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(71) Applicant: **HOWA MACHINERY LIMITED**
Nagoya-shi Aichi (JP)

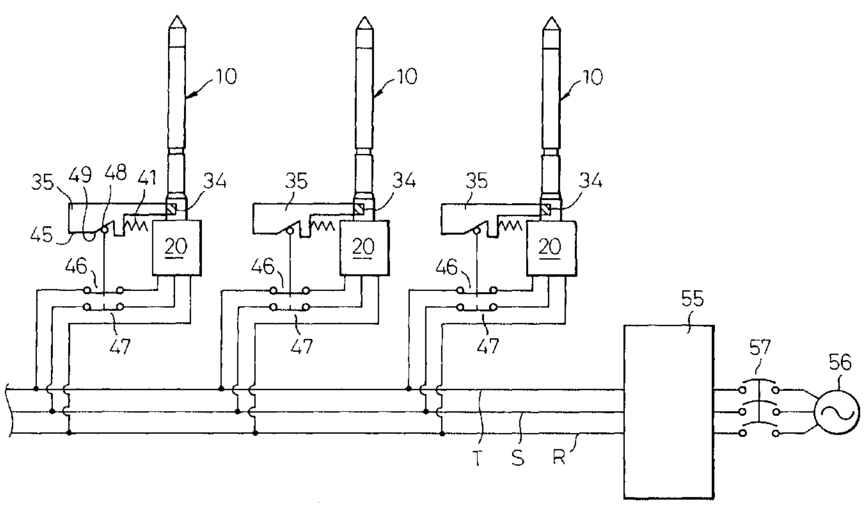
(72) Inventors:
- **Tanaka, yutaka**
Gifu-Shi, Gifu (JP)
- **Suzuki, Susumu**
Ichinomiya-shi, Aichi (JP)
- **Asakawa, Ryoji**
Nishikasugai-gun, Aichi (JP)

(74) Representative: **Savoye, Jean-Paul et al**
Moinas Kiehl Savoye & Cronin,
42, rue Plantamour
1201 Genève (CH)

(54) **Stopping and restarting device in independent driven spindle in spinning machine**

(57) Regarding an independently driven type spindle in a spinning machine, when a yarn breakage is occurred in a spindle 10, a brake operating member 35 of the spindle 10 is moved toward a spindle shaft 13. During the movement of the brake operating member 35, control surfaces 49 of the brake operating member 35 cause the stop/restart switches 46 and 47 to be made OFF between the electric driving motor 20 and alternate current lines S and T, thereby causing the motor 20 to be rotated under its own momentum. Then, braking parts 34 of the brake operating member 35 is pressed to the outer peripheral surface of the spindle shaft 13, thereby executing a mechanical braking operation. After the withdrawal of an end of broken yarn, the brake operating member 35 is released, so that a force of the springs 41 causes the brake operating member 35 to be detached from the spindle shaft 13, thereby canceling the braking operation. The movement of the brake operating member 35 also causes the stop/restart switches 46 and 47 to be made ON, thereby restarting the drive motor 20.

Fig.4



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Description

The present invention relates to a spinning machine such as a ring fine spinning frame or a ring twisting machine having driving motors for driving respective spindles independently. In particular, the present invention relates to stopping and restarting such a spinning machine for use when a yarn breakage occurs.

Known in a prior art is a ring fine spinning frame wherein a plurality of spindles for winding yarn are independently connected to respective driving motors. In the fine spinning frame having such an independent spindle driving system, all of the spindles in the fine spinning frame are usually subjected to a simultaneous rotating movement by respective driving motors. On the other hand, switches to selectively stop and restart the drive motors are also independently provided for the respective spindles. Thus, upon an occurrence of a yarn breakage in a spindle, a switch of the corresponding spindle is turned OFF by an operator, so that a drive motor of the corresponding spindle is stopped in order to allow the operator to execute a piecing operation on the broken yarn. After the execution of the piecing, the corresponding switch is turned ON by the operator, which allows the corresponding spindle to be restarted. See, for example, Japanese Unexamined Patent Publication (Kokai) No. 6-57549.

As another related art, Japanese Unexamined Patent Publication (Kokai) No. 2-160934 discloses a fine spinning frame having an independent spindle driving system including independent driving motors for respective spindles, wherein each of the spindles is provided with a stationary braking device for preventing the spindle from being subjected to a torsional force, which otherwise causes the spindle to be rotated in the reverse direction. However, this prior art is not related to the independent stopping of a spindle where a yarn breakage is occurred.

Fig. 20 shows, schematically, a spindle to spindle based driving system in the prior art, where spindles SP are provided, independently, with electric driving motors which are grouped. M1 to M6 are driving motors in one of such groups. In other words, each group includes six motors. Control circuits S1 to S6 are provided for independent stop/restart operation of the driving motors M1 to M6 in the group. These control circuits S1 to S6 for the driving motors M1 to M6 in each group are combined as a single control circuit board S0. The driving motors are, generally, driven by a three phase alternating current, while a direct current is employed for obtaining a braking operation for stopping the driving motors. Thus, the control circuit boards between the groups are connected to an alternating current source AC via connectors X and alternating current lines L1 and are connected to a direct current source DC via connectors X and direct current lines L2. Furthermore, switches SW1 to SW6 are provided for the respective spindles and the control circuits S1 to S6 are constructed by sequential circuits including relays with contacts. The relays are operated by switches SW1 to SW6 in such a manner that the connection of the electric motors to the alternating current source causes the electric motors to be disconnected from the direct current source while the connection of the electric motors to the direct current source causes the electric motors to be disconnected from the alternating current source.

In the prior art as explained above, the control circuits S1 to S6 corresponding to the spindle of a predetermined number in a group are combined to a single circuit board S0. However, in a fine spinning frame, the total number of the spindle may be up to several hundred, which causes the total number of the control circuit board S0 to be correspondingly increased. Furthermore, as explained above with reference to Fig. 1, each of the control circuit board S0 is connected to a total of five lines, three three-phase alternating current lines L1 and the two direct current lines L2. As a result, a total number of the connecting points constructed by the connectors X is highly increased, which results in an increase in the chance of occurrence of electrically imperfect connection, thereby reducing the reliability of an operation of the textile machine, such as a reduced reliability in the braking operation. Furthermore, a direct current is employed for executing the braking function, which makes it necessary to provide, in addition to the alternating electric current source AC, the direct electric current source DC. In addition, each of the spindles must be provided with a control sequence circuit for obtaining a reliable switching operation between the alternating current and the direct current, which increased the production cost of the control circuit S0, i.e., the cost of production of the spinning machine.

An object of the present invention is to provide, in a spinning machine of a spindle to spindle based driving system, an apparatus for a stop/restart of a spindle, capable of reducing the number of points for an electrical connection, thereby enhancing the reliability of operation while reducing the production cost. Another object of the present invention is to provide a spindle having a capability of stopping and restarting.

In order to attain the above object, an apparatus is provided in a fine spinning frame for stopping an independently driven spindle in a spinning machine having spindles having independent electric drive motors for the respective spindles where each of the drive motors is fed by alternate current lines, characterized in that the spindle includes a braking device for executing a mechanical braking operation on the spindle where a yarn breakage has occurred and a stop/restart switch which is for merely switching ON or OFF the connection of the drive motor, of the spindle where the yarn breakage has occurred, with said alternating current lines.

According to this construction, as a braking of the spindle is executed by the mechanical brake action, unlike the DC brake as in the prior art, it is possible to eliminate at least a DC power source, DC power source lines, electrical connections to the DC power source and a circuit for controlling a switching action between the AC and DC power sources, whereby the device can be produced at a lower cost and operative at a higher reliability with less electrical troubles even though a mechanical stop/restart mechanism is adopted instead of the eliminated parts.

Preferably, the braking device brakes a spindle shaft due to a frictional resistance applied on both sides of the spindle shaft relative to a spindle axis. More preferably, a braking load is applied to the spindle shaft in a direction generally transverse to a rotary axis of the spindle. According to these constitutions, since the braking load is symmetrically applied to the spindle shaft from both sides while interposing the rotary axis of the spindle shaft therebetween, it is possible to prevent an eccentric braking load from being generated relative to the spindle shaft even though the spindle shaft is liable to vibrate in structure, whereby the spindle shaft is made to stop smoothly while maintaining a gap between the rotor and the stator of the drive motor at a predetermined distance. Particularly, when the device is adapted to apply the braking load to the spindle shaft generally transverse to the rotary axis of the spindle, it is possible to minimize a force added to members for supporting the spindle shaft and suppress the generation of vibration.

Preferably, the braking device and the stop/restart switch are so associated with each other that, by actuating the braking device, the stop/restart switch disconnects the AC power source lines from the drive motor and the spindle shaft is braked. According to this constitution, the operability is improved because the stop/restart switch is operated together with the actuation of the braking device. In addition thereto, preferably, the braking device and the stop/restart switch are so associated with each other that, by releasing the braking action of the braking device, the stop/restart switch connects the AC power source lines with the drive motor, or the braking device and the stop/restart switch are so associated with each other that, even if the braking action of the braking device is released, the stop/restart switch holds the connection of the AC power source lines with the drive motor, and thereafter, by returning the braking device to a waiting position, the stop/restart switch disconnects the AC power source lines from the drive motor. According thereto, the operability is also improved when the spindle is restarted again as in a case when the spindle is braked.

Concretely, the braking device comprises a brake-operating member movable between a braking position and a waiting position, a brake section to be brought into press contact with the spindle shaft by the movement of the brake-operating member in the braking direction, and an actuator section for operating the stop/restart switch interposed between the AC power source lines and the drive motor.

A spindle according to the present invention is characterized in that a housing of a drive motor for driving a spindle shaft of the spindle is provided with a braking device for mechanically braking the spindle shaft and a stop/restart switch for merely opening/closing the connection between the drive motor and the AC power source lines. Since the spindle is structured as a unit together with the braking device and the stop/restart switch, the installation thereof becomes easy.

Preferably, also in this spindle, the braking device and the stop/restart switch are so associated with each other that, by actuating the braking device, the stop/restart switch disconnects the AC power source lines from the drive motor, whereby the operability is enhanced. For example, the braking device comprises a brake-operating member movable between a braking position and a waiting position, a brake section to be brought into press contact with the spindle shaft by the movement of the brake-operating member in the braking direction, and an actuator section for operating the stop/restart switch interposed between the AC power source lines and the drive motor, wherein the actuator section holds the stop/restart switch in the OFF state to disconnect the AC power lines from the drive motor even if the braking action due to the brake section is released, and, by returning the brake-operating member to the waiting position, cancels the holding action of the stop/restart switch.

Preferably, the brake-operating member having a bifurcate front end nipping the spindle shaft is mounted to the housing to be rotatable upward and downward, and the brake sections provided at the front end of the brake-operating member are brought into contact with a flange of the spindle shaft to apply a downward pressure onto an upper surface thereof in the axial direction of the spindle shaft, whereby the generation of eccentric braking load is further effectively suppressed.

Also, according to the present invention, the braking device for mechanically braking the spindle shaft of the single drive spindle is of a portable type. Since the braking device is of a portable type, it is unnecessary to provide the braking devices in the respective spindles, which results in the reduction of the number of parts. Thus, the troublesome installing operation is eliminated and a chance of machine trouble is minimized.

The portable type braking device preferably has a engagement member detachably engageable with the single drive spindle and a brake-operation member having a brake section to be in press contact with the spindle shaft, wherein the brake section is brought into press contact with the spindle shaft while the engagement member is engaged with the engagement section of the single drive spindle. According to this structure, since the brake-operating member itself forms a braking device, it is possible to reduce the number of parts as well as a weight of the portable type braking device, which is suitable for the portable type. The portable type braking device preferably has an actuator section capable of actuating a stop/restart switch interposed between the AC power source lines and the drive motor when the engagement member is engaged with the single drive spindle. Since the stop/restart switch is actuated by the engagement operation of the portable type braking device according to this structure, the operability is facilitated.

Now, embodiments of the present invention will he explained with reference to attached drawings, in which:

Fig. 1 is a side sectional view of a single drive spindle.

Fig. 2 is a sectional view taken along line II-II in Fig. 1.

Fig. 3 is a sectional view taken along line III-III in Fig. 2.

Fig. 4 is a wiring diagram.

Fig. 5 is a front view of another embodiment.

Fig. 6 is as plan view of Fig. 5.

Fig. 7 is a right side view of Fig. 5.

Fig. 8 is a front view showing an operative state.

Fig. 9 is a plan view of Fig. 8.

Fig. 10 is a right side view of Fig. 8.

Fig. 11 is a side sectional view showing a further embodiment of a single drive spindle.

Fig. 12 is a plan view of Fig. 11.

Fig. 13 is a sectional view taken along line XIII-XIII in Fig. 11.

Fig. 14 is a sectional view taken along line XIV-XIV in Fig. 11.

Fig. 15 is similar to Fig. 14 but is an illustration of another shape of an operating part.

Fig. 16 is a sectional view illustrating a different embodiment of a braking device.

