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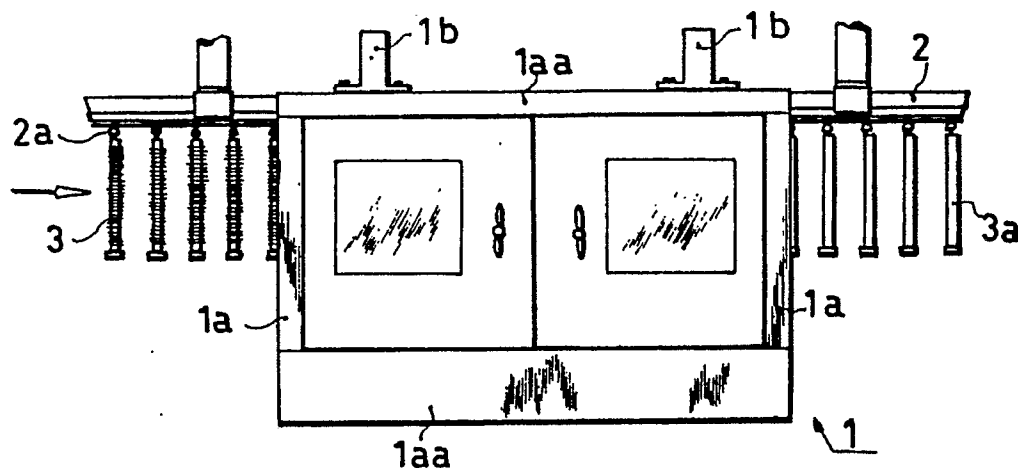
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54 **Apparatus for removing residual yarn from roving bobbin by suction.**

57 Disclosed is an apparatus for removing residual yarns from roving bobbins (3) by suction which bobbins are conveyed by a roving bobbin conveyance line (2) provided with a large number of bobbin hangers (2a). Plural suction nozzles are provided respectively in opposed relation to the plural roving bobbins, and by moving the nozzles forward there are ensured suitable gaps for the suction of residual yarn ends according to different amounts of yarns

remaining on the roving bobbins. The nozzles are vertically moved simultaneously to search for and suck in yarn ends and then retreated to remove residual roving yarns by suction in certain positions. Further, below the roving bobbins there is provided a driving device capable of rising and rotating the bobbins positively, whereby the residual roving yarns can be removed surely.

FIG. 1



Apparatus for Removing Residual Yarn from Roving Bobbin by Suction

Various means are known for removing roving yarn (residual yarn) remaining on a roving bobbin (formed by molding using wood, synthetic resin, metal, or paper). For example, there are known a cutting type in which residual yarn is removed by cutting with a sharp cutting edge applied to the peripheral surface of a roving bobbin in an axial direction of the bobbin; a suction type in which residual yarn is rewound by utilizing a pneumatic suction force while a roving bobbin is held rotatably, and at the same time such air current is utilized to disintegrate roving yarn; and a winding type in which a roving bobbin is held rotatably and is brought into contact with a roving yarn winding band member or the like which is moving to wind roving yarn onto the band for removal.

In those known methods it is required to feed roving bobbins to a residual yarn removing apparatus and take out empty bobbins.

On the other hand, in the recent spinning mills, the conveyance of roving bobbins is rationalized. For example, in the creel of a ring frame, roving bobbins are replaced at a time, or in some construction, roving bobbins after winding in a roving frame are mounted to a conveying device and thereby moved to the creel portion of a ring frame, where they constitute a creel directly. Such a conveyance line is utilized also as an empty bobbin discharge line.

It is very difficult to wind a predetermined certain length of roving yarn around a roving bobbin. The roving yarn length differs between roving frames or due to breakage of the yarn during spinning. Therefore, the simultaneous replacement of roving bobbins in the creel is inevitably based on the shortest roving bobbin, and roving yarn remains on most of the bobbins taken out along a conveyance line. Such residual yarn on the roving bobbin cannot be removed at all by the foregoing conventional methods.

According to the present invention, in view of the above-mentioned point, a plurality of suction nozzles and a driving device for rotating plural roving bobbins are provided in part of a conveyance line for the return of the roving bobbins in corresponding relation to the bobbins which have been introduced and stopped in a row along the said conveyance line. The nozzles are moved simultaneously toward the peripheral surfaces of the bobbins while an appropriate suction spacing from the yarn end is maintained according to the amount of the residual yarn on each bobbin. Further, the nozzles are moved vertically at a time to search for and such in the yarn end, then moved back in a required height position while sucking in the resid-

ual yarn. The roving yarn thus sucked in is immediately disintegrated by utilizing the suction air current in each suction nozzle. In the case of bobbins each provided with an auxiliary member for the winding of roving yarn, the nozzles are again moved up to the positions of such auxiliary members, so that the residual yarns on the bobbins can be surely removed by suction.

Fig. 1 is a front view of a residual yarn removing apparatus embodying the present invention which apparatus is provided along part of a roving bobbin conveyance line;

Fig. 2 is a left side view of Fig. 1;

Fig. 3 is a enlarged view of Fig. 2, partially broken away;

Fig. 4 is a right-hand sectional view taken along line IV-IV of Fig. 3;

Fig. 5 is a left-hand sectional view taken along line IV-IV of Fig. 3;

Fig. 6 is an enlarged sectional view taken along line VI-VI of Fig. 4 as seen in the direction of arrows;

Fig. 7 is a sectional view taken along line VII-VII of Fig. 6 as seen in the direction of arrows;

Fig. 8 is a view explanatory of the operation of the apparatus illustrated in Fig. 7;

Fig. 9 is a partially enlarged view of Fig. 4;

Fig. 10 is a sectional view taken along line X-X of Fig. 9 as seen in the direction of arrows;

Fig. 11 is a partial, central, sectional view of Fig. 10;

Fig. 12 is a view explanatory of the operation of the portion illustrated in Fig. 10;

Fig. 13 is a developed view, partially broken away, showing the construction of a nozzle;

Fig. 14, 15, 16 and 17 are explanatory views showing nozzle positions and the displacement of a rotative driving device in a roving yarn removing operation by suction; and

Figs. 18(A) to (D) are plan views showing nozzle positions corresponding to residual yarn quantities on roving bobbins as well as the state of suction.

Fig. 1 shows an apparatus 1 for removing residual yarn from roving bobbins by suction according to the present invention, which apparatus is disposed in opposed relation to a conveyance line 2. In the bobbin conveyance line 2, which is for the return of bobbins after creel replacement, a large number of bobbin hangers 2a are held for travel at predetermined intervals in a guide rail and are moved in the direction of arrow by a driving device (not shown). From the bobbin hangers 2a there are suspended bobbins 3 with residual yarn so as to be each rotatable freely.

On the other hand, the apparatus 1 for removing residual yarn by suction is provided inside a frame 1a. As shown in Fig. 2, the frame 1a comprises side wall frames 1a, 1a and upper and lower lateral frames 1aa, 1aa, which are mounted together, and hanger frames 1b, 1b are mounted to the upper lateral frame 1aa. The residual yarn removing apparatus 1 is provided between the side wall frames 1a, 1a in a sandwiching relation to the conveyance line 2. Although in this embodiment the apparatus 1 is disposed in a suspended state, it may be mounted on a base constituted by suitable frame members. The apparatus 1 is for removing residual yarns on a large number of bobbins 3 simultaneously by suction, and in the illustrated embodiment twelve roving bobbins 2 are to be processed by the apparatus 1, but the number of roving bobbins to be processed may be increased or decreased as necessary. In the operation for removing residual yarn by suction, a specific number (twelve in the drawings) of roving bobbins 3 are introduced into the residual yarn removing apparatus 1, and when they reach a predetermined position, the operation of the conveyance line 2 is stopped and the residual yarn on each bobbin is removed. When this processing is over, the conveyance line 2 is driven and moved again, whereby the bobbins are taken out as empty bobbins 3a as in Fig. 1.

The residual yarns on the bobbins can be sucked in and removed by disposing suction nozzles held at reduced pressure in opposed relation to the bobbins and then rotating the bobbins in a direction of unwinding the residual yarns. In this case, for a large number of bobbins, it is necessary to supply a large quantity of air held at reduced pressure in order to search for and such in end portions of the residual yarns. Therefore, in the apparatus of the present invention there is adopted a residual yarn suction nozzle of the type in which pressurized air is introduced and jetted on a pull-in side and an air current formed on the opposite side is utilized as a suction force. The pressurized air is introduced from a compressor provided separately or from a compressor disposed within the base which supports the base 1. The residual yarn thus sucked in is taken out from a discharge port 4a shown in Fig. 2. If necessary, the discharge port 4a may be connected for the supply of the residual yarn to a collector through a duct provided in the above supporting base.

