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

(11) Publication number: **0 294 480**
A1

(12) # EUROPEAN PATENT APPLICATION

published in accordance with Art. 158(3) EPC

(21) Application number: **87900282.2**

(51) Int. Cl.³: **B 21 C 47/06**

(22) Date of filing: **25.12.86**

Data of the international application taken as a basis:

(86) International application number:
PCT/JP86/00652

(87) International publication number:
WO88/04966 (14.07.88 88/15)

(43) Date of publication of application:
14.12.88 Bulletin 88/50

(84) Designated Contracting States:
DE FR GB IT

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(54) **COILER.**

(57) A coiler comprises a first frame of which the front end is opposed to the outer periphery of a mandrel that takes up a strap and of which the base end is rotatable about an axis in parallel with the axis of the mandrel, a drive device for turning the first frame, a second frame pivoted to the front end of the first frame to rotate about an axis in parallel with the axis of the mandrel, a second drive device for turning the second frame, a pushing roller which is rotatably supported by the second frame and which assists the winding of the strap onto the mandrel, and a circular guide which is mounted on the second frame so as to be opposed to the mandrel. According to the invention, the function of a frame for operating the unit roller is shared between the second frame which supports the pushing roller and the first frame which turns the second frame. Unlike the conventional apparatus, therefore, there is no limitation on the arrangement, the strap is desirably wound on the mandrel, and the pushing roller exhibits greatly improved response characteristics.

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Fig. 1

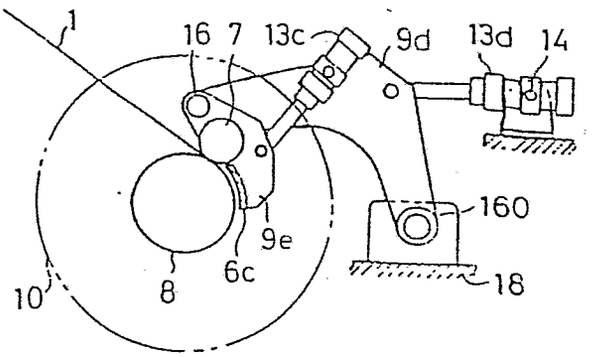
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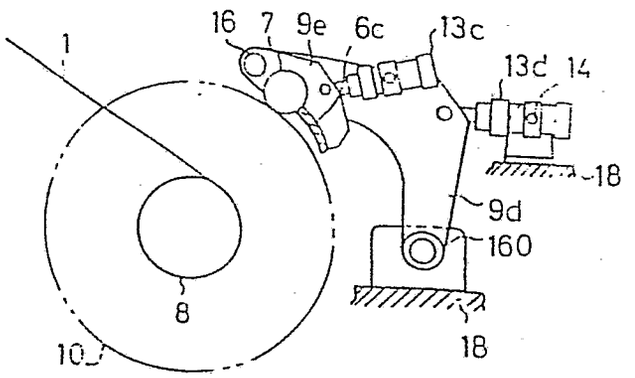
Fig. 2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SPECIFICATION

TITLE OF THE INVENTION

Coiler

TECHNICAL FIELD

This invention relates to a coiler of the type in which a band plate is pressed against a mandrel by rollers.

BACKGROUND ART

The coiler is an installation for coiling a rolled band plate into the form of a coil to facilitate the transportation or shipment thereof to subsequent processes. The known types of coilers are: the unit roller type in which the band plate is pressed against a mandrel by unit rollers and guided by circular guides, the belt horn type in which a belt is disposed so that the band plate is laid along the periphery of a mandrel, the chain horn type in which a roller chain is used instead of the belt, and the gripper type in which the advance of the leading end of the band plate is temporarily stopped when it reaches a mandrel and this leading end is gripped by a gripper provided on the periphery of the mandrel.

The unit roller type is further classified into two types: the roller independent movable type which has

the function of individually opening/closing a plurality of unit rollers provided in one coiler and the roller interlocking movable type in which a plurality of unit rollers are opened/closed by one actuator by means of a link mechanism or a slide mechanism.

Fig. 3 shows a conventional coiler, in which a rolled band plate 1 is conveyed on a roller table 2 and pulled in by a pair of pinch rollers 3a and 3b. Then, this band plate is guided between a gate 4 and an apron 5 and between an over guide 6a and a throat guide 6b, and is pressed against the periphery of a mandrel 8 by a plurality of unit rollers 7. After the leading end of the band plate 1 reaches the mandrel 8, the band plate 1 is bent so as to lie along the periphery of the mandrel 8 by the mandrel 8 and the unit rollers 7, rotating at circumferential speeds faster than the incoming speed of the band plate 1, and by circular guides 6c not rotating together with the mandrel 8; as a result, the band plate is progressively coiled around the mandrel 8 in piled form.

