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J. B. TYTUS

METAL ROLLING

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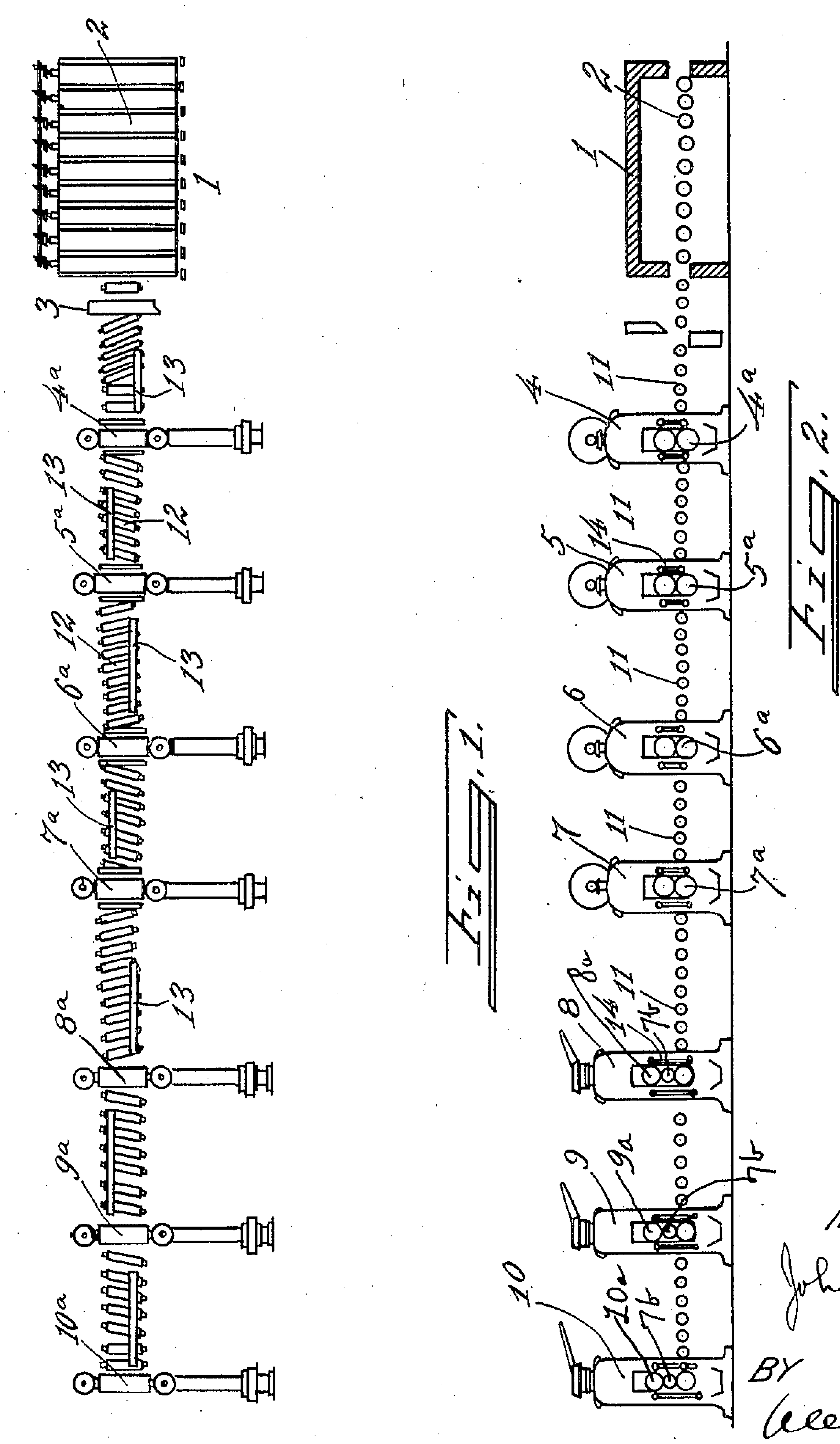

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METAL ROLLING.

