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(54) **Automatic register device for cup printing machine**

(57) An automatic register device for a cup printing machine, including a printing roller, a roll shaft, a center roller, and a center shaft. The center roller being flexibly fit on the center shaft, the roll shaft being parallel to the center shaft, the center shaft being rotably disposed in a hole of a wallboard, and transmission connected to a power mechanism of the cup printing machine. The automatic register device for a cup printing machine further includes an axial adjustment mechanism, a circumferential adjustment mechanism, a pressure adjustment mechanism, and a fast adjustment mechanism. The roll shaft is an eccentric shaft, a supported end of the eccentric shaft is disposed in the hole of the wallboard, an extension end of the eccentric shaft extends from the wallboard, and the printing roller is rotably connected to the extension end of the eccentric shaft, and capable of axially sliding. The automatic register device for a cup printing machine features simple structure, and is capable of implementing fast adjustment of a register device, and axial adjustment, circumferential adjustment, and pressure adjustment of a register device during printing. Adjustment thereof is fast and accurate, efficiency thereof is high, and automatic adjustment can be facilitated, which improves grade of products.

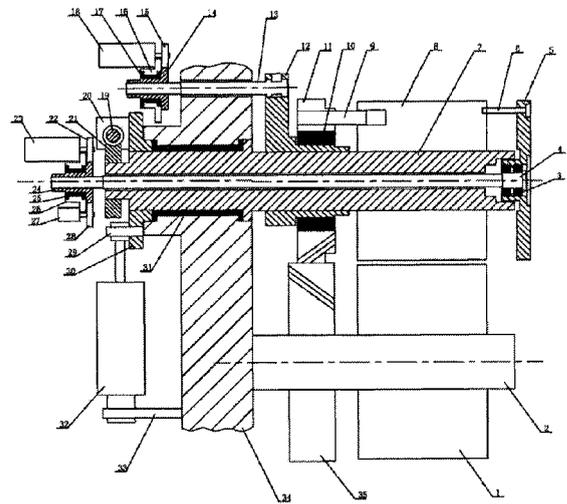


FIG. 2

**EP 2 409 837 A1**

## Description

**[0001]** The invention relates to a cup printing machine, and more particularly to an automatic register device for a cup printing machine.

**[0002]** Nowadays, cup printing machines are widely used to transfer inked images onto cups automatically. Printing quality of the cup printing machine is mainly determined by register during printing. Register refers to adjustment of printing roller with respect to a center roll, and comprises axial adjustment, circumferential adjustment, pressure adjustment, and register adjustment. Printing quality can be ensured only if accurate register is facilitated. A conventional register device comprises a printing roller, and a center roll. The printing roller is rotably disposed outside an eccentric sleeve, the eccentric sleeve is rotably disposed on a fixed shaft of the printing roller, the fixed shaft of the printing roller is fixedly disposed on the wallboard, the center roller is fixedly connected to the center shaft, and the center shaft is rotably disposed in a hole of the wallboard. 1. An axial adjustment mechanism is as follows: an axial adjustment nut is fixed on end surface of the printing roller, a bolt connects the axial adjustment nut with a sleeve of the printing roller, during adjustment, nuts on both ends are released to adjust the bolt, so that the axial adjustment nut drives the printing roller to axially move whereby facilitating axial adjustment of the printing roller with respect to the center roll. However, this adjustment mechanism can operate only after the machine is shut down, adjustment at each time cannot be quantized, appropriate register requires large amount of time, and efficiency thereof is very low. 2. A circumferential adjustment mechanism is as follows: an adjustment ring is connected to each of a sleeve of the printing roller, and the printing roller, a pair of adjustment nuts are disposed between the adjustment rings, a screw on the adjustment nut enables the adjustment rings to rotate whereby facilitating adjustment of the printing roller with respect to the center roller. This adjustment mechanism can operate after the machine is shut down, adjustment at each time cannot be quantized, appropriate register requires large amount of time, and efficiency thereof is very low. 3. A pressure adjustment mechanism is as follows: a housing of a gear box is manually toggled during adjustment, a planetary gear transmission device in the middle drives an eccentric sleeve to rotate whereby facilitating pressure adjustment between the printing roller and the center roller. However, the adjustment mechanism features complex structure and inaccurate adjustment positions, and adjustment can be performed only as the machine is shut down, which reduces efficiency thereof. 4. A register adjustment mechanism is as follows: a handle is manually toggled during adjustment, a gear transmission device in the middle drives an eccentric sleeve to rotate whereby facilitating attachment and detachment between the printing roller and the center roller, however, this adjustment mechanism features complex structure, inaccurate adjustment positions, and

low efficiency.

