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Miciukiewicz

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[54] **SHEET ORIENTING APPARATUS**

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[73] Assignee: **Pitney-Bowes, Inc.,** Stamford, Conn.

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Related U.S. Application Data

[62] Division of Ser. No. 413,836, Nov. 8, 1973, Pat. No. 3,877,696.

[52] **U.S. Cl.** **271/240;** 271/250

[51] **Int. Cl.²** **B65H 9/10**

[58] **Field of Search** 271/250, 248, 252, 240, 271/234, 238, 236, 221

[56] **References Cited**

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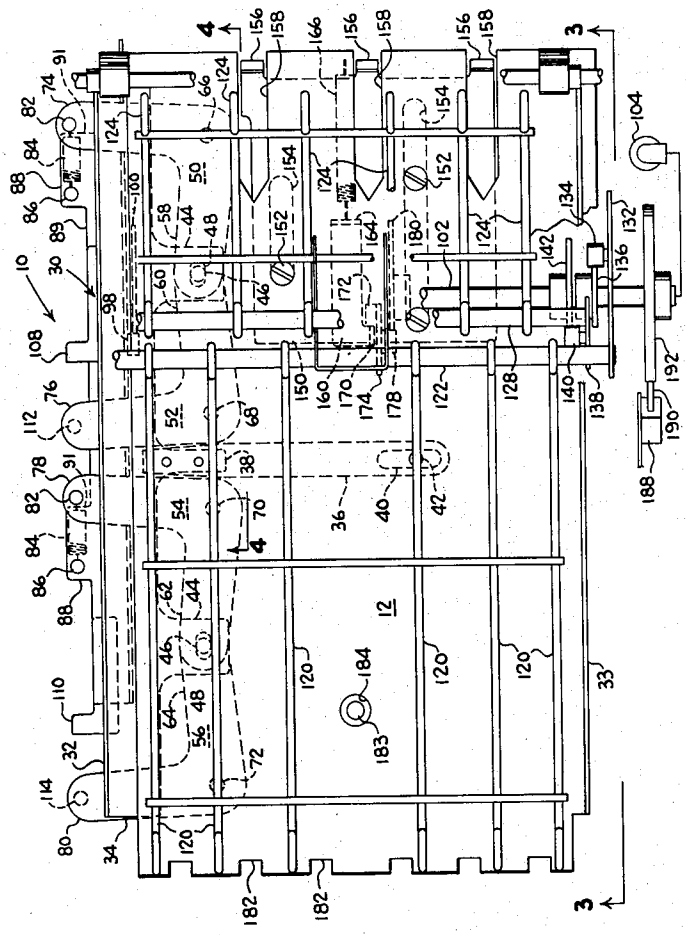
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Assistant Examiner—Bruce H. Stoner, Jr.
Attorney, Agent, or Firm—William D. Soltow, Jr.; Albert W. Scribner; Martin D. Wittstein

[57] **ABSTRACT**

Disclosed is an apparatus for properly orienting a thin flexible lithographic master sheet prior to the master sheet being fed to and clamped onto the master sheet cylinder of a lithographic press. The apparatus is basically a flat tray with movable pushers mounted thereon for shifting a sheet deposited on the tray in a lateral direction with respect to the direction of travel of the sheet and also longitudinally along the direction of travel of the sheet in order to place the sheet in a precise predetermined position with respect to a take-away mechanism. The apparatus also includes a movable wire guide device which maintains the sheet in a flat condition while it is being oriented to prevent the sheet from buckling more than the very slight degree which is specifically provided for to assure proper orientation. The device is constructed to be self-powered and readily removable from the duplicating machine with which it is normally associated.

