Oct. 15, 1968 M. B. FLEISHER ETAL 3,405,626

APPARATUS FOR PROCESSING PHOTOGRAPHIC MATERIAL AND THE LIKE

Filed June 11, 1965 3 Sheets-Sheet 1

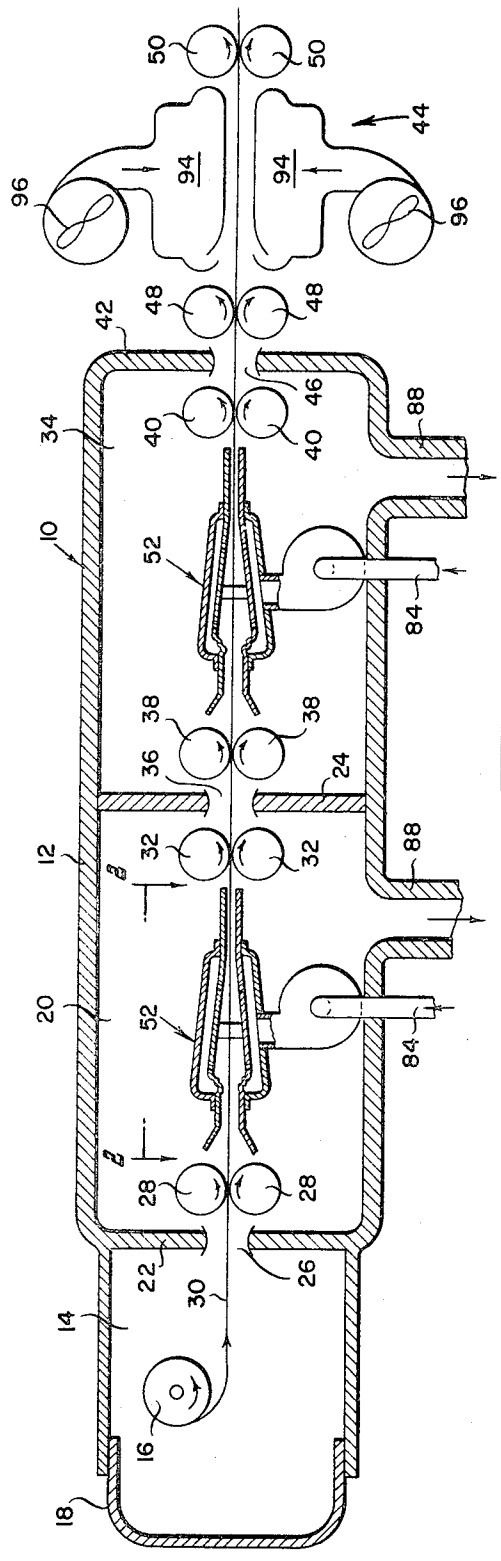


Fig. 1

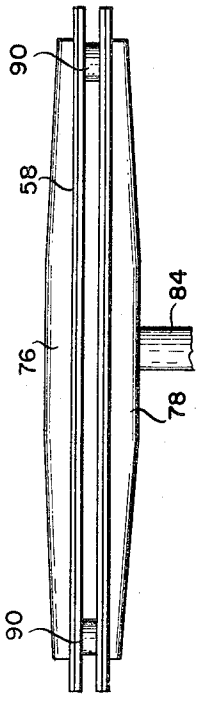


Fig. 3

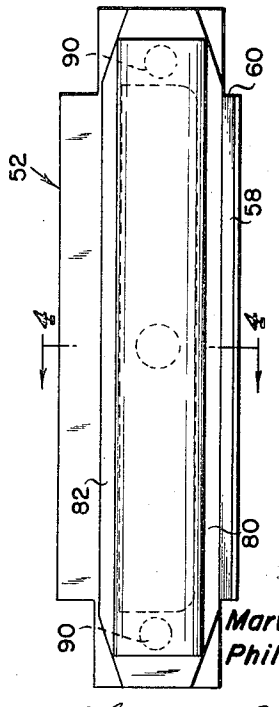


Fig. 2

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APPARATUS FOR PROCESSING PHOTOGRAPHIC MATERIAL AND THE LIKE

Filed June 11, 1965 3 Sheets-Sheet 2

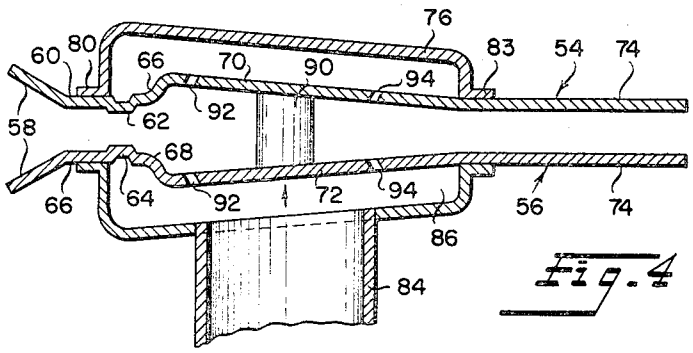


Fig. 4

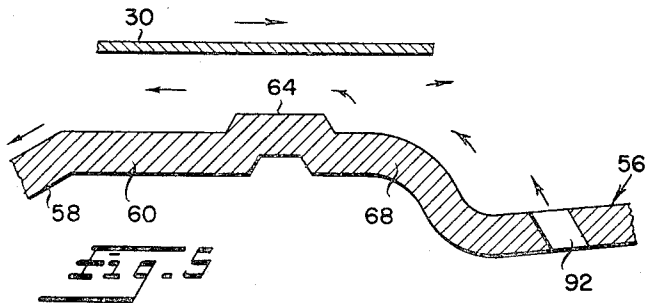


Fig. 5

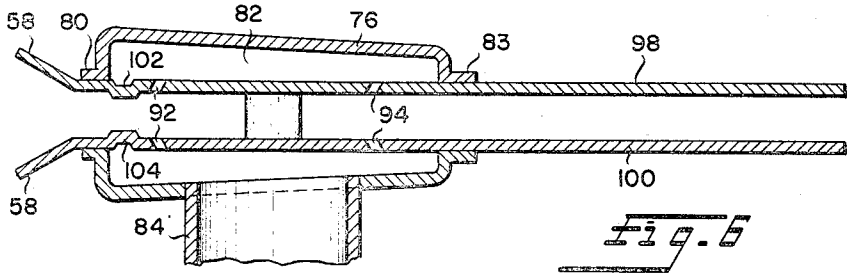


Fig. 6

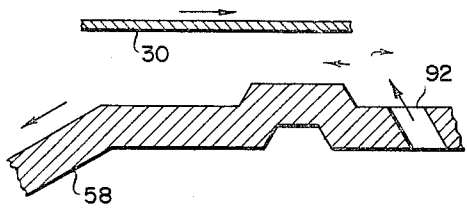


Fig. 1

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APPARATUS FOR PROCESSING PHOTOGRAPHIC MATERIAL AND THE LIKE

Filed June 11, 1965 3 Sheets-Sheet 3

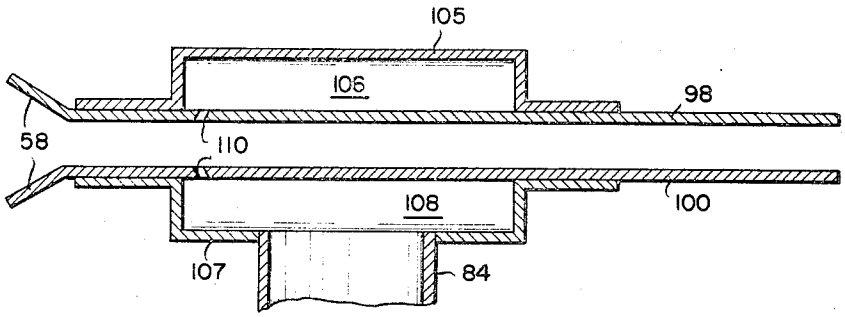


Fig. 8

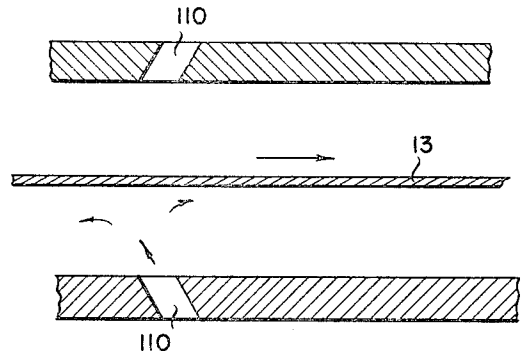


Fig. 9

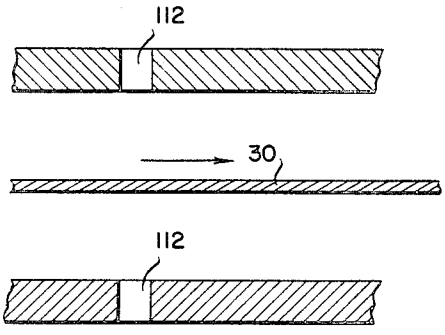


Fig. 10

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APPARATUS FOR PROCESSING PHOTOGRAPHIC MATERIAL AND THE LIKE

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Filed June 11, 1965, Ser. No. 463,309
10 Claims. (Cl. 95—94)

ABSTRACT OF THE DISCLOSURE

A fluid applicator for applying a liquid bed of processing fluid to web or sheet material passing through the applicator in a straight line, the web or sheet material being driven by at least one pair of rollers positioned adjacent the applicator. The applicator is made up of a pair of symmetrical plate members that are spaced apart from each other to form a channel therebetween through which the web material is passed. The plate members have a plurality of inlet ports for feeding liquid solution to the interior of the channel and inwardly extending ribs, transverse to the line of travel of the web material, to properly regulate the flow of processing solution from the inlet ports.

