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APPARATUS FOR ROLLING STRIP

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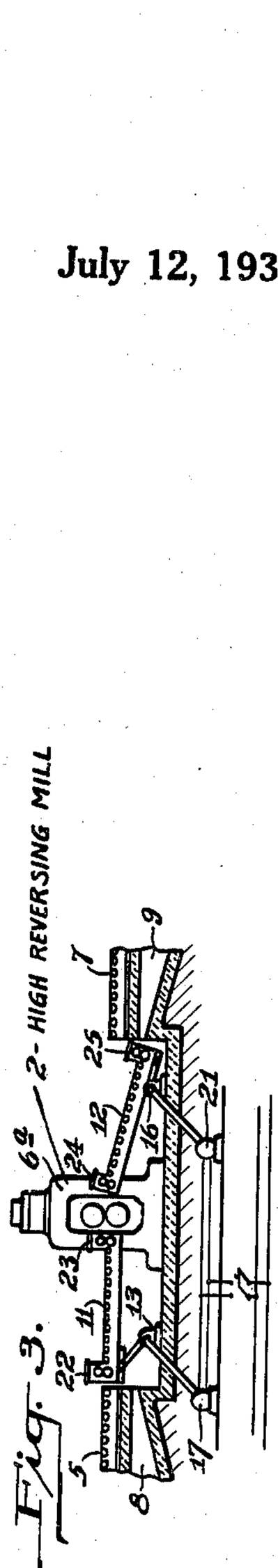

Fig. 3.

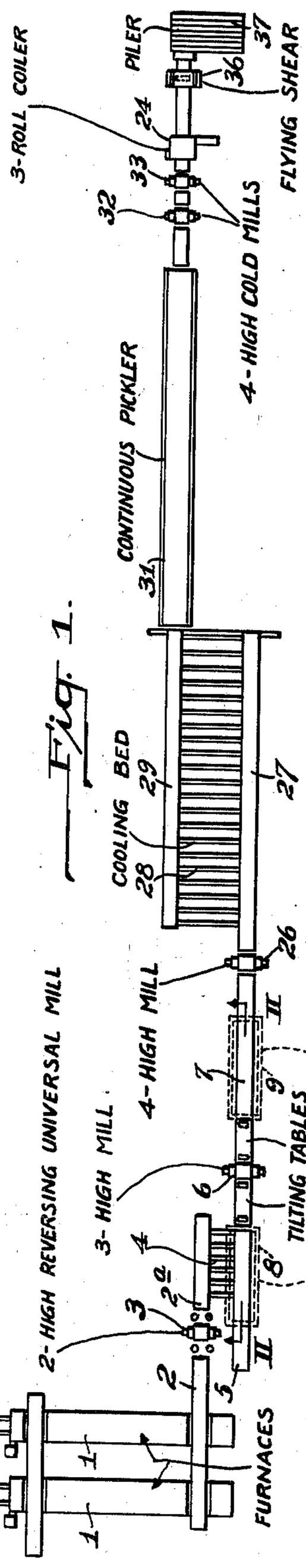

Fig. 1.

