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(54) Apparatus for butt splicing webs.

(57) An apparatus for butt splicing webs is provided, wherein the splicing accuracy can be improved and the cost can be decreased since the webs can be spliced without an accumulator and the splicing mechanism can be simplified.

When the remainder length of the old roll (28) becomes short, the splicing unit (36) is moved to be abutted to the outer peripheral surface of the new roll (30) and stopped and the new roll (30) is rotated previously at the same speed as the conveying speed of the old roll (28). Then, when the forward end portion (32) of the rotating new roll (30) is detected by the sensor (68) while splicing webs, the cutting drum (42), the cutting-splicing drum (44) and the splicing drum (46) are started to run based on the detected signals and are rotated at the same speed as the conveying speed of the web, and then the forward end portion (32) is stuck and drawn out by the suction pad (42C) of the cutting drum (42), and the webs are cut and spliced in the state that the tail end of the old roll (28) and the forward end of the new roll (30) are held by the respective drums (42), (44) and (46). And, when the splicing of the webs is completed, the splicing unit (36) is retracted from the outer peripheral surface of the new roll and returns to the former position. Therefore, the webs can be spliced without decreasing the rewinding speed of the old roll (28) and the splicing mechanism can be simplified.

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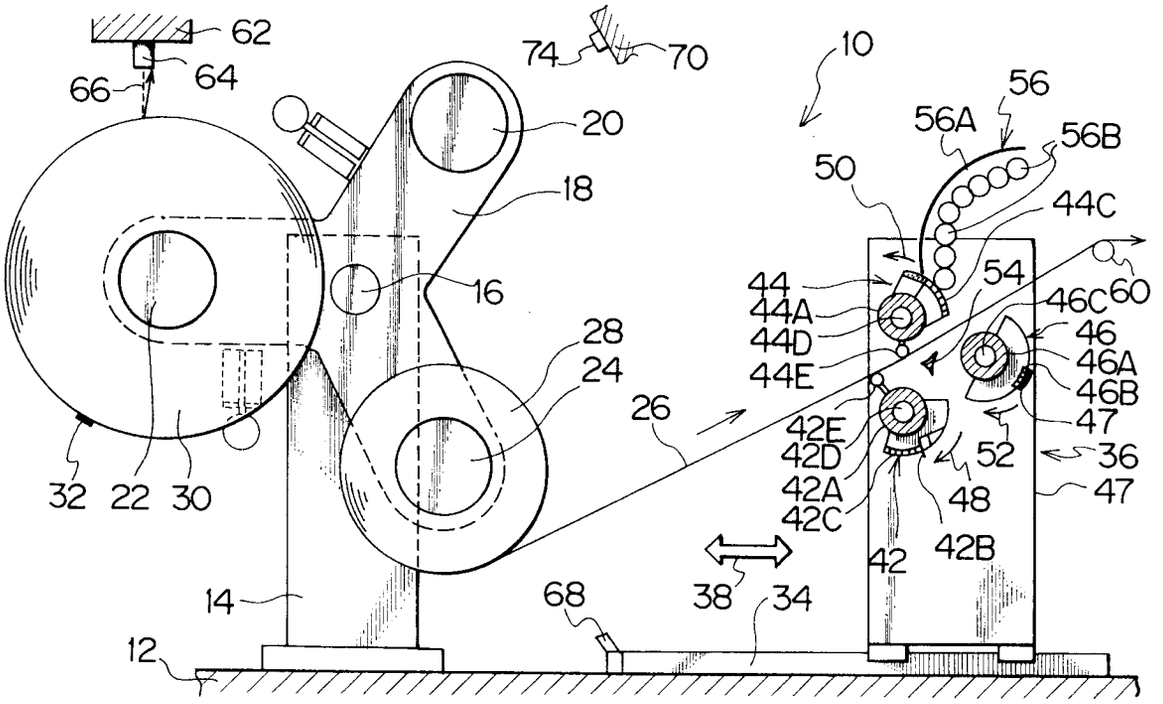
FIG. 1


62
64
66
74
70
10
56
56A
56B
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44C
20
18
16
28
24
26
44
44A
44D
44E
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46C
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46A
46B
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42E
42D
42A
42C
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42B
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BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an apparatus for butt splicing webs, more precisely, to an apparatus for butt splicing webs in the state that ends of old and new rolls of a belt-like materials such as plastic, paper, metallic foil and the like are butted.

2. Description of the Related Art

In the conventional apparatus for butt splicing webs, in order to splice webs accurately in the state that the end of an old web and the forward end of a new web are butted, the webs are spliced in the state that the line of the spreading machine or the processing machine which has the splicing apparatus is stopped, or the webs are fed at low speed by using an accumulator. However, there is a problem in that the production efficiency deteriorates by stopping the line or slowing down whenever webs are spliced.

Moreover, when the webs are fed without stopping or slowing down the line to be spliced, the web conveying is performed at high speed (more than 100 m/min). Therefore, when the web conveying at high speed is performed in the conventional apparatus for butt splicing webs, there are problems in that a high-power motor is needed for the rapid speed-up of the new roll and side-weaving is generated on the new roll by a rapid torque.

In the apparatus for splicing webs of Japanese Patent Application Laid-open No. 55-74940, before splicing webs, the draw-out member for drawing out the forward end of the new roll is sped up until corresponding with the conveying speed of the old web, then, the new roll and the draw-out member are relatively approached to draw out the forward end of the new roll, and further, the drawn forward end is fed to the splicing unit at the same speed as the conveying speed of the old web to thereby supply to the cutting drum and the splicing drum, whereby the webs are spliced.

In the apparatus for splicing webs of Japanese Patent Application Laid-open No. 61-119555, before splicing webs, the web forward end of the new roll is sucked and held by the holding arm of the new roll supported with the turret arm and the holding arm and the new roll is rotated previously until the speed becomes equal to the web conveying speed. Then, in splicing the webs, the tail end of the old roll and the forward end of the new roll are held between the holding arm and the cut drum and the splice drum of the splicing unit in the state that the rotating speed of the holding arm and the web conveying speed are kept, whereby the webs are cut and spliced.

In the apparatus for splicing webs of Japanese Patent Application Laid-open No. 63-31963, the guide web is previously rolled at the web forward end of the new roll and fed, whereby the rotation of the new roll is speeded up gradually so as to rotate the new web lead by the guide web at the same speed as the conveying speed of the old web, thereafter, the old web and the new web are spliced.

However, the apparatus for splicing webs of Japanese Patent Application Laid-open No. 55-74940 has disadvantages in that the mechanism is complicated since an apparatus for drawing out and conveying the forward end of the new roll to the splicing unit at the same speed as the web conveying speed must be provided between the new roll and the splicing unit, and the splicing accuracy deteriorates by the difference between the conveying speeds of the old web and the new web since the forward end of the new roll is sent out to the splicing unit by the conveying apparatus.

Moreover, in the apparatus for splicing webs of Japanese Patent Application Laid-open No. 61-119555, the webs are spliced on the splicing unit by the holding arm wherein the turret arm is rotating, therefore, respective mechanisms rotating at high speed are made to be simultaneous so as to obtain the most suitable timing for splicing, so that high accuracy is required. Thus, there is a disadvantage in that the apparatus becomes expensive.

The apparatus for splicing webs of Japanese Patent Application Laid-open No. 63-31963 has a disadvantages in that the arrangement becomes troublesome since a guide web must be used repeatedly by every new roll to avoid higher cost by throwing away guide webs.

