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(54) **Rolling mill and method for manufacturing helically shaped metal strips**

(57) The invention relates to a rolling mill for rolling helically shaped metal strips. The arrangement comprises a frame (9) with three rolls(10a,10b,11), of which at least one roll is mounted adjustable, a second conveyor track (15) via which a metal strip is supplied and a first conveyor track (12) onto which a first trolley (13) may slide onto which the second conveyor track (15) is connected. During rolling, the first trolley (13) will slide over the first conveyor track (12), which means that the rolling process will not be influenced by sidewards acting forces. As soon as the metal strip approaches an end of the rolling mill, the adjustable roll may be released and the first trolley (13) may be moved back, after which the rolling process may be resumed.

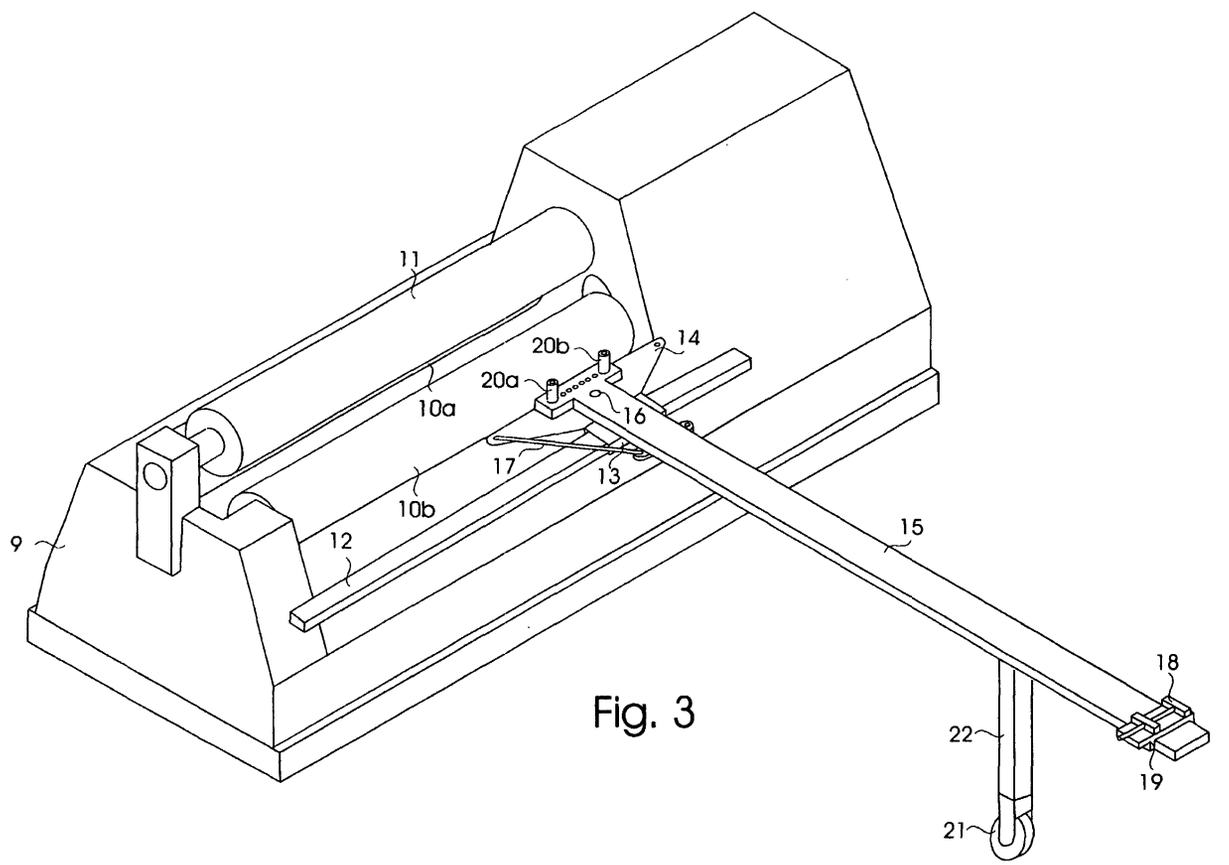

Fig. 3

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Description

[0001] The invention relates to a rolling mill for milling helically shaped metal strips, like for example stringboards of staircases, comprising a frame, provided with at least three rollers of which at least one roller is mounted adjustable, drive means for driving at least one of the rollers and supply means for the supply of material to be rolled towards the rollers.

