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Publication number:

0 294 480 B2

12

NEW EUROPEAN PATENT SPECIFICATION

45 Date of publication of the new patent specification: 51 Int. Cl.⁶: **B21C 47/06**
31.05.95

21 Application number: **87900282.2**

22 Date of filing: **25.12.86**

86 International application number:
PCT/JP86/00652

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

54 **COILER.**

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

45 Publication of the grant of the patent:
15.05.91 Bulletin 91/20

45 Mention of the opposition decision:
31.05.95 Bulletin 95/22

84 Designated Contracting States:
DE FR GB IT

56 References cited:
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DE-B- 2 633 408
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US-A- 3 328 990

PATENT ABSTRACTS OF JAPAN, vol. 3, no. 23 (C-38), 26th February 1979, page 154 C 38; & JP-A-53 149 852 (ISHIKAWAJIMA HARIMA JUKOGYO K.K.) 27-12-1978

IHI Engineering Review Vol. 16, No. 1, Jan. 1983, pages 39 - 45, figs. 2, 4 and 6

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EP 0 294 480 B2

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Description

TECHNICAL FIELD

This invention relates to a coiler of the type in which a hand plate is pressed against a mandrel by rollers, and more particularly to a coiler defined by the precharacterising features of the single claim.

BACKGROUND ART

A 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 pressing roller type in which the band plate is pressed against a mandrel by pressing 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 pressing roller type is further classified into two types : the roller independent movable type which has the function of individually opening/closing a plurality of pressing rollers provided in one coiler and the roller interlocking movable type in which a plurality of pressing 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 pressing 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 pressing 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 pressing rollers 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 pressing 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 plied from around the periphery of the mandrel 8 by being pressed against the mandrel 8 by means of the pressing 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 pressing rollers 7 press the band plate 1 ; hence, the pressing rollers 7 are retracted to the outside of an allowable maximum coil to 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 pressing roller 7 such that the pressing rollers 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 pressing roller 7 is subjected to control, it is necessary to increase the steep of instantaneous shift or the speed of response of the press roller 7 in the radial direction of the mandrel 8, or where the position of the pressing roller 7 is not subjected to control, it is necessary to decrease the reaction force of inertia of the press 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 pressing roller 7, the total weight of the pressing roller 7 and its support frame must be decreased, the shift direction in opening/closing of the pressing 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 pressing 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 pressing rollers 7 and of circular guides 6c provided in one coiler, only one pressing 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 pressing 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 pressing roller 7 of the coiler shown in Fig. 7, the coiler shown in Fig. 8, which coiler is of the type defined by the precharacterizing features of the single claim, has the pressing roller 7 rigidly supported by a roller frame 9b of small mass. A buffer spring 15 is interposed between the main frame 9a and the roller frame 9b. In this conventional 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.

A coiler similar to that one shown on Fig 8 is known from the JP-A-53 149 852. This known coiler differs from that one shown on Fig. 8 insofar as the buffer spring thereof is replaced by a liquid cylinder.

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 pressing roller 7, because the support and shift motion of the pressing 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 pressing roller 7 can be controlled by the hydraulic cylinder 13 such that the pressing 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 pressing 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 pressing 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 pressing roller 7 in the coiler shown in Fig. 4, the angle α between the shift direction of the pressing roller 7 and the line connecting the axial center of the pressing roller 7 with the axial center of the mandrel 8 must be made to approach zero. If made so, since the pressing roller 7 runs on the stepped/raised portion of the coiled band plate 1 whose height corresponds to the thickness thereof, the distance of shift becomes small, or the shift distance of the pressing roller 7 when it retracts become small in case the position of the pressing roller 7 is subjected to control; accordingly, the responsibility of the pressing roller 7 will be improved. Incidentally, the minimum value of the shift distance of the pressing 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 pressing 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 pressing 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 pressing roller 7 is provided on the main frame 9a made integral with the circular guide 6c, the shiftable distance of the pressing 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 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 pressing 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 avoid 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 pressing 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 pressing 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 pressing roller 7.