SUMMARY OF THE INVENTION

This invention has been developed to eliminate the above-described disadvantages and aims to provide an apparatus for butt splicing webs, wherein an old web and a new web can be spliced without an accumulator, and the splicing accuracy can be improved and the cost of the apparatus can be decreased by simplifying the mechanism in the apparatus.

To achieve the above-described aim, according to this invention, an apparatus for butt splicing webs, wherein, while the webs are conveyed, a tail end of a web of an old roll is superposed on a forward end of a web of a new roll, then, the both webs are cut to bring the both webs in the abutment against each other and the both webs are spliced to each other in this state, and said apparatus is characterized in that: said apparatus comprises a turret arm rotatable through a predeter-

mined angle, for rewindably supporting the old roll and the new roll, a splicing unit linearly movable an outer peripheral surface of the new roll, including a cutting drum having a cutting member and a draw-out member for drawing out a forward end portion of the web of the new roll and being rotatable at a speed equal to a speed for conveying the webs at the time of splicing, a cutting-splicing drum having a cutting member and being rotatable at a speed equal to the speed for conveying the webs at the time of splicing, a splicing drum peelably holding a splicing tape and being rotatable at a speed equal to the speed for conveying the webs at the time of splicing the webs, and a sensing means for sensing the forward end portion of the web of the rotating new roll; before splicing the webs, said splicing unit is moved so as to approach the outer peripheral surface of the new roll, and the new roll is previously rotated at a speed equal to the speed for conveying the webs; and at the time of splicing the webs, said respective drums are operated in response to a sensing signal of said sensing means to rotate at a speed equal to the speed for conveying the webs, the forward end portion of the new roll is drawn out by the draw-out member of said cutting drum, and the webs are cut and spliced to each other while the tail end of the old roll and the forward end of the new roll are clamped by said respective drums.

According to this invention, when the remainder of an old roll becomes little, the splicing unit is moved to be adjacent to the outer peripheral surface of a new roll and stopped, and the new roll is previously rotated at the same speed as the conveying speed of the old roll.

Next, when the sensing means detects the forward end of the rotating new roll during splicing webs, the cutting drum, the cutting-splicing drum, the splicing drum are respectively operated so as to be rotated at the same speed as the conveying speed of the web, and then the forward end of the new roll is drawn out by the draw-out member of the cutting drum (by a suction force, an adhesion and the like) and the webs are cut and spliced with the holding the tail end of the old roll and the forward end of the new roll by the respective drums. Then, when the splicing is completed, the splicing unit is retracted from the outer peripheral surface of the new roll and returned to the former position.

With this arrangement, in an apparatus for butt splicing webs according this invention, the webs can be spliced without decreasing the rewinding speed of the old roll, therefore, an accumulator is unnecessary.

Moreover, the splicing unit provided is to be linearly movable, the forward end of the rotating new roll is directly drawn out by the draw-out member of the cutting drum in the splicing unit, and the webs are cut and spliced by the cutting drum, the cutting-splicing drum and the splicing drum in the splicing unit, therefore, a conveying mechanism for conveying the forward end of the new roll to the splicing unit is unnecessary. With this arrangement, the splicing mechanism can be simplified, so that the splicing accuracy can be improved and the cost of the apparatus can be decreased.

Further, an expander roller made of rotatable and diameter-expandable elastic materials such as rubber is provided in the splicing unit, and the diameter of the expander roller is expanded so as to be abutted to the outer peripheral surface of the new roll when splicing, then, the forward end of the new roll is drawn out and delivered to the draw-out member of the cutting drum in the state that it rotates in accordance with the rotating new roll. With this arrangement, the expander roller rotates in accordance with the new roll, therefore, the forward end of the new roll can be drawn out more smoothly.

Moreover, the outer diameter of the new roll supported with the turret arm is measured by the outer diameter measuring means and the moving distance that the splicing unit approaches the outer peripheral surface of the new roll is decided based on the measured result. Therefore, though the distance to the outer peripheral surface varies depending on the winding times, the positional relation between the outer peripheral surface of the new roll and the splicing unit can be kept constant.

Furthermore, a tail end mark informing that the wound value becomes under a predetermined value is made on the old roll supported by the turret arm, and when the tail end mark is detected by the sensing means, the new roll supported by the turret arm is begun to rotate at the same speed as the conveying speed of the web, whereby the timing of the rotation beginning of the new roll is determined.

And, the web remainder of the old roll which had been cut when splicing is removed from the splicing unit by the removing means.

BRIEF DESCRIPTION OF THE DRAWINGS

The exact nature of this invention, as well as other objects and advantages thereof , will be readily apparent from the consideration of the following specification relating to the accompanying drawings, in which like reference characters designate the same or similar parts throughout the figures thereof and wherein:

Fig. 1 is a constitutional view of the first embodiment of the apparatus for butt splicing webs according to this invention;

Fig. 2 is an essential constitutional view of the splicing unit in the first embodiment;
Fig. 3 is structural view of the removing unit which removes the cut remainder of the old roll;
Figure 4 is a state view showing the state immediately before the splicing in the first embodiment;
Fig. 5 is an explanatory view explaining the draw-out of the forward end of the new roll in the first embodiment;
Fig. 6 is a graph explaining the draw-out of the forward end of the new roll in the first embodiment;
Fig. 7 is an essential enlarged view explaining the cut of the web in the first embodiment;
Fig. 8 is an essential enlarged view explaining the splicing of the webs in the first embodiment.
Fig. 9 is a constitutional view of the second embodiment of the apparatus for butt splicing webs according to this invention;
Fig. 10 is a schematic sectional view showing the structure of the expander roller;
Fig. 11 is a essential enlarged view explaining the draw-out of the forward end of the new roll in the second embodiment; and,
Fig. 12 is an essential enlarged view explaining that the forward end of the new roll is delivered from the expander roller to the cutting drum in the second embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Detailed description will hereunder be given of the preferred embodiment of the apparatus for butt splicing webs according to the present invention with reference to the accompanying drawings.

Fig. 1 shows the first embodiment of the apparatus for butt splicing webs according to this invention. A post 14 is set up on a base and three-forked turret arm 18 is supported rotatably by a turret axis 16 at the upper position of the post 14. And, the turret arm 18 can be rotated intermittently every 120° about the turret axis 16. And, roll axes 20, 22, 24 are rotatably supported at the respective front portion of the turret arm 18, and an old roll 28 wound with an old web 26 to being conveyed and a new roll 30 wound with a new web are supported by two roll axes 22, 24, respectively and rewindably. Another new roll which is used next to the roll 30 is supported at the roll axis 20 which is not used. Further, each axis 20, 22, 24 is connected with the motor, not shown, and the new roll 30 can be rotated at the same speed as the conveying speed of the old web 26 when the old and new webs are spliced as described later. Moreover, the forward end of the new roll 30 is temporarily put on with the adhesive tape so that the forward end should not come off from the wind-beginning of the web while rotating the new roll 30 and is put on with a forward end mark 32.

And, a guide rail 34 is constructed on the base 12 in the conveying direction of the web, and a splicing unit 36 is provided so as to be movable on the guide rail 34. Therefore, the splicing unit 36 is linearly movable in the direction of an arrow 38 in Fig. 1 concerning the turret arm 18.

Moreover, a cutting drum 42, a cutting-splicing drum 44 and a splicing drum 46 are rotatably supported by respective rotational axes 42A, 44A, and 46A so as to rotate freely thereabout in a casing 40 of the splicing unit 36. And, the respective rotational axes 42A, 44A and 46A are connected with the motor, not shown, so that the drums 42, 44 and 46 can be rotated in the respective directions of arrows 48, 50 and 52 at the same speed as the conveying speed of the old web 26 when splicing webs.

