April 17, 1934. W. S. KING 1,955,503

METHOD AND APPARATUS FOR PRODUCING SHEET LIKE MATERIAL

Filed April 7, 1930

Fig. 1.

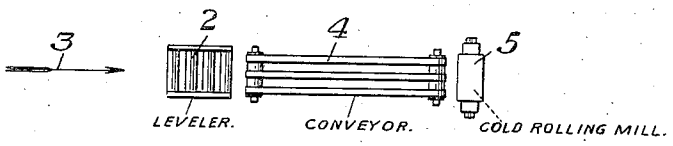


Fig. 2.

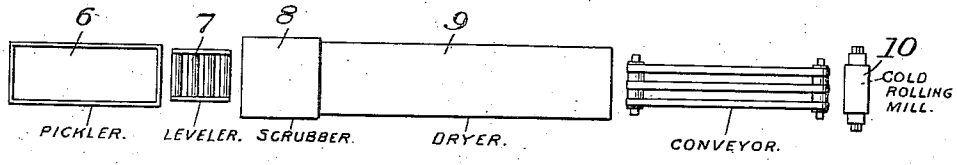
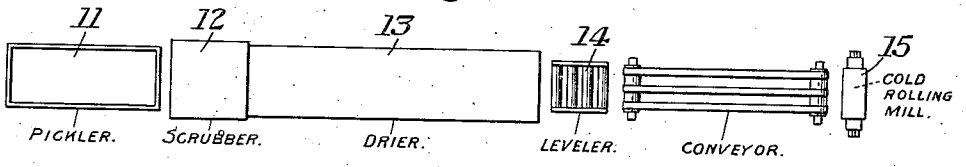


Fig. 3.



INVENTOR

Welty S. King,

by Byrnes, Lawlins, Parmelee & Clarke

Its attys.

Patented Apr. 17, 1934 1,955,503

UNITED STATES PATENT OFFICE

1,955,503

METHOD AND APPARATUS FOR PRODUCING SHEET-LIKE MATERIAL

Welty S. King, Youngstown, Ohio

Application April 7, 1930, Serial No. 442,324

9 Claims. (Cl. 29—18)

The present invention relates broadly to the art of producing sheet material, and more particularly to a method and apparatus for producing such material by a rolling operation.

At the present time, due to the many advantages obtainable by the use of so-called cold rolling mills, their use has very appreciably increased, so that they now constitute a very important part of the sheet and strip mill equipment. Experience gained from the use of such cold rolling mills has shown a tendency to produce defects commonly referred to by operators as "spreaders", "flowers" and "squeezers". These defects are characterized by a vein-like and somewhat irregular series of lines of depression on the surface of the material. These defects are usually more pronounced in the direction of rolling, and it is believed that they are caused either by a non-uniform extension or compression of the material during the cold rolling operation. While such lines of depression are extremely shallow, they are of sufficient depth to be detrimental to the appearance of the full finished sheets such as those used in the automotive industry, for metal furniture, or for other purposes in which a high degree of finish is required.

In partial explanation of the present invention, if a section of a sheet be considered in a microscopic sense, it will be noted that the elastic limit of different adjacent sections is not uniform over the entire surface. This may be easily shown by subjecting a sheet to a so-called stretcher leveling operation wherein the sheets are gripped at the opposite ends by mechanical means and stretched until a desired degree of flatness is obtained. It will be noted that such an operation if effected substantially immediately after hot rolling, annealing or normalizing, will result in lines of depression in a direction at right angles to that of stretching. These may be explained as resulting from the tendency of numerous portions of the sheet to undergo extension or yielding in advance of other portions, thereby resulting in a slight "necking down" of the metal at such points, this "necking down" appearing as lines of depression on the sheet surface, and ordinarily characterized as "stretcher strains". Such "necking down" is progressive, beginning with the portions of lowest elastic limit and gradually extending to portions of higher and higher elastic limit.

By subjecting the metal to a roller leveling operation prior to cold rolling, the material is mildly worked, the working resulting in a slight degree of hardening, which in turn tends to equalize the elastic limits of adjacent sections, thereby resulting in the production of a sheet having a more nearly uniform elastic limit throughout the entire sheet, whereby subsequent cold rolling will affect the sheet substantially the same in all of its portions.

