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IMAGE READING DEVICE AND IMAGE FORMING APPARATUS

Abstract

An image reading device includes a document table, an image reading unit, a reading unit moving part, a cursor, and a cursor moving part. The reading unit is disposed below the document table, and scans the placed document in a main-scanning direction to read an image. The reading unit moving part moves the reading unit in a sub-scanning direction crossing the main-scanning direction and in an opposite direction. To the cursor, a reading start side edge of the document placed on the document table in the sub-scanning direction is abutted. The cursor moving part moves the cursor along the sub-scanning direction in a reciprocating manner. The cursor moving part moves the cursor from a reference position of the reading unit in the opposite direction in conjunction with a movement of the reading unit from the home position in the opposite direction.

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Background/Summary

INCORPORATION BY REFERENCE

[0001] This application is based on and claims the benefit of priority from Japanese patent application No. 2024-023511 filed on Feb. 20, 2024, which is incorporated by reference in its entirety.

BACKGROUND

[0002] The present disclosure relates to an image reading device which reads an image of a document placed on a document table and an image forming apparatus provided with the image reading device.

[0003] The image reading device may be configured to read the image of the document by two kinds of document reading systems, a sheet-through system and a sheet fixing system. In the sheet-through system, the document is automatically conveyed to a reading position on a document table by a document conveying device, and the image of the document is read by a reading sensor at the reading position. In the sheet fixing system, the document is placed on the document table, and the image of the placed document is read by moving the reading sensor.

[0004] In order to position the document in the sheet fixing system, the image reading device is provided with an abutting reference plate for regulating a reading start position of the document. The user places the document on the document table, and positions the document by abutting the reading start side edge of the document against the reference plate. Thereafter, the reading sensor is moved to read the image of the placed document.

[0005] In the image reading device described above, since the reference plate is immovable, a size of the document to be placed is restricted. As an example, the maximum size is a size of the A4 size document (210 mm×297 mm) which is longitudinally placed (the longitudinal direction of the document is along the sub-scanning direction). In this case, for example, there is a problem that it is impossible to read a document having a legal size (215.9 mm×355.6 mm) in the sheet fixing system.

SUMMARY

[0006] An image reading device according to the present disclosure includes a document table, an image reading unit, a reading unit moving part, a cursor, and a cursor moving part. On the document table, a document is placed. The reading unit is disposed below the document table, and scans the placed document in a main-scanning direction to read an image. The reading unit moving part moves the reading unit in a sub-scanning direction crossing the main-scanning direction and in an opposite direction to the reading direction. To the cursor, a reading start side edge of the document placed on the document table in the sub-scanning direction is abutted. The cursor moving part moves the cursor along the sub-scanning direction in a reciprocating manner. The cursor moving part moves the cursor from a reference position of the reading unit in the opposite direction in conjunction with a movement of the reading unit from the home position in the opposite direction, so that an image readable range in the sub-scanning direction can be increased.

[0007] An image forming according to the present disclosure includes the image reading device, and an image forming part which forms an image on a sheet based on image date of the document read by the image reading device.

[0008] The above and other objects, features, and advantages of the present disclosure will become more apparent from the following description when taken in conjunction with the accompanying

drawings in which a preferred embodiment of the present disclosure is shown by way of illustrative example.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a front view schematically showing an internal structure of an image forming apparatus according to one embodiment of the present disclosure.

[0010] FIG. **2** is a perspective view showing a reading part of an image reading device according to one embodiment of the present disclosure.

[0011] FIG. **3** is a front view showing a reading unit moving part of the image reading device according to the embodiment of the present disclosure.

[0012] FIG. **4** is a plan view showing a cursor of the image reading device according to the embodiment of the present disclosure.

[0013] FIG. **5**A is a perspective view showing the front end portion of the cursor of the image reading device according to the embodiment of the present disclosure.

[0014] FIG. **5**B is a perspective view showing the rear end portion of the cursor of the image reading device according to the embodiment of the present disclosure.

[0015] FIG. **6** is a perspective view showing a cursor moving part of the image reading device according to the embodiment of the present disclosure.

[0016] FIG. **7** is a front view schematically showing the cursor moving part of the image reading device according to the embodiment of the present disclosure.

[0017] FIG. **8** is a cross-sectional view showing the reading unit (at the home position) and the cursor (at the first reference position) in the image reading device according to the embodiment of the present disclosure.

