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METHOD OF PRODUCING MAT FINISH ON HARDENED ROLLS

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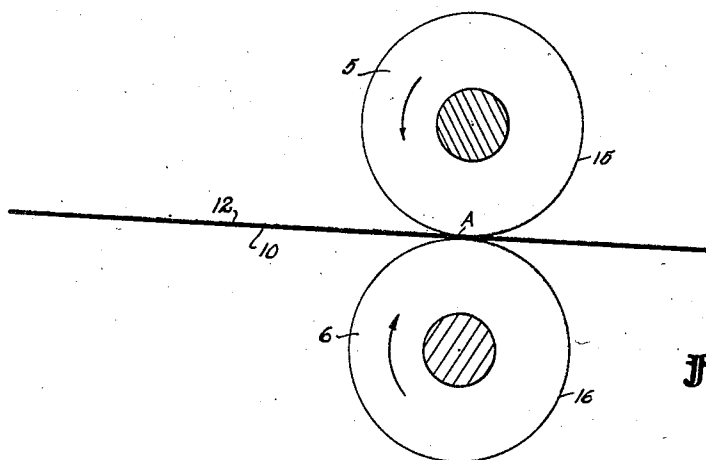


Fig. 1

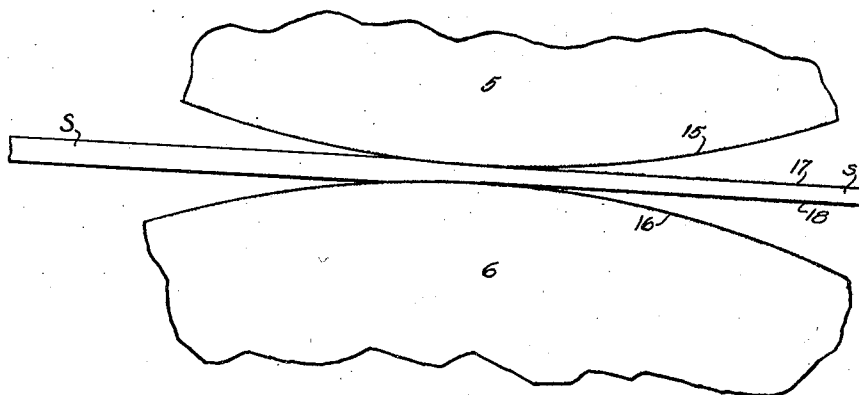


Fig. 2

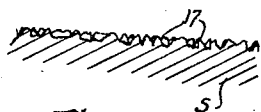


Fig. 4

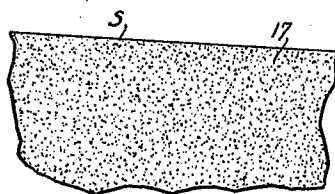


Fig. 3

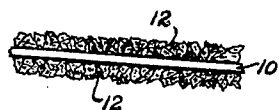


Fig. 5

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METHOD OF PRODUCING MAT FINISH ON
HARDENED ROLLS

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8 Claims. (Cl. 76-107)

It has long been known to be desirable to provide a roughened surface upon steel rolls used in producing steel sheets, strips and the like. This desirability arises for several reasons. Heretofore for example, it has been proposed to roughen rolls to increase the gripping action of the rolls upon the stock, so that greater reductions may be made with each pass.

Another purpose frequently sought to be obtained is that of producing a dull satin or mat finish upon the finished sheets. Such a dull finish is useful for various purposes and is frequently required in order to hold coated finishes to be applied to the sheets or strips.

Another very important advantage in providing a roughened surface is that plates may be more economically processed in the manufacturing steps, which include rolling, coiling, shearing, wash pickling, pickle etching and box annealing. One of the expensive pickle etching steps for example may be entirely eliminated and the normalizing and annealing step in some processes for production of steel sheets or strips may be eliminated by the production of a roughened or mat finish upon the sheets from the rolling mill.

