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ROLLING METAL

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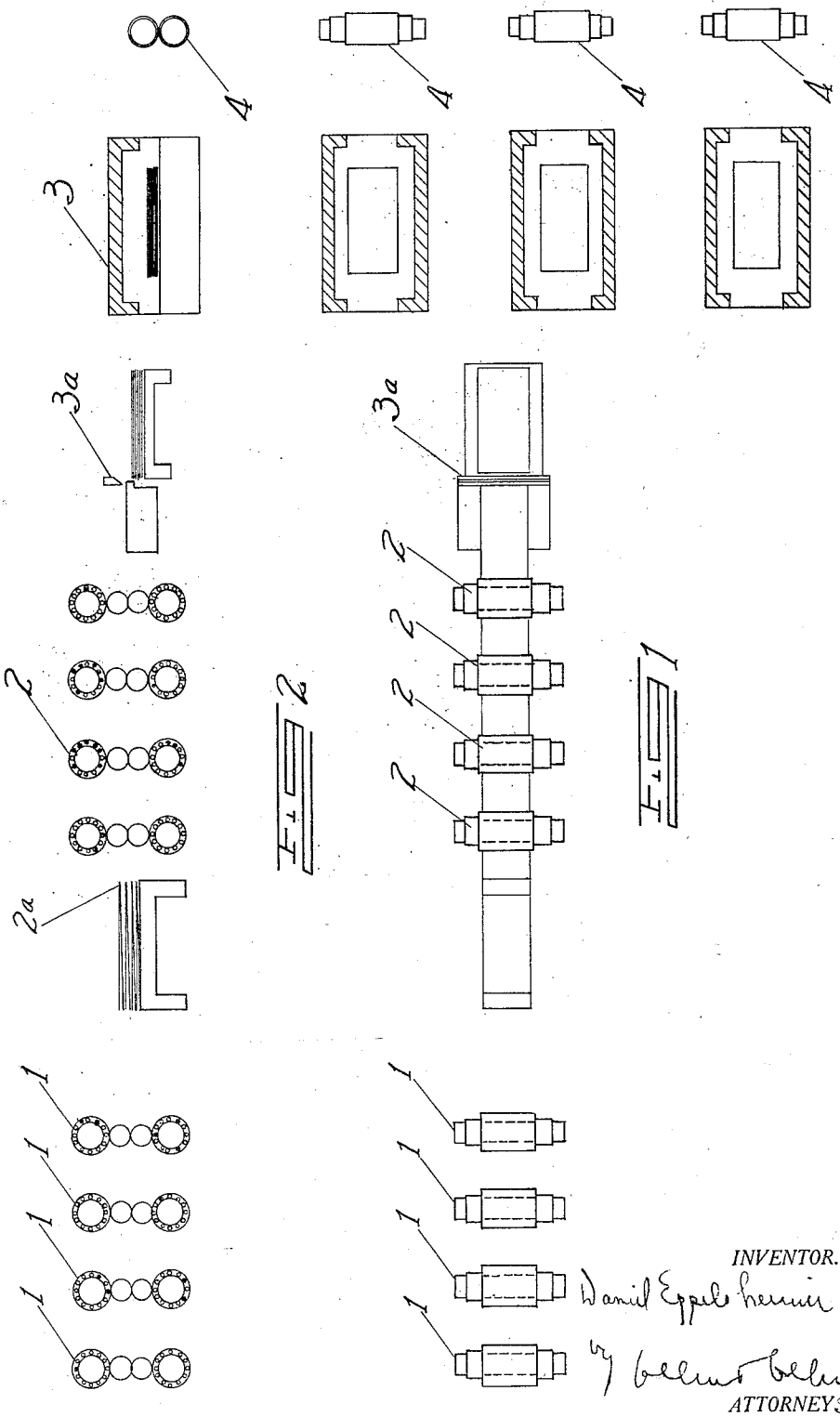

FIG 2

FIG 1

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UNITED STATES PATENT OFFICE

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ROLLING METAL

Application filed December 10, 1927. Serial No. 239,213.

My invention relates to processes for the open pass rolling of sheets and tin plate, and contemplates a continuous reduction step, in single thickness, a finishing or pack preparation step or steps, and a final reduction step where desired, all but the first step being either continuous or not.

By continuous rolling I refer to processes of reduction of metal by means of rolls which engage the piece in single, successive passes, such as by a series of stands of rolls in a row, through which the piece passes seriatim. The processes of rolling which are more familiar to the trade are those in which the piece is passed repeatedly through a single stand of rolls, for each reduction stage, the stages normally being preceded by a heating period when the piece is being hot rolled, and in sheet rolling by a matching or doubling step.

