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(54) Process for coiler drum alternation in incessant hot rolling and apparatus therefor.

(57) Disclosed herein is a process for coiler drum alternation in incessant hot rolling in which continual finish hot rolling of rough-rolled sheet bars united on the entry side of a finishing hot rolling mill is carried out by tilting upper and lower tillable pinch rolls disposed on the exit side of a shear on the downstream of the finishing mill, thereby changing the traveling direction of the steel strip so that a leading end formed upon cutting the strip will be directed toward the next coiler drum to be used, and thereafter cutting the strip. This process enables an easy and assured alternation of coiler drums, thereby contributing to increases in the speed and efficiency of incessant hot rolling.

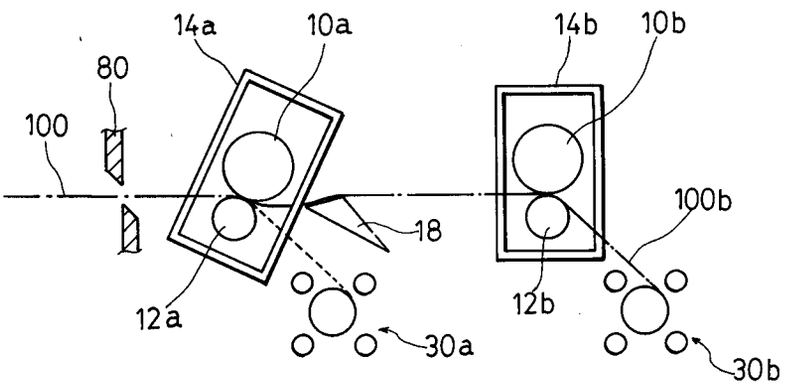

FIG.2

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BACKGROUND OF THE INVENTION

(1) Field of the Invention

This invention relates to a process for coiler drum alternation in incessant hot rolling of steel strip and to an apparatus therefor.

(2) Prior Technology

By the term "incessant hot rolling" herein is meant a system in which preceding ones and succeeding ones of rough rolled slabs are joined together one after another by a flying welder on the entry side of a finishing hot rolling mill, and the joined slabs are subjected continually to finish hot rolling to produce a steel strip.

In hot rolling lines, conventionally, rolling of steel strips has been carried out by the batch rolling system. That is to say, it has been a common practice to rough roll the rolling stocks one by one to make sheet bars, finish roll the sheet bars to steel strips, and take up the steel strips by coilers, respectively. In order to moderate the impact load at an actual nip of the rolls for gripping the rough rolled sheet bar into the finish rolling mill, in the batch rolling system, it has been necessary to limit the traveling speed of the sheet bar at the actual nip. In addition, it has also been necessary to vary the rolling speed, for controlling the plate thickness and shape of the head and tail ends of the rolled product. In the finish rolling of thin sheets, in particular, the traveling speed of the steel strip has been controlled to or below a predetermined value until the leading end of the strip starts being wrapped around the mandrel of the coiler, so as to prevent the leading end portion from being lifted while traveling. Thus, the batch rolling system has the drawback of varied rolling speeds and low rolling efficiency. In addition, the batch rolling system involves waste of time in, for example, peparatory operations between the rolling of a preceding rolling stock and the rolling of the following rolling stock, leading to low efficiency in using the equipment. Furthermore, there has been the problem that the finish rolled products are liable to have poor shape at the head and tail ends thereof, resulting in a low production efficiency, and so on.

For solving these problems, incessant hot rolling is adopted. In the incessant hot rolling, the steel strip obtained by continual rolling of joined slabs is cut up by a flying shear into lengths of strip corresponding to the initial slabs, followed by coiling by coilers. It is necessary in this case to change over the path of the steel strip so that the leading ends of the cut lengths of strip are guided to be taken up on the respective coiler drums. Techniques for such coiler drum ternation are disclosed in Japanese Patent Application Laid-Open (KOKAI) No. 61-014003 (1986) (Process for Down-Coiler Alternation in Incessant Hot Rolling) and Japanese Patent Application Laid-Open (KOKAI) No. 61-119326 (1986) (Gate Device for RollingLine Alternation).