**[0003]** To summarize, the conventional register device for a cup printing machine features complex structure and inaccurate adjustment positions, axial adjustment, circumferential adjustment, and pressure adjustment can be done after the machine is shut down, appropriate register requires large amount of time, efficiency thereof is very low, automatic adjustment cannot be facilitated, and grade of products is not high.

**[0004]** In view of the above-described problem, it is one objective of the invention to provide an automatic register device for a cup printing machine that features simple structure, accurate adjustment, and high efficiency, and is capable of facilitating fast and automatic adjustment, axial adjustment, circumferential adjustment, pressure adjustment during printing.

**[0005]** To solve the above-mentioned problems, the invention is facilitated as follows:

**[0006]** An automatic register device for a cup printing machine, comprising a printing roller, a roll shaft, a center roller, and a center shaft, the printing roller being flexibly fit on the roll shaft, the center roller being fixedly fit on the center shaft, the roll shaft being parallel to the center shaft, the center shaft being rotably disposed in a hole of a wallboard, and transmission connected to a power mechanism of the cup printing machine, wherein the automatic register device for a cup printing machine further comprises an axial adjustment mechanism, a circumferential adjustment mechanism, a pressure adjustment mechanism, and a fast adjustment mechanism, the axial adjustment mechanism and the circumferential adjustment mechanism are connected to the printing roller, the pressure adjustment mechanism and the fast adjustment mechanism are connected to the roll shaft, the roll shaft is an eccentric shaft, a supported end of the eccentric shaft is disposed in the hole of the wallboard, an extension end of the eccentric shaft extends from the wallboard, and the printing roller is rotably connected to the extension end of the eccentric shaft, and capable of axially sliding. Since the roll shaft uses the eccentric shaft, under the action of the pressure adjustment mechanism and the fast adjustment mechanism, a position of the printing roller disposed on the extension end of the eccentric shaft with respect to an axis of the center roller changes, and thus pressure adjustment, contact, and detachment between the printing roller and the center roller are facilitated. Moreover, since the printing roller is rotably connected to the extension end of the eccentric shaft and capable of axially sliding, under the action of the axial adjustment mechanism and the circumferential adjustment mechanism, the printing roller is capable of axially moving and circumferentially rotating on the eccentric shaft, and thus axial adjustment and circumferential adjustment of the printing roller with respect to the center roller are facilitated. During printing, rotation of the printing roller does not affect the axial adjustment mechanism, the circumferential adjustment mechanism, and the pressure adjustment mechanism, which facilitates axial ad-

justment, circumferential adjustment, and pressure adjustment without shutting down the register device, and the adjustment process is fast, accurate, and high efficient.

**[0007]** Advantageously, the axial adjustment mechanism comprises a motor and an adjustment rod, the adjustment rod is disposed in a hole of the eccentric shaft, thread is disposed on an inner shaft end of the adjustment rod, an adjustment nut is connected to the thread, and rotably disposed in a bearing seat, the bearing seat is fixed on the wallboard, the adjustment nut is transmission connected to the motor, an outer shaft end of the adjustment nut is rotably disposed in another bearing seat, and the bearing seat is connected to the printing roller. The motor is electrically connected to a potentiometer. Axial movement of the printing roller on the eccentric shaft is driven via an adjustment rod, and does not affect rotation of the printing roller during printing. Therefore, automatic axial adjustment during printing is facilitated. Moreover, the potentiometer accurately controls rotation of the motor, and thus axial adjustment is fast, accurate, and high efficient.

