A finishing rolling device for manufacturing a thin magnesium strip based on a coil fed to the device includes a roll stand for accommodating at least two working rolls (32, 33) that define a roll gap. A first coiler accommodates the coil and feeds the magnesium strip to the roll gap and a second coiler for winding up the magnesium strip after it passes through the roll gap. The first coiler is provided with a heating device and a hood arrangement that shields the coil or the magnesium strip against heat radiation. The hood arrangement of the first coiler features a coil passage opening for introducing the coil into the hood arrangement on its housing side that faces away from the roll stand.
FINISH-ROLLING DEVICE, AS WELL AS METHOD FOR MANUFACTURING A MAGNESIUM STRIP IN SUCH A FINISH-ROLLING DEVICE

CROSS REFERENCE TO RELATED APPLICATION

[0001] The present application claims the benefit of German Patent Application No. 102011003046.8 filed Jan. 24, 2011, which is fully incorporated herein by reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

FIELD OF THE INVENTION

[0003] The present invention pertains to a finish-rolling device for manufacturing a thin magnesium strip based on a coil that is fed to the finish-rolling device, particularly after a preheating process in a preheating furnace, comprising a roll stand for accommodating at least two working rolls that define a roll gap, a first coiler for accommodating the coil and feeding the magnesium strip to the roll gap and a second coiler for winding up the magnesium strip after it passes through the roll gap. The invention furthermore pertains to a method for manufacturing a thin magnesium strip in such a finish-rolling mill.

BACKGROUND OF THE INVENTION

[0004] Due to the increasing demand, the manufacture of thin magnesium sheets is becoming more and more prominent. It was determined, in particular, that magnesium sheets are also suitable for the manufacture of car bodies, wherein a magnesium sheet has strength properties that are comparable to those of an aluminum sheet, but a lower weight such that options for conserving energy during the operation of motor vehicles other than the development of new drive concepts could potentially be realized.

[0005] In comparison with the manufacture of steel or aluminum sheets, however, the manufacture of magnesium sheets proved to be relatively complicated because magnesium is brittle at the processing temperatures that usually exist during cold-rolling processes due to its hexagonal lattice structure such that the successful manufacture of a magnesium sheet requires the observation of a defined temperature range that approximately lies between 230°C and 450°C in order to utilize the relative ductility of the material that can be attained in this temperature range for processing the magnesium sheet.

[0006] DE 10 2006 036224 A1 discloses a finish-rolling device that forms part of a production line for manufacturing a magnesium strip and during the operation of which different measures are taken for maintaining an elevated temperature level of the magnesium strip that is wound up into a coil after it is introduced into the finish-rolling device. For example, winding tubes are provided on the coilers of the reversing finish-rolling device and form an outer encapsulation of the coiler mandrels such that the magnesium strip arranged on the coiler mandrel is covered by the winding tube in order to maintain the temperature loss in the coiler at a minimum. In addition, a continuous furnace is arranged between the roll stand and the coiler on the delivery side in the known finish-rolling device and makes it possible to heat the magnesium strip in the reversing mode.

[0007] In the known finish-rolling device, the additional continuous furnace represents a complementary component of the production line such that not only the installation expenditures and the space requirement of the finish-rolling device are increased, but the intermediate arrangement of the continuous furnace also results in a longer strip conveying distance between the coilers such that the strip surface is increased between the coilers. Consequently, the temperature increase of the magnesium strip realized in the continuous furnace is at least in part compensated with higher temperature losses.

SUMMARY OF THE INVENTION

[0008] The present invention is based on the objective of proposing a finish-rolling device, as well as a method for manufacturing a thin magnesium strip in such a finish-rolling device, in which the above-described disadvantages are eliminated and the magnesium strip can be heated more effectively within the finish-rolling device. This objective is attained in an embodiment of the invention in the form of the inventive finish-rolling device disclosed herein.

[0009] In the inventive finish-rolling device, at least the first coiler and/or the roll stand, particularly the working rolls or the backup rolls that support the working rolls, is provided with a heating device, as well as a hood arrangement that shields the coil or the magnesium strip against heat radiation, wherein at least the hood arrangement of the first coiler features a coil passage opening for introducing the coil into the hood arrangement on its housing side that faces away from the roll stand.