Fig. 17 is a plan view of Fig. 16.

Fig. 18 is a sectional view illustrating a different embodiment of a braking device.

Fig. 19 is a plan view of Fig. 18.

Fig. 20 is an illustration of a prior art.

In Fig. 1, a spindle rail 1 is arranged along a front side of a machine frame of a ring fine spinning frame. A plurality of independently driven spindles (below, spindles) 10, which are arranged at a predetermined spacing along the length of the machine frame, are mounted on the spindle rail 1. Each of the spindle 10 has a bolster 11, which is inserted to a mounting hole la formed in the spindle rail 1 and is fixedly connected thereto by means of a nut 2. In each of the independently driven spindles 10, an electric driving motor 20 is provided, which has a motor housing 30, which is made integral with respect to the bolster 11.

The spindle 1 is formed as a shaft 13 provided with a bobbin insert part 13a to which a bobbin (not shown) is inserted, a base part 13b, which extends downwardly from the part 13a and a small diameter part 13c, which is coaxial with the shaft 13 and extends downwardly from the base part 13b. The small diameter part 13c is, at its top and bottom ends, rotatably supported to the bolster 11 by means of vertically spaced set of bearing units 14 and 15, while allowing the spindle shaft 13 to be removed upwardly. The lower bearing unit 15 is constructed by members which are able to move radially and urged radially inwardly toward the axis of the spindle by a suitable means, so that a kind of a damper is created which functions to absorb a vibration during a high speed rotating movement of the spindle shaft 13, thereby suppressing an operational noise. Namely, due to this construction, the spindle is able to swing about the upper bearing unit 14, which functions as a fulcrum.

The drive motor 20 includes, in addition to the housing 30, a rotor 21, which is fixedly arranged around the base portion 13c of the spindle shaft 13, and a stator 22, which arranged inside of the housing 30. A spacing t exists between the rotor 20 and the stator 22 for an effective rotating movement.

The housing 30 is formed as an assembly constructed by a body 31 having a space therein for storing the motor 20 and a cover 32 in which a part of a braking device 40 according to present invention as well as stop/restart switches 46 and 47 are housed.

As shown in Fig. 2, the braking device 40 includes a shoe holder member 33 formed as a resilient member such as a flat spring of a substantially C-shape and a brake operating member 35 for causing a braking operation to be executed. The shoe holder member 33 has a base portion 33a, which is sandwiched between a front wall 32a of the cover 32 and a front wall 31a of the body 31 and a pair of arm (bifurcated) portions 33b, between which the spindle shaft 13 is arranged in such a manner that the portions 33b are urged radially outwardly from the shaft 13 under the action of the spring force of the holder itself, while the portions 33b are moved radially inwardly toward the shaft 13 against the force of the spring. Furthermore, at the ends of the arm portions 33b, braking parts (brake shoes) 34, which are located at diametrically spaced positions with respect to the spindle shaft 13, are integrally formed. When the brake shoes 34 are under a pressed condition with respect to the surface of the spindle shaft 13, a frictional resistance force is generated, which cause the spindle to be subjected to a braking operation.

As shown in Fig. 2, the brake operating member 35 is formed with a bifurcated portion 36 constructed by a pair of arms 36a having ends located between a side wall of the arm portions 33b of the holder member 33 and a side wall of the cover 32. Furthermore, each of the arms 36a is, at its end, formed with a hook shaped catch portion 37, which is opened outwardly. The brake operating member 35 has, at its rear side opposite the arms 36a, a tongue portion 39 of a narrow width, which is inserted to a window 38 of a rectangular shape formed in a rear wall 32b of the cover 32 and is projected outwardly therefrom. As shown in Fig. 3, the cover member 32 has opposite side walls 32-1 which form guide grooves 32, to which the arms 36a of the brake operating member 35 are respectively slidably inserted, so that the member 35 is moved toward and away from the shaft 13. As shown in Fig. 2, between the arms 36a of the brake operating member 35 and the inner front wall 32 of the cover member 32, springs 41 are arranged so that the brake operating member 35 is usually moved away from the front wall 32 of the cover member 32 in the right-handed direction in Fig. 2. Thus, so long as the brake operating member 35 is not subjected to a pressing force, the catch members 37 are, at their end parts, engaged with respective stopper portions 43 formed in the cover member 32, which results in the catch members 35 are at awaiting position as shown by a solid line A in Fig. 2.

In Fig. 2, the arms 36a of the brake operating member 35 are, at the inner sides, inclined surfaces 36b which are tapered in a rearward direction. Thus, during a movement of the brake operating member from the waiting position A to a braking position B as shown by dotted lines, the tapered inner surfaces 36b of the arms 36a of the brake operating member 36 come to a contact with the arm portions 33b of the shoe holding member 33, which causes the brake shoes 34 to be moved radially inwardly toward the outer surface of the spindle shaft 13, thereby commencing a braking operation of the spindle shaft 13. Contrary this, a movement of the brake operating member 36 in the opposite direction causes the braking shoes 34 to be detached from the outer surface of the spindle shaft 13 under the resiliency of the shoe holding member 33, which causes the braking operation to be canceled.

As shown in Fig. 2, the brake operating member 36 is, at locations between the arms 36a and the narrow width portion 39, formed with operating parts 45 so that the parts 45 are faced with stopping/restart switches 46 and 47 on the cover 32 at positions located outwardly from the narrow wall portion 39 in the direction of the width of the portion 39. Each of the stopping/restart switches 46 and 47 is an ON/OFF type switch having a normally closed inner contact and is formed with an operating member 48, which is spring urged so that the operating member 48 is normally projected outwardly so that the switch takes ON position. When the operating member 48 is pressed inwardly, the switch is moved to the OFF position. The operating parts 45 of the switch operating member 36 selectively cooperate with the operating members 48 of the switches 46 and 47. The operating part 45 is formed with a cam surface (inclined surface) 49 cooperated with the operating member 48. Namely, during the movement of the brake operating member 35 from the waiting position A to the operating position B, the cam surface 49 engages with the operating member 48, which causes the latter to be moved inwardly, which causes the switch to be moved to OFF condition. Contrary to this, during the movement of the brake operating member 35 from the operating position B to the waiting position A, the cam surface 49 is disengaged from the operating member 48, which causes the latter to be projected outwardly, which causes the switch to be moved to ON condition.

As shown in Figs. 1 and 2, the rear wall 32b of the cover 32 has, at its sides, a pair of handle support members 51 projected rearwardly, between which an operating handle 52 is connected in such a manner that the operating handle is rotated between a non-operating position C where the operating handle 52 hangs vertically as shown by a solid line and an operating position D, where the operating handle 52 extends horizontally as shown by a dotted line. The operating handle 52 has a cam part (engaging part) 53 of an arc shaped cross section made of a material of an increased friction such as a rubber. In the rotating movement of the handle 52 from the non-operating position C to the operating position D, the cam portion 53 causes the brake operating member 36 to be moved from the waiting position A to the braking position B against the force of the springs 41. Contrary to this, in an opposite movement of the operating handle 52, the force of the spring causes the brake operating member 36 to be moved back to the waiting position A from the braking position B.

Fig. 4 schematically illustrates an electrical connection of the motors 20 and the stop/restart switches 46 and 47 in the respective spindles 10 with respect to alternate current lines R, S and T at an outlet side of a frequency variable control device formed as an inverter device 55, which is, itself, well known. The inverter device 55 is in electrical connection with a three phase alternate current source 56 via a main switch 57. In the alternate current lines R, S and T, the line R is connected directly to the drive motors 20 of the respective spindles 10. The lines S and T are connected to the electric motors 20 via the normally closed contacts of the switches 46 and 47, respectively. In Fig. 4, in the braking apparatus 40, only the brake operating members 35, the switch control surfaces (cam surfaces) 49, the springs 41 and the brake shoes 34 are schematically illustrated. As will be easily understood from this structure, the present invention eliminates a DC source and direct current lines, so that any electric connection regarding the DC lines as well as a switching circuit between the AC current and DC current are not needed, although the mechanical braking devices are additionally needed in the respective spindles. Thus, the present invention makes it possible to avoid troubles which may otherwise be generated by electrical connections. On the other hand, the cost for the provision of the mechanical braking devices is not high and the operation of the mechanical braking device is reliable. Thus, a reliable operation is obtained while keeping a low cost of the system.

Now, an operation of the first embodiment will be explained. The main switch 57 is made ON and a restart switch (not shown) is made ON, which causes the inverter device 55 to commence a frequency control operation in such a manner that a predetermined pattern of a control of a rotating speed of the spindles 10 is obtained. In this case, in all of the spindles 10, the brake operating members 35 of the braking devices 40 are in the respective waiting positions A, i.e., under the brake released conditions, while the restart/stop switches 46 and 47 are made ON, causing all of the alternate current lines R, S and T to be in electrical connection with the motors 20. Thus, a frequency control of the inverter 55 is restarted, which causes, finally, the speed of each of the spindles 10 to be increased to a predetermined steadly spinning speed.

When yarn breakage is occurs at a spindle 10 during its rotating movement, an operator manipulates the operating handle 52 from the non-operating position C to the operating position D. During such a movement of the operating handle 52, the engaging part 53 of the handle 52 pushes the brake operating member 35 at its rear end, so that brake operating member 35 is moved, from the waiting position A, to the braking position B. During the movement of the brake operating member 35 from the waiting position A to the braking position B, the switch control surfaces 49 push the operating members 48 of the switches 46 and 47, respectively, thereby causing the latter to be switched to the respective OFF positions, which causes the respective motors 20 to be disconnected from the alternate current lines S and T, so that any subsequent rotating movement of the motor is done under its own momentum. Furthermore, during the movement of the brake operating member 35 from the waiting position A to the braking position B, the inclined surfaces 36b of the brake operating member 35 come to contact with the tip ends of the respective arms 33b of the shoe holding member 33, which causes the arms 33b to be laterally inwardly moved, so that the brake shoes 34 are pressed to the outer peripheral surface of the spindle shaft 13. Thus, when the braking position B of the brake operating member 35 is obtained, a mechanical braking is generated on the spindle shaft 13 subjected to the momentum driven rotating movement, resulting in a quick stoppage of the spindle shaft 13. A locking of the brake operating member 35 to the braking position B is obtained due to the fact that the engaging part 53 is under a frictional engagement with the rear end of the brake operating member 35. In short, according to present invention, the de-energization of the driving motor 20 cooperates with the braking operation, which makes the operation simplified, in comparison with the case where the de-energization of the driving motor and the braking operation are done independently. It should be noted that the braking position B is not permanently fixed. Namely, a factor such as a wear of the shoe 34 causes the position B to vary slightly.

Upon the completion of a stoppage of the spindle shaft 13, a broken end of the yarn is, in a well known manner, withdrawn from the bobbin fitted to the spindle shaft 13, is passed through a traveler (not shown) and a snail wire (not shown), and is held at a location in front of a front draft roller of the fine spinning frame. Then, the operating handle 52 in the locked position D is moved downwardly to the non-operating position C, so that the brake operating member 35 is retracted under the action of the springs 41, so that the brake shoes 34 are detached from the peripheral surface of the spindle shaft 13 under the action of the spring force of the shoe holding member 33, thereby releasing the braked condition, which is followed by a disengagement of the switch control surfaces 49 from the operating members 48 of the switches 46 and 47, so that the latter are switched to the respective ON conditions, resulting in an electrical connection of the alternate current lines S and T to the motor 20. As a result, the electric feeding to the electric motor 20 is commenced, so that the rotating speed of the motor 20 is instantly increased to its designated speed, which is the same as that in the remaining spindles. When the rotating movement of the spindle shaft commenced, an operator effects, in a well known manner, a manual piecing operation, where the drawn end of the yarn is pieced to a fleece of fibers issued from the front roller (not shown) of the fine spinning frame.

Figs. 5 to 10 shows a modification of the embodiment of the present invention. Namely, in a brake device 40A in the modification, a brake operating member 235 is constructed as a mounting part 236 of a rectangular shape which is to be connected to an upper surface 30a of the housing 30, arm parts 238 located on sides of the part 236 and connecting parts 237 connecting integrally the arm parts 238 with the mounting part 236. The brake operating member 235 includes a inner surface 235a, which faces an integral flange part 13d of the spindle shaft 13 and encircles the flange part 13d over substantially one half of the entire periphery of the flange part 13d. Furthermore, the arm parts 238 have free ends 238a, which are arranged at diametrically opposite positions with respect to the axis of the spindle shaft 13, while located outwardly from the outer surface of the flange part 13d. Brake shoes 234 are connected to the inner surface of the arm parts 238 at their ends. The arm parts 238 have rear ends 238b which extend rearwardly from the connection parts 237 while grooves 239 are formed between the rear ends 238b and the mounting part 236. The brake operating member 235 is integrally formed from a material having an elasticity such as a synthetic resin. Furthermore, the connecting parts 237 have a portion of a small thickness in the front to back direction over the remaining parts of the brake operating member 235. As a result, when the rear parts 238b of the arm portions 238 are widened outwardly, the arms 238 are subjected to an elastic deformation in such a manner that the arms 238 are displaced about the connecting parts 237 as a fulcrum, so that the arms 238 are, at their free ends, moved toward each other. Furthermore, as described later, a construction of the brake operating member 235 is such that, in the condition where the brake operating member 235 is mounted to the housing 30, the brake shoes 234 are held at waiting positions A as shown in Fig. 6 where the brake shoes 234 are spaced from the outer periphery of the flange part 13d, when the arms 238 are not subjected to the widening force for increasing the lateral spacing between the arms 238.

