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(54) **PULL-DOWN DEVICE FOR KNITTED FABRIC**

(57) There is provided a pull-down device for fabric that prevents unevenness of pressures on a middle part surfaces in a knitting width direction such that the application of the pressure to the middle part does not affect the operation of opening pull-down members.

The pull-down device for fabric 1 includes a pressure lever 5 on the middle part in the knitting width direction to apply pressures between main rollers 3, 4. Opening and closing mechanisms provided on both sides in the knitting width direction swing to open and close the main roller 4 with respect to the main roller 3. The opening and closing mechanisms on the both sides are interlocked to swing by an opening and closing shaft 6 extending in the

knitting width direction. The pressure lever 5 is inserted into the opening and closing shaft 6 to swing on the opening and closing shaft 6 as a fulcrum point. A switch member 7 is interposed between the opening and closing shaft 6 and the pressure lever 5. An interlocking switch part 12 is formed between a hole 7c in the switch member 7 and a pin 5e on the pressure lever 5. Even when the main rollers 3, 4 are closed, the interlocking switch part 12 makes effective the application of pressures by a pressure spring 8 within a gap between the hole 7c and the pin 5e so that the application of the pressures does not affect the opening operation.

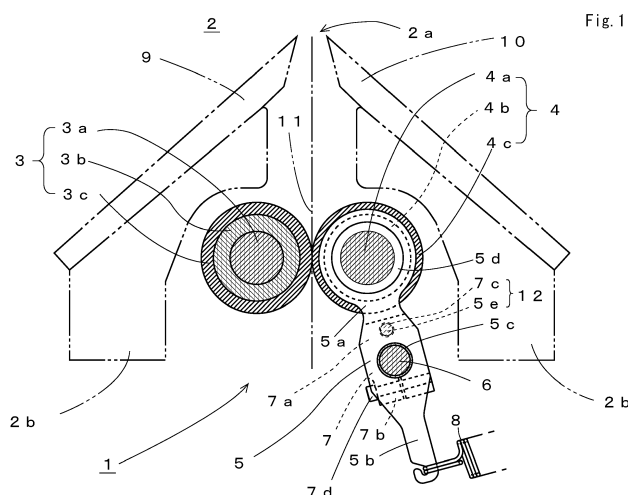


Fig. 1

Description

[Technical Field]

[0001] The present invention relates to a pull-down device for fabric knitted with needle beds of a flatbed knitting machine, which pulls down the fabric to underneath a needle bed gap.

[Background Art]

[0002] Conventionally, a flatbed knitting machines includes a pair of front and back needle beds opposed to each other with a needle bed gap left therebetween and knits a fabric while supplying a knitting yarn to hooks at leading ends of knitting needles advancing and retracting between each of the needle beds and the needle bed gap. A pull-down device for fabric exerts a downward tension on the knitted fabric (for example, see Patent Literature 1).

[0003] The pull-down device for fabric described in Patent Literature 1 includes a pair of rollers, a drive mechanism, an opening and closing mechanism, and an opening and closing shaft. The pair of rollers are capable of opening to a direction in which their outer peripheries are opened, and of closing to a direction in which their outer peripheries are closed. Each of the rollers functions as a pull-down member in a closed state, has a cylindrical outer peripheral surface and is driven to revolve by a rotation shaft extending in a knitting width direction. The rollers are driven to revolve in a direction in which to pull-down the knitted fabric while sandwiching the knitted fabric between their closed outer peripheries. The drive mechanism is provided at least at one end in the knitting width direction to drive the rotation shaft. The opening and closing mechanisms are provided on both sides in the knitting width direction to open and close the rollers. The opening and closing shaft extends in the knitting width direction and turns to interlock the opening and closing mechanisms on the both sides. The opening and closing mechanisms have springs that bias the rollers into the closing direction such that the rollers sandwiching the knitted fabric therebetween apply pressures on surfaces of the knitted fabric.

[0004] There has also been disclosed a pull-down device for fabric that includes opening and closing mechanisms with springs capable of applying pressures on surfaces of rollers on both sides and a middle part in the knitting width direction so that the pressures are also applicable to the middle part (see Patent Literature 2, Fig. 1). The opening and closing mechanisms in this pull-down device for fabric include swing arms that swing around a support shaft coupling the both sides in the knitting width direction. The swing arms are swingably supported by the support shaft, support the rollers on one side in a radial direction around the support shaft, and are driven on the other side. The swinging of the swing arms opens or closes the rollers. The swing arms are

driven by cut flanges provided at a drive shaft to couple the both sides in the knitting width direction, separately from the support shaft. Springs for applying pressures are provided between the cut flanges and the swing arms to bias the rollers to the closing direction. The swinging of the swing arms in the direction of opening the rollers is driven by cut end surfaces of the cut flanges abutting against lock members in the swing arms.

10 [Citation List]

[Patent literatures]

[0005]

Patent Literature 1: WO 2011/018891A

Patent Literature 2: JP H06-65780B

20 [Summary of Invention]

[Technical Problem]

[0006] As the knitting width in a flatbed knitting machine increases, the rollers and the like in a pull-down device for fabric become elongated. The pull-down device for fabric described in Patent Literature 1 applies pressures with spring to bias the opening and closing mechanisms on the both sides of the knitting width. However, the elongated rollers are likely to bend in the middle part, and the pressures properly act on the both sides close to the springs but are less effective and become uneven with increasing proximity to the middle part. The pull-down of the knitted fabric affects the knitting process in which a new stitch is formed by a knitting needle and the previously formed stitch is knocked over. When the pressures become uneven and less effective, the force to pull-down the knitted fabric may decrease to cause stitches to be improperly knocked over. The unevenness of the pressures results in uneven force to pull-down the knitted fabric, which adversely affects the size of the formed stitches and the outer dimensions of the knitted fabric.

[0007] It is expected that the risk of uneven pressures on the middle part surface in the knitting width direction will be eliminated by making a configuration in which the pressures are also added to the middle part surface as described in Patent Literature 2. However, in order to couple the both sides in the knitting width direction, there are required two shafts, that is, a support shaft functions as a fulcrum around which the swing arms are swung in the opening and closing mechanisms, and a drive shaft of the cut flanges to drive the swing arms, which are larger by one in number than that required in the configuration described in Patent Literature 1. Extending the springs to increase the pressures in the opening and closing mechanisms will increase the spacing between the cut end surfaces of the cut flanges and the lock members of

the swing arms. To drive the rollers to open from each other, the cut end surfaces need to abut against the lock members so that the operation of opening the rollers may become delayed depending on the pressures.

[0008] An object of the present invention is to provide a pull-down device for fabric that prevents unevenness of pressures on the middle part surfaces in the knitting width direction such that the application of the pressures to the middle part surfaces does not affect the operation to open pull-down members.

[Solution to Problem]

[0009] The present invention is a pull-down device for fabric provided with:

a pair of pull-down members capable of sandwiching a fabric which is being knitted by a flatbed knitting machine and is drooping down under a needle bed gap,

both of the pull-down members are able to open in a direction of opening them each other and able to close in a direction of closing them, each of the pull-down members having an outer periphery driven to revolve by a rotation shaft extending in a knitting width direction, and the driving to revolve being performed in a direction to pull-down the fabric in a closing state where the fabric is capable of being sandwiched between the outer peripheries;

a driving mechanism for the rotation shaft, provided at least on one side in the knitting width direction; opening and closing mechanisms for the both pull-down members, provided on both sides in the knitting direction; and an opening and closing shaft, extending in the knitting width direction and turning to interlock the opening and closing mechanisms on the both sides,

characterized in that the pull-down device for fabric comprises

a pressure lever provided on a middle part in the knitting width direction, angularly displaceable with respect to the opening and closing shaft, swinging on the opening and closing shaft as a fulcrum point, and connected to the pull-down member by a pressure arm extending from the fulcrum point to one side in a radial direction; a pressure spring for biasing the pull-down member in the closing direction by the pressure lever, and an interlocking switch part for switching between interlocking states with a gap left between the opening and closing shaft and the pressure lever,

when the opening and closing shaft opens the

pull-down members, the opening and closing shaft swings the pressure lever in a direction in which the pull-down members are separated from each other, and

when the opening and closing shaft closes the pull-down members, the pressure lever is biased by the pressure spring to swing following the opening and closing shaft until the pull-down members are closed, and after the closing of the pull-down members, the opening and closing shaft alone turns within the gap.