Although each unit roller 7 is controlled such that its circumferential speed becomes identical with the advancing speed of the band plate 1 after the band plate 1 reaches the position of the unit roller 7 and is pressed against the mandrel 8, the circumferential speed of the

mandrel 8 is kept faster than the advancing speed of the band plate 1 until the band plate 1 fastens integrally around the mandrel 8. Then, the band plate 1 lying on the periphery of the mandrel 8, after coiled a few turns in piled form around the periphery of the mandrel 8 by being pressed against the mandrel 8 by means of the unit rollers 7, fastens integrally around the mandrel 8. Generally, it is not necessary after the band plate 1 has fastened around the mandrel 8 that the unit rollers 7 press the band plate 1; hence, the unit rollers 7 are retracted to the outside of an allowable maximum coil 10 which the mandrel 8 can accommodate in coiling.

In the coiler, to improve the capability of the band plate 1 to fasten around the mandrel 8 to thereby reduce scratches that would be formed in the surface of the band plate 1, it is important to decrease the number of turns created up to the moment the band plate 1 fastens around the mandrel 8. Further, it is important to improve the responsibility of the unit roller 7 such that the unit roller 7 runs on a stepped portion of the coiled/piled band plate 1 corresponding to the leading end thereof without any shock to thereby reduce dents (top marks) that would be formed in the stepped portion and enhance the quality of the product coil. Therefore, where the

position of the unit roller 7 is subjected to control, it is necessary to increase the speed of instantaneous shift or the speed of response of the unit roller 7 in the radial direction of the mandrel 8, or where the position of the unit roller 7 is not subjected to control, it is necessary to decrease the reaction force of inertia of the unit roller 7 and of its support mechanism in the radial direction of the mandrel 8.

To improve the capability of the band plate 1 to fasten around the mandrel 8, it is necessary to make a play or sag between the first turn of the band plate 1 and the periphery of the mandrel 8 as small as possible. Further, to improve the responsibility of the unit roller 7, the total weight of the unit roller 7 and its support frame must be decreased, the shift direction in opening/closing of the unit roller 7 must be made to accord closely with the normal direction of the peripheral surface of the mandrel 8, the distance of shift of the unit roller 7 resulting from an increase in diameter of the coiled band plate 1 must be decreased, and so on.

Conventional coilers of the roller independent movable type will now be described with reference to Figs. 7 through 12. In these drawings, among a plurality of unit rollers 7 and of circular guides 6c provided in one

coiler, only one unit roller for pressing the leading end of the incoming band plate 1 against the mandrel 8 at first and one circular guide for guiding the same at first, as well as their support frames, are illustrated with the other identical components being omitted.

The coiler shown in Fig. 7 is featured in that a rotary bearing portion of the unit roller 7 is integral with the circular guide 6c, these components are secured to a main frame 9a which is in turn pivotably supported via a frame bearing 16 by a coiler housing 18, and these components are caused to open/close by means of a hydraulic cylinder 13 supported via a trunnion 14 by the coiler housing 18; hence, this coiler is the most popular one of the roller independent movable type.

To improve the responsibility of the unit roller 7 of the coiler shown in Fig. 7, the coiler shown in Fig. 8 is featured in that the unit roller 7 is rigidly supported by a roller frame 9b of small mass, and a buffer spring 15 is interposed between the main frame 9a and the roller frame 9b. In this coiler, since the circular guide 6c is supported by the main frame 9a, there is the drawback that the shift distance of the roller frame 9b relative to the main frame 9a cannot be made large.

The coiler shown in Fig. 9 is featured in that

an auxiliary circular guide 17 is secured to the roller frame 9b, and the respective tie-in portions of the auxiliary circular guide 17 and the circular guide 6c, which interfere with each other when the auxiliary circular guide 17 shifts relatively with respect to the circular guide 6c, are shaped in the form of comb teeth to prevent interference; hence, this coiler can partly ease the inconvenience of the coiler shown in Fig. 8.

The coiler shown in Fig. 10 is improved in the responsibility of the unit roller 7, because the support and shift motion of the unit roller 7 are achieved independent of the circular guide 6c.

The coiler shown in Fig. 11 is featured in that instead of the spring 15 used in the coiler of Fig. 8 or in addition thereto, a hydraulic cylinder 13 is assembled in, so that the position of the unit roller 7 can be controlled by the hydraulic cylinder 13 such that the unit roller 7 runs on the stepped portion of the coiled/piled band plate 1 corresponding to the leading end thereof without any shock.

The coiler shown in Fig. 12 is featured in that the main frame 9a is shifted by a link mechanism composed of two arms 11.

In the conventional coilers described above, both

the responsibility of the unit roller and the capability of the band plate to fasten around the mandrel cannot be improved appreciably in view of mechanical limitations. The reasons why they are difficult to improve will now be described in greater detail with reference to Figs. 4 through 6.

