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71 Applicant: **KYOEI STEEL LTD.**
1-go, 1-ban, 3-chome Nakamiya Oike
Hirakata Osaka Prefecture(JP)

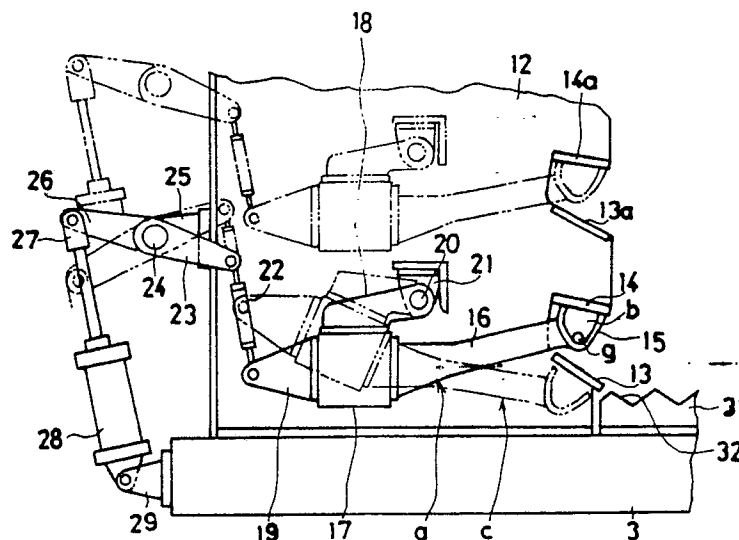
72 Inventor: **Zensai, Junichi**
3-go, 8-ban, 3-chome Miyokenhigashi
Katano Osaka Prefecture(JP)

74 Representative: **Westwood, Edgar Bruce et al**
STEVENS, HEWLETT & PERKINS 5, Quality
Court Chancery Lane
London WC2A 1HZ(GB)

54 **A cooling bed for steel bar.**

57 A cooling bed (3) for steel bar (G) has a run-in table (1) so designed that jumping of bar steel G out of the run-in table (1) can be prevented and bar steel can be stopped exactly at a predetermined position for supply onto the cooling bed (3). The run-in table (1) comprises a trough (a) pivotable about an axis 20 and which when pushed upwardly from below against a closure plate (14) forms a run-in trough of closed shape (b). When swung down the steel bar (G) is taken onto a sloping chute (13) and slides down onto the cooling bed (3).

FIG.3



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A COOLING BED FOR STEEL BAR

This invention relates to a cooling bed for hot rolled steel bar which is intended to preventing steel bar rolled in the required shape by rolls of a final finishing stand from jumping out of a run-in table, for preventing finished products from bending and for stopping them at a fixed position so as to feed them reliably to a succeeding process.

Conventionally, in the production of steel bar by means of hot rolling, in order to manufacture products of high accuracy having the desired diameter and the desired length effectively with less loss, ingots or billets of uniform unit weight should be used as material. However, it is practically impossible to have all ingots, billets, etc. uniform in weight. Depending upon the diameter of the steel bar to be produced, at an intermediate process in which the same material is rolled each material is cut into pieces of a fixed unit length, but in general, a final cut piece of one lot is shorter than the fixed length. Therefore, steel bar finished products conveyed from the final finishing rolls, when they are transferred on a run-in table of a cooling bed, are difficult to stop at a predetermined position because of the difference in inertia corresponding to the rolling speed. With this in view, in designing a cooling bed the length of a run-in table is made longer to allow a margin. This leads to a higher cost of equipment and a larger size of mill structure for equipment. Moreover, when steel bar is cooled and sent to a succeeding process, it is required to align the top ends of finished products, otherwise troubles may occur. This aligning process of the top ends must be done manually or by a separate device.

In order to prevent the above trouble, it has been suggested to stop a steel bar which has passed through a final rolling process at a predetermined position, when it is conveyed on a run-in table.

In order to improve production efficiency, it has been suggested to increase the speed at which a steel bar is conveyed on a run-in table. However, the speed at which a steel bar is conveyed on a run-in table is generally less than 17m/sec. and a guide device at a cooling bed run-in table is of L-shape and also of upwardly open type is so designed that bar steel in the guide device falls onto the cooling bed from within the guide by means of a kick off device. Therefore, if the rolling speed is higher than 17m/sec., such problems as finished products jumping out of the guide device, a steel bar being bent at a part where it was kicked off and others were inevitable.