Still another important advantage is that in the stacking of such sheets for box annealing, smooth finish sheets frequently will stick together at certain annealing temperatures which are necessary to produce the proper or desired annealed condition of the sheets for ductility required in deep drawing processes.

Another advantage found from properly matting or roughening the surface of the sheets by our method is that of improved finish surface coatings such as enamels, lacquers, etc. in the full finished sheets or strips. We have found that the producing of such a mat finish on the product in one stage of its process and later rolling on a smooth mill gives a better finished product than that of rolling entirely on smooth finish rolls.

Attempts to produce these finishes have included methods of attempting to roughen the rolls and then pass the sheets or strips there-through. In modern mill practice rolls of a hardness designated as 100 scleroscope or over of forged steel are used and the roughening of these rolls has been attempted by sand blasting or grit blasting, but this requires the dismantling of the mill and expensive apparatus to handle the rolls and so treat them, with corresponding great expense resulting from the time lost from a shut down of the mill. Attempts are made to roughen

the sheets by passing the sheets between two rough sheets in "sandwich" fashion, with obvious disadvantages of handling, cost of material, and comparatively ineffective results. One of the difficulties of this prior method is that of controlling the evenness or flatness of the surfaces of these sheets and the inaccuracies in gauge of the material result.

Other attempts have been made to produce a wavy or mottled finish by slight indentations formed by spreading particles of foreign material upon the top of the sheet as it is passing between the rolls. Control of the even distribution of the surface matting by this method is so difficult as to render it entirely impractical. For other reasons it is not suitable for high production of steel sheets or strips. Other previous efforts to produce such finishes or treating rolls in so doing have included etching on the surface of the rolls by chemical means. Chemical etching does not result in producing sharply defined or abrupt projections. Also it is usually of uneven depth. There have been attempts to knurl the surface of the roll with knurling tools. With respect to the latter, obviously if a roll of 100 scleroscope forged steel is used, it is literally incapable of being knurled and if soft enough to be knurled, its time of use is exceedingly short before the knurling is destroyed or rolled flat.

The objects of our invention therefore are to produce such a mat finish on the sheets or strips on both hardened, chilled and forged steel rolls which transfer the mat finish to the surface of the sheets or strips, and it involves the preparation of the surface of the hardened rolls, and a further object is to do this without dismantling the mill and otherwise most effectively, evenly and very economically.

Summarizing the objects of our invention, they are first, to provide an efficient, economical method of producing sharply defined projections and which shall be adapted to existing conditions; second, one which may be carried out without removing the rolls from the mill; third, to very greatly reduce the time involved in producing a mat finish on the rolls, and which shall be permanently put on for a very long continued use; fourth, the cost for equipment and practice of our method being small, in fact being practically negligible as compared with other methods and with the cost of producing sheet strip products; fifth, the coarseness or refinement and sharpness of the finish may be widely varied with great facility.

In carrying out our invention, the essence of it is to pass a sheet of material perfectly thin and flexible coated or impregnated with very hard abrasive particles, such as carborundum, through a pair of rolls while they are being held tightly together under high pressure so that the carborundum particles are pressed into the surface of the rolls, producing innumerable small particles or indentations on the surface of the rolls. This surface condition is generally known as "mat surface or mat finish". As the steel sheets or strips, such for instance as cold rolled steel, are being passed therethrough, the counterpart of the mat finish is transferred to the surface of the sheets or strips.

We will further describe our invention in connection with the accompanying drawing, in which

Fig. 1 is a diagrammatic sectional view through a pair of rolls showing the passing of the roughening, grit coated, sheet therethrough.

Fig. 2 is a diagrammatic sectional view showing the rolls in use, passing a sheet or strip therethrough.

Fig. 3 is a fragmentary plane illustrating the mat finish.

Fig. 4 is a view enlarged (microscopically) showing a section of a portion of the finished sheet.