In the coiler shown in Fig. 4, the frame bearing 16 serving as the center of rotation for the unit roller 7 or the circular guide 6c when they are to be shifted is located outside the allowable maximum coil 10, and even in a type like that shown in Fig. 9 in which the auxiliary circular guide 17 is provided so as to pivot inside the allowable maximum coil 10, the frame bearing 16 serving as the center of pivot of the circular guide 6c itself is located outside the allowable maximum coil 10. If desired to improve the responsibility of the unit roller 7 in the coiler shown in Fig. 4, the angle α between the shift direction of the unit roller 7 and the line connecting the axial center of the unit roller 7 with the axial center of the mandrel 8 must be made to approach zero. If made so, since the unit roller 7 runs on the stepped/raised portion of the coiled band plate 1 whose height corresponds to the thickness t thereof, the distance of shift becomes small, or the shift distance of the unit roller 7 when it retracts

becomes small in case the position of the unit roller 7 is subjected to control; accordingly, the responsibility of the unit roller 7 will be improved. Incidentally, the minimum value of the shift distance of the unit roller 7 is t when $\alpha = 0$ (degree).

For such a purpose as above, if the frame bearing 16 serving as the support point of pivot for both the circular guide 6c and the unit roller 7 is displaced leftward in the drawing from the position shown in Fig. 4 in which it is located outside the allowable maximum coil 10, the relationship between the increasing thickness h of the coiled band plate 1 and the spacing ε left between the peripheral surface of the coiled band plate 1 and the distal end of the circular guide 6c located on the opposite side to the unit roller 7 becomes as illustrated in Fig. 5 by curves a, b and c. In the case of curve c, the mechanism does not achieve its intended function. Also, in a type like the coilers shown in Figs. 8, 9 and 11 in which the roller frame 9b supporting the unit roller 7 is provided on the main frame 9a made integral with the circular guide 6c, the shiftable distance of the unit roller 7 relative to the main frame 9a in the radial direction of the mandrel 8 is small and the relationship between h and ε is identical with the foregoing; thus,

there is the drawback that the value of α cannot be made small.

In Fig. 6, referring to the spacing δ between the leading end of the band plate 1 and the peripheral surface of the mandrel 8 when the leading end of the band plate 1 has taken one turn around the mandrel 8, thereby coming to the piled state and to the angle β defined at the center of rotation of the mandrel 8 between the distal end of the throat guide 6b located on the side of the mandrel 8 and the center of rotation of the first unit roller 7, the smaller the angle β, the smaller is the index value δ representing the dip of the band plate 1. That is, the dip of the first turn of the band plate 1 with respect to the mandrel 8 decreases as the value of δ decreases, and the capability of the band plate 1 to fasten around the mandrel 8 is improved correspondingly.

In the conventional coilers, however, the rotation center 16 of the frame had to be located outside the outer diameter of the maximum coil 10 without exception. Further, (in order to avoide interference when the maximum coil is reached), the frame bearing 16 had to be located at a position where it cannot interfere with an incoming line 19 (a tangent line with respect to both the bottom pinch roller 3b and the outer diameter of the

maximum coil) of the band plate when the maximum coil is reached as shown in Fig. 3. Due to such positional limitations, the unit roller 7, when pivoting about its center of pivot 16, had to be moved or shifted while assuming a certain angle with respect to the line connecting the centers of the mandrel 8 and the unit roller 7; therefore, when running on the stepped portion of the coiled band plate created because of the presence of the thickness thereof, the unit roller had to move considerably. This, therefore, resulted in degradation in the responsibility of the unit roller 7.

Further, to decrease the angle β in the conventional coilers, the unit roller 7 had to be located close to the throat guide 6b. However, the frame bearing 16 could not be displaced leftward in Fig. 4 for the foregoing reasons; as a result, the angle β could not be made small.

DISCLOSURE OF THE INVENTION

It is the object of the present invention to solve the foregoing several problems of the conventional coilers, thus to provide a coiler capable of remarkably improving the responsibility of a unit roller and the capability of a band plate to fasten around a mandrel.

A coiler according to the present invention has a plurality of frame units, each frame unit comprising

a first frame whose point portion faces opposite to the periphery of a mandrel for coiling a band plate and whose base end portion is rotatably pivoted to a shaft parallel to the axial line of the mandrel, a first drive unit for moving the first frame, a second frame rotatably pivoted in the point portion of the first frame to a shaft parallel to the axial line of the mandrel, a second drive unit coupled to the second frame and the first frame for moving the second frame, a pressing roller rotatably supported by the second frame for assisting fastening of the band plate around the mandrel, and a circular guide provided on the second frame so as to face opposite to the mandrel.

According to the present invention, the second frame rotatably supporting the pressing roller is pivoted to the point portion of the first frame and each of these two frames is provided with a driving cylinder; therefore, the location of the point of pivot of the second frame can be freely selected, so that both the angle α shown in Fig. 4 and the angle β shown in Fig. 6 can be made small.

As described above, according to the coiler of the present invention, the frame member for supporting the unit roller is divided into two: the second frame for rotatably supporting the pressing roller and the first

frame for pivotably supporting the second frame; therefore, the limitations in arrangement of the conventional coilers are removed, hence, the capability of the band plate to fasten around the mandrel and the responsibility of the pressing roller are remarkably improved.