According to the Japanese Patent Application Laid-Open (KOKAI) No. 61-119326 (1986), a deflector disposed on the entry side of coiler rolls is moved up and down to achieve alternation of coilers. The up-down motion of the deflector may flaw the steel strip. To avoid the formation of flaws, the deflector is provided with auxiliary rollers. Since the auxiliary rollers are to be arranged in a limited space, however, the rollers should be small in diameter and, due to the small roller diameter, a slight deviation in the position of contact of the roller with the steel strip can render the strip guiding direction unstable, making it impossible to coil the strip. In the technique according to the Japanese Patent Application Laid-Open (KOKAI) No. 61-014003 (1986), on the other hand, each coiler is provided with a main and an auxiliary set of pinch rolls, which are operated to achieve coiler drum alternation. This technique requires a complicated mechanism.

SUMMARY OF THE INVENTION

It is accordingly an object of this invention to enable higher-speed alternation of coiler drums for coiling of cut steel strips in incessant hot rolling, one by one, and to achieve higher productivity.

It is another object of this invention to enable an easy and assured change of direction so as to guide the leading end of a cut steel strip toward the next coiler to be used.

It is a further object of this invention to enable changeover from a coiler on the downstream side to a coiler on the upstream side.

In order to attain the above objects, this invention makes an improvement on the alternation of coiler drums for a traveling steel strip in incessant hot rolling, by adopting the following process. The process for coiler drum alternation in incessant hot rolling comprises the steps of oscillating upper and lower tillable pinch rolls disposed on the exit side of a shear, thereby changing the direction of the steel strip so that a leading end formed upon cutting the strip will be directed toward the coiler drum to be used next, and cutting the steel strip.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an illustration of an alternation apparatus preferable for carrying out this invention;
Figure 2 is an illustration of an alternation process according to this invention, in the case of

changeover from a coiler on the downstream side to a coiler on the upstream side;

Figure 3 is an illustration of changeover from a coiler on the upstream side to a coiler on the downstream side;

Figure 4 is an illustration of an exemplary system according to the prior art; and

Figure 5 is a general view of a hot rolling line.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Figure 5 illustrates the entire steps carried out in a hot rolling line. A steel slab 90 is rough rolled by hot roughing mills 50, to become a sheet bar 95. The sheet bar 95 is finish rolled by hot finishing stands 60 into an elongate steel strip 100. In the conventional batch rolling system, the sheet bars 50 are finish rolled one by one, and the resultant steel strips are coiled by coilers 30 one by one (each strip being coiled on one of coiler drums). After one steel strip is taken up on one coiler drum, in the conventional batch rolling system, there is sufficient time for such a preparatory operation as to enable the next steel strip to be coiled on another coiler drum.

In the incessant hot rolling to which this invention is applied, a welder 70 for joining the sheet bars 95 is provided between the roughing mills 50 and the finishing stands 60, so as to joint the leading end of the succeeding sheet bar to the tail end of the preceding sheet bar. Therefore, the hot finishing stands 60 performs continual rolling of a multiplicity of sheet bars 95 joined together. Since the joined body of sheet bars 95 finish rolled continually in this manner has discontinuity only at the foremost and backmost ends, it is possible to carry out high-speed finish rolling, without any complicated modification of rolling speed.

After the continual finish rolling, the steel strip 100 is cut at the joint portions thereof by a shear 80, and the cut lengths of strip are coiled separately by the coilers 30. For the cutting of the steel strip 100 during the highspeed rolling and for alternation of the coilers 30 in preparation for the next coiling operation, the path for the steel strip should be changed assuredly at high speed.

Figure 4 shows an apparatus according to the prior art, in which pinch rolls 40, 42 can be moved farther apart, and a deflector 44 capable of being moved up and down is provided on the entry side of coiler drums 30a, 30b so as to change the traveling direction of the steel strip 100. The deflector 44 is provided with auxiliary rollers 48 small in diameter. In this conventional apparatus, a slight deviation in the position of contact of the strip 100 with the roller 48 can render the strip guiding direction unstable, making it impossible to coil the strip.

