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METAL WORKING

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The present invention relates broadly to the art of metal working, and more particularly to the rolling of metal by a rolling operation involving the so-called cold rolling step.

In the cold rolling of metals to produce thin gauges, there are involved several problems with respect to accuracy of control of the rolling conditions, and the quality of the product produced varies in accordance with the accuracy with which it is possible to effect the necessary control.

If it is desired, as it usually is, to produce a uniform product, it is necessary to maintain a fixed definite total load on the mill. If the working load of the mill varies while the total load is maintained constant, it necessarily follows that one of the other load factors, such for example as tension, must also vary. One of the working load factors which plays an important part, is the friction factor. Mill construction and lubrication have minimized the difficulties encountered by reason of friction with respect to the mill structure itself. Heretofore, however, it has not been possible to maintain the desired constancy of friction between the rolls and the material being rolled, and it has necessarily followed that variation in friction load, while maintaining a constant total load on the mill, must result in a compensating change in some other factor. The result of such a compensating change may be reflected in the thickness of the material, or accuracy of gauge, in the flatness of the material, in the appearance, or in the quality thereof.

It has heretofore been proposed to lubricate the stock being rolled in an effort to maintain a substantially constant friction load. It has been found, however, that even with lubrication in accordance with known practices, the factors entering into the rolling operation have varied quite considerably.

I have found that it is possible to materially improve the constancy of the working factors as well as the quality and uniformity of the product, by effecting a continuous cold rolling operation of metal stock, usually in the form of strip, which during the rolling operation, or prior thereto, is coated with palm oil.

In the preferred embodiment of my invention, the palm oil is applied to the strip steel prior to the coiling thereof and therefore prior to the cold rolling operation. In this way the surfaces of the metal strip are protected while the coils are in stock ready for rolling, and a desired body of palm oil is present to produce the desired results during the rolling operation itself.

While I am not fully aware of the reasons underlying all of the results obtained, an effort will be made herein to set forth the improved results insofar as they are at present understood.

The heavy body of palm oil makes it an ideal covering for the strip steel, in that it adheres firmly to the steel. By artificially heating the palm oil, and maintaining it in heated condition during the application, it is maintained quite fluid, thereby facilitating its application and insuring effective spreading. Upon contact with the metal, however, it congeals to a greater or lesser extent, but in any case to such an extent that it does not run off, and thus affords a good protective coating while the coils are in stock.

During the rolling operation itself, it is apparently a great advantage due to the heavy body of the oil before referred to, and its adhesive qualities, these two properties being such as to maintain a very appreciable film between the metal and the rolls such as to prevent actual contact therebetween. An indication of such a film, and of the better lubrication afforded by the use of palm oil, is readily apparent from the lack of any squeaking noises during the rolling operation. It may likewise be observed that with mineral oil as ordinarily utilized, the roll surfaces

remain bright and shiny, while with palm oil the roll surfaces are dull. This is likewise true of the metal itself, thereby indicating the continuous presence of a protecting film. The improved lubricating properties are evidenced by the fact that it is many times necessary to remove the palm oil coating from the leading end of the strip in order to effect entry thereof into the first roll stand of a continuous cold rolling mill, the quality of the lubrication being such that the rolls are unable to grip or "take hold of the strip" unless the lubricant is removed.

In may further be observed that the use of palm oil makes a marked difference in the power required to operate the mill screw downs, and particularly the screw downs of the first mill, while the mill is in operation, thus showing that the pressure required for the rolling itself is reduced. With ordinary mineral oil lubrication it has been found impossible to operate the screw down for such mill in full, i. e., both sides at once, while with palm oil lubrication a full operation of the screw down is accomplished with ease.

Not only is the difference in power noticeable with respect to the screw down operation, but it is noticeable with respect to the mill operation as a whole. Under normal conditions of operation when lubricating with mineral oil as has heretofore been customary, there has resulted from a given continuous cold rolling mill an average production of 3.53 tons per k. w., while by merely changing to the use of palm oil as herein set forth, the average production on the same mill has been increased to 4.73 tons per k. w., this representing a power saving of over 20%. This increase in quantity produced with the same power input is also accompanied by an improvement in quality resulting from the greater accuracy of control of the rolling conditions as before described, it being possible to maintain the factors of total load and working load, including friction load and tension load, within materially closer limits.

As a specific example, it may be pointed out that with mineral oil lubrication it has heretofore been customary in the practice of rolling a sheet for roofing or expanded metal, to tandem roll the material through three stands, and then through a single mill for the purpose of giving a correct gauge and also for eliminating surface irregularities and producing a commercially flat sheet. This single mill has been necessary to effect a gauge correction due to the non-uniformity of gauge resulting from the lack of accurate gauge control when tandem rolling through the three stands. With such an operation, the scrap loss from the tandem rolling operation averaged 3.5%, while the scrap loss from the single stand averaged 1.6%, the production on the three stand tandem mill being 8 tons per hour, while the production of the single mill was 7 tons per hour. By the use of palm oil, it has been possible to control both the gauge and flatness of the material during the tandem rolling operation, so that the necessity of the single pass after tandem rolling may be entirely eliminated. At the same time, there has been an average reduction in scrap loss on a tandem mill from 3.5% to .5% with of course a 100% elimination of the scrap loss which before occurred in the single mill. Where a flat pass is utilized following the tandem rolls, the material goes to the flat pass in much better condition, with a corresponding reduction in breakage and broken up coils.

It is also possible with palm oil lubrication to take heavier drafts on each roll stand used, and thereby effect the same total reduction in a fewer number of stands.

While the advantages hereinbefore referred to are obtainable by the use of palm oil lubrication of metal subjected to a tandem rolling or continuous cold rolling operation, it is believed that the advantageous results are at least in part attributable to the greater body of the lubricant, its improved lubricating properties, its greater adhesiveness to the metal surfaces, and its ability to maintain a lubricating film such that the roll surfaces and metal surfaces are maintained out of direct contact such as characterizes usual tandem rolling or cold rolling operation.

I have also ascertained that the roll life is likewise increased in direct proportion to the greater ease of rolling and easier control.

Further advantages of the use of palm oil arise from the greater ease with which the oil may be frequently removed to prepare the material for commercial uses.

While I have herein referred to the preferred embodiment of my invention residing in the application of palm oil prior to rolling, it will be understood that changes in the time and manner of application of the lubricant may be made without departing either from the spirit of my invention or the scope of my broader claims.

I claim:

1. In the method of continuous cold rolling, the step comprising applying a palm oil lubricant to the material being rolled.

2. In the method of continuous rolling, the steps comprising applying a heated lubricant to the material to be rolled, permitting the lubricant to congeal, and thereafter rolling the metal with the congealed lubricant thereon.

3. In the method of metal working, the steps comprising heating a body of palm oil, applying the palm oil while heated to the metal to be worked, and thereafter subjecting the metal to a multiple pass rolling operation.

4. In the method of cold rolling metal

strip, the step comprising maintaining a film of palm oil between the strip and the cold rolling rolls.

5. In the method of metal working, the steps comprising producing a hot rolled strip, applying palm oil thereto prior to any coiling, coiling the strip, and then uncoil and cold rolling the strip.

In testimony whereof I have hereunto set my hand.

PARKER F. WILSON.