As shown in Fig. 2 and 3, the residual yarn sucking and removing apparatus 1 is provided with a residual yarn sucking nozzle device 5 and a bobbin driving device 6, and the roving bobbins 3 introduced are guided on the root side thereby by a guide piece 7 extending throughout the overall length of the apparatus 1. The guide piece 7 is

enlarged on the bobbin introducing side (Figs. 7 and 8). The suction nozzle device 5 comprises nozzles 10 which are projected in a biased state from a nozzle holding box 11 capable of being moved forward and backward, and a duct 8 for moving the nozzle 10 vertically while supporting them thereon. The duct 8 and the discharge side of each nozzle 10 are connected through a connecting pipe 12.

As shown in Figs. 4 and 6, the duct 8 is mounted to lift seats 14, 14 which are connected to lift drives 13, 13 and on the top of the duct 8 there are provided slide seats 9, 9 which support the nozzle holding box 11 slidably. More specifically, slide pieces 11a, 11a are fixed to the underside of the nozzle holding box 11 so as to be slidable forward and backward along the slide seats 9. As driving means for this movement there is provided a driving motor 15 nearly centrally of the nozzle holding box 11, as shown in Fig. 7. The driving motor 15 can be changed over between forward and reverse rotations. More particularly, a screw shaft 16 is engaged on one end side thereof with a retaining piece 17 attached to the duct 8, and by rotating the screw shaft 16 the nozzle holding box 11 is moved forward and backward. And the nozzle holding box thus moved is stopped in a specific advanced or retreated position. In the advanced position of the nozzle holding box 11 a nose portion of each biased and projected suction nozzle 10 is in abutment with the outer periphery of an empty bobbin after the removal of residual yarn from the suspended roving bobbin 3 opposed thereto (Fig. 8), while in the retreated position the nozzles and the bobbins are in such a relation as shown in Fig. 7.

The lift drives 13 are each constituted as shown in Fig. 6. A well frame 1ab in the shape of a square pillar is formed, extending to the upper and lower portions of the frame 1a, and a guide rod 18 is provided within the frame 1ab, extending to the upper and lower portions of the frame 1ab. The lift seat 14 is mounted to the guide rod 18 vertically movably. The front side of the lift seat 14 is projecting from a slit formed in the front side of the square pillar-like wall frame 1ab. Further, bearing brackets 19a and 19 are attached to the upper and lower portions respectively, of the frame 1ab, and a sprocket wheel is loosely supported by the upper bracket 19a, while a driving shaft 20 is loosely supported by the lower bracket 19, with a sprocket wheel attached thereto. Chains 21 are passed round these sprocket wheels and retained at one ends thereof to the upper and lower portions, respectively, of the lift seat 14, while the other ends thereof are anchored to a turnbuckle type tension adjusting threaded rod 22. The driving shaft 20 is driven by a motor 23 capable of being changed

over between forward and reverse rotations. By the operation of the driving shaft 20 the lift seat 14 is moved vertically. In connection with this vertical movement, an arm 24 is attached to part of the lift seat 14 in a rearwardly projecting state, and position detecting switches 24a, 24b, 24c, 24d (the switch 24a being hidden behind the arm 24) are mounted in the wall frame 1ab so as to be adjustable position. The motor 23 is stopped upon operation of each such position detecting switch. More specifically, the detecting switch 24a detects the lowest position of residual yarn wound round each roving bobbin 3; the switch 24b detects a height position of a later-described, axially winding member attached to the bobbin; the switch 24c detects a nearly central height position of the residual yarn wound portion; and the switch 24d detects the highest position of the residual yarn wound round the bobbin.

On the other hand, discharge pipes 25, 25 are connected through bellows to the lower portion of the duct 8 which is mounted to the lift seats 14 and supports the suction nozzle device 5. The discharge pipes 25, 25 are connected to a residual yarn storage box 4 which is shown in Fig. 4. As illustrated in Fig. 4, photoelectric type sensors 4b, 4b, for detecting the passing of sucked residual yarn are provided between the residual yarn storage box 4 and the discharge port 4a. The sensors 4b, 4b which are disposed oppositely to a transparent pipe, detects that there is no longer residual yarn (fiber) passing, in other words, confirms that the residual yarn on each roving bobbin 3 under processing has been removed.

As shown in Fig. 5, the roving bobbins 3 which have been introduced are guided on the root side thereof by the guide piece 7, and the bobbin driving device 6 is disposed below the bobbins. The driving device 6 has a holder box 26 in which are supported bobbin pulleys 27 each through a shaft in corresponding relation to the roving bobbins 3. The bobbin pulleys 27, which are projected on the front end side, are rotated simultaneously through a belt by means of a driving motor 28 which is mounted nearly centrally and on the rear side of the holder box 26. The driving motor 28 can be changed over between forward and reverse rotations and its rotating speed can also be changed over. Further, frames 29, 29 are disposed below the holder body 26 and connected to pushing-up devices 30, 30 which are mounted on a base plate. The frames 29, 29 are pushed up by the operation of the pushing-up devices 30, 30, whereby the bobbin pulleys 27 are fitted in the root side of the roving bobbins 3 to rotate the bobbins.

In the residual yarn suction nozzles 10 used in the present invention, as previously noted, pressurized air is introduced and jetted rotatively on the

residual yarn taking-out side of each nozzle, and an air current formed by this jet is utilized as a suction air current, and the residual yarn is disintegrated at once by the resulting rotating air current. Therefore, unless there is any space of the suction side (front end side), the suction air current will not be formed.

The roving bobbins 3 are different from one another in the amount of yarn remaining thereon, and end portions of residual yarns are not present in certain positions, some hanging down. Therefore, it is necessary to search for and suck in a residual yarn end while maintaining a spacing between the suction nose of each suction nozzle 10 and the corresponding roving bobbin 3 according to the amount of yarn remaining on each individual yarn. In the case where a residual yarn end hangs down, it is necessary to once rotate the bobbin concerned in the winding direction. Some roving bobbin is provided with such an auxiliary winding member 3b as shown in Fig. 17 to facilitate the winding of a winding start end of roving yarn round the bobbin. As the auxiliary winding member 3b, woven cloth or napped cloth is provided so as not to project from the outer peripheral surface of an empty bobbin 3a. Under this construction, a terminal end of residual yarn is sometimes adhered to the auxiliary winding member 3b when the residual yarn is sucked in.

In view of the above-mentioned point the apparatus of the present invention is constructed so that when the suction nozzles 10 are made corresponding to the roving bobbins 3, the nose portions of the nozzles 10 are held in positions in which there are kept spacings according to the amounts of yarns remaining on the respective bobbins, and in this state residual yarn ends are searched for and sucked in. Thereafter, the nozzles 10 are retreated to nearly central portions of the residual yarn winding heights and the roving bobbins 3 are rotated in the rewinding direction at high speed, while the residual yarns are removed by suction. After the lapse of a certain time, the nozzles are again moved to the positions of the auxiliary winding members 3b and the yarns remaining thereon are removed by suction.

The suction nozzles 10 disposed in the nozzle holding box 11 are projected from the box in a biased state, as shown in Figs. 9 and 10, and when the box 11 moved forward and the nose portions of the nozzles come into abutment with the roving bobbins 3 and are pushed into the nozzle holding box 11 side, the pushed-in positions are held. After the search and suction of residual yarn ends, the box 11 is retreated, whereby the aforesaid holding of the positions is released.