**[0008]** Advantageously, the circumferential adjustment mechanism comprises an electric adjustment device, and a helical transmission gear and a helical sun gear engaged with each other, a sliding sleeve of the electric adjustment device is disposed on an extension end of the eccentric shaft, and capable of axially sliding, the helical transmission gear is rotably disposed on excircle of the sliding sleeve, the helical transmission gear and the printing roller are transmission connected to each other via a pin, and capable of axially moving with respect to each other, and the helical sun gear is fixedly connected to the center shaft. The electric adjustment device comprises a motor, a pull rod, and the sliding sleeve, the pull rod passes through the wallboard, one end of the pull rod is connected to the sliding sleeve, thread is disposed on the other end thereof and connected to an adjustment nut, the adjustment nut is rotably disposed in the bearing seat, the bearing seat is fixed on the wallboard, and the adjustment nut is transmission connected to the motor. The motor is electrically connected to a potentiometer. Since the helical transmissions gear is rotably connected to the sliding sleeve, and the sliding sleeve is capable of axially sliding on the extension end of the eccentric shaft under the action of the electric adjustment device, the helical transmission gear is capable of axially moving on the extension end of the eccentric shaft. Since the helical transmission gear and the helical sun gear each has a helical angle, and the helical sun gear is axially fixed, the helical transmission gear rotates in a spiral-uprising direction with respect to the helical sun gear during axial movement. Thus, the helical transmission gear drives the printing roller to circumferentially rotate on the eccentric shaft via the pin, and the printing roller circumferentially moves with respect to the center roller. Circumferential adjustment of the printing roller does not affect rotation of the printing roller. Therefore,

circumferential adjustment during printing is facilitated. Moreover, the potentiometer accurately controls rotation of the motor, and thus circumferential adjustment is fast, accurate, and high efficient.

**[0009]** Advantageously, the pressure adjustment mechanism comprises a worm gear, a worm, a motor, and a potentiometer, the worm gear is connected to a shaft end of the supported end of the eccentric shaft, shaft ends of the worm are respectively connected to an output shaft of each of the motor and the potentiometer, and the motor is electrically connected to the potentiometer. The motor drives the worm, the worm gear, and the eccentric shaft to rotate, and thus a position of an axis of the printing roller with respect to that of the center roller is changed, and contact pressure between the printing roller and the center roller is changed. The structure is very simple, and rotation of the printing roller does not affect pressure adjustment, and thus automatic pressure adjustment during printing is facilitated. Moreover, the potentiometer accurately controls rotation of the motor, and thus pressure adjustment is fast, accurate, and high efficient.

**[0010]** Advantageously, the fast adjustment mechanism comprises a gas cylinder, and a cover plate, the cover plate is connected to the supported end of the eccentric shaft, and a piston rod and a tailstock of the gas cylinder are respectively hinge connected to the cover plate and the wallboard. The gas cylinder pushes and adjusts the cover plate, so that the cover plate drives the eccentric shaft to rotate, and thus the position of the axis of the printing roller with respect to that of the center roller is changed, and contact and detachment between the printing roller and the center roller are facilitated. The structure is simple, and adjustment is fast. Moreover, since the gas cylinder only has two positions, and inaccuracy caused by manual adjustment is avoided, and thus adjustment is fast, accurate, and high efficient.

**[0011]** Advantageously, the motor and the gas cylinder are controlled via a touch screen. Starting of the motor and control of the gas cylinder are implemented via the touch screen, and thus automatic adjustment is facilitated, and grade of products is improved.

**[0012]** To summarize, the automatic register device for a cup printing machine of the invention features simple structure, accurate adjustment, and high efficiency, and is capable of facilitating fast and automatic adjustment, axial adjustment, circumferential adjustment, pressure adjustment during printing, and improving grade of products.

**[0013]** The invention comprises the following figures:

**[0014]** FIG. 1 is a schematic view of an automatic register device for a cup printing machine of an exemplary embodiment of the invention; and

**[0015]** FIG. 2 is an axial cross-sectional view of FIG. 1.

**[0016]** In the drawings, the following reference numbers are used: **1** - center roller, **2** - center shaft, **3** - bearing, **4** - adjustment rod, **5** - bearing seat, **6** - bolt, **7** - roll shaft (eccentric shaft), **8** - printing roller, **9** - pin, **10** -

bearing, **11** - helical transmission gear, **12** - sliding sleeve, **13** - pull rod, **14** - adjustment nut, **15** - motor gear, **16** - bearing seat, **17** - bearing, **18** - motor, **19** - worm, **20** - worm base, **21** - worm gear, **22** - motor gear, **23** - motor, **24** - adjustment nut, **25** - bearing, **26** - bearing seat, **27** - potentiometer, **28** - potentiometer gear, **29** - pin, **30** - cover plate, **31** - bearing, **32** - gas cylinder, **33** - pin, **34** - wallboard, **35** - helical sun gear, **36** - potentiometer, **37** - motor, **38** - potentiometer