Further, to decrease the angle β in the conventional coilers, the pressing 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 of the type defined by the precharacterizing features of the single claims which coiler is capable of remarkably improving the responsibility of a unit roller and the capability of a band plate to fasten around a mandrel. This object is attained by characterizing features of the single claim.

According to the present invention, the roller frame rotatably supporting the pressing roller is rotatably linked to the point portion of the main frame and each of these two frame is provided with a driving cylinder; therefore, the location of the point of pivot of the roller 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.

The limitations in arrangement of the conventional coilers are removed for the coiler according to the invention. 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

Fig. 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 main frame 9d is provided with a frame bearing 16 serving as the center of rotation of a compact, roller frame 9e which integrally supports a pressing roller 7 and a circular guide 6c, and with a cylinder 13c for causing the pivotal motion of the roller frame. The main 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 main frame 9d and the roller frame 9e can independently perform open/close motion. As will be appreciated from Figs. 1 and 2, the main frame 9d and the roller frame 9e can move or shift in opposite directions independently. As shown in Figs. 1 and 2, when the main 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.

The center of rotation 160 of the main frame 9d is located at the downstream side of the pivoted

point 16 of the roller frame 9e with respect to the travelling direction of the band plate 1 and the center of rotation of the pressing roller 7 is located between the pivoted point 16 of the roller frame 9e and the center of rotation 160 of the main frame 9d with respect to the travelling direction of the band plate 1.

In pressing the band plate 1 against a mandrel 8 by means of the pressing 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 pressing 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.

Claims

1. A coiler having a plurality of frame units, each frame unit comprising
 a main frame (9d) whose point portion faces the periphery of a mandrel (8) for coiling a band plate (1) and whose end portion is rotatably pivoted to a shaft parallel to the axial line of the mandrel (8),
 a first drive unit (13d) for rotatably moving the main frame (9d),
 a roller frame (9e) rotatably pivoted at the main frame (9d) to a shaft parallel to the axial line of the mandrel (8),
 a pressing roller (7) rotatably supported by the roller frame (9e) for assisting fastening of the band plate (1) around the mandrel (8),
 a circular guide (6c) provided on one of the frames (9d, 9e) so as to face the mandrel (8), and
 a second drive unit (13c) being coupled to the roller frame (9e) and the main frame (9d) for rotatably moving the roller frame (9e),
 wherein the pivoted point (16) of the roller frame (9e) to the main frame (9d) is located inside a maximum coil at the initial stage of coiling of the band plate (1),
 characterized in that
 the circular guide (6c) is provided on the roller frame (9e),
 the roller frame (9e) is rotatably linked to the main frame (9d) at the point portion thereof,
 the center of rotation (160) of the main frame (9d) is located at the downstream side of the pivoted point (16) of the roller frame (9e) with respect to the travelling direction of the band

plate (1), and
 the center of rotation of the pressing roller (7) is located between the pivoted point (16) of the roller frame (9e) and the center of rotation (160) of the main frame (9d) with respect to the travelling direction of the band plate (1).

Patentansprüche

1. Wickelvorrichtung mit mehreren Rahmeneinheiten, von denen jede Rahmeneinheit umfaßt:
 einen Hauptrahmen (9d), dessen Spitzenabschnitt dem Umfang eines Dorns (8) zum Aufwickeln eines Blechbands (1) zugewandt ist und dessen Endabschnitt auf einer Achse parallel zur Achslinie des Dorns (8) dreh- oder schwenkbar gelagert ist,
 eine erste Antriebseinheit (13d) zum drehenden Bewegen des Hauptrahmens (9d),
 einen auf einer Achse parallel zur Achslinie des Dorns (8) am Hauptrahmen (9d) dreh- oder schwenkbar gelagerten Rollenrahmen (9e),
 eine vom Rollenrahmen (9e) drehbar getragene Andrückrolle (7) zur Unterstützung der Befestigung des Blechbands (1) um den Dorn (8) herum,
 eine an einem der Rahmen (9d, 9e) vorgesehene, dem Dorn (8) zugewandte Kreisbogenführung (6c) und
 eine mit dem Rollenrahmen (9e) und dem Hauptrahmen (9d) gekoppelte zweite Antriebseinheit (13c) zum drehenden Bewegen des Rollenrahmens (9e),
 wobei der Schwenkpunkt (16) des Rollenrahmens (9e) am Hauptrahmen (9d) in der Anfangsstufe des Aufwickelns des Blechbands (1) innerhalb eines größten Wickels liegt, dadurch gekennzeichnet, daß
 die Kreisbogenführung (6c) am Rollenrahmen (9e) vorgesehen ist,
 der Rollenrahmen (9e) mit dem Hauptrahmen (9d) am Spitzenabschnitt desselben drehbar gekoppelt ist,
 das Drehzentrum (160) des Hauptrahmens (9d) in bezug auf die Laufrichtung des Blechbands (1) an der Stromabseite des Schwenkpunkts (16) des Rollenrahmens (9e) liegt und
 das Drehzentrum der Andrückrolle (7) in bezug auf die Laufrichtung des Blechbands (1) zwischen dem Schwenkpunkt (16) des Rollenrahmens (9e) und dem Drehzentrum (160) des Hauptrahmens (9d) angeordnet ist.