The suction nozzles are each constructed as shown in Figs. 11 and 13. Each nozzle 10 com-

prises a flange 10a and a threaded portion 10b. In the core portion of the nozzle there is formed a through hole 10c so that the diameter of the hole 10c becomes gradually larger toward the front end side. On the other hand, a support cylinder 31 which comes into threaded engagement with the threaded portion 10b of the nozzle 10 comprises a large diameter portion 31a and a small diameter portion 31b both formed integrally with each other. In the core of the small-diameter portion 31b there is formed a jet hole 31c so that the diameter of the hole 31c becomes gradually larger toward the rear side. On the other hand, the large-diameter portion 31a has a bore 31d formed in parallel with the core. Into the bore 31d is inserted a restriction cylinder 32 through packings 33, 33. The restriction cylinder 32 has a through hole 32c formed in parallel with the core. Further, projecting rings 32a, 32a rear formed on the front and rear sides of the outer periphery of the cylinder 32, and an intermediate concave portion 32b is utilized as an air sump portion. In the concave portion 32b there are formed plural vent holes 32 not parallel with the core toward the outlet side of the through hole 32c. In the large-diameter portion 31a of the support cylinder 31 there is formed a pressurized air inlet port 31e, which comes into communication with the concave portion 32b of the restriction cylinder 32 received in the bore 31d. In mounting these components to the nozzle holding box 11, an annular seat 34 which supports the small-diameter portion 31b of the support cylinder 31 slidably is mounted to the rear wall side of the box 11, and a coil spring 35 is interposed between the annular seat 34 and the stepped part of the large diameter portion of the support cylinder 31. On the other hand, a front-side annular seat 36 which supports the nozzle 10 slidably is inserted beforehand into the nozzle, and at the time of mounting to the nozzle holding box 11, a smaller outside diameter portion 36b of the annular seat 36 is fitted in a hole formed in the front wall side of the box 11 so that a circumferential groove 36d formed in the smaller outside diameter portion 36b is exposed to the exterior of the box 11. Then, a stop ring 37 is fitted in the circumferential groove 36d to retain the front-side annular seat 36. In this construction, by pushing the front end side of the nozzle 10, the nozzle can retreat to the nozzle holding box 11 side while sliding on the annular seats 34 and 36 against the biasing force of the coil spring 35. Upon release of the pushing, the nozzle is projected by the biasing force of the coil spring 35. Numeral 38 denotes a buffer ring (not shown in Fig. 13).

Within the nozzle holding box 11 there is disposed a pressurized air introducing duct 39, and pressurized air is fed into the box 11 from a compressor (not shown) through a flexible pipe.

Then from the duct 39 the pressurized air is branched into the pressurized air inlet port 31e of the support cylinder 31 through a flexible pipe 40. Then, as shown in Fig. 11, the pressurized air thus introduced is stored in the concave portion 32b of the restriction cylinder 32, passes through the plural vent holes 32d and is jetted to the divergent, jet hole 31c. In this case, the inclination of the jet hole 31c causes the jet to form a rotating air current, which is jetted from the jet hole 31c of the support cylinder. This rotating air current rotates in an untwisting direction for the sucked residual yarn to disintegrate the yarn immediately. With this jetting of the compressed air, a suction air current is formed in the through hole 10c of the nozzle 10. The suction nozzle used in the present invention utilizes this suction air current to search for and suck in a residual yarn end and at the same time suck in and remove the residual yarn. It is necessary that the nozzles provided in the nozzle holding box 11 be held unrotatable. To this end, in the illustrated embodiment, a plane portion 31f (Fig. 10) is formed on one side of the large-diameter portion 31a of the support cylinder 31 so that it extends along a flat plate portion of a guide piece 41 mounted to the inside bottom of the nozzle holding box 11, thereby preventing the rotation of each nozzle while permitting forward and backward movements thereof.

To search for and suck in residual yarn ends of plural roving bobbins by utilizing the suction nozzles 10 in the present invention, it is necessary to ensure a suction spacing according to the amount of yarn remaining on each bobbin. Also, for forming a suction air current on the nose side of each suction nozzle 10 it is necessary to form a gap between the nose of the nozzle and the residual yarn winding surface. More specifically, as shown in Fig. 14, each nozzle 10 projected in a biased state from the nozzle holding box 11 is moved forward to the lowest position of the residual yarn winding as indicated by an arrow with respect to the corresponding roving bobbin 3 which has been conveyed into the apparatus and stopped. In searching for and sucking in residual yarn end, as shown in Fig. 15, the corresponding bobbin pulley 27 of the driving device 6 is raised and fitted in the bobbin 3, then the bobbin 3 is rotated at a low speed (30 r.p.m. or so) and at the same time the nose portion of the nozzle 10 is raised in the arrowed direction while maintaining a spacing f of about 5 to 10 mm from the residual yarn winding surface to suck in a residual yarn end. For removing the residual yarn by suction, as shown in Fig. 16, the nozzle 10 is retreated and positioned nearly centrally of the bobbin winding length, then the bobbin 3 is rotated in a residual yarn unwinding direction at a high speed (1,000 r.p.m. or so), and

in this state the residual yarn is removed by suction.

To ensure the spacing f it is necessary to select a suitable projection length of each nozzle 10 projecting from the nozzle holding box 11 according to the amount of yarn remaining on the corresponding to this end, as shown in Fig. 18(A), the stopped position in the forward movement of the nozzle holding box 11 which is advanced toward a row of roving bobbins is restricted to a position in which the nose portions of the nozzles 10 which are projected in a biased state about the surfaces of empty bobbins 3a. (Actually, the empty bobbins 3a are not present in many cases.) Consequently, as shown in Fig. 18(B), when the nozzle holding box 11 stops in the forward movement restricting position, the nozzles 10 are used into the box 11 respectively according to the amounts of yarns remaining on the bobbins. Then, as shown in Fig. 18(C), when the nozzle holding box 11 is retreated a certain distance (in the range of 5 to 10 mm), there is formed a spacing f between each nozzle 10 and the opposed roving bobbin according to the amount of yarn remaining on the bobbin. More specifically, a nozzle 10-1 retreats slightly and is held there, while a nozzle 10-2 opposed to a bobbin 3c having a large amount of residual yarn retreats the longest distance and is held there. In this state there is performed the residual yarn end searching and sucking operation shown in Fig. 15. In removing the residual yarn by suction, as shown in Figs. 18(D) and 16, the nozzle holding box 11 moves backward and the residual yarn is removed by suction in the central height position of the yarn winding. In this state it is not necessary to make the amount of projection of each nozzle 10 corresponding to that of yarn remaining on the opposed bobbin, and for processing of the roving bobbins to be fed next, it is necessary to restore the biased and projected state of the nozzles 10. To this end, there is provided a retaining means for holding the position of each nozzle 10 which was pushed in upon abutment thereof with residual yarn. This retaining means is constructed so that it is released automatically when the nozzle holding box reaches its retreated position.

More specifically, as shown in Figs. 9 and 10, 11 and 12, grooved teeth 42 are formed on the underside of the large-diameter portion 31a of the support cylinder 31 along the axis of the same cylinder, while a lever 43 having an edge pawl 43a for engagement with the grooved teeth 42 is supported pivotably by a bracket 44 mounted to the inside bottom of the nozzle holding box 11. Further, a coil spring 45 is mounted on the pivot shaft of the lever 43 to press the edge pawl 43a for engagement with the grooved teeth 42. The lower side of the lever 43 is projected from a slit formed

in the bottom of the nozzle holding box 11. Under this construction, when the front end side of the nozzle 10 is pushed, the edge pawl 43a of the lever 43 is disengaged from the grooved teeth 42 and the nozzle 10 moves back against the coil spring 35 together with the support cylinder 31. When the pushing is stopped, the pawl 43a and the teeth 42 are engaged with each other to hold the pushed-in position of the nozzle.

Above the duct 8 there are supported operating rods 47 each through stand brackets 46, 46. As shown in Fig. 12, the operating rods 47 are each mounted so as to contact the lever 44 and rotate the lever in a counterclockwise direction upon retreat of the nozzle holding box 11. Thus, when the box 11 moves back, the grooved teeth 42 and the pawl are disengaged from each other, so that the nozzle 10 is projected by the biasing force of the coil spring 35 on the support cylinder. The lever 44 may be constituted so that the lower side thereof is heavy to omit the coil spring 45.

The apparatus for removing residual yarn by suction thus constructed according to the present invention operates as follows. When it is detected that twelve roving bobbins 3 have been fed into the apparatus 1 along the bobbin conveyance line 2 and stopped in the predetermined position, a reduced pressure is applied to the residual yarn storage box 4. Then, the motor 28 of the bobbin driving device 6 is rotated at low speed to rotate the bobbin pulley 27 at about 30 r.p.m. This rotation is for winding round the bobbin 3 the residual yarn end which is hanging down from the bobbin. The bobbin pulley 27 is rotated in a direction of rotating the bobbin 3 in the yarn winding direction. Then, pressurized air is introduced into the pushing-up devices 30 to push up the bobbin deriving device 6, whereby the roving bobbins 3 are rotated. The upper-limit position of the pushing-up device 30 is restricted by detection pieces provided in portions of the frames 29 and limit switches erected on the pushing devices and the base.