[0018] FIG. **9** is a cross-sectional view showing the reading unit (at the conveyed document reading position) and the cursor (at the first reference position) in the image reading device according to the embodiment of the present disclosure.

[0019] FIG. **10** is a cross-sectional view showing the reading unit (the conveyed document reading position.fwdarw.the maximum opposite position) and the cursor (the first reference position.fwdarw.the second reference position) in the image reading device according to an embodiment of the present disclosure.

[0020] FIG. **11** is a cross-sectional view showing the reading unit (at the maximum opposite position) and the cursor (at the second reference position) in the image reading device according to an embodiment of the present disclosure.

[0021] FIG. **12** is a cross-sectional view showing the reading unit (at the legal reading start position) and the cursor (at the second reference position) in the image reading device according to an embodiment of the present disclosure.

[0022] FIG. **13** is a plan view showing positions of the reading unit and the cursor in the image reading device according to the embodiment of the present disclosure.

BRIEF DESCRIPTION OF THE DISCLOSURE

[0023] Hereinafter, with reference to the drawings, an image reading device and an image forming apparatus according to one embodiment of the present disclosure will be described.

[0024] First, with reference to FIG. **1**, the image forming apparatus **1** will be described. FIG. **1** is a front view schematically showing the internal structure of the image forming apparatus **1**. Fr, Rr, L and R in each figure indicate the front side, rear side, left side and right side of the image forming apparatus **1**, respectively.

[0025] The image forming apparatus **1** is provided with an image forming part **3** which forms an image on a sheet, and an image reading part **5** which is disposed above the image forming part **3**

and reads an image (document) to be formed in the image forming part **3**.
[0026] First, the image forming part **3** will be described. The image forming part **3** includes a plurality of sheet feeding cassettes **11**, a plurality of sheet feeding devices **13** which feed the sheets from the sheet feeding cassettes **11**, a toner image forming part **15** which forms a toner image on the sheet, a fixing part **17** which fixes the toner image to the sheet, and a discharge part **19** which discharges the sheet. In the image forming part **3**, a discharge tray **21** is formed below the discharge part **19**. Further, in the image forming part **3**, a conveyance path **23** along which the sheet is conveyed from each sheet feeding device **13** toward the discharge part **19** through the toner image forming part **15** and the fixing part **17** is formed.
[0027] The sheet fed from one of the sheet feeding cassettes **11** by the corresponding sheet feeding device **13** is conveyed to the toner image forming part **15** along the conveyance path **23**. The toner image forming part **15** forms a toner image on the sheet based on an image read by the image reading part **5**. The sheet on which the toner image is formed is conveyed to the fixing part **17** along the conveyance path **23**. The fixing part **17** fixes the toner image to the sheet. Thereafter, the sheet is discharged from the discharge part **19**, and stacked on the discharge tray **21**.
[0028] Next, the image reading part **5** will be described. The image reading part **5** includes a reading part **31** which reads the image of the document, and a conveying part **33** which is disposed above the reading part **31** and conveys the document to the reading part **31**.
[0029] First, the reading part **31** will be described with reference to FIG. **2**. FIG. **2** is a perspective view showing the reading part **31**. The reading part **31** includes a document table **41** on which the document is placed, a reading unit **43** (see FIG. **1**) disposed below the document table **41**, a reading unit moving part **45** (not shown in FIG. **1** and FIG. **2**, and will be described later with reference to FIG. **3**) which moves the reading unit **43** in a reciprocating manner, a cursor **47** (see FIG. **2**) which positions the document placed on the document table **41**, and a cursor moving part **49** (see FIG. **2**) which moves the cursor **47** in a reciprocating manner. They are supported by a housing **51**.
[0030] First, the housing **51** will be described. As shown in FIG. **2**, the housing **51** has a rectangular parallelepiped box-like shape having a top plate **61**, a bottom plate, front and rear side plates, and left and right side plates. The top plate **61** has a substantially rectangular opening **63** elongated in the left-and-right direction. The opening **63** has a rectangular main opening **63***a* and a rectangular left opening **63***b* having a longer length in the front-and-rear direction than the main opening **63***a*. With this configuration, front and rear stepped surfaces **63***c* along the front-and-rear direction are formed between the front and rear side surfaces of the main opening **63***a* and the front and rear side surfaces of the left opening **63***b*.
[0031] As shown in FIG. **2**, front and rear rails **65**F and **65**R are formed along the front and rear edges of the left opening **63***b* in the left-and-right direction. The front and rear rails **65**F and **65**R are L-shaped in a side view, having upright walls stood from the front and rear edges of the left opening **63***b*, and horizontal walls bent from the upper ends of the upright walls in directions facing each other. The horizontal wall of the front rail **65**F has a bent piece (not shown) bent downward from the tip.
[0032] Next, the document table **41** will be described with reference to FIG. **2**. The document table **41** has a rectangular shape, and is made of transparent glass. The document table **41** is supported by the housing **51** so as to be exposed to the opening **63** from below the top plate **61** of the housing **51**. An area **41**X exposed from the main opening **63***a* of the opening **63** serves as a document placement surface on which the document is placed in the sheet fixing system. An area **41**Y exposed from the left opening **63***b* of the opening **63** is a reading position at which the image of the document is read in the sheet-through system.
[0033] Next, the reading unit **43** will be described with reference to FIG. **1**. The reading unit **43** includes a contact image sensor (CIS) **71** and a holder **73** which holds the CIS**71**. The CIS**71** includes a light source for irradiating light toward the image to be read, and a plurality of light receiving elements which photoelectrically converts light reflected by the document. The light