Revendications

1. Bobineuse comportant une pluralité d'unités de châssis, chaque unité de châssis comprenant :
 un châssis principal (9d) dont une partie

en forme de pointe fait face à la périphérie d'un mandrin (8) pour bobiner une plaque en forme de bande et dont une partie d'extrémité est pivotée par rotation sur un arbre parallèle à la ligne axiale du mandrin (8) ; 5

une première unité de commande (13d) pour déplacer par rotation le châssis principal (9d) ;

un châssis de rouleau (9e) qui est pivoté par rotation au niveau du châssis principal (9d) sur un arbre parallèle à la ligne axiale du mandrin (8) ; 10

un rouleau de pression (7) qui est supporté à rotation par le châssis de rouleau (9e) pour aider à la fixation de la plaque en forme de bande autour du mandrin (8) ; 15

un guide circulaire (6c) prévu sur un des châssis (9d, 9e) de manière à faire face au mandrin (8) ; et

une seconde unité de commande (13c) qui est coupée au châssis de rouleau (9e) et au châssis principal (9d) pour déplacer par rotation le châssis de rouleau (9e) ; 20

dans laquelle le point de pivotement (16) du châssis de rouleau (9e) par rapport au châssis principal (9d) est situé à l'intérieur d'une bobine maximum, et ce au démarrage initial du bobinage de la plaque en forme de bande (1), 25

caractérisée en ce que :

le guide circulaire (6c) est prévu sur le châssis de rouleau (9e) ; 30

le châssis de rouleau (9e) est lié à rotation au châssis principal (9d) au niveau de la partie en forme de pointe de celui-ci ; 35

le centre de rotation (160) du châssis principal (9d) est situé au niveau du côté aval du point de pivotement (16) du châssis de rouleau (9e) par rapport à la direction de transport de la plaque en forme de bande (1) ; et 40

le centre de rotation du rouleau de pression (7) est situé entre le point de pivotement (16) du châssis de rouleau (9e) et le centre de rotation (160) du châssis principal (9d) par rapport à la direction de transport de la plaque en forme de bande (1). 45