There have been developed and placed in operation continuous rolling processes for the reduction of metal which is quite wide, to a fairly fine gauge such as, say sixteen gauge U. S. standard. The process having the largest and most economical production is accomplished by the use of four-high rolling mills, having relatively small rolls to engage the piece and large backing up rolls, which are supported in roller bearings, the smaller or working rolls being driven and serving to engage the piece. In such mills the problem of control of active pass in each stand is readily handled, and great rigidity, heavy drafts, and high speed can be obtained, so that a piece which is comparative in its ratio of width to gauge with sheet metal as known in the past, and of practically unlimited length, can be produced.

I do not wish to limit myself, however, to the use of this one type of mill for continuous rolling, and my invention is directed to the processes of further reduction of any continuously rolled hot metal, particularly where same is used for forming packs for further reduction.

The requirements for heavy draft, and high speed in the production of hot sheet metal, either in strips of which the length is indeterminate, or in shorter lengths, result inevitably, so far as I have been able to determine, in a product which is not entirely uniform in gauge, and in which irregularities in surface, and slight irregularities in cross sectional contour are more or less generally to be expected.

The reason for this is that the working rolls cut away rapidly under the very heavy requirements and do not remain the same at all times. The rolls when worn are reground and, of course, are finally replaced, but it is not practical to be shifting rolls constantly to regrind them or discard them, so that continuously rolled hot mill products are not uniformly regular in runs of a mill. Also in rolling long pieces in the continuous mill, the temperature of the piece varies so that the back end of the piece is rolled when colder than when the front end is rolled.

In attempting to make up packs from the continuous hot mill product, the units of which are thin enough to relieve the sheet mill, or tin mill, roller from repeated rolling stages, interspaced by heating and matching stages, as at present employed, it has been found that the slight irregularities of the elements of the packs with relation to each other are such as to result in "sticking" of the packs, or difficulty in rolling to a smooth, flat product. By "sticking" is meant the adherence of the elements of the pack together such that the packs cannot be torn apart without tearing holes or ruining the surface of the elements thereof. Also any striking diversity of gauge in the elements of a pack will result in a product in which the gauge is not uniform and which is not commercially salable without expensive sorting which itself would be impractical because sheet metal is produced on order, and must be satisfactory both as to length and gauge.

It has been suggested by John B. Tytus, in his application for Letters Patent, Serial No. 227,600 filed October 20, 1927, that the hot rolled "continuous" strip or sheet metal be given a pass through a cold mill in order to cure surface defects, and bring the portions of the strips or sheet to uniform gauge. This solves the difficulty above noted unless the finishing is to be to a fine gauge, in which

case the product of the cold mill will be too thick to eliminate sufficient of the stages of tin plate or thin sheet metal production practice to result in the maximum saving. This is because of the fact that pieces formed by hot rolling in strip form, in single thickness and given single thickness passes in cold rolls, cannot with any economy be brought down to fine enough gauge to permit of being reduced to finished gauge in the hand mill when combined in packs at a single heating.

So far as I am advised, it has never been suggested in the past that cold sheet or strip metal could be rolled in a mill in packs of a plurality of thicknesses. This is because the elements of the pack would not adhere to each other, and would "fan" as soon as the pack was gripped by the mill.

However, I have discovered that if a piece of metal is doubled upon itself, and while cold is inserted, doubled edge first, into a cold mill, it will pass through the mill satisfactorily without fanning. Instead of a single piece being doubled, more than one piece arranged in a pack could be doubled.

Accordingly, instead of the cold mill pass suggested by Tytus, or in addition thereto, it is my process to take the product of the continuous hot rolling, which may be also given a single thickness cold mill reduction, and double it, and then pass it through cold rolls, either for a single pass or more than one pass, or through a series of passes each in a separate stand, arranged in tandem and (or) operating continuously, as desired.

It is my practice, for example, to take a sixteen or eighteen gauge continuously hot rolled strip which may or may not have been cold rolled and annealed, say of the width of sheet metal as regularly produced in the past, and cut it into sections, if it is too long, and then double the sections and cold roll them, doubled edge first to twenty-four gauge U. S. standard. The irregularities in surface and in cross sectional contour, arising from continuous rot rolling are thus largely corrected.

The product has smooth surfaces throughout, and is practically uniform in gauge and uniform in cross section. It can then be sold as a finished product, if desired, or used for making packs for further reduction.

The mills used by me in cold rolling may be of the four high roller bearing type heretofore referred to.