receiving elements are arranged in the main-scanning direction X**1**. The main-scanning direction X**1** is the front-and-rear direction in this embodiment. At the center portion of the holder **73** in the front-and-rear direction, a reading unit-side rack gear **75** with teeth facing downward is formed along the sub-scanning direction X**2** (in this embodiment, the left-and-right direction) orthogonal to the main-scanning direction X**1**.

[0034] Next, the reading unit moving part **45** will be described with reference to FIG. **3**. FIG. **3** is a side view schematically showing the reading unit moving part **45**. The reading unit moving part **45** moves the reading unit **43** from the home position HP in the reading direction Y**1** (the right direction in this embodiment) along the sub-scanning direction X**2** (the left-and-right direction) and the opposite direction Y**2** (the left direction in this embodiment). The home position HP is a position below the left end portion of the document placement surface (the area **41**X exposed from the main opening **63***a* in FIG. **2**) of the document table **41**, and is a document reading start position by the document fixing system.

[0035] The reading unit moving part **45** includes a driving pulley **81** and a driven pulley **83** spaced apart in the sub-scanning direction X**2**, a motor **85** which rotates the driving pulley **81**, and a timing belt **87** wound between both pulleys **81** and **83**. The driving pulley **81** is disposed at one end portion (the right end portion, in this embodiment) in the sub-scanning direction X**2**, and rotatably supported around a rotational shaft provided along the upper-and-lower direction. The motor **85** rotates the driving pulley **81** in one direction and the other direction. The driven pulley **83** is disposed at the other end portion (the left end portion, in this embodiment) in the sub-scanning direction X**2**, and rotatably supported around a rotational shaft provided along the upper-and-lower direction. The timing belt **87** is wound around the rotational shafts of the driving pulley **81** and the driven pulley **83**. The holder **73** of the reading unit **43** is connected to the front side track portion of the timing belt **87**.

[0036] When the driving pulley **81** is driven by the motor **85** and rotates in one direction and the other direction, the timing belt **87** circulates in one direction and the other direction, and the reading unit **43** is moved along the sub-scanning direction X**2** in a reciprocating manner. More specifically, when the driving pulley **81** rotates a predetermined number of revolutions in the counterclockwise direction CCW of FIG. **3**, the timing belt **87** circulates in the counterclockwise direction, and the reading unit **43** moves in the reading direction Y**1** from the home position HP to the predetermined moving end position P**1**. Thus, the image of the document placed on the document placement surface can be read in the document fixing system. On the other hand, when the driving pulley **81** rotates by a predetermined number of revolutions in the clockwise direction CW of FIG. **3**, the timing belt **87** circulates in the clockwise direction, and the reading unit **43** moves in the opposite direction Y**2** from the home position HP to the conveyed document reading position P**2** below the reading position in the sheet-through system. Thus, the image of the document conveyed to the reading position in the sheet-through system can be read.

[0037] Thus, the reading unit **43** is movable from the home position HP in the reading direction Y**1**, and also movable from the home position HP in the opposite direction Y**2** to the reading direction Y**1**.