[0010] According to the invention, at least the first coiler and/or the roll stand is combined with a heating device, the efficiency of which is improved with a hood arrangement that respectively shields the coil against heat radiation in the region of the coiler and the magnesium strip against heat radiation in the region of the roll stand. In this way, the magnesium strip can be heated in the region of the finish-rolling device without disadvantageously affecting the conveying distance between the coilers, i.e., the magnesium strip can be heated without the potential for higher temperature losses due to an extended conveying distance. In comparison with a conventional finish-rolling device, the inventive finish-rolling device also does not require any additional space for the installation.

[0011] Since at least the hood arrangement of the first coiler features a coil passage opening for introducing the coil into the hood arrangement on its housing side that faces away from the roll stand, it is not necessary to remove the hood arrangement from the coiler when a coil is loaded into the coiler such that preventable temperature losses also do not occur in the region of the coiler during the loading process. The coil passage opening is preferably realized such that it can be closed in order to achieve an even better shield against heat losses during the operation of the coiler after the coil is loaded therein.

[0012] It is particularly advantageous to arrange the heating device on the hood arrangement such that the hood arrangements are realized in the form of units that can be modularly retrofitted and combined with existing coilers, wherein these
units already feature a heating device such that no separate installation of a heating device on the coiler or the roll stand is required.

[0013] Particularly with respect to the roll stand, it is naturally also possible to realize the heating devices independently of the hood arrangement, for example, in the form of heat radiators that are arranged in the region of the working rolls or the backup rolls and may be provided with separate shields, and/or to realize the hood arrangement in the form of a fume hood that shields the entire roll stand or the finish-rolling device.

[0014] It is particularly advantageous that the hood arrangement of the coiler features a spool passage opening on the housing side that faces a floor space of the finish-rolling device in order to respectively introduce and remove a spool for accommodating the coil. After the magnesium strip has been unwound from a spool accommodated in the coiler, it is therefore possible, for example, to remove the spool from the coiler without having to detach the hood arrangement from the coiler and to introduce a new preheated spool into the coiler prior to winding up the magnesium strip during the subsequent roll pass such that the magnesium strip is not cooled due to a heat transfer to the spool, but rather supplied with heat by the preheated spool.

[0015] With respect to a fast exchange of the spool and with respect to minimal handling and conveying distances for the spools, it is particularly advantageous to provide a spool supply device for supplying at least one spool underneath the floor space in the form of a subsurface arrangement, wherein this spool supply device is provided with a spool handling device that serves for respectively introducing and removing the spool into/from a spool receptacle device of the coiler situated in the hood arrangement.

[0016] It is also particularly advantageous to provide the spool supply device with a heating device in order to preheat the spools.

[0017] In order to supply a plurality of spools, it is particularly advantageous that the spool supply device comprises a horizontal conveyor for magazineing the plurality of spools in a transfer position, and that the spool handling device features a vertical conveyor for conveying the spools between the transfer position and a wind-up position in the spool receptacle device.

[0018] This objective is attained in an embodiment of the invention in the form of the inventive method disclosed herein. In the inventive method, at least the first coiler and/or the roll stand is provided with a hood arrangement that respectively shields the coil accommodated in the coiler and the magnesium strip conveyed through the roll gap against heat radiation during the operation of the finish-rolling device, wherein the coil or the magnesium strip is acted upon with heat after the introduction of the coil into the hood arrangement by means of a heating device on the side of the hood arrangement that faces away from the roll stand.

[0019] Unnecessary temperature losses can already be prevented at the beginning of the rolling process by quickly transferring the coil to the coiler on the inlet side of the roll stand such that the thermal energy introduced into the magnesium strip by the heating device in the region of the hood arrangement is not partially consumed by the compensation of unnecessary temperature losses.