The present invention relates to an apparatus for the fluid treatment of material, and more particularly relates to photographic processing means for films, printing paper, glass plates, photosensitive aluminum, or other photosensitized material and the like.

It is an object of the present invention to provide a film processing apparatus which will have a simple and inexpensive structure for completely processing the exposed, undeveloped film material from a roll or cut sheet of material fed through the apparatus.

It is another object of the present invention to provide a film processing apparatus in which the strip of film is fed between spaced pairs of rollers and in which the film strip travels in a straight line path through the apparatus.

It is another object of the present invention to provide a film processing apparatus that transports photographic film without damage to its surface.

Another object of the present invention is to provide an improved film processing apparatus in which any excess solution or fluid is removed and prevented from creating droplets on the film material or contaminating the adjacent processing bath.

It is another object of the present invention to provide an appratus in which the solution is applied to the strip of film being fed through the apparatus in a uniform manner.

Another object of the present invention is to provide a film processing apparatus having a plurality of stations or sections therein, for example a developer station and a fixer station and a washing station and a drying station all having a common plane in alignment with each other so that the strip of film material is self-threaded through pairs of nip rollers disposed along this common plane.

It is another object of the present invention to provide a photographic film material apparatus having applicator means therein with one or more rows of slots or small apertures through which the fluid is fed so as to contact the film being processed.