In the guide device at a cooling bed run-in table of high speed steel bar rolling equipment, it

has been proposed that a semicircular guide of fixed type and a semicircular movable guide, positioned opposite each other, be formed into a cylindrical guide by a closing motion mechanism that this cylindrical guide act as a guide for a high speed rolling (higher than 17m/sec.) run-in table for small steel bars. However, the driving mechanism of a movable guide is generally complicated, especially the many pins and bearing parts of a link mechanism are liable to become shaky due to wear caused by trembling motions at high speed and high frequency. Moreover, as a result of accumulation of such shakiness, irregularity of the opening and shutting motion of the movable guide occurs frequently and also gaps are caused due to incomplete closing, with the result that small steel bar is bitten into such gaps and the guide is clogged with steel bar, which leads to stop of the succeeding rolling operation and much less time required for interchanging guides.

Jumping out and bending of finished products in the high speed rolling can be eliminated by changing the structure of the run-in trough.

SUMMARY OF THE INVENTION

At the frame of cooling bed according to the present invention are devised with plural shoots of steep slope in falling down direction, a fixed upper plate of gentle slope above the said shoots, a groove type trough which, when pushed upwardly to the fixed upper plate, forms a run-in trough and a movable trough having a lever which supports said groove type trough movably and a cylinder for opening and shutting said movable trough. In the position where the movable trough and parts connected thereto are hung down freely with a pin of the arm swinging lever, both edges of the groove type trough maintain weight balance as if pressing force were applied to the fixed upper plate.

An example of a cooling bed for steel bar according to the present invention will now be described with reference to the accompanying drawings, in which:-

Fig. 1 is a plan view of an outline of the cooling bed;

Fig. 2 is a side view of the cooling bed of Rechen type;

Fig. 3 is a side view of a trough part; and

Fig. 4 is a plan view of the trough part.

In the drawings, reference A denotes the whole of a cooling bed according to the present invention.

The cooling bed A has a run-in table at one side thereof and a run-out table 2 at the other side thereof, both being in parallel with each other. A Rechen type cooling bed proper 3 is arranged between both tables 1, 2. Steel bars G supplied from the run-in table 1 are placed one by one on the cooling bed proper 3 as they are put in a direction crossing the direction in which they are conveyed on the run-in table. While steel bars are conveyed on the cooling bed proper 3, they are cooled down to the desired degree and after cooling, they are taken out of the run-out terminal table 2 at a terminal end of the cooling bed proper 3.

Arranged in front of the upstream end of the run-in table 1 are final finishing rolls 4. The top end of a steel bar G which has passed through the rolls 4 is detected by a sensor 5 (photoelectric or other type) arranged at the required position relative to the run-in table 1. The sensor 5 is connected electrically to an automatic control circuit 6 to which is connected a braking device 7 set at the required position of the run-in table 1. With this arrangement, upon the sensor 5 detecting the top end of the steel bar G being fed, the control circuit 6 measures the timing according to the running speed of the steel bar and the distance between the sensor and a braking position (or a fixed position at which the steel bar is to be stopped) and operates the braking device, whereby the steel bar stops exactly at the fixed position.

The steel bar G which is stopped at the fixed position is kicked off to the side of the cooling bed proper 3. This kicking off of the steel bar G is done by a groove type trough provided at the run-in table 1 and a steeply sloping chute, as shown in Fig. 3.

An explanation is made below about the structure of the groove type trough.

Fig. 3 shows the lower main portion of the device according to the present invention. A required number of frames 12 are fixed on the upper part of the cooling bed proper 3 throughout its whole length at regular intervals. Each frame 12 is connected with the lowest steeply sloping chute 13 and another steeply sloping chute 13a is provided above the chute 13. Spaced above the chutes 13, are fixed upper trough - closure plates 14, 14a.