In making packs for hot mill finishing, it will be the practice to pass the cold rolled pieces through a suitable furnace to bring them to temperature, and thereupon to assemble the pieces in as many thicknesses as desired and finish the packs so formed in as few rolling stages on the hot sheet mill as possible to twenty-eight gauge or thinner, or the pieces may be assembled before going into the furnace and heated in packs.

To state all of the factors which are to be considered, whereby the furnishing to the finishing rolling mill of packs of which the elements are smooth surfaced, uniform in cross section, and of as fine a gauge as say twenty-four gauge, is a great economy in rolling mill practice, would require a very involved discussion, and I have not attempted to do so. There is a limit always to the amount of draft which can be imparted to a piece in any mill at a single heating without reheating and building up the packs into more laminæ either by doubling or matching.

There is also, as pointed out by Tytus in the application aforesaid, a very great practical difficulty in pack rolling where the elements thereof are not true with relation to each other and are rough, or of uneven contour.

By my invention I obviate the limitations of the past, and considerably expand the possibilities of use of continuously hot rolled, flat, thin metal, by economizing on the finishing mill or tin mill operations.

In order to illustrate a mill whereby my practice can be followed, I have appended drawings to my specifications, wherein

Figure 1 is a diagrammatic plan view of a mill for use in my process.

Figure 2 is a diagrammatic side elevation of the same.

I have shown a series of four-high roll stands at 1, in the drawings, which are operated to produce a long, single thickness piece of hot metal which will preferably be of the width desired for the finished product, and of as fine a gauge as is easily producible, having regard to the width.

This product is then cut into sections, and the sections doubled, to make two thicknesses of metal.

The mill 2 is shown as a four-high roller bearing cold mill. The double pieces are inserted into this mill, doubled edge first, as indicated at 2*a*.

The pieces or "doubles" when cold rolled, with the doubled edge sheared away or not, as desired, are set into heating furnaces, if the product is not of finished length and gauge for sale. The furnaces 3 are shown as three in number. If the hot-rolled strip is to be cold rolled before the doubling step, there may be a like mill to the mill 2 and a continuous furnace located between the mill 1 and the mill 2 as illustrated.

The pieces are formed into packs after being withdrawn at proper temperature from the furnaces, usually with the folded edges sheared off and rolled as packs in the finishing mills 4. I have indicated a shear at 3*a*.

As noted heretofore, the furnaces could have feeding devices therein, thus serving as "continuous" furnaces, and the finishing

mills, instead of being used to roll the packs down by the usual processes, could be arranged in tandem and operated as a continuous pack rolling mill.

In general, my process is based on the novel doubled cold rolling step, particularly when used on hot rolled or cold rolled strips of sheet width, both for producing commercial material and for producing ıe elements of packs for hot mill finishing. ıt is not limited to any particular mechanisms or processes of hot rolling either before or after the doubled cold rolling step. In one form of my process, I take the pieces of sheet like material and match them into a pair, and then double the pair and cold roll it, with the doubled edge foremost, and proceeding in this manner or some analogous way, I produce any desired gauge by cold rolling without hot rolling in packs at all. In this variation of my process a quick open annealing is found desirable if repeated passes through the cold rolls is to be given.

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

1. A process for rolling metal, which consists in continuously rolling single thickness hot metal, doubling the product or sections thereof, and cold rolling the doubles, with the doubled edges first.

2. A process for rolling metal, which consists in continuously rolling single thickness hot metal, doubling the product or sections thereof, and cold rolling the doubles, with the doubled edges first, reheating the product, and finishing the same in packs.

3. A process for rolling metal, which consists in continuously rolling single thickness hot metal, doubling the product or sections thereof, and cold rolling the doubles, with the doubled edges first, reheating the product, and finishing the same in packs in a single stand of rolls by repeated passes.

4. A process for reducing the gauge and enhancing the quality of hot rolled strip metal, which consists in doubling said strip metal or sections thereof, and cold rolling the doubles, with the doubled edges first.

5. A process for rolling metal, which consists in continuously rolling single thickness hot metal, doubling the product or sections thereof, and cold rolling the doubles, with the doubled edges first, said hot metal being given a cold rolling in individual thickness prior to doubling.

6. A process for rolling metal, which consists in continuously rolling single thickness hot metal, doubling the product or sections thereof, and cold rolling the doubles, with the doubled edges first, said hot metal being given a cold rolling in individual thickness and an annealing prior to doubling.

7. A process for rolling metal, which consists in continuously rolling single thickness hot meal, doubling matched piles of the product or sections thereof, and cold rolling the doubles, with the doubled edges first.

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