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[54] **MEANS FOR COOLING AND TRANSVERSELY CONVEYING METAL SHEETS**
3 Claims, 3 Drawing Figs.

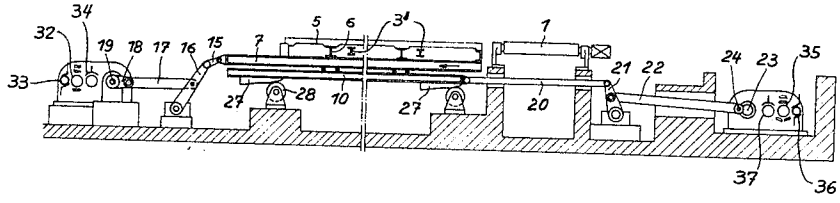
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[50] **Field of Search** 198/219

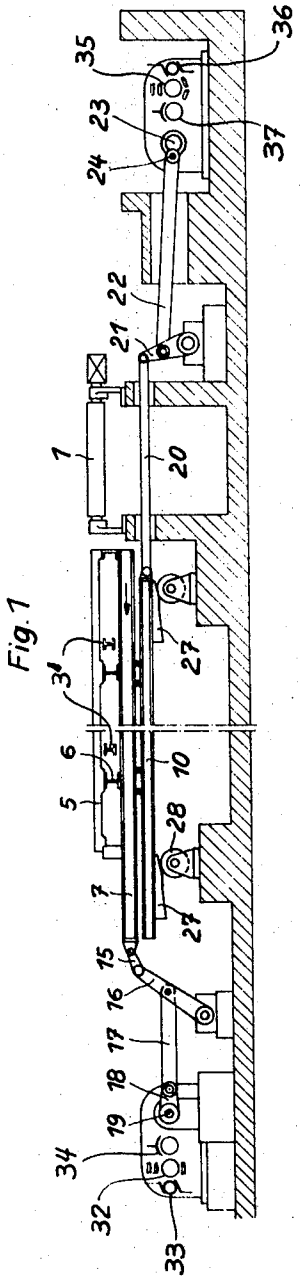
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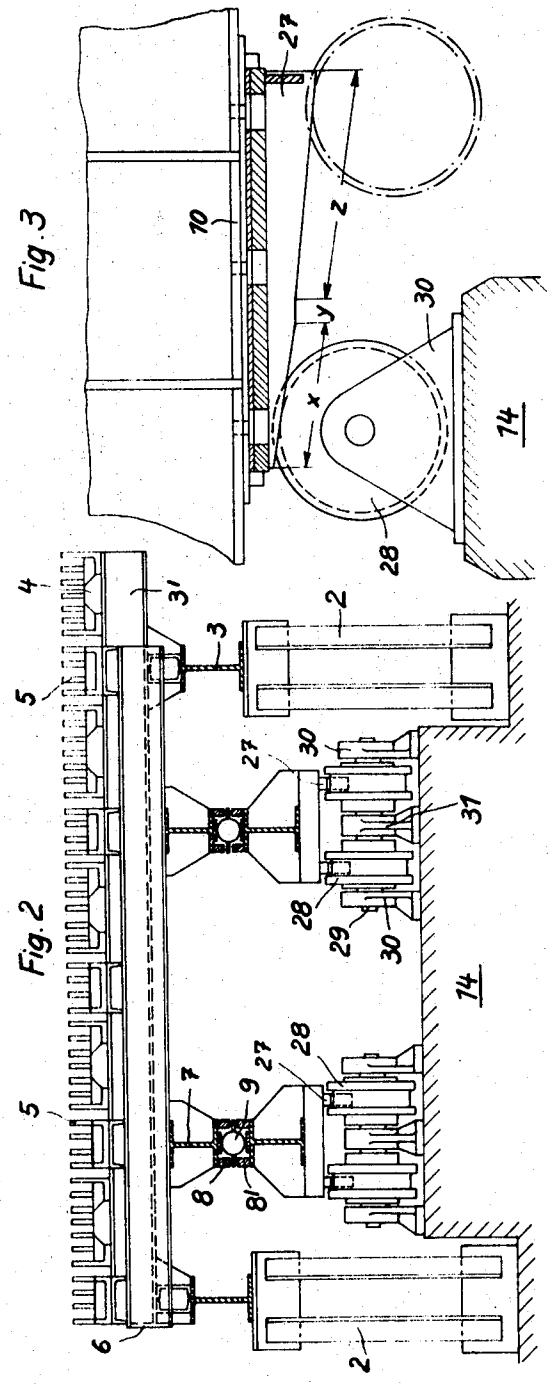
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ABSTRACT: Apparatus with stationary supporting gratings, and with supporting gratings movable reversibly by control members, for cooling and transversely conveying metal sheets deposited upon a support carried by rollers, with the interposition of inclined guiding tracks, so arranged that the movable gratings will be raised when they are displaced forward and lowered when they are displaced rearward, the forward and lifting movement of the movable gratings being followed by a rearward and lowering movement, and then by a partial forward stroke which brings the upper edge of the movable gratings up to the level of the upper edge of the stationary gratings, the inclination of the guiding tracks being interrupted by a horizontal section in a position which corresponds to that position of the rollers in which the upper edge of the movable gratings is flush with the upper edge of the flush gratings.