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Fig. 1

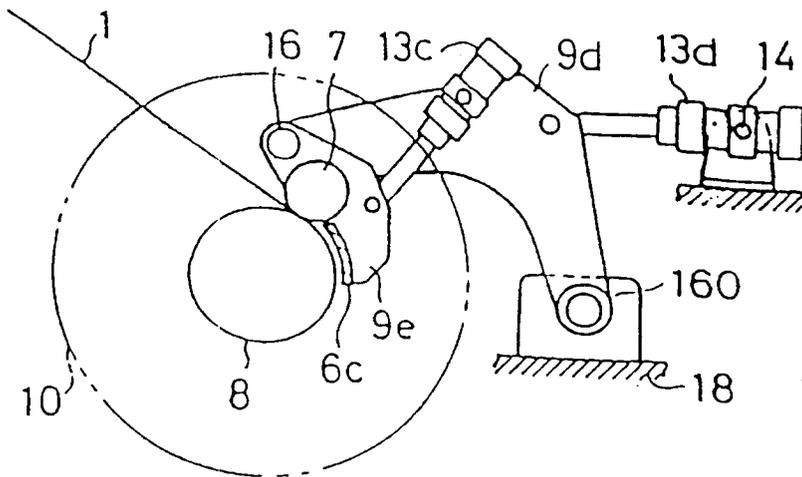


Fig. 2

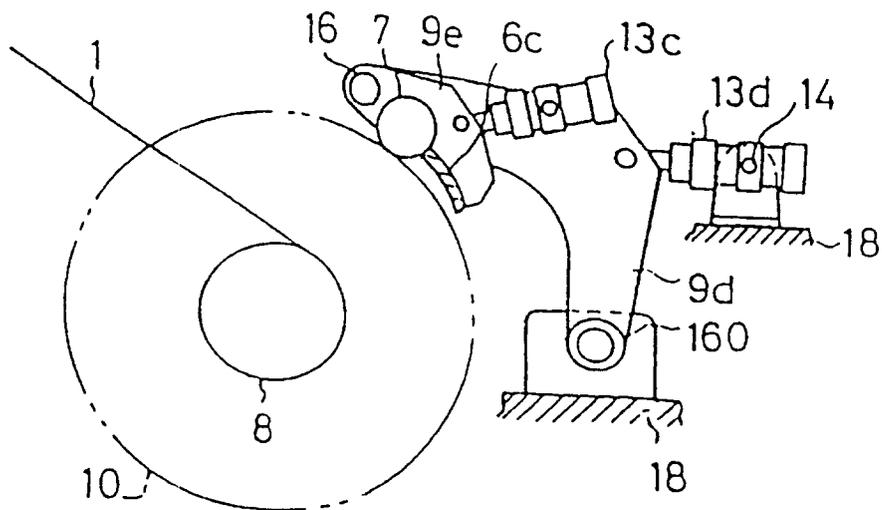