[0010] In the present invention, said pull-down members are pull-down rollers in which said outer peripheries have cylindrical surfaces around said rotation shaft.

[0011] In the present invention, the pull-down device further comprises a switch member, which includes:

a support part, supported by said opening and closing shaft and adjustable in angle to be supported; and a fixing part for fixing the support part to the opening and closing shaft, and forms said interlocking switch part to said pressure lever in between.

[0012] In the present invention, one of said pressure lever and said switch member has a pin parallel to said opening and closing shaft, and the other has a hole which has an inner diameter larger than an outer diameter of the pin, so that the pin able to insert into the hole, and said interlocking switch part is formed with the pin inserted into the hole.

[0013] In the present invention, the pull-down device further comprises a receiving member, provided on said middle part in said knitting width direction and receiving said opening and closing shaft to restrict deformation of the opening and closing shaft.

[Advantageous Effects of Invention]

[0014] According to the present invention, the pressure spring biases the pressure lever to apply a pressure to the middle part surface in the knitting width direction to sandwich the knitted fabric between the pull-down members, which prevents the pressure from becoming less effective and uneven. The operation of opening the pull-down members eliminates the gap between the interlocking switch parts and then causes the pressure lever to interlock with the opening and closing shaft. Since the gap is small, the operation of opening can be performed even with the middle part in the knitting width direction without a lag behind the operation of opening on the both sides. The gap between the interlocking switch parts is not influenced by increasing or decreasing the applied pressure, and thus the application of the pressure to the middle part surface does not affect the operation of opening the pull-down members.

[0015] According to the present invention, even when

the rollers of the pull-down members are elongated, it is possible to prevent unevenness of the pressure to the middle part surface in the knitting width direction.

[0016] According to the present invention, the rotation of the opening and closing shaft is transferred from the switching member to the pressure lever via the interlocking switch parts. The angle of the switch member supported by the opening and closing shaft is adjustable. This makes it easy to generate a gap between the interlocking switch parts when the pull-down members are closed.

[0017] According to the present invention, the gap between the interlocking switch parts can be generated in a state in which the pin is inserted into the hole.

[0018] According to the present invention, the receiving member can prevent the deformation of the opening and closing shaft on the middle part in the knitting width direction.

[Brief Description of Drawings]

[0019]

[Fig. 1] Fig. 1 is a simplified right-side cross-sectional view of a schematic configuration of a pull-down device for fabric 1 as a first example of the present invention.

[Fig. 2] Fig. 2 is a partial front view of the pull-down device for fabric 1 shown in Fig. 1.

[Fig. 3] Fig. 3 is a simplified right-side cross-sectional view of the pull-down device for fabric 1 shown in Fig. 1, in which main rollers 3, 4 are closed.

[Fig. 4] Fig. 4 is a simplified right-side cross-sectional view of the pull-down device for fabric 1 shown in Fig. 1, in which the main rollers 3, 4 are opened.

[Fig. 5] Fig. 5 is a front view and a right side view of a configuration of a pressure lever 5 shown in Fig. 1.

[Fig. 6] Fig. 6 is a front view and a right side view of a configuration of a switch member 7 shown in Fig. 1.

[Fig. 7] Fig. 7 is a partial right-side cross-sectional view of operations of an interlocking switch part 12 shown in Fig. 1.

[Fig. 8] Fig. 8 is a partial front view of a schematic configuration of a pull-down device for fabric 21 as a second example of the present invention.

[Fig. 9] Fig. 9 is a right side view of a configuration of a receiving mechanism 22 shown in Fig. 8.

[Description of Embodiments]

[0020] Drawings from Fig. 1 to Fig. 7 relate to a configuration of a pull-down device for fabric 1 as a first example of the present invention. Drawings of Fig. 8 and Fig. 9 relate to a configuration of a pull-down device for fabric 21 as a second example of the present invention. Corresponding parts shown in the drawings are given identical reference signs and duplicated description thereof may be omitted. For the convenience of description, any

part not shown in a drawing being currently described may be mentioned with the use of the reference sign shown in another drawing.

5 [Example 1]

[0021] Fig. shows a schematic configuration of the pull-down device for fabric 1 as the first example of the present invention. The pull-down device for fabric 1 is provided under a needle bed gap 2a in a flatbed knitting machine 2 and includes main rollers 3, 4 on the front and rear sides, which are a pair of pull-down members. The front main roller 3 is fixed and the rear main roller 4 moves so that the main rollers 3, 4 are capable of opening and closing in directions in which they are opened and closed. When the rear main roller 4 is to be fixed and the front main roller 3 is to move, a pressure lever 5 needs to be provided under the main roller 3. The main rollers 3, 4 have respectively rotation shafts 3a, 4a extending in a knitting width direction, core materials 3b, 4b, and outer peripheral materials 3c, 4c. The rotation shafts 3a, 4a and the core materials 3b, 4b are made of metal, for example. The outer peripheral materials 3c, 4c are elastic materials such as rubber materials, for example, which have asperities on the outer peripheral surface. Except for such asperities, the outer peripheral surfaces of the outer peripheral materials 3c, 4c are cylindrical surfaces centered on the rotation shafts 3a, 4a. There may be provided sub rollers between the main rollers 3, 4 and the needle bed gap 2a. The main rollers 3, 4 and the sub rollers generate a pull-down force in a state where the outer peripheries are closed. A drive mechanism for the rotation shafts 3a, 4a is provided at least on one side in the knitting width direction. Opening and closing mechanisms for the main rollers 3, 4 similar to those disclosed in Patent Literature 1 are provided on both sides in the knitting width direction and include a spring for applying a pressure between the main rollers 3, 4. The pull-down device for fabric 1 in the present example includes the pressure lever 5 biased by a pressure spring 8 to apply a pressure between the main rollers 3, 4 even on the middle part surfaces in the knitting width direction.

[0022] The opening and closing mechanisms on the both sides in the knitting width direction swing to open and close one rotation shaft 4a with respect to the other rotation shaft 3a. The opening and closing mechanisms on the both sides are interlocked to swing by an opening and closing shaft 6 extending in the knitting width direction. The pressure lever 5 lets the opening and closing shaft 6 through and swings on the opening and closing shaft 6 as a fulcrum. The pressure lever 5 has a pressure arm 5a extending from the fulcrum point to one side in a radial direction and has a drive arm 5b extending to the other side. The pressure arm 5a is connected to the rotation shaft 4a of the rear main roller 4. The pressure lever 5 has a bearing 5c around the opening and closing shaft 6 and thus is angularly displaceable with respect to the opening and closing shaft 6. The pressure arm 5a

has a bearing 5d at a position connected to the rotation shaft 4a. The opening and closing shaft 6 drives the pressure lever 5 to swing via a switch member 7. The switch member 7 includes a support part 7a that is supported by the opening and closing shaft 6 and is adjustable in the angle of support, and a fixing part 7b that fixes the switch member 7 to the opening and closing shaft 6. The support part 7a has a hole 7c into which a pin 5e provided on the pressure arm 5a side of the pressure lever 5 is insertable. The inner diameter of the hole 7c is larger than the outer diameter of the pin 5e. The fixing part 7b is fastened to the opening and closing shaft 6 by a screw 7d. The drive arm 5b of the pressure lever 5 receives a tension of the pressure spring 8. The tension biases the pressure arm 5a swinging on the opening and closing shaft 6 as a fulcrum point in such a manner as to press the main roller 4 against the main roller 3, thereby applying a pressure between the main rollers 3, 4. The pressure spring 8 has one end hooked on the drive arm 5b and the other end hooked on a rear frame 2c as shown in Figs. 3, 4. Pluralities of pressure levers 5, switch members 7, and pressure springs 8 can be arranged with spacing left therebetween on the middle part in the knitting width direction.