As shown in Fig. 6, an operating handle 240 is formed as a bifurcated shape constructed by a pair of arms 241, which are inserted into the laterally spaced grooves 239, between which the mounting part 236 is located. Furthermore, each of the arms 241 is formed with a laterally and outwardly projected stub shaft 242, which is rotatably inserted to a corresponding supporting hole 243 formed in the brake operating member 235. As a result of this structure, the operating handle 240 is moved between a horizontal position E as shown in Fig. 5 and an inclined position F as shown in Fig. 8. The operating handle 240 has, at the root portion of the bifurcated shape, a beveled portion 244, which prevents the root portion from interfering with the mounting part 236 when the operating handle 240 is rotated between the horizontal position E and -the inclined position F. Furthermore, in order to prevent the operating handle 240 from being rotated below the horizontal position E as shown in Fig. 5, the operating handle is, at a location below the beveled part 244, formed with a abutting surface 245, which is contacted with the mounting portion 236 at its rear surface 236a. The operating handle 240 is, at its lower side, integrally formed with an operating projection 246. The operating projection 246 is adapted to press a plate spring 250 which will be explained later in more detail.

In the instant embodiment, in order to allow the electric lines R, S and T to be independently made ON or OFF in the three phase alternate current, stop/restart switches as micro-switches 46 and 47 between the electric lines R, S and T and the drive motor 20, similar to the first embodiment, as well as additional stop/restart switch 47A between the electric line R and the drive motor 20 are arranged below the operating projection 246. In this embodiment, these stop/restart switches 46, 47 and 47A are the normally open (OFF) type. When the operating member 48 is pressed, a corresponding inner contact (not shown) is made ON. On the other hand, when the operating member 48 is freed so that the operating member 48 is projected outwardly projected position, the inner contact of the corresponding switch is made OFF.

The plate spring 250 having a hook shaped end is arranged between the operating projection 246 and the stop/restart switches 46, 47 and 47A. The plate spring 250 functions as an operating part which causes the contact operating members of the three switches 46, 47 and 47A to be simultaneously operated. As shown in Fig. 5, the plate spring 250 has a base portion, which is fitted to a recess 30b formed at a top surface 30a of the housing 30 and which is, together with the mounting part 236 of the brake operating member 235, integrally connected to the housing 30 by means of a bolt 251 screwed from the above to a screw hole in the housing, while maintaining lateral positions of the members 235 and 250 by means of the recess 30b. In the three stop/restart switches 46, 47 and 47A, it may be possible that the displacements of the respective operating members 48 for causing the corresponding switches to be made on are slightly different from each other. However, the switching-on of the switches is done by pressing elastically the respective operating member 48 via the plate spring 250, which allows the difference in the displacement to be absorbed, thereby affirming a positive switching operations of the three stop/restart switch.

The brake operating member 235 has a laterally spaced pair of rear parts 238b, which have, at the inner surfaces faced with each other, stepped cam surfaces 260, which are constructed by inwardly projected upper cam portions 261 and lower cam portions 262. The lateral spacing between the upper cam portions 261 is narrower than that between the lower cam portions 262. As a result of this structure, a rotating movement of the operating handle 240 between the horizontal position E and the vertical position F causes the operating arms 238 of the brake operating member 235 to be moved between a rest position (non braking position) A in Fig. 6 where a small gap exists between the brake shoes 234 and the outer peripheral surface of the flange portion 13d of the spindle 13 and a braking position B in Fig. 9, where the brake shoes 234 are in a press contact with the outer periphery of the flange part 13d of the spindle for generating a mechanical braking force in the spindle shaft 13.

On the other hand, the lateral spacing between the lower cam portion 262 is roughly equalized with the lateral width of the operating handle between the side surfaces 240a. Thus, the operating handle 240 is in the horizontal position E as shown Fig. 5, held between the lower cam portions 262, so that the outwardly opening movement of the rear parts 238b of the brake operating member 235 by means of the operating handle 240 is prevented as shown in Figs. 6 and 7. Contrary to this, the lateral spacing between the upper cam parts 261 is such that a positioning of the side surfaces 240a of the handle 240 between the upper cam parts 261 in the inclined position F of the operating handle 240 causes the rear parts 238b of the brake operating member 235 to be urged laterally outwardly, which causes the brake shows 234 to be pressed to the flange part 13d of the spindle shaft 13 as shown in Figs. 9 and 10.

When the handle 240 is in the horizontal position E, the plate spring 250 is urged downwardly by means of the operating projection 246, so that the operating members 48 of each of the stop/restart switches 46, 47 and 47A are pressed, which causes the switches to be made ON. In this case, an upwardly directed force applied to the operating handle 240 by means of the plate spring 250 is received at the stepped portion between the upper cam part 261 and the lower cam part 262, which allows the horizontal position E of operating handle 240 to be maintained. As a result, electric motor 20 is maintained to be fed by the three phase alternate current lines R, S and T, thereby keeping a rotating movement of the spindle.

When a yarn breakage in a spindle occurs, an operator moves the operating handle 240 in the corresponding spindle, so that it is rotated to the inclined position F in Fig. 8. Such a movement to the position F causes the plate spring 250 to be displaced from the operating members 48 of the stop/restart switches 46, 47 and 47A, which causes the switches to be made OFF, thereby preventing electric current being fed to the motor 20. Furthermore, the side surfaces 240a of the operating handle 240 causes the upper cam parts 261 of the brake operating member 235 to be laterally outwardly opened, which causes the arm portions 238 to be elastically displaced from the rest position A to the operating position B. At the operating position B, the flange portion i3d is, at its outer periphery, held between the brake shoes 234, thereby braking the spindle. Then, the operator executes a piecing operation.

After the completion of the yarn piecing operation, the operating handle 240 is returned, from the inclined position F, to the horizontal position E, which allows the spindle 13 to commence a rotating movement, thereby commencing a spinning operation.

In the above mentioned second embodiment, a construction is employed that the brake shoes 234 are moved inwardly in order to make the brake shoes 234 to be made contacted with the spindle shaft 13 at its diametrically opposite locations. Furthermore, the brake shoes 234 at the opposite sides are simultaneously contacted with the peripheral surface of the spindle shaft 13. Thus, the spindle shaft 13 is maintained at a vertically extended position, while a braking force is applied thereto, even in a situation that the spindle 13 is under an arrangement that the spindle 13 is easily shaken. Thus, it is desirable that the situation will not occur where a spindle shaft 13 is inclined or shaken, which causes the gap between the rotor 13 and the stator 22 to be reduced or causes, in a extreme case, the rotor 13 and the stator 22 to be brought into a mutual contact to damage the parts, as is the case when the spindle shaft 13 is subjected to a braking load only at its spindle side. However, the structure in the second embodiment is disadvantageous in that a simultaneous and equalized application of the braking load by the braking shoes 34 to the outer periphery of the spindle shaft 13 is needed, resulting in an increased requirement as to a precision of the parts, since, in the structure in the second embodiment, where a braking load is applied to the outer periphery of the spindle 13 at its diametrically opposite positions in a direction transverse to the axis of the spindle, a generation of an inclination of the spindle shaft 13 is likely even in a situation that a small difference exists between the timings of the application of the brake shoes 34 at the opposite sides to the spindle shaft 13.

Now, a third embodiment according to present invention capable of overcoming the above mentioned difficulty will be explained. In the third embodiment in Figs. 11 to 14, the electric drive motor 20 is stored in a body 31 of a housing 30 and the spindle shaft 13 is rotatably supported to the housing 30 under the similar damping function. A braking device 140 is provided, which includes a pair of laterally spaced support members 160 mounted on an upper surface of the cover member 32 and a brake operating member 135 of a substantially L shape having an intermediate boss portion 135-1 which is supported rotatably on the support members 160 by means of pins 135-2 in such a manner that the brake operating member 135 is rotated between a rest position A as shown by a solid line in Fig. 11 and a brake operating position B as shown by a dotted line.

The brake operating member 135 has, at its tip end portion, a bifurcated portion 136 as shown in Fig. 12, which is constructed by a pair of spaced arms 136a located on the sides of the spindle shaft 13. Each of the arms 136a has a free end, which is provided with, at its lower surface, a braking portion (brake shoe) 134, which is faced with an upper surface of the flange 13d of the spindle shaft 13 and which is pressed axially downwardly during the execution of the braking operation. The brake operating member 135 forms, at the opposite end, an operating handle 152.

As shown in Fig. 13, a gripper 60 is fixedly connected to an outer surface of the rear wall 31b of the housing 31 in such a manner that the operating handle 152 is releasably engaged with the gripper 60. Namely, as shown in Fig. 11, the gripper 60 is of a substantially C cross sectional shape having a pair of gripping pieces 61. The gripper 60 is made of a resilient material such as a spring steel or synthetic resin. Thus, the gripping pieces 61 releasably engage with the side walls of the operating handle 152 when the operating handle 152 is rotated to the operating position A as shown in Fig. 11.

At a location of the rear wall 32b of the cover 32, an operating member 145 is arranged. The operating member 145 functions as a switch holding/canceling means to maintain OFF positions of the stop/restart switches 46 and 47 when a braking operation by the brake shoes 134 is canceled and functions to cancel the OFF holding operation of the switches 46 and 47 when the brake operating member 1345 is returned to the rest position A. In more detail, the operating member 145 is, as shown in Fig. 14, provided with an operating shaft 148, which is slidably inserted to a hole in the rear wall 32b of the cover 32 in the front-to-back direction, while means is provided for preventing the operating shaft 148 from rotated about its own axis. The operating shaft 148 is projected rearwardly from the rear wall 32b of the cover 32 in such a manner that the projected end forms a head part 149, which is in contact with the front surface of the operating handle 152. Between the head part 149 and the rear wall 32b of the cover 32, a washer 150 and the spring 151 are arranged, so that the operating shaft 148 is urged to be moved in a rearward direction. The operating shaft 148 is formed with a front end projected to the space inside the cover 32 and an operating piece 153, which extends integrally and laterally from the shaft 148. The operating piece 153 forms, at the lateral ends, inclined end surfaces as cam control surfaces 153b.

On the cover 32 at locations laterally outward from the switch operating surfaces 153b, two stop/restart switches 46 and 47 are mounted, which have normally closed contacts located between the alternate current lines S and T and the drive motor 20. Furthermore, in the position A in Fig. 11 where the operating handle 152 is held by the holder member 60, the operating handle 152 pushes the head 149 of the operating shaft 148, so that the operating piece 153 is prevented from pushing the operating members 48 of the stop/restart switches 46 and 47, thereby maintaining the ON conditions of the switches. Contrary to this, when the operating handle 152 is released from the gripper 60 as shown by the dotted line B in Fig. 11, the force of the spring causes the operating shaft 148 to be moved rearwardly, so that the operating piece 153 pushes the operating members 48 inwardly, which causes the stop/restart switches 46 and 47 to be made OFF. It should be noted that the connection of the switches 46 and 47 with the alternate current lines R, S and T and the connection of the lines R, S and T with the inverter device and the alternate current source are identical as those shown in Fig. 4. Finally, as a modification, as shown in Fig. 15, a construction may also be possible in which a rear surface of the end of the operating piece 153 is formed as the switch operating surfaces 153b, to which the operating members 48 of the switches 46 and 47 face as shown in Fig. 15.

When an operator finds a yarn breakage, the operating handle 152 of the spindle 10 is disengaged from the gripping member 60 and is rotated from the rest position A to the brake operating position B. During the rotating movement, -the operating shaft 148 is, under the spring force of the spring 151, retracted, so that the operating piece 153 comes to engagement with the operating members 48 of the stop/restart switches, causing the switches to be made OFF, thereby deenergizing the electric drive motor 20, which is, thus, brought into a condition that it rotates under its own momentum. Such a rotating movement of the spindle shaft 13 is stopped by a frictional resistance force which is generated when the shoes 134 at the ends of the brake operating member 135 are pressed against an upper surface of the flange portion 13d. When the operator removes his or her hand from the operating handle 152 after the stoppage of the spindle shaft 13, the brake operating member 135 is under a non-braking condition where the brake shoe 134 is riot press contacted with the flange portion 13d. However, the position of the brake operating member 135 is not at the rest position A but at the non-braking position which is slightly spaced from the braking position B. Then, the end of the broken yarn is withdrawn in the similar way as explained with reference to the first embodiment, and, then, the operator pushes the operating member 135 to the rest position A, which causes the operating handle 152 to be pushed into the gripping member 60. This movement of the operating handle 152 causes the operating shaft 148 to be moved forwardly, so that the operating piece 153 is detached from the operating members 48 of the stop/restart switches 46 and 47, causing the switches to be made ON, which allows the drive motor 20 to be fed with the alternate current lines R, S and T, thereby causing the rotating speed of the spindle shaft 13 to instantly increase.

