(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 331 340 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **08.09.93** (51) Int. Cl.5: **B21B 43/00**

(21) Application number: **89301722.8**

(22) Date of filing: **22.02.89**

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

(30) Priority: **22.02.88 JP 22898/88**

(43) Date of publication of application:
06.09.89 Bulletin 89/36

(45) Publication of the grant of the patent:
08.09.93 Bulletin 93/36

(84) Designated Contracting States:
DE ES FR GB IT

(56) References cited:
EP-A- 0 189 616
DE-A- 3 145 739
DE-C- 465 625
DE-C- 483 199
DE-C- 923 963

(73) Proprietor: **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: **Brooke-Smith, Fred et al**
Stevens, Hewlett & Perkins 1 Serjeants' Inn
Fleet Street
London EC4Y 1LL (GB)

Rank Xerox (UK) Business Services
(3.10/3.6/3.3.1)

Description

This invention relates to a cooling bed and apparatus for transferring hot rolled steel bar to a thereto.

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 the final cut piece of the lot is often 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. However, when steel bar is cooled and sent to a succeeding process, it is required to align the leading ends of finished products, otherwise troubles may occur. This aligning process of the leading ends can 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. 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 means of a kick off device.

However, 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. If the rolling speed is higher than 17m/sec., such problems as finished products jumping out of the guide device, or a steel bar becoming bent where it was kicked 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 fixed type guide and a semicircular movable guide, positioned opposite each other, be formed into a closed guide by a closing motion mechanism and that this closed 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 high speed rolling can be eliminated by changing the structure and operation of the run-in table so that it forms part of a transfer apparatus for the steel bar.

DE-C-923963 discloses a cooling bed and a transfer arrangement for metal bar according to the pre-characterizing part of claim 1 in which grooved receiving elements for the bar are carried by sliding rotating elements which cause the receiving elements to tip the bar out on to a chute leading to a cooling bed.

According to the present invention there is provided a cooling bed and apparatus for transferring hot rolled steel bar thereto comprising a run-in table and means for stopping steel bar fed to the run-in table at a predetermined position on the run-in table, the run-in table being formed in a plurality of sections spaced lengthwise of the bar, each section comprising an open trough movable into an upper position abutting a closure plate to receive bar fed to the run-in table and into a lower position to discharge the bar, and a sloping chute for conveying the bar from the trough to the cooling bed, characterized in that the chute is formed in sections aligned lengthwise of the run-in table and disposed at a level above the troughs when the troughs are in their lower position, so as to remove the bar from the open troughs during the downward movement of the troughs.

An example of a cooling bed and transfer apparatus 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 a cooling bed arrangement incorporating the invention,

Fig. 2 is a side view of the cooling bed arrangement of Figure 1,

Fig. 3 is a side view of the transfer apparatus, and

Fig. 4 is a plan view of the apparatus.

In the drawings, reference A denotes the whole of a cooling bed arrangement incorporating the present invention. The cooling bed A has a run-in table 1 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 leading 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 leading 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 transferred to the side of the cooling bed proper 3. This transfer of the steel bar G is done by troughs forming the run-in table 1, and a steeply sloping chute, as shown in Figure 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 a 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. The 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 sawteeth. 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.

In use of the apparatus according to the present invention, steel bars are supplied onto a cooling bed at a predetermined position, with leading 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 closed 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 (3) and apparatus for transferring hot rolled steel bar (G) thereto, comprising a run-in table (1), and means (5, 6) for stopping steel bar (G) fed to the run-in table at a predetermined position on the run-in table, the run-in table being formed in a plurality of sections spaced lengthwise of the bar, each section comprising an open trough (15) movable into an upper position abutting a closure plate (14a) to receive bar fed to the run-in table and into a lower position to discharge the bar, and a sloping chute (13) for conveying the bar from the trough to the cooling bed (3), characterized in that the chute is formed in sections aligned lengthwise of the run-in table and disposed at a level above the troughs (15) when the troughs are in their lower position, so as to remove the bar from the open troughs during the downward movement of the troughs.