[0002] According to the state of the art, for rolling a helically shaped metal strip a rectangular plate is guided between the rollers, which is then rolled to a part of a cylinder having the right diameter, after which helically shaped metal strip parts can be cut out of the cylinder and welded together. This process can be repeated until a helically shaped strip with the desired length is obtained. The disadvantage is that much material will be lost and that the end product often does not satisfy the requested standard of quality, which means that the end product must be considered lost and a lot of material and man-hours will be lost with it. The rolling mill according to the invention substantially obviates this disadvantage and is characterised in that the supply means are arranged for supplying metal strip material as material to be rolled.

[0003] A favourable embodiment of the inventive arrangement is characterised in that supply means comprise a first conveyor track, mounted to the frame, as well as a trolley, slidably mounted onto the first conveyor track and provided with a clamping arrangement for clamping the metal strip, in such a way that the rolling mill can pull the metal strip in a previously determined direction between the rolls substantially without any friction, in the process of which the direction cannot change.

[0004] An embodiment with which the direction of the metal strip may be determined more accurately, without significantly increasing the friction in the conveyor track, is characterised in that the first conveyor track is at least near the frame provided with guiding means, for guiding the metal strip.

[0005] A further embodiment of the inventive arrangement is characterised in that the first conveyor track is hingedly connected to the frame, in such a way that a previously determined pitch may easily be adjusted for the helically shaped metal strip.

[0006] A further embodiment of the inventive arrangement is characterised in that a second conveyor track is provided, which is mounted to the frame, at least substantially parallel to a non-adjustable roller, which second conveyor track is provided with a second trolley, to which the first conveyor track is hingedly connected. A sidewards directed force, generated by the rolls, will now result in a sidewards movement of the second trolley together with the metal strip, which results in a qualitatively better end product, because the metal strip will not wriggle or slide between the rolls and its surface will remain practically undamaged. Moreover, the dimensions of the end product turn out to correspond better to the desired dimensions. Finally, during the rolling process, the metal strip may easily be moved with the aid of the second trolley after the adjustable roller has been disengaged, whereupon the rolling process can be resumed. In this way, relatively long helically shaped metal strips can be manufactured.

[0007] The invention also relates to a conveyor system, comprising a second conveyor track, provided with a second trolley, a first conveyor track, hingedly mounted to the second trolley and provided with a first trolley with a clamping arrangement mounted onto it, suitable to be mounted as part of a rolling mill of the type described in the previous chapters.

[0008] The invention also relates to a method for rolling helically shaped metal strips, like for example stringboards of staircases, in the process of which material to be milled is guided between a system of rollers. It is characterised in that the material is guided between the rollers as strip metal.

[0009] A favourable realisation of the inventive method, with which a pitch of the obtained helically shaped strip can be determined in a simple and accurate way is characterised in that the material is guided between the rollers under a previously determined angle.

[0010] A further favourable realisation is characterised in that the material is guided between the rollers in such a way that it may freely move in a direction parallel to a non-adjustable roller. A sidewards directed force, generated by the rolls, will now result in a sidewards movement of the second trolley together with the metal strip, which results in a qualitatively better end product, because the metal strip will not wriggle or slide between the rolls and its surface will remain practically undamaged. Moreover, the dimensions of the end product turn out to correspond better to the desired dimensions.

[0011] A favourable realisation is according to another aspect of the invention characterised in that the rolling of a strip is periodically interrupted, after which a mutual distance between at least two rollers of the system of rollers is increased, after which the material is moved in a direction parallel to the rollers, after which the distance between the at least two rolls is decreased to the starting position, after which the rolling is resumed. In this way, relatively long helically shaped strips can be rolled, because the metal strip can be shifted sidewards in case it approaches an end of the rolls.