Then, it is detected by the detecting switch 24a that the lift seat 14 (nozzle holding box 11) in each lift drive 13 is in its lowest position (Fig. 14). At the same time, the motor 28 of the bobbin driving device 6 is stopped to stop the rotation of the roving bobbin 3. Subsequently, the motor 15 of the suction nozzle device 5 is operated to move the nozzle holding box 11 forward to the bobbin side (Fig. 8). As previously noted, this advanced position is defined to be a position in which the front ends of the biased and projected nozzles 10 about the surfaces of empty bobbins. This restriction is made using a limit switch (not shown) provided on the duct 8, and upon operation of the limit switch the motor 15 is stopped. Then, in one second after turning OFF of the motor 15, the same motor is

rotated in the reverse direction to move the nozzle holding box 11 backward in the range of 5 to 10 mm, thereby maintaining the foregoing spacing f for the search and suction of a yarn end on each bobbin. These advanced position and yarn end searching and sucking position are restricted using limit switches provided on the top surface of the duct 8 which switches function to sense detection pieces provided on the nozzle holding box side (these components are not shown). After the yarn end searching and sucking position was confirmed, pressurized air is introduced into the air introducing duct 39 provided in the nozzle holding box 11, whereby a suction air current is formed in each nozzle 10. At the same time, the motor 28 of the bobbin driving device 6 is driven to rotate the bobbins 3 in a direction of unwinding the residual yarns thereon. This rotation is made at a low speed (20 r.p.m. or so). Subsequently, the motor 23 of the lift drives 13 is operated to raise the duct 8 (nozzle holding box 11). Upon operation of the detecting switch 24d, the motor 23 once stops, then in one second it rotates in the reverse direction to bring down the nozzle holding box 11, and upon operation of the detecting switch 24c the motor 23 stops. This stopped position corresponds to the height position in Fig. 16, and in this state each nozzle 10 continues the search and suction of a residual yarn end. Then, the motor 15 of the nozzle device 5 is rotated in the reverse direction to restore the holding box 11 to its retreated position and the rotating speed of the motor 28 of the bobbin driving device 6 is increased to rotate the roving bobbins 3 in the unwinding direction (about 1,000 r.p.m.), so that the yarns remaining on the bobbins are removed by suction. This unwinding rotation is continued until when the residual yarn passing sensors 4b (Fig. 4) provided on the outlet side of the residual yarn storage box 4 do not detect the passage of yarn for five seconds. When the passage of yarn is not detected for five seconds or more, it is judged that the suction and removal of residual yarn have been completed, whereupon the supply of compressed air to the nozzles is stopped. Subsequently, the motor 23 of the lift drives 13 is operated and then stopped when the nozzle holding box 11 is opposed to the detecting switch 24b. Again, the motor 15 is operated to move the holding box 11 forward and let it assume its advanced position. Now, as shown in Fig. 17, each nozzle 10 is opposed to the auxiliary winding member 3b provided on the opposed bobbin 3a. Then, pressurized air is again introduced into the nozzle 10 to form a suction air current at a nozzle end, and the motor 28 is reverse-rotated at a low speed (about 30 r.p.m.) for a short time (about 1 second), whereby the winding start end of the residual yarn on the auxiliary winding member 3b can be removed by

suction. In the case of a bobbin not provided with such auxiliary winding member, these operations may be omitted.

In this way the yarns remaining on the roving bobbins 3 introduced are sure to be removed by suction. The nozzle holding box 11 is restored to its retreated position and the motor 23 of the lift drives 13 is rotated to bring down the holding box 11 to the position opposed to the detecting switch 24a, now ready for processing of roving bobbins to be fed next, empty bobbins are taken out by operation of the conveyance line 2 to be introduced next roving bobbins. The explanation described above indicates the case that the nozzle holding box 11 (corresponding to detecting switch 24a) retreats and is in lowest position at waiting position. The position which the nozzle holding box 11 is switch 24b (a height position of auxiliary winding member) can be restoring position, a height position that the holding box 11 is advanced to connect to residual yarns can also restoring position.

An apparatus for removing residual yarn by suction of the present invention is structured such as above-mentioned so yarns remaining on a large number of roving bobbins can be removed by suction simultaneously along the conveyance line of the roving bobbin, automatically and that quickly. Moreover, since the suction nozzles disposed in the nozzle holding box are each projected in a biased state and a suitable projection length of the front end of each nozzle can be held according to the amount of yarn remaining on the bobbin opposed to the nozzle, it is possible to surely effect the search and suction of a residual yarn end. Further, since the suction nozzles each utilize a suction air current formed by rotative jetting of compressed air, the sucked residual yarn is disintegrated immediately and can be taken out as raw fibers.

Claims

1. Apparatus for removing residual yarns from roving bobbins automatically by suction, the roving bobbins conveyed rotatably in a suspended state, **characterized by** a suction nozzle device (5) disposed along part of a roving bobbin conveyance line (20) in opposed relation to roving bobbins (3) which have been fed along said conveyance line and stopped, said suction nozzle device being capable of moving forward and backward on one side thereof with respect to said roving bobbins and also capable of moving vertically in the axial direction of the bobbins; and a bobbin driving device (6) capable of moving upward to the underside of said roving bobbins, which have been fed and stopped and causing the

bobbins to rotate positively.

2. An apparatus according to claim 1, **characterized** in that said suction nozzle device (5) capable of moving forward and backward with respect to said roving bobbins (3) and moving vertically in the axial direction of the bobbins comprises a nozzle holding box (11) and nozzles (10) disposed in said nozzle holding box so that the front ends of the nozzles are projected from the nozzle holding box each in biased state by a spring, and wherein said nozzle holding box (11) is stopped in a position in which the front ends of the nozzles (10) abut empty bobbins, and when each said nozzle thus projected in a biased state abuts a residual yarn and is retreated, this retreated position is held, which holding of the position is released by the backward movement of said nozzle holding box.

3. An apparatus according to claim 1 or 2, **characterized** in that said nozzle holding box (11) capable of moving forward and backward with respect to said roving bobbins (3) and moving vertically in the axial direction of the bobbins causes the front end of each said nozzle projected in a biased state to move down to a height position of an auxiliary roving yarn winding member provided in each said bobbin after the suction of the residual yarn and then again causes said nozzle front end to the bobbin side to suck in the yarn remaining on said auxiliary member.

4. An apparatus according to one of claims 1 to 3, **characterized** in that compressed air is introduced into each of said suction nozzles (10) provided in said nozzle holding box (11) in a biased and projected state, and is jetted rotatively to the suction side, and an air current formed by said jet is exerted on the front suction end of the nozzle.