In the third embodiment, as explained above, the braking force is applied downwardly to the upper surface of the flange part 13d of the spindle shaft 13. Thus, the direction of the braking force is mainly along the axis of the spindle shaft 13. In other words, a component of the braking force in the direction transverse to the axis of the spindle shaft 13, which causes the later to be skewed, is small. Thus, an increased precision, which makes the laterally space braking parts 34 to be evenly and simultaneously applied to the flange part 13d, is not required, while preventing the spindle shaft 13 from being largely skewed during the braking operation, which otherwise causes the gap to be lost between the rotor 21 and the stator 22 and to make them to be brought into a mutual contact.

The above embodiments are directed to a spindle unit of a spindle-to-spindle driven type having a housing in which a mechanical braking device and stop/restart switches associated with the braking device. This arrangement is advantageous in that an installation of the spindle unit to the ring rail causes both of the braking device and the switches to be automatically installed. However, the present invention is not necessarily limited to the application to this integrated structure. For example, an arrangement is within the scope of the invention wherein a mechanical brake device as well as a stop/restart switch, which are separate from an independent driven spindle shaft, can be provided.

In the above description of the embodiments, the spindle shaft 13 is directed to the one having a damper for absorbing a vibration during a high speed rotating movement of the spindle. However, the present invention can be applied to a type of an independent driven spindle which is, as similar to a conventional alternate current electric motor, simply rotatably supported by vertically spaced bearing units between which a drive motor is arranged, i.e., a damper mechanism is not provided, as is disclosed, for example, in Japanese Unexamined Patent Publication No. 5-247738. In this construction, a braking force on one side of the axis of the spindle will not cause the gap to be changed between a rotor and a stator. However, this construction is also included in the scope of the present invention.

Figs. 16 and 17 illustrate a separate embodiment wherein a braking device is structured by a portable type braking device 40D. A front portion of a brake-operating member 35D of the portable type braking device 40D is formed as a wider section 74 having a larger width than an operating handle 52D formed in a rear portion thereof. An arcuate braking surface (brake section) 74a to be in press contact with an outer circumference of a flange 13d is formed at a front end of the front portion 74. Bulge sections 75 project downward from opposite sides of a lower surface of the wider section 74, and engagement pins 76 projecting inward from the respective bulge sections 75 are integrally formed. Also, an actuator section 77 for operating a stop/restart switch 46D is integrally formed on a lower surface of a front portion of the operating handle 52D.

The stop/restart switch 46D is an alternate type ON/OFF switch accommodated in a housing 30 so that a switch button 48D projects rearward. Engagement grooves 78 for guiding the engagement pins 76 are provided on opposite side surfaces of the housing 30 closer to the switch button 48D. A front portion of the engagement groove 78 curves upward to form a hook-like profile. A stop 80 for stopping the spindle shaft 13 in association with the portable type braking device 40D is integrally formed on an upper surface of a front portion of a cover 32 of the housing 30. A surface of the stop 80 opposite to the outer circumference of the flange 13d is formed as an arcuate braking surface 80a complementary to the outer circumference of the flange 13d. A small gap t_0 is provided between the braking surface 80a and the outer circumference of the flange 13d. The small gap t_0, is selected to be smaller than a gap $\underline{t}$ between the rotor 21 and the stator 22 so that the contact of the rotor 21 with the stator 22 is prevented even when the brake-operating member 35D is applied to the spindle shaft 13 from a side on which the switch button 48D is present and the braking surface 74a of the brake-operating member 35D presses the outer circumference of the flange 13d to slightly tilt the spindle shaft 13 and to nip the outer circumference of the flange 13d in a diametrical direction between the braking surface 74a and the braking surface 80a of the stop 80.

When yarn breakage is detected, the operator pushingly applies the portable type braking device 40D to the spindle shaft 13 while engaging the engagement members 76a with the engagement grooves 78. During this pushing operation, the actuator section 77 pushes the switch button 48D to turn the stop/restart switch 46D OFF, which state is held to interrupt the power supply to the drive motor 20 whereby the spindle shaft 13 is subjected to inertial rotation.

Thereafter, the braking device 40D is further pushed forward to fit the engagement pin 76 into the hook-shaped section 78a of the engagement groove 78. When the operating handle 52D is raised while maintaining this state, the braking surface 74a presses the outer circumference of the flange 13d due to a lever action having a fulcrum at a contact point of the engagement pin 70 with the hook-shaped section 78a. Thus, the spindle shaft 13 is brought into press contact with the braking surface 80a while slightly tilting, whereby the spindle shaft 13 is nipped between the braking surfaces 74a and 80a and the braking load is applied thereto on both sides thereof in the diametrical direction to stop the spindle shaft 13. In a similar manner as in the third embodiment, while maintaining this state, the operator withdraws a broken yarn end to a position in front of the front rollers and releases the braking device 35D to turn the stop/restart switch 46A from OFF to ON. Thus, the drive motor 20 is supplied with a power source to rotate the spindle shaft 13. Then the yarn-piecing operation is carried out.

Next, Figs. 18 and 19 illustrate another embodiment of a portable type braking device 40E. The portable type braking device 40E has a pair of brake-operating members 90 which are operative as a pincers relatively rotatable about a pin 91. Rear portions of the brake-operating members 90 form operating handles 92, and front portions thereof form grip sections 93. A free end of the grip section 93 bends inward to define brake sections 94. A spring 96 is interposed between the operating handles 92 to always bias both the operating handles 92 away from each other. The pin 91 projects downward from the brake-operating members 90 so that a projected portion forms an engagement section 91a engageable with an engagement groove 95 provided in a cover 32 of a housing 30. An external switch button 48E of a stop/restart switch (alternate switch) 46E is provided in a rear wall 31b of a main body of the housing 30 at a position closer to one side thereof.

When yarn breakage is detected, the operator pushes the switch button 48E to turn the stop/restart switch 46E from ON to OFF and hold this state. Thereby, the power supply to a drive motor 20 is interrupted, and a spindle shaft 13 is subjected to inertial rotation. Thereafter, the operator applies the engagement sections 91a of the portable type braking device 40E maintained so that the grip sections 93 are open due to the action of the spring 96 to the engagement grooves 95. Then, the operator grips the operating handles 90 so that the brake sections 94 simultaneously nips the spindle shaft 13 from both side in the diametrical direction, whereby the spindle shaft 13 is applied with a braking load and stops without tilting. Thereafter, the operator withdraws a broken yarn end to a position in front of the front rollers while the spindle shaft 13 is maintained stationary, releases the braking device 40E, turns the stop/restart switch 46E from OFF to ON to supply the drive motor 20 with power so that the spindle shaft 13 is restarted, and carries out the yarn piecing operation.

A stop/restart switch having a normally-open contact may be used for the present invention. For example, it is possible to adapt the device so that the contact is made to open by an operating piece when an actuator shaft is pushed in, and vice versa. While the power supply to the drive motor is controlled by the ON/OFF operation of two phases of the three-phase AC power source in the above embodiments, it is also possible to adapt the device so that the control is carried out by the ON/OFF operation of all of the three phases.

As described above, since the spindle is mechanically braked according to the present invention, it is possible to eliminate at least a DC power source, DC power source lines, electrical joints for the DC power source and a switching circuit between AC and DC power sources which are necessary in the prior art device wherein a DC-brake system is adopted. Thereby, the stop/restart device of the present invention is inexpensive in manufacturing cost and has a high reliability with less electrical trouble even though it requires a mechanical braking mechanism. Since a braking load is applied to both sides of a rotary axis of the spindle shaft to minimize an eccentric component added to the spindle shaft, it is possible to brake the same while maintaining a necessary gap between the rotor and the stator of the drive motor. Particularly, according to a type wherein the braking load is applied to a spindle axis generally transverse thereto, it is possible to reduce a force acted on the spindle bearings and suppress the generation of vibration. Since the braking device is associated with the restart/stop switch, the operability is enhanced. Since the spindle is combined with the braking device and the restart/stop switch as a single unit, the installation thereof to a spinning frame is very easy compared with a case wherein the braking device and the restart/stop switch are separately installed to the spinning frame.

Also, a portable type braking device is usable commonly to a plurality of single drive spindles, whereby the number of parts and troublesome installing operation can be reduced to a great extent compared with a case wherein the braking device is exclusively provided in the respective single drive spindle.

Claims

1. An apparatus in a fine spinning frame for stopping an independent driven spindle in a spinning machines having spindles having independent electric drive motors for the respective spindles where each of the drive motors is fed by alternate current lines, characterized in that the spindle includes a braking device for executing a mechanical braking operation in the spindle where a yarn breakage is occurred and a stop/restart switch which merely switches ON or OFF the connection of the drive motor of the spindle, where the yarn breakage has occurred, with respect to said alternate current lines.

2. An apparatus in a fine spinning frame for stopping an independent driven spindle in a spinning machines having spindles having independent electric drive motors for the respective spindles where each of the drive motors is fed by alternate current lines, characterized in that the spindle includes a braking device for executing a mechanical braking operation in the spindle where a yarn breakage is occurred and a stop/restart switch which merely switches ON or OFF the connection of the drive motor of the spindle where the yarn breakage is occurred with said alternate current lines and in that said braking device is constructed such that a braking is executed by imparting a frictional resistance force to the spindle shaft at its sides.

3. A device for stopping/restart a single drive spindle as defined by claim 2, characterized in that a braking load is applied the spindle shaft in a direction substantially transverse to a rotating axis of the spindle.

4. A device for stopping/restart a single drive spindle as defined by any one of claims 1 to 3, characterized in that the braking device and the stop/restart switch are so associated with each other that, by actuating the braking device, the stop/restart switch disconnects the AC power source lines from the drive motor and the spindle shaft is braked.

5. A device for stopping/restart a single drive spindle as defined by claim 4, characterized in that the braking device and the stop/restart switch are so associated with each other that, by releasing the braking action of the braking device, the stop/restart switch connects the AC power source lines with the drive motor.

6. A device for stopping/restart a single drive spindle as defined by claim 4, characterized in that the braking device and the stop/restart switch are so associated with each other that, even if the braking action of the braking device is released, the stop/restart switch holds the connection of the AC power source lines with the drive motor, and thereafter, by returning the braking device to a waiting position, the stop/restart switch disconnects the AC power source lines from the drive motor.

7. A device for stopping/restart a single drive spindle as defined by any one of claims 4 to 6, characterized in that the braking device comprises a brake-operating member movable between a braking position and a waiting position, a brake section to be brought into press contact with the spindle shaft by the movement of the brake-operating member in the braking direction, and an actuator section for operating the stop/restart switch interposed between the AC power source lines and the drive motor.

8. A single drive spindle used for a spinning frame, characterized in that a housing of a drive motor for driving a spindle shaft of the spindle is provided with a braking device for mechanically braking the spindle shaft and a stop/restart switch for merely opening/closing the connection between the drive motor and the AC power source lines.

9. A single drive spindle as defined by claim 8, characterized in that the braking device and the stop/restart switch are so associated with each other

that, by actuating the braking device, the stop/restart switch disconnects the AC power source lines from the drive motor and the spindle is braked, and, by releasing the braking action of the braking device, the stop/restart switch connects the AC power source lines with the drive motor.

10. A single drive spindle as defined by claim 8, characterized in that the braking device and the stop/restart switch are so associated with each other that, by actuating the braking device, the stop/restart switch disconnects the AC power source lines from the drive motor and the spindle is braked, the disconnection of the AC power source lines being held by the stop/restart switch even if the braking action of the braking device is released, and thereafter, by returning the braking device to a waiting position, the stop/restart switch connects the AC power source lines to the drive motor.

11. A single drive spindle as defined by claim 10, characterized in that the braking device comprises a brake-operating member movable between a braking position and a waiting position, a brake section to be brought into press contact with the spindle shaft by the movement of the brake-operating member in the braking direction, and an actuator section for operating the stop/restart switch interposed between the AC power source lines and the drive motor, wherein the actuator section holds the stop/restart switch in the OFF state to disconnect the AC power lines from the drive motor even if the braking action due to the brake section is released, and, by the returning the brake-operating member to the waiting position, cancels the holding action of the stop/restart switch.