[0012] The invention will now be further explained with a reference to the following figures, in which:

Fig. 1 schematically represents a possible embodiment of a spiral staircase, provided with a stringboard;

Fig. 2A schematically represents a solid steel plate, out of which parts of the stringboard may be cut after it has been rolled;

) Fig. 2B schematically represents a composite steel plate, out of part of the stringboard may be

cut after it has been rolled;

Fig. 3 schematically represents a possible embodiment of a rolling mill according to the invention.

[0013] Fig. 1 schematically represents a possible embodiment of a spiral staircase 1, provided with a stringboard 2 and a newel 3, between which steps 4 can be mounted. It may be noted that newel 3 may be lacking. The production of a stringboard is difficult, time consuming and usually there is quite a lot of scrap-iron and rejects. As a stringboard must be placed in or onto a finished building, the demands with regard to the accuracy of the dimensions are high. For that reason, parts of the stringboard are usually cut out of a solid steel plate which has previously been rolled, after which these parts are welded together.

[0014] Fig. 2A schematically represents a solid steel plate 4, which is rolled in a rolling mill according to the state of the art in a direction indicated by an arrow, with a diameter that corresponds with the diameter of stringboard 2, after which for example parts 5a,5b,5c may be cut out of steel plate 4 and welded together in a longitudinal direction. Obviously, much material is spilled, while welding together the relatively short parts may have a negative effect on the accuracy.

[0015] Fig. 2B schematically represents a composite steel plate 6, consisting of a strip-shaped part 7 which will become part of stringboard 2 and which is welded inside a frame 8, also put together of strips made of steel plate. Composite steel plate 6 is rolled in a rolling mill according to the state of the art in a direction indicated by an arrow, with a diameter that corresponds with the diameter of stringboard 2, after which strip-shaped part 7 is cut out of composite steel plate 6 and used. During rolling, the presence of strip-shaped part 7 will generate a force perpendicular to the rolling direction. The aim of frame 8 is to prevent this force from causing composite steel plate 6 to make unwanted movements, which could negatively influence the accuracy, in fact by imitating a solid steel plate.

[0016] With the rolling mill according to the invention, only a strip-shaped part 7 is guided between the rolls of the rolling mill, of which the rolls have been adjusted such that strip-shaped part 7 will be rolled to a diameter which corresponds to the diameter of stringboard 2. During rolling, the direction of strip-shaped part 7 is stabilised with mechanical means. The force acting onto strip-shaped part 7 in a direction rectangular to the rolling direction results in a sidewards movement of strip-shaped part 7, which movement is according to the invention permitted and even not opposed at all. Fig. 3 schematically represents a possible embodiment of a rolling mill according to the invention, consisting of a frame 9 in which two driven, adjustable rolls 10a, 10b are placed and one non-adjustable possibly driven roll 11. Parallel to rolls 10a, 10b, 11, a first conveyor track 12 is mounted, in this embodiment consisting of a steel profile, onto which a first trolley 13 may ride or slide freely. To a mounting plate 14, connected to first trolley 13, a second conveyor track 15 is hingedly mounted round a hinge point 16. The angle between first conveyor track 12 and second conveyor track 15 may be selected with the aid of an adjusting rod 17, mounted between mounting plate 14 and second conveyor track 15. Via second conveyor track 15 a strip, not shown here, is supplied to the rolling mill, in the process of which the strip is clamped in a clamp 18 which is mounted onto a second trolley 19 which may ride or slide freely over second conveyor track 15. Close to the rolling mill, the strip is sidewards supported with the aid of two rolls 20a,20b. The rolls 10a, 10b, 11 can pull the strip inwards, with the angle being completely determined, while the strip is free to move in a sidewards direction. Preferably, a free end of second conveyor track 15 is supported, for example with the aid of a leg 22 mounted onto a swivelling wheel 21. As soon as the strip approaches due to the sidewards movement an end of a roll, one slightly lowers rolls 10a,10b, after which the strip is moved to the other end of the roll, together with first trolley 13 and second conveyor track 15. Then rolls 10a,10b are brought in their original position and the rolling process may be continued.

Claims

1. Rolling mill for milling helically shaped metal strips, like for example stringboards of staircases, comprising a frame, provided with at least three rollers of which at least one roller is mounted adjustable, drive means for driving at least one of the rollers and supply means for the supply of material to be rolled towards the rollers, **characterised in that** the supply means are arranged for supplying metal strip material as material to be rolled.