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FIG. 1

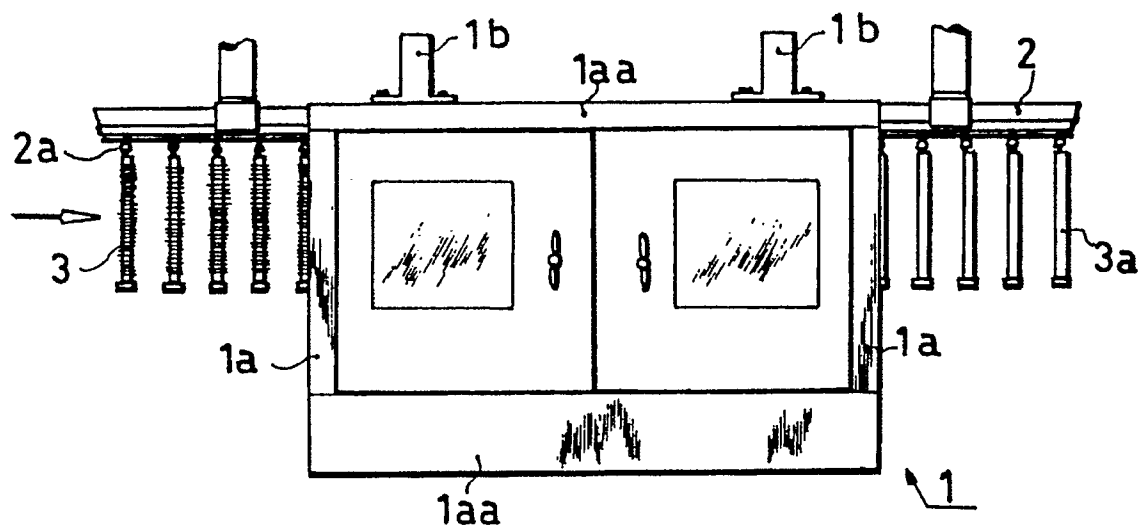


FIG. 2

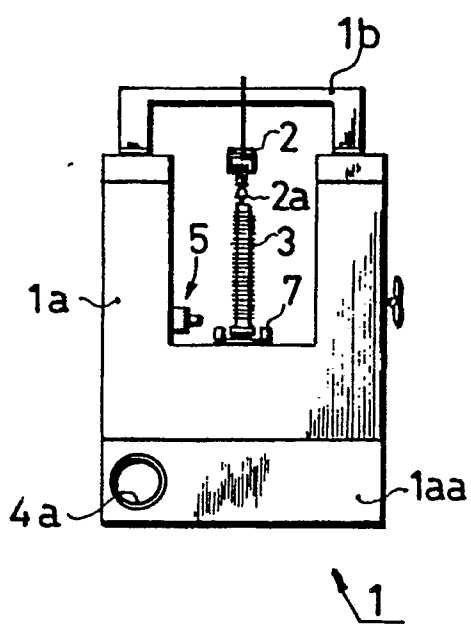
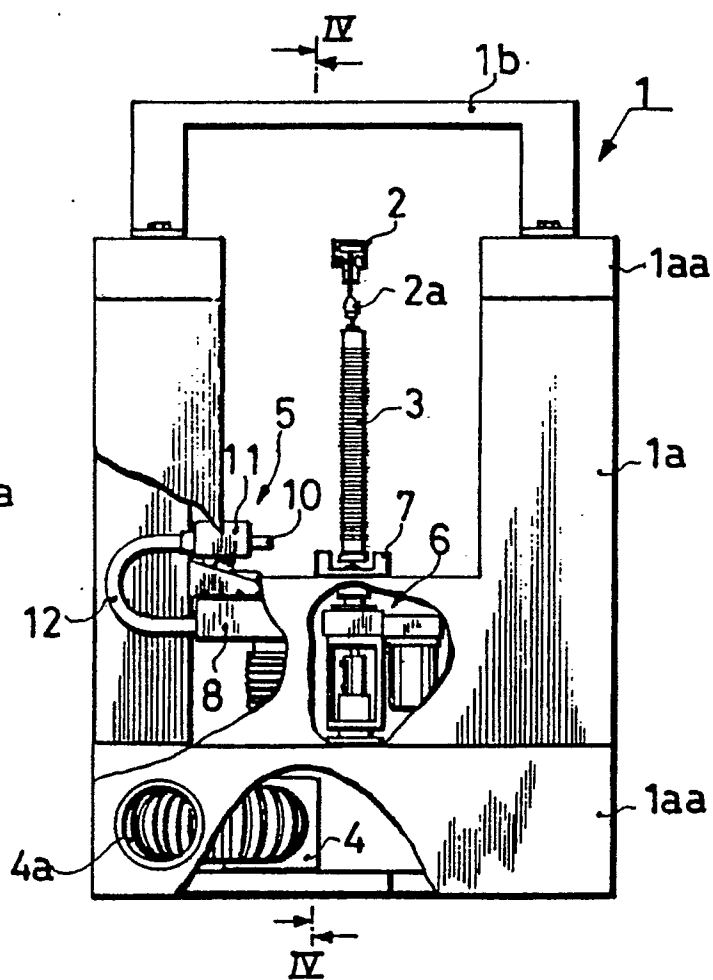


