

June 18, 1935.

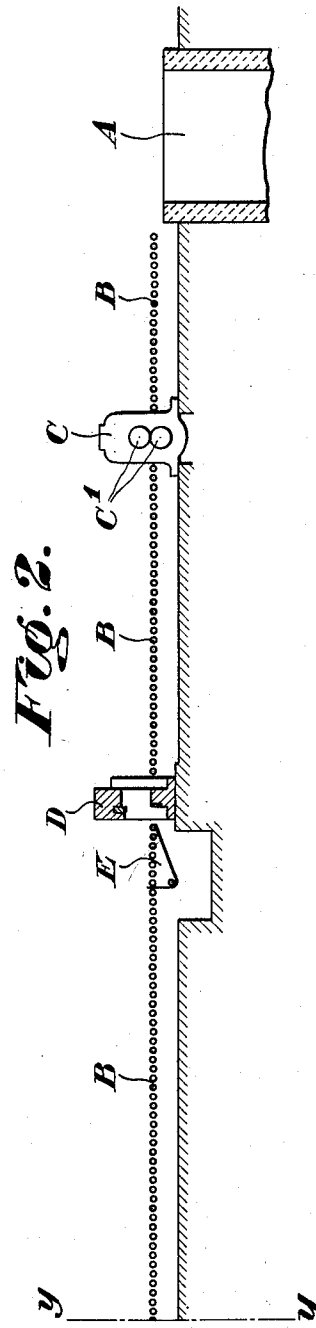
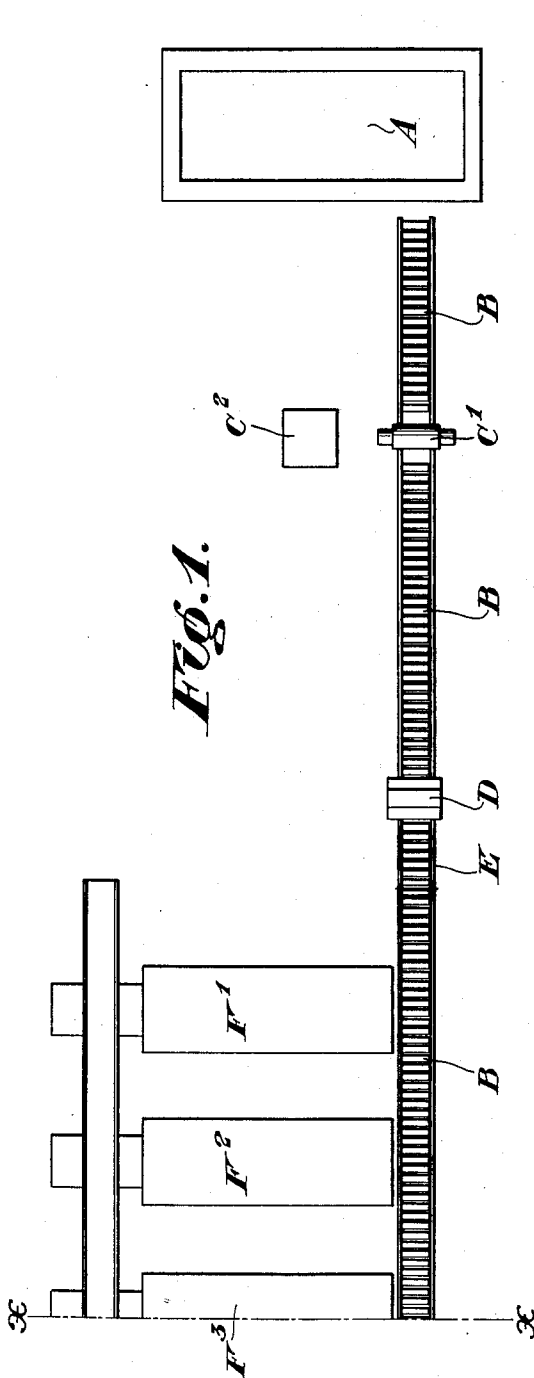
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2,005,152