4 Claims, 5 Drawing Figures



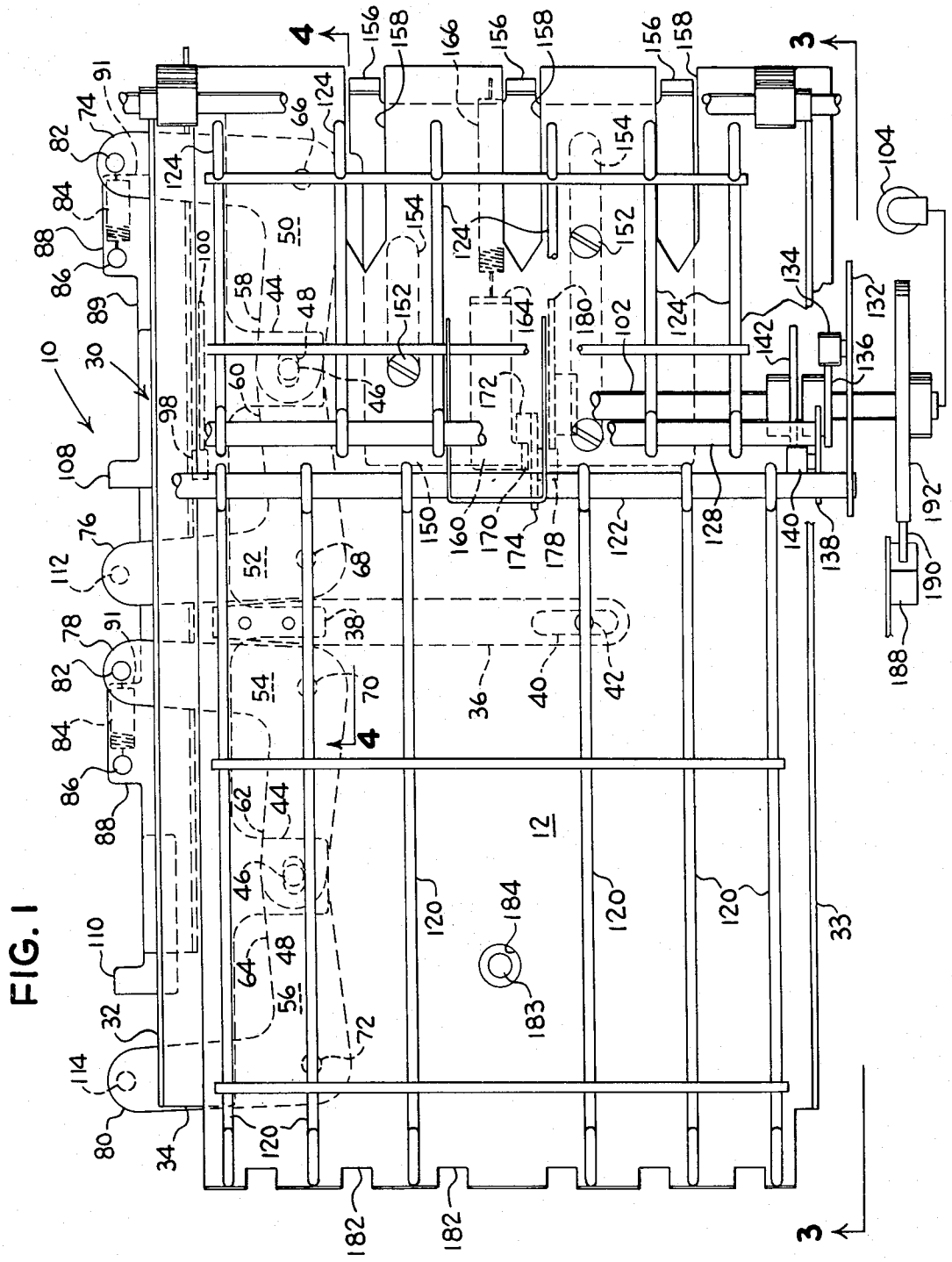


FIG. 1

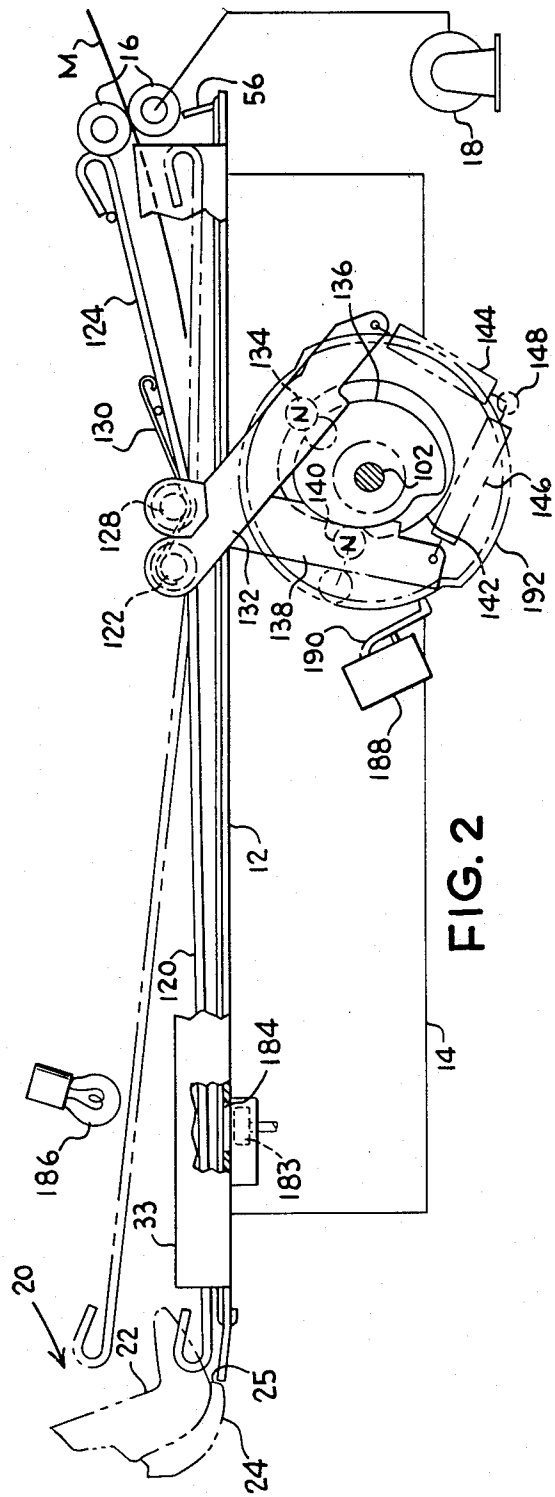


FIG. 2

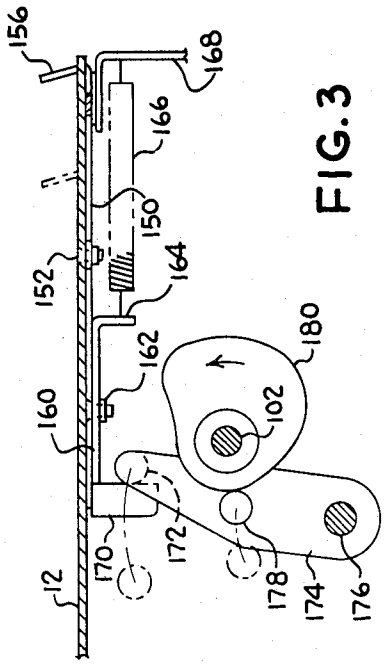


FIG. 3

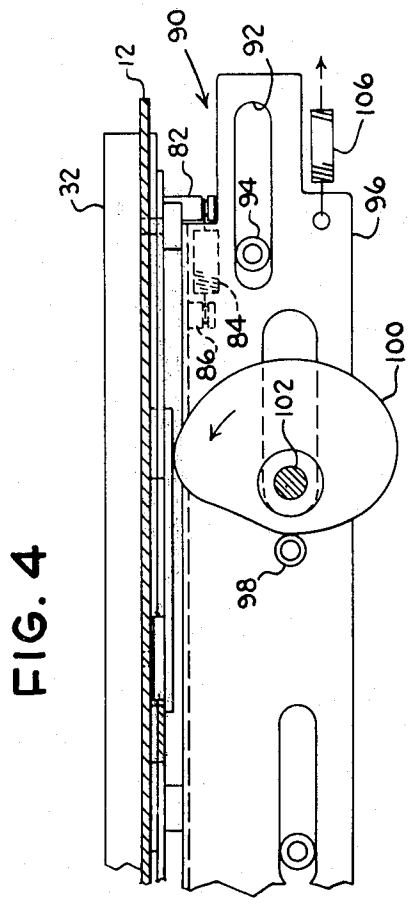


FIG. 4

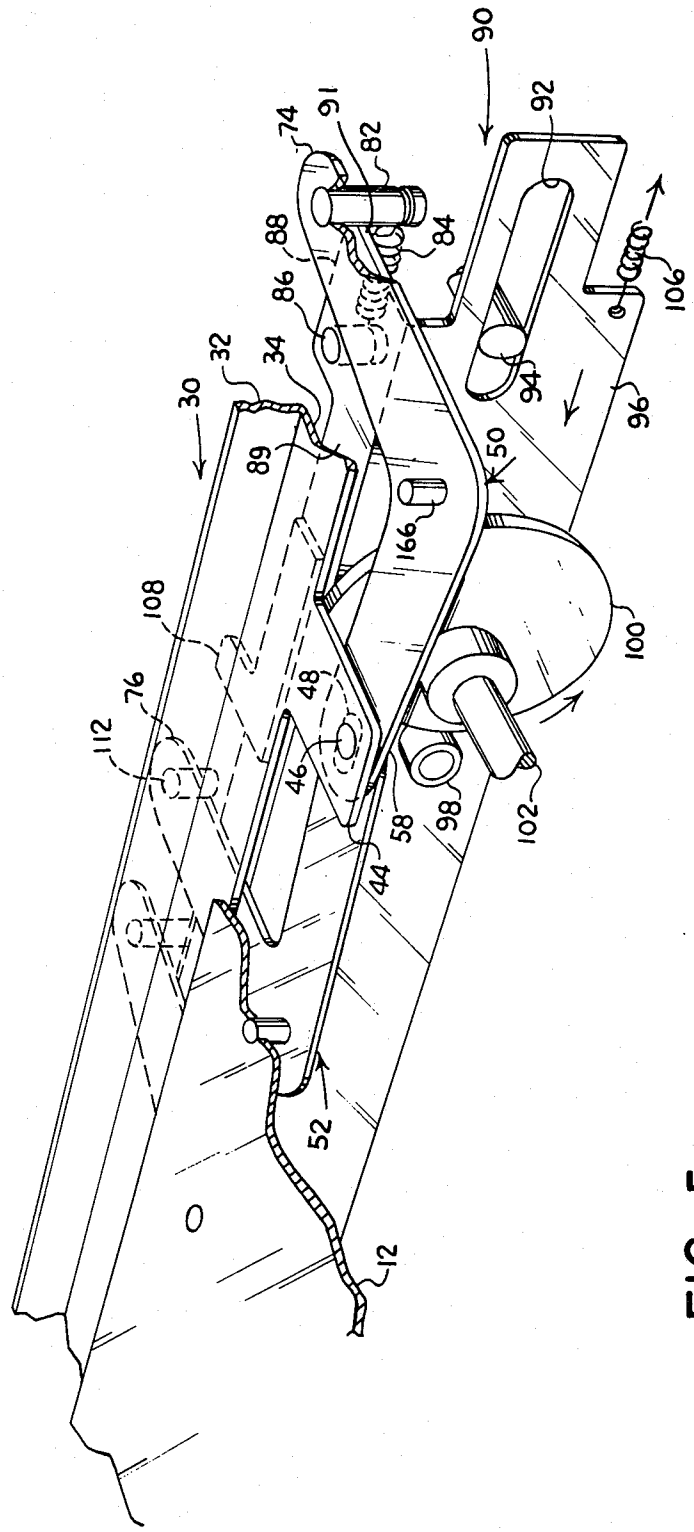

90
92
74
91
82
88
84
86
106
32
34
30
94
96
89
50
166
108
100
76
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112
46
58
98
102
44
52
12

FIG. 5

SHEET ORIENTING APPARATUS

This is a division, of application Ser. No. 413,836 filed Nov. 8, 1973, now U.S. Pat. No. 3,877,696.

BACKGROUND OF THE INVENTION

The apparatus of the present invention has been designed principally for use in a relatively new concept in the graphic duplicating field, that is, in a machine which combines electrostatic copying and lithographic duplicating techniques to produce large numbers of copies of documents. Such a machine, as well as a novel method for producing the copies are disclosed in a copending application Ser. No. 453,274, filed Mar. 21, 1974, now U.S. Pat. No. 3,861,306, and assigned to the assignee of this application. Basically, the concept of the method and machine disclosed in that application is the combination of the electrostatic and lithographic disciplines in such a manner that the electrostatic component of the machine produces a single electrostatic copy of a document in a form suitable for simple conversion of the electrostatic copy to a lithographic master which is then used in a lithographic press to make ink copies of the original document.

While electrostatic copiers and lithographic presses per se have long been well known, the combination machine disclosed in the above mentioned application (which disclosure is incorporated herein by reference) provides a totally automatic and continuous sequence of operations, one of which is accomplished by the apparatus of the present invention. The machine referred to utilizes a suitable photoconductive material which is thin and flexible so that it can be handled by a rotary press. A sheet of this material is uniformly electrostatically charged, exposed to a light pattern from an original document to produce a latent electrostatic image and then developed by the application of electrostatically attractable toner particles. The sheet is then fed, through the instrumentality of the present invention, to a lithographic press in which the sheet is first etched with an appropriate etching solution which renders the background areas on the sheet hydrophilic so as to attract water and repel ink, while the image areas remain oleophilic by the nature of the toner particles so that the image areas repel water and attract ink. Thereafter, ink copies are produced in a normal manner.