**[0017]** Detailed description of the invention will be given below in conjunction with accompanying drawings.

**[0018]** As shown in FIGS. 1 and 2, an automatic register device for a cup printing machine of the invention comprises an axial adjustment mechanism, a circumferential adjustment mechanism, a pressure adjustment mechanism, a fast adjustment mechanism, a printing roller **8**, a roll shaft **7**, a center roller **1**, and a center shaft **2**. The axial adjustment mechanism and the circumferential adjustment mechanism are connected to the printing roller **8**, the pressure adjustment mechanism and the fast adjustment mechanism are connected to the roll shaft **7**. The roll shaft **7** is an eccentric shaft, a left end of the eccentric shaft **7** is a supported end, and a right end thereof is an extension end. The supported end and the extension end are eccentrically disposed. The supported end of the eccentric shaft **7** is rotably disposed in a hole of the wallboard **34** via a bearing **31**, and the extension end thereof extends from the wallboard. The printing roller **8** is rotably connected to the extension end of the eccentric shaft **7**, and capable of axially sliding. The center roller **1** is fixedly fit on the center shaft **2**. The roll shaft **7** is parallel to the center shaft **2**. The center shaft **2** is rotably disposed in the hole of the wallboard **34**, and transmission connected to a power mechanism of the cup printing machine (not shown).

**[0019]** As shown in FIG. 2, the axial adjustment mechanism comprises a motor **23**, a potentiometer **27**, and an adjustment rod **4**. The adjustment rod **4** is flexibly disposed in an inner hole of the eccentric shaft **7**. Thread is disposed on an inner shaft end of the adjustment rod **4**, an adjustment nut **24** is connected to the thread, and rotably disposed in a bearing seat **26**. The bearing seat **26** is fixed on the wallboard **34**. Gear teeth are disposed on excircle of the adjustment nut **24**, and engaged with a motor gear **22** of the motor **23**, and a potentiometer gear **28** of a potentiometer **27**, whereby forming transmission connection. The motor **23** and the potentiometer **27** are fixedly connected to the bearing seat **26**. The motor **23** is electrically connected to the potentiometer **27**. The potentiometer **27** controls rotation of the motor **23**. An external shaft end of the adjustment rod **4** is rotably disposed in the bearing seat **5** via the bearing **3**. The bearing seat **5** is capable of axially moving along with the adjustment rod **4**, and fixedly connected to the printing roller **8** via a bolt **6**.

**[0020]** As shown in FIG. 2, the circumferential adjustment mechanism comprises an electric adjustment device, and a helical transmission gear **11** and a helical sun

gear **35** engaged with each other. The electric adjustment device comprises a motor **18**, a potentiometer **36**, a pull rod **13**, and a sliding sleeve **12**. A sliding sleeve **12** of the electric adjustment device is flexibly disposed on the extension end of the eccentric shaft **7**, and capable of axially sliding. The pull rod **13** passes through the wallboard **34**. The right of the pull rod **13** is connected to the sliding sleeve **12**. Thread is disposed on the left of the pull rod **13**, and connected to an adjustment nut **14**. The adjustment nut **14** is rotably disposed in a bearing seat **16**. The bearing seat **16** is fixed on the wallboard **34**. Gear teeth are disposed on excircle of the adjustment nut **14**, and engaged with a motor gear **15** of the motor **18**, and a potentiometer gear of a potentiometer **36**, whereby forming transmission connection. The motor **18** and the potentiometer **36** are fixedly connected to the bearing seat **16**. The motor **18** is electrically connected to the potentiometer. The potentiometer controls rotation of the motor **18**. The helical transmission gear **11** is rotably disposed on excircle of the sliding sleeve **12** via a bearing **10**, the helical transmission gear **11** and the printing roller **8** are transmission connected to each other via a pin **9**. The left of the pin **9** is fixedly connected to the helical transmission gear **11**, and the right thereof is flexibly connected to the printing roller **8**. Thus, the printing roller and the helical transmission gear can rotate and axially move with respect to each other. The helical sun gear **35** is fixedly connected to the center shaft **2**.