APPARATUS FOR MANUFACTURING PLATES AND THE LIKE

Filed Sept. 21, 1933

2 Sheets-Sheet 1



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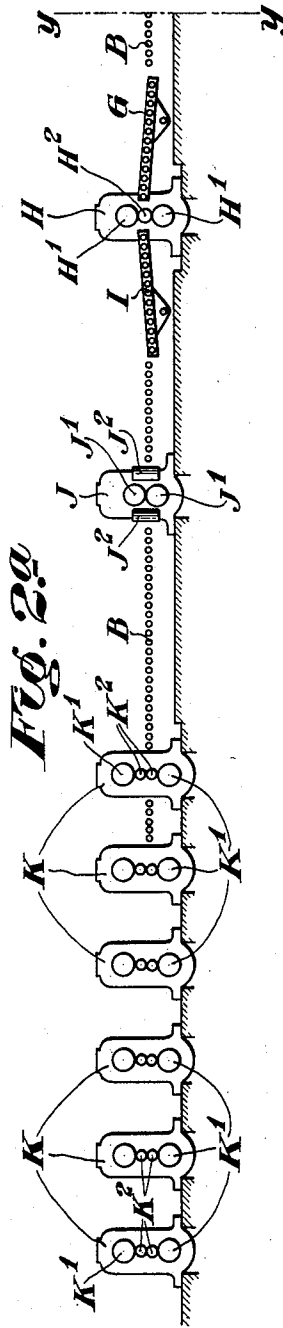
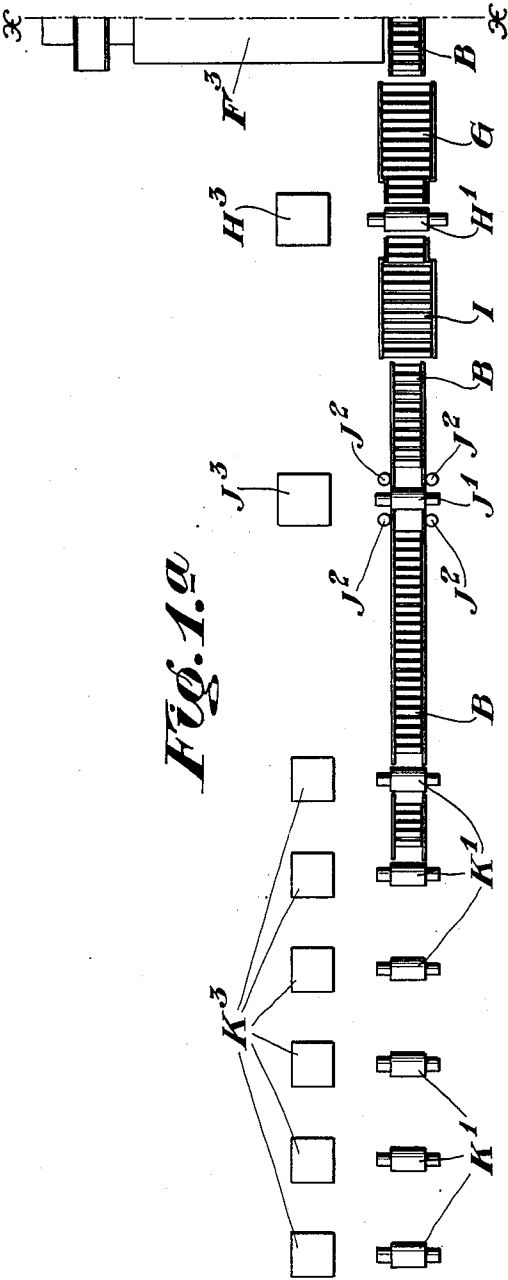
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UNITED STATES PATENT OFFICE

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APPARATUS FOR MANUFACTURING PLATES
AND THE LIKE

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4 Claims. (Cl. 29—17)

This invention relates to a method and apparatus for manufacturing plates and the like.

At the present time there are two general methods of rolling plates which have been sheared from reduced slabs; the single (or tandem) 3-high mill or the 2-high reversing mill, and the continuous plate mill. The reason for the existence of both of these methods is due to the fact that each possesses certain characteristic advantages over the other, dependent upon the amount and class of product being rolled. The continuous mill is, of course, considered to be decidedly superior over any of the other devices of the prior art, and consists generally of several stands of rolls in tandem, so arranged that the plate being rolled is in two or more stands simultaneously, which, of course, requires exact regulation of the relative speeds and drafts of the several stands. Preceding the continuous mill there is ordinarily one or more single unidirectional mills which are used to remove scale, spread the slab to the required width, and break the slab down to a suitable thickness before entering the continuous mill. One or more stands of vertical rolls are usually employed with the unidirectional mill or mills for working the edges of the slab to a uniform width, otherwise it could not be processed in the continuous mill.