[0023] The flatbed knitting machine 2 knits a fabric 11 by causing the knitting needles to advance and retard with respect to the needle bed gap 2a from needle beds 9, 10 opposed to each other on the front and rear sides. The needle beds 9, 10 are supported by a frame 2b of the flatbed knitting machine 2. The main rollers 3, 4 are closed to sandwich and to pull down the fabric 11 drooping down under the needle bed gap 2a. The main rollers 3, 4 need to be opened in order to let a set up device through them at the time of forming the knitted fabric 11. The set up of the fabric 11 is performed by the set up device, which elevates from and descends to down below the needle bed gap 2a and is omitted to be shown.

[0024] The pin 5e provided on the pressure lever 5 is parallel to the opening and closing shaft 6 and forms an interlocking switch part 12 between the pin 5e and the hole 7c of the switch member 7. The interlocking switch part 12 switches between interlocking states with a gap left between the opening closing shaft 6 and the pressure lever 5. When the opening and closing shaft 6 turns in a direction of opening the main rollers 3, 4, the pressure lever 5 is driven by the opening and closing shaft 6 to swing in a direction of separating the main rollers 3, 4. When the opening and closing shaft 6 turns in a direction of closing the main rollers 3, 4, the pressure lever 5 is biased by the pressure spring 8 to swing following the opening and closing shaft 6 in such a manner as to keep the pin 5e in abutment with the hole 7c until the main rollers 3, 4 are closed. When the main rollers 3, 4 are closed, the pressure lever 5 stops swinging. When the pressure lever 5 no longer swings following the opening and closing shaft 6, only the opening closing shaft 6 turns within a gap that is formable between the hole 7c and the pin 5e. In this state, the pressure spring 8 applies an

effective pressure between the main rollers 3, 4. The pressure applied by the pressure spring 8 can be changed by increasing or decreasing the distance between one end and the other end to change the hanging length or by replacing with another pressure spring different in tension. Changing the length of the pressure spring 8 from the fulcrum point by altering the position where one end of the pressure spring 8 is hooked on the drive arm 5b makes it possible to change the pressure by the length change.

[0025] As shown in Fig. 2, the pressure lever 5 and the switch member 7 are aligned along the opening and closing shaft 6. The main roller 4 has the core material 4b and outer peripheral material 4c aligned in block form along the rotation shaft 4a. There are provided spacers 4d between the blocks. This configuration is also applied to the main roller 3. The pressure lever 5 has the pressure arm 5a connected to the rotation shaft 4a with the bearing 5d interposed therebetween instead of the spacers 4d. The use of the bearing 5d allows the pressure arm 5a to support the rotation shaft 4a in a smoothly rotatable manner.

[0026] pull-down members are not limited to the main rollers 3, 4 but the present invention is also applicable to sub rollers. In addition, the pull-down members are not limited to roller types but may be belt types that are driven to revolve by a rotation shaft. The use of the belts makes it possible to implement pull-down members that revolve in a path to sandwich the fabric 11 between their flat surfaces. Also in the case of using belts as pull-down members, the pressure arm 5a of the pressure lever 5 can act on the rotation shaft at positions of cuts in the belts on the middle part in the knitting width direction. Long belts may have discontinuities generated by being divided into a plurality of parts in the knitting width direction.

[0027] As shown in Fig. 3, the pressure can be applied in the direction in which the main rollers 3, 4 are closed by tension of the pressure spring 8. The pressure spring 8 is hung between the drive arm 5b of the pressure lever 5 and the rear frame 2c of the flatbed knitting machine 2. When there is a gap between the pin 5e of the interlocking switch part 12 and the hole 7c, the pressure on the surface of the main roller 4 can be adjusted by changing the tension of the pressure spring 8. As shown in Fig. 4, the pressure lever 5 is quickly driven by the opening and closing shaft 6 via the switch member 7 in the direction in which the main rollers 3, 4 are opened.

[0028] Fig. 5 shows a configuration of the pressure lever 5 by the front view on the left side and the right side view on the right side. A portion of the pressure lever 5 into which the opening and closing shaft 6 as the fulcrum point for swinging is inserted is located on the inner peripheral side of the bearing 5c. The bearing 5c is press-fitted into an attachment hole in the pressure lever 5 and fixed to the pressure lever 5. The pressure arm 5a has a pin press-fit hole 5f into which the pin 5e is press-fitted and a bearing attachment hole 5g to which the bearing

5d is attached. One side surface of the pressure lever 5 is set as a reference surface 5h. Accurately making the positional relationship between the reference surface 5h and the pin press-fit hole 5f makes also accurate the positional relationship between the pin press-fit hole 5f and the press-fitted pin 5e.

[0029] Fig. 6 shows a configuration of the switch member 7 by the front view on the left side and the right side view on the right side. The support part 7a has an opening and closing shaft hole 7e into which the opening and closing shaft 6 is inserted. The fixing part 7b has an insertion hole 7f, a screw hole 7g, and a middle slit. The fixing part 7b is fastened by inserting a screw 7d from the insertion hole 7f side into the screw hole 7g side. When the opening and closing shaft 6 is inserted into the opening and closing shaft hole 7e, the switch member 7 is fixed to the opening and closing shaft 6 by screwing. One side surface of the switch member 7 is set as a reference surface 7h, and the positional relationship between the hole 7c and the reference surface 7h is formed to be accurate. The switch member 7 can be fixed to the opening and closing shaft 6 by another mechanism. For example, the opening and closing shaft 6 may be sandwiched and screwed in a member divided into two halved parts with respect to the opening and closing shaft hole 7e.

[0030] Fig. 7 shows an operational state of the interlocking switch part 12. The left side of Fig. 7 shows the state in which the pin 5e is in the center of the hole 7c. The right side of Fig. 7 shows the state in which the pin 5e is in contact with the hole 7c. The closed state shown in Fig. 3 corresponds to the left side of Fig. 7, and the open state shown in Fig. 4 corresponds to the right side of Fig. 7. When the main rollers 3, 4 are closed, the interlocking switch part 12 is desirably in the state shown on the left side of Fig. 7. The state shown on the left side can be obtained by closing the main rollers 3, 4 and fixing the respective reference surfaces 5h, 7h of the pressure lever 5 and the switch member 7 to each other by the screw 7d. Since the pin 5e and the hole 7c are not in contact with each other, the pressure applied by the pressure spring 8 is effective. When the pin 5e and the hole 7c are brought into contact with each other as shown on the right side of Fig. 7, the pressure corresponding to the pressure spring 8 becomes no longer effective. The shift from the closing to opening states of the main rollers 3, 4 is driven by the opening and closing mechanisms on the both sides in the knitting width direction, and the driving force is transferred by the opening and closing shaft 6. The interlocking switch part 12 shifts from the state in which there is a gap between the pin 5e and the hole 7c as shown on the left side of Fig. 7 to the state in which the pin 5e and the hole 7c are in contact with each other as shown on the right side of Fig. 7, so that the pin 5e is pressed by the hole 7c to open the main rollers 3, 4 even on the middle part in the knitting width direction. Since the gap is small, the shift from the closing to opening states can be quickly accomplished almost without delay.

Only the pressure lever 5 and the pressure spring 8 are provided on the middle part in the knitting width direction, the pressure can be applied but the open and close driving is not performed without the interlocking switch part 12 so that the main rollers 3, 4 cannot be quickly opened.