Fig. 3

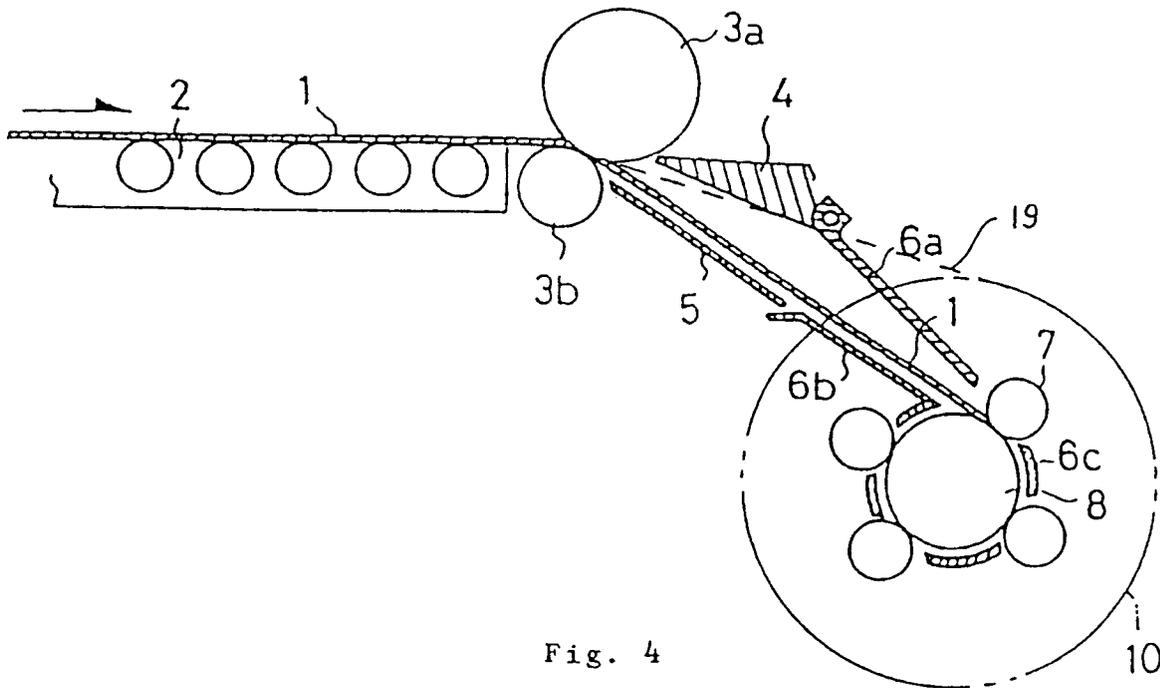


Fig. 4

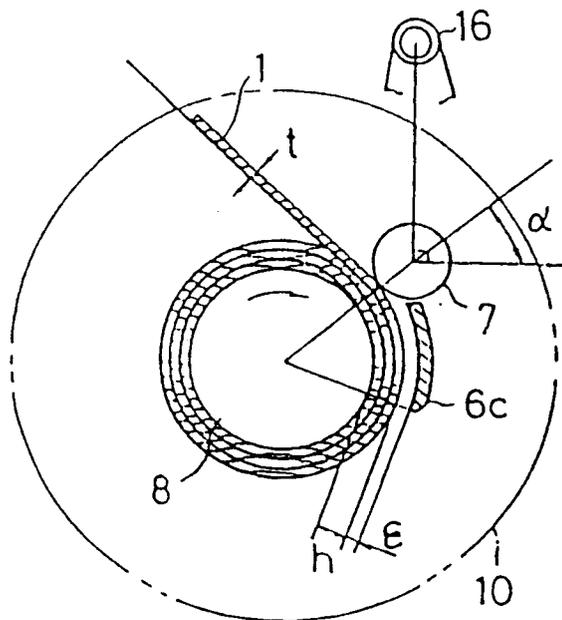


Fig. 5

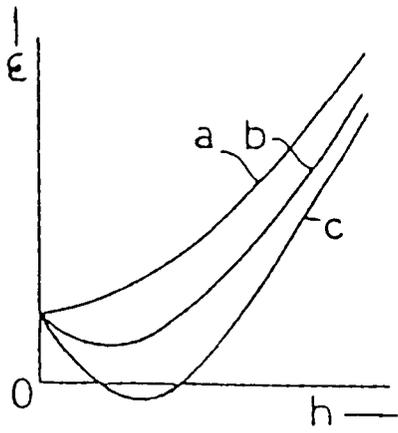


Fig. 6