Figure 1 is an illustration of the apparatus for coiler drum alternation according to this invention. In the process for coiler drum alternation in incessant hot rolling according to this invention, rough-rolled sheet bars are jointed end to end at a position on the entry side of the finishing stands, the jointed sheet bars are continually hot rolled in the finishing stands, the resultant steel strip is cut up on the entry side of coilers, and the cut lengths of strip are successively coiled, in an alternating manner, on a plurality of coilers arranged in series.

In Figure 1, upper and lower pinch rolls 10 and 12 are placed in a housing 14. The housing 14 is so designed as to be tilted by a hydraulic cylinder 16. To coil a steel strip 100 by a coiler 30, therefore, the housing 14 is tilted by the hydraulic cylinder 16 so that the center line 22 passing through the centers of the upper and lower pinch rolls 10, 12 is tilted as indicated by 22a, and a deflector 18 is directed to the side of the coiler 30, whereby the strip 100 is coiled. At the time of coiling by a coiler on the downstream side, the housing 14 is returned into the solid-line position in Figure 1, and the deflector 18 into the position for directing downstream.

The process for coiler drum alternation is illustrated in Figures 2 and 3. Figure 2 shows the changeover from a coiler 30b on the downstream side to a coiler 30a on the upstream side. To make a changeover from the coiling of the steel strip 100 by the downstream-side coiler 30b to that by the upstream-side coiler 30a, a housing 14 on the upstream side is tilted so that the center line passing through the centers of the upper and lower pinch rolls 10a, 12a is tilted, the upstream-side coiler 30a is set ready for coiling, and the steel strip 100 is cut by the shear 80. In this case, the upper and lower pinch rolls 10b, 12b of the downstream-side coiler 30b may be in the non-tilted condition. It is thereby possible to maintain a tail end portion of the steel strip 100b securely by the pinch rolls 10b, 12b until the coiling of the strip 100b is finished, and to obtain a better coil form.

Figure 3 shows a changeover from the coiler 30a on the upstream side to the coiler 30b on the downstream side.

To make a changeover from the coiling of a steel strip 100a by the upstream-side coiler 30a to the coiling of a steel strip 100b by the downstream-side coiler 30b, the housing 14b on the downstream side is tilted so that the center line passing through the centers of the upper and lower pinch rolls 10b, 12b of the downstream-side coiler 14b is tilted, and the downstream-side coiler 30b is set ready for coiling. In this case, the center line passing through the centers of the upper and lower pinch rolls 10a, 12a of the upstream-side coiler 30a

is kept untilted. The steel strip 100 is cut by the shear while the upper pinch roll 10a of the upstream-side coiler 30a is thus prevented from exerting a downward bending force on the succeeding portion of strip. Upon the cutting of the steel strip 100, the succeeding portion of strip is moved straight ahead to be caught by the pinch rolls 10b, 12b on the downstream side, and is wrapped around the downstream-side coiler 30b.

This invention produces the following excellent effects:

(1) The need for a deflector with a complicated construction, as in the prior art, is eliminated.

(2) The tail end of the preceding steel strip can be clamped by the upper pinch roll.

(3) The head end of the succeeding steel strip can be guided by the upper pinch roll.

(4) It is sufficient to provide the coiler on the upstream side with only one set of pinch rolls, as contrasted to two sets of pinch rolls required according to the prior art.

Claims

1. A process for alternation of coiler drums for a traveling steel strip in incessant hot rolling, the process comprising the steps of oscillating upper and lower tillable pinch rolls disposed on the exit side of a shear, thereby changing the direction of the steel strip so that a head end formed upon cutting the strip will be directed toward the coiler drum to be used next, and cutting the steel strip.

2. The process as set forth in claim 1, wherein the oscillation of the upper and lower pinch rolls is carried out by use of a hydraulic cylinder.

3. The process as set forth in claim 1, further comprising the step of moving up and down a deflector disposed on the exit side of the pinch rolls, according to the oscillation of the pinch rolls.

4. Apparatus for incessant hot rolling which comprises upper and lower pinch rolls for nipping a steel strip therebetween on the entry side of a coiler in the apparatus, a frame for accommodating the pinch rolls, the frame being supported at a lower end thereof by a pin so that the center line connecting the centers of the upper and lower pinch rolls can be tilted in the traveling direction of the steel strip, and means for tilting the frame on the pin.