[0031] The distance from the opening and closing shaft 6 as the fulcum point for swinging of the pressure lever 5 to the rotation shaft 4a of the main roller 4 is longer than the distance from the opening and closing shaft 6 to the position of the interlocking switch part 12. In the state shown on the left side of Fig. 7, the movement in the gap allowed for the pin 5e can be more increased by opening and closing the main rollers 3, 4 to absorb changes due to fluctuation of thickness of the fabric 11. The portion corresponding to the interlocking switch part 12 can also be provided at another position such as the drive arm 5b of the pressure lever 5. However, the drive arm 5b of the first example would need to be provided with the interlocking switch part 12 in a shape and at a position allowing for the arrangement on the fixing part 7b side of the switch member 7.

[0032] The interlocking switching with a gap can be performed by providing a key on the opening and closing shaft 6 and providing a key groove wider than the key in the pressure lever 5 without using the switch member 7 as in the present first example. In case of using the switch member 7, the same advantageous effects as those of the present example can be obtained by providing a pin on the switch member 7 and forming a hole in the pressure lever 5. The shapes of a convex part such as a pin and a concave part such as a hole are not limited to a circle but may be another shape such as an angular column. The concave part may not be penetrating like a hole but may be a bottomed hole. The gap to be provided in the interlocking switch part may be adjusted indirectly by alignment of the reference surfaces 5h, 7h or the like, or may be adjusted directly while watching the gap.

[Example 2]

[0033] Fig. 8 shows a schematic configuration of a pull-down device for fabric 21 as a second example of the present invention. The pull-down device for fabric 21 is configured such that a receiving mechanism 22 is added to the pull-down device for fabric 1 in the first example. One or more receiving mechanisms 22 are provided on the middle part in the knitting width direction but are arranged at positions not interfering with the pressure lever 5 and the switch member 7. The receiving mechanism 22 has a receiving member 23 that receives the opening and closing shaft 6 to restrict its deformation. The receiving member 23 is provided on the middle part in the knitting width direction and can receive the opening and closing shaft 6 from underneath. The receiving member 23 is supported from a rear frame 2d via an adjustment member 24 and a support member 25. The position where the receiving member 23 receives the opening and closing shaft 6 is adjustable by an adjustment screw 26, and after

the adjustment, the receiving member 23 is fixed by a fixing screw 27. The support member 25 is attached to the frame 2d by attachment screws 28.

[0034] As shown in Fig. 8, the receiving member 23 receives the opening and closing shaft 6 from underneath by a substantially semicircular inner peripheral surface, which makes it possible to prevent the opening and closing shaft 6 from bending downward due to its own weight and warping in a front-back direction. The receiving member 23 may be provided with a cylindrical insertion hole to receive the entire periphery of the opening and closing shaft 6. The receiving member 23 can be supported from the rear frame 2d on the opening and closing shaft 6 with respect to the main roller 4 on the rear side. This is because the space under the main rollers 3 and 4 is used for setting up and discharging the fabric 11.

[Reference Signs List]

[0035]

1, 21	Pull-down device for fabric	
2	Flatbed knitting machine	
2a	Needle bed gap	
2b, 2c, 2d	Frame	
3, 4	Main roller	
3a, 4a	Rotation shaft	
3c, 4c	Outer peripheral material	
5	Pressure lever	
5e	Pin	
5h, 7h	Reference surface	
6	Opening and closing shaft	
7	Switch member	
7a	Support part	
7b	Fixing part	
7c	Hole	
8	Pressure spring	
9, 10	Needle bed	
11	Fabric	
12	Interlocking switch part	
22	Receiving mechanism	
23	Receiving member	

Claims

1. A pull-down device for fabric (1, 21) provided with:

a pair of pull-down members (3, 4) capable of sandwiching a fabric (11) which is being knitted by a flatbed knitting machine (2) and is drooping down under a needle bed gap (2a),

both of the pull-down members (3, 4) are able to open in a direction of opening them each other and able to close in a direction of closing them,
each of the pull-down members (3, 4) hav-

ing an outer periphery (3c, 4c) driven to revolve by a rotation shaft (3a, 4a) extending in a knitting width direction, and the driving to revolve being performed in a direction to pull-down the fabric (11) in a closing state where the fabric (11) is capable of being sandwiched between the outer peripheries (3c, 4c);

a driving mechanism for the rotation shaft (3a, 4a), provided at least on one side in the knitting width direction;
opening and closing mechanisms for the both pull-down members (3, 4), provided on both sides in the knitting direction; and
an opening and closing shaft (6), extending in the knitting width direction and turning to interlock the opening and closing mechanisms on the both sides,

characterized in that the pull-down device for fabric (1, 21) comprises

a pressure lever (5) provided on a middle part in the knitting width direction, angularly displaceable with respect to the opening and closing shaft (6), swinging on the opening and closing shaft (6) as a fulcrum point, and connected to the pull-down member (4) by a pressure arm (5a) extending from the fulcrum point to one side in a radial direction;
a pressure spring (8) for biasing the pull-down member (4) in the closing direction by the pressure lever (5), and
an interlocking switch part (12) for switching between interlocking states with a gap left between the opening and closing shaft (6) and the pressure lever (5),

when the opening and closing shaft (6) opens the pull-down members (3, 4), the opening and closing shaft (6) swings the pressure lever (5) in a direction in which the pull-down members (3, 4) are separated from each other, and
when the opening and closing shaft (6) closes the pull-down members (3, 4), the pressure lever (5) is biased by the pressure spring (8) to swing following the opening and closing shaft (6) until the pull-down members (3, 4) are closed, and after the closing of the pull-down members (3, 4), the opening and closing shaft (6) alone turns within the gap.

2. The pull-down device for fabric (1, 21) according to claim 1, wherein, said pull-down members (3, 4) are pull-down rollers (3, 4) in which said outer periph-

ies (3c, 4c) have cylindrical surfaces around said rotation shaft (3a, 4a).

3. The pull-down device for fabric (1, 21) according to claim 1 or 2, further comprises a switch member (7), which includes:
- a support part (7a), supported by said opening and closing shaft (6) and adjustable in angle to be supported; and
 - a fixing part (7b) for fixing the support part (7a) to the opening and closing shaft (6), and forms said interlocking switch part (12) to said pressure lever (5) in between.
4. The pull-down device for fabric (1, 21) according to claim 3, wherein one of said pressure lever (5) and said switch member (7) has a pin (5e) parallel to said opening and closing shaft (6), and the other has a hole (7c) which has an inner diameter larger than an outer diameter of the pin (5e), so that the pin (5e) able to insert into the hole (7c), and said interlocking switch part (12) is formed with the pin (5e) inserted into the hole (7c).
5. The pull-down device for fabric (21) according to any one of claims 1 to 4, further comprises a receiving member (23), provided on said middle part in said knitting width direction and receiving said opening and closing shaft (6) to restrict deformation of the opening and closing shaft (6).

