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PROCESS OF COLD REDUCING METALS

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This invention relates to improvements in the art of cold reducing metals and, while not limited thereto, relates more particularly to cold rolling of thin, wide strips of steel on a 4-high cold mill, and has for one of its objects the use of an improved cooling and lubricating medium applied in a certain manner to control the contour of the working rolls and at the same time provide lubrication to cause the metal to flow freely without excessive screw pressure.

In the process of cold reducing metal, and especially in rolling thin, wide strips of steel on a 4-high cold mill, there is considerable heat generated, due to the energy expended in deforming the metal. It is necessary, for continuous and satisfactory operation, to provide means for dissipating this heat.

In order that a 4-high cold mill may operate satisfactorily, it is necessary that the contour of the working rolls be kept constant, that a lubricant be provided to cause the metal to flow freely without excessive screw pressure, and that the lubricant will not leave objectionable deposits on the product, especially when the product is subsequently heat treated. It is necessary and often desirable that the product be coated with an antirust solution to prevent oxidation while the reduction is being effected.

Heretofore, various mediums have been used in an attempt to get satisfactory operation from cold mills. Water has been used alone and was found unsatisfactory because it did not provide sufficient lubrication, which made it necessary to use excessive screw pressures, which pressures caused buckling and ruffling of the edges of the resultant product and caused pits and ruffing on the working rolls.

Water, when used alone, did not prevent oxidation nor rusting of the product. Water has been sprayed on the working rolls and small amounts of engine oil fed on the surface of the strip prior to its entry into the working rolls of the mill. While this combination of water and oil was better than water alone in that it provided a certain amount of lubrication and reduced the excessive screw pressures, it was not satisfactory for the reason that the water and oil was not mixed uniformly, and the product was therefore not uniform and the capacity of the mill reduced below that at which it was rated.

Engine oil may be used alone for cooling the rolls and lubricating the product by providing cross circulating systems which spray the oil across the working face of the rolls. The oil sprayed across the rolls is collected in a sump where its temperature is modified, either by cooling or heating, to that desired, and is then repumped back to the spray, making a continuous or closed system.

The use of engine oil in the above manner provided good lubrication and reduced the screw pressure materially over any other medium previously used, provided a good surface on the rolls and the product but, due to the low specific heat of the oil, the amount of heat which was absorbed from the mill was limited. Consequently the capacity of the mill was limited.

Furthermore, the use of engine oil was objectionable since the oil on the strip was difficult and expensive to remove and when not thoroughly removed the product of the mill could not be satisfactorily coated. The uncoated products, when heat treated, had deposits of carbon from the burnt oil which was also objectionable and expensive to remove.

Recently water and soluble oil were mixed and used as a cooling and lubricating medium, and this medium while somewhat better than using water alone proved unsatisfactory for the same reason as water alone, although to a slightly less degree.

The present invention overcomes all of the objections to the previously used and known cooling and lubricating means and results in an improved product and increased capacity of the mill. The present invention consists in a cooling medium used in a circulation system composed of a mixture of water, engine oil and soluble oil. The medium is sprayed through nozzles against the surfaces of the working rolls, collected in a sump where its temperature is regulated by cooling or heating coils, as desired, pumped from the sump into the circulating system and resprayed on to the working rolls.

The temperature controlling and lubricating medium of this invention composed of water, engine oil and soluble oil may be made up in various proportions; the engine oil content may be between 2 per cent. and 10 per cent., the soluble oil between 1 and 8 per cent. In every instance the water will greatly predominate over the combined oil content, and it is preferable to have the engine oil predominate over the soluble oil.

The proportions found so far by experience to be the most practical are 95 per cent. water, 3 per cent. engine oil and 2 per cent. soluble oil.

In high speed rolling it has been found that a solution composed of 3 per cent. to 4 per cent. water soluble oil, 7 per cent. to 8 per cent. engine

or mineral oil and enough water to make 100 per cent. gives excellent results.

In the medium above described the water acts as a heat absorbing or cooling medium, the engine oil serves as a lubricant and the soluble oil serves as a vehicle to hold the engine oil in suspension and in finely divided state. The oils also form a protective coating on the products rolling in the mill to prevent oxidation. However, there is not sufficient oil in the medium to make the cleaning of the products difficult nor expensive, nor to cause undesirable deposits of carbon on the surface of the products if subsequently heat treated.

Experience has shown that the medium of this invention should be maintained between 115 degrees and 125 degrees Fahrenheit at all times, since if allowed to go below or above this range it has been found that the oils tend to separate from the mixture and cause non-uniform operations resulting in a non-uniform product. In practice, an attempt is made to maintain the solution at 120 degrees Fahrenheit as it is most satisfactory at this temperature.