The present invention will now be described with reference to a preferred embodiment shown in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1 and 2 are functional schematic diagrams showing an embodiment of a coiler according to the present invention,

Fig. 3 is a schematic diagram showing an exemplary coiler in a band plate rolling installation,

Fig. 4 is a schematic diagram showing a band plate being coiled around a mandrel,

Fig. 5 is a graph illustrating the relationship between the thickness of the coiled band plate and the spacing left between the band plate and a circular guide,

Fig. 6 is a schematic diagram showing the band plate whose leading end has taken one turn around the mandrel, thereby coming to the piled state, and

Figs. 7 through 12 are mechanical schematic diagrams showing conventional coilers.

BEST MODE FOR CARRYING OUT THE INVENTION

As shown in Figs. 1 and 2 illustrating the schematic configuration of an embodiment of a coiler according to the present invention, a first frame 9d is provided with a frame bearing 16 serving as the center of rotation of a compact, second frame 9e which integrally supports a unit roller (a pressing roller) 7 and a circular guide 6c, and with a cylinder 13c for causing the pivotal motion of the second frame. The first frame 9d is pivoted by a cylinder 13d, which is supported by a trunnion 14, about a frame bearing 160 located outside an allowable maximum coil 10 of a band plate 1. Thus, the first frame 9d and the second frame 9e can independently perform open/close motion. As will be appreciated from Figs. 1 and 2, the first frame 9d and the second frame 9e can move or shift in opposite directions independently. As shown in Figs. 1 and 2, when the first frame 9d is in the closed state, the frame bearing 16 serving as the center of rotation of the second frame 9e is located inside the allowable maximum coil 10, and it can be located on the left-hand side enough.

In pressing the band plate 1 against a mandrel 8 by means of the unit roller 7 to start coiling, at the initial stage of coiling of the band plate 1 as shown in

Fig. 4, the frame bearing 16 of the second frame 9e supporting both the unit roller 7 and the circular guide 6c is located inside the allowable maximum coil 10 so that it is located close to the mandrel 8 with decreasing its radius of rotation, and as shown in Figs. 1 and 2, by locating the frame bearing 16 on the left-hand side enough, the angle α shown in Fig. 4 and the angle β shown in Fig. 6 can be made small; therefore, all the problems of the conventional coilers described with reference to Figs. 4 through 6 are solved.

What is claimed is:

1. A coiler having a plurality of frame units, each frame unit comprising a first frame whose point portion faces opposite to the periphery of a mandrel for coiling a band plate and whose base end portion is rotatably pivoted to a shaft parallel to the axial line of the mandrel, a first drive unit for moving the first frame, a second frame rotatably pivoted in the point portion of the first frame to a shaft parallel to the axial line of the mandrel, a second drive unit coupled to the second frame and the first frame for moving the second frame, a pressing roller rotatably supported by the second frame for assisting fastening of the band plate around the mandrel, and a circular guide provided on the second frame so as to face opposite to the mandrel.

2. A coiler according to claim 1, wherein the pivoted point of the second frame to the first frame is located inside a maximum coil at the initial stage of coiling of the band plate.

Fig. 1

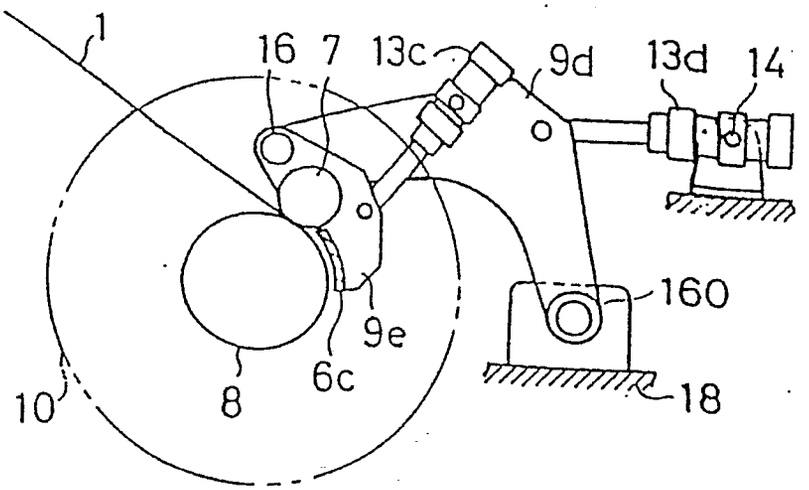
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Fig. 2