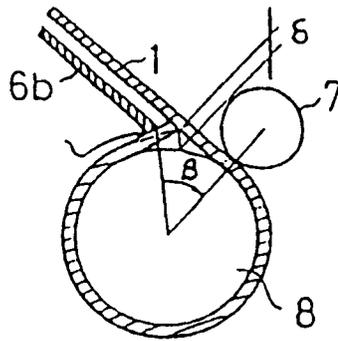


Fig. 7

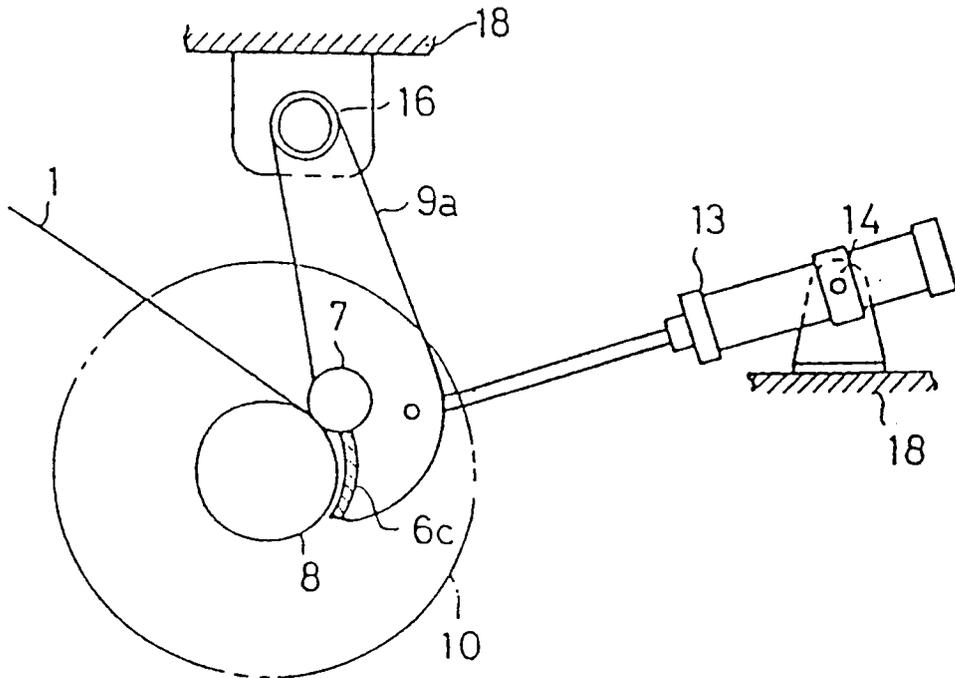


Fig. 8

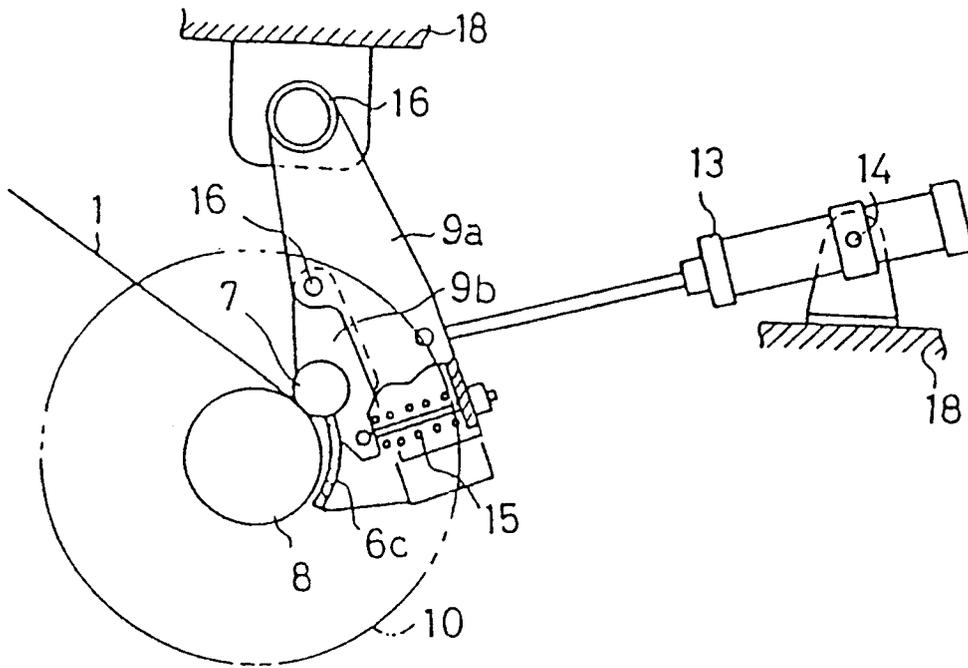


Fig. 9