Moreover, as shown in Fig. 2, the outer peripheral portion of the cutting drum 42 is formed with the elastic material such as rubber, a cutter 42B is provided at the middle of the outer peripheral portion arid a suction pad 42C is formed on the front portion of the outer peripheral surface about the rotating direction , whereby the cutting drum 42 is connected with a suck apparatus not shown through a hollow shaft 42D. And, the cutting and splicing drum 44 has an abutting plate 44B on the front portion of the outer peripheral portion about the rotational direction thereof, and the abutting plate 44B and the cutter 42B of the cutting drum 42 are abutted, whereby the shearing force is acted so as to cut the web. Further, a suction pad 44C is located on the rear portion of the outer peripheral surface about the rotational direction of the cutting-splicing drum 44 and connected the suck apparatus not shown through an hollow shaft portion 44D. Moreover, the splicing drum 46 has a suction pad 46B for sucking the back of a splicing tape 47 such that can be taken off about the middle of the outer peripheral portion thereof, and is connected with the suck apparatus, not shown, through an hollow shaft portion 46C. And, rollers 42E and 44E are attached to the cutting drum 42 and the cutting-splicing drum 44, whereby the web between the old roll 28 and a pass roller 60 is supported. Further, a sectional-triangle-shaped guide member 54, which guides the web to be spliced so as not to stray from the web conveying route, is provided with the casing 40 at the triangle-shaped space enclosed by each drum 42, 44 and 46.

And, a removing unit 56 for removing the remainder of the old web 26 to be cut when splicing from the web conveying route is arranged in the upper vicinity of the cutting-splicing drum 44 as shown in Fig. 3. The removing unit 56 has an

interval slightly thicker than the web along the circular-arc-shaped guide board 56A and a plurality of rotating rolls 56B, 56B... are located, whereby a removing route 56 is formed between the guide board 56A and the rotating rolls 56B, 56B.... And, a plurality of the rotating rolls are connected with the motor, not shown, and is rotated faster than the cutting-splicing drum 44 in the opposite rotating direction thereof. Therefore, the remainder of the old web 26, which has been cut is held by the suction pad 44C, is put in between the cutting-splicing drum 44 and the rotating roll 56B and fed to the removing path 58, to thereby be removed from the web conveying route.

Further, as shown in Fig. 1, a sensor 64 for measuring the outer diameter of the new roll 30 is attached on a wall 62 located above the new roll 30. Then, a light beam 66 from the sensor 64 is reflected with the outer peripheral surface and the distance to the outer periphery of the new roll 30 is measured, whereby the outer diameter of the new roll 30 can be measured. Moreover, a sensor 68 is placed at the end of the guide rail 34 on side of the turret arm 18. And, the sensor 68 detects the forward end mark of the new roll 30 when the turret arm 18 rotates about 120° to thereby move the new roll 30 to the position shown in Fig. 4. Moreover, a sensor 74, which detects the tail end mark 72 put on the tail end of the old roll 28, is attached on a wall 70 above the old roll 28 which moves to the position shown in Fig. 4. And, signals of the respective sensors 64, 68 and 74 are input to a controller not shown, whereby the moving distance of the splicing unit and the rotation timings of the respective drums 42, 44 and 46 are controlled.

Next, the explanation will be given of the action of the apparatus 10 for butt splicing webs according to this invention constructed like the above-mentioned.

As shown in Fig. 1, the old web 26 rewound from the old roll 28 is supported by the pass roller so as to be fed through the cutting-splicing drum 42, the cutting drum 42 and the splicing drum 46, and passed to the spreading process or processing process, not shown. At this time, the old web 26 is supported by the guide rollers 42E and 44E of the cutting drum 42 and the cutting-splicing drum 44 to prevent it from bending.

While rewinding the old web 26 in the state of Fig. 1, the outer diameter of the new roll 30 is measured by the sensor 64 and signals thereof are input to the controller not shown. And, when the outer diameter of the new roll is measured, the turret arm 18 is rotated by 120° so that the old roll 28 and the new roll 30 are moved to the position shown in Fig. 4, and the splicing unit 36 is moved on the guide rail 34 in the direction of the arrow 78 based on the moving distance calculated from the outer diameter of the new roll input to the controller and stopped at the position adjacent to the outer peripheral surface of the new roll 30. Next, the tail end mark 72 on the old roll 28 is detected by the sensor 74 and signals of informing that the web length of the old roll 28 decreased to a value less than the predetermined value. And, in the controller, the instruction is given to the motor for driving the rotational axis 22 of the new roll 30, so that the new roll 30 is rotated counterclockwise and accelerated to the same speed as the conveying speed of the old web 26 (for instance, more than 100m/minute).

Next, when the sensor 68 detects the forward end mark 32 of the new roll 30 and the signals are input to the controller, the controller instructs the motor to rotate the rotational axes 42A, 44A and 46A of the drums 42, 44 and 46 so as to rotate the respective drums 42, 44 and 46 at the same speed as the conveying speed of the old web 26, and to make the suction pads 42C, 44C and 46B of the respective drums 42, 44 and 46 in the sucking state. At this time, the cutting drum 42 begins to rotate so as to be the same speed as the conveying speed of the old web 26 at the draw-out position where the forward end of the new roll 30 is drawn out, and the forward end of the new roll 30 is held by the suction pad 42C of the cutting drum 42 and drawn out. That is, as shown in Fig. 5, when the outer peripheral speed of the new roll 30 is represented by V and the time for moving the distance A from the forward end sensing position B to the draw-out position C of the new roll 30 is represented by t, as shown in Fig. 6, the cutting drum 42 is driven to be rotated, such that the rotation speed becomes the same as the outer peripheral speed V of the new roll 30 after seconds from starting the rotation. Therefore, the web forward end of the new roll 30 can be certainly drawn out by the suction pad 42C of the cutting drum 44. Similarly, the rotations of the cutting-splicing drum 44 and the cutting drum 42 are started according to the timing for the web cutting and splicing which will be described later. And, when each drum 42, 44 and 46 is rotated by the angle shown in Fig. 7, the old web 26 and the new web 80 are piled and held by the cutting drum 42 and the cutting-splicing drum 44, and the old and new webs 26, 80 are cut with the cutter 42B and abutting plate 44B of the cutting-splicing drum 44. At this time, the web forward end of the new web 80 after cutting is quickly put into the space between the cutting drum 42 and the cutting-splicing drum 44 which rotate opposite to each other and held, then moved in the conveying direction by guiding with the guide member 54. Further, the forward end of the new web 80 is fed to the forward end portion side by rotating the new roll 30, therefore, it never

strays off from the cutting part. On the other hand, the tail end of the old web 26 after cutting is held by the cutting-splicing drum 44 and the splicing drum 46 to be moved in the web conveying direction. Therefore, the tail end of the old web 26 after cutting and the forward end of the new web 80 after cutting are conveyed certainly to the splicing position in the state of be butted with each other.

Next, when the respective drums 42, 44 and 46 are rotated by the angle shown in Fig. 8, the butting positions of the the old and new webs 26 and 80 are spliced with the splicing tape 47 sucked and held by the suction pad 46B of the splicing drum in the state that the old and new webs 26 and 80 are held by the cutting-splicing drum 44 and the splicing drum 46. Then, after splicing, each drum 42, 44 and 46 is rotated to the former position and stopped, and the pull of the suction pad 42C, 44C and 46B of each drum 42, 44 and 46 is released. And, the splicing unit 36 is moved on the guide rail 34 and extracted to the former position, and the web conveying of the new roll 30 is begun again in the state of Fig. 1. Moreover, while the cut remainder of old web 26 which has been cut when cutting is removed from the conveying route by the removing unit 56 shown in Fig. 3, the cut remainder of the new web 80 is pulled and held by the suction pad 42C of the cut drum 42 and moved to the stopping position of the cutting drum 42, and then the pull of the suction pad 42C is released, whereby it falls from the cutting drum 42 by the deadweight. Therefore, the butt splicing of the old and new webs 26 and 80 is completed.