In one form of a combined electrostatic and lithographic duplicating machine shown in U.S. Pat. Nos. 3,451,336 and 3,521,560, a lithographic master is prepared by means of electrostatic copying techniques and is then conveyed from the copying apparatus to and through an etching both device, after which the master is convveyed to a lithographic press. No particular means is disclosed in these patents for orienting the master with respect to the master cylinder of the press other than mere guide means defining a path of travel from the etching device to the press. Another U.S. Pat. No. 3,649,005, discloses a type of sheet aligning device which may be used in conjunction with the machine disclosed in the previously mentioned patents, but this device has not proven to be satisfactory since it relies on yieldable spring members to orient a sheet disposed in the wire frame member. The degree of proper orientation is dependent on variable factors such as the flexibility of the sheet material, the extent of moisture in the sheet and variations in the strength of the spring material, all of which affect the relativve freedom of movement of the master sheet within the wire frame. Thus the device is not reliable for lateral alignment, and is totally lacking in longitudinal alignment.

SUMMARY OF THE INVENTION

The present invention relates generally to sheet orienting devices and more particularly to such devices for use in orienting master sheets preparatory to loading the sheets onto the master cylinder of a lithographic press.

The device comprises, in its broader aspects, a flat sheet support tray which is adapted to be supported in the duplicating machine in position to receive master sheets from the copying component and to discharge the oriented sheets to a transfer gripper mechanism which forms part of the lithographic press component of the duplicating machine. A suitable feeding means is provided for feeding sheets onto the support tray. There is also provided a movable side edge sheet registering means and movable front edge sheet registering means, each with an independently operable actuating mechanism for moving the sheet both laterally and longitudinally on the sheet support tray in order to establish a predetermined dimensional and time relationship between the sheet and the transfer gripper mechanism of the lithographic press component. Means are provided for initiating operation of the actuating mechanism in a predetermined timed sequence in response to the arrival of a sheet on the sheet support tray.

Preferably, the device also includes a wire guide mechanism which overlies the sheet support tray and which comprises a plurality of wire fingers mounted for movement toward and away from the support tray, there being independently movable front and rear wire guide mechanism and independently operable actuating means for each wire guide mechanism so that they can be actuated in a predetermined timed sequence. Further, all of the actuating means are controlled by cams mounted on a single cam shaft which is driven by a motor mounted on the orienter device whereby the device is self powered and requires only an initiating signal to cause the orienter device to run through a cycle of operation. Preferably this signal is generated in response to the arrival of a sheet on the support tray.

The orienter device of this invention, when interposed between the copying component and the press component of a duplicating machine such as disclosed in the above noted U.S. patents provides a predetermined dimensional and time relationship between two units which otherwise operate asynchronously. Without the device of this invention, it is necessary to precisely synchronize the operation of the copier component with that of the press component in order to assure properly spaced and timed transfer of master sheets from the copier component to the press component.

Having described the general nature of the present invention, it is a principal object thereof to provide an orienting device for establishing a predetermined dimensional and time relationship between a sheet and a receiving apparatus to which the sheet is fed by the orienter device.

It is another object of the present invention to provide an orienter device interposed between the electrostatic copier and lithographic press components of a duplicating machine which components have asynchronous operation, the orienter device serving to receive a master sheet from the copier component and properly

orient the sheet and deliver it to the press component.

It is a further object of the present invention to provide an orienter device which receives a sheet in flat condition and positively shifts the sheet both laterally and longitudinally in order to precisely register the sheet with predetermined guide means.

It is yet another object of the present invention to provide an orienter device in which all of the sheet moving and restraining instrumentalities of the device are powered by means contained within the orienter device so that the device is self powered and modular, thereby making the device easily removable from the duplicating machine for service or replacement.

It is a still further object of the present invention to provide an orienter device which is reliable in operation, relatively inexpensive to manufacture and maintain and which requires substantially no operator control.

These and other objects and advantages of the present invention will be more readily appreciated from an understanding of the following detailed description of a preferred embodiment of the invention when considered in conjunction with the accompanying drawings in which:

FIG. **1** is a plan view of the orienter device of the present invention,

FIG. **2** is a side elevation of the orienter device shown in FIG. **1**;

FIG. **3** is a sectional view taken on the line **3—3** of FIG. **1**;

FIG. **4** is a sectional view taken on the line **4—4** of FIG. **1**; and

FIG. **5** is a perspective view of the side edge registering portion of the orienter device shown in FIG. **1** with portions broken away for clarity.

DETAILED DESCRIPTION

Referring now to the drawings and particularly to FIGS. **1** and **2** thereof, there is shown a sheet orienting device **10** which comprises a flat, generally rectangular sheet support plate **12** which is dimensioned a little larger in length and width than the corresponding dimensions of the master copy sheet generated by the duplicating machine in which the orienter apparatus will be used. The plate **12** is supported in the aforesaid duplicating machine by a pair of side frame plates **14** of which one is shown in FIG. **2**, the orienter being mounted in the duplicating machine such that the entry end of the orienter, which is defined by the feed roller pair **16**, is disposed adjacent the discharge end of the sheet conveying structure of the duplicating machine which feeds the master sheets to the orienting device **10.** The feed roller pair **16** is driven by any suitable connection from the main drive motor **18** of the copying component of the duplicating machine, this motor being continuously driven while the master copy sheet is being made and being turned off after the lithograph press commences to operate. The copying component motor is re-energized when a new copying cycle is initiated, thereby restarting the roller pair **16.** Since the particular driving means for the roller pair **16** is not significant to the present invention, it is not shown in detail. The letter M designates a master copy sheet being delivered onto the sheet support plate **12** by the roller pair **16,** the sheet M being withdrawn from the upstream conveying structure as mentioned above.