**[0021]** As shown in FIG. 2, the pressure adjustment mechanism comprises a worm gear **21**, a worm **19**, a worm base **20**, a motor **37**, and a potentiometer **38**. The worm gear **21** is connected to a shaft end of the supported end of the eccentric shaft **7**, shaft ends of the worm **19** are respectively connected to an output shaft of each of the motor **37** and the potentiometer **38**, and the motor **37** is electrically connected to the potentiometer **38**. The potentiometer **38** controls rotation of the motor **37**, the motor **37** and the potentiometer **38** are fixedly connected to the worm base **20**, and the worm base **20** is fixedly disposed on the wallboard **34**.

**[0022]** As shown in FIG. 2, the fast adjustment mechanism comprises a gas cylinder **32**, and a cover plate **30**. The cover plate **30** is connected to the supported end of the eccentric shaft **7**, a piston rod of the gas cylinder **32** is hinge connected to the cover plate **30** via a pin **29**, and a tailstock of the gas cylinder **32** is hinge connected to the wallboard **34** via another pin **33**.

**[0023]** The above-mentioned motors and the gas cylinder **32** are controlled via a touch screen. Starting of the motor and control of the gas cylinder **32** are implemented via the touch screen, and thus automatic adjustment is facilitated, and grade of products is improved.

**[0024]** Operation principle of the invention is as follows:

**[0025]** After the cup printing machine is started, there is a gap between the printing roller and the center roller, if printing ink cannot be transferred to the center roller, printing cannot be facilitated. At this time, the touch

screen controls one end of the gas cylinder to intake air, the piston rod of the gas cylinder extends and applies pivoting torque on the cover plate, and the cover plate rotates, then the eccentric shaft rotates along therewith, the position the axis of the extension end of the eccentric shaft is changed, and the position of the axis of the printing roller with respect to that of the center roller is changed. Thus the printing roller is contacted with the center roller, the printing ink on the printing roller is transferred to the center roller, and a printing process begins. As the printing process is to be stopped, the touch screen controls the other end of the gas cylinder to intake air, the piston rod is retracted, and the printing roller is reset. At this time, the printing roller is detached from the center roller, and the printing process is stopped. Since the gas cylinder has only two positions, attachment and detachment between the printing roller and the center roller are accurate, and fast adjustment of register is facilitated, and is accurate, which prevents inaccuracy caused by manual adjustment.

**[0026]** During printing of the cup printing machine, the printing roller rotates, as the position of the printing roller with respect to the center roller is to be axially adjusted, the touch screen starts the motor, the motor drives the motor gear and the adjustment nut to rotate, and the adjustment rod axially moves. The adjustment rod drives the roll shaft to axially move via the bearing seat, and movement of the roller shaft does not affect rotation of the printing roller, which facilitates axial adjustment during printing. Moreover, the potentiometer accurately controls rotation of the motor, and fast and accurate adjustment is facilitated.

**[0027]** As the position of the printing roller with respect to the center roller is to be circumferentially adjusted, the touch screen starts the motor, the motor drives the motor gear and the adjustment nut to rotate, and the pull rod axially moves, and drives the sliding sleeve and the helical transmission gear to axially move. Since there is a helical angle between the helical transmission gear and the helical sun gear, and the helical sun gear is axially fixed, the helical transmission gear rotates in a spiral-uprising direction with respect to the helical sun gear during axial movement. Thus, the helical transmission gear drives the printing roller to circumferentially rotate on the eccentric shaft via the pin, and the printing roller circumferentially moves with respect to the center roller. Circumferential adjustment of the printing roller does not affect rotation of the printing roller. Therefore, circumferential adjustment during printing is facilitated. Moreover, the potentiometer accurately controls rotation of the motor, and thus circumferential adjustment is fast, accurate, and high efficient.

**[0028]** During printing of the cup printing machine, there is pressure between the printing roller and the center roller. As the pressure is to be adjusted, the touch screen starts the motor, the motor drives the worm, the worm gear, and the eccentric shaft to rotate, and thus a position of an axis of the printing roller with respect to

that of the center roller is changed, and contact pressure between the printing roller and the center roller is changed. Rotation of the printing roller does not affect pressure adjustment, and thus automatic pressure adjustment during printing is facilitated. Moreover, the potentiometer accurately controls rotation of the motor, and thus pressure adjustment is fast, accurate, and high efficient.