In the apparatus 10 for butt splicing webs according to this invention, the splicing unit 36 is approached to the outer periphery of the new roll 30 based on the signals from the sensor 64 for detecting the outer diameter of the new roll 30, and the new roll 30 is previously rotated so as to be at the same speed as the conveying speed of the old web 26, and then the forward end of the new roll 30 is drawn out by the suction pad 42C of the cutting drum 42 in the splicing unit 36 and the ends of the old and new webs 26, 80 are butt spliced with the cutting drum 42, the cutting-splicing drum 44 and the splicing drum. With this arrangement, webs can be spliced without decreasing the rewinding speed of the old web 26, therefore, an accumulator is not needed. Further, there is no need to stop or slow down a production line when splicing, therefore, the productity can be improved.

Moreover, the splicing unit 36 is provided linearly movable and the forward end of the rotating new roll 30 is drawn out directly by the cutting drum 42, therefore, it is unnecessary that the forward end of the new roll is fed to the splicing unit. With this arrangement, the splicing mechanism can be simplified, therefore, the splicing accuracy can be improved and the cost of the apparatus can be decreased.

Moreover, the outer peripheral portion of the cutting drum 42 is formed with the elastic material such as rubber, whereby the web can be drawn out without damage when the forward end of the new roll 30 is drawn out.

Next, the second embodiment of the apparatus for butt splicing webs according to this invention is explained with Fig. 9. The same members as the first embodiment are applied with the same numerals and explained.

As shown in Fig. 9 (corresponding to Fig. 4 in the first embodiment), an expander roller 82 is supported rotatably by the rotational axis 84 in the vicinity of the cutting drum 42 and can be rotated according to an rotor when touching thereto. And, as shown Fig. 10, the expander roller 82 is fitted to the rotational axis 84 and formed with an almost cylinder-shaped the metallic frame 88 having an air ventilation path 86 and a rubber film 90 which can expand and contract and covers the metallic frame 88 in the sealing state. With this arrangement, a space part 92 which leads to the ventilation path 86 can be formed between the metallic frame 88 and the rubber film 90. And, when air from the air supply apparatus not shown is injected into the space part 92 through the ventilation path 86, the rubber film expands in the directions of the arrow 94. Incidentally, members and devices except the expander roller 82 are similar to the first embodiment.

Next, the explanation will be given of the action of the apparatus for butt splicing webs provided with the expander roller 82 according to this invention.

When the remainder of the old roll 28 becomes under a predetermined value the new roll 30 is rotated to be at the same speed as the conveying speed of the old web 26 and the splicing unit 36 becomes adjacent to the new roll 30 to stop, as well as the first embodiment. In this case, the new roll 30 is rotated clockwise contrary to the first embodiment. Moreover, an adhesive tape is temporarily adhered so as not to come off from a windbeginning of the web on the back of the forward end of the new roll 30, and an adhesive tape 32, which is used as the forward end mark and has much stronger adhesive force than that of the back, is attached on the surface thereof.

Next, as shown in Fig. 11, when the sensor 68 detects the forward end mark 32 of the new roll 30, the expander roller 82 is injected with air and expanded, then it is abutted to the outer peripheral surface of the new roll 30 and rotated in accordance with the rotation of the new roll 30. And, when the forward end of the new roll 30 is moved

to the expander roller 82, the adhesive tape 32 is stuck on the expander roller 82, whereby the forward end of the new roll 30 is drawn out. Then, the web forward end of the new roll 30 drawn out with the expander roller 82, as shown in Fig. 12, is pulled and held by the suction pad 42C of the cutting drum 42 and delivered to the cutting drum 42. At this time, the adhesive force of the suction pad 42C of the cutting drum 42 is made stronger than that of the adhesive tape 32 , whereby the web forward end of the new roll 30 can be easily delivered from the expander roller 82 to the cutting drum 42. Moreover, the timing of the rotation beginning for the cutting drum 42, as well as the first embodiment, is controlled by the controller based on the signals from the sensor 68. Then, the new web 80 received by the cutting drum 42 is spliced with the old web 26, as well as the first embodiment.

In this way, the splicing unit 36 is provided with the expander roller 82 which can rotate and expand the diameter thereof, and the diameter of the expander roller 82 is expanded so as to be in contact with the outer peripheral surface of the new roll 30 when splicing and the web forward end of the new roll 30 is drawn out and delivered to the cutting drum 42 in the state that the expander roller 82 is rotated in accordance with the rotating new roll 30. Therefore, in the second embodiment, the same effect as the first embodiment can be obtained, and the expander roller 82 rotate in accordance with the new roll 30, so that the web forward end of the new roll 30 can be drawn out more smoothly.

Incidentally, the forward end of the new roll 30 is drawn out by the cutting drum 42 with the holding force in the first embodiment, however, an adhesion may be used as the draw-out member of the cutting drum 42.

As has been described hereinabove, in the apparatus for butt splicing webs according to this invention, webs can be spliced without decelerating the rewinding speed of the old web, therefore an accumulator is not needed. And, there is no need that the line should be stopped or slowed down when splicing, therefore, the production efficiency can be improved.

Further, the splicing unit is provided linearly movable and the forward end of the rotating new roll is drawn out by the cutting drum directly, therefore, there is no need that the forward end of the new roll is fed to the splicing unit. Therefore, the splicing mechanism can be simplified, therefore, the splicing accuracy can be improved and the cost of the apparatus can be decreased.

Moreover, the splicing unit is provided with the expander roller formed with elastic material such as rubber, which can rotate and expand in diameter, and the forward end of the new roll is drawn out once by the expander roller in the state that the expander roller rotates in accordance with the new roll and delivered to the cutting drum, therefore, the forward end of the new roll can be drawn out more smoothly.

And, the outer diameter of the new roll supported by the turret arm is measured by the outer diameter measuring means and the moving distance that the splicing unit becomes adjacent to the outer peripheral surface of the new roll is decided based on the measured result. Therefore, the positional relation of the outer peripheral surface of the new roll and the splicing unit can always be kept constant though there are differences in the outer diameter depending on the winding strength of the new roll, thus, the forward end of the new roll can be surely drawn out.

Moreover, the tail end mark for informing that the wound length becomes under the predetermined value is made on the old roll supported by the turret arm, and when the tail end mark is detected by the tail end mark sensing means, the new roll supported by the turret arm begins to rotate at the same speed as the conveying speed of the web. Therefore, since the timing for starting the rotation of the new roll can be decided more efficiently, the waste of the power expense by useless rotation can be avoided and the winding strength of the roll is never lost.

Further, since the web remainder of the old roll cut at splicing is removed from the splicing unit by the removing means, the web remainder never obstructs the splicing of webs and never causes it to stop the web conveying line, therefore, the webs can surely be spliced.

It should be understood, however, that there is no intention to limit the invention to specific forms disclosed, but on the contrary, the invention is to cover all modifications, alternate constructions and equivalents falling within the spirit and scope of the invention as expressed in the appended claims.