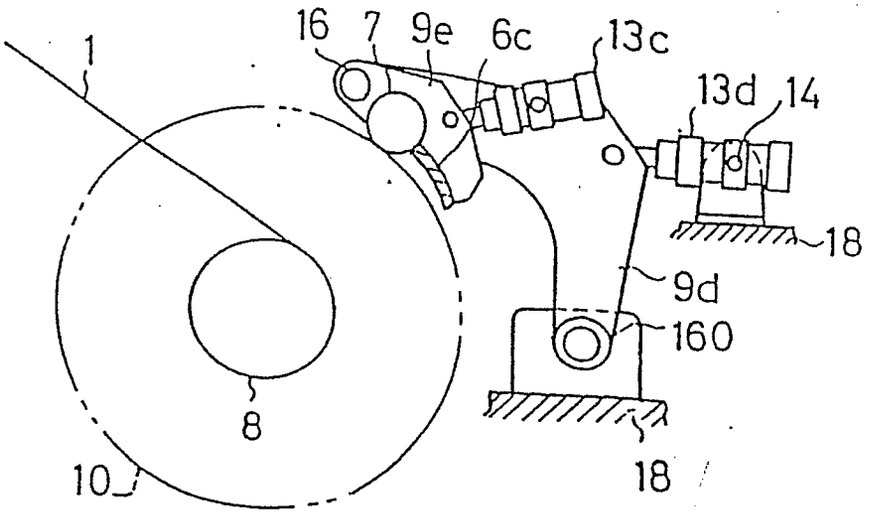
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Fig. 3

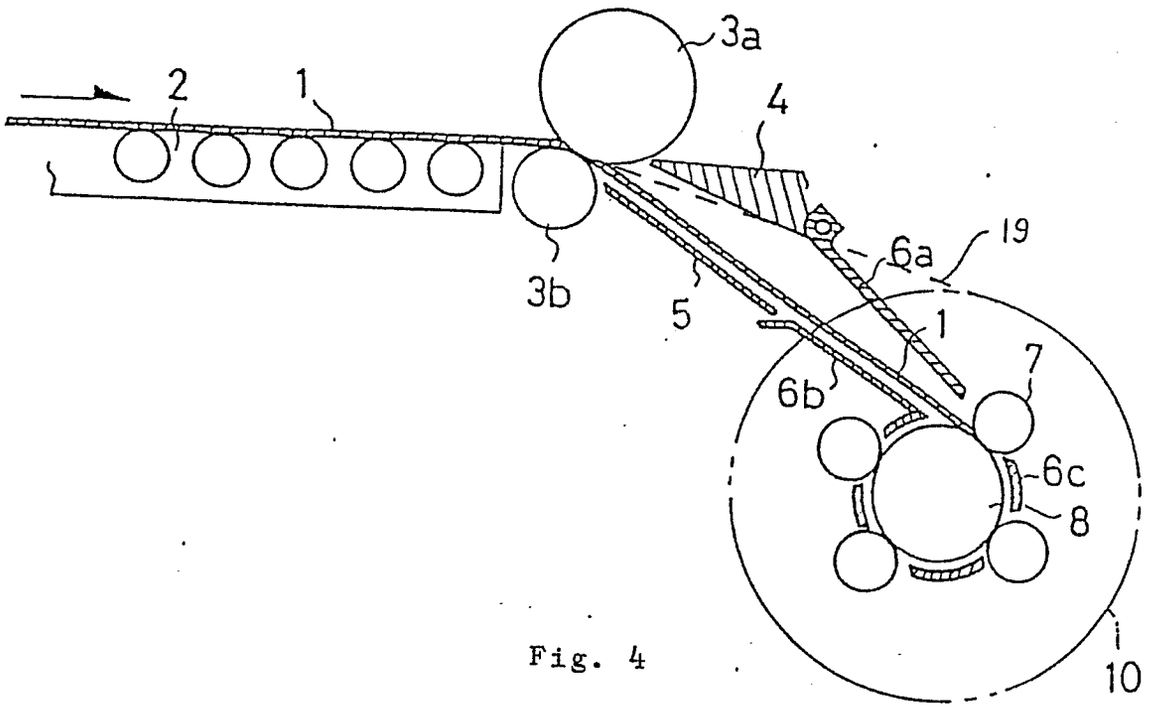


Fig. 4

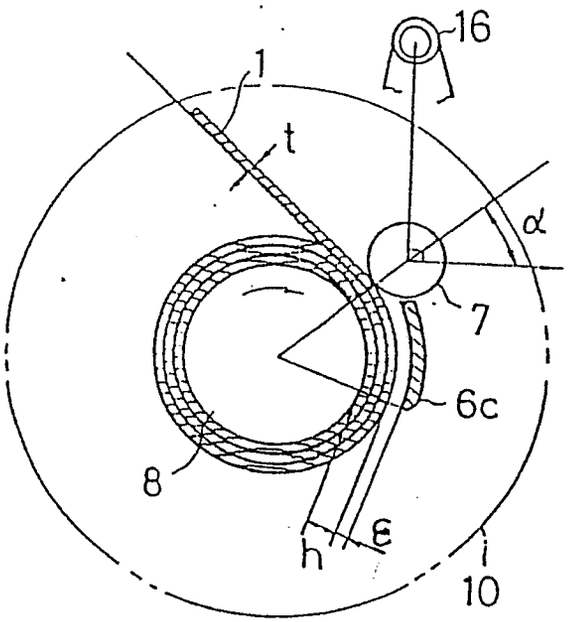
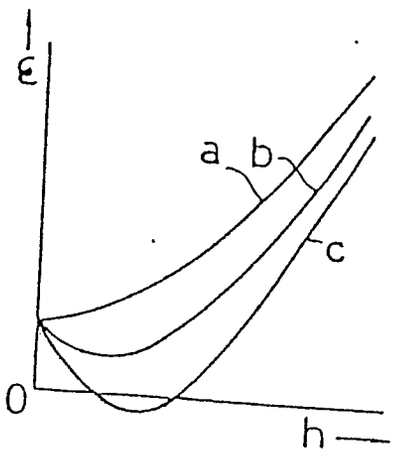