Fig. 5 illustrates a similar view of a section of the sheet carrying carborundum particles on both sides of the same for treating the rolls.

In Figs. 1 and 2, 5 and 6 indicate a pair of steel rolls which are preferably chilled, forged steel rolls of 100 scleroscope hardness. Assuming that they are cylindrical or substantially so for the rolling of flat sheet, thin gage, stock for purposes of illustration, it will be seen that they may be brought tightly together and there held while a thin sheet such as paper or cloth indicated at 10 coated with particles (grits) 12 on one or both sides is passed therethrough. On a wide "strip mill" such as 72" mill, it is preferred to use the grit coated sheets in strips of narrow widths, for example widths of 12 to 24", and pass a fresh strip through successive zones of the mill, providing the indentations and projections indicated at 15 and 16 respectively at each pass of the strip until the entire length of the surface of the rolls 5 and 6 has been so treated.

The material of the sheet 12 may be paper, cloth or the like, being somewhat similar to carborundum paper or cloth used for rubbing and polishing surfaces. In the passage of the sheet 10 and its particles thereon through the rolls, if coated only on one side, the extreme pressure to which the individual particles or grits are subjected, as they pass through the line of contact as at A between the rolls, presses them through the paper or other carrying sheet and thus treating the surfaces of the rolls. However, it may be desired to use the carborundum particles on both sides of the sheets 10, as illustrated in the enlarged scale view in Fig. 5.

With the rolls so treated, the sheets or strips S are passed through the rolls 5 and 6 of the rolling mill in the usual manner and the counterpart of the projections and indentations is impressed upon the final sheet, as described, these being indicated at 17 and 18, giving the desired finish for the sheet.

Obviously the desired fineness or coarseness of the roughened surface may be determined by selecting the size of the particles to be placed on

the sheet 10. Carborundum grits, as is well known, may be obtained in various sizes from that which pass through a very fine mesh screen up to considerable coarseness. That found desirable for mat finish of steel sheets, for example that of the gauge for use on the body and fender sheets and the like, is preferably 20 to 40 mesh screen grits. Other form of grits such as steel grits or diamond dust may be used, but we have found carborundum gives very satisfactory results.

If it is desired to have a smooth finished surface, the projections 17 on the sheet S may be pressed down by passing the sheet between smooth rolls, and this working of the structure and surface of the sheet first into the indentations and projections themselves and then pressing down gives a structure to the surface of the sheet actually improving the surface over that obtained from rolling the smooth sheets entirely on smooth rolls. It is in effect a kneading of the metal of the surface.

As above indicated, treatment of the rolls and the producing of roughness of the surface of the sheet constituting an important part of our process, however, lends itself with facility to being carried on with the present processes of manufacture of sheets or strips in a steel plant, with the result that very great economies may be effected in eliminating certain pickling and preliminary annealing steps.

In one method of manufacture, after rolling, sheets are coiled, sheared, wash pickled, then pickle etched with nitric acid, in order that the sheets will not stick together during the box annealing which follows.

By our method, after rolling and producing upon the surface of the sheets or strips the mat finish described, the simple wash pickling is sufficient to prepare the sheets for the box annealing step. In the box annealing, the sheets may be subjected to certain higher temperatures without danger or likelihood of their sticking together, with the result that the desired crystalline structure and other metallurgical requirements may be obtained, the pickle etching having been entirely eliminated.

In another standard method, after rolling, coiling and shearing, the sheets are passed through annealing furnaces known as a normalizing type, then pickled with acid and box annealed. Again the advantage of having the desired surface immediately after rolling is apparent as before. In our new process with this surface produced as described, the sheets pass from the rolling mill through a simple process of scrub washing or pickling directly to the box annealing, thus eliminating either normalizing or acid pickling, or in some instances both. The result is actually a very substantial saving in the cost per ton of producing thin gauge sheets, strips and the like.