The orienter device **10** in general is provided with movable side edge and lead edge registering means in order to establish a predetermined position of the sheet M on the plate **12** both laterally and longitudinally with respect to the direction of travel of the sheet M through the orienter device **10.** The device is also provided with a movable sheet hold down means to maintain the sheet M in a flat condition on the plate **12,** therebeing a separate and independently movable hold down means for both the entry and exit ends of the orienter device. There is also provided actuating means for moving the side and lead edge registering means and both hold down means all in a timed sequence so that each instrumentality acts on the sheet in a particular timed relationship with the result that the sheet M is presented to a plurality of take-away grippers, generally designated by the numeral **20,** at the proper moment and properly located with respect to the grippers **20.**

It should be generally noted at this point that the grippers **20** are part of a transfer structure which takes the sheet M from the orienter **10** and transfers the sheet from the orienter to the master sheet cylinder of the lithographic press component of the duplicating machine. This is accomplished by causing the upper and lower gripping fingers **22** and **24** to separate to allow the lead edge of the sheet M to enter therebetween, after which the fingers **22** and **24** close and the entire transfer structure swings in an arc to move the lead edge of the sheet M into the path of a plurality of gripping fingers which are mounted on and rotating with the master cylinder of the lithographic press. In a manner well known in the art, the sheet M is then transferred from the transfer gripping structure **20** to the master cylinder gripping fingers and the transfer grippers **20** return to the position shown in FIG. **2** to await the arrival of the next master sheet.

Considering now the above mentioned instrumentalities in more detail, the side edge registering comprises an elongate L-shaped pusher plate generally designated by the numeral **30** and best seen in FIG. **5.** The pusher plate **30** comprises an upstanding flange **32** which abuts the side edge of a sheet M to move the latter laterally on the plate **12.** The flange **32** is integral with a horizontal plate portion **34** which is suitably supported beneath the plate **12** for limited lateral movement by means of a link **36** (FIG. **1**) connected as at **38** to the plate portion **34,** the link **36** having an elongate slot **40** which permits limited reciprocatory movement of the link **36** with respect to a pin **42** mounted on the underside of the plate **12.** The L-shaped pusher plate **30** is additionally supported by two pairs of bell cranks which in turn are supported by the plate **12,** all in a manner and for the purpose now to be described.

The pusher plate portion **34** has a pair of spaced extensions **44** formed integrally with the portion **34** and each extension having a pin **46** carried thereby for engagement by a slot **48** formed in one leg of each of two pairs of bell cranks generally designated by the numerals **50, 52, 54** and **56** as best seen in FIG. **1.** In other words, adjacent legs **58** and **60,** and **62** and **64** respectively of each pair of bell cranks are connected by the pins **46.** The bell cranks **50, 52, 54** and **56** are pivotally connected to the plate **12** by pivot pins **66, 68, 70** and **72** respectively. The above arrangement for the bell crank **50** is more clearly shown in FIG. **5.** From the construction thus far described, it will be seen that if the bell crank pairs are oscillated about their respective pivots, the pusher plate **30** will be reciprocated inwardly and outwardly within the limits of the engagement between the slot **40** and the pin **42.** Two exten-

sions **44** and two sets of bell cranks are provided to assure that the pusher plate **30** remains properly aligned with the support plate **12** and the fixed guide **33** during movement of the pusher plate **30.**

In order to oscillate the bell cranks, there is provided a yielded connection between one bell crank of each pair and an actuating mechanism which moves the bell cranks under the influence of a timing cam. Thus, referring again to FIG. **1,** each bell crank has an outwardly extending leg **74, 76, 78** and **80** respectively for the bell cranks **50, 52, 54** and **56.** The legs **74** and **78** of the bell cranks **50** and **54** each carry a pin **82** on the lower end of each of which is connected one end of a spring **84,** the other end of each spring being connected to another pin **86,** again each of which is carried by a horizontal tab **88,** the two such tabs **88** being formed integrally with the horizontal web **89** of an L-shaped slide bar generally indicated by the numeral **90** (note FIGS. **4** and **5**). The slide bar **90** is supported on the orienter **10** by a pair of slot and pin connections, one of which is shown in FIGS. **4** and **5** as slot **92** and pin **94,** the latter being mounted in one of the side frame plates **14.** The vertical web **96** of the slide bar **90** carries a cam follower **98** which is acted upon by a cam **100** fixed to a cam shaft **102** suitably supported by the side frame plates **14** and extending across the width of the orienter as seen in FIG. **1** and driven by a motor **104** which is mounted on one of the side frame plates **14** in any suitable manner.

By considering the structure thus far described with reference to FIGS. **1, 4** and **5,** it will be seen that rotation of the cam shaft **102** in a counterclockwise direction as indicated by the arrows in FIGS. **4** and **5** will cause the cam **100** initially to push the cam follower **98** toward the left as viewed in FIGS. **4** and **5,** which will move the slide bar **90** correspondingly within the limits of the engagement of the slot **92** and pin **94.** The movement of the slide bar, carrying the two pins **86,** will act on the springs **84** to yieldably urge the legs **74** and **78** of the bell cranks **50** and **54** toward the left as seen in FIG. **1,** thereby pivoting the bell cranks and moving the side edge pusher member inwardly as heretofore described. When the cam **100** rotates sufficiently to allow the follower **98** to move toward the right as viewed in FIG. **4,** the slide bar **90** will be urged in the reverse direction by any suitable yielding means such as the tension spring **106** connected between the right end of the slide bar and any suitable fixed point on the orienter **10.** This return movement of the slide bar **90** will in turn act through the yieldable connection between the slide bar **90** and the bell cranks **50** and **54** to allow the latter to return to their normal position under the influence of the spring **106** which causes the edges **91** of the tabs **88** to contact the pins **82** thereby pushing the bell cranks **50** and **54** to their normal position, which will in turn move the side edge pusher member **30** outwardly to its initial position.

In order to properly register a sheet M on the plate **12,** the latter is provided with an upstanding flange **33** (FIG. **1**) on the sie of the plate **12** opposite from the flange **32** of the movable pusher plate **30.** It will be apparent that the distance between the flange **32** and **33** may be such that the movable pusher plate **30** moves the sheet M laterally on the plate **12** just far enough that the side edge of the sheet M abuts the flange **33,** which thereby constitutes a fixed side guide for the sheet M.