Fig. 1
35
36
23
37
24
22
21
1
20
27
34
6
10
5
28
7
27
15
16
17
18
19
34
32
33


Fig. 3
27
10
z
y
x
30
14
28
Fig. 2
4
31
2
3
5
27
30
31
28
29
30
14
7
9
27
28
5
8
8'
6
2

MEANS FOR COOLING AND TRANSVERSELY CONVEYING METAL SHEETS

This invention relates to a cooling bed, in which the sheet or plate to be cooled is lifted and transported by a movable supporting grating or bearing grid from a stationary transporting grating or bearing grid.

The invention relates to a cooling bed with stationary and movable supporting gratings, in which the lifting and horizontal conveying is followed by a return stroke of the movable supporting gratings through the same distance, and its aim is to render the cooling more uniform. In order to ensure that all parts of a sheet to be cooled are either supported upon or lifted from a grating over equal intervals of time, it is provided according to our said prior specification that the horizontal return movement of the movable supporting gratings should be followed by a partial stroke, which stops their upper edges flush with the upper edges of the stationary supporting gratings.

For carrying out the method described, there is further proposed, according to our said prior specification, apparatus in which travelling supporting gratings, reversible by control members, are carried upon a support which is displaceable upon sliding or rolling tracks inclined to the horizontal, by a controlling member which can be stopped in the end positions and in an intermediate position.

For the attainment of a uniform cooling it is requisite to stop the movable supporting grating exactly flush with the stationary supporting grating. This precise controlling of the level is attainable only with an expensive direct-current drive.

The present invention provides a further development of the apparatus, such that a less expensive polyphase motor can provide for the travelling of the support.

For the attainment of this aim, the inclination of the guiding tracks is interrupted by a horizontal section, the arrangement of which corresponds to a position of the rollers in which the upper edge of the movable supporting gratings is flush with the upper edge of the stationary supporting gratings.

In this way the exact flush position is attained as soon as the rollers are in contact with the horizontal section of the guiding tracks, and it is immaterial upon what point of the horizontal section the stationary position is reached.

This apparatus requires less expenditure with respect to the positioning of the support, and for this reason an ordinary polyphase induction motor may be employed. If the controlling is effected with a fluid-pressure cylinder, here again the exact positioning of the support is attainable with simpler controlling means.

A further advantage consists in the feature that the support does not have to be fixed by the drive in relation to the downward slope, but maintains of itself the position assumed.

In a further development of the invention, the use of a motor of low power becomes possible owing to the fact that the horizontal section of the guiding track is arranged in such a way that there is a shorter inclined section in the lowering direction and a longer section in the lifting direction, the shorter section presenting a steeper inclination than the longer section.

In this way the lowering and lifting speeds in the unloaded lower region are increased, and in the loaded upper region are diminished, whereby the peak load in this region is lowered, and the power output of the motor is better utilized.

When driving by means of a hydraulic cylinder it is correspondingly possible to work either with lower admission of liquid or with a smaller piston diameter. In this case, however, it may also be advantageous to utilize the horizontal travel saved by the greater inclination in the unloaded region of the track for an advantageous shortening of the cylinder stroke.

In driving the support by motor-driven cranks, a uniform loading of the motor may be attained by constructing the inclined tracks according to a curve the course of which is determined from points of equal or approximately equal driving torque during the upward movement.

One embodiment of the invention is illustrated by way of example in the accompanying drawings, in which:

FIG. 1 shows a section through a cooling bed parallel to the direction of transport;

FIG. 2 shows a cross section through the stationary and movable supporting gratings; and

FIG. 3 shows an enlarged representation of a stationarily arranged roller, upon which the inclined track of a support rests and travels.

Beside a roller table **1**, stationary supporting gratings **4** are arranged spaced apart from one another, upon girders **3**, **3'**, connected with the foundation by vertical struts **2**. Between the stationary supporting gratings **4** are arranged movable supporting gratings **5** upon movable transverse girders **6**, which are supported upon longitudinal girders **7**. The longitudinal girders **7** are supported, with the interposition of balls **9** or wheels accommodated in upper guides **8** and lower guides **8'**, upon the upper side of a support **10**.

On the under side of the support **10** are provided guiding tracks **27**, which bear upon rollers **28**, which are supported by journals **29** in bearing pedestals **30** and **31**. The bearing pedestals **30** and **31** are anchored upon a base **14**. The tracks **27** are each composed of a relatively short sharply inclined section *x*, and a longer and less steeply inclined section *z*, between which a horizontally extending section *y* is provided.