[0020] In order to realize this transfer quickly, it is particularly advantageous to load the coiler arranged on the inlet side of the roll stand with the coil in such a way that the coil arranged on a coil buggy is introduced into the hood arrangement through the coil passage opening that faces away from the roll stand by means of the coil buggy in order to be accommodated in the coiler.

[0021] Particularly in instances, in which the coil was preheated in a preheating furnace prior to being loaded into the coiler on the inlet side, this makes it possible to reduce the temperature losses over the conveying section between the preheating furnace and the coiler to a minimum.

[0022] After unwinding the magnesium strip from the spool, it is also particularly advantageous to remove the spool arranged within the hood arrangement from a spool receptacle device of the coiler by means of a spool handling device that is arranged underneath the floor space of the finish-rolling device and to simultaneously transport the wound-up magnesium strip from the coiler on the outlet side to a coil depositing station by means of the coil buggy.

[0023] The formation of a heat sink also can be largely prevented in the region of the coiler on the outlet side by exchanging the spool accommodated in the spool receptacle device on the outlet side while the coiler on the inlet side is loaded with a coil.

[0024] It is furthermore advantageous to utilize rolls that were previously preheated outside the roll stand at the beginning of the rolling process and/or after a roll exchange required during the operation of the finish-rolling device.

[0025] A preferred embodiment of the finish-rolling device is described in greater detail below with reference to the drawing in order to elucidate a preferred variation of the method for manufacturing a thin magnesium strip in the finish-rolling device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] In the drawings:

[0027] FIG. 1 shows a schematic of a finish-rolling device incorporating the present invention.

DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS

[0028] As shown in the drawing in FIG. 1, a finish-rolling device 10 incorporating the present invention includes a roll stand 11 and two coilers 12, 13 that accommodate the roll stand 11 between one another and are arranged on a common floor level 14 together with the roll stand. The drawing furthermore shows that the finish-rolling device 10 is in this case supplemented with a preheating furnace 15 in the form of an overhead furnace that is arranged above and spaced apart from the floor level 14. A spool supply device 17 with a horizontal conveyor 16 is situated underneath the floor level 14, wherein two spool handling devices 18, 19 that respectively feature a vertical conveyor 20 are arranged underneath the coilers 12, 13 and assigned to the spool supply device.

[0029] According to the exemplary embodiment of the finish-rolling device 10 illustrated in the drawing, the two coilers 12, 13 as well as the roll stand 11 are respectively provided with hood arrangements 21 and 22. In this case, the hood arrangements 21 of the coilers 12, 13 respectively feature a coil passage opening 23 that is arranged opposite the preheating furnace 15 on the coiler 13 on the inlet side 24 of the roll stand 11 and opposite a coil depositing station 26 on the coiler 12 on the outlet side 25 of the roll stand 11. Both hood arrangements 21 also feature spool passage openings 41 that respectively face the floor level 14. The interiors of the hood
arrangements 21 are provided with heating devices 27 that are realized, for example, in the form of heat radiators and oriented such that they radiate thermal energy in the direction of a coiler receptacle device 28, namely in such a way that a magnesium strip 30 wound up into a coil, as well as the spool receptacle device 28 within the hood arrangement 21, is actuated upon with thermal energy when a coil 29 is respectively arranged in the spool receptacle device 28 of the respective coilers 12 and 13.

[0030] The hood arrangement 22 assigned to the roll stand 11 is in this case realized similar to a furnace hood, wherein this hood arrangement forms a shield or reflection device for thermal energy emitted in the region of the roll stand 11 and is arranged on the upper end of the roll stand 11. According to the drawing, the roll stand features two working rolls 32, 33 that define a roll gap 31 and two backup rolls 34, 35 that respectively support one working roll 32, 33. In this case, heating devices 37 are arranged opposite of one another in pairs in a frame 36 of the roll stand 11, wherein the backup rolls 34, 35 are situated between the heating devices 37 and therefore can be actuated upon with thermal energy by the heating devices 37. As an alternative to the arrangement of the heating devices 37 on the frame 36, it is also possible to combine these heating devices with the hood arrangement 22 of the roll stand 11.