[0038] Next, the cursor **47** will be described with reference to FIG. **2** and FIG. **4**, and FIG. **5**A and FIG. **5**B. FIG. **4** is a perspective view showing the cursor **47**, and FIG. **5**A and FIG. **5**B are perspective views showing the end portions of the cursor **47**. The cursor **47** has a plate-like body part **91** having a length equal to a length of the document table **41** along the front-and-rear direction, and a guide part **93** having a length equal to a length of the body part **91** and having a triangular shape in cross-sectional view. The upper and lower surfaces of the body part **91** are formed horizontally. One long side surface of the body part **91** is formed at right angles to the upper and lower surfaces. The long side face is an abutting surface **95** against which the reading start side edge of the document in the sub-scanning direction X**2** abuts. A scale indicating a size of the document is marked on the upper surface of the body part **91**. The scale indicates a length

(along the main-scanning direction X**1**) of the document of a predetermined size from a reference position Z on one end in the longitudinal direction (see FIG. **4**). A shading plate (not shown) for CIS adjustment is embedded in the lower surface of the body part **91**.

[0039] The guide part **93** is fixed to the other long side surface of the body part **91** opposite to the abutting surface **95**. The lower surface of the guide part **93** is continuous with the lower surface of the body part **91**. The guide part **93** is higher than the body part **91**, and has a guide surface inclined upward toward the body part **91**. Along the guide surface, the document which has passed the reading position is guided to the downstream side in the sheet-through system.

[0040] As shown in FIG. **5**A, on the upper surface of the front end portion of the body part **91**, two guide walls **97** along the left-and-right direction are formed at a predetermined interval in the front-and-rear direction. Further, on the lower surface of the front end portion of the body part **91**, a cursor-side rack gear **99** with teeth facing downward is formed along the left-and-right direction. The cursor-side rack gear **99** extends from the lower surface of the body part **91** in the direction opposite to the guide part **93**.

[0041] As shown in FIG. **5**B, on the upper surface of the rear end portion of the body part **91**, two recesses are formed spaced in the left-and-right direction. A pulley **101** rotatable around a rotational shaft provided along the front-and-rear direction is accommodated in each recess so as to protrude from the upper surface. Further, on the upper surface, a locking piece **103** is formed on the inner side (center side) of the recesses. The locking piece **103** has an upright wall vertically stood from the upper surface and a horizontal wall bent rearward from the upper end of the upright wall.

[0042] As shown in FIG. **2**, the cursor **47** is placed on the upper surface of the document table **41** in a posture long the main-scanning direction X**1** (the front-and-rear direction). The rear end portion of the body part **91** enters below the horizontal wall of the rear rail **65**R provided on the top plate **61** of the housing **51**, and the locking piece **103** (see FIG. **5**B) provided on the upper surface of the body part **91** is placed on the horizontal wall of the rear rail **65**R. Further, the cursor-side rack gear **99** (see FIG. **5**A) provided at the front end portion of the body part **91** protrudes downward below the document table **41** on the front side of the document table **41** (see FIG. **6**). Further, the bent piece of the front rail **65**F provided on the top plate **61** of the housing **51** enters between the two guide walls **97** provided on the upper surface of the front end portion of the body part **91**.

[0043] In this manner, the cursor **47** can move along the upper surface of the document table **41** in the sub-scanning direction X**2** (the left-and-right direction). More specifically, the cursor **47** is movable in the opposite direction Y**2** (leftward) from a first reference position R**1** (see the solid line in FIG. **2**) where the abutting surface **95** abuts the stepped surfaces **63***c* of the top plate **61** of the housing **51** to a second reference position R**2** (see the dashed line in FIG. **2**) where the left edge of the guide part **93** abuts the left side surface **63***d* of the left opening **63***b* of the top plate **61** of the housing **51**. By moving the abutting surface **95** in the opposite direction Y**2** in this manner, a size of the document which can be placed on the document table **41** can be extended in the sub-scanning direction X**2**. As an example, at the first reference position R**1**, the document of the A4 vertical size can be placed, and at the second reference position R**2**, the document of the legal size can be placed.

[0044] The first reference position R**1** is a position downstream of the home position HP of the reading unit **43** in the reading direction Y**1**.

[0045] Next, the cursor moving part **49** will be described with reference to FIG. **6** and FIG. **7**. FIG. **6** is a perspective view showing the cursor moving part **49**, and FIG. **7** is a front view schematically showing the cursor moving part **49**. The cursor moving part **49** moves the cursor **47** along the sub-scanning direction X**2** (the left-and-right direction) in a reciprocating manner. In particular, the cursor moving part **49** moves the cursor **47** from the first reference position R**1** to the second reference position R**2** in conjunction with the movement of the reading unit **43** from the home position HP to the opposite direction Y**2** (leftward).