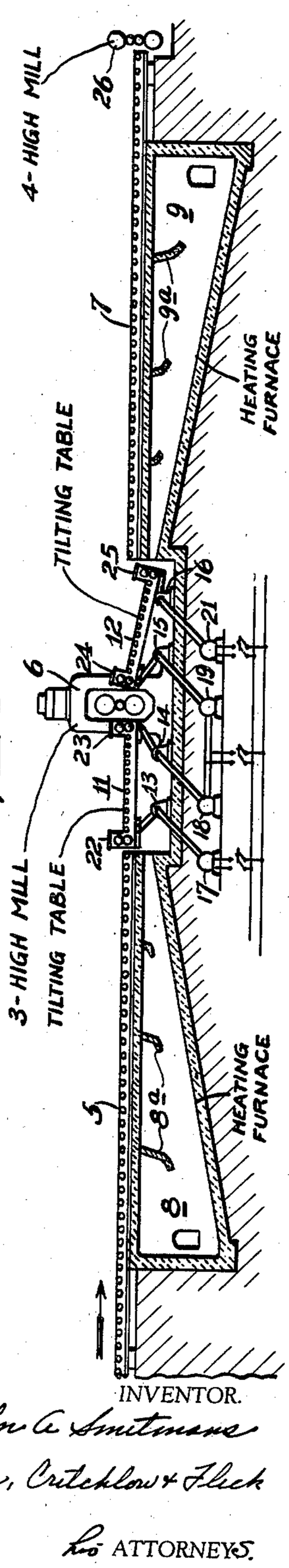

Fig. 2.

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APPARATUS FOR ROLLING STRIP

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8 Claims. (Cl. 80—33)

This invention relates to the rolling of metal strip and more particularly to an improvement in method of and apparatus for rolling such material.

An object of the invention is to provide an improved and reliable method of and apparatus for rolling metal strip, which is simple of construction, efficient in operation and economical to install and maintain.

A more particular object is to provide an improved method and apparatus of this character which is especially adapted for economically carrying out low tonnage rolling.

Another object is to provide an improvement in method of and apparatus for rolling metal strip whereby a considerable saving is effected in the cost and amount of equipment required for producing such material as compared to the usual practice.

These and various other objects, as well as the various other novel features and advantages of the invention, will be fully apparent when the following detailed description is read in conjunction with the accompanying drawing of which Fig. 1 is a plan view of a rolling mill assembly embodying the invention; Fig. 2 a sectional view taken on the line II—II of Fig. 1; and Fig. 3 a view similar to Fig. 2 of a modification of the invention.

Referring in detail to the drawing, the mill assembly illustrated comprises a plurality of furnaces 1, used for heating the slabs to be rolled to the proper temperature for rolling before they are delivered to the mill proper. At the outlet end of such furnaces there is provided a delivery table 2 for feeding the slabs as they are taken therefrom into a two-high reversing universal mill 3 where they are given a plurality of break-down passes and then transferred by a suitable transfer mechanism 4 to a conveyor table 5 which in turn delivers them to either a three-high mill 6, as shown in Fig. 2, or a reversing mill 6*a*, as shown in Fig. 3.

At the rear side of this mill a conveyor table 7 similar to the forward conveyor table 5 is provided for assisting the latter in handling the blanks as they are passed back and forth through the mill and then discharged from it. Below such tables there is provided a pair of heating furnaces 8 and 9, respectively, which are equipped with suitable heating means not shown and employed for reheating the blanks as may be needed for efficiency and economy while they are being worked in the mill 6. Arranged within these furnaces at the top thereof is a plurality of spaced baffles 8*a* and 9*a* which are disposed to prevent the heat in the furnace from escaping. As shown, these are preferably curved at their lower ends toward the rear of the furnaces. This not only assists in retaining the heat, but also adapts them to function as guides for the strip in the event it tends to engage the baffles when entering the furnaces. It will be appreciated that the strip is in this way most effectively heated as it is maintained in a flat condition, notwithstanding it may be allowed to loop somewhat if it exceeds in length the length of the furnaces.

To facilitate the delivery of the strip to the furnaces they are inclined upwardly at their mill ends 6, and a pair of tilting tables 11 and 12, respectively, is arranged adjacent the mill 6 to deliver the stock from the mill into them, and from them into the mill as well as onto the conveyors 5 and 7. To render the furnaces conveniently accessible in the case of cobble the tables 5 and 7, together with the roofs of the furnaces, are in sections adapted in any suitable manner to be readily removed, the tables, of course, being properly insulated from the heat of the furnaces.