[0031] During the operation of the exemplary finish-rolling device 10 shown, a coil 29 that was tempered or preheated in a preheating furnace 15 is transferred to a coil buggy 38 arranged underneath the preheating furnace 15. Subsequently, the coil buggy is positioned underneath the spool receptacle device 28 of the coiler 13 arranged on the inlet side 24 on the floor level 14 and transferred to the coiler 13 by inserting the spool 39 of the coil 29 into the spool receptacle device 28. During this transfer, the coil buggy 38 carrying the coil 29 moves into the hood arrangement 21 through the coil passage opening 23 and the spool passage opening 41 in the hood arrangement 21. After the coil 29 is accommodated in the coiler 13, a coiler opener 42 arranged on the coiler 13 or the hood arrangement 21 makes it possible to access the not-shown beginning of the strip that is inserted into the roll gap 31 from the inlet side 24 and then routed to the coiler 12 arranged on the outlet side 25 of the roll stand 21. The not-shown beginning of the strip is then fixed on a spool 39 accommodated in the spool receptacle device 25 of the coiler 12 with conventional means such as, for example, a wind-up device such that the magnesium strip 30 can subsequently be wound up on the spool 39 in the coiler 12 in accordance with the unwinding of the magnesium strip 30 in the coiler 13. The drawing shows a phase during the course of a roll pass, in which about half of the magnesium strip 30 that was originally arranged on the coil 29 has been transferred to the spool 39 that is arranged in the coiler 12 and serves for winding up the magnesium strip. Depending on the desired final thickness of the magnesium strip 30 being processed in the finish-rolling device 10, a defined number of roll passes is carried out in the reversing mode such that the coilers 12 and 13 are alternately operated as an unwinding device and a wind-up device.

[0032] After the last roll pass has been carried out, the entire length of the magnesium strip 30 is situated on the spool 39 in the coiler 12 such that the coil 29 arranged in the coiler 12 can be removed from the spool receptacle device 28 of the coiler 12 and transferred to the coil buggy 43 arranged on the outlet side 25, wherein this coil buggy subsequently moves out of the hood arrangement 21 together with the coil 29 through the coil passage opening 23 in order to transfer the coil 29 from the coil buggy 43 to the coil depositing station 26.

[0033] While the coil 29 is transferred to the coil depositing station 26, a new coil 29 can be transferred from the preheating furnace 15 to the coiler 13 on the inlet side 24 by means of the coil buggy 38.

[0034] After the respective completion of the last roll pass, i.e., once the magnesium strip 30 was transferred from the unwinding coiler 13 to the wind-up coiler 12, the empty spool 39 is removed from the coiler 13 by the coil handling device 19 and delivered to the coil supply device 17. On the outlet side 25, the finish-rolled coil is simultaneously transported to the coil depositing station 26 by means of the coil buggy 43 and a coil 39 that is held ready in the coil supply device 17 and was preheated by a heating device provided on the coil supply device 17 is inserted into the coil receptacle device 28 of the coiler 12. After the spool 39 has been transferred into a transfer position 45 by means of the horizontal conveyor 16 of the spool supply device 17, it is exchanged with the spool 39 that was previously arranged in the coiler 12 by means of the coil handling device 18, 19. In order to realize this exchange motion, the spool handling devices 18, 19 respectively feature a vertical conveyor 20 that is arranged underneath the spool receptacle device 28 of the coilers 12, 13.

[0035] While the magnesium strip 30 is conveyed through the roll gap 31, heat is emitted by the magnesium strip 30 along the conveying section between the coilers 12, 13. On the other hand, the magnesium strip 30 is acted upon with heat by the heating devices 27, 37 within the hood arrangements 21, as well as within the hood arrangement 22 of the roll stand 11. In the exemplary embodiment illustrated in the drawing, the hood arrangement 22 of the roll stand 11 is realized in such a way that it covers the conveying section between the coilers 12, 13, i.e., the hood arrangement 22 not only forms a shield against heat radiation in the region of the roll stand 11, but also in the region of the entire finish-rolling device 10.

