from the roll.

3. A coolant wiper for a rolling mill roll com-

prising a strip of resilient material to extend longitudinally of the roll with an edge close to the roll, said edge being of reduced thickness to yield in the direction of roll surface travel, to adapt itself to irregularities of formation of the roll surface, and having embedded in its thin edge an abrasive to remove foreign substances from the roll surface coincident with its coolant-wiping action. 5

4. A combined coolant wiper and foreign substance remover for rolling mill rolls, comprising a member of hard rubber and an abrasive member, both of said members being located along an area longitudinally of the roll and of such limited extent circumferentially of the roll as to perform their respective functions substantially coincidentally on a given area of the roll surface. 10 15

PAUL H. LONG.