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My invention relates to processes for rolling hot metal and particularly to continuous processes, wherein the metal piece is moved from one stand of rolls to another without being given more than one pass in each stand.

It is the object of my invention to provide a rolling mill which will produce by single reductions of a metal piece in successive stands of rolls, a product which has not hitherto been practical to produce in this manner. The product which I produce is a thin, flat piece of metal, such as iron and steel.

In the steel industry the terminology for the product of rolling mills is usually traceable to the kind of process by which the product has been formed. Thus the product of a plate mill is called plate, and of a jobbing mill and sheet mill are called sheets and of a strip mill, the product is called a strip, even though there is an overlapping zone in which a product having no differences in length, thickness, or width can be produced by any of the mills. In other words, a short, thick strip, a narrow thick sheet, and a narrow thin plate, may all be the same.

Exigencies of process, however, have in the past made is entirely impractical in a plate mill, to produce metal rolled down to anything like as fine a gauge as the sheet mill, and the strip mill cannot produce a material which is anywhere near as wide as either a plate mill or a sheet mill.

The product which I produce by my mill and process is that which lies between the zone of possible production on the plate mill of today, and the usual production on the sheet mill.

At the present time the product which I produce is made on the jobbing mill, which is hand fed with heated bars, which are first rolled single and then in pairs, the entire operation being hand controlled, usually on two stands of rolls, not tandem, one for roughing and one for finishing.

It is my object to make such material at a high rate of speed with minimum of labor, by a continuous process.

It is my object to provide an arrangement of furnace, shears and mill stands, together with feed tables intermediate the several machine elements, which will result in sufficient supply of hot pieces of manageable length to the rolls, for successive or continuous treatment.

I accomplish my object by that certain construction and arrangement of parts and that certain processing of the metal which will be hereinafter more specifically pointed out and claimed.

In the drawing:

Figure 1 is a plan view partially in diagram of my device.

Figure 2 is a side elevation thereof.

In the drawings I have shown a furnace 1, in which are live rollers 2, that feed a metal piece which is long, wide and thick through the furnace. The furnace is operated so as to conserve the heat of the piece during shearing, and the shears 3 are located at the exit end of the furnace, so that each piece as it is sheared off from the long piece will have a substantially equal temperature to begin with.

From the practical point of view it is found highly desirable by me to employ in the rolling process of my new mill a single piece which is fairly long in the direction of its path through the rolls. The usual sheet bar, for example, is only around eight inches in length, as used, being cut from a narrow thick bar and then turned at right angles and fed through the jobbing or sheet mill.

Accordingly in my process I use a wide thick plate or it might be termed a slab, and cross cut the slab by shears to give pieces which have substantial dimension lengthwise, and crosswise have the dimension which it is desired to have in the final product.

With my new mill the pieces are reduced singly and without reheating, which is an economy in time and expense, but demands high speed operation, and accurate fit of the piece, as soon as it gets its preliminary reduction, to the remaining rolls of the successive stands.

I find it to be impractical to use sheet bars turned crosswise in my process, and can conceive of no practical way in which a properly heated, uniform temperature, and uniform cross section piece can be provided for a high speed reduction mill of my new type, except by some such mode as I have described, namely, to provide a succession of long thick plates or slabs, and cut them across into pieces of desired metal content, as the plates emerge from the furnace, and just before the pieces are engaged in the rolls.

I have shown the stands of rolls in the mill, having closed type housings 4, 5, 6, 7, 8, 9 and 10, with rolls 4^a, 5^a, 6^a, 7^a, 8^a, etc. I have indicated in the last three stands a small diameter friction driven roll 7^b, lying between the main rolls 8^a, 9^a and 10^a.