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Fig. 1

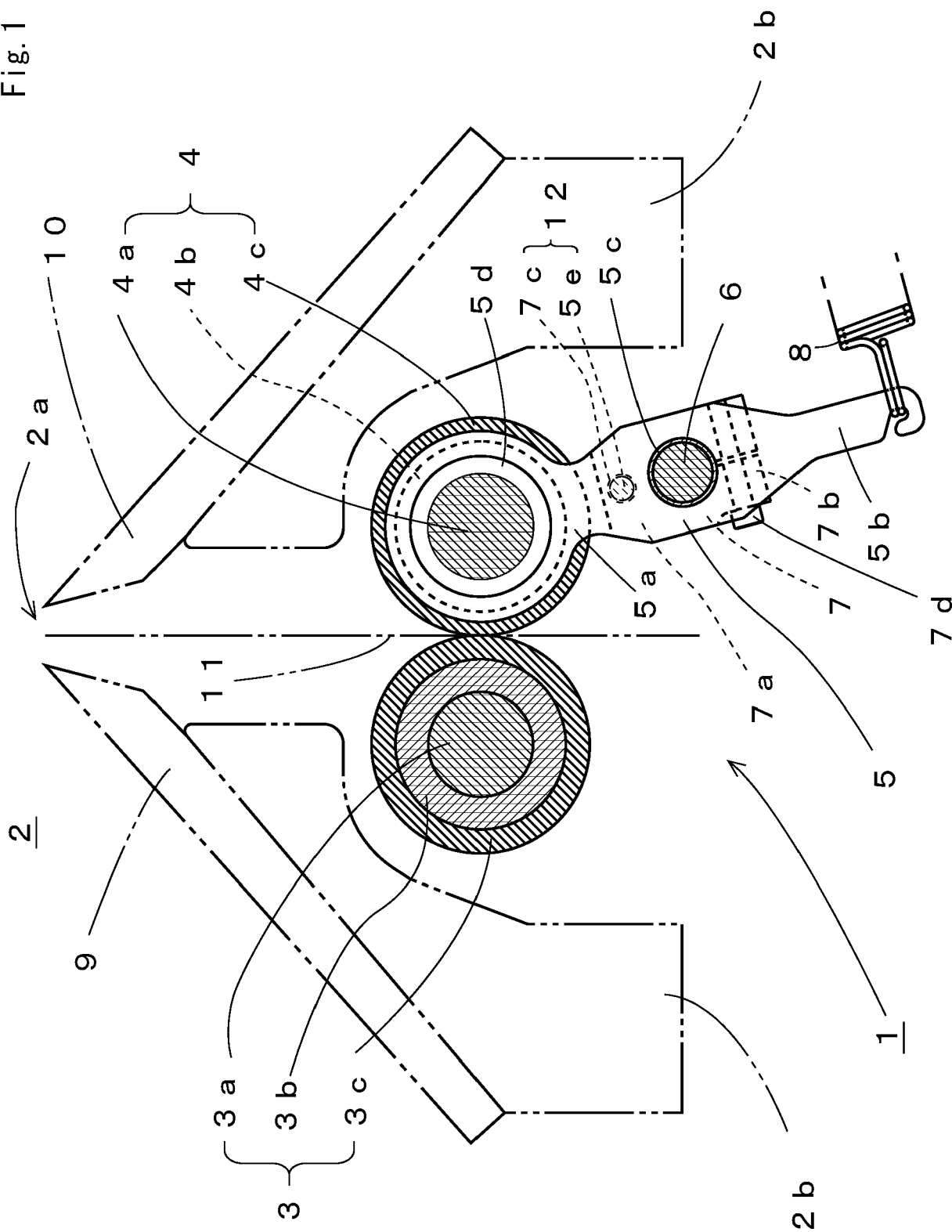


Fig. 2

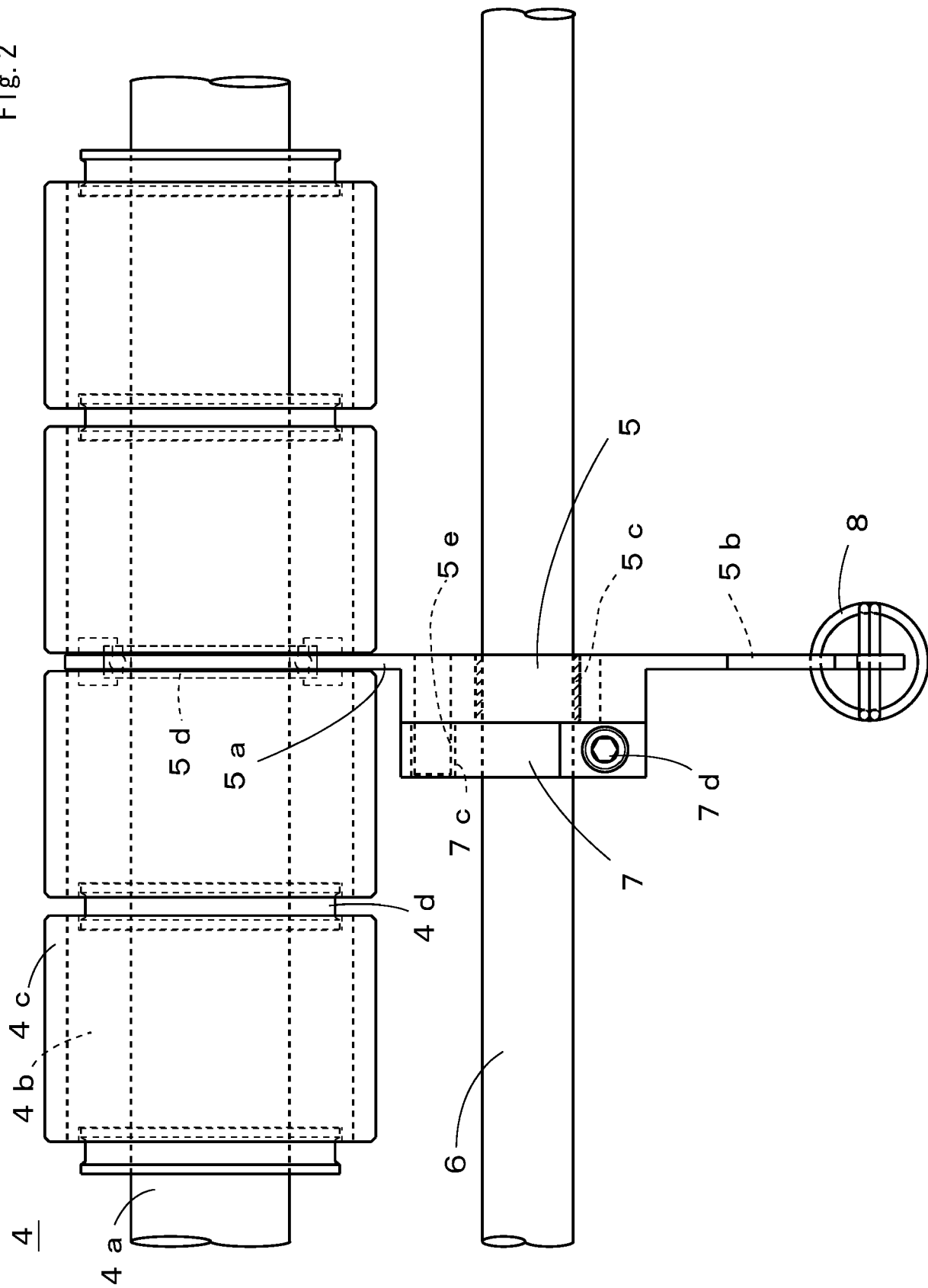


Fig. 3