Preferably, however, the movable pusher mechanism just described is designed to push the edge of the sheet which it contacts a little closer to the fixed side guide than the width of the sheet, thereby producing a slight longitudinal buckle in the sheet, after which the movable pusher backs off a small amount so that the sheet lies flat on the plate **12.** The advantage of this is to assure that the sheet M, which is still slightly damp from the developer solution and somewhat limp, is properly registered with the fixed side guide **33.** This function is accomplished in the following manner. Referring again to FIGS. **1** and **4,** it will be seen that the horizontal web **89** of the L-shaped slide bar **90** is provided with a pair of tabs **108** and **110** which project outwardly far enough to contact a pair of pins **112** and **114** respectively carried by the legs **76** and **80** of the bell cranks **52** and **56.** The tabs **108** and **110** contact the pins **112** and **114** just a little in advance of the point where the cam **100** has moved the cam follower **98** through its full extent of movement toward the left as viewed in FIGS. **4** and **5,** with the result that at the moment of contact of the tabs with the pins, the slide bar **90** will still move further toward the left upon continued rotation of the cam **100.**

With the above in mind, it will now be noted that the parts are dimensionally related so that the flange **32** has moved the side of the sheet M which it contacts closer to the fixed flange **33** than the width of the sheet, thereby producing the longitudinal buckle, at the time when the tabs **108** and **110** contact the pins **112** and **114,** so that the sheet M is now properly registered with the fixed flange **33.** Upon continued rotation of the cam **100** and slight further movement of the cam follower **98** toward the left, the slide bar **90** and the tabs **108** and **110** will also move further toward the left, as viewed in FIGs. **1** and **5,** and this will cause a slight rotation of the bell cranks **52** and **56** in a counterclockwise direction. This in turn will cause a slight reverse movement of the pusher plate **30** thereby slightly moving the flange **32** away from the fixed flange **33** to the point where the sheet M lies flat on the plate **12.** The slight reverse movement of the bell cranks **50, 52, 54** and **56** while the slide bar **90** is still moving toward the left is accommodated by the spring connections **84** between the pins **86** on the slide bar **90** and the pins **82** on the bell cranks **50** and **54.** The springs **84** are selected to have sufficient strength to rotate the bell cranks to move the pusher plate **30** inwardly until the tabs **108** and **110** strike the pins **112** and **114,** but to yield at that point to allow the slight opposite rotation of the bell cranks to withdraw the pusher plate enough to allow the sheet M to lie flat. The dimensions of the parts are selected so that the pusher plate flange **32** will be spaced from the fixed side guide **33** by approximately the width of the sheet M when the pusher plate **30** has moved to its final position so that the flange **32** and guide **33** form a channel for guiding the sheet M in a straight path when the sheet M is moved in a longitudinal direction as hereinafter more fully described.

The orienting device **10** is provided with a wire guide mechanism which overlies the plate **12** in spaced relation therewith. The wire guide mechanism functions to guide the lead edge of the sheet onto the plate **12** while the sheet is being moved thereon by the feed rollers **16,** to hold the sheet flat while it is being registered with the fixed side guide **33** and to prevvent the sheet from being lifted off of the plate **12** by a vacuum drying device which is located over the orienting device **10** in the

copier-duplicating machine in order to achieve further drying of the sheet M while it is waiting to be loaded onto the master cylinder of the lithographic press. The wire guide mechanism is divided into two independently movable front and rear wire guides, each with its own actuating mechanism to move the wire guide mechanism toward and away from the plate **12.**

More particularly, and with reference to FIGS. **1** and **2,** there is provided a front wire guide comprising a plurality of wire fingers **120** which are suitably rigidly mounted on a shaft **122** which in turn is rotatably supported by the side frame members of the orienter **10.** As best seen in FIG. **2,** the fingers **120** normally lie a slight distance over the upper surface of the plate **12,** and are movable from the solid line position to an elevated position shown in dotted lines by means yet to be described. The rear wire guide comprises a plurality of similar wire fingers **124** which are rigidly mounted on another shaft **128** which in turn is rotatably supported by the side frame plates of the orienter. The rear wire guide fingers **124** normally lie in an elevated position with respect to the plate **12** as shown in the solid line position in FIG. **2** and are movable to the flat position shown in dotted lines by actuating mechanism yet to be described. Any suitable spring means, such as the leaf springs **130** (FIG. **2**) may be employed to maintain the front and rear guide fingers in their respective solid line normal position. It will now be apparent that rotation of the shafts **122** and **128** in a clockwise direction will raise the front guides **120** and lower the rear guides **124,** and rotation of the shafts in the opposite direction will lower the front guides and raise the rear guides. It should be noted that the front and rear guide fingers are not mounted on the same shaft because movement thereof is sequential rather than simultaneous by the actuating mechanism to be described.

Referring to FIG. **2,** a link **132** is rigidly connected to the shaft **122** and projects downwardly beneath the plate **12,** the link **132** carries a cam follower **134** which engages a cam **136** rigidly mounted on the shaft **102** previously described. Another link **138** is rigidly connected to the shaft **128** and projects downwardly beneath the plate **12,** the link **138** also carrying a cam follower **140** which engages a cam **142** rigidly mounted on the shaft **102** adjacent to the cam **136.** The spatial relation of the links, cam followers and cams can be seen in FIG. **1,** wherein it will be seen that at least the links **132** and **138** which project above the plate **12** are outside the fixed guide flange **33** so as not to interfere with proper registration of the sheet M against the flange **33.** Referring back to FIG. **2,** it will be seen that tension springs **144** and **146** are connected at one end respectively to the lower end of the links **132** and **138** and at the other end to a pin **148** mounted in the adjacent side frame member, the springs serving to maintain the cam followers **134** and **140** in continuous contact with their respective cams.