I have found that this phenomena, due either to such non-uniform extension or compression, is present in cold rolling such material as hot rolled sheets, annealed sheets or normalized sheets, and that in all such material the defects previously referred to as "spreaders", "flowers" and "squeezers" will be produced.

I have further found that the tendency to form such defects during cold rolling can be materially decreased if not completely obviated by a suitable roller leveling operation just prior to the cold rolling. In this connection, however, experience has shown that if the sheet material is roller leveled and allowed to stand, say for example for a period of 24 hours, before being subjected to a cold rolling operation, substantially if not quite all of the beneficial effects of the roller leveling operation are lost or negatived to such an extent that the defects before referred to will form during cold rolling much the same as though no roller leveling operation had been resorted to. It is therefore not only desirable, but essential, if the maximum degree of benefit is to be maintained, to cold roll the sheet material as soon as possible after the roller leveling operation. To this end, the invention is preferably practiced by effecting a continuous or substantially continuous movement of the sheet material from the time of roller leveling to the time of cold rolling.

The present invention provides a method and apparatus by means of which it is possible to eliminate defects of the character referred to and obtain at the same time a minimum handling of the material with a consequent economy of production.

In the accompanying drawing I have shown for purposes of illustration only certain preferred embodiments of the invention, by means of which the desirable results herein referred to may be accomplished.

In the drawing, Figure 1 is a diagrammatic plan view illustrating a roller leveler and cold rolling mill in such position as to permit roller leveling of sheet material followed by a cold rolling operation,

Figure 2 is a diagrammatic plan view illustrating a slightly modified embodiment of the invention effective for obtaining pickling, roller level-

ing, scrubbing, drying and cold rolling of sheet material, and

Figure 3 is a view similar to Figure 2 illustrating a layout effective for pickling, scrubbing, drying, roller leveling and then cold rolling the sheet material.

It will be understood by those skilled in the art that the expression "sheet material" is herein used generically as definitive not only of such articles of manufacture as ordinarily designated sheets, but of similar material in more or less strip form, the invention being applicable to such materials broadly without regard to the specific dimensions or form thereof.

In the embodiment of the invention illustrated in Figure 1 of the drawing, there is provided a roller leveler 2 of any desired construction through which the material passes in the direction indicated by the arrow 3 onto suitable skids or conveying means 4 effective for feeding the material directly to the roll pass of a cold rolling mill 5. By such a layout, it will be apparent that the material is subjected to a cold rolling operation immediately following the roller leveling operation.

In the ordinary practice of roller leveling sheets, four men are required, these men usually being designated as a "flopper" a "feeder" and two "catchers". Inasmuch as the usual cold rolling operation requires two men at the entering side of the cold rolling mill, it will be apparent that not only does the present invention enable defects of the character referred to to be eliminated from sheet material, but it effects a co-ordination of a roller leveler and cold rolling mill such as to decrease the total number of operatives required for their operation. This is true for the reason that the two men usually positioned at the entering side of the cold rolling mill are simply moved to a position in front of the roller leveler for starting the sheet material therethrough rather than through the mill. After passage through the roller leveler, the material passes automatically, by reason of skids or other conveying means, directly into the mill.

Experience in the practice of cold rolling sheet steel has shown that certain desirable properties of the sheets are enhanced by so called "rolling in oil". By this is meant a rolling operation including completely coating the sheets with a light covering of oil before they are entered between the cold rolls. In some practices this coating of oil is applied by a common type of oiler with felt rolls, the sheets being either passed from the oiler directly into the cold rolls or stacked on the floor before cold rolling. Such a practice, however, possesses at least two disadvantages. The first of these is due to the tendency of small particles of felt to adhere to the sheets, which particles seriously damage the fine surface of full finished sheets during the subsequent cold rolling operation. The second disadvantage is the tendency of dust and dirt to quickly accumulate on the oiled surfaces of the sheets when piled in stacks. Such accumulations are likewise objectionable for the reason that they will mar the sheet surfaces during the cold rolling operation.