2. A cooling bed as claimed in claim 1, wherein each trough (15) is mounted on one end of a lever (16-19) which is pivotable about a fixed axis (20) disposed intermediate the ends of the lever engagements and extending parallel to the trough.

3. A cooling bed as claimed in claim 2, wherein the lever (16-19) is so balanced that when the trough is in its upper position the sides of the trough (15) are held against the closure plate (14), the lever being movable into said lever position by an actuator (28) connected to the other end of the lever.

4. A cooling bed as claimed in claim 3, wherein said actuator (28) is connected to rotate a common shaft (24) extending parallel to the troughs, and individual actuating lever (23) on said shaft are connected to the levers of the respective troughs through respective links incorporating turnbuckles (22).

Patentansprüche

1. Kühlbett (3) und Vorrichtung zum Zuführen von warm gewalztem Stabstahl (G), mit einem Einlauftisch (1) und Mitteln (5,6) zum Anhalten des dem Einlauftisch zugeführten Stabstahls (G) in einer vorbestimmten Lage auf dem Einlauftisch, der aus mehreren, im Abstand längs des Stabes angeordneten Teilstücken besteht, wobei jedes Teilstück einen zum Aufnehmen des dem Einlauftisch zugeführten Stabes in eine obere, an eine Verschlußplatte (14a) angrenzende Stellung und zum Entladen des Stabes in eine untere Stellung bewegbare offene Rinne (15) und eine geneigte Rutsche (13) zum Überführen des Stabes von der Rinne zum Kühlbett (3) aufweist, **dadurch gekennzeichnet**, daß die Rutsche aus längs des Einlauftischs ausgerichteten und in der unteren Stellung der Rinnen (15) auf einem Niveau oberhalb der Rinnen angeordneten Teilstücken gebildet ist, derart, daß der Stab während der Abwärtsbewegung der Rinnen aus den offenen Rinnen entnommen wird.

2. Kühlbett nach Anspruch 1, **dadurch gekennzeichnet**, daß jede Rinne (15) an einem Ende eines Hebels (16 - 19) montiert ist, der um eine zwischen den Enden der Hebeleingriffe angeordnete und parallel zu den Rinnen verlaufende feststehende Achse (20) schwenkbar ist.

3. Kühlbett nach Anspruch 2, **dadurch gekennzeichnet**, daß der Hebel (16 - 19) derart im Gleichgewicht steht, daß die Seitenwände der Rinne (15) in der oberen Stellung der Rinne gegen die Verschlußplatte (14) gehalten werden, wobei der Hebel durch ein mit dem anderen Hebelende verbundenes Betätigungsglied

(28) in die genannte Hebelstellung bewegbar ist.

4. Kühlbett nach Anspruch 3, **dadurch gekennzeichnet**, daß das Betätigungsglied (28) zum Drehantrieb einer gemeinsamen, parallel zu den Rinnen verlaufenden Welle (24) vorgesehen ist, und daß einzelne an der Welle angeordnete Betätigungshebel (23) mit den Hebeln der jeweiligen Rinnen über jeweilige Verbindungsglieder verbunden sind, die eine Spannschraube (22) enthalten.

Revendications

1. Un lit refroidissant (3) et un appareil de transfert de barres d'acier laminées à chaud (G) vers ce lit, comprenant une table de descente (1) et des moyens (5, 6) d'arrêt de la barre d'acier (5) amenée à la table de descente à une position prédéterminée de la table de descente, la table de descente étant formée de plusieurs sections espacées sur la longueur de la barre, chaque section comprenant une auge ouverte (15) mobile vers une position supérieure en butée sur une plaque de fermeture (14a), pour recevoir la barre amenée à la table de descente, et vers une position inférieure pour décharger la barre, et une goulotte inclinée (13) pour transporter la barre de l'auge au lit refroidissant (3), caractérisé en ce que la goulotte est formée de sections alignées sur la longueur de la table de descente et disposées à un niveau supérieur à celui des auges (15) lorsque les auges sont dans leur position inférieure de façon à enlever la barre hors des auges ouvertes pendant le mouvement descendant des auges.