FIG. 3



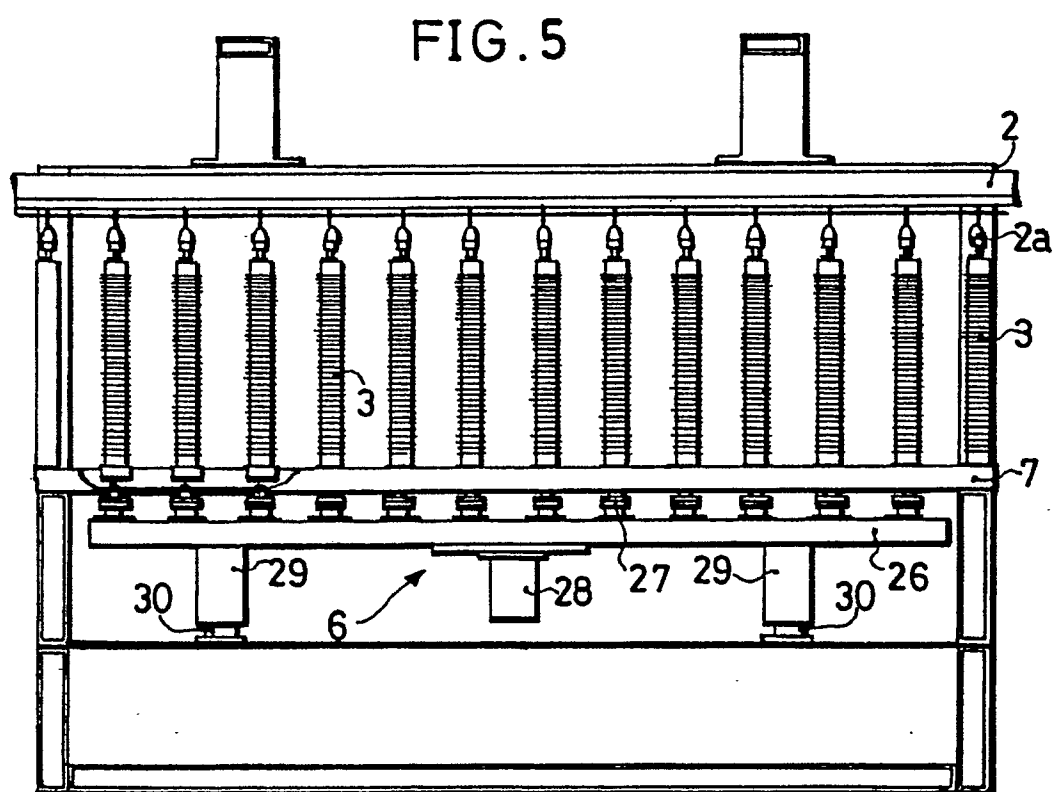
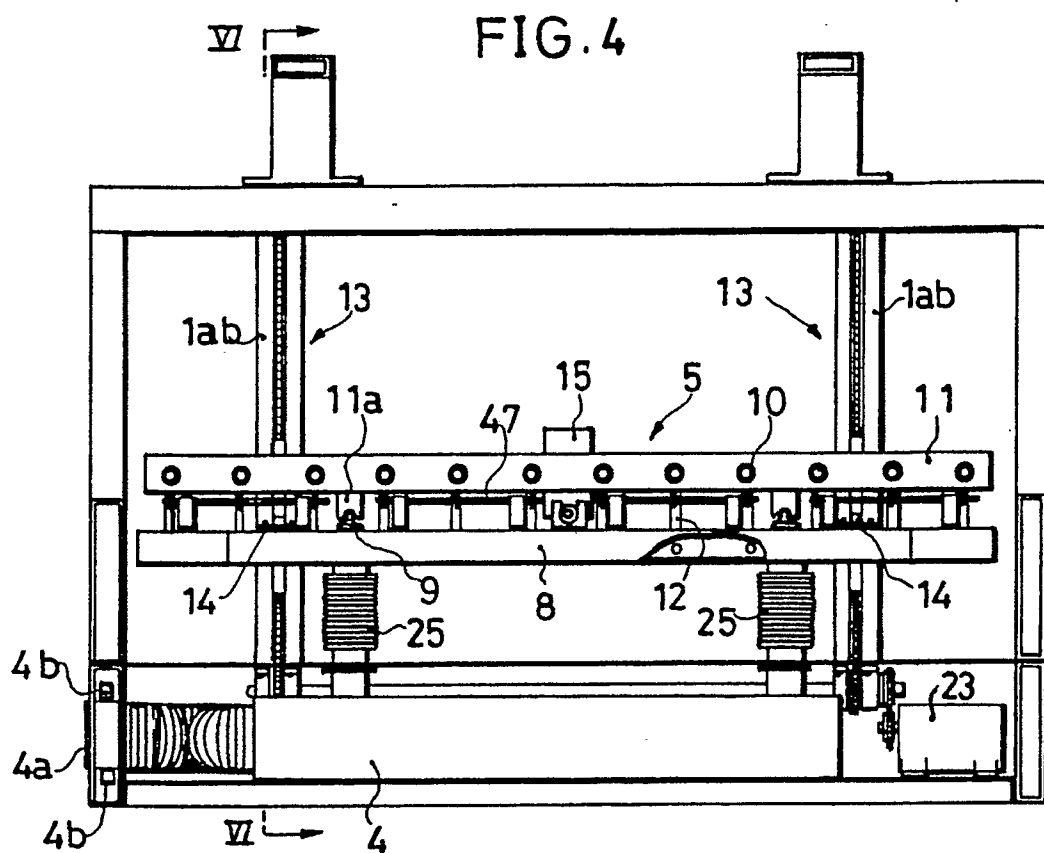
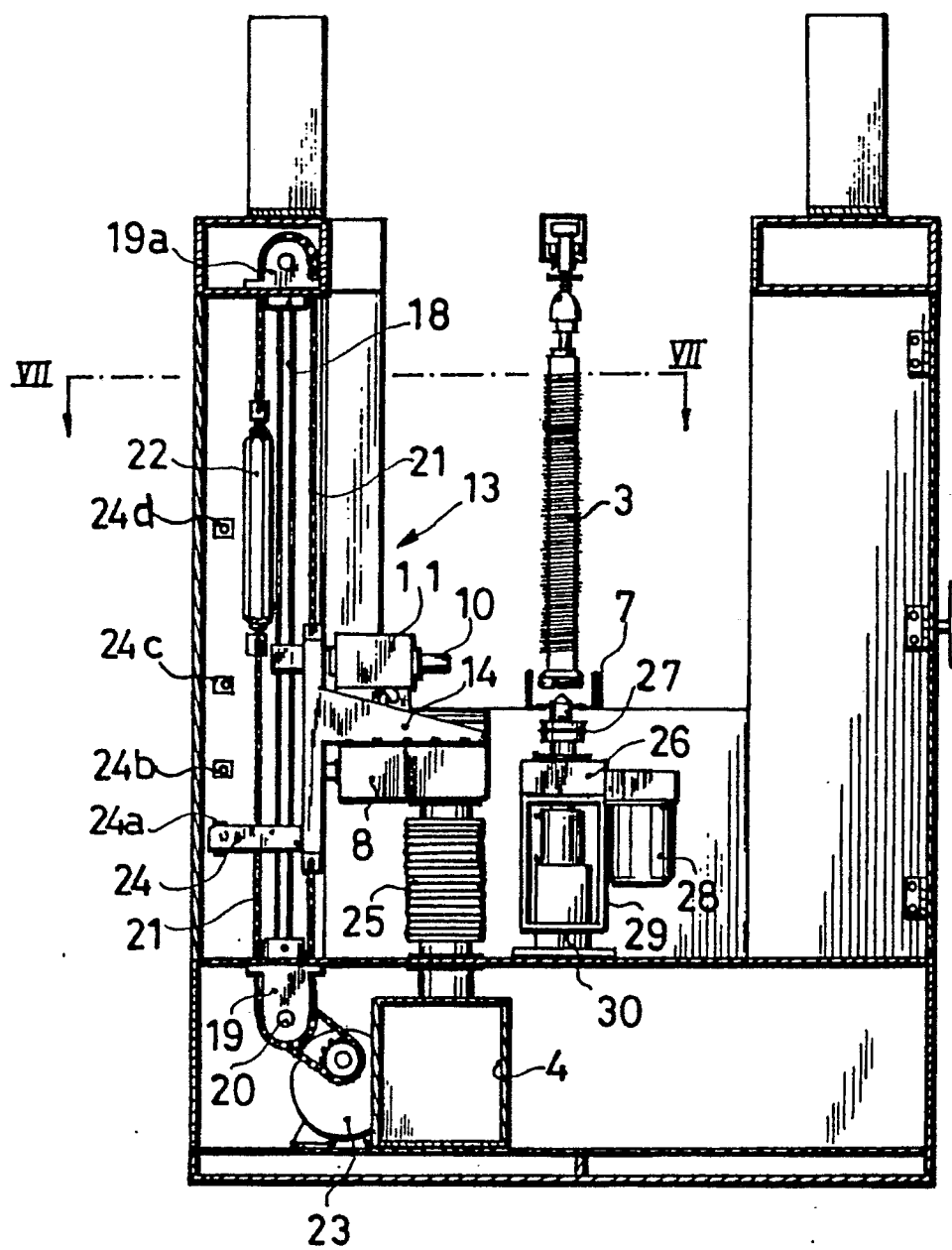
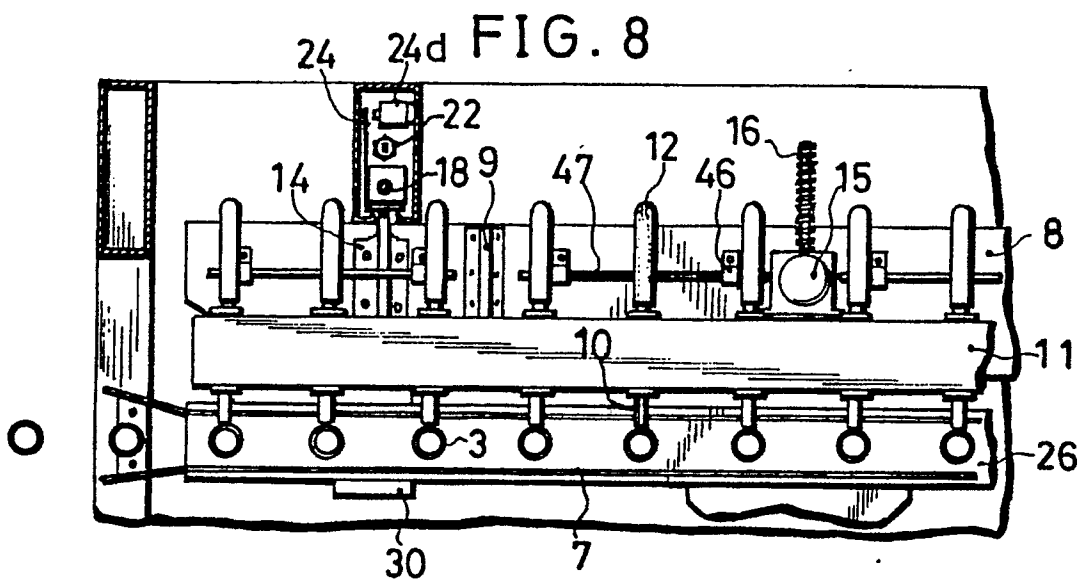
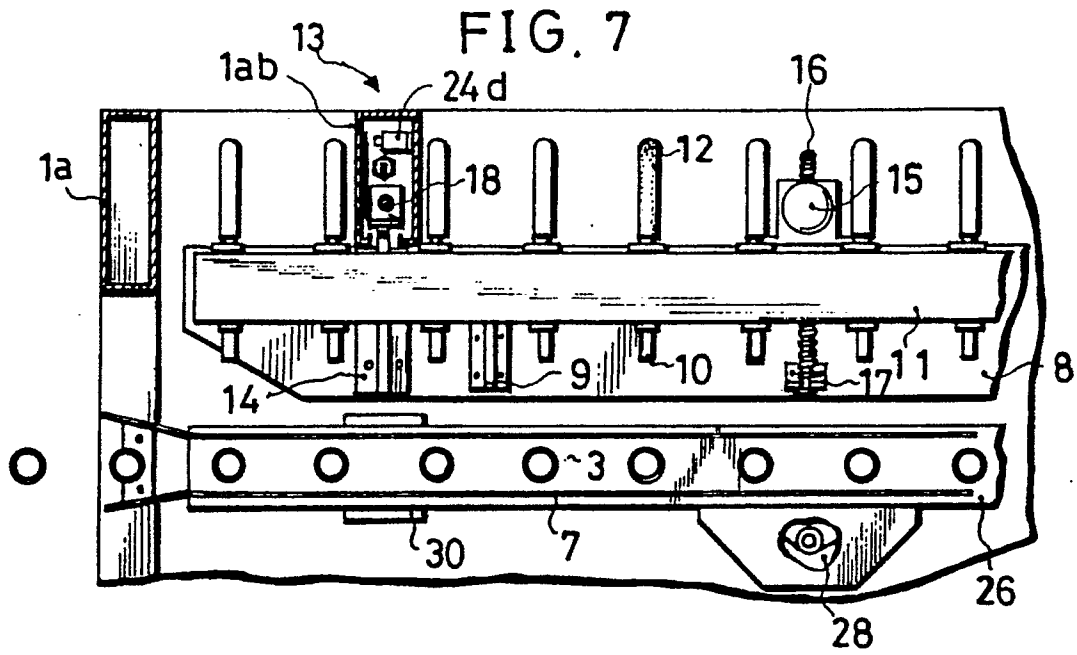