[0046] The cursor moving part **49** includes a driving gear **111** engageable with the reading unit-side

rack gear **75** of the reading unit **43**, a one-way clutch **115** provided on a rotational shaft **113** of the driving gear **111**, a pulley **117**, a timing belt **119** connecting the pulley **117** and the one-way clutch **115**, a locking mechanism **121** for the cursor **47**, and a spiral spring **123** arranged between the pulley **117** and the housing **51**.

[0047] First, the driving gear **111** will be described. The driving gear **111** is disposed at the left end portion of the inside of the housing **51**, and is supported so as to be rotatable integrally with the rotational shaft **113** provided along the front-and-rear direction. In a state where the reading unit **43** is moved to the home position HP, the driving gear **111** is not engaged with the reading unit-side rack gear **75** of the holder **73**. The reading unit **43** moves in the opposite direction Y**2** from the home position HP, then passes below the reading position in the seat-through system, and then the reading unit-side rack gear **75** of the holder **73** is engaged with the driving gear **111**. When the reading unit **43** further moves in the opposite direction Y**2**, the driving gear **111** rotates in the counterclockwise direction CCW.

[0048] Next, the one-way clutch **115** will be described. The one-way clutch **115** is fixed to the other end portion of the rotational shaft **113**. Only the rotational force in the counterclockwise direction CCW of the rotational shaft **113** is transmitted to the one-way clutch **115** to rotate it in the counterclockwise direction, while the rotational force in the clockwise direction CW of the rotational shaft **113** is not transmitted.

[0049] Next, the pulley **117** will be described. The pulley **117** is arranged so as to be engaged with the cursor-side rack gear **99** provided in the cursor **47**, and is supported by the housing **51** so as to be rotatable around a rotational shaft provided along the front-and-rear direction. That is, when the pulley **117** rotates, the cursor-side rack gear **99**, that is, the cursor **47** moves along the left-and-right direction (the sub-scanning direction X**2**).

[0050] Next, the timing belt **119** will be described. The timing belt **119** is wound around the pulley **117** and the one-way clutch **115**, and transmits the rotation of the one-way clutch **115** to the pulley **117**.

[0051] When the driving gear **111** rotates in the counterclockwise direction CCW and the rotational shaft **113** rotates in the counterclockwise direction CCW, the rotation of the shaft in rotational **113** the counterclockwise direction CCW is transmitted to the one-way clutch **115**, and the one-way clutch **115** rotates in the counterclockwise direction CCW. The rotation of the one-way clutch **115** is transmitted to the pulley **117** via the timing belt **119**, and the pulley **117** rotates in the counterclockwise direction CCW. Then, the cursor **47** moves in the opposite direction Y**2** (leftward) together with the cursor-side rack gear **99**. On the other hand, when the driving gear **111** rotates in the clockwise direction CW and the rotational shaft **113** rotates in the clockwise direction CW, the rotation of the rotational shaft **113** in the clockwise direction CW is not transmitted to the one-way clutch **115**, so that the one-way clutch **115** does not rotate. That is, the cursor **47** also does not move.

[0052] Next, the locking mechanism **121** will be described with reference to FIG. **7**. When the cursor **47** moves to the second reference position R**2**, the locking mechanism **121** locks the cursor-side rack gear **99**, that is the cursor **47**. The locking mechanism **121** includes a gear tooth **131** engageable with the cursor-side rack gear **99**, and a button **133** integrally provided with the gear tooth **131**.

[0053] The gear tooth **131** have a substantially triangular shape in cross-sectional view, which can be engaged with the tooth groove of the cursor-side rack gear **99**. The button **133** is disposed in an opening formed in the top plate **61** of the housing **51**, and is biased upward by a coil spring **135**. The gear tooth **131** are integrally provided with the button **133** by an arm **137**.

[0054] When the cursor **47** moves to the second reference position R**2**, the gear tooth **131** is engaged with the most opposite side tooth groove of the cursor-side rack gear **99** in the opposite direction Y**2**, and the movement of the cursor-side rack gear **99** is restricted. On the other hand, when the button **133** is pushed in, the gear tooth **131** is separated downward from the cursor-side

rack gear **99** (see the dash-dotted line in FIG. **7**), and the cursor-side rack gear **99**, that is, the cursor **47** can be moved.