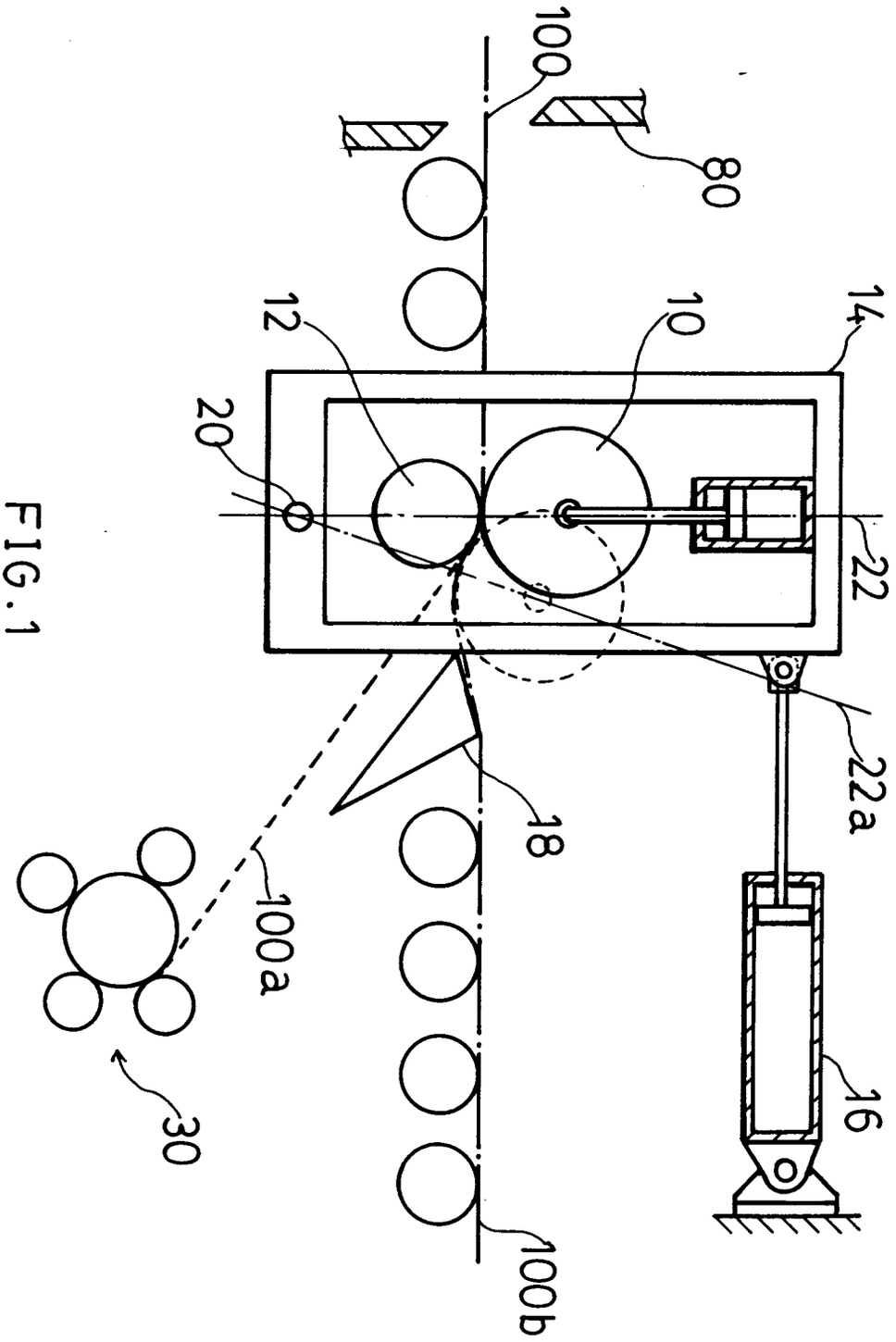

FIG.1

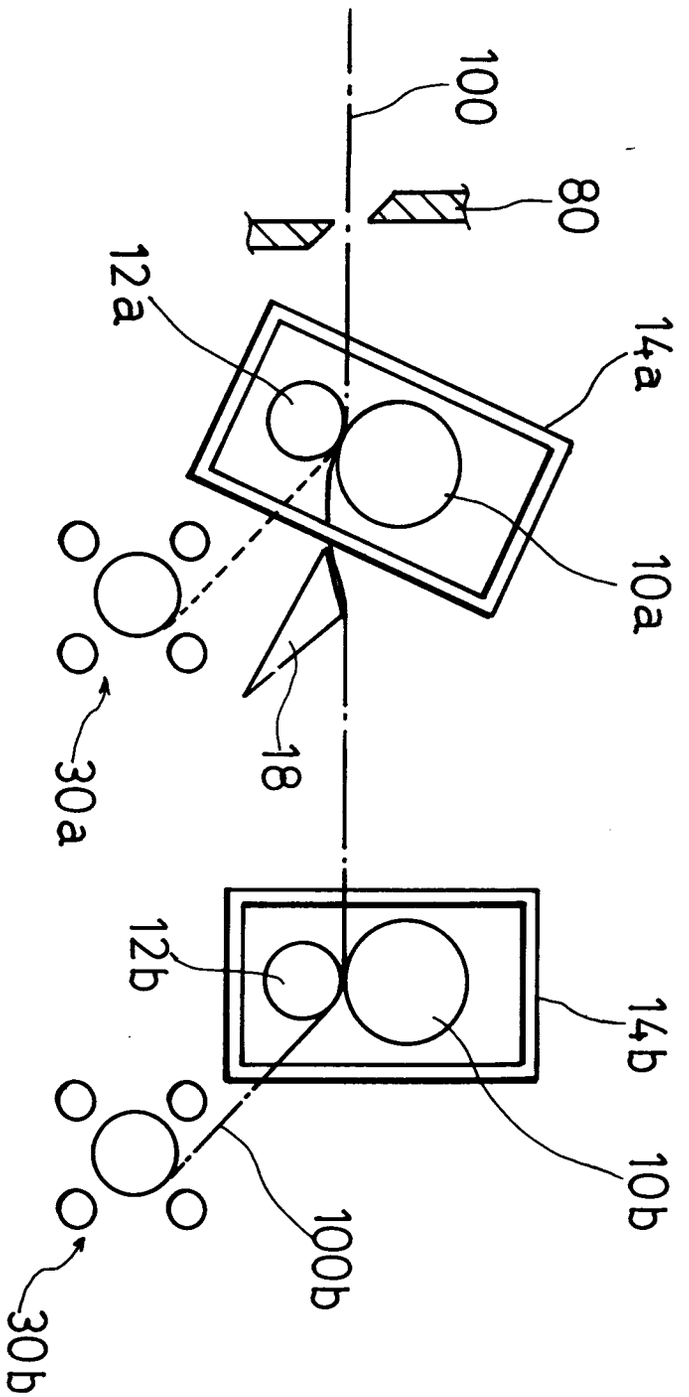

FIG.2