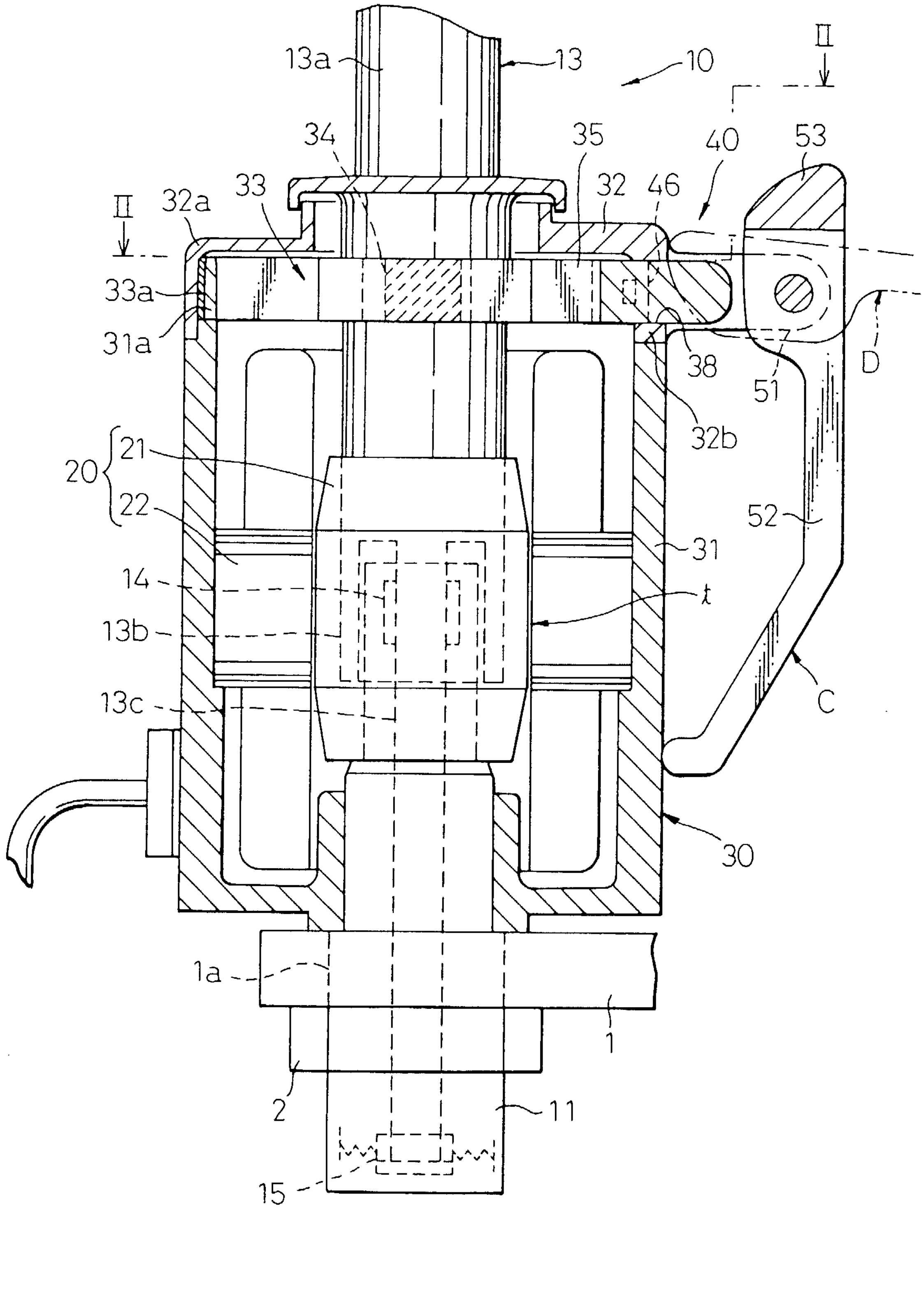
12. A single drive spindle as defined by claim 11, characterized in that the brake-operating member having a bifurcate front end nipping the spindle shaft is mounted to the housing to be rotatable upward and downward, and the brake sections provided at the front end of the brake-operating member are brought into contact with a flange of the spindle shaft to apply a downward pressure onto an upper surface thereof in the axial direction of the spindle shaft.

13. A device for stopping/restart a single drive spindle as defined by claim 1, characterized in that the braking device is of a portable type.

14. A device for stopping/restart a single drive spindle as defined by claim 14, characterized in that the portable type braking device has a engagement member detachably engageable with the single drive spindle and a brake-operation member having a brake section to be in press contact with the spindle shaft, wherein the brake section is brought into press contact with the spindle shaft while the engagement member is engaged with the engagement section of the single drive spindle.

15. A device for stopping/restart a single drive spindle as defined by claim 14, characterized in that the portable type braking device has an actuator section capable of actuating a stop/restart switch interposed between the AC power source lines and the drive motor when the engagement member is engaged with the single drive spindle.

Fig.1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13
10
II
34
35
40
53
II
32a
33
32
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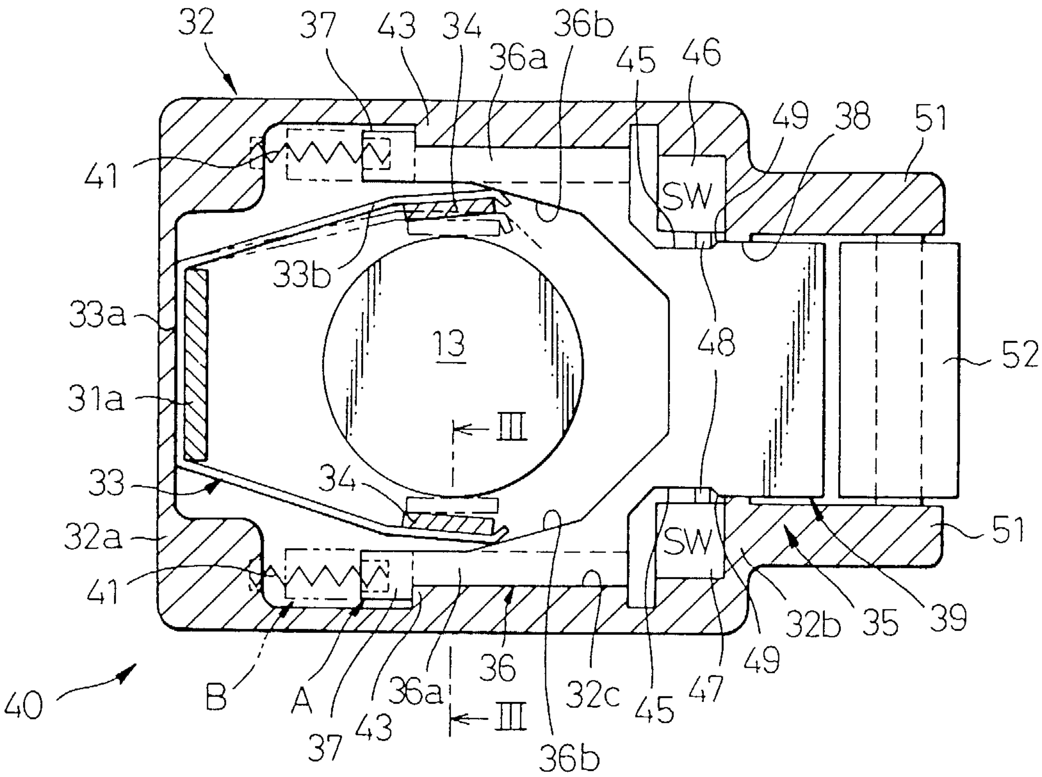
33a
31a
38
51
D
32b
20
21
22
52
31
14
t
13b
13c
C
30
1a
1
2
11
15

Fig.2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37
43
34
36b
36a
45
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38
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33a
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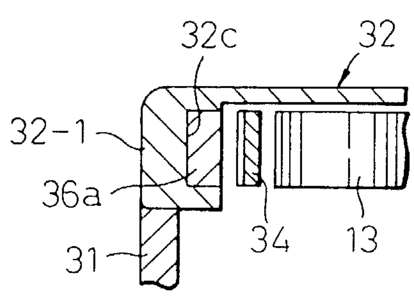
33
34
51
32a
SW
41
32b
35
39
49
40
B
A
36
36a
32c
45
47
37
43
III
36b