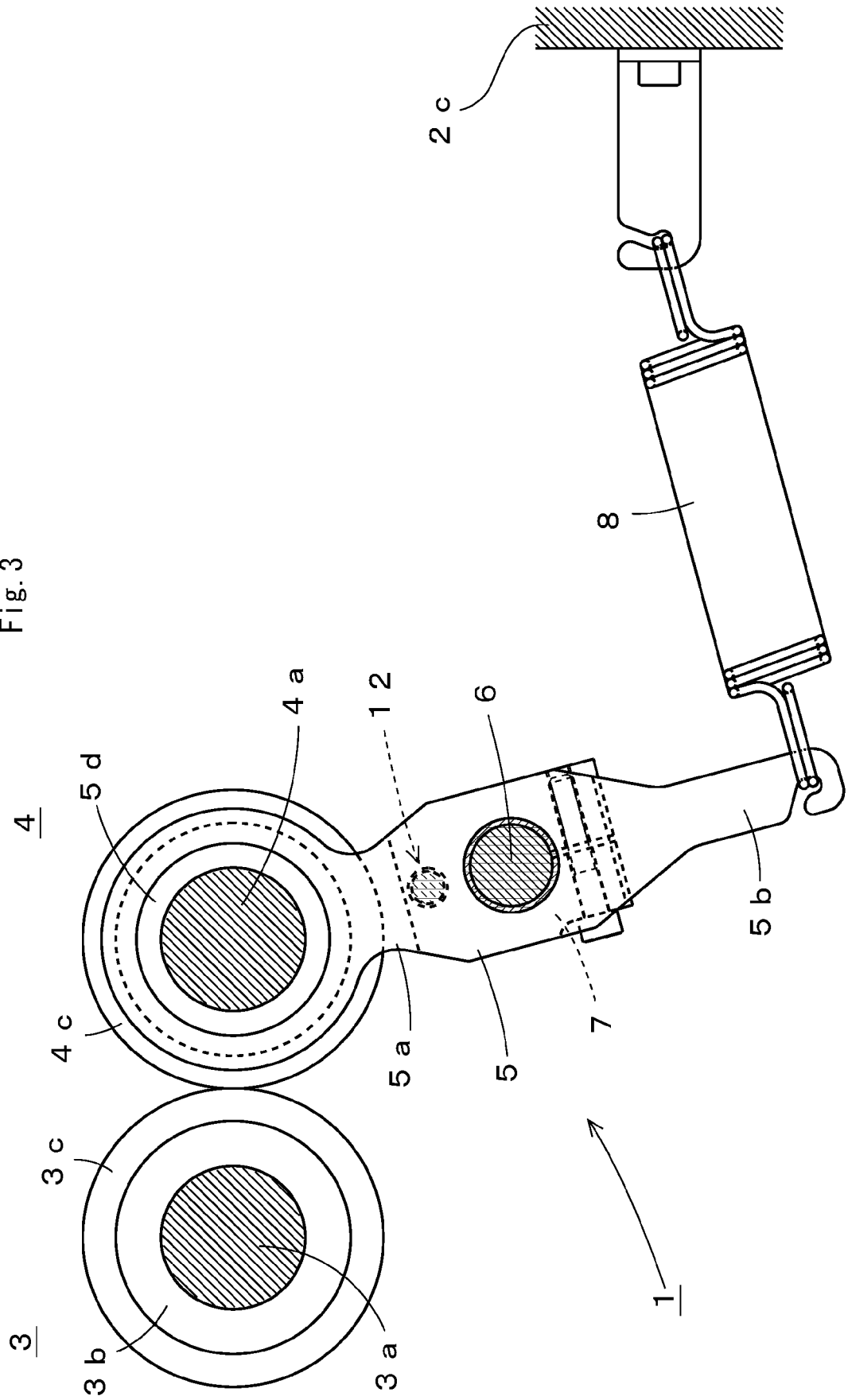


Fig. 4

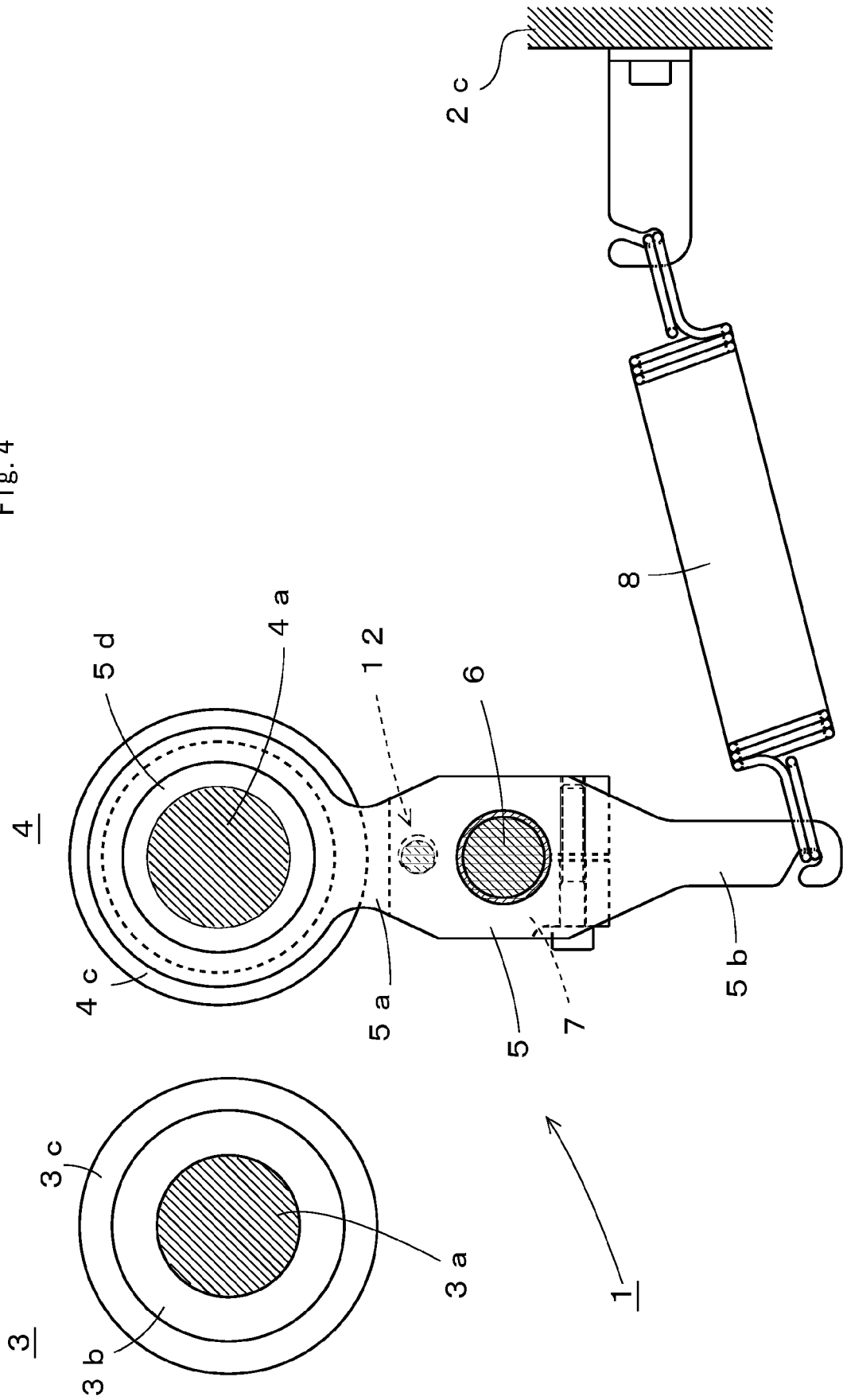


Fig. 5

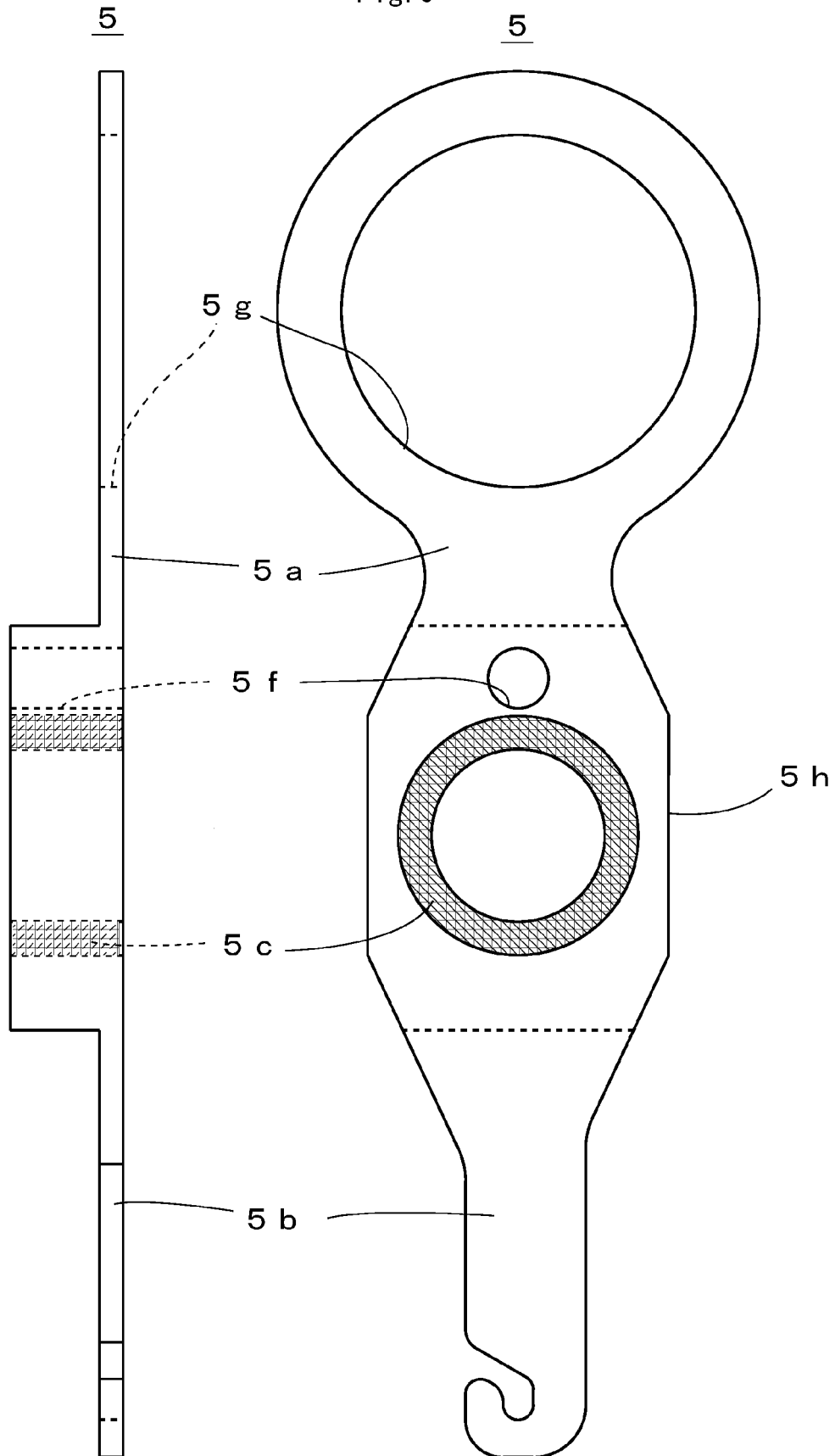


Fig. 6

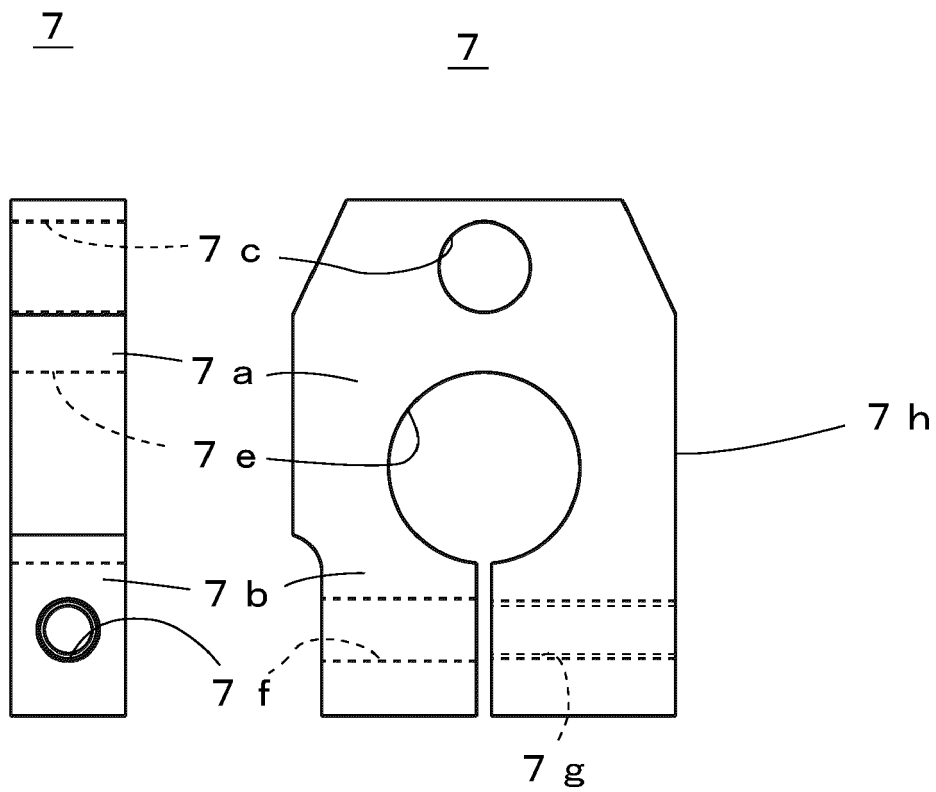