It is another object of the present invention to provide applicator means for a photographic film processing apparatus that prevents the loss of solution sidewise through the applicator.

Another object of the present invention is to provide an applicator means for a photographic film apparatus which greatly improves the quality of work produced and which has additional slots or apertures which prevent the uneven

development when the top and bottom portions of the applicator are not exactly matched.

It is yet another object of the present invention to provide a novel applicator means for a film processing apparatus in which the applicator is provided with a plurality of C-slots which are sloped from the horizontal plate members of the applicator.

It is another object of the present invention to provide an applicator provided with a plurality of perpendicular apertures or slots for discharging solution to the film passing through the apparatus, which perpendicular slots are disposed in substantially horizontally extending applicator plate members.

Various other objects and advantages of the present invention will be readily apparent from the following detailed description when considered in connection with the accompanying drawings forming a part thereof and in which:

FIGURE 1 is a side elevational view partly broken away and in section, illustrating the embodiment of the present invention.

FIGURE 2 is a top plan view taken along the line 2—2 of FIGURE 1.

FIGURE 3 is a front end view of the inlet end of the applicator shown in FIGURE 2.

FIGURE 4 is an enlarged detail view of the applicator shown in FIGURE 1.

FIGURE 5 is a fragmentary detail view of a portion of the applicator shown in FIGURE 4.

FIGURE 6 is a detail view of a modification of the applicator shown in FIGURE 4.