Fig.3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32
32-1
36a
34
13
31

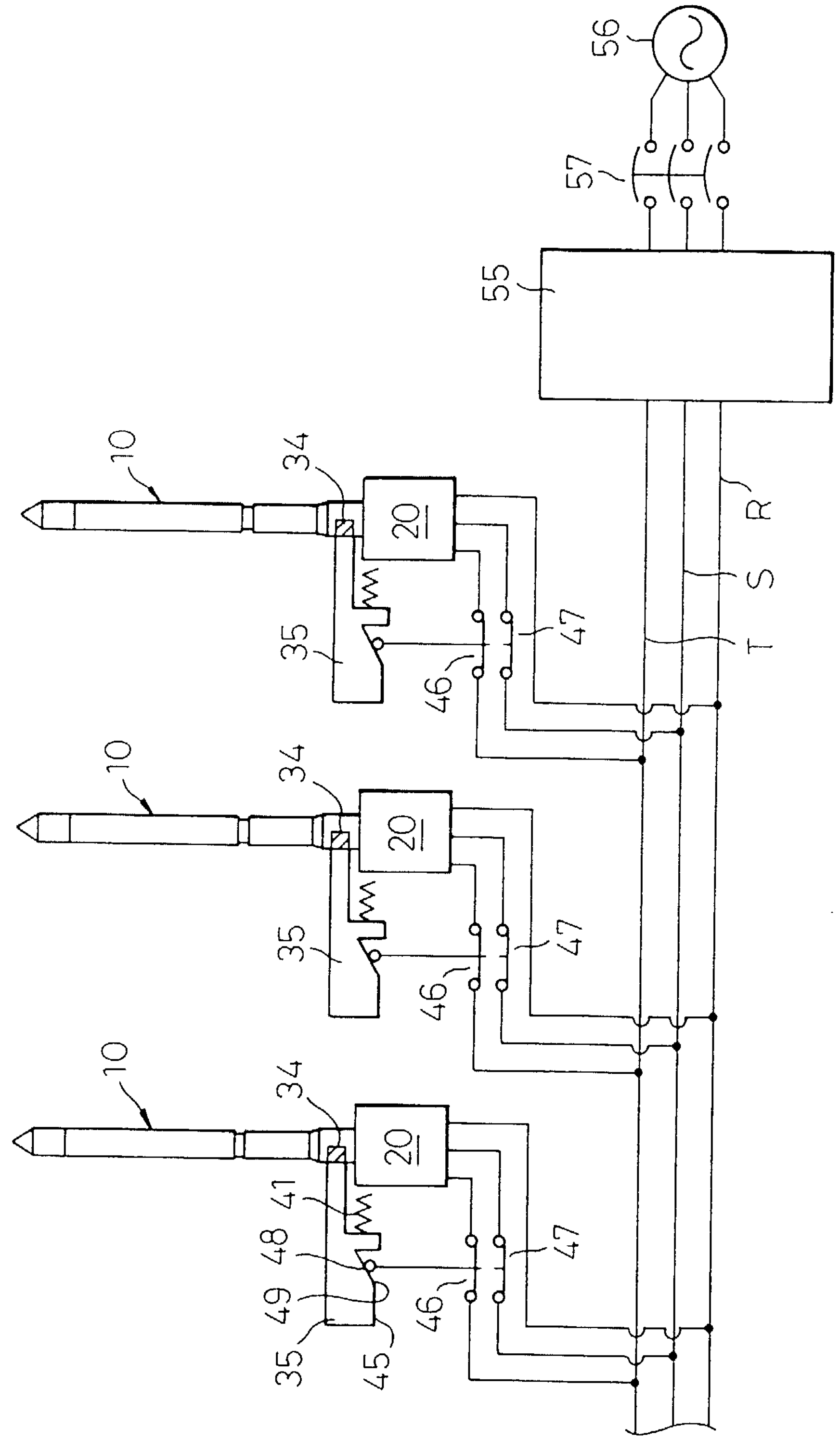


Fig. 4

Fig.5

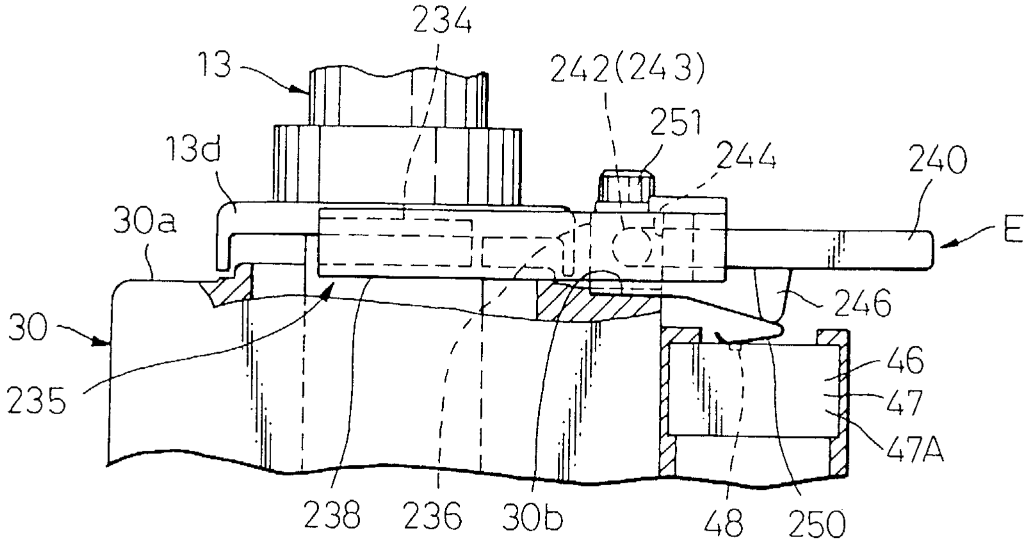
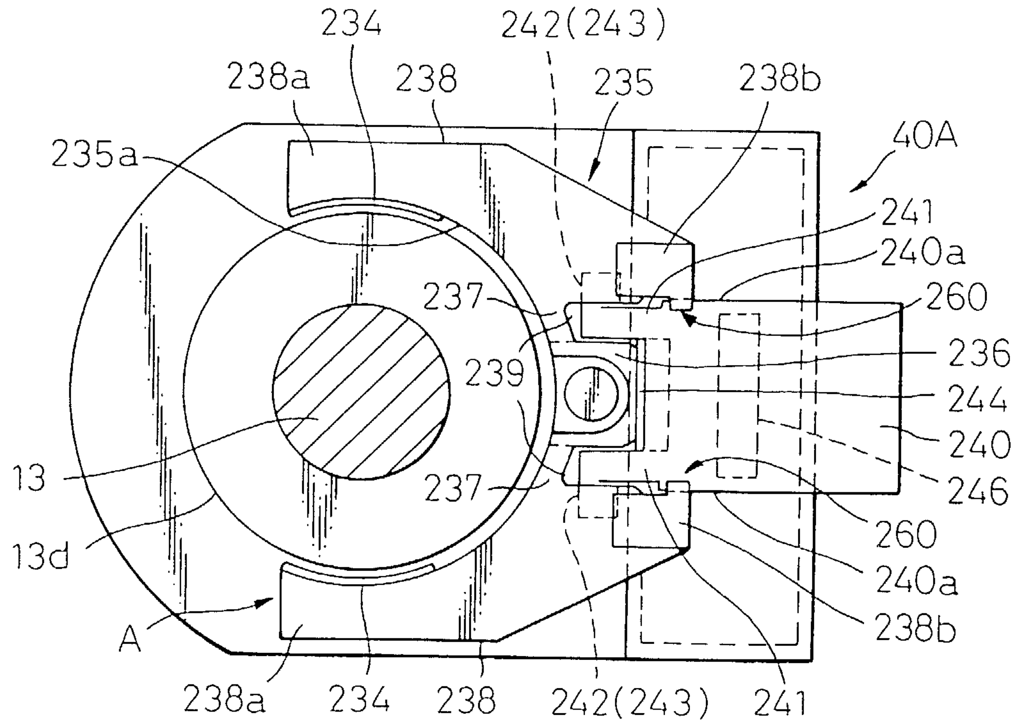

234
13
242(243)
251
13d
244
240
30a
E
246
30
46
47
235
47A
238
236
30b
48
250

Fig.6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242(243)
238a
238
235
238b
40A
235a
241
240a
237
260
239
236
244
240
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13d
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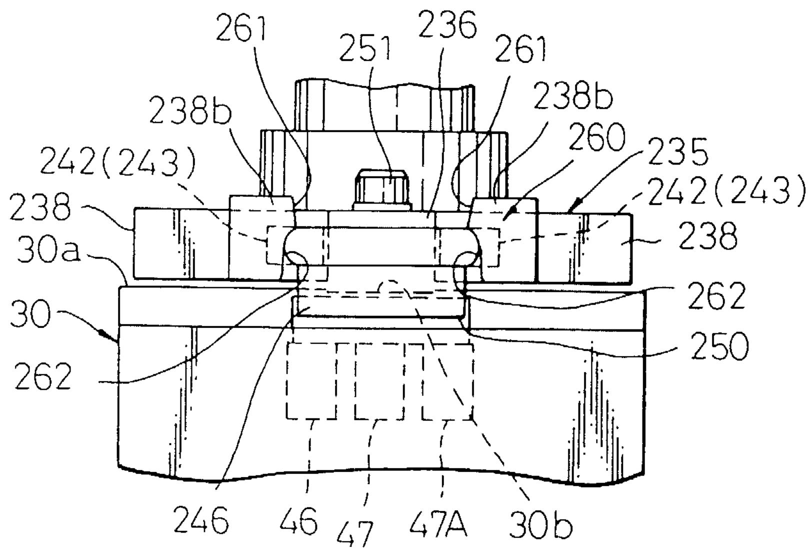
238b
A
238a
234
238
242(243)
241

Fig.7


261
251
236
261
238b
238b
260
235
242(243)
242(243)
238
238
30a
262
30
250
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246
46
47
47A
30b

Fig.8

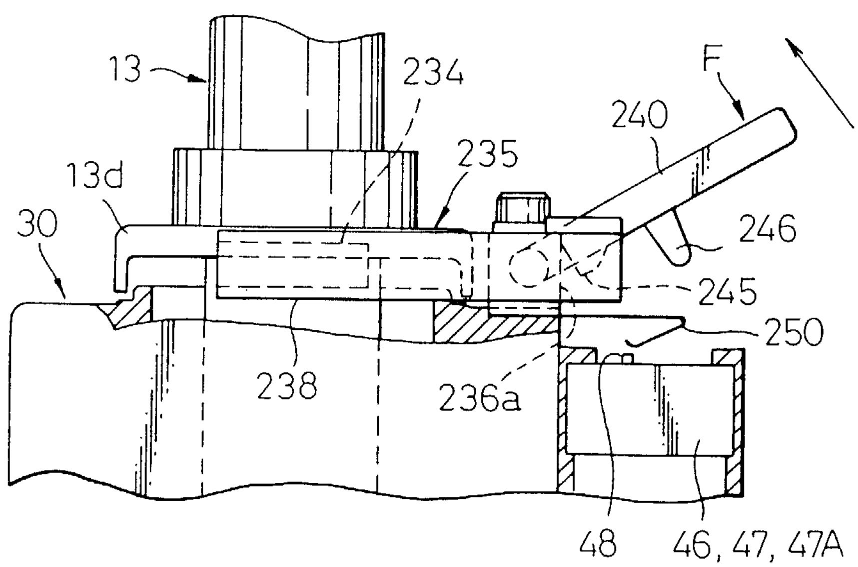

F
13
234
240
235
13d
30
246
245
250
238
236a
48
46, 47, 47A

Fig.9

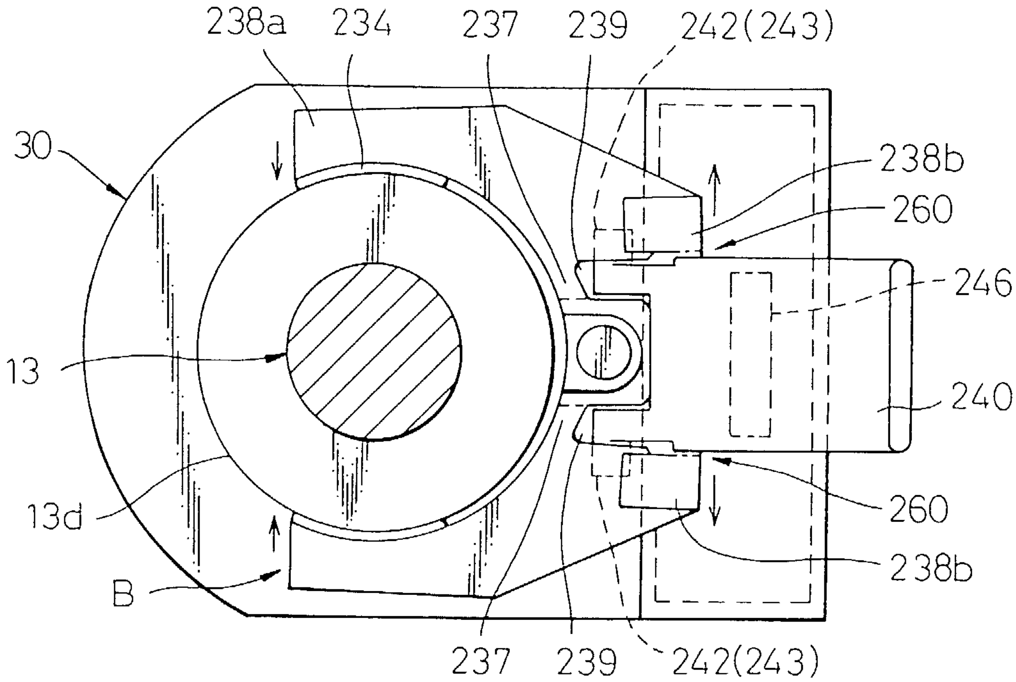

238a
234
237
239
242(243)
30
238b
260
246
13
240
13d
260
238b
B
237
239
242(243)

Fig.10

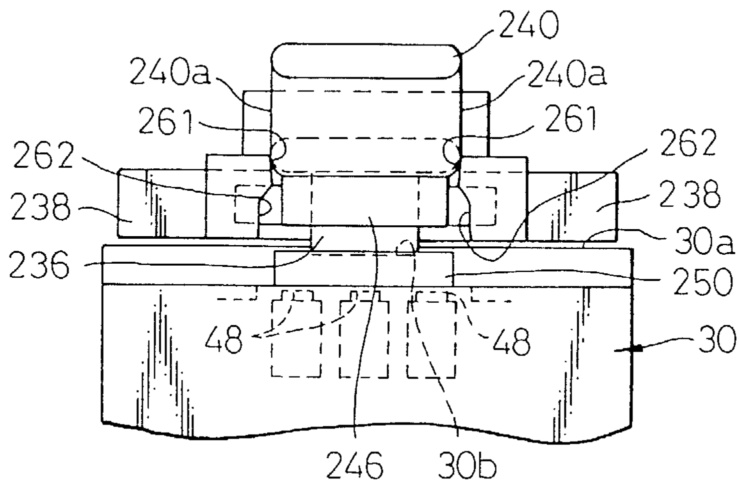

240
240a
240a
261
261
262
262
238
238
30a
236
250
48
48
30
246
30b

Fig.11

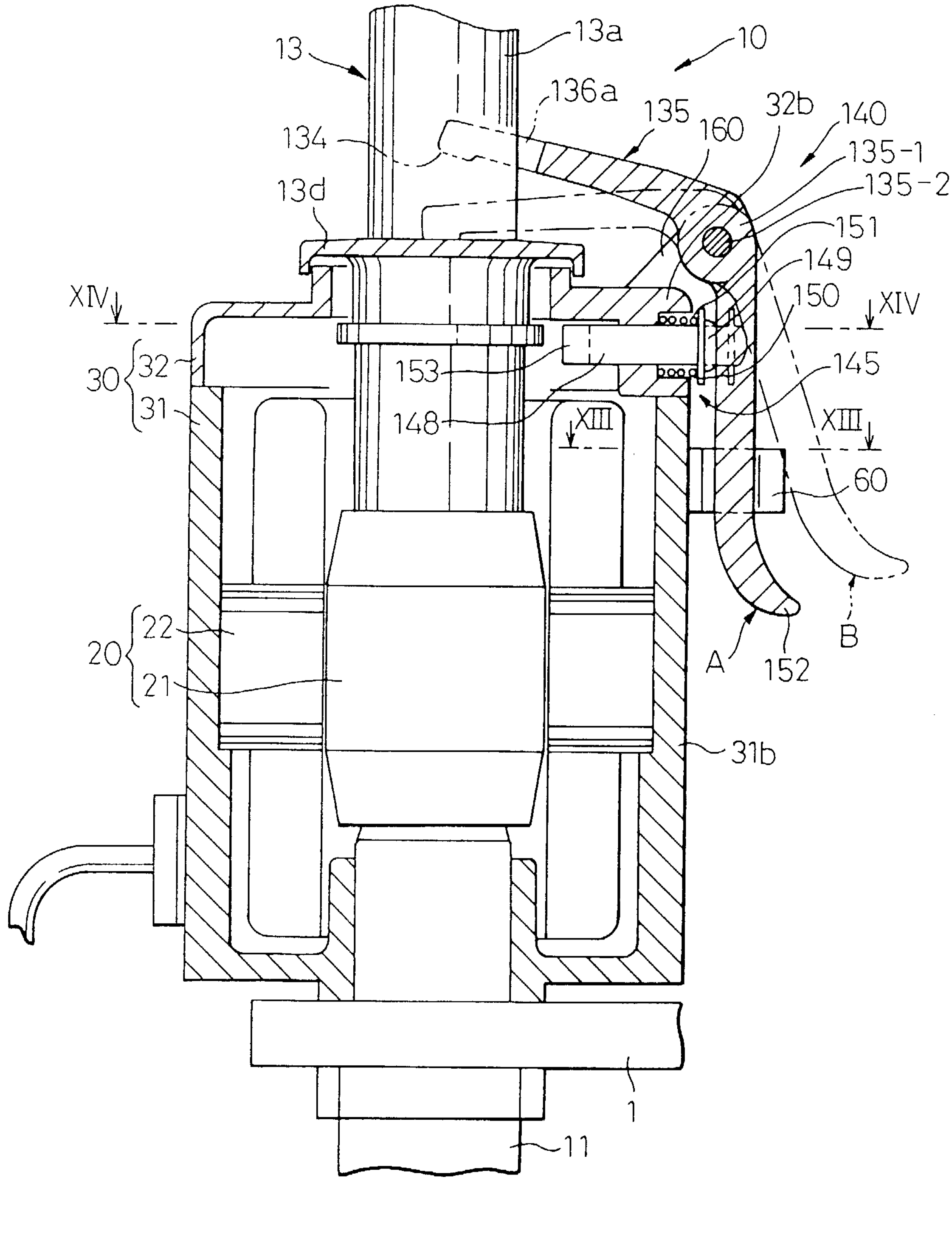

13
13a
10
136a
135
32b
140
134
160
135-1
135-2
13d
151
149
XIV
150
XIV
30
32
31
153
145
148
XIII
XIII
60
20
22
21
A
152
B
31b
1
11