[0036] While there has been shown and described what are at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention defined by the appended claims. Therefore, various alternatives and embodiments are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter regarded as the invention.

1. A finish-rolling device for manufacturing a thin magnesium strip based on a coil that is fed to the finish-rolling mill, particularly after a preheating process in a preheating furnace, said finish-rolling device comprising:

   a roll stand for accommodating at least two working rolls that define a roll gap;

   a first coiler for accommodating the coil and feeding the magnesium strip to the roll gap, wherein the first coiler is provided with a heating device and a hood arrangement that shields the coil or the magnesium strip against heat radiation, and the hood arrangement features a coil passage opening for introducing the coil into the hood arrangement on a side of the hood arrangement facing away from the roll stand; and

   a second coiler for winding up the magnesium strip after it passes through the roll gap.
2. The finish-rolling device according to claim 1, in which the heating device is arranged on the hood arrangement.

3. The finish-rolling device according to claim 1, in which the hood arrangement of the coiler features a spool passage opening on the housing side that faces a floor space of the finish-rolling device in order to respectively introduce and remove a spool for accommodating the coil.

4. The finish-rolling device according to claim 3, in which a spool supply device for supplying at least one spool is provided underneath the floor space in the form of a subsurface arrangement, wherein this spool supply device features a spool handling device that serves for respectively introducing and removing a spool into/from a spool receptacle device of the coiler situated in the hood arrangement.

5. The finish-rolling device according to claim 4, in which the spool supply device is provided with a heating device for heating the spools.

6. The finish-rolling device according to claim 4, in which the spool supply device comprises a horizontal conveyor for magazining a plurality of spools and conveying the spools into a transfer position, and in that the spool handling device features a vertical conveyor for conveying the spools between the transfer position and a wind-up position in the spool receptacle device.

7. The finish-rolling device according to claim 1, in which the working rolls and/or the backup rolls that support the working rolls are realized in the form of heatable rolls.

8. The finish-rolling device according to claim 1, in which at least the second coiler features a heatable coil receptacle device.

9. The finish-rolling device according to claim 1, in which at least the second coiler is provided with a heatable wind-up device.

10. A method for manufacturing a thin magnesium strip in a finish-rolling device based on a coil that is fed to the finish-rolling device, particularly after a preheating process in a preheating furnace, said method comprising:

conveying a magnesium strip through a roll gap formed in a roll stand between two working rolls in the reversing mode such that two coilers that accommodate the roll stand between one another are alternately operated as an unwinding device and a wind-up device;

shielding the coil accommodated in the first coiler with a hood arrangement that respectively shields the coil accommodated in the coiler and the magnesium strip conveyed through the roll gap against heat radiation during the operation of the finish-rolling device; and

heating at least one of the coil and the magnesium strip by means of a heating device after introduction of the coil into the hood arrangement through a coil passage opening on a housing side of the hood arrangement that faces away from the roll stand.

11. The method according to claim 10, in which the coiler arranged on the inlet side of the roll stand is loaded with a coil that was heated, in particular, in a preheating furnace and is arranged on a spool in such a way that the coil is transferred to a coil buggy, if applicable, from the preheating furnace and introduced into the hood arrangement by means of the coil buggy through the coil passage opening that faces away from the roll stand in order to be accommodated in the coiler.

12. The method according to claim 10, in which the spool situated within the hood arrangement is removed from a spool receptacle device of the coiler by means of a spool handling device that is arranged underneath a floor space of the finish-rolling device after the magnesium strip has been unwound from the spool, wherein the wound-up magnesium strip is simultaneously transported from the coiler into a coil depositing station by means of the coil buggy.

13. The method according to claim 10, in which the spool receptacle device of the coiler on the outlet side of the roll stand is loaded with a spool that was preheated in the spool supply device by means of the spool handling device while a coil is loaded into the coiler on the inlet side of the roll stand.

14. The method according to claim 10, in which the working rolls and/or the backup rolls for supporting the working rolls used in the roll stand are preheated outside the roll stand prior to the operation of the roll stand for manufacturing the magnesium strip.

* * * * *