From the structure thus described, it will be apparent that rotation of the shaft **102** and the cams **136** and **142** will cause the cam followers **134** and **140** to move from the positions indicated by the circles which have numeral lead lines connected thereto to the adjacent positions indicated by the circles without lead lines. This causes corresponding rotation of the links **132** and **138** and the shafts **122** and **128** which in turn rotates the guide fingers **120** and **124** with respect to the plate **12** as hereinabove described. As will be explained in more detail later, the cams **136** and **142** are shaped so as to produce the aforementioned movement of the guide fingers **120** and **124** in a predetermined timed sequence along with the other functions of the orienting device **10.**

The orienter **10** is also provided with a lead edge registering means which acts upon the trail edge of the sheet after it has been deposited on the support plate to move the sheet longitudinally to a predetermined location in which the lead edge of the sheet is properly registered with the transfer gripper mechanism **20** associated with the lithographic process component of the duplicating machine. This gripper mechanism and its interaction with the orienter device of the present invention will be better understood from the following detailed description.

Referring to FIGS. **1** and **3,** there is shown a slide plate **150** mounted on the under surface of the plate **12** by means of a suitable screw and washer fastener **152,** the slide plate **150** having elongate slits **154** which permit limited movement of the slide plate **150** longitudinally of the support plate **12.** The right hand end of the slide plate **150** is provided with a plurality of upstanding fingers **156** which project upwardly through elongate notches **158** formed in the support plate **12.** An L-shaped link **160** is connected by means of screw and nut fasteners **162** to the slide bar **150,** the depending leg **164** of the link **160** having one end of a tension spring **166** connected thereto, the other end of which is connected to a depending tab **168** which is suitably connected to the support plate **12.** Thus, the spring **166** acting through the link **160** and the slide bar **150** maintains the fingers **156** in their normal solid line position shown in FIG. **3.** It should be noted that the rearmost position of the fingers **156** is substantially beneath the feed rollers **16** so that the trail edge of the sheet M will be deposited in front of the fingers **156.**

An actuating mechanism is provided for alternately moving the fingers **156** to the dotted line position shown in FIG. **3.** Thus, the link **160** is provided with an angled, downwardly extending tab **170** which is engaged by a pin **172** carried by the upper end of a rocker arm **174** rotatably mounted on a shaft **176** suppoted between the side frame plates **14.** The rocker arm **174** also carries a cam follower **178** which is engaged by a cam **180** mounted on the shaft **102** heretofore described. It will now be apparent that rotation of the shaft **102** and the cam **180** moves the cam follower from the solid line position of FIG. **3** to the dotted line position which in turn rocks the arm **174** to move the pin **172** to the left hand dotted line position, thereby moving the link **160,** the slide bar **150** and the fingers **156** toward the left until the fingers **156** reach the dotted line position thereof. The fingers **156** bear against the rear edge of a sheet M in order to register the lead edge thereof with the aforementioned transfer gripper mechanism as now to be described.

As briefly mentioned in the early portion of the detailed description of the invention, the transfer gripper mechanism **20** comprises a pair of gripper fingers **22** and **24** which separate by suitable mechanism which need not be further described to allow the lead edge of a sheet M to enter therebetween and be gripped by the fingers **22** and **24** after the fingers close. The gripper structure **20** then swings in a predetermined arc from the position shown in FIG. **2** to a remote location where the lead edge of the sheet is transferred from the transfer gripper **20** to gripping fingers mounted on the rotating master cylinder. The edge of the support plate **12** is

provided with notches **182** to allow spaced portions of the lead edge of the sheet accessible to the grippers **20.** It will be understood that the orienter device **10** is mounted in the duplicating machine so that the notches **182** are properly aligned with the plurality of grippers **20** both laterally and longitudinally with regard to the right hand limit position of the grippers **20** as viewed in FIG. **2.** Also, the parts of the orienter **10** associated with the limits of movement of side pusher plate **30** and the rear pushing finger **156** are designed so that the sheet is in the desired position with respect to the grippers **20** when the pushers are at the limit of their movement.

There has been described thus far the structure by which a desired dimensional relationship is established between the master sheet and the transfer gripper mechanism. Now to be described is the means by which a desired time relationship is established between the master sheet and the gripper mechanism so that the dimensional relationship is properly timed with the movement of the grippper mechanism and the other operating components of the duplicating machine. This is best accomplished by describing a cycle of operation of the orienter device in conjunction with its function in cooperation with the copying and duplicating components of the entire duplicating machine.

When it is desired to make several copies of a document, the document is placed in the copying component and the latter is energized to make an electrostatic copy of the document by electrostatic techniques well known in the art and which form no part of the present invention. However, when the copier component is energized, the main driving motor **18** for the copier component begins to run and this drives the feed rollers **16** through any suitable connection. When the master sheet M exits from the copier component, it is directed into the nip of the feed rollers **16** by any suitable guide means and the feed rollers **16** move the sheet M onto the support plate **12.** At this point, the rear wire guide fingers **124** are in their elevated position, the front wire guide fingers **120** are in their lower position, the side pusher plate **30** is in its outermost position and the rear pusher fingers **156** are in their outermost position, all as shown in the solid line positions of these parts in the drawings. Also, the transfer gripper mechanism **20** of the lithographic press is in the position shown in FIG. **2.**

As the sheet M moves along the support plate **12** under the influence of the feed rollers **16,** the lead edge of the sheet passes between a photocell **183** suitably mounted on the under surface of the support plate **12,** the photocell normally receiving light through an aperture **184** in the plate **12** from any suitable source of illumination **186** mounted over the plate **12.** The function of the photocell **183** is to energize the motor **104** of the orienter **10** to start driving the shaft **102** on which all of the previously described actuating cams are mounted. When the lead edge of the sheet M blocks the illumination to the photocell and energizes the motor **104,** there is an initial period of rotation of the shaft **102** during which nothing happens to allow the entire sheet M to be fed through the feed rollers **16** and to settle upon the support plate **12.** It should be noted at this point that normally the sheet M will be entirely upon the support plate **12** before the lead edge thereof reaches the exit end of the support plate; howevver, in the unlikely event that the sheet M tends to over-travel the orienter device, the lower gripper finger **24** of the transfer gripper **20** is formed with a nose portion **25** which lies in the path of movement of the sheet M and acts as a front stop to prevent further movement of the sheet.