I show feed tables 11 between the several stands of rolls, and prefer to make these tables of skewed driven rollers 12, and having a single side guide bar 13 for the piece, which directs it toward the middle of each stand of rolls.

I show the first three stands of rolls arranged in tandem, and the last two stands, equally spaced from the stands preceding them, which will result in their operating as continuous mill stands, if the piece is long enough.

If the operation were slow, at least while the piece is thick, there might be a chance for obtaining enough reduction if the mills were like the plate mill stands of the present day, but economy of operation makes as one of my chief objectives a very high speed operation with minimum labor.

If the operation were slow, and the capacity of the mill kept low, it might be possible to control the shape of the rolls of the several stands, and permit them to run hot and attain a greater reduction per pass.

However, the high capacity operation, resulting in a rapid heating of the rolls by the great volume of pieces passing between them, requires a cooled roll mill operation, and accordingly I provide for an ample flow of water over the rolls as by means of spray pipes 14.

With plenty of water on the rolls I am able to arrive at a desired controlled temperature thereof, which gives me one factor which is controllable in providing for proper bite of the rolls on the piece. By delivering the pieces to the mill at a uniform temperature and uniform cross section, for any given run, and passing them through at high speed without reheating, I can rely upon definite cross sectional and temperature characteristics of the pieces in each stand.

I have discovered as the principle governing fit of a piece to a roll stand in hot rolling practice, that the piece will enter the stand and pass through it smoothly, if the active pass between the rolls of the stand, as they engage over the piece is such as to be a little less convex, than the shape of the piece, furnished to the stand, said convexity running lengthwise of the "pass", and crosswise of the piece. The best practice is to reduce the contour (cross sectional periphery) of the piece so as to retain the same or slightly decrease the proportionate thickness of its middle as to its edges, which as can be observed requires more reduction of the thicker than the thinner parts of a piece in each pass. The mere control of the screw is not enough to insure proper pass since for required reductions of a piece there are quite definite limitations in screw adjustment, and the piece must have a required length when finished.

In control of "pass" in successive stands of rolls operating on a piece, there are a number of factors of importance, i. e., the original composition, shape, temperature of the rolls, the nature, and temperature of the piece, and the pressure on the rolls in the form of "screw".

In building my mill I provide for the extreme of rigidity in the housings, and form the rolls of large diameter in proportion to length, also giving rigidity. By providing an extremely rigid mill I am enabled to control the screw on the rolls in the several stands, to give desired reduction of pieces passed through singly, and to bring single pieces down to comparatively fine gauge. When the housings are springy, the natural elasticity of parts requires of the screw that it take up all of this elasticity before a reduction can be made on a thin piece, then the strain on the bearings of the rolls would be almost as great when there was no piece in them as if the piece were there, which makes excessive wear. In a springy stand of rolls it is very difficult with accuracy to take up enough of the spring by turning down the screw, to obtain desired reductions.

The use of three high stands of rolls, with a small diameter middle roll, gives more rapid reduction to the piece without sacrifice of the necessary rigidity. The middle roll can be drawn out leaving the mill "two high". Also the piece is met by one positively driven roll, i. e., one of the main rolls instead of passing between two idler rolls, as in a four high roll stand, with the two middle rolls of small diameter. Furthermore, the multiplication of factors in controlling roll shape when engaging the piece, by use of four rolls, will give greater difficulty than where but three are used.

By description in the foregoing of special expedients, as being of primary importance, I do not wish to be taken as meaning that equivalent expedients could not be adopted. It is my purpose in the claim that follows to state the invention inherent in my application from its different aspects, and in the specifications have given a description of a way of accomplishing the entire objective, without intent of limiting the scope of my claim.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

That process of reducing thick wide metal to thin plates which consists in furnishing a series of heated pieces to thick metal, passing said metal in single thickness through successive stands of rolls, without reheating, maintaining said rolls cold, and providing in each stand for enforcing a transverse convexity on the piece with each stand enforcing a less convexity than the preceding stand.

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