For manipulating these tables 11 and 12 so as to carry out their required functions, they are provided at their ends with elevating units 13, 14, 15 and 16 of any suitable construction which in the present instance are schematically shown as being connected for operation by a plurality of motors 17, 18, 19 and 21, respectively. In operation these elevators are adapted to move the mill ends of the tilting tables 11 and 12 into registration with the two pass lines of the mill shown in Fig. 2 and the opposite ends thereof into registration with the entrances to the furnaces 8 and 9 and the adjacent ends of the conveyor tables 5 and 7 so that the blanks being rolled can be fed back and forth through the mill and into and out of the furnaces as well as back and forth on the conveyor tables 5 and 7.

When a reversing mill such as the mill 6*a* shown in Fig. 3 is substituted for the three-high mill 6 of Fig. 2, the elevators 14 and 15 can be dispensed with. When used with the three-high mill 6, however, they are preferably either electrically or mechanically locked together so that they will be actuated from one pass line of the mill to the other simultaneously or in synchronism with each other. While such an electrical tie-up is indicated in Fig. 2, it will be obvious that this end can be accomplished in numerous

ways and therefore need not be described in detail.

To permit the blank being passed completely through the mill 6 and then fed back into it, suitable sets of pinch rolls 22, 23, 24 and 25 are mounted at the two ends of the tilting tables 11 and 12 and provided with a suitable drive, not shown.

For further reducing the blanks after they have been discharged from the intermediary mill 6, a four-high Bullhead mill 26 is arranged at the outer end of the conveyor table 7. This is provided with a discharge table 27 from which the blanks are transferred laterally onto a cooling bed 28 where they are permitted to cool. At the opposite side of this cooling bed 28 there is provided another conveyor 29 which is utilized to convey the blanks into a continuous pickler 31 disposed in alignment therewith and in which they are pickled and then delivered to a pair of tandemly arranged four-high cold mills. In alignment with these mills there are arranged in suitable spaced relation a coiler 34, a shear 36, and a sheet piler 37 for either coiling the strip as it leaves the latter mills, or cutting it into lengths and piling it.

In accordance with the invention slabs, for example, about four inches thick, four feet wide and eight feet long are first placed in the furnaces 1 and heated. When at the proper temperature for rolling they are withdrawn one at a time and fed by the tables 2 and 2*a* forwardly and backwardly through the rolls of the two-high reversing universal mill 3 until they are reduced to a thickness of about .70 of an inch, resulting in a length of about 46 feet. At such thickness the strip begins to lose its heat quite rapidly and in the past it has been the practice to pass the strip as it leaves the break-down mill through a series of tandemly arranged four-high mills. To eliminate the necessity of such a series of four-high mills, which are very costly, the heating furnaces 8 and 9 are provided in accordance with this invention to keep the temperature of the strip up to the correct value while it is being further reduced in the mill 6 which may be termed an intermediary mill.

In carrying out the working operations in this latter mill, the tilting tables 11 and 12 are actuated as previously described to conduct the strip into and out of the heating furnaces 8 and 9 as may be required to keep its temperature up to the proper value while it is being so worked. To also completely work it from end to end it is passed entirely out of the mill each time it is worked and may be stopped short of the pinch rolls 23 and 24 adjacent the mill or short of the pinch rolls 22 and 25 adjacent the furnace which are provided for holding the strip and feeding it back into the mill. In this particular example, about three passes are taken in this mill and the strip reduced thereby to a thickness of around .220 of an inch. It is to be understood, however, that the number of passes may vary according to the rolling schedule.

On completion of operation in the intermediary mill 6 the strip is passed through the four-high Bullhead mill 26 and a heavy draft taken, reducing it to a thickness of about .160 of an inch. It is then passed over the cooling bed 28, through the continuous pickler 31 and the two four-high tandemly arranged cold mills 32 and 33 wherein it is reduced from .160 to about .0625 of an inch. It is then either coiled in the coiler 34 or cut in lengths by the shears 36 and piled.