Open groove type troughs 15 co-operable with both the fixed upper plates 14 and the chutes are mounted on arms 16, being separated into plural units in each frame and arranged in series. The arm 16 is screwed to a fitting beam 17, to which are fixed an arm swinging lever 18 and an arm driving lever 19. Reference numerals 15, 16, 17, 18 and 19 compose a one-body movable trough construction supported swingably about an axis 20 of a bracket 21. The arm driving lever 19 is connected by a pin to a link swinging lever 23 via a

turn buckle 22. A link swinging lever 23 is fixed to a link shaft 24, which is connected to the cooling bed in its whole length and is supported on the frame 12 by bearings 25. A driving position for the link shaft 24 is provided at about the central part of the cooling bed. A driving shaft lever 26 fixed to the link shaft 24 is connected by pin to a free end 27 of a cylinder 28 which is fixed to the cooling bed by a fitting seat 29.

The motion of the run-in trough device of the cooling bed with the above construction will now be explained.

Open troughs 15 arranged over the whole length of the cooling bed are transformed into closed tubular trough configurations B by the pushing up motion of the air cylinder 28. After the preparation for entry of finished products is completed by the entry of the finished products into the run-in trough b and stopping being signalled, the air cylinder 28 moves downwardly and the movable trough 15 descends. In the course of its descent, the finished product G in the trough 15 is put on the chute 13 on which it slides down to fall on a first step groove 32 of a straightening table 31 of the cooling bed proper 3. In the foregoing motion, the movable trough a completes its downward opening motion at a position c below the chute 13, and before the next finished product enters the air cylinder 28 is raised and the open movable trough in opened position is restored to the closed configuration b ready for the following process. The foregoing motion is done by one and the same mechanism, covering from the next portion to the uppermost portion.

As shown in Fig. 2, in a Rechen type cooling bed 3 movable rakes 33 which are saw-toothed on their top surface and extend the whole length of the cooling bed are held by saddles 34. The saddles 34 straddles over an eccentric sheaves 35 and axles 36 make one revolution by a signal of the sensor 5 and moves by only one pitch of saw-teeth. Such motion is repeated in succession so that a steel bar is transferred from the run-in table side toward the run-out table side, during which the steel bar is cooled down.

According to the present invention, steel bars are supplied onto a cooling bed at a predetermined position, with top ends thereof aligned. Therefore, the succeeding feeding out process can be carried out precisely. When the movable trough a is supported in freely hanging state by an axis 20, such point of support by the axis is selected in due consideration of the weight balance of the structure so that both edges of the trough 15 press the undersurface of the fixed upper plate 14 and therefore even if gaps (shaking) take place and build up due to wear of any movable connecting parts, including the supporting point of the axis 20, which

are caused by repeated opening and closing motion at high frequency and high speed, opening and closing motion of the movable trough a is not hindered, which is one of characteristics of this system.

Irregularity of processing accuracy or irregularity composing parts for the movable trough a, namely, the trough 15, the arm 16, the fitting beam 17, the arm swinging lever 18 and the arm driving lever 19, and incomplete contacts of both edges of the trough 15 and the fixed plate 14 are all remedied individually and easily.

As both edges of the groove type trough 15 of the movable trough a, in close contact with the undersurface of the fixed upper plate 14, form a cylindrical trough b in closed position and are maintainable, there is no fear that small steel bars bite into gaps of the trough, resulting in clogging and run out, resulting in stop of the following rolling process.

Since the component parts of the present device are fewer in number and the movable trough a in a one-body construction itself maintains a weight balance with the supporting point as centre, total consumption of electric power required for the opening and closing motion is reduced to a large extent.

Not only spare parts, consumables, etc. can be saved considerably, but also power saving effect and labour saving effect are large because of easy maintenance and inspection. Also, high speed rolling (higher than 17m/sec.) is made possible and small steel bars (60 - 80) can be conveyed to a cooling bed in straight-bar condition. Thus, this invention can be said most effective and practical.

Claims

1. A cooling bed (A) for hot rolled steel bar comprising a run-in table (1), characterised in that the run-in table (1) comprises an open trough (a) pivotally supported for movement in a vertical plane between a raised position (b) in which the trough assumes a closed configuration by abutment against a closure plate (14) for accepting steel bar (G) fed to the run-in table, and a lowered position (c), a steeply sloping chute (13) for taking the steel bar (G) from the trough during the latter's descent from position (a) to position (c) and permitting bar (G) to slide thereover onto the cooling bed proper (3) and means (5, 6) for stopping steel bar (G) fed to the run-in table (1) at a predetermined position on the run-in table (1).