Fig. 5



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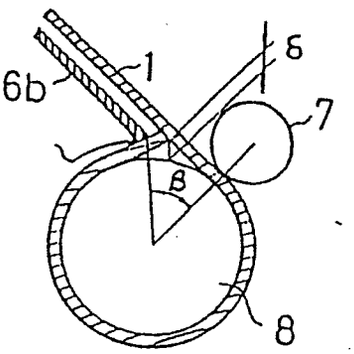

Fig. 7

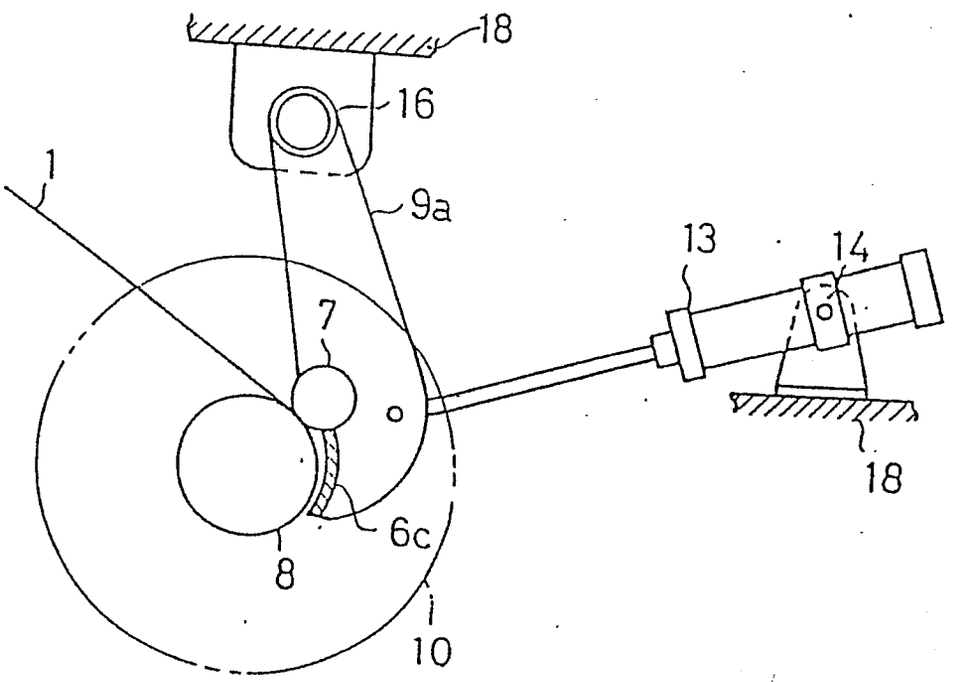

Fig. 8