In the position illustrated in FIG. **3**, the section *x* of the track **27** is resting upon the roller **28**. The unloaded movable supporting gratings **5** are quickly raised and lowered upon this sharply inclined section, the power output of the motor being better utilized. For the transporting of the sheets the section *z* of the track **27** is conveyed upon the roller **28**. In consequence of the smaller inclination of this section the raising and lowering of the load proceed more slowly, and for this reason a motor of lower power may be employed.

When the movable supporting gratings **5** are to lie in one plane with the stationary supporting gratings **4** between the transporting strokes, the support **10** need only be moved so far until some point of the horizontal section *y* is in contact with the roller **28**. This positioning can be carried out accurately enough with a polyphase induction motor.

The longitudinal girder **7** connected with the movable supporting gratings **5** is connected at one end, by way of an intermediate member **15**, with a rocking lever **16** journaled upon the foundation, and to about the middle of this rocking lever is pivotally connected a rod **17** connecting it with a crank **18**, with the shaft **19** of which is connected a rotating limit switch **32**, with two contact points. This limit switch, in the end positions of the horizontal travel, switches off a motor **33** and switches on a brake **34**.

Upon the opposite end the support **10** is connected with a rod **20**, the other end of which is pivotally connected with a transmission lever **21** journaled upon the foundation, and to about the middle of this lever is attached the connecting rod **22** of a crank **24** mounted upon a motor-driven shaft **23**. A rotating limit switch **35** with three contact points, which is connected with the shaft **23**, controls the alternate switching on and off of a motor and a brake for the vertical lifting movements. The control described may be replaced by a digital position-regulator.

The sheets brought along by the roller table **1** are transferred for cooling, by a delivery device not shown, on to the supporting gratings **4** and **5**. For the stepwise transverse transporting of the sheets over the cooling bed, first of all the crank **24** controlling the movement of the support **10** is rotated right into the position in which the support **10** extends farthest towards the right, and the movable supporting gratings **5** are located in the highest position, with the section *z* resting on the roller **28**. In this position, in which the sheets are lying upon the raised movable supporting gratings **5**, the limit switch **35** stops the motor **36** and switches on the brake **37**, which holds the support **10** fast. Upon the other side the motor **33** now rotates the crank **18** connected with the movable supporting gratings **5**, by which the sheets are transported in a horizontal direction. In the opposite position of the crank **18** this movement is terminated by the limit switch, or manually by means of a pushbutton switch, in an intermediate position, by switching off the motor and actuating the brake **34**.

By the crank **24** the support **10** is then displaced into the opposite position, whereby the movable supporting gratings resting upon it are lowered to a position beneath the level of the upper edge of the stationary gratings, with the section *x* of the guides **27** resting on the rollers **28**. Thereupon the crank **18** moves the movable supporting gratings back into their initial position.

The switching on of the motors **33** and **36**, and the releasing of the brakes **34** and **37**, can be controlled separately by hand for any partial movement. It is however also possible to provide a follow-up control, in such a way that with the controlling impulse given by rotating limit switches **32** and **35** for switching off and braking the apparatus for a partial movement, a further impulse for starting the motor and releasing the brake for the succeeding partial movement is given. In this case, after once switching on, a transport movement proceeds automatically as far as the position of rest.

In order that the sheets, in the position of rest between the transporting strokes, may bear both upon the stationary gratings upon the movable gratings, the crank **24** is thereupon rotated into an intermediate position, determined by limit switches, so that the movable supporting gratings **5** lie in the same plane as the stationary supporting gratings **4**, with the section *y* of the guide **27** resting on the roller **28**. The renewed lifting of the sheets is then effected from this position, in which no shocks can occur. The bearing conditions are the same for all regions of the sheets, so that uniform cooling is ensured.

We claim:

1. Apparatus for cooling and transversely conveying metal sheets, comprising: stationary and reversibly movable supporting gratings, upon which the sheets are deposited, longitudinal girders carrying the movable gratings, rollers journaled in stationary positions carrying the said longitudinal girders, inclined guiding tracks interposed between the rollers and the longitudinal girders carried thereby, means for moving the longitudinal gratings, together with the longitudinal girders carrying them, forward and backward, and thereby raising and lowering them, means for controlling the reversible longitudinal movements of the movable gratings, the inclination of the inclined guiding tracks being interrupted at an intermediate point by a horizontal track section, the position of which corresponds to that position of the rollers in which the upper edge of the movable supporting tracks is flush with the upper edge of the stationary supporting tracks.

2. Apparatus for cooling and conveying metal sheets as claimed in claim **1**, the inclined sections of the guiding track preceding and following the horizontal section differing from one another in length and inclination, the section that comes into operation first in the lifting direction being shorter and steeper than the other section.

3. Apparatus for cooling and conveying metal sheets as claimed in claim **2**, the inclination of the two inclined sections of the guiding tracks being such that the power required for moving the movable gratings will be substantially the same, whichever section is in contact with the rollers.