2. Un lit refroidissant selon la revendication 1, dans lequel chaque auge (15) est montée sur une extrémité d'un levier (16 - 19) qui peut pivoter autour d'un axe fixe (20) disposé entre les extrémités des contacts des leviers et s'étendant en parallèle à l'auge.

3. Un lit refroidissant selon la revendication 2, dans lequel le levier (16 - 19) est équilibré d'une manière telle que les côtés de l'auge sont maintenus contre la plaque de fermeture (14) quand l'auge est dans sa position supérieure, le levier étant mobile vers ladite position de levier sous l'effet d'un actionneur (28) relié à l'autre extrémité du levier.

4. Un lit refroidissant selon la revendication 3, dans lequel ledit actionneur (28) est relié de manière à faire tourner un arbre commun (24) s'étendant en parallèle aux auges, et des leviers individuels d'actionnement (3) sur ledit arbre sont reliés aux leviers des auges respectives par l'intermédiaire de liaisons respectives incorporant des étriers de serrage à vis axiale (22).

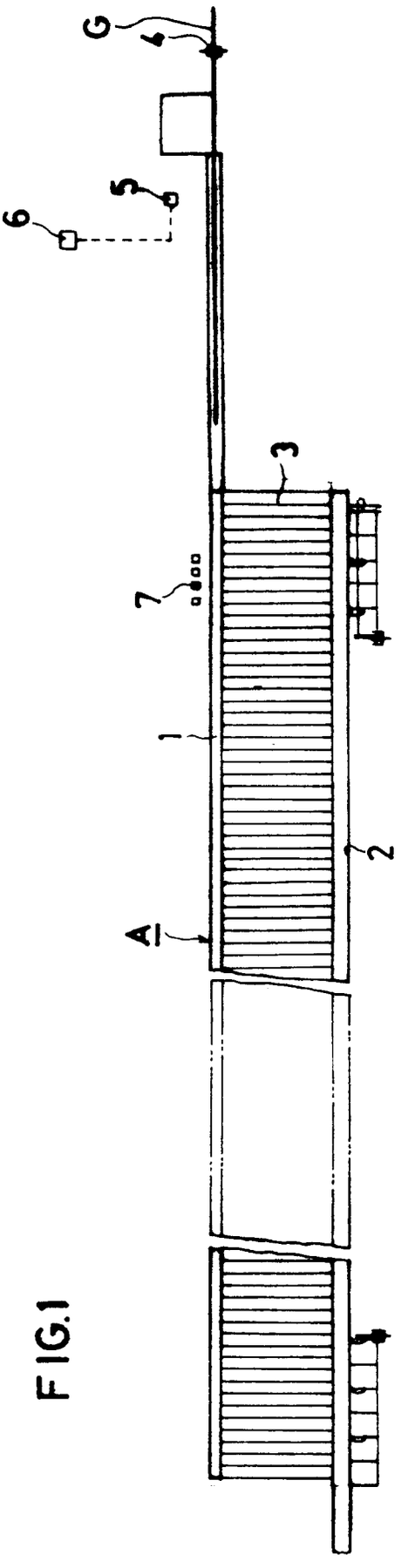


FIG.1

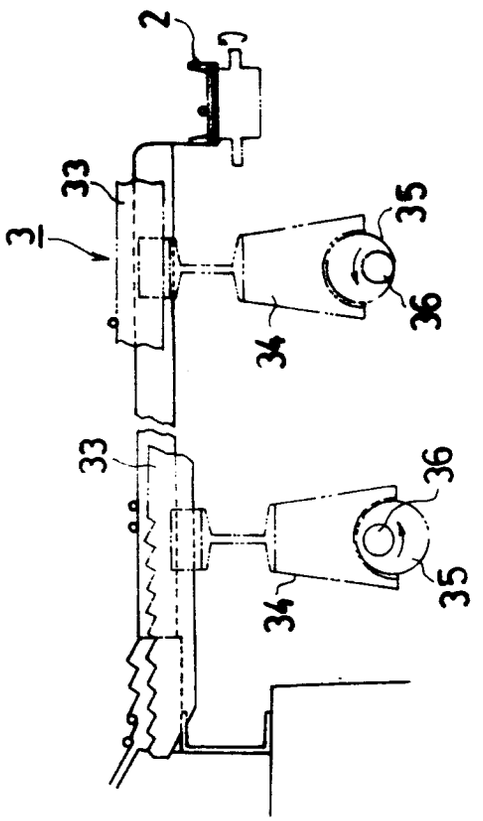
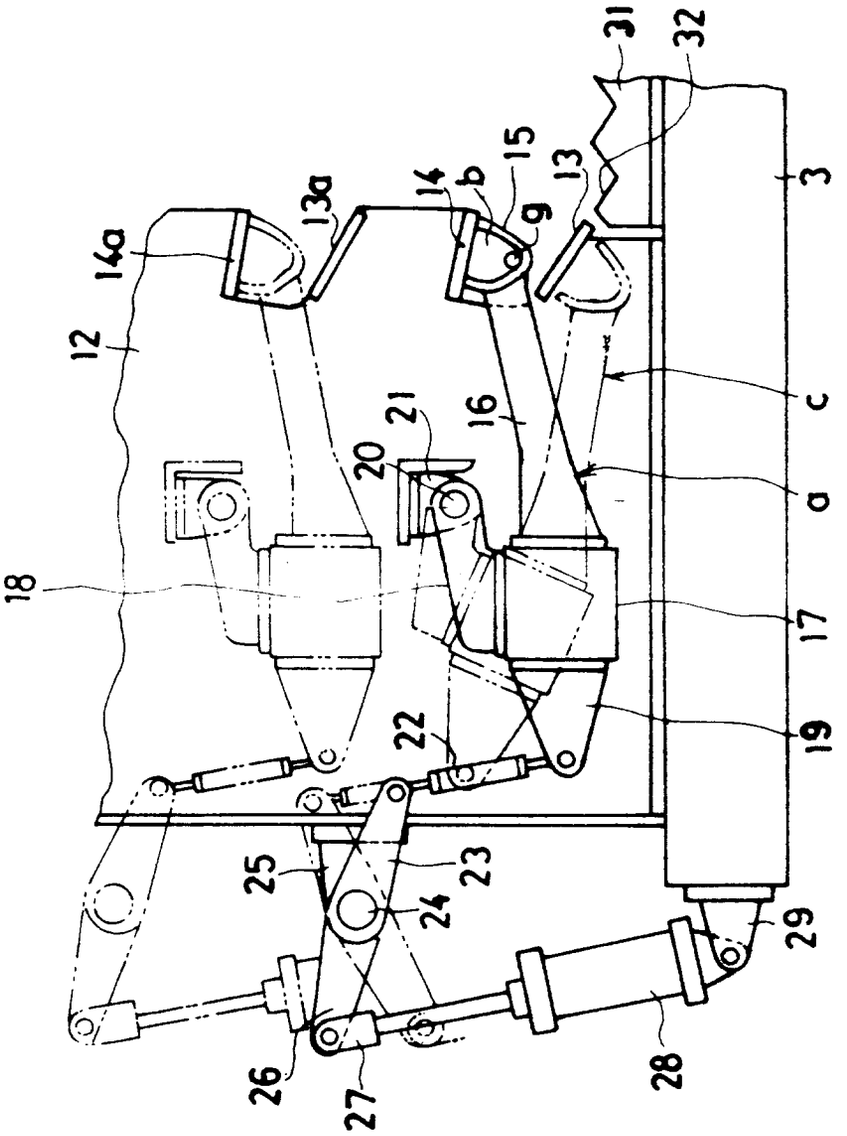