[0055] Next, the spiral spring **123** will be described with reference to FIG. **6**. The center end of the spiral spring **123** is fixed to the rotational shaft of the pulley **117**, and the outer end is fixed to the housing **51**. When the pulley **117** rotates in the counterclockwise direction CCW, the spiral spring **123** is wound and deformed so as to reduce the outer diameter. Thereafter, when the force for rotating the pulley **117** is released, the spiral spring **123** is deformed so as to increase the outer diameter. With this deformation, the spiral spring **123** is fed out, and the pulley **117** rotates in the clockwise direction.

[0056] Next, referring again to FIG. **1**, the conveying part **33** will be described. The conveying part **33** has a conveyance path **145** along which the document placed on a document tray **141** is conveyed to the sheet discharge tray **143** via the reading position. A reading guide **147** is supported at the reading position so as to be movable in the upper-and-lower direction. The conveying part **33** is turnable upward and downward around a support shaft provided at the rear end of the reading part **31**. When the conveying part **33** is turned upward, the document table **41** is opened, and the document can be placed on the document table **41** or taken out from the document table **41**. When the conveying part **33** is turned downward, the document placed on the document table **41** is fixed by the conveying part **33**.

[0057] An image reading operation (in the document fixing system) in the reading part **31** having the above configuration will be described with reference to FIG. **2** and FIG. **8** to FIG. **12**. FIG. **8** to FIG. **11** are front views showing the cursor **47** and the reading unit **43**. FIG. **12** is a plan view showing the positions of the cursor **47** and the reading unit **43**.

[0058] As shown in FIG. **8**, in the standby state, the reading unit **43** is moved to the home position HP. The cursor **47** is arranged at the first reference position R**1**. As described above, the first reference position R**1** is a position downstream of the home position HP of the reading unit **43** in the reading direction Y**1**. In a case of reading an image of an A4 size document, the conveying part **33** is turned upward to expose the document table **41**, and the document is placed on the document placement surface. At this time, the left rear corner of the document is positioned so as to align with the corner between the side surface of the main opening **63***a* of the top plate **61** of the housing **51** and the abutting surface **95** of the cursor **47**. Thereafter, the conveying part **33** is turned downward, and the document is fixed to the document table **41**.

[0059] When the start of reading is instructed, the motor **85** (see FIG. **3**) of the reading unit moving part **45** is driven to rotate the driving pulley **81** in the counterclockwise direction CCW. Then, the timing belt **87** travels in the counterclockwise direction, and the reading unit **43** having the holder **73** fixed to the timing belt **87** moves from the home position HP in the reading direction Y**1**. When the reading unit **43** moves to the moving end position P**1**, the image of the document is read by the CIS**71**. After the reading unit **43** is moved to the moving end position P**1** (see FIG. **13**), the motor **85** is stopped, and then the motor **85** is driven to rotate the driving pulley **81** in the clockwise direction CW, the timing belt **87** travels in the clockwise direction, and the reading unit **43** returns to the home position HP.

[0060] Next, a case of reading an image of a legal size document will be described. When an information that the document size is a legal size is input, the motor **85** (see FIG. **3**) of the reading unit moving part **45** is driven to drive the driving pulley **81** in the clockwise direction CW. Then, the timing belt **87** travels in the clockwise direction, and the reading unit **43** starts to move in the opposite direction Y**2**.

[0061] Then, as shown in FIG. **9**, when the reading unit **43** moves in the opposite direction Y**2** to the conveyed document reading position P**2**, the reading unit-side rack gear **75** is engaged with the driving gear **111** of the cursor moving part **49**. Then, as shown in FIG. **6**, the driving gear **111** rotates in the counterclockwise direction CCW, and the rotational shaft **113** rotates in the counterclockwise direction CCW together with the driving gear **111**. The rotation of the rotational

shaft **113** in the counterclockwise direction CCW is transmitted to the one-way clutch **115**, and the one-way clutch **115** rotates in the counterclockwise direction CCW. The rotation of the one-way clutch **115** is transmitted to the pulley **117** via the timing belt **119**, and the pulley **117** rotates in the counterclockwise direction CCW. Thus, the cursor **47** starts to move in the opposite direction Y**2** from the first reference position R**1** together with the cursor-side rack gear **99** engaged with the pulley **117**. The rotation of the pulley **117** causes the spiral spring **123** to be wound and deformed so as to reduce the outer diameter.