Claims

1. An apparatus for butt splicing webs, wherein, while the webs are conveyed, a tail end of a web (26) of an old roll is superposed on a forward end of a web (80) of a new roll (30), then, the both webs are cut to bring the both webs in the abutment against each other and the both webs are spliced to each other in this state, characterized in that:

said apparatus comprises a turret arm (18) rotatable through a predetermined angle, for rewindably supporting the old roll (28) and the new roll (30), a splicing unit (36) linearly movable an outer peripheral surface of the new roll (30), including a cutting drum (42) having a

cutting member (42B) and a draw-out member (42C) for drawing out a forward end portion of the web of the new roll (30) and being rotatable at a speed equal to a speed for conveying the webs (26) and (80) at the time of splicing, a cutting-splicing drum (44) having an abutting plate (44B) and being rotatable at a speed equal to the speed for conveying the webs (26) and (80) at the time of splicing, a splicing drum (46) peelably holding a splicing tape (47) and being rotatable at a speed equal to the speed for conveying the webs at the time of splicing the web (26) to the web (80), and a sensing means (68) for sensing the forward end portion of the web of the rotating new roll (30);

before splicing the web (26) and the web (80), said splicing unit (36) is moved so as to approach the outer peripheral surface of the new roll (30), and the new roll (30) is previously rotated at a speed equal to the speed for conveying the webs; and

at the time of splicing the web (26) and the web (80), said respective drums (42), (44) and (46) are operated in response to a sensing signal of said sensing means (68) to rotate at a speed equal to the speed for conveying the webs, the forward end portion of the new roll (30) is drawn out by the draw-out member (42C) of said cutting drum (42), and the webs (26) and (80) are cut and spliced to each other while the tail end of the old roll (28) and the forward end of the new roll (30) are clamped by said respective drums (42), (44) and (46).

2. An apparatus for butt splicing webs as set forth in claim 1, characterized in that the forward end portion of the web is drawn out by said cutting drum (42) through one of a suction and an adhesion.

3. An apparatus for butt splicing webs as set forth in claim 1, characterized in that:

a rotatable and diameter-expandable expander roller (82) is provided on said splicing unit (36);

at the time of splicing, said expander roller (82) is expanded in diameter to abut against the outer peripheral surface of said new roll (30); and

the forward end portion of the web (80) of the new roll (30) is drawn out and delivered to the drawn-out member (42C) of said cutting drum (42) while said expander roller (82) is rotated in accordance with the rotating new roll (30).

4. An apparatus for butt splicing webs as set forth in claim 1, characterized in that an outer diameter of the new roll (30) supported by said turret arm (18) is provided, and a moving distance for said splicing unit (36) to approach the outer peripheral surface of the new roll (30) is determined on the basis of a measured result.

5. An apparatus for butt splicing webs as set forth in claim 1, characterized in that a tail end mark (72) for informing of that a rolling length of the web (26) of the old roll (28) decreases to a value less than a predetermined value of the old roll (28) is marked on the old roll (28) supported by said turret arm (18), a tail end mark detecting means (74) for detecting said tail end mark (72) is provided, and, at the time when the tail end mark (72) is detected by the tail end mark detecting means (74), the new roll (30) supported by the turret arm (18) is rotated at a speed equal to the speed for conveying the webs.

6. An apparatus for butt splicing webs as set forth in claim 1, characterized in that a removing means 56 for removing a remaining part of the web (26) of the old roll (28), which has been cut at the time of splicing, is removed to the outside of said splicing unit (36) is provided in the vicinity of said cutting-splicing drum (44).

FIG. 1

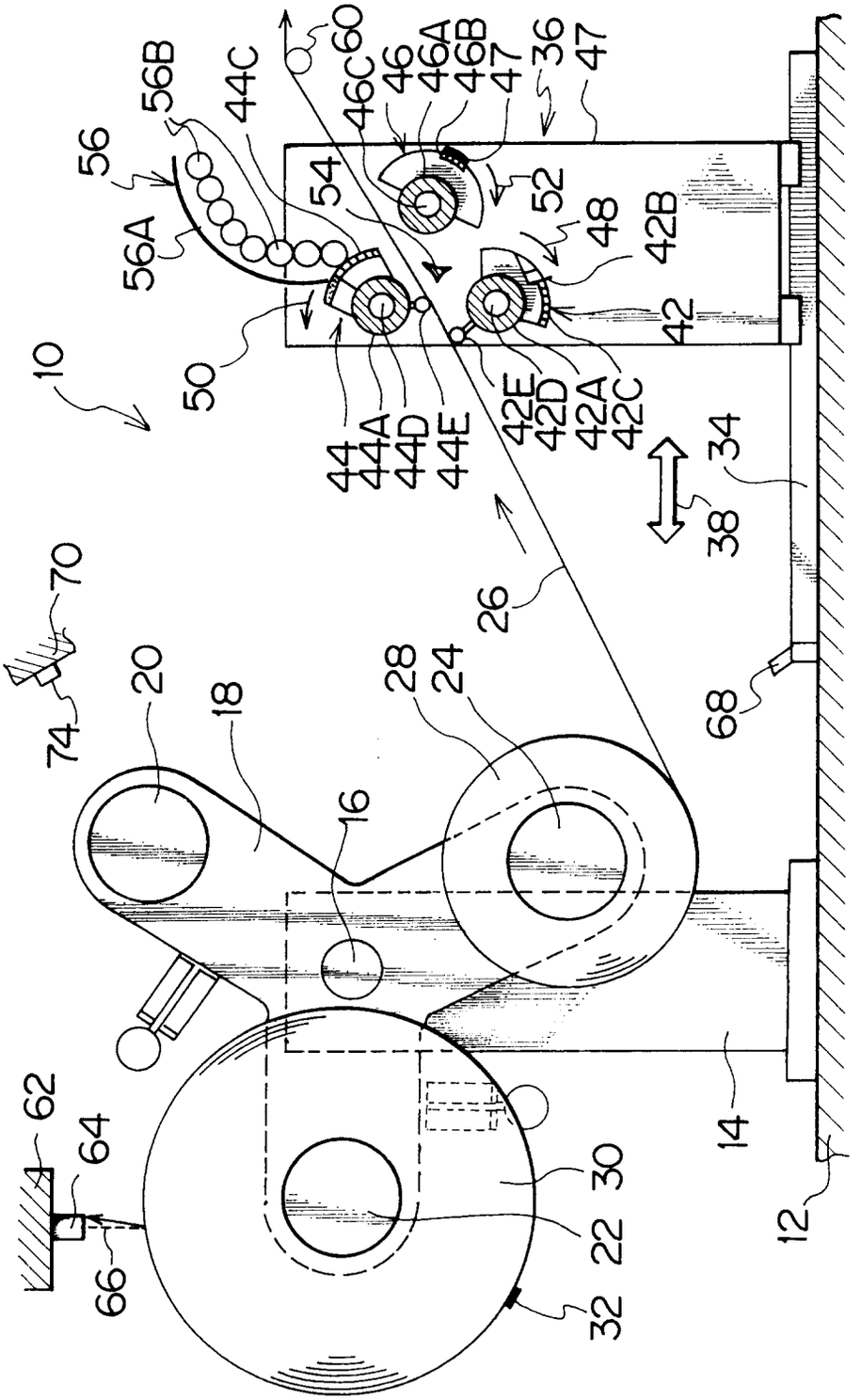
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
42
42A
42B
42C
42D
42E
44
44A
44C
44D
44E
46
46A
46B
46C
47
48
50
52
54
56
56A
56B
60
62
64
66
68
70
74