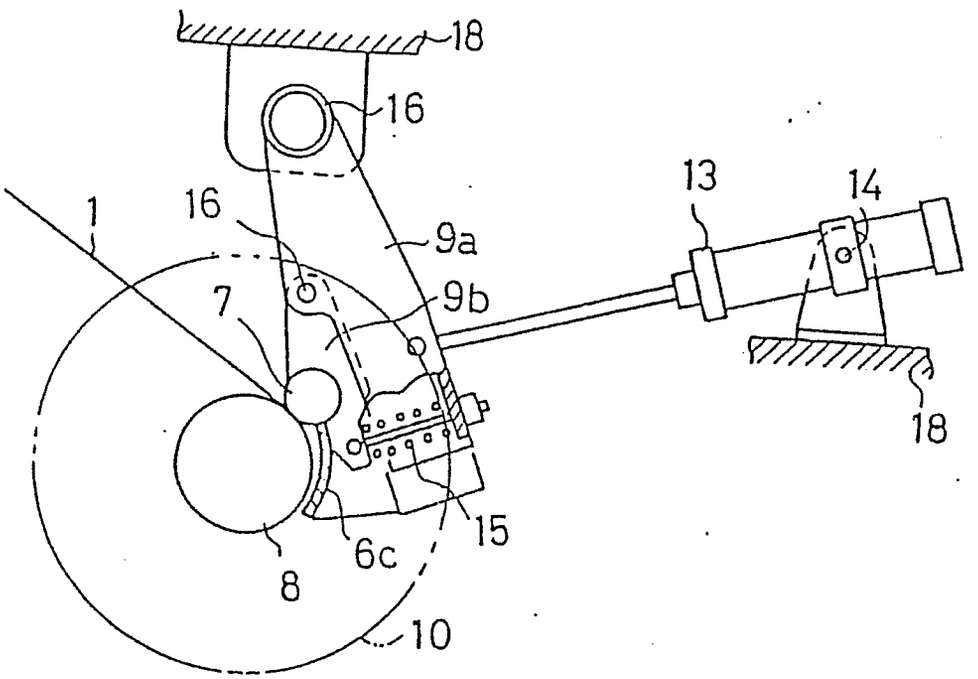

Fig. 9

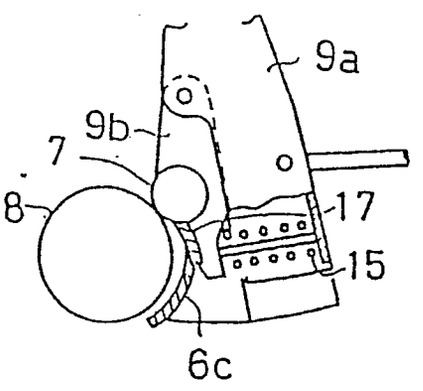

Fig. 10

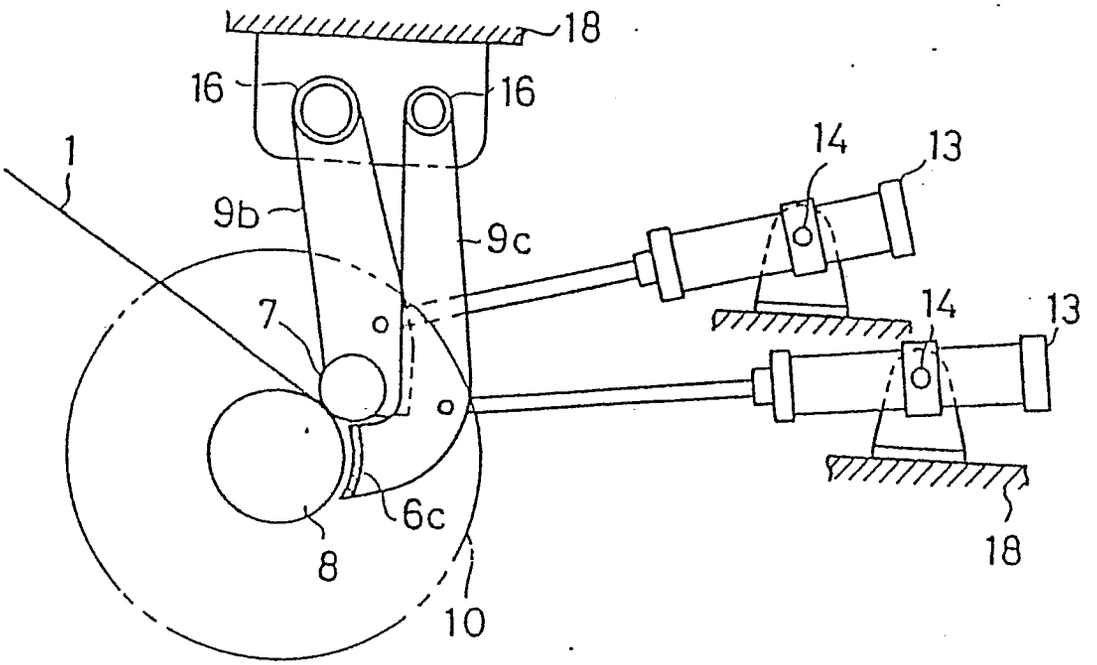
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Fig. 11