2. A cooling bed (A) for steel bar, comprising a plurality of chutes (13) steeply sloping in the downwards direction, a fixed upper plate (14) of gentle slope above the chutes (13), a groove type trough

(15) which is movable and has an arm (16), an arm fitting beam (17), an arm driving lever (19) and an arm swinging lever (18) all (15 - 19) being connected to one another integrally, so that the groove type trough (15) when pushed from below upwardly against said fixed upper plate (14) forms a run-in trough in closed shape (b), said driving lever (19) being connected to a swinging lever (23, 26) through the medium of a turn buckle (22), said swinging lever (23, 26) being fixed to a link shaft (24) which is connected to an air cylinder (28) for operation to open and close said movable trough, the one-body construction of the movable trough maintaining weight balance as if both edges of the groove type trough (15) applied pressure force to the fixed upper plate (14) when the movable trough is hanging on a support pin (20).

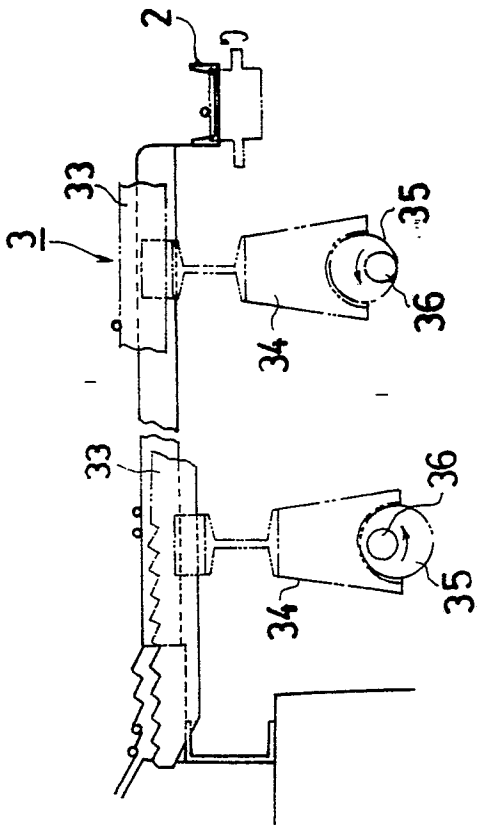


FIG. 2

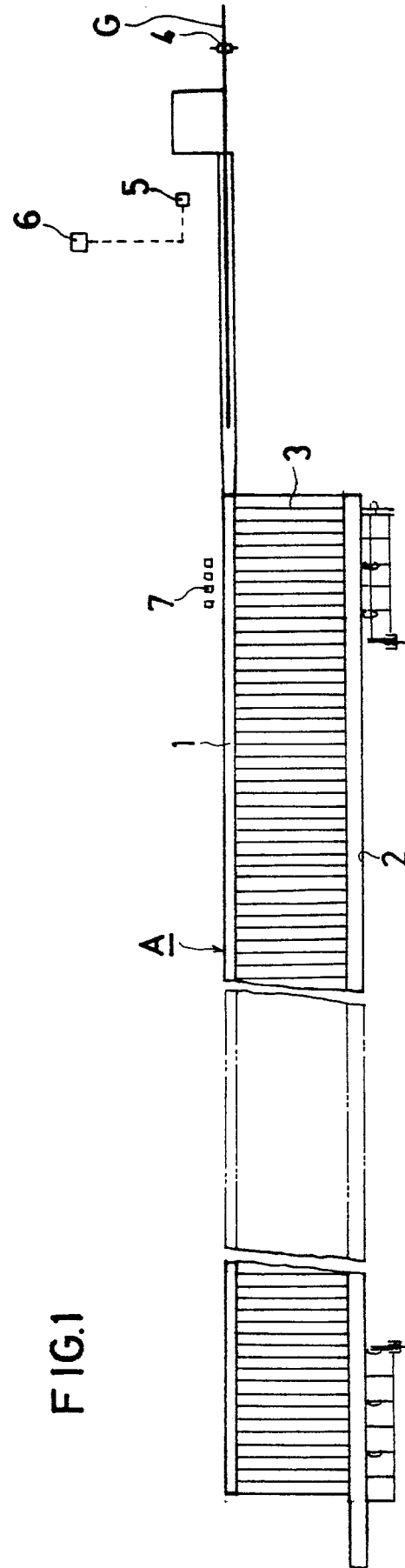
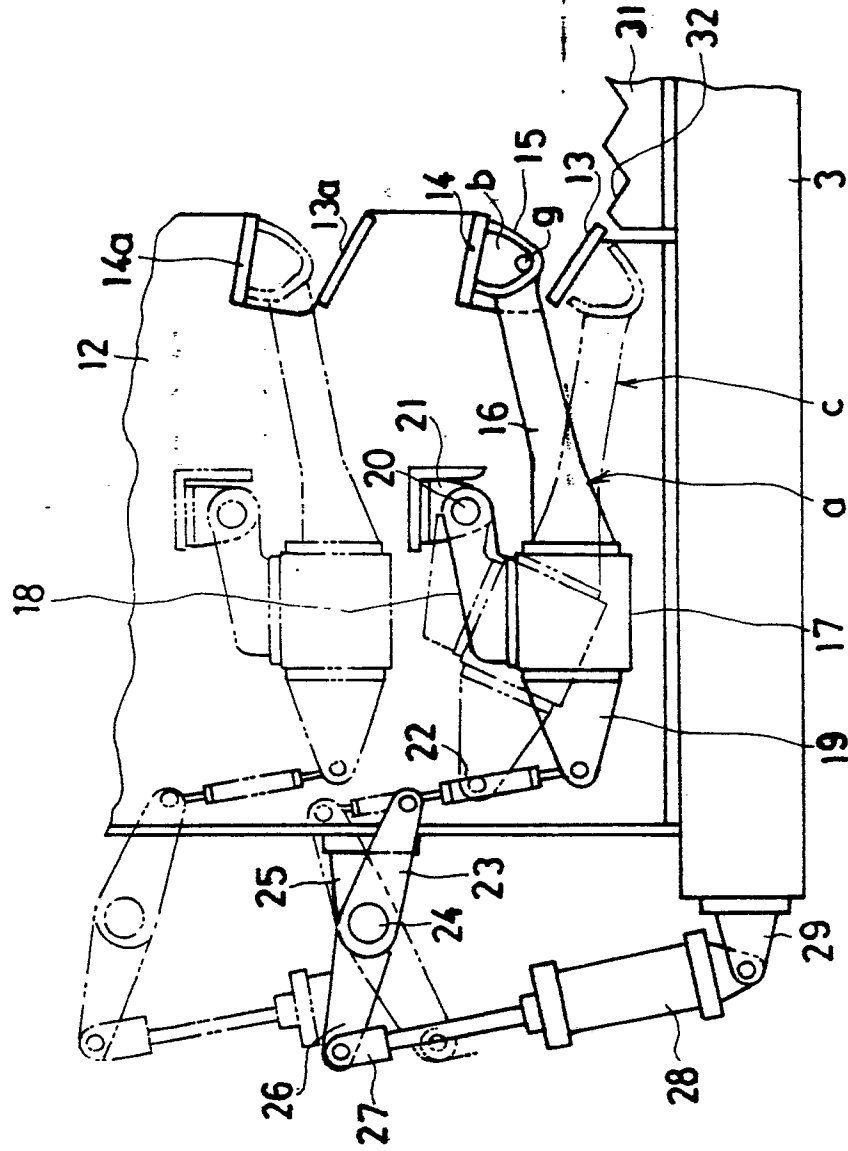
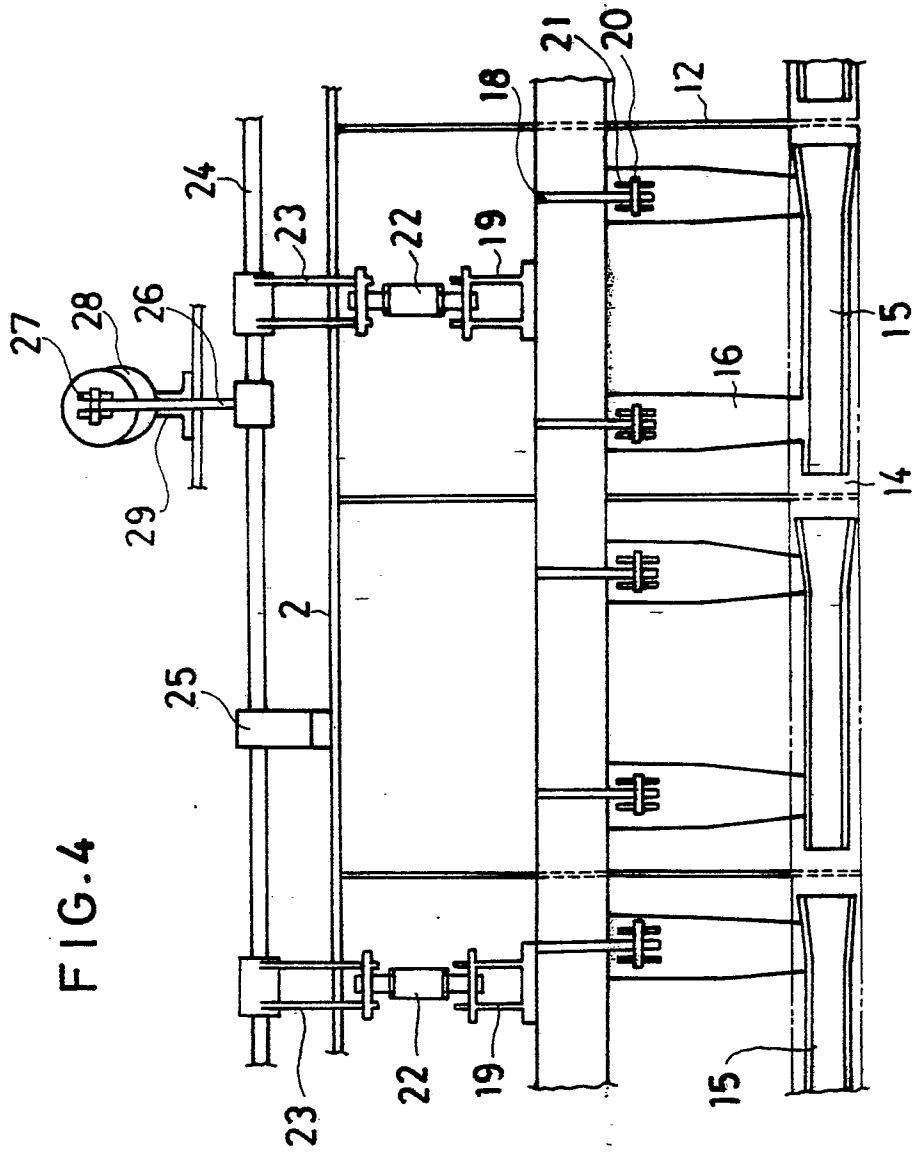