2. Rolling mill according to claim 1, **characterised in that** supply means comprise a first conveyor track, mounted to the frame, as well as a trolley, slidably mounted onto the first conveyor track and provided with a clamping arrangement for clamping the metal strip.

3. Rolling mill according to claim 2, **characterised in that** the first conveyor track is at least near the frame provided with guiding means, for guiding the metal strip.

4. Rolling mill according to claim 2, **characterised in that** the first conveyor track is hingedly connected to the frame.

5. Rolling mill according to claim 4, **characterised in that** a second conveyor track is provided, which is mounted to the frame, at least substantially parallel

to a non-adjustable roller, which second conveyor track is provided with a second trolley, to which the first conveyor track is hingedly connected.

6. Conveyor system, comprising a second conveyor track, provided with a second trolley, a first conveyor track, hingedly mounted to the second trolley and provided with a first trolley with a clamping arrangement mounted onto it, suitable to be mounted as part of a rolling mill according to one of the claims 1 to 5.

7. Method for rolling helically shaped metal strips, like for example stringboards of staircases, in the process of which material to be milled is guided between a system of rollers, **characterised in that** the material is guided between the rollers as strip metal.

8. Method according to claim 7, **characterised in that** the material is guided between the rollers under a previously determined angle.

9. Method according to claim 8, **characterised in that** the material is guided between the rollers in such a way that it may freely move in a direction parallel to a non-adjustable roller.

10. Method according to claim 9, **characterised in that** the rolling of a strip is periodically interrupted, after which a mutual distance between at least two rollers of the system of rollers is increased, after which the material is moved in a direction parallel to the rollers, after which the distance between the at least two rolls is decreased to the starting position, after which the rolling is resumed.