Fig.12

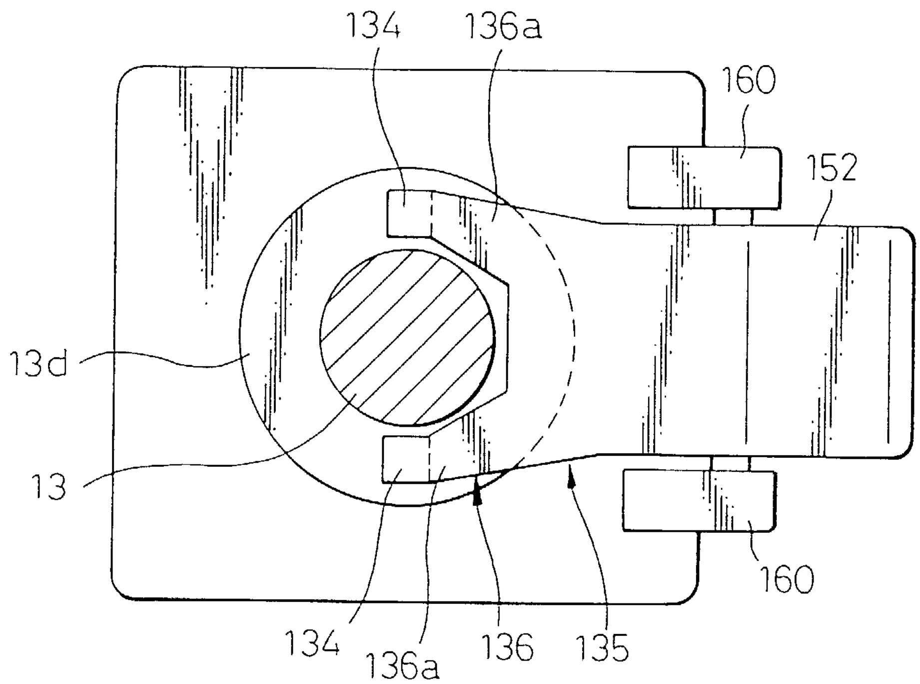


Fig.13

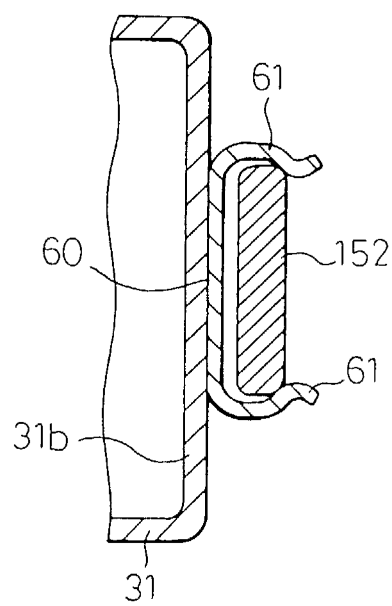
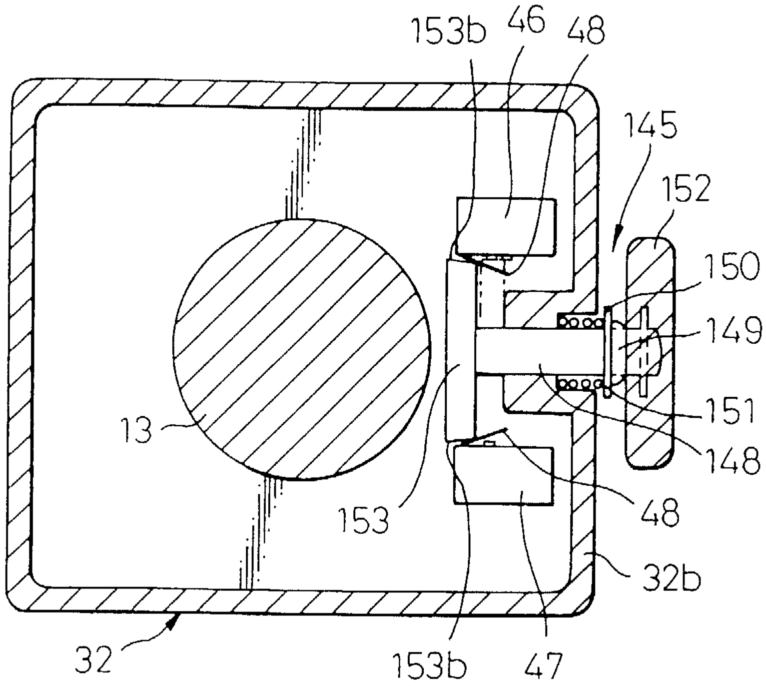


Fig.14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153b
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Fig.15

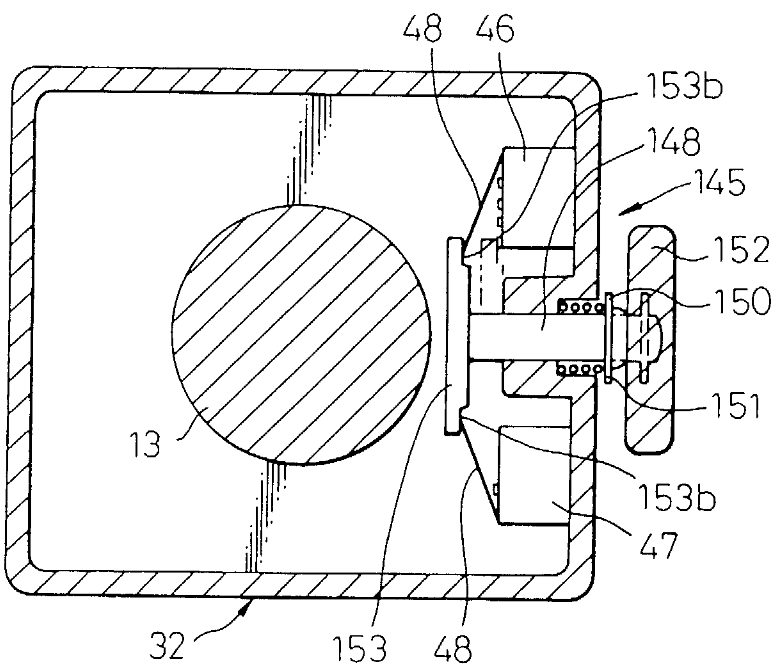
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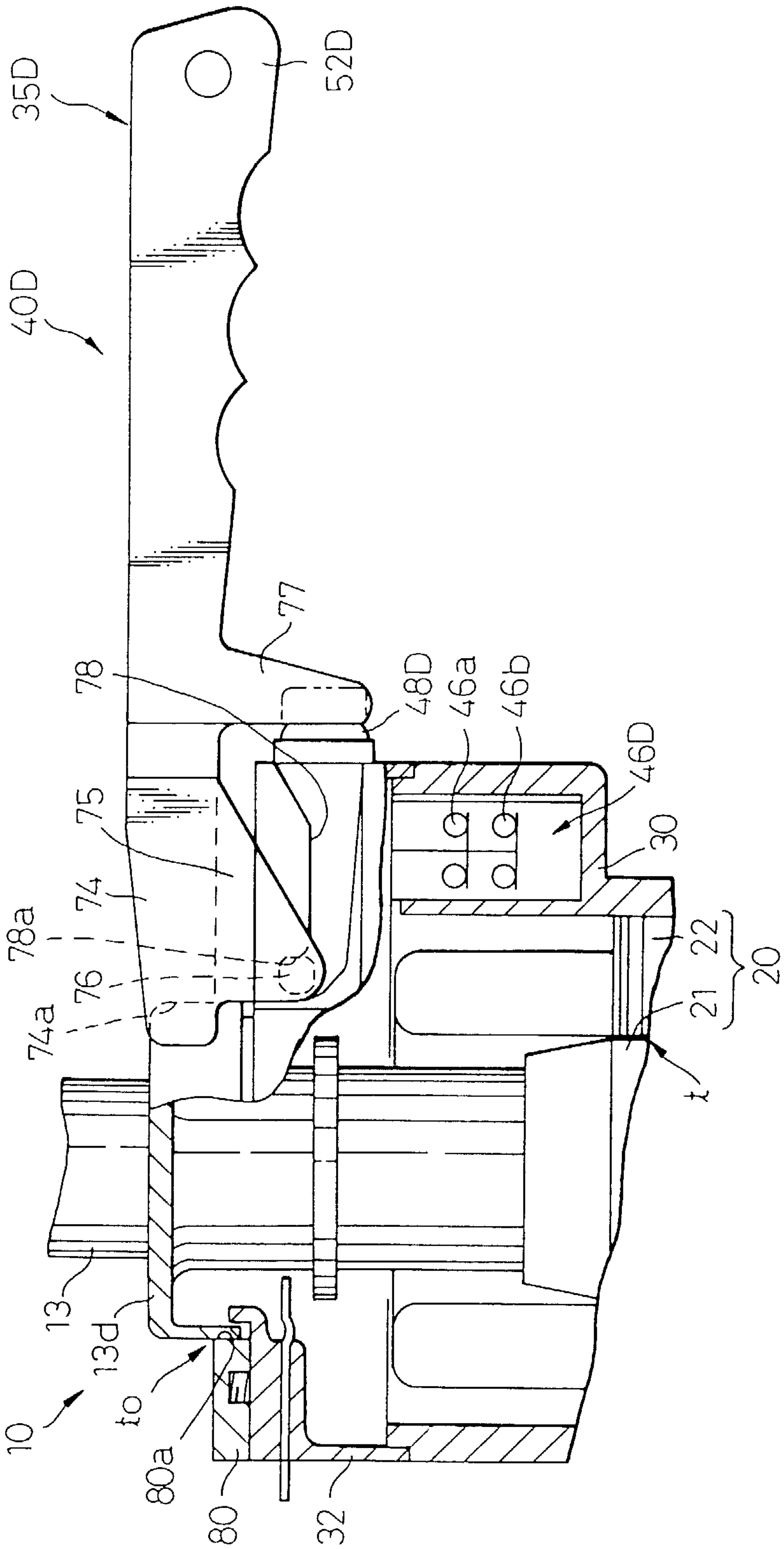
Fig.16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48D
46a
46b
46D
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78a
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74a
22
20
21
t
13
13d
10
to
80a
80
32