It is a well known fact that continuous plate mills generally produce many times as much tonnage as the single or tandem mills; the surface of the plates produced is decidedly superior to other existing methods and are of much more uniform gage. In addition, considerably longer plates can be produced on continuous plate mills, and will be much more free from "camber." However, due to loss of time in the changing of adjustments on the continuous mill to roll different sizes and thicknesses of plates, they may be used only to advantage when processing large orders of material.

It is also true that continuous plate mills after adjustment must be furnished with slabs of unvarying width and thickness, which precludes the possibility of utilizing varying sizes of slabs which have accumulated, due to being left over from previous orders, etc.

Single (or tandem) mills are usually of the 2-high reversing type, or the 3-high mill which is unidirectional but permits reversing of direction of travel of the plate by passing the same over or under the middle roll. Tandem mills, as may be gathered from the title, comprise a combination of two single mills, either 2 or 3-high, in tandem. The advantages of these types of mills are that they are extremely flexible in operation and can roll plates of the same width and thickness from varying sizes of slabs and without appreciable loss of tonnage. In addition, they may be fre-

quently changed from one sized plate to another without hardship.

One object of the present invention is to provide a novel method and apparatus for manufacturing plates and the like which will enable the production of an article of manufacture having the superior characteristics of the product of continuous rolling mills and one which will, at the same time, be capable of a much wider range of operation than the latter.

Another object is to provide means for manufacturing plates and the like of substantial length, free from "camber", unusually uniform in gage, which are characteristic of materials finely finished in a continuous rolling mill, and by the use of which complicated adjustments or set-up operations are avoided.

A further object is to provide a novel method and apparatus of the class described enabling the use of work-pieces which vary widely in size, together with means for modifying the various sizes to any extent desired before the final finishing operation.

These and still further objects will be apparent after referring to the drawings, in which:

Figures 1 and 1a represent a plan of the layout of the invention divided on the line X—X.

Figures 2 and 2a are an elevation of the layout of Figure 1 divided on the line Y—Y.

Referring more particularly to the drawings, the letter A indicates a strip furnace wherein the slabs are heated to a processing temperature. An elongated conveyer B extends from the pit furnace A throughout the length of the layout of the invention. A 2-high reversing slabbing mill C is disposed adjacent the pit furnace A and comprises a pair of rolls C' extending across the conveyer B, which receive rotation from an adjacent motor C².

A slab shear D, having associated therewith a tilting table E on the side thereof remote from the 2-high reversing slabbing mill C, successively follows in position on the conveyer B.

A bank of reheating furnaces F¹, F² and F³ are successively disposed adjacent the elongated conveyer B for raising the temperature of material progressing from the shear D prior to further processing.

A tilting table G is disposed in line with the conveyer B for facilitating the handling of the reheated slabs through a 3-high plate mill H, comprising a pair of backing-up rolls H' and an intermediately disposed roll H², which is preferably fluted for removing scale. The rolls H' and H² receive rotation from an adjacent motor H³. A tilting table I is disposed on the other side of the 3-high plate mill H for cooperating with the tilting table G during the well known scaling and spreading operation in the 3-high mill.

The elongated conveyer B extends from the tilt-

ing table I to a 2-high universal reversing roughing mill J, comprising a pair of horizontal rolls J' extending across the conveyer and a pair of vertical rolls J² on either side thereof. The rolls J' and J² are suitably driven by an adjacent motor J³.

A series of 4-high continuous mill finishing stands are disposed at the ends of the elongated conveyer B adjacent the 2-high reversing roughing mill J and comprise, individually, a pair of backing-up rolls K' having disposed therebetween a pair of small metal working rolls K², suitable motors K³ being adjacently disposed for enabling their rotation.

In operation, suitable slabs are heated in the pit furnace A and fed over the conveyer B to the 2-high reversing slabbing mill C where it is substantially reduced, from whence it continues on the conveyer B to the slabbing shear D which, assisted by the tilting table E, shears the slab into required lengths, after which they progress into one of the reheating furnaces F¹, F² or F³. After the sheared slabs have been restored to the proper processing temperature they are replaced on the conveyer B and moved onto the tilting table G of the 3-high plate mill H which, with the tilting table I, functions to force the slab through the passes between the large rolls H' and the smaller middle roll H² a sufficient number of times. During this stage of the operation the fluted middle roll described, in combination with the larger backing-up roll A', serves to scale the slab and spread it over a substantial area.