Fig. 7

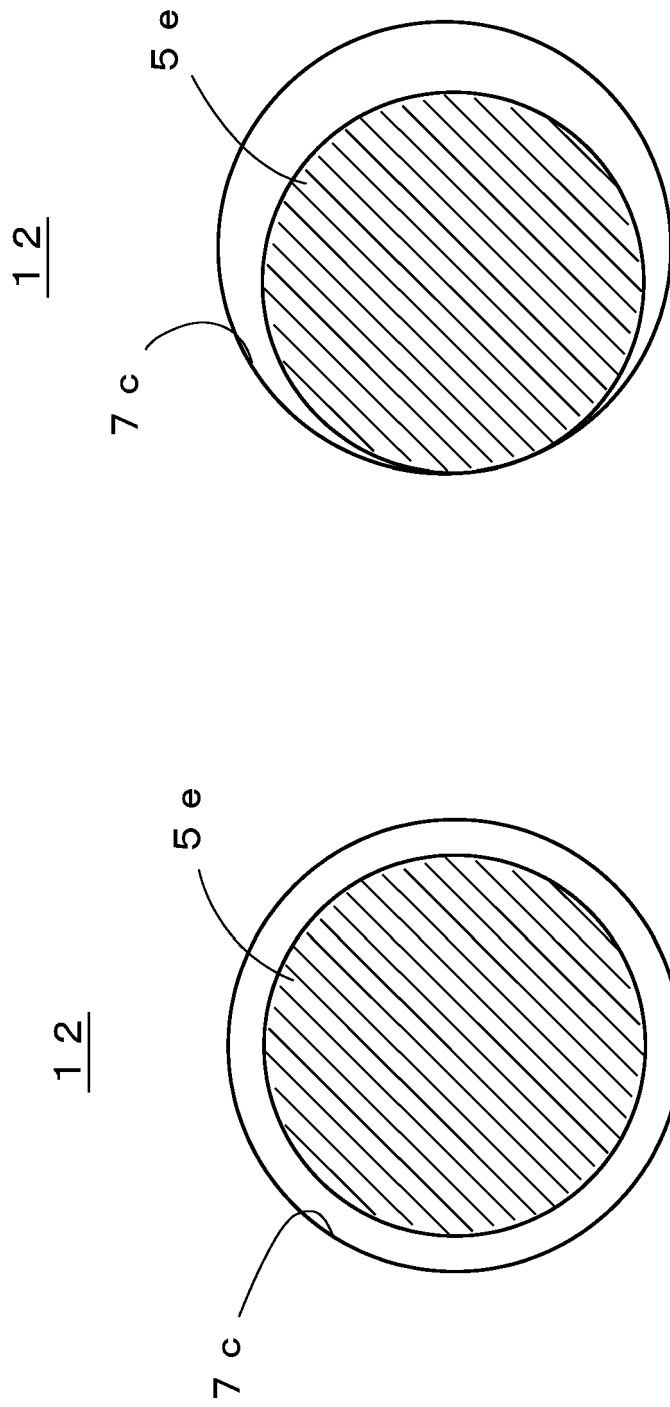


Fig. 8

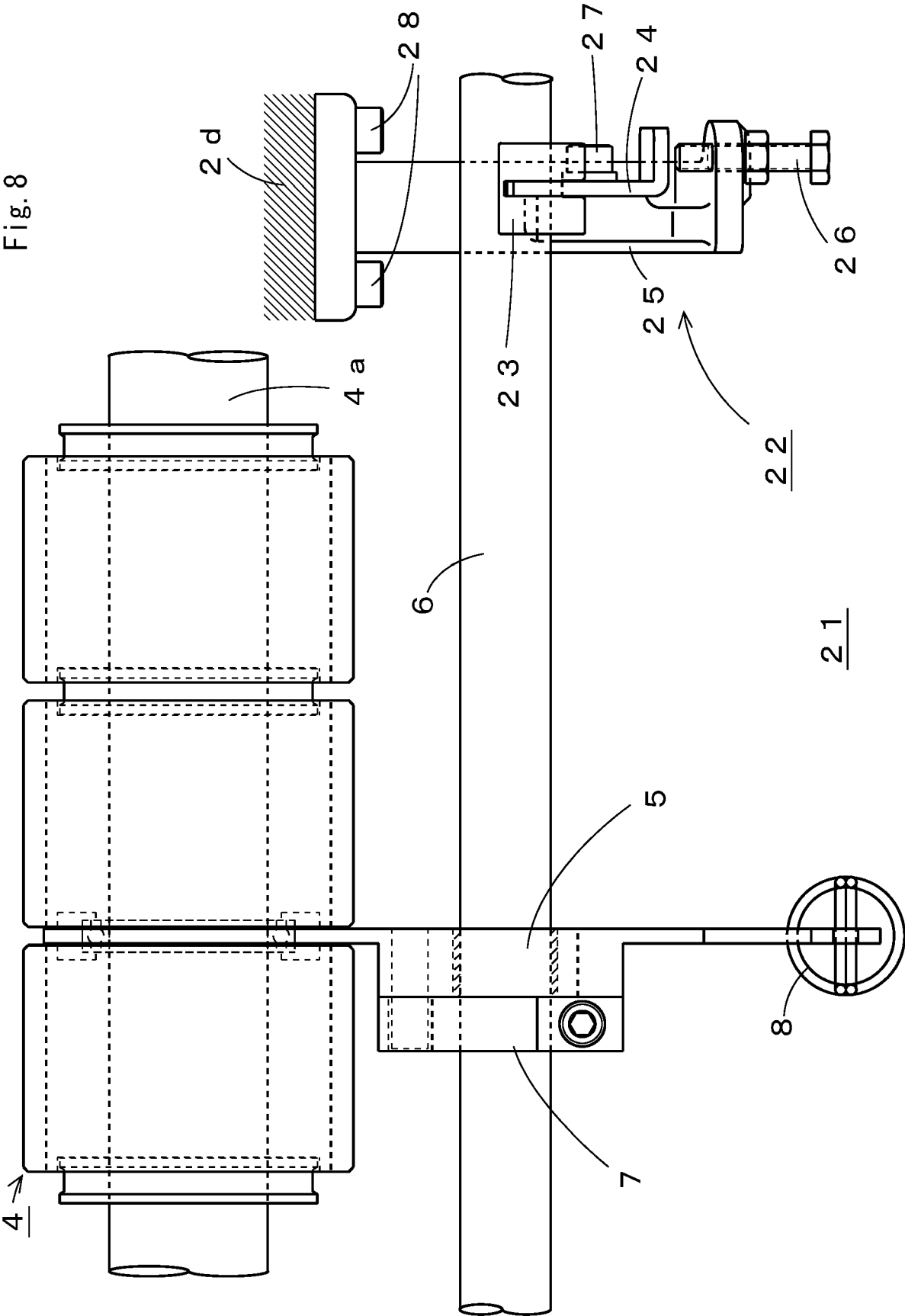
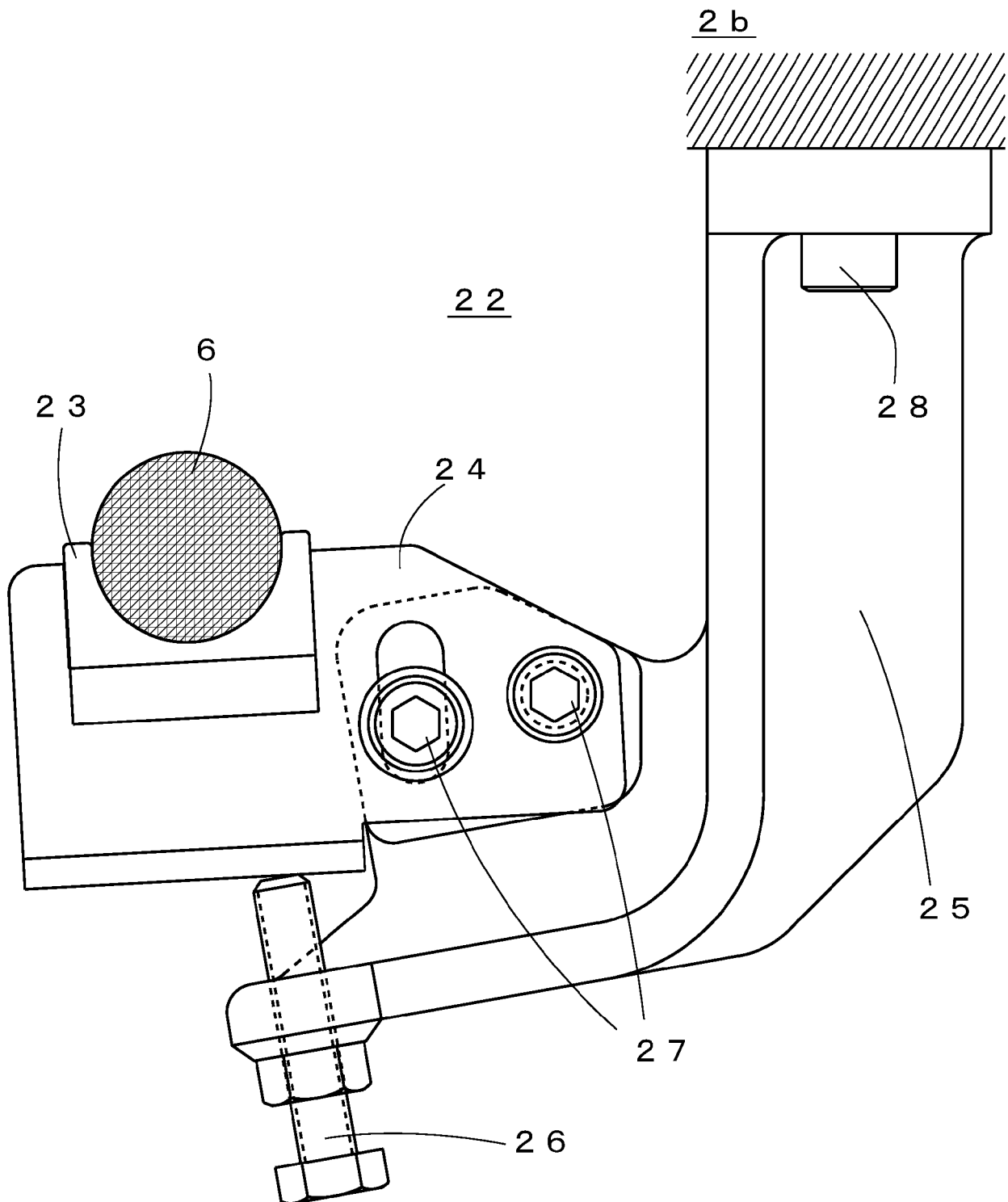


Fig. 9





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			D03D D04B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 October 2020	Examiner Messai, Sonia
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