FIG. 6





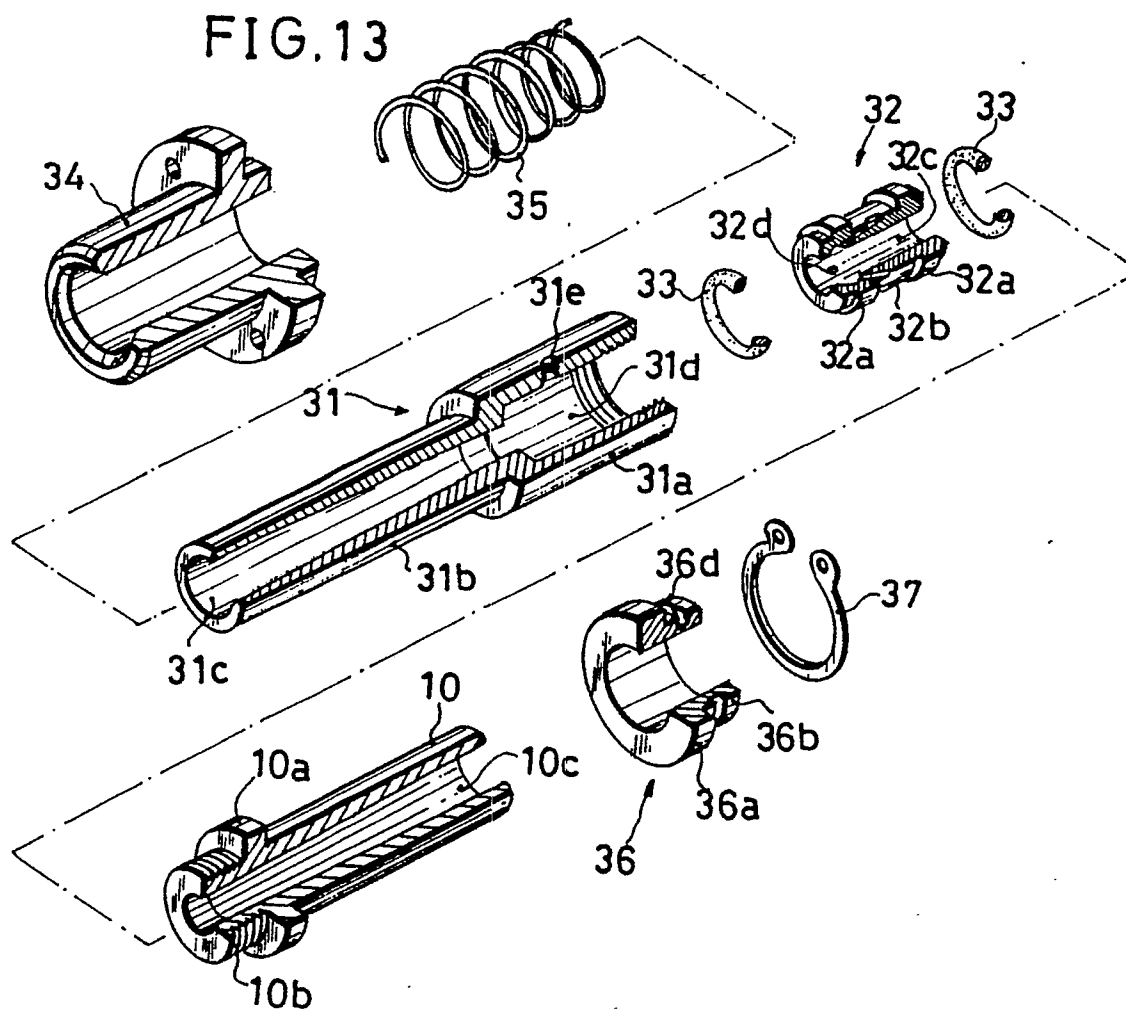
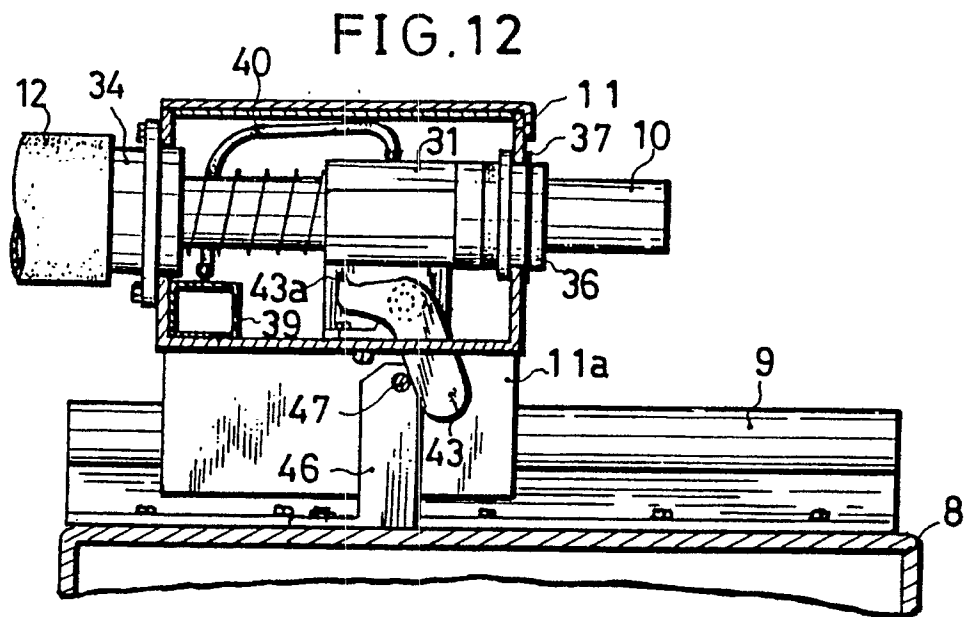