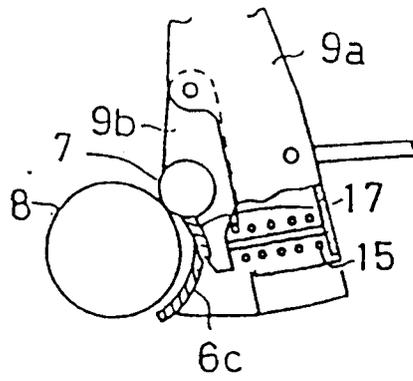


Fig. 10

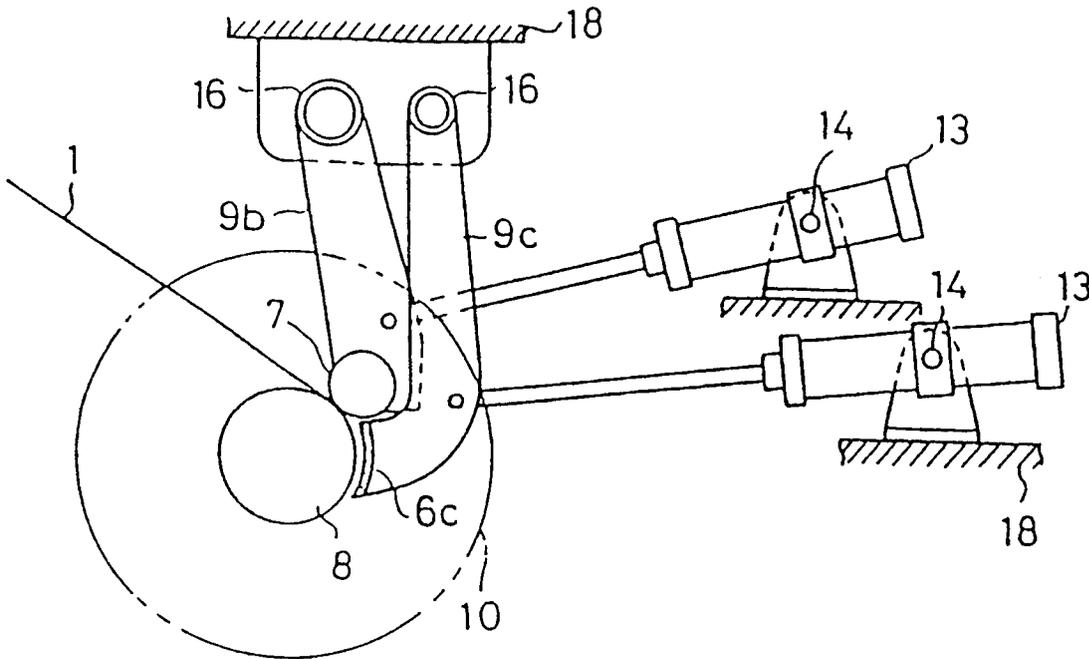


Fig. 11

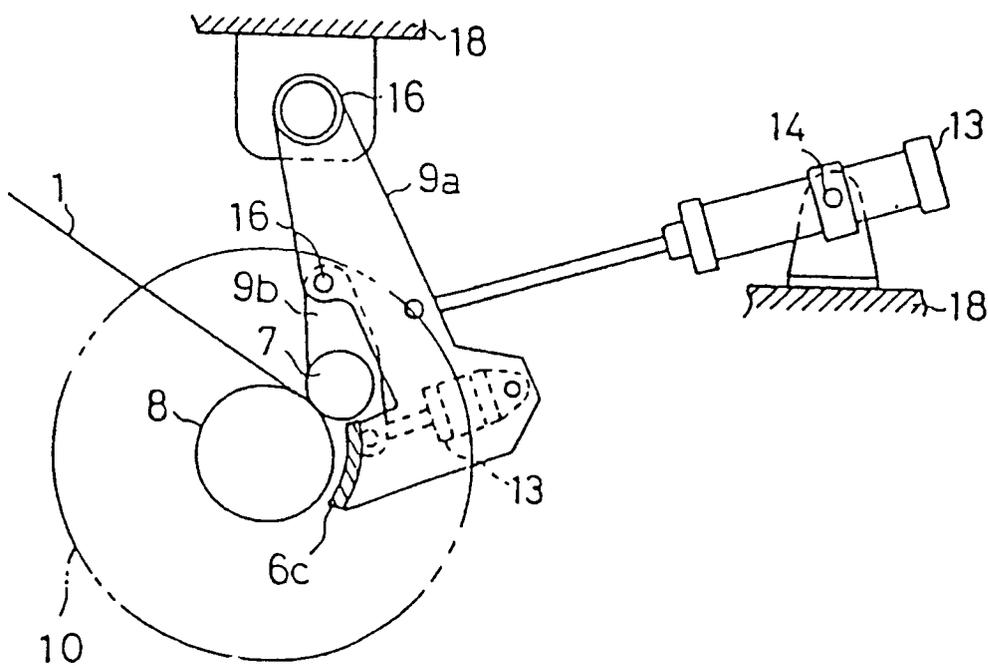


Fig. 12