**[0029]** To summarize, the automatic register device for a cup printing machine of the invention features simple structure, accurate adjustment, and high efficiency, is capable of facilitating fast and automatic adjustment, axial adjustment, circumferential adjustment, pressure adjustment during printing, and improving grade of products, and will bring users with great convenience and active use effect.

## Claims

1. An automatic register device for a cup printing machine, comprising a printing roller (8), a roll shaft (7), a center roller (1), and a center shaft (2), said printing roller (8) being flexibly fit on said roll shaft (7), said center roller (1) being fixedly fit on said center shaft (2), said roll shaft (7) being parallel to said center shaft (2), said center shaft (2) being rotably disposed in a hole of a wallboard (34), and transmission connected to a power mechanism of said cup printing machine,
 

**characterized in that**

said automatic register device for a cup printing machine further comprises an axial adjustment mechanism, a circumferential adjustment mechanism; a pressure adjustment mechanism; and a fast adjustment mechanism;

said axial adjustment mechanism and said circumferential adjustment mechanism are connected to said printing roller (8);

said pressure adjustment mechanism and said fast adjustment mechanism are connected to said roll shaft (7);

said roll shaft (7) is an eccentric shaft;

a supported end of said eccentric shaft is disposed in said hole of said wallboard (34);

an extension end of said eccentric shaft extends from said wallboard (34); and

said printing roller (8) is rotably connected to said extension end of said eccentric shaft, and capable of axially sliding.
2. The automatic register device of claim 1, **characterized in that**

said axial adjustment mechanism comprises a motor (23) and an adjustment rod (4);

said adjustment rod (4) is disposed in a hole of said eccentric shaft;

thread is disposed on an inner shaft end of said ad-

justment rod (4);  
 an adjustment nut (24) is connected to said thread,  
 and rotably disposed in a bearing seat (26);  
 said bearing seat (26) is fixed on said wallboard (34);  
 said adjustment nut (24) is transmission connected  
 to said motor (23);  
 an outer shaft end of said adjustment rod (4) is ro-  
 tably disposed in another bearing seat (5); and  
 said bearing seat (5) is connected to said printing  
 roller(8).

3. The automatic register device of claim 1, **character-  
 ized in that**

said circumferential adjustment mechanism com-  
 prises an electric adjustment device, and a helical  
 transmission gear (11) and a helical sun gear (35)  
 engaged with each other;  
 a sliding sleeve (12) of said electric adjustment de-  
 vice is disposed on an extension end of said eccen-  
 tric shaft, and capable of axially sliding;  
 said helical transmission gear (11) is rotably dis-  
 posed on excircle of said sliding sleeve (12);  
 said helical transmission gear (11) and said printing  
 roller (8) are transmission connected to each other  
 via a pin (9), and capable of axially moving with re-  
 spect to each other; and  
 said helical sun gear (35) is fixedly connected to said  
 center shaft (2).

4. The automatic register device of claim 3, **character-  
 ized in that**

said electric adjustment device comprises a motor  
 (18), a pull rod (13), and said sliding sleeve (12);  
 said pull rod (13) passes through said wallboard (34);  
 one end of said pull rod (13) is connected to said  
 sliding sleeve (12);  
 thread is disposed on the other end thereof and con-  
 nected to an adjustment nut (14);  
 said adjustment nut (14) is rotably disposed in said  
 bearing seat (16);  
 said bearing seat (16) is fixed on said wallboard (34);  
 and  
 said adjustment nut (14) is transmission connected  
 to said motor (18).

5. The automatic register device of claim 2 or 4, **char-  
 acterized in that** said motor is electrically connected  
 to a potentiometer.

6. The automatic register device of claim 1, **character-  
 ized in that**

said pressure adjustment mechanism comprises a  
 worm gear (21), a worm (19), a motor (37), and a  
 potentiometer (38);  
 said worm gear (21) is connected to a shaft end of  
 said supported end of said eccentric shaft;  
 shaft ends of said worm (19) are respectively con-  
 nected to an output shaft of each of said motor (37)

and said potentiometer (38); and  
 said motor is electrically connected to said potenti-  
 ometer (38).

7. The automatic register device of claim 1, **character-  
 ized in that**

said fast adjustment mechanism comprises a gas  
 cylinder (32), and a cover plate (30);  
 said cover plate is connected to said supported end  
 of said eccentric shaft; and  
 a piston rod and a tailstock of said gas cylinder (32)  
 are respectively hinge connected to said cover plate  
 (30) and said wallboard (34).