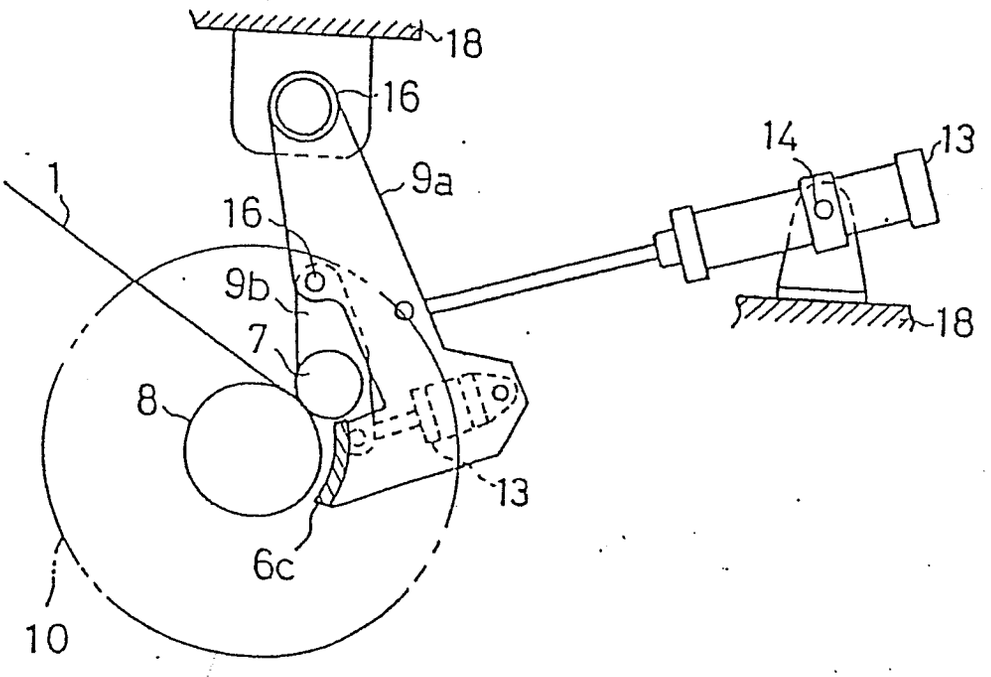
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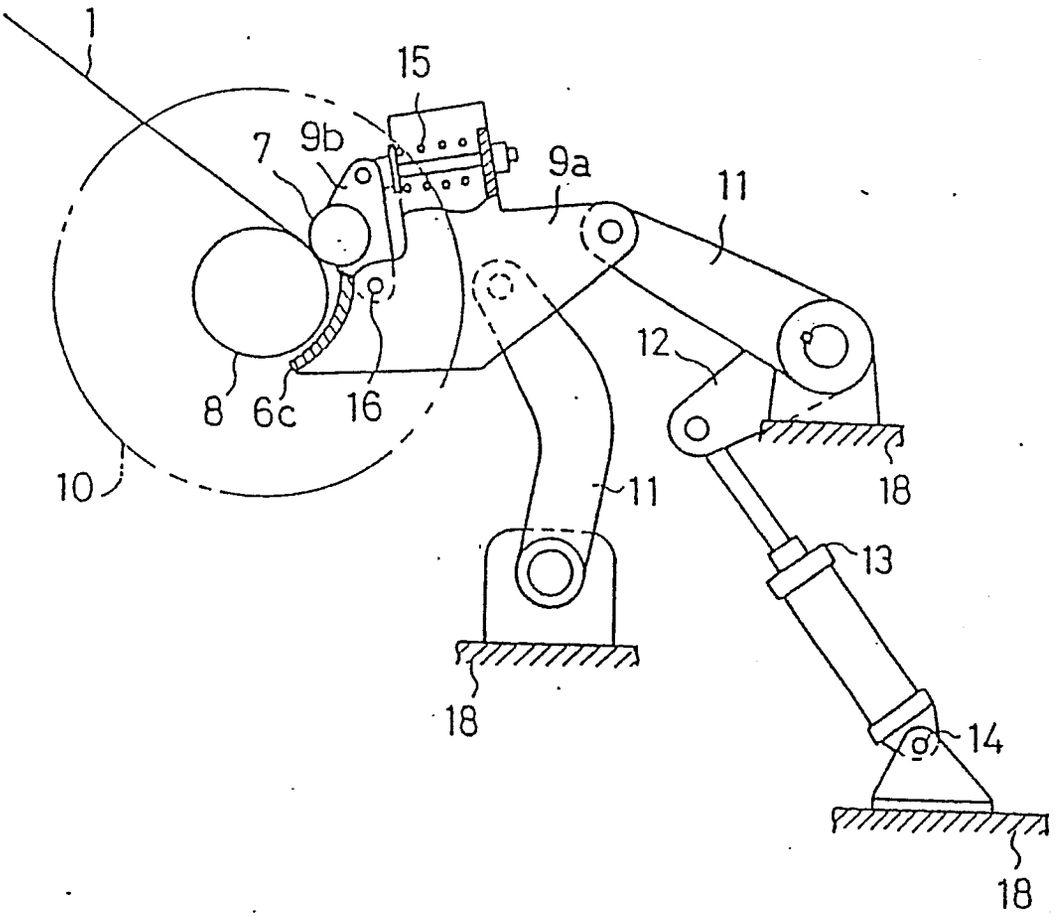
Fig. 12



INTERNATIONAL SEARCH REPORT

0294480

International Application No. PCT/JP86/00652

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl[4] B21C47/06

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC	B21C47/06

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

Jitsuyo Shinan Koho 1940 - 1987
Kokai Jitsuyo Shinan Koho 1971 - 1987

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category*	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	JP, U, 54-91438 (Ishikawajima-Harima Heavy Industries Co., Ltd.) 28 June 1979 (28. 06. 79) Figs. 2, 3 (Family: none)	1, 2

* Special categories of cited documents: [18]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
March 11, 1987 (11. 03. 87)	March 23, 1987 (23. 03. 87)
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Japanese Patent Office	