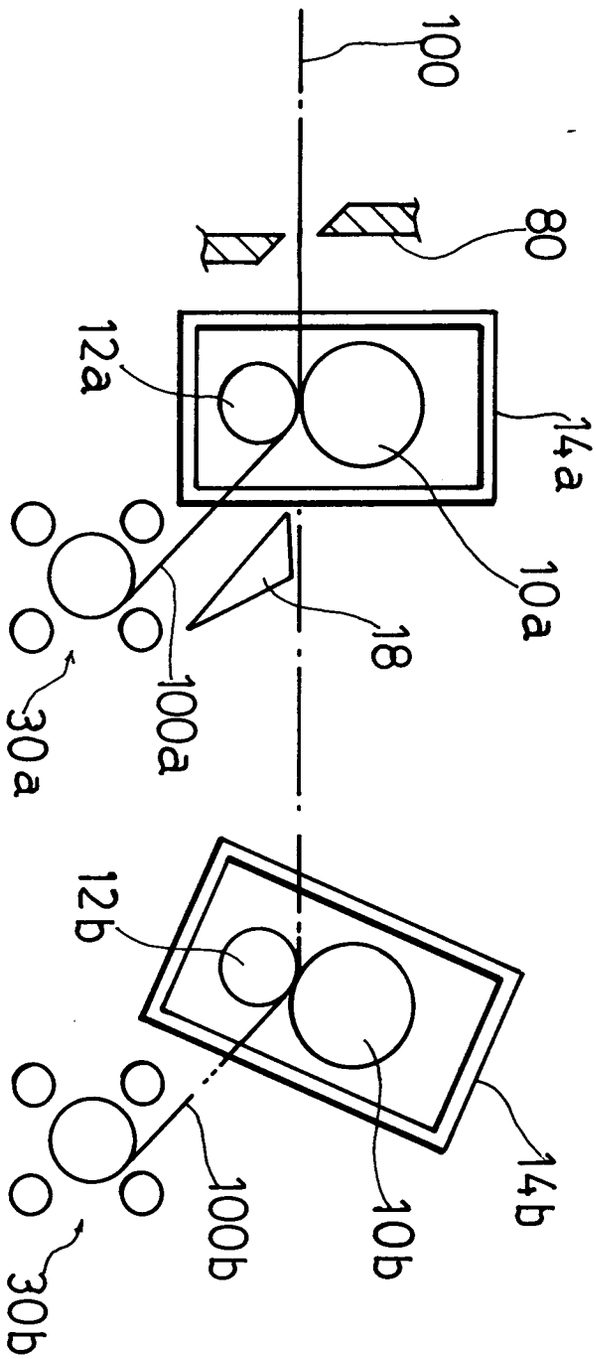

FIG.3

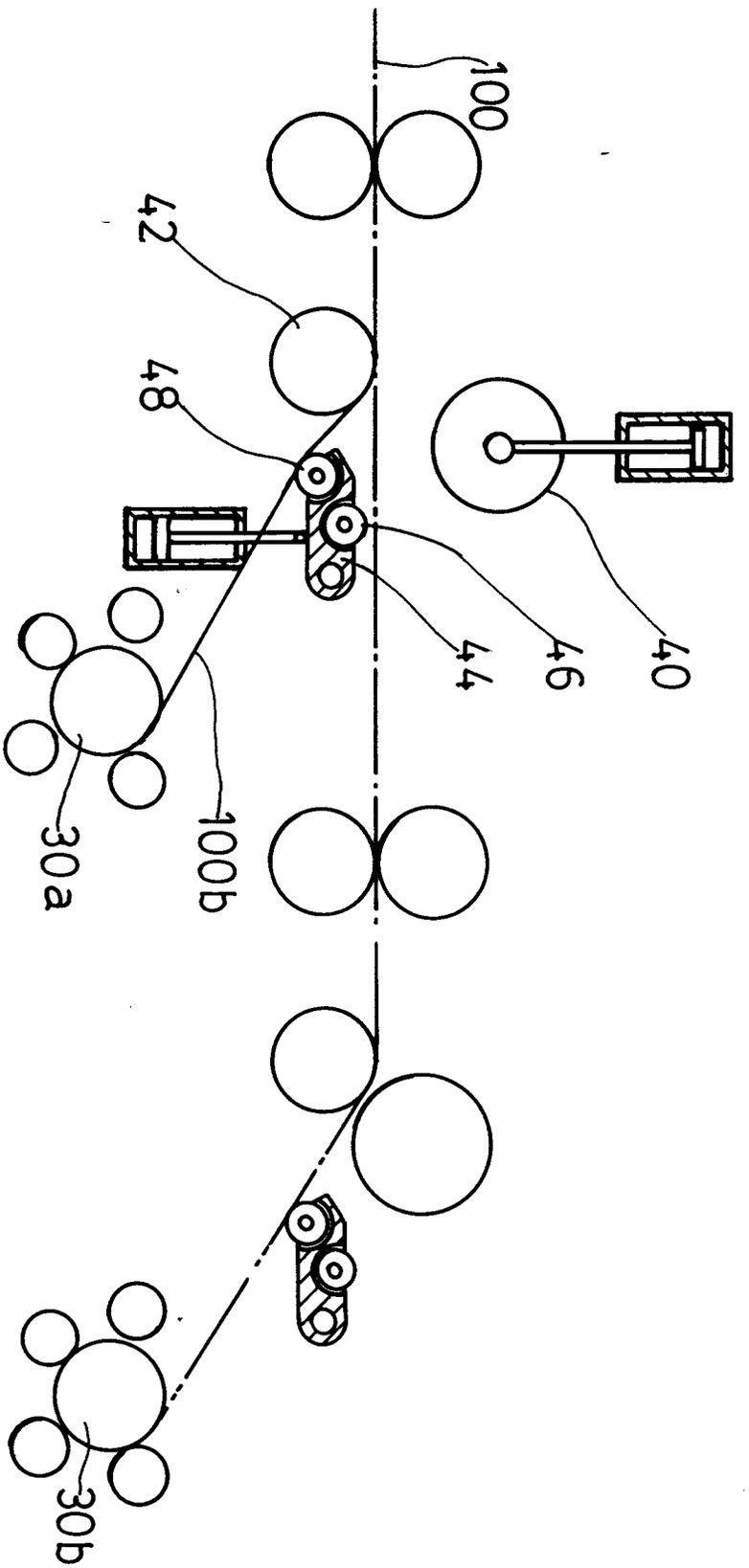