8. The automatic register device of claim 2, 4, 6 or 7,  
**characterized in that** said motor and said gas cyl-  
 nder are controlled via a touch screen.



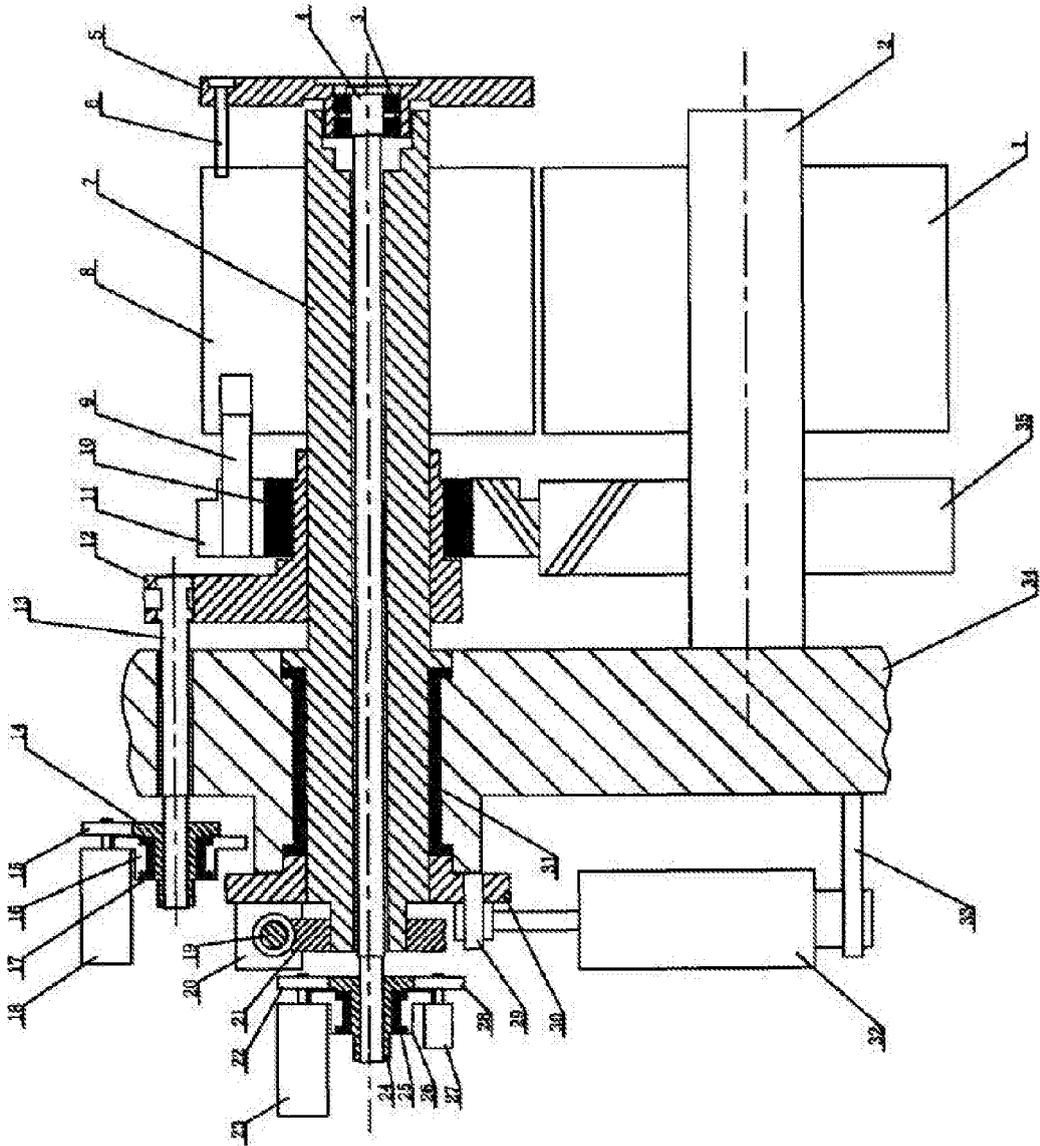


FIG. 2



EUROPEAN SEARCH REPORT

Application Number  
EP 11 16 6974

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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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