Through the use of this invention, as will be readily apparent to those skilled in the art, it is possible to very efficiently and economically produce strip of the character contemplated and to do so with a limited amount of equipment. Due to this, as will be apparent, although obviously not necessarily so limited in use, it is especially adapted for use in carrying out low tonnage operations which are difficult to economically carry out in accordance with the prior practice.

While the method of the invention has been described herein in connection with a somewhat limited example it will be appreciated that it can be considerably modified without departing from the spirit of the invention as contemplated by the claims.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. The combination with a rolling mill for manufacturing hot metallic strip which has a plurality of working passes, of conveyors for delivering the strip to and from said mill, a pair of furnaces located under said conveyors, a pair of tilting tables at the two sides of the mill for guiding the strip as it leaves the mill either into the furnaces or onto the conveyors, and means for adjusting said tables to register at the mill end with the different pass lines thereof and at their other ends with either the furnaces or the conveyors.

2. The combination with a rolling mill for manufacturing hot metallic strip which has a plurality of working passes, of conveyors for delivering the strip to and from said mill, a pair of furnaces located below said conveyors, a pair of tilting tables at the two sides of the mill between it and said conveyors and furnaces for guiding the strip onto said conveyors or into said furnaces, means for independently adjusting the outer ends of said tables to register with said furnaces or said conveyors, and means for conjointly registering the mill ends of said tables with the different pass lines thereof.

3. The combination with a rolling mill for manufacturing metallic strip, of conveyors at the sides thereof for delivering the strip to and from the mill, a pair of heating furnaces located below said conveyors with their entrances disposed toward the mill and their inner lower strip supporting surface inclining upwardly in a plane passing substantially through the pass line of the mill, and a pair of tilting tables disposed between the mill and said conveyors and furnaces for delivering the strip leaving the mill into either said furnaces or onto said conveyors.

4. The combination with a rolling mill for rolling metallic strip, of conveyors at the two sides of the mill for delivering the strip to and from the mill, furnaces located below said conveyors for receiving the strip as it is discharged from the mill, tilting tables located between the mill and said conveyors and furnaces for directing the strip into said furnaces or onto said conveyors as it leaves the mill, and power-driven pinch rolls at the two ends of said tilting tables for pulling the strip from the furnaces and feeding it back into the mill.

5. The combination with a rolling mill for manufacturing long thin pieces of metallic strip, of conveyors for delivering the strip to and from the mill, elongate downwardly sloping furnaces located below said conveyors for receiving the strip as it issues from the mill, baffle means in said furnaces for retarding the escape of heat from the furnace chambers, and means for guiding the strip leaving said mill either into said furnaces or onto said conveyors.

6. The combination with a rolling mill for manufacturing long thin pieces of metallic strip, of conveyors for delivering the strip to and from the mill, furnaces located below said conveyors for receiving the strip without coiling as it issues from the mill, a plurality of axially spaced backwardly inclined transversely disposed baffles suspended from the top of said furnaces for preventing heat escaping therefrom, and means for guiding the strip leaving said mill either into said furnaces or onto said conveyors.

7. The combination with a rolling mill for manufacturing long thin pieces of hot rolled metallic strip, of conveyor means disposed at the two sides of said mill for delivering the strip to and from the mill, a pair of elongate furnaces located below said conveyors, a pair of tilting tables located adjacent the mill for selectively guiding the strip as it leaves the mill into the adjacent furnace or onto the adjacent table, and pinch rolls on said tilting tables at the mill ends thereof for engaging and feeding the strip into the mill.

8. The combination with a rolling mill for manufacturing long thin pieces of hot rolled metallic strip, of conveyor means disposed at the two sides of said mill for delivering the strip to and from the mill, a pair of elongate furnaces located below said conveyors, a pair of tilting tables located adjacent the mill for selectively guiding the strip as it leaves the mill into the adjacent furnace or onto the adjacent table, and pinch rolls on the opposite ends of said tilting tables for engaging and feeding the strip into the furnaces and also into the mill.

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