FIG. 14

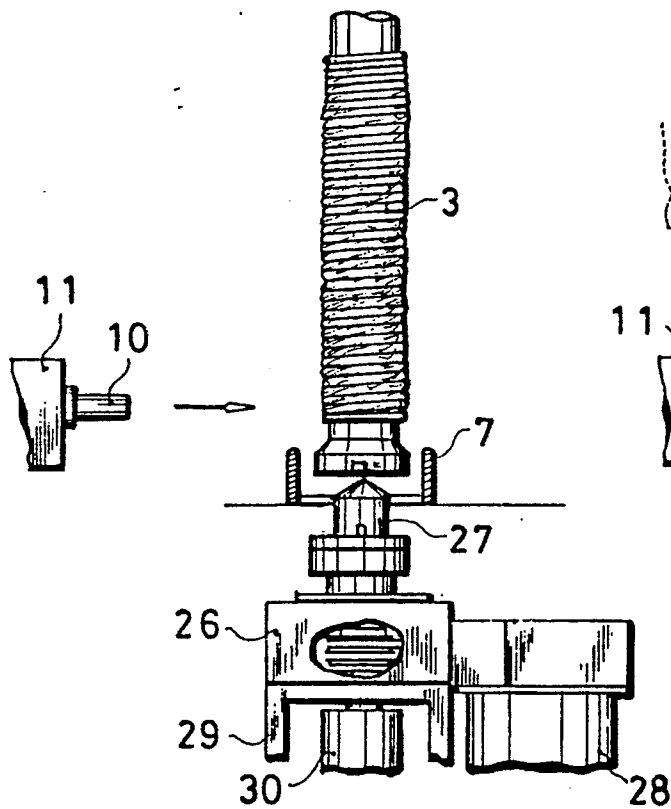


FIG. 15

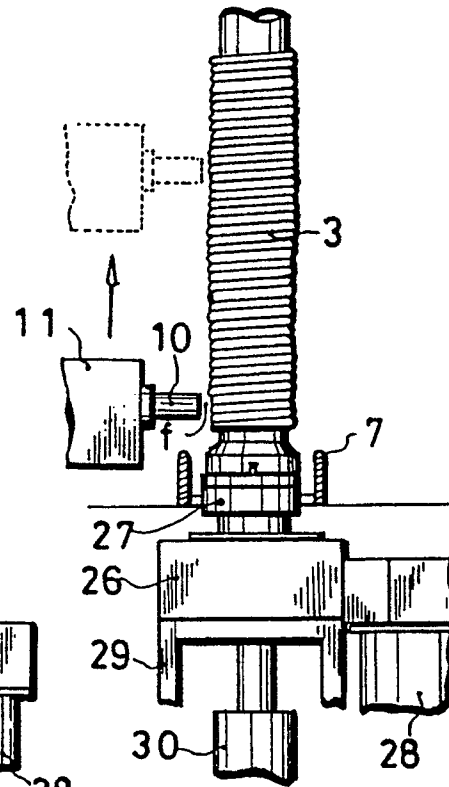


FIG. 16

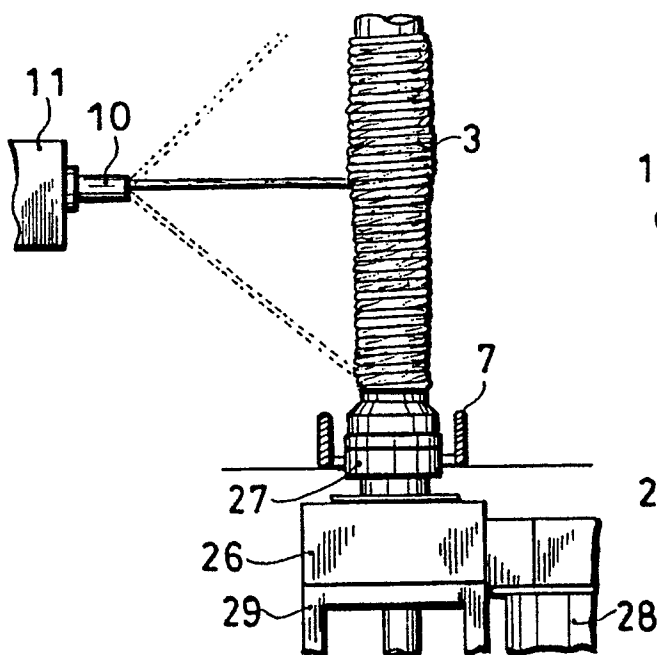


FIG. 17

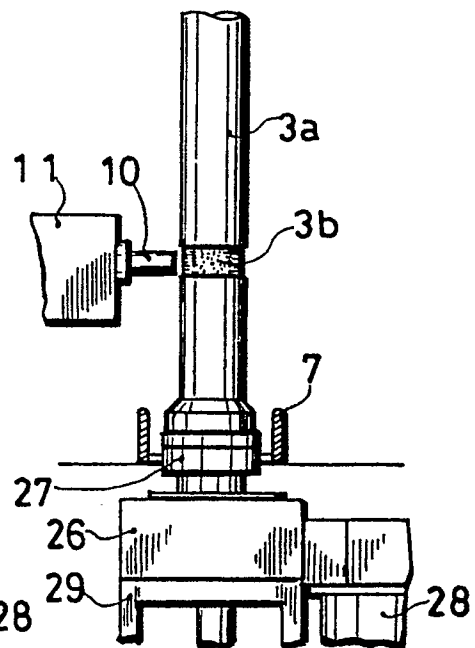
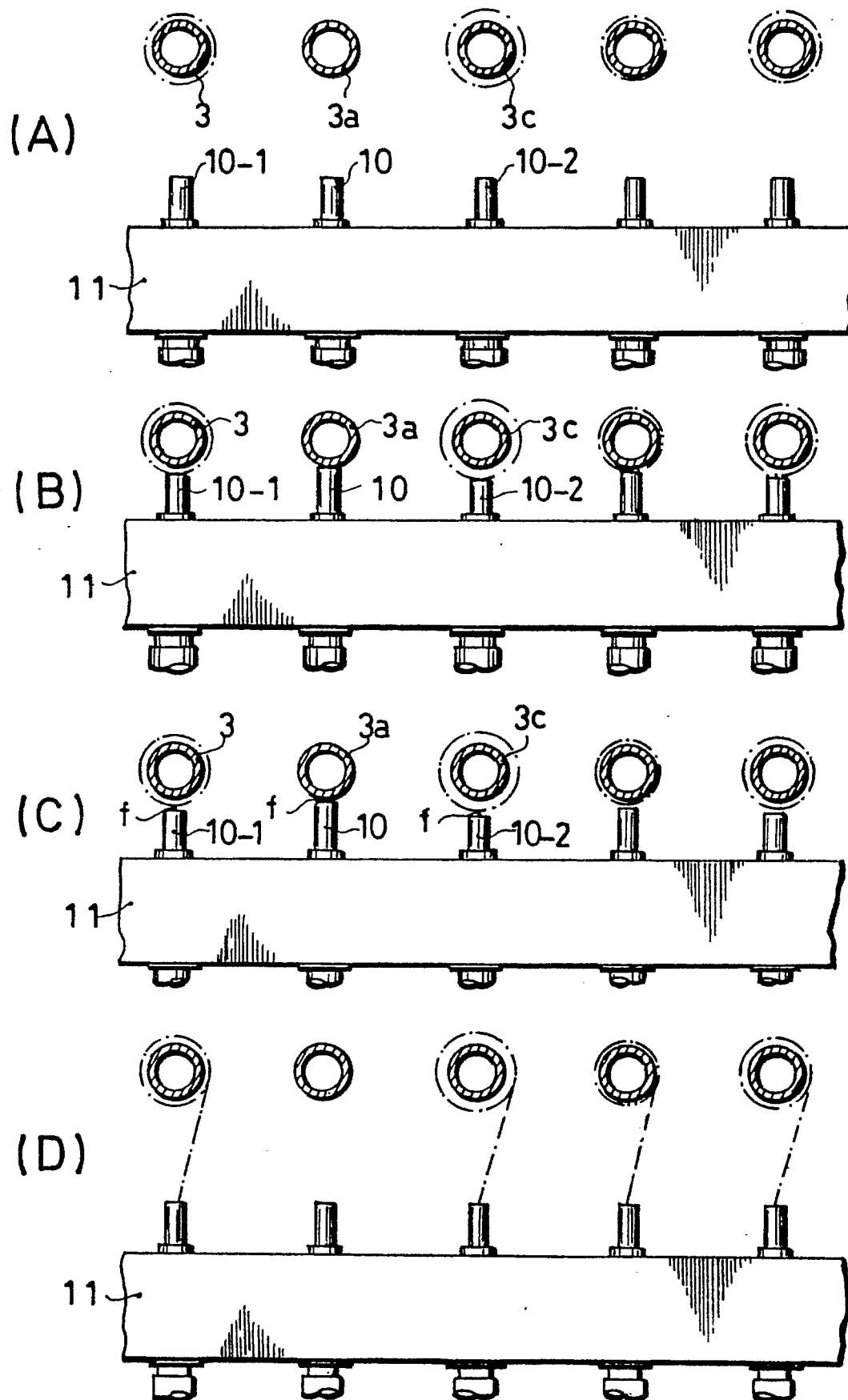


FIG.18





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 90 11 0816

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	PATENT ABSTRACTS OF JAPAN vol. 13, no. 151 (C-584)(3449) 12 April 1989, & JP-A-63 309632 (MURAO BOKI K.K.) * the whole document *	1	D01H1/38 B65H73/00
A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 237 (C-305)(1960) 24 September 1985, & JP-A-60 094628 (MURAO BOUKI K.K.) * the whole document *	1	
A	EP-A-318435 (BALTEC MASCHINENBAU AG) * claim 1 *	1	
A	DE-A-2947808 (B.V.MASCHINEFABRIEK M.BROUWER & CO) * page 7, lines 5 - 23 *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 12, no. 333 (C-526)(3180) 08 September 1988, & JP-A-63 092735 (MURAO BOKI K.K.) * the whole document *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	EP-A-259880 (MURAO BOKI K.K.) * claim 1 *	1	D01H B65H
A	EP-A-219129 (MURAO BOKI K.K.) * claims 1, 2 *	1	
A	US-A-3910021 (L.B.VAN PETTEN) * column 3, line 10 - column 4, line 4; figures 1, 6 *	1	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27 AUGUST 1990	Examiner HOEFER W.D.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document			