FIG.4

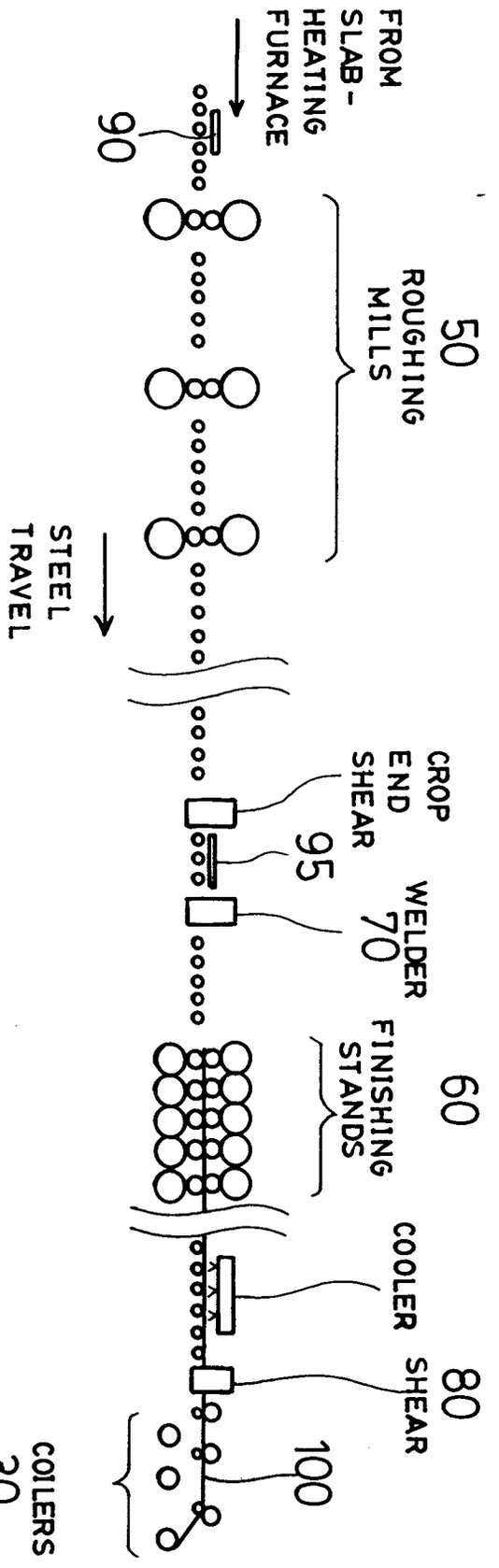
FROM SLAB-HEATING FURNACE
90
50
ROUGHING MILLS
STEEL TRAVEL
CROP END SHEAR
95
WELDER
70
FINISHING STANDS
60
COOLER
SHEAR
80
100
COILERS
30

FIG. 5