In accordance with the present invention, the roller leveler placed in line with the cold rolls is also conveniently used as an oiler. This may be accomplished by oiling the sheet material at the same time that it is being passed through a roller leveler. After passing through such an oiling roller leveler, the sheet material is free from dirt and lint for the reason that the roller leveler rolls are clean and free from dirt and therefore enable the maintenance of a clean surface on the material. Since the material passes in continuous operation from the oiling roller leveler into the cold rolls, it is not afforded any opportunity for dust or dirt accumulation on the material.

In the embodiment of the invention illustrated in Figure 2, there is indicated a suitable pickling vat 6 from which the pickled sheets pass to a roller leveler 7 and thence through a scrubber 8 and a dryer 9 to cold rolls 10. It will be apparent that the time which elapses from the roller leveling operation to the cold rolling operation is not such that the beneficial effects of roller leveling are lost.

In the embodiment of the invention illustrated in Figure 3, the sheet material pickled in a suitable pickling vat 11 passes through a scrubber 12 and a dryer 13 to a roller leveler 14 and thence to the cold rolls 15. With this embodiment of the invention it will be apparent that the roller leveler may be used also as an oiler in the manner described in connection with Figure 1, with all of the advantages hereinbefore referred to.

To those skilled in the art it will be apparent that not only does the present invention provide convenient means for the effective handling of material of the character herein contemplated, but that it also enables such material to be subjected to the desired cold rolling operation within such a time interval after the roller leveling, as to insure the obtaining of maximum benefits. In actual practice I have found that it is possible to reduce surface defects of the character referred to to such an extent that a saving of from 1 to 3% is obtained under ordinary mill conditions. One economy of the layout alone, in addition to the superior sheets produced, results in a substantial labor saving per ton of material.

Certain advantages of the invention arise from the step of subjecting sheet material to a roller leveling operation immediately or substantially immediately preceding a cold rolling operation. Still further advantages arise from the utilization of the roller leveler as an oiler whereby the sheet material before entering the cold rolls is provided with an oil coating.

Still other advantages of the invention result from the combination of a roller leveler and cold rolling mill in such manner that the two operatives usually required at the entering side of the cold rolling mill may serve the function of feeders for the roller leveler, which in turn serves as an automatic feeding means for the cold rolling mill.

Other advantages of the invention will be apparent to those conversant with the production of sheet material of the character herein referred to and with the operation of mill equipment for the production of sheet material, it being understood that changes in the construction and arrangement of the various mechanisms herein referred to may be made without departing either from the spirit of the invention or the scope of my broader claims.

I claim:

1. In the method of producing sheet material, the steps comprising subjecting the material to a roller leveling operation followed by a cold rolling operation, and applying a liquid film of oil to the material prior to the cold rolling operation.

2. In the method of producing sheet material, the steps comprising passing the material sub-

stantially continuously through a roller leveler and a cold rolling mill, and applying a film of oil to the material prior to its entry into the cold rolling mill.

3. In a rolling mill, the combination with a cold rolling mill, of an oiler roller leveler in advance thereof effective for roller levelling and oiling material during its passage to the cold rolling mill.

4. In a rolling mill, a cold roll mill stand, means in the feed path to said stand for simultaneously subjecting material to a roller leveling and oiling operation, and means for passing the leveled and oiled material to the cold roll mill stand.

5. In a mill, a cold roll stand, means for pickling sheet material in sequence and substantially continuously, and means for subjecting the pickled material to a roller leveling operation and then cold rolling.

6. In the method of producing metallic material, the steps comprising subjecting the metal to a mild working by roller levelling to unify the elastic limit throughout the entire body thereof, and thereafter cold rolling the same within such a time interval as to retain the beneficial effects of the levelling operation.

7. In the method of producing metallic material, the steps comprising subjecting the metal to a mild working by roller levelling for slightly hardening the same and equalizing the elastic limits of adjacent sections of the metal prior to a cold rolling operation, and thereafter cold rolling the same within such a time interval as to retain the beneficial effects of the levelling operation.

8. In a sheet mill, means for imparting a final finish to sheets, and means for preparing the sheets for finishing including a pickler and a roller leveler disposed to operate on the sheets sequentially and prior to the final finishing.

9. In a sheet mill, a final stand of cold rolls imparting a finish to the sheets, and means for preparing the sheets for the cold roll stand including pickling means and leveling means so disposed adjacent said stand as to operate on the sheets sequentially and prior to said stand.

WELTY S. KING.