FIG.2

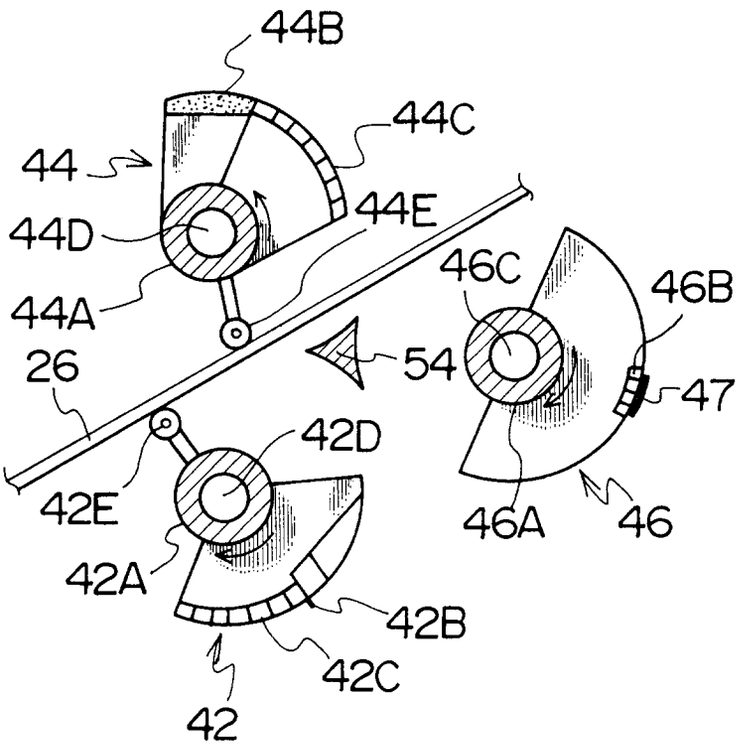
44B
44C
44
44E
44D
44A
26
54
46C
46B
47
42D
42E
42A
42B
42C
42
46A
46

FIG.3

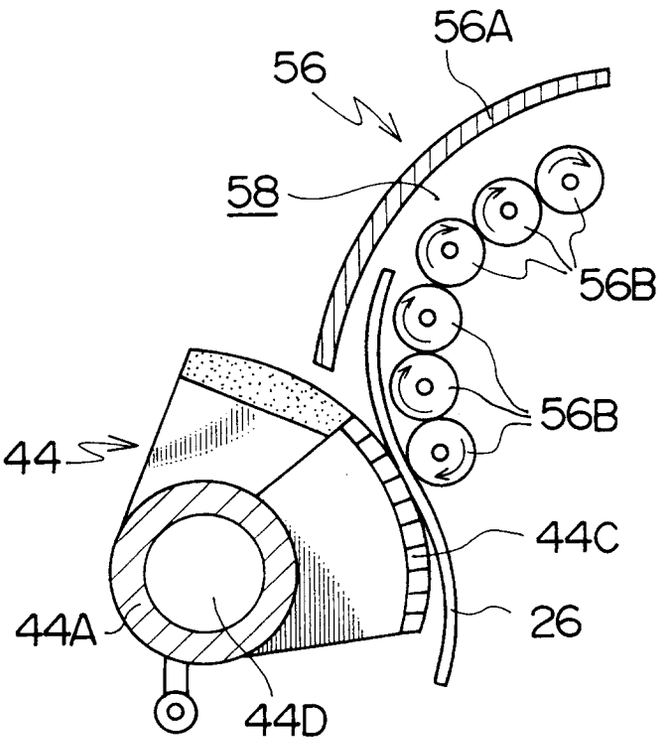

FIG.4

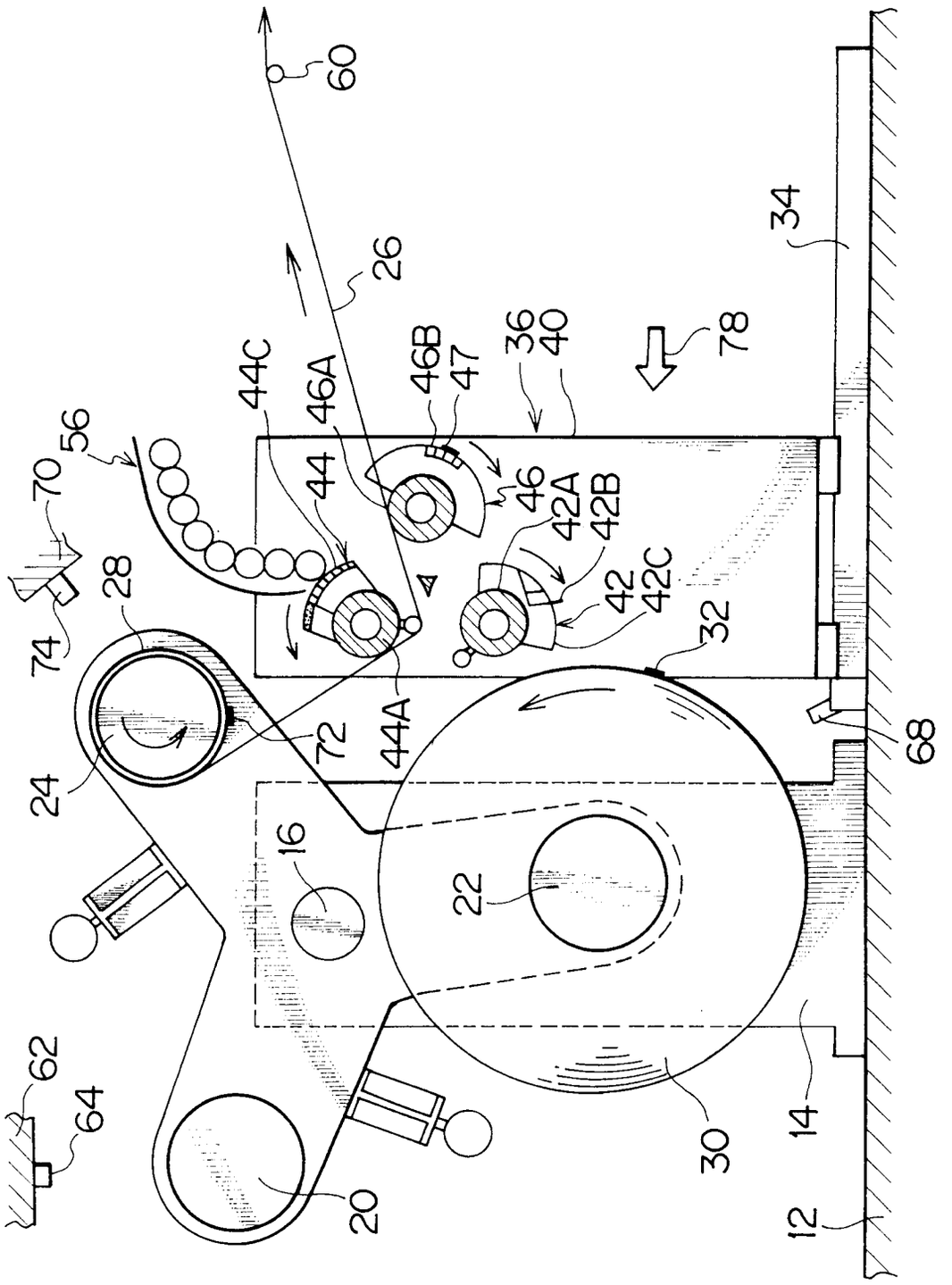
60
26
34
36
40
78
44C
46A
46B
47
56
70
44
46
42A
42B
28
74
42
42C
32
72
44A
68
24
16
22
62
64
30
14
20
12