[0062] At this time, the front and rear end portions of the cursor **47** are guided by the front and rear rails **65**F and **65**R provided in the housing **51**. In the front end portion of the cursor **47**, the bent piece of the front rail **65**F enters between the two guide walls **97** (see FIG. **5**A) provided on the upper surface of the body part **91**. Thus, the cursor **47** can be surely guided in the right-and-left direction (the sub-scanning direction X**2**). Further, in the rear end portion of the cursor **47**, the horizontal wall of the locking piece **103** (see FIG. **5**B) provided in the body part **91** is placed on the horizontal wall of the rear rail **65**R, and the two pulleys **101** abut against the lower surface of the horizontal wall, so that friction between the cursor **47** and the rail **65**R can be reduced. In this manner, the cursor **47** stably moves along the left-and-right direction (the sub-scanning direction X**2**).

[0063] The reading unit **43** moves further in the opposite direction Y**2** beyond below the reading position. With the movement of the reading unit **43**, the cursor **47** moves further in the opposite direction Y**2** together with the cursor-side rack gear **99**. As shown in FIG. **10**, when the cursor **47** passes through the reading position, the reading guide **147** of the conveying part **33** is pushed upward by the guide part **93** of the cursor **47**.

[0064] As shown in FIG. **11**, when the reading unit **43** moves to the maximum opposite position P**3**, the motor **85** of the reading unit moving part **45** stops. With the movement of the reading unit **43**, the cursor **47** moves to the second reference position R**2**. At the second reference position R**2**, the cursor **47** is locked by the locking mechanism **121** as described above. That is, the gear tooth **131** of the locking mechanism **121** is engaged with the tooth groove of the cursor-side rack gear **99**.

[0065] Thereafter, the motor **85** of the reading unit moving part **45** is driven to rotate the driving pulley **81** in the counterclockwise direction CCW, and the timing belt **87** travels in the counterclockwise direction, so that the reading unit **43** moves from the maximum opposite position P**3** to the reading direction Y**1**. As shown in FIG. **12**, the reading unit **43** moves until the reading unit-side rack gear **75** is separated from the driving gear **111** of the cursor moving part **49**. A position of the reading unit **43** at this time is the legal reading start position P**4** (see FIG. **12**). The legal reading start position P**4** is a position between the maximum opposite position P**3** and the conveyed document reading position P**2**, and is a position upstream of the second reference position R**2** of the cursor **47** in the reading direction Y**1**.

[0066] When the reading unit **43** is moved in the reading direction Y**1**, as shown in FIG. **6**, the driving gear **111** engaged with the reading unit-side rack gear **75** rotates in the clockwise direction CW, and the rotational shaft **113** rotates in the clockwise direction CW. At this time, since the rotation of the rotational shaft **113** in the clockwise direction CW is not transmitted to the one-way clutch **115**, the one-way clutch **115** does not rotate. That is, the rotational force of the rotational shaft **113** is not transmitted to the pulley **117**.

[0067] Thereafter, the conveying part **33** is opened to expose the document table **41**, and the document is placed on the document placement surface. At this time, the left rear corner of the document is positioned so as to align with the corner between the side surface of the main opening **63***a* of the top plate **61** of the housing **51** and the abutting surface **95** of the cursor **47**. Thereafter, the conveying part **33** is turned downward.

[0068] When the start of reading is instructed, the motor **85** of the reading unit moving part **45** is driven, and the driving pulley **81** rotates in the counterclockwise direction CCW (see FIG. **3**). As a result, the timing belt **87** travels in the counterclockwise direction CCW, and the reading unit **43**

moves from the legal reading start position P**4** in the reading direction Y**1**. When the reading unit **43** moves to the moving end position P**1**, the image of the document is read by the reading unit **43**. After the reading unit **43** moves to the moving end position P**1**, the motor **85** stops, and then the motor **85** is driven to rotate the driving pulley **81** in the clockwise direction CW, the timing belt **87** travels in the clockwise direction CW, and the reading unit **43** returns to the home position HP.

[0069] After the reading of the legal size document is completed in this manner, the button **133** of the locking mechanism **121** is pushed downward as shown in FIG. **7**. Then, the gear tooth **131** is separated downward from the cursor-side rack gear **99**. Thereby, the cursor-side rack gear **99**, that is, the cursor **47** is unlocked, and the pulley **107** is free to rotate. Then, the wound spiral spring **123** is fed out and deformed so as to increase the outer diameter, and the pulley **117** rotates in the clockwise direction. As a result, the cursor **47** moves in the reading direction Y**1** together with the cursor-side rack gear **99**. The cursor **47** is returned to the first reference position R**1** where the abutting surface **95** abuts against the stepped surface **63***c* of the opening **63** of the top plate **61** of the housing **51**. As described above, the spiral spring **123** is an example of the biasing member which biases the pulley **117** in the opposite direction to the rotational direction of the one-way clutch **115** in the present disclosure.