After the scaled and spread, or widened, slabs leave the tilting table I they progress on the conveyer B into the 2-high universal reversing roughing mill J, wherein, through the action of the horizontal rolls J' and the vertical rolls J², they are brought to suitable dimensions through repeated processing. That is to say, if a slab should occasionally be spread to a greater width than desired in the 3-high plate mill H, it will be given a sufficient number of passes in the 2-high universal reversing roughing mill J to permit the vertical rolls J² to reduce it to the proper width. This function is not possible with present continuous mills, as they are equipped with but one, or at most two, sets of vertical rolls through which the slabs can pass but once, as they are unidirectional.

The universal reversing mill J can process a plate, or scaled and spread slab, of any thickness within practical limits and would be found to be of the required thickness before delivery to the continuous mill. This function also is not possible with the present continuous mills as they are equipped with but one or two sets of unidirectional, horizontal mills for reducing the plates after spreading. The plates in such mills can therefore be worked only once in each mill, which greatly limits the amount of possible reduction. In rolling the plates from the 2-high universal reversing roughing mill J in the series of 4-high continuous finishing mill stands K, it is well known that for each thickness of plate rolled there is a certain desirable distance between the two metal working rolls K² in each of the several stands. The screw-downs on these several mills may be electrically controlled so that if a certain thickness of plate is to be rolled the rolls in the several stands can be automatically and simultaneously moved to the previously determined desirable position. That is, the regulation of the relative speed and draft of the several stands may be automatically adjusted as required.

Accordingly, the mill may be readily and quickly changed to any desired thickness of plate, within reasonable limits, from a central control point by the use of suitable and conventional electrical apparatus, which form no part of the present invention and are, therefore, neither shown nor described.

It will thus be seen that the layout herein referred to enables a great flexibility of operation and the processing of slabs of variable sizes down to the desired plate size before entering the continuous mills K, with the consequent reduction to an absolute minimum of losses in tonnage, due to left over material or rejected yield from the mill; and having the uniformity of gage, finely finished surface and substantial length, which it is impossible to obtain in the usual single or tandem 2-high reversing mill, or 3-high mill, which runs unidirectional but permits reversing of direction of travel of the plate by passing it over or under the middle roll.

It is to be understood that the various devices of the layout are individually old with respect to their construction, the invention lying in the method and novel layout for accomplishing the same, and while I have shown and described one specific embodiment it will be understood that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of my invention, as defined in the following claims.

I claim:

1. A layout for manufacturing plates and the like comprising a 2-high reversing slabbing mill, a slab shear, a tilting table associated with said slab shear, a 3-high plate mill, a tilting table on either side of said 3-high plate mill, a 2-high universal reversing roughing mill, a series of 4-high continuous mill finishing stands, and transfer means between each of said devices.

2. A layout for manufacturing plates and the like comprising a furnace, a conveyer for said furnace, a 2-high reversing slabbing mill at the end of said conveyer, a conveyer for said 2-high reversing and slabbing mill, a slab shear at the end of said conveyer, a tilting table associated with said slab shear, a conveyer for said tilting table, a reheating furnace adjacent said conveyer, a second tilting table at the end of said conveyer, a 3-high plate mill adjacent said last named tilting table, a second tilting table on the other side of said 3-high plate mill, a conveyer for said last named tilting table, a 2-high universal reversing roughing mill at the end of said conveyer, a conveyer for said 2-high universal reversing roughing mill, and a series of 4-high continuous mill finishing stands at the end of said last named conveyer.

3. A layout for manufacturing plates and the like comprising a two-high reversing slabbing mill, a slab shear, a three-high plate mill, a tilting table on either side of said three-high plate mill, a two-high universal reversing roughing mill, a series of four-high continuous mill finishing stands, and transfer means between each of said devices.

4. A layout for manufacturing plates and the like comprising a two-high reversing slabbing mill, a slab shear, a tilting table associated with said slab shear, a three-high plate mill, a two-high universal reversing roughing mill, a series of four-high continuous mill finishing stands, and transfer means between each of said devices.