FIG.5

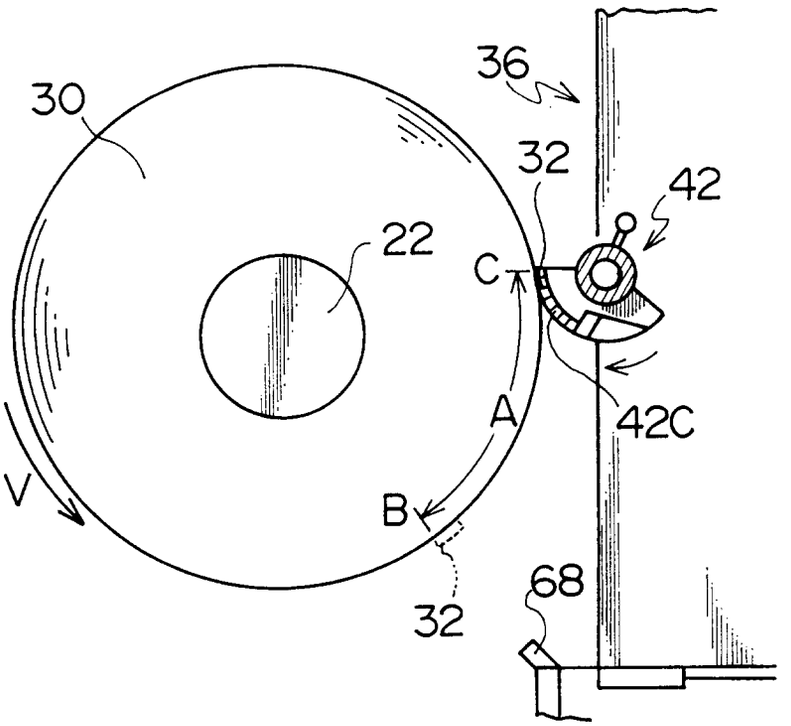
36
30
32
42
22
C
A
42C
V
B
32
68

FIG.6

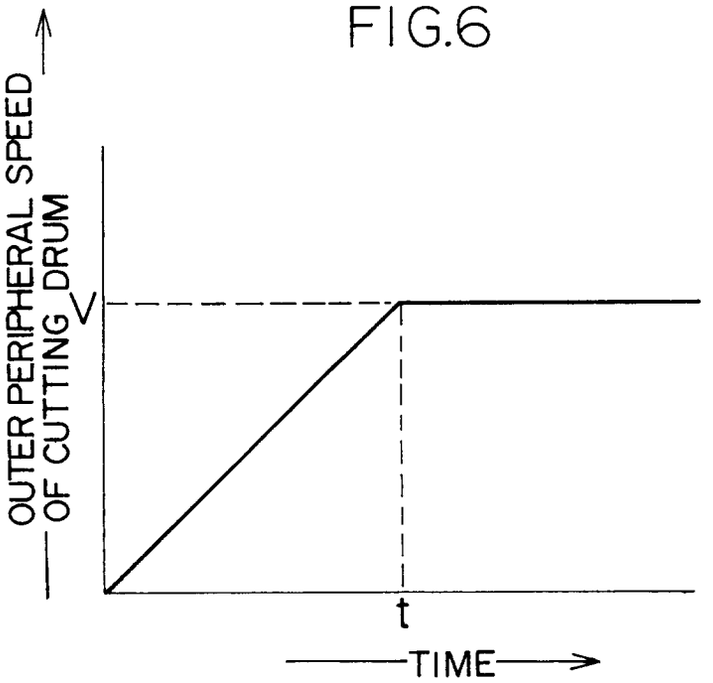
OUTER PERIPHERAL SPEED OF CUTTING DRUM
V
t
TIME

FIG. 7

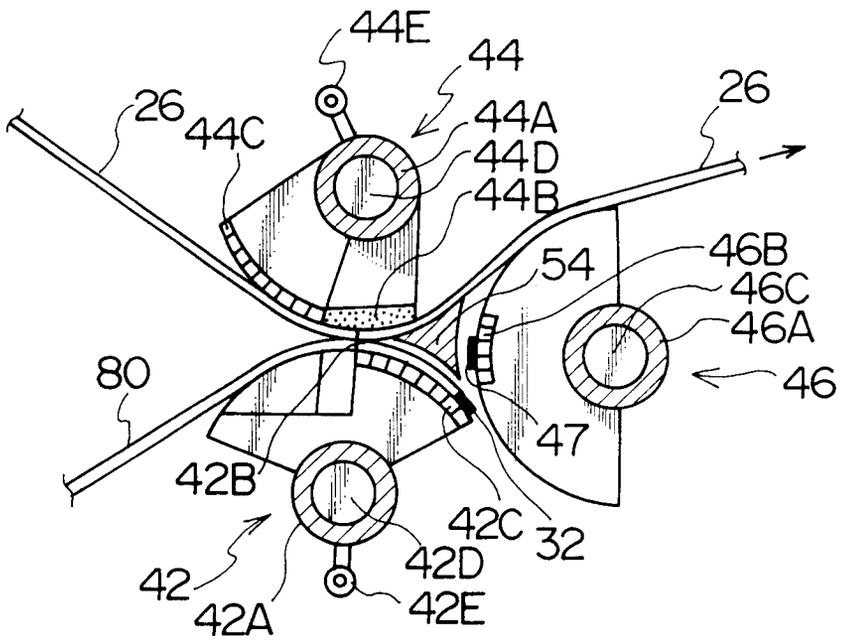
44E
44
26
26
44C
44A
44D
44B
54
46B
46C
46A
46
80
47
42B
42C
32
42D
42
42A
42E

FIG. 8

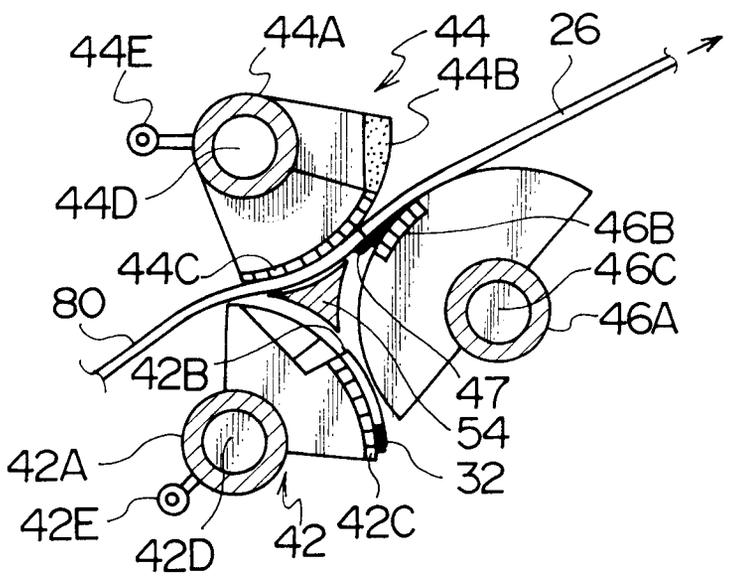
44E
44A
44
26
44B
44D
46B
44C
46C
80
46A
42B
47
54
42A
32
42E
42D
42
42C