FIGURE 7 is a fragmentary detail view of a portion of the applicator shown in FIGURE 6.

FIGURE 8 is another modification of the applicator shown in FIGURE 4.

FIGURE 9 is a fragmentary detail view of a portion of the applicator shown in FIGURE 8.

FIGURE 10 is a fragmentary detail view of a modification of the slots or apertures shown in FIGURE 9 in the plate members of the applicator.

Referring to the drawings, the reference numeral **10** generally designates the photographic developing apparatus of the present invention, and is provided with a substantially horizontally extending casing or housing **12**. The housing **12** is divided into a plurality of sections or compartments. The first compartment on the inlet end of the casing is generally designated **14** and is adapted to contain a roll **16** of film to be processed. The front end of the compartment or section **14** is provided with a removable cover **18** for closing off the inlet end of the housing after the roll of film **16** is disposed therein. The housing is a light-tight housing so that no sunlight or other type of light will enter the interior of the housing and expose the film before it is properly developed. Disposed adjacent the outlet end of the compartment **14** is a developer section or compartment **20**. The developer section **20** is substantially rectangular shape in cross-section and is provided with a front wall **22** and a rear wall **24**. The front wall **22** separates the compartment **20** from the inlet or film supply compartment **14** and the film is fed to the developer compartment **20** through a horizontally extending opening **26** disposed in front wall **22** of compartment **20**. A pair of rollers **28** are disposed in the front inlet end of the compartment **20** as best seen in FIGURE 1, to feed the strip of film **30** therebetween for processing. The rear or end of compartment **20** adjacent the rear wall **24** is also provided with a pair of rollers **32** for threading the strip of film **30** into the next processing station or compartment **34**. The compartment **34** is a fixer station and the strip **30** of film enters the compartment **34** through a substantially horizontally

extending opening **36** in the rear wall **24** of the compartment **20**. The compartment **34** is also provided with a pair of inlet rollers **38** and a pair of outlet rollers **40** adjacent the front and rear ends of the compartment.

Disposed adjacent the extreme rear wall **42** of the housing **12** is a drying station generally designated **44**. The strip of film is fed through an opening **46** in the rear wall **42** to the drying station **44** and this station is similarly provided with pairs of inlet and discharge rollers **48** and **50**, respectively.

Although the apparatus has been shown as having a developer, fixer, and drying station, it is of course realized that the number of stations can be increased or decreased as desired without departing from the scope of the invention.

The rollers are disposed in alignment with one another and the openings **26**, **36** and **46** are also disposed in horizontal alignment so that the strip of film material is fed in a straight line through the apparatus.

The nip rollers preferably have a synthetic elastomer surface so that they will not do any damage to the film being passed therebetween and the rollers are rotated by means, not shown, in the direction indicated by the arrows so as to firmly but gently pull or thread the film through the apparatus.

The developer processing compartment or section **20** and the fixer compartment or section **34** are both provided with an applicator member which are identical and are generally designated as **52**. The applicator shown in FIGURE 1 comprises a pair of plate members **54** and **56**, respectively, as best seen in FIGURE 4. The applicators **52** extend transversely of the housing **12** and have their upper and lower plates **54** and **56** disposed in spaced relationship with one another so that the film can be readily conveyed therethrough as best seen in FIGURE 1. It will be noted that the horizontal axis of the applicator is disposed in horizontal alignment with the common plane running or extending through the openings **26**, **36** and **46**, and between the pairs of rollers disposed in the apparatus. Referring to FIGURE 4, it will be noted that the two plates **54** and **56** are provided with opposed inclined lips **58** forming an enlarged inlet opening and the plates thereafter are provided with horizontal sections **60**, after which the upper plate is provided with a downwardly extending rib **62** while the lower plate **56** is provided with an opposed upwardly extending rib **64**. Thereafter, the upper plate **54** is curved upwardly at **66** while the lower plate is curved downwardly at **68**. The upper plate then is inclined downwardly at **70** while the lower plate is inclined upwardly at **72** and both plates extend to a point adjacent the rear end of the applicator at which they both extend in a substantially horizontal direction as indicated at **74**.