FIG. 1

FIG.3







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.4)												
X	DE-C- 923 963 (MORGARDSHAMMARS MEK. VERKSTADS AB) * Whole document * ---	1,2	B 21 B 43/00												
X	EP-A-0 189 616 (DANIELI) * Pages 3-5; figures * ---	1,2													
X	DE-C- 465 625 (NÖLL) * Page 1; figure 1 * ---	1,2													
X	DE-C- 483 199 (DEMAG) * Whole document * ---	1,2													
A	DE-A-3 145 739 (VEB SCHWERMASCHINENBAUKOMBINAT "ERNST THÄLMANN" MAGDEBURG) * Pages 5,6; figure 1 * -----	1													
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)												
			B 21 B												
The present search report has been drawn up for all claims															
Place of search THE HAGUE		Date of completion of the search 12-06-1989	Examiner ROSENBAUM H.F.J.												
<table border="0"><tr><td>CATEGORY OF CITED DOCUMENTS</td><td>T : theory or principle underlying the invention</td></tr><tr><td>X : particularly relevant if taken alone</td><td>E : earlier patent document, but published on, or after the filing date</td></tr><tr><td>Y : particularly relevant if combined with another document of the same category</td><td>D : document cited in the application</td></tr><tr><td>A : technological background</td><td>L : document cited for other reasons</td></tr><tr><td>O : non-written disclosure</td><td>.....</td></tr><tr><td>P : intermediate document</td><td>& : member of the same patent family, corresponding document</td></tr></table>				CATEGORY OF CITED DOCUMENTS	T : theory or principle underlying the invention	X : particularly relevant if taken alone	E : earlier patent document, but published on, or after the filing date	Y : particularly relevant if combined with another document of the same category	D : document cited in the application	A : technological background	L : document cited for other reasons	O : non-written disclosure		P : intermediate document	& : member of the same patent family, corresponding document
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