After the sheet M has settled upon the support plate **12,** further rotation of the shaft **102** causes the cam **142** to rotate to the point where the cam follower **140** allows the link **138** to pivot in a clockwise direction under the influence of the spring **146** thereby rotating the shaft **128** to drop the wire guide fingers **124** to the dotted line position shown in FIG. **2.** At this point both the front and rear wire guide fingers are in their depressed position. Next, the cam **100** begins to move the cam follower **98** toward the left as viewed in FIG. **5,** thereby moving the L-shaped slide plate **90** and pulling on the springs **84** so as to rotate the bell cranks **50, 52, 54** and **56** in their respective proper directions so as to move the pusher plate **30** toward the fixed side guide **33,** thereby moving the sheet M laterally in the same direction, and causing the longitudinal buckle in the sheet M at a point just before the cam **100** exerts its greatest influence on the cam follower **98.** Further rotation of the cam **100** then causes the tabs **108** and **110** to engage and push on the pins **112** and **144** to cause slight counter rotation of the bell cranks **50, 52, 54** and **56** in order to slightly retract the pusher plate **30,** thereby allowing the sheet M to assume a fully flat position on the plate **12.**

At this point the cam **180** begins to move the cam follower **178** to rock the arm **174** in a counterclockwise direction to move the link **160** and slide bar **150** toward the left, thereby moving the rear edge pusher fingers **156** to the dotted line position of FIG. **3** and moving the sheet M toward the exit end of the orienter **10.**

Immediately after the rear pusher fingers **156** reach the limit of their movement, the transfer gripper mechanism **20** of the press component grips the leading edge of the sheet M. At that point, the cam **136** has rotated far enough to commence movement of the cam follower **134** in order to pivot the link **132** in a counter clockwise direction against the urging of the spring **144** thereby rotating the shaft **122** in the same direction to raise the front wire fingers **120** to their dotted line position. At this point, the transfer gripper mechanism **20** swings away from the orienter **10** and carries the sheet M therewith for transfer to the master cylinder of the press component.

When the trailing edge of the sheet M passes the photocell **183,** the motor **104** is not deenergized because a holding circuit switch **188** having an actuating arm **190** is held closed by the action of another cam **192** mounted on the shaft **102.** Thus the shaft **102** continues to rotate until it reaches its "home" position or the position it occupied at the beginning of the cycle. During this continued rotation of the shaft **102,** the cams **136** and **142** sequentially reset the rear and front wire guide fingers by reverse movement of the parts described above, and similarly the cams **100** and **180** continue rotation to the point where the side pusher plate **30** and rear pusher fingers **156** are reset to their original positions. When the shaft **102** has completed one revolution, the cam **192** allows the switch **188** to open the holding circuit to the motor **104** thereby deenergizing the motor and completing the cycle of operation of the orienter device **10.**

What is claimed is:

1. A sheet orienting device for establishing a predetermined position of a sheet having a predetermined width and consisting of a relatively soft and limp mate-

rial, said device comprising:

A. an elongate relatively flat sheet supporting member having a fixed side edge guide extending along one longitudinal edge of said supporting member,

B. sheet pushing means extending along the opposite longitudinal edge of said supporting member and normally spaced laterally of said supporting member from said fixed guide by a distance greater than the width of a sheet to be oriented,

C. means mounting said sheet pushing means for limited movement toward and away from said fixed guide, the innermost limit of movement of said pushing means toward said fixed guide being a distance slightly less than the predetermined width of the sheet to be oriented, and

D. actuating means for moving said pushing means toward said fixed guide from said normally spaced position to said innermost position and then back to a position where said pushing means is spaced from said fixed guide by a distance substantially equal to the predetermined width of the sheet, whereby a sheet placed on said supporting member is moved toward said fixed guide and is slightly buckled longitudinally to assure proper alignment of the edge of the sheet with said fixed guide and is then allowed to flatten on the sheet supporting means by said movement of said pushing means away from said fixed guide to said position where its distance from said fixed guide is substantially equal to the predetermined width of the sheet, after which said fixed guide and said pushing means define a channel for guiding the sheet during longitudinal movement thereof.

2. A device according to claim **1** wherein said actuating means comprises:

A. driving means operable through a fixed range of movement,

B. driven means directly connected to said pushing means and resiliently connected to said driving means,

C. means cooperating between said driving means and said driven means for reversing the direction of movement of said driven means before said driving means moves through its full range of movement, said reverse direction of movement of said driven means being accommodated by said resilient connection, and

D. means for moving said driving means.

3. A device according to claim **2** wherein said driving means comprises a slide plate movably mounted adjacent said sheet supporting member and having an abutment means thereon, and wherein said driven means comprises:

A. a first portion directly connected to said pushing means for moving said pushing means,

B. a second portion resiliently connected to said slide bar for moving said driven member in one direction and

C. a third portion operatively located to interfere with said abutment means on said driving member for causing said reverse direction movement of said driven member as said slide bar approaches the end of its range of movement.

4. A device according to claim **2** wherein said driving means comprises a slide plate movably mounted adjacent said sheet supporting member and having an abutment means mounted thereon, and wherein said driven means comprises a pair of bell cranks each pivotally secured to said sheet supporting means and each having one leg connected to a single point on said pushing means, the opposite leg of one bell crank being resiliently connected to said slide bar and the opposite leg of the other bell crank being operatively located to interfere with said abutment means on said slide bar before said slide bar moves through its full range of movement whereby said slide plate moves said bell cranks and said pushing means in one direction through said resilient connection until said abutment means contacts said opposite leg of said other bell crank whereupon said bell cranks and said pushing means are moved in the opposite direction as said slide plate moves through the rest of its range of movement.

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