The plates **54** and **56** are disposed between substantially horizontally extending U-shaped members **76** and **78**, respectively. The upper U-shaped member **76** is secured to the outer surface of the plate **54** adjacent the sections of plate **54** indicated as **60** and **74**, with the U-shaped member **76** being provided with outwardly extending lips **80** and **83** which are secured to the plate by any suitable means so that the interior of the U-shaped member **76** provides a liquid-tight container **82** or plenum chamber.

The lower U-shaped member **78** is provided with similar lips or outwardly extending rims secured to the lower plate **56** and is further provided with a liquid or solution supply pipe or conduit **84** extending downwardly therefrom. It will be noted that the U-shaped members **76** and **78** have their main surfaces being inclined or tapering in the same direction as the portions **70** and **72** of the plates **54** and **56**. The lower U-shaped member **78** provides a plenum chamber **86** in its interior for receiving the developer solution or liquid from the supply conduit **84**. The supply conduit **84** extends out of the bottom of the compartment **20** to a liquid source of supply, not shown. The compartment **20** is also provided with a discharge outlet or conduit **88** as best seen in FIGURE 1 for returning the solution to the source of supply, not shown.

The opposite sides of the applicator plates **54** and **56** are provided with riser conduits **90** in communication with the plenum chamber **86** of the U-shaped member **78** and the plenum chamber **82** of the U-shaped member **76** so as to supply liquid solution under pressure to the plenum chamber **82**.

When the processing solution is fed under pressure through the inlet or supply conduit **84** the solution will enter the plenum chamber **86** and will be forced through the riser conduits **90** to the upper plenum chamber **82**.

The portions **70** and **72** of the plates **54** and **56**, respectively, are provided with spaced rows of transversely extending feed openings or ports **92** and **94** for feeding the solution to the interior or space between the plates **54** and **56** through which the strip of film **30** passes. The flow of the solution is best shown in FIGURE 5 in the direction indicated by the arrows therein. The first row of feed ports **92** is disposed adjacent the curved sections **66** and **68** of the plates **54** and **56**, respectively, and the ports are inclined at an angle with respect to the vertical as best seen in FIGURE 5. The feed ports **94** are also inclined at the same angle with respect to the vertical and are disposed in the applicator plates toward the rear end of the U-shaped members.

In operation, the film is disposed in the compartment **14** and the strip is fed through the opening **26** and between the rollers **28** through the applicators **52** and the respective rollers in the compartments **20** and **34**.

As the strip of film passes through the compartments **20** and **34**, the liquid solution which would be developer solution in the compartment **20** and fixer solution in the compartment **34**, is fed through the respective supply conduits **84** in the compartments. The solution is fed under pressure so that the solution is forced up through the lower plenum chambers **86** and through the riser tubes **90** into the upper plenum chambers **82**. Since the combined flow opposition or resistance of the orifices of riser tubes **90** is smaller than the resistance of the solution feed ports **92** and **94**, the resulting lower resistance presented by the riser tubes **90** will allow the upper plenum chamber to be filled before much solution flows out of the plurality of rows of feed ports **92** and **94**. Once the plenum chambers are filled, the solution is then forced out through the feed ports into the channel formed between the configured plates **54** and **56** and the solution properly covers the strip of film **30** or is properly distributed in a uniform manner thereon so as to perform its function.

With the configuration described in connection with the embodiment of the applicator shown in FIGURE 4, there is no excessive fluttering of the fluid and the fluid will properly drain. The fluid after it has performed its function flows by gravity back into the discharge member **88** in each treating compartment or section. Any fluid remaining on the film strip **30** after it leaves the applicator is discharged from the film strip by gravity and is prevented from passing to the next station or section by the barrier of the nip of the exit rollers. The squeegee action of the pair of exit rollers in each compartment removes excess solution and forces it to drop to the bottom of the processing station. Thereafter the solution passes downwardly through the discharge conduits **88** from the housing.

After the film leaves the compartment **34** it is passed through a drying station **44** that is provided with dual air chambers **94** supplied with heated air from a source, not shown, by fans **96**.

Thus the present invention provides a film developing apparatus with a novel and improved applicator therein that can be made of simple and inexpensive construction and which provides a uniform distribution of the process-

ing solution or liquid over the continuous strip of film as it passes through the apparatus.