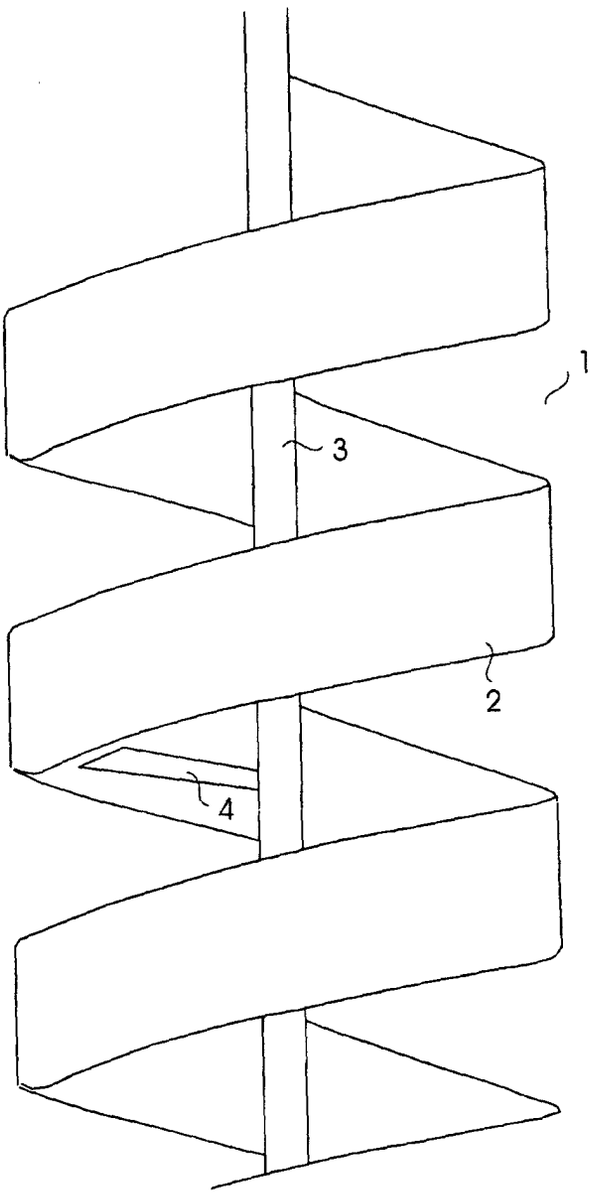

Fig. 1

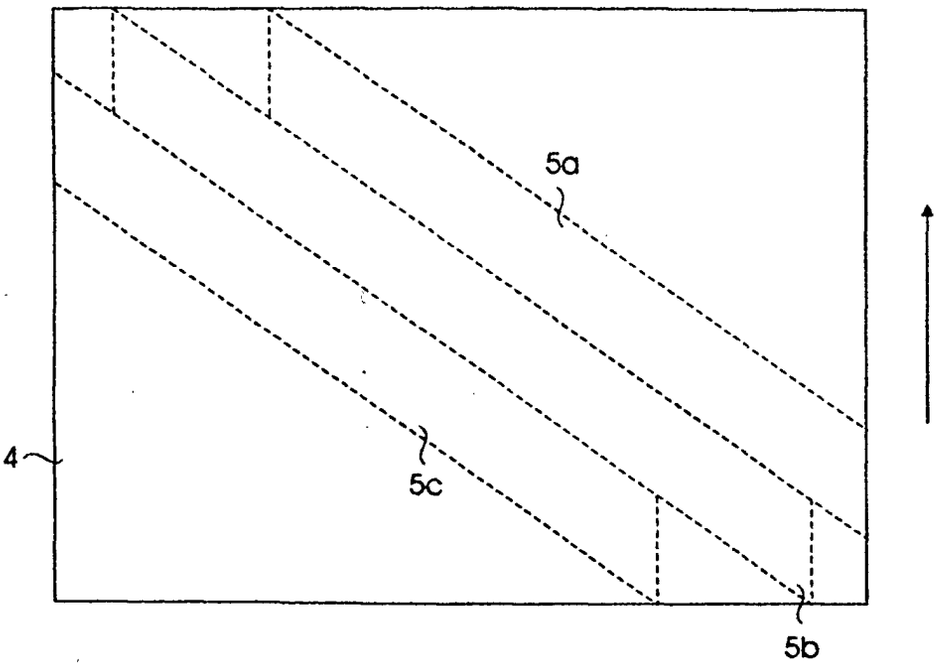

Fig. 2A

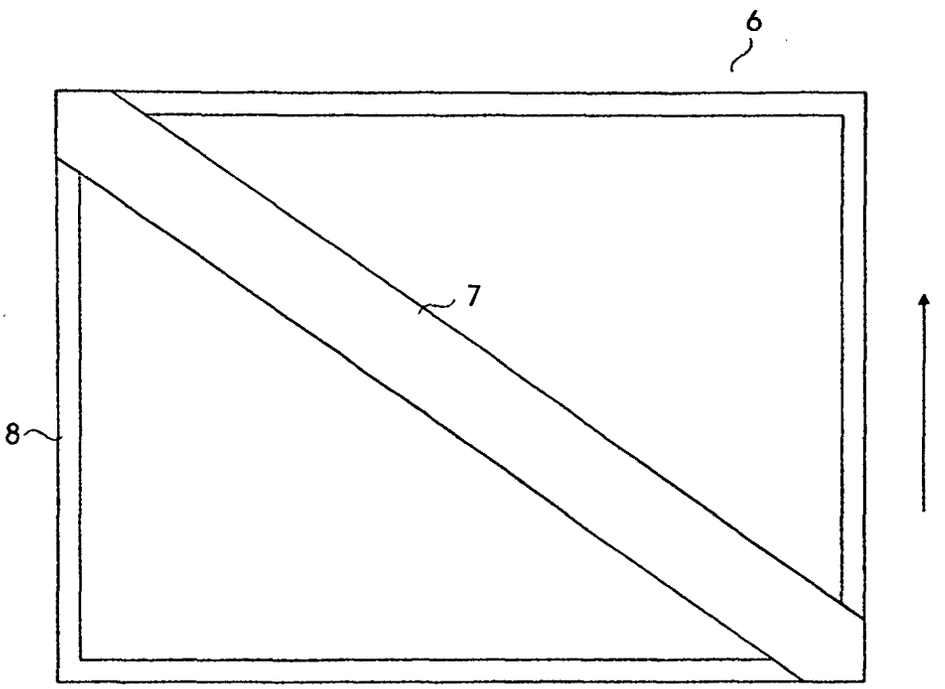

Fig. 2B

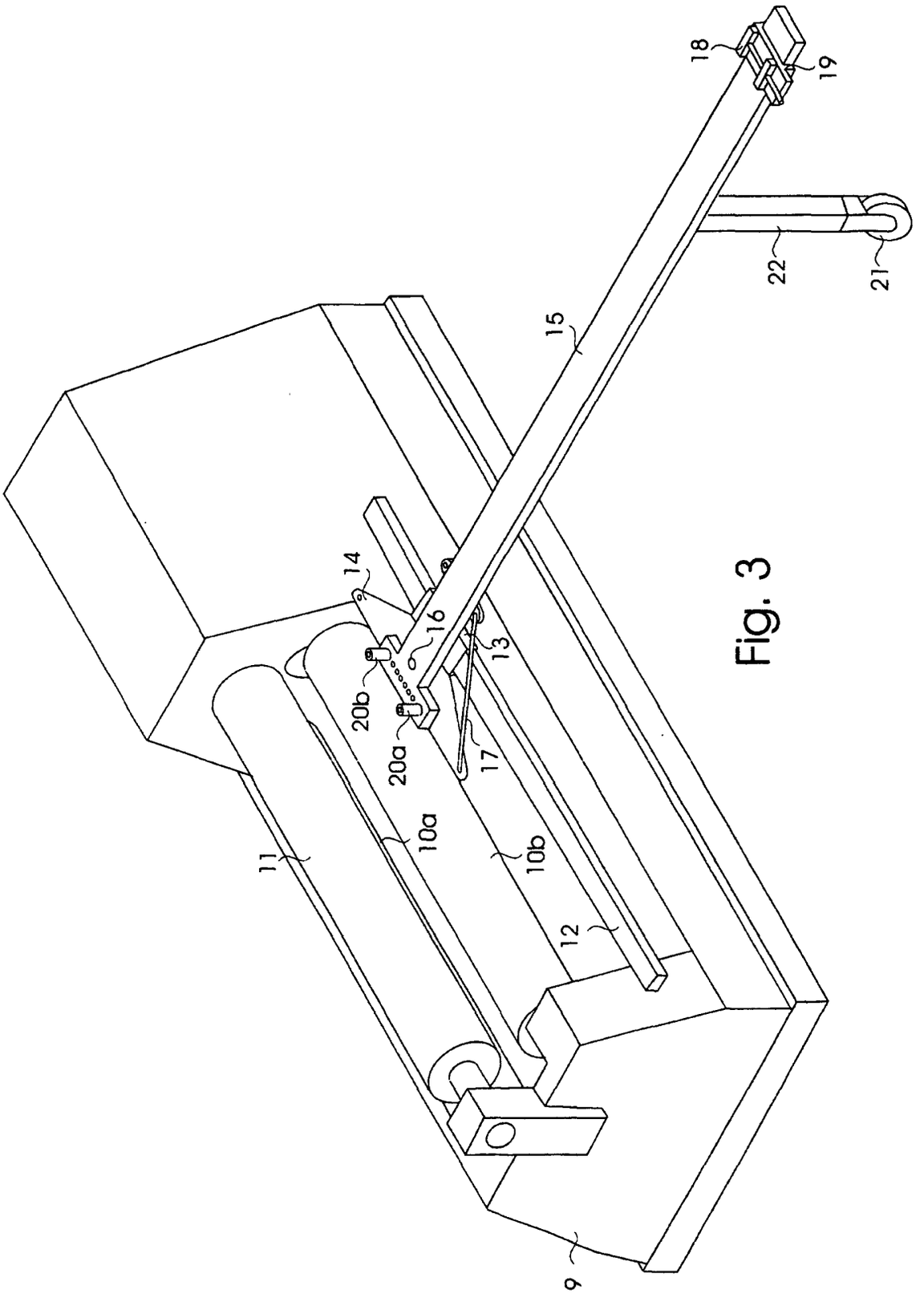

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 04 07 7892

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)
B21D
B21C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 January 2005	Ris, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 07 7892

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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