FIG. 9

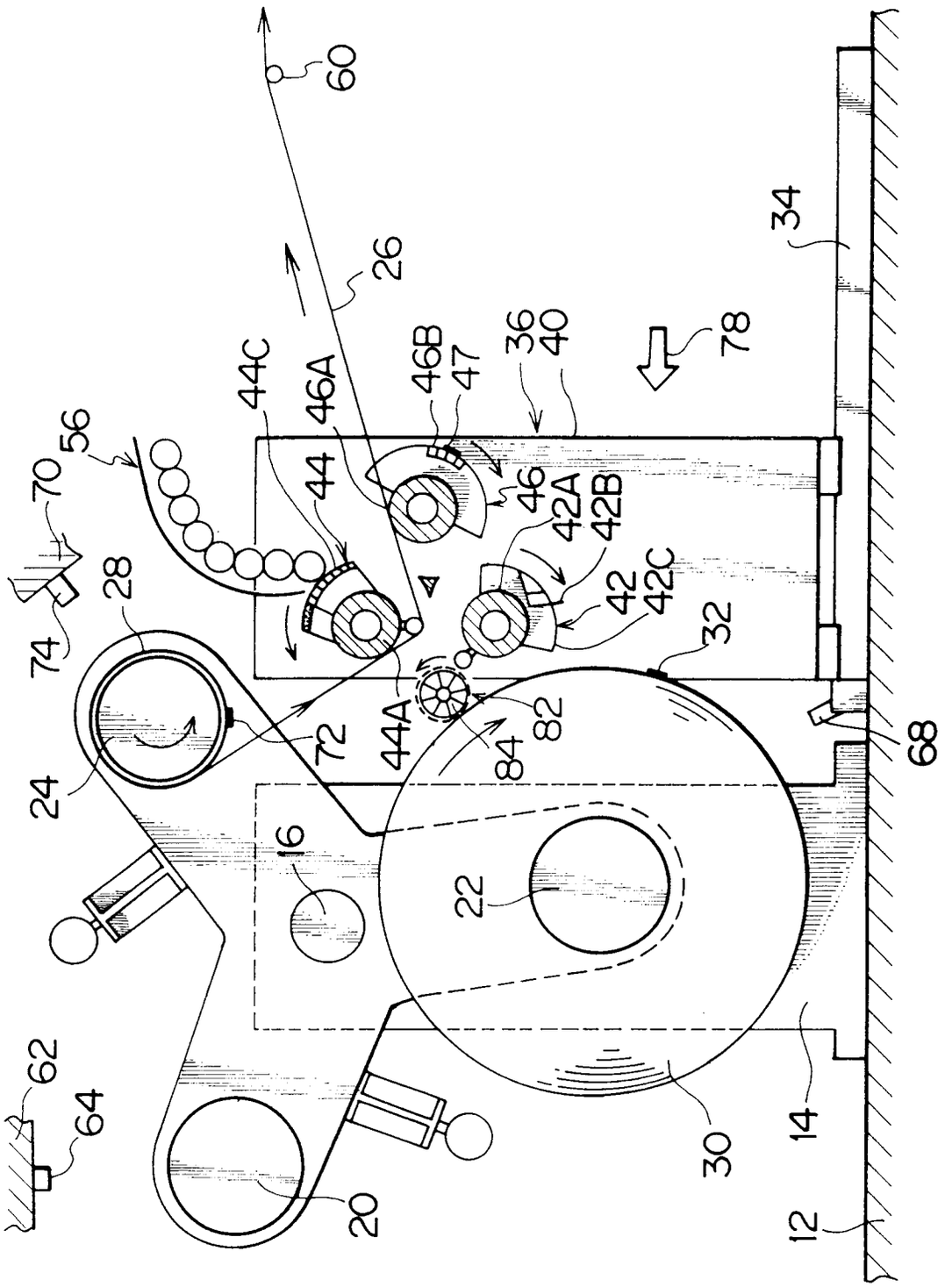
60
26
34
36
40
78
44C
46A
46B
47
56
70
44
46
42A
42B
28
42
42C
74
32
72
44A
82
84
68
24
16
22
62
64
30
14
20
12

FIG. 10

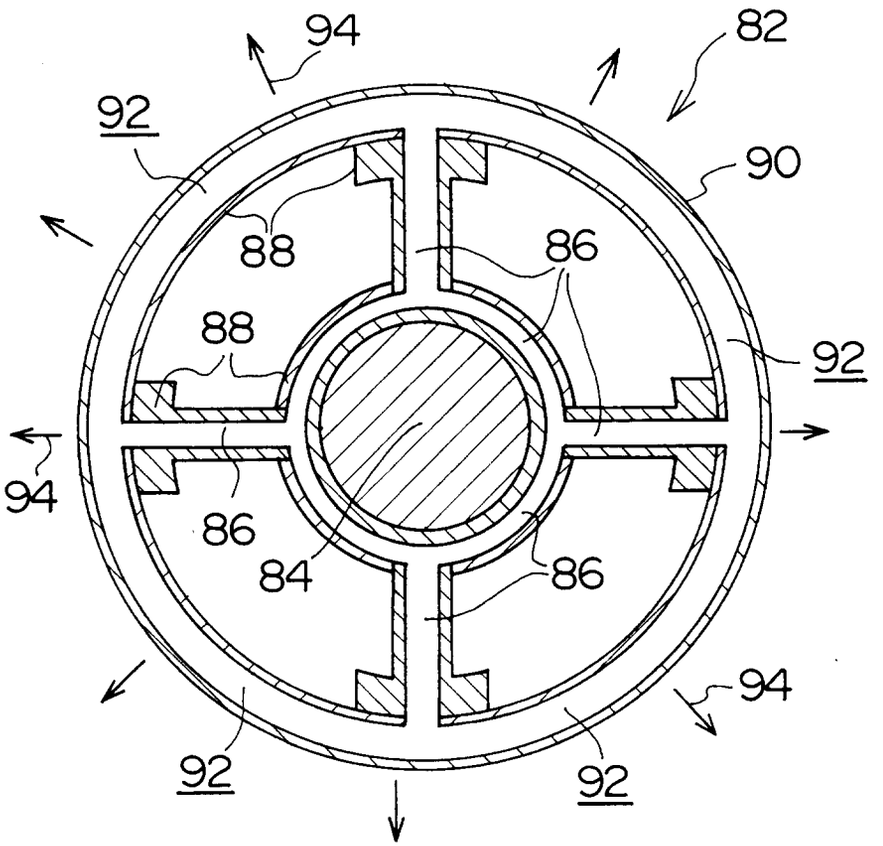

FIG. 11

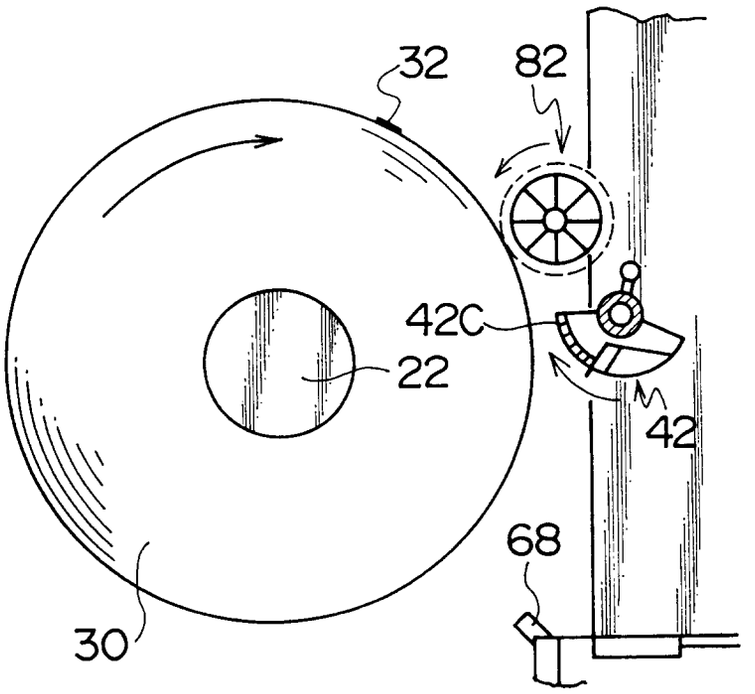

FIG. 12