Referring to the embodiment of the invention shown in FIGURES 6 and 7, this is substantially the same as that already described in connection with FIGURES 1 to 5, except that the plate members **98** and **100** are parallel to each other and extend substantially in a horizontal direction. The plates are provided with opposed ribs **102** and **104** adjacent the inlet end of the applicator, but the remaining portion of the applicator presents a cross-sectional area of the same dimension.

Referring to the embodiment of the invention shown in FIGURES 8 and 9, this is substantially the same as that shown in FIGURES 6 and 7 except that the plates **98** and and **100** of the applicator do not have the ribs **102** and **104** but are completely horizontally extending. Thus, the cross-sectional area of the plates **98** and **100** in this embodiment is constant. Also, the U-shaped members **105** and **107** are not tapered so as to provide a substantially rectangular cross-sectional area in the plenum chambers **106** and **108**. The transversely extending row of feed inlet ports **110** in the plates **98** and **100** are disposed in a sloped direction so as to form a plurality of C slots with respect to each other. The direction of flow of the solution is indicated by the arrows in the fragmentary detail view in FIGURE 9.

With respect to the embodiment of the invention illustrated in FIGURE 10, this is substantially the same as that shown in FIGURES 8 and 9 except that the feed inlet ports **112** are perpendicular to a horizontal axis extending through the applicator.

Inasmuch as changes may be made in the form, location, and relative arrangement of the several parts of the invention, without departing from the principle of the invention, it will be understood that the invention is not to be limited except by the scope of the appended claims.

What is claimed is:

1. An applicator for use in processing a strip of film material passed along a straight line of travel in a substantially horizontal plane comprising a pair of plate members spaced apart to provide a channel therebetween through which the film strip is passed, said plate members having outwardly flared portions adjacent their inlet ends; intermediate portions next to said flared portions including inwardly extending ribs, transverse to the line of travel of said strip, elongated portions next to said intermediate portions, said elongated portions being substantially longer than the length of all said other mentioned portions and inlet port means in said elongated portions to feed liquid solution to the interior of said channel.

2. The combination as set forth in claim **1** wherein said elongated portions are inwardly flared.

3. The combination as set forth in claim **1** wherein said intermediate portions include horizontally oriented subportions in addition to said ribs.

4. The combination as set forth in claim **1** wherein said elongated portions are inwardly flared and said intermediate portions include horizontally oriented subportions in addition to said ribs.

5. An applicator for use in processing a strip of film material passed along a straight line of travel in a substantially horizontal plane comprising a pair of plate members spaced apart to provide a channel therebetween through which the film strip is passed, said plate members being symmetrical and having outwardly flared portions adjacent their inlet ends, a horizontal portion next to said flared portion, inwardly extending ribs next to said horizontal portions, outwardly curved portions next to said ribs, inwardly flared portions next to said curved portions, said inwardly flared portions being substantially longer than the length of all said other mentioned portions, and a plurality of spaced feed inlet port means in said inwardly flared portion to feed liquid solution to the interior of said channel.

6. The applicator of claim **5** wherein said feed port means consist of at least two rows of spaced passageways disposed at an acute angle with respect to said horizontal plane.

7. The applicator of claim **5** wherein said feed port means consist of at least one row of openings.

8. The applicator of claim **7** wherein plenum chambers are disposed on the sides of said plate members facing away from each other, and riser conduits connect said plenum chambers with each other, and a liquid supply conduit is connected to one of said plenum chambers.

9. An applicator for use in processing a strip of film material passed along a straight line of travel in a substantially horizontal plane comprising a pair of symmetrical plate members spaced apart to provide a channel therebetween through which the film strip is passed, said plate members having outwardly flared portions adjacent their inlet end, straight horizontal portions next to said flared portions, inwardly extending ribs adjacent said straight portions, and second straight horizontal portions adjacent said ribs substantially longer than all the other mentioned portions, at least two rows of feed inlet port means in said second straight portion disposed at an acute angle with respect to said horizontal plane, a plenum chamber disposed on each plate member adjacent the surfaces which face away from each other for supplying liquid to said feed port means, a pair of riser conduits connecting said plenum chambers to each other, and a liquid solution supply conduit connected to one of said plenum chambers.

10. The applicator of claim **9** wherein said rows of feed inlet port means are disposed at opposite angles with respect to each other.

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