In another method of treating sheets or strips, they are subjected to a very expensive apparatus for treating the surface, referred to as "wheel brading" in which grits are thrown onto the sheets by centrifugal force to produce the desired mat finish. This is sometimes referred to as "shot throwing" and such treatment is obviously eliminated by our method.

In the preparing of rolls of hardened forged steel as described, only one pass of each narrow strip through the mills is required for treating the zone through which the strip passes, although additional projections may be produced by passing another grit coated sheet 10 between the rolls.

No dismantling of the mill is required, no expensive equipment such as chemical etching or sand-blasting is used, and the time required for treating a pair of 72 inch rolls has been found in practice to be a matter of but a few minutes. For example, we have found that in using 12" wide strips 10 in lengths corresponding to the circumference of the rolls, we may treat one pair of 72" rolls in 15 minutes or less. Following such treatment many hundreds of tons of thin gauge sheet have been mat finished and passed through these rolls without apparent diminution of the roughness, that is, the projections and depressions show no tear or wear. Observation of a pair of such rolls so treated indicated no appreciable surface change after rolling seven hundred tons of 21 to 16 gauge sheet.

This economical method is strikingly compared to cost of shutting down a large rolling mill with a consequent loss of time and labor to the plant of from one to two hours, for roll change plus the time of sand blasting or etching, with the correspondingly expensive equipment required.

Having thus described our invention, what we claim is:

1. A method of roughening the surfaces of hardened steel rolls for use in the manufacturing of metal sheets or the like, consisting of bringing the rolls tightly together and passing there-through a sheet carrying evenly distributed hard particles thereon, thus pressing the particles into the rolls, while the rolls are being urged together with very great pressure and in the absence of sheets or the like.

2. A method of producing mat finish on hardened rolls approximately 100 scleroscope hardness for making sheets or strips, consisting of bringing the rolls tightly together and while so held rotating the rolls and passing therethrough a sheet carrying evenly distributed very hard small particles on the surface thereof.

3. A method of treating rolls for making sheets or the like, consisting of covering a sheet of material with evenly distributed particles of abrasive-like substance, causing the particles to adhere to the sheet, then bringing the rolls tightly together and passing said sheet therebetween to cause the particles to be impressed into the surface of the rolls.

4. A method of producing mat finish surfaces on hardened steel sheet or strip rolls, consisting

of evenly applying particles of carborundum to both sides of a thin flexible sheet of fibrous material, causing the particles to adhere thereto, bringing the rolls together and there tightly holding them under pressure and then rotating the rolls and passing the sheet with its particles thereon between them to cause the particles to impress the surfaces thereof.

5. The method of treating surfaces of wide cylindrical rolls of hardened steel, consisting of passing comparatively narrow strips of fibrous material coated with small hard particles between the rolls in a series of passes to roughen the rolls in successive zones until the entire working surface of the rolls is treated.

6. A method of producing mat finished surfaces on hardened rolls for the subsequent manufacture of steel sheet or strip, consisting of uniformly applying hard granular particles to a thin flexible sheet, causing the particles to adhere thereto in evenly distributed arrangement, bringing a pair of rolls to be treated together and there tightly holding them under pressure and then rotating the rolls, and passing the sheet with said particles thereon between them to cause the particles to uniformly roughen the surfaces of the rolls.

7. A method of producing mat finishing surface on hardened steel rolls for use in making cold rolled sheet or strip, consisting of bringing the rolls tightly together and while so held rotating the rolls and passing therethrough a thin sheet carrying evenly distributed hard granular materials, the pressure being so great as to cause these particles to indent the both roll surfaces simultaneously, the sheet being of a thin frangible character.

8. A method of producing a permanent mat pattern in the work surface of hardened sheet or strip mill rolls and which surface shall impress complementary patterns on sheet or strip during continued use thereafter, the method comprising passing a sheet through the rolls while they are urged together under great pressure, said sheet having thereon evenly distributed hard granular particles, thus causing such particles to evenly roughen the work surfaces of the rolls.

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