Fig.17

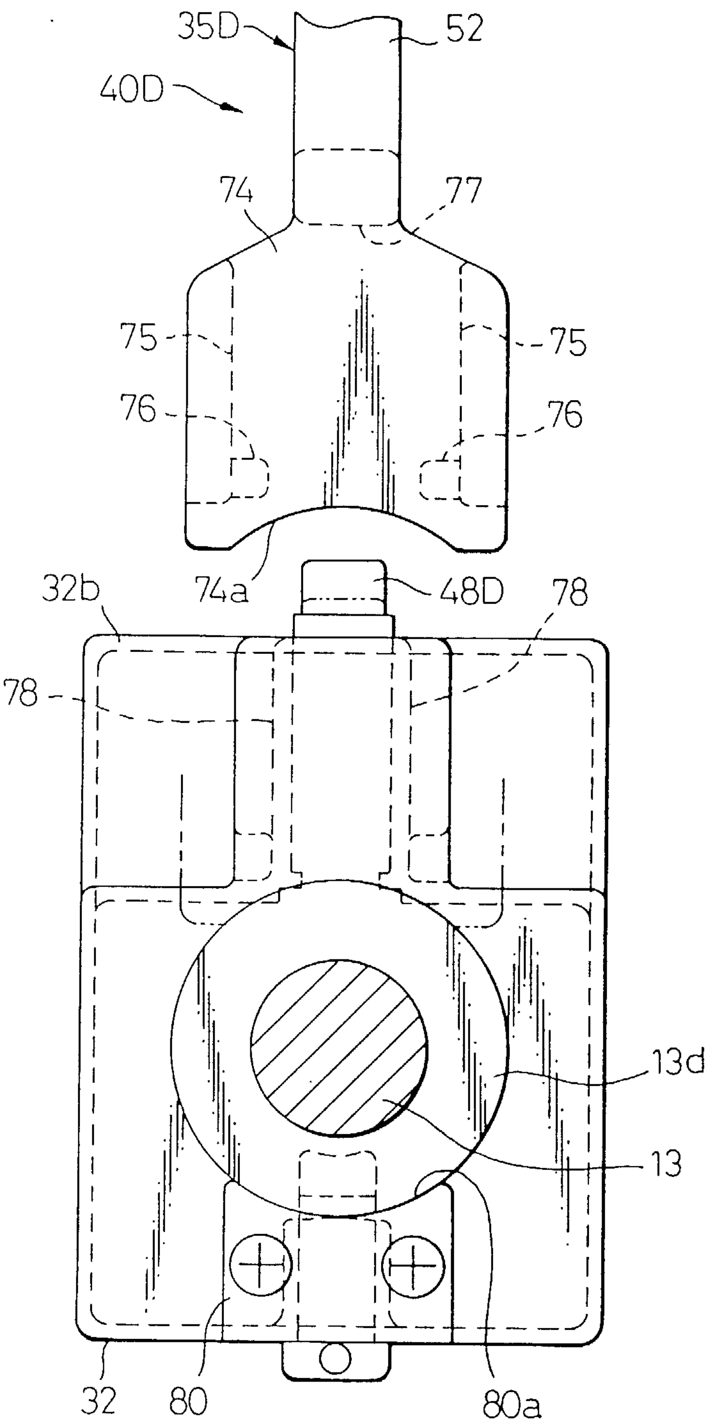


Fig.18

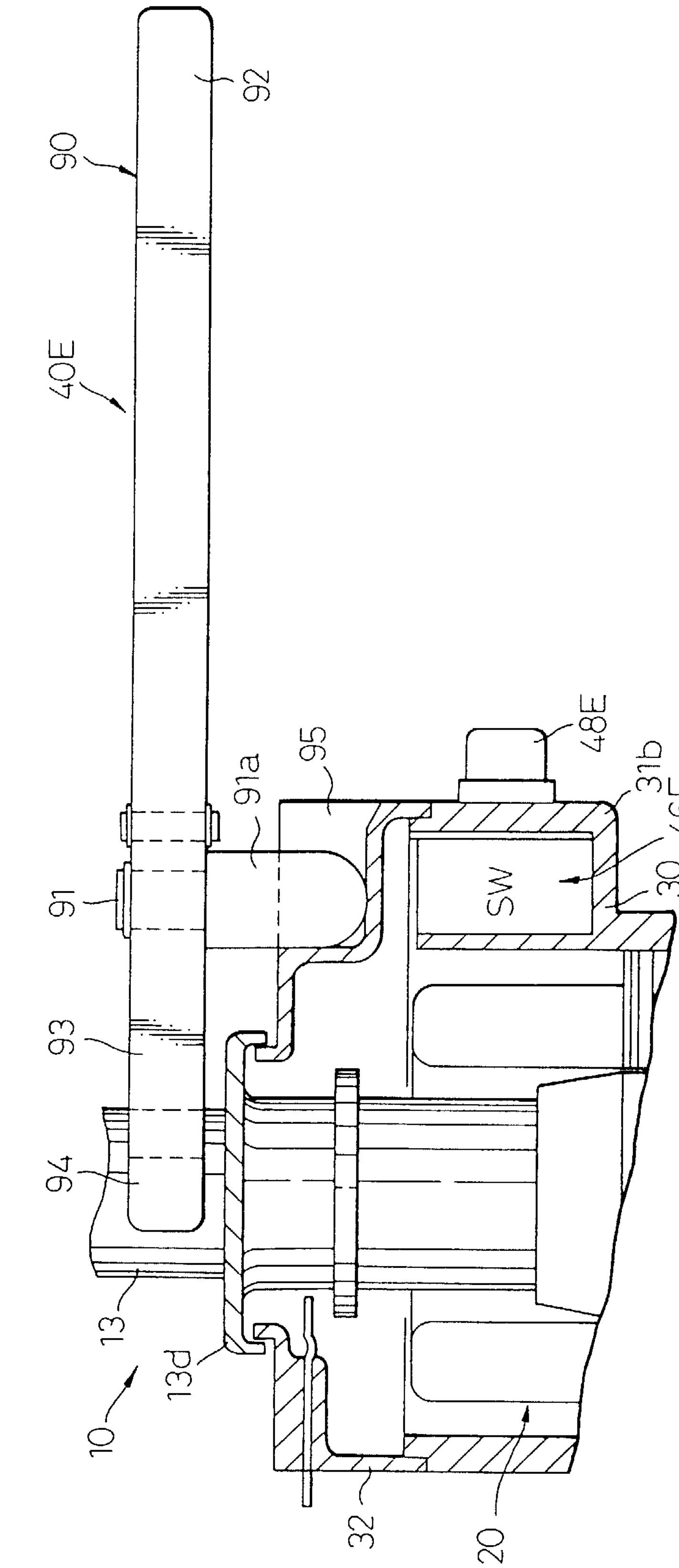


Fig.19

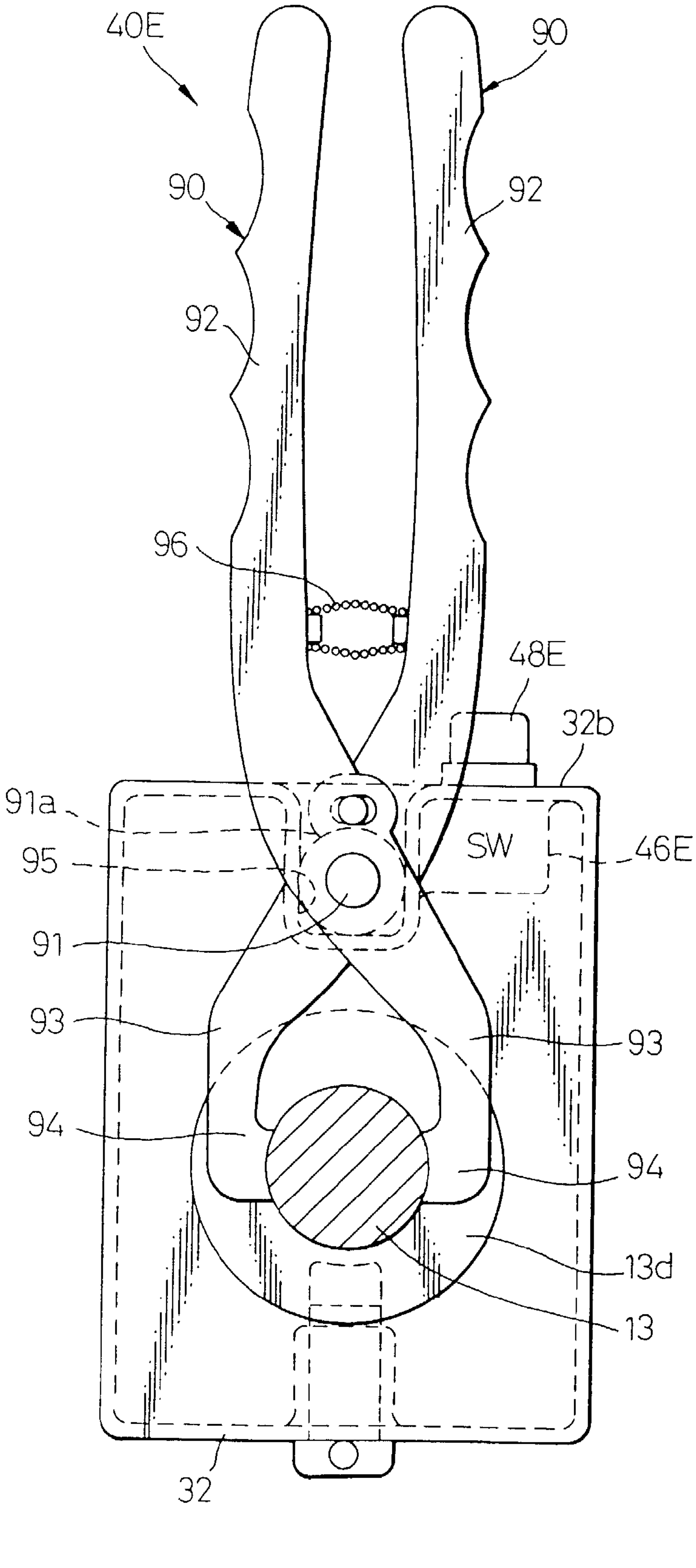
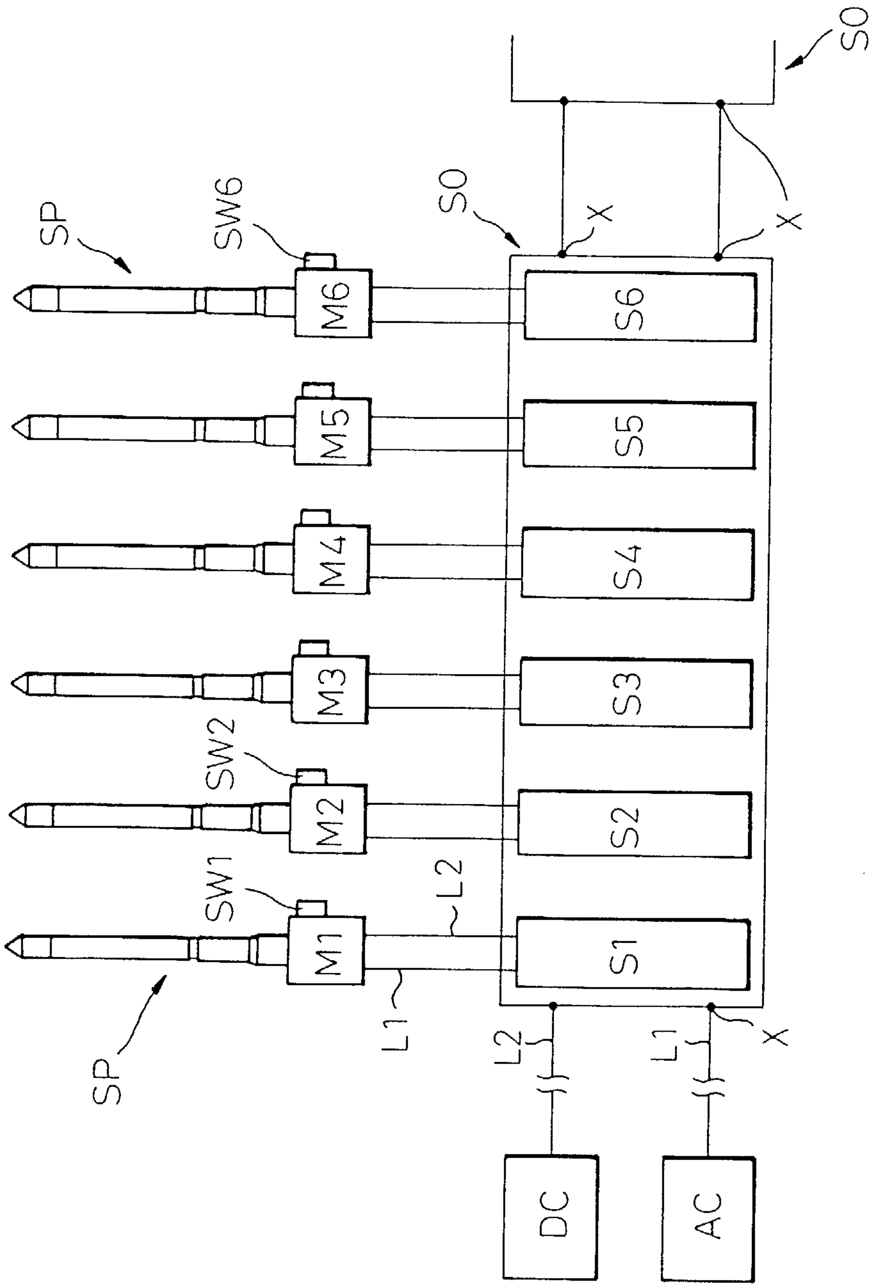


Fig.20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S2
S3
S4
S5
S6
L2
L1
DC
AC

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EUROPEAN SEARCH REPORT

Application Number
EP 97 81 0849

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.6)
E	EP 0 806 501 A (HATTORI MOTONOBU) * claims 1,5,8 *	1-11	D01H7/22 D01H1/244
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 382 (C-0749), 17 August 1990 -& JP 02 139429 A (MURATA MACH LTD), 29 May 1990, * abstract *	1,8	
A	EP 0 371 214 A (ZINSER TEXTILMASCHINEN GMBH) * column 3, line 47 - line 53 *	1,8	
A	DE 41 06 953 A (STAHLECKER FRITZ ;STAHLECKER HANS (DE)) * claims *	1,8	
A	EP 0 456 996 A (ZINSER TEXTILMASCHINEN GMBH) * column 2, line 35 - line 47 *	1,8	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 March 1998	Tamme, H-M

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