In this specification and claims, "engine oil" is used to designate oil known as engine oil in the trade, which is a light viscosity oil made from either a petroleum or asphaltum base crude oil and not soluble in water. The term "soluble oil" is meant to define the oil known in the trade as soluble oil which is any oil soluble in water. It may be made from a petroleum base oil treated with hard resin, elaine, caustic soda and wood alcohol or ammonia. In some instances other base oils than petroleum base oil are treated to form soluble oil, and any of these oils are meant to be covered by the term "soluble oil".

Some products, before being cold rolled or reduced, are pickled and coated with palm oil, and in rolling or reducing this material the palm oil is washed from the products by the cooling medium. It has been found that a small amount of this palm oil is not detrimental, however, the amount in the cooling medium should be kept to the minimum by skimming it from the top of the medium or mixture in the sump.

When cold rolling metal strip or cold reducing any metal, using the cooling and lubricating medium of this invention to control the contour of the working rolls and to lubricate the material to reduce the screw pressure, the temperature of the working rolls can be closely controlled so that exact contours of these rolls may be maintained at any speed of rolling, and lubrication of the strip so even and constant that the metal flows freely. This so greatly reduces the screw pressure that a materially better surface condition of the working rolls results than has heretofore been possible, whereby great reductions in the number of roll changes necessary for a given tonnage is necessary. It has also been found that a materially better surface of the product results.

The medium disclosed in this application has been used in a 4-high cold reducing mill for rolling thin, wide strip material and experience has shown that, by the use of this medium, a reduction of two (2) passes through the mill has been made; that is, where another cooling and lubricating medium was used, five (5) passes were necessary to reduce the material to a given gage, while with the use of the present medium only three (3) passes were necessary to reduce the material to the same gage.

While I have described a certain specific embodiment of the invention, it will be understood that I do not wish to be limited thereto nor to the specific proportions of the ingredients of the medium, since various modifications may be made without departing from the scope of my invention, as defined in the appended claims.

I claim:

1. The method of cold reducing metals which consists in controlling the temperature of the reducing members by applying a temperature exchanging solution thereto composed of a mixture of at least 2 per cent. engine oil, at least 1 per cent. water soluble oil and water to make 100 per cent.

2. A solution for controlling the temperature of the reducing members of a cold metal reducing apparatus and for lubricating the metal being reduced comprising a mixture of from 2 percent. to 10 per cent. engine oil, 1 per cent. to 8 per cent. water soluble oil and water to make 100 per cent.

3. A solution for controlling the temperature of the reducing members of a cold metal reducing apparatus and for lubricating the metal being reduced comprising a mixture of water, engine oil and water soluble oil, the mixture containing more than 2 per cent. engine oil, more than 1 per cent. water soluble oil and the water materially predominating over the combined oils.

4. A solution for controlling the temperature of the reducing members of a cold metal reducing apparatus and for lubricating the metal being reduced comprising a mixture of water, engine oil and water soluble oil, the engine oil forming at least 2 per cent. of the solution, the water soluble oil forming at least 1 per cent. of the solution and the water forming over 80 per cent. of the total solution.

5. A solution for controlling the contour of the working rolls of a cold rolling mill and for lubricating the metal being rolled so as to reduce the screw pressures on the mill, composed of approximately 95 per cent. water, approximately 3 per cent. engine oil and approximately 2 per cent. water soluble oil.

6. A solution for controlling the contour of the working rolls of a cold rolling mill and for lubricating the metal being rolled so as to reduce the screw pressures on the mill, composed of approximately 95 per cent. water, approximately 3 per cent. engine oil and approximately 2 per cent. water soluble oil, said solution being maintained at a temperature of approximately 120 degrees Fahrenheit.

7. The method of cold rolling thin, wide steel strips which includes controlling the contour of the working rolls and the reduction of the screw pressures by applying a temperature exchanging and lubricating solution composed of a mixture of at least 2 per cent. engine oil, at least 1 per cent. water soluble oil and water sufficient to make 100 per cent. to the rolls and to the strip being rolled, the water content of said solution materially predominating over the combined oils and the engine oil slightly predominating over the water soluble oil.

8. The method of cold reducing metals which consists in controlling the temperature of the reducing members by applying temperature exchanging solution thereto composed of a mixture of at least 2 per cent engine oil, at least 1 per cent water soluble oil and sufficient water to make 100 per cent., said solution being maintained at a temperature of from 115 degrees to 125 degrees Fahrenheit.

9. The method of cold rolling thin, wide steel strips which includes controlling the contour of the working rolls and the reduction of the screw

pressures by applying a temperature exchanging and lubricating solution composed of a mixture of at least 2 per cent. engine oil, at least 1 per cent. water soluble oil and sufficient water to make 100 per cent. to the rolls and to the strip being rolled and maintaining said solution at a temperature of from 115 degrees to 125 degrees Fahrenheit.

10. A solution for controlling the temperature of the reducing members of a cold metal reducing apparatus and for lubricating the metal being reduced comprising a mixture of from 3 per cent. to 4 per cent. water soluble oil, 7 per cent. to 8 per cent. engine oil and sufficient water to make 100 per cent.

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