FIG2

FIG.3


31
32
3
15
13
14
b
9
13a
14a
12
c
21
16
20
a
18
17
19
22
25
23
24
29
26
27
28

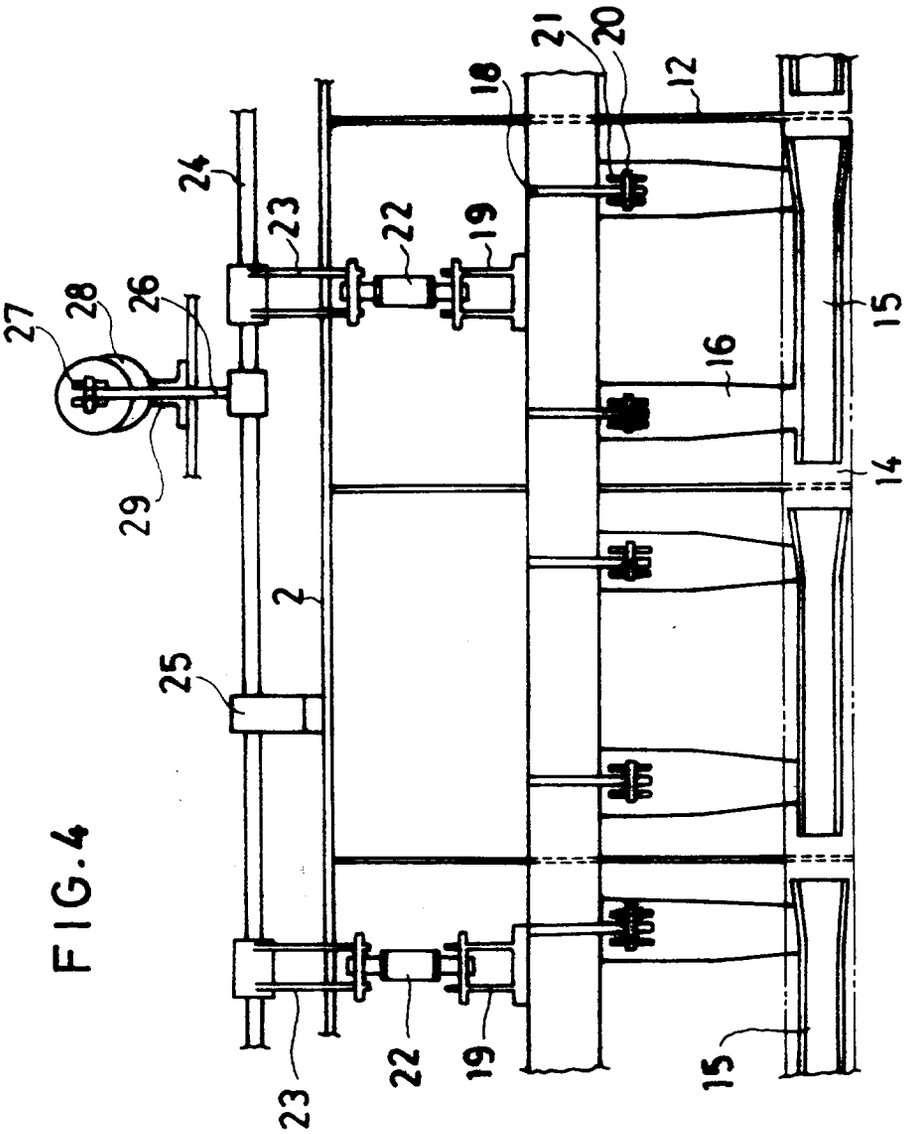


FIG.4