[0070] As described above, according to the present disclosure, the cursor moving part **49** moves the cursor **47** in the opposite direction Y**2** in conjunction with the movement of the reading unit **43** in the opposite direction Y**2** to the reading direction Y**1**. Therefore, the image reading range of the document positioned by the cursor **47** can be lengthened in the sub-scanning direction X**2**. For example, when the cursor **47** is provided in accordance with the A4 vertical size document, the cursor **47** can be moved to a position where the legal size document can be read.

[0071] Specifically, as shown in FIG. **13**, in the case of the A4 vertical size, the reading start position of the document is the first reference position R**1**, and the reading unit **43** moves from the home position HP to the moving end position P**1** to read the image of the document (a moving distance W**1**). In the case of the legal size, the reading start position of the document is the second reference position R**2**, and the reading unit **43** moves from the legal reading start position P**4** to the moving end position P**1** to read the image of the document (a moving distance W**2**>W**1**).

[0072] Further, the cursor moving part **49** moves the cursor **47** in the opposite direction Y**2** only in association with the movement of the reading unit **43** in the opposite direction Y**2**, and is not in association with the movement of the reading unit **43** in the reading direction Y**1**. Therefore, during the image reading, the reading unit **43** can be stably moved in the reading direction Y**1** while the cursor **47** is maintained at a predetermined reference position. On the other hand, the cursor **47** can be moved in the reading direction Y**1** by using the spiral spring **123** of the cursor moving part **49** and automatically returned to the first reference position R**1** by a simple operation of pushing the button **133**.

[0073] The document positioned at the second reference position R**2** may be a document other than a legal size document.

[0074] While the present disclosure has been described for specific embodiments, the present disclosure is not limited to those embodiments. A person skilled in the art may modify the above embodiments without departing from the scope and spirit of the present disclosure.

Claims

1. An image reading device comprising: a document table on which a document is placed; a reading unit which is disposed below the document table and scans the placed document in a main-scanning direction to read an image; a reading unit moving part which moves the reading unit in a sub-scanning direction crossing the main-scanning direction and in an opposite direction to the reading direction; a cursor to which a reading start side edge of the document placed on the document table in the sub-scanning direction is abutted; and a cursor moving part which moves the

cursor along the sub-scanning direction in a reciprocating manner, wherein the cursor moving part moves the cursor from a reference position of the reading unit in the opposite direction in conjunction with a movement of the reading unit from the home position in the opposite direction, so that an image readable range in the sub-scanning direction can be increased.

2. The image reading device according to claim 1, wherein the reading unit includes: an image reading sensor; a holder which holds the image reading sensor; and a reading unit side rack gear which is provided in the holder in the sub-scanning direction, the cursor moving part includes: a driving gear which is engageable with the reading unit side rack gear; a one-way clutch which is provided coaxially with the driving gear; a cursor side rack gear which is provided in the cursor along the sub-scanning direction; a pulley which is engageable with the cursor side rack gear; and a timing belt which connects the pulley to the one-way clutch, when the reading unit passes through a predetermined position away from the home position in the opposite direction, the reading unit side rack gear is engaged with the driving gear to rotate the driving gear, a rotation of the driving gear is transmitted from the one-way clutch to the pulley via the timing belt, and the pulley rotates to move the cursor in the opposite direction together with the cursor side rack gear.

3. The image reading device according to claim 2, wherein the cursor moving part includes: a locking mechanism which locks the cursor side rack gear when the cursor moves to a position away from the reference position in the opposite direction; and a biasing member which biases the pulley in a direction opposite to the rotational direction of the one-way clutch, when the locking mechanism unlocks the cursor side rack gear, the pulley is rotated by the biasing member, and the cursor returns to the reference position together with the cursor side rack gear.

4. The image reading device according to claim 2, the reading unit moving part moves the reading unit in the opposite direction, then moves the reading unit in the reading direction until the reading unit side rack gear is separated from the driving gear, and then image reading by the reading unit is started.

5. An image forming apparatus comprising: the image reading device according to claim 1, and an image forming part which forms